



ICAR-CIRCOT



2016-17 ANNUAL REPORT



Towards Sustainability and Inclusive Growth in Cotton Sector....



ISO 9001:2008

ICAR-CIRCOT

ANNUAL REPORT 2016-17

ICAR - CENTRAL INSTITUTE FOR RESEARCH ON COTTON TECHNOLOGY

Adenwala Road, Matunga, Mumbai - 400 019

(An ISO 9001:2008 Certified Institute and NABL Accredited Lab)

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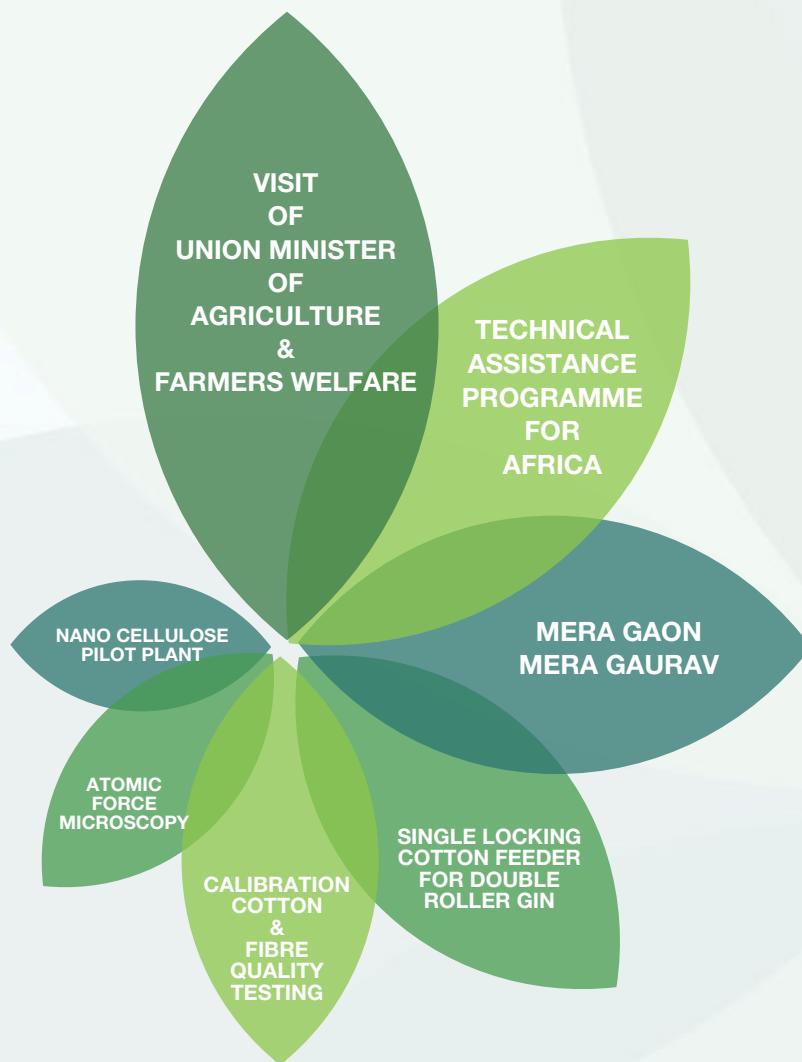
ICAR-CIRCOT Annual Report 2016-17

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PREFACE



In 2016-17, world cotton production increased despite reduction in world acreage under cotton, owing to the improvement in the world average yield. India maintained its position as the world's largest cotton producer yet again, with an output touching 6 million tonnes. It's the right time that the country revitalizes the cotton value chain segment. Development of sustainable enterprise and skill development are the key to remain competitive in the sector.

ICAR-CIRCOT strives to play a significant role in ensuring the quality and create diversified utilization of Indian cotton through R&D efforts besides creating skilled human resource and providing commercial services to the stakeholders in the sector. The Institute provides skill development programmes for farmers and other stakeholders in the areas of ginning, value addition to cotton by-products and specialized training programmes in the areas of nanotechnology, absorbent cotton technology and characterization of textiles materials etc.

The Institute is engaged in developing new technologies and refinement of the already developed technologies in the areas of post-harvest processing of cotton. Research is focused on ginning and pre-ginning operations; mechanical processing, technical textiles and composites; characterization of natural fibres, yarns and textiles; chemical and biochemical processing; and entrepreneurship development. The quality worthiness and cost competitiveness are the major factors influencing the competition of cotton with synthetic fibres.

Cottonseed is an important by-product of cotton, rich in oil and protein and a source of edible oil and feed for livestock. As India is the net importer of edible oil, the improvement in process efficiency of cottonseed oil extraction needs urgent attention. In addition to oil, cottonseed is also a source of other useful products like linters, hulls and meal or cake. All these products can be obtained from cottonseed by processing it in a scientific manner which involves delinting and dehulling of cottonseeds prior to oil extraction. It is important to fully utilize all cottonseed products to make cotton cultivation more remunerative. Cotton stalk and other agro wastes can be utilized for making pellets and briquettes as an alternative to coal, firewood, cooking gas and for conversion into ethanol as an alternative to fossil fuel.

All of the cotton produced in India is harvested manually by hand picking while about 30% of the cotton produced in the world is harvested mechanically. However, machine-harvested cotton contain lot of trash consisting of leaves, sticks, stems, seed-coat fragments etc. To reduce the trash level of mechanically picked cotton, a cleaning system has been developed for processing the mechanically picked cotton before ginning. An on-board cleaner has been developed for on-field cleaning of cotton harvested using stripper machine.

The Institute maintains liaison with different institutions including private organizations and entrepreneurs to meet their technological needs and also to generate revenue for the Institute. A total of twelve consultancies were undertaken during the year catering to the needs of various organizations. To promote research and teaching in the sphere of cotton science and technology, the Institute has signed MoUs with a number of educational institutions. This enables not only carrying out joint research work but also creates an opportunity to pursue postgraduate & doctoral degree programmes. There are seven PhD students on roll with the Institute.

On technology commercialization and transfer activities front, consultancies were undertaken and MoUs signed with stakeholders, exhibitions & awareness programmes organized to showcase the technologies across the country. The Institute has established an Agri-Business Incubation (ABI) centre for nurturing young entrepreneurs and providing avenues to venture into start-up companies in the area of the post-harvest processing of cotton. An incubatee has successfully graduated culminating into an enterprise M/s Sana Agro Industries producing degossypolized cottonseed meal for poultry and fish feed using the Institute's technology and another in-house incubatee M/s Greyy has ventured into a new start-up dealing with development of natural fibre based blended textiles.

The Institute is involved in strengthening cotton value chain in Africa. Under the Cotton TAP programme, a regional knowledge cluster – *cum* – training centre has been established at Bohicon, Benin. In-country training programmes were organized at Mondou, Chad, Nigeria and Burkina Faso. The Institute is also working towards development of technology for producing currency grade pulp using indigenous raw material which will ensure self-reliance in this field and also improve the economic conditions of the farmers. Under 'Mera Gaon Mera Gaurav', an outreach program launched by the Government of India for scientist-farmer direct interaction, thirty villages have been adopted in cotton growing Vidarbha region of Maharashtra. The Institute scientists regularly organize demonstrations and awareness meets in these selected villages.

The Institute ensured 100% utilization of the sanctioned plan budget allocation of ₹ 329.60 lakhs for the year 2016-17 and generated a revenue of ₹ 86 lakhs (26.13% of plan budget) through technology licensing, commercial services, skill development programmes and agri-business incubation and is positioned as one of the top revenue generating institutes of ICAR. Accredited by NABL and certified for ISO 9001:2008, ICAR-CIRCOT is a unique referral laboratory in the country for testing cotton textiles with facilities for conducting over 120 different types of tests on textile materials and cotton by-products.

The year ended with the recognition of the steps taken by the Institute towards digital society and cashless economy, being bestowed with an award for the first “Cashless Institute” in the ICAR system.

Mumbai
25 May 2017

Dr. P.G. Patil
Director



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ABBREVIATIONS

ABI	Agri-Business Incubation
AFM	Atomic Force Microscopy
AICRP	All India Coordinated Research Project
AKMU	Agricultural Knowledge Management Unit
ASRB	Agricultural Scientists Recruitment Board
ASTM	American Society for Testing and Materials International
BIS	Bureau of Indian Standards
BSKKV	Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth
CBPD	Chemical & Biochemical Processing Division
CIRCOT	Central Institute for Research on Cotton Technology
CTRL	Cotton Technological Research Laboratory
DR	Double Roller
FTIR	Fourier Transform Infrared Spectroscopy
GTC	Ginning Training Centre
HDPS	High Density Planting System
HVI	High Volume Instrument
ICAR	Indian Council of Agricultural Research
ICCC	Indian Central Cotton Committee
ICT	Institute of Chemical Technology
IFS	Indian Fibre Society
IJSC	Institute Joint Staff Council
IMC	Institute Management Committee
INRAB	Institute National des Recherches Agricoles du Benin
IP	Indian Pharmacopoeia
IRC	Institute Research Council
ISAE	Indian Society of Agricultural Engineers
ISCI	Indian Society for Cotton Improvement
ISO	International Organization for Standardization
ITMF	International Textile Manufacturers Federation
ITMU	Institute Technology Management Unit
MFC	Micro Fibrillated Cellulose
MGMG	Mera Gaon Mera Gaurav
MoU	Memorandum of Understanding
MPD	Mechanical Processing Division
NABL	National Accreditation Board for Testing and Calibration of Laboratories
NAIF	National Agriculture Innovation Fund
PMC	Project Monitoring and Evaluation Committee
PMFBY	Pradhan Mantri Fasal Bima Yojana
QEID	Quality Evaluation and Improvement Division
RAC	Research Advisory Committee
R&D	Research and Development
SEM	Scanning Electron Microscopy
SBEE	Society of Benin Electrical Engineering
SNDT	Shreemati Nathibai Damodar Thackersey (Women's University)
TAP	Technical Assistance Programme
TTD	Technology Transfer Division
USDA	United States Department of Agriculture
UAS	University of Agricultural Sciences
VJTI	Veermata Jijabai Technological Institute



EXECUTIVE SUMMARY

ICAR-CIRCOT Mumbai is a premier research institute working in the field of post-harvest processing of cotton and value addition to cotton biomass and by-products. It is actively engaged in generating technological solutions to cotton industry and farmers through research, training, education and technology transfer. It also acts as a referral laboratory for cotton quality evaluation. A number of technologies have been developed through various research projects in areas right from ginning, spinning, quality evaluation and chemical processing to nanotechnology.

Some of the technologies developed during 2016-17 are:

- A novel salt free dyeing process through cationization of cotton fabric to get dye shade comparable with that obtained using salt in the conventional dyeing process. The new process saves on the usage of sodium chloride and sodium sulfate required during the exhaustion process of dyeing fabric.
- Durable antibacterial and UV protective finish of cotton-bamboo (65:35) blended fabric through in-situ synthesis of nano zinc oxide. The process does not affect other fabric properties like water absorbency and fabric colour.
- A process for preparing nano-ligno-cellulose from coconut fibres with potential applications as reinforcement agents in composites for its better mechanical, electrical and permeability properties.
- Rubber composite having improved mechanical properties using nylon 6, 6 fabric. Chemical treatment of nylon 6, 6 fabric helps achieve higher roughness resulting into better adhesion of fabrics. Hydrolysis of polyamide surface and surface roughening leads to increase in hydrogen bonding along with the mechanical interlocking effect that contributes to the increase in the interfacial adhesion of nylon with rubber material. Peel strength of nylon-rubber composite increases along both warp and weft directions.
- A technology to prepare activated carbon from phosphoric acid modified cotton stalks yielding significantly higher mesoporosity of 140 mg/g compared to 25 mg/g in the conventional dry method.
- A new device for opening of cotton lint samples used for micronaire testing gives uniform lint opening at a capacity matching to the HVI handling capacity.
- Micro Fibrillated Cellulose (MFC) as a furnish additive to improve the strength of kraft paper. The inter-fiber bond strength (IBS) derived by integrating z-directional stress-strain curve and the burst factor, which indicates tolerance to pressure before it ruptures, increases by addition of the MFC. Use of MFC helps to reduce the requirement of imported virgin pulp and acts as agro-biomass based renewable source of raw material.

- Mosquito repellent finishing of textiles by citronella oil microencapsulation using complex coacervation technique with gum arabic as wall material. Uniform distribution of capsules on the treated cotton fabric showed 100% mosquito repellence with finish durability up to 5 washes.
- A cheaper method for making absorbent cotton by removing non-cellulosic substances from raw cotton using CIRCOT anaerobic consortium avoids use of commercially available costly pectinase enzyme. The absorbent cotton prepared conforms to the Indian Pharmacopoeia (IP) and Bureau of Indian Standard (BIS) standards.
- Three hundred and ninety-six containers of ICAR-CIRCOT calibration cotton, which is an import substitute for costly USDA standards for calibrating textile testing equipment, were produced and sold during the year generating a revenue of ₹ 2,82,800/-.
- Two patents were granted, thirteen consultancies undertaken and eight MoUs signed for commercialization of the technologies during the year.
- Twenty training programmes were organized for human resource development in the areas of ginning, quality evaluation of cotton fibres, yarns and fabrics, textile processing, value addition to cotton and biomass, application of nanotechnology, advances in microscopy, characterisation of materials using XRD, absorbent cotton technology, basic statistical techniques for textile research and electro-spinning techniques & their applications.

Some of the other achievements during the year are:

- A database for non-metameric computer colour matching of cotton textiles overcomes the problem of metamerism due to visual colour matching currently used to match samples.
- A survey of spinning mills in and around Coimbatore, Kolhapur and clusters of Punjab & Haryana indicated the overall status of contamination of Indian cotton at insignificant to moderate levels as against high contamination levels reported by the International Textile Manufacturers Federation (ITMF).
- Economic analysis of logistics of harvesting, collection, chipping and transportation of cotton stalks showed that an additional revenue of ₹ 1200 per tonne of cotton stalks could be generated to the farmer if cotton stalk is supplied to industry for making particle boards, pellets and briquettes.
- An international training programme was organised at Burkina Faso, Africa on post-harvest management of cotton and value addition to crop residues on May 16-17, 2016.
- Monitoring of the erection and commissioning of facilities for “Regional Knowledge-cum-Training Centre for Post-Harvest & Ginning Technology” at Bohicon, Benin, Africa under the Cotton Technology Assistance Programme for Africa.
- Sixty four research papers were published / presented in seminars / conferences during the year. E-newsletter was published every month online.

- Technology for innovative cotton-rich blended fabric for enhanced feel and thermal comfort was commercialised through licensing to M/s Greyy, Navi Mumbai.
- An incubatee graduated from the ABI centre in degossypolization of cottonseed meal has set up a unit in Raichur, Karnataka for the production of degossypolised cottonseed meal through microbial method.
- Under Swachh Bharat Abhiyaan, cleanliness activities were carried out in the Institute premises and at the staff quarters regularly throughout the year with active participation of the staff.
- Mera Gaon Mera Gaurav (MGMG) activities and awareness programmes were conducted benefitting thirty villages in cotton growing Wardha district of Maharashtra where scientists and technical officers demonstrated farmer friendly technologies for enhancing farm income.
- Nationally and internationally important days and weeks like the constitution day, unity day, science day and hindi week were observed and celebrated.
- Solar panels were installed for providing hot water in the guest house rooms at the Institute headquarters, as part of the continuous efforts to cut down the use of electricity and harvesting solar energy.
- The institute became cashless and was bestowed with certificate and cash award of ₹ 5 lakhs for carrying out cashless transactions by ministry of Agriculture & Farmers Welfare, New Delhi .
- Flexi check dam technology for watersheds was conferred with outstanding interdisciplinary team work in agricultural and allied sciences for the year 2013-14 under the category of NRM and Agricultural Engineering.
- The Institute won five gold and five silver medals during the west zone sports tournament.
- Dr. P.G. Patil, Director received the 'ISAE Fellowship 2016' Award during the 51st ISAE convention at CCSHAU Hisar. He, along with other Institute scientists, also received best paper and poster presentation awards at different seminars and conferences.
- The Institute ensured near complete 99.99% utilization of the sanctioned plan budget allocation of 329.60 lakhs for year 2016-17 and generated a gross revenue of ₹ 86.04 lakhs, which is 26.13% of the plan budget of the Institute.



1. INTRODUCTION

ICAR-CIRCOT, Mumbai is a 92 year old Institute, inaugurated on 3rd December, 1924 by the then Viceroy & Governor General of India as the Cotton Technological Research Laboratory (CTRL) under the then Indian Central Cotton Committee (ICCC). In 1966, the administrative control of the Institute was transferred to ICAR and later in 1991, it was renamed as the Central Institute for Research on Cotton Technology (CIRCOT).

Over the past nine decades, the Institute has made phenomenal contribution to the progress of post-harvest processing of cotton. The Institute has been continually providing technological support to cotton breeding programmes and skilled manpower to the ginning sector in the country. Significant contribution in the area of ginning machinery research have helped the country not only to be self-reliant but also exporter of ginning machinery.

Ginning equipment is now being exported not only to the Afro-Asian countries but also to the developed countries like USA and Australia earning precious foreign exchange for the country. Many new machines and products have been developed and successfully commercialised; some of them worth mentioning are on-board cleaner for cotton stripper, saw band pre-cleaner for mechanically picked cotton, stick removal for mechanically picked cotton, double roller gin with self-grooving rubber roller, miniature spinning system and village level sliver making

machine, blended textiles, cotton lint opener, rubberised baton and rubber composites for flexi check dam.

The Institute has been playing an important role in screening and developing quality cotton genotypes under the All India Coordinated Research Project on Cotton. Lauding its efforts, the institute's status has been recently elevated to the level of principal investigator in the project for cotton quality. ICAR-CIRCOT calibration cotton is an import substitute for the costly USDA reference material used for calibrating testing instruments like the HVI.

Recently, the Institute has been carrying out research in many new areas like the mosquito repellent finishing for textile materials, colour matching of textiles through indigenously developed software and solvent extraction of gossypol as food for non-ruminants. Application of nano-cellulose in cement concrete, rubber composite, pulp and paper to enhance functional properties, development of security grade paper from mixing pulp from different sources are being explored. Apart from carrying out research in the field of nano-coated films for packaging, the Institute has a project on natural fibres in consortium mode with participation of other related institutes. Efforts are under way on the use of briquettes and pellets made from cotton stalk as fuel in crematoria to replace wooden fuel.

The Institute has been offering innovative tailor made skill development programmes in a host

of subjects which were not offered before. Coherent with the government initiative for doubling farmers' income, the Institute has taken up popularisation of mushroom cultivation using cotton biomass for enhancing farm income. A survey has also been taken up to find out the bottleneck as to why scientific processing of cottonseed has not gained popularity in the country, which is recommended for higher remuneration.

The Institute is headed by the Director assisted by four research divisions, administration, finance & accounts sections and various other committees including the Institute Management Committee (IMC), Project Monitoring and Evaluation Committee (PMC), Research Advisory Committee (RAC), Institute Research Council (IRC), Institute Joint Staff Council (IJSC) and Grievance Committee. There are a number of service sections like Library, Agricultural Knowledge Management Unit (AKMU) and Test House to facilitate the information services, maintaining research data bank, testing and other activities.

Research, Consultancy, Training, Testing and Technology Transfer activities are facilitated and monitored through four research divisions: Quality Evaluation and Improvement Division (QEID), Mechanical Processing Division (MPD), Chemical & Biochemical Processing Division (CBPD) and Technology Transfer Division (TTD). Research programmes are grouped under five broad core areas as (i) pre-ginning and ginning; (ii) mechanical processing: technical textiles and composites; (iii) characterization - cotton and other natural fibres, yarns and textiles; (iv) chemical and biochemical processing and biomass and by-product utilization and (v) entrepreneurship and human resource development.

With the headquarters at Mumbai, the Institute has six regional units located at Nagpur, Coimbatore, Sirsa, Surat, Guntur and Dharwad.

VISION

Global Excellence
in Cotton Technology

MISSION

To Provide Scientific and Managerial Interventions to Post-Harvest Processing and Value Addition to Cotton and Utilization of its By-Products to Maximize Economic, Environmental and Societal Benefits

MANDATE

Basic and Strategic Research on Processing Cotton and its Agro-Residues, Development of Value Added Products and Quality Assessment

Skill Development and Business Incubation Services and Function as Referral Laboratory for Cotton Fibres



Fig. 1.1 Organogram of ICAR-CIRCOT, Mumbai



2. SALIENT RESEARCH ACHIEVEMENTS

2.1 CORE AREA - I : PRE-GINNING AND GINNING

2.1.1 Force Analysis of Double Roller Gins

The forces acting on different components of double roller (DR) gin were investigated under different working conditions to study the effect of moisture content and machine settings on fibre quality attributes, lint productivity, energy consumption and electrical parameters.

Modelling of Machine Assembly

A 3-D model of DR gin was developed using CATIA V5R17 software for explaining the operating mechanism including gears, connecting rod and beater shaft coupler. The model was imported into Altair's 'hyperworks' software for analysis of forces and stresses acting on different components of the machine. The meshing for different critical components was generated using 'hypermesh' module of the software. The meshing of models was done using the tetrahedral elements for solid complex shapes and 1-D elements to define bolts and round bar. The rigid body element (RBE2) with independent single node was used wherever rotation type of joints were available while providing with necessary types of restricted degree of freedom (DOF).

Mathematical Modelling

The model was solved in 'motion solve' module of the hyperworks software. The forces on beater shaft and rollers were

analyzed for changes in the moisture content of the cotton to be ginned. Assumptions were developed for analysis of back forces applied by the cotton on beater shaft at different moisture contents. The model was trained with different possible external loads and ginning forces for analysis of forces, stresses and displacement under different working conditions. Mathematical modelling was carried out to analyze the force applied on beater shaft and ginning force (shearing forces) acting between roller and fixed knife at different moisture levels.

Force Analysis

The analysis part was carried out using 'optistruct' module of hyperworks software. Results showed that, under normal working conditions, forces on beater shaft varied in the range of 4000 to 7000 N. Under no-load condition, only about 1/4 hp power is utilized to oscillate the beater shaft while 4 hp power is consumed by the roller. The failure of the beater shaft might be attributed to the increased load due to high moisture content and improper setting of the machine components. Data was generated on lint productivity, fibre properties, energy consumption and electrical parameters at different moisture contents.

2.1.2 Single Locking Cotton Feeder for Double Roller Gins

Low ginning efficiency of double roller (DR) gins due to low capacities provides an economic barrier to its widespread application. Cotton feeding mechanism to DR gin significantly affects ginning efficiency. Existing feeding mechanism comprises of distribution conveyor, micro-feeder and auto-feeder. Erratic cotton flow rate, feeding in lumps, overfeeding/underfeeding, cotton accumulation in ginning hopper, improper metering of seeds and lack of cotton feeding at ginning point adversely affect the ginning performance. These problems are addressed while designing an automatic single locking cotton feeder to regulate feed rate to optimum and ensures single locking of cotton and feed continuous batt of cotton exactly at ginning points across the knife edges of the DR gin.

Single locking cotton feeder was designed with three different mechanisms- (1) saw band cylinders with twin regulator and apron (2) spike cylinders and feed roller and (3) combination of spike cylinders and feed roller with saw band cylinders and apron. The first mechanism consists of twin regulator assembly with sensor controlled regulated

feeding, and saw band cylinder assembly for single locking of seed cotton, apron for uniform feeding of single locules at ginning point, power transmission assembly and main frame assembly. Second mechanism consists of a pair of feed roller, pair of spiked cylinders and grid bar housed in a hopper, chute for cotton distribution on either side, power transmission and main frame assembly. Third mechanism is a combination of the first and second mechanisms and comprises of feed roller, spike cylinders with saw band cylinders and apron, power transmission and main frame assembly.

Prototypes of single locking cotton feeder with three designs have been fabricated. Preliminary testing for checking functional design was carried out. Refinements in design and prototypes are being carried out based on preliminary testing. The prototype and the schematic diagram of single locking cotton feeding mechanism is shown below. Designed single locking cotton feeder would be a better option to enhance the ginning efficiency of double roller gins.

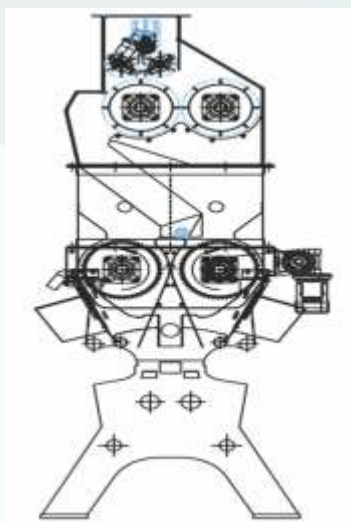


Fig. 2.1 Single Locking Cotton Feeder for Double Roller (DR) Gin

2.2 CORE AREA - II : MECHANICAL PROCESSING, TECHNICAL TEXTILES AND COMPOSITES

2.2.1 Innovative Fibre Blends and Finishes for Cotton Textiles

The functionality of cotton textile materials can be improved by blending cotton with other functional fibres and by developing suitable finishes. Experiments were conducted to study the improvement in blended fabric properties in terms of feel, moisture management, thermal properties, anti-bacterial efficiency, UV-blocking efficiency and crease recovery.

Cotton / Bamboo ZnO Finished Garments

An industrial trial for production of cotton / bamboo viscose blended products was carried out. The blend proportion of 60:40 was chosen after conducting series of experimental trials with different blend

proportions. Cotton bamboo viscose fibres were spun to 30s Ne hosiery grade yarn using compact ring spinning technology and knit into pique structure, which gives a textured surface on fabric. The fabric was bleached using the standard peroxide bleaching method. The bleached material was then given *in-situ* ZnO treatment followed by softener treatment. The developed fabric possesses multifunctional properties of smoothness, softness, antimicrobial properties and UV protection ability. The fabric (GSM 170) was then cut and stitched into garments of different sizes. The produced garment can be used as a leisure wear as well as an active wear.



Fig. 2.2 Cotton / Bamboo Viscose T-Shirt

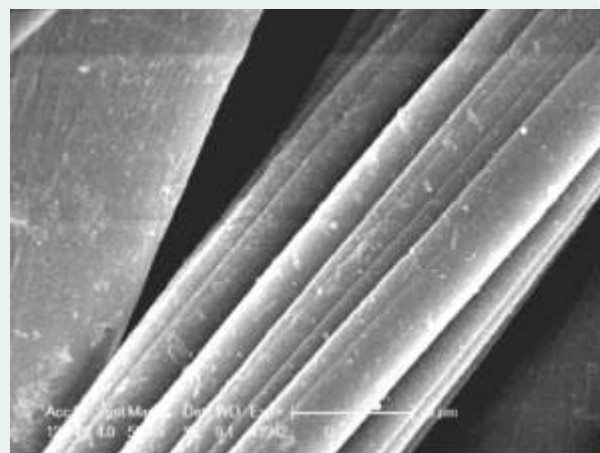


Fig. 2.3 Zinc Oxide Particles on the Fabric

Cotton / Super Absorbent Fibre Blend

Cotton and super absorbent fibres (SAF) were mixed and successfully spun into yarn (20s and 30s). SAF material of length 50 mm and fineness 9 denier was used for the blend. A core spun yarn had SAF core and cotton sheath. Non-woven route was also attempted to bring together cotton and SAF for

production of high absorbent wipes. In this case, bleached cotton was mixed with SAF and low melt polyester and nonwoven sheets were made using thermal bonding method. The fabric was of 200 GSM.

Super Critical Dyeing of Cotton/ Bamboo/ PLA

Dyeing of three component blend fabrics was carried out using supercritical carbon dioxide dyeing method followed by low salt dyeing. The PLA part was dyed using supercritical carbon dioxide whereas the cellulosic part was dyed using low salt reactive dyes. The blend proportion of the fabric dyed was 50/30/20 (Cotton/PLA/Bamboo).

Modified disperse dyes were used to dye PLA part at a temperature of 80°C with 28 MPa (280 bar) pressure for a time period of 1h. As supercritical dyeing completely eliminates the use of water and low salt dyeing reduces effluent load, the product produced is environmentally friendly compared to the conventional ones.

2.2.2 Activated Carbon from Cotton Stalk for Protective Textiles

Activated carbon, predominantly an amorphous solid with large internal surface area and pore volume, is known as effective adsorbent due to its highly developed porosity, large surface area, variable characteristics of surface chemistry and high degree of surface reactivity. However, due to high production costs these materials tend to be more expensive than other adsorbents. Activated carbon was developed from cheaper cotton stalks by chemical activation method

by chemical soaking of cotton stalks followed by thermal degradation. The variables in the preparation of activated carbon such as impregnation ratio, temperature and activation time were experimented using a three variable Box-Behnken design based on a quadratic model and a response surface methodology. The responses analyzed for optimization were the yield, methylene blue number and the iodine number.

2.2.3 Anti-Microbial Cotton Textiles

Durable antimicrobial properties in blended yarns and fabrics could be achieved by blending cotton fibre with anti-microbial incorporated fibres. Cotton is easily affected by microorganisms because of large surface area and ability to retain moisture on the fabric. These effects include the generation of unpleasant odour, stains, discolouration in

the fabric, a reduction in the tensile strength of the fabric and an increased likelihood of contamination. By blending the cotton and antimicrobial fibre, a new product was developed for the apparel and home textiles applications such as active wear, hosiery, under wear, carpeting and upholstery for controlling odour and staining.

Cotton Blend with Antimicrobial Polyester Fibre

Polyester antimicrobial fibre with fibre property of 1.2 denier and 38 mm length were tested for the antimicrobial activity as per the ASTM E2149-10 (Table 2.1). The 100% cotton fibres with 2.5% span length of 32 mm and fibre fineness of 3.4 Mic were processed

through the sequence of blow room, carding, drawing, roving and compact ring spinning to a count of 40s with TM of 4.0. The blends with antimicrobial polyester fibre of 80/20, 65/35, 50/50 and 35/65 (cotton/polyester antimicrobial) were also processed.

TABLE 2.1 ANTI-MICROBIAL ACTIVITY OF FIBRES

Sample Description	0 h count (cfu/ml)	1 h count (cfu/ml)	% reduction
Inoculum only- <i>S. aureus</i>	2.4×10^5	1.5×10^4	-
Treated- <i>S. aureus</i>	6.0×10^4	1000	93.30
Inoculum only- <i>Escherichia coli</i>	6.4×10^5	3.2×10^5	-
Treated- <i>Escherichia coli</i>	1.5×10^5	49	99.98

Cotton Blend with X-Static Fibre

Commercially available cotton/x-static blends (95/5 and 90/10) were tested for antimicrobial properties against *S. aureus* and *K. pneumoniae* by AATCC method 147-2004 for both grey and dyed yarn samples.

The preparatory process and dyeing does not affect antimicrobial properties of the yarn. However, 10% X-static fibre in the cotton blended yarn showed better antimicrobial properties than the 5% X-static fibre.



Fig. 2.4 Cotton / X-Static Blends (90/10 and 95/5)

2.3 CORE AREA - III : CHARACTERISATION – COTTON AND OTHER NATURAL FIBRES, YARNS AND TEXTILES

2.3.1 Quality Assessment of Indian Cottons

Pertaining to the zonal trials (north, central and south zones) and national trials under the AICRP on Cotton, samples were received from the cotton breeders throughout the country for assessment of quality parameters at the Institute headquarters at Mumbai and its regional units at Sirsa, Surat, Nagpur, Coimbatore, Dharwad and Guntur.

In all, the data on 3755 samples have been reported of which 2644 samples belong to the national trials, 1058 to the zonal trials (north-210, central-466, and south-382) and 53 samples to the agronomy trials. Fibre quality data of 3702 cotton samples and yarn quality data of 53 samples were compiled, analysed and edited. A technological report was

prepared and presented in the Annual Group Meet held at Surat on April 7-9, 2016.

Realising the significant role played by the Institute in the overall programme of AICRP on Cotton, a new discipline '**Quality Research**' has been added in the project and ICAR-CIRCOT has been included as the 'Principal Investigator' w.e.f. August 30, 2016.

The Central Variety Identification Committee screened 38 proposals and identified 12 proposals (Table 2.2) after due deliberations considering aspects like area, production and fibre qualities.

TABLE 2.2 COTTON VARIETIES IDENTIFIED BY THE CENTRAL VARIETY IDENTIFICATION COMMITTEE

Variety	Type	Zone	Irrigated / Rainfed	Average Fibre Parameters (ICC Mode)			
				SL, mm	Mic	Strength, g/tex	Spinnability
CSH 3075	Compact Hirsutum Culture	North	Irrigated	26.0	4.3	21.7	30s
F2381	Compact Hirsutum Culture	North	Irrigated	27.5	4.7	21.8	20s
F 2276	Hirsutum Culture	North	Irrigated	28.0	4.4	22.1	30s
FHH 209	Intra Hirsutum Hybrid	North	Irrigated	26.5	4.2	21.0	20s
ARBC 19	Compact Hirsutum Culture	Central	Irrigated	26.5	4.9	20.0	24s
RHH 0917	Intra Hirsutum Hybrid	Central	Irrigated	29.7	4.1	21.9	40s
RHB 0812	Inter specific H X H Hybrid	Central	Irrigated	34.8	3.3	26.6	60s
CCH 4474	Compact Hirsutum Culture	South	Irrigated	31.3	3.9	23.7	-
TCH 1705	Compact Hirsutum Culture	South	Irrigated	27.1	4.3	21.5	34s
RHB 0812	Inter specific H X B Hybrid	South	Irrigated	35.5	3.4	26.4	80s
AAH 32	Desi Hybrid	South	Rain fed	22.6	6.0	18.8	Non-Spinnable
GAM 162	Arborerum Culture	Central	Rain fed	24.4	5.1	18.7	16s

2.3.2 Contamination of Indian Cotton

The extent of contamination of Indian cotton was assessed by undertaking a questionnaire survey of 50 spinning mills in Coimbatore (Southern Zone) and Kolhapur (Central Zone) regions as well as textile clusters in Punjab & Haryana (Northern Zone). The major contaminants observed in the lot were fibres and strings of woven plastic and plastic films, sand dust, grease and colour marks, cloth bits, jute & hessian, metal parts and leaf bits. Plastic films were the serious contaminants. The extent of the contamination for different descriptions of cotton processed in the country as evidenced from the response of the surveyed mills are presented in Table 2.3 in the form of percent respondents reporting insignificant, moderate and severe contamination of the cotton processed in their mills.

The overall contamination status of the cotton were graded as insignificant to moderately contaminated with less than 10% of the surveyed mills reporting severe contamination. The nature of the contamination also reveals the prevalence of man-made contamination and also need to develop appropriate packaging material. The study recommends that besides creating awareness on clean cotton picking among the farmers, it is necessary to initiate appropriate quality control at ginneries by increasing the number of bales tested.

The current findings refute the false claims, of Indian Cotton being the most contaminated, made by the International Textile Manufacturers Federation (ITMF), Zurich, Switzerland based on the response of only about 15-16 mills in India.

TABLE 2.3 CONTAMINATION OF INDIAN COTTON

DESCRIPTION	RESPONDENT %		
	INSIGNIFICANT	MODERATE	SEVERE
S-6	74	17	9
MCU 5	68	21	12
DCH 32	73	19	8
MECH	69	26	5
Bunny	70	24	6
All Country /All Growth	74	17	9

2.3.3 Cotton Lint Opener for Fibre Quality Testing

Proper opening of lint samples used for fibre quality testing is essential to get the correct fineness values. Presently HVI testing laboratories generally employ human labour

for opening samples by hand or trash analyser. The extent of lint opening is not uniform and optimum in both these methods and also the speed of opening is very slow. A new device

has been designed and developed for opening cotton lint samples for micronaire testing. The research prototype of the lint opener was fabricated in public private partnership mode at M/s Precision Tooling Engineers, Nagpur.

The machine consists of licker-in cylinder, feeder roller and suction assemblies mounted on a MS frame provided with safety covers. Opening of cotton lint is achieved by carding principle where licker-in wires having sharp profile scrub open the lint fibres. Specially designed 3 mm thick SS sheet is provided underneath the main licker-in cylinder for opening of lint by scrubbing action. Feeder roller assembly ensures proper feeding of the sample lap at the desired feeding rate. Both licker-in cylinder and feeder roller obtain drive from electric motor through pulley and belt-chain arrangement. High voltage brushless blower and HDPE piping arrangement make up the suction assembly for taking the opened lint over to the perforated collection chamber,

which can accommodate about 100 g of opened lint. Glass window in the door provides for viewing the collection of opened lint in the chamber.

Preliminary test trials were conducted for performance evaluation of the Prototype Lint Opener *vis-à-vis* MAG Sitra Trash Separator, SDL Blender and Hand Opening method. The Lint Opener gave performance similar to that of trash separator and SDL blender in terms of specific volume after sample opening. Specific volume of unopened sample (40-60 cc/g) was found to nearly double (90-110 cc/g) after opening using the lint opener. The capacity of the lint opener at 40-50 samples/h was the highest among all the four methods. The machine was formally inaugurated on August 19, 2016 at Nagpur by the ASRB ex-chairman Dr. C. D. Mayee and ICAR-CIRCOT Director Dr. P. G. Patil in presence of CICR Director Dr. K. R. Kranthi and host of representatives from the cotton industry.



Fig. 2.5 Inauguration of Cotton Lint Opener by Dr. C.D. Mayee, Ex-Chairman, ASRB

2.4 CORE AREA - IV : CHEMICAL AND BIOCHEMICAL PROCESSING AND BIOMASS AND BY-PRODUCT UTILISATION

2.4.1 Innovative Finishing Processes for Cotton Garments

An encapsulation process using citronella oil as core material for application on cotton has been optimized. The size of the capsule was in the range of 250-500 nm as analysed by DLS principle using particle size analyser. The capsules were applied on cotton fabric using acrylic binder. The presence of citronella was confirmed through FT-IR spectra.

The presence of a peak at 1736 cm^{-1} related to citronella oil confirms the presence of aromatic oil in the treated fabric. The finishing of

the tested fabric was found to be durable for up to 5 washes. Multi-layer coating method and plasma pre-treatment are being attempted to increase the durability.

Nano TiO_2 and its doped catalyst were used to develop photo-oxidation for denim fading. However, indigo pigments were more resistant to photo fading even after several hours of exposure to UV light. Alternatively, a laccase based eco-friendly enzyme based process has been optimized for fading.

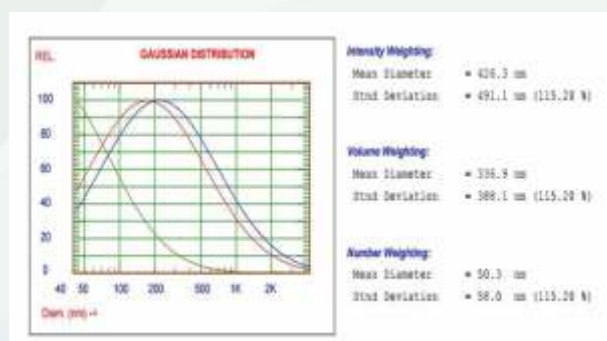


Fig. 2.6 Gaussian Distribution

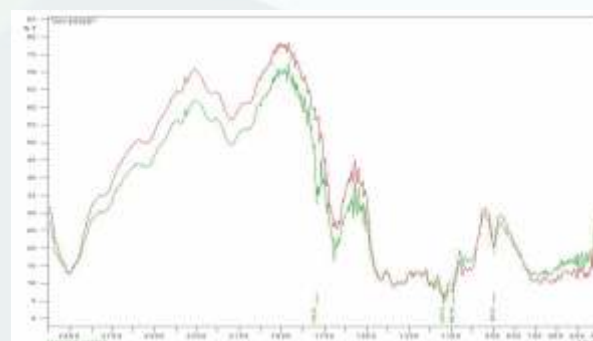


Fig. 2.7 FTIR spectra of treated and control fabrics

2.4.2 Non-Metameric Colour Matching in Textile

Colour matching in textile industry is a complicated process. Presently, the CIE method is used in colour matching, but the issue of metamerism persists. To address this problem, a database has been prepared by dyeing cotton fabrics using various concentrations of reactive dyes through which dye recipe can be calculated to match any shade. Reactive HE dyes (15 different colours) were dyed on cotton fabric samples with 10 different concentrations (0.1 to 4.0%).

Total 150 samples at different range of shades were obtained for each reactive dye. The reflectance values of the dyed samples were measured using spectrophotometer and their alpha values were calculated to use them as input for the software program (database), which has been developed using 'BASIC' language to predict the dye recipe for non-metameric colour matching. The predicted dye recipe provides non-metameric colour matching, which is otherwise known as spectral match.



Fig. 2.8 Cotton samples dyed using Reactive Red HE3B dye

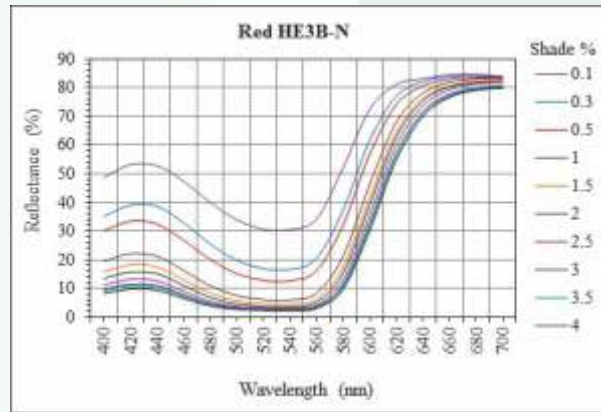


Fig. 2.9 Database for Reactive Red HE3B dye and respective dyed samples

2.4.3 Low-Gossypol Cottonseed Meal for Non-Ruminants

Cottonseed contains about 18-21% oil and 20-23% good quality protein. Oil is widely used for edible purposes after refining but the protein rich meal is only used as ruminant feed due to the presence of gossypol, a poly-phenolic pigment which is toxic to non-ruminants and humans. Gossypol content can be reduced by fermentation but the fermented meal possesses unpleasant dark colour and is not suitable for human consumption.

Attempts were made to remove gossypol by extraction with various solvents. Acetone was found to be the most effective solvent. Mixture of acetone and water reduced free and total gossypol contents of the kernels by 97 and 70 per cent, respectively. Total and free gossypol contents of extracted kernels were 0.56 and 0.015 per cent, well within the BIS limits of 1.2 and 0.06, respectively, prescribed for edible cottonseed flour. Protein and lysine contents of defatted kernel powder were about 50 and 1 per cent, respectively. Efficiency of gossypol removal was higher upon powdering the kernels but filtration was slow and a darkening of kernel powder was observed for acetone-

water solvent, probably due to the interaction with gossypol pigment present in extraction solvent. Flaking of kernels for better solvent contact and ease of filtration and the use of modifiers along with solvent would now be tried to improve gossypol removal with minimum discoloration.



Fig. 2.10: Cottonseed kernel powder after extraction with different solvents

2.5 CORE AREA - V : ENTREPRENEURSHIP AND HUMAN RESOURCE DEVELOPMENT

2.5.1 Compost and Oyster Mushroom Production from Cotton Stalks

In India, about 40 million tonnes of cotton stalks are available annually, most of which are burnt in the field causing emission of greenhouse gases and air pollution. ICAR-CIRCOT has developed technologies for on-farm utilization of cotton stalks to restore soil fertility and bring additional remuneration to farmers by preparation of bio-enriched compost and cultivation of oyster mushroom using cotton stalks.

A farmer can earn ₹ 1000 per acre by preparation of compost from cotton stalks. On an average, one tonne of cotton stalks are generated from an acre of land. The cost of production of one tonne of compost comes out to be around ₹ 3000 which can be sold for ₹ 4000, thus earning a profit of ₹ 1000. The nutrient content of cotton stalk compost is three times than that of farm yard manure. The usage of compost not only increases soil

nutrient content but also biological activity and restores soil fertility.

Oyster mushroom is an edible fungi, rich in protein that easily grows in ligno-cellulosic residues. With a production cost of ₹ 50 and the selling price of ₹ 80, a farmer can make a profit of ₹ 30 per kg of oyster mushroom. Demonstration unit for production of bio-enriched compost and oyster mushroom cultivation using cotton stalks were set-up at GTC, Nagpur for imparting hands-on-training to farmers.

A total of 14 such training-cum-awareness programs for about 300 farmers from 12 villages (Palasgaon, Satoda, Rehaki, Ghorad, Digras, Sirasgaon, Tekoda, Godavari, Amgaon, Mopa, Kadki and Pavnoor) of Wardha and Nagpur districts in Maharashtra were conducted during the year 2016-17.

2.5.2 Nano-Cellulose for Cement Concrete, Rubber Composites and Paper

Nano-cellulose reinforced cement concrete was produced and analyzed for mechanical and functional properties.

Increase in compressive and flexural strength of cement concrete: An optimum NCC content is found to be 1% where compressive strength and flexural strength showed increment of 8.7 and 4.9 percent, respectively. The 0.5% reinforcement level is found to be optimum for NFC with increase in compressive strength by 13% and flexural strength by 12.5%. NCC showed better results as compared to NFC at all tested reinforcement levels.

Increase in durability of the concrete: Nano-cellulose can be effectively used in plain concrete to increase the flexural strength of concrete without compromising compressive strength. It is feasible to incorporate nano-cellulose in M40 grade concrete where flexural strength is of vital importance. Further investigation is necessary to identify the effects of nano-cellulose on different grades of concrete. Apart from its mechanical properties its sustainability can also be an advantageous factor in adopting nano-cellulose as a component of concrete as it is cheap, abundant, renewable, and bio-degradable.

2.5.3 Scientific Cottonseed Processing in India

Scientific cottonseed processing needs to be promoted among stakeholders in India. To investigate the current situation of units involved in scientific cottonseed processing, an assessment study was undertaken in cooperation with All India Cottonseed Crushers Association (AICOSCA), National Cotton Ginners Association, All Gujarat Cotton Ginners Association, Maharashtra Cotton Ginners Association and Solvent Extractors Association of India. Different types of assessment questionnaires were designed for various stakeholders that include conventional cottonseed processing units as well as units who have already adopted scientific

cottonseed processing. Along with them other stakeholders are the purchasers and users of the products whether it is the conventional (oil and de-oiled/ un-decorticated cake) and scientifically processed (linter, hull, oil and de-oiled meal). The questionnaire includes sections such as basic information about the unit, technological information, machineries installed, products manufactured, human resource employed, advantages and disadvantages of the scientific processing of cottonseed, constraints if any, rectification needed (technological, financial, statutory), view point for the future for the industry.

2.6 EXTERNALLY AIDED PROJECTS

2.6.1 Cotton Technical Assistance Programme (Cotton TAP)

Cotton Technical Assistance Programme (TAP) for Africa was initiated as an outcome of the second Indo-African summit aimed to strengthen the cotton value chain in the cotton-4 countries (Benin, Burkina Faso, Chad and Mali) and Malawi, Nigeria and Uganda in Africa. The specific objective of ICAR-CIRCOT is to enhance the capacity of professionals in targeted countries in post-harvest management and utilization of crop residues; increase the critical mass of the professionals in targeted countries for post-harvest management and utilization of crop residues and create the knowledge cluster cum training centre on ginning and post-harvest based industries on pilot basis to promote technology led interventions.

An in-country training programme on “post-harvest management of cotton and value addition to biomass” was organized at Ouagadougou, Burkina Faso during May 16-17, 2016, which was attended by 17 participants.

Under component B6, CIRCOT officials also visited Bohicon, Benin during May 18-24, 2016 to monitor the progress of erection and commissioning of regional knowledge cum training centre for post-harvest & ginning technology. The commissioning of machinery and the trials of individual machinery were completed successfully.



Fig. 2.11 Regional knowledge cum training centre for post-harvest & ginning technology at Bohicon, Benin, Africa

2.6.2 Technology Mission on Cotton (TMC) - Mini Mission

Cotton Picking Machinery for Small Scale Cotton Production Systems

Small scale cotton pickers, suitable for small farm sizes and multiplicity of genotypes and available power sources under Indian conditions, were designed and developed for enhanced cotton picking rates. Cotton strippers were developed for harvesting of cotton under High Density Planting System (HDPS).

A viable solution was also worked out for on-board cleaning of the machine stripped trashy cotton. A set of cleaning machinery consisting of 6-cylinder cleaner, a stripper, 2-stage stick machine and impact cleaner can bring down trash content in machine picked cotton from 30% to about 9 and 6 per cent in single and double pass, respectively.

Brush type stripper consists of two rotary brushes for stripping of cotton from plants and auger conveyors for collection of the stripped cotton, which is fed to a belt conveying system. The onboard cleaner was used for cleaning the stripped cotton. The stripper was able to harvest cotton from above the plant height of 30 cm and the cotton bolls situated below it remained un-harvested, mainly

because of positioning of brushes at that height above the ground surface.

The performance of the brush type stripper was compared with that of the finger type stripper. It was found that brush type stripped cotton is much cleaner than the finger type stripped cotton with trash contents of brush type and finger type stripped cottons as 16 and 29 per cent respectively, on raw cotton basis.

Agro Techniques for High Density Planting System and Surgical Cotton Varieties

Cotton is used for technical applications such as surgical or absorbent cotton and offers good prospects for value addition. Short fibre, high micronaire, desi cotton is especially suitable for such applications due to high absorbency. Surge in demand for absorbent cotton has led to a shortage of desi cotton. The project aims to identify desi arboreum cultures suitable for absorbent cotton applications and to explore eco- friendly ways of making absorbent cotton. More than 150 cultures have been earlier screened for fibre properties and were used subsequently to make absorbent cotton. The cotton thus prepared was analyzed for various criteria for absorbent cotton prescribed by BIS and Indian

Pharmacopoeia (IP) and it was found that most of these cottons are suitable.

Twenty three arboreum cultures received from CICR, Nagpur were analyzed for fibre properties and absorbent cotton was prepared by using single step chemical process. Evaluation for absorbency, sinking time, water holding capacity, and sulphated ash revealed that all test samples meet the criteria and therefore are suitable for absorbent cotton applications.

Three methods of making absorbent cotton viz., single step chemical, enzymatic and microbial (employing CIRCOT anaerobic microbial consortium) were studied using

Phule Dhanwantary cotton cultivar for identifying an eco-friendly method.

All the three processes produced the absorbent cotton meeting standard performance criteria. However, it was observed that enzymatic process resulted in significantly lower sulphated ash content and single step chemical process resulted in lower whiteness index. Water consumption and effluent load in terms of COD and BOD was higher for single step chemical process, but chemical consumption in this method was lower. Also the effluent pH value of 9 was within the permissible limits whereas other process effluents were more alkaline.

TABLE 2.4 PROPERTIES OF ABSORBENT COTTON (PHULE DHANWANTARY) BY DIFFERENT PROCESSES

Process	Sulphated Ash (%)	Absorbency Time(s)	Sinking Time(s)	Water Holding Capacity (g/g)	Water Soluble Matter (%)	Whiteness Index(CIE)
Chemical	0.40	1.2	1.9	24.6	0.19	52.6
Enzymatic	0.17	1.3	1.9	25.8	0.26	59.8
Microbial	0.42	4.6	6.3	27.8	0.45	59.1
Standard	≤ 0.5	≤ 10.0	≤ 10.0	≥23.0	≤ 0.5	-

2.6.3 Agri-Business Incubation (ABI) Centre

In January 2016, ICAR sanctioned an agri-business incubation (ABI) centre under the XII plan scheme of National Agriculture Innovation Fund (NAIF) (Component II) – Incubation Fund to CIRCOT, Mumbai. Opened with the launch workshop on February 5, 2016, the ABI centre has been created to promote incubation and

business development in cotton and its by-products, conduct techno- entrepreneurial activities in cotton value chain for building prospective clientele and to facilitate skill development of selected stakeholders in the cotton sector.

TABLE 2.5 ENTREPRENEURS ADMITTED FOR INCUBATION FOR DIFFERENT TECHNOLOGIES

TECHNOLOGIES FOR INCUBATION	INCUBATEES ADMITTED
Nano-Cellulose Application in Textile- Yarn Spinning	M/s The Kadri Mills Ltd, Coimbatore, Tamil Nadu
Development of Cotton Reinforced Rubber Baton	M/s Life Long Combines, Kerala
Cotton Lint Opener	M/s Precision Tooling Engineers, Nagpur
Development of Clothing using Cotton Blends	M/s Greyy, Navi Mumbai
Development of Thermal and Bath Blankets using Cotton and Biodegradable Polyester	M/s Bloom Textile, Tamil Nadu

2.6.4 ICAR - Extra Mural Project on Specialty Grade Pulp from Natural Fibres

High quality paper was made from pulp prepared using natural fibres such as cotton, cotton linter, and banana and flax fibres. Paper was obtained from both un-bleached and bleached pulps of cellulosic fibres having beating degree of 50°SR well within the recommended range of 50-55 °SR. The quality of handmade paper was compared with standard paper in terms of mechanical and optical properties.

Papers made from unbleached banana fibres showed very high double fold and bursting strength compared to papers from cotton fibre and cotton linters. However, the brightness was observed to be good in case of cotton and cotton linter. Brightness was exceptionally low in case of banana fibre. Brightness improved significantly by bleaching, although adversely

affecting double fold and bursting strength. The drop in double fold was more pronounced in case of paper made from cotton fibre than that made from banana fibre.

Flax fibre emerged as the best among all the fibres in terms of double fold even after bleaching. Its bursting strength was found to be higher than the standard requirement and very close to banana fibre which had highest bursting strength. Though, banana and flax fibres display very good physical properties, yet they are poor in case of α -cellulose content and brightness. They may be blended with either cotton fibre or cotton linters to get the required brightness and α -cellulose content desired of standard high grade papers.

**TABLE 2.6 PROPERTIES OF HANDMADE PAPER (90GSM)
MADE FROM CELLULOSIC FIBRES**

Parameters	Cotton		Banana		Flax		
	Unbleached	Bleached	Unbleached	Bleached	Unbleached	Bleached	Standard Requirement
Brightness, %	67.6	79.7	46.5	57.2	18.32	61.9	84
Bursting Strength, kg/cm ²	3.4	2.2	2.7	5.4	7.2	3.8	2.5
Double Fold, No.	900	207	280	2835	4585	4269	1200

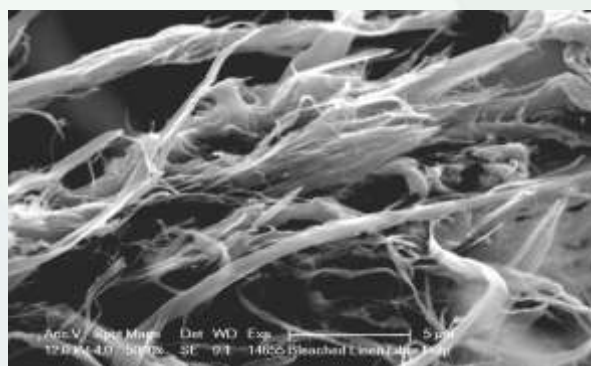
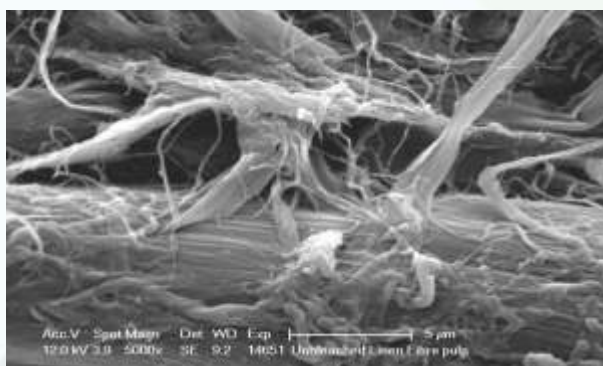


Fig. 2.12 SEM images of unbleached and bleached pulps

2.6.5 Consortia Research Project (CRP) on Nano Technology

Cellulose based Nano-Composite Films for Food Packaging

Widely used polymers from synthetic materials are high molecular weight substances usually produced from petroleum based raw materials. Most of these manmade polymeric substances are non-biodegradable. Moreover, fossil fuel resources are depleting day by day. Excess use of non-biodegradable polymers is also causing serious environmental issues. Hence, there is increasing attention for polymeric products that are biodegradable and obtained from renewable resources. Promising one among them are the starch based films.

However, it is very difficult to process starch in commercial melt-blowing process due to its thermo-labile nature. Also, starch films are highly hydrophilic in nature and have very poor mechanical strength.

The focus was to develop a simple and efficient process for preparation of starch based films having better gas and moisture barrier properties and suitable for food packaging. It was also attempted to detect fish spoilage during storage using pH based colour sensor. When fish spoils, it releases volatile amines which are detected using appropriate pH detectors based on colour change.

The transmission, solubility, tensile properties and water vapour transmission rate (WVTR) of starch nano-composite films were studied. There was a significant increase in tensile properties and reduction in water vapour transmission rate due to addition of nano-fillers in starch film. The surface morphology was characterized by scanning electron microscopy (SEM) and atomic force microscopy (AFM).

Various pH indicators were evaluated for use along with the starch film (while packaging). The source of gas release was Triethylamine (1:1500) in 1ml. The change in colour of the sensor due to its exposure to amino compounds suggests the possible application in fish packaging wherein, volatile amine compounds are released during the fish spoilage. Also, the sealability of these films was found to be very good using commercial thermal sealing machine. Storage trials of starch films were carried out both in ambient environment and refrigerated condition. Fish stored in the Chitosan/Nano-Ag impregnated starch film could withstand for three months even in the ambient environment.

Nano chitosan was prepared by ionic gelation process and nano-chitin was prepared by high speed homogenization process. The tendency of aggregation of nano-cellulose during drying process was overcome by addition of stabilizer. Among the three starches tried-potato, tapioca and corn, film formation was very good with the corn starch. Pilot scale starch film (control) was prepared at M/s Steer Engg, Bangalore. Stable & self-standing starch composite films could be prepared by solvent-casting process using nano-cellulose as reinforcing agent and nano-chitosan/nano silver as antimicrobial agent. AFM and SEM micrographs showed the presence of uniformly distributed nano-materials. The transmission of the films were reduced to the level of 10% due to addition of nano-materials. Significant improvement in tensile properties and reduction in water vapour transmission rate were noticed due to addition of nano-materials. Nano-composite films were found to be stable in the ambient environment for more than three months. Starch-nano-composite films can hold oil after thermal sealing, without any leakage or deformation.

TABLE 2.7 PROPERTIES OF NANO COMPOSITE STARCH FILMS

Starch Films	Transmission (%)	Solubility (%)	Tensile Properties		Water Vapour Transmission Rate (g/m ² h ⁻¹)
			Tensile Stress at Break (MPa)	Tensile Strain at Break	
Control	75.50 ± 3.1	18.33 ± 0.2	2.1 ± 0.5	0.33 ± 0.04	0.044
Nano-Chitosan	64.35 ± 4.6	23.33 ± 2.3	2.3 ± 0.4	0.35 ± 0.04	0.039
Nano-Cellulose	64.39 ± 1.3	21.11 ± 1.1	3.7 ± 0.8	0.34 ± 0.03	0.036
Nano-Chitosan + Nano-Cellulose	62.40 ± 1.1	17.14 ± 2.6	3.5 ± 0.8	0.29 ± 0.03	0.035

**TABLE 2.8 SENSING TRI ETHYL AMINE
(REPRESENTATIVE CHEMICAL) USING PH INDICATORS**

Indicator	Solvent Concentration	pH	Exposure Time, min	Color Change
Methyl Red	2ml Ethanol + Sample 0.5mg	4.1	05	Light Red - Yellow
Phenol Red	2ml Ethanol+ Sample 5.0mg	3.5	10	Yellowish Orange - Red
Neutral Red	50% 2ml Acetic Acid +Sample 5mg	3.5	15	Light Brown - Dark Brown
Bromo Cresol Green	40ml DI Water +1gm Sample	3.5	15	Yellow - Blue
Bromo Thymol Blue	40ml DI Water +1gm Sample	6.5	10	Light Pink - Light Yellow
Bromo Phenol Blue	40ml DI Water +1gm Sample	3.1	10	Light Pink - Light Yellow

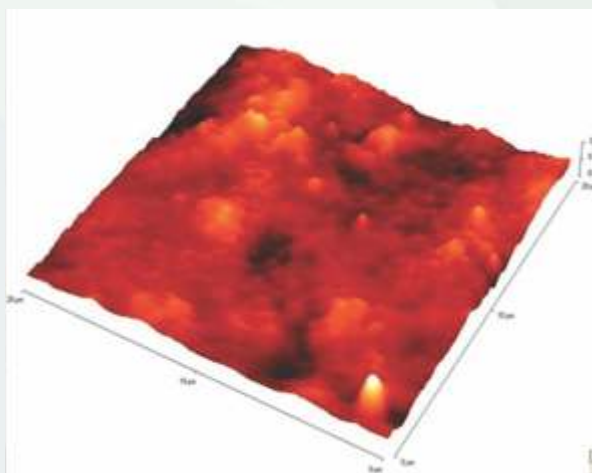
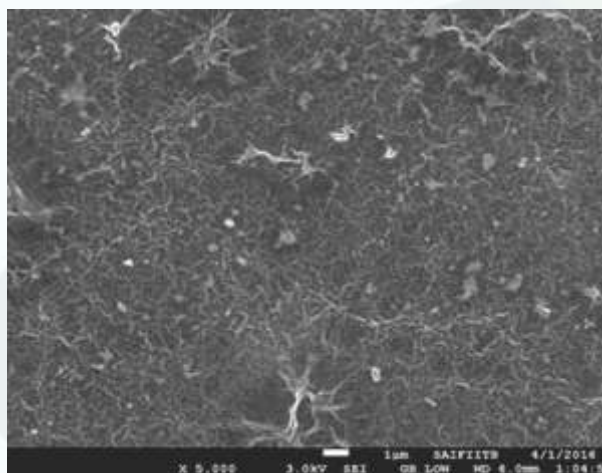


Fig. 2.13 SEM and AFM images of starch nano-composite films

2.6.6 Consortia Research Projects (CRP) on Natural Fibres

CRP.01 : Utilization of Ligno-Cellulosic Fibre Based Biomass as Renewable Energy

Optimization of Moisture Content

Pelleting of cotton stalk beyond 35% moisture content produces pellets having over 10% moisture content. Excess moisture in pellets gets evaporated during storage that reduces pellet strength and density. The 20% moisture level was found to be optimum for optimization of other process parameters.

Optimization of Particle Size

Reduction of caloric value and increase in ash content was observed with reduction in particle size as most of the minerals present in milled cotton stalk passed through sieves while fibres having high caloric value and low ash content were segregated. Hence, pellets prepared from sieved fine material had low

calorific value and high ash content. Particle size of 3 mm was considered as optimum for preparation of pellets.

Effect of Blending Materials

Pellets were prepared from cotton stalk by blending 4% and 8% of both cashew nut shells and sal seed powder and 45% coal fines and 5% molasses. Blending of cashew nut shells and sal seed powder with cotton stalk improved bulk density, durability index and calorific values of pellets and reduced the ash content. Blending of 8% cashew nut shells with cotton stalk yielded the best quality pellets.

CRP.02 : Nano-Ligno-Cellulose for Polymer Composites

Nano-cellulose, though a high-strength additive material, is not compatible with many of the commodity polymers that are hydrophobic in nature. Nano-Ligno-Cellulose (NLC) was isolated from coconut fibers and cottonstalks for use as fillers in epoxy resin composites. Due to partial hydrophobicity of lignin, NLC could be uniformly dispersed in the epoxy resin. The process for preparation of NLC from coconut fibers by a two stage process (Refining and Homogenization) was optimized. The NLC was used as filler in preparation of epoxy composites. Addition of fibrillated coconut fibers significantly increased the impact strength while the tensile strength and ductility index reduced indicating an increase in brittleness and Young's modulus. Increase in refining time improved thermal stability of prepared composites impregnated with coconut fibres as indicated by their increased melting temperature.

Effect of Starch as Binder

Starch as binder was found to improve the characteristics of cotton stalk pellets. Pellets prepared with 0.075% starch binder can be used in special applications where high bulk density and durability are required.

Effect of Sieving

Effect of sieving on properties of pellets was studied to improve the calorific value and ash content of the final product. Cottonstalks milled to 3 mm and 8% cashew nut shells produced pellets meeting all standards of premium grade as prescribed by Pellet Fuel Institute, USA except the ash content percentage.

Thus, NLC could be produced from coconut fibres by a two stage process: refining and high pressure homogenization; and from cotton stalks by a three stage process: pulverization, refining and high pressure homogenization. NLC having a mean size of 375.5 ± 28.8 nm and zeta potential of -27 mV could be produced. Better phase mixing of nano-fillers in composites was demonstrated by measuring the surface resistivity of composites. About 61% increase was noticed in impact strength due to addition of NLC in epoxy composites.

The potential areas of applications of nano-composites include panelling/helmet shell; electrical insulation panels & in electronic circuits; molds, master models, laminates, castings, fixtures; components for air-craft, high-performance boats and automotive; filament wound pipe for oil industry; windmill blades and sports equipment.

TABLE 2.9. IMPACT & TENSILE STRENGTH ANALYSIS

Samples	Damage Force (N)	Total Energy (J)	Ductility Index	Tensile Load (N)	Total Energy (%)
Epoxy	4.75 ± 2.15	1.05 ± 0.35	72.99 ± 24.80	2950 ± 232	8.9 ± 0.2
Epoxy + Raw Coconut Fibres	3.56 ± 2.30	3.18 ± 0.79	60.12 ± 12.25	1090 ± 192	4.1 ± 0.6
Epoxy + Fibrillated Coconut Fibres	5.72 ± 0.80	1.39 ± 0.38	40.79 ± 08.50	1220 ± 415	4.4 ± 0.5

TABLE 2.10 THERMAL STABILITY OF EPOXY COMPOSITES BY DSC ANALYSIS

Samples	Melting Temperature (°C)
Epoxy alone (Control)	294.75
Coconut fibres reinforced	338.96
Refined fibres reinforced (10 min)	353.27
Refined fibres reinforced (20 min)	353.41
Refined fibres reinforced (30 min)	351.80
Refined fibres reinforced (40 min)	350.99

**Fig. 2.14 Epoxy resin composites impregnated with cotton stalks and NLC prepared from cotton stalks**

CRP.03 : Eco-Friendly Method of Preparing Absorbent - Surgical Cotton

An ecofriendly process was developed for preparation of absorbent cotton from non-spinnable short staple cotton fibres. The crude enzyme extract of solid state fermentation was employed for absorbent cotton treatments. Solid state fermentation conditions and absorbent cotton process parameters were optimized. The 7 seconds absorbency period was recorded under optimized solid state fermentation conditions - fungal strain (*P. flabellatus*), substrate composition of 60:30:10 (banana pseudo stem, cottonseed hulls and cottonseed meal) and fermentation period of 5 days.

Process parameters of single bath enzymatic scouring and bleaching process were optimized as enzyme extract (30 gpl), temperature (60°C), time (40 min), pH (7.0) and wetting agent (1 gpl) to get the absorbency period of 3 seconds and whiteness index of 31.5. The pectinase and laccase activity recorded in the enzyme extract was 25 and 7 units/ml respectively. The characterization using Scanning Electron Microscope (SEM) revealed the fibre surface modification in the enzyme treated cotton.

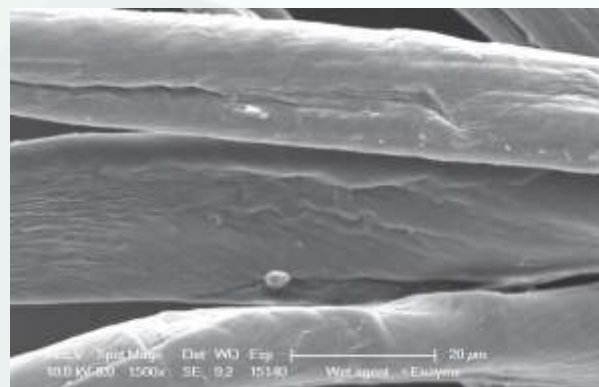
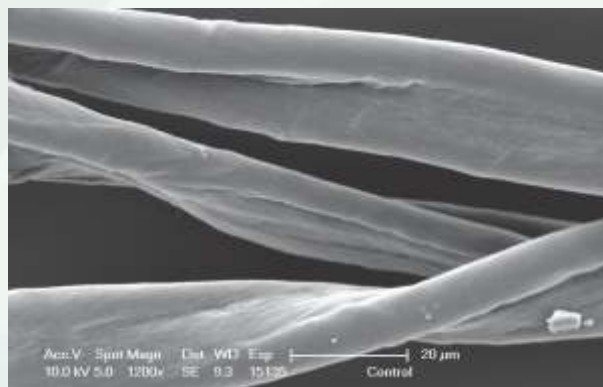


Fig. 2.15 SEM micrographs of raw and enzyme treated cottons



Fig. 2.16 Absorbent and Non-Absorbent Cotton

CRP.04 : Sustainable Green Technology for Dyeing of Cotton Textiles

Reactive dyes are widely used in cotton materials due to their brilliant colours and overall good fastness properties. Large amount of inorganic electrolytes such as sodium chloride and sodium sulfate are added during dyeing of cotton using reactive dyes for exhaustion. Electrolytes released as effluents after dyeing require sophisticated treatment processes to remove them. In order to solve the problem, an attempt was made to cationize cotton fabric using quaternary ammonium compounds followed by dyeing using reactive dyes (Crimson HEXL).

The k/s value of cationized cotton fabric dyed without using salt was 59.6 which was higher than 56.1 obtained in case of cotton fabric dyed using the conventional salt method. The k/s value of the control cotton fabric dyed

without salt was 24.3. These results indicate that the cationized cotton fabric can be dyed without addition of salt and the dye shade comparable to that of cotton fabric dyed using conventional method with addition of salt can be obtained.



Fig. 2.17 Salt free dyed T-shirts



Fig. 2.18 Cotton fabrics dyed with and without salt using crimson HEXL reactive dye



3. INSTITUTE TECHNOLOGY MANAGEMENT

The Institute is engaged in developing new technologies and refinement of the already developed technologies in the areas of post-harvest processing of cotton, eco-friendly finishing of textiles and utilization of cotton stalks. Technologies developed are protected through management of intellectual property

3.1 Intellectual Property Management

Institute Technology Management Unit (ITMU) takes care of the protection of intellectual property rights of the technologies developed in the Institute and is also involved in

rights. Assessment, popularization and commercial adoption of viable technologies are carried out through demonstrations, industrial trials, awareness meets, exhibitions and seminars. Impact assessment of already commercialized technologies is also taken up.

commercialization of these technologies. The table below gives an account of various activities in the ITMU during the year.

TABLE 3.1 PATENTS GRANTED

Sr. No.	Patent Title	Patent Number	Date of Grant	Inventors
1	New Enzymatic Process for the Preparation of Absorbent Cotton From Non Spinnable Short Staple Cotton	273512	13.06.2016	S. G. Gayal R. D. Nagarkar
2	Process for the Preparation of Cellulose Nanoparticles using the Fungus, <i>Trichoderma reesei</i>	275149	24.08.2016	Dr. N. Vigneshwaran Dr. A.A. Kathe

3.2 Agri-Business Incubation (ABI)

ICAR-CIRCOT has established an Agri-Business Incubation (ABI) Centre for the benefit of prospective entrepreneurs who wish to start their own units using Institute technologies for post-harvest processing of cotton and value addition to its by-products.

One such entrepreneur, Ms. Pratima Uke from M/s Green Globe, Mumbai, was incubated with a focus on launching a new product “Anti-Microbial Cotton Bed Sheets”, which uses *in-situ* nano-ZnO preparation technology developed in the Institute. The product is

targeted for use in hospitals, hotels, railways, hostels and even in homes; to avoid cross-contamination due to its anti-microbial property. The anti-microbial cotton bed sheets were given to the incubatee for Test Marketing and obtaining the market acceptability and feedback. To validate this technology, a large scale trial was undertaken on 5000m long cotton fabric to produce antimicrobial bed sheets by M/s Green Globe at M/s Ujwal Texprints, Madhavnagar, Sangli.

Two young entrepreneurs from Kerala Shri. C. A. Manoj Kumar and Shri. K. K. Anand were admitted as incubatees for 'Development of Cotton Reinforced Rubber Baton' through an MoU on June 30, 2016. The rubber baton has

applications in the police force and the security agencies of the country.



Fig. 3.1 An MoU being signed with Kerala entrepreneurs C.A. Manoj Kumar and K.K. Anand for 'Development of Cotton Reinforced Rubber Baton' on June 30, 2016



Fig. 3.2 Dr. P. G. Patil, Director, ICAR-CIRCOT Mumbai handing over the anti-microbial cotton bed sheets to Ms. Pratima Uke, M/s Green Globe, Mumbai on August 17, 2016

3.3 Technology Assessment and Transfer

An industrial trial on nano-cellulose application in textile-yarn spinning was undertaken at Coimbatore spinning mill to evaluate use of nano-cellulose suspension as an alternative

for mixing oil that is conventionally used to spray on cotton fibres for enhanced fibre-fibre cohesion and reduced static charge accumulation.

3.4 Awareness Meets and Demonstrations

The Institute conducts awareness meetings and demonstrations regularly at its Mumbai headquarters and all the regional centres located in various parts of the country for the benefit of the cotton farmers, traders and other stake holders.

GTC Nagpur conducts such programmes throughout the year where farmers from cotton growing areas of Maharashtra and other states come to get the first hand feel of the Institute technologies in ginning and by-products utilization for value addition. During 2016-17, twenty farmers from Madhya Pradesh visited GTC Nagpur on August 29, 2016 and October 14, 2016 for learning the importance of clean cotton picking and value addition to cotton and better utilization of cotton by-products for increasing additional remuneration through cotton cultivation, briquetting, pelleting and composting of cotton stalks. A one-day awareness and demonstration programme was organized on the preparation of bio-enriched compost and oyster mushroom cultivation from cotton stalks for 35 villagers of Pavnoor, Wardha on January 30, 2017.

Sirsa centre also organised a one-day awareness meeting for the farmers of Shahpur

Begu village on November 18, 2016. Cotton farmers were delivered lecture on picking and provided training followed by on-farm live demonstration in the field. They were given tips on how to pick clean cotton and minimise contamination in storage and transportation to market. They were also made aware of how trashy and contaminated cotton increases cost of yarn and fabric production which results in cotton fetching lesser price in the market. Shri Rajaram, an award winning progressive farmer and Secretary, Kisan Club, Sirsa shared his experience and spoke about the benefits of clean cotton picking. A display of commonly found contaminants was also made for the awareness of cotton pickers and farmers.

Under the aegis of Mukkhya Mantri Khet Tirth Yojana, seven farmers of Hoshangabad (MP) visited GTC, Nagpur on July 05, 2016 and participated in the awareness and demonstration programme.

Awareness Programme for farmers on 'Production and Post-Harvest Processing Technologies of Cotton' was organized for 80 farmers at ICAR-CIRCOT, Mumbai on August 19, 2016.

3.4.1 Pradhan Mantri Fasal Bima Yojana (PMFBY)

Ginning Training Centre, Nagpur participated in farmers' awareness meet on Pradhan Mantri Fasal Bima Yojana (PMFBY) organized by ICAR-CICR, Nagpur on April 16, 2016. The meeting was presided over by Shri. Nitin Gadkari, Hon. Union Minister for Road Transport, Highways and Shipping. Shri Krupal Tumane, Member of Parliament, Ramtek (MS) and Dr. C.D. Mayee,

ex-chairman, ASRB were the Guests of Honour on the occasion. Shri. Nitin Gadkari ji urged farmers to effectively utilize the PMFBY scheme and protect the crop from any natural disasters. Institute technologies, processes and products were displayed in the exhibition organised on the occasion. More than three hundred farmers and stake holders attended the program.



Fig. 3.3 Union Minister Shri. Nitin Gadkari at farmers awareness meet on Pradhan Mantri Fasal Bima Yojana (PMFBY) at Nagpur on April 16, 2016

3.4.2 Oyster Mushroom Cultivation

An awareness-cum-demonstration program was organised at Godavari village, Ashti taluk, Wardha district, Maharashtra on May 20, 2016 for preparation of compost and oyster mushroom production using cotton stalks. Twenty-five farmers participated in the program. Shri. Y. N. Kabra, a progressive farmer from Godavari village gave the welcome address and scientists Dr. V. Mageshwaran and Er. Varsha Satankar delivered lectures and demonstrated the technology for preparation of bed for mushroom cultivation. Demonstration was conducted with respect to spawn production and cultivation of mushroom using cotton stalks. Farmers were also demonstrated about preparation of pellets from cotton stalks.

The training programme was repeated on September 17, 2016 and January 30, 2017 at GTC Nagpur for the benefit of other batches of farmers from Wardha district.

One day training program on the preparation of compost and oyster mushroom from cotton stalks for twenty-two farmers from Amgaon and kadki villages under Selu Taluk in Wardha district and Mopa Village under Kalmeshwar Taluk in Nagpur district was organized on January 28, 2017 at GTC, Nagpur.



Fig. 3.4 Training on oyster mushroom cultivation and preparation of compost from cotton plant stalks at Godavari village, Asti, Wardha, Maharashtra on May 20, 2016

3.4.3 Organic Farming Incentives Plan

A farmers' awareness programme was organized at Nagpur on May 3, 2016, under Organic Farming Incentives Plan. Seventy-One farmers of Balaghat (MP) participated in the programme. Dr. S. K. Shukla, Officer In-charge, GTC, Nagpur explained about research activities and methods for collection and utilization of cotton stalk and other agro residues to increase farm income. Dr. V. Mageshwaran, scientist explained about preparation of bio-enriched compost from cotton stalk and other agro-residues. Farmers were also shown live demonstration of fibre testing, particle board preparation, ginning and pressing operations.



Fig. 3.5 MP farmers visited GTC Nagpur on May 3, 2016 under Organic Farming Incentives Plan

3.4.4 Kisan Goshti

Kisan Goshti cum technology demonstration programme was organized for farmers of Rehaki and Antargaon in Selu taluka of Wardha district on July 29, 2016. The program was aimed (i) to identify current problems faced by farmers in cotton cultivation (ii) at increasing farm income through adoption of best management practices and (iii) to share latest farmer friendly technologies.

Methods for achieving substantial increase in cotton productivity, reducing the production

cost, optimum cotton plant population, timing and doses of fertilizers and micronutrients, soil health, etc. were explained to the farmers. Importance of cotton quality parameters, safe cotton storage practices, impact of moisture during picking and storage were also highlighted. Team of experts visited farmers' fields and demonstrated effective method of fertilizer application. Rhizobium seed treatment for improved nitrogen fixation was also illustrated.

3.4.5 Training of Women Farmers on Utilization of Cotton By-Products

Three one-day training programs on cotton by-products utilization were organized for more than 200 women farmers each from three districts of Wardha, Amravati and Nagpur during September 27-29, 2016. New opportunities exist in the area of cotton by-products utilization to enhance livelihood of women farmers. The programme covered topics like cultivation of oyster mushroom using cotton stalk, surgical cotton preparation, poultry feed from cottonseed meal and preparation of briquettes and pellets from cotton and other agro residues. Demonstrations on preparation of value added

products from cotton stalk were also conducted.

A one day awareness program on Cotton stalks processing and utilization was conducted at GTC, Nagpur for seventeen trainees from Regional Centre of Organic farming under skill development programme for organic growers on March 30, 2017. The trainees were briefed about collection and logistics of cotton stalks for generating energy, both theoretical and practical session on preparation of bio-enriched compost and growing oyster mushroom using cotton stalks.



Fig. 3.6 Training program on cotton by-products utilization for women farmers at Wardha and Amravati during September 27-28, 2016

3.5 Exhibitions and Agri-Fairs

The Institute participated in and arranged various exhibitions and agricultural fairs organized in different parts of the country and displayed its technologies benefiting a large number of farmers and stakeholders.

As part of the ICAR initiative on doubling farmers' income through increasing productivity and adoption of latest farm and processing technologies, ICAR-CIRCOT, Mumbai in association with Agro-plus Foundation, Nagpur organized a Technology and Machinery Demonstration Mela-2017 on Cotton Processing & By-product Utilization on March 01, 2017 at Ginning Training Centre, Nagpur. Over 150 farmers from 10 villages of Wardha and Nagpur districts, scientists, stakeholders from industries and research organizations attended the program.

1. All India Meet on Cotton Trade organized by Khandesh Ginning and Pressing Factory Owners and Traders Association, Jalgaon on October 15, 2016.
2. Demonstrations to women farmers from Farmer Training Center, Khedbrahma, Dist: Sabarkantha, Gujarat on January 23, 2017.
3. Exhibition-cum-National Seminar on Wealth from Waste: Technology Options in Agriculture & Allied Sectors for enabling Swachh Bharat Mission at KVK, Shikohpur, Gurgaon on October 27, 2016.
4. Maha-Agro exhibition jointly organized by Marathwada Sheti Sahay Mandal and Maharashtra Chamber of Commerce, Industry and Agriculture at Aurangabad, Maharashtra during December 24-27, 2016.

5. Vigyan Yagya – 2016 at Vidyavihar, Mumbai during December 07-10, 2016.
6. Krishi Unnati Mela 2017 at IARI campus, New Delhi from March 15-17, 2017 jointly organized by ICAR and Ministry of Agriculture & Farmers Welfare.
7. Technology and Machinery Demonstration Mela-2017 on Cotton Processing & By-Product Utilization at GTC Nagpur on March 01, 2017



Fig. 3.7 Shri. Sudarshan Bhagat, Minister of State for Agriculture & Farmers Welfare and Shri. Chhabilendra Roul, Secretary, ICAR at the Institute stall



Fig. 3.8 Student visitors at the Institute exhibition stall taking keen interest in cotton by-products



4. TRAINING AND CAPACITY BUILDING

In pursuit of achieving excellence in the field, training and capacity building activities continue in the Institute throughout the year, both for its own employees including all categories of staff right from the top management to the supporting staff and for its different stakeholders including farmers, industry personnel, students and others. Training programmes cover diverse areas right from clean cotton picking, ginning to cotton quality evaluation for farmers and personnel from cotton trade and industry. Ginning Training Centre, Nagpur conducts training courses for gin fitters and other workers in ginning industry on technologies for production of clean quality cotton, maintenance of various ginning and allied machines apart from solving technical problems arising in ginning industry. The Institute also organises customized special

training programmes on spinning, quality evaluation, and chemical characterisation to personnel from the industry on specific topics.

4.1 Participation in Trainings

Trainings constitute a continuous education process at the Institute to upgrade knowledge, skills and abilities of both the employees and stakeholders at national and international level. Different research areas identified for possible foreign collaboration were received through inputs collected from experts in different fields. Subject areas finalized for foreign collaboration include processing of mechanical harvesting of cotton, industrial application of microbial degossypolization and biopolymer based nanocomposites. Category-wise skill development programmes for the year are given in Table 4.1 along with the names of participating staff.

TABLE 4.1 CATEGORY-WISE SKILL DEVELOPMENT PROGRAMMES

Sr. No.	Title of the Programme	Duration	Venue	Names of Staff
Scientific				
1	CEP short term course on Finite Element Method & Applications in Civil Engineering	Jul 04-08, 2016	IIT, Mumbai	N. Vigneshwaran Virendra Prasad
2	Executive Development Program on Leadership Development	Aug 26-Sep 01, 2016	ICAR-NAARM, Hyderabad	P. G. Patil

Sr. No.	Title of the Programme	Duration	Venue	Names of Staff
3	Developing Winning Research Proposals in Agricultural Research	Sep 20-24, 2016	ICAR-NAARM, Hyderabad	G. Krishna Prasad P. Jagajanantha
4	Technology Valuation	Sep 23-24, 2016	CSIR-NCL, Pune	C. Sundaramoorthy A. Arputharaj
5	Transition and internal Audit on Quality Management Systems as per IS/ISO 9001: 2015	Oct 13-14, 2016	ICAR-CIRCOT, Mumbai	A. S. M. Raja N. Vigneshwaran Virendra Prasad C. Sundaramoorthy P. S. Deshmukh A. Arputharaj G. T. V. Prabu
6	Characterisation of Materials using X-Ray Diffractometer (XRD)	Dec 19-21, 2016	ICAR-CIRCOT, Mumbai	Manoj Kumar Sharmila Patil Archana Mahapatra
7	Advances in Microscopy	Jan 16-18, 2017	ICAR-CIRCOT, Mumbai	Manoj Kumar Sharmila Patil Archana Mahapatra
8	Microbial Identification: A Polyphasic Approach	Feb 01-10, 2017	ICAR-NBAIM, Mau	V. Mageshwaran
9	Competency Enhancement Programme for Effective Implementation of Training Functions by HRD Nodal Officers of ICAR	Feb 16-18, 2017	ICAR-NAARM, Hyderabad	T. Senthilkumar
Technical				
10	Operation of Sampling Loom	Jun 20-26, 2016	DKTE, Ichalkaranji	H.S. Koli
11	Workshop on Vyavharik Hindi	Aug 20, 2016	ICAR-CIRCOT, Mumbai	R. S. Prabhudesai B. R. Pawar R. K. Jadhav S. Banerjee H. S. Koli S. R. Kawlekar P. S. Nirhali P. N. Sahane P. R. Mhatre C. D. Prabha R. S. Narkar
12	Competence Enhancement Programme on Hospitality Management	Aug 10-12, 2016	ICAR-NAARM, Hyderabad	Sharad Kokane

Sr. No.	Title of the Programme	Duration	Venue	Names of Staff
13	Transition and internal Audit on Quality Management Systems as per IS/ISO 9001: 2015	Oct 13-14, 2016	ICAR-CIRCOT, Mumbai	R. S. Prabhudesai M. V.Vivekanandan B. R. Pawar R. K. Jadhav P. R. Mhatre S. V. Kokane P. N. Sahane Bindu Venugopal
14	Workshop on Liasion Officer for SC & ST (WLO (SC/ST))	Oct 20-21, 2016	ISTM, New Delhi	R.D. Nagarkar
15	Training programme on Maintenance of Lab and Field Equipment for Technical staff of ICAR	Jan 17-30, 2017	ICAR-CIFE, Mumbai	V.G. Udikeri M. Bhaskar B.V. Shirsath
Administrative				
16	Enhancing Efficiency and Behavioural Skills	Jul 28 – Aug 3, 2016	ICAR-NAARM, Hyderabad	S.D. Dudam
17	Transition and Internal Audit on Quality Management Systems as per IS/ISO 9001: 2015	Oct 13-14, 2016	ICAR-CIRCOT, Mumbai	S. Koshy Y. R. Pathare T. P. Mokal R. K. Pallewad S. S. Angane
18	Public Financial Management System organised by Institute of Government Accounts & Finanace (INGAF), Ministry of Finance, Govt of India	Feb 22-23, 2017	Panaji, Goa	S.V. Kasabe
Skilled Supporting				
19	Operation of Sampling Loom	Jun 20-26, 2016	DKTE, Ichalkaranji	V. Murugan
20	Work Opportunities for Development (by Shri Arun Naik, Trainer & Consultant, Astitva Training Institute, Mumbai)	March 15, 2017	ICAR-CIRCOT, Mumbai	Skilled Support Staff at Mumbai

4.1.1 National Trainings

The Institute has been conducting regular training programmes for students, farmers, entrepreneurs and personnel employed in cotton and ginning sector of the country. The training programmes related to advances in cotton technology in the field of chemical processing, nano-technology, spinning, quality evaluation and use of advanced

instrumentation are conducted at Mumbai headquarters whereas training programmes exclusively on ginning technology are conducted at the Ginning Training Centre, Nagpur. National training programmes conducted during 2016-17 are listed in Table 4.2.

TABLE 4.2 TRAININGS IMPARTED DURING 2016-17

Sr. No.	Title of the Programme	Duration	No. of Participants	Participant Profile
ICAR-CIRCOT, Mumbai				
1	Chemical Processing of Textile Materials	Apr 22, 2016	12	Students from Indian School of Design and Innovation, Mumbai
2	Electrospinning Techniques & Their Applications	Jul 11-13, 2016	12	Industry Personnel
3	Quality Evaluation of Cotton	Jul 18-22, 2016	08	Industry Personnel
4	Value addition to Cottonseed	Aug 29 – Sep 01, 2016	08	Industry and Academia
5	ICAR Short course on Synthesis and Characterization of Nanomaterials for Agricultural Applications	Sept 19-28, 2016	20	ICAR and SAU staff
6	Quality Evaluation of Cotton	Sep 26-30, 2016	03	Cotton Trade
7	Training on Fibre and Yarn Quality Management in Spinning	Oct 05-07, 2016	11	Cotton Trade and Universities
8	Basic Statistical Techniques for Textile Research	Nov 15-17, 2016	11	Textile related college staff and students
9	Training Programme on Absorbent Cotton Technology	Nov 21-23, 2016	10	Entrepreneurs and students

Sr. No.	Title of the Programme	Duration	No. of Participants	Participant Profile
10	Synthesis and Characterization of Nanomaterials for Agricultural Applications	Sep 19-28, 2016	20	Students and Researchers
11	Characterisation of Materials using X-ray Diffractometer (XRD)	Dec 19-21, 2016	11	Students and Scientists
12	Advances in Microscopy	Jan 16-18, 2017	16	Students and Researchers
13	Training on Advances in Applications of Nanotechnology	Feb 06-10, 2017	12	Students and Researchers
14	Quality Evaluation of Cotton	Feb 06-10, 2017	06	Farmers and CCI
15	Implementation of 7th CPC Recommendations -Pay Fixation Option by Shri.V. R. Ramankutty, ICAS (Retd), Regional Training Institute, Mumbai	Feb 04, 2017	All Staff	Institute Staff
GTC, Nagpur				
16	Double Roller Ginning Technology and Cotton Quality Evaluation	Apr 25-30, 2016	04	Industry Personnel
17	Double Roller Ginning Technology and Cotton Quality Evaluation	Jul 11-16, 2016	04	Industry Personnel
18	Double Roller Ginning Technology and Cotton Quality Evaluation	Aug 22-27, 2016	10	Industry Personnel
19	Preparation of Compost and Cultivation of Oyster Mushroom using Cotton Stalks	Jan 28, 2017	22	Farmers
20	Training on Double Roller Ginning	Jan 02-07, 2017	04	Industry

4.1.2 International Trainings

An in-country skill development-cum-training programme on post-harvest management of cotton and value addition to crop residue was conducted at Cotton House, Ouagadougou, Burkina Faso, Africa during May 16-17, 2016 as part of the Cotton Technical Assistance Programme (TAP) for Africa with the aim to increase the critical mass of government R&D and develop extension professionals with enhanced capacity for post-harvest management and utilization of crop residues in Africa. Senior Scientists- Dr. S.K. Shukla and Dr. C. Sundaramoorthy conducted and coordinated the training programme for a group of 17 professionals from Burkina Faso with diverse background and from different organizations from government and private sector, policy makers, ginners and entrepreneurs.

A country specific manual on scientific post-harvest management of cotton was developed in french language and distributed to the delegates. One day field visit was organized to FASO Cotton - a ginning industry to give

industrial exposure to the participants. Further, the duo also visited Benin, Africa during May 18-24, 2016 to monitor the erection and commissioning of facilities for establishment of “Regional Knowledge-cum-Training Centre for Post-Harvest & Ginning Technology” at Bohicon, Benin under Cotton TAP for Africa.

The team held discussions with Dr. David Y. Arodokoun, Director General, *Institute National des Recherches Agricoles du Benin* (INRAB), Cotonou and his team during May 19-23, 2016 on the progress on the work site and related issues. The progress of work at Bohicon was also seen for monitoring. They met the Director and Engineers of Society of Benin Electrical Engineering (SBEE), Bohicon related to laying of 20 kV electric line at the site. They also met Dr Yacoubou Toure Idrissou, Chief of Staff, Minister's Officer, Ministry of Agriculture, Republic of Benin to apprise the issues regarding erection and commissioning of regional knowledge *cum* training centre for post-harvest & ginning technology at Benin.



Fig. 4.1 An in-country training programme on scientific post-harvest management of cotton at Burkina Faso, Africa

4.2 Education

To promote research and teaching in the sphere of cotton science and technology, the Institute has signed MoUs with a number of educational institutions like VJTI, SNDT and ICT in Mumbai; DBSKKV, Dapoli and UAS, Dharwad enabling not only carrying out joint research work but also creating opportunities to pursue postgraduate & doctoral degree programmes. In addition, to promote the quality of post-graduate research and training in cutting edge areas, the Institute facilitates students from NARS and other organizations to access specialized guidance and facilities as per the “ICAR guidelines for students to

conduct research for their degree programmes as trainees at ICAR institutions”.

The Institute has a permanent recognition of the University of Mumbai for guiding students leading to MSc and PhD in physics, biophysics, microbiology and organic chemistry. List of Research Topics and PhD students on Roll is given in Table 4.3. This year, a PhD student- Mr. Vijay Mayekar, under the guidance of Dr. R.P. Nachane, submitted his thesis entitled “Study of pilling behaviour of textile fabrics” to the University of Mumbai.

TABLE 4.3 LIST OF RESEARCH TOPICS AND PHD STUDENTS ON ROLL

Sr. No.	Research Topic	Name of Student	Name of Scientist Guide	Year of Admission
1	Anaerobic retting of coconut fibres to produce textile grade fibres	Soniya Shetty	Dr. R.H. Balasubramanya	2008
2	Study of pilling behaviour of textile fabrics	Vijay Mayekar	Dr. R.P. Nachane	2010
3	Effect of silver, zinc oxide and titania nanoparticles on nitrogen fixing, phosphate solubilizing and biofilm forming bacteria found in soil ecosystems	Sangeeta Chavan	Dr. N. Vigneshwaran	2012
4	Preparation of nanofibre mats of alginate and pullulan by electro spinning and its application as nanosensor for detection of food spoilage	Komal Saraf	Dr. N. Vigneshwaran	2012
5	Microbial production and characterization of nano-lignin and its application onto cotton and linen fabrics for functional properties	Siddhi Juikar	Dr. N. Vigneshwaran	2012
6	Immobilization of antimicrobial peptides on nanocellulose for potential use in active food packaging	Priyanka Bagde	Dr. N. Vigneshwaran	2014

4.3 HRD Activities

The Institute has a special HRD cell for regularly monitoring and facilitating training programmes based on the requirements received from all the four divisions.

Table 4.4 shows the staff category-wise targets and achievements of training programmes during 2016-17.

TABLE 4.4 ACHIEVEMENTS OF HRD PROGRAMME

Category of Staff	No. of Training Programmes	No. of Employees	No. of Employees Trained
Scientific	12	26	25
Technical	6	71	26
Administrative & Finance	6	29	12
Skilled Support Staff	2	41	32
Total	26	167	95



Fig. 4.2 Discussion with INRAB officials on erection and commissioning of regional knowledge cum training centre for post-harvest & ginning technology at Benin, Africa



5. LINKAGES AND COLLABORATION

The Institute maintains linkages with various organizations at national and international level to develop newer technologies and processes in the areas of post-harvest processing of cotton, eco-friendly finishing of textiles and utilization of cotton biomass and by-products. Linkages with stakeholders help enhance technology assessment for refinement and technology transfer. The quality evaluation units of ICAR-CIRCOT are located within the premises of other institutes and agricultural universities in the country. Other than functioning as extension wings, these units also facilitate linkages and collaboration with host institutes. Five such units together with the Ginning Training Centre, Nagpur and Agri-Business Incubation Centre at the headquarters promote the technologies developed by the Institute. Private players like M/s Bajaj Steel Industries Ltd. and M/s Precision Tooling Engineers, both

from Nagpur have already taken up few of the technologies developed by the Institute for commercial production.

Some of the prominent areas of collaboration with national and international institutes in the field of cotton science and technology are – AICRP on Cotton, Technology Mission on Cotton, Nano Technology, Natural Fibre Research and Cotton Technology Assistance Programme. Collaborating institutes include premier research organizations like CICR Nagpur and NIRJAFT Kolkata, universities like ICT Mumbai, VJTI Mumbai and DBSKKV Dapoli, as well as private companies like Lafarge India.

A total of eight MoUs were signed with different industries and with individuals for development and commercialization of Institute technologies for cotton processing and value addition to by-products.



Fig. 5.1 MoU with GREYY, a start-up by three graduates from IIT, Kanpur and NIFT, Mumbai for development of clothing using cotton blends



Fig. 5.2 MoU with M/s Precision Tooling Engineers, Nagpur for development of cotton lint opener



Fig. 5.3 National and International Linkages of ICAR-CIRCOT Mumbai



Fig. 5.4 Areas of Collaboration and Partnering Institutes

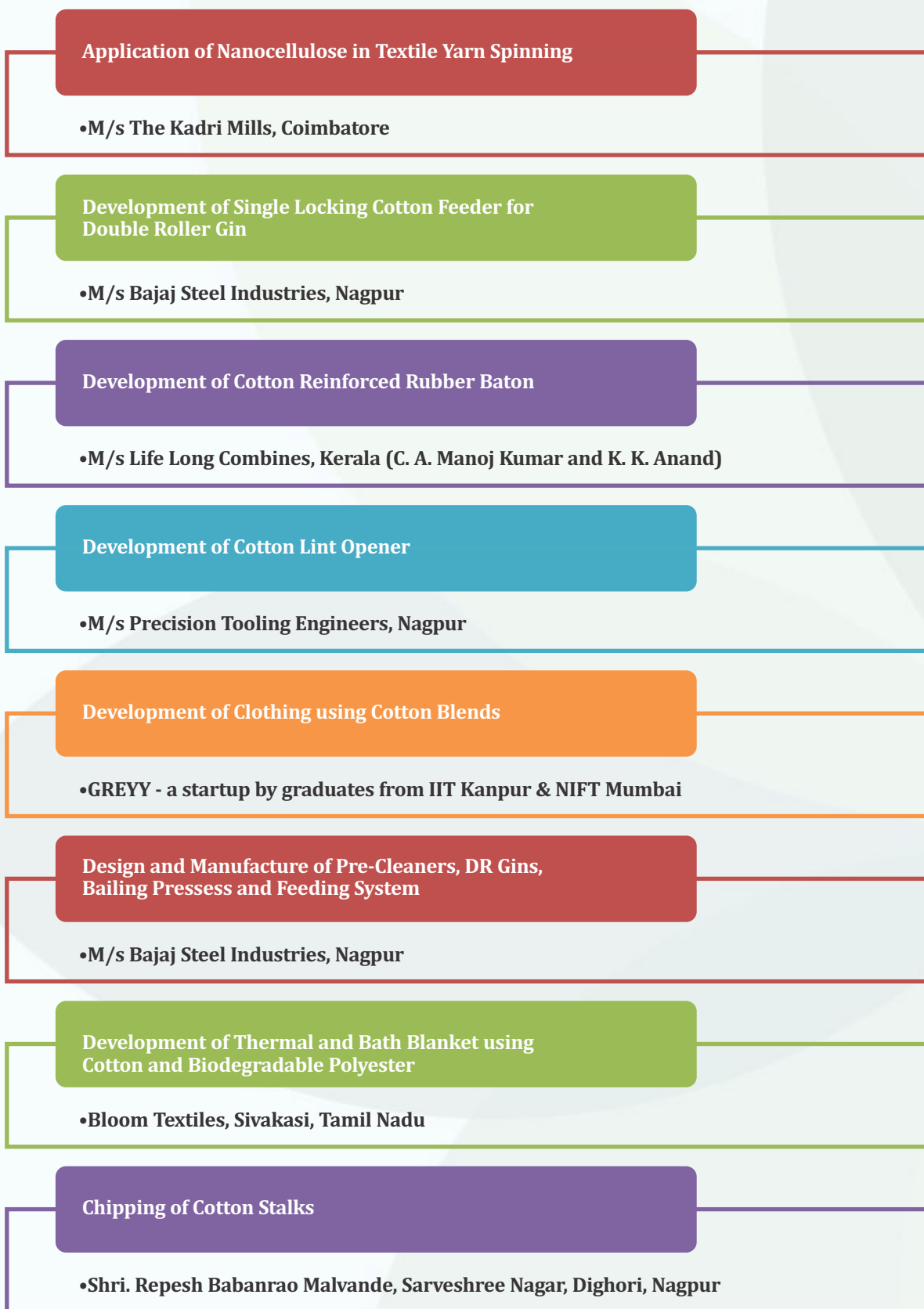


Fig. 5.5 MoUs signed with private firms and individuals during 2016-17

5.1 Commercial Testing and Consultancy Services

CIRCOT is one of the acclaimed cotton testing laboratories in India. It has been accredited by the National Accreditation Board for Testing and Calibration of Laboratories (NABL), since 1999 and also from the ISO. The Institute has facilities for conducting more than 160 tests on different textile materials and cotton by-products. These facilities are extended to all the textiles mills, government departments and private sectors. During the year under report, a total of 10,764 samples were tested at different test centres including Mumbai headquarters, GTC Nagpur and quality

evaluation units at Coimbatore, Dharwad, Guntur and Sirsa. The total revenue generated through commercial testing was ₹ 48,22,294/-. Besides regular tests, special tests were also carried out as per demand on samples received from various government / private organisations and universities. The Institute maintains liaison with different institutions including private organizations and entrepreneurs and strives to meet their technological needs by offering various other need based services generating additional revenue through the activity.

Consultancy Services

The Institute maintains liaison with different institutions including private organizations and entrepreneurs to meet their technological needs and also to generate revenue for the

Institute. Consultancy projects carried out at the Institute by various scientists during 2016-17 are listed in Table 5.3

TABLE 5.1 NUMBER OF PAID SAMPLES TESTED AND REVENUE GENERATED

TEST CENTRE	NO. OF SAMPLES TESTED	REVENUE GENERATED (₹)
Mumbai	4,122	35,83,997
Nagpur	2,889	5,50,042
Coimbatore	1,584	1,98,022
Dharwad	917	1,63,971
Guntur	410	97,387
Sirsa	815	2,23,125
Surat	27	5,750
Total	10,764	48,22,294

TABLE 5.2 TESTS CONDUCTED AND CLIENTELE

TYPE OF TEST	CLIENTELE
1. Alpha Cellulose	<ul style="list-style-type: none"> • Ambika Cot seeds, Mehasana • Thakurji Solvex, Jalna
2. Antibacterial	<ul style="list-style-type: none"> • Jawaharlal Darda Institute of Engineering & Technology
3. Atomic Absorption Spectrum	<ul style="list-style-type: none"> • North Mumbai Welfare Society HS, Mumbai
4. Atomic Force Microscopy	<ul style="list-style-type: none"> • Institute of Chemical Technology, Mumbai • ICAR-NIRJAFT, Kolkata
5. Cellulose yield, Trash, Moisture	<ul style="list-style-type: none"> • Bajaj Steel Industries, Nagpur • Thakurji Solvex, Jalna • Mulchand Phulchand Krishi Udyog, Jalna • Anjaneya Agro Tech, Harihar • LN Oils, Dharwad
6. DSC	<ul style="list-style-type: none"> • ICAR-CIFT, Vashi
7. FTIR	<ul style="list-style-type: none"> • ICAR-CIFT, Vashi • Institute of Science, Mumbai
8. Gossypol Content	<ul style="list-style-type: none"> • CP Aquaculture, Chennai • OM CHICKS, Pune
9. Honey Dew	<ul style="list-style-type: none"> • Eurotex Ind. & Exports, Mumbai
10. Instron Testing	<ul style="list-style-type: none"> • RA Podar Medical college, Mumbai • VJTI, Mumbai
11. KES	<ul style="list-style-type: none"> • CSTRI, Bangalore • UAS, Dharwad • Birla cellulose • Grasim Industries • Intertek India, Mumbai • Pidilite Industries, Mumbai • ICAR-NIRJAFT, Kolkata, • SITRA, Coimbatore
12. Lignin Content	<ul style="list-style-type: none"> • VJTI, Mumbai,
13. Linter Content	<ul style="list-style-type: none"> • Ambika Cotseeds Ltd, Mehasana, • Sri Anjaneya Agro Tech, Harihar
14. LOI	<ul style="list-style-type: none"> • ICAR-NIRJAFT, Kolkata, • Delkon Textile, Faridabad, • NMRL, Ambernath

TYPE OF TEST	CLIENTELE
15. Lyophilization	<ul style="list-style-type: none"> • Krishgen Biosystems, Mumbai
16. Paper Testing	<ul style="list-style-type: none"> • Mumbai University Press, Mumbai
17. Particle Board Testing	<ul style="list-style-type: none"> • ICAR-IARI, New Delhi
18. Particle Size	<ul style="list-style-type: none"> • KBP College, Vashi
19. Protein	<ul style="list-style-type: none"> • AN College, Patna
20. Scanning Electron Microscope	<ul style="list-style-type: none"> • Reliance Industries, Navi Mumbai • Aditya Birla • Grasim, Navi Mumbai • ICAR-NIRJAFT, Kolkata • Loreal India, Mumbai • ICT, Mumbai • CoroChem, Mumbai • Indoco Remedies, Navi Mumbai • VJTI, Matunga, Mumbai • ICAR-CIFE, Mumbai • ICAR-CIFT, Vashi • Institute of Science, Mumbai, • BATU, Mangaon • RP Gogate College of Arts & Science, Ratnagiri, • Hindustan Unilever, Mumbai • IPCA labs, Mumbai • Johnson & Johnson, Mumbai • Bharati Vidyapeeth's College of Pharmacy, Navi Mumbai
21. Surface Tension	<ul style="list-style-type: none"> • Croda India, Navi Mumbai • Dura Colour, Ahmedabad
22. Thermal Insulation of Fabric	<ul style="list-style-type: none"> • CSTRI, Bangalore
23. Thermal Conductivity of Fabric	<ul style="list-style-type: none"> • CSTRI, Bangalore
24. XRD	<ul style="list-style-type: none"> • DKTES Textile & Engineering Institute, Ichalakaranji • CoroChem, Mumbai • Institute of Science, Mumbai • CKTACS College, Panvel • Vivekanand Education Society, Chembur • Atharv Creation, Thane

TABLE 5.3 CONSULTANCY PROJECTS CARRIED OUT DURING 2016-17

No.	TITLE	FIRM	INVESTIGATORS
1	Enzymatic preparation of absorbent cotton (₹ 51,525)	S.A. Pharmachem Pvt Ltd, 233/234, Udyog Bhavan, Sonawala Road, Goregaon East, Mumbai	Dr. A.S.M. Raja
2	Nano-cellulose application in textile yarn spinning (₹ 1,00,000)	The Kadri Mills Ltd, KG House, 126 Arts College, Coimbatore	Dr. N. Vigneshwaran
3	Cotton TAP to strengthen Cotton Value Chain in C-4 countries and Malawi, Nigeria + Uganda in Africa (B2 & B6 activities) (₹ 7,00,000)	Infrastructure Leasing and Financial Services (IL &FS) Clusters Development Initiative Ltd. New Delhi	Dr. P.G. Patil
4	Evaluation of colour stability of test materials (₹ 29,325)	Dr. Nupur Shirao, P.G. Student, Deptt. of Prosthodontics and Implantology, VSPM Dental College, Nagpur	Dr. (Mrs.) Sujata Saxena
5	Study of washing treatments on bending properties of cotton fabrics (₹ 57,500)	Hindustan Unilever Ltd, BD Sawant Marg, Chakala, Andheri E, Mumbai	Dr. (Mrs.) Sheela Raj
6	Antibacterial treatment of textile materials (₹ 1,15,000)	Green Globe, Mumbai	Dr. N. Vigneshwaran
7	To study the potential of tectonagrandis leaf and <i>terminalia arjuna</i> bark for dyeing of Cotton textiles (₹ 41,400)	Shailendra Anil Rane, R. Ruia College, Deptt. of Chemistry, Matunga (East), Mumbai	Dr. (Mrs.) Sujata Saxena
8	Development of Cotton and Cotton blends and application of functional finishes to impart antibacterial and moisture management (₹ 94,300)	GREYY, Tathastu, Plot No. 11, Sector-28, Vashi, Navi Mumbai	Dr. R. Guruprasad
9	Development of thermal and bath blankets using cotton and biodegradable polyester (₹ 99,994)	Bloom Textile, Sivakasi, Tamilnadu-626123	Dr. A.S.M. Raja
10	Design & machinery for automatic cotton ginning plant (₹ 2,45,000)	Bajaj Steel Industries Ltd, Imambada Road, Nagpur	Dr. P.G. Patil
11	Effect of pick densities and weaves on thermal properties of worsted suiting fabric samples (₹ 43,700)	Prof. Ganesh Kakad, Head, Dept. of Textile Engineering, JDIET, Yavatmal, Maharashtra	Dr. (Mrs.) Sheela Raj
12	Technical assistance for cotton stalk chipping (₹ 15,000)	Mr. Rupesh B. Malvande, Near Navnath ITI, Rajapeth, Nagpur, MS	Dr. S.K. Shukla
13	Design and manufacturing of pre-cleaner, double roller gin, baling presses and feeding systems (₹ 1,57,500)	Bajaj Steel Industries Ltd, Imambada Road, Nagpur	Dr. P.G. Patil



Fig. 5.6 Consultancy Projects taken up during 2016-17



6. AWARDS AND RECOGNITION

6.1 Cashless Transaction Award

The Institute bagged a certificate and an award of ₹ 5 lakhs for carrying out cashless transactions as per the government directive to carry out cashless transactions in all its offices. The award was conferred by the Council during the Directors' Conference on February 14, 2017



6.2 ISAE Fellowship

Dr. P.G. Patil, Director received the “ISAE Fellowship Award 2016” at the 51st Annual Convention of the Indian Society of Agricultural Engineers (ISAE) at CCSHAU, Hisar during February 16-18, 2017.



Fig. 6.1 Dr. P.G. Patil, Director received the ISAE Fellowship Award 2016



Fig. 6.2 Dr. P.G. Patil, Director receiving the cashless institute award from Shri Radha Mohan Singh, Union Minister of Agriculture and Farmers Welfare

6.3 ICAR Award for Outstanding Interdisciplinary Team

On the occasion of the 88th ICAR Foundation Day and Award Ceremony at Vigyan Bhavan, New Delhi on July 16, 2016, ICAR-CIRCOT, Mumbai along with other consortia partners ICAR-DWM, Bhubaneshwar and IRMARA, Thane was conferred the ICAR award for outstanding interdisciplinary team in agricultural and allied sciences for the year 2013-14 under the category of NRM and Agricultural Engineering for development of flexi check dam technology for watersheds.



Fig. 6.3 ICAR Award for Outstanding Inter-Disciplinary Team Research

6.4 Konark Memorial Award 2017 (for excellence in Bio-Research)

Siddhi Juikar and Vigneshwaran, N. Application of Nano-lignin onto Cotton Fabrics to Impart Multifunctional Properties (Sajjan Gupta – Konark Memorial Award 2017) (for excellence in Bio-Research) by Konark Group & VES college of Arts, Science & Commerce, Chembur, Mumbai on January 18, 2017.

6.5 Hindi Implementation

Smt. K.R. Joshi, Hindi Officer of the Institute was felicitated for her work and achievements in the field of Hindi language implementation at a meeting organised by Shruti Sammwaad

Sahitya Kala Academy in collaboration with ICAR-CIRCOT, Mumbai at a function on July 26, 2016.

Dr. P.K. Mandhyan, Sr. Scientist was felicitated for carrying out excellent work in Hindi during the 11th Aashirwad Rajbhasha Felicitation function of officers of central government at Doordarshan Kendra, Worli, Mumbai on September 23, 2016.

6.6 Lead / Invited Presentations

Dr. P.K. Mandhyan, Sr. Scientist gave a lead presentation showcasing the Institute technologies - absorbent cotton, briquettes and pellets making and sampling loom at a seminar on opportunities for entrepreneurs in agri-based products and technologies organized by the Southern Gujarat Chamber of Commerce and Industry at Surat on July 26, 2016. He also gave a lead presentation “Present Status and Requirement of Quality Cotton and By-Products” on the occasion of the Golden Jubilee celebration of AICRP on Cotton at CICR, Regional Station, Coimbatore on November 9-10, 2016.

Dr. Sujata Saxena presented a paper on “Towards Self Sufficiency in Oilseeds – Contribution of Cottonseed oil” in brain storming session on climate smart technologies for enhancing vegetable oil production organized by ISOR & ICAR- IIOR in collaboration with NAAS at ICAR-IIOR, Hyderabad on January 19-20, 2017. She, along with scientists Dr Raja and Arputharaj, gave a presentation on “Protective Textiles and ICAR-CIRCOT R&D” at the conference on Segments of Technical Textiles: Present Scenario and Opportunities organized by Dept of Textile and Fashion Technology, College of Home Science, Mumbai on February 03, 2017.

6.7 Best Paper / Poster

Dr. T. Senthilkumar's oral presentation "Preparation of Activated Carbon from Agro-Waste" during the CHEMCON 2016 of Indian Institute of Chemical Engineers held at A.C. Tech, Anna University, Chennai on December 27-30, 2016 received the Best Paper Award.

Waghmode, Kambli, Prasad, Bharimalla, Patil, Arputharaj and Vigneshwaran received the first prize for their poster presentation on "Nanocellulose Reinforced Starch Film for Application in Food Packaging" at the National Seminar on Futuristic Scope in Biotechnological Advancement and Allied Instrumentation at Amity University, Chhattisgarh, Raipur during July 28-29, 2016.

Santanu Basak received the best poster award for his presentation on "Fire Retardant Textile Material Using Plant Bio-Molecule" at the International Conference for Apparel and Home Textiles organized by Okhla Garment and Textile Clusture (OGTC) at India Habitat Centre, New Delhi on October 15, 2016.

Mandhyan and Patil received the best poster award for "Present Status and Requirement of Quality Cotton and By-products" at the brain storming sessions on "Fifty Years of Cotton Research- Lessons Learnt and the Way Forward" organized by AICRP-on Cotton at CICR, Coimbatore on November 10, 2016.

Dr. P.S. Deshmukh's paper on Arecanut Husk: From Present Environmental Hazard to Potential Wealth at the International Conference on Climate Change Adaptation and Biodiversity : Ecological Sustainability and Resource Management for Livelihood Security at ICAR-CIARI, Port Blair on December 8-10, 2016 received the Best Poster Presentation Award.

Bharimalla, Patil, Vigneshwaran, Arude, Mandhyan, Sundaramoorthy, Senthil kumar and Pawar received best poster award for "ABI Centre of ICAR-CIRCOT: An Opportunity for Sustainable Entrepreneurship" during the third International Symposium on Coconut Research and Development (ISOCRAD-3) at ICAR-CPCRI, Kasargod on December 10-12, 2016.

6.8 IEI Young Engineer Award 2016-17

Institute scientist Shri Santhanu Basak received IEI Young Engineer Award 2016-17 in textile engineering discipline from Institute of Engineers, India for his contribution in the textile research, technology development and product development in textile industry.

6.9 Member of Textile Department Advisory Committee


Dr. P.K.Mandhyan, Sr. Scientist (FD-Technical Textiles) was inducted as the Member of Textile Department Advisory Committee, DKTE, Ichalkaranji.


6.10 Ph.D.


On March 23, 2017, Dr. P.S. Deshmukh, Sr. Scientist (FMP) was conferred Ph.D. (Agri.Engg.) by DBSKKV, Dapoli for his work on "Development and Testing of Arecanut (*Areca catechu L.*) Husk, Fibres Separation Machine".


6.11 Sports Tournament


A team of 44 players of the Institute participated in the ICAR West Zone Sports Tournament 2016 at ICAR-NRC on Camel, Bikaner during September 24-27, 2016 and bagged ten medals in various events.


 **GOLD MEDALS**


 **Carrom**
SK Parab


 **Carrom**
Smita Paiyala


 **Table Tennis (Singles)**
Smita Paiyala


 **Table Tennis (Doubles)**
Smita Paiyala
Vijaya Walzade


 **Chess**
Varsha Satankar

 **SILVER MEDALS**

 **Table Tennis**
R.D. Nagarkar
P.V. Jadhav
Manoj Ambare
H.S. Koli
M.M. Kadam

 **Relay (100 x 4 m)**
N.V. Kambli
Manoj Ambare
Dhawal Dhodia
S.P. Naik

 **Chess**
Hemangi Pednekar

 **Badminton**
Smita Paiyala


 **Javeline Throw**
Smita Paiyala

Fig. 6.4 Medals from ICAR West Zone Sports Tournament



Fig. 6.5 Jubilant Sports contingent with the Director



7. PUBLICATIONS

7.1 Research Papers

1. Agarwal, A., Jeengar, A., Arputharaj, A., Bhowmick, M., Satyamurthy, P., Samanta, K.K., Souza, C.D., Vigenshwaran, N. (2016) Performance characteristics of electrospun cellulose acetate nanofiber mat embedded with Nano-ZnO/Vitamins, *International Journal of Nanotechnology and Applications*, 6(3), 1-12.
2. Ammayappan, L., Sekhar Das, Guruprasad, R., Deb Prasad Ray, Prasanta Kumar Ganguly (2016) Effect of lac treatment on mechanical properties of jute fabric/polyester resin based biocomposite, *Indian Journal of Fibre and Textile Research*, Vol.41, pp. 312-317.
3. Arude, V.G., Shukla, S.K., Patil, P.G. and Deshmukh, P.S. (2016) Adoption of rotary knife roller ginning technology for Indian cotton. *Cotton Research Journal*, 7(1): 40-45.
4. Bhanage, G.B., Shahare, P.U., Aware, V.V., Dhande, K.G. and Deshmukh, P.S. (2016) Laboratory testing of paddy stripping header mechanism. *Agriculture Update*, 11(2):139-144.
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7. Deshmukh, P.S., Shahare, P.U., Bhanage, G.B., Dhekale, J.S. and Patil, P.G. (2016) Measurement of arecanut (*Areca catechu* L.) husk fibre properties, *Cotton Research Journal*, 7(2): 68-71.
8. Raja, A.S.M., Arputharaj, A., Saxena, S., and Patil, P.G. (2016) A One bath chemo-enzymatic process for preparation of absorbent cotton, *Perspectives in Science*. 8:254-256
9. Krishna Prasad, G., Periyasamy, S., Chattopadhyay, S.K., Raja, A.S.M., Rajkumar, K. and Santosh Jagadale (2016) Surface modification of nylon fabric and its optimization for improved adhesion in rubber composites. *The Journal of The Textile Institute*, 108(6), 1001-1009.
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13. Prasad, V., Arputharaj, A., Bharimalla, A.K., Patil, P.G., Vigneshwaran, N. - (2016), Durable multifunctional finishing of cotton fabrics by in situ synthesis of nano ZnO, *Applied Surface Science*, 2016, 390, 936-940.
14. Bharimalla, A.K., Deshmukh, S.P., Vigneshwaran, N., Patil, P.G., Prasad, V. (2017) Nanocellulose-Polymer Composites for Applications in Food Packaging: Current Status, Future Prospects and Challenges. *Polymer-Plastics Technology and Engineering*. 56(8):805-823.
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35. Senthilkumar, T., Chattopadhyay, S.K. and Lima Rose Miranda (2016) Optimization of activated carbon preparation from pomegranate peel (*Punica granatum* Peel) using RSM. Chemical Engg Communications, DOI: <https://doi.org/10.1080/00986445.2016.1262358>

7.2 Paper Presentations

1. Mageshwaran, V. (2016) Microbial process for degossypolization and nutritive quality improvement of cottonseed cake at the one day seminar on “De-oiled cake (DOC) as cattle, poultry and fish feed” organized by All India Cottonseed Crushers Association (AICOSCA) at Guntur, A.P., on June 25.
2. Mandhyan, P.K. (2016) Lead presentation on technology/products developed by ICAR-CIRCOT at the one day seminar on opportunities for entrepreneurs in agro-based products and technologies at the Southern Gujarat Chamber of Commerce and Industry on July 26.
3. Raja, A.S.M., Arputharaj, A., Sujata Saxena, Patil, P.G. (2016) Development of low temperature process for the preparation of absorbent/bleached cotton for industrial application at the International Conference on Industrial Textiles – Products, Application and Prospects organized by PSG College of Technology at PSG College of Technology and Textile Commissioner, Govt. of India at Coimbatore on August 26 and 27.
4. Krishna Prasad, G. (2016) Surface Modification of Nylon Fabric through Enzymatic Treatment and its Interfacial Adhesion Improvement in Rubber Composite at INDUTECH 2016 organized by P.S.G. College of Technology Coimbatore, Tamil Nadu during August 26-27.
5. Murugesana, M., Karthika, R., Senthilkumar, T., Krishnaswamy, J. and Jagajanantha P. (2016) Mechanical properties of modified jute reinforced composite at INDUTECH 2016 organized by P.S.G. College of Technology Coimbatore, Tamil Nadu during August 26–27.
6. Arputharaj, A., Sujata Saxena, Raja, A.S.M., Kawlekar, S.R., Samanta, K.K. and Patil, P.G. (2016) Development of Atmospheric Pressure Plasma Assisted Process for Denim Materials at INDUTECH 2016 organized by P.S.G. College of Technology Coimbatore, Tamil Nadu in collaboration with collaboration with Office of the Textile Commissioner, Government of India and HOF University, Germany during August 26-27.
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8. Deshmukh, P.S. (2016) Cotton by-products and its potential industrial application at Cotton Trade organized by Khandesh Gin and Press Association at Jalgaon under the aegis of Maharashtra Cotton Ginners Association, Aurangabad on October 15.

9. Mageshwaran, V. (2016) Development of an ecofriendly enzymatic process for preparation of absorbent cotton from short staple cotton at International Conference on "Sustainable Utilization of Tropical Plant Biomass: Bioproducts, Biocatalysts and Biorefinery (SutB4) at the Tamil Nadu Agricultural University, Coimbatore on November 17-18.
10. Deshmukh, P.S. (2016) Arecaunt (Areca catechu L.) Husk: from present environmental hazard to potential wealth at the International Conference on Climate Change Adaptation and Biodiversity: Ecological Sustainability and Resource Management for Livelihood Security at ICAR-CIARI, Port Blair on December 8-10.
11. Sundaramoorthy, C. (2016) Cotton Crop Residue Management: A Case for Climate Change Mitigation and Livelihood Security at the International Conference on Climate Change Adaptation and Biodiversity: Ecological Sustainability and Resource Management for Livelihood Security at ICAR-CIARI, Port Blair on December 8-10.
12. Senthilkumar, T. (2016) Production of Fibrillated Coconut fibre Reinforced Epoxy Composite at the 3rd International Symposium on Coconut Research and Development at ICAR-Central Plantation Crops Research Institute, Kasaragod, Kerala, India on December 10-12.
13. Senthilkumar, T. (2016) Agri-Business incubation Centre of ICAR-CIRCOT: An opportunity for sustainable entrepreneurship at the 3rd International Symposium on Coconut Research and Development at ICAR-CPCRI, Kasargod, Kerala on December 10-12.
14. Guruprasad, R., Krishna Prasad, G., Senthilkumar, T., Virendra Prasad and Patil, P.G. (2016) Analysis of sportswear garments for moisture management behaviour and other performance characteristics, 44th Textile Research Symposium, New Delhi during December 14-16.
15. Raja, A.S.M., Sujatha Kawlekar, Sujata Saxena, Arputharaj, A. and Patil, P.G. (2016) Mosquito Repellent Finishing of Textile Materials at the National Seminar on Recent Advances in Textile Finishing organised by ICAR-CIRCOT in collaboration with Indian Fibre Society (IFS), Mumbai on December 17.
16. Saxena, S., Narkar, R.S. and Arputharaj, A. (2016) Pesticide Protective Clothing – A New Application for Repellent Finished Fabrics at the National Seminar on Recent Advances in Textile Finishing organised by ICAR-CIRCOT in collaboration with Indian Fibre Society (IFS), Mumbai on December 17.
17. Vigneshwaran, N., Prasad, V., Arputharaj, A., Bharimalla, A.K. and Patil, P.G. (2016) Multifunctional Finishing of Cotton Fabrics using Nanomaterials at the National Seminar on Recent Advances in Textile Finishing organised by ICAR-CIRCOT in collaboration with Indian Fibre Society (IFS), Mumbai on December 17.
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- Session of Indian Institute of Chemical Engineers (CHEMCON 2016) held at A.C.Tech, Anna University, Chennai on Dec 27-30.
19. Basak, S. (2016) Fire retardancy of cellulosic textile by using wastage plant biomolecule presented at the 11th All India Peoples Technology Congress organised by Forum of Scientist, Engineers and Technologist (FOSET) at Kolkotta on Feb 4–5.
 20. Sujata Saxena (2017) Towards self-sufficiency in Oilseeds – Contribution of Cottonseed Oil at the Brainstorming session on Climate Smart Technologies for Enhancing Vegetable Oil Production organized by ISOR and ICAR-IIOR, Hyderabad in collaboration with NASS, New Delhi on Jan 19-20.
 21. Shukla, S.K. (2017) Mission mode approach is the way forward for successful adoption of mechanical cotton harvesting in India at the Indian Seed Congress 2017, Kolkata, Feb 13-14.
 22. Deshmukh, P.S., Shahare, P.U., Dhekale, J.S., Patil, P.G., Bhanage, G.B., Arude, V.G. and Bharimalla, A.K. (2017) Development and study of needle drum type mechanism for arecanut (*Areca catechu L.*) husk fibre separation presented at the 51st Annual Convention of ISAE and National Symposium on Agricultural Engineering for Sustainable and Climate Smart Agriculture, CCSHAU, Hisar, Haryana, Feb 16-18.
 23. Deshmukh, P.S., Shahare, P.U., Dhekale, J.S., Patil, P.G., Bhanage, G.B., Arude, V.G. and Ghadge, S.V. (2017) Study of beater mechanism for Arecanut (*Areca catechu L.*) husk fibre separation presented at the 51st Annual Convention of ISAE and National Symposium on Agricultural Engineering for Sustainable and Climate Smart Agriculture, CCSHAU, Hisar, Feb 16-18.
 24. Ghadge, S.V., Patil, P.G., Shukla, S.K., Arude, V.G., Bharimalla, A.K., Deshmukh, P.S. and Sundaramoorthy, C. (2017) Method of Opening Cotton Lint Samples for Fibre Quality testing presented at the 51st Annual Convention of ISAE and National Symposium on Agricultural Engineering for Sustainable and Climate Smart Agriculture, CCSHAU, Hisar, Haryana, Feb 16-18.
 25. Mageshwaran, V. (2017) Compost production and Oyster mushroom cultivation- A potential entrepreneurship for cotton growing farmers presented at the National Conference on Agro processing Based Entrepreneurship Development for Sustainable Livelihood, PDKV, Akola, Feb 22–23.
 26. Varsha Satankar (2017) Utilization of cotton stalks for preparation of pellets - A source of entrepreneurship development at the National Conference on Agro processing Based Entrepreneurship Development for Sustainable Livelihood, PDKV, Akola, Feb 22–23.

27. Arude, V.G., Deshmukh, S.P., Shukla, S.K., Patil, P.G. (2016) Design of single locking cotton feeder for double roller gin. International Conference on Emerging Technologies in Agricultural and Food Engineering (ETAE 2016) IIT Kharagpur. December 27–30.
28. Bharimalla, A.K., Patil, P.G., Deshmukh, S.P., Vigneshwaran, N., Deshmukh, P.S. and Arude, V.G. (2016) Ultra-high pressure homogenization process for production of nanocellulose from cotton linters. International Conference on Emerging Technologies in Agricultural and Food Engineering (ETAE 2016) IIT Kharagpur. December 27–30.
29. Deshmukh, P.S., Shahare, P.U., Dhekale, J.S., Patil, P.G., Arude, V.G., Bharimalla, A.K. (2016) Engineering properties of Arecanut Husk (*Areca catechu L.*) cv. Shreevardhini for Waste to Wealth Conversion. ETAE 2016, IIT Kharagpur. December 27–30, 2016.

7.3 Conference Proceedings

1. Sujata, S., Raja, A.S.M. and Arputharaj, A. (2016) Souvenir of the National Seminar on Recent Advances in Textile Finishing organized by ICAR- CIRCOT & Indian Fibre Society, Mumbai on 17th December, 2016, Indian Fibre Society, Mumbai 50 p.
2. Sujata, S., Raja, A.S.M. and Arputharaj, A. (2016) Book of Papers of the National Seminar on Recent Advances in Textile Finishing organized by ICAR-CIRCOT & Indian Fibre Society, Mumbai on December 17, 2016, ICAR- CIRCOT, Mumbai 150 p.

7.4 Book Chapters

1. Vigneshwaran, N., Satyamurthy, P. (2016) Nanocellulose Production Using Cellulose Degrading Fungi in the Book: Advances and Applications through Fungal Nanobiotechnology, 321-331, Springer International Publishing.
2. Sujata, S., Raja, A.S.M. and Arputharaj, A. (2017) Challenges in Sustainable Wet Processing of Textiles. In (ed.) S.S. Muthu, Textile Science and Clothing Sustainability - Sustainable Textile Chemical processes, Textile Science and Clothing Technology series, Springer Science + Business Media, Singapore, 132p.
3. Deshmukh, P.S., Shahare, P. U., Dhekale, J. S., Patil, P.G., Arude, V. G. and Bharimalla, A. K. (2016) Engineering Properties of Arecanut Husk (*Areca catechu L.*) in: Food Process Engineering and Technology (eds. S.K. Das, A.K. Datta, T.K. Goswami and P.S. Rao) (ISBN 978-93-86256-30-0). Excel India Publishers, New Delhi, 634 p.

7.5 Training Manuals

1. Characterization of Materials Using X-Ray Diffractometer (XRD). 114p.
2. Value Addition to Cottonseed. 105p.
3. Absorbent Cotton Technology. 53p.

7.6 Training Leaflets

1. Double Roller Ginning Technology and Cotton Grading
2. Value Addition to Cottonseed

3. Quality Evaluation and Spinning Performance of Indian Cottons using Advanced Techniques
4. Absorbent cotton Technology
5. Quality Evaluation of Cotton
6. Fibre and Yarn Quality Management in Spinning
7. Instrumental Evaluation of Clothing Comfort
8. Spectroscopic & Chromatographic Techniques for Material Characterisation
9. Advances in Application of Nanotechnology
10. Characterization of Materials Using X-Ray Diffractometer (XRD)
11. Basic Statistical Techniques for Textile Research
12. Advances in Microscopy
4. Guruprasad, R., Senthilkumar, T., Prabu, G.T.V., Prachi Mhatre. Vastra ke Satahi samshodhan mein plasma ka badhta prabhav, p. 21–24.
5. Prabu, G.T.V., Guruprasad, R., Krishna Prasad, G., Senthilkumar, T., Chattopadhyay, S.K. Electro Chidkad aur Electro Katai Dwara Suti Kapade ka Karyatmak Parishkaran, p. 25–26.
6. Ghadge, S.V. Kapas ke Reshom ki Mahinmata Parikshan mein mahatvapoorna Batein, p. 27.
7. Arputharaj, A., Virendra Prasad, Raja, A.S.M., Saxena, S. and Patil, P.G. Vastro ki sthayi rasayanik prasamskaran mein chunoutiyam, p. 28–30.
8. Guruprasad, R., Krishna Prasad, R., Senthilkumar, T., Prabu, G.T.V., Deepak Meena, Chattopadhyay, S.K. Kapas ka nyunatam samarthan mulya, p. 31–33.
9. Virendra Prasad, Manoj Ambare, Saxena, S., Arputharaj, A., Raja, A.S.M. Mudra Kagas, p. 34–35.
10. Senthilkumar, T., Guruprasad, R., Krishna Prasad, G., Prabu, G.T.V. and Prache Mhatre – Sakriyit Carbon ek avalokan, p. 36–38.
11. Joshi, K.R. Pariyavaran santhulan, p. 39–41.

7.7 Popular Articles (Hindi)

- Yadav, A., Vigneshwaran, N. and Manoj Srivastava Nano Takniki Se Mrida Sudhaar published in Kheti, May 2016.
 - Articles published in annual hindi magazine of the Institute 'Amber 2015'-
1. Vigneshwaran, N. Kapas linter se Nanocellulose ka Nirman, p. 3-7.
 2. Mandhyan, P.K., Banerjee, S., More, C.M. and Pawar, B.R. Soot ki Gunavatta, p. 8-13.
 3. Sujata, S. and Tiwari, S. Binola Khadia Tel Ka Uttam Sthrot, p. 14–20.

7.8 Other Publications

1. Ambar 2015 - Hindi Magazine (annual)
2. ICAR-CIRCOT Test Fee Schedule (English and Hindi)
3. Annual Report 2015-16 (English & Hindi)
4. ICAR-CIRCOT : A Profile
5. ICAR-CIRCOTE-Newsletters (monthly)



8. IRC, RAC and IMC

8.1 Institute Research Council (IRC)

The 116th meeting of the IRC was held on April 02, 2016 to review the progress of research work and to consider new project proposals. Dr. P.G. Patil, Director chaired the meeting. Dr. R.P. Kachru, former ADG (PE), ICAR; Dr. S. Sreenivasan and Dr. A.J. Shaikh, former Directors of the Institute attended the meeting as subject matter specialists. The seven project proposals approved during the meeting are :

1. Design and Development of Single Locking Cotton Feeder for Double Roller Gin for Enhancing Ginning Efficiency
2. Development of Activated Carbon from Cotton Stalk for Use in Protective Textiles
3. Development of Durable Antimicrobial Cotton Textile through Fibre Blending Process
4. Development of Suitable Solvent Extraction Process for Obtaining Low Gossypol Cottonseed Meal for Non Ruminant Feed and Food Applications
5. Popularization of CIRCOT Technologies on Compost and Oyster Mushroom Production using Cotton Stalks among the Cotton Growing Farmers of Vidarbha Region
6. Application of Nanocellulose in Cement Concrete, Rubber Composites, Pulp and Paper for Enhancement of Functional and Mechanical Properties
7. Assessment of Factors Influencing Adoption of Scientific Cottonseed Processing in India



Fig. 8.1 The 116th IRC meeting under progress on April 02, 2016

The Half-Yearly IRC meeting was held on October 17-18, 2016 to review the progress of research during April–September 2016. A concept note on Technology Assessment of ICAR Flexi-Check Dam in Different Hydrogeological Regions of Maharashtra was discussed and approved for putting up after carrying out the preliminary work. The Action Taken Report (ATR) on the proceedings of the XXII RAC meeting held on February 26, 2016 was also discussed during the meeting.

The 117th Annual IRC Meeting was held on March 20, 2017. The meeting was chaired by Dr. P.G. Patil, Director, ICAR-CIRCOT. Dr. G.S. Nadiger, Consultant, SASMIRA & RAC Member, Dr. P.V. Varadarajan, Former Principal Scientist, CBPD and Dr. G.R. Anap, International Consultant for Ginning were the external experts present during the deliberations.

Dr. P.G. Patil, Director, in his welcome address, highlighted the research work to be undertaken by the Institute along with the

targets for next three years 2017-20. The focus of the discussion was towards development of technology that will meet the stakeholder's requirement and the ways and means to increase linkages with them. The progress of 13 Institute funded projects and 9 externally funded projects was reviewed. There were seven new project proposals by the scientists.

8.2 Institute Management Council (IMC)

The newly constituted committee held the 76th IMC meeting on December 06, 2016 and reviewed the progress of research carried out, confirmation of the proceedings and ATR on the previous meeting, proposal for approval of new items under plan budget, expenditure up to November, 2016, action taken on the settlement of outstanding audit paras, report on the official language implementation and matters related to grievance cell, IJSC and women cell.



Fig. 8.2 The 76th IMC meeting in progress

8.3 Research Advisory Committee (RAC)

The RAC has been recently reconstituted for a period of three years with effect from November 24, 2016. The newly constituted RAC held its first meeting on February 8-9, 2017 for reviewing the progress of research

carried out over the past one year and gave recommendations for future research work. Two Institute publications were also released on the occasion- 'ICAR-CIRCOT:A Profile' and 'Antimicrobial Cotton Bed Sheets'.



Fig. 8.3 The 23rd RAC meeting in progress



Fig. 8.4 RAC members visit the Nano Cellulose Pilot Plant



9. SEMINARS / CONFERENCES

To keep abreast of the latest developments in specific research areas, the Institute extends support to its staff on selective basis, for attending seminars, symposia, training programmes, workshops and conferences at national and international level.

TABLE 9.1 LIST OF SEMINARS / SYMPOSIA / CONFERENCES / WORKSHOPS / MEETINGS ATTENDED DURING 2016-17

No.	Name of the Conference	Organizer / Venue	Participants
1	INDUTECH 2016	P.S.G. College of Technology, Coimbatore, Tamil Nadu in collaboration with Office of the Textile Commissioner, Government of India and HOF University, Germany (August 26-27, 2016)	A.S.M. Raja A. Arputharaj Krishna Prasad
2	World Textile Conference - 2	The Textile Association (India), Mumbai (September 16-17, 2016)	C. Sundaramoorthy
3	10 th International Conference on Controlled Atmosphere and Fumigation in Stored Products	ICAR, New Delhi (November 06-11, 2016)	P.G. Patil Virendra Prasad Varsha Satankar Sharmila Patil Archana Mahapatra Manoj Kumar N. M. Ashtaputre C. M. More C. P. D' Souza
4	International Textile Conference "Make In India" – Global Vision of Indian Textile Industry	The Lalit Hotel, Andheri, Mumbai (December 1-2, 2016)	P.G. Patil Sujata Saxena
5	Tex Summit - 2016 International Conference on 'Frontiers in Fibres, Textile & Apparel Processing	Jointly Organized by International Textile Machinery Exhibition (ITME 2016) and Institute of Chemical Technology, Mumbai (December 05, 2016)	Sujata Saxena A.S.M. Raja T. Senthilkumar

No.	Name of the Conference	Organizer / Venue	Participants
6	Climate Change Adoption and Biodiversity: Ecological Sustainability for Resource Management for Livelihood Security	ICAR-CIARI, Port Blair (December 08-10, 2016)	C. Sundaramoorthy P.S. Deshmukh
7	International Conference on Emerging Technologies in Agricultural and Food Engineering (ETAE 2016)	IIT, Kharagpur (December 27-30, 2016.)	P.S. Deshmukh V.G. Arude
8	Conference on Segments of Technical Textiles: Present Scenario and Opportunities	Nirmala Niketan College of Home Science, Mumbai (February 03, 2017)	Sujata Saxena
9	De-oiled cake (DOC) as cattle, poultry and fish feed	All India Cottonseed Crushers Association (AICOSCA), Guntur, Andhra Pradesh (June 25, 2016)	V. Mageshwaran
10	Creating Wealth from Waste : Key ICAR Technologies	KVK Sikohpur, Gurgaon, Haryana (October 27, 2016)	Virendra Prasad
11	Meet on Cotton Trade	Maharashtra Cotton Ginners Association, Aurangabad, Jalgaon (October 15, 2016)	P.S. Deshmukh
12	3 rd International Symposium on Coconut Research and Development	ICAR-CPCRI, Kasargod, Kerala (December 10-12, 2016)	T. Senthilkumar
13	44 th Textile Research Symposium	IIT, New Delhi (December 14-16, 2016)	R. Guruprasad
14	Recent Advances in Textile Finishing	ICAR-CIRCOT & Indian Fibre Society Mumbai (December 17, 2016)	All Scientists and Technical Officers
15	51 st Annual Convention of Indian Society of Agricultural Engineers and National Symposium on Agricultural Engineering for Sustainable and Climate Smart Agriculture	CCSHAU, Hisar (February 16-18, 2017)	P.G. Patil S.V. Ghadge P.S. Deshmukh
16	Promotion of <i>Desi</i> Cotton Varieties	ICAR, New Delhi (April 04, 2016)	P.G. Patil
17	Central Cotton Variety Identification Committee	Agricultural Produce Market Committee (APMC) Surat (April 07, 2016)	P.G. Patil

No.	Name of the Conference	Organizer / Venue	Participants
18	First Meeting of the Panel TX 07/ P1 under TXD 07 Textiles Specialty Chemicals and Dyestuffs	Manak Bhawan, New Delhi (April 12, 2016)	Sujata Saxena
19	Meeting on CRP Projects, Scientific, Technical, Financial and Administrative Issues	ICAR, New Delhi (May 10, 2016)	P.G. Patil
20	Interactive meeting to discuss about severe drought and to improve the livelihood situation of farmers in Maharashtra	MPKV, Rahuri; Jalna, Maharashtra (May 30-31, 2016)	P.G. Patil
21	18 th Steering Committee Meeting for Cotton TAP	Ministry of Commerce, Udyog Bhavan, New Delhi (May 31, 2016)	C. Sundaramoorthy
22	Review Meeting of ICAR Regional Committee No. VII	ICAR-CICR, Nagpur (June 02, 2016)	P.G. Patil
23	Review of Research and Educational Activities by Hon. Union Minister of Agriculture Shri Radha Mohan Singh	ICAR-CIFE, Mumbai (July 04, 2016)	P.G. Patil
24	Opportunities for Entrepreneurs in Agro-based Products and Technologies	Gujarat Chamber of Commerce & Industry, Gujarat (July 26, 2016)	P.K. Mandhyan Bharat Pawar
25	24 th Meeting of ICAR Regional Committee VII	The International Centre, Goa (September 08-09, 2016)	P.G. Patil
26	Review Meeting of Directors and Project Coordinators of Engineering Division	ICAR, New Delhi (September 22, 2016)	P.G. Patil
27	Interactive Workshop on “Administrative and Financial Matters” of the ICAR Institutes located in West Zone	CIFE, Mumbai (November 24, 2016)	P.G. Patil T. Venugopal Sujatha Koshy
28	International Textile Conference on “Make in India-GlobalVision of Indian Textile Industry	The Textile Association of India, Mumbai (December 1-2, 2016)	Sujata Saxena
29	Meeting to discuss use of de-gossypolized cottonseed meal to be used as feed component for non-ruminant animals like Pig, Fish and Poultry	ICAR-CCARI, Goa (December 8, 2016)	P.G. Patil

No.	Name of the Conference	Organizer / Venue	Participants
30	One day Brainstorming Workshop on Development of Portal and Mobile App for Agricultural Engineering Division of ICAR	IASRI, New Delhi (December 27, 2016)	P.K. Mandhyan K. Narayanan
31	Indian Chemical Engineering Congress, 69th Annual Session of Indian Institute of Chemical Engineers (CHEMCON 2016)	A.C. Tech, Anna University, Chennai (December 27-30, 2016)	T. Senthilkumar
32	79 th Foundation Day of ICAR-NIRJAFT Kolkata	ICAR-NIRJAFT, Kolkata (January 02-04, 2017)	P.G. Patil
33	Propagation of Extra Mural Research Scheme of Ministry of AYUSH Govt of India	Hotel Kohinoor Park, Mumbai (January 16, 2017)	N. Vigneshwaran
34	Agri-Tech Commercialization Workshop	NASC Complex, New Delhi (January 18-20, 2017)	A. K. Bharimalla
35	Agricultural Exhibition and Farmers' Fare	Krishi Vigyan Kendra, Baramati (January 19-22, 2017)	P.G. Patil
36	Brainstorming Session on Climate Smart Technologies for Enhancing Vegetable oil Production	New Delhi (January 19-20, 2017)	Sujata Saxena
37	Second Workshop on ICAR Research Data Management Repository	ICAR, New Delhi (January 24-25, 2017)	R. Guruprasad
38	Brainstorming Session on Challenges facing Cotton Sector	ICAR-CIRCOT, Mumbai (February 08. 2017)	Scientists and Technical Officers
39	Agricultural Advisory Committee meeting of Doordarshan Kendra, Mumbai	DBSKKV, Dapoli (March 04, 2017)	P.S. Deshmukh
40	Annual review workshop of CRP on Natural Fibres and AICRP on Post-Harvest Engineering and Technology	CIPHET, Ludhiana (March 8-10, 2017)	P.G. Patil A.S.M. Raja



10. EVENTS ORGANISED

10.1 Nano-Cellulose Expert Committee Meeting

Urging the scientists and stakeholders to explore diversified avenues for utilization of nanocellulose from cotton and other agro biomass, the eighth and the final meeting of the nanocellulose pilot plant expert committee concluded on April 01, 2016 which was attended by former ADG, Dr. R.P. Kachru;

former Directors Dr. S. Sreenivasan and Dr. A.J. Shaikh; former director IRMRA, Mumbai Dr. M.S. Banerji; Associate Professor ICT, Mumbai Dr. P.S. Deshmukh; ICAR-CIRCOT Director Dr. P.G. Patil; Senior Scientists Er. A.K. Bharimalla and Dr. N. Vigneshwaran and representative from Lafarge India, Mumbai.

10.2 Annual Group Meeting of AICRP on Cotton

The AICRP on Cotton held its annual meeting at Surat on April 7-9, 2016. Director Dr. P.G. Patil and senior scientist Dr. P.K. Mandhyan, attended the meeting along with technical officers- Dr. S. Venkatkrishnan, Mr. R.S. Prabhudesai, Dr. Hamid Hasan, Mr. R.K. Jadhav, and Mr. Rangari. Shri. Ramanbhai N Patel, Chairman, APMC, Gujarat inaugurated the meeting. Dr. Mandhyan presented the fibre quality evaluation report. During his special address, Dr. Patil stressed upon the importance of quality cotton and need of

the textile industry. He also appealed cotton scientists to consider various quality aspects while formulating their research programmes for enhanced spinning performance of the varieties. Highlighting the importance of utilization of cotton stalk to increase farmer's income, he said that by converting cotton stalk into pellets and briquettes not only solve the problem of burning of stalk in the field but also pave the way for the green energy. He urged to create awareness about scientific crushing of cotton seed.

10.3 Dr. Babasaheb Ambedkar Jayanti

On April 13, all the staff members of the Institute paid homage to an architect of the Indian constitution Dr. Babasaheb Ambedkar on the eve of his 125th Birth Anniversary. Director Dr. P.G. Patil, highlighted about various facets, dreams of Dr. Babasaheb Ambedkar and his contributions to the development of new India.



Fig. 10.1 Dr. Babasaheb Ambedkar Jayanti

10.4 ABI Advisory Meeting

The first advisory sub-committee meeting of ICAR-CIRCOT Agri-Business Incubation (ABI) centre was held on June 13, 2016. It was attended by the former ADG, ICAR Dr. R.P. Kachru and former directors of ICAR-CIRCOT Dr. S. Sreenivasan and Dr. A.J. Shaikh. Dr. P.G. Patil, Director, ICAR-CIRCOT, in his welcome address, presented the achievements of the ABI centre, budget received, support provided to innovations in textile technology, promotion of innovative viable technologies and different performance indicators of the centre. Within a short period of six months three incubatees have been admitted in the ICAR-CIRCOT ABI Centre - M/s Green Globe Mumbai; Mr. R. Annush from M/s The Kadri Mills, Coimbatore and Mr. Irfan Ali, entrepreneur from Raichur, Karnataka. The PI of the project Er. A.K. Bharimalla presented the proposed management strategies of the ABI centre comprising of its objectives and scope, proposed terms & conditions and draft guidelines for incubatees to be admitted at the

centre. The member of the ABI management team Dr. N. Vigneshwaran presented the progress of the activities till date.

10.5 ISO 9001:2008

For the ISO 9001:2008 accreditation, the Bureau of Indian Standards (BIS) conducted the mandatory surveillance audit during August 16-17, 2016. Shri. Sanjay Vij, team leader and Shri. G.P. Kanchi, expert conducted the audit in the MR and top management, chemical and biochemical processing division, administration and the PME cell. The meeting was attended by the management team, expert auditors from outside and the internal auditors. The auditors expressed satisfaction over the functioning of the Quality Management System of the Institute as per the ISO 9001:2008. During the closing remarks, Dr. P.G. Patil, Director, ICAR-CIRCOT appreciated the efforts of scientists Dr. A.S.M. Raja and Mr. A. Arputhraj for maintaining the QMS and hoped for the ISO 9001:2015 during accreditation renewal.



Fig. 10.2 International Yoga Day Workshop by Ambika Yoga Kutir, Mumbai (June 21, 2016)

10.6 Make in India / Made in India

A discussion on “**Make in India/Made in India in Textiles**” was organized jointly with the Indian Fibre Society (IFS) on September 11, 2016. Dr. S.N. Pandey, President, IFS; Dr. S.Sreenivasan, Former Director, ICAR-CIRCOT; Dr. R.P. Nachane, Chairman, IFS; Shri R.M.Gurjar, Secretary, IFS, Dr.P.G. Patil, Director, ICAR-CIRCOT; Shri. Suresh Vaidya, Textile Consultant; Shri. Ulhas Nimkar, Textile Consultant; Dr. G.S.Nadiger, Former Director, Textiles Committee, and Textile Consultant; Dr. P.Varadarajan, Assessor, NABL; Dr.G.R. Anap, International Ginning Consultant; Shri.ArunRoongta, Textile Consultant cum Journalist; Shri.Vidhur, Industrialist; Mr. Mepani, Industrialist and scientists participated in the discussion.

Dr.S.N. Pandey expressed the need for producing quality products at competitive prices. Dr. R.P. Nachane highlighted the positives of Indian textile industry such as high spindleage, rotor capacity, loom capacity and manpower availability. Touching upon the need to develop indigenous machinery he mentioned about the increase in domestic demand for quality products. He pointed out that Indian companies are performing poorly in chemical finishing and garment finishing sectors and advocated measures from central and state governments to ease policies for licensing of industries. Dr. P. G. Patil emphasized that better infrastructure facilities and skill development are the core issues to be targeted for success of this initiative. Applauding the active participation of all members, Dr. S. Sreenivasan concluded the session insisting for better utilization of cotton materials and training of manpower to improve productivity.

It emerged from the brainstorming session that home textile industry in India is flourishing and India can become dominant supplier of home textile products in the future. Immediate action is necessary for quality improvement of long staple cotton to maintain our status as a prominent cotton producer and manufacturer. Need was expressed for fundamental research in waste management; skill development of manpower; revival of the Indian eco label, formulation of Indian organic standard and projection of uniqueness of Indian products.

10.7 National Seminar on Recent Advances in Textile Finishing

A **National Seminar on Recent Advances in Textile Finishing** was organized by ICAR-CIRCOT and Indian Fibre Society (IFS) on December 17, 2016. The seminar was attended by researchers, entrepreneurs, policy makers and students.

Dr. P.G. Patil, Director, ICAR-CIRCOT, during his welcome address, stressed upon the importance of value addition achieved through functional finishing of textiles. “Clothing is no more a basic need, it has become a fashion statement” he said. He referred to the vast energy consumption and pollution load it creates on the environment and overcoming them is the major challenge facing the industry. He also briefed the audience about the research activities carried out in the area of textile finishing like fire retardancy, durable anti-microbial, plasma and nano applications in the finishing of cotton textiles.

Dr. Sujata Saxena, Principal Scientist and Head-In-Charge, CBPD gave an overview of the seminar that has brought researchers, entrepreneurs and policy makers on a common platform for better interaction.

Dr. S.N. Pandey, President, IFS and former director, during his presidential address, referred to textile finishing as a complex process involving imparting functional properties like easy care, durable press, flame retardancy and anti-microbial property which would add value to the cotton garment. While appreciating organizing a national seminar on such an important topic, Dr. Pandey urged the audience, especially the younger generation, to become members of the IFS and carry forward the good work done by the society in the coming years.

Dr. Kavita Gupta, IAS, Textile Commissioner, and the chief guest, congratulated the scientists for carrying out good research work in textile finishing and addressed the audience briefly on the Indian textile industry. She wished that more industries attended this seminar for taking advantage on the various important topics covered. She stressed on the importance of adding value to the finished product through different methods and at the same time pricing them appropriately so that we can compete both in the international and domestic market and that this strategy is the need of the hour, she mentioned. She reminded about the huge gap between India and China with regard to textile production.

She said "We need to regain the lost sheen in textile production which we occupied during ancient times." Through this seminar, we need to discuss how to develop good quality finishing so that we place ourselves better in the international level, she hoped. She elaborately discussed on how government funding can be sought from the textile ministry and exhorted the industries and research organizations to visit the website of the Textile Commissioner's office to get information on the various schemes under which government funds can be sought for modernization or for upgrading the testing facilities.

Dr. R.P. Nachane, Chairman, IFS and Dr. R.M. Gurjar, Secretary, IFS participated in the deliberations and proposed vote of thanks during inaugural function. Deliberations in the seminar were under three sessions- an overview of textile finishing, functional finishing of textiles and application of plant materials for textile finishing with Dr. G.S. Nadiger, Dr. S. Sreenivasan and Dr. N. Bhattacharyya as the chairpersons. There were five oral presentation in each of the three sessions. There was also a poster session. Three publications- A Book of Papers, Souvenir and ICAR-CIRCOT: A Profile were released on the occasion.



Fig. 10.3 Release of ICAR-CIRCOT: A Profile by Dr. Kavita Gupta, Textile Commissioner

10.8 Brainstorming Sessions

On January 09, 2017, a brainstorming session was held on utilisation of cotton stalk as animal feed. A team of Institute scientists interacted with Prof. Narendra Shah along with researchers from IIT, Mumbai and Dr. Narendra Karamble from Bombay Veterinary College on the possibilities of treating cotton stalk for making it suitable for animal feed.

To explore various innovative methods for commercialisation of the Institute technologies through business incubation / start-ups / entrepreneurships, a brainstorming session on “Agri-Business Incubation Ideas” was organised on January 21, 2017. Dr. P.G. Patil, Director chaired the session attended by Dr. S. Sreenivasan, former director and the scientists of the Institute.

To formulate a road map for research in the coming three years, a brainstorming session on “Challenges in Cotton Sector and Role of ICAR-CIRCOT” was organized on February 8, 2017. The session was chaired by Dr. Nawab Ali, Chairman, RAC; co-chaired by Dr. G.S.

Nadiger, Member, RAC and Dr. S.N. Jha, ADG (PE), ICAR and attended by RAC members, invitees from cotton trade and industry, Director, NIRJAFT and former directors. Dr. P.G. Patil, Director briefed about the current research activities of the Institute. The invitees expressed their views on the role of the institute in cotton sector.

10.9 Vigilance Awareness Week

With the focus on 'Public Participation on Promoting Integrity & Eradicating Corruption' vigilance awareness week was celebrated during October 31 - November 05. An invited talk on the topic was delivered by Mr. Jai Kumar, Superintendent of Police, CBI, Mumbai. Vigilance pledge was administered to all the staff of the Institute.

10.10 Communal Harmony Week

Communal Harmony Week was observed in the Institute during November 19-25, 2016. The Director administered the Communal Harmony Oath to the staff.



Fig. 10.4 Dr. Nawab Ali, Chairman making a point during the brainstorming session on “Challenges in Cotton Sector and Role of ICAR-CIRCOT” (February 8, 2017)

10.11 Agricultural Education Day

The birth anniversary of the first president of independent India and union minister of agriculture Bharat Ratna Dr. Rajendra Prasad was commemorated as **Krishi Shiksha Divas** on December 03, 2016. The objective of this celebration was to expose students from schools and colleges to various facets of agriculture and their relevance to country's development. Aimed to inculcate interest in agriculture among students so that they choose agriculture and allied subjects as their professional careers after schooling and become agri-entrepreneurs in future, various events were arranged like debate, essay and art competitions, exhibitions and interaction with agricultural scientists, policy makers, administrators and farmers.

The day was celebrated by facilitating the visit to the Institute of fifty eight students from Sitaram Prakash Higher Secondary School, Wadala, Mumbai. The students were taken to various divisions and explained about the research activities conducted there. They were also taken to the nano-cellulose pilot plant. A documentary on nano-cellulose production

and a glimpse of ICAR-CIRCOT were shown to them. Dr. V.A. Mayande, former vice chancellor, Dr. Panjabrao Deshmukh Krishi Vidyapeeth (PDKV), Akola delivered a talk on the importance of agriculture in the overall development of the country and career options in agriculture after schooling to enthuse interest in students.

10.12 National Productivity Week

From Waste to Profits – through Reduce, Recycle and Reuse was the theme chosen this year for observing the National Productivity Week which was celebrated in the Institute during February 12-18, 2017 by organizing workshops, essay / painting / slogan competitions and debates. Dr. A.S.M. Raja, Sr. Scientist delivered a talk on the subject on February 13, 2017 through a power point presentation highlighting value addition to cotton biomass for producing particle board, corrugated boxes; briquetting and pelleting for energy generation. Two essay competitions were held on **profit generation from cotton and their by-products** and **conversion of agro-waste to useful products**.



Fig. 10.5 *Krishi Shiksha Divas* Celebration on December 03, 2016

10.13 National Science Day

The 27th national science day was celebrated on February 28, 2017 by observing an open day for school children when they were taken to different sections and laboratories to show the latest cotton technology research.

10.14 Director's Visits

- Review meeting of ICAR Regional Committee No.VII at ICAR-CICR, Nagpur on June 2, 2016.
- The 24th meeting of ICAR Regional Committee No.VII at Goa on September 8-9, 2016.
- Review meeting of Directors and Project Coordinators of Engineering Division at ICAR, New Delhi on September 22, 2016.
- Golden Jubilee Celebrations of AICRP and Brain Storming Session at ICAR-CICR Regional Station, Coimbatore on November 9-10, 2016.
- An interactive workshop on “Administrative and Financial Matters” of the ICAR Institutes located in West Zone at CIFE, Mumbai on November 24, 2016.
- Sirsa Unit of ICAR-CIRCOT on February 16, 2017.
- Annual review workshop of CRP on Natural Fibres and AICRP on Post-Harvest Engineering and Technology at CIPHET, Ludhiana during March 8-10, 2017.
- “Krishi Unnati Mela” at Pusa Campus, New Delhi during March 15-17, 2017.

Dr. R.P. Nachane, former head, QEID, ICAR-CIRCOT was also invited to deliver a talk on **Science and Technology for Specially Abled Persons** on the occasion.



Fig. 10.6 Visit to ICAR-CIRCOT Sirsa Unit on Feb 16, 2017



11. HINDI IMPLEMENTATION

11.1 Hindi Workshops

A number of workshops and programmes promoting use of hindi language were organised throughout the year in the Institute. A one-day hindi workshop was organised on June 24, 2016 for the supporting staff of the Institute on Karyalayeen Kamkaj Avam Patrachaar. Smt. Sadhana Tripathi, Assistant Director (Hindi), implementation office of the official language and Dr. Vishwanath Jha, Deputy Director, Hindi teaching scheme delivered lectures on “Karyalayeen Kamkaj” and “Patrachaar”.

Another one-day workshop on Vyavharik Hindi was arranged on August 20, 2016 for the eleven technical officers of the Institute. Shri Sunjay Nigam, former chief marketing manager, Dena Bank and Prof. Mahendra Jain, Hindi teaching scheme, Govt. of India

delivered lectures on the implementation of Hindi language.

Shruti Sammwaad Sahitya Kala Academy in collaboration with ICAR-CIRCOT organized a function on July 26, 2016 to release the 16th edition of Hindi PATRAKARITA KOSH edited by Mr. Aftab Aalam. On this occasion Smt. K.R. Joshi, Hindi Officer of the Institute was felicitated for her achievements in hindi language implementation. Dr. P.G. Patil, Director presided over the function attended by Shri. Kundan Vyas (Editor, Janamabhoomi Group), Shri. Sanjay Singh (Editor, Zee News), Shri. Raghvendra Dwivedi (Editor, Hamara Mahanagar), Shri. Abhijeet Rane (Group Editor, Mumbai Mitra / Vrutt Mitra), Dr. M.H. Ansari (Editor, Qaumi Paigham) and Shri. Sarfaraj Arju (Editor, Roznama Hindustan).



Fig. 11.1 Release of the 16th edition of Hindi Patrakarita Kosh - 2016

A workshop on noting and drafting in Hindi was organized on November 19, 2016 for the administrative staff. Shri. Virendra Kulkarni, Deputy Director, Official Language, Heavy Water Board, Dept. of Atomic Energy, BARC and Shri. V.B.S. Chauhan, Hindi Officer, Dept. of Atomic Energy, Nuclear Power Corporation



Fig. 11.2 Hindi workshop on noting and drafting (November 19, 2016)

of India, Mumbai were the outside guest experts. Shri. Virendra Kulkarni conducted a workshop on scientific and technical writing in Hindi for the technical personnel on March 18, 2017. Under the hindi teaching scheme, classes for 'Hindi Parangat' were arranged during January - May 2017.



Fig. 11.3 Hindi workshop on scientific and technical writing (March 18, 2017)

11.2 Hindi Week / Hindi Day

Hindi Week was celebrated during Sept 8-14, by conducting competitions in noting-drafting, hindi typing, technical translation and Shuddhalekhan. Hindi magazine Ambar

having articles contributed by the staff was brought out. The staff clearing Hindi Prabodh and Pravin exams were felicitated on the occasion of Hindi Diwas on Sept 14, 2016.



Fig. 11.4 Hindi Day - Week celebrations during September 8-14, 2016

11.3 Parliamentary Committee on Official Language

The parliamentary sub-committee on official language reviewed the implementation of Hindi in ICAR-CIRCOT along with other central government offices located in Mumbai during January 12-15, 2017. The honourable members of the committee included Rajya Sabha MP Dr. Prasanna Kumar Patsani and Dr. Sunil Baliram Gaikwad. Dr. S.N. Jha, ADG (PE),

ICAR represented the council during the inspection. Dr. P.G. Patil, Director gave a presentation on the progress of hindi language implementation in the Insitute. The honourable members expressed satisfaction on the work carried out in the Institute related to implementation of the official language.



Fig. 11.5 Visit of Parliamentary Sub-Committee on Official Language (January 12-15, 2017)



12. DISTINGUISHED VISITORS



Fig. 12.1 Shri Radha Mohan Singh, Union Minister for Agriculture and Farmers Welfare along with Shri. Chhabilendra Raul, Secretary, ICAR and Dr. S.N. Jha, ADG(PE), ICAR at the Nano Cellulose Pilot Plant on July 03, 2016



Fig. 12.2 Dr. Trilochan Mohapatra, Secretary, DARE & DG, ICAR at the Exhibition Room on May 06, 2016. He also visited GTC, Nagpur on October 27, 2016



Fig. 12.3 Padma Vibhushan Dr. Anil Kakodkar, Former Chairman, Atomic Energy Commission and Secretary, Govt. of India along with Dr. C.D. Mayee, Former Chairman, ASRB and Dr. K.R. Kranthi, Director, ICAR-CICR, Nagpur on March 07, 2017



Fig. 12.4 Dr. Panjab Singh, Chancellor, Rani Lakshmi Bai Central Agricultural University, Jhansi and Former Secretary DARE and DG, ICAR at the Nano Cellulose Pilot Plant on March 26, 2017.



Fig. 12.5 Dr. K. Alagusundaram, DDG along with Dr. K.K. Singh, ADG, ICAR at scientific seed crushing plant, GTC, Nagpur on June 02, 2016



Fig. 12.6 African Study Tour Delegation from Ethiopia, Sudan, Kenya, Malawi, Swaziland and Zambia on November 14, 2016.



13. SWACHH BHARAT ABHIYAN

The Institute is making all out efforts to keep its premises clean and educate and inculcate the importance of cleaning in all segments of the society. The committee consisting of scientists, technical and administrative staff has been constituted under the chairmanship of the Director to execute and oversee the various activities. Intensive cleanliness campaign was carried out in the Institute premises at regular intervals during the year. Programmes were conducted to remove scrap and other unused discarded materials from various sections and divisions. Innovative activities were conducted to spread the message of cleanliness in and around the premises. All the staff of the Institute contributed in the various cleanliness activities taking due care to avoid any accidents and injuries by using proper cleanliness gears.

Swachha Bharat Pakhwara was observed during May 16-30, 2016. The campaign was kick-started with administering the cleanliness oath to all the Institute staff to maintain cleanliness of their working places and residential premises. A series of events were organized during the fortnight for generating awareness about the programme. A special lecture on “*Swachha Bharat Abhiyan - Nagarikon ki Jimmedari*” was arranged on May 24th 2016 by Shri. Jayanta Joshi, Manager

Glasco Fermentation, Thane. The importance of cleanliness and the waste disposal techniques for in house composting at domestic level was demonstrated by him. An essay competition was conducted on 25th May 2016 on “Swachha Bharat Abhiyan” in which the Institute staff participated enthusiastically.

A drama on the state of cleanliness affairs in Mumbai city was staged by professional “Rangkarmi” group for creating awareness on the filthiness problem in various parts of the city. It was followed by three lectures arranged to create the awareness about other issues emanating from non-cleanliness of the surroundings. The speakers included prominent personality of Matunga and the corporator Smt. Naina Seth, Mr. Tanaji Ghagh of BMC and Mr. Vikram Vaid. Dr. P. G. Patil, Director welcomed the guests and delivered the introductory remarks about swachha bharat abhiyaan in the Institute. All the three speakers highlighted about the importance of segregation of the waste for its easy recycling and composting to make India a clean country. On the concluding day, Smt. Kiran Joshi, Hindi Officer of the Institute delivered a talk on “*Paryavaran Ka Santulan*” and the programme ended with prizes distributed to winners of essay competition.



Fig. 13.1 Cleaning of basement area in the V. Sundaram Building on October 02, 2016



Fig. 13.2 Cleaning of office premises and maintenance of flower pots



Fig. 13.3 Cleanliness Oath during Swachha Bharat Pakhwara



Fig. 13.4 Lecture by Shri. Jayanta Joshi, Glasco Fermentation, Thane



Fig. 13.5 Stage Show by Rangkarmi Group, Mumbai



Fig. 13.6 Smt. Naina Seth's lecture on cleanliness



Fig. 13.7 Cleaning up operation in Mechanical Processing Division



Fig. 13.8 Removing debris and scrap equipment from the QEID



14. MERA GAON MERA GAURAV

The 'Mera Gaon Mera Gaurav' (My Village My Pride) programme launched by the Prime Minister of India in 2015 is one of major initiatives of Govt. of India towards doubling the farm income by way of strengthening the interface of scientists with farmers and to speed up the "lab to land" process. During this course, scientists identified villages in the vicinity of the Institutions for providing information on inputs, weather, markets, govt. schemes through advisories and consultations and conduct awareness, demonstration and training programmes etc., for technology dissemination.

As per this directive, CIRCOT identified and adopted 30 villages in Wardha district of Vidarbha region in Maharashtra. Six teams comprising of four multidisciplinary scientists of each group were formed and each team was allotted five villages for implementation of MGMG programme. Initially, scientists of each group have conducted baseline survey in which basic information of each adopted villages like cropping pattern, land holdings, livestock and problems facing by farmers was collected and analysed. The major annual crops grown in the identified villages are Cotton, Red gram, Soybean, Wheat, Sugarcane and Groundnut. Based on the information gathered from the database, the action plan for 2016-17 was formulated to address the farming and related issues faced by the farmers as given in Table 13.1. The major common agricultural problem identified

in the villages is lower net returns due to minimal farm related activity in addition to main crop cultivation. To increase crop production and sustainable farm income, a series of awareness / demonstration / training programmes were organised along with experts.

Each team of scientists regularly interacted with farmers and arranged awareness programmes, field and technology demonstrations, kisan gothis / meets on different aspects of cotton production, processing and value addition to address the identified problems of the farmers on quarterly basis. The mobile number of a large number of adopted village farmers were added to mobile based advisory services managed by ICAR-CICR, Nagpur that issue weekly advisories to farmers on different aspect of cotton cultivation. The MGMG village farmers were also provided opportunity to interact with institute experts and experts of other research institutes and organisations through farmers' meet and field visits. Thus, a linkage was created between farmers and Institutes, NGO's, State departments and Industries through MGMG programme.

Special training *cum* demonstration programmes on preparation of bio-enriched compost and oyster mushroom from cotton stalk was conducted at six villages in which a large number of farmers from nearby villages were also participated. Hands-on-training was

given to large a number of farmers at GTC, Nagpur on different steps involved in preparation of compost. Farmers have also been provided mobile shredders for on-farm shredding of cotton stalks for preparation of different value added products like briquettes, pellets, composts, mushroom, etc. Awareness about Swachh Bharat Abhiyaan, climate change, water conservation, soil fertility, etc. were spread among farmers. Also, awareness among farmers about various programmes being implemented by different organisations and institutions working at local level were also created.

A Technology and Machinery Demonstration Mela-2017 was organized at GTC, Nagpur to showcase latest technologies, machinery and products on cotton processing & by-product utilisation, specially for MGMG farmers. Live demonstrations on preparation of bio-enriched compost, pellets, particle board and

oyster mushroom cultivation using cotton stalks and cotton processing were also arranged for the benefit of farmers. On this occasion, 12 progressive cotton farmers and budding entrepreneurs were felicitated for their achievement in attaining new heights on cotton productivity and value-addition to cotton stalks.



Fig. 14.1 Scientists interaction with the farmers at Pavnor village

TABLE 14.1 ACTION PLAN PREPARED FOR MGMG FOR THE YEAR 2016-17

No.	PROBLEMS IDENTIFIED	ACTION PLAN TO ADDRESS THE PROBLEM
1.	Lack of knowledge on best management practices for cotton cultivation	Providing latest information on best management practices of cotton cultivation
2.	Harmful effects on overuse of chemical fertilizers on soil health	Use of organic inputs like biofertilizers and compost on improving soil health
3.	Low crop productivity	Soil and water conservation techniques to increase crop productivity
4.	Burning of cotton stalks in the field	Providing information on utilization of cotton stalks for various applications
5.	Low returns from main crop and lack of knowledge on additional farm activity	Preparation of briquettes, pellets, compost and mushroom using cotton stalks to have additional farm income
6.	Lack of information on quality based lint marketing	Clean cotton picking and quality based cotton grading

Awareness Programmes

Best management practices for cotton cultivation, role of bio fertilizers in organic farming, soil and water conservation techniques, lint based marketing, on-farm utilization of cotton stalks, etc.

Demonstration Programmes

Preparation of bio-enriched compost from cotton stalks, oyster mushroom cultivation using cotton stalks, best management practices for clean cotton picking and safe storage, appropriate logistics for supply of cotton stalks, etc.

Training Programmes

Cotton quality parameters and cotton grading, entrepreneurship development on value addition of cotton and its residues.



Fig. 14.2 Awareness programme on preparation of bioenriched compost



Fig. 14.3 CIRCOT experts interact with Ghorad village farmers



Fig. 14.4 Interactive meeting of farmers with scientists and experts on a farmer's field at Sawali (Wagh) village



Fig. 14.5 Inauguration of Machinery and Technology Exhibition



Fig. 14.6 A progressive farmer being felicitated by Dr. K.R. Kranthi



Fig. 14.7 Visit of Mera Gaon Mera Gaurav farmers from Wardha district to GTC, Nagpur



15. INFRASTRUCTURAL FACILITIES

The Institute is well equipped with state of art research and testing facilities for conducting research in post-harvest processing of cotton and allied fibres. Some of the facilities include modern ginning & allied machinery, High Volume Instrument (HVI), Advanced Fibre Information System (AFIS), Scanning Electron Microscope (SEM), X-Ray Diffraction (XRD), Universal Tensile Tester, Tensorapid, Evenness and Hairiness Tester; Vibroscope; Miniature & Full Scale Spinning Machines, DREF Spinning System, Core & Compact Spinning Systems, Banana Fibre Spinning Machines; Circular Knitting Machines; Computerised Sample Weaving Machine; Compression Moulding Machine; Kawabata

Evaluation System (KESF); Contact Angle Tensiometer; Gas Chromatography with Mass Spectrometer (GC-MS), High Performance Liquid Chromatography (HPLC), Fast Protein Liquid Chromatography (FPLC); Atomic Force Microscope (AFM); Thermo Gravimetric Analyser & Differential Scanning Calorimeter; Fourier Transform Infrared Spectrometer (FTIR), Atomic Absorption Spectrometer (AAS); Plasma Reactor for Textile Materials; UPF Analyser, Ultra High Pressure Homogenizer, Nano Particle Size Analyser; Pulp, Paper and Board Making and Testing Facilities; Scientific Cotton Seed Processing Pilot Plant and data analysis softwares (SAS & MATLAB).

INFRASTRUCTURAL FACILITIES CREATED DURING 2016-17

Muffle Furnace	Table Top Refrigerated Centrifuge	Variable Frequency Drive (VFD)
Vacuum Pump Oil Free	Audio and Video Conference System	Modular Furniture for Administration and Accounts
BOD Incubator	Hydro Extractor	HTHP Bleaching Machine
Bacteriological Shaker Incubator	Water Analysis Equipment	Garment Dyeing Machine



Fig. 15.1 Compression Moulding Machine



Fig. 15.2 Garment dyeing machine



Fig. 15.3 Conference Room



Fig. 15.4 Record Room



Fig. 15.5 Training Room



Fig. 15.6 Rooftop Solar water heater



ANNEXURE I

LIST OF ONGOING PROJECTS

Sr. No.	Title	Investigators	Duration
INSTITUTE FUNDED PROJECTS			
Pre-Ginning and Ginning			
1	Investigation of Forces Acting on Different Components of Double Roller (DR) Gins under Different Working Conditions	Varsha Satankar P. G. Patil S. K. Shukla V. G. Arude	2015-17
2	Design and Development of Single Locking Cotton Feeder for Double Roller Gin for Enhancing Ginning Efficiency	V. G. Arude S. K. Shukla P. S. Deshmukh	2016-18
Mechanical Processing, Technical Textiles and Composites			
3	Development of Innovative Fibre Blends and Finishes for Improved Functionality of Cotton Textiles	R. Guruprasad S. K. Chattopadhyay G. T. V. Prabu G. Krishna Prasad T. Senthilkumar P. K. Mandhyan Sujata Saxena A. Arputharaj Virendra Prasad N. Vigneshwaran	2012-17
4	Development of Activated Carbon from Cotton Stalk for Use in Protective Textiles	T. Senthilkumar S. K. Chattopadhyay Sujata Saxena R. Guruprasad	2016-18
5	Development of Durable Antimicrobial Cotton Textile through Fibre Blending Process	G. Krishna Prasad S. K. Chattopadhyay R. Guruprasad T. Senthilkumar A. S. M. Raja Bindu Venugopal Nandita Ashtaputre	2016-18

Sr. No.	Title	Investigators	Duration
Characterisation of Cotton and other Natural Fibres, Yarns and Textiles			
6	Quality Assessment and Performance Improvement of Indian Cottons	P. K. Mandhyan S. K. Dey G. T. V. Prabu	2012-17
7	Design and Development of Lint Opener for Preparation of Samples for Micronaire Testing	S. V. Ghadge S. K. Shukla V. G. Arude A. K. Bharimalla C. Sundaramoorthy P. G. Patil	2015-17
Chemical and Biological Processing, Biomass and By-Products Utilisation			
8	Development of Innovative Dyeing and Finishing Process for Cotton Garments	A. S. M. Raja Virendra Prasad A. Arputharaj Sujata Saxena	2015-18
9	Advanced Technology to Predict Dye Recipe for Non-metameric Colour Matching in Textile	P. Jagajanantha A. S. M. Raja C. Sundaramoorthy A. K. Bharimalla	2015-17
10	Development of Suitable Solvent Extraction Process for Obtaining Low Gossypol Cottonseed Meal for Non Ruminant Feed and Food Applications	Sujata Saxena Virendra Prasad Sudha Tiwari Charlene D'Souza	2016-18
Entrepreneurship and Human Resource Development			
11	Popularization of CIRCOT Technologies on Compost and Oyster Mushroom Production using Cotton Stalks among the Cotton Growing Farmers of Vidarbha Region	V. Mageshwaran S. K. Shukla C. Sundaramoorthy Varsha Satankar	2016-17
12	Application of Nano Cellulose in Cement Concrete, Rubber Composites, Pulp and Paper for Enhancement of Functional and Mechanical Properties	A. K. Bharimalla N. Vigneshwaran P. G. Patil	2016-17
13	Assessment of Factors Influencing Adoption of Scientific Cottonseed Processing in India	P. S. Deshmukh C. Sundaramoorthy Varsha Satankar	2016-18

Sr. No.	Title	Investigators	Duration
EXTERNALLY FUNDED PROJECTS			
Ministry of External Affairs, Govt of India			
1	Technical Assistance Programme (TAP) to Strengthen Cotton Value Chain in Cotton-4 Countries (Benin, Burkina Faso, Chad & Mali), Malawi, Nigeria and Uganda in Africa	P. G. Patil A. K. Bharimalla S. K. Shukla V. G. Arude C. Sundaramoorthy Jyoti Nath P. S. Deshmukh	2012-17
Technology Mission on Cotton – Mini Mission			
2	Development of Cotton Picking Machinery for Small Scale Cotton Production System	S. K. Shukla V. G. Arude	2013-17
3	Agro Techniques for High Density Planting System and Surgical Cotton Varieties: Evaluating Promising Genotypes for Yield and Surgical / Absorbent Properties	Sujata Saxena R. D. Nagarkar R. S. Prabhudesai Nandita Ashtaputre S. V. Ghadge	2013-17
Collaborative Project with CPRI, Shimla			
4	Cellulose Based Nano Composite Film for Application in Packaging	N. Vigneshwaran A. K. Bharimalla Virendra Prasad A. Arputharaj	2014-17
Extra Mural Project			
5	Preparation of Specialty Grade Pulp from Cotton Linters for Production of Security Paper	Virendra Prasad Sujata Saxena A. S. M. Raja P. K. Mandhyan A. Arputharaj	2016-18
Agri Business Incubation (ABI)			
6	Agri Business Incubation Centre at ICAR – CIRCOT, Mumbai	A. K. Bharimalla S. K. Shukla N. Vigneshwaran P. K. Mandhyan V. G. Arude C. Sundaramoorthy V. Mageshwaran S. Venkatakrishnan Hamid Hasan Bharat Pawar	2015-17

Sr. No.	Title	Investigators	Duration
Consortia Research Project (CRP)			
7	Utilisation of Ligno Cellulosic Fibre based Biomass as Renewable Energy for Rural and Industrial Application	S. K. Shukla C. Mageshwaran Varsha Satankar C. Sundaramoorthy S. V. Ghadge P. G. Patil A. S. M. Raja V. G. Arude	2015-17
8	Preparation of Nano Ligno Cellulose and its Incorporation in Polymer Composites for Improved Performance	N. Vigneshwaran A. K. Bharimalla Virendra Prasad C. Sundaramoorthy T. Senthilkumar	2015-17
9	Eco-friendly method of preparing absorbent/surgical cotton from non-spinnable cotton	P. Jagajanantha A. K. Bharimalla P. K. Mandhyan S. K. Shukla V. Mageshwaran Varsha Satankar	2015-17
10	Sustainable Green Technology for Dyeing of Cotton Textile	A. S. M. Raja Virendra Prasad A. Arputharaj T. Senthilkumar	2015-17



ANNEXURE II

PERSONNEL

(as on March 31, 2017)

DIRECTOR

Dr. P.G. Patil

M. Tech., Ph.D. (Engg.), F.T.A.

HQ, MUMBAI

PRINCIPAL SCIENTISTS

1. **Dr. S.K. Chattopadhyay**, M.Tech., Ph.D. (Tech.), F.T.I.
Pr. Scientist (Textile Manufacture)
2. **Dr. (Smt.) Sujata Saxena**, M.Sc., Ph.D.
Pr. Scientist (Organic Chemistry)
Head-in-Charge, CBPD

SENIOR SCIENTISTS

1. **Dr. S.V. Ghadge**, M.E., MBA, Ph.D.
Sr. Scientist (Farm Machinery & Power)
2. **Dr. A.S.M. Raja**, M. Sc., Ph.D.
Sr. Scientist (Textile Chemistry)
3. **Dr. S.K. Dey**, M. Tech., Ph.D. (Engg.)
Sr. Scientist (Physics)
4. **Er. A.K. Bharimalla**, M. Tech.,
Sr. Scientist (Composite)
Head-in-Charge, TTD
5. **Dr. P.K. Mandhyan**, M.Sc., Ph.D., A.T.A
Sr. Scientist (Technical Textiles)
Head-in-Charge, QEID
6. **Dr. N. Vigneshwaran**, M.Sc., MBA, Ph.D.
Sr. Scientist (Agricultural Microbiology)
7. **Dr. P.S. Deshmukh**, M. Tech., Ph.D.
Sr. Scientist (Farm Machinery & Power)

8. **Dr. Virendra Prasad**, M.Sc., Ph.D.
Sr. Scientist (Organic Chemistry)
9. **Dr. C. Sundaramoorthy**, M.Sc., Ph.D.
Sr. Scientist (Agricultural Economics)

SCIENTISTS

1. **Er. V.G. Arude**, M. Tech.
Scientist (Farm Machinery & Power)
Head-in-Charge, MPD
2. **Shri.A. Arputharaj**, M.Sc., M. Tech.
Scientist (Textile Chemistry)
3. **Dr. R. Guruprasad**, M. Tech., Ph.D.
Scientist (Textile Manufacture)
4. **Shri. G.T.V. Prabu**, M. Tech.
Scientist (Textile Manufacture)
(on study leave)
5. **Shri. G. Krishna Prasad**, M. Tech.
Scientist (Textile Manufacture)
6. **Dr. T. Senthilkumar**, M. Tech., Ph.D.
Scientist (Textile Manufacture)
7. **Shri. Santanu Basak**, M. Tech.
Scientist (Textile Chemistry)
(on study leave)
8. **Dr. P. Jagajanantha**, M. Tech., Ph.D.
Scientist (Textile Chemistry)
9. **Dr. (Smt.) Sharmila Patil**, M.Sc., Ph.D.
Scientist (Agril. Process Engg)
10. **Er. (Smt.) Archana Mahapatra**, M.Tech.
Scientist (Agril. Process Engg)
11. **Dr. Manoj Kumar**, M.Sc., Ph.D.
Scientist (Plant Biochemistry)

TECHNICAL STAFF

Chief Technical Officers

Shri. M. Mohan, M.Sc., Dip. J.
Dr. (Smt.) Sheela Raj, M.Sc., Ph.D.

Assistant Chief Technical Officers

1. **Dr. R. D. Nagarkar**, M.Sc., Ph.D.
2. **Shri. R. S. Prabhudesai**, M.Sc., D.C.M.
3. **Shri. G. B. Hadge**, M.Sc.
4. **Dr. M. V. Vivekanandan**, M.Sc., Ph.D.
5. **Shri. B. R. Pawar**, M. Sc., LL.M.
6. **Dr. (Smt.) N. M. Ashtaputre**, M.Sc.,
Ph. D.
7. **Shri. R. K. Jadhav**, M.Sc.
8. **Shri. S. Banerjee**, M.Sc.
9. **Shri. C. M. More**, M.Sc.
10. **Shri. R. R. Chhagani**, M.Sc.
11. **Shri. H. S. Koli**, M.Sc., LL.B.
12. **Shri. D. N. Moon**, B.Sc.
13. **Dr. (Smt.) S. R. Kawlekar**, M.Sc.,
P.I.M.R., Ph.D.
14. **Dr. (Smt.) Sudha Tiwari**, B.Sc., Ph.D.
15. **Smt. P. S. Nirhali**, M.Sc.
16. **Shri. S. V. Kokane**, M.A.

Senior Technical Officers

1. **Shri. T. Venugopal**, B.E.
2. **Shri. S. M. Gogate**, B.Sc.
3. **Shri. K. Narayanan**, B.Sc.
4. **Shri. P. N. Sahane**, D.I.F.T.
5. **Smt. Binu Sunil**, M.Sc.
6. **Shri. D. U. Kamble**, B.Sc.
7. **Smt. N. A. Sonkusle**, B.Sc.
8. **Smt. Bindu Venugopal**, M.Sc.
9. **Dr. (Ms.) C. P. D' Souza**, M.Sc., Ph.D.
10. **Shri. R. S. Narkar**, M.Sc., D.C.I.A.
11. **Smt. P. R. Mhatre**, B.Sc., M.Lib.
12. **Smt. C. D. Prabha**, M.Sc.

Technical Officers

1. **Shri. V. D. Kalsekar**, B.Sc.
2. **Shri. C. V. Shivgan**, Cert. Elec. Supr.
PWD, Cert. M. & A.W. Technician
3. **Shri. M. G. Ambare**, M.Sc.
4. **Shri. S. N. Patil**, B.E. (Civil)
5. **Shri. N. D. Kambli**, M.Sc.

Senior Technical Assistants

1. **Shri. D. M. Correia**, I.T.I., N.C.T.V.T.
(Mechanic)
2. **Smt. H. R. Pednekar**, B.A., B.Lib.
3. **Shri. R. P. Kadam**, M.Sc.
4. **Smt. M. P. Kamble**, B.A., M.Lib.
5. **Shri. A. R. Jadhav**, B.Sc.

Technical Assistants

1. **Dr. Deepak Meena** (on Lien)
2. **Shri. Krishna Bara**, D.H.T.
3. **Shri. S. K. Parab**, Cert. Cot. Spin.
4. **Shri. D. A. Salaskar**, Driver

Senior Technicians

1. **Shri. D. M. Raje**
2. **Shri. R. R. Gosai**
3. **Shri. N. K. Shaikh**
4. **Shri. Mahabir Singh**
5. **Shri. S.V. Kokane**
6. **Shri. M. M. Kadam**
7. **Shri. S. G. Phalke**
8. **Shri. D. J. Dhodia**
9. **Shri. Yogesh Nagpure**

Technicians

1. **Shri. D. G. Gole**

ADMINISTRATIVE STAFF

Assistant Administrative Officers

1. **Smt. S. Koshy**, B.Com. (Head of Office)
2. **Shri. Y. R. Pathare**, B.Sc., M.B.A.
3. **Smt. T. P. Mokal**, M.A.(Hindi)
4. **Shri. R. K. Pallewad**, B.A.
5. **Shri. S. A. Telpande**, M.Com.

Private Secretary

1. **Smt. S.D. Dudam**, M.A.

Assistants

1. **Smt. V. V. Janaskar**, B.Com.,
M.A.(Hindi)
2. **Smt. S. R. Shirsat**, B.A.
3. **Shri. N. V. Kambli**
4. **Smt. N. M. Deshmukh**, M.A., LL.B.
5. **Shri. S. D. Ambolkar**
6. **Shri. P. V. Jadhav**

Personal Assistants

1. **Smt. T.T. D'Souza**
2. **Smt. U.N. Bhandari**

Assistant Finance & Accounts Officer

1. **Shri. S.V. Kasabe**, B.Com, L.L.B.

Stenographer Gr. III

1. **Smt. R.R. Tawde**, B.Com.
2. **Smt. V. R. Naik**, B.A.

Upper Division Clerks

1. **Smt. S. G. Parab**, B.A. (Sociology),
B.A. (Hindi)
2. **Smt. S. P. Paiyala**
3. **Smt. J. R. Chavkute**
4. **Shri. V. M. Sable**
5. **Smt. B. D. Kherodkar**
6. **Shri. S. S. Angane**
7. **Shri. T. D. Dhamange**, B.Com.
8. **Shri. S. N. Bandre**

Lower Division Clerk

1. **Smt. V.N. Walzade**, B.A.

SKILLED SUPPORT STAFF

1. **Shri. M.Z. Rathi**
2. **Shri. M.K. Ghadge**
3. **Shri. D.B. Temgire**
4. **Shri. C.S. Salvi**
5. **Shri. K.T. Mahida**
6. **Shri. M.M. Katpara**
7. **Shri. M.A.A. Rashid**
8. **Shri. G.N. Mayawanshi**
9. **Shri. H.B. Vesmiya**
10. **Shri. M.J. Sumra**
11. **Shri. S.K. Bobate**
12. **Shri. P.P. Patil**
13. **Shri. R.G. Tak**
14. **Shri. R.P. Karkate**
15. **Shri. C.D. Acharekar**
16. **Shri. M.K. Prabhulkar**
17. **Shri. J.D. Sakpal**
18. **Shri. V. Murugan**
19. **Shri. S.D. Magar**
20. **Shri. S.B. Worlikar**
21. **Shri. S.R. Tondse**
22. **Shri. V.B. Poojari**
23. **Shri. M.N. Kamble**
24. **Shri. S.S. Surkule**
25. **Shri. S.P. Naik**
26. **Smt. K. Murugan**
27. **Shri. D.K. Kasar**
28. **Shri. S.R. Tondse**
29. **Shri. D.R. Gawde**
30. **Shri. S.M. Chandanshive**
31. **Shri. P.E. Gurav**
32. **Shri. M.C. Solanki**

GTC, NAGPUR**SCIENTIFIC STAFF**

1. **Dr. S.K. Shukla**, M.Tech., Ph.D.
Sr. Scientist (Agril. Process Engg) & I/c
2. **Dr. (Mrs.) Jyoti M. Nath**, M.Sc., Ph.D.
Sr. Scientist (Electronics & Instrumentation)
3. **Dr. V. Mageshwaran**, M.Sc., Ph.D.
Scientist (Agricultural Microbiology)
4. **Er. (Ms.) Varsha Satankar**, M.Tech.
Scientist (Agril. Structures and Process Engg)

TECHNICAL STAFF

1. **Er. D. U. Patil, B. Tech.** (Agril. Engg.)
Chief Technical Officer
2. **Shri. V.L. Rangari**, M.Sc.
Senior Technical Officer
3. **Shri. U.D. Devikar**, M.Sc.
Senior Technical Officer
4. **Shri. S.L. Bhanuse**, B.Sc.
Senior Technical Officer
5. **Shri. R. G. Dhakate**, B.Sc.
Senior Technical Officer

6. **Shri. S.N. Hedau**, B.Sc.
Senior Technical Officer
7. **Shri. B.V. Shirsath**, M.A., I.T.I
Senior Technical Assistant
8. **Shri. Umrao Meena**
Senior Technician

ADMINISTRATIVE STAFF

1. **Shri. K. Parleswar**
Assistant Administrative Officer
2. **Shri. R. G. Matel**
Lower Division Clerk
3. **Shri. R. D. Shambharkar**, M.A.
Stenographer (Gr. III)

SKILLED SUPPORT STAFF

1. **Shri. M. P. Tohokar**
2. **Shri. J. P. Patel**
3. **Shri. R. B. Kautkar**
4. **Shri. R. S. Umare**
5. **Smt. M.M. Bhandakkar**

QE UNIT, COIMBATORE

1. **Dr. S. Venkatakrishnan**, M.Sc., Ph.D.,
A.T.A., F.T.A
Chief Technical Officer & I/c
2. **Shri. S. Mukundan**, M.Sc.
Asstt. Chief Technical Officer
3. **Shri. M. Bhaskar**, Dip. Ref. & Air-Cond.
Technical Officer
4. **Shri. V. Subbaiah**
Skilled Support Staff

QE UNIT, DHARWAD

1. **Smt. V.G. Udikeri**, B.Sc.
Technical Officer & I/c
2. **Shri. C.J. Bagalkoti**
Skilled Support Staff
3. **Shri. A.F. Gudadur**
Skilled Support Staff

QE UNIT, GUNTUR

1. **Shri. K. Thiagarajan**, M.Sc.
Asstt. Chief Technical Officer & I/c

QE UNIT, SIRSA

1. **Dr. Hamid Hasan**, M.Sc., Ph.D.
Asstt. Chief Technical Officer & I/c
2. **Dr. Jal Singh**, M.Sc., Ph.D.
Sr. Technical Officer

QE UNIT, SURAT

1. **Shri. G.G. Mistry**, B.Sc.
Senior Technical Officer & I/c
2. **Shri. M.B. Patel**, B.Sc., L.L.B
Senior Technical Officer
3. **Shri. M.G. Sosa**
Skilled Support Staff

APPOINTMENTS

Scientific Appointments w.e.f. 05-07-2016

1. **Dr. (Smt.) Sharmila Patil**, M.Sc., Ph.D.
Scientist (Agril. Process Engineering)
2. **Er. (Smt.) Archana Mahapatra**, M.Tech.
Scientist (Agril. Process Engineering)
3. **Dr. Manoj Kumar**, M.Sc.
Scientist (Plant Biochemistry)

PROBATION CLEARANCE

Scientific Probation Clearance w.e.f. January 28, 2017

1. **Dr. P. Jagajantha**, M. Tech., Ph.D.
Scientist (Textile Chemistry)
2. **Er. (Ms.) Varsha Satankar**, M.Tech.
Scientist (Agricultural Structures and
Process Engineering)

PROMOTIONS

Sr. No.	Name of Staff	Grade to which Promoted	Date of Effect
1	Dr. P.S. Deshmukh	Senior Scientist	20-03-2013
2	Shri. M. Mohan	Chief Technical Officer	01-01-2016
3	Dr. (Smt.) Sheela Raj	Chief Technical Officer	01-01-2016
4	Dr. (Smt.) Sudha Tiwari	Assistant Chief Technical Officer	05-09-2009
5	Smt. P. S. Nirhali	Assistant Chief Technical Officer	20-11-2015
6	Shri. S. V. Kokane	Assistant Chief Technical Officer	01-01-2016
7	Shri. T. Venugopal	Senior Technical Officer	05-11-2003
8	Shri. N.V. Bansode	Senior Technical Officer	01-07-2004
9	Dr. (Ms.) C. P. D' Souza	Senior Technical Officer	30-06-2014
10	Shri. R. S. Narkar	Senior Technical Officer	29-07-2014
11	Smt. P. R. Mhatre	Senior Technical Officer	01-09-2014
12	Smt. C. D. Prabha	Senior Technical Officer	01-07-2015
13	Shri. S. N. Patil	Technical Officer	07-07-2015
14	Shri. M. G. Ambare	Technical Officer	01-08-2015
15	Smt. V. G. Udikeri	Technical Officer	04-08-2015
16	Shri. N. D. Kambli	Technical Officer	28-12-2015
17	Shri. R. P. Kadam	Senior Technical Assistant	29-06-2014
18	Smt. M. P. Kamble	Senior Technical Assistant	16-10-2014
19	Shri. A. R. Jadhav	Senior Technical Assistant	19-04-2016
20	Shri. D. J. Dhodia	Senior Technician	01-03-2016
21	Shri. Umrao Meena	Senior Technician	23-03-2016
22	Shri. Yogesh Nagpure	Senior Technician	05-04-2016
23	Shri. S. A. Telpande	Assistant Administrative Officer	09-03-2017

DEPUTATIONS ABROAD

Names of Scientists	Name of the Programme	Place	Period
Dr. S. K. Shukla Dr. C. Sundaramoorthy	Skill development-cum-training programme on Post-harvest management of cotton and value addition to crop residue	Cotton House, Ouagadougou, Burkina Faso	May 16-17, 2016
Dr. S. K. Shukla Dr. C. Sundaramoorthy	In-country training Programme on Post-harvest Management & Value addition to Crop Residue under Cotton TAP	Benin, Africa	May 14-24, 2016

TRANSFERS

1. **Shri. Manik Bhowmick**, Scientist transferred to ICAR–NIRJAFT, Kolkata w.e.f. 13-05-2016.
2. **Shri. D.U. Patil**, Chief Technical Officer transferred from ICAR–IIWM, Bhubaneswar to GTC, Nagpur w.e.f. 18-04-2016.
3. **Shri. S. Mukundan**, Asstt Chief Technical Officer transferred from Guntur to Coimbatore centre w.e.f. 06-05-2016
4. **Shri. K. Thiagarajan**, Asstt Chief Technical Officer transferred from Coimbatore to Guntur centre w.e.f. 21-07-2016

RETIREMENTS

1. **Smt. K. R. Joshi**, Sr. Technical Officer superannuated on August 31, 2016

ON LIEN

1. **Dr. Deepak Meena**, Technical Assistant w.e.f. May 09, 2016

RESIGNATIONS

1. **Shri. Vijay Kumar Suthar**, Technician resigned w.e.f. July 22, 2016



ANNEXURE III

LIST OF COMMITTEES

Institute Management Committee (IMC)

Dr. P.G. Patil, Director, Chairman

Dr. S.N. Jha, ADG (PE), ICAR, New Delhi

Dr. Sandhya Kranthi, Head, Crop Protection Division, ICAR-CICR, Nagpur

Dr. S.N. Chattopadhyay, Principal Scientist, ICAR-NIRJAFT, Kolkata

Dr. A.L. Kamble, F&AO I/c, ICAR-NIASM, Baramati

Research Advisory Committee (RAC)

Dr. Nawab Ali, Former DDG (Agril. Engg.), ICAR, Chairman

Dr. G.S. Nadiger, Research Advisor (SASMIRA) & Former Director (Textile Committee), Mumbai

Dr. Anup Rakshit, Executive Director, Indian Technical Textiles Association, Mumbai

Dr. Narendra G. Shah, Professor, Centre for Technology Alternatives for Rural Areas, IIT, Mumbai

Dr. Bijay K. Behera, Professor & Head, Department of Textile Technology, IIT, Delhi

Dr. D. Nag, Former Director, ICAR-NIRJAFT, Kolkata

Dr. P.G. Patil, Director, ICAR-CIRCOT, Mumbai

Dr. S.N. Jha, ADG (PE), ICAR, New Delhi

Er. V.G. Arude, i/c PME Cell, Member-Secretary

Project Monitoring and Evaluation Committee (PMC)

Dr. P.G. Patil, Director, Chairman

Dr. (Smt.) Sujata Saxena, In-charge Head, CBPD

Dr. P.K. Mandhyan, In-charge Head, QEID

Er. A.K. Bharimalla, In-charge Head, TTD

Er. V.G. Arude, In-charge Head, MPD & i/c PME Cell, Member secretary

Priority-setting, Monitoring & Evaluation (PME) Cell

Er. V.G. Arude, Scientist, In-charge

Er. A.K. Bharimalla, Sr. Scientist

Dr. N. Vigneshwaran, Sr. Scientist

Dr. P.K. Mandhyan, Sr. Scientist

Dr. R. Guruprasad, Scientist

Dr. C. Sundaramoorhty, Sr. Scientist, Nodal Officer

Shri M. Mohan, CTO

Shri K. Narayanan, STO

Smt. H.R. Pednekar, STA

Institute Technology Management Committee (ITMC)

Dr. P.G. Patil, Director, Chairman
Dr. (Smt.) Sujata Saxena, In-charge Head, CBPD
Er. V.G. Arude, In-charge Head, MPD
Dr. N. Vigneshwaran, Sr. Scientist, CBPD
Dr. B.B. Nayak, Principal Scientist, CIFE, Mumbai
Dr. C. Sundaramoorthy, Sr. Scientist, TTD, Member Secretary
Er. A.K. Bharimalla, Head In-charge TTD& in-charge ITMU

Institute Technology Management Unit (ITMU)

Er. A.K. Bharimalla, Sr. Scientist, In-charge
Dr. N. Vigneshwaran, Sr. Scientist
Dr. P.K. Mandhyan, Sr. Scientist
Dr. M.V. Vivekanandan, ACTO
Shri G.B. Hadge, ACTO

Institute Joint Staff Council

Dr. P.G. Patil, Director, Chairman
Dr. P.K. Mandhyan, Sr. Scientist
Er. V.G. Arude, Scientist
Shri. R.D. Nagarkar, ACTO
Smt. Sujata Koshy, Head of Office
Shri. S.V. Kasabe, AF&AO
Shri. Yogesh Pathare, AAO, Member Secretary
Shri. Sudhakar M Chandanshive, SSS, staff side, Secretary
Shri. P.V. Jadhav, Assistant, CJSC Member
Shri. R.R. Gosai, T-2
Shri. S.D. Magar, SSS

Women Complaint Cell

Dr. (Smt.) Sujata Saxena, In-charge Head, CBPD, Chairman
Smt. Rohini Jadhav
Er. V.G. Arude, Scientist
Dr. (Smt.) Sheela Raj, ACTO
Smt. Viniya Nayak, Stenographar
Smt. S.R. Shirsat, Assistant
Smt. P.R. Mhatre, Technical Officer, Member Secretary

Staff Welfare Fund Committee

Dr. P.K. Mandhyan, Sr. Scientist, Chairman
Dr. R. Guruprasad, Scientist
Shri D.U. Kamble, STO
Shri S.V. Kasabe, (AF&AO)
Shri P.V. Jadhav, Assistant
Smt. Sujata Koshy, AAO, Member Secretary

Innovation Cell

Dr. P.G. Patil, Director, Chairman
Dr.(Smt.) Sujata saxena, In-charge Head, CBPD
Er. V.G. Arude, Scientist
Dr. A.S.M. Raja, Sr. Scientist
Er. G.T.V. Prabu, Scientist, Member -Secretary
Dr. R.D. Nagarkar, ACTO
Administrative Officer
AF&AO

ISO-9001:2008 Management Committee

Dr. P.G. Patil, Director, Chairman
Dr. (Smt.) Sujata Saxena, Head In-charge, CBPD
Er, V.G. Arude, Head In-charge, MPD
Dr. P.K. Mandhyan, In-charge Head, QEID
Dr. A.S.M. Raja, Sr. Scientist
Er. A.K. Bharimalla, Head In-charge, TTD
Shri A. Arputharaj, Scientist
Administrative officer
AF&AO

Sports Committee

Er. G.T.V. Prabu, Scientist, Chairman
Smt. Sujata Koshi, Head of Office
Shri. S.V. Kasabe, AF&AO
Shri. Yogesh Pathare, AAO, Admn IV & V
Shri. D.U. Kamble, Senior Technical Officer
Smt. Smita Paiyala, Senior Clerk
Shri. S.M. Chandanshive, S.S.S, IJSC Member
Shri. Manoj Ambare, Technical Officer, Member Secretary

Purchase Committee

Dr. (Mrs.) Sujata Saxena, Principal Scientist & i/c Head CBPD, Chairperson
Er. Ashok Bharimalla, Sr. Scientist
Dr. Virendra Prasad, Sr. Scientist
Er. G. Krishna Prasad, Scientist
Shri. S. Banerjee, ACTO
Assistant Finance & Accounts Officer
Assistant Administrative Officer (admn II), Secretary

Technical Evaluation Committee

Dr. S.V. Ghadge, Sr. Scientist, Chairman
Er. V.G. Arude, Scientist
Dr. N. Vigneshwaran, Sr. Scientist
Dr. Senthilkumar, Scientist
Dr. R. Guruprasad, Scientist
Mr. S. Banerjee, ACTO
Smt. Sujatha Koshy, AAO (Admn II), Member Secretary

Swachhata Mission Committee

Dr. P.G. Patil, Director, Chairman
Dr. A.S.M. Raja, Sr. Scientist
Dr. S.K. Dey, Sr. Scientist
Dr. Virendra Prasad, Sr. Scientist
Dr. Jagajanantha. P, Scientist
Smt. Sujata Koshy, Head of Office
Shri Sharad V. Kokane, Security Officer
Shri N.D. Kambli, Technical Officer

Rajbhasha Committee

Dr. P.G. Patil, Director, Chairman
Dr. (Mrs.) Sujata Saxena, Principal Scientist & i/c Head CBPD
Dr. A.S.M. Raja, Sr. Scientist
Er. V.G. Arude, Scientist
Er. Ashok Bharimalla, Sr. Scientist
Dr. P.K. Mandhyan, Sr. Scientist
Smt. P.R. Mhatre, Technical Officer
Smt. Sujata Koshy, Head of Office
Shri S.V. Kasabe, AF&AO
Shri R.K. Pallewad, AAO
Shri Yogesh Pathare, AAO
Smt. T.P. Mokal, AAO

Works Committee

Er. A.K. Bharimalla, Sr. Scientist & i/c Head TTD, Chairman
Shri A. Arputharaj, Scientist
Shri B.R. Pawar, ACTO
Smt. Sujata Koshy, Head of Office
Shri S.V. Kasabe, AF&AO
Er. T. Venugopal, Officer i/c Engg., Member Secretary



Citizen's/Client's Charter
ICAR – Central Institute for Research on Cotton Technology
 Adenwala Road, Matunga, Mumbai – 400019
Phone: (022) 24127273/76, 24184274/75, **Fax:** (022) 24130835
Website: <http://www.circot.res.in>



VISION

Global Excellence in Cotton Technology

MISSION

To provide scientific and managerial interventions to post-harvest processing and value addition to cotton and utilization of its by-products to maximize economic, environmental and societal benefits.

MAIN SERVICES/TRANSACTIONS

Sr. No.	Services/Transactions	Responsible Persons
1	Commercial Testing:Fibre, Yarn, Fabric, Garment, Spinnability, Non-Lint Content, Linter, Seed, Paper, Chemical and Biochemical Tests of Textile Materials, ECO, SEM, XRD, etc.	Mrs. P.S. Nirhali Test House Phone Ext 456 / 457 circotest@gmail.com
2	Imparting Training to Stakeholders	Dr. P.S. Deshmukh Technology Transfer Division Phone Ext 227 prashadeshmukh@gmail.com AND Dr. S.K. Shukla Ginning Training Centre, Nagpur Phone (0712) 2500592 , 2500289 skshukla2000@gmail.com
3	Supply of Calibration Cotton	Dr. P.K. Mandhyan Quality Evaluation and Improvement Division Phone Ext447 pkmandhyan@gmail.com
4	Consultancy and Technology Transfer	Er. A.K. Bharimalla Technology Transfer Division Phone Ext467 ashokbhari72@gmail.com

Public Grievance Officer

Ms. Sujatha Koshy, Head of Office
Phone: 022-24127627 Ext138, **E-mail:** sujata.koshy@icar.gov.in

For Further Information, Contact

Dr. P.G. Patil, Director, ICAR-CIRCOT, Mumbai



सूचना का
अधिकार

हमारा उद्देश

OUR MOTIVE

पारदर्शिता को बढ़ावा देने के लिए

To Promote Transparency

जबाबदेही को बढ़ावा देने के लिए

To Promote Accountability

सूचना का अधिकार अधिनियम, २००५ की घोषणा के अनुसरण में, निम्नलिखित अधिकारियों को इस संस्थान में जनसूचना अधिकारी, सहाय्यक जनसूचना अधिकारी और अपीलीय प्राधिकारी के रूप में नामित किया गया है।

In Persuance of the promulgation of Right to Information Act, 2005, the following Officers are designed as CPIO, Assistant CPIO and Appellate Authority at this institute.

क्रेन्द्रीय लोक सूचना अधिकारी

Central Public Information Officer

श्रीमती. सुजाता कोशी

कार्यालय प्रमुख, भा.कू.अनु.प-के.क.क.प्रौ.अनु.सं.

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सहाय्यक क्रेन्द्रीय लोक सूचना अधिकारी

Assistant Central Public Information Officer

श्री.योगेश पाठारे

सहाय्यक प्रशासनिक अधिकारी, भा.कू.अनु.प-के.क.क.प्रौ.अनु.सं.

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अपीलीय प्रधिकारी

Appellate Authority

डॉ. पी. जी. पाटील

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ICAR-CIRCOT

Regional Stations



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Adenwala Road, Matunga, Mumbai - 400 019



हर कदम, हर डगर

किसानों का हगसफर

भारतीय कृषि अनुसंधान परिषद

*Agri*search with a human touch