

ANNUAL REPORT 2021



भा.कृ.अनु.प. - केंद्रीय कपास प्रौद्योगिकी अनुसंधान संस्थान, मुंबई
ICAR-Central Institute for Research on Cotton Technology (ICAR-CIRCOT), Mumbai
 Towards Doubling Farmer's Income through Sustainable Processing Technology & Value Addition to by-produce



ICAR-CIRCOT

ANNUAL REPORT 2021



ISO 9001:2015

ICAR-Central Institute for Research on Cotton Technology

Adenwala Road, Matunga (East), Mumbai-400 019

(An ISO 9001:2015 Certified Institute and NABL Accredited Lab)

www.circot.res.in

Published by :

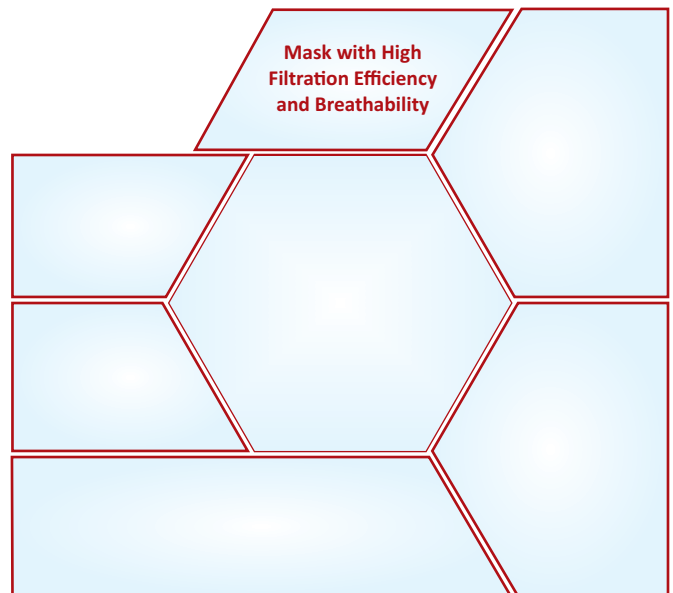
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Printed at : **COLOUR COUNT, MUMBAI**

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Citation : ICAR-CIRCOT Annual Report 2021. ICAR-Central Institute for Research on Cotton Technology, Mumbai.



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ABBREVIATIONS

ABI	Agri-Business Incubation
AFIS	Advanced Fibre Information System
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
BNPM	Bank Note Paper Mill
DBSKKV	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 Gin	Double Roller Gin
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
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
NRCG	National Research Centre for Grapes
PMC	Project Monitoring and Evaluation Committee
QEID	Quality Evaluation and Improvement Division
QRT	Quinquennial Review Team
R&D	Research and Development
RAC	Research Advisory Committee
RAFTAAR	Remunerative Approaches for Agriculture and Allied Sector Rejuvenation
RKVY	Rashtriya Krishi Vikas Yojana
RPM	Revolutions per minute
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
VJTI	Veer mata Jijabai Technological Institute

PREFACE

The global cotton sector has revived from the pandemic as reflected by robust growth in the demand along the entire cotton value chain. Globally, the area under cotton cultivation in 2021-22 season was 33.1 million hectares with a major share from Indian acreage of 12.6 million hectares. India is yet again a leader in world cotton production with estimated output of 5.8 million tonnes. The resurgence in the domestic cotton sector coincides with a rare occurrence that all the stakeholders in the cotton value chain viz., farmers, ginners, spinners, textile manufacturers and exporters were benefitted. The price upsurge of cotton in the period is attributed to the delay in harvest due to excessive rain, late arrivals coupled with strong demand from the spinning mills. The raw cotton that was procured from farmers under MSP in the 2020-21 season experienced a buoyant surge in the price bringing the smiles to the face of the cotton farmers.



ICAR-Central Institute for Research on Cotton Technology has made committed efforts in carrying out its activities for the stakeholders despite pandemic. During the year, the institute has initiated the contract research programme with the Cotton procurement agencies viz., Cotton Corporation of India and Maharashtra state Co-operative Cotton Growers Marketing Federation for creating a standard protocol for transparency in quality evaluation and lot wise analysis of fully pressed bales. The institute has improved its linkages with other research and academic institutions and has initiated inter-institutional projects for technology development, evaluation and validation of its application.

The institute has continued to offer the commercial services to its stakeholders with ISO 9001:2015 “Quality Management System” and NABL accreditation for its laboratories. The skill development programmes were specially designed for the farmers, research consultancy programmes for its stakeholders and incubation services for the start-ups with technical mentoring and financial support. During the year twelve new start-ups received funding to the tune of 1.55 crores under the second cohort of the RKVY-RAFTAAR Incubation Centre functioning at the institute. Eleven MoAs have been signed with the Start-ups to facilitate their growth and development through sanctioned Grant-in-Aid. The commercial testing activity of the institute has registered a vibrant growth contributing to over two-third of the institutes Internal Resource Generation.

The institute is committed to its financial prudence ensuring 100% utilization of the funds allotted during 2020-21 and is expecting a similar performance in 2021-22. The institute has also attained the calibre of generating a revenue over Rs.3 Crores consistently through its R&D, Skill Development programmes, Consultancy, Incubation services etc., for the second year in a row. The revenue generated by the institute accounts for more than one-third of the financial support received from the Council (excluding Salary component).

ICAR-CIRCOT is organising various activities under the “Azadi Ka Amrut Mahotsav”, implementing the Swachhata Campaign involving public, has adopted 12 new villages under MGMG programme and SCSP for the benefit of targeted stakeholders. The institute is exploring new avenues and is a part of research programmes of National importance viz. National Technical Textile Mission, National mission on use of Biomass for co-firing thermal power plants etc.

The institute is marching towards its centenary celebration in a couple of years and is consistently focussing towards attaining global excellence in Cotton technology with substantial benefit to its stakeholders.

Sujata Saxena
Director (A)



EXECUTIVE SUMMARY

ICAR-CIRCOT has a very dedicated scientific and technical workforce which is always striving hard towards achieving sustainability & inclusive growth in the cotton sector. The Institute undertakes research activities in the following five major core areas :

- 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 of cotton and its biomass & by-product utilization;
- v. Business incubation, Entrepreneurship and Human Resource Development.

The salient achievements made by the institute during 2021 are:

Research

During the year various new machineries, process technologies, value added products and other significant research outcomes have been achieved.

Process technologies

- Enzymatic preparation of protein hydrolysate from cottonseed meal
- Process Protocol for branding Indian Cotton as "Kasturi Cotton India" for Exports
- A revised model for relationship between Count and Count Strength Product (CSP)
- Process protocol for spinning of recycled cotton fibre extracted from pre-consumer knitted fabric waste

Machineries / value added products

- Cotton rich high comfort knitted fabric with smart drying property

- Digital Ginning Percentage Indicator (DGPI) for Portable Cotton Gins
- Rotating Drum collector for aligned nanofibre production
- 100 % Cotton Engineered fabric structure for face mask application
- Cotton based reusable face mask with breathability and antimicrobial Property
- Low-Cost Energy Efficient Cotton Stalk Briquette Based Crematorium
- Marker fibres for the traceability of Naturally Coloured Cotton textiles

Technology Impact assessment

- Environmental Impact of ICAR-CIRCOT Nanocellulose
- Economic Surplus Approach to assess the Impact of CIRCOT Bajaj Pre-Cleaner

Publications

- Published 49 research papers in peer reviewed journals, 19 conference papers, 4 training manuals, 11 Book chapters and 10 popular articles.

Skill Development initiative

- 28 training programmes including 8 specialized (self-sponsored) trainings & 16 Farmers trainings (online) have been organized, benefitting 1071 participants.
- Revenue generated from training during 2021 was ₹17.56 lakhs.

Technology Management and Popularisation

- Seventeen consultancy projects were implemented during the period. Eight MoUs were signed for Research collaboration & technology commercialization and 11 MoA signed with Start-Ups for incubation.



- Participated in 1 exhibition, 2 industry-interface meets. Institute scientists participated in various meetings, seminars, workshops and conferences for disseminating institute technologies among stakeholders.
- Mera Gaon Mera Gaurav (MGMG) activities were conducted in 12 new villages in Nagpur district of Vidarbha region in Maharashtra where scientists and technical officers demonstrated farmer friendly technologies for enhancing farm income. In 2021, ICAR-CIRCOT conducted 1 workshop, 4 webinars, 8 village visits, demonstrations and awareness programmes in which about 530 farmers participated.
- Three television talks on DD Sahyadri and four radio talks on Asmita Vahini, Akashvani Mumbai were delivered by institute scientists and technical officers.
- ABI centre at ICAR-CIRCOT: Two incubatees graduated and five new incubatees were admitted during 2021 for developing new enterprises in 'Development of starch based film for packaging', 'Development of Paddy straw based particle boards' and 'Preparation of bio-degradable products using agro biomass (banana fibre, rice straw, bagasse)'.
 - RAFTAAR - Agri Business Incubation Centre (R-ABI) of RKVY by the Department of Agricultural Cooperation and Farmers welfare at ICAR-CIRCOT. Five applicants for pre-seed stage funding and ten applicants for Seed stage funding were incubated in 1st Cohort, 12 Agri start-ups incubated under 2nd Cohort and Incubated 10 Agri startups under 3rd Cohort.

Accreditation

- Accredited with ISO 9001:2015 for Quality Management System by Bureau of Indian Standards.
- NABL accreditation for Mechanical and Chemical testing of cotton fibres, yarn and fabrics under ISO/IEC 17025:2017.

Commercial Services

- ICAR-CIRCOT continued as Approved Assayer with Indian Clearing Corporation Ltd. and Multi Commodity Exchange of India Ltd.
- During 2021, a total of 33,813 samples were tested at Mumbai headquarters, GTC Nagpur and other regional units generating a total revenue of ₹ 90.83 lakhs through commercial testing.
- ICAR-CIRCOT calibration cotton (an import substitute for USDA standards for calibrating textile testing equipment) - 179 containers sold to stakeholders generating a revenue of ₹ 1,69,155/- during the year 2021.

Financial Management

- All transactions in the Institute are 100% digital and cashless.
- The Institute ensured complete utilization (100%) of the sanctioned budget allocation during 2020-21 and 76.84% during 2021-22 (up to 31 December 2021).
- The revenue generation was 320.34 lakhs during the year 2021.

Other activities

- Implemented Swachh Bharat Abhiyan programme by organising campaigns and spreading awareness among the public.

The institute is celebrating Azadi Ka Amrit Mohatsav and has organized various programme under it. Also observed World Cotton Day, World Soil Day, World Food Day, World Water Day, Mahila Kisan Diwas, International Yoga Day, International Women's Day, National Handloom Day, Parthenium Awareness Week, National Unity Day, Vigilance Awareness week etc.

1. Introduction

ICAR-Central Institute for Research on Cotton Technology has completed 97 years of its glorious existence. Inaugurated on 03rd December, 1924, as *Technological Laboratory* under the then Indian Central Cotton Committee (ICCC), the institute has realigned itself to address the emerging needs of the stakeholders of the cotton and allied sectors from time to time.

<i>Genesis</i>	
1924	Technological Laboratory (ICCC)
1966	Cotton Technological Research Laboratory (ICAR)
1991	Central Institute for Research on Cotton Technology (CIRCOT)

ICAR-CIRCOT is one of the premier institutes of ICAR, working under the Agricultural Engineering Division, with its Headquarter at Mumbai. The institute functions with the following Vision, Mission and Mandate.

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-produce to maximize economic, environmental and societal benefits
Mandate 1. Basic and Strategic Research on Processing Cotton and its Agro-Residues, Development of Value-Added Products and Quality Assessment 2. Skill Development and Business Incubation Services and Function as Referral Laboratory for Cotton Fibres

The institute has four research divisions namely,

- Quality Evaluation and Improvement Division (QEID)
- Mechanical Processing Division (MPD)
- Chemical & Biochemical Processing Division (CBPD)

- Technology Transfer Division (TTD).

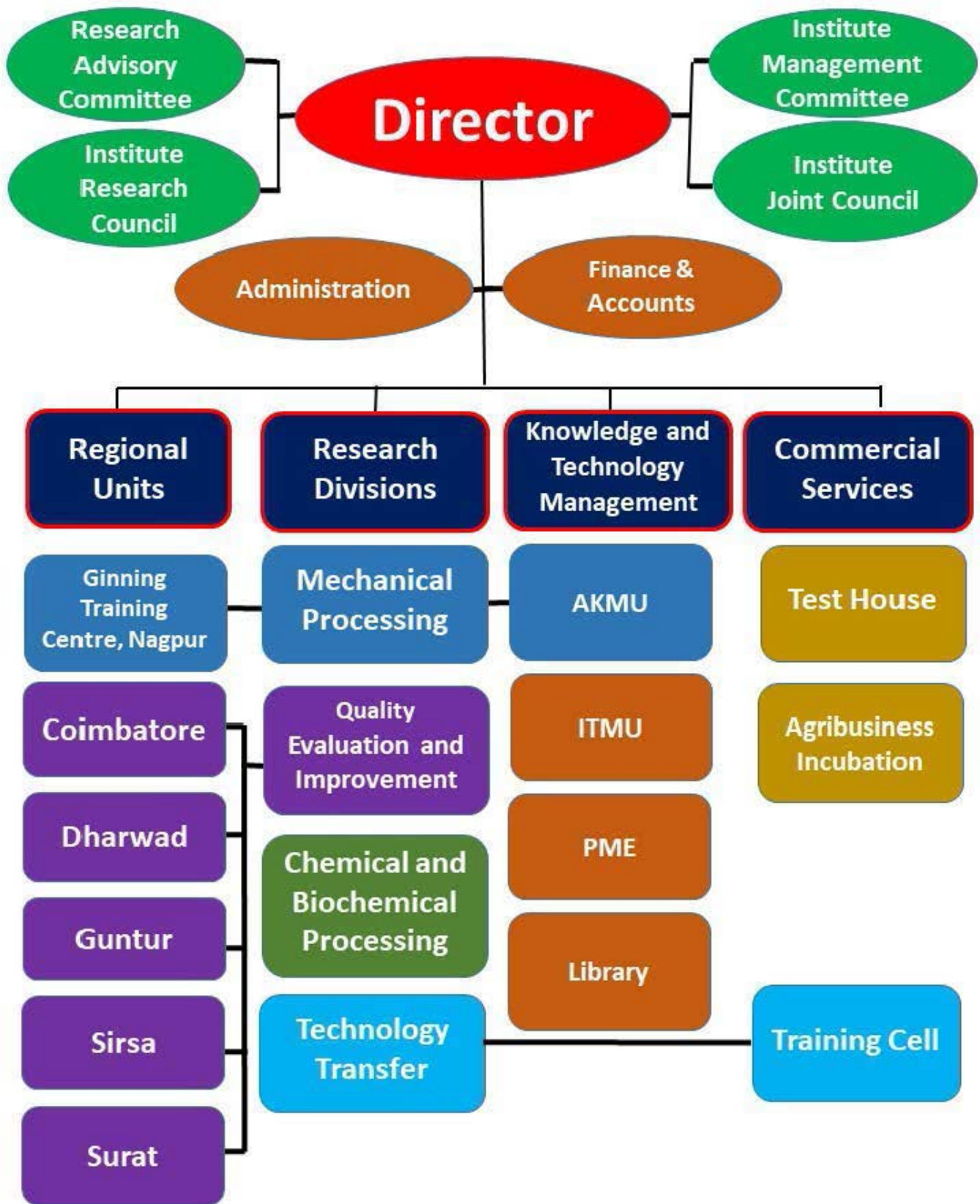
There are six regional units that includes Ginning Training Centre at Nagpur and Regional Quality Evaluation Units situated at Coimbatore, Sirsa, Surat, Guntur and Dharwad. The Research divisions along with the regional units facilitate the various activities of the institute viz., Research, Skill Development, Technology transfer and commercial services like testing, consultancy and Incubation in the domain of post-harvest processing of cotton and value addition to its by-products and biomass.

The Director is heading the Institute assisted by the Heads of the Divisions, administration and finance & accounts sections. The Priority-setting, Monitoring and Evaluation (PME) Cell assists the Director in assessing the performance of various research projects, handling communications with the Council etc.

The Research Advisory Committee (RAC) guides the Director in streamlining the research programmes of the institute. The research programmes of the institute are carried out under the following five broad core areas:

- 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 & by-product utilization
- v. Entrepreneurship and Human Resource Development

The institute is one of its kind in the World to carry out research solely on Cotton technology. The contribution of the Institute to the progress of post-harvest processing of cotton and value addition to cotton by-produce and biomass over the past nine and half decades of its existence is phenomenal. The institute has also played a pivotal role under the Technology Mission on Cotton (TMC) in Modernization of the Ginning Industry in the country. The significant contributions in the area of ginning machinery research have helped the country to be self-reliant and also become net exporter of ginning machinery. The Ginning machinery is now being exported to the Afro-Asian countries earning precious foreign exchange for the country.



Organogram of ICAR-CIRCOT, Mumbai



The institute has made a significant contribution to the country's Cotton breeding Programme in development of varieties that suit industry needs, by providing objective quality evaluation of cotton fibres and its processability along the value chain. The Institute is playing an important role as the Technology partner under the All India Coordinated Research Project (AICRP) on Cotton and is designated as Principal Investigator for Quality Research in the programme. ICAR-CIRCOT calibration cotton, an indigenously developed Standard Reference Material, is an import substitute for the USDA reference material used for calibrating fibre testing instruments such as High-Volume Instrument (HVI).

ICAR-CIRCOT is also supporting the private sector in its R&D efforts for development of machineries in the post-harvest processing of cotton and value addition to agro-biomass. The institute has successfully commercialised machines and products developed in the institute. On-board pre-cleaner for cotton stripper, saw band pre-cleaner and stick removal machine for mechanically picked cotton, double roller gin with self-grooving rubber roller, miniature spinning system, village level sliver making machine, cotton lint opener, rubber composites for flexi check dam etc. are worth mentioning. Many process technologies for the value addition of cotton fibres and cotton biomass are also developed and demonstrated by the Institute. In its efforts to promote effective utilization of the cotton stalks, the institute has developed low-cost Green Crematorium and continuous feeding pellets stove that uses cotton stalk based briquettes and pellets respectively, and has been commercialised through technology licensing.

The Institute has worked towards enhancing the diversified application of cotton and developed many products and processes like cotton rich blended fabrics for sportswear, application of cotton in technical textiles especially medical textiles. CIRCOT also explored the development of Naturally Coloured cotton products and value added products from Banana pseudostem fibres. The institute has contributed towards making the

chemical processing and finishing of cotton textiles eco-friendly. In this context, a lot of work has been carried out on extraction and application of natural dyes to cotton textiles, eco- friendly mosquito repellent finishing for textile materials using natural extracts, salt free dyeing technology etc. The institute has actively participated in formulation of BIS and ISO standards for identification of natural dyes. The institute has developed the solvent extraction process and also the microbial process for removal of gossypol present in cottonseed meal to enable its utilization as non-ruminant feed.

The institute has done a pioneering work in the area of nanotechnology and its application in textiles & composites. The processes to impart various functional finishes to cotton textiles such as anti-microbial, UV protective, water repellent using nanomaterials have been developed by the Institute. A Pilot Plant facility, first of its kind in Asia to produce nanocellulose from cotton linters through indigenously developed chemo-mechanical process was established in the year 2015. Applications of nanocellulose in cement concrete, rubber composite, pulp and paper and packaging to enhance functional properties and in paint formulation as a rheology modifier have also been carried out. Development of security grade paper from a blend of cotton and natural fibre pulp and imparting security feature have also been demonstrated by the Institute. Nano-ZnO production technology for fertilizer application was commercialized to M/s. Rashtriya Chemicals and Fertilizers, Mumbai. The institute is also working on the use of Nano Sulphur produced by it as fertilizer formulation in different crops.

ICAR-CIRCOT is the Lead institute and the Nodal Centre for implementing *the Consortia Research Platform (CRP) on Natural Fibres launched in 2015*. The aims of CRP on Natural Fibres are:

- To exploit the available natural fibres and their by-products by using high-end technologies to fuel the growth of fibre sector in India and in turn the farm income as a whole.
- To identify and isolate newer fibrous raw materials for value addition and thereby



provide enhanced income to all the stakeholders in the value chain.

The Institute has been offering innovative customised skill development programmes at national and international level. The institute also offers farmers training programme on post-harvest processing and value addition to cotton by-produce, Increase in farm income through increase in production and processing at Village level. During the current year, ICAR-CIRCOT's Ginning Training Centre at Nagpur organized one day online training programmes in 16 batches in October 2021. Around 900 lead farmers associated with FPOs under State of Maharashtra Agribusiness and Rural Transformation (SMART) Livelihood project assisted by World Bank, agricultural officers and other stakeholders attended this programme.

The institute has also catered to the capacity building needs of the cotton sector in the African countries. Under the Cotton Technical Assistance Programme (Cotton TAP) for Africa, the institute has contributed towards capacity building of the stakeholders in seven African countries viz., Benin, Burkina Faso, Chad, Mali, Malawi, Nigeria and Uganda. ICAR-CIRCOT was also instrumental in establishing a Regional Knowledge Cluster cum Training Centre for Post-harvest and Ginning Technologies at Bohicon, Benin. The institute also caters to skill building of the African Stakeholders as per Indo-African Forum Summit. Recently ICAR-CIRCOT has assisted the United Nations Conference on Trade and Development (UNCTAD) in implementing a UN Development account Project 1617K on "Promoting Cotton by-products in Eastern and Southern Africa" in Zambia, Zimbabwe, Tanzania and Uganda.

The Agri-Business Incubation (ABI) Centre of the institute is promoting and nurturing the new enterprise based on the innovative technologies in post-harvest processing and value addition to cotton by-product and its biomass in line with the Government programme of Start-Up India.

CIRCOT RKVY RAFTAAR Agri Business Incubator (CIRCOT-R-ABI) was sanctioned by RKVY Division,

Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Govt. of India in January 2019. This incubator is providing funding support as grant-in-aid to agripreneurs in product development, commercialization and scaling up.

Coherent with the government initiative for doubling farmers' income, the Institute has taken up many innovative projects. Value addition to cotton biomass through preparation of compost from cotton biomass, popularisation of mushroom cultivation using cotton biomass and preparation of briquettes and pellets from cotton stalks as a source of renewable energy are some of the activities taken up for creating economic value for the cotton stalks and enhancing the farm income.

ICAR-CIRCOT has a very good track record in meeting the revenue generation targets provided by the Council through its Internal Resource Generation. The institute has generated revenue through Technology Commercialization, Technology Incubation, Consultancy and Commercial testing services besides sale of the products developed using Institute technologies. ICAR-CIRCOT makes every effort to ensure 100 % utilization of the allocated Funds.

ICAR-CIRCOT is one of the most recognised laboratories for testing of cotton fibres, yarn and textiles made of cotton and cotton blends with other fibres. It provides commercial services for the stakeholders in the cotton value chain. Many testing facilities in the institute are accredited with ISO 17025:2005 by the National Accreditation Board for Testing and Calibration of Laboratories (NABL) since 1999 (ISO 17025:2017 at present). The Institute is also accredited with ISO 9001:2015 Quality Management System by the Bureau of Indian Standards (BIS).

The staff position of the institute as on 31-12-2021 is given in Table 1.1.



Table 1.1 Staff Position as on 31.12.2021

Category	Sanctioned	In-Position	Vacant
Scientific	48 +1	31	17 +1
Technical	112	63	49
Administrative	37	26	11
Skilled Supporting	57	25	32
Total	254	145	109 +1

Table 1.2 Funds utilization during FY 2020-21

₹ Lakhs

Head of Expenditure		ICAR-CIRCOT (including SCSP)			CRP on Natural Fibres		
		Allocation	Expenditure	% utilization	Allocation	Expenditure	% utilization
Grant-in-Aid- Capital		75.00	75.00	100	2.00	2.00	100
Grant-in-Aid- Salaries		1865.86	1865.86	100	--	--	--
Grant-in-Aid- General	Pension only	390.61	390.61	100	--	--	--
	Other than Pension	570.00	570.00	100	40.00	40.00	100
Total		2901.47	2901.47	100	42.00	42.00	100

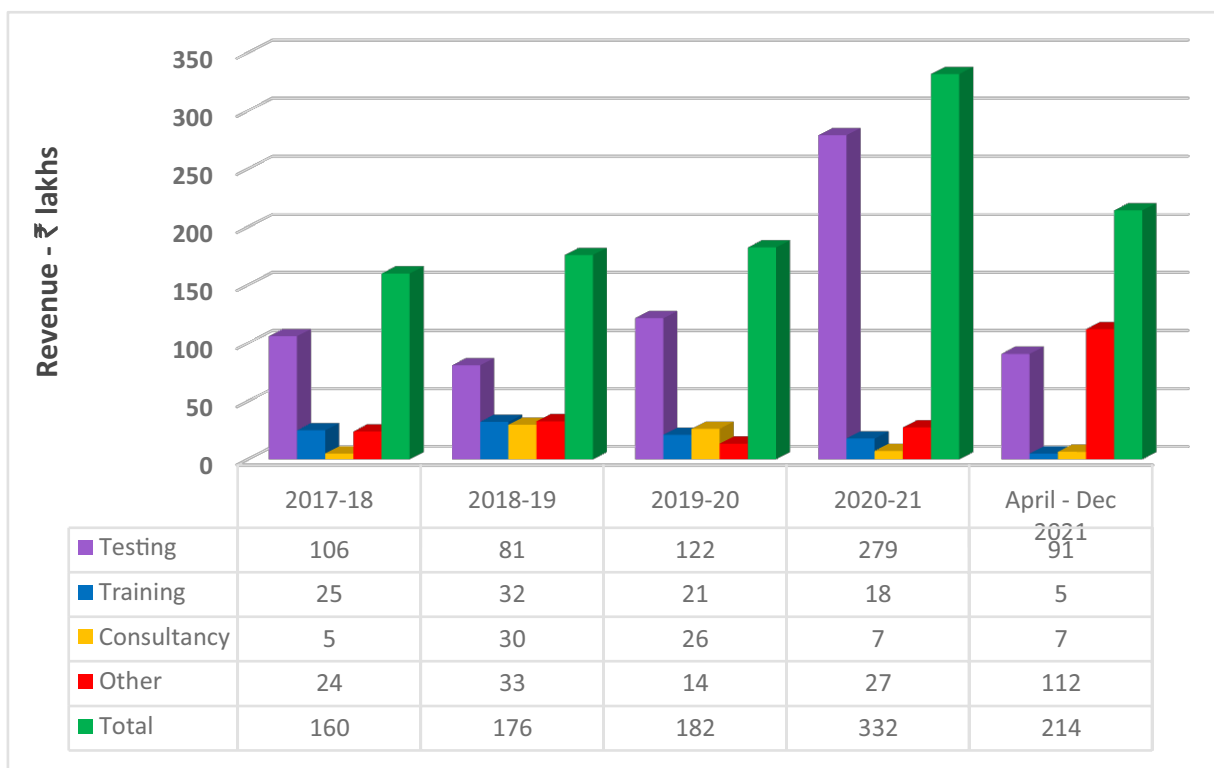
Table 1.3 Funds Utilisation during the Year 2021

₹ Lakhs

Head of Expenditure		ICAR-CIRCOT (including SCSP)		CRP on Natural Fibres	
		Allocation (2021-22)	Expenditure (Apr – Dec 2021)	Allocation (2021-22)	Expenditure (Apr – Dec 2021)
Grant-in-Aid- Capital		129.63	1.77	10.67	0.00
Grant-in-Aid- Salaries		1887.10	1566.73	--	--
Grant-in-Aid- General	Pension only	259.00	222.73	--	--
	Other than Pension	518.13	368.08	43.68	29.35
Total		2793.86	2159.31	54.35	29.35
Funds released		2427.58		46.70	



Revenue Generation



2. Salient Research Achievements

2.1 CORE AREA - I: PRE-GINNING AND GINNING

2.1.1 Kawadi Cotton Boll Opener

Cotton Boll Opener machine has been designed and developed for processing of kawadi cotton, the immature and infested seed-cotton removed during pre-cleaning of seed cotton in Indian ginneries, to recover usable lint from it. Kawadi cotton is not ginnable as such on a double roller (DR) gin due to its closely held fibres which are not picked up by the DR gin rollers. About 5% of such seed cotton is separated as Kawadi cotton by Indian ginneries i.e., about 10 lakh tonnes of seed cotton every year. Around 40% of this i.e., 4-8 lakh tonnes of seed cotton can be processed for obtaining usable lint from it, minimising losses incurred by ginneries on account of unprocessed kawadi cotton.

Cotton Boll Opener machine was modified to make it useful for opening such unopened cotton bolls to extract cotton fibres from it. Raw cotton bolls are opened by air turbulence. The machine is expected to reduce manpower required for sorting, by allowing dust, leaves and immature bolls to fall below through grids with holes of different sizes for separate collection. Opened and cleaned raw cotton is delivered at the discharge-end. It recovers useful raw cotton without any damage to cotton fibres in the process.

The overall dimension of developed machine is 3.5 x 1.5 x 1 m, weighing 500 kg and connected Total Power of 5 HP. The boll opener machine has the capacity for processing 6-8 Q/h of raw kawadi cotton with lint recovery of around 25%.

2.1.2 Development and Evaluation of Digital Ginning Percentage Indicator (DGPI) for Portable Cotton Gins

Digital Ginning Percentage Indicator (DGPI), an attachment to portable gin, was developed on electrometrical principle for real time and accurate determination of GP. It comprises of weight recording system made out of load cells, GOC-PLC setup, electronic display unit and accessories for integration with portable cotton gin. Weight recording System consists of three load cells with weight transmitters for weighing seed cotton, cottonseed and lint. The Graphic Operation Controller (GOC) PLC setup consists of GOC-35-DI/DO, Ethernet module and RS 485 module. Inbuilt HMI is provided in GOC-35 PLC and load cells are connected to a PCC-HMI panel. A software program was developed to determine GP from recorded weights. Load cells transfer weight data to PLC through transmission unit.



Fig. 2.1 GOC PLC setup with electronic display unit

Performance of the portable cotton gin with DGPI was evaluated in terms of its functionality, ginning percentage, ginning output and fibre quality. Validation of the DGPI was carried out by testing 40 seed cotton samples of 1 kg each of different cotton cultivars procured from farmers. The standard protocol has been established for testing of DGPI on portable gin. DGPI was found to display accurate GP digitally on real time during ginning. The results were compared with conventional method of determining GP with portable gin. DGPI would aid in increased usage of portable gins and accelerate GP based trading of seed cotton in ginning industries & market yards and empower farmers with premium rates for their cotton over and above 34% GP as one percent increase in GP may result in benefit of about two hundred rupees per quintal to farmers and ginners.



Fig. 2.2 Portable cotton gin with DGPI

2.1.3 Adoption and performance evaluation of seed cotton contamination cleaner for assessing its suitability for Indian ginning industry

Present level of trashes in Indian cotton bales range between 1 to 5% as against International standard of less than 1%. Higher trash and contaminants make Indian cotton less attractive in comparison to cotton grown in other countries and forced to sell at discounted prices in international market. Trash and contamination removal efficiency of the ginning industry as a whole is questionable, despite use of pre and post cleaners. Across the world for producing contamination and trash free cotton, primarily seed cotton contamination cleaner is being used to remove contaminants from seed cotton in the ginning factories. Suitability of Seed cotton contamination cleaner machine being used in foreign countries for contamination and trash removal was examined for adoption in Indian ginning industry.

A commercial model of Seed cotton contamination cleaner was adopted for its assessment for contamination and trash control in Indian ginning industry. Design features, principal of operation and its specific peculiarities over the indigenous seed cotton cleaning machinery were studied. Seed cotton contamination cleaner has multiple cleaning sections viz. foreign matter twining section, leaf

cleaning section, separating section, foreign matter separation section. Seed cotton contamination cleaner is designed to clean impurities in seed cotton such as plastic mulch, feathers, woven fabric, cotton leaves, mote, dust, etc. which is not possible with the indigenous seed cotton cleaning machines. It can be used in both hand-picked and machine-picked seed cotton. The design features of machine as per manufacturer were; capacity 15 tonnes seed cotton per hour, soft trash removing rate and residue film removing rate: $\geq 80\%$.



Fig. 2.3 Seed cotton contamination cleaner

Seed cotton contamination cleaner was installed in a modernised commercial ginning factory for performance testing and its suitability for contamination and trash removal. Cleaning trials were conducted with and without seed cotton contamination cleaner. Contamination removal efficiency was observed to be 42% which was found to be lower than desired and also deterioration in fibre quality was observed. Longer contaminants like nylon strips, threads, longer cloth pieces etc. got separated in twinning section. Cotton leaf and small size foreign particles up to 3-4 mm were removed in the cotton leaf section. Contaminants like plastic wrappers, small size threads and nylon strips could not be removed. Excessive single locking of cotton bolls and wick formation of output seed cotton was observed. Good quality seed cotton was also found in trash chambers.



Fig. 2.4 Seed cotton contamination cleaner installed in ginning industry

2.1.4 Device for seed cotton ginning percentage measurement

Currently seed cotton is purchased with assumption that it contain 33% lint (weight basis). Although seed cotton cultivars upto 42% lint content are being cultivated by farmers. But the proportionate return on account of high realization of lint is not passed on to farmers. The project aims to develop portable device for seed cotton ginning percentage measurement.

To achieve this, creation of database of properties of seed cotton in correlation to ginning percent / lint content is needed and this can be done in a systematic way. To collect maximum cultivars for the database creation, request was made to AICRP

In order to improve contamination removal efficiency and avoid wick formation, modifications were carried out in different cleaning sections of seed cotton contamination cleaner. Changes in suction and blower fans were carried out to adjust air pressure. Redesigned and modified twinning section rollers wherein length of spikes increased from 50 mm to 75 mm and spike pattern changed from zigzag pattern to straight pattern. Modifications were made in twinning section and leaf cleaner section to reduce roller speed to 350 rpm from existing 473 rpm by replacing 8 pole electric motor in place of 6 pole.

Cleaning trials were carried out after modifications but no improvement was observed in contamination and trash removal efficiency. Besides this, additional 250 hp power is required for operation and seed cotton handling through seed cotton contamination cleaner.

on Cotton, Coimbatore, for supply of seed cotton of varying ginning percentage from all of its coordinating centres. Till reporting period a total of 41 seed cotton samples were received.

To study the effect of moisture content on the ginning percent of trade varieties, an experiment at three different relative humidity conditions (33, 50 and 80 %) created in dessicators to determine the equilibrium moisture content (EMC)..

From the initial results it is found that among seed cotton, lint and cottonseed, seed holds maximum moisture, followed by seed cotton and lint.

2.1.5 Optimization of groove profile and diameter of chrome leather roller for enhancing the performance of double roller gin

The main aim of the study was to see the effect of chrome leather roller groove profile on the performance of double roller gin. Ginning Experiments with different groove profile were carried out with 21 quintal of seed cotton of Rashi-659 variety (BGII). Following activities were carried out during reporting period;



i. Modification and design of groove profile of chrome leather roller

Groove profile of chrome leather roller was designed and rollers were modified according to the experimental design. The rollers with required diameter (130-170mm) and number of grooves (12-20) were modified and formed at M/s. Bajaj Steel Industries, Nagpur (Figure 2.5).



Fig. 2.5 (a & b) Modification of groove profile of chrome leather roller

ii. Determination of GP and MC of seed cotton and ginning trails

The ginning percentage (GP) of purchased cotton was determined using experimental gin stand with ten replications. Moisture content (MC) of seed cotton was determined using standard cotton moisture meter. The average GP and MC of experimental seed cotton used in the study was 35.0 % and 7.0 % respectively. The ginning experiments were conducted as per planned combinations of roller diameter from 130 to 170mm with 12-20 number of grooves (Figure 2.6). It was observed from 32 numbers of ginning experiments that, the lint outturn varies from 46.0 kg/h to 78.0 kg/h. The lowest outturn was recorded using roller having 14 numbers of grooves and 160 mm diameter however the highest outturn was recorded by roller with 22 numbers of grooves and 160 mm diameters. It is evident from the obtained results that, the lint output is a function of groove profile and roller diameter. It increased with

increasing number of grooves as well as roller diameter. However, the impact of maximum number of grooves (20 or 22) in the chrome leather roller on the lint quality in term of seed cut, fibre length etc. is under investigation.



Fig. 2.6 Ginning experiments

2.1.6 Development and Optimisation of Seed cotton Trash Analyser

With the emergence of quality based marketing system for cotton, there is a need for commercial equipment that is capable of measuring the trash content in the seed cotton. At present the raw cotton in India is continued to be marketed based on visual inspection. Trash content in lint is determined using Shirley principle-based Trash Analyser, which requires about 35-40 min duration for testing of a lint sample in accordance with CIRCOT Trash Testing Standard. A skilled operator can hardly test 12-15 number of samples in a day using the Shirley trash analyser. Moreover to measure the trash content of seed cotton in Shirley analyser, the seed cotton has to be ginned prior to analysis of the trash content.

The pneumatic fractionator based on Shephard (1972) principle is used to determine foreign matter content of seed cotton at the USDA-ARS cotton ginning laboratories. It is a faster means for determining foreign matter content in lint than the Shirley Analyser. The time required to process the sample averaged 4 min for the fractionator and 20 min for the Shirley Analyser.

This project is taken up to develop a pneumatic fractionator device for measuring trash content in seed cotton. During the reported period, a seed cotton trash analyser based on pneumatic fractionation principle has been designed.

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

2.2.1 Evaluation of spinnability and formulation of guidelines for spinning of recycled fibre from fabric waste and develop value added products

Spinning process protocol optimized for recycled fibre obtained from pre-consumer knitted fabric waste

The recycled fibres were extracted from the pre-consumer cotton knitted fabric waste collected from an industry. These waste fabrics contain mixture of single colour dyed fabrics with different fabric structures such as single jersey, interlock, purl etc. The fibre was extracted through mechanical action such as cutting, shredding of fabrics and opening of fibre. The

recycled fibres were mainly short fibres in opened manner. The percentage of lint, Trash and invisible loss were found to be 97.85%, 0.67% and 1.48% respectively. UHML and ML were observed as 18.6mm and 12.8mm respectively. The percentage of cellulose fibre is found to be 99.1%. The surface morphology of the recycled and virgin cotton fibres, was analysed using scanning electron microscopic and presented in Figure 2.7 and Figure 2.8. The recycled fibres appear broken due to the mechanical action.

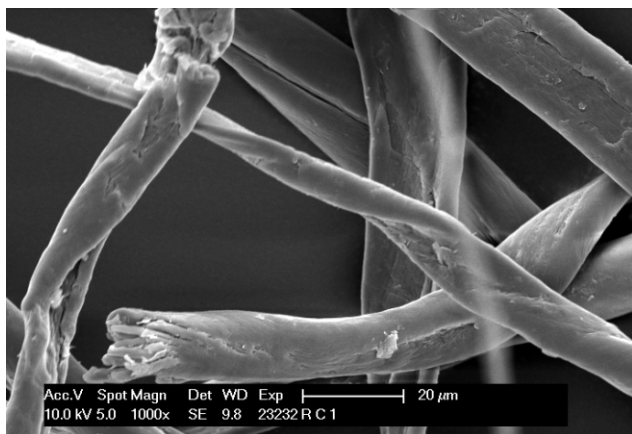


Fig. 2.7 Recycled Cotton Fibre

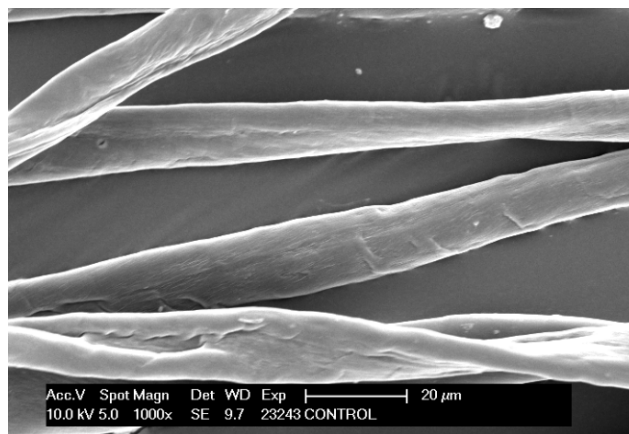


Fig. 2.8 Virgin Cotton Fibre

Yarn was produced from recycled cotton fibre (RF) with blending of virgin cotton (VC) fibre in different blend proportions such as 50RF/50VC, 65RF/35VC, 80RC/20VC, 90RC/10VC and 100%VC through microspinning technique using optimized spinning

protocol. Since recycled cotton fibres are short, it is very difficult to spin 100% recycled fibre alone. It requires minimum 10% of long fibres for transportation or holding the short fibre during its transfer between the rollers and yarn forming.



Fig. 2.9 Recycled cotton fibre



Fig. 2.10 Sliver



Fig. 2.11 Recycled cotton fibre based yarn

The plain structure woven fabric were made using recycled yarns using sample loom. For this, four different recycled blended yarns namely 90/10, 80/20, 65/35, 50/50 and 100% virgin cotton yarn taken as weft and 100% cotton yarn taken as warp. The fabrics were tested for functional properties like hand-feel, moisture management, thermal insulation, air permeability etc. It was found that

the addition of recycled fibre to virgin cotton contributes to the improved handle of the blended fabrics. The THV value of 65RF/35VC based fabrics better when compare to other fabrics and it is more suitable for men's shirt (summer). The fabrics made from 90RC/10VC is more suitable for men's suiting (winter).

2.2.2 Development of cotton covered electrospun nanofiber-based micronutrient sachet for agriculture applications

Development of Electrospun Nanofibre based micronutrient sachet:

The needle electrospinning machine was used to develop a micronutrient encapsulated nanofibre matrix. Zinc sulphate micronutrient 5 & 10 wt % was loaded with PVA nanofibre. The uniformity of the nanofibre was primarily considered as a

response variable for optimization of the process. The achieved fibre diameters range from 150 nm to 300 nm (Fig. 2.12). The produced PVA control, 5 wt % and 10 wt % zinc sulphate impregnated electrospun mats were converted into sachets by covering with 100% cotton woven fabric (Fig: 2.13).

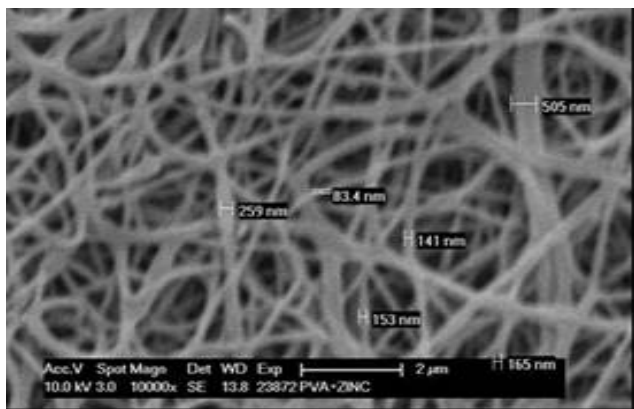


Fig. 2.12 SEM image of 10 wt % zinc sulphate impregnated PVA electrospun mat.



Fig. 2.13 Control, 5 wt% and 10 wt% Zinc Sulphate Micronutrient impregnated PVA electrospun Mat sachet for agriculture application

Development of High-pressure nozzle electrospinning setup to produce nanofibres

The major limitation in Nanofibre composite production is needle blocking and uneven distribution of the particle into nanofibre. To address this issue, high-pressure nozzle electrospinning was developed with enhanced production (Fig.2.14). A trial running was

conducted with 10 wt% PVA polymer to produce nanofibres. The process parameters were optimized using different distributions of the flow field and air pressure. It was found that nanofibres could be produced by an 18 gauge needle with a 1.5 ml/h flow rate at 20 psi pressure and the produced fibre diameter was around 200-500 nm (Fig 2.15).



Fig. 2.14: Multi-feed High-pressure nozzle electrospinning setup

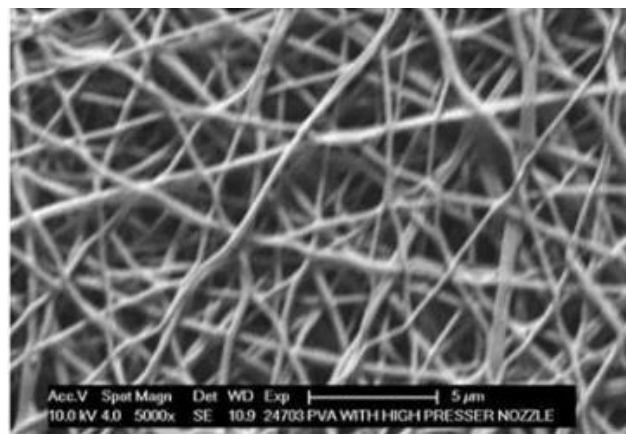


Fig 2.15 Nanofibre produced from a high-pressure nozzle

2.2.3 Development of filter fabric for indoor decontamination

The activated charcoal particles were applied on the fabric (50:50 blend of polyester and cotton) as mentioned in Fig.2.16 under different experimental conditions to optimize the concentration of acrylic binder, activated charcoal particle and exhaustion time. Charcoal particle concentration: 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0%, acrylic binder: 0, 2.5,

5.0, 7.5, 10.0, 12.5, 15.0, 17.5, 20.0%, exhaustion time: 5, 10, 15, 20, 25, 30, 35, 40 min. and M:L ratio: 1:10 was used. All the processes were carried out at room temperature. It was observed that 10% acrylic binder solution, 25 minutes exhaustion time and 3.5% of activated charcoal solution showed higher carbon add on percentage of 12.36.

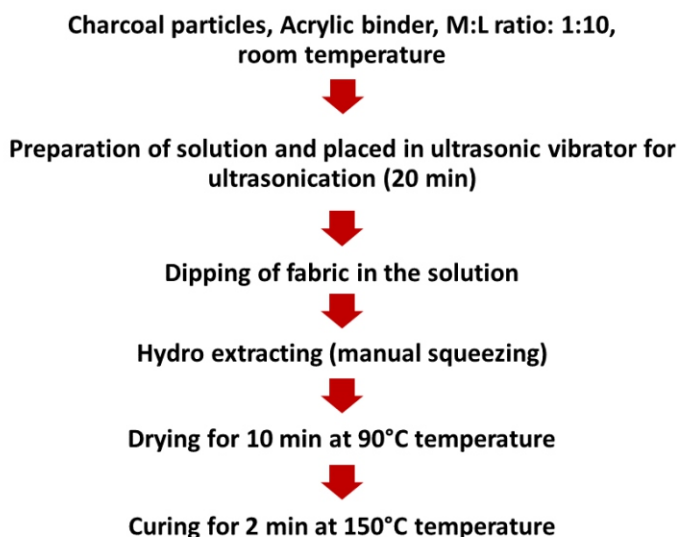


Fig. 2.16. Flowchart for application of activated charcoal particles on fabric using Exhaust method

Application of activated charcoal particles on fabrics of different GSM and thickness using exhaust method

Five different fabric samples of different GSM and thickness were selected. Activated charcoal particle were applied on all fabric samples with the optimised recipe as mentioned in Table 2.1 using exhaust method.

It was observed that among the cotton fabrics, the sample having 110 GSM showed maximum carbon add on percentage. In case of Polyester cotton blend, 50:50 showed higher carbon add on percentage.

Table 2.1: Application of activated charcoal particles on different fabrics

Fabric samples	GSM (g/m ²)	Thickness (mm)	Carbon Add on %
Cotton	110	0.21	6.64
Cotton	122	0.21	5.78
Cotton	155	0.27	5.51
PC blend (50:50)	163	0.35	12.36
PC blend (67:33)	123	0.20	5.80

2.2.4 Development of Cut-Resistant Fabric using 3D Weaving

The project aims to develop a cut resistance fabric with better structural stability and impact resistance by enhancing its flexibility using 3D/Multilayer weaving technology.

Core-Spun Yarn Preparation

The cotton roving of 1.3 hank was wrapped over 420 D Nylon 6,6 using the core-ring spinning method. The steaming process was done for core spun yarn at 90-95°C temperature for 20 min to set the twist permanently. The steel wire with diameter of 0.12 mm as core and cotton as a sheath was used to produce the core-spun yarn with a count of 4s Ne.

Multilayer Weaving (3D Weave)

Multilayer weaving structure consisted of three layers of warp yarns of Kevlar (1000D) on the top layer, cotton/nylon on the middle, and cotton/steel wire on the bottom layer. For the insertion of weft yarn, kevlar and steel wire are used with three different combinations, i.e. two picks of Kevlar and two picks of steel wire alternatively, three picks of Kevlar and one pick of steel wire, and five picks of Kevlar and one pick of steel wire. The multilayer fabric was produced with 20 ends per inch and 40 picks per inch with 12 heald frames.

2.2.5 Development of bio-nanocomposite films using extrusion process (Inter-institutional project)

The main objective of this project is to explore the potential of micro/nano cellulose fibres extracted from cotton linter as a green reinforcement in starch based bio-composite films.

Cellulase treatment

In this process, the bleached cotton linters were subjected to enzymatic treatment using cellulase enzyme. The bleached cotton linter was uniformly

dispersed in water (MLR= 1:30) and cellulase enzyme was added to it at various concentrations (0.1%, 0.5%, 1%). The temperature of the mixture was maintained at about 45°C for 45 mins for partial hydrolysis of the cellulosic fibres. The reaction was carried out in a pulper provided with a D-type configuration for better mixing and with three electrical coils attached around the jacket for uniform heating. The reaction was stopped by

deactivating the cellulase enzyme by heating over 70°C for 10-15 mins. The treated linter fibres were then washed off several times with tap water to remove the enzyme. The effect of cellulase treatment was evaluated by studying the surface morphology of the treated fibres. The SEM analysis

clearly showed the partial hydrolysis and fibrillation of linter fibres by cellulase enzyme. However, the enzymatic treatment of cotton linters with 1% cellulase caused scaling and degradation of majority of the fibres (Fig. 2.17).

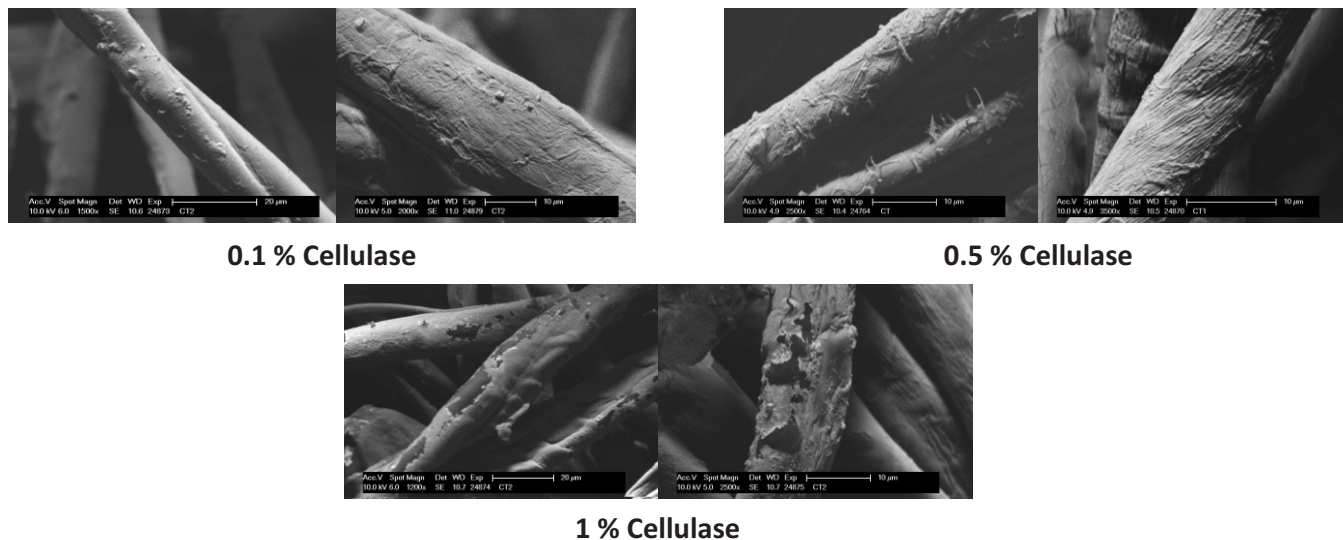


Fig 2.17: Surface morphology of cellulase enzyme treated cotton linter fibres

TEMPO-Mediated Oxidation

One of the most popular chemical pre-treatments in the manufacture of cellulose micro/nanofibrils is oxidation mediated by TEMPO (2,2,6,6-Tetramethylpiperidin-1-yl)oxyl. For this pre-treatment, the bleached cotton linter (12g, on dry basis) was suspended in 480 mL of deionized water and stirred vigorously at room temperature. Then, 6.0 mL aqueous solution of sodium bromide (15000 mg) and TEMPO (150 mg) was added into reaction suspension and the mixture was stirred continuously for 10 min. A 13% sodium hypochlorite solution (about 20 mL) was added drop wise to the mixture while maintaining the pH 10–11 by adding 0.5 M sodium hydroxide solution. After 1 h, about (20 mL) of ethanol was added to

quench the reaction and the pH was adjusted to 7.0 with the addition of 0.5 M HCl solution. The reaction suspension was filtered and washed several times with deionized water. The TEMPO-oxidized fibres were dispersed in deionized water, sonicated and subjected to the SEM analysis.

SEM images of TEMPO-oxidized fibres showed significant changes in their surface morphology. TEMPO-oxidation affected the structural integrity of the fibres, as they appeared to flatten significantly. TEMPO-oxidized fibres tended to unfold, indicating a reduction in curl and kink (Fig. 2.18). The effect of TEMPO-oxidation will further be measured in terms of carboxyl groups present in the treated fibres.

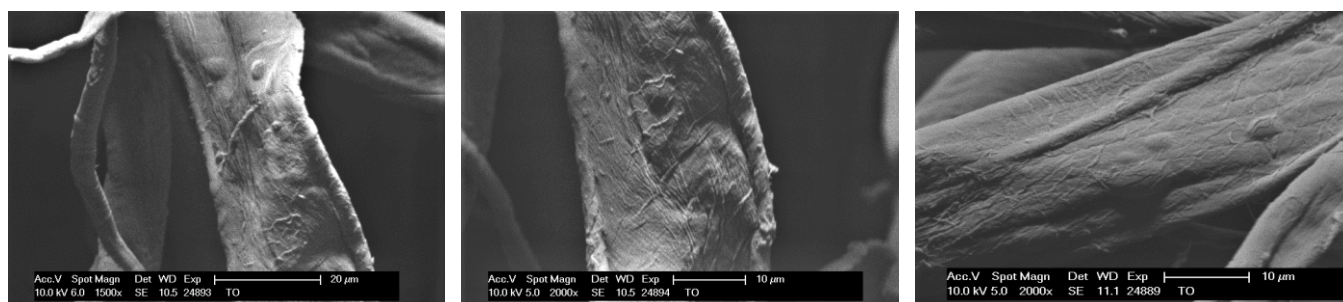


Fig. 2.18: Surface morphology of TEMPO-oxidized cotton linter fibres

2.2.6 Development of biopolymer-based coating emulsions to impart functionality to paper fruit protection bags (Inter institutional)

This project aims to develop eco-friendly paper fruit protection bags with functional properties.

Development of biopolymer-based coating emulsions to impart functionality to paper fruit protection bags

For paper coating the o/w emulsions were prepared using various concentrations of antimicrobial agent and natural wax to achieve antimicrobial and hydrophobic properties. Chitosan (1% w/v) was mixed with beeswax (1% w/v to 5% w/v) using acetic acid and emulsifier in water. The mixture was stirred for 20-30 min at 70-80°C and homogenized using Ultra-Turrax dispersing instrument for 10-15 min at 8,000-10,000 rpm. The prepared emulsions were characterized for various physicochemical properties. Antimicrobial properties (qualitative analysis) of emulsions were evaluated to check their efficacy against Gram +ve and Gram -ve bacteria. Initial particle size, zeta

potential, viscosity and creaming stability during 1 month storage of emulsions ranged from 438 ± 37 nm to 928 ± 136 nm, -10.25 to -27.31 mV, 45.89 to 156.27 cP, 25 to 93%. The results suggested that emulsions containing 1% w/v chitosan and 3% w/v beeswax were most stable with minimum particle size and maximum creaming stability. However, antimicrobial evaluation indicated little activity against both *S. aureus* and *K. pneumoniae* bacteria. Two types of paper (bleached white and kraft) were coated with prepared emulsions and physical, mechanical and antimicrobial properties were evaluated. Overall, the coated paper shown significant increase in mechanical (bursting, tearing, & tensile index and breaking length) and decrease in barrier (water vapour permeance and porosity) properties. The results obtained suggested targeted hydrophobic paper surface was achieved while further improvement in antimicrobial properties is needed.

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

2.3.1 All India Coordinated Research project on Cotton (Quality Research)

Quality evaluation of the cotton samples received from the cotton breeders across the country under the ICAR-AICRP on Cotton Zonal Trials (North Zone, Central Zone and South Zone) and National Trials were carried out at CIRCOT, Mumbai and its regional Quality Evaluation units.. In all, the technological data on 3496 samples have been compiled of which 1163 samples belong to National trials while 974 cotton samples correspond to Zonal Trials. Out of the zonal trials, 110 cotton samples

belong to North zone, 449 cotton samples belong to Central zone and 415 belong to South zone. Under ICAR-Bt Trials 1297 samples were received and analysed for fibre quality parameters and under Agronomy trial 62 samples were assessed for spinning performance along with fibre quality assessment. The quality parameters of all cotton fibre samples were measured using the High Volume Instrument operated in the HVI Mode.

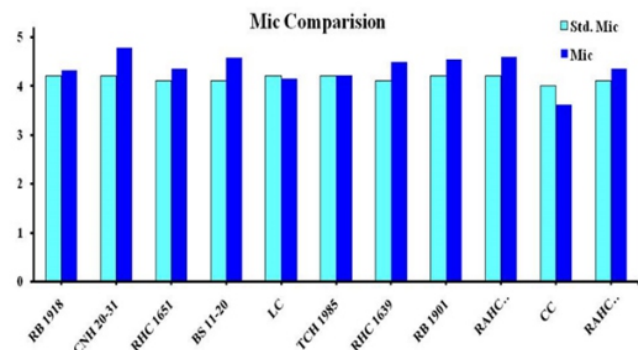
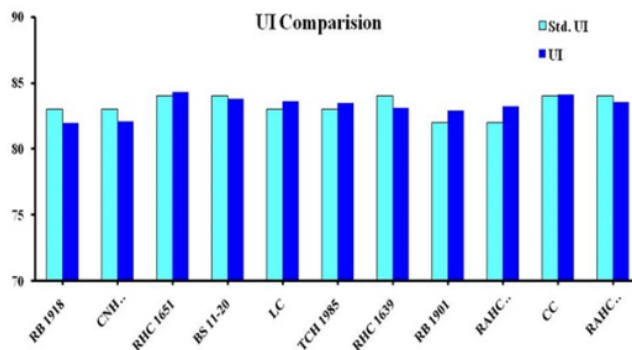
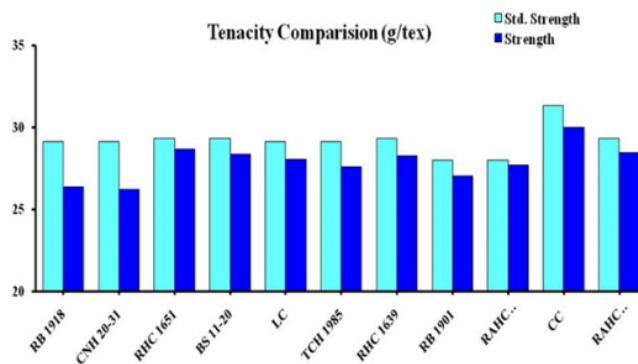
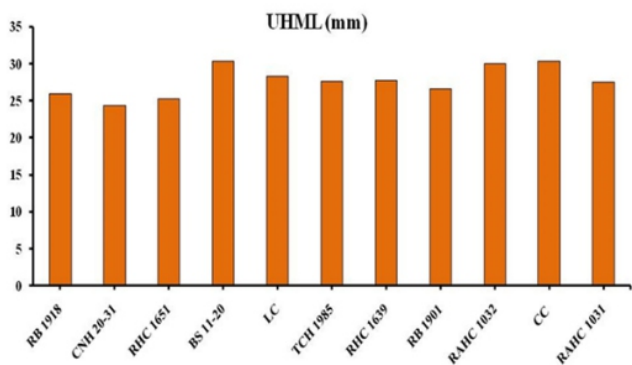
National trial

Br06a compact genotypes trial under irrigated conditions

Observations

- Majority of the samples were in UHML range of 26-29 mm.

- The tenacity of the samples was marginally low compared to the minimum requirement



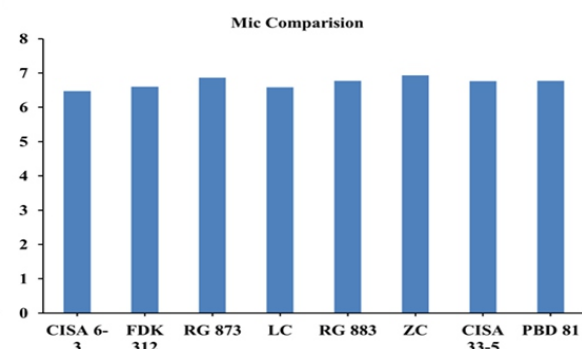
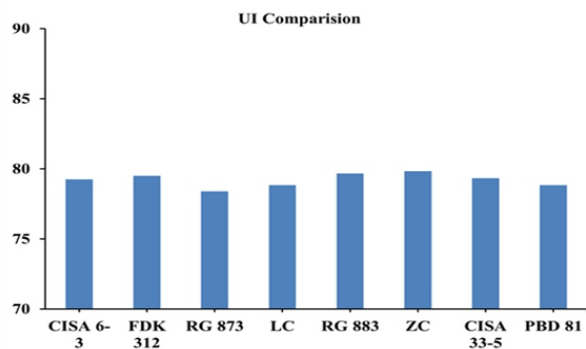
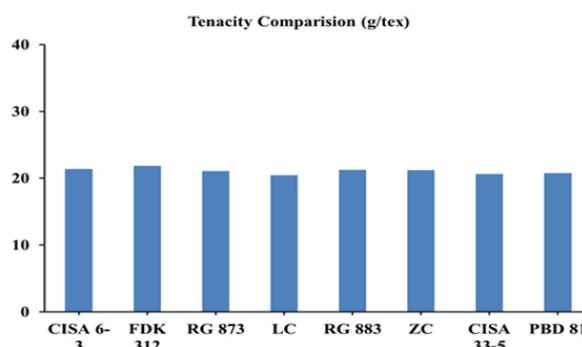
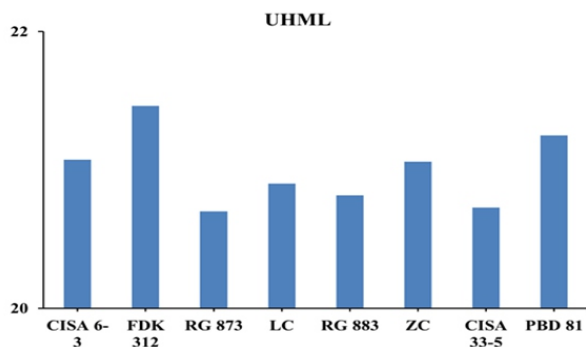
Recommendations

- Entry BS 11-20 (30.4 mm UHML, Tenacity 28.8 g/tex, Mic 3.8, Uniformity Index 84), Entry RAHC (30.0 mm UHML, Tenacity 28.0 g/tex, Mic 4.0, Uniformity Index 82), have performed well

Observations

- Majority of samples were in UHML range of below 21 mm.
- Samples with UHML below 22 mm are useful for absorbent cotton production

North Zone Trials (Br-22ab)



Recommendations

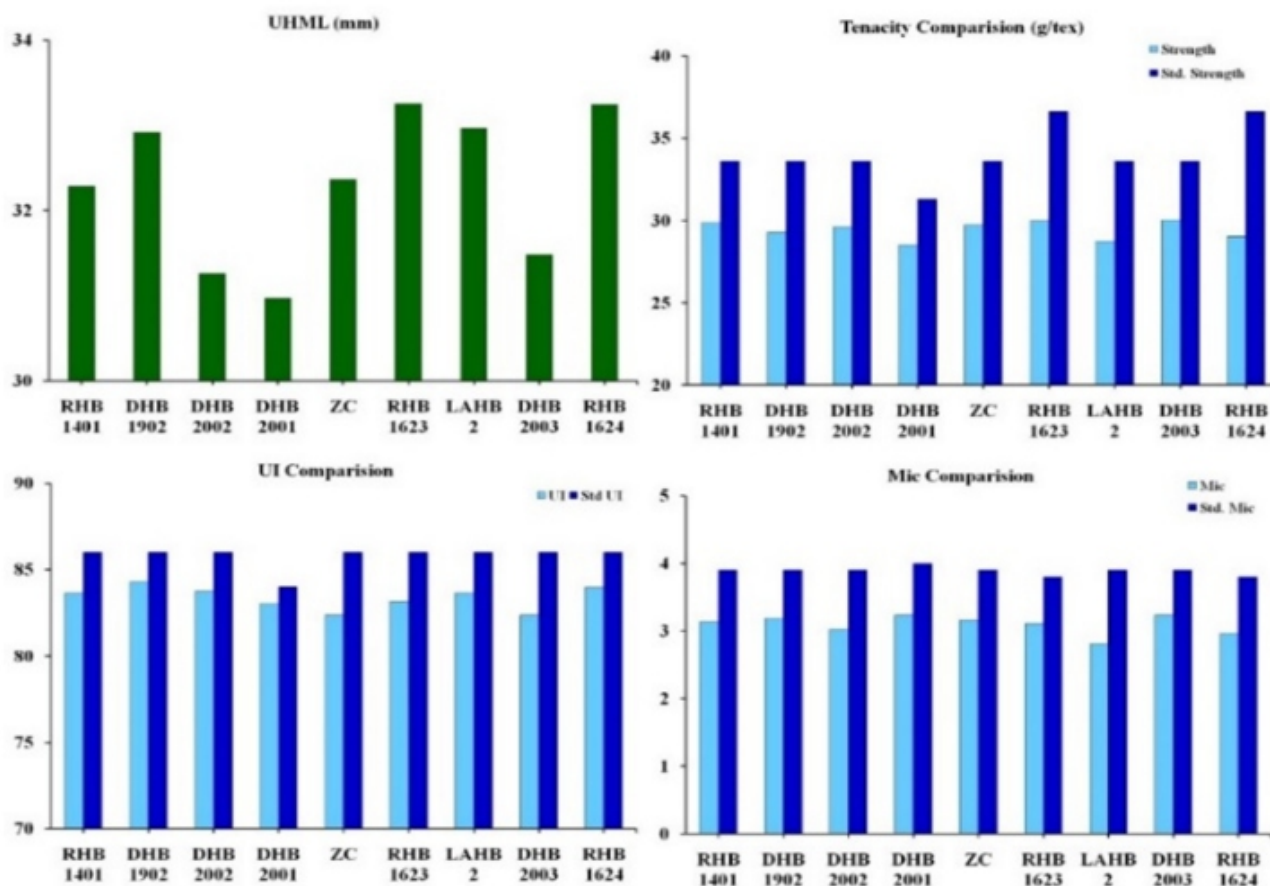
- Entry FDK 312 (21.5 mm UHML, Tenacity 21.9 g/tex, Mic 6.6, Uniformity Index 80), has performed well.

Central Zone Trials (Br15a CHTHXB)

Observations

- In this trial, most of the samples were having UHML varying from 31 mm to 33 mm.

- The tenacity values were lower than the minimum requirement.
- The UI of the samples across the UHML ranges was lower than minimum requirement.
- The micronaire values of the samples were lower than the minimum requirement.



Recommendations

- Entry RHB 162 (UHML 33.3 mm, Tenacity 30.0 g/tex, Uniformity Index 83, Micronaire 3.1) has performed well.

South Zone Trials (Br15a CHTHXB)

Observations

- The samples were having UI equal to the minimum requirement

- The tenacity of the samples was either at par or marginally low compared to the minimum requirement.
- The micronaire values of all the samples were higher than the maximum required micronaire as depicted below.

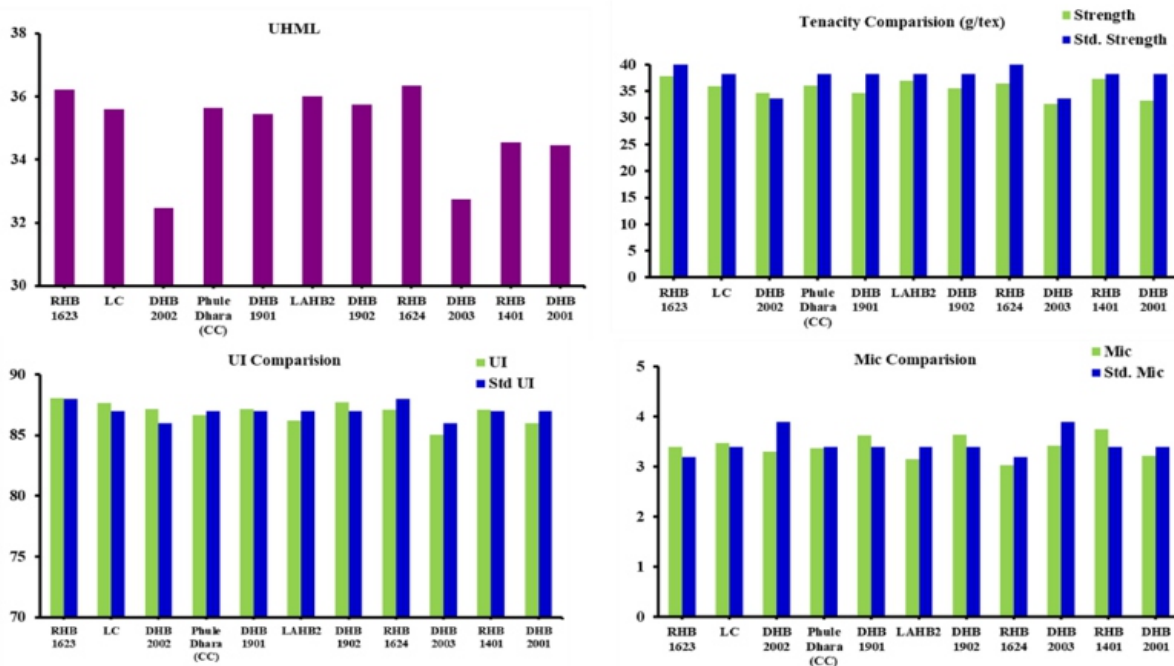


Figure 2.19: Comparison of different fibre properties of cotton sample received under Br15a CHT H X B trial

Entry RHB 1623 (UHML 36.2 mm, Tenacity 37.9 g/tex, Uniformity Index 88, Mic 3.4) and RHB 1624

(UHML 36.4 mm, Tenacity 36.4 g/tex, Uniformity Index 87, Mic 3.2) have performed well.

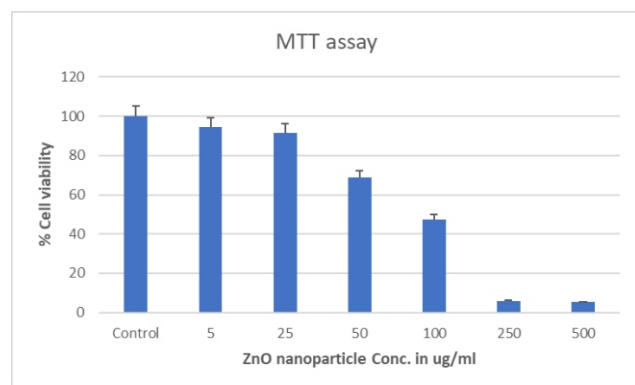
2.4 CORE AREA - IV: CHEMICAL & BIOCHEMICAL PROCESSING AND BIOMASS & BY-PRODUCTS UTILISATION

2.4.1 Toxicological and Environmental impact of ICAR-CIRCOT's nanomaterials (Nanocellulose, Nanosilver and Nano-ZnO)

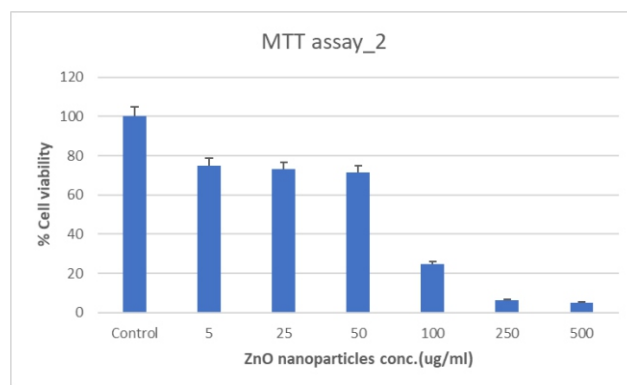
MTT assay for Nano-ZnO powder

The MTT assay to check cytotoxicity of nano-ZnO powder was carried out at ICMR-National Institute for Research and Reproductive Health, Mumbai. The cytotoxicity of nano-ZnO treated MRC5 fibroblasts was monitored by the 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium

bromide (MTT, Sigma Aldrich, USA). The absorbance was measured at 570 nm and 650nm using a microplate reader (BioRad, Model 680 S/N 20819). The cell viability (%) was calculated as $(OD_{570} \text{ sample} - OD_{650} \text{ sample}) / (OD_{570} \text{ control} - OD_{650} \text{ control}) \times 100$.



(A)



(B)

Figure 2.20 (A) Cytotoxicity of ZnO NPs dispersed in incomplete medium. (B) Cytotoxicity of ZnO NPs dispersed in DMSO+ incomplete medium.

While evaluating the effects of nano-ZnO dispersed in incomplete medium, the MTT viability assay showed significant cytotoxicity in a dose-dependent manner on MRC-5 cell line. Nano-ZnO at 100 µg/ml showed approximately 50% cell viability (Fig 2.20 A). The concentrations lower than 100 µg/ml showed no toxic effects on MRC5 cell line, whereas the concentrations above 100 µg/ml showed very less cell viability as compared to control cells. While evaluating the effects of nano-ZnO dispersed in DMSO+ incomplete medium on the viability of the MRC5 cell line, nano-ZnO at 100 µg/ml showed less than 50% cell viability (Fig 2.20 B). The concentrations lower than 100 µg/ml showed no toxic effects on MRC5 cell line, whereas the concentrations above 100 µg/ml showed very less cell viability as compared to control cells.

In vitro cytotoxicity of Nano ZnO treated cotton textile materials on L929 cell line

The *In Vitro* Cytotoxicity method was done using L929 mouse fibroblast cells. This test was carried out at M/s. Liveon Biolabs private limited, Tumkuru, Karnataka. L929 mouse fibroblast cells were seeded in 6 well plates and wells with subconfluent monolayer were selected for the test. The growth medium in each well was replaced with 2 mL of test item extract, negative control (HDPE and Untreated Cotton Textile Materials) and positive control (Polyurethane) in triplicates. Cells in the vehicle

control extract wells, test item extract wells and negative control extract wells did not show cell lysis and no reduction of cell growth and no reactivity (Grade 0). In contrast, the positive control extract wells showed evidence of complete destruction of the cell layer with severe reactivity (Grade 4) and this confirms the reliability of test procedure followed in this study. Based on the results obtained under the testing conditions employed, qualitative morphological grading of cytotoxicity of the test item extract was not greater than 2. Hence, the test item "Nano ZnO treated cotton textile materials" is considered as 'non-cytotoxic' to the subconfluent monolayer of L929 mouse fibroblast cells.

MIC and MBC assay of nano-ZnO

Nano-ZnO and zinc sulphate (ZnSO₄) were evaluated for their minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) against *Bacillus megaterium* by using broth micro dilution assay. MIC was determined colorimetrically by adding 1:10 volume of 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide MTT solution (5 mg/mL) into the dilutions followed by 4h incubation one more time. MIC endpoint was recorded as the lowest concentration of the nano-ZnO and ZnSO₄ that inhibits bacterial growth in the broth showing no visible colour change of the dye from yellow to purple.

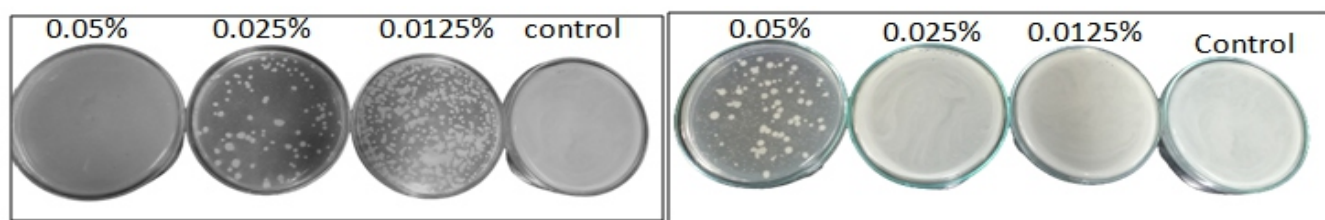


Fig. 2.21 MBC of ZnO NPs (a) and Zinc sulphate (b) against *B. megaterium*

MBC of ZnO NPs was recorded as 0.05% as there were no bacterial colonies at this concentration whereas MBC of ZnSO₄ was more than 0.05%. MIC of ZnO NPs was recorded as 0.025% as there was no visible change in the colour of MTT dye from yellow to purple at this concentration whereas MIC of ZnSO₄ was 0.05%.

Phosphate solubilization assay

For determining the nanoparticles mediated

inhibition of inorganic phosphate solubilization, nano-ZnO, ZnSO₄ and Ag NPs in the concentration range of 0.1-0.4% and 3 to 13% respectively were added to the tubes containing Pikovskaya's liquid medium followed by inoculation with the bacterial strains (*P. aeruginosa*, *P. putida* and *B. megaterium*). Controls contained inoculum of respective bacterial cultures but not test samples. Phosphate measurement was performed after 20 days of incubation at 37° under shaking conditions.

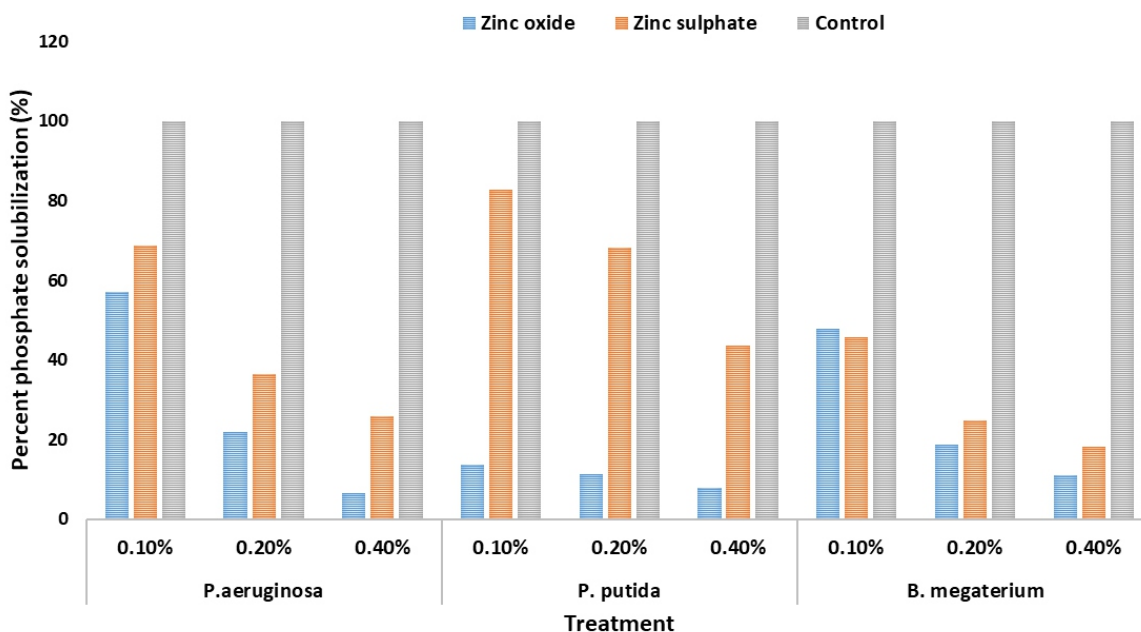


Fig. 2.22. Effect of ZnO NPs and ZnSO₄ on phosphate solubilization.

At 0.1% concentration of ZnO NPs, *P. aeruginosa*, *P. putida* and *B. megaterium* showed 57%, 13.6% and 47.8% phosphate solubilization respectively as compared to control whereas in case of zinc sulphate, the phosphate solubilization at 0.1%

concentration was 68.69%, 82.67% and 45.67% with respect to control. At 3% concentration of AgNPs, *P. aeruginosa*, *P. putida* and *B. megaterium* showed 67.6%, 56.63% and 95.7% phosphate solubilization respectively with respect to control.

2.4.2 Efficacy evaluation of ICAR-CIRCOT Nano-ZnO as nanofertilizer in field crops

This project was initiated to understand the efficacy of ICAR-CIRCOT nano-ZnO as micronutrient for various field crops and also to optimize its mode of application (seed priming, soil application or foliar application) for better zinc use efficiency

ICAR-CIRCOT's earlier protocol for preparation of nano-ZnO is useful for powder formulation of nano zinc fertilizer. But, in suspension, they are not very stable since the overall size along with starch stabilizer is bigger, and they tend to settle down. So, foliar application of this nano-ZnO is very much difficult. Hence, a novel protocol was developed for the production of nano-Zn suspension. In this process, zinc nitrate hexahydrate and sodium

hydroxide were used as precursors and soluble starch and CMC were tried as stabilizers. Out of the two stabilizers, CMC gave a better result in formulating stable nano-Zn suspension. The photograph of various formulations are given in figure 2.23. The CMC stabilized nano-Zn suspension is stable even after 24 hours. The produced stable nano-Zn suspension was taken up for further analysis for its UV-Vis spectrum, particle size and zeta potential. Figure 2.24 shows the particle size distribution spectrum of nano-Zn suspension with CMC stabilizer. The mean diameter was 82.3 nm. The zeta potential of the sample was +25 mV. In UV-Vis spectrum, peak was observed at 370 nm that corresponds to the oxide form of zinc.



Fig. 2.23. Photograph of different nano-Zn formulations. Left one shows the nano-Zn stabilized by solubilized starch; middle one is without any stabilizer and right one is with CMC.

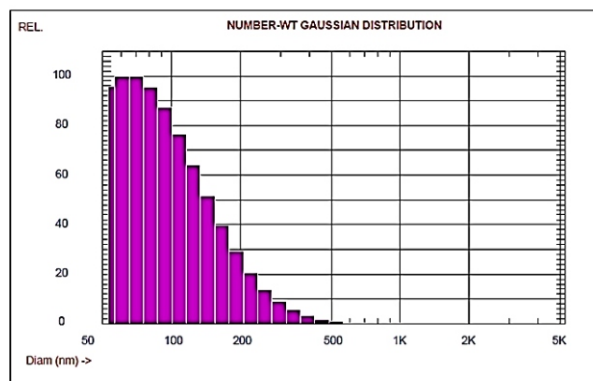


Fig. 2.24 Particle size distribution of nano-Zn suspension with CMC stabilize

2.4.3 Development of a healthier cottonseed based cooking oil by blending with other vegetable oils

Refined cottonseed oil is free from gossypol and can be safely used for edible purposes. It however has more than 50% content of polyunsaturated (mainly omega 6) fatty acids and therefore it can be made healthier with better oxidative and storage stability by blending with other vegetable oils. Refined cottonseed and palm oil and a few other common vegetable oils (cold pressed) viz. groundnut oil, sesame oil, and coconut oil were procured from the local market. Cold pressed oils did not contain any added antioxidant. All oils were analyzed for their physicochemical properties such as color, density, viscosity and free fatty acids. Four binary blends of cottonseed oil (CSO) were formulated by mixing it with groundnut oil, sesame oil, coconut oil and palm oil in 50:50 (w/w) ratio. The blends were kept at shaking conditions for 6 hours and stored in the dark till further analysis.

Pure vegetable oils displayed difference in color with coconut oil being the least pale followed by cottonseed oil, groundnut oil and palm oil with sesame oil being the most yellow and the same observation was confirmed by instrumental measurement. Density of these vegetable oils and

their blends with CSO was determined and the values are presented in Table 1. Density was found to vary from 0.898 for CSO and sesame oil blend to 0.911 for CSO and groundnut oil blend. The difference in density between the oils is due to the difference in nature of fatty acids that compose the oil. Oil viscosity is also important in design of process equipment for the edible fat and oil industry. Viscosity values of different oils and their blends at 25°C determined using Ostwald viscometer are also summarized in Table 2.2. It is seen that palm oil was most viscous (50.48cps) followed by groundnut oil (41.55 cps) while CSO was least viscous (30.67cps) and blending with CSO considerably reduced the viscosity of both palm and groundnut oils. Free fatty acid (FFA) values of the oils and blends determined using AOCS method are also presented in Table 2.2. It is observed that CSO had lowest FFA content and blending with it has reduced the FFA content of sesame oil from 2.11 to 0.12 which is lowest among the blends. These oils and the blends will be analysed for fatty acid composition by GLC analysis of their methyl ester after the required capillary column is received.

Table 2.2 Density, Viscosity and Free Fatty Acid value of vegetable oils and their blends with CSO

Oil	Density (g/ml)	Viscosity (centipoise)	Free fatty acids (%)
Sesame oil (SO)	0.903	35.44	2.11
Groundnut oil (GO)	0.905	41.55	0.45
Cottonseed oil (CSO)	0.902	30.67	0.10
Coconut oil (CO)	0.908	32.43	0.12
Palm oil (PO)	0.905	50.48	0.17
CSO + SO	0.898	33.40	0.12
CSO + PO	0.907	42.10	0.15
CSO + GO	0.911	33.07	0.23
CSO + CO	0.910	33.66	0.13

It was planned to use Rosemary extract (RE) as a natural antioxidant for improving the oxidative and thermal stability of CSO. Rosemary leaves were extracted with ethanol in the laboratory and the extract obtained after removing the solvent was evaluated for antioxidant properties by carrying out DPPH radical scavenging assay. RE was found to have IC₅₀ value of 235.40 µg/mL which reveals the presence of compounds responsible for quenching of free radicals in it and therefore it can be used to stabilize and retard oil oxidation.

Generally, the antioxidant activity is due to the presence of phenolic compounds in the extract. Therefore the extract was evaluated for Total Phenolic Content (TPC) by Folin–Ciocalteu colorimetric method as described by Singleton et al. (1999) with some modifications. TPC is expressed as milligrams of gallic acid equivalent (GAE) per gram of the dried extract. TPC of ethanol extract of

rosemary leaves was found to be 106.22 mg GAE/g of the dried extract.

The rosemary extract was added to the cottonseed oil at a concentration of 1.00 mg/kg (0.1%) to improve oxidative stability and a control was taken without the added extract. To simulate the behavior of supplemented and control oils during frying, these were heated on hot plate separately at 150° C for 6 h/day for 5 consecutive days and analysed for peroxide value, acid value and iodine value employing the AOCS methods before and after heat treatment in order to estimate and compare the heat induced oxidative deterioration in RE supplemented and control oils. These parameters were also determined after storing for 15 days to know about the effect of RE supplementation on storage stability and the results are presented in Table 2.3.

Table 2.3 Oxidative stability parameters of cottonseed oil with and without RE

Cottonseed oil samples	Peroxide value Meq O/kg	Acid Value mg KOH/g of oil	Iodine Value Gram iodine/100g
Fresh oil without RE	11.00	0.23	110.00
Fresh oil with RE	10.00	0.22	109.50
Heat treated oil without RE (150° C)	35.45	1.02	105.50
Heat treated oil with RE (150° C)	25.00	0.51	106.00
Oil without RE (after 15 day storage)	18.00	0.64	107.00
Oil with RE (storage 15 days)	14.00	0.256	108.00

It was observed that the acid value, an indicator of free fatty acids in oil was low in fresh cottonseed oil with the value for with and without RE being almost at par. However, the value increased substantially after the heat treatment at 150°C and the value for oil with RE was almost half of the value for control. Similarly in respect of peroxide value also, the increase observed for oil with RE was much lower

than that observed for the control. Storage also increased the peroxide value and acid value but the increase was much lower for oil with RE. There was not much change in the iodine values of cottonseed oil after heat treatment or storage in both RE supplemented or plain CSO. Thus Rosemary extract was found to be quite effective in improving the oxidative stability of cottonseed oil.

2.4.4 Development of health drink from cottonseed

A non Bt cotton variety Vihani-161 was used to extract cottonseed-based milk using traditional method.

Preparation of cottonseed milk started by soaking the cottonseeds overnight and washing them in running water by picking out the cotton and mud sticking to them. Continued cleaning in running water for 3 to 4 times. Extracted milk from cottonseeds by adding water to it and blending in the blender. Milk was strained using a muslin cloth or strainer. Then again, poured a cup of water and blended it again and filtered the milk from cottonseed mash. The milk was re-extracted twice to improve the efficiency of the process. The

preparation of cottonseed milk from cottonseeds is shown in figure 2.25.

The obtained cottonseed milk was then subjected to lyophilisation for getting powdered form of the cottonseed milk. The lyophilised cottonseed milk was grinded in the mortar pestle for getting a powdered sample of cottonseed milk (Fig. 2.25). It was observed that obtained cottonseed milk powder has high content of crude protein but also has significant levels of free and total gossypol. Hence some method to reduce gossypol content needs to be explored to make it suitable for human consumption.

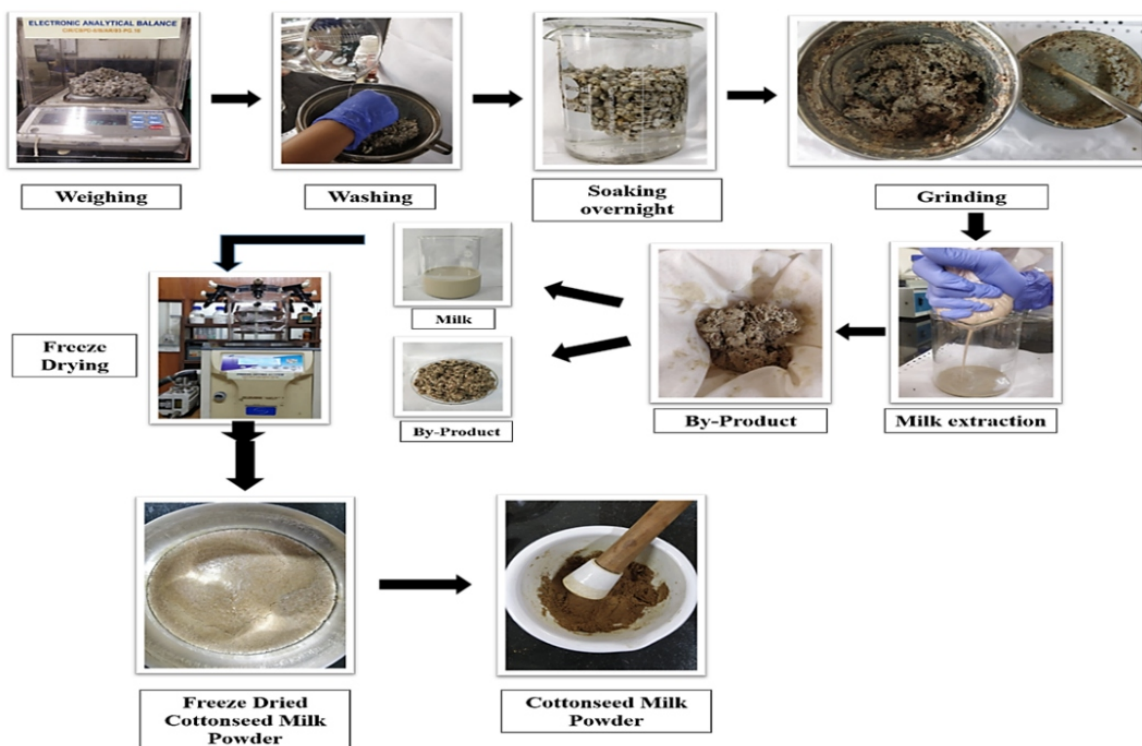


Fig. 2.25 Flow diagram of preparation of cottonseed milk powder from cottonseed

2.4.5 Development of microbial xylanase enzyme based process for eco-friendly bleaching of paper pulp

To identify the prominent xylanase producing microbes, a total of 18 bacterial cultures from the ICAR-CIRCOT, Mumbai (12 cultures) and CSIR-IMTECH, Chandigarh (06 cultures) were qualitatively screened for xylanase activity on Nutrient Agar (NA) media individually supplemented with 0.5 % oat spelt xylan and 1 % wheat bran as a Carbon source. Bacterial cultures showing xylan hydrolysis on 0.5% oat spelt NA were further assayed for xylanase detection on 0.5 % wheat bran supplemented NA media.

Subsequently, these NA plates were spot inoculated with bacterial culture (24h old) and incubated for 3-4 days at 30 °C. Xylanase activity was confirmed by observing the clear halo zone of xylan hydrolysis (in mm) around the bacterial colony. Further, halo zone index (HI) (as the ratio of halo zone of hydrolysis to colony growth, in mm) was measured (Figure 2.26) to select the promising xylanase producing bacteria.

The result indicated that the out of the 12 ICAR-CIRCOT bacterial cultures, 04 cultures namely, *Acetobacter xylinum* (NCIM2526) *Bacillus cereus*(AC11778), *Bacillus subtilis*(ATCC159), and *Bacillus subtilis* (6015A) showed xylanase activity on 0.5% oat spelt xylan NA media. Among the CSIR-

IMTECH, Chandigarh microbial cultures, all cultures showed strong xylanase activity after 24 and 48 hrs of growth except for *Bacillus firmus* (MTCC2411). In terms of halo zone index (HI), *Cellulosimicrobium* sp. (MTCC10645), *Bacillus pumilus* (MTCC9862), *Bacillus licheniformis* (MTCC9415), and *Bacillus pumilus* (MTCC 10414) showed the highest HI of 2.29, 2.24, 1.83, and 1.62, respectively. In regards to HI on wheat bran supplemented NA, the highest HI (2.88) was shown by *B. subtilis* (ATCC159), followed by *Cellulosimicrobium* sp. (HI-1.83), *B. licheniformis* (HI-1.80), *B. pumilus* (MTCC9862)(HI-1.67), and *B. pumilus* (MTCC 10414)(HI-1.65) (Table 2.4).

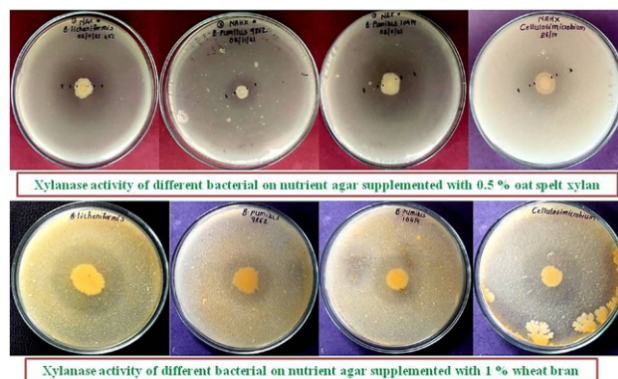


Fig. 2.26 Clear halo zone of xylan hydrolysis formed by bacteria on the nutrient agar media supplemented with oat spelt xylan and wheat bran

Table 2.4 Qualitative screening of microbial cultures for production of xylanase enzymes using oat spelt xylan and wheat bran as a raw material

List of bacterial cultures screened	Xylanase activity on NA with 0.5% oat spelt xylan		Xylanase activity on the NA with 1% wheat bran		
	Halo zone (H) of xylan hydrolysis (in mm)	Avg. Halo zone (HI) Index (H:C)	Halo zone (H) of xylan hydrolysis (in mm)	Halo zone (HI)Index (H:C)	
	24hrs	48hrs	24hrs		
CSIR-IMTECH, Chandigarh bacterial cultures					
<i>Bacillus pumilus</i> (MTCC9862)	22.00±1.7	33.00±1.2	2.24	20.0±2.89	1.67
<i>Bacillus pumilus</i> (MTCC 10414)	32.50±3.8	46.50±4.9	1.62	19.0±2.89	1.65
<i>Cellulosimicrobium</i> sp. (MTCC10645)	20.50±0.3	38.00±1.7	2.29	21.0±4.04	1.83
<i>Bacillus halodurans</i> (MTCC9512)	14.50±2.0	35.00±0.6	1.4	-	-
<i>Bacillus licheniformis</i> (MTCC9415)	23.50±2.0	37.50±1.4	1.83	22.5±4.33	1.80
ICAR-CIRCOT, Mumbai bacterial cultures					
<i>Acetobacter xylinum</i> (NCIM2526)	18.00±1.00	35.00±1.00	1.26	-	-
<i>Bacillus cereus</i> (ATCC11778)	31.33±2.67	38.00±3.00	1.42	37.5±7.22	2.88
<i>Bacillus subtilis</i> (ATCC6051a)	36.67±15.67	43.67±13.67	1.23	34.5±6.06	1.26
<i>Bacillus subtilis</i> ATCC159	21.00±2.00	31.67±1.67	1.29	22±2.31	1.44

Quantification of xylanase activities and its comparisons with the cellulase activity

The xylanase and cellulase activity was examined by the 3,5-dinitro salicylic acid(DNS) method by measuring the amount of reducing sugars liberated from xylan & cellulose and using a calibration curve for xylose and glucose, respectively. The xylanase activity was quantified after 24, 48 and 72 hours of bacterial growth. The obtained results indicated that the highest xylanase activity was exhibited by *Cellulosimicrobium* sp., *B. pumilus* (MTCC 10414), *B. licheniformis*, and *B. pumilus* (MTCC9862). All these cultures showed the highest xylanase activity after 24 h of their growth, except for *B. pumilus* (MTCC9862), which showed the highest xylanase activity after 48 h of growth. After 24h, the highest xylanase activity shown by *Cellulosimicrobium* sp., was 1.40 IU/mg protein, followed by *B. pumilus* (MTCC 10414) (1.28 IU/mg protein) *B. licheniformis* (1.22 IU/mg protein), and *B. pumilus* (MTCC9862)

(1.05 IU/mg protein). Conversely, the lowest xylanase activity (0.3 IU/mg protein) was found in *Acetobacter xylinum* (NCIM2526). In order to have an effective removal of hemicelluloses and lignin, and cause minimum damage to cellulose fibres in the lignocelluloses pulp, bacterial cultures must have the high amount of xylanase activity with a very low /negligible amount of cellulase activity. Cellulase activity in *Cellulosimicrobium* sp., *B. pumilus* (MTCC 10414), *B. licheniformis*, and *B. pumilus* (MTCC9862) were 0.094 IU/mg protein, 0.067 IU/mg protein, 0.069 IU/mg protein and 0.058 IU/mg protein, respectively. In comparison to cellulase activity, the xylanase activity in *B. pumilus* (MTCC 10414), *B. pumilus* (MTCC9862), *B. licheniformis*, and *Cellulosimicrobium* sp., was almost 19.10, 18.10, 17.68 and 14.89 times higher than that of cellulase activity. Compared to cellulase activity, xylanase activity in other cultures was low as compared to these four bacterial strains (Table 2.5).

Table 2.5. Quantification of xylanase activities and its comparison with cellulase activity

Bacterial cultures	Cellulase activity (IU/mg protein)	Xylanase activity (IU/mg protein)	Xylanase:Cellulase ratio
<i>Cellulosimicrobium</i> sp. (MTCC10645)	0.094	1.40	14.89
<i>B. licheniformis</i> (MTCC9415)	0.069	1.22	17.68
<i>Bacillus halodurans</i> (MTCC9512)	0.065	0.41	06.31
<i>Bacillus pumilus</i> (MTCC 9862)	0.058	1.05	18.10
<i>Bacillus pumilus</i> (MTCC10414)	0.067	1.28	19.10
<i>Bacillus firmus</i> (MTCC2411)	0.067	0.37	05.52
<i>Bacillus subtilis</i> (ATCC6051a)	0.086	0.40	04.65
<i>Bacillus subtilis</i> (ATCC159)	0.082	0.40	04.88
<i>Bacillus cereus</i> (ATCC11778)	0.070	0.43	06.14
<i>Acetobacter xylinum</i> (NCIM2526)	0.074	0.30	04.05

2.5 CORE AREA - V: ENTREPRENEURSHIP AND HUMAN RESOURCE DEVELOPMENT

2.5.1 Development of nanocellulose based edible coating for fruits and vegetables

The coating formulation containing sodium alginate, oleic acid and crystalline nanocellulose was optimized by Box-Behnken design. The optimum emulsion possessed 100% stability till 120 days storage period with average particle size of 440 nm. The water vapour permeability of films was found to be $1.64 \times 10^{-10} \text{ g m/s m}^2 \text{ Pa}$.

Fresh fruits such as pears, guava, sapota, yellow and green bananas were dipped in the prepared nanoemulsion and dried under convective air flow at room temperature to get a uniform coating on the fruits. All fruits were then stored under ambient condition for shelf life and quality analysis. The result indicated extension in shelf life of pears,

guava, banana and sapota in the nanoemulsion based coating as compared to uncoated fruits. The developed coating enhanced the shelf life of pears, guava, bananas and sapota by 80%, 100%, 42% (green), 66% (yellow) and 50% than uncoated fruits and the quality remained intact during the ambient storage period. Further, in case of pears, ripening, internal browning and spoilage was observed after 36 day of storage in control coated fruits, whereas the nanoemulsion coated fruits remained intact. The results indicated the developed coating to be novel, efficient, eco-friendly and water soluble and can be an alternative to synthetic wax based coating for enhancing quality and shelf life of fruits and vegetables.



Fig. 2.27: Fruits (a) control and (b) coated with Nanocellulose based Pickering emulsion after several days of ambient storage (guava: 6 days, pears: 36 days, banana: 6 days and sapota: 12 days)

2.5.2 Refinement and popularisation of nutrient-enriched compost production from cotton micro-dust

In the present project, attempts were made to identify cellulolytic microorganisms which can tolerate high temperatures for their exploitation in composting of cotton micro-dust. A total of twenty microbial isolates were obtained and they were

screened for production of cellulase enzyme on Reese's mineral medium supplemented with 1% (w/v) CMC at 55 °C. The colonies which showed orange halo zone around their growth indicated positive for cellulase enzyme production (Fig.2.28).

Among 20 isolates, 5 isolates were found to produce cellulase enzyme at thermophilic temperature (55 °C). Qualitative and quantitative screening of isolates showed that two isolates, M-10 and M-12 were able to produce high solubilization index at both 30°C and 55°C. These two promising isolates were selected for further

studies and the compatibility among these two were studied on Nutrient Agar medium. The results revealed that these two isolates were compatible with each other. Based on the above observation, a microbial consortium comprising of these two isolates was developed.

Table 2.6 Qualitative screening of selected isolates for cellulolytic enzyme production at 30 °C

Isolates	Colony Dia. (mm)	Halo Zone Dia. (mm)	Solubilization Index
M-2	0.8	1	1.25
M-5	0.9	1.2	1.33
M-6	0.9	1.2	1.33
M-10	0.8	1.4	1.75
M-12	0.6	1.2	2.00

Table 2.7 Qualitative screening of selected isolates for cellulolytic enzyme production at 55 °C

Isolates	Colony Dia. (mm)	Halo Zone Dia. (mm)	Solubilization Index
M-2	0.8	1	1.25
M-5	0.7	1.2	1.71
M-6	0.8	1.2	1.50
M-10	0.7	1.4	2.00
M-12	1	1.8	1.80

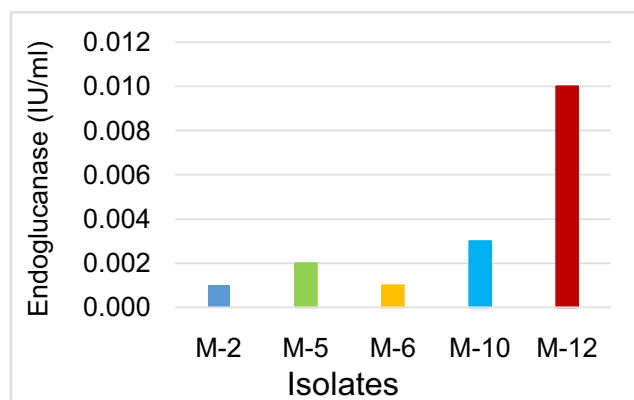


Fig.2.28 Quantitative screening of selected isolates for endoglucanase production at 30 °C

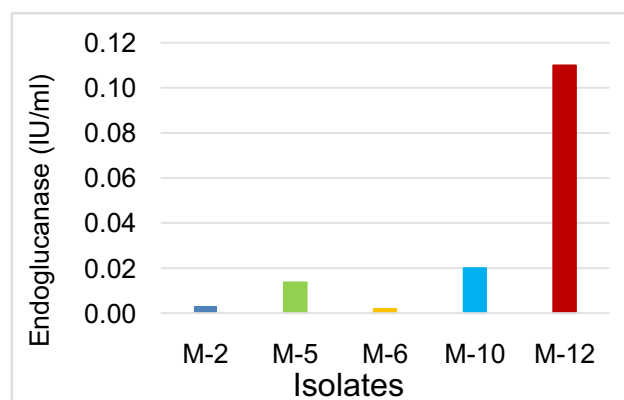


Fig. 2.29 Quantitative screening of selected isolates for endoglucanase production at 55 °C

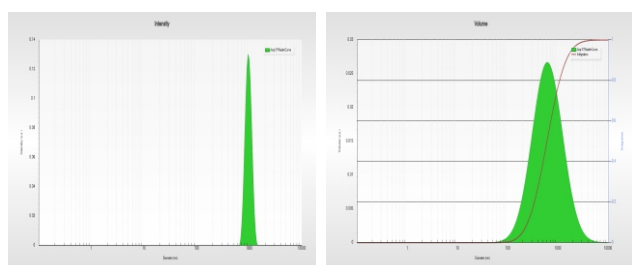
2.5.3 Development of process protocol for synthesis of nano-sulphur and its application in agriculture

The process protocol of synthesizing nano sulphur using chemo-mechanical approach was standardized. The initial formulation containing elemental sulphur (1000 g) was mixed with water (1200 ml) and SPAN 85 surfactant (1%) and subjected to stirring for 45-60 minutes at 2000-3000 rpm. This pre-mix was poured for grinding in super mass colloidar by gradually reducing the scale of diminution. The set of rotary grinder stones are the core component of the machine responsible for the grinding. The scale of diminution was set using the dial gauge and handle fixing screw. The gap between the grinding stones was gradually reduced (from positive to negative) and appropriate amount of water was added during the process so as to obtain requisite grinding while maintaining smooth flow of the mixture. The mixture was fed for at least 3 times at a particular scale. As per the preliminary trials results, the mixture was grinded in super mass colloidar from +9 scale to -9 scale where 1 scale =10 microns. Thereafter, characterization (particle size, SEM, TEM, viscosity) was performed by adopting the standard procedures. It was found that around 500-800 nm particles were obtained using SPAN 85,

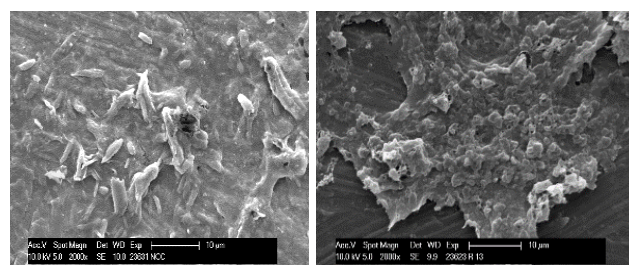
while the settling time (5-10 min) and viscosity (20-25 cP) were observed.

Synthesis of nano sulphur using STANSTED high pressure homogenizer

A set of experiments was conducted using the laboratory model of STANSTED high pressure homogenizer (Model S-PCH-10, M/s Homogenizing Systems Ltd., UK, max. pressure 60000 psi) which was operated on 30000 psi. Response surface methodology (Design expert, Version 13) was used to design the experiments and the Box-Behnken design was adopted. Based on the preliminary trials, the range of the independent variables i.e. nanocellulose (25, 50, 75 ml), elemental sulphur (5, 10, 15 g) and number of passes (1, 2, 3) was decided. From the results, it was observed that the settling time ranged from 0.26 to 20.60 min, particle size ranged from 300-1800 nm, viscosity (100 rpm) ranged from 23.96 to 420 cP, and viscosity (200 rpm) ranged from 15.62 to 226 cP. The SEM analysis confirmed the size reduction and mixing of sulphur particles with nanocellulose.



(a)



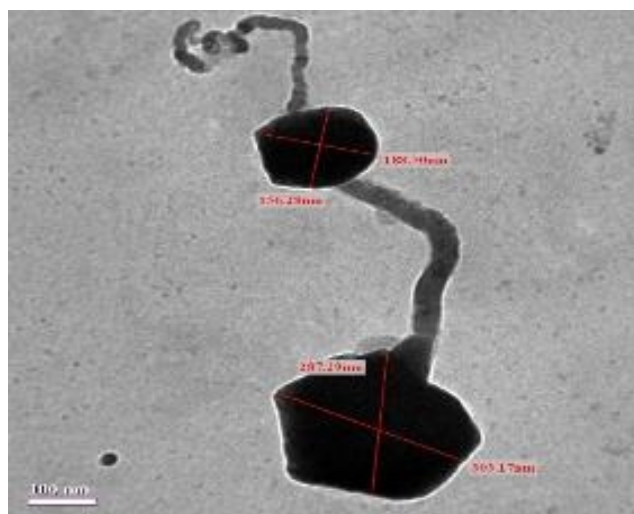
(b)

Fig. 2.30: (a) Size estimation of the samples (b) SEM analysis of the sample

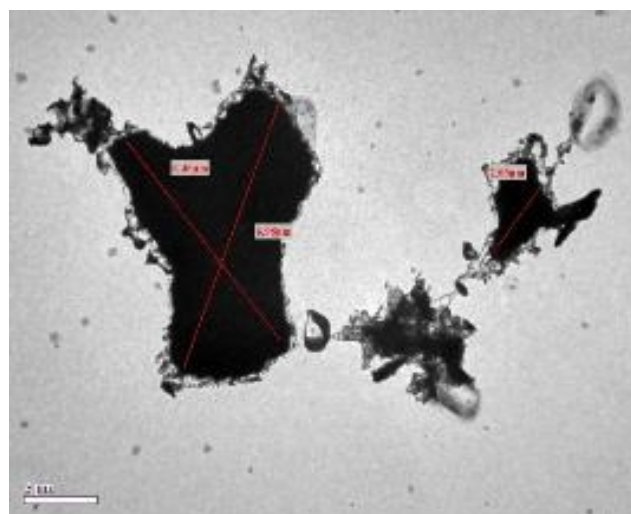
Characterization of nanosulphur samples

The atomic force microscopy (AFM) and transmission electron microscopy (TEM) analysis of the nanosulphur samples obtained using mass colloidar and high pressure homogenizer was carried out. The analysis revealed that significant

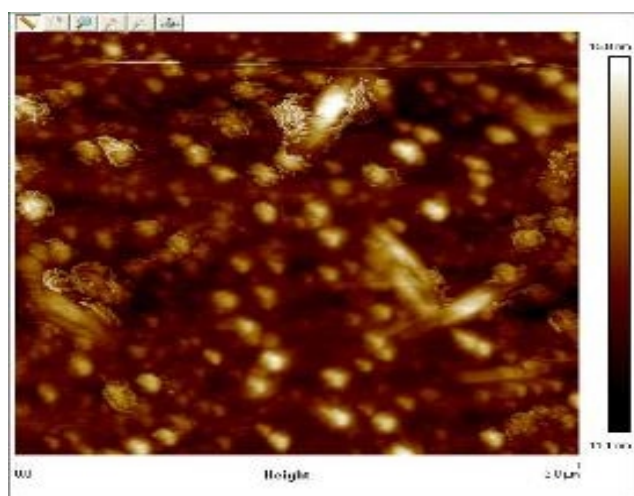
size reduction was observed in the homogenized sample (156-304 nm) as compared to mass colloidar sample (2-7 μm). The AFM images also suggested that there are uniform size particles in homogenized samples as compared to mass colloidar samples.



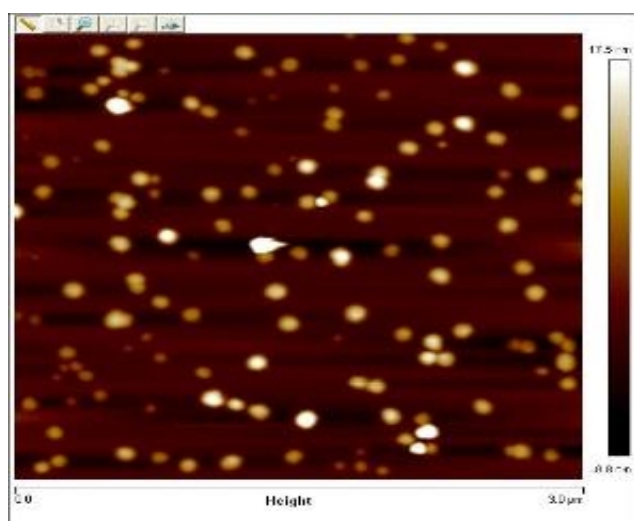
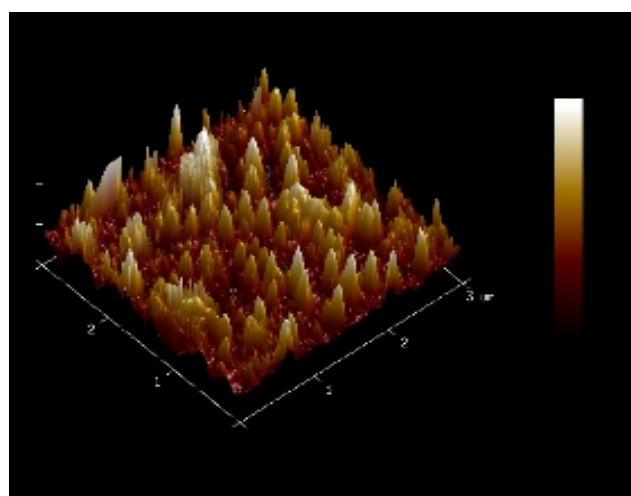
(a)



(b)



(c)



(d)

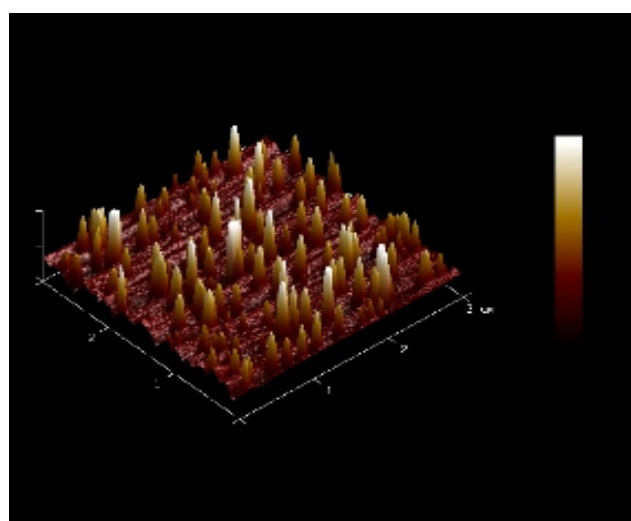


Fig. 2.31: (a) TEM image of Homogenized sample (b) TEM image of mass colloidal sample (c) AFM of Nano sulphur (Super mass colloidal) (d) AFM of Nano sulphur (High Pressure Homogenizer)

2.5.4 Impact Assessment of CIRCOT technologies

Impact assessment of CIRCOT Bajaj Pre-Cleaner:

The impact assessment of the CIRCOT-Bajaj pre-cleaner was carried out using the Difference in difference method, wherein the impact of the technology adoption in the individual ginning industry was studied. The concept of economic surplus has been used to measure economic welfare to the stakeholders due to adoption of this technology. The methodology permits estimation of economic benefits generated by adoption of technological innovations, compared to the situation before (without) the adoption, where only traditional technology was available. With information on productivity change generated by research, equilibrium price of product, adoption rate and costs, price elasticity of supply and

demand, it is possible to calculate the magnitude of change of supply as a result of the technology adoption.

The maximum yield increase as a result of adoption of the CIRCOT-Bajaj pre-cleaner to the ginning industry was estimated at 5%. The adoption of the CIRCOT-Bajaj Pre-cleaner in the ginning industry, comprising of over 3000 ginning factories, has grown from 12% in 2009 to around 32% in 2020. With the estimates of the elasticity of demand (0.30) and elasticity of supply (0.23) for cotton lint, the overall economic benefit computed as a result of the utilization of the CIRCOT-Bajaj Pre Cleaner was estimated at Rs.438 crores per annum.

2.5.5 Efficacy evaluation of ICAR-CIRCOT Nano-Sulphur fertilizer formulation for different field crops (Inter-institutional Project)

The chemo-mechanical process for production of Nano sulphur was optimized for production of average particle size ranging between 500-800 nm. ICAR-CIRCOT is developing fertilizer formulation of nano Sulphur and is carrying out field evaluation study in collaboration with ICAR-Directorate of

Onion and Garlic Research (DOGR), Pune, ICAR-Indian Institute of Soil Science (IISS), Bhopal & M/s. Devdhar Chemicals Private Limited, Pune. Furthermore, the team has developed a logo shown below for the nano sulphur fertilizer formulation supplied to partner institutions.



ICAR-IISS Bhopal initiated the trials with plantation of maize as an exhaust crop and then sowing of mustard was taken for the field trials. About 30 litres of nano-sulphur fertilizer formulation has been sent to ICAR-IISS Bhopal for conducting the field trials.



The fertility status of the soil used for evaluation of the nano Sulphur as a fertilizer has been carried out and is presented in table 2.8.

Table 2.8: Initial chemical properties of the experimental field soil

Site	Soil depth (cm)	pH (1:2.5)	EC (dS/m)	OC (%)	P (kg/ha)	K (kg/ha)	Available sulphur (kg/ha)
S1	0-15	7.97	0.14	0.58	10.10	444	17.20
	15-30	8.10	0.18	0.52	9.60	454	12.60
S2	0-15	8.26	0.16	0.60	17.10	453	18.16
	15-30	8.34	0.16	0.55	14.00	455	13.25
S3	0-15	8.41	0.14	0.49	11.30	474	14.30
	15-30	8.45	0.17	0.45	10.20	494	12.10
S4	0-15	8.41	0.16	0.55	15.50	449	14.50
	15-30	8.46	0.17	0.49	10.30	475	11.90

ICAR-DOGR Pune, was supplied with 20 litres of nano Sulphur formulation and has initiated the trials for onion and garlic (Late kharif/Rabi) with different fertilizer treatment. The recommended dose of Sulphur (RDS) for onion is 20 kg /ha and for garlic is 30 kg /ha. Comparative evaluation of the sulphur use efficiency with application of elemental

sulphur and nano sulphur were carried out. For nano sulphur 0, 50% RDS, 75% RDS, 100% RDS, and 125% RDS were taken and the individual plot size was 40 m × 1.2 m = 48 m². The result of sulphur uptake showed that 70-80% of the total S uptake was recorded till 80 days after transplanting.



2.33 The field view of the experimental trials being conducted at ICAR-DOGR Pune

2.6 CONSORTIA RESEARCH PROJECT (CRP) ON NATURAL FIBRES

2.6.1 Development of cotton incorporated Personal Protective Equipment (PPE) body suit with smart respirator for healthcare workers with enhanced comfort

Cool air circulation system (cooling belt) for active cooling of PPE kit was developed. It is a mini air conditioning system which can create comfort zone in the internal environment between the human body and the PPE suit. The cooling belt works by drawing out the internal air present with in the PPE suit and passing it into the Peltier module. Peltier module is a component which exhibits hotness at one surface and coolness on the other. In order to bring down the temperature of the circulated air effectively, an aluminium heat sink was designed and mounted on the cooling side of the Peltier module where the temperature can reduce up to 15°C. This setup is fixed into a closed chamber where the air can circulate continuously between the PPE suit and the cooling chamber. This continuous circulation of air through the heat sink brings down the hot environment into cool while wearing the PPE suit.

It was observed that the temperature can be reduced by 2°C, from 31°C to 29°C, within 20

minutes and that temperature is maintained throughout the wearing time. Without using the cooling belt, it was observed that the internal temperature increased from 31°C to 39°C with in the time span of 20 minutes. The cooling system is controlled by an electronic circuit with three mode power options, to increase or decrease the cooling effect. A normal power bank was used to operate complete system with 5 to 12V and 2A power supply.

Equipment for air filtration evaluation

An Equipment for evaluation of the air filtration of fabrics has been fabricated, which can filter out the hazardous substances like particulate matter, volatile organic compounds, carbon dioxide & formaldehyde and can measure the air quality along with other environmental conditions. The equipment consisted of two major components i.e. the testing chamber (control chamber and result chamber) and the measurement and display electronics.

2.6.2 Development of Cotton Based face mask with improved particle filtration efficiency and breathability using electro spun nano materials and antiviral coatings

A bulk trial to produce cotton based high performance mask was undertaken using 550 meters of fabric having three different weave patterns. Required chemical treatments viz. Water repellent Treatment & Antimicrobial treatment on the fabrics were done at M/S Gini Silks, Boisar.

A three layered cotton fabric based mask was developed using the treated fabrics which provided required breathability to the wearer along with antimicrobial and water repellent characteristics. The Top & bottom Layers of the mask were made up of fluorine free water repellent treated fabric which provided water repellent and quick drying properties to the mask. The middle Layer of the mask was made up of 100% cotton fabric treated with institute developed non-leaching type antimicrobial agent (CAT- R). The performance of

the mask was tested at Centre of Medical Textiles SITRA, Coimbatore as per the international standard methods. The breathability of the developed mask was 37 ft³/min/ft². The differential pressure was 46 Pa/cm². The optimum value should be less than 50 Pa/cm². The particle filtration efficiency of the developed mask is 59%. The bacterial filtration efficiency was 78% when tested under dynamic conditions and the antimicrobial efficiency was 100% against both Gram positive and negative bacteria. The durability of the antimicrobial finish was up to 25 washes. The antimicrobial CAT-R treated fabric was also tested for in-vitro toxicity using Indirect & direct method as per ISO 10993:5. The results showed that test sample had no cytotoxic reactivity to L929 cells after 24hr contact.



Fig: 2.34 Cotton based reusable face mask with breathability, antimicrobial and repellent property

The developed mask is reusable, antimicrobial and has good breathability with quick drying properties imparted by water repellent coating.

Prototype Development of Engineered Cotton Fabric Face Mask

100% cotton double fabric structure was used to prepare 3, 4 and 5 layered face masks (Fig 2.35) with high breathability and enhanced particle filtration efficiency. The produced double fabric structure was placed opposite to each other with respect to each layer of the fabric. Out of two structures, one is

a highly floated structure with high air permeability and the other structure was compact with high air resistance. Due to simultaneous compact and open structure, the air movement was restricted in compact structure with free air entry in floated structure. Since the fabrics were laid opposite to each other, the air movement was diverted and transferred through the open structure in the subsequent layer, hence the air permeability was maintained. Whereas the particles which travelled along with air can be filtered through compact fabric structure present in the preceding fabric.

Development of Replaceable Nanofibre filter cartridge

Nanofibre based replaceable cartridge was developed to use in multi-layered engineered cotton fabric face masks. The coated nonwoven fabric was sandwiched with two layers of uncoated nonwoven fabric, which can be inserted with the multi-layer face mask as a replaceable filter media.



Fig: 2.35 Engineered Cotton Fabric Face Mask

Design and development of rotating Drum collector for aligned nanofibre production

A high speed rotating drum collector was designed and fabricated to produce aligned nanofibres. Aligned nanofibre production through electrospinning is one of the important requirement for precise applications. Hence the high speed rotating drum collector was designed and fabricated to produce aligned nanofibres (Fig

2.36 (a)). It consists of detachable fibre collection rollers with two different materials namely copper and stainless steel. Fibre collector roller can be changed based on the requirement. Further, the roller speed can be adjusted from 0-1500 RPM with the electrical controller and the working width of the collector is about 300 mm. The multi-phase electrospinning machine panel was upgraded with safety sensor for enhancing its operations.



Fig: 2.36 (a) Fabricated rotating drum collector to produce aligned nanofibres (b) upgraded multi-phase electrospinning machine display (c) upgraded multi-phase electrospinning machine Panel

2.7 EXTERNALLY AIDED PROJECTS

2.7.1 ICAR-CIRCOT-Agri-Business Incubation (ABI) Centre (NAIF)

ICAR-CIRCOT Agri-Business Incubation (ABI) Centre promotes incubation and business development in cotton and its by-products, conducts techno-entrepreneurial activities in cotton value chain for building prospective clientele and facilitates skill development in selected stakeholders related to cotton sector.

During the current year five new entrepreneurs were admitted at the Centre for incubation on different technologies.

Two incubatees graduated from the incubation centre namely M/s. FNV Agro Pack, Pune (development of Banana based Value Added Products) and M/s. Shree Agro Invent Tech Pvt. Ltd.,

Mumbai (Conceptualization, Design and development of technically Advanced Textile Materials and conversion to related Products). Six specialized training programmes, two workshops and eight online lecture sessions, were organized to guide and mentor incubatees and startups of CIRCOT ABI Centre.

Fifth meeting of the ABI Centre Advisory Committee was organised on 10th December 2021 in hybrid mode. Six advisory committee members, seven incubates and ten technology mentors participated in this meeting. On this occasion, exhibition of products made by ICAR-CIRCOT-ABI Incubatees was also held to appraise the advisory committee of the Incubatees progress.

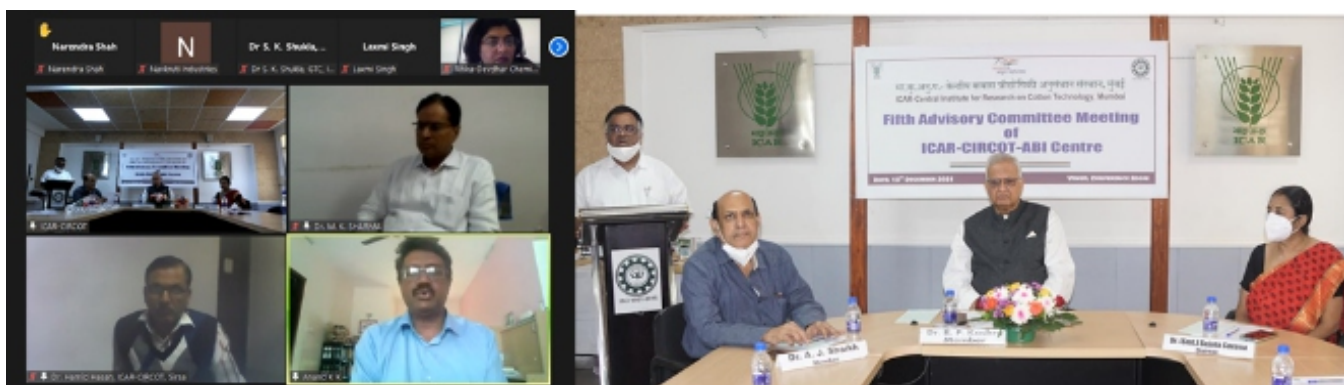


Fig. 2.37 Fifth Advisory Committee Meeting of ICAR-CIRCOT-ABI Centre (10th December 2021)

2.7.2 Valorization of Cottonseed Meal: Extraction of Quality Protein for improving the Livelihood of Cotton Farmers (DST)

The protein isolates obtained from optimised conditions showed excellent functional food properties such as protein solubility, water holding capacity, oil holding capacity, and emulsification properties. Amino acid profile was balanced.

However, further study needs to be conducted since COMET test showed some toxicity on lymphocytes when rats were fed with cottonseed protein isolate.

2.7.3 An Inclusive Agribusiness Model for Sustainable Cotton Marketing in the State of Maharashtra (NASF)

The farmers are the weakest link in the Cotton value chain especially due to small farm holding and less than threshold volume of production to have any bargaining power. The aim of the project is to assess the existing market mechanism of the cotton farmers for its sustainability and profitability, study the price quality relations and evaluate the harvesting and post harvesting practices of cotton farmers in relation to price quality linkages in cotton market and examine the utilization pattern & market for the cotton by-products and to come up with an inclusive agri-business model to improve the profitability of the cotton farmers. Six major cotton growing districts and also representative of the different regions of Maharashtra viz., Jalgaon (Khandesh), Aurangabad; Parbhani (Marathwada), Yavatmal & Amaravati (Vidharba), and Ahmednagar (Western Maharashtra) were covered in the study. A total of around 500 farmers were surveyed along with other stakeholders, viz., traders, ginners and FPO's.

Choice of the Marketing Channel on the Profitability: Among the 6 districts covered for the study viz., Amaravati, Yavatmal, Jalgaon, Parbhani, Ahmednagar and Aurangabad, 74% of the surveyed farmers resorted to traders or village agents to sell their produce and 23% sold directly to the ginners. Farmer Producer Organizations' (FPOs) are emerging as a new channel to link the farmers to the value chain. Choice of marketing channel determines the profitability to the farmers as revealed by the returns to the total cost ratio (BC ratio) of 1.19, 1.24, 1.29, and 1.40 for transaction through village agents, traders, ginners and through FPOs respectively. The weak linkage of smallholder

cotton farmers with the value chain is due to their risk averse nature predominantly influenced by factors viz., quantity of marketable produce, immediate need for money, chance of rejection on quality aspect, distance of factories etc. It's also evident that weaker the linkage with the value chain lower is the price realization.

Price Quality Linkage: The price quality linkage of the existing marketing practices show that staple length and colour grade has positive relation and significant influence on price, whereas other parameters do not exert any influence on the price. In case of the public procurement operation, moisture content plays a significant role and is inversely related to the price. The Hedonic price model to link the price and quality parameters at the lint marketing stage reveals that Uniformity index, micronaire, colour grade and strength also influences the pricing of cotton.

Spinning consistency index was developed based on fibre quality parameters of samples collected from farmers to correlate the price received by the farmers with quality of cotton in view of their harvest and post-harvest practices. It was clearly established that where farmers adhered to appropriate practices (picking/quality wise storage/selling), they received their remuneration in accordance with the quality of the produce.

Cotton biomass value chain is in the nascent stage. The supply chain logistics was analyzed with a case study, which revealed the potential for additional remuneration to the tune of Rs.1000/acre to farmers through sale of cotton stalks by working in

association/groups. Full potential is not exploited due to the missing link between the farmers and the user industry.

The sustainable cotton initiatives viz. Better cotton initiative (BCI) and Organic cotton production are growing at a faster pace among the small holder cotton farmers impacting the farmers by considerably reducing the cost of cultivation to the tune of 12-15% in case of BCI farmers and 30- 35% for organic cotton growers. The market linkage is crucial to establish a distinct value chain so that farmers get suitable remuneration. The FPOs are enabling the farmers to fetch premium price of Rs 500/quintal by linking the farmers with the value chain and ensuring assured market for their produce. In case of the organic cotton cultivation, FPOs are involved in streamlining production, certification as well as in marketing of the cotton creating a distinct linkage with the end users. Organic cotton growers linked to the consumer industry through FPOs are ensured assured market

and premium price over the prevailing market price as reflected by the BC ratio of 1.42.

The farmers' perception about the FPOs as measured by Garrett Ranking technique reveals that training/organizing meeting is an important factor that influences farmers to become a member of FPO, followed by the perception of improvement in income & hassle free marketing, equal treatment for all members, linkage with value chain and input services offered by FPOs.

The inclusive agri-business model envisages Farmer Producer Organization (FPO) in pivotal role to link small holder farmers to the value chain, either to ginners (with better bargaining power) or to the spinners, providing sustainable marketing solution with improved profitability to the farmers. They can also provide the scope for commercial exploitation of the under-utilized biomass to improve the farmers' income.

2.7.4 Technology Incubation - RAFTAAR Agri-Business Incubation (DAC&FW)

ICAR-CIRCOT is bestowed with RKVY-RAFTAAR Agri-Business Incubator (R-ABI), one among the 29 Incubators, under RKVY-RAFTAAR (Remunerative Approaches for Agri and Allied Sectors Rejuvenation) scheme that aims to promote entrepreneurship in Agriculture and innovation led growth in the agriculture and allied sector. The CIRCOT R-ABI is functioning since 31st January 2019. CIRCOT R-ABI provides a platform to graduates/rural youth/farmers and other stakeholders, with pre-seed and seed stage funding of Rs. 5 lakhs and Rs. 25 Lakhs respectively, to materialize/commercialize their innovative ideas/concepts in agriculture and allied sectors. Through this platform individuals/startups with innovative ideas can have access to experienced expertise from the institute and it's networking partners to bring their ideas in to reality.

CIRCOT R-ABI offers two funding programs namely Uday, pre-seed stage funding program, under which funds up to Rs 5 lakhs are being provided to agri-startups to translate innovative Ideas in to workable prototype and Ankur, seed stage funding program, under which grant in aid amount up to Rs 25 lakhs is being provided to agri-startups to commercialize their MVP/scale up the business activity.

CIRCOT R-ABI operates under continuous guidance and supervision of RAFTAAR Incubation Committee (RIC) constituted as per the guidelines of RKVY-RAFTAAR, the CIRCOT-RAFTAAR Incubation Committee (RIC) comprises of following members.

Sl. No.	Name	Designation	Post
1.	Dr. (Smt.) Sujata Saxena	Director (Acting), ICAR-CIRCOT	Chairman
2.	Mr. Ramesh R. Kadam	Retired General Manager Bank of India	Member (Representative of Bank)
3.	Dr. G. R. Anap	Former International Cotton Consultant, World Bank Project (Africa)	Member (Domain expert from Industry)
4.	Prof. (Dr.) V. D. Gotmare	Former Associate Professor, Department of Textile Manufacture, VJTI, Mumbai	Member (Domain expert from Academia)
5.	Prof. (Dr.) A. S. Vastrad	Professor and Dy. Director, Student Welfare, University of Agricultural Science (UAS), Dharwad	Member (RKVY Knowledge Partner nominee)
6.	Mr. Abasaheb Kisanrao Haral	Rtd. Joint Director of Agriculture and Chief Co- ordinator (PPP-IAD), Dept. of Agriculture, Govt. of Maharashtra	Member
7.	Dr. A. K. Bharimalla	Senior Scientist, TTD ICAR-CIRCOT, Mumbai	Member Secretary (Principal Investigator- Chief Executive Officer (PI-CEO), CIRCOT-RABI)
8.	Dr. N. J. Thakor	Former Dean, College of Agricultural Engineering and Technology, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli	Domain Expert (Invitee)

Funding support to agribusiness startups:

CIRCOT R-ABI has been successful in facilitating Grant-in-aid support to the start-ups during different cohorts.

First cohort: Twelve agri business startups were sanctioned Grant-in-aid of Rs.144 lakhs and were disbursed 2nd Instalment of sanctioned Grant-in-aid of Rs 49 lakh [Pre-seed stage funding Rs 4.60 Lakh & Seed stage funding Rs 44.40 Lakh] during the reporting period.

Second cohort: Twelve (12) start-ups were sanctioned Grant-in-aid of Rs.153 lakhs [Four (4): Pre-seed stage funding and Eight (8): Seed stage funding]. Eleven Memorandum of Agreements (MoAs) were signed with agri business startups

under Second cohort on 3rd December 2021 for release of 1st installment of sanctioned grant in aid.

Third cohort: The Agripreneurship Orientation Programme (AoP) & Incubation cum Training Programme was organized for the incubatees of 3rd Cohort during 23 September to 23rd November 2021. Out of 83 applications (39 for pre-seed and 44 for seed stage funding), ten Start-Ups (5 for pre-seed and 5 for seed stage funding) were selected and admitted for the AoP programme.

Fourth cohort: Nineteen (19) agri-start-ups were screened for Agripreneurship Orientation Program (AOP) cum Resident Incubation program.

Mentoring Sessions:

Eleven mentoring sessions organised during reported period

- 1st COHORT: Two Mentoring sessions regarding Judicious Expenditure of Grant in aid received as 1st Installment in June 2021.
- 2nd COHORT: Mentoring for the start-ups to prepare them for final CIC Meeting held during 23/04/2021 and 26/04/2021.
- Four (04) Mentoring sessions during AOP and Incubation program were organised on 23/09/2021, 24/09/2021, 25/09/2021, & 27/09/2021
- Three (03) Mentoring and Technical Discussion with start-ups selected for AOP and Incubation program Under 3rd COHORT.

Publications:**Brochure**

- Online Brochure with QR code
- E-brochure for World Soil Day

Book:

- *CIRCOT-R-ABI Endeavour: Bolstering Women Agri-Startups*

Events Organized:

- Celebrated National Handloom day on 7th August 2021. All start-ups of 1st, 2nd & 3rd COHORT participated.
- Inauguration Function of Agripreneurship Orientation Program (AOP) and Incubation-cum-Training program of 3rd COHORT of CIRCOT-R-ABI held on 23rd September 2021.
- Valedictory Function of Agripreneurship Orientation program & Incubation cum Training Program of 3rd COHORT on 23rd November 2021.
- **Investor meet:** Meeting of CIRCOT R-ABI startup M/s PAWAAK FOODS with investor Mr Yogesh Nimodia and Mr Abhay Asalkar, Directors of PIOTEX VENTURES PVT LTD, Pune (A company having Turnover of Rs 1,000 cr).

Lectures conducted:

Eight lectures conducted to guide agribusiness startups on different aspects of business viz., business proposal, strategy, innovation management, funding, exports, regulations, IP

management etc.

1. *Basic of Export* delivered by Mr. Hemant Ladgaonkar, Business Manager, CIRCOT- RABI on 11th October 2021
2. *Strategy for better Agri Innovative Proposal* delivered by Dr. C. Sundaramoorthy, Senior Scientist, TTD, ICAR-CIRCOT on 12th November 2021
3. *Innovation Management: Startup Perspective* delivered by Mrs. Rohini Wayal, Senior Manager, Intellectual Property, M/s. Godavari Biorefineries, Mumbai on 13th November 2021
4. *Regulatory Compliances for Agri-startups (with special reference to food products);* delivered by Dr. Sharmila Patil, Scientist, QEID, ICAR-CIRCOT on 16th November 2021
5. *How to make agri startups business effective* delivered by Dr. N. J. Thakor, Consultant, Agro-Food Processing, Food Technology & Safety, Pune on 18th November 2021
6. *Funding avenues for business enterprise,* delivered by Mr. Shantanu Chainy, Credit Officer, Bank of Baroda on 21st November 2021
7. *Translation of Research into Successful Business Enterprise* delivered by Dr. Parthsarathi Bhattacharya, Founder & Director (Research), M/s. Tierra Seed Science Private Limited, Hyderabad on 6th December 2021
8. *Translation of my Innovation into Successful Business Enterprise* delivered by Mr. Rana Atheya, CEO & Founder, M/s. Dogspot, New Delhi on 7th December 2021.

Women agripreneurs incubated at CIRCOT-RABI

Women agribusiness startups funded by CIRCOT-RABI under three cohorts:

- I Cohort: Five women startups were incubated; received funding of Rs. 49 lakhs for commercial scaling up of their innovations
- II Cohort: Four women startups were incubated; received funding of Rs. 63 lakhs for commercial scaling up of their innovations
- III Cohort: Three Women startups have completed their Agripreneurship Orientation & Resident Incubation Programme

3rd Cohort:
• Startups and their ideas selected for mentoring for Pre-Seed Stage Funding

Sr No	Name of Startup/ Agripreneurs	Idea/Concept
1	M/s Ocean Farms (Mr. Akshay Jadhav)	Seaweed Cultivation & Development of seaweed-based products
2	M/s Tejasvi AgroIndustries (Mr. Vilas Rajole)	Value chain of Tamarind processing
3	M/s One Stop Digital Agri-solutions Private Ltd. (Mr. Pratapsinh Chavan)	One stop digital agri-solutions platform
4	M/s Kayadhu Vermicompost (Mr. Akshay Patange)	Innovative decomposable organic waste such as goat dung, farmresidues used as composting material
5	M/s Recleno SkincareLLP (Mrs. Gauri Khatpe)	Development of process protocol for Value addition to cottonseed oil through manufacturing of Handmade cold process soap with 100 % natural ingredients

• Startups selected for mentoring for Seed Stage Funding

Sr. No.	Name of Startup/Agripreneurs	Idea/Concept
1	M/s.VRSS Agro Engineering LLP (Mr.Vinod Atkari, Mr. Rajendra Kolhe, Mrs. Vishakha Kolhe, Mrs. Swapnali Atakari)	Innovative Food Grain Storage Silo for Farmers, FPOs & Farmers groups
2	M/s Rajwardhini Nutricare and Foods (Ms.Pradnya Rane)	Naturally fortified affordable baby foods
3	M/s Biological ResearchInnovation Centre andSolutions LLP (Mr. Ravishankar Bhat)	Textile fabric stain remover using plant-based constituents
4	M/s Baseline Engineering LLP (Mr.Arvind Ghadge)	De-salinated Sea Water for Drinking
5	M/s Arde Patil Pharma Pvt Ltd. (Mr. Sarjerao Patil)	Extraction of medicinal plant extracts and its use

4th Cohort:
• Startups and their ideas selected for mentoring for Pre-Seed Stage Funding

Sr No	Name of Startup/Agripreneurs	Idea/Concept
1	Dr. Anup B Sonawane Mr. Sachin R. Adsare	Rapid Detection Kit for Determining Viable and non-viable Onion Seeds
2	M/s MASTER TECHNOLOGIES PVT.LTD (Mr.Himanshu Vinayak Dixit)	Novel approach to produce an automated solo machine for soil intercrop cultivation needs of farmers
3	M/s Technovus AgroTech (Mr. Abhishek Vilas Chaudhari)	To design a system for extraction of plant stalk, processing and convert it into valuable product for rural empowerment and sustainable future
4	M/s ORGANIC CITY (Mr.Kartik Salvi)	Vermicompost, Vermiwash, Vermicast,Panchgavya, Gavyamrit, Jeevamrit
5	M/s Adivashi Krishi Paryatan (Mr.Ganesh Lavankush Jadhav)	To generate sustainable income source to villagers through agro tourism module
6	M/s Crop Care (Mr. Harish Omprakash Choudhari)	An Image recognition, Data Analytics & Artificial Intelligence based mobile app that helps farmers to find cures for diseases of their crops & plants
7	M/s Riya Laboratories (Ms. Sonali Ulhas Suryawanshi)	Doorstep soil, water, leaf petiole testing & consultancy services through the android-based application.
8	M/s Suryavanshi Raising of Other Animals Firm (Mr.Shankarsing Suryavanshi)	A innovative business concept of rising a silk worm and production of silk worm through farmers group in rural area and to set up thread making plant and marketing of those final products

• Startups selected for mentoring for Seed Stage Funding

Sr. No.	Name of Startup/Agripreneurs	Idea/Concept
1	M/s Apricitas Engineering Pvt Ltd (Mr. Amit Arvind Patil)	Banana fibers through Innovative Automatic Hi-tech Hi-speed Banana Fiber Extraction Machine for Large scale Banana fiber Production
2	M/s Uni-5 Elements (Mr. Abhijit Arvind Malankar)	EV Express Vend @ Home Service: An Agri-Tech oriented Innovation for Farm Retailing & Supply Chain Services
3	M/s Smaran Udyog (Mr.Mahesh Maruthi Borhade)	Innovative process protocol for extraction of essential oil and value addition to byproduct for use in food, Pharma and cosmetics
4	M/s Madhuamrut (Mr. Dayawan Shrikant Patil)	Production of Honey, Wax, Royal jelly, Pollen Collect, Bee Venom from Honey Bee Keeping
5	M/s Forecast Agrotech Innovations Pvt Ltd (Mr. Santosh Harishchandra Sahane)	Sustainable conversion of bio digested sludge in to bio fertilizer and bio-slurry

Sr. No.	Name of Startup/Agripreneurs	Idea/Concept
6	M/s Maharashtra Food Processing Technologies (Mr. Nitin Pralhad Khade)	Novel process of dehydration of vegetables and fruits
7	M/s Vishwa Natural Fab Prints (Dr. A. Sarada Devi)	Direct Natural Dye printed fabrics
8	M/s Tola Biotech (Mr. Shashank Sudhakar Chede & Mr. Sanjay Tumbre)	Chemical free and residue free Herbal Formulation for use as insecticide in Agriculture, specially to control bacterial blight in pomegranate
9	M/s Ananya Poultry Farms (Mr. Rajesh Maruti Thoke)	Pellet Poultry Manure Fertilizer
10	M/s Rajmudra Hort Industry (Mr. Rahul Rajendra Bhilare)	Tissue cultured Strawberry plants
11	M/s Nutrisafe Food and Agro Enterprise (Mr. Devkant Kalidas Chaudhari & Sonal Naresh Chaudhari)	Soya Processing (Tofu and Soymilk)

2.7.5 Application of Irradiation for Extraction of Protein from De-oiled Cotton cake & By-product utilization (BRNS)

Desi cotton seed of LRA variety was used as raw material for current study (Fig. 2.38). Comparative study was conducted on physical properties of linted and delinted cottonseeds. The comparative study concluded delinting process insignificantly affects linear dimensions of cottonseeds. However, remarkable difference was observed in weight of 1000 seeds and bulk density and angle of repose after delinting process of linted seeds. Preliminary experiments were conducted on extraction of protein from defatted cottonseed meal. Trial experiments were conducted to study protein suspension stability. Protein powder and surfactant was mixed in distilled water and solution was shear homogenized. Trial runs of protein stability study concluded high rpm of homogenizer and time of homogenization resulted in darkening of the solution. Whereas, low rpm of homogenizer and time of homogenization showed no colour change.



Fig 2.38. Desi De-linted cotton seed of LRA variety

2.7.6 Design and Developmet of Pilot Plant for Extraction of Protein from Deoiled Cotton cake and Value Addition/ By-product Utilisation (DST)

Comminuted cottonseed meal (CSM) was used as a raw material in the present study. The CSM was treated with moisture and microwave drying for developing CSM product having low free gossypol and total gossypol with high protein content. Three factor three level experiments were conducted by using Box Behken design. In that, influence of moisture content for pretreatment, microwave power level and microwave time was evaluated. For optimization, the range of moisture content for pretreatment 24% to 28%, microwave power level 300 W to 900 W and duration for detoxification of defatted cottonseed meal by microwave treatment 2 min to 6 min of process parameter were analyzed for reduction of free gossypol and total gossypol and higher protein content (Fig. 2.39). On the basis of different responses of optimized parameters, experiment were conducted i.e. determination of

free gossypol, total gossypol and protein content. Figure 2.40 to 2.42 show that the best combination of process variables for the best set of response properties included 26% moisture content, 900 W microwave power level and 6 min microwave time. Under the optimized conditions, the experimental values of free gossypol, total gossypol and protein content were found to be 0.047%, 1.15% and 52.54% respectively (Table 2.15). RSM was successful in optimizing the extraction conditions with good match of experimental values with predicted values indicating the suitability of developed models. On the basis of best optimized condition, primary protein extraction experiments were conducted using two different protocols. One with ammonium salt precipitation and another one using citric acid.

Table 2.14. Comparison between Predicted and Experimental values

Responses	Predicted values	Experimental Values	SD (±)	C.V (%)
Protein Content	51.675	52.54	0.6545	1.39
Total Gossypol	1.196	1.15	0.0576	4.36
Free Gossypol	0.056	0.047	0.0071	9.50

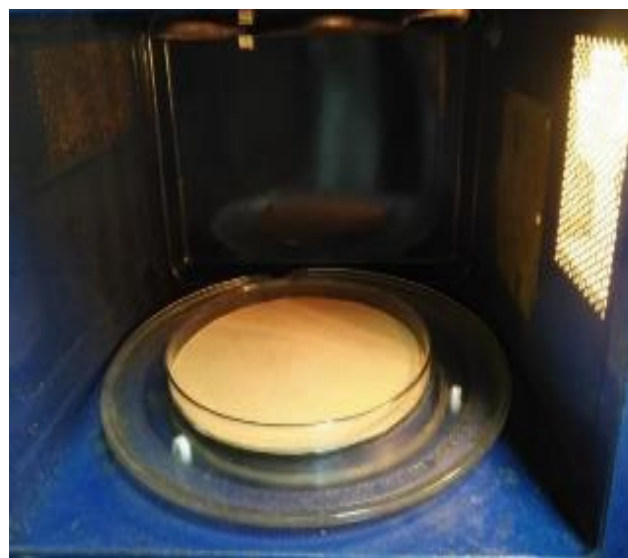


Fig 2.39 De-fatted Cottonseed Meal and Microwave treatment

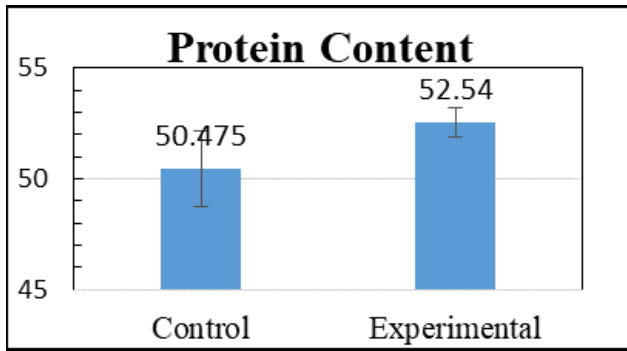


Fig. 2.40 Effect of Microwave treatment on protein content value compare to control.

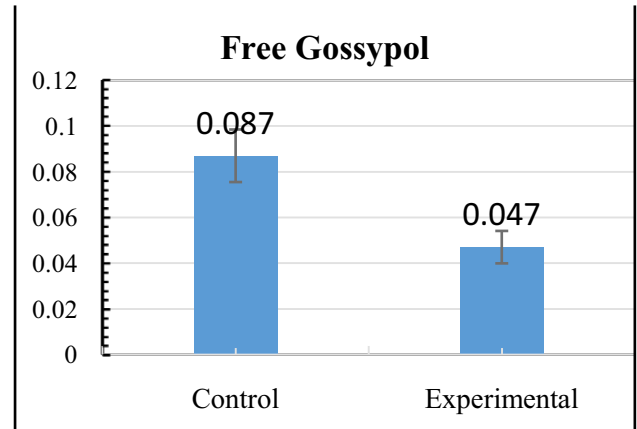


Fig. 2.42 Effect of Microwave treatment on free gossypol content in CSM.

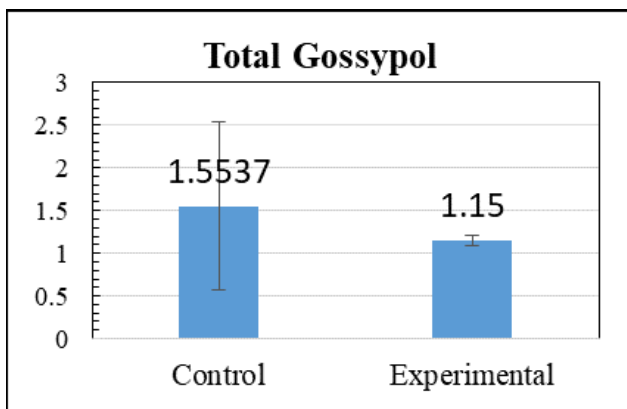


Fig. 2.41 Effect of Microwave treatment on total gossypol content in CSM.

3. TECHNOLOGY MANAGEMENT

ICAR-CIRCOT carries out basic & strategic research in processing of cotton and its agro residues, development of value added products and quality assessment. The research work results in development of machinery, products and process protocols. The Institute is also engaged in the refinement of the already developed technologies in the areas of post-harvest processing of cotton, eco-friendly processing and finishing of textiles and value addition of cotton stalks. Technologies developed are protected through management of intellectual property rights. Assessment, popularization and commercial adoption of viable technologies is carried out regularly through demonstrations, industrial trials, awareness meets, exhibitions and seminars. Impact assessment of already commercialized technologies is also taken up for further improvement.

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 evaluation of commercial value of different consultancy projects and the licensing of technologies.

During this period seventeen consultancy projects listed below have been evaluated and processed through twenty Institute Technology Management Unit (ITMU) meetings.

Sr. No.	Consultancy Project No	Title of Project	Name of Organisation to which Consultancy offered
1	CP-7/20-21	Bleaching trials with chemical requirements and testing of effluents from the bleaching bath	M/s. Amarnath Engineering Coimbatore, Tamilnadu
2	CP-8/20-21	Studies on comfort and handle characteristics of fabric made from Air jet textured yarns using Kawabata Evaluation System (KES)	M/s. Chandrala Textiles Ichalkaranji, Maharashtra
3	CP-9/20-21	Scouring and bleaching studies on cotton linters	M/s. Nouryon Chemicals India Pvt. Ltd. Mahad, Dist. Raigad, Maharashtra
4	CP-10/20-21	Developing banana fibre based composite materials and preparation of Microcrystalline Cellulose (MCC)	M/s. Apricitas Technologies Private Limited, Pune
5	CP-11/20-21	SEM Characterisation and analysis	Mr. Cephass A. Vanderhyde, Bhaskar Waman Thakur College of Science, Virar (West), Mumbai
6	CP-12/20-21	Evaluation of sizing chemical and their weaveability for 30's count yarn	M/s. Scientize Chemicals Pvt. Ltd. Andheri (West), Mumbai
7	CP-13/20-21	Internal Audit of NABL for CAI Mumbai Laboratory	M/s Cotton Association of India, Mumbai
8	CP-14/20-21	Design and Manufacturing of Pre-cleaner, double roller gin, bale press and feeding system	M/s. Bajaj Steel Industries Ltd., Nagpur

Sr. No.	Consultancy Project No	Title of Project	Name of Organisation to which Consultancy offered
9	CP15/20-21	Bleaching and Lab analysis of desi cotton for surgical cotton purpose	Cotton Research Station, Veppanthattai, Tamilnadu
10	CP -1/21-22	Wet mass bacterial cellulose-processing for size reduction	M/s Reliance Corporate Park, Thane Belapur Road, Ghansoli, Navi Mumbai
11	CP-2/21-22	Specialty filter paper from bleached cotton linters	M/s. Molbio Diagnostics Private Limited, Rajajinagar, Bangalore
12	CP-3/21-22	Spinning of Kemp fibre and its blends	Dr. Amit Kumar Vyas, Chhabily Ghati, Bikaner
13	CP-4/21-22	Spinning of silk waste fibre and its blend	College of Community Science, Assam Agricultural University, Jorhat
14	CP-5/21-22	Evaluation of ICAR-CIRCOT Nanosulphur as fertilizer and pesticide	M/s. Devdhar Chemicals Pvt. Ltd., Erandawane, Pune
15	CP-6/21-22	Spinning of reclaimed cotton fibre and its blend	M/s. Indo count Industries Limited, Gokulshirgaon, Kolhapur, Maharashtra
16	CP-7/21-22	Microspinning trial of Helicteres isora fibre blend with cotton for further consultancy mode	College of Home Science, Panaji, Goa
17	CP-8/21-22	Spinning of blends of Tasar, Muga and mulberry silk waste fibre	College of Community Science, Assam Agricultural University, Jorhat, Assam

3.2 Awareness Meets and Demonstrations

- Ginning Training Centre (GTC) of ICAR-CIRCOT, Nagpur organised an awareness programme on “CIRCOT's Ecofriendly, Efficient and Rapid Burning Crematorium for burning of dead bodies” at Shanti Dham, Chandrapur Municipal Corporation (CMC), Chandrapur District, Maharashtra on 8th February 2021. About 15 persons attended the programme.
- Awareness programme on Quality-based Marketing of Cotton was conducted on 11th February 2021 at Mohagaon village, Kalmeshwar Taluk, Nagpur and 10 farmers participated in the programme.
- A demonstration programme about utilization of cotton stalk for production of bio-enriched compost using CIRCOT's Technology was conducted on 10th February 2021 at Godavari village, Ashti Taluk. About 10 farmers participated in this programme.
- Demonstration of Biocide to control the slime problem in currency paper factory was carried out at M/s. Bank Note Paper Mill Ltd., Mysuru during 14th -16th July 2021
- Awareness programme on Appropriate Storage and Marketing of Cotton to increase farm income (under MGMG) was organized at village Mohapa, Kalmeshwar, Nagpur on 15th July 2021. About 35 farmers participated in this programme.
- An Awareness campaign on “Importance of Clean Cotton production” was organized under MGMG programme at village Ghogli, Ghorad and Kalmeshwar, Nagpur on 12th August 2021. About 29 farmers participated in this programme.
- Parthenium Awareness Week was observed at ICAR-CIRCOT and its Ginning Training Centre at Nagpur from 16th to 22nd August, 2021. The ill

effects of Parthenium and importance of their removal from field and roadside were explained to the farmers and Institute staff to create awareness.



- Awareness Programme on Management of Contamination and trash content in ginneries was organized for ginners and farmers at Dhapewada on 18th October 2021.
- Awareness Programme on Management of Contamination and trash content in ginneries was organized for ginners and farmers at Pulgaon on 21st October 2021.
- An awareness cum training programme on clean cotton picking was organized at village Chaharwala in District - Sirsa (Haryana) on 2nd October 2021. Dr. Hamid Hasan, Chief Technical Officer delivered a lecture and practically demonstrated clean cotton picking technology at a farmer's field. The farmers were provided clean cotton picking aids viz. apron, headgear, tarpaulin etc. In all, 20 farmers were trained in clean cotton picking.



- Ginning Training Centre (GTC), ICAR-CIRCOT, Nagpur organized Farmers – Scientists Interface Meet on 'Natural Farming' at Mhasepathar

Village, Kalmeshwar, Nagpur on December 16, 2021.

- GTC, Nagpur organized a cleanliness and sanitation drive under “Swachhta Pakhwada” in MGMG adopted Village Mandavi, Kalmeshwar, Nagpur on December 18, 2021.
- 'Kisan Diwas 2021' was celebrated at Ginning Training Centre, Nagpur on 23rd December 2021. The programme was attended by about fifty farmers and equal number of students from nearby villages. Shri Milind Shende, District Superintending Agriculture Officer, Nagpur District graced the event as chief guest. During this programme farmers were urged to continue adopting good agricultural practices in cotton cultivation.

3.3 Exhibitions and Agri-Fair

- GTC of ICAR-CIRCOT, Nagpur demonstrated CIRCOT's products and technologies in the “AgroVision 2021” held at Nagpur during December 24-27, 2021.

3.4 Television / Radio Talks

- A TV Talk on “Measures to Destroy and Prevent the spread of Pink Bollworm from Cotton Ginning Industry” by Dr. V. G. Arude, Sr. Scientist was telecast on DD Sahyadri under Krishidarshan programme on 20th and 21st April, 2021.



- Dr. Prashant Deshmukh, Senior Scientist participated in a TV talk on “Agri startups under RKVY-RAFTAAR scheme” in Krishidarshan programme of Doordarshan on 8th June 2021.
- Dr. Jyoti Dhakane-Lad, Scientist delivered a TV

talk on the topic "केळीच्या खोडापासून धागा निर्मिती व इतर प्रक्रिया" broadcasted on 24th August, 2021 at 6:30 pm during 'Krishidarshan' program on DD Sahyadri channel.



- An interview of Dr. P. S. Deshmukh, Senior Scientist on "Agricultural mechanization and Maintenance of Implements" was broadcasted on Akashvani- All India Radio, Mumbai in an

Agriculture programme: Maze Awar Maza Shivaar- Hello Shanka Samadhan, on 23rd March 2021.

- Dr. Sharmila Patil, Scientist delivered a Radio talk on "RKVY-RAFTAAR Scheme" which was broadcasted on Aakashvani, Mumbai (Asmita Channel) on 12th June 2021.
- Radio talk on "Startup scheme for innovative ideas under RKVY" (in Marathi) was delivered by Dr. P. S. Deshmukh, Senior Scientist on Asmita Channel of All India Radio, on 26th July 2021.
- Radio talk on "Women's contribution in Indian Agriculture" (in Marathi) was delivered by Dr. N. Ashtaputre, Chief Tech. Officer on Asmita channel of All India Radio on 31st July 2021.

4. SKILL DEVELOPMENT AND CAPACITY BUILDING

4.1 Capacity building of Staff

Skill upgradation of the work force in their respective fields with latest developments is essential to enable them to provide maximum output for the organization. To facilitate the capacity building of the staff members, the training needs assessment was carried out for different category of staff viz., scientific, technical and administrative staff.

Institute staff were trained as per the Training Needs Assessment plans for the years 2020-2021 and 2021-22 in the relevant fields. The employees were trained in premier institutions to learn the cutting-edge technologies and project management methodologies. Impact assessment of the training programme is also carried out after a period of one year to analyse the outcome. The percent realization of trainings planned during the financial year 2021-22 was 78% Scientists

underwent training in diversified fields like Data Analysis, Formation of Textile Structures and Characterization of Textile materials, Enhancing Research Skills and Refinement of Technology, Purchase Management, Cyber Security, electrospinning, Environmental sustainability and Research Ethics, stress management etc. Technical staff underwent training in the area of Health Management and Safety measures in work place, cyber security, Repair and Maintenance of Office and Residential Building including Guest Houses, E-Governance Applications, Parliament Questions and assurance etc. Administrative staff were trained in Accrual Accounting, Noting and Drafting, Purchase Management, Government e-Marketplace, Establishment matters etc. Supporting staff underwent training on Health Management and Safety measures in work place.

Table 4.1 Skill development of Institute Staff during 2021

Programme Title	Duration	Organised by	Name(s)
Scientific Staff			
Time Series Data Analysis	January 04-09, 2021	ICAR-NAARM, Hyderabad	Dr. C. Sundaramoorthy
Formation of Textile Structures and Characterization of Textiles materials (Hybrid mode)	January 05-07, 2021	ICAR-CIRCOT, Mumbai	Dr. S. K. Shukla Dr. P. K. Mandhyan Dr. A. K. Bharimalla Dr. G. T. V. Prabu Shri Himanshushekhar Chaurasia
Computational Based Material Science (Online Certificate course)	January 16-26, 2021	G N Khalsa College of Arts, Science and Commerce, Mumbai	Dr. N. Vigneshwaran
Enhancing Research Skills and Refinement of Technology by a Scientist (online)	January 18-20, 2021	ICAR-IIHR, Bengaluru	Dr. V. G. Arude
Purchase Management in Government (online)	February 02, 2021	ICAR, New Delhi	Dr. P. G. Patil Dr. P. K. Mandhyan Dr. A. K. Bharimalla
Electrospinning of Nanofibre, Polymer, Ceramic, Carbon and Nano fibrous structures (online)	February 03-05, 2021	Wollo University-KIOT, Ethiopia	Dr. T. Senthilkumar Dr. G. Krishna Prasad Dr. Sharmila S. Patil



Programme Title	Duration	Organised by	Name(s)
Scientific Staff			
Environmental sustainability and Research Ethics (online)	February 03-11, 2021	Avinashilingam Institute for Home Science and Higher Education for women, Coimbatore	Dr. T. Senthilkumar
Cyber Security (online)	February 17, 2021	C-DAC, ISEA, Telangana	Shri Himanshusekhar Chaurasia
Food Livelihood & Human Security in Disaster Risk Reduction (online)	February 17-19, 2021	National Institute of Disaster Management, Ministry of Home Affairs, Govt. of India	Dr. G. T. V. Prabu
Material Characterization (online)	March 02, 2021	Wollo University, Ethiopia	Dr. T. Senthilkumar Dr. G. Krishna Prasad
Injectable hydrogels for biomedical applications (online)	April 24, 2021	Kumaraguru College of Technology, Coimbatore	Dr. T. Senthilkumar Dr. G. Krishna Prasad
Healthy Workplace Initiative Ergonomics (International Training Series) (online)	21 st June, 28 th June and 05 th July, 2021	Maharana Pratap University of Agriculture and Technology (MPUAT), Udaipur, Rajasthan	Dr. G. T. V. Prabu
Stress Management (online)	July 06-09, 2021	ICAR-NAARM, Hyderabad	Dr. Sujata Saxena
Programming of Web & Mobile Applications using Low-code Platforms (online)	July 07-12, 2021	ICAR-NAARM, Hyderabad	Shri Himanshusekhar Chaurasia
Training Workshop for Vigilance Officers of ICAR Institutes (online)	August 16-18, 2021	ICAR-NAARM, Hyderabad	Dr. N. Vigneshwaran
Response Surface Methodology (online)	August 24-25, 2021	ICAR-NAARM, Hyderabad	Dr. T. Senthilkumar Dr. P. Jagajanantha Dr. Kirti Jalgaonkar Dr. Ajinath S. Dukare Dr. S. S. Kautkar
Design Thinking in Research Project Formulation & Implementation	August 24-28, 2021	ICAR-NAARM, Hyderabad	Dr. Manoj Kumar Puniya
NABL Assessors Training Course on ISO/IEC (online)	August 25-27, 2021	NABL, New Delhi	Dr. A. S. M Raja
Natural Fibre Production, Processing and Evaluation of Value-Added Products (Faculty Development Programme) (online)	September 13-22, 2021	ICAR-NINFET, Kolkata	Dr. Kirti Jalgaonkar Dr. Ajinath Shridhar Dukare Dr. S. S. Kautkar



Programme Title	Duration	Organised by	Name(s)
Scientific Staff			
Refresher course on 'Mechanical Processing of Natural Fibres' (online)	September 21-25, 2021	ICAR-NINFET, Kolkata	Dr. Jyoti Dhakane-Lad
MDP on Market Research & Value Chain Management of Agricultural Commodities (online)	September 21-25, 2021	ICAR-NAARM, Hyderabad	Dr. C. Sundaramoorthy Dr. Sharmila Patil
Laboratory Assessor course as per ISO/IEC 17025:2017 (Physical mode)	October 21-23, 2021	NABL, New Delhi at Bengaluru	Dr. A. S. M. Raja
Nonwoven Technology (online)	October 27-29, 2021	ICAR-NINFET, Kolkata	Dr. Jyoti Dhakane-Lad
Parliament Questions and assurance (online)	November 8, 2021	Parliamentary and Administrative Research Institute (PARI), New Delhi	Dr. N. Vigneshwaran
Programme Title	Duration	Organised by	Name(s)
Technical Staff			
Formation of Textile Structures and Characterization of Textile materials (Hybrid mode)	January 05-07, 2021	ICAR-CIRCOT, Mumbai	Shri D. U. Patil Dr. Hamid Hasan Dr. (Smt.) Sheela Raj Shri K. Thiagarajan Shri U. D. Devikar Shri S. L. Bhanuse Shri P. N. Sahane Shri K. Narayanan Shri R. G. Dhakate Shri S. N. Hedau Shri D. U. Kamble Dr. Jal Singh Shri M. B. Patel Smt. Binu Sunil Smt. Bindu Venugopal Shri R. S. Narkar
Health Management and Safety measures in work place (Hybrid mode)	January 18-20, 2021	ICAR-CIRCOT, Mumbai	Smt. C. D. Prabha Shri D. M. Correia Shri M. M. Kadam Shri Umrao Meena
Purchase Management in Government (online)	February 02, 2021	ICAR, New Delhi	Dr. M. V. Vivekanandan Shri T. Venugopal
Cyber Security (online)	February 17, 2021	C-DAC, ISEA, Telangana	Dr. M. V. Vivekanandan Shri Yogesh Nagpure
Open Source Library Management System (KOHA) & Agricultural Knowledge Management (online)	March 22-23, 2021	ICAR-IVRI, Izatnagar (UP)	Smt. Medha P Kamble



Programme Title	Duration	Organised by	Name(s)
Technical Staff			
Repair and Maintenance of Office and Residential Building including Guest Houses	August 10-12, 2021	ICAR-CIAE, Bhopal	Shri P. N. Sahane
E-Governance Applications in ICAR” (online)	September 6-10, 2021	ICAR-IASRI, New Delhi	Shri K. Narayanan Shri S. N. Hedau Shri S. L. Bhanuse Shri U. D. Devikar Dr. Jal Singh Smt. V. G. Udikeri
Competence Enhancement Programme on Soft Skills and Personality Development for T-1 to T-4 staff of ICAR (online)	September 21-30, 2021	ICAR-NAARM, Hyderabad	Shri Rajesh P. Kadam Shri Krishna Bara Shri M. M. Kadam Shri S. G. Phalke
Parliament Questions and assurance (online)	November 8, 2021	Parliamentary and Administrative Research Institute (PARI), New Delhi	Shri K. Narayanan
Life skill enhancement and personality development	November 16-20 th , 2021	ICAR-IARI, New Delhi	Shri Manoj G. Ambare
Programme Title	Duration	Organised by	Name(s)
Administrative Staff			
Accrual Accounting	January 12-14, 2021	ICAR-NRRI, Cuttack	Shri S. V. Kasabe
Accrual Accounting	January 19-21, 2021	ICAR-NRRI, Cuttack	Miss Himani Singh Shri T. D. Dhamange
Health Management and Safety measures in work place (Hybrid mode)	January 18-20, 2021	ICAR-CIRCOT, Mumbai	Shri Yogesh R. Pathare Smt. Trupti P. Mokal Shri K. Parleshwar Smt. S. P. Paiyala Smt. S. G. Parab Shri V. M. Sable Smt. B. D. Kherodkar Shri R. G. Matel Shri Avinash Aman Shri Sainath N. Sahane



Programme Title	Duration	Organised by	Name(s)
Administrative Staff			
Purchase Management in Government (online)	February 02, 2021	ICAR, New Delhi	Shri Sunil Kumar Shri M. Radhakrishnan Shri S. V. Kasabe Shri S. A. Telpande Smt. Pooja Tiwari Miss Himani Singh Shri V. M. Sable Shri S. N. Bandre
Noting and Drafting (online)	March 15-17, 2021	Institute for secretariat training & Management, Govt. of India, New Delhi	Smt. Smita Prakash Paiyala
Government e-Marketplace (GeM) training programme cum Interactive session (online)	August 27, 2021	ICAR, New Delhi	Shri M. Radhakrishnan Shri S. V. Kasabe Shri S. A. Telpande Shri S. N. Bandre
Training Workshop on MS-Word (online)	October 20-22, 2021	ISTM, New Delhi	Smt. B. D. Kherodkar Smt. J. R. Chavkute Shri S. N. Bandre Shri R. G. Matel
Establishment matters for LDCs and UDCs (online)	November 15-20, 2021	ICAR-IISR, Lucknow	Smt. J. R. Chavkute Smt. B. D. Kherodkar Shri V. M. Sable Shri Avinash Aman
Programme Title	Duration	Organised by	Name(s)
Skilled Support staff			
Health Management and Safety measures in work place (Hybrid mode)	January 18-20, 2021	ICAR-CIRCOT, Mumbai	Shri M. J. Sumra Shri K. T. Mahida Shri H. B. Vesmiya Shri R. B. Kautkar Shri M. M. Katpara Shri S. K. Bobate Shri P. P. Patil Shri R. G. Tak Shri R. P. Karkate Shri S. B. Worlikar Shri D. G. Gole Shri A. F. Guddadur Shri M. K. Prabulkar Shri J. D. Sakpal Shri S. D. Magar Shri M. G. Sosa

Programme Title	Duration	Organised by	Name(s)
Skilled Support staff			
			Shri V. Subbiah Shri V. B. Poojari Shri S. P. Naik Shri M. N. Kamble Smt. Kamala Murugan Shri D. K. Kasar Shri Suhas R. Tondse Shri S. S. Surkule Shri D. R. Gawde Shri S. M. Chandanshive Shri P. E. Gurav Shri M. C. Solanki Smt. M. M. Bhandakkar Shri Thapa Gorkha Bahadur Ovalal

Professional Attachemnt Training

Newly joined Scientists Dr. Kanika Sharma and Shri Himanshushekhar Chaurasia have completed their professional attachment training as part of their FOCARS training.

Dr. Kanika Sharma Completed three months Professional attachment training on “Value addition of cottonseed by-products by exploring and improving their properties” during Feb 25, 2021 to June 10, 2021 at Institute of Chemical Technology, Mumbai. The study was carried out to explore the properties of cottonseed, a by product

of cotton in order to increase its value.

Shri Himanshushekhar Chaurasia Completed three months professional attachment training on "A Revised Model for Determination of CSP Using Count of Cotton Yarn" during March 8, 2021 to June 21, 2021 at Veermata Jijabai Technological Institute, Mumbai. The study was done to derive a revised linear regression model for relationship between Count and CSP, and to give new standards for CSP. The new linear regression model between Count and CSP can be given as $CSP = 9.6(C+200)$.

4.2 HRD Achievements:

Table 4.2 HRD Targets & Achievements for April 2020 to March 2021

Category	Total No. of Employees	No. of trainings planned for each category during 2020-21 as per ATP	No. of employees undergone training during April 2020 to March 2021	% realization of trainings planned during 2020-21
Scientist	28	10	10	100
Technical	60	19	20	105
Administrative & Finance	28	13	14	108
SSS	33	12	30	250
Total	149	54	74	141

Table 4.3 HRD Targets & Achievements for April 2021 to December 2021

<i>Category</i>	<i>Total No. of Employees as on April 2021</i>	<i>No. of trainings planned for each category during 2021-22 as per ATP</i>	<i>No. of employees undergone training during April-Dec 2021</i>	<i>% realization of trainings during 2021-22</i>
Scientist	30	8	14	175
Technical	63	15	12	80
Administrative & Finance	26	11	09	82
SSS	25	11	0	0
Total	144	45	35	78

4.3 Trainings imparted to stakeholders

Skill development in the area of post-harvest processing of cotton and value addition to its biomass is one of the mandate of ICAR-CIRCOT. Training programmes are organised by the institute for the stakeholders including farmers, ginners, personnel from cotton trade and industry throughout the year. These trainings covered diverse areas of cotton processing.

Ginning Training Centre (GTC) of the Institute at Nagpur regularly conducts training for the farmers covering production and post-harvest processing of cotton and utilisation of cotton biomass for value

added products. Training courses for Gin fitters and other workers in the ginning industry on technologies for production of clean quality cotton, maintenance of various ginning and allied machines are also organized regularly by GTC.

The institute also organises specialised training programmes on spinning, quality evaluation, Knitting, material characterisation, nanotechnology, microscopy, electrospinning, absorbent cotton technology, composite materials, value addition to cottonseeds etc. for the personnel from the academia, industry and entrepreneurs.

Table 4.4 Training Programmes organised during 2021

Programme Title	Duration	No. of Participants	Participants' Profile
ICAR-CIRCOT, Mumbai			
Formation of Textile Structures and Characterization of Textile materials (Hybrid mode)	January 05-07, 2021	21	ICAR-CIRCOT staff
Health Management and Safety measures in work place (Hybrid mode)	January 18-20, 2021	47	ICAR-CIRCOT staff
Value Addition to cottonseed (online)	March 26-28, 2021	20	Industry, Farmer, Students



Programme Title	Duration	No. of Participants	Participants' Profile
<i>ICAR-CIRCOT, Mumbai</i>			
Agripreneurship Orientation Programme (AOP) (Two months virtual incubation cum training under CIRCOT R-ABI) (online)	September 23 – November 23, 2021	12	Agri. startups
Nanotechnology & its Advanced Applications (online)	November 22-26, 2021	15	Research Scientists, academicians, students
<i>GTC of ICAR-CIRCOT, Nagpur</i>			
Double Roller Ginning Technology and Basics of Cotton Grading	January 25-30, 2021	09	Ginners
Double Roller Ginning Technology and Basics of Cotton Grading	July 26-31, 2021	11	Ginners
Double Roller Ginning Technology and Basics of Cotton Grading	August 16-21, 2021	13	Ginners
Double Roller Ginning Technology and Basics of Cotton Grading	September 27-October 2, 2021	16	Ginners
Best cotton picking, grading, storage and handling practices for farmers - (A series of one day online Training Programmes in collaboration with MSCCGMF Ltd.)	October 11-30, 2021 16 batches	867	Farmers
Cotton Quality Evaluation and Grading (under SCSP)	December 20-24, 2021	13	Traders/Farmers
DR Gin Setting and Maintenance (under SCSP)	December 20-24, 2021	14	Ginners
Cotton Quality Evaluation and Grading (under SCSP)	December 27-31, 2021	13	Traders/Farmers
DR Gin Setting and Maintenance (under SCSP)	December 27-31, 2021	14	Ginners

Total number of training programmes conducted	Target	Number of beneficiaries	Revenue generated (Rs. Lakhs)
29	10	1085	17.56



4.4 Education

Dr. N. Vigneshwaran is Major Advisor for two PhD scholars in Microbiology (under affiliation from

University of Mumbai).

Name of Student	Year of Admission	Registration No. & date	Research Topic	Remarks
Mrs. Sangeeta M. Chavan	2012	13/10-10-2012	Effect of silver, zinc oxide and titania nanoparticles on nitrogen fixing, phosphate solubilizing and biofilm forming bacteria found in soil ecosystems.	On-going
Ms. Komal Saraf	2012	14/ 19-11-2013	Preparation of nanofibre mats of alginate and pullulan by electro spinning and its application as nanosensor for detection of food spoilage	On-going

Dr. Sujata Saxena is the co-guide for Er. Arun Waghmode, Ph.D student (Regn. No. 2019/029) of College of Agricultural Engineering and Technology,

DBSKKV, Dapoli on research topic Pesticide exposure and Risk Assessment of spraying with power sprayer. (Guide – Dr. V. V. Aware)

5. Linkages and Collaboration

ICAR-CIRCOT has established a good network with various organizations at national and international level in the domains of research, education, skill development and extension. These linkages with stakeholders help to foster research, enhance technology assessment and refinement, capacity building and eases the transfer of technology from lab to the land.

ICAR-CIRCOT has its Regional Quality Evaluation (QE) units located within the premises of other ICAR institutes and agricultural universities in the major cotton growing areas of the country. The main functioning of these units is as extension wings of the Institute. In addition to this, these units also facilitate linkages and collaboration with the host institutes.

5.1 R&D Linkage

Cotton Breeding Programme:

ICAR-CIRCOT is an integral part of the All India Coordinated Research Programme (AICRP) on Cotton, functioning as Principal investigator of Quality Research. The institute is linked to ICAR institutions and State Agricultural University involved in cotton breeding programmes. The institute is also a part of the Central Variety Release Committee and adhering to CIRCOT quality norms is a pre requisite for release of the cotton varieties. Technological advice on fibre quality parameters of the Bt cotton trials of both public institutions and private sector seed companies for variety release is provided by the Institute.

Contract Research: The Institute's initiative to include industrial stakeholders at the project initiation stage has led to the development of linkage with industrial stakeholders through signing of Memorandum of Understanding (MoU) for carrying out collaborative research in Public Private Partnership (PPP) mode. The association with the institutional stakeholders like Cotton Corporation of India (CCI) and Maharashtra State Co-operative Cotton Growers Marketing Federation has also

been strengthened to work in participatory mode for providing technological inputs in cotton procurement.

Inter-Institutional Research Programmes:

ICAR-CIRCOT is the nodal centre for implementation of the *Consortia Research Platform (CRP) on Natural Fibres*. Under this project the linkage has been established with institutes working in the field of natural fibres such as ICAR-NINFET, Kolkata, TNAU, Coimbatore and ICAR-CSWRI, Avikanagar.

Inter-Institutional research projects with other ICAR institutes viz., ICAR-IISS, Bhopal, ICAR-DOGR, Pune, ICAR-IIPR, Kanpur, ICAR-CICR, Nagpur and ICAR-NIASM, Baramati have also been initiated for field evaluation of the Nano Zinc and Nano Sulphur formulation developed by the institute as fertilizers.

Incubation Centre:

Agri-Business Incubation (ABI) and R-ABI centres of the Institute work towards promotion of entrepreneurship based on institute technologies and nurturing of Start-Ups with innovative business ideas in agriculture and allied sector. These incubation centres have mentored budding agripreneurs for innovative product development, guided them in product refinement as per market needs, facilitated funding for product upscaling and establishment of successful ventures for commercial scale production. The CIRCOT incubation centre has created linkages with budding entrepreneurs, industries and has also established networking linkages with Institutions working towards transformation of innovative ideas into new enterprises.

Platform for Cotton Quality Evaluation:

Institute regularly participates in the Round Robin tests for evaluation of cotton fibre quality conducted by Bremen Institute and USDA to ensure matching of our results with other world laboratories. Since past 5 years it is also participating in the inter-lab Round test for

stickiness measuring methods conducted by International Cotton Committee on Testing Methods of the International Textile Manufacturers federation (ICCTM-ITMF).

MoU Signed

Memoranda of understanding (MoUs) were signed for development / commercialization of Institute technologies for cotton processing and value addition to by-products with different institutions, industries and individuals.

Research Collaboration

1. Development of Standard Protocol for ensuring Transparency in Evaluation of Quality and Lot Wise Analysis of Cotton Fully Pressed (FP) Bales” with Cotton Corporation of India (MoU signed on 10th March 2021)
2. "Development of Standard Protocol for ensuring Transparency in Evaluation of Quality and Lot Wise Analysis of Cotton Fully Pressed (FP) Bales" with M/s. The Maharashtra State Co-operative Cotton Growers Marketing Federation (MSCCGMF) Limited, Nagpur (MoU signed on 12th March 2021)
3. "Evaluation of ICAR-CIRCOT Nanosulphur as Fertilizer and Pesticide" with M/s. Devdhar Chemicals Private Limited, Pune (Incubatee) (MoU signed on 27th October 2021 under public private partnership mode).

Technology Commercialization

1. A MoU was signed with M/s MolBio Diagnostics, Bangalore for taking up *incubation, technical mentoring and further non-exclusive technology licensing* for "**Making Specialty filter paper from bleached cotton linter**" on 11th February 2021.
2. MoU signed with M/s. Forech Mining & Construction International LLP, New Delhi for *Non-exclusive Technology License to Manufacture Technical Textile Reinforced Rubber Composite Sheet for making "ICAR Flexi-Check Dam"* on 11th August 2021

3. MoU Signed with M/s. Vidarbha Sales, Nagpur for *license* to manufacture "**ICAR-CIRCOT Trapezoidal Shaped Low-Cost Briquette-Based Crematorium**" on 25th November 2021.

4. MoU was signed with M/s. Apricitas Technologies Private Limited, Near Akurdi Railway Station, Nigdi Pradhikaran, Pimpri Chinchwad, Pune for incubation, technical consultancy and licensing of the following two technologies:

(i). Development of banana fibre based composite materials and preparation of Microcrystalline Cellulose (MCC) using banana fibres.

(ii). Development of thermal seat covers for automotive applications.

MoAs for Technology Incubation

Eleven Memorandum of Agreements (MoA) were signed with agri startups of the Second cohort of CIRCOT R-ABI that were sanctioned Grant-in-Aid support under the RKVY-RAFTAAR programme on 3rd December 2021:

1. *M/s Setu Agro-Biotech & Textile Industry Pvt Ltd* on development of cost effective hydroponic system
2. *M/s Siddaganga Bio Product* on manufacturing of Heatproof, Microwave safe & Fit for refrigeration, water resistant arecanut leaf plates in various designs without chemicals or additives.
3. *M/s Mandeshi Goat Farm* on development of Goat Farming Cluster for sustainable Supply Chain of Meat and Goat Milk Products for empowerment of Rural Women
4. *M/s Ramiz Agro Food Industries* on manufacturing of natural fruit pulp mixed vermicelli
5. *M/s Energy Chakra* on production and promotion of Solar dryers (Hybrid Models) for dehydration of agri-produce
6. *M/s Pawak Food* on chemical free Jaggery with innovative cube shape with PET jar packing for better shelf life

7. Divyang Creations LLP on Making baby textile products like baby Towels, Caps, Quilts, Beddings, Socks etc. with desi cotton by involving differently abled persons
8. *M/s Varad Vishwa Automation LLP* on manufacturing of fully Automatic Agricultural Spraying Machine
9. *M/s Vasundhara Shashwat sheti Mal Utpadak & Prakriya Sanstha* on production of organic Jaggery products viz Powder, granules, chunks, Syrup etc
10. *M/s S.R.Foods & Breweries* on manufacturing of Cashew Apple nectar, making Cashew apple pomace powder for making cookies
11. *M/s. Prafulla Winery & Hospitality Pvt Ltd* on manufacturing of Beetroot wine and Promotion of Beet root contract Farming

testing laboratory in India. The Institute has facilities for conducting more than 190 tests on different textile materials and cotton by-products. These facilities are extended to various stakeholders. Besides regular tests, special tests are also carried out as per demand on samples received from various government/ private organisations and universities.

During the year 2021 a total number of **33813** samples were tested at headquarters at Mumbai, GTC Nagpur and quality evaluation units at Coimbatore, Dharwad, Guntur, Sirsa and Surat. Total revenue generated through commercial testing during the year 2021 was ₹ **90.83 lakhs**.

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 and generates additional revenue through the activity.

5.2 Commercial Testing Services

CIRCOT is an acclaimed NABL accredited cotton

Table 5.1 Tests Conducted and Clientele

Test	Company Name
AFM Imaging Test	<ul style="list-style-type: none"> • Ashwini A Patil, Mumbai • ICAR-National Institute of Natural Fibre Engg.&Tech, Kolkata • Institute of Chemical Technology, Mumbai • Mr. N.B. Banarase, Anjora, Durg
Alpha Cellulose	<ul style="list-style-type: none"> • ICAR-National Institute of Natural Fibre Engg.&Tech Kolkata • M/s. Moirai Cotton Pulp Pvt. Ltd., Hisar • Gopika Maheshwari, Mumbai
Ash Content %	<ul style="list-style-type: none"> • M/s. Moirai Cotton Pulp Pvt. Ltd., Hisar • M/s. Nissan Plastics Pvt Ltd, Mumbai • M/s. OGO Fibers India PVT. LTD., Mumbai
BET Surface Area Analysis	<ul style="list-style-type: none"> • Institute of Chemical Technology, Mumbai
Biodegradation	<ul style="list-style-type: none"> • M/s. Hindustan Gum & Chemicals Ltd., Haryana
Blend Composition	<ul style="list-style-type: none"> • Kiran Palhal, Mumbai • M/s. Murbadkar Business Industries, Kalyan • M/s. Varun Textile, Mumbai
BOD Analysis	<ul style="list-style-type: none"> • Babita Chaudhary, Mumbai • M/s. Sukushal Polymers, Kolhapur



Test	Company Name
Bursting Strength	<ul style="list-style-type: none"> Indian Institute of Technology, Delhi M/s. Nissan Plastics Pvt Ltd, Mumbai M/s. OGO Fibers India PVT. LTD., Mumbai M/s. Aditya Mart, Bengaluru M/s. Sunshine Enterprises, Kolar
Co-Efficient of Friction	<ul style="list-style-type: none"> European Textile Chemical Corporation, Hosur
Compression Properties	<ul style="list-style-type: none"> Nazeem Banu, Chennai
Content of Zinc Oxide	<ul style="list-style-type: none"> M/s. Medii Heal Solutions, Nagpur
Degree of Polymerisation	<ul style="list-style-type: none"> M/s. Moirai Cotton Pulp Pvt. Ltd., Hisar
Free Gossypol	<ul style="list-style-type: none"> M/s. Krishi I-Dal Pvt Ltd., Jalna M/s. Shanthi Feeds Pvt Ltd., Coimbatore
FTIR Scanning	<ul style="list-style-type: none"> Central Institute of Fisheries Education, Mumbai Ms Nikita Thakare, Fort J. D. Birla Institute, Kolkata V.J.T.I., Mumbai
Full Spinning Test	<ul style="list-style-type: none"> M/s. Ajeet Seeds Pvt. Ltd., Aurangabad M/s. Shakti Vardhak Hybrid Seeds Pvt. Ltd., Hisar
Ginning Percentage	<ul style="list-style-type: none"> VNMKV, Parbhani M/s. Indian Cotton Solutions.Com Pvt. Ltd., Guntur M/s. Nuziveedu Seeds Ltd., Aurangabad M/s. Organica Biotech Pvt. Ltd., Mumbai AINP on Soil Biodiversity-Biofertilizers, Parbhani
Hemi Cellulose	<ul style="list-style-type: none"> ICAR-National Institute of Natural Fibre Engg.&Tech, Kolkata
Instron Test	<ul style="list-style-type: none"> M/s. Gencrest Pvt. Ltd., Mumbai Institute of Chemical Technology, Mumbai
K/S value (L,a,b, delta E)	<ul style="list-style-type: none"> Dr. Rutuja S. Mali, Khed
Kawabata Test	<ul style="list-style-type: none"> Meenakshi Tamta, PAU, Ludhiana M/s. S H Kelkar & Co. Ltd., Mumbai D.Anita Rachel, Asst prof of NIFT-TEA, Tirupur D.K.T.E., Ichalkarnaji Indian Institute of Technology, Delhi Priyanka Bagi, Dharwad
Particle Size Analysis	<ul style="list-style-type: none"> Mumbai Veterinary College, Mumbai Dr. Vishal Mudgal, Hisar Mr. N.B. Banarase, Anjora, Durg MRC OF ICAR CIFT, Navi Mumbai

Test	Company Name
SEM Analysis	<ul style="list-style-type: none"> • Anusha Mishra, Mumbai • ICAR-National Institute of Natural Fibre Engg.&Tech, Kolkata • M/s. Teva Pharm, Thane • Ashwini A Patil, Mumbai • Gangwal Chemicals Pvt. Ltd., Palghar • Institute of Chemical Technology, Mumbai • Ms. Nikita Nair, Mumbai • M/s. Novo Excipients Pvt. Ltd., Mumbai • ICAR- Central Institute of Fisheries Education, Mumbai • M/s. TUV SUD South Asia Pvt. Ltd., Mumbai • V.J.T.I., Mumbai
Surface Tension	<ul style="list-style-type: none"> • M/s. Dura Color, Ahmedabad • M/s. Mangalam Dura Jet Technologies Pvt Ltd, Ahmedabad
TGA Scan	<ul style="list-style-type: none"> • VJTI, Mumbai • ICAR-National Institute of Natural Fibre Engg.&Tech, kolkata
Total Gossypol	<ul style="list-style-type: none"> • M/s. Adani Wilmar Ltd., Gujarat • M/s. Shanthi Feeds Pvt Ltd., Coimbatore
U%	<ul style="list-style-type: none"> • Shri Vinayak Agro, Haryana
Ultra-Violet Protection Factor	<ul style="list-style-type: none"> • J. D. Birla Institute, Kolkata
Zeta Potential Test	<ul style="list-style-type: none"> • MRC OF ICAR CIFT Navi Mumbai

5.3 Consultancy Services

Linkages with Institutions through consultancy projects





5.4 Linkage with BIS

Director and scientists of the institute have been contributing to the development and review of the test methods & standards in the field of textiles as members/chairman in various committees of the Bureau of Indian Standards (BIS). Director of the Institute is the member of the Textile Division Council (TXDC) and Dr. Sujata Saxena, Principal Scientist, has been nominated by BIS to be a member of the TC 38 (Textiles) Committee of the ISO. Dr. P. G. Patil, Director, Dr. Sujata Saxena, Director (Acting); Institute scientists Dr. Pradeep Mandhyan, Dr. T. Senthilkumar, Dr. A. S. M. Raja, Dr. V. G. Arude, Dr. A. Arputharaj, Dr. N. Vigneshwaran, Dr. G. Krishna Prasad, Dr. P. Jagajanantha and Dr. Ashok Kumar Bharimalla, functioned as

Chairman/members in various committees of BIS such as Physical Methods of Test (TXD 01), Chemical Methods of Test (TXD 05), Textiles Speciality Chemicals & Dyestuffs (TXD 07), Textile Machinery and Accessories (TXD 14), Man-made Fibres, Cotton and their Products (TXD 31), Technical Textiles for Agrotech Applications (TXD 35), Technical Textiles for Sportech Applications (TXD 37), Technical Textiles for Mobiltech Applications (TXD 38), Technical Textiles for Clothtech Applications including Narrow Fabrics and Braids (TXD 39), Composites and Speciality Fibres (TXD 40) and Agriculture and Food Processing Equipment's Sectional Committee (FAD 20).

6. AWARDS AND RECOGNITION

Young Scientist Award

Scientist	Award	Organization/ Institution/ Prof. Society	Event / Occasion
Dr. Sharmila Patil	Young Scientist Award	VDGOOD Professional Association, Chennai, Tamil Nadu	“International Scientist Awards on Engineering, Science and Medicine” held on March 6-7, 2021 at Goa
Dr. Ajinath Dukare	Young Scientist Award (Agril. Microbiology)	Agro Environmental Development Society (AEDS), Uttar Pradesh.	“4 th International Conference on “Current Approaches in Agricultural, Animal Husbandry and Allied Sciences for Successful Entrepreneurship (CAAHASSE-2021)” held on March 13-15, 2021
Dr. S. S. Kautkar	Best Ph. D. thesis award		
Dr. Sharmila Patil	Young Women Scientist Award		
Dr. Kirti Jalgaonkar	Young Scientist Award	VDGOOD Professional Association, Chennai, Tamil Nadu	“International Scientist Awards on Engineering, Science and Medicine” held on July 16-17, 2021 at Mysore
Dr. S. S. Kautkar	Young Scientist Award	“Vigyan Varta”- An International E-Magazine for Science Enthusiasts	Vigyan Varta Awards-2021 on May 9, 2021

Recognition

Dr. N. Vigneshwaran was listed among the Top 2% scientists in the world – 2021” by Stanford University (Source:

<https://elsevier.digitalcommonsdata.com/datasets/btchxktzyw/3?fbclid=IwAR34fN0ugsDk3gXe9bHTMIw1fUlqDSid2FRokNsoJk3pU7B814LFfveBLQA>

Best Paper Award

Publication/ Presentation	Seminar / Conference / Journal	Organised by (period)	Authour (s)	Award
“Choice of Marketing Channel on the Profitability of Cotton Farmers in Maharashtra”	National Conference on “Transforming Agriculture for Food Security and Farm Sustainability”	DBSKKV, Dapoli and MSAE, Maharashtra (Feb 13-14, 2021)	Sundaramoorthy C, Santhosh, Amit Mandpe, Sonali Jadhav	Best oral presentation

Publication/ Presentation	Seminar / Conference / Journal	Organised by (period)	Authour (s)	Award
"Effect of pulping conditions and surface coatings on properties of banana fibre based dense paper"	International Conference (Virtual) on Sustainable Approaches in Food Engineering and Technology (SAFETy-2021)	Tezpur University, Assam and Dept. of Food Science & Tech., University of Georgia, (June 24-25, 2021)	Jyoti Dhakane-Lad, Archana Mahapatra, Sharmila Patil, Priyanka Sakare, A. K. Bharimalla, Manoj Ambare & Sujata Saxena	Best Poster
"Agricultural Waste Based Eco friendly Crematorium"	National Seminar on "Role of Agricultural Engineering in the economic development and self-reliance of the country in the circumstances caused by COVID-19"	CIAE, Bhopal (July 28-29, 2021)	Dr. V. G. Arude	Third prize
"Study on the synthesis of Nano sulphur using different surfactants"	5 th International Conference on "Advances in Agriculture, Environmental and Biosciences for Sustainable Development"	Agro Environmental Development Society (AEDS), CAU, Imphal, NABARD, CAIE (Aug 5-7, 2021)	Mahawar, M. K., Bharimalla, A. K., Palkar, J., Arputhraj, A., Vigneshwaran, N., Dhakane-Lad, J., Saxena, S.	Best Oral Presentation

Lead / Invited Presentations

Topic	Event / Organizer / Venue	Delivered by
Demand projection of Cotton fibre under COVID 19 Pandemic	Seminar "Demand projection of Textile fibres under COVID 19 Pandemic" organized by Textile Association of India on 26 th June, 2021	Dr. Sujata Saxena
Sustainable chemical processing of cotton	Webinar organized by Department of Textile Technology, Bannari Amman Institute of Technology, Sathyamangalam on 14 th July, 2021	Dr. A. S. M. Raja
Innovations in Textile Composites	Webinar organized by K. S. R College of Technology, Tiruchengode, Tamil Nadu, on 22 nd July 2021	Dr. T. Senthilkumar



Topic	Event / Organizer / Venue	Delivered by
“Agricultural Input Nanomaterials and their Environment Impact” in Energy and Environmental Science Section	First NABS International Conference organized by Annamalai University Tamil Nadu and National Academy of Biological Sciences, Tamil Nadu on 28 th August , 2021,	Dr. N. Vigneshwaran
Past, present and future perspective of cotton fibres	FDP on Natural fibre production, processing and evaluation of value added products organised by NINFET, Kolkata (13-22 September, 2021) on 13 th September, 2021	Dr. Sujata Saxena
Kapas Mulya Shrinkhla ka Bharat ko Atmanirbhar banane mein yogdan	Aatmnirbhar Bharat ki or Badhte Kadam- Hindi scientific seminar organised by ICAR-NINFET, Kolkata on 27 th September, 2021	Dr. Sujata Saxena
Eco-Friendly Processing and Dyeing in Cotton"	Online Training Program on Extension Strategies for Promotion organized by Extension Education Institute, Hyderabad on 28 th September 2021.	Dr. A. S. M. Raja
Branding, Packaging and IT-enabled Marketing of Agricultural Produce	Training Programme on IT-enabled Extension Strategies organized by EEI, Hyderabad on 30 th September, 2021	Dr. C. Sundaramoorthy
Food waste valorization: considerations and recommendations for improving soil health	Two day workshop organised by International Association of Students in Agricultural and Related Sciences, India of Lovely Professional University, on 12 th October 2021	Dr. Kanika Sharma
Diversified uses of Cotton Linters	Webinar Cotton Linters: Present Scenario and Future Prospects organised on 3 rd December, 2021 by ICAR-CIRCOT, ISCI and AICOSCA, Mumbai	Dr. Sujata Saxena
Bio-technological aspects in sustainable wet processing	MDP programme on Environmental and Social Governance/Sustainability in wet processing organized by SVKM'S NMIM'S University, MPSTME, Center for Textile Functions, Shirpur on 22 nd December 2021.	Dr. A. S. M. Raja
Value Chain Management in Cotton	Lecture delivered on 23 rd December during Training program on Value Chain Management in Natural fibres organised by ICAR-NINFET, Kolkata and MANAGE, Hyderabad during 20-24 December, 2021	Dr. Sujata Saxena

7. PUBLICATIONS

7.1 Research papers

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7.2 Book Chapters

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6. Nivetha N., Asha A. D., Bandeppa, Thakur JK., Dukare AS., Paul B and Paul, S. "Microbial-Based Nanoparticles as Potential Approach of Insect Pest Management". In: Khan M.A., Ahmad W. (eds) *Microbes for Sustainable Insect Pest Management. Sustainability in Plant and Crop Protection*, 17:135-157. Springer, Cham.
7. Maheshwari H.S., Bharati, A., Agnihotri, R., Dukare, A., B. Jeberlin Prabina, A.B., Gangola, S., Sharma, M.P. (2021). "Combating the Abiotic Stress through Phytomicrobiome Studies". In: Verma, A., Saini, J.K., El-Latif Hesham, A., Singh, H.B. (eds). *Phytomicrobiome Interactions and Sustainable Agriculture*. First edition (Pg: 45-65). Wiley Blackwell, USA,
8. Maheshwari H.S., Agnihotri, R., Bharati, A., Chourasiya, D., Laad, P., Dukare, A., Jeberlin Prabina, A., Sharma, M.P. & Sharma, S.K (2021) "Signalling in the Rhizosphere for Better Plant and Soil Health". In: Sharma S.K., Singh U.B., Sahu P.K., Singh H.V., Sharma P.K. (eds) *Rhizosphere Microbes, Microorganisms for Sustainability*, 23:149-173. Springer, Singapore.
9. Kumar S. Wakchaure, G.C, Meena, KK Kumar M., Singh, AK., Rane J., Bhushan B and Dukare AS (2021). "Metagenomic Insights into the Microbial Communities of Desert Ecosystems". In: *Metagenomics and Microbial Ecology: Techniques and applications*. First edition, CRC Press.
10. A., S., M., Raja, A. Arputharaj, G. Krishnaprasad, Sujata Saxena, P. G. Patil (2021). "Challenges in dyeing of cellulose with reactive dyes and practical sustainable feasibility", In: Subramanian Senthilkannan Muthu (eds), *The Textile Institute Book Series, Chemical Management in Textiles and Fashion*, Pages 79-98, Woodhead Publishing, ISBN

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11. Malviya, D., Singh, U.B., Singh, S., Sahu, P.K., Pandiyan, K., Kashyap, A.S., Manzar, N., Sharma, P.K., Singh, H.V., Rai, J.P., Sharma, S.K. (2021) "Microbial Interactions in the Rhizosphere Contributing Crop Resilience to Biotic and Abiotic Stresses". In: S.K. Sharma et al., (eds) *Rhizosphere Microbes, Microorganisms for Sustainability*, Springer Nature, Singapore https://doi.org/10.1007/978-981-15-9154-9_1
12. A. K. Bharimalla, Sujata Saxena, C. Sundaramoorthy and Saswati Mukherjee (2021) Technology transfer approach for entrepreneurship development: A case of ICAR-CIRCOT. in Proceedings, E-Conference on Emerging Trends in Management and Technology, Eds Kiran Kumar Thoti & Ch. Shankar, pp 541-548, www.kluniversity.in, ISBN No. 978-93-90631-57-5

7.3 Paper Presentations

The following three papers were presented in *National e-Conference on "Agricultural Education, Innovation and Research for Future Livelihood-Indian Scenario in 2050"* organised at Dr. PDKV, Akola during January 28-29, 2021.

1. Ashok Kumar Bharimalla, Manoj Kumar Mahawar, Saswati Mukherjee and P. G. Patil "Multidimensional approaches for sustainable agri-business incubation ecosystem at ICAR-CIRCOT Mumbai"
2. Archana Mahapatra, Ashok Kumar Bharimalla and P. G. Patil "Characterization of Sodium alginate- Nanocellulose composite coating for storability of whole pear fruits"
3. Ashok Kumar Bharimalla, P. G. Patil, C. Sundaramoorthy, Hemant Ladgaonkar and Saswati Mukherjee "Internet of Things (IoT) based innovative agriculture: A Sunrise Sector for Young Agripreneurs"
4. Sundaramoorthy, C., Mandape A. M., Nagargoje, S. C. and Jadhav S. C "Choice of marketing channel on the profitability of cotton farmers of Maharashtra." was presented in *National Conference on "Transforming Agriculture for Food Security and Farm Sustainability"* organised by Maharashtra Society of Agricultural Economics and Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli (Maharashtra) during February 13-14, 2021 at DBSKKV, Dapoli,.
5. Sharmila Patil, A. K. Bharimalla, P. K. Mandhyan, P. Jagajanantha, A. Arputharaj, Kirti Jalgaonkar and Manoj Kumar Mahawar "Biodegradable films for packaging of fruits and vegetables" was presented in *International Conference (by virtual mode) on "Current Approaches in Agricultural, Animal Husbandry and Allied Sciences for Successful Entrepreneurship (CAAHASSE-2021)"* organised by Agro Environmental Development Society (AEDS), Rampur, Uttar Pradesh during March 13-15, 2021
6. Sheshrao Kautkar, S. K. Shukla, S. V. Ghadge, V. G. Arude, B. V. Shirsath and D. U. Patil "Study on Chrome Leather Rollers Groove Profile adopted by Cotton Ginning Industries" was presented in *International Conference (by virtual mode) on "Current Approaches in Agricultural, Animal Husbandry and Allied Sciences for Successful Entrepreneurship (CAAHASSE-2021)"* organised by Agro Environmental Development Society (AEDS), Rampur, Uttar Pradesh during March 13-15, 2021
7. A. K. Bharimalla, S. Saxena and S. Mukherjee "Nanocellulose reinforced cementitious composite material for better functional property" was presented in *International conference on sustainable materials and its green technologies for Industry 4.0 (SMIGT-2021)* organised by Adithya Institute of Technology, Coimbatore during 7-9 April, 2021.
8. Prabu, G.T.V. presented a paper on "Nanofibre Production and its Applications" in AICTE – ISTE Sponsored Induction/ Refresher program in the seminar "Advance Ecological Techniques in Textile Chemical Processing for Sustainable Development" organised by K S. Rangasamy College of Technology, Tiruchengode. on 13th

April 2021.

9. Prabu, G.T.V. presented a seminar paper on “Production and Processing of Functional Nanofibres” in AICTE – ISTE Sponsored Induction/ Refresher program “Advance Ecological Techniques in Textile Chemical Processing for Sustainable Development” organised by K. S. Rangasamy College of Technology, Tiruchengode on 29th April 2021.
10. Sharmila Patil, Archana Mahapatra, Jyoti Dhakane-Lad, A. K. Bharimalla, P. K. Mandhyan. (2021) "Bionanocomposites for food packaging applications" was presented in International Conference (Virtual) on “Sustainable Approaches in Food Engineering and Technology” (SAFETy) organized by the Department of Food Engineering and Technology, Tezpur University, Assam, India in collaboration with the Department of Food Science & Technology, College of Agricultural & Environmental Sciences, University of Georgia, Georgia during 24- 25 June 2021.
11. Jyoti Dhakane-Lad, Archana Mahapatra, Sharmila Patil, Priyanka Sakare, A. K. Bharimalla, Manoj Ambare & Sujata Saxena, "Effect of pulping conditions and surface coatings on properties of banana fibre based dense paper" was presented as a poster in International Conference (Virtual) Sustainable Approaches in Food Engineering and Technology (SAFETy-2021) organized by the Department of Food Engineering and Technology, Tezpur University, Assam, India in collaboration with the Department of Food Science & Technology, College of Agricultural & Environmental Sciences, University of Georgia, Georgia during 24- 25 June 2021
12. Dr. C. Sundaramoorthy, participated in the "International Summit on Management Case studies" and presented a case study titled “Management of Agri-Business Incubation Centre in New Normal” organized by IIM, Ranchi during June 12-13, 2021
13. Dr. V. G. Arude participated in National Seminar “कोविड -19 जनित परिस्थितियों में देश के आर्थिक विकास एवं आत्मनिर्भरता में कृषि अभियांत्रिकी की भूमिका” organised by ICAR-CIAE, Bhopal during 28-29 July, 2021 and presented a paper titled “कृषि अपशिष्ट आधारित पर्यावरण स्नेही शब्दाहिनी” authored by Arude, V. G. and Shukla, S. K.
14. Dr. Manoj Kumar Mahawar presented a paper on “Study on the synthesis of Nano Sulphur using different surfactants” in the 5th *International conference on Advances in Agriculture, Environmental and Biosciences for Sustainable Development* organised in virtual mode by Agro Environmental Development Society (AEDS), in collaboration with College of Horticulture and Forestry, CAU, Imphal, NABARD, Centre for Agribusiness Incubation and Entrepreneurship & Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalyaya, Gwalior (M.P.) during 5 - 7 August, 2021.
15. Sharmila Patil, A. K. Bharimalla, Jyoti Dhakane-Lad, Archana Mahapatra, Kirti Jalgaonkar, Manoj Kumar Mahawar, A. Arputharaj, Sujata Saxena. (2021). “Biodegradable nanocomposite films for oil packaging: Blend optimization and storage studies” was presented in International Conference on “Recent Advances in Agriculture, Engineering and Biotechnology for Food Security” (ICRAAEBFS), organized by Mahima Research Foundation and Social Welfare, BHU, Varanasi jointly in collaboration with School of Agriculture, Lovely Professional University, Jalandhar, Punjab from 25-26 September, 2021.
16. Dattatreya M Kadam, Sharmila Patil, Manoj Kumar, Akansha Kasara, Mrunal Barabhai, and Pallavi Satao: “Effect of Microwaves Pre-Treatments on Deoiled Cotton Cake to Obtain Gossypol Free Protein” was presented in XV AGRICULTURAL SCIENCE CONGRESS & ASC EXPO organised at Institute of Agricultural Sciences, Banarus Hindu University, Varanasi, 13-16 November, 2021.
17. V G Arude, S. K. Shukla and P. S. Deshmukh. (2021) “Electromechanical device for portable gin to determine ginning percentage on real time to accelerate objective grading of cotton” was presented in *International Symposium on “Emerging Trends in Agricultural Engineering*

Education, Research and Extension and 55th ISAE convention on 'Challenges and Technological Solutions for Ensuring Food, Water and Energy Security' held at RPCAU, Patna during 23-25 November, 2021

18. "Optimization of Some Process Parameter for Production of Protein from Deoiled Cotton Cake by Box-Behnken Design" by Dattatreya M Kadam*, Akansha Kasara, Dr. Manoj Kumar Mahawar, Dr. Manoj Kumar, Dr. V. G. Arude, Sayali S. Parab " was presented during the 55th Annual Convention of Indian Society of Agricultural Engineers (ISAE) on Challenges and Technological Solutions for Ensuring Food, Water and Energy Security and International Symposium on "Emerging Trends in Agricultural Engineering Education, Research and Extension" at Patna from 23 - 25 November, 2021,

19. **Jalgaonkar K, Jha SK, Mahawar MK** (2021) Development of wheat semolina- pearl millet based functional pasta incorporated with moringa leaves powder was presented in National e-Conference on "Moringa Food Conclave 2021" September 28-29th, organized by CSAUAT Kanpur

7.4 Popular Articles

1. Mahawar MK and Jalgaonkar K. (2020), Applications of robotics in Fruits and Vegetables Processing, Annual Technical Volume of *Agricultural Engineering Division Board*, Volume III. 19-23.
2. V. T. Sundaramurthy & S. Saxena, Development of the Environment and Textile Industry friendly cotton variety, *Indica, Cotton Statistics & News*, 2020-21, 39, 9th March 2021, CAI
3. Arude, V. G. "Cotton Gin Trash Treatment System to Destroy and Prevent Carryover of Pink Bollworm from Ginning Mills" published in *The ICAC Recorder*, March 2021, pp 38-40.
4. N. Vigneshwaran, 2021, "Innovative applications of nanotechnologies for functional cotton textiles", in: *Cotton Innovations*, 1(3), 13-

16.

5. Ajinath Dukare, Sujata Saxena, Kanika Sharma, N Vigneshwaran and Sheshrao Kautkar (2021). *Microbial Xylanase: An Eco-friendly Tool for Bleaching of Lignocellulosic Paper Pulp*. *Vigyan Varta e-magazine*, 2(12), 62-65.
6. Sharmila Patil (2021). *Fibre extraction from banana pseudostem* (केळीच्या खोडापासून धागा निर्मिति प्रक्रिया) *Krishi Panan Mitra* (कृषि पणन मित्र) (September Issue), Published by Maharashtra State Agricultural Marketing Board, Pune. Page no. 42-45. ISSN 2394-580X
7. Archana Mahapatra, Manoj Kumar Mahawar, Jyoti Dhakane-Lad, Sharmila Patil, Ashok Kumar Bharimalla. (2021). खाद्य कोटिंग से फल भंडारण गुणवत्ता मे वृद्धि. वैज्ञानिक बागवानी की लोकप्रिय पत्रिका- फल फूल, 42(6), नवम्बर-दिसंबर, 2021, 57-58.
8. चन्द्रशेखर सहाय, **शेषराव काऊतकर**, अमित कुमार पाटील और प्रभाकांत पाठक सम्पूर्ण चारा ब्लॉक बनाने की हस्तचालित मशीन एवं उपयोग. कृषक निदान. अक्टूबर-दिसंबर, 04(01): 10-12

7.5 Newspaper Articles/ Report

1. Newspaper article on रंगीत कापसाच्या ब्रॉडिंगसाठी 'सिरकोट' चा पुठाकार published on 31st January 2021, in Pune edition of *Agrowon*.
2. Popular news article on "कपाशी अवशेषातील बोंड अळीचा नाश करणारी यांत्रिक उपचार प्रणाली" by Dr. V. G. Arude and Dr. P. G. Patil. 2021, published in *Agrowon News Paper* dated 3rd March 2021.
3. News Article on "कापूस जिनिंग उद्योगातील कच-यामधुन गुलाबी बोडेंअळीचा नाश आणि प्रसार रोखण्यासाठी यांत्रिकी उपचार प्रणाली" by V. G. Arude, P. G. Patil, 2021 was published in *Agrowon Marathi Daily Magazine*. Published by Sakal, Issue March 2021. pp:2
4. News article was published in *Navbharat Times* on "Mass media campaign about Post-Harvest Technologies of Cotton and By-products developed by ICAR-CIRCOT" on 16th April 2021.
5. A news article on "ICAR-CIRCOT Green crematorium" was published in Marathi newspaper "Loksatta" (Nagpur ed.) on 9th May, 2021.



6. News item entitled "बोंडअळी रोखण्यासाठी यांत्रिकी प्रणाली" by V. G. Arude was Published in Marathi Newspaper सकाळ, सोलापुर (Sakal, Solapur) on 4th May 2021.pp.1.
7. A newsarticle on "ICAR-CIRCOT Green crematorium "सिरकॉट की हरित श्मशान भूमि" was published in Hindi newspaper "Samna" on 18th May 2021.
8. A Newspaper article in Marathi on "कपाशी पिकाच्या अवशेषांपासून मूल्यवर्धित उत्पादने" published in Agrowon on 26th May 2021.
9. On the occasion of 93rd ICAR Foundation Day on 16th July, 2021, Dr. Manoj Kumar Puniya, Scientist at the institute delivered online presentation on 'Benefits of growing trees and their management practices'. It was reported in Hindi newspaper 'Saamana' on 18th July, 2021.
10. Hindi article on "ICAR-CIRCOT Eco Friendly Crematorium" was published in the Dainik Bhaskar (Nagpur ed.) dated 13th August 2021
11. Hindi article on "ICAR-CIRCOT Eco Friendly Crematorium" was published in Navbharat (Nagpur edition) dated 23rd August 2021
12. A News article on रुईच्या टक्केवारीनुसार कापसाचा दर्जा ठरविण्यासाठी डिजिटल रुई उतारा सूचक लघु जिनिंग यंत्र by V. G. Arude was Published in Marathi Newspaper सकाळ, सोलापुर (Sakal, Solapur) on 14th September 2021.pp.1.
13. News items " शेतक-यांच्या हितासाठी रुईच्या उता-यानुसार कापसाचे वर्गीकरण आणि विपणन करणे आवश्यक" by V. G. Arude and Dr. Sujata Saxena was published in Marathi Weekly Newspaper "Shetkaryancha Asud" in a special issue brought out on the Occasion of World Cotton Day on 7th Oct 2021. pp.1.

7.6 Other Publications

1. Annual Report 2020
2. Fibre Quality Report- AICRP on Cotton, May 2021.

8. IMC, RAC and IRC Meetings

8.1 XXVII Research Advisory Committee

The 27th meeting of the Research Advisory Committee (RAC) of ICAR-CIRCOT, Mumbai was held on virtual platform on 1st & 2nd June 2021. Dr. N. C. Patel, Former Vice Chancellor, Junagarh Agricultural University and Anand Agricultural University and Chairman, RAC presided over the meeting. The members of the Research Advisory Committee, Dr. M. K. Sharma, Prof. (Dr.) U. J. Patil, Prof. (Dr.) S. R. Shukla, Dr. N.N. Mahapatra, Prof. (Dr.) Narendra G. Shah, Dr. S. N. Jha, ADG (PE) participated in the online meeting. All Heads of Division and scientists participated in the online meeting.

Dr. Sujata Saxena, Director, ICAR-CIRCOT, made a presentation of major research achievements and other activities undertaken by the institute. She also briefed about the priorities of institute for next plan 2021-2026.

Progress of research in all five core areas and CRP on Natural Fibres was then presented and discussed. Various suggestions to further improve the research output and the institute's performance were provided by the members. RAC suggested to prioritise the institutes research activities with focus on researchable areas viz., use of cotton in non-wovens, traceability of cotton, effluent management and pollution control in cotton processing industry, application of nanotechnology in agriculture, utilization of cotton by-products, application of AI, IoT, Sensor technology and robotics in cotton post-harvest operations, impact assessment of the institute technologies etc.

Dr. S. N. Jha, ADG (PE) appreciated institute staff for their excellent work and for receiving Sardar Patel Outstanding ICAR Institute Award 2019.

On this occasion, a flip book '*FAQs on Nano technology*' was released.



8.2 Institute Research Council (IRC)

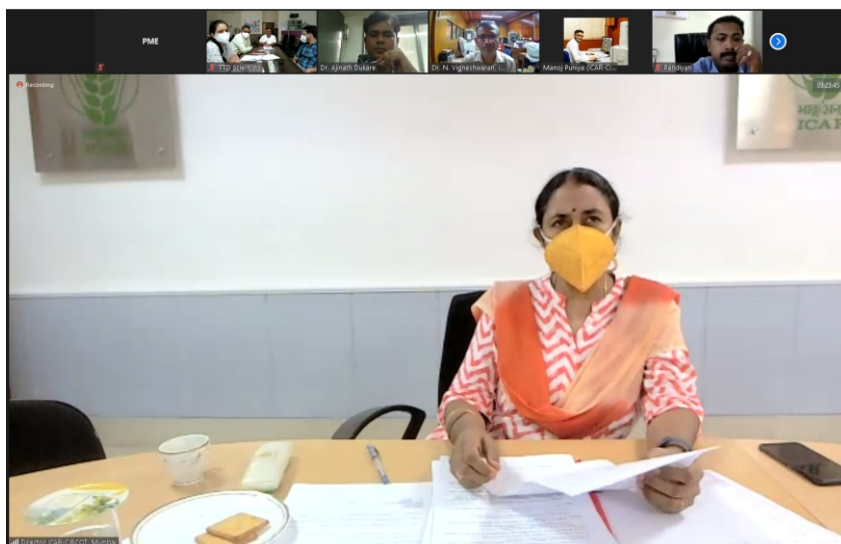
121st Annual IRC Meeting

121st Annual Institute Research Council (IRC) Meeting was held through online platform on 12th July 2021 at 10.00 am under the chairmanship of Dr.

Sujata Saxena, Acting Director. All HoDs, Scientists and Technical officers (ACTO and above) attended the meeting online. Dr. A. S. M. Raja, In-charge, PME Cell welcomed all the Participants. Dr. Sujata

Saxena, Director and Chairperson IRC, in her opening remarks discussed on the issues raised in ICAR Directors' conference. She emphasized the need to analyze the requirements of our stakeholders while formulating new project proposals and focus on better documentation. She stressed on development of short videos on institute technologies to create awareness among stakeholders. She also highlighted on the implementation of the Agricultural Research Management System (ARMS) and asked all the scientists to update their data in ARMS portal.

The progress of Research in the Institute was presented core area wise by the Principal Investigators of the concerned project. This was followed by the presentations of the progress in externally funded projects, final reports of the completed projects and new project proposals for consideration of the IRC. **Four** projects were completed and **six** new project proposals were approved. Meeting ended with the Vote of Thanks by Dr. G. T. V. Prabu, Nodal Officer, PME.



Half-yearly IRC Meeting

The Half-yearly Institute Research Council (IRC) Meeting of ICAR-CIRCOT, Mumbai was held on 28th & 29th December, 2021 under the chairmanship of Dr. Sujata Saxena, Director (Acting) in the conference hall. Outstation staff joined the meeting through virtual platform.

The six-monthly progress made in the ongoing projects presented by the scientists was discussed and suggestions were made to further improve the outputs.



9. Participation in Seminars /Conferences / Meetings / Workshops

Scientists and technical staff of the institute attend seminars / symposia / workshops / conferences at national as well as international level to present their research work and to keep them abreast of the latest developments in the domain of their research interest. Their participation in such events and

publication of proceedings / abstracts results in wider dissemination of the institute activities. The staff members also present their work and share experience and knowledge gained during the visit with fellow colleagues through formal presentations.

Table 9.1 Participation in conferences during 2021

Name of the Conference	Organizer / Venue	Date	Participants
National e-conference on Agricultural Education, Innovation and Research for Future Livelihood-Indian Scenario in 2050	Faculty of Agricultural Engineering, Dr. PDKV, Akola.	28-29 January, 2021	Dr. Manoj Kumar Mahawar Dr. Archana Mahapatra Shri Hemant Ladgaonkar
National Conference on "Transforming Agriculture for Food Security and Farm Sustainability"	Maharashtra Society of Agricultural Economics and DBSKKV, Dapoli, at Dapoli	13-14 February, 2021	Shri Amit Mandape
International Conference (virtual) on "Current Approaches in Agricultural, Animal Husbandry and Allied Sciences for Successful Entrepreneurship (CAAHASSE-2021)"	Agro Environmental Development Society (AEDS), Rampur, Uttar Pradesh	13-15, March, 2021	Dr. Sharmila Patil Dr. Sheshrao Kautkar Dr. Ajinath Dukare
International Conference on Sustainable Materials and its Green Technologies for Industry 4.0 (SMIGT-2021)	Adithya Institute of Technology, Coimbatore (Virtual)	07-09 April, 2021	Dr. Ashok Kumar Bharimalla
International e-conference on Emerging trends in Management & Technology	KLH Business School, Hyderabad & Universiti Malaysia Kelantan, Malaysia	3-4 June, 2021	Dr. Ashok Kumar Bharimalla
International Summit on Management Case studies	Indian Institute of Management, Ranchi (Virtual)	12-13 June, 2021	Dr. C. Sundaramoorthy



Name of the Conference	Organizer / Venue	Date	Participants
International Conference (Virtual) Sustainable Approaches in Food Engineering and Technology (SAFETy-2021)	The Department of Food Engineering & Technology, Tezpur University, Assam, and Department of Food Science & Technology, University of Georgia, Georgia (US) Online	24-25 June, 2021	Dr. Sharmila Patil Dr. Jyoti Dhakane-Lad Dr. Archana Mahapatra
National Conference on "कोविड -19 जनित परिस्थितियों में देश के आर्थिक विकास एवं आत्मनिर्भरता में कृषि अभियांत्रिकी की भूमिका"	ICAR – CIAE, Bhopal (online)	28 July, 2021	Dr. Sujata Saxena Dr. V. G. Arude
5 th International conference on Advances in Agriculture, Environmental and Biosciences for Sustainable Development	Central Agricultural University, Arunachal Pradesh and NABARD (Virtual)	5-7 August, 2021	Dr. Manoj Kumar Mahawar
International Conference on Recent Advances in Agriculture, Engineering & Biotechnology for Food Security (ICRAAEBFS)	Mahima Research Foundation and Social Welfare, Varanasi & School of Agriculture, Lovely Professional University, Phagwara (Virtual)	26-27 September, 2021	Dr. Sharmila Patil Dr. Jyoti Dhakane-Lad
National e-Conference on "Moringa Food Conclave 2021"	CSAUAT, Kanpur (Virtual)	28-29 September, 2021	Dr. Kirti Jalgaonkar
International Conference on Textiles & Apparel, Indian Textiles: Unleashing the next wave of growth (13 th edition)	Confederation of Indian Industry (CII)	21-22 October 2021	Dr. T. Senthilkumar Dr. G. Krishna Prasad Dr. G. T. V. Prabu
55 th ISAE Convention and International Conference on "Emerging Trends in Agricultural Engineering Education, Research and Extension	ISAE and Dr. RPCAU, Patna (Virtual)	23-25 November, 2021	Dr. D. M. Kadam Dr. V. G. Arude

Table 9.2 Participation in Seminars / Webinars / symposia

Title	Organizer / Venue	Date	Participants
International Virtual Seminar on Textile Industry and Covid-19	Dept. of Textiles & Apparel Design, Bharathiar University	04-12 January, 2021	Shri G. T. V. Prabu
Seminar on “Demand Projection of Fibres under Covid 19 Pandemic”	The Textile Association of India, Mumbai, (Virtual)	26 th June 2021	Dr. Sujata Saxena Dr. A. S. M. Raja
Virtual Interactive Cotton Webinar	CITI-CDRA,	7 th October, 2021	Dr. Sujata Saxena Dr. P. S. Deshmukh
Seminar on “Sustainable Textile – Standards and Regulations”	ICAR-NINFET, Kolkata (online)	18 th November, 2021	Dr. N. Shanmugam
Industry interaction on Jute geo textiles - A sustainable geotechnical solution	ICAR-NINFET, Kolkata (online)	1 st December 2021	Dr. N. Shanmugam
Webinar on cotton linters: Current scenario and future prospects	ICAR-CIRCOT, Mumbai; ISCI, Mumbai and AICOSCA, Mumbai (Hybrid mode)	3 rd December 2021	All Scientists
Webinar on ‘Modelling soil physical processes for improving resource use efficiency in agriculture’	The Indian Society of Agrophysics and ICAR-IARI New Delhi (online)	8 th December, 2021	Dr. Manoj Kumar Mahawar
Webinar on Nanomechanical Testing & Property correlation	INSTRON (online)	17 th December, 2021	Dr. T. Senthilkumar

Table 9.3 Workshops / Meetings attended

Title	Organizer / Venue	Date	Participants
Workshop on Commodity Price Risk Management	Multi Commodity Exchange (MCX)	21 May, 2021	Dr. C. Sundaramoorthy
One Week “National e-Workshop on Innovation & Intellectual Property Rights (New IPR-2021)”	CSIR-Institute of Minerals & Materials Technology, Bhubaneswar	14-19 June 2021	Dr. Jyoti Dhakane-Lad



Title	Organizer / Venue	Date	Participants
India-Australia Workshop on “Nano & Biomaterials: Synthesis & Applications” 2021	National Institute of Technology, Tiruchirappalli.	21- 25 June 2021	Dr. G. T. V. Prabu
Annual Zonal Workshop of KVKs- ATARI, Pune on Extension vista: Boundless Horizon for Technology Application and Hi-Tech Farming for Doubling Farmers Income	ICAR-ATARI, Pune Online	04 August, 2021	Dr. Sujata Saxena
Cotton workshop	Cotton Corporation of India Ltd. (Virtual)	24 August, 2021	Dr. Sujata Saxena
Review & Sensitization Workshop of ITMUs/PMEs under NAIF Scheme ICAR-ZTMU (Engg.)	NAIF, ICAR	08 October, 2021	Dr. Ashok Kumar Bharimalla
Workshop on Climatic Resilience	ICAR-CICR, Nagpur	08 November, 2021	Dr. A. S. M. Raja
National e-Workshop on Carbon Materials for Energy Applications	Indian Carbon Society, New Delhi and CSIR-NPL, New Delhi	13 December 2021	Dr. G. Krishna Prasad Dr. T. Senthilkumar
Sensitization workshop on “Implementation and Use of Agricultural Research Management System”	ICAR, New Delhi	8 th June, 2021	Dr. C. Sundaramoorthy
15 th Special Meeting of the Board of Management, NAU, Navsari	NAU, Navsari	02 February, 2021	Dr. P. G. Patil
RCC meeting of Central Silk Board	Central Silk Board	02 February, 2021	Dr. P. G. Patil
Meetings of National Mission on use of Biomass for cofiring in Thermal Power Plants (Sub-Group-1)	Central Power Research Institute Online	03 August, 2021 23 September, 2021 01 November, 2021 14 December, 2021	Dr. Sujata Saxena

Title	Organizer / Venue	Date	Participants
AICOSCA AGM & Award function	AICOSCA Online	13 September, 2021	Dr. Sujata Saxena
Mid Term IRC Meeting of ICAR-NINFET	ICAR-NINFET Online	05 October, 2021	Dr. Ashok Kumar Bharimalla (as an external expert on IPR Management & Agri-Business Incubation)
ISO-TC-38 plenary meeting	ISO Secretariat Online	15 October, 2021	Dr. Sujata Saxena
Town Official Language Implementation Committee (TOLIC) meeting	TOLIC, Mumbai (online)	29 October, 2021	Dr. Sujata Saxena
Interaction meet on Cotton mechanization with Dr. C. R. Mehta, Director, ICAR-CIAE, Bhopal	ICAR-CIRCOT, Mumbai	12 November, 2021	Dr. Sujata Saxena HoDs Scientists of APE discipline
Stakeholders' meeting and Meeting of Committee on Cotton Production and Consumption	Textile Commissioner, Mumbai (online)	12 November, 2021	Dr. Sujata Saxena Dr. A. S. M. Raja Dr. P. K. Mandhyan
Joint AGRESCO- 2021 meeting	VNMKV, Parbhani Online	24 December, 2021	Dr. Sujata Saxena

Table 9.4 Participation as Experts in BIS committees

Title	Organizer / Venue	Date	Participants
Textile Materials for Clothtech Applications including Narrow Fabrics and Braids Sectional Committee, TXD 39 for standardization of standards	Bureau of Indian Standards, (online)	08 April, 2021	Dr. T. Senthilkumar
Meeting of Technical Textile for Sportech application TXD 37	Bureau of Indian Standards, (online)	26 April, 2021 & 14 December, 2021	Dr. T. Senthilkumar
23 rd Meeting of Physical Methods of Test Sectional Committee, (TXD 01) for standardization of standards	Bureau of Indian Standards, Online	09 July, 2021	Dr. T. Senthilkumar

Title	Organizer / Venue	Date	Participants
16 th Meeting of Technical Textiles for Agro-tech Sectional Committee, TXD 35	Bureau of Indian Standards, Online	4 August, 2021	Dr. G. Krishna Prasad
16 th meeting of TXD 07 Textiles Specialty Chemicals & Dyestuff committee of BIS	Bureau of Indian Standards, Online	8 September, 2021	Dr. Sujata Saxena
20 th Meeting of Man-made Fibres, Cotton and their Products Sectional Committee, TXD 31	Bureau of Indian Standards, Online	21 September, 2021	Dr. P. K. Mandhyan
Meeting of the TXD07 : WG07 on development of natural dye mark / certification	Bureau of Indian Standards, Online	25 September, 2021	Dr. Sujata Saxena
Meeting of TXD 05 Chemical methods of Tests Sectional Committee	Bureau of Indian Standards, Online	28 October, 2021	Dr. Sujata Saxena
17 th Meeting of Textile Machinery and Accessories Sectional Committee, TXD 14	Bureau of Indian Standards, Online	09 December, 2021	Dr. T. Senthilkumar
“Made in India for the world – BIS contribution to International Standardization” workshop	Bureau of Indian Standards, Online	23 December, 2021	Dr. Sujata Saxena

Director's participation in Major meetings / events

- Dr. Sujata Saxena, Director (Acting) attended Research and recognition committee meeting of the SNTD University on 22nd January, 2021
- Dr. Sujata Saxena, Director (A), attended the online programme of dedication of ICAR technologies to farmers and Kritagya Hackathon Award Ceremony on 31st May, 2021
- Dr. Sujata Saxena, Director (A) along with Dr. A S M Raja, Dr. Vigneshwaran, Dr. C. Sundaramoorthy and Mr. S. V. Kasabe attended a workshop on “EFC Presentation and Preparation” on 4th June 2021 organized by PIM division of ICAR under the chairmanship of Secretary DARE and DG, ICAR.
- Dr. Sujata Saxena, Director (A) along with Dr A S M Raja, Dr. Ashok Kumar Bharimalla and Dr. V. G. Arude attended meeting on 2nd June, 2021 for discussion on short-medium-long term strategies on Roadmap of Agricultural Mechanisation organized by Agricultural Engineering SMD.
- Dr. Sujata Saxena Director (A) & Dr. A S M Raja attended the SFC presentation of the Scheme Post-harvest Process Engineering on 19th June, 2021 and presented institute SFC before Secretary DARE and DG, ICAR.
- Dr. Sujata Saxena, Director (A), ICAR-CIRCOT attended ICAR Director's conference held online on 2nd July, 2021. Dr. A. S. M. Raja also was present.



- Dr. Sujata Saxena, Director (A) attended online meeting on Finalization of protocol for "KASTURI COTTON INDIA" organized by Textiles Committee, Mumbai on 29th June, 2021
- Dr. Sujata Saxena, Director (A) attended Mid Term Review Meeting of ICAR Regional Committee V organised Online by ICAR-IASRI, New Delhi on 27th July, 2021
- Dr. Sujata Saxena, Director (A) attended online Meeting on fixing the price for ELS cotton organized by the Textile Commissioner's Office, Mumbai on 21st August, 2021
- Dr. Sujata Saxena, Director (A) attended 26th Meeting (Online) of ICAR Regional Committee No. VII organized by ICAR-CIAE, Bhopal on 25th August, 2021
- Dr. Sujata Saxena, Director (A) attended Online Meeting of ICAR Regional Committee No. VIII organized by ICAR-IIHR, Bengaluru on 14th September, 2021
- Dr. Sujata Saxena, Director (A) attended Online Review meeting on Special campaign and pending matters under the chairmanship of Hon'ble Agriculture Minister along with Secretary, DARE & DG, ICAR on 27th October, 2021
- Dr. Sujata Saxena, Director(A) attended Online meeting of the Task force on Agro-Climatic zone-XII organized by CIFE, Mumbai on 29th October, 2021
- Dr. Sujata Saxena, Director (A) attended Board of Studies Meeting, in Textile Science and Apparel Design of SNTD University on 18th November, 2021
- Dr. Sujata Saxena, Director (A) attended XXV meeting (Online) of ICAR Regional committee III on 11th December, 2021

Visits to Regional units and other Institutions

- Dr. Sujata Saxena, Director (A), ICAR-CIRCOT visited GTC, Nagpur in connection with the visit of Dr. S. K. Chaudhari, DDG (NRM & Ag. Engg.), to Nagpur and inauguration of renovated Farmers' Guest House at GTC, Nagpur by him on 15th September, 2021.

10. Events Organized

Workshops / Seminars / Conference / Meetings / Lectures

Webinar on World Cotton Day

ICAR- Central Institute for Research on Cotton Technology, Mumbai celebrated the World Cotton Day on 7th October 2021 by organizing a webinar on “Cotton for Comfort and Prosperity” in collaboration with Indian Society for Cotton Improvement (ISCI), Mumbai and Indian Fibre Society (IFS), Mumbai. Dr C.D. Mayee, Former Chairman ASRB, as the Chief Guest and Dr K.R. K. Iyer, Former Director, ICAR- CIRCOT, as Guest of Honour graced the occasion

Dr Sujata Saxena, Director (Acting), greeted all the dignitaries and participants and delivered welcome address. A video clipping about the demonstration on Clean Cotton Picking organised on the occasion by regional unit at Sirsa, Haryana was shown to the participants.

Three distinguished speakers, Dr. V. Kumar (Former Head, Cotton Research Station, Surat), Dr. R. P. Nachane (Former Head, QEID, CIRCOT & President IFS) and Dr. C. Sundaramoorthy (Senior Scientist, TTD, ICAR-CIRCOT) presented and elaborated on topics such as “Cotton and Man-Made Fabrics in India's Textile Economy and their Environmental Foot Prints”, “Cotton for Comfort” and “Value addition to Cotton By-products and Biomass for Prosperity” respectively.

On the occasion “ICAR-CIRCOT Antimicrobial and water repellent cotton face mask” with good particle filtration and breathability developed under the CRP on Natural Fibres project was released by the Chief Guest. Guest of Honour, Dr K.R.K. Iyer, in his address highlighted the role played by the Technology Mission on Cotton (TMC) in modernization of Indian ginning industry and improvement of cotton quality and called for yet another mission to address the emerging cotton quality issues.

This webinar was attended by more than 130 participants including present and past cotton

researchers, scientists, stakeholders from Industry and trade, farmers, Agri-entrepreneurs and media persons.



Celebrations at GTC, Nagpur

Ginning Training Centre (GTC), Nagpur in association with Confederation of Indian Textile Industry (CITI), Mumbai organised a one-day workshop on “Quality Requirements of Textile Industry for Indian Cotton Branding: Farmers Perspectives” to commemorate the World Cotton Day and 75 years of India's Independence.

Shri G. H. Wairale, Coordinator, CITI, highlighted the various initiatives taken by CITI towards upliftment of farmers of Vidarbha region.

Dr. S. K. Shukla, Pr. Scientist & Officer In-Charge, GTC elaborated on the significance of cotton quality parameters and need to revive the past glory of the Indian cotton to fetch premium rates in the global market.

Shri Milind Shende, District Superintending Agricultural Officer (SAO), Nagpur highlighted the difficulties faced by the farmers in terms of labour shortage, increasing input cost, biomass management, etc and urged the scientists for development of viable technologies for mechanical harvesting of cotton as well as cotton biomass collection and chipping.

Dr. M.K. Sharma, CEO & Whole-time Director, M/s. Bajaj Steel Industries Ltd., Nagpur highlighted various cotton processing machineries and technologies marketed by them across the globe and urged the ginners to employ the right kind of

machinery and technology to improve the Indian cotton grades.

Around fifteen progressive farmers and other stakeholders were felicitated on the occasion for attaining higher cotton productivity, producing contamination free bales and value addition to cotton and its biomass such as briquettes, pellets, surgical cotton etc. Shri Prashant Mohota, MD, M/s. Gimatex Industries Pvt. Ltd., Nagpur informed about the 5-10-fold monetary benefits for production and supply of the organic cotton in the international market. He urged the farmers to concentrate on quality parameters and organic cotton production to increase the farm income.

In his lead address, Dr. Y. G. Prasad, Director, ICAR-Central Institute for Cotton Research (CICR), Nagpur thanked the farmers for their contribution to bring India on top with respect to cotton production at global level. He also mentioned that we are behind other countries in terms of productivity and insisted upon the need to increase the productivity by adoption of latest technologies and practices. He further added that High Density Planting System (HDPS) would help in overcoming this issue that will be introduced by next year positively.



Mahila Kisan Diwas

Every year 15th October is celebrated as International Rural Women's Day in the world and it is celebrated in our country as Mahila Kisan Diwas since 2016. On the eve of Women Farmer's Day (14th October, 2021), a webinar was organized on "Equity and Empowerment". Dr. Sujata Saxena, Director (Acting) welcomed participants and highlighted the contributions made by women in agricultural production, post-harvest processing and value

addition to supplement the household income. She said that with hand holding and technology and funding support there is a good scope for farm women today to become agripreneurs and be employment providers and fulfill the government objective of Atmanirbhar Bharat.

On this occasion, Ms. Apoorva Bajaj, a budding entrepreneur and Managing Partner of MEDICON-Surgical cotton manufacturing unit in Kalaburagi, Karnataka delivered a lecture on "Women empowerment through agripreneurship". She narrated her entrepreneurial journey of establishing a fully automated plant with latest technology for manufacturing Surgical/ Absorbent Cotton Wool (IP) and allied products with her team of passionate women entrepreneurs. She elaborated on how her team contributed their bit to the economic development of locals, generating employment and women empowerment in a rural area. The program was attended by more than 100 viewers in hybrid mode which included scientists, cotton experts and traders, women farmers, start-ups, Incubatees, NGOs and other stakeholders. The programme was also live streamed on YouTube channel.



World Food Day

The "World Food Day" was observed on, 16th October, 2021 on the theme "Safe Food Now for a Healthy Tomorrow". A webinar in hybrid mode was organised on the occasion. Dr Sujata Saxena, Director (Acting), ICAR-CIRCOT welcomed all dignitaries & participants and stressed on the importance of food for humanity. Dr Sheshrao Kautkar, Scientist, TTD, ICAR-CIRCOT delivered a lecture on "Common Food Adulterants and Household Methods for their Detection". He explained common food adulteration practices and

their ill effects on human health and techniques for their detection using materials readily available in the household. He also covered the adulteration in commonly consumed products like fruits, vegetables, fish, honey, paneer and spices such as turmeric etc. Dr. Kanika Sharma, scientist, CBPD coordinated the programme. The program was also live streamed on YouTube.



Webinar on Cotton Linters: Present Scenario and Future Prospects

On 3rd December, 2021, on the occasion of 98th Foundation Day of ICAR-CIRCOT and Agricultural Education Day, a webinar on “Cotton Linters Present Scenario and Future Prospects” was organized in Hybrid mode in collaboration with Indian Society for Cotton Improvement (ISCI) Mumbai and All India Cotton Seed Crushers Association (AICOSCA), Mumbai. Dr. C. D. Mayee, President, ISCI & Former Chairman, ASRB delivered

the inaugural address and complemented the institute on organizing a webinar for discussion on this unexplored cotton byproduct. Shri. Sandeep Bajoria, Chairman, AICOSCA emphasized on the importance of promotion of scientific cottonseed processing for maximum utilization of cottonseed and its constituents such as linters. In the technical session Shri Bharat, M/s. Cottor Plants India Pvt. Ltd., Mumbai shared his experience on the topic “Linter Production in India through Scientific Processing of Cottonseed”. Shri Ram Bohra, MD, M/s. Cottor Plants India Pvt. Ltd., Mumbai delivered presentation on “Indian Cotton Linters - Quality Issues” and Dr. Sujata Saxena, Director (Acting), ICAR-CIRCOT made a presentation on “Diversified uses of Cotton Linters”. More than 100 participants attended the webinar.



Other Events

Celebration of 98th Foundation day

98th Foundation Day of ICAR-CIRCOT along with the Agricultural Education Day was celebrated on 3rd December, 2021 in Hybrid mode. Dr. A. K. Bharimalla, Convener of the event, welcomed all participants and briefed about the program. Dr. (Mrs.) Sujata Saxena, Director (Acting), delivered welcome address and highlighted the significant research achievements and other major activities organized at the institute during past year and congratulated all the staff members of the institute for their significant contribution.

Dr. S. K. Chaudhari, Deputy Director General (NRM & Engg), Chief Guest of the programme, joining in online mode applauded the Institute for its

achievements in the area of ginning technology, cotton quality improvement, nano technology, revenue generation and skill development, etc. He also emphasized on the Institute's role in addressing the emerging needs of the sector to attain Global Excellence in cotton technology. He also announced the “Best employee of the institute” awards for scientific, technical and administrative category staff for the year and also released a publication “CIRCOT R-ABI endeavours: Bolstering the women startups”.

A Memorandum of Understanding (MoU) was signed with M/s Vidarbha Sales, Nagpur for the commercialization of technology titled “ICAR-CIRCOT Trapezoidal Shaped Low-cost Briquette

Based Crematorium”. Memorandum of Agreement (MoA) was also signed with ten agri-startups of 2nd cohort of CIRCOT R-ABI.

Dr. S. N. Jha, ADG (PE), ICAR, New Delhi, wished all the staff members and applauded the journey of the institute in last five years and its recognition as an excellent institute in ICAR. Dr. K. K. Singh ADG (AE.), ICAR, New Delhi, praised the glorious past of the ICAR-CIRCOT and wished the institute many fold success in future.

Dr. C. R. Mehta, Director, ICAR-CIAE, Bhopal; Dr. N. Kotwaliwale, Director, ICAR-CIPHET, Ludhiana, Dr. K. K. Sharma, Director, ICAR-IINRG, Ranchi and Dr. Y. G. Prasad, Director, ICAR-CICR graced the function virtually and appreciated the institute for its achievements. Former directors of the Institute Dr. K. R. K. Iyer and Dr. A. J. Shaikh also blessed the function with their august presence and shared their memories. Around 200 participants including many former employees joined the function.



International Women's Day

The International Women's Day was celebrated with full zeal at ICAR-CIRCOT by observing the current year's theme “Women Leadership in Agriculture: Entrepreneurship, Equity and Empowerment”. The Institute arranged live streaming of the virtual program held at ICAR Head Quarters at New Delhi where Hon'ble Ministers of State for Agriculture & Farmers Welfare, Shri Parshottam Rupala and Shri Kailash Chaudhary along with Dr. T. Mohapatra, Secretary DARE & DG, ICAR and other dignitaries were present. It was followed by the Institute's program held in both online as well as offline modes.

Dr. (Smt.) Sujata Saxena, Director, in her welcome address congratulated all women staff members and opined that on this occasion every woman must reflect upon the struggles she underwent and achievements she got and think of the ways in which she can further contribute to the development of herself, her family, her workplace and society.

Dr A K Bharimalla, Senior Scientist & Head, I/c. T.T.D. PI & CEO, CIRCOT R-ABI gave a brief presentation on 'Role of CIRCOT R-ABI in Evolving Women Entrepreneurship with Agri-startup Ecosystem'.

A book entitled; 'Empowering Women Leadership through Agri Start-ups: CIRCOT-R-ABI Initiative' was released to mark the achievements of women agri-entrepreneurs enrolled with CIRCOT-R-ABI.

On this occasion, virtual presentations of the following five successful women Agri-Start-ups of CIRCOT R-ABI were arranged who shared their entrepreneurial journey;

1. Mrs. Perna Sude, M/s. Divyang Creations, Latur, Maharashtra
2. Ms. Apoorva Bajaj, M/s. Medicon, Gulbarga, Karnataka
3. Mrs. Manjula Deshmukh, M/s. Prafulla Winery & Hospitality Pvt. Ltd., Kolhapur, Maharashtra
4. Ms. Ashwini Jadhav, M/s. Sambru Agro Industries, Kolhapur, Maharashtra
5. Ms. Manjusha Patil, M/s. Mystic Herbals, Sangli, Maharashtra

Around 150 participants including staff from Headquarter and regional stations attended this program in virtual and physical mode.



World Water Day

ICAR-CIRCOT celebrated the World Water Day on 22nd March, 2021 in a big way. Director and many staff members attended ICAR's Celebration of World Water Day organized on virtual platform which was addressed by Shri. Parshottam Rupala, Hon'ble Minister of State for Agriculture & Farmer's Welfare and a virtual lecture by Dr. Mark Smith, Director General, International Water Management Institute (IWMI).

Two events were also organized at institute level on this occasion, A Virtual presentation on the theme of this year's celebration i.e. "Valuing Water" by Dr. S. K. Jena, Principal Scientist, ICAR-IIWM, Bhubaneswar which was attended by about 60 staff members and 12 incubatees of CIRCOT-R-ABI in online as well as offline mode.



A Drawing Competition for children of the staff members was also organized on this occasion. Total 29 children participated in the drawing competition held in two categories. There were four winners in each category and prizes to the winners and the participation certificates were distributed by Dr. Sujata Saxena, Director (Acting) during the event.

International Yoga Day

On the occasion of the seventh International Yoga Day, a virtual Yoga workshop was organized in ICAR-CIRCOT on 21st June, 2021 in the video conferencing hall of the Institute where eight participants were present with social distancing. Arrangements were made for virtual demonstration. All the other staff members including Regional Units staff participated in the workshop in virtual mode from their work place. Yogasanas were demonstrated by the teachers and instructors from Ghatkopar Branch of Shri Ambika Yoga Kutir, Thane.

The workshop started with welcome address by Dr. (Mrs.) Sujata Saxena, Director ICAR-CIRCOT, Mumbai. Shri Sudhir Sawant, Sanchalak of Shri Ambika Yoga Kutir, Ghatkopar Branch briefed about the importance of Yoga and thereafter Yogasanas were performed by all the staff members under the virtual guidance of instructors of Shri Ambika Yoga Kutir as per the protocol from Ayush Ministry, Government of India. Names of all the participating staff members were registered through Shri Ambika Yoga Kutir on the site of Ayush Ministry. Shri Bharat Pawar, CTO & Nodal Officer, IYD 2021, presented vote of thanks. Nearly 145 participants attended this virtual celebration.



Vigilance Awareness week

Vigilance Awareness Week on the theme of "Independent India@75: Self Reliance with Integrity" was celebrated during 26th October to 1st November 2021. Dr. Sujata Saxena, Director administered the Integrity Pledge to the Employees on 26th October 2021.



Mr. Amit Kumar, Deputy Superintendent of Police, ACB, Mumbai delivered a lecture to ICAR-CIRCOT staff on the theme "Independent India@75: Self Reliance with Integrity" on 29th October 2021.

Aazadi Ka Amrit Mahotsav

ICAR-CIRCOT organised a series of events as part of the DARE-ICAR commemorative celebration of India@75 under Government of India's Commemoration of 75 years of India's Independence as 'Azadi ka Amrut Mahotsav'. Various programmes were organised by the institute in line with directions received from ICAR from time to time. Besides, institute staff also attended various online lectures and programmes organised by ICAR on this occasion

Mass-media campaign on Post-Harvest Technologies of Cotton and Value Addition to its By-products

The first campaign organized as a part of the DARE-ICAR commemorative celebration of India@75 theme "Fibre Processing & Value addition" was Mass-media campaign on Post-Harvest Technologies of Cotton and Value Addition to its By-products on Friday, 16th April 2021 in virtual mode. An informative lecture on "Cotton Quality and its role in marketing" was delivered by Mr. P. D. Mepani, a well-known Cotton Trade and Market Expert. Around 180 people joined this campaign which included veteran cotton researchers, persons related to cotton trade, textile consultants, agricultural and textile students, incubatees, start-ups and eminent media journalists.



Webinar on Fibre Processing and Value Addition

Webinar on Fibre Processing and Value Addition was organised on 31.5.2021. The lecture series in this webinar includes Mechanical Processing of Fibres, Cotton Quality and Fibre Processing and Cotton Scenario in Pandemic (Covid-19). Dr S.K. Shukla, Principal Scientist, GTC, ICAR-CIRCOT, delivered a presentation on "Mechanical Processing of Fibres".

In the second lecture on "Cotton Quality and Fibre processing", Dr P. Jagajantha, Scientist, QEID, ICAR-CIRCOT explained about the importance of cotton fibre quality and its impact on the spinning process. The role of ICAR-CIRCOT in Cotton quality Evaluation was also highlighted. Dr C. Sundramoorthy, Senior Scientist, TTD, ICAR-CIRCOT in his presentation on "Cotton Scenario in Pandemic (Covid-19)" elucidated on the global and Indian cotton scenario and its resilience in the time of pandemic. This webinar was attended by more than 100 participants



Farmers' awareness campaign on 'Balanced Use of Fertilizers'

A Farmers' awareness campaign on 'Balanced Use of Fertilizers' was organised on Friday, 18th June 2021 on virtual mode.

On this occasion, a presentation on 'ICAR-CIRCOT's Initiatives on Nanofertilizers: Prospects & Future Challenges' was delivered by Dr. A. K. Bharimalla, Senior Scientist and Dr. Manoj Mahawar, Scientist.

Dr. Manoj Mahavar briefed about synthesis, application & efficacy of Nano fertilizers and also brought attention to ICAR-CIRCOT's R & D on nanotechnology applications. Entire program was conducted in Hindi which was well received by the farmers, who had joined this virtual campaign from Sirsa and Nagpur regional centres. Overall, more than 100 people including 30 farmers participated in this campaign. The program was live streamed on YouTube for larger public accessibility.



ICAR Foundation Day

The Nation-wide campaign on tree plantation & awareness was planned under the theme 'हर मोड़ पर पेड़' (Tree on Every Weir) on ICAR Foundation Day on Friday 16th July 2021. Tree plantation drive was conducted at the institute as well as Ginning Training Centre of the Institute at Nagpur.

On this day, the Director, HODs and staff members of the institute attended the virtual tree plantation ceremony by the DG, ICAR and other senior officers of the ICAR. They also participated in the 93rd ICAR Foundation Day and Awards Ceremony program.

Dr. Manoj Kumar Puniya, Scientist delivered a presentation on 'Benefits of growing trees and their management practices'. This was followed by tree plantation in the Institute premises. Saplings of Golden shower tree (), Burflower tree (), Platane, Karnikara and Sita Ashok were planted by the Director and Divisional Heads. Around 120 people participated in this program in online as well as offline mode which was also streamed live on YouTube for larger public accessibility. This event was also reported in Hindi newspaper 'Saamna' on 18th July 2021.



7th National Handloom Day

ICAR-CIRCOT celebrated 7th National Handloom Day on 7th August 2021 as 5th campaign under "Azadi ka Amrrut Mahotsav" with a Mass Media Campaign '#MyHandloomMyPride' in virtual mode.

Textile expert & Social entrepreneur Dr. (Ms) Manjula Jagatramka, Dean (Textiles), Institute of Heritage Textiles, JJTU, Rajasthan and Founder Director, Vaitarna, Mumbai enlightened the audience with the nitty-gritties of handloom sector in a very vivid and lucid way and shared her entrepreneurial journey in setting up of Vaitarna - a platform working towards the economic empowerment of underprivileged women by organising various training activities at the grass-root level and showcasing the handlooms and handicraft products made by them.

It was followed by presentations by two CIRCOT R-ABI start-ups. Shri. Pralhad Nemade, Partner, Prayogsheel Shetkari Pariwar, Akola (Maharashtra), narrated his innovation in textile machinery to make fine yarn at village level for establishing sustainable cotton value chain through handloom units in rural areas. Mr. Prashant Sude and Mrs. Perna Sude, Partners, Divyang Creations, Latur (Maharashtra) shared their journey of successful social entrepreneurship wherein they trained visually impaired people to work on specially customized handlooms and helped them to earn a living and a respectable life.

Chief Guest Dr. V.D. Gotmare, former Head, Textile Manufactures Department, VJTI, Mumbai in his address appreciated the speakers and their dedication towards Handlooms. The program was attended by more than 100 viewers



An Exhibition cum sale of khadi & handloom products in the Institute premises through stalls of Co-optex and KVIC was arranged on the occasion. The staff members as well as residents in the neighbourhood visited these stalls, bought handloom products and shared their pictures and selfies with these items on their social media accounts with tagline #MyHandloomMyPride'.



Parthenium Awareness Week

In response to the appeal by DG, ICAR to keep the campus Parthenium free under Swachh Bharat Abhiyan and as a part of celebration of Azadi ka Amrut Mahostav, ICAR - Central Institute for Research on Cotton Technology, Mumbai observed "Parthenium Awareness Week" during 16-22 August, 2021 in the Head Quarters at Mumbai and at its regional centres. The posters and extension materials especially developed for this occasion by ICAR-DWR, Jabalpur were distributed among the farmers, start-ups associated with the Agri-Business Incubation Centre of the Institute and exhibited all over the campus to educate the farmers and general public about the harmful effects of Parthenium and ways of its management.



Webinar on "Cotton Crop for Food and Nutrition

The theme for the month of August 2021 was "Food and Nutrition for Farmers". ICAR-CIRCOT being the only Institute in Asia doing post-harvest technology

research work on every part of Cotton plant organized a webinar on "Cotton Crop for Food and Nutrition (खाद्य एवं पोषण के लिए कपास फसल)" on 26th August 2021 on virtual platform.

A lecture- cum-presentation on "Cotton Crop for Food and Nutrition (खाद्य एवं पोषण के लिए कपास फसल)" was delivered in Hindi by Dr. Jyoti Dhakne-Lad, Scientist from Technology Transfer Division of the Institute. She elucidated sustainable utilization of cotton by-products through multilevel intervention to enable food and nutrition for farmer and society as well. She also showcased some innovative nutritive health products made from cotton seeds for human as well as for non-ruminants which will help in improving farmers' livelihood, health status and waste valorization.



More than 150 people including NARS fraternity, stakeholders, farmers, students, Incubatees and media persons along with staff members attended this program through Zoom link and Youtube live session. ICAR-CIRCOT staff also attended the National level campaign on Food & Nutrition for Farmers Hosted by ICAR which was addressed by Hon'ble Minister of Agriculture and Farmers' Welfare

Fit India Freedom Run 2.0*

Fit India Freedom Run 2.0 was celebrated at the national level under the India@75 festival of Azadi ka Amrit Mahotsav. As a part of this campaign, ICAR-CIRCOT organized a series of run/brisk walks as per the guidelines received from the Council. Around 100 staff members enrolled for the events that were organized in batches of 15-20 participants in compliance with covid guidelines.



The campaign was inaugurated by Dr. Sujata Saxena, Director, on 4th September 2021. On this occasion, Dr. A.K. Bharimalla, Senior Scientist, Chairman, Committee for celebration of DARE-ICAR-CIRCOT campaigns under India @75 informed the staff members about *Fit India Freedom Run 2.0* celebration theme and how it will be celebrated at the Institute. Director in her inaugural address briefed on the benefits of physical activities in today's sedentary life style. She urged everyone to practice yoga, stretching exercises, running and brisk walk in whichever way possible to keep body fit which eventually keeps the mind fresh. After that the first batch of 19 participants headed by Director flagged off for a 30 minute brisk walk in the Five Garden area.

A run was organised under this campaign on 7th September 2021. Batch of 20 participants including Scientists, Technical, Administrative and Supporting Staff participated in a run for 30 minutes and covered approximately 2 KMs. in the area around the institute.

Brisk walk was organised on 16th September 2021 and 29th September 2021 in which 26 and 31 participants respectively joined in a walk for 30 minutes and covered approximately 2 KMs. in the area around the institute.

In total 4 events in series of run/brisk walks under *Fit India Freedom Run 2.0* were organised. Videos and photos of both these events are uploaded on ICAR-CIRCOT website and Youtube.

Poshan Mah and Tree Plantation campaign



On the occasion of Poshan Mah and Tree Plantation Campaign held on 17th Sept 2021, 11 saplings were planted in the premises of ICAR-CIRCOT, Mumbai by Chief guest and special guest of the event Prof. Dr. Shirish Upadhye, Dean, MAFSU, Nagpur & Prof. Dr. Ajit S. Ranade, Associate Dean of MAFSU, Nagpur along with Dr. Sujata Saxena, Director, ICAR-CIRCOT in presence of HoDs, SAO, AO, AAO and other staff of ICAR-CIRCOT.

Also 12 girls from the vicinity were invited to the Institute to have nutritious food. Dr. Sujata Saxena, Director, ICAR-CIRCOT while interacting with these girls briefed them about various nutritional components and importance of balanced diet for good health and all round development.



On this day Ginning Training Centre (GTC), ICAR-CIRCOT, Nagpur organized a programme on distribution of Vegetable Seeds to the Progressive Farmers and Healthy Foods to Girl Child at Village Yerla near Nagpur. Two hundred seed packets were distributed amongst 50 farmers and nutritious food was provided to 40 school children, mainly girls. Tree plantation program was arranged in the school premises of Yerla village. It was presided over by Smt. Mayatayee Thakre, Sarpanch of the village. Sh. Pramod Gamey, Dy-Sarpanch, Sh. Parikshit Borale, Panchayat Secretary, Yerla and other members of the gram panchayat were also present during the

celebrations along with the GTC staff coordinating the event.

Farmers' awareness programme on "Climate Resilient Agriculture"

ICAR-CIRCOT, its Ginning Training Centre (GTC) at Nagpur and regional units at Surat, Guntur, Sirsa, Dharwad and Coimbatore participated in the PM's Farmers' awareness programme on "Climate Resilient Agriculture" on 28th September 2021. Total 100 staff members of ICAR-CIRCOT, Mumbai and its regional units attended the programme.



After the Prime Minister's address, "Farmers – Scientists Interface Meet" was arranged for the benefit of farmers, especially with regard to two major crops viz., cotton and citrus grown in the area in association with The Confederation of Indian Textile Industry - Cotton Development & Research Association (CITI-CDRA) at Mohpa village, Kalmeshwar, Nagpur. This programme was attended by 100 farmers, 14 staff members and 3 VIPs (Smt. Shobha Kautkar, City President, Mohpa Nagar Palika, Dr. Phundan Singh, former Director, ICAR-CICR, Nagpur and Sh. G. H. Wairale, President, CITI-CDRA). The importance of production of high yield of cotton fibres by adopting climate resilient varieties and technologies, Benefits of clean cotton picking were briefed to the farmers and also Utilisation of cotton stalk biomass for increasing farm income was discussed at length.



National Swachhta Campaign on "Waste to Wealth"

On the occasion of ICAR's Special National Swachhta Campaign on "Waste to Wealth", around 28 staff members of ICAR-CIRCOT, Mumbai carried out the maintenance of the aerobic compost bin on 12th October 2021. The wet waste was collected from the kitchen of Institute's canteen and dry waste from the surrounding. Both the wastes were added into the aerobic compost bin and microbial inoculum was added and mixed thoroughly. In addition, the earlier produced compost was used to plant new saplings at the hands of Director and other officials. Also, awareness was created among the staff members regarding the benefits of aerobic composting of solid wastes.



On this day, Ginning Training Centre of ICAR-CIRCOT, Nagpur organized a programme in association with The CITI-CDRA, Mumbai at Mohapa village, Kalmeshwar, Nagpur to sensitize the farmers about 'Swachhta and Waste to Wealth' as well as to spread awareness about different methods for value addition to the various agro-residues to fetch additional income to the farmers.



National Unity Day

ICAR-CIRCOT celebrated 31st October the birth anniversary of Bharat Ratna Sardar Vallabhbhai Patel as National Unity Day. This year it was organized with gaiety under the Amrit Mahotsav of Independence. Dr. Sujata Saxena, Director (A) administered the oath of National Unity Day to the employees of the institute. A short film based on

the life and work of Sardar Patel was screened during the programme. On this occasion, an essay competition (Hindi and English) was also organized by the institute on the topic “Importance of National Unity for Self-reliant India”.



Agriculture and Environment: the Citizen Face

A National Campaign on the theme “Agriculture and Environment: the Citizen Face” was arranged under Amrut Mahostav on 26th November 2021.

A visit of college students' to the institute was arranged. A batch of 21 college students visited Exhibition cum Visitors' room and research laboratories of the institute. Various eco-friendly systems adopted by the institutes were shown to them and a quiz competition was also arranged.

11. Hindi Implementation

11.1 Hindi Day / Chetana Month/ Hindi Pakhwada 2021 celebration

Hindi Chetana Month to honour Hindi as the Official Language was observed from 1st September to 30th September 2021. Various competitions were organized during Hindi Day/Fortnight from 14th September, 2021 to 30th September 2021 such as; Poetry recitation, Essay writing, Dictation, Technical words, Unicode typing, and Crosswords.

On September 14, 2021, Dr. (Mrs.) Sujata Saxena, Director presided over the Hindi day celebration and Dr. Sunil Chavan, Head, Department of Hindi, S. N. Arts, D.J. Malpani Commerce and B. N Sarada Science College, Sangamner, District-Ahmednagar was present in online mode as Chief Guest. The opening ceremony of Hindi Pakhwada celebration and poetry recital competition were organized through virtual mode. Smt. Prachi Mhatre, Senior Technical Officer administered the official language pledge of Hindi Day to all and read out the message given by Union Agriculture and Farmers Welfare Minister Shri Narendra Singh Tomar ji on this occasion.

In her inaugural address, the Director said that all the languages of the country are important. Hindi is unanimously an easy and simple language because most of the people in our country can speak, write and understand Hindi easily. She extended warm greetings to all the employees on the occasion of Hindi Day.

A Poster presentation competition on the theme 'Azadi Ka Amrit Mahotsav' was also organised as part of the celebrations and exhibition of posters on this theme was arranged. All competitions in Hindi Pakhwada were organized observing the Standard Operating Procedure (SOP) issued by the Central Government from time to time in the context of the Covid-19 epidemic. Despite the Covid crisis, there was enthusiastic participation by the employees in these competitions.

During the Hindi Chetana month, staff members were encouraged to sign in Hindi and to use Hindi in routine notings as well as official correspondence,

which led to a significant increase in the official language usage at the institute.

On September 30, 2021, the closing ceremony was held in hybrid mode under the chairmanship of Dr. Sujata Saxena, Director (A) in the online presence of Chief Guest Dr. Ashish Kandhave, Editor, "Gagananchal" Indian Council for Cultural Relations, Ministry of External Affairs, Government of India, New Delhi and physical presence of the Guest of Honour Dr. Mrigendra Rai, Professor, Khalsa College. In her presidential address, Dr. Sujata Saxena said that in spite of scientific and technical nature of work in our institute, lot of work is being done in Hindi. She appealed to all the employees to keep on working in Hindi and said that it is our responsibility to use Hindi in our day-to-day work and it should be done throughout the year. She appreciated the activities being carried out by the Official Language Cell for the implementation of the Official Language and expressed satisfaction over the participation of the staff members of the Institute in the competitions despite the challenges caused by the pandemic.

The chairman of the Pakhwada Organizing Committee, Dr. VG. Arude, Senior Scientist presented the information about various competitions and activities organized during the fortnight. A total of 7 competitions were organized during the fortnight in which a total of 94 officers/employees of the institute actively participated. Mrs. Tripti Mokal, Assistant Administrative Officer and in-charge, Rajbhasha Cell, briefed on achievements of the institute in Hindi implementation during the year.

The guest of honour Dr. Mrigendra Rai expressed happiness over the activities of the institute and its use of Hindi and wished that the institute should make progress in the field of Hindi that other institutions can follow. He also threw light on the international usage of Hindi and stressed on the maximum use of all Indian languages.

Chief guest Dr. Ashish Kandhwe in his address told that today Hindi is the number one language of the world, being taught in many universities across the world citing the example of the Department of Hindi, in Hungary which is 149 years old. He stressed that we should respect our dialect and language and make the new generation aware of our culture and teach them our mother tongue so that they can use it in everyday life. It is a matter of great pride that Oxford dictionary has accepted many Hindi words. He expressed satisfaction over the development of Hindi at the national and international level and stressed on its maximum use.

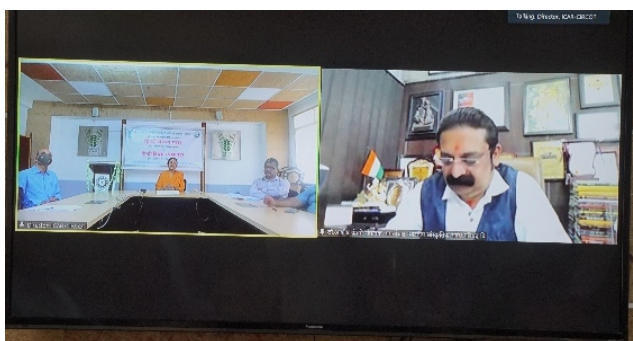


Inauguration of Hindi Pakhwada celebration

Awards were given to the employees who participated in the incentive scheme for comments/writing in the official work in Hindi for the year 2020-21. In the closing ceremony, Rajbhasha Chal-Vaijayanti shield for best Hindi implementation for the year 2020-21 was given to Administration (Personnel Section) among Administrative Sections and Technology Transfer Division among Research Divisions for the year 2020-21.



Competition for Skilled Support Staff



Closing ceremony of Hindi Pakhwada



GTC, Nagpur

Hindi Week celebrations were organized at the Institute's Ginning Training Center, Nagpur from 14th September, 2021 to 20th September, 2021 in which

total 5 competitions were organized. All the employees of the center participated enthusiastically in these events.

11.2 Hindi workshops

1. On March 20, 2021, a workshop by Dr. Mahendra Jain, Professor, Hindi Teaching Scheme was arranged on the topic "Problems and their solutions" for all the scientific,

technical and administrative officers/employees of the institute headquarter and regional units.

2. On June 19, 2021, Shri Virendra Kulkarni, Deputy Director (Official Language), Heavy Water Board, Department of Atomic Energy, Government of India, Anushakti Nagar, Mumbai conducted a workshop on the subject “Official Language Policy” for all scientific, technical and administrative staff. Total 67 employees participated.

3. Ms. Seema Chopra, Director (Official Language), New Delhi conducted a workshop regarding filling the questionnaire of Parliamentary Committee on Official Language for the members of the Official Language Implementation Committee of ICAR-CIRCOT on August 16, 2021. A total of 29 officers/employees participated.



4. On December 27, 2021, a workshop by Dr. Mahendra Jain, Professor, Hindi Teaching Scheme was conducted on the subject of digitization in official work for all scientific,

technical and administrative officers/employees. A total of 69 officers/employees from headquarter and regional units participated.



11.3 Meeting of Official Language Implementation Committee

A total of 4 meetings of Official Language Implementation Committee were held during the year on 27.02.2021, 10.06.2021, 12.08.2021, 26.10.2021 in which progress in implementation of official language was reviewed and measures for improving its implementation were suggested.

11.4 Meeting of the Town Official Language Implementation Committee

The Director of the Institute, Dr. (Mrs.) Sujata Saxena, participated in half yearly meeting of Town Official Language Implementation Committee, Mumbai through online mode on 29.10.2021.

12. Distinguished Visitors

Dr. S. K. Chaudhari, DDG (NRM and AE)

Dr. S. K. Chaudhari, DDG (NRM and AE) ICAR, New Delhi visited Ginning Training Centre (GTC) of ICAR-CIRCOT, Nagpur on September 15, 2021. The renovated Farmers' Hostel of GTC, Nagpur was inaugurated by his hands in presence of Dr. B. S.

Dwivedi, Director, NBSS&LUP, Nagpur and Dr. Sujata Saxena, Director, ICAR-CIRCOT, Mumbai. Dr. Chaudhari also visited the facilities at GTC and witnessed the demonstration of various processing plants, machineries and testing facilities.



Dr. R. K. Singh, ADG (Commercial crops)

Dr. R. K. Singh, ADG (Commercial crops), Crop Science Division visited ICAR-CIRCOT, Mumbai on 13th October, 2021. He visited the research laboratories, Pilot plant and incubation facilities established in the Institute.

Uganda visited Ginning Training Centre of ICAR-CIRCOT, Nagpur on 21st September, 2021.

Dr. C. R. Mehta, Director, ICAR-CIAE, Bhopal

Dr. C. R. Mehta, Director, ICAR-CIAE, Bhopal visited CIRCOT, Mumbai on 12th November, 2021. An interaction meeting with him and scientists of Agricultural Engineering discipline in the institute and HODs was organised with the objective of exploring possible collaborations in research, training, facility sharing etc.



High Commissioner of Uganda

H. E. (Ms.) Grace Akello, High Commissioner of

13. SWACHH BHARAT ABHIYAN

On 2nd October, 2021 a cleanliness drive to spread awareness was organised by staff members residing in staff quarters in Mahim at 'Veer Abhimanyu Udyan' Mahim, Mumbai as part of 'Special National Swachhta Campaign' mission. The garden was cleaned and the public in park was requested not to litter in the park. The swachhta drive was organized by following COVID-19 norms. Similarly, the road outside the park was also cleaned.

On the occasion of ICAR's Special National Swachhta Campaign on "Waste to Wealth", on 12th October, 2021 around 28 staff members of ICAR-

CIRCOT Mumbai actively participated in the maintenance and charging of the aerobic compost bin and planted saplings using the compost made earlier from the bin.

As per the guidelines received from the Council, a special "Swachh Bharat Abhiyan" campaign was launched in ICAR-CIRCOT, Mumbai and its regional stations from 16th December to 31st December, 2021 by undertaking various activities like Swachhta pledge, organizing drawing competition, special drives on cleanliness, etc. Following activities were carried out during the programme.

Sl. No.	Date	Activities
1.	16.12.2021	Displayed banner at prominent places. Director administered the oath to all the staff to maintain cleanliness of their working places and residential premises.
2.	17.12.2021	Stock taking on digitization of office records/ e-office implementation was done.
3.	18.12.2021	Arranged Cleanliness and sanitation drive in the villages adopted under the Mera Gaon Mera Gaurav Programme involving village community.
4.	19.12.2021	The ICAR-CIRCOT aerobic compost bin was invigorated by the addition of fresh microbial inoculum. The Institute's gardener, who maintains the compost bin, was felicitated at the hands of Director Dr. Sujata Saxena.
5.	20.12.2021	Eco-friendly Kulhad (terrakotta) cups were introduced in canteen as an alternative to the use of plastic cups. Simultaneously, a poster session was arranged to sensitize the institute staff and neighbours about the issues being faced due to the use of single-use plastics and alternate technologies available to mitigate the issues were explained to them.
6.	21.12.2021	ICAR-CIRCOT Unit, Coimbatore was engaged in massive cleaning work inside and outside the campus. The office was totally cleaned, unwanted files were removed, plastic wastes and other unnecessary items were removed.
7.	22.12.2021	Cleanliness and sanitation drive was arranged within campuses
8.	23.12.2021	'Kisan Diwas 2021' was celebrated at Ginning Training Centre, Nagpur on December 23, 2021. The programme was attended by about fifty farmers and equal number of students from nearby villages.
9.	24.12.2021	A Swachhta Awareness Campaign with emphasis on cleanliness and conversion of agro-waste to wealth was organised at Begu village in Sirsa district, Haryana.
10.	25.12.2021	A major cleanliness drive was arranged at a local garden "Veer Abhimanu Udyan" located at Mahim in Mumbai with the special emphasis to remove the non-biodegradable materials and to clean public places.
11.	26.12.2021	A Webinar was organised on "Cleanliness in Daily Life" by Dr. P. Jagajanantha, Scientist. Also, a Drawing Competition for Children was organized on the topic "Swachh Ghar, Swachh Parisar, Swachh Bharat". Eleven school children of various age group participated in the competition.

Sl. No.	Date	Activities
12.	27.12.2021	A cleanliness programme was organized by the staff at headquarter as well as in the premises of Surat regional unit of the institute.
13.	28.12.2021	A cleanliness programme was organized in the residential area by the staff of Sirsa, regional unit of the institute.
14.	29.12.2021	A cleanliness programme was organized in the residential area by the staff of ICAR-CIRCOT, Mumbai unit.
15.	30.12.2021	A cleanliness programme was organized in the residential area by the staff of ICAR-CIRCOT, Mumbai unit.

Some photographs taken during the above mentioned activities conducted under “Swachh Bharat Abhiyan” in the institute, are attached below :



Cleaning programme at Veer Abhimanyu Udyan, Mahim



Director administered the oath to maintain cleanliness



Kisan Diwas programme at GTC, Nagpur



Cleaning programme at public places



Aerobic composting of biodegradable waste



Cleaning programme at staff quarters premises



Banner of Swachh Bharat Abhiyan



Disposal of the waste materials at office premises

14. MERA GAON MERA GAURAV

Under the Mera Gaon Mera Gaurav (MGMG) initiative, ICAR-CIRCOT identified and adopted 12 new villages in Nagpur district of Vidarbha region in Maharashtra in July 2021. During the first half of the year 2021, the programme was successfully implemented in 30 villages of Wardha district identified earlier. Experience gained in the Wardha district was utilized to formulate the action plan for assisting the farmers of the adopted villages in increasing their farm income and reducing the input cost. Six multidisciplinary teams comprising of four-five scientists in each team have been formed and two villages were allotted to each team for implementation of the programme.

The farmers of the adopted villages were provided technical knowhow on best cotton production and harvesting practices, value addition to agro-residues, quality-based marketing, etc. by the experts of ICAR-CIRCOT, ICAR-CICR, ginneries, textile industries, etc. A number of regular programmes i.e. interaction (online/personal) with farmers, awareness programmes, field and technology demonstrations, kisan gosthis/meets, skill development and knowledge enhancement programmes were organised in the adopted MGMT villages for sustainable cotton production and doubling farm income. In addition, the interaction of experts from other research institutes was also arranged for providing crop specific advice on the package of practices to the farmers, thus created a linkage between farmers and research institutes, NGOs, state departments and industry.



Distribution of vegetable seeds at Village Yerla on 17th September, 2021

The severe 2nd wave of COVID19 pandemic limited personal interactions with farmers and field visits. However, farmers of the adopted villages were in regular touch with the ICAR-CIRCOT scientific and technical team through various online modes. During the reported period, ICAR-CIRCOT conducted one workshop, four webinars, eight village visits, demonstrations and awareness programmes in which about *530 farmers participated*. Latest technologies, processes and products of the Institute were showcased during these programmes and various farming related issues were discussed. Farmers were enlightened through organisation of webinars about application of nano-fertilizers for saving input cost, climate resilient technologies and practices, wealth from waste, natural farming, etc. A number of experts from textile industries, ginneries, local ICAR institutes etc. delivered lectures and created awareness about Indian cotton branding from farmers' perspective.

In and around Nagpur region, where cotton is cultivated in large areas, a number of pellet manufacturing units have come up in less than a year. Demand of over 5000 tonnes of agro-residues per day for running of these pelleting units has been created in and around Nagpur region. Cotton stalks have proved to be an excellent agro-residue for preparation of briquettes and pellets. Awareness was created among farmers for collection, shredding and supply of cotton stalks to nearby briquetting and pelleting units.



Kisan Mela and One-day workshop on World Cotton Day



Farmers - Scientist interaction on 28-09-2021



Special National Rashtriya Swachhata campaign on Wealth to waste 12-10-2021



Nutritional food given to children at Village Yerla on 17-09-2021



Tree plantation at Village Yerla on 17-09-2021



MGMG programme on 15-07-2021 at Mohapa



Zoom meeting on Nanofertilizer on 18-06-2021

Activities undertaken under MGMG Programme in 2021

15. Infrastructural Facilities

ICAR-CIRCOT is well equipped with state-of-art research and testing facilities for conducting research in post-harvest processing of cotton & allied fibres and value addition to crop residues.

Some of the facilities available in the Institute include

- **Fibre, Yarn and Fabric Testing Laboratory:** (With High Volume Instrument and Advanced Fibre Information System): The laboratory has all the instruments for analysing the quality parameters of the Cotton and other fibres, yarn and fabrics. Besides research, this service is also provided to the traders and other stakeholders in the cotton value chain.
- **Nanocellulose Pilot Plant Facility:** Capacity to produce 10 kg of Nanocellulose per day. The Service is extended to Research organizations, Industrial stakeholders for carrying out studies on application of nanocellulose.
- **National Laboratory for Advanced Material Characterization:** To support research, testing and incubation needs of start-ups, students, researchers, entrepreneurs and industries, the laboratory is adequately equipped with sophisticated instruments like X-ray Diffractometer, X-ray fluorescence spectrometer, Weather-O-meter, Automatic single yarn tensile strength tester, Particle size analyser, Goniometer, Polarized light microscope and Security Feature Detection System etc.



3D printer

- Other Unique research and instrumentation facility available at the institute include Scanning Electron Microscopy (SEM); DREF Spinning Machines; Kawabata Evaluation System (KES); Atomic Force Microscopy (AFM); Thermo Gravimetric Analyser; Fourier Transformation Infrared Spectrometer; Atomic Absorption Spectrometer; Ultra High-Pressure Homogenizer; Particle size analyser; Gas Chromatography with Mass Spectrometer.
- Pulp and paper making and testing lab
- Electrospinning Facility
- Computerised sample Weaving Facility
- Composite Lab facility
- Modern Ginning and Pressing Plant
- Pilot scale scientific Cottonseed Processing Plant
- Pilot Plant for Particle Board Manufacturing: One tonne per day production capacity plant is established in Nagpur. The facility is used by Incubatees to undertake scale up trials.
- Pelleting Plant at GTC, Nagpur
- Weaving Laboratory

Smart Textile Laboratory

During the year, a **Smart Textile Laboratory** facility for development of smart textile and e-textile products was created. The facility comprises of

- **3D printer** to create innovative models using various filaments like PLA, ABS, PETG, nylon etc.
- **High resistivity testing instrument** for both surface and volume resistivity measurements.
- Oscilloscope



Soldering Station

Annexure 1

Ongoing Research Projects Institute Funded Projects

S. No.	Title	Investigators	Duration
Core Area I: Pre-Ginning and Ginning			
1.	Development of Digital Ginning Percent Indicator for Portable Cotton Gins	V. G. Arude (PI) S. K. Shukla P. S. Deshmukh	01-04-2020 to 31-03-2022
2.	Assessment of suitability of adoption of seed cotton contamination cleaner for contamination and trash control in Indian ginning industry	V. G. Arude (PI) S. K. Shukla S. S. Kautkar	01-04-2020 to 31-03-2022
3.	Device for seed cotton ginning percentage measurement	P. S. Deshmukh (PI) V. G. Arude M. K. Mahawar	01-04-2020 to 31-03-2023
4.	Optimization of groove profile and diameter of chrome leather roller for enhancing the performance of double roller gin	S. S. Kautkar (PI) S. K. Shukla S. V. Ghadge V. G. Arude	01-04-2020 to 31-03-2022
5.	Development of a seed cotton trash content analyser based on pneumatic fractionation methodology	S. K. Shukla (PI) S. V. Ghadge V. G. Arude	01-04-2021 to 31-03-2023
Core Area II: Mechanical Processing, Technical Textiles and Composites			
6.	Evaluation of spinnability and formulation of guidelines for spinning of recycled fibre from fabric waste and develop value added products	T. Senthilkumar (PI) G. Krishna Prasad V. G. Arude A. S. M. Raja	01-04-2020 to 31-03-2023
7.	Development of cellulosic nanofibre based micronutrient delivery system for urban farming	G. T. V. Prabu (PI) T. Senthilkumar N. Vigneshwaran	01-04-2020 to 31-03-2023
8.	Development of filter fabric for indoor decontamination	Kirti Jalgaonkar (PI) P. Jagajanantha	01-04-2020 to 31-03-2022
9.	Development of cut-resistant fabric using 3D weaving	G. Krishna Prasad (PI) T. Senthilkumar A. S. M. Raja	01-04-2021 to 31-03-2024
Core Area III: Characterisation of Cotton and other Natural Fibres, Yarns and Textiles			
10.	AICRP on Cotton (Quality Research)	P.K. Mandhyan (PI) A. Arputharaj P. Jagajanantha G. T. V. Prabu	Continuous
11.	Development of Electrically conductive cotton materials	P. Jagajanantha (PI) G. T. V. Prabu Kirti Jalgaonkar Sharmila Patil	01-04-2021 to 31-03-2023



S. No.	Title	Investigators	Duration
12.	Development of Machine Learning Model for Trash content Analysis based on High Volume Instrument and Gravimetric Method of Trash content Estimation	Himanshushekhar Chaurasia (PI) T. Senthilkumar P. Jagajanantha	01-09-2021 to 31-08-2023
Core Area IV: Chemical and Biological Processing, Biomass and By-products Utilisation			
13.	Toxicological and Environmental impact of ICAR - CIRCOT's nanomaterials (Nanocellulose, Nanosilver and Nano-ZnO)	N. Vigneshwaran (PI) A. K. Bharimalla A. S. M. Raja A. Arputharaj Kanika Sharma	01-04-2020 to 31-03-2023
14.	Development of a healthier cottonseed based cooking oil by blending with other vegetable oils	Sujata Saxena (PI) Manoj Kumar Kanika Sharma	01-10-2020 to 30-09-2022
15.	Development of Health Drink from cottonseed	Manoj Kumar (PI) Sujata Saxena Kanika Sharma	01-04-2021 to 31-03-2022
16.	Development of microbial xylanase enzyme based process for eco-friendly bleaching of paper pulp	Ajinath Dukare (PI) Kanika Sharma N. Vigneshwaran Sujata Saxena	01-04-2021 to 31-03-2023
Core Area V: Entrepreneurship and Human Resource Development			
17.	Refinement and popularisation of nutrient-enriched compost production from cotton micro-dust	K. Pandiyan (PI) S. K. Shukla S. S. Kautkar	01-04-2020 to 31-03-2022
18.	Development of process protocol for synthesis of nano-sulphur and its application in agriculture	M. K. Mahawar (PI) A. K. Bharimalla N. Vigneshwaran A. Arputharaj	01-04-2020 to 31-03-2022
19.	Impact Assessment of CIRCOT technologies	C. Sundaramoorthy (PI) A. K. Bharimalla Himanshushekhar Chaurasia	01-04-2020 to 31-03-2025

Inter-Institutional Projects

S. No.	Title	Investigators		Duration
		ICAR-CIRCOT	Collaborating Institution	
20.	Development of biocompatible nano-clay polymer composites and nanoparticles with reference to retention and release of iron and zinc in Grape (<i>Vitis Vinifera</i> L.)	P. K. Mandhyan (CCPI) Sharmila Patil	<i>ICAR-NRC Grapes</i> Yukti Verma (PI) A. K. Upadhyay	01-04-2020 to 30-06-2023



S. No.	Title	Investigators		Duration
		ICAR-CIRCOT	Collaborating Institution	
21.	Efficacy evaluation of ICAR-CIRCOT Nano-ZnO as nanofertilizer in field crops	N. Vigneshwaran (PI) A. K. Bharimalla A. Arputharaj	ICAR-IIPR, Kanpur K. Mrunalini (CCPI) C. P. Nath C. S. Praharaj ICAR-CICR, Nagpur and Coimbatore D. Kanjana (CCPI) A. Manikandan (CCPI) ICAR-NIASM, Baramati Paritosh Kumar (CCPI) Aliza Pradhan	01-04-2021 to 31-03-2024
22.	Development of eco-friendly fruit protection bags for quality enhancement	Jyoti Dhakane-Lad (PI) M. K. Mahawar P. Jagajanantha Kirti Jalgaonkar A. K. Bharimalla	ICAR-NRC Grapes Ajay Kumar Sharma (CCPI) Nishant A. Deshmukh Ahammed Shabeer T. P.	01-04-2021 to 31-03-2023
23.	Development of bionanocomposite films using extrusion process	Sharmila Patil (PI) A. K. Bharimalla Kirti Jalgaonkar M. K. Mahawar Jyoti Dhakane-Lad A. S. M. Raja Sujata Saxena	CIPET:SARP-LARPM, Bhubaneswar Smita Mohanty (CCPI) Manoranjan Biswal Himalaya Vardikar	01-09-2021 to 31-08-2023
24.	Efficacy evaluation of ICAR-CIRCOT Nano-Sulphur as fertilizer formulation for different field crops	A. K. Bharimalla (PI) M. K. Mahawar N. Vigneshwaran A. Arputharaj Jyoti Dhakane-Lad A. S. M. Raja Sujata Saxena	ICAR-IISS, Bhopal Tapan Adhikari (CCPI) Prabhat Tripathi Ajay Rahul Mishra Abhinab Dash Vasanda Coumar J. K. Saha A. K. Patra ICAR-DOGR, Pune A Thangasamy (CCPI) Sourav Ghosh Ashok Kumar Bhushan Bibwe MPKV, Rahuri B. D. Bhakare A. G. Durgude S. R. Shelke N.A. Musmade	01-07-2021 to 31-03-2024

Consortia Research Platform (CRP) on Natural Fibres

S. No.	Title	Investigators	Duration
25.	Development of cotton incorporated Personal Protective Equipment (PPE) body suit with smart respirator for healthcare workers with enhanced comfort	P. K. Mandhyan (PI) A. Arputharaj A. S. M. Raja P. Jagajanantha Kirti Jalgaonkar	01-04-2020 to 31-03-2022
26.	Development of Cotton Based face mask with improved particle filtration efficiency and breathability using electro spun nano materials and antiviral coatings -	A. S. M. Raja (PI) T. Senthilkumar G. Krishna Prasad G. T. V. Prabu N. Vigneshwaran C. Sundaramoorthy A. K. Bharimalla P. K. Mandhyan	01-04-2020 to 31-03-2023

Externally Funded Projects

27.	Agri Business Incubation Centre at ICAR – CIRCOT, Mumbai (NAIF -Incubation Fund)	A. K. Bharimalla (PI) S. K. Shukla N. Vigneshwaran P. K. Mandhyan V. G. Arude C. Sundaramoorthy	01-04-2015 to 31-03-2023
28.	An Inclusive Agribusiness Model for Sustainable Cotton Marketing in the State of Maharashtra (NASF)	C. Sundaramoorthy (PI) G. Krishna Prasad	2018-21
29.	Remunerative Approaches for Agriculture and Allied Sectors Rejuvenation (RAFTAAR) - Agribusiness Incubation Centre (R-ABI) (DAC&FW)	A. K. Bharimalla (PI) C. Sundaramoorthy P. S. Deshmukh V. G. Arude P. K. Mandhyan N. Vigneshwaran Sharmila Patil S. K. Shukla Hamid Hasan Bharat Pawar Prachi Mhatre	31-01-2019 to 31-01-2023
30.	Design and Development of Pilot Plant for Extraction of Protein from Deoiled Cotton Cake and Value Addition/(By-Products Utilization) (DST)	D. M. Kadam (PI) Manoj Kumar V. G. Arude	01-03-2021 to 28-02-2023

Annexure II

PERSONNEL

(As on December 31, 2021)

DIRECTOR (Acting)

Dr. Sujata Saxena

M.Sc., Ph.D., FTA (Organic Chemistry)

Head i/c, Chemical and Biochemical Processing Division & Technology Transfer Division

SCIENTIFIC STAFF

HQ, MUMBAI

PRINCIPAL SCIENTIST

1. Dr. P.G.Patil, M.Tech. (PHE), Ph.D. (Engg.), FTA, F. ISAE (Agricultural Process Engineering) (on deputation as VC, MPKV, Rahuri since 2.3.2021)
2. Dr. Dattatreya M. Kadam, M. Tech, Ph.D (Agricultural Process Engineering)
3. Dr. N. Shanmugam, M. Tech., MIE, D.TT., Ph.D. (Textile Manufacture & Technology)
4. Dr. A. S. M. Raja, M. Sc., Ph.D. (Textile Chemistry) Head i/c, Quality Evaluation and Improvement Division
5. Dr. P. K. Mandhyan, M.Sc., Ph.D., A.T.A (Technical Textiles) Head i/c, Mechanical Processing Division
6. Dr. N. Vigneshwaran, M.Sc. (Agri.), M.B.A., Ph.D. (Agricultural Microbiology)
7. Dr. P. S. Deshmukh, M. Tech., Ph.D., FIE. (Farm Machinery & Power)
8. Dr. C. Sundaramoorthy, M.Sc., Ph.D. (Agricultural Economics)

SENIOR SCIENTIST

1. Dr. (Mrs.) Jyoti M. Nath, M.Sc., Ph.D. (Electronics & Instrumentation)
2. Dr. A. K. Bharimalla, M. Tech., Ph.D. (Composite)
3. Dr. V. G. Arude, M. Tech. Ph.D. (Farm Machinery & Power)

SCIENTIST

1. Dr. A. Arputharaj, M.Sc., M. Tech., Ph.D. (Textile Chemistry)
2. Dr. T. Senthilkumar, M. Tech., Ph.D. (Textile Manufacture)
3. Dr. G. Krishna Prasad, M. Tech., Ph.D. (Textile Tech.)
4. Dr. Jalgaonkar Kirti Ramesh, M.Sc. (PHT), Ph.D., (Agricultural Structures and Process Engineering)
5. Dr. Dukare Ajinath Sridhar (Agricultural Microbiology)
6. Dr. Manoj Kumar Mahawar, M.Tech. Ph.D. (DPHT)(Agricultural Structures and Process Engineering)
7. Dr. G. T. V. Prabu, M. Tech. Ph.D. (Textile Tech.)
8. Dr. P. Jagajanantha, M. Tech., Ph.D. (Textile Tech.)
9. Dr. Kautkar Sheshrao Sakharam, M.Sc. Ph.D. (Agricultural Structures and Process Engineering)
10. Dr. (Smt.) Sharmila Patil, M.Sc. (P.H.T.), Ph.D. (Agricultural Process Engineering)
11. Dr. (Smt.) Archana Mahapatra, M.Tech., Ph.D. (Agricultural Process Engineering)
12. Dr. Manoj Kumar, M.Sc., Ph.D. (Plant Biochemistry)
13. Dr. (Smt.) Jyoti Dhakane- Lad, M.Tech. Ph.D. (Agricultural Process Engineering)
14. Dr. Kanika Sharma, M.Sc., Ph.D, (Plant Biochemistry)
15. Shri Himanshu Shekhar Chaurasia, M.Sc. (Computer Application & IT)



GTC, NAGPUR

PRINCIPAL SCIENTIST

- | | |
|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| 1. Dr. S. K. Shukla, M. Tech., Ph.D. (Agricultural Process Engineering), Officer-In-Charge, GTC | 2. Dr. S. V. Ghadge, M.E. (Ag.) M.B.A., Ph.D. (Farm Machinery & Power) |
|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|

SCIENTIST

- | | |
|------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1. Dr. K. Pandian, M.Sc. Ph.D. (Agricultural Microbiology) | 2. Er. (Ms.) Varsha Satankar, M.Tech. (Agricultural Structures and Process Engineering) |
|------------------------------------------------------------|-----------------------------------------------------------------------------------------|

TECHNICAL STAFF

HQ, MUMBAI

CHIEF TECHNICAL OFFICER

- | | |
|------------------------------------------------|------------------------------------|
| 1. Dr. (Smt.) Sheela Raj, M.Sc., Ph.D. | 5. Shri S. Banerjee, M.Sc. |
| 2. Shri T. Venugopal, B.E. | 6. Shri B. R. Pawar, M. Sc., LL.M. |
| 3. Dr. (Smt.). N. M. Ashtaputre, M.Sc., Ph. D. | 7. Shri R. K. Jadhav, M.Sc. |
| 4. Shri R. S. Prabhudesai, M.Sc., D.C.M. | |

ASSISTANT CHIEF TECHNICAL OFFICER

- | | |
|------------------------------------------------------|----------------------------------------|
| 1. Shri C. M. More, M.Sc. | 6. Shri K. Narayanan, B.Sc. |
| 2. Shri R. R. Chhagani, M.Sc. | 7. Smt. P. S. Nirhali, M.Sc. |
| 3. Shri H. S. Koli, M.Sc., LL.B. | 8. Shri S. V. Kokane, M.A. |
| 4. Dr. (Smt.) S. R. Kawlekar, M.Sc., P.I.M.R., Ph.D. | 9. Shri D. U. Kamble, B.Sc. |
| 5. Shri P. N. Sahane, D.I.F.T. | 10. Er. Chandrika Ram, M. Tech. (APFE) |

SENIOR TECHNICAL OFFICER

- | | |
|------------------------------------------|---------------------------------------------------|
| 1. Smt. Binu Sunil, M.Sc. | 4. Shri R. S. Narkar, M.Sc., D.C.I.A. |
| 2. Smt. Bindu Venugopal, M.Sc. | 5. Smt. P. R. Mhatre, B.Sc., P.G.D.E.P.C.T., MLIS |
| 3. Dr. (Ms.) C. P. D'Souza, M.Sc., Ph.D. | |

TECHNICAL OFFICER

- | | |
|--------------------------------------------------------------------------|------------------------------------------------------|
| 1. Shri V. D. Kalsekar, B.Sc. | 4. Shri S. N. Patil, B.E. (Civil) |
| 2. Shri C. V. Shivgan, Cert. Elec. Supr. PWD, Cert. M. & A.W. Technician | 5. Shri N. D. Kambli, M.Sc. |
| 3. Shri M. G. Ambare, M.Sc. | 6. Shri D. M. Correia, I.T.I., N.C.T.V.T. (Mechanic) |

SENIOR TECHNICAL ASSISTANT

- | | |
|--------------------------------------|------------------------------|
| 1. Smt. H. R. Pednekar, B.A., B.Lib. | 4. Shri A. R. Jadhav, B.Sc. |
| 2. Shri R. P. Kadam, M.Sc. | 5. Shri Krishna Bara, D.H.T. |
| 3. Smt. M. P. Kamble, B.A., M.Lib. | |

TECHNICAL ASSISTANT

- | | |
|---------------------------------------------|-------------------------------------------------------|
| 1. Shri S. K. Parab, Cert. Cot. Spin. | 4. Shri P. G. Gavhale, B.Sc. (Agri.), Dip. Agrl. Sci. |
| 2. Shri D. A. Salaskar, Driver | 5. Shri D. M. Raje |
| 3. Shri P. P. Thakur, B. Tech. (Agrl. Eng.) | 6. Shri R. R. Gosai |



SENIOR TECHNICIAN

1. Shri Mahabir Singh
2. Shri S. V. Kokane, Driver
3. Shri M. M. Kadam
4. Shri S. G. Phalke
5. Shri D. J. Dhodia
6. Shri Yogesh Nagpure

TECHNICIAN

1. Kum. Nevali S. Pathare
2. Shri P. P. Patil
3. Shri D. G. Gole
4. Shri S. S. Surkule
5. Shri Suhas R. Tondse

GTC, NAGPUR

CHIEF TECHNICAL OFFICER

1. Er. D. U. Patil, B. Tech. (Agril. Engg.)

ASSISTANT CHIEF TECHNICAL OFFICER

1. Shri U. D. Devikar, M.Sc.
2. Shri S. L. Bhanuse, M.Sc

SENIOR TECHNICAL OFFICER

1. Shri R. G. Dhakate, B.Sc.

TECHNICAL OFFICER

1. Shri B.V. Shirsath, B.A., I.T.I

QE UNIT, COIMBATORE

1. Shri K. Thiagarajan, M.Sc., Chief Technical Officer
2. Shri M. Bhaskar, Dip. Ref. & Air-Cond., Technical Officer

QE UNIT, DHARWAD

1. Smt. V. G. Udikeri, M.Sc., Technical Officer
2. Shri A. F. Gudadur, Technician

QE UNIT, GUNTUR

1. Shri S. N. Hedau, B.Sc.

QE UNIT, SIRSA

1. Dr. Hamid Hasan, M.Sc., Ph.D., Chief Technical Officer
2. Dr. Jal Singh, M.Sc., Ph.D., Senior Technical Officer
3. Shri Umrao Meena, Senior Technician

QE UNIT, SURAT

1. Shri M. B. Patel, B.Sc., L.L.B, Senior Technical Officer

ADMINISTRATIVE STAFF

HQ, MUMBAI

Sr. ADMINISTRATIVE OFFICER : Shri Sunil Kumar, B.A. (Hons.)

Sr. FINANCE & ACCOUNTS OFFICER : Shri M. Radhakrishnan

ADMINISTRATIVE OFFICER : Smt. Sujata Koshy, B.Com.



ASSISTANT ADMINISTRATIVE OFFICER

1. Smt. T. P. Mokal, M.A.(Hindi)
2. Shri S. A. Telpande, M.Com.
3. Smt. N. M. Deshmukh, M.A., LL.B.
4. Shri S. D. Ambolkar

ASSISTANT

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

UPPER DIVISION CLERK

1. Shri S. S. Angane
2. Shri S. N. Bandre
3. Smt. V. N. Walzade, B.A.

LOWER DIVISION CLERK

1. Shri Avinash Aman, B. Tech.
2. Shri S. N. Sahane
3. Shri D. K. Kasar
4. Shri S. M. Chandanshive

PRIVATE SECRETARY : Smt. U. N. Bhandari

PERSONAL ASSISTANT

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

GTC, NAGPUR

LOWER DIVISION CLERK : Shri R. G. Matel

PERSONAL ASSISTANT : Shri R. D. Shambharkar, M.A.

SKILLED SUPPORT STAFF

HQ, MUMBAI

1. Shri M. J. Sumra
2. Shri K. T. Mahida
3. Shri H. B. Vesmiya
4. Shri M. M. Katpara
5. Shri S. K. Bobate
6. Shri R. G. Tak
7. Shri R. P. Karkate
8. Shri S. B. Worlikar
9. Shri M. K. Prabhulkar
10. Shri J. D. Sakpal
11. Shri V. Murugan
12. Shri S. D. Magar
13. Shri Sunil R. Tondse
14. Shri V. B. Poojari
15. Shri S. P. Naik
16. Shri M. N. Kamble
17. Smt. Kamala Murugan
18. Shri D. R. Gawde
19. Shri P. E. Gurav
20. Shri Mahesh C. Solanki
21. Shri Thapa Gorkha Bahadur Ovilal

GTC, NAGPUR

1. Shri R. S. Umare
2. Smt. M. M. Bhandakkar

QE UNIT, COIMBATORE

1. Shri V. Subbaiah

QE UNIT, SURAT

1. Shri M. G. Sosa

APPOINTMENTS

Kum. Nevali S. Pathare appointed to the post of Technician (T-1) (DR) w. e. f. 03-11-2021.

SCIENTIST PROBATION COMPLETION

Dr. Archana Mahapatra, Scientist (APE), completed probation on 04-07-2018

Dr. Sharmila Patil, Scientist (APE), completed probation on 04-07-2018

Dr. Manoj Kumar, Scientist (Plant Biochemistry) completed probation on 04-07-2018.

Dr. Jyoti Dhakne-Lad, Scientist (APE), completed probation on 04-01-2019.

PROMOTIONS

Sr. No.	Name of Staff	Grade to which Promoted	Effective Date of Promotion
1.	Dr. P. S. Deshmukh	Principal Scientist	12-08-2019
2.	Dr. C. Sundaramoorthy	Principal Scientist	11-08-2020
3.	Dr. V. Mageshwaran	Senior Scientist RGP 8000/-	04-11-2018
4.	Dr. Santanu Basak	Scientist (RGP 7000/-)	15-09-2016
5.	Dr. P. Jagajanantha	Scientist (RGP 7000/-)	01-07-2017
6.	Dr. G. T. V. Prabu	Scientist (RGP 7000/-)	15-09-2016
7.	Shri P. V. Jadhav	Assistant Administrative Officer	05-02-2021
8.	Smt. V. R. Naik	Personal Assistant	20-07-2021
9.	Shri V. M. Sable	Assistant	20-07-2021
10.	Shri M. Radhakrishnan	Senior Finance and Accounts Officer	29-12-2021
11.	Shri P. P. Patil	Technician (T-1) Lab	15-12-2021
12.	Shri D. G. Gole	Technician (T-1) Lab	15-12-2021
13.	Shri A. F. Gudadur	Technician (T-1) Lab	15-12-2021
14.	Shri S. S. Surkule	Technician (T-1) Lab	15-12-2021
15.	Shri S. R. Tondse	Technician (T-1) Lab	15-12-2021
16.	Shri D. K. Kasar	Lower Division Clerk	17-12-2021
17.	Shri S. M. Chandanshive	Lower Division Clerk	17-12-2021
18.	Shri Tushar D. Dhamange	Assistant	23-12-2021
19.	Smt. J. R. Chavkute	Assistant	28-12-2021

TRANSFERS

Scientists

- Dr. Dukare Ajinath Shridhar, Scientists transferred from ICAR-CIPHET, Ludhiana joined ICAR-CIRCOT on 03-03-2021.
- Dr. S. S. Kautkar, Scientist transferred from GTC of ICAR-CIRCOT to ICAR-CIRCOT, Mumbai w. e. f. 27-02-2021.
- Dr. N. Shanmugam, Principal Scientist transferred from ICAR-CSWRI, Avikanagar joined ICAR-CIRCOT, Mumbai on 04-10-2021.

Technical

- Shri C. M. More, ACTO transferred form Q. E. Unit of ICAR-CIRCOT, Guntur to ICAR-CIRCOT, Mumbai w. e. f. 21-12-2021.

**Administrative**

- Smt. Pooja Tiwari on Inter-institutional transfer to ICAR-IARI, New Delhi relieved on 19-06-2021 (AN).
- Kum. Himani P. Singh, Assistant on 3 years deputation to the Warehousing Development and Regulatory Authority, New Delhi relieved w. e. f. 12-08-2021 (AN).
- Shri Yogesh R. Pathare, Consequent on his promotion and appointment to the post of Administrative Officer at ICAR-CCRI, Nagpur relieved on 12-11-2021 (AN).
- Shri S. V. Kasabe, Consequent on his promotion and appointment to the post of Finance and Accounts Officer at ICAR-CIFE, Mumbai relieved on 24-11-2021 (AN)

RETIREMENTS

1. K. Parleshwar, AAO, superannuated on 31st January 2021.
2. Smt. C. D. Prabha, Senior Technical Officer, superannuated on 31st March 2021
3. Dr. M.V. Vivekanandan, Chief Technical Officer, superannuated on 30th April 2021
4. Shri P. V. Jadhav, Assistant Administrative Officer, superannuated on 31st May, 2021
5. Shri R. B. Kautkar, Skilled Support Staff at GTC, Nagpur superannuated on 31st August, 2021

OBITURY

- Shri L. R. Indurkar, retired Supporting Staff Gr.IV expired on 26th January, 2021
- Shri S. B. Kamble, Retired T-3, expired on 22nd February, 2021
- Dr. Y. Subramanyam, retired Senior Scientist expired on 5th April, 2021
- Shri M. Y. Chandanshive, Retired T-3, expired on 19th April, 2021
- Dr. S. B. Jadhav, Retired Principal Scientist expired on 20th April, 2021
- Shri P. Ramamurthy, retired Senior Administrative Officer expired on 17th August, 2021
- Shri T. S. Mhaske, Retired T-I-3 expired on 9th December, 2021
- Shri C. L. Mundale, Retired T-I-3 expired on 19th December, 2021
- Dr. Sudha Tiwari, Chief Technical Officer expired on 25th December, 2021

Annexure III

LIST OF COMMITTEES

Institute Management Committee (IMC)

Dr. P. G. Patil	Director, CIRCOT (Chairman - up to March 2021)
Dr. Sujata Saxena	Director (A), CIRCOT Chairman - April 2021)
Dr. S. N. Jha	ADG (PE), ICAR, New Delhi
Dr. Abhijit Kar	Principal Scientist, ICAR-IARI, New Delhi
Dr. G. Balasubramani	Principal Scientist, ICAR-CICR, Nagpur
Dr. Vilas Kharche	Director of Research, Dr. PDKV, Akola
Dr. L. K. Nayak	Principal Scientist, ICAR- NINFET, Kolkata
Shri D. B. Sawale Patil	Buldana, Maharashtra (up to 4.2.21)
Dr. (Smt.) Sujata Saxena	Principal Scientist, ICAR-CIRCOT, Mumbai
Shri Sunil Kumar	Sr. AO, Member Secretary

Research Advisory Committee (RAC)

Dr. N. C. Patel	Former VC, JAU & AAU, Chairman
Dr. M. K. Sharma	CEO, M/s. Bajaj Steel Industries Ltd, Nagpur
Prof. (Dr.) U. J. Patil	Head, Department of Textiles D.K.T.E., Ichalkaranji
Dr. N. N. Mahapatra	Business Head (Dyes) Shree Pushkar Chemicals & Fertilisers Ltd.
Prof. (Dr.) S. R. Shukla	Former Professor, ICT, Mumbai
Dr. Narendra G. Shah	Professor, IIT Mumbai
Dr. Sujata Saxena	Director (Acting), ICAR-CIRCOT, Mumbai
Dr. S. N. Jha	ADG (PE), ICAR, New Delhi
Dr. V. G. Arude	Senior Scientist, Member-Secretary

Project Monitoring and Evaluation Committee (PMC)

Dr. Sujata Saxena	Director (A) & In-charge Head, CBPD Chairman
Dr. P. K. Mandhyan	In-charge Head, MPD
Dr. A. K. Bharimalla	In-charge, Head, TTD (upto Aug. 2021)
Dr. V. G. Arude	in-charge MPD (upto Aug. 2021)
Dr. A. S. M. Raja	In-charge PME Cell & QEID, Member secretary

Priority-setting, Monitoring & Evaluation (PME) Committee

Dr. A. S. M. Raja	Principal Scientist, In-charge
Dr. A. K. Bharimalla	Senior Scientist
Dr. P. K. Mandhyan	Principal Scientist
Dr. N. Vigneshwaran	Principal Scientist
Dr. C. Sundaramoorthy	Principal Scientist

**Priority-setting, Monitoring & Evaluation (PME) Cell**

Dr. A. S. M. Raja	Principal Scientist, In-charge
Dr. GTV Prabu	Scientist, Nodal Officer, PME
Shri K. Narayanan	ACTO
Smt. H. R. Pednekar	STA
Shri Anand R Jadhav	STA

Institute Technology Management Committee (ITMC)

Dr. Sujata Saxena	Director (A), Chairman
Dr. P. K. Mandhyan	Principal Scientist, I/c. Head, MPD
Dr. A. S. M. Raja	Principal Scientist, CBPD, I/c QEID & PME Cell
Dr. C. Sundaramoorthy	Principal Scientist, TTD
Dr. G. Krishna Prasad	Scientist, MPD
Dr. B. B. Nayak	Principal Scientist, CIFE, Mumbai
Dr. A. K. Bharimalla	Senior Scientist, Member Secretary

Institute Technology Management Unit (ITMU)

Dr. A. K. Bharimalla	Senior Scientist, Officer-In-charge
Dr. P. K. Mandhyan	Principal Scientist
Dr. N. Vigneshwaran	Principal Scientist
Dr. C. Sundaramoorthy	Principal Scientist
Dr. Nishant D. Kambli	Technical Officer

Institute Joint Staff Council

Dr. Sujata Saxena	Director (A), Chairman
Dr. P. S. Deshmukh	Principal Scientist
Shri Sunil Kumar	SAO
Shri. M. Radhakrishnan	SFAO
Shri R. R. Changani	ACTO
Shri S. A. Telpande	AAO
Staff side members :	
Shri Mahavir Singh	Sr. Technician
Shri Yogesh Nagpure	Technical Assistant
Smt. Smita Paiyala	Assistant
Smt. Bharati Kherodkar	UDC
Shri S. D. Magar	SSS
Shri S. P. Naik	SSS

**Internal Committee**

Dr. (Smt.) Sharmila Patil	Scientist, Chairperson
Smt. Shilpa Charankar	Former Principal, Dr. BNM college of Home science, Matunga, External Member
Dr. P. S. Deshmukh	Principal Scientist
Dr. (Smt.) N. Ashtaputre	CTO
Smt. P. R. Mhatre	STO
Smt. Sujatha Koshy	AO, Member Secretary

Purchase Committee

Dr. P. K. Mandhyan	Principal Scientist & in-charge Head MPD, Chairman
Dr. A. K. Bharimalla	Senior Scientist, TTD
Dr. G. Krishna Prasad	Scientist, MPD
Dr. P. Jagajanantha	Scientist, QEID
Shri Sunil Kumar	SAO
Shri. M. Radhakrishnan	SFAO
Smt. Sujatha Koshy	AO
Shri S. A. Telpande	AAO, Member Secretary

Technical Evaluation Committee

Dr. A. S. M. Raja	Principal Scientist in-charge Head QEID, Chairman
Dr. Senthilkumar	Scientist
Dr. P. Jagajanantha	Scientist
Smt. Sujatha Koshy	AO, Member Secretary

Rajbhasha Committee

Dr. Sujata Saxena	Director (A) & in-charge Head CBPD & TTD Chairperson
Dr. A. S. M. Raja	Principal Scientist, in-charge QEID
Dr. P. K. Mandhyan	Principal Scientist, in-charge, MPD
Shri Sunil Kumar	Senior Administrative Officer
Smt. S. Koshy	AO
Shri M. Radhakrishnan	SFAO
Smt. P. R. Mhatre	STO
Shri S. A. Telpande	AAO
Shri Ashish Chobey	AAO
Smt. N. Deshmukh	AAO
Shri S. D. Ambolkar	AAO
Smt. T. P. Mokal	AAO, Member Secretary

**Grievance Committee**

Dr. Sujata Saxena	Director (A), Chairman
<i>Nominated Members</i>	
Dr. P. K. Mandhyan	Principal Scientist
Shri Sunil Kumar	SAO
Shri M. Radhakrishnan	SFAO
Shri S. A. Telpande	Member Secretary
<i>Elected Members</i>	
Dr. P. S. Deshmukh	Principal Scientist (Scientific Category)
Shri C. V. Shivgan	TO (Technical Category)
Shri Sainath Sahane	LDC (Administrative Category)
Shri. S. B. Worlikar	S. S. S (Skilled Supporting Staff Category)

ABI Advisory Committee

Dr. Sujata Saxena	Director(A), Chairman
Dr. R. P. Kachru	Former ADG (PE), ICAR, New Delhi
Dr. A. J. Shaikh	Former Director, ICAR-CIRCOT, Mumbai
Prof. Narendra G Shah	CTARA, IIT, Mumbai
Dr. M. K. Sharma	Whole Time Director & CEO, Bajaj Steel Industries Limited, Nagpur
Dr. A. K. Bharimalla	Sr. Scientist, Principal Investigator: ICAR-CIRCOT-ABI Centre, Member-Secretary

RAFTAAR-Incubation Committee (RIC) of CIRCOT RABI

Dr. Sujata Saxena	Director (A), Chairman
Mr. Ramesh. R Kadam	Rtd, General Manager, Bank of India, Member (Representative of Bank)
Dr. G. R. Anap	Former International Cotton Consultant, World Bank Project (Africa)
Prof. (Dr.) V. D. Gotmare	Former HOD, Textile Manufacture Department, VJTI, Mumbai
Prof. (Dr.) A. S. Vastrad	Professor and Dy. Director, Student Welfare, University of Agricultural Science (UAS), Dharwad
Shri. Abasaheb K. Haral	Rtd. Joint Director Agriculture and chief coordinator (PPP-IAD), Dept. of Agriculture, Govt. of Maharashtra
Dr. N. J. Thakor (Invitee)	Former Dean, College of Agriculture Engineering and Technology, DBSKKV, Dapoli
Dr. Ashok K. Bharimalla	Senior Scientist, PI-CEO: CIRCOT R-ABI, Member Secretary

Works Committee

Dr. A. K. Bharimalla	Sr. Scientist, Chairman
Dr. A. Arputharaj	Scientist
Dr. Senthil Kumar	Scientist
Shri B. R. Pawar	CTO
Shri Sunil Kumar	SAO
Shri M. Radhakrishnan	SFAO
Er. T. Venugopal	Officer in-charge Engg., Member Secretary

**Test Fee Revision Committee**

Dr. Sujata Saxena	Director(A) & in-charge Head, CBPD, Chairperson
Dr. P. K. Mandhyan	Principal Scientist and In-charge Head, QEID
Dr. A. K. Bharimalla	Senior Scientist
Dr. V. G. Arude	Senior Scientist
Shri B. R. Pawar	CTO
Smt. P. S. Nirhali	ACTO, Member Secretary

Swachhata Mission Committee

Dr. Sujata Saxena	Director(A), Chairman
Dr. A. S. M. Raja	Principal Scientist
Dr. A. K. Bharimalla	Senior Scientist
Dr. P. Jagajantha	Scientist
Shri Sharad V. Kokane	ACTO Security Officer
Dr. Nishant D. Kambli	Technical Officer, Member Secretary

CRP on Natural Fibres Project Implementation Unit

Dr. Sujata Saxena	Director (A), Nodal Officer
Dr. A. S. M. Raja	Principal Scientist, Lead Centre Project Coordinator
Dr. C. Sundaramoorthy	Principal Scientist
Shri Sunil Kumar	Sr. AO
Shri M Radhakrishnan	FAO
Smt. Sujatha Koshi	AO
Shri S. V. Kasabe	AFAO (upto 24 th November, 2021)

ISO-9001:2015 Management Committee

Dr. Sujata Saxena	Director (A), Chairman Head In-charge, CBPD & TTD
Dr. A. S. M. Raja	Principal Scientist, In-charge Head, QEID & Management Representative
Dr. P.K. Mandhyan	Principal Scientist, In-charge Head, MPD
Dr. A.K. Bharimalla	Senior Scientist, TTD, In-charge, ITMU & ABI
Dr, V.G. Arude	Senior Scientist, MPD
Shri. Sunil Kumar	SAO
Shri. S. Radhakrishnan	SFAO
Shri A. Arputharaj	Scientist, CBPD, Deputy MR & Member Secretary

Library Committee

Dr. A. S. M. Raja	I/c Head, QEID, Chairman
Dr. P. K. Mandhyan	I/c Head, MPD
Dr. N. Vigneshwaran	Principal Scientist, CBPD
Dr. A. K. Bharimalla	Senior Scientist, TTD



Smt. Sujata Koshy	AO
Shri M. Radhakrishnan	SFAO
Smt. Prachi Mhatre	STO, I/c, Library

Committee for Azadi ka Amrit Mahotsav Celebration

Dr. A. K. Bharimalla	Sr. Scientist, TTD, Chairman
Dr. G. T. V. Prabu	Scientist, MPD, Program Coordinator
Dr. Kirti Jalgaonkar	Scientist, QEID
Dr. Kanika Sharma	Scientist, CBPD
Dr. Charlene D'Souza	STO, CBPD
Shri B. R. Pawar	CTO, QEID
Shri S. V. Kokane	ACTO Security Officer
Smt. Sujata Koshy	AO
Smt. Medha Kamble	STA, Library
Shri Anand Jadhav	STA, PME
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CITIZEN'S/CLIENT'S CHARTER

ICAR – Central Institute for Research on Cotton Technology
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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, Board, Absorbent cotton, Chemical and Biochemical Tests of Textile Materials, ECO, SEM, XRD, e tc.	Mrs. P.S. Nirhali Assistant Chief Technical Officer Incharge, Test House test.circot@icar.gov.in ; cottontest@rediff.com Phone Ext 456 / 457
2.	Imparting Training to Stakeholders	Dr. A.K. Bharimalla Technology Transfer Division ashokbhari72@gmail.com Phone Ext 467 and Dr. S.K. Shukla Ginning Training Centre, Nagpur skshukla2000@gmail.com Phone (0712) 2500592 , 2500289
3.	Supply of Calibration Cotton	Dr. A. S. M. Raja Quality Evaluation and Improvement Division asmraja16475@gmail.com Phone Ext 447
4.	Consultancy and Technology Transfer	Dr. A.K. Bharimalla Technology Transfer Division ashokbhari72@gmail.com Phone Ext 467

Public Grievance Officer

Shri Sunil Kumar, Senior Administrative officer
Phone: 022-24127627, E-mail sunkr2@rediffmail.com, Ext 138

For Further Information, Contact
Dr. Sujata Saxena, Director, ICAR-CIRCOT, Mumbai



हमारा उद्देश्य
OUR MOTIVE

पारदर्शिता को बढ़ावा देने के लिए
To Promote Transparency

जवाबदेही को बढ़ावा देने के लिए
To Promote Accountability

सूचना का अधिकार अधिनियम, 2005 की घोषणा के अनुसरण में निम्नलिखित अधिकारियों को इस संस्थान में जनसूचना अधिकारी, सहायक जनसूचना अधिकारी और अपीलिय प्राधिकारी के रूप में नामित किया गया है।

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

<p>केन्द्रीय लोक सूचना अधिकारी Central Public Information Officer श्री सुनील कुमार वरिष्ठ प्रशासनिक अधिकारी, भा. कृ. अनु. प. - के. क. प्रौ. अनु. सं. E-mail : director.circot@icar.gov.in : sunil.kumar@icar.gov.in Tel : 2412 7627 : 2412 7273 / 76, 2418 4274 / 75 FAX No. : 2413 0835 / 2415 7239</p> <p>सहायक केन्द्रीय लोक सूचना अधिकारी Assistant Central Public Information Officer श्रीमती. सुजाता कोशी प्रशासनिक अधिकारी, भा. कृ. अनु. प. - के. क. प्रौ. अनु. सं. E-mail : director.circot@icar.gov.in : sujata.koshy@icar.gov.in Tel : 2412 7273 / 76, 2418 4274 / 75 FAX No. : 2413 0835 / 2415 7239</p>	<p>अपीलीय प्राधिकारी Appellate Authority डॉ. सुजाता सक्सेना निदेशक, भा. कृ. अनु. प. - के. क. प्रौ. अनु. सं. E-mail : director.circot@icar.gov.in Tel : 2414 6002 : 2412 7273 / 76, 2418 4274 / 75 FAX No. : 2413 0835 / 2415 7239</p>
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