भाकृअनुप
ICAR

# ICAR-CIRCOT

# ANNUAL REPORT 2023

Centenary Celebration

ISO 9001:2015

1924-2024


**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.icar.gov.in**

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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 |
| **BSKKV** | Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth |
| **CBPD** | Chemical & Biochemical Processing Division |
| **CIRCOT** | Central Institute for Research on Cotton Technology |
| **CTRL** | Cotton Technological Research Laboratory |
| **Co-PI** | Co-Principal Investigator |
| **DRGin** | 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 |
| **MoA** | Memorandum of Agreement |
| **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 |
| **PI** | Principal Investigator |
| **PMC** | Project Monitoring and Evaluation Committee |
| **PME** | Priority-setting, Monitoring and Evaluation |
| **QEID** | Quality Evaluation and Improvement Division |
| **QRT** | Quinquennial Review Team |
| **R&D** | Research and Development |
| **RAC** | Research Advisory Committee |
| **R-ABI** | RKVY-RAFTAAR Agri-Business Incubator |
| **RAFTAAR** | Remunerative Approaches for Agriculture and Allied Sector Rejuvenation |
| **RKVY** | Rashtriya Krishi Vikas Yojana |
| **RPM** | Revolutions per minute |
| **SEM** | Scanning Electron Microscopy |
| **SNDT** | Shreemati Nathibai Damodar Thackersey (Women's University) |
| **TEXPROCIL** | Textile Export Promotion Council |
| **TTD** | Technology Transfer Division |
| **USDA** | United States Department of Agriculture |
| **VJTI** | VeermataJijabai Technological Institute |

# PREFACE

ICAR-CIRCOT, celebrating its Centenary Year, is spearheading the Research and Development in the Cotton Sector with its basic and strategic research in processing of cotton & its agro residues, quality assessment of cotton, and development of novel value-added products. The institute has made a noteworthy contribution in capacity building among the stakeholders in cotton value chain inclusive of farmers, through its customized skill development programmes. The institute has also ventured into the domain of mentoring promising entrepreneurs and creating viable business propositions through its Agri-Business Incubation Centres. ICAR-CIRCOT is mandated to function as the referral laboratory for cotton fibres.

The Institute commenced the Centenary Year celebration in a befitting manner by hosting the 9th Asian Cotton Research & Development Network (ACRDN) Meeting and International Conference on "Innovations for Resilient and Sustainable Cotton Production and Viable Value Chain", during December 6-8, 2023. The institute has revitalized its linkage with the stakeholders through various industry interface meets, organized sensitization workshops with special focus to attract potential entrepreneurs and interaction with institutional stakeholders. ICAR-CIRCOT has become an "Associate Member" of the Kasturi Cotton Programme.

The institute is adopting itself to the application of the emerging technologies viz., Bio nanotechnology, Electrospinning, application of Robotics, Artificial Intelligence/Machine learning, etc. in the post-harvest processing of cotton, value addition and value creation to bring

about a transformation in the sector, benefitting the stakeholders. During the period, twelve technologies of ICAR-CIRCOT were certified by ICAR and among that, "Heat Generating Smart Cotton Textile" Technology was in the top 5 technologies identified by the Engineering SMD.

The Institute is providing its continued support as the quality partner in the All India Coordinated Research Programme (AICRP) on Cotton. CIRCOT is also the nodal centre for the implementation of the Consortia Research Platform (CRP) project on Natural Fibres. The institute has made a substantial progress in research on torrefaction of the biomass to promote use of biomass as energy source in thermal power plants under the 'National Biomass Mission' initiatives of Ministry of Power.

CIRCOT is actively associated with the World bank funded 'Smart Cotton Initiative' of Government of Maharashtra, working towards capacity building among the Government officials, farmers and community-based organizations for promoting world class cotton production. The institute has a well-established Agri-business incubation centre and also hosts RAFTAAR-Agri-business incubator (R-ABI) funded by Department of Agriculture & Farmers Welfare. During the period, 33 startups completed Agripreneurship Orientation Programme. In total, the programme has incubated over 60 start-ups with the funding support of over 8.4 crores.

The institute is actively involved in providing various commercial services to its valued stakeholders viz., consultancy, contract research & services, commercial testing services and sale of the products that are outcome of the research activity. The institute has generated revenue of over ₹ 2.24 cr during the April-December 2023. The financial prudence of the institute is established with the 100% utilization of the funds allocated during 2022-23 and is poised for similar performance in 2023-24 as well.

I wish to ensure that, this institute, in its journey with a vision of achieving global excellence in cotton technology, will consistently deliver the technologies and services to the complete satisfaction of its stakeholders.

**S.K. Shukla**
Director

# EXECUTIVE SUMMARY

ICAR-Central Institute for Research on Cotton Technology (CIRCOT), established in 1924, is a premier institute of ICAR working under the Agricultural Engineering SMD making a positive impact on cotton farmers and the textile industry. ***The institute is celebrating the centenary year of its establishment (2023-24).***

The institute is carrying out *Basic and Strategic research on processing cotton and its agro residues, development of value-added products & cotton quality assessment* with a vision of achieving Global Excellence in Cotton Technology. The institute is providing *skill development, incubation services and is functioning as a referral laboratory for cotton fibres.*

The Institute undertakes research activities in the following 5 major core areas viz., *Pre-ginning and Ginning; Mechanical processing, Technical textiles and Composites; Characterization of Cotton & other natural fibres, yarns and textiles; Chemical & Biochemical processing of cotton and its biomass & by-product utilization; and Entrepreneurship and Human Resource Development.*

***The salient achievements made by the institute during 2023 are:***

## Research

*During the year the following machinery, process technology, new value-added products and other significant research outcomes have been achieved.*

### *Process technologies*

- *Optimization of Process Parameter for the torrefaction of cotton stalks and other agro residues*
- *Industry scale biocide coating of paper for improving antimicrobial property*

### *Machineries / value added products*

- *Compact and Energy Efficient Cottonseed Dryer*
- *Lab Model SR 700 – Portable ginning machine*
- *One-time pre-grooved leather roller used for cotton ginning industries*
- *EMI Shield fabric using graphite conductive paste*

### *Models/Concept /Technology Impact assessment*

- *AI based prediction model for Highest Spinnable Count Index (HSC)*
- *Toxicology analysis of ICAR-CIRCOT Nano-Zn Suspension*

### *Technologies Commercialized*

- *Technology on bio-enriched compost production from cotton micro-dust*
- *ICAR-CIRCOT Green Crematorium*

### *Technology Release*

- *Twelve technologies of ICAR-CIRCOT were certified by ICAR. 'Heat generating smart cotton textiles Technology', was in the 'Top 5 Technologies' among Engineering SMD of ICAR and was released during the ICAR Foundation Day*

### *Technology Mentoring*

- *Development of value-added products using Electrospinning Technology*
- *Preparation of Value-added product using Banana leaf and pseudostem*
- *Nano formulation of Rock Phosphate for making Phosphate Rich Organic Manure (PROM)*

## Publications

- Published **36** *Research papers* in peer reviewed journals; **43** *Conference papers;* **15** *Books/Booklet,* **8** *Book chapters,* **17** *popular articles* and **26** *leaflets.*

## Skill Development initiative

- *Thirty skill development programme* including the specialized training programmes under SCSP were organized benefitting 924 stakeholders including farmers under the smart cotton initiative.
- Revenue generated from training during 2023 was around **₹ 40.00 lakhs.**

## Technology Management and Popularization

- Patents Filed (1):
  - *Novel One-time deep grooved chrome leather rollers used in cotton ginning industry*
- ***Twelve Technologies were certified*** by ICAR during the period
- ***Ten*** consultancy projects were implemented during the period. ***Sixteen MoUs*** were signed for academic cooperation, research collaboration, technology commercialization, Technology incubation and contract research & Services. 5 MoA were signed with Start-Up for incubation under CIRCOT RKVY-RAFTAAR Agri-Business Incubator.
- ***Seventeen awareness cum demonstration programme*** was organized. Participated in fourteen exhibitions, organized pitching cum awareness programme for young entrepreneurs. The institute scientists have presented over 43 papers in international/national conferences and popularizing 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. Five village visits, one interface meeting and 3 awareness meeting were organized in MGMG villages.
- ***One TV Talk*** in DD Sahyadri, ***Two Radio Talk*** in All India Radio, Asmita Vahini, Mumbai were delivered by institute scientists. ***A documentary*** of the institute was broadcasted in the DD Sahyadri channel of Doordarshan.

## Accreditation

- Accreditation with ISO 9001:2015 for Quality Management System by Bureau of Indian Standards.
- Certificate of Accreditation under NABL for Mechanical and Chemical testing of cotton fibre, yarn and fabrics under ISO/ IEC 17025:2017.
- Approved Assayer for cotton quality evaluation with Multi Commodity Exchange of India Ltd.
- The Institute has become the associate member of Kasturi Cotton Programme of TEXPROCIL

## Commercial Services

- During 2023, a total of 8642 samples were tested at Mumbai headquarters, GTC Nagpur and other regional units located at Guntur, Sirsa, Surat and Coimbatore generating a total revenue of ₹ 49,75,488/- through commercial testing.
- ICAR-CIRCOT calibration cotton (an import substitute for USDA standards for calibrating textile testing equipment) -194 containers were sold to stakeholders generating revenue of ₹ 1,86,273/- during 2023.
- ABI centre at ICAR-CIRCOT: One new entrepreneur admitted for incubation, three incubations are under progress, two start-Ups are graduated. One new product has been developed by the incubatee.

RAFTAAR - Agri Business Incubator (R - A B I) of R K V Y funded by the Department of Agricultural and Farmers welfare is functioning at ICAR-CIRCOT. During the period 6th and 7th Cohort were under progress. Two-month AOP and SAIP programme were completed for 33 and 35 Start-ups under 6th and 7th Cohort respectively. The Centre of Excellence Incubation Committee (CIC) has recommended for funding of 3 seed stage and 2 pre-seed stage start-ups in 6th Cohort for funding of ₹ 68 Lakh and ₹ 10 lakhs respectively. ***The R-ABI of ICAR-CIRCOT is incubating 60 Start-Ups with a funding support of over 8.4 Crores.***

## Financial Management

- All transactions in the Institute are 100% digital and cashless.
- The Institute ensured complete utilization (100%) of the sanctioned budget allocation during 2022-23 and 91.36% during 2023-24 (Apr-Dec 2023).
- The revenue generation was ₹ 227 lakhs during the year 2022-23 and ₹ 224 lakhs during April-December 2023.

## Centenary Activities

- In commemoration of the centenary celebration of the Institute, ICAR-CIRCOT hosted the ***9th ACRDN Meeting and the International Conference on "Innovations for Resilient & Sustainable Cotton Production and Viable Value Chain"*** during December 6-8, 2023 in collaboration with International Cotton Advisory Committee (ICAC), Washington DC, ISCI, ICAR-CICR, and IFS.

## Other Activities

- Implemented Swachh Bharat Abhiyan programme by organizing campaigns and spreading awareness among the public.
- Organized various events under Azadi Ka Amrit Mahotsav Programme, observed World Environment Day, World Intellectual Property Day, International Women's Day, National Unity Day, Vigilance Awareness Campaign, World Cotton Day, World Soil Day, World Food Day, International Yoga Day, Parthenium Awareness Week, Vigilance

# 1. Introduction

ICAR-CIRCOT was established in 1924 by the Indian Central Cotton Committee (ICCC) as a *Technological Laboratory,* the first of its kind in the East, to conduct basic research on cotton properties, authoritative quality evaluation, and spinning tests on various cotton strains from agricultural departments & universities in the country.

Presently, *ICAR-Central Institute for Research on Cotton Technology (CIRCOT)* is a Premier institute under the Indian Council of Agricultural Research (ICAR), mandated to carry out basic and strategic research in post-harvest technology of cotton and value addition to its by-produce. It is globally unique in its R&D efforts on utilizing every part of the cotton plant and serves as a referral laboratory for cotton fibres. Since the initiation of the All India Coordinated Cotton Improvement Programme, the institute has been providing technological assistance for breeding, focused on fibre quality. Additionally, the institute is dedicated to enhancing the skills of farmers and other stakeholders in the sector through its Skill Development program, as well as providing Agri-business incubation services and other commercial services such as testing, consultancy, and contract research.

ICAR-CIRCOT is accredited with ***ISO 9001:2015*** *for the Quality Management System by* BIS and is also an NABL accredited Laboratory ***(ISO 17025:2005)*** for *Mechanical and Physical testing*. The ICAR-Central Institute for Research on Cotton Technology, Mumbai was honoured with Sardar Patel Best ICAR Institution Award in 2004 and again in 2019, under the small institute category.

***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*

ICAR-CIRCOT is headquartered in Mumbai, with regional units located in the northern, central, and southern cotton production zones. The six regional units of the institute include Ginning Training Centre (GTC), Nagpur and Quality Evaluation Units situated in Coimbatore, Dharwad, Guntur, Sirsa and Surat. The headquarters is home to four distinct research division namely,

- Quality Evaluation and Improvement Division (QEID)
- Mechanical Processing Division (MPD)
- Chemical & Biochemical Processing Division (CBPD)
- Engineering Technology Transfer Division (ETTD).

The Ginning Training Centre in Nagpur falls under the administrative control of the

**Technological Laboratory, ICC (Dec 3, 1924)** → **Cotton Technological Research Laboratory [CTRL], ICAR (1966)** → **Central Institute for Research on Cotton Technology [CIRCOT] (1991)**

Mechanical Processing Division, whereas other five Regional Quality Evaluation Units are under the administrative control of QEID. The Research divisions along with the regional units facilitate the various activities of the institute viz., Research, Skill Development, Technology Transfer, and commercial services including testing, consultancy, and incubation in the field of post-harvest processing of cotton and value addition to its by-products and biomass.

## Research

The primary mandate of the institute is to undertake basic and strategic research on processing of the cotton & it's by-produce and development of value-added products. The institute's research initiatives are focused on five core areas.

- Pre-ginning and ginning
- Mechanical processing, Technical textiles and Composites
- Characterization: Cotton and other natural fibres, yarns and textiles
- Chemical and biochemical processing and Biomass & by-product utilization
- Entrepreneurship and Human Resource Development

ICAR-CIRCOT is the Lead institute and the Nodal Centre for executing the Consortia Research Platform (CRP) on Natural Fibres. The objectives 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 a pioneer in the world of cotton technology research. Over the past 100 years, it has made significant contributions to the post-harvest processing of cotton and the enhancement of cotton by-products and biomass. The institute has also played a crucial role in the modernization of the ginning industry in the country through the Technology Mission on Cotton (TMC). Its research in ginning machinery has not only made the country self-reliant, but has also turned it into a net exporter of ginning machinery, with exports to Afro-Asian countries. Additionally, ICAR-CIRCOT has been supporting the private sector in their R&D efforts for the development of machinery in post-harvest processing of cotton and value addition to agro-biomass. The institute has successfully commercialized various machines and products, including on-board pre-cleaner for cotton stripper, saw band pre-cleaner for mechanically picked cotton, 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, and many more. Furthermore, the institute has developed and demonstrated numerous process technologies for the value addition of cotton fibres and cotton biomass. In its commitment to promoting the effective utilization of cotton stalks, the institute has developed a low-cost Green Crematorium and continuously feeding pellets stove, which use cotton stalk-based briquettes and pellets, and has commercialised them through technology licensing.

The Institute has focused on expanding the diverse use of cotton by creating various products and techniques such as cotton rich blended fabrics for sportswear, utilizing cotton in technical textiles, particularly medical & protective textiles. CIRCOT has also explored into producing Naturally Coloured cotton products and value-added products from Banana pseudostem fibres. The institution has played a role in promoting

environmentally friendly chemical processing and finishing of cotton textiles. A significant amount of research has been conducted on extracting and applying natural dyes to cotton textiles, developing eco-friendly mosquito repellent finishes for textile materials using natural extracts, salt-free dyeing technology, and more. The institute is actively involved in shaping BIS and ISO standards for the identification of natural dyes. Additionally, the institute has devised a solvent extraction process and a microbial process for removing gossypol from cottonseed meal, allowing for its use as non-ruminant feed.

The institution has made substantial progress in the field of nanotechnology and its utilization in textiles, composites and agriculture. Innovative methods have been developed to apply various functional finishes to cotton textiles, including anti-microbial, UV protective, and water repellent finishes using nanomaterials. In 2015, the Institute established India's first Nanocellulose Pilot Plant facility to produce nanocellulose from cotton linter through an indigenous chemo-mechanical process. Furthermore, nanocellulose has been successfully applied in cement concrete, rubber composite, pulp and paper industries to enhance functional properties, as well as in paint formulation as a rheology modifier. The Institute has also demonstrated the production of security grade paper by blending cotton with natural fibre pulp and incorporating security features. Additionally, Nano-ZnO production technology for fertilizer application has been commercialised. Ongoing research includes the utilization of Nano Sulphur, produced by the Institute, in fertilizer formulations for various crops.

The Institute has embarked on numerous innovative projects in line with the government's efforts to double farmers' income. Some of the initiatives include enhancing the economic value of cotton stalks by converting them into compost, promoting mushroom cultivation using cotton biomass, and producing briquettes and pellets from cotton stalks for renewable energy purposes. These activities aim to increase farm income and create economic opportunities for farmers.

## Quality Assessment

The institution has made a significant impact on the Cotton breeding Programme in the country by contributing to varietal development through the provision of objective quality assessment of cotton fibres and their processability across the value chain. It plays a crucial role as the Technology partner in the All India Coordinated Research Project (AICRP) on Cotton and is assigned the role of Principal Investigator for Quality Research. The institution has developed indigenous Standard Reference Material known as "ICAR-CIRCOT calibration cotton," which serves as a substitute for the USDA reference material utilized in calibrating fibre testing equipment like the High-Volume Instrument (HVI). ICAR-CIRCOT is recognized as an approved assayer by the Indian Clearing Corporation for conducting quality evaluation of cotton in the commodity market.

## Skill Development

The Institute has been providing customized skill development programme at both national and international levels. Additionally, the institute offers training programme for farmers on post-harvest processing and value addition to cotton by-products, as well as increasing farm income through production and processing at the village level. In the current year, ICAR-CIRCOT's Ginning Training Centre in Nagpur conducted both online and in-person training sessions for over 1000 lead farmers from FPOs as part of the Maharashtra Agribusiness and Rural Transformation (SMART) Livelihood project, which is funded by the World Bank. The training was also attended by agricultural officers and other stakeholders.

The institute has also been involved in addressing the capacity building requirements of the cotton sector in African nations, through the Cotton Technical Assistance Programme (Cotton TAP) for Africa. ICAR-CIRCOT has also provided assistance to the United Nations Conference on Trade and Development (UNCTAD) in implementing a UN Development account Project aimed at promoting Cotton by-products in Eastern and Southern Africa.

## Incubation Service

The Agri-Business Incubation (ABI) Centre of the institute is dedicated to fostering and supporting new businesses that utilize innovative technologies for post-harvest processing and adding value to cotton and its biomass, aligning with the Start-Up India initiative by the Government.

CIRCOT RKVY RAFTAAR Agri Business Incubator (CIRCOT-R-ABI) received approval from the RKVY Division, Department of Agriculture and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India in January 2019. The incubator offers financial assistance in the form of grant-in-aid to Agripreneurs for product development, commercialization, and expansion.

## Commercial Services

ICAR-CIRCOT is widely acknowledged as a leading laboratory specializing in the testing of cotton fibres, yarn, and textiles composed of cotton and cotton blends with other fibres. It offers commercial services to various stakeholders within the cotton value chain. Numerous testing facilities within the institution have been accredited with ISO 17025:2005 by the National Accreditation Board for Testing and Calibration of Laboratories (NABL) since 1999. Additionally, the Institute holds accreditation with ISO 9001:2015 for Quality Management System by the Bureau of Indian Standards (BIS).

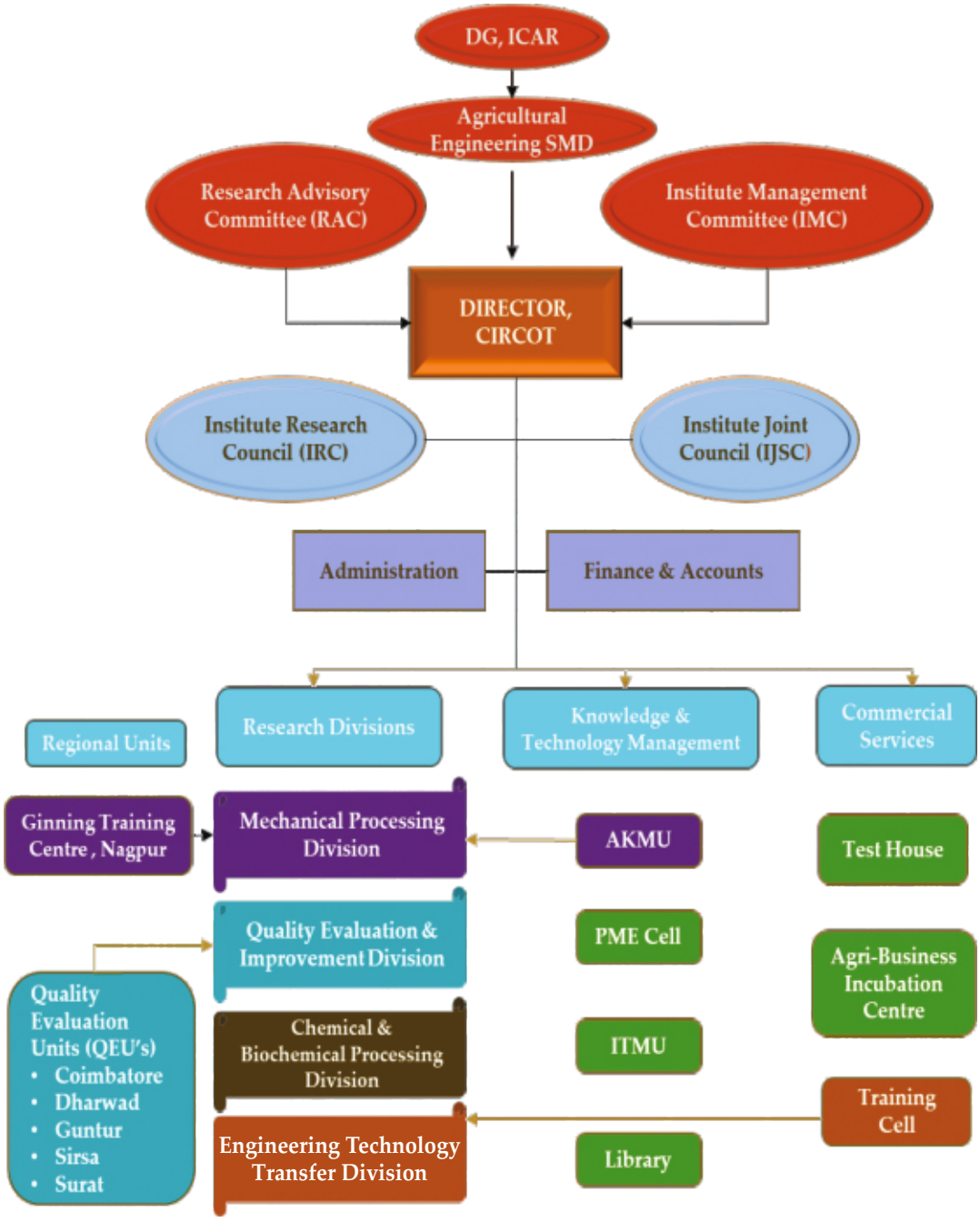
## Research Management &Administration

The Institute is led by the Director, who is supported by the Heads of the Divisions, administration, and finance & accounts sections. The Research Advisory Committee (RAC), established by the Council, assists the Director in organizing the research programs of the institute. The Institute Management Committee offers essential assistance in managing the institute's affairs. The progress of the institute's research activities is supervised by the Director through the Institute Research Council, which meets biannually. The Priority-setting, Monitoring and Evaluation (PME) Cell supports the Director in evaluating the effectiveness of different research projects, managing communications with the council, and more.

The institute's commercial testing operations are carried out through the Test House, which provides timely and authentic test results.

## BIS & Internal Audit

The Bureau of Indian Standards conducted a three-day recertification audit at the institute from June 19-21, 2023, for the license obtained under ISO 9001:2015. The director provided an overview of the new initiatives implemented by the institute to comply with and maintain the ISO standard.




Organogram of ICAR-CIRCOT, Mumbai

## Internal Audit

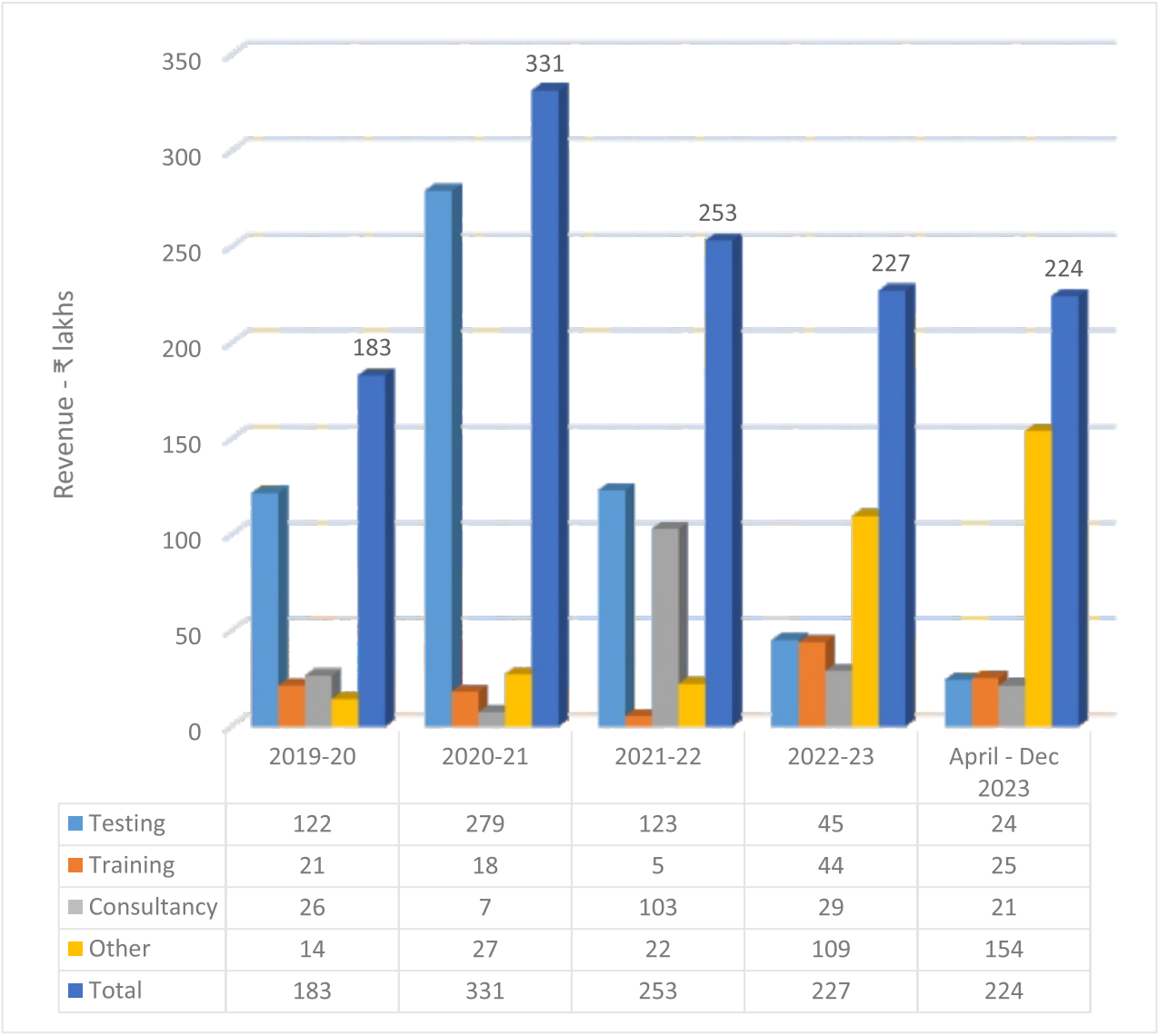
The Institute of Public Auditors of India (IPAI), New Delhi, appointed by ICAR Headquarters, New Delhi, conducted the Internal Audit of the Institute for the financial years 2019-20 to 2022-23 from December 11-18, 2023.

An audit was carried out at ICAR-CIRCOT by the Office of the Director General of Audit (Central), Mumbai from June 07-13, 2023.

## Finance Management

ICAR-CIRCOT has a strong history of meeting the revenue generation target set by the Council through its Internal Resource Generation. The institute has successfully generated revenue through Technology Commercialization, Technology Incubation Service, Consultancy, and Commercial testing services, as well as the sale of products developed based on Institute technologies. ICAR-CIRCOT strives to ensure 100% utilization of the allocated funds, and this goal has been accomplished.

**Fig 1.1 Internal Resource Generation**




| | 2019-20 | 2020-21 | 2021-22 | 2022-23 | April - Dec 2023 |
|---|---|---|---|---|---|
| Testing | 122 | 279 | 123 | 45 | 24 |
| Training | 21 | 18 | 5 | 44 | 25 |
| Consultancy | 26 | 7 | 103 | 29 | 21 |
| Other | 14 | 27 | 22 | 109 | 154 |
| Total | 183 | 331 | 253 | 227 | 224 |

**Table 1.2 Funds utilization under ICAR-CIRCOT (including SCSP) (Lakhs)**

| Head of Expenditure | | FY 2022-23 | | | Apr - Dec, 2023 | |
|---|---|---|---|---|---|---|
| | | Allocation | Expenditure | Utilization | Allocation | Expenditure |
| Grant-in-Aid- Capital | | 129.89 | 129.89 | 100 % | 273.67 | 217.57 |
| Grant-in-Aid- Salaries | | 2075.60 | 2075.60 | 100 % | 1458.75 | 1458.13 |
| Grant-in-Aid-General | Pension only | 683.92 | 683.92 | 100 % | 243.81 | 229.44 |
| | Other than Pension | 440.57 | 440.57 | 100 % | 501.98 | 359.09 |
| **Total** | | **3329.98** | **3329.98** | **100 %** | **2478.21** | **2264.23** |

**Table 1.3 Funds Utilisation under CRP on Natural Fibres (Lakhs)**

| Head of Expenditure | FY 2022-23 | | Apr - Dec, 2023 | |
|---|---|---|---|---|
| | Allocation | Expenditure | Allocation | Expenditure |
| Grant-in-Aid- Capital | 11.14 | 11.14 | 15.00 | 12.47 |
| Grant-in-Aid-General (other than pension) | 37.15 | 37.15 | 33.75 | 32.81 |
| **Total** | **48.29** | **48.29** | **48.29** | **45.28** |

# 2. Salient Research Achievements

## 2.1 CORE AREA – I
## PRE-GINNING AND GINNING

### 2.1.1. Optimization trial of the ICAR-CIRCOT Kawdi opener at factory level

The harvested seed cotton may contain immature and unopened cotton bolls, called 'kawdi cotton', which are separated as waste during pre-cleaning operation in ginneries. Annually, 3-5 lakh tonnes i.e., 2% of total seed cotton arrivals, is separated as kawdi cotton resulting in huge losses to ginners. However, if properly processed using boll opener machines, good quality lint can be recovered from cleaned and opened kawdi cotton yielding additional economic benefits to ginners. Without proper opening and cleaning, kawdi is not ginnable on a double roller gin because its fibres are not fluffy enough and snuggly held to the seed and are not easily picked up by gin rollers.

Cotton Boll Opener machine has been designed and developed for opening up of kawdi cotton to further extract and recover usable lint. The new paddle type cotton boll opener works on the principle of operation for opening up of fibres by air turbulence, beating and rubbing action of rotating beater assembly mounted centrally on a horizontal cylindrical structure having perforated concave screens for separating dust and seeds from the cleaned and opened kawdi cotton. The machine enables to reduce manpower required for sorting, by allowing dust, seeds, leaves and immature bolls to be separated through grids, with holes of different sizes for collection. The opened and cleaned raw cotton is delivered at the discharge-end. There is no damage to cotton fibres in the process.

The new design has centrally mounted paddle type beater assembly, motor drive, feed hopper and concave screen sections for processing of raw kawdi with enhanced efficiency, yielding, opened and cleaned kawdi cotton that can be ginned on double roller gin to extract lint and cottonseed, yielding additional economic benefits to ginners.

### 2.1.2. Evaluation, Optimization and Standardization of different types of lint cleaners used in ginneries

Lint cleaner is used to remove smaller particles of foreign matter present in ginned cotton (lint). In India, inclined cylinder type lint cleaner is predominantly used. The efficiency of the lint cleaner depends on factors such as design parameters, speed of the machine, amount & nature of trash, moisture content, different pickings of cotton etc.

In the present study, ginning industries were surveyed to study the design features such as speed of cylinder, grid size, machine size, capacity, cleaning efficiency, specific energy consumption etc. to determine the efficiency of lint cleaners. It was found that different ginneries are using lint cleaners having 3 or 6 no. of cylinders (Make: Bajaj, Jadhav, Taj Engineering, AVI), Spike & Spade type cylinders with length 1230-2700 mm & cylinder speed in the range from 290 – 485 rpm. The capacity of the lint cleaners varied from 10-22 bales/h. The opening cylinder speed were 540 - 960 rpm and the grid sizes were 8-9.5 mm and power required was 5 – 7.5 HP.

The performance evaluation of different types of lint cleaners was carried out and the effect of design parameters on trash content and fibre quality parameters was analyzed. The analysis revealed that six-cylinders lint cleaner showed higher cleaning efficiency (25-28%) compared to three-cylinder lint cleaner (0-15%). It was also observed that for the same type of lint cleaner, the higher cleaning efficiency (3-5%) and lower neps count were obtained with the lint cleaner that had lower cylinder speed (290 rpm) than the one with higher cylinder speed (400 rpm and above). It was found that there was 30-35% increase in total neps count in the cleaned cotton when the cylinder speed was 290 rpm, while it increased by 60% and 131% at the cylinder speed of 400 rpm and 485 rpm respectively (Table 1).

Higher cleaning efficiency is obtained with a lower cylinder speed (290 rpm) as compared to higher cylinder speed (400 rpm and above)

*Table 1. Effects of cleaning cylinder and cylinder speed on total Neps count*

| S. No. | Lint Cleaner Type | Speed of LC | Total Neps count in Ginned Cotton | Total Neps count in Cleaned Cotton | (%) Increase |
|---|---|---|---|---|---|
| 1 | 6 Cylinder | 290 | 81 | 98 | 21% |
| 2 | 6 Cylinder | 290 | 63 | 82 | 30 % |
| 3 | 3 Cylinder | 290 | 48 | 66 | 37.5 % |
| 4 | 3 Cylinder | 400 | 73 | 118 | 62% |
| 5 | 3 Cylinder | 480 | 115 | 266 | 131% |

### 2.1.3. Development of Standard Protocol for determination of ginning percentage of seed cotton

***Seed cotton conditioning to achieve moisture contents***

The project aimed to study the effect of varying moisture contents on ginning percentage of seed cotton. For this, the experiments on the conditioning of the seed cotton samples of different varieties were conducted to reach desired moisture levels (4, 6, 8, 10, 12, 14, 16, 18, 20% w.b.) at standard atmospheric conditions (65% RH, 25°C temp.). The calculated amount of water to reach specific moisture content was uniformly sprayed on the weighed samples. The moistened samples were packed in zip-lock bags and then kept inside the desiccator maintained at 65±2% RH and 25±2°C temperature. The samples were drawn at regular intervals (24h, 48h, 72h, 96h) for determination of their moisture content. It was interesting to note that the seed samples attained the same moisture level as desired, whereas seed cotton samples exhibited 1-1.5% lower moisture as compared to the seed. Considering the high moisture absorption of seed as well as considering the moisture evaporation losses, about 2% more water than the calculated amount is required to reach at desired moisture level of seed cotton samples. To attain moisture levels, the samples were dried at 65ºC until they lost the calculated amount of moisture.

*Fig. 1: Conditioning of seed cotton samples*

The moisture absorption-desorption behavior of cotton samples of 5 different trade varieties (NCS-2778, RCH-659, Harish, ATM, Isha gold-30) was studied at 25±2ºC and 30-90% RH. Significant differences in the Equilibrium Moisture Content (EMC) of lint, seed cotton, and seed samples were observed for all varieties at a given RH. All samples however exhibited an S-shape curve with a distinct hysteresis. The maximum moisture absorption at the highest RH (90%) showed the EMC range of 14.7% to 16.95% for lint samples, 17.26% to 20.89% for seed cotton samples and 18.84% to 23.56% for seed samples. The lint samples showed higher hysteresis than seed cotton and seed samples. This may be attributed to the variations in the structural deformation of the fibre or seed matrix during water sorption.

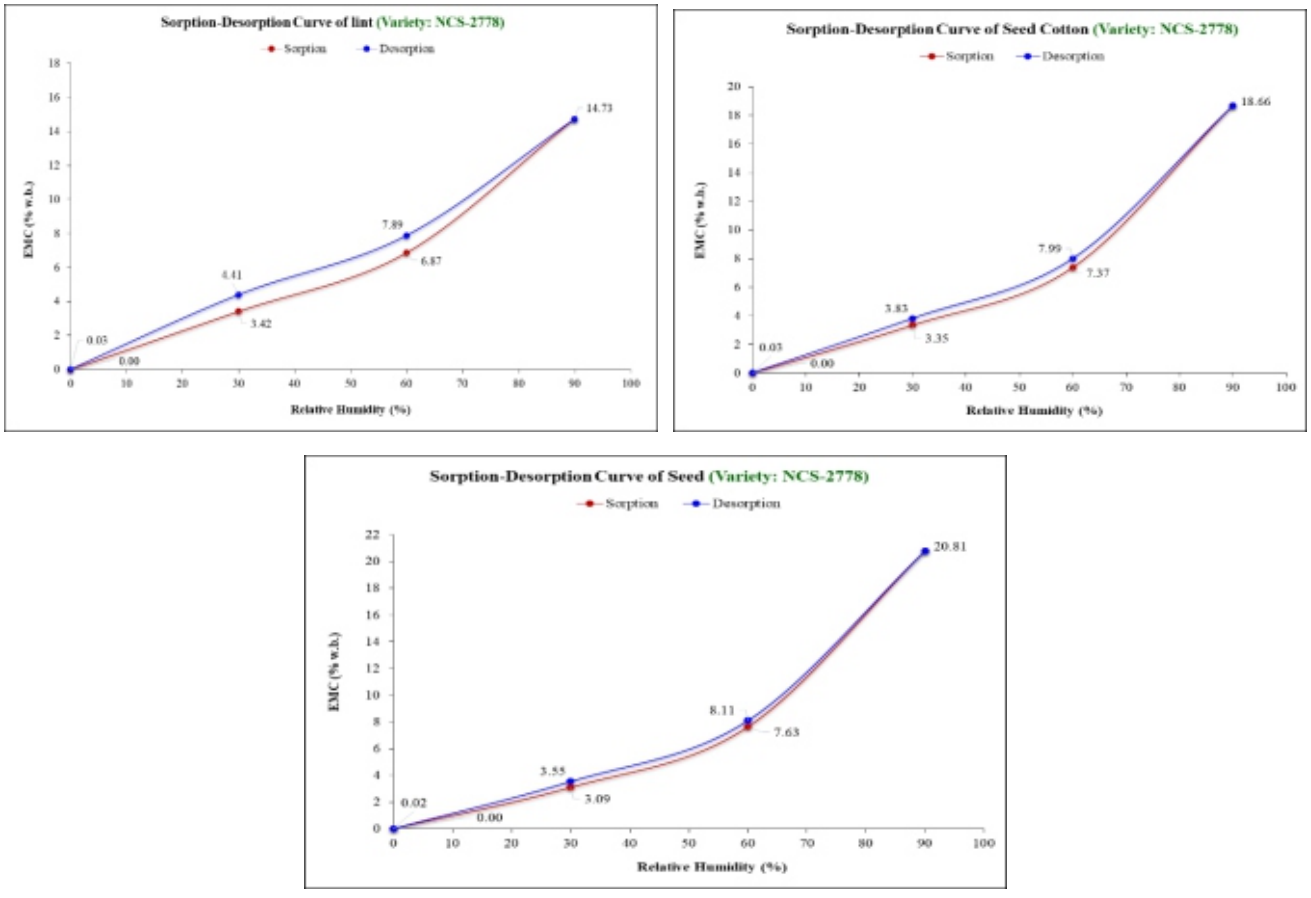



*Fig. 2: Moisture absorption-desorption isotherms of lint, seed cotton and seed samples*

## 2.1.4.Assessment of Processing Losses in Indian Cotton Ginning Industries

The processing loss in cotton ginning industry was assessed by conducting the study in three ginning industries located in Nagpur and Dharwad during the reporting period. The sequence of machineries and the working mechanism of the different ginning industries were considered while analyzing the quantum of processing waste to account for the variations. The various outlets were identified and cleaned before the ginning of seed cotton. The initial sample of seed cotton was collected to analyse the moisture content, ginning percentage, and trash percentage.

*Dispenser* *Pre-cleaner* *Lint cleaner*

*Fig 3. Different spots of waste generation in Ginning Industry*

*Dispenser waste* *Super cleaner waste* *Double roller gin waste* *Yellow picking waste*

*Fig 4. Collection of samples from different outlets in ginning factory to assess processing loss*

*Table 2. Cumulative loss percentage in ginning factories (%)*

| Ginning industry | Dispenser | DR gin | Yellow picking | Lint cleaner | Pre cleaner | Dust room | Total |
|---|---|---|---|---|---|---|---|
| 1 | 0.440 | 0.550 | 0.020 | 0.190 | 0.010 | 0.170 | 1.38 |
| 2 | 0.047 | 0.169 | 0.018 | 0.115 | 0.083 | 0.568 | 1.00 |
| 3 | - | 1.152 | 0.082 | 0.468 | 1.658 | 0.139 | 3.50 |

### 2.1.5 Design and Development of High-capacity double roller gin to enhance ginning efficiency [CRP on Natural Fibres]

The high-capacity double roller (DR) gin is being designed and developed with an aim to increase ginning capacity of DR gin by around two-fold and thus enhance the viability of roller ginning industry. The project is implemented in *PPP* mode with M/s. Bajaj Steel Industries Ltd, Nagpur *(MoU signed for collaborative research)*

***Conceptualization and Design Considerations for High-Capacity Double Roller Gin:*** The design features and identified areas of design changes and modifications to be made in conventional double roller gin to enhance ginning capacity and efficiency were assessed. To enhance ginning capacity, special emphasis was placed on increasing roller diameter and increasing the area for metering of ginned cottonseeds through the seed grid. Accordingly, all other design changes were made in different DR gin sub-assemblies viz., roller assembly, beater assembly, seed grid assembly, knife rail assembly, Side frames, mechanism for pressure application, mechanism between roller and fixed knife and independent drives for beater, roller assembly through gear box, VFD and auto-feeder.

***Experimentation for determination of power requirement to drive ginning roller with large diameter:*** The fabricated experimental setup comprises of two roller and fixed knife arrangement with mechanism for pressure application. The ginning rollers with canvass cloth were prepared with diameter of 381mm. The weight of each roller was 205 kg. The pressure was applied on the roller and knife by pneumatic cylinders. The roller speed was kept around 120 RPM. The power to drive two rollers was calculated to be 5 HP.

***Preparation of 2D and 3D drawings for Fabrication of High-Capacity Double Roller gin:*** Prepared the 2D and 3D drawing of each component of all subassemblies of High-Capacity Double Roller Gin. Fig. 5 depicts the pictorial 3D view of designed machine with auto-feeder.

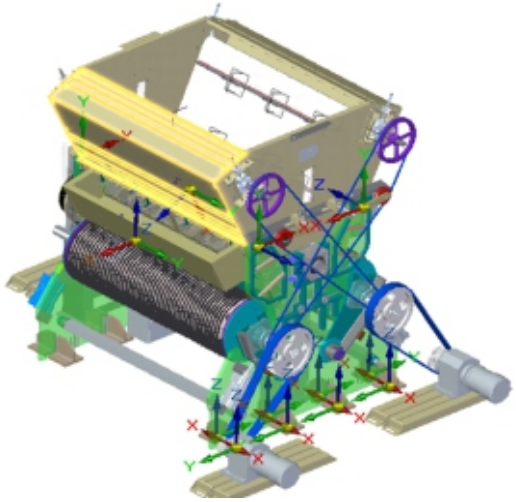


*Fig. 5: View of High-Capacity Double Roller Gin with Auto-feeder in 3D*

***Fabrication of Large Diameter Ginning Roller using Chrome Leather:*** A die for cutting chrome leather washers for making ginning roller of 381 mm diameter is fabricated. Leather rollers (Fig. 6) is fabricated with roller diameter of 381 mm and length of 1202.5 mm. Leather roller is made out of leather washers (around 100 washers per roller). Roller is fabricated by pressing washer together over the roller shaft and fitted with end washer at both ends, turned and properly grooved to the desired diameter.

*Fig. 6: Chrome Leather Roller of 381mm Diameter*

***Fabrication of Components and Sub-assemblies:*** The manufacturing drawings of all the components are prepared. The components of side frames, beater assembly, knife rail assembly, roller assembly, swing lever, spring-loaded cylinder assembly, auto-feeder assembly, power drive assembly are fabricated. Machine assembling is under progress.

## 2.1.6 Development and Evaluation of Pre-grooved Chrome Leather Roller and automatic deep-cut grooving machine for double roller gin [CRP on Natural Fibres]

***Development of novel one-time pre-grooved chrome leather rollers:*** Individual chrome leather washers were cut at a depth of 25 mm using hand operated marble cutter. The deep cut pre-grooved washers were filled and pressed on a metallic shaft in such a way that the grooves would form spirally on the periphery of the roller surface. The pre-grooved rollers were turned at required roller diameter of 170-180 mm on lathe machine and installed in a commercial ginning factory for conducting trials (Fig. 7).

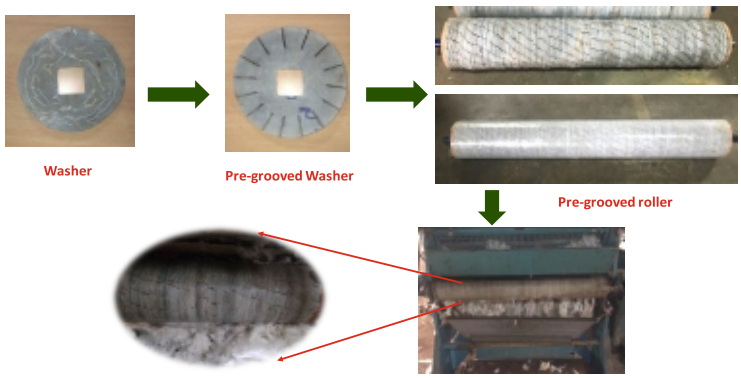



*Fig. 7: Development of one-time pre-grooved chrome leather roller*

***Ginning experiments:*** Long staple hybrid variety of cotton was used for ginning experiments. Ginning output (GO), roller temperature (TR), current (A) and roller diameter (RD) were noted down for DR gin with deep cut pre-grooved roller (PGR) and conventional roller (CR) for comparing the performance between them. Table 3 shows the performances of PGR and CR. It is evident from table that, GO of pre-grooved roller is more than conventional roller in the range from 0.5-2.6 kg/h per DR gin. Also, the reduction in diameter of the deep-grooved roller is slower than conventional rollers. The current required to gin the cotton using PGR is either equal or less than the CR.

*Table 3. Performances of PGR and CR rollers*

| Parameter | Rep | R1 | | R2 | | R3 | | R4 | |
|---|---|---|---|---|---|---|---|---|---|
| | Unit | PGR | CR | PGR | CR | PGR | CR | PGR | CR |
| GO | kg/h | 42.3 | 41.8 | 42.1 | 39.5 | 47.2 | 45.2 | 46.9 | 45.8 |
| $R_D$ | mm | 156.7 | 155 | 151.8 | 151.1 | 149.9 | 147.7 | 147.8 | 146.1 |
| $T_R$ | °C | 64.7 | 58.7 | 65.0 | 59.3 | 64.0 | 59.3 | 66.6 | 62.3 |
| A | Amp | 6.6 | 6.8 | 5.9 | 6.2 | 6.4 | 6.5 | 5.8 | 5.8 |

***Lint quality analysis:*** The lint samples from both PGR and CR were collected and analysed using HVI and AFIS. It was observed that, there was no significant difference between the quality of lint produced by PGR and CR. All the quality parameters were found within acceptable range. However, it can be further confirmed by conducting more number of ginning trials and analysing more representative lint samples.

### 2.1.7 Assessment of field performance and effectiveness of hand-held mechanical cotton picker [CCI funded Project]

The field and ergonomic performance of Hand-Held Mechanical Cotton Picker (HHMCP) in comparison to Hand picking method was assessed for comparative suitability and acceptability of HHMCP over Hand picking.

The average output capacity, post-harvest losses and trash content were found to be 3.45 kg/h, 4.7% and 2.1% in cotton picked with HHMCP as against 4.92 kg/h, 1.48% and 1.6% in hand picking. The overall picking efficiency of HHCMP in comparison to hand picking was found as 73.37%. HHMCP suffers from frequent breakdown problems due to many technical reasons which resulted in loss of picking time (10 to 15%). Trash content and post-harvest losses were higher for hand held mechanical picker than hand picking.

The physiological cost of work in terms of total cardiac cost (beats) was found higher in HHMCP as compared to hand picking. Picking with HHMCP was found to be more strenuous to workers. The higher Body Parts Discomfort Score (BPDS) ratings in HHMCP was observed mainly

because of the additional weight of the machine and battery. Subjective assessment indicated that the overall acceptability of HHMCP is low as compared to hand picking.

The technology of hand-held mechanical cotton picker does not give any added advantage in terms of output capacity, cotton quality, economic and social benefit over hand picking. It further creates health issues such as increased physiological work load, discomfort and drudgery to the workers.

The technology of hand-held mechanical cotton picker needs considerable improvements along with picking practices to enhance the output capacity of the machine at least double to that of hand picking, picking efficiency, operators' comfort and reduction of drudgery experienced while cotton picking.

Also extensive training on operation and maintenance of machine need to be imparted to the users to acquaint with machine picking, in the similar way as that of hand picking.

## 2.2 CORE AREA II
## MECHANICAL PROCESSING, TECHNICAL TEXTILES AND COMPOSITES

### Evaluation of spinnability and formulation of guidelines for Spinning of recycled fibre from fabric waste and develop value added products (Project Code: MP95)

Textile production waste is an undesirable but inevitable by-product in many manufacturing processes, such as spinning, weaving, knitting, and garment manufacturing, and is frequently undervalued. However, if such waste can be economically converted into useful products, there will be a great contribution to the sector. Many guidelines and norms are available for virgin cotton fibre spinning; however, proper guidelines for recycled cotton spinning are not available. To address this issue, the properties of recycled fibre obtained from different sources were studied and evaluated for the spinnability of recycled cotton and its blends.

The salient achievements of the project are as follows:

- The fibre quality parameters of recycled fibre obtained from pre- and post-consumer waste were evaluated.
- Process Protocol for spinning recycled fibre obtained from pre-consumer-knitted fabric waste was developed.
- Optimized spinning process parameters for recycled cotton fiber/polyester fibre for rotor spinning.
- The developed union woven fabric using recycled cotton yarn as a weft.

### 2.2.2 Development of filter fabric for indoor decontamination

Indoor air pollution is a complex issue involving a wide diversity and variability of pollutants that affects human health. In order to reduce the indoor pollution, an air purifying curtain was made using multilayer (triple) fabric. Multilayer fabric consists of inner layer and outer layer of cotton fabric and middle layer of activated charcoal treated polyester and cotton blend (PC blend) fabric. The properties of the developed fabric in comparison with the similar product available in the market is listed in Table 4.

*Table 4. Properties of developed multilayer fabric*

| Fabric | Thickness (mm) | GSM | Air permeability (ft3/min/ft2) | Filtration efficiency of PM 2.5* | Filtration efficiency of PM 10* | Filtration efficiency of VOC** |
|---|---|---|---|---|---|---|
| Multilayer fabric (Cotton: activated charcoal treated PC blend: Cotton) | 0.84 | 299 | 26.77 | 88.98 | 90.55 | 70.17 |
| Market Samples (Non-woven polyester) | 0.38 | 48.86 | 31.75 | 88.38 | 88.99 | 71.61 |

**Particulate matter, ** Volatile organic compounds*

*Fig. 8. Activated Charcoal Embedded Air Purifying Curtain*

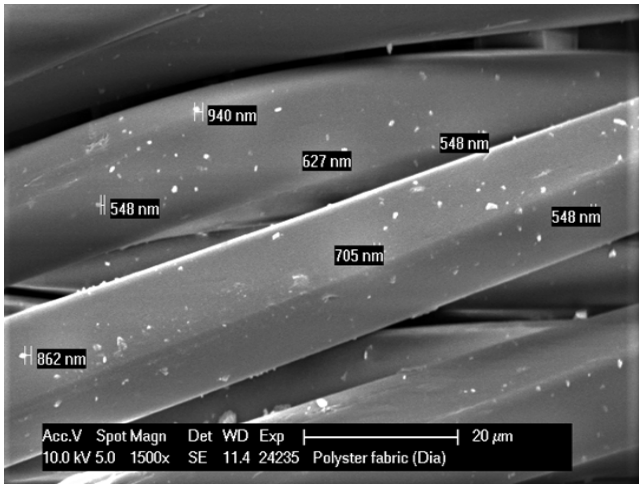



*Fig.9 Scanning Electron Microscopy (SEM) image of treated fabric after filtration testing of fabric*

The SEM image (Fig. 9) clearly shows that dust particles are arrested by treated fabric. The particle of size less than 1 µm were deposited on the fabric.

### 2.2.3 Development of Cut-resistant fabric using 3D weaving

The single-layer high-performance fabric is often inadequate for protecting against sharp tool-object accidents, which account for a significant percentage of injuries. To address this issue, a multilayer weaving technique that combines different materials was used to develop a lightweight cut-resistant glove that maintains its primary function of protection along with comfort, and mobility. The glove is constructed with three layers of warp sheets: cotton is used for the top and bottom layers, while Ultra-High Molecular Weight Polyethylene (UHMWPE) multifilament is used in the middle layer. Four distinct types of weft yarns were used in the fabric namely core-spun cotton/nylon, UHMWPE, cotton, and cotton/recycled para-aramid. The developed multilayered fabric was tested according to the EN308 standard, and the results are shown in Fig. 10.

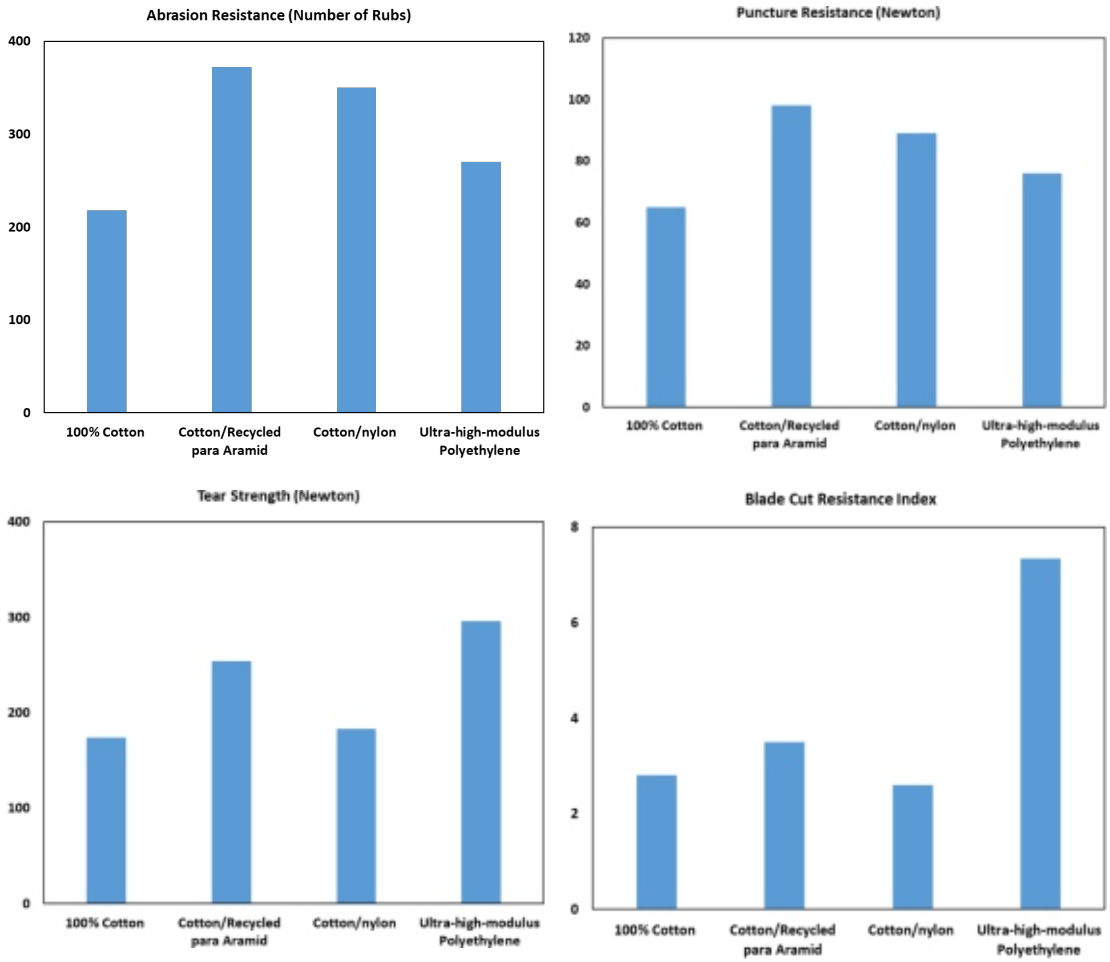



*Fig.10 Abrasion resistance, Puncture resistance, Tear Strength and Blade Cut resistance index of multilayer fabric.*

The outcomes demonstrated that the recycled aramid/cotton blend fabric, exhibited better abrasion resistance, and puncture resistance in comparison to other weft yarns. Conversely, the ultra-high-modulus polyethylene-based fabric displayed exceptional cut-resistance and tear strength relative to the other fabrics.

A seamless knitted glove (Fig.11) was produced from blending of cotton and recycled high-performance fibers using optimized proportion. Specifically, the cotton/recycled high-performance blend with a proportion of 30/70 was found to have a good TDM cut-resistance level C and excellent flame resistance properties.

*Fig. 11 Seamless knitted gloves crafted from cotton/recycled high-performance blended yarn.*

### 2.2.4 Evaluation of Electrospun nano-fibre based multi-nutrient sachet for high value crops [Inter-Institutional Project]

***a) Development of multi-nozzle arrangement to enhance the nanofibre production:*** In this project, a multi-nozzle electrospinning arrangement was developed, that is capable of producing nanofibers with enhanced production capacity compared to conventional needle electrospinning setup. A 12-gauge nozzle was specially designed to enhance the process. The fibre production trial was carried out using 10% wt. PVA polymer with a the flow rate of the nozzle at 4.0 ml/h and the applied voltage was 35 kV. The distance between the nozzle and collector was fixed at 12-15 cm. The average fibre diameter achieved was around 350 nm.

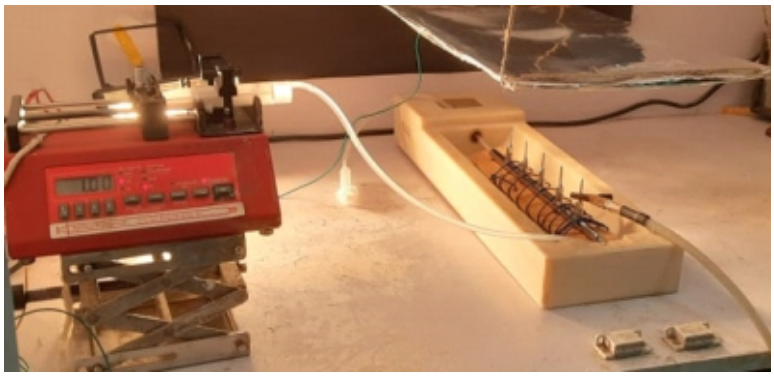


*Fig. 12 Prototype of a spinneret arrangement with five nozzles*

***b) Development of cotton covered Multi-nutrient nanofiber sachet:*** The multi-phase electrospinning technique was used to produce a multi-nutrient encapsulated nanofiber matrix. Three different multi-nutrient combinations viz., zinc, iron, and boron-impregnated PVA electrospun mats were developed (Fig. 13), each with three different proportions. In order to ensure the uniformity of fibre uniform distribution of nutrients, the multi-phase machine process conditions were optimized. The optimised condition for production of Electrospun mat with desired quantity of multi-nutrient are: Collector distance 13-15 cm, Flow rate 0.4-0.6 mL/h, syringe pump traverse speed of 2 mm/sec, Applied voltage 22-25 kV. Furthermore, an electrospun nanofibre mat was efficiently produced using a rotating drum collector speed of 400 RPM.


*Fig. 13 PVA Electrospun mat with three multi-nutrients of different proportions*

### 2.2.5 Development of eco-friendly fruit protection bags for quality enhancement [Inter-Institutional Project]

***Application of biopolymer-based coatings to cotton fabric to improve barrier properties:*** A study was undertaken to develop fruit protection bags using functionalized cotton fabric. The fabric was coated using o/w emulsions prepared using chitosan and natural wax to achieve antimicrobial and hydrophobic properties. Cotton fabric with different grammage was dipped in emulsions, passed through padding mangle and dried. Physical, mechanical and barrier properties of uncoated (1) and coated (2) grey (G) and bleached (B) fabrics were evaluated to understand the efficacy of coating (Table 5). Grammage of grey fabric increased upon bleaching from 70 to 75 g/m2. Coated grey fabric showed increase by 10 g/m2 while coated bleached fabric showed increase by only 5 g/m2. Similar trend was observed for thickness. There was significant improvement in air resistivity and wetting time of uncoated and coated fabrics in both the cases. Spray rating improved from 50 to 60 in case of grey coated fabric and from 0 to 60 in case of bleached coated fabric. The developed fabric has been given for evaluation in grapes.

*Table 5. Properties of uncoated (1) and coated (2) cotton fabric*

| Sl. No. | WVTR (g/m². day) (Avg.) | | Air resistivity (kPa.s/m) (Avg.) | | Tensile strength (N) (Avg.) | | | | Spray Rating (AATCC) (Avg.) | | Wetting time (sec) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | G | B | G | B | G | | B | | G | B | G | B |
| | | | | | warp | weft | warp | weft | | | | |
| 1 | 540 | 580 | 0.009 | 0.022 | 223 | 94 | 161 | 80 | 50 | 0 | 60 | <30 |
| 2 | 514 | 517 | 0.030 | 0.024 | 240 | 101 | 152 | 90 | 60 | 60 | >180 | >180 |

### 2.2.6 Development of bio-nano composite films using extrusion process [Inter-Institutional Project]

***Development of nanocellulose incorporated bio-composite films using blown film extrusion process:*** The experiments on melt compounding of nanocellulose with a biopolymer blend were conducted using a twin-screw extruder. Different types of crosslinking agents and initializers were used to improve the dispersion of nanocellulose within the polymer matrix. Many compositions with varying proportions of biopolymer blend, amount of plasticizer, percent incorporation of nanocellulose and types of cross-inking agent were prepared. The melt compounding of the formulations was done in a twin-screw extruder at 160°C temp and 100 rpm screw speed. After extruding, all the formulations were pelletized for blown film extrusion. The films were prepared by processing all the formulations through a blown film extruder. The process parameters (barrel temp, die temp, screw speed, nip roller speed) were optimized.

*Fig.14 Blown film extrusion of the developed pellets*

The bio-composite films were analysed for surface morphology, mechanical properties (tensile strength, elongation at break, elasticity modulus), water vapor barrier. Scanning Electron Microscopy of films revealed that nanocellulose reinforcement beyond certain limits resulted in agglomeration due to strong inter-particle interaction and high surface energy. The optimized film with 115 µm thickness showed 19 Mpa tensile strength, 1% elongation at break 1.3 GPa elasticity modulus, and 68 g/m2/24h water vapour transmission rate. The reinforcement of nanocellulose in the composition improved the barrier properties of the films exponentially. Because of its nanoscale size, high crystalline nature, and capacity to form hydrogen bonds, resulting in a strong network, nanocellulose makes it exceedingly difficult for water molecules to penetrate through, implying the high barrier properties.

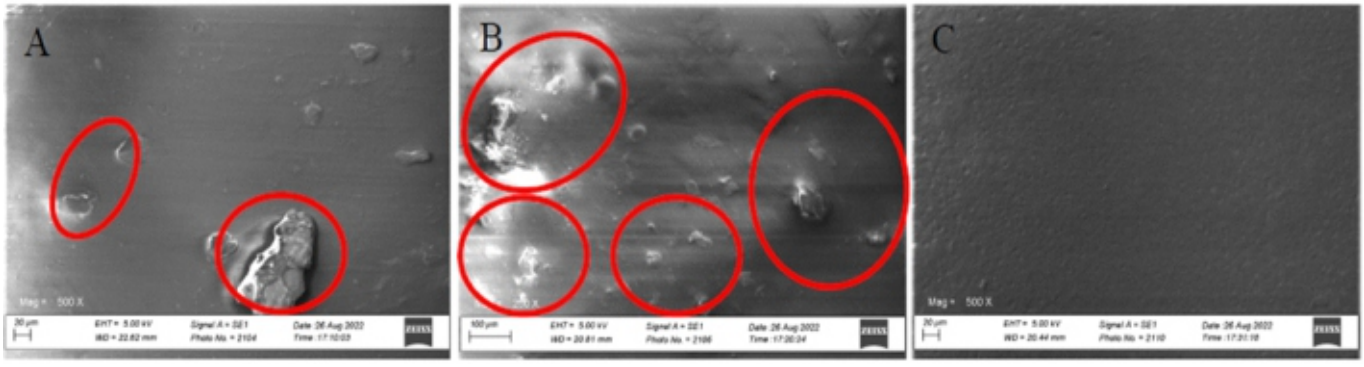



*Fig.15 SEM images of Composition 1 (A), Composition 2 (B), Composition 3 (C)*

### 2.2.7 Development of Building Materials using Natural Fibres and other fibrous crop residues [CRP on Natural Fibres]

***Coir-fibre composite cubes as coarse aggregate replacement:*** In this study, coarse aggregates 10 mm in size, used in concrete, were replaced with a coir fiber-reinforced composite 1cm$^3$ in size. The impact of two variables, fibre volume fraction in the composite and coarse aggregate replacement,

on the compressive strength of concrete were analyzed after 28 days of curing. A central composite design was used and 13 tests were conducted based on this design having centre points (25% fibre volume fraction and 24% coarse aggregate replacement) with five repetitions. The results revealed that both the fibre volume fraction and coarse aggregate replacement significantly influenced the compressive strength of concrete. A maximum compressive strength of 34 N/mm² was observed at 27% fibre volume fraction and 18% coarse aggregate replacement. It can be concluded that, using only raw coir fibres as reinforcement, only 4% can be used for replacement of course aggregate. But, using coir-fibre composite cubes, we can replace 18% course aggregate with maximum compressive strength of 34 N/mm² without affecting workability of concrete.

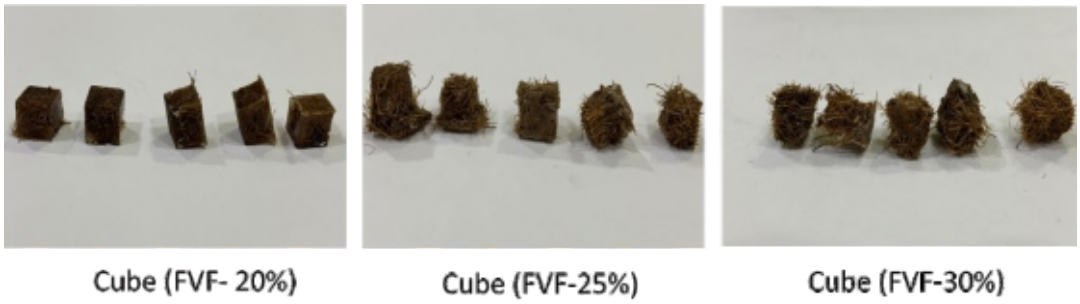



*Fig.16 Coir composite cube prepared with different fibre volume fraction*

*Fig.17 Coir fibre reinforced composite concrete cube before and after compression strength test*

### 2.2.8 Optimization of Spinning Process parameters for Cotton/hemp blends and develop value added products. [CRP on Natural Fibres]

***Process protocol for Cottonization of hemp fibre:***
The hemp fibre (Cannabis Sativa L.) has to be cottonized, so that it will look-like, feel-like, and have strength-like cotton fibre for blend development. Initially Indian hemp fibre was pre-treated with chemical formulations followed by bleaching in a closed vessel for 60-120 min at 80-90℃ and keeping the material to liquor ratio at 1:20 with hydrogen peroxide, trisodium phosphate, Ultravon JU, and sodium silicate (10 g/L). The pH of the bath was maintained at 10-11. After bleaching, the fibre was washed thoroughly, neutralized, and dried to obtain cottonized hemp (Fig.1). There was 22% weight loss due to cottonization of hemp fibre. The colour parameter of hemp samples shows that the whiteness index of the hemp fibre improved from 49 in the untreated to 75 in cottonized fibre samples

respectively, with significant reduction in Fibre bundle strength and fineness.

***Spinning process protocol optimization for development of cotton/hemp blended yarn in ring spinning system:*** The initial spinning trial was attempted to produce 15s Ne of cotton/hemp blended yarn with a blend proportion of 50:50 through the micro spinning mode. The Count Strength Product (CSP) of cotton/hemp blended yarn (50:50) is 1715. The CSP of 100% cotton yarn is 3640, when it is blended with 50% hemp fibre the CSP is reduced by over 50%. To improve the yarn properties the blend proportion of hemp fibre was reduced to 30% and the cotton/hemp (70:30) blended yarn of 30s Ne was produced. The CSP of 30s Ne of cotton/hemp (70:30) blended yarn is 2243.

*Raw Hemp*
*Whiteness Index – 48.71*
*Fibre Bundle Strength (g/tex) – 28.3*
*Fibre Fineness – 4.3*

*Cottonized Hemp*
*Whiteness Index – 74.88*
*Fibre Bundle Strength (g/tex) – 16.2*
*Fibre Fineness – 1.9*

*Fig. 18 Colour and fibre parameter of untreated, cottonized hemp fibres*

### 2.2.9 Development of Smart-foods, bio-composites, green packaging and bio-energy from agro-residues [Externally Funded Project - NASF]

Foams are lightweight materials primarily composed of dispersed gas trapped in a liquid or solid phase. These materials find applications in various industries such as construction, transportation, packaging, cushioning, safety, medical, thermal, and water insulation. Traditionally, foam materials have been produced from both natural and synthetic polymers. However, the use of synthetic foams contributes to three major environmental issues, including the release of micro-plastics during production, high greenhouse gas emissions post-use, and the release of toxic gases like dioxins, furans, mercury, and polychlorinated biphenyls after burning. In response to these challenges, natural polymers, such as starch and cellulose, are being explored as substitutes for synthetic foams. Starch foam, designed for protective and food packaging applications, exhibits high water absorption due to its hydrophilic nature, limiting its applications in moist environments. On the other hand, cellulose foam, suitable for medical and filtration applications, incurs high costs due to the initial purification and extraction processes of micro and nano cellulose. To address the limitations of starch and cellulose foams, this project focuses on lignocellulose foam derived from ligno-cellulosic agro-residues. These residues, such as cotton stalk, paddy straw, and bamboo dust, contain high amounts of cellulose and lignin. Lignocellulose foams offer advantages such as being lightweight, cost-effective, and

exhibiting low water absorption and thermal insulation properties compared to starch and cellulose foams. The foams are prepared using surfactants and binders, with the surfactant controlling the foaming ability of the lignocellulose foam. In this project, a novel low-cost lignocellulose foam was successfully prepared from three agro-residues: cotton stalk, paddy straw, and bamboo dust. The formulation included tapioca flour, sodium bicarbonate, sodium lauryl sulfate (SLS), and glycerol. Optimization of ingredients and process parameters yielded the best results for loose filling packaging applications. The optimized formulation comprised 60g of agro-residues, tapioca flour, SLS, 0.5g of sodium carbonate, and glycerol. The resulting lignocellulose foam exhibited a density ranging from 0.28 to 0.35 g/cc, with 7 to 11% moisture content. This project demonstrates the successful development of a cost-effective lignocellulose foam from agro-residues for loose filling packaging applications.

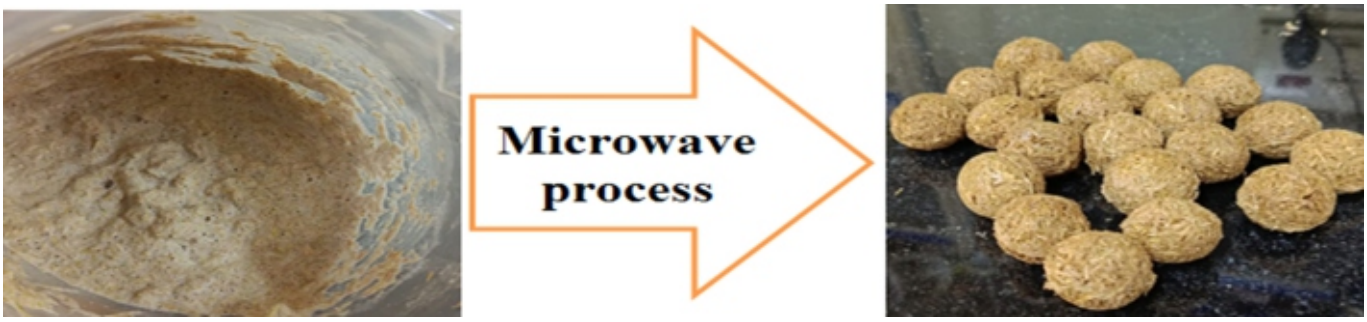



*Fig. 19 Lignocellulosic foam from agro-residues*

## 2.3 CORE AREA III
## CHARACTERISATION – COTTON & OTHER NATURAL FIBRES, YARNS & TEXTILES

### 2.3.1 All India Coordinated Research Project on Cotton (Quality Research)

- Fibre quality analysis of all samples received (4308 numbers) in the AICRP- cotton project have been completed.
- In initial evaluation of G. hirsutum under organic conditions, KGH-VS 2323 (UHML 28.9mm, Strength 28.1 gpt, micronaire 4.2 and GOT-36.3%) performed well.
- In Preliminary Hybrid Trial of HxH hybrids under organic conditions (Irrigated/Rainfed), KGHH-VS-2318-1 (UHML 29.1mm, Strength 28.6 gpt, UI 84, micronaire 4.3 and GOT-34%) performed well.
- In Initial evaluation trials of North Zone, G. arboreum culture FDK 340 (UHML 20.8mm, Strength 20.2 gpt, UI 79, micronaire 6.4 and GOT 39.2%) performed well.
- In Coordinated Variety Trial of G. arboreum (NZ), RG 868 (UHML 21.5 mm, Strength 21.7gpt, UI 79, micronaire 6.4 and GOT 39.8%) performed well
- In Central Zone trials, among the coloured genotype, both entries FC 4001 (GOT-32.1%) and 16301 DB (UHML-22.1, Strength-21.8, Mic-4.1 and GOT-34.4%) are having comparable qualities in the coloured cotton category.

- In PVT Colour Cotton – irrigated (SZ), DHCC 2351 (UHML-23.8, Strength-22.1, Mic-4.1 & GOT-33.7%) has good fibre qualities under colour cotton category.
- In, Br-14 a CVT G. barbadense, CCB-22-1 (UHML- 35.1mm, UI-86, Strength-36.9gpt, Mic-2.8 and GOT-31.2%),CCB-22-2 (UHML-34 mm, UI-86, Strength-34.5gpt, Mic-3.3, and GOT-35%),CCB-23-2 (UHML- 33.3 mm, UI-86, Strength-38.2gpt Mic-3.5 and GOT-35.6%),SIMA B-8 (UHML- 34.8 mm, UI-86, Strength-37.8gpt Mic-3.5 and GOT-33.9%) have performed well
- The CVIC meeting was held on 31.07.2023 and proposals for Bt. and non-Bt. were screened on the basis of fibre quality parameters

| *Non Bt varieties/hybrids identified* | *Bt varieties/hybrids identified* |
|---|---|
| 16 | 45 |

### 2.3.2 Development of Electrically Conductive cotton material

Conductive paste was developed using carbon and graphene powder along with suitable binder for textile application. Using the optimized conductive paste, cotton fabrics and yarn were coated to produce electrically conductive cotton materials. The products were found to have the resistance of 20-30 Ω/cm. The coated conductive fabric has EMF shielding efficiency of 92.1% at 100 MHz frequency and 87.5% at 1500 MHz frequency. These conductive fabrics can be used as protective fabrics against the radiations from mobile phone and other electronic appliances. This conductive paste can be used for printing flexible electronic circuits on fabric and other substrates. This can also be used to make 3D printer filaments which will be electrically conductive.

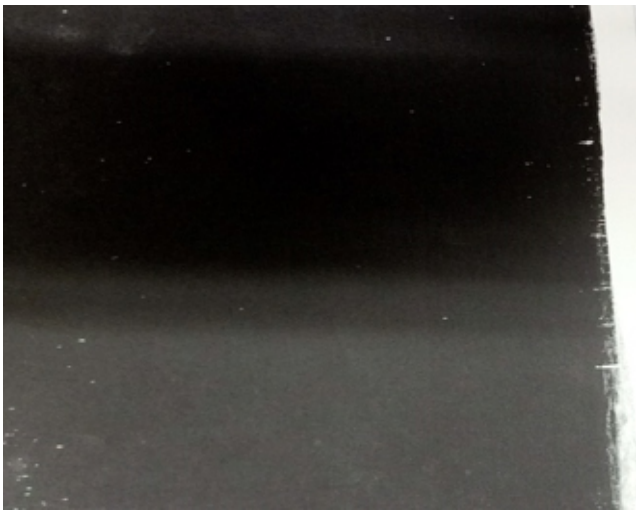


*Fig. 20 (a) Conductive fabric*

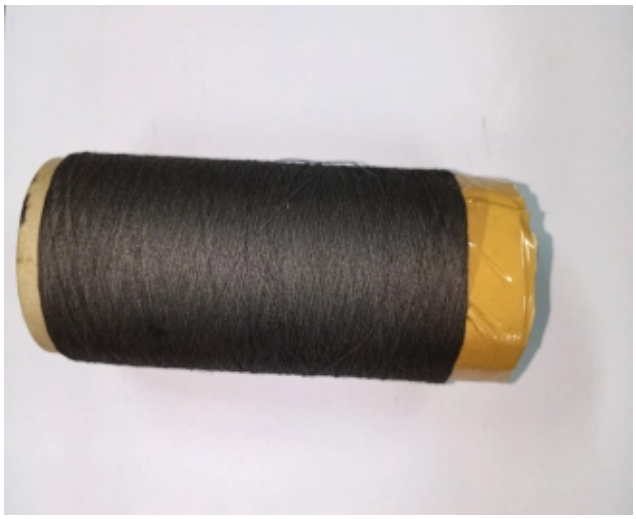


*Fig. 20 (b) Conductive Cotton Yarn*

### 2.3.3 Development of AI based prediction model for yarn quality characteristics

***Studies on fibre and yarn property relationships:***

Twenty-five samples covering many varieties of cotton were selected and tested for their fibre parameters. Upper Half Mean Length (UHML), micronaire, bundle strength and uniformity Index were measured by using High Volume Instrument (HVI). All the samples were spun to two counts, one under spun and the other over-spun as per CIRCOT CSP norms, using CIRCOT full spinning test. Yarn samples were tested for Lea CSP, Unevenness, thin places, thick places, neps, single thread strength, elongation and hairiness. The actual count and lea strength were determined simultaneously using a computerised lea strength tester. Totally 30 leas were made from 10 bobbins (3 leas from each bobbin). Unevenness (U%), thin places, thick places and neps were measured using UT4 evenness tester. The thin, thick places and neps were measured at the sensitivity levels of –50%, +50% and +200% respectively. Single thread tenacity and elongation were measured using automatic single thread strength tester.

Fibre and yarn properties are given at Table 6 & 7. Cotton fibre selected for study contains UHML range of 22.0 to 35.0 mm and count range spun out of this cotton is 12s Ne to 100s Ne. Lowest CSP observed was 1400 and highest CSP was noted at 2844. UHML range of 23.3 mm to 28.2 mm was able to spun a count of 20s Ne. Among various counts spun, all counts are meeting RKM (tenacity, g/tex) 75 percentile norms of carded counts. Correlation of fibre properties (Table 8) revealed that UHML is negatively correlated with Micronaire (-0.472, 0.01), positively correlated with Uniformity Index (0.621, 0.01), bundle Strength (0.945, 0.01) and elongation (0.884, 0.01). It can be seen from Fig 21 that higher fibre length is associated with lower micronaire. UHML and under spun count found to have a linear relationship. Higher i.e. finer counts are possible with higher fibre length (Fig. 22). Another 30 cotton fibre samples are being tested for various yarn properties and on completion of yarn testing, regression and AI model will be developed for predicting yarn properties namely RKM, yarn U%, imperfections and hairiness.

*Table 6: Fibre and yarn properties*

| S. No. | Properties | Minimum | Maximum |
|---|---|---|---|
| 1 | Upper Half Mean Length, mm | 22.0 | 35.0 |
| 2 | Uniformity Index (UI) | 79.0 | 84.0 |
| 3 | Micronaire (Mic) | 2.9 | 5.9 |
| 4 | Bundle strength (Str), g/tex | 21.8 | 32.2 |
| 5 | Elongation (E), % | 5.2 | 6.1 |
| 6 | Under Spun count (Count_1), Ne | 12.0 | 80.0 |
| 7 | Count Strength Product (CSP_1) | 1529 | 2844 |
| 8 | Count_1 Breaking strength, grams | 97.0 | 698.0 |
| 9 | Count_1 tenacity, g/tex, RKM | 9.8 | 16.1 |
| 10 | Count_1Elongation, % | 2.80 | 8.10 |
| 11 | Count_1 Breaking strength CV % | 8.6 | 64.5 |
| 12 | Count_1 Elongation CV% | 6.1 | 32.8 |
| 13 | Over spun count (Count_2), Ne | 16.0 | 100.0 |
| 14 | Count Strength Product (CSP_2) | 1400 | 2608 |
| 15 | Count_2 Breaking strength, grams | 82.0 | 481.0 |
| 16 | Count_2tenacity, g/tex, RKM | 9.2 | 16.3 |
| 17 | Count_2 Elongation, % | 3.70 | 8.50 |

*Table 7: Yarn count spun and fibre parameters*

| Properties | 20s Ne | | 30s Ne | | 50s Ne | | 60s Ne | |
|---|---|---|---|---|---|---|---|---|
| | Min | Max | Min | Max | Min | Max | Min | Max |
| UHML | 23.3 | 28.2 | 24.7 | 27.1 | 29.3 | 30 | 31.9 | 35 |
| UI | 81 | 84 | 79 | 84 | 83 | 84 | 84 | 84 |
| Mic | 4.1 | 5.9 | 3.4 | 4.6 | 3.9 | 4 | 2.9 | 3.1 |
| Str | 22 | 28.6 | 25.8 | 27.6 | 28.8 | 29.4 | 31.3 | 32.2 |
| E | 5.2 | 5.7 | 5.5 | 5.7 | 5.7 | 5.7 | 5.9 | 6 |
| Count_1 | 20 | 20 | 30 | 30 | 50 | 50 | 60 | 60 |
| CSP_1 | 1858 | 2282 | 2229 | 2523 | 2179 | 2398 | 2502 | 2844 |
| C1_BS | 331 | 430 | 260 | 295 | 173 | 174 | 149 | 151 |
| C1_Ten | 11.6 | 14.3 | 9.8 | 14.9 | 14.7 | 14.8 | 15.4 | 16.1 |
| C1_Elong | 5.3 | 7.6 | 4.3 | 6.6 | 5.6 | 5.9 | 4.98 | 5.6 |
| Nos | 6 | | 5 | | 2 | | 2 | |

*Table 8: Correlation of fibre properties*

| Properties | UHML | UI | Mic | Str | E |
|---|---|---|---|---|---|
| UHML | 1 | .621** | -.472* | .945** | .884** |
| UI | .621** | 1 | -0.138 | .653** | .660** |
| Mic | -.472* | -0.138 | 1 | -.439* | -0.227 |
| Str | .945* | .653** | -.439* | 1 | .864** |
| E | *.884** | .660** | -0.227 | .864** | 1 |

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

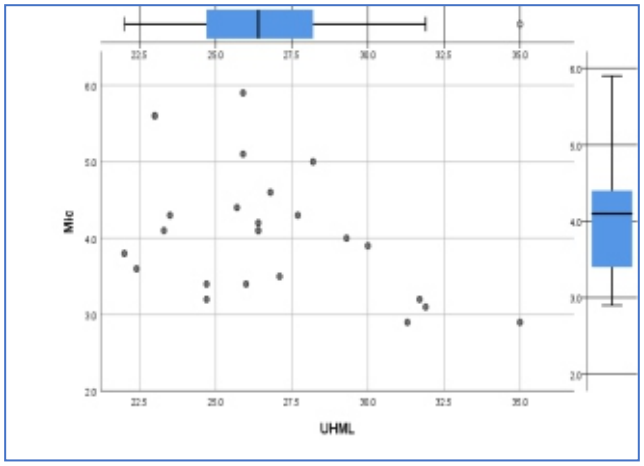



*Fig: 21 UHML and Mic Relationship*

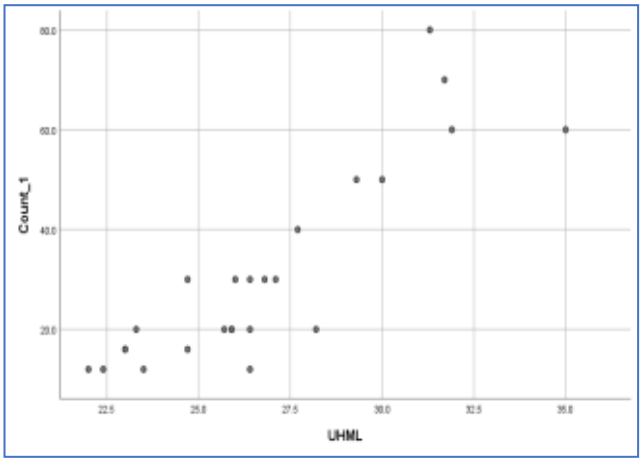



*Fig 22. Under spun count vs UHML*

### 2.3.4 Development of Viscose based marker fibre for the traceability of cotton

*Production of marker viscose fibres:* The marker chemical was synthesized in the laboratory and supplied to the industry partner for the production of marker fibres. However, the following challenges were faced in the production of marker fibres viz., particle size, alkali stability and surface charge. It was finalized to add the marker chemical in the viscose manufacturing process in the stage of blending and ripening. The identified chemical was found to produce gel formation during the viscose production. Accordingly, the procedure was modified and the properties such as particle size and zeta potential were measured. With this process, the marker fibre was obtained with the added chemical and its presence was confirmed by the analytical technique

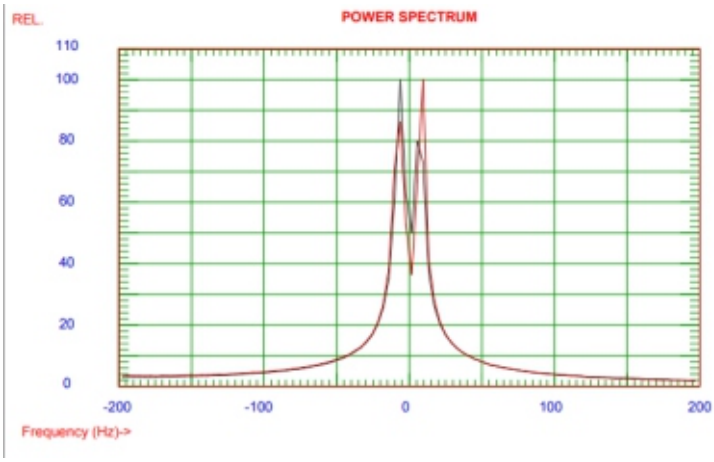



*Fig 23. Zeta potential analysis of synthesized chemical*

### 2.3.5 Development of portable instrument to measure the colour grade of cotton

The design for the portable colour measuring instrument have been developed, encompassing the careful selection of light sources and necessary circuits. The appropriate colour sensor for seamless integration into the portable device has been identified. The successful integration of these selected sensors into the prototype and the software was achieved, ensuring compatibility and reliability. The culmination of these efforts resulted in the creation of an initial prototype for the portable instrument, aligning with the conceptual design.

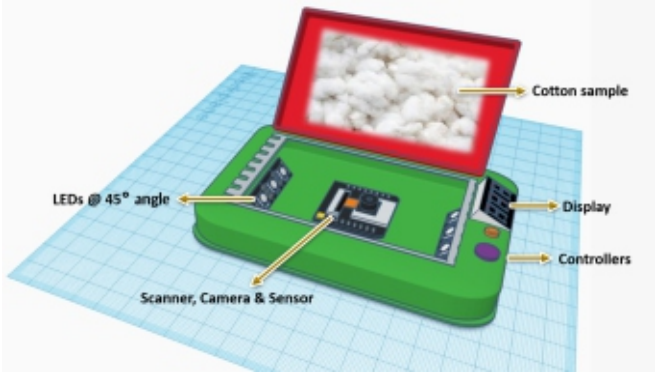



*Fig. 24 Model Cotton colour measuring portable Instrument*

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

### 2.4.1Toxicological and Environmental impact of ICAR-CIRCOT's nano material

Even though cellulose is a natural biopolymer that can degrade in nature, the properties of engineered nanocellulose is very different. Chemical, enzymatic and mechanical processes are used for the production of nanocellulose and their effects can impact the environment, differently. ICAR-CIRCOT Nanocellulose is being utilized by various stakeholders for novel product developments from 2015 onwards. Hence, its environmental impact was assessed in comparison with the other nanocellulose, prepared by enzymatic and carboxymethylation processes, using OpenLCA® software in a cradle-to-gate approach. ICAR-CIRCOT process does not involve both concentrated acid hydrolysis and surface modification (carboxymethylation) techniques. Hence, the cumulative energy demand per kg of nanocellulose production is only 55.5 MJ while it is 87 MJ for enzymatic process and 1800 MJ for carboxymethylation process. Similarly, the global warming potential in terms of kg $CO_2$ eq/kg is very less (0.42) when compared to that of enzymatic (0.79) and carboxymethylation (99) processes. Likewise, the water depletion index in terms of $m^3$/kg is only 0.01, while it is 0.24 for enzymatic and 1.00 for carboxymethylation processes. Hence, it is concluded that the environmental impact of ICAR-CIRCOT nanocellulose is very less when compared to that of other two processes being followed by the industries.

The cytotoxicity of nano-zinc suspension was outsourced from M/s. Liveon Biolabs Pvt. Ltd., Tumakuru, Karnataka. The acute dermal irritation / corrosion study in New Zealand White Rabbit was conducted to evaluate the skin irritation potential of Nano-Zn suspension. This study provides a rational basis for risk assessment in humans. There were no skin reactions (erythema / edema) clinical signs / mortality and morbidity in any of the animals. No macroscopic changes were observed at necropsy. Based on the results, ICAR CIRCOT developed 'Nano-Zn suspension' is classified as “Non-irritant” as per the Globally Harmonized System of Classification (GHS) and labelling of chemicals.

Toxicity evaluation of nano-sulphur against beneficial soil microbes (Pseudomonas aeruginosa and Pantoa agglomerans) was carried out using 3-(4, 5-dimethylthiazol-2-yl) -2, 5-diphenyltetrazolium bromide (MTT) dye reduction assay. The assay was performed by inoculating overnight grown cultures of each test bacterial strain in the nutrient broth (NB) supplemented with different concentrations of Nano-Sulphur (4000-7000 ppm). Viability of the cells was assessed by the ability of living cells to reduce the yellow dye MTT to blue formazan crystals. Nano-sulphur was not found to be toxic to the tested beneficial soil bacteria up to 5000 ppm concentration. For determining the effect on bacterial growth curve, active inoculums of test bacteria (Pseudomonas aeruginosa and Pantoa agglomerans) were inoculated in NB supplemented with sub-inhibitory doses (µg/mL) of nano-sulphur and kept for incubation at 37°C

for 48 h in a shaking incubator (120 rpm). The changes in the growth kinetics were monitored at fixed intervals by recording the optical density (OD) at 600 nm. The growth curves showed that treatment with up to 5000 ppm of nano-suphur had no effect on the growth of either bacterium. It is evident from the growth curves that the nano-sulphur exhibited dose dependent effect on the test bacterial strains

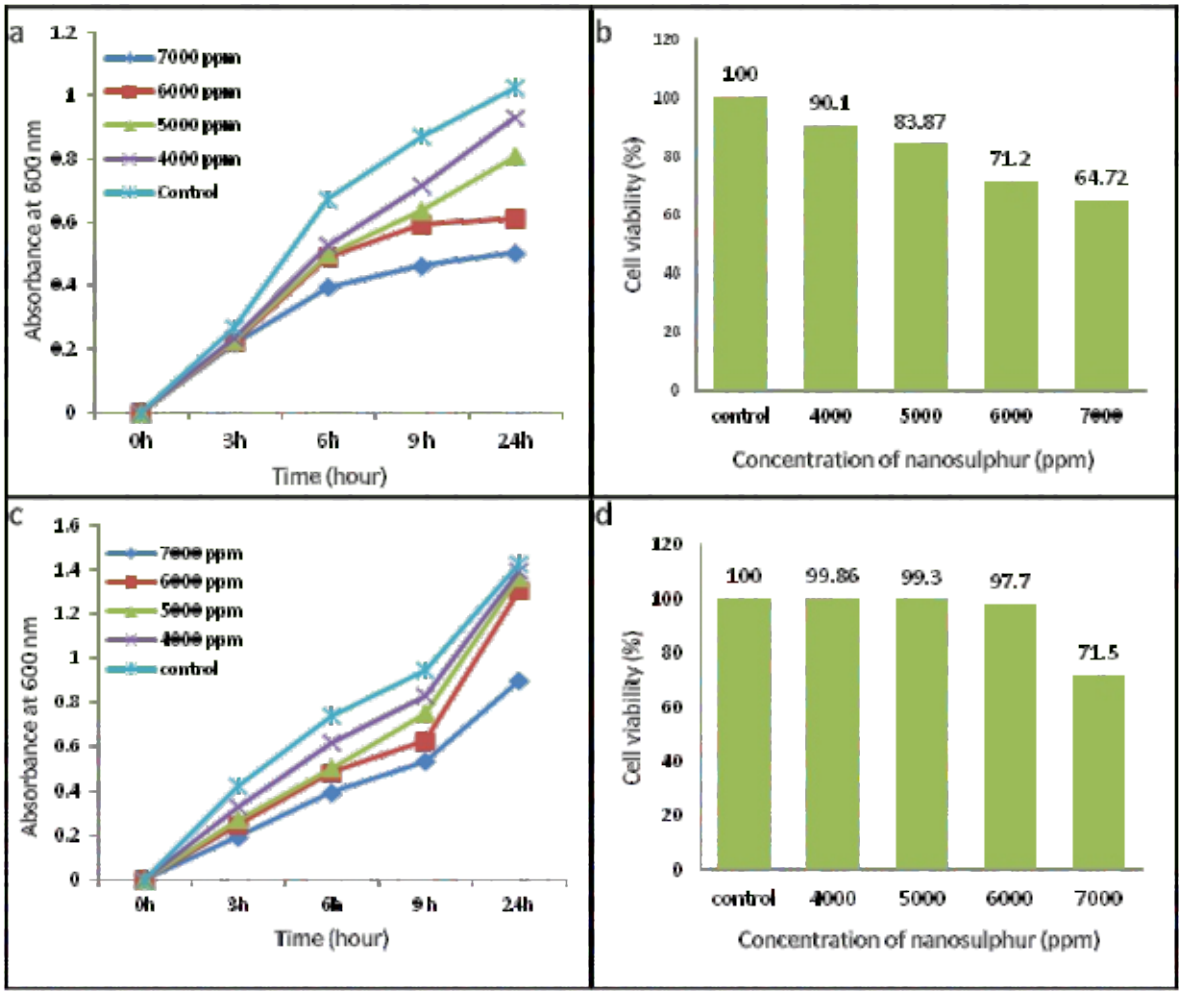



*Fig.25 Growth curves and cell viability of (a, b) Pantoa agglomerans and (c, d) Pseudomonas aeruginosa in the presence of nano-sulphur.*

### 2.4.2 Development of Healthier cottonseed-based cooking oil by blending with other vegetable oils

Frying is a popular method of cooking which is performed at high temperature (160-180˚C). Exposure to atmospheric oxygen and to the water and steam generated from the material being fried at elevated temperature leads to oxidative changes in oil composition. These oxidative changes depend upon the nature of fatty acid constituting the oil and also to the natural or

added antioxidants present in the oil. Oils made up of fatty acids having higher degree of unsaturation are likely to be more susceptible to oxidation. CSO being rich in polyunsaturated fatty acids can be expected to have lower oxidative stability. Frying stability of cottonseed oil (CSO), coconut oil (CO), groundnut oil (GO), sesame oil (SO) and Palmolein (PO) and 50:50 blends of CSO with other oils was studied by frying 100 g potato slices (finger chips) in a deep fryer at 180˚C for 1 min. CSO and PO used were refined; other oils were cold pressed. The oil was allowed to cool after frying one batch of slices and after twenty minutes, another batch of potato slices was fried. Total 10 number of fryings were conducted. At the end of all frying operations, oil samples were analysed for various physical parameters such as colour value, specific gravity and viscosity. Chemical parameters such as acid value (AV), peroxide value (PV), para anisidine value (p-AV) and TOTOX value were analysed initially and after 1st and 10th frying.

Colour is often used in food industry for prompt monitoring of oil quality. Colour of an oil during frying may change by the degradation products derived from the oil during hydrolysis, oxidation, and polymerization reactions occurring during frying or elution of fried food pigments and particles into the oil. Also, there may be some absorption of pigments present in oil by the food item being fried. The colour parameters of the fresh oils and their 50:50 blends with CSO and after 10 times of repeated frying as measured by the computerized colour matching system showed that SO and PO which were more yellow in colour showed a reduction in yellowness (b*) values from 41.78 and 39.46 to 23.52 and 11.26 respectively after 10 fryings. Yellowness index also reduced from 74.82 and 72.2 to 42.8 and 23.28 respectively. After same number of fryings, CO (least yellow initially) and GO showed an increase in yellowness (b*) from 6.04 and 36.55 to 42.17 and 48.22 respectively after frying and yellowness index increased from 12.42 and 63.91 to 73.5 and 84.77 respectively. Yellowness and yellowness index of CSO showed only a marginal increase.

There was not much change in specific gravity of oils due to frying but viscosity of the oils increased from 2.8% in PO to 11% in GO. Viscosity of the blends of CSO showed an increase ranging from 12.9% (SO) to 18.8% (GO) and 18% reduction was observed for the blend with PO. Heavy frothing during frying was observed for CSO blend with CO.

Among the chemical parameters, acid value (AV) is a measure of free fatty acid (FFA) content of the oil and peroxide value (PV) is a measure of primary oxidation status of the oil. Para anisidine value (p-AV) indicates the formation of secondary oxidation products such as aldehydes which are responsible for the off or rancid flavour of the oils. TOTOX value is calculated from the PV and p-AV of the oils by the formula 2 X PV + p-AV and is a measure of the total oxidation status of an oil. Acid value and TOTOX values of various oils and their blends with CSO initially and after one and ten frying cycle are presented in Table 9. It is seen from the Table that acid value of the oils was usually low and not much change was seen in this parameter after frying. This means that either there is no FFA formation during frying or the FFA formed are being removed through volatilisation.

*Table 9. Acid and TOTOX values of oils and CSO blends before and after frying*

| Oil | AV after frying cycles | | | TOTOX Value after frying cycles | | |
|---|---|---|---|---|---|---|
| | 0 | 1 | 10 | 0 | 1 | 10 |
| CSO | 0.1 | 0 | 0.16 | 14.47 | 62.92 | 125.73 |
| CO | 0.66 | 0.61 | 0.78 | 3.22 | 1.54 | 41.22 |
| GO | 2.23 | 1.42 | 1.62 | 12.53 | 21.08 | 74.75 |
| SO | 3.12 | 3.24 | 3.35 | 19.54 | 22.06 | 92.41 |
| PO | 0.55 | 0.27 | 0.44 | 8.03 | 25.19 | 117.18 |
| CSO+CO | 0.22 | 0.39 | 0.55 | 21.43 | 36.13 | 160.12 |
| CSO+GO | 1.06 | 0.39 | 0.22 | 24.33 | 45.53 | 154.27 |
| CSO+SO | 0.14 | 1.67 | 1.73 | 26.63 | 35.26 | 83.09 |
| CSO+PO | 0.39 | 0.16 | 0.44 | 36.24 | 46.51 | 142.1 |

A perusal of the TOTOX value of oils listed in the Table reveals that CO and PO have quite low initial value for these parameters which shows their oxidative stability as these are considered to have greater proportion of saturated fatty acids. Blends had higher TOTOX values which may be due to some oxidative degradation caused by exposure to the atmospheric oxygen during blending in the laboratory. A substantial increase in this value is seen as these oils are subjected to frying with the exception of CO, where TOTOX value has reduced perhaps due to the loss of some low molecular weight peroxides by volatilisation. One frying has increased the TOTOX values of SO, GO, PO and CSO by 12.9, 68, 213.9 and 334.8%. The percentage increase observed for CSO blends was much lower; 28.3, 32.4, 68.6 and 87.1% for its blends with PO, SO, CO and GO respectively. As numerical value is more important than the percentage increase, it is observed that all blends have performed better than CSO with blend with SO performing best and blend with CO a close second. Perhaps this may be due to the presence of natural antioxidants in SO and largely saturated fatty acid composition of CO.

After nine more fryings (ten in total), the TOTOX value of CO in spite of increasing by about 27 times was lowest (41.22). The value for CSO had almost doubled and was the highest (125.73) among all oils. Among CSO blends, only SO blend had lower TOTOX value than CSO though it also showed a higher percent increase (135%). Blend with CO showed highest TOTOX value and also the highest percent increase. This blend therefore seems to be incompatible as lot of frothing was also seen during frying.

Sunflower oil (SFO), soybean oil (SBO) and Rice bran oil (RBO) being popular edible oils were also used for blending with CSO. All these oils were of refined type and obtained from local super market. Refined CSO from another company was obtained for checking the frying stability to confirm the previous findings. Blends (50:50) of above oils viz. SFO, SBO and RBO with CSO were prepared and frying stability of the oils and blends was studied as done earlier. Colour values of oils before and after using 10 times for frying were determined. All oils showed an increase in yellowness (b*) and yellowness index values after frying. PV and p-AV values of the oils were

determined before, and after 1, 5 and 10 frying cycles and were used to calculate the TOTOX values which are listed in Table 10. It is seen from the Table that in comparison to the previous CSO sample, this one showed much lower increase in TOTOX after the first frying but values after 10 frying cycles were almost similar to those obtained with previous oil sample. Value after 5 fryings was in between and almost double of the value observed after one frying. Increase observed for other oils both in terms of percentage increase and numerical value was much lower even after 10 fryings. Blends showed good performance and their oxidative load was much lower than CSO and was almost similar to the oil used for blending. Blend of CSO with SFO showed very high oxidative stability as there was very low increase in oxidative load with increase in number of frying cycles.

*Table 10. TOTOX values of oils and CSO blends after frying*

| Oil | TOTOX Value after frying cycles | | | |
|---|---|---|---|---|
| | 0 | 1 | 5 | 10 |
| CSO | 31.95 | 33.77 | 76.99 | 129.61 |
| RBO | 40.15 | 42.03 | 49.72 | 65.19 |
| SBO | 23.24 | 28.14 | 35.18 | 47.59 |
| SFO | 34.34 | 36.55 | 40.86 | 45.47 |
| CSO+RBO | 26.03 | 28.73 | 47.24 | 68.04 |
| CSO+SBO | 28.53 | 27.98 | 39.66 | 47.25 |
| CSO+SFO | 33.69 | 40.48 | 42.20 | 42.36 |

**Fatty acid composition of oils**

Fatty acids present in the oils and their blends were analysed by capillary GC by preparing methyl esters using BF3- methanol and comparing the retention time and quantity present with reference standards. Fatty acid composition of experimental oils when seen against the frying stability, it is observed that CSO, SO, SBO, SFO are all rich in linoleic acid which is an omega 6 polyunsaturated fatty acid (PUFA). If oleic acid which is a monounsaturated fatty acid is also included, SFO, SBO and SO have higher level of unsaturation than CSO but showed better frying stability. This may be due to the higher amount of natural antioxidants in SO (cold pressed oil) and added synthetic antioxidants in refined SFO and SBO.

From the experiments, it can be concluded that cotton seed oil has satisfactory oxidative stability for single frying operations, but is more prone to oxidative degradation when subjected to multiple frying operations. As it is a PUFA rich oil, blending with higher MUFA content oils not only improves the nutritive value due to balanced fatty acid composition but also improves the oxidative stability during storage as well as multiple frying operations.

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

The bacterial crude xylanase-based pretreatment process for the bio bleaching of banana pseudostem fibers and cotton stalk-based paper pulp was optimized. The optimization of xylanase-based pulp bio-bleaching pre-treatment was based on the doses of crude xylanase (25, 50, 75 and 100 % v) produced by B. pumilus and B. licheniformis, enzyme-pulp incubation temperature (50, 60 and 70 0C), enzyme-pulp incubation time (60, 120 and 180 min), and material (pulp) to liquor ratio (1:5, 1:10, and 1:20). The bio bleaching effect of crude xylanase was determined by spectrometric estimation of liberated lignin compounds (at 400 nm), phenolic/ hydrophobic compounds (at 465 nm) and reducing sugar from enzyme treated pulp. Furthermore, the bio bleaching effect was also confirmed by analyzing the brightness index of the treated paper pulp.

The result indicated that bacterial crude xylanase, when used in 100 % concentrations, resulted in the maximum release of lignin and hydrophobic compounds from both cotton stalk and banana fiber pulp (Fig 26). Likewise, the considerable amount of lignin and hydrophobic compounds was released when bacterial crude xylanase and pulp was incubated for 120 min. Likewise, optimized temperature of 50 0C and 1:10 as a material to liquor ratio were found most effective for the subsequent liberation of these compounds after bacterial crude xylanase pretreatment. Furthermore, approximately 5 % (in cotton pulp) to 15 % (in banana pulp) improvement in the brightness level of paper pulp also ascertained the effectiveness of crude xylanase-based pretreatment for bio bleaching.

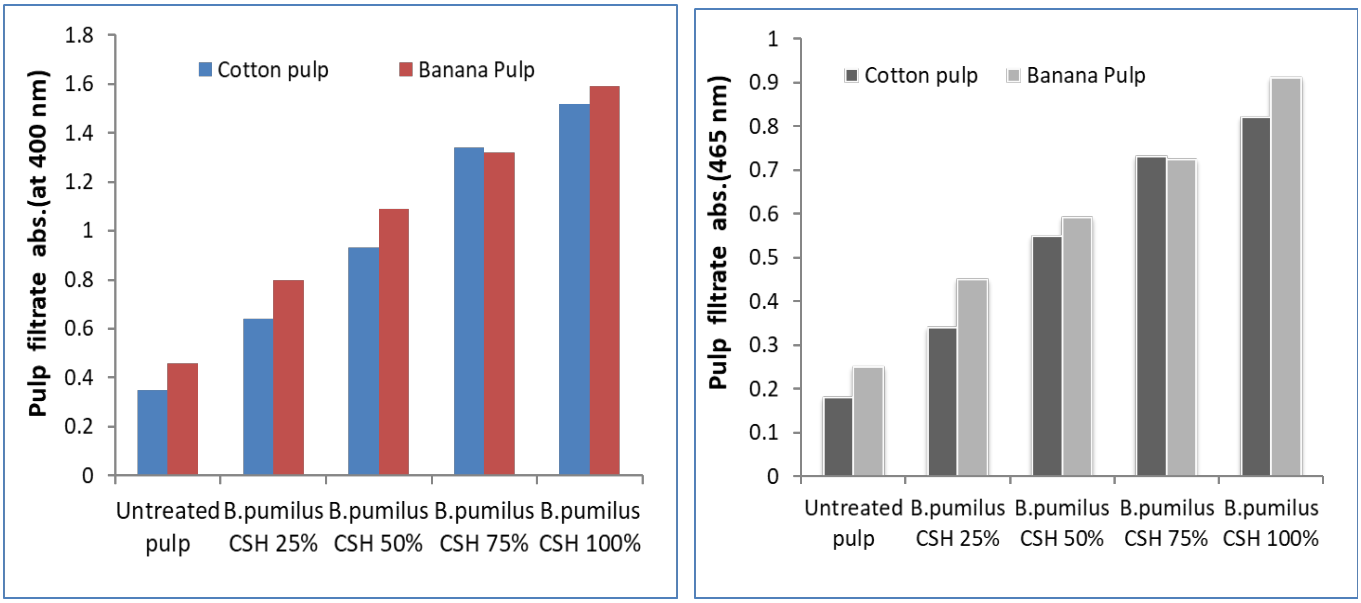



*Fig 26. Effect of different xylanase doses on the release of lignin compounds (at 400 nm) and hydrophobic compounds (at 465 nm) from lignin-carbohydrates complex of pulp biomass*

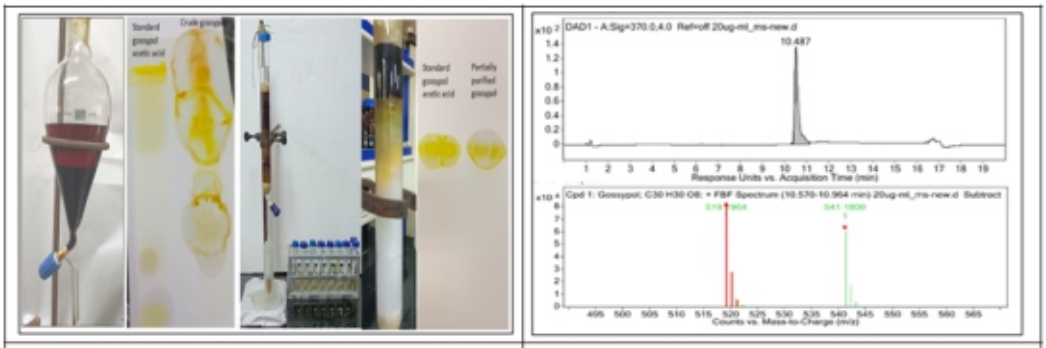
### 2.4.4 Isolation of gossypol from cottonseed and its evaluation as a botanical fungicide

The project was carried out for developing and optimizing a suitable technology for the recovery and purification of gossypol from cottonseed and soap stock (by-product of the cottonseed oil refining process). Gossypol, a bioactive compound found in cotton plants, has significant potential in pharmaceutical and agricultural applications due to its antioxidant, antibacterial, anti-parasitic, antifungal and anticancer properties. Key parameters for isolating gossypol such as solid-to-solvent ratio, acid concentration, and extraction time, were optimized for achieving the most efficient gossypol recovery. The crude gossypol extract was then partially purified using solvent-solvent extraction to remove oil and wax impurities, followed by further purification with silica column chromatography.

The structural integrity and purity of the partially purified gossypol were verified using UV-Visible spectroscopy, FTIR and Thin Layer Chromatography (TLC). In UV-visible spectrum, both standard gossypol acetic acid and crude gossypol extract from soap stock showed absorbance maxima ($\lambda$max) within the range of 370-375 nm. In FTIR spectrum, both standard gossypol acetic acid and partially purified gossypol showed peaks at the similar wavelength. However, the intensity of peaks shown by crude gossypol was lower which may be due to the presence of impurities. HPLC/MS characterization method for the determination of gossypol was developed by using different concentrations of standard gossypol acetic acid. Retention time (RT) of gossypol acetic acid was found to be 10.487.

The partially purified gossypol extract was evaluated for antioxidant, antifungal and antibacterial properties. DPPH radical scavenging assay was used to analyze the antioxidant activity of crude gossypol extract as well as standard gossypol acetic acid. The radical scavenging activity of standard gossypol acetic acid was 51.4% at a concentration of 40 µg/mL with IC50 of 36.71 µg/mL. However, crude gossypol extract from soap stock showed 57.6% DPPH scavenging at a concentration of 20 µL. Antifungal activity of crude gossypol extract was evaluated using poison food assay against four fungal strains namely Fusarium oxysporum, Aspergillus niger, Aspergillus flavus and Rhizopus. Both standard gossypol acetic acid as well as crude gossypol extract derived from soap stock showed non-significant antifungal activity against the tested fungal strains except Fusarium oxysporum. Broth dilution assay with MTT dye was used to evaluate the antibacterial activity against Klebsiella pneumoniae. The standard gossypol acetic acid showed Minimum inhibitory concentration (MIC) between 40 to 80 µg/mL.

For improving the stability of recovered gossypol, the partially purified gossypol extract was mixed with chitosan (0.5%) and a dried gossypol powder obtained using spray drying. Thus, gossypol can be obtained from soap stock/cottonseed which after purification and stability improvement, can serve as valuable bioactive compound in pharmaceutical and agricultural field.



Partial purification of the crude gossypol using silica column & screening using TLC

HPLC/MS characterization of standard gossypol acetic acid

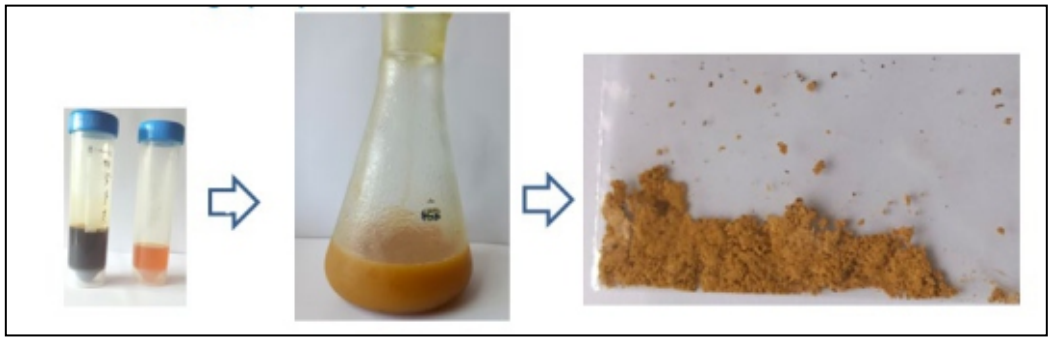
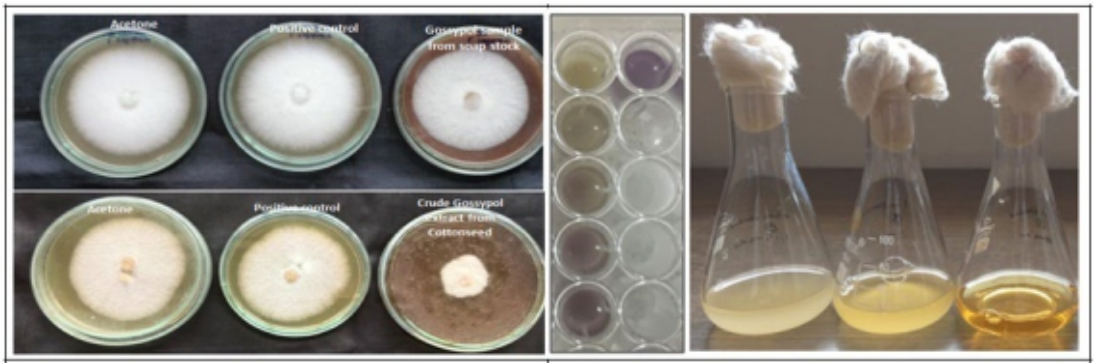


*Fig 27. Conversion of partially purified gossypol extract into chitosan bound dried form*




Antifungal activity of crude gossypol from soap stock and cottonseed against *F. oxysporum*

Antibacterial activity of standard gossypol acetic acid against *K. pneumoniae*

### 2.4.5 Effects of process parameters on cottonseed oil extraction

***Physical properties of cottonseeds:*** Principle dimensions and related characteristics of eight varieties of cottonseeds namely Phule Dhanwantari, Bunny, Phule Yamuna, Yuva, Suraj, J-34, DCH-32 and NCS 2778 were determined. Average length of cottonseeds varied from 7.19 ± 0.43 mm (Phule Dhanwantari) to 9.33 ± 0.63 mm (DCH-32), width from 4.27 ± 0.25 mm (Phule Dhanwantari) to 5.35 ± 0.41 mm (DCH-32) and thickness from 3.61 ± 0.30 mm (Phule Dhanwantari) to 4.46 ± 0.48 mm (NCS 2278). The geometric mean diameter (mm), arithmetic mean diameter (mm) and sphericity (%) were 4.96 ± 0.25 (Phule Dhanwantari) to 6.07 ± 0.38 (Bunny), 5.02 ± 0.26 (Phule Dhanwantari) to 6.33 ± 0.30 (DCH-32),

64 ± 0.04 (DCH-32) to 71 ± 0.05 (NCS 2778) respectively.

***Effect of cottonseed moisture content on oil recovery:*** Cottonseeds with different moisture contents (7.5 to 19 % w.b.) were processed in screw type oil expeller operating at different screw speed (12 to 17 rpm) to check its effect on oil recovery (Fig. 27). Analysis of result indicated that there is inverse relation between screw speed and oil recovery (r = -0.86) as well as moisture content of cottonseed and oil recovery (r = -0.69). It was noted that the cottonseeds processed at combination of lowest moisture content (7.5 ± 0.5 %) and lowest screw speed (12 rpm) yielded highest oil (14.8 %).

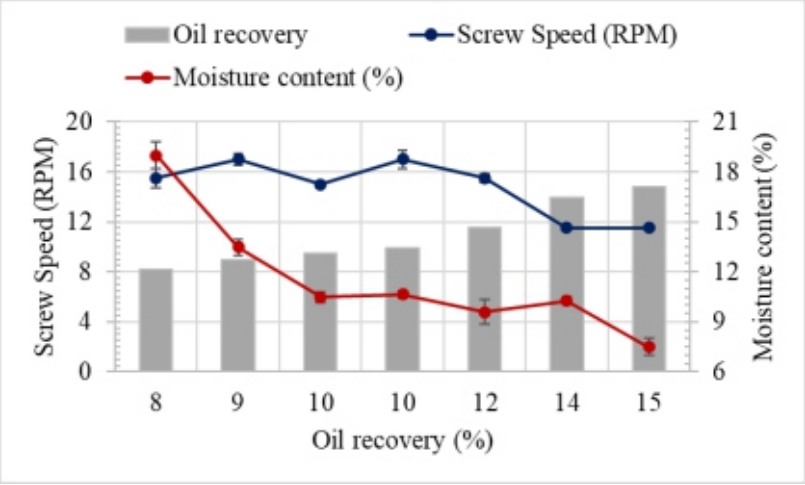



*Fig 28. Effect of moisture content and screw speed on oil recovery*

## 2.4.6 Evaluation of cotton based lignocellulosic biomass for production of furfural

For the efficient production of furfural from cottonseed hull, pretreatment, acid hydrolysis, and dehydration of pentose sugars were optimized using various conditions. Pretreatment enhances the accessibility of cellulose and hemicellulose, creating favorable conditions for efficient furfural production. In the initial trials, a chemical pretreatment method was employed using a 1% sulfuric acid ($H_2SO_4$) solution. This chemical pretreatment played a crucial role in increasing the surface area of the biomass particles, facilitating better interaction between the biomass and $H_2SO_4$ in the furfural production process. To optimize the pretreatment conditions, seven experiments were conducted, varying the ratio of cottonseed hull to 1% $H_2SO_4$ at three different ratios (1:5, 1:10, and 1:15), while maintaining a constant time of 60 minutes. After pretreatment, the optimized yield of furfural is influenced by the acid hydrolysis and dehydration of the pentose sugar. For optimizing the acid hydrolysis stage, seven experiments have been conducted, varying the ratio of pretreated cottonseed hulls to 5% H2SO4 at three different ratios (1:2.5, 1:5, and 1:7.5) with varying reaction time. Quantification was done using UV-Vis Spectrophotometry, where the standard furfural was assessed by obtaining spectra of the known standard. The maximum absorption spectra were identified at 275 nm. The highest furfural concentrations (110 ppm) were observed at a solvent-to-solid ratio of 10:1 during the pre-treatment stage and 7.5:1 during the acid hydrolysis stage, with a reaction time of 90 minutes at the acid hydrolysis stage. A flow diagram illustrating the furfural production from cottonseed hulls is presented in Fig. 29.

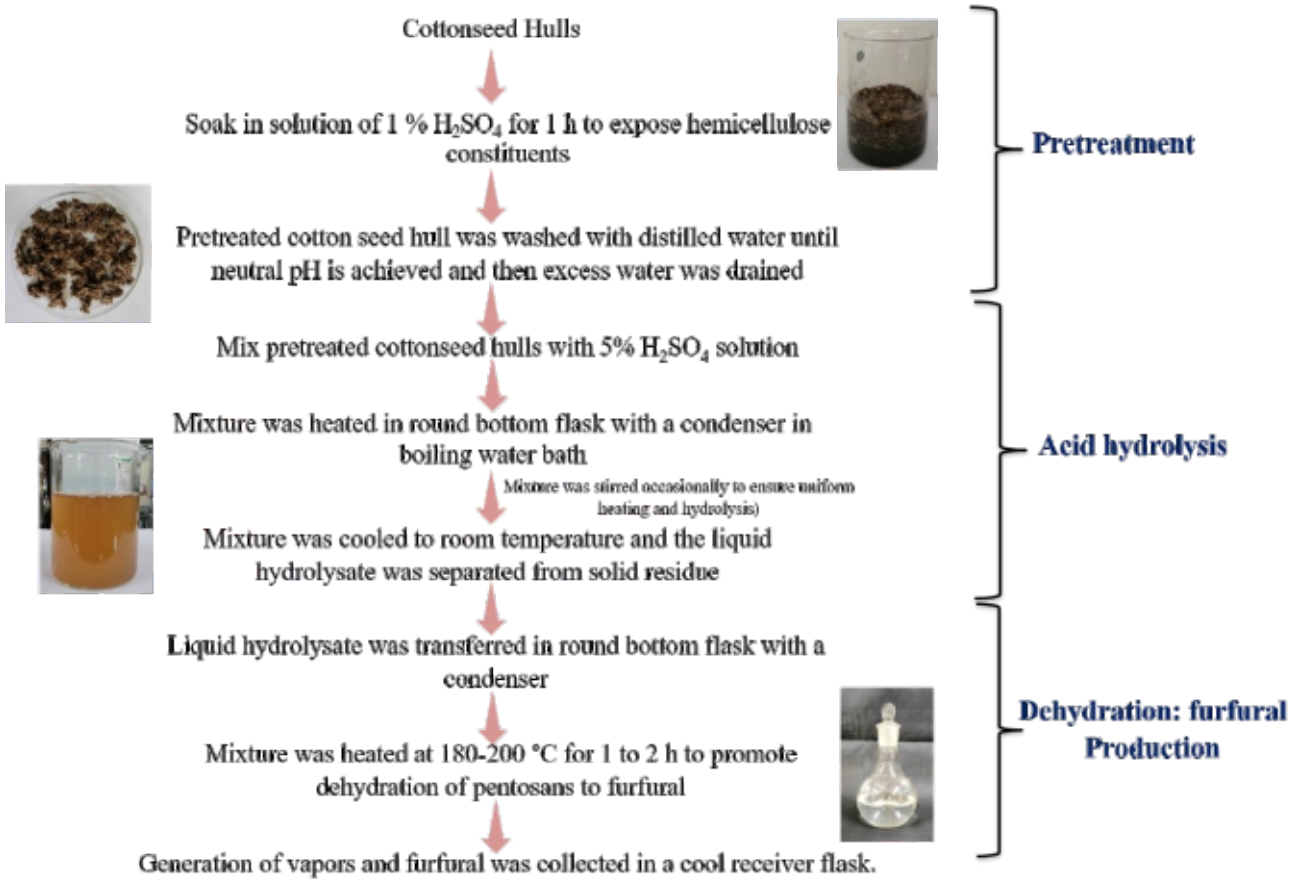



*Fig 29. Flow diagram showing the furfural production from cottonseed hulls*

### 2.4.7 Development of Microbial enzyme mediated delinting process from cottonseeds

Cotton seeds, which are the by-product of a cotton ginning operation, are covered with fibrous lint attached to the seeds. Cottonseed consists of about 8% linters in its total weight. This lint causes an agglomeration or clustering of the seeds and prevents the ready mechanical handling of individual seeds. Delinting is the process of removal of fuzz from the seed coat in cotton. Chemical delinting is the most widely used method to rid cottonseed of linters or tags till date. Conventional chemical delinting processes utilize hydrochloric acid gas (HCl) or sulfuric acid ($H_2SO_4$) to 'degrade' the residual lint attached to the hulls of the cotton seeds, which leaves a completely smooth seed with no usable short fibres. In the present project, attempts were made to explore the enzymes that can degrade the linters without hindering the seed characteristics. The crude enzyme was produced from thermophilic fungi by growing it at 40- and 50-degree C for 7 days using cotton micro-dust collected from different spinning mills located in the nearby Nagpur region (Wani, Hinganghat, Kalmeshwar and Bela). The substrate was added with Citrate buffer and kept at shaking for 30 min. The mixture was filtered using Whatman No. 1 filter paper and the crude enzyme was employed for delinting of cotton seed. The enzyme activity

of fungus at both the temperature was evaluated. The reaction mixture contained different concentrations of enzyme and cotton seed in 50 ml Erlenmeyer flasks and incubated under shaking condition. After incubation, the mixtures were filtered using muslin cloth and the filtrate was analysed for total reducing sugar using DNSA method.

The results showed that maximum endoglucanase (2.52 ± 0.14 IU/ml) activity was observed from micro-dust of Wani while the maximum exoglucanase (1.67 ± 0.42 IU/ml) activity was obtained from Bela unit. Both the enzyme showed maximum activity from fungus grown at 50 °C which reveals its optimal temperature as 50 °C.

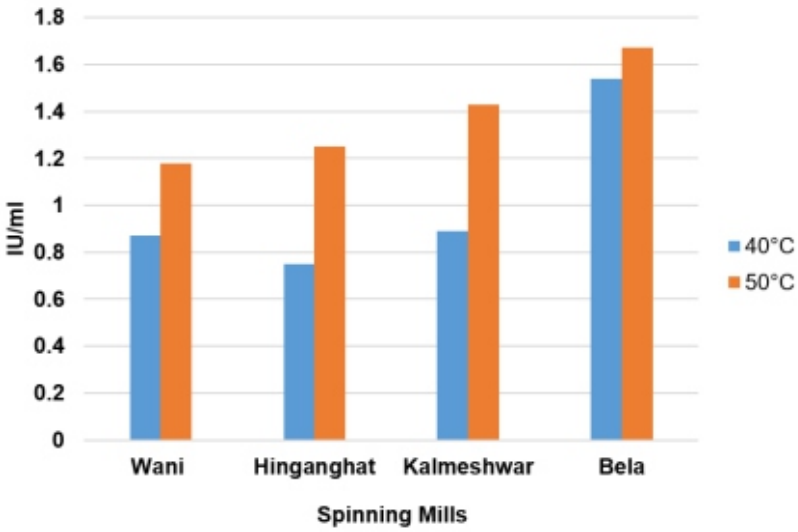



*Fig.1 Endoglucanase activity of fungus CF-T at both 40 and 50 °C*

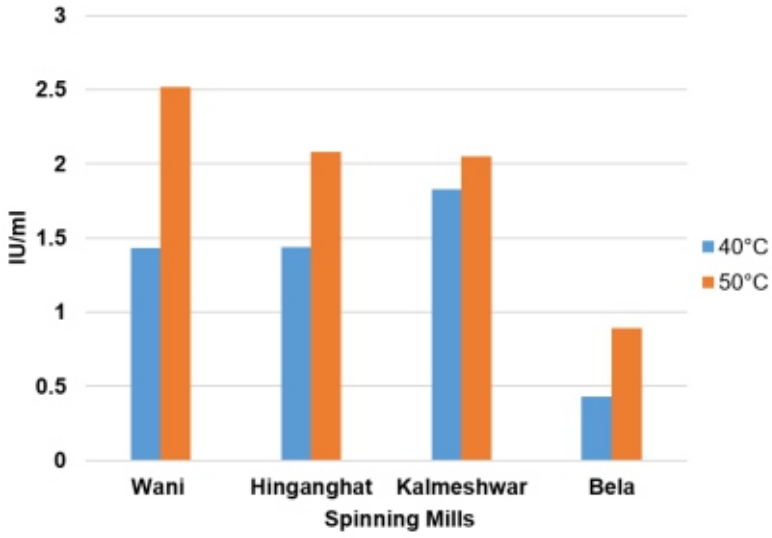



*Fig.1 Exoglucanase activity of fungus CF-T at both 40 and 50 °C*

### 2.4.8 Efficacy evaluation of ICAR-CIRCOT Nano-ZnO as nano fertilizer in field crops [Inter-Institutional Project]

This inter-institutional project is being carried out to evaluate the efficacy of nano-zinc fertilizer formulation developed at ICAR-CIRCOT, Mumbai in chickpea, cotton and paddy crops. ICAR-IIPR, Kanpur; ICAR-CICR, Nagpur & Coimbatore; and, ICAR-NIASM, Baramati institutions are collaborating to carryout pot culture and field evaluation.

The salient findings from this project are given below.

a. ICAR-IIPR, Kanpur reported 30% increase in grain yield in the chick pea field trial, in sandy soil (Fig. 30).

b. ICAR-CICR, Coimbatore reported significant increase in yield parameters like number of opened bolls/plant, boll weight and seed cotton yield due to the foliar application of nano Zn suspension (Fig 31).

c. ICAR-NIASM, Baramati reported equivalent yield in paddy crop (pot culture) with the use of 25% of nano-Zn. Hence, the requirement of zinc is reduced by 75% with the use of nano-Zinc formulation (Fig. 32).

d. ICAR-CICR, Nagpur reported that though the biomass and yield of cotton has increased due to the application of nano-zinc fertilizer, the improvement was not significant. It might be due to the use of black soil that was rich in zinc. Hence, further study is being carried out on calcareous soil / zinc deficient soil to understand the effect of nanofertilizer.


*Fig.31 Field trial of nano-Zn in Chick pea at ICAR-IIPR, Kanpur*

*Fig. 32 Field trial of nano-Zn in Cotton at ICAR-CICR, Nagpur*

*Fig.33 Field trials of nano-Zn in paddy (left) and chickpea (right) at ICAR-NIASM, Baramati*

### 2.4.9 Efficacy evaluation of ICAR-CIRCOT Nano-Sulphur as fertilizer formulation for different field crops [Inter-Institutional Project]

Nano sulphur (20% w/v) was synthesised using the standardized process protocol and supplied to the different collaborative institutes for conducting the field trials.

The efficacy of nano-sulphur as fertilizer formulation was evaluated on soybean cv. Phule Sangam cultivated on an inceptisol soil in a plot size of 4×3 m with a spacing of 30×10 cm at MPKV Rahuri. The experiment was performed with eight treatment combinations with three replications in a randomized block design. The experiments were conducted to evaluate the effect of farm yard manure, soil and foliar application of nano-sulphur. The observations recorded with respect to the crop growth parameters were as follows:

*Table 12. The effect of nano sulphur application on crop growth parameters of Soybean*

| Treatment | Total chlorophyll (mg/g) | Plant Height (cm) | No. of Branches/ plant | No. of Pods/ plant | Grain yield (q/ha) | Test weight (100 g | Protein (%) | Oil (%) |
|---|---|---|---|---|---|---|---|---|
| $T_1$ (w/o FYM: Control) | 1.703 | 87.76 | 11.38 | 72.12 | 29.33 | 148.57 | 36.46 | 19.47 |
| $T_2$ (with FYM: Control) | 1.765 | 89.76 | 12.41 | 74.41 | 32.61 | 155.03 | 36.70 | 19.60 |
| $T_3$ (T2+ES) | 1.828 | 90.68 | 12.73 | 78.32 | 34.94 | 163.17 | 37.21 | 19.87 |
| $T_4$ (T2+100%NS) | 1.800 | 89.79 | 12.67 | 76.24 | 33.84 | 160.30 | 36.78 | 19.83 |
| $T_5$ (T2+75% NS) | 1.791 | 89.99 | 12.60 | 75.01 | 33.42 | 158.92 | 36.45 | 19.80 |
| $T_6$ (T2+50%NS) | 1.752 | 90.31 | 12.16 | 74.51 | 33.02 | 159.23 | 36.52 | 19.70 |
| $T_7$ (T2+NSF @0.25%) | 1.772 | 90.34 | 12.48 | 74.95 | 32.96 | 155.73 | 36.93 | 19.33 |
| $T_8$ (T2+NSF@0.50%) | 1.780 | 90.65 | 12.56 | 75.00 | 33.14 | 158.40 | 37.08 | 19.23 |

The results suggested that elemental sulphur (40 kg/ha) treatment was at par with the 75% of recommended dose of sulphur applied through drenching of nano-sulphur. The post-harvest parameters were, total chlorophyll (1.791 mg/g), plant height (89.99 cm), no. of branches/plant (12.60), no. of pods/plant (75.01), grain yield (33.42 q/ha), test weight (158.92 g), protein (36.45 %), and oil content (19.80%), respectively.

*Fig.34 Field view of the experimental trials at MPKV Rahuri*

The field experiments carried out at VNMKV Parbhani on soybean and cotton crops sown during Kharif season. The soybean crop was sown on 10th July and the cotton was sown on 07th July. The soybean crop was harvested on 01.11.2023, while the cotton picking is in progress.

a b

*Fig.35 Field view of the experimental trials at VNMKV, Parbhani (a) Soybean (b) Cotton*

### 2.4.10 Bioprocessing of natural fibres and agro residues for production of oligo saccharides and lignin-derived aromatics [CRP on Natural Fibres]

Xylo-oligosaccharide (XOS) production from extracted xylan and pre-treated banana fibre was experimented by using the enzymatic hydrolysis method. Two sources of xylanase enzyme are used in XOS production; one from solid-state fermentation using wheat bran substrate (WBX) and the other from submerged fermentation using commercial birch wood xylan (BWX). Pre-optimization and optimization for influential parameters like biomass load, enzyme load, pH, temperature, and incubation time in XOS production was done using RSM. The results showed that XOS production from extracted xylan using submerged xylanase (BWX) has shown significant XOS yield of 4.051 mg mL-1 (12%) when the process was run at 3% w/v biomass load with 80 U g-1xylanase (BWX) by maintaining the initial pH 5.0 followed by incubation at 45 °C for 24 h.

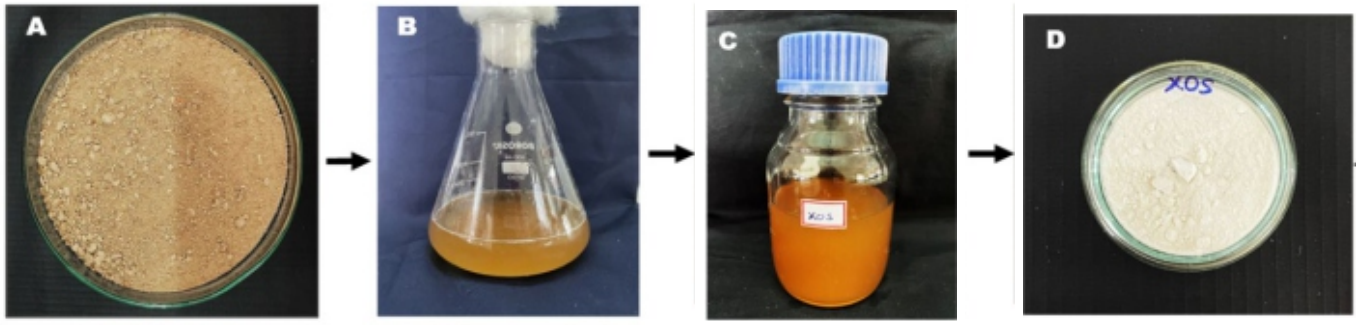



*Fig. 36 A- Extracted xylan, B- Enzymatic hydrolysis of xylan, C- Crude XOS obtained after hydrolysis, D- Freeze dried XOS product*

Cello-oligosaccharide: After xylan extraction was processed from the pre-treated banana fibre, the major composition left behind was the cellulose content. To complete the valorization of the biomass the cellulose portion was subjected to the production of cello-oligosaccharides from the banana fibre cellulose (BFC) and pre-treated banana fibre (PTBF). The process parameters were optimized using RSM. The COS yield of 7.750 mg mL-1 (15%) was obtained when the process was run at 4% w/v biomass load with 30 FPU g-1cellulase load by maintaining the initial pH -4.5 followed by incubation at 45 °C for 18 h time duration.

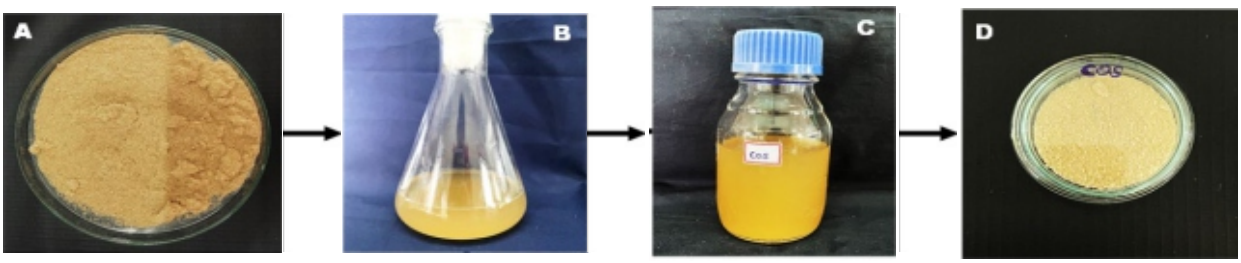



*Fig. 37 A- Extracted xylan, B- Enzymatic hydrolysis of xylan, C- Crude XOS obtained after hydrolysis, D- Freeze dried XOS product*

**Extraction of sugars from Cotton linters**

For this experiment, whole cottonseed containing 5-8% linters was used. Two gram of seed was suspended with 20 ml sodium citrate buffer with 50% (v/v) enzyme load (T1) and 20%(v/v) enzyme load (T2) and incubated at 50 °C under shaking conditions at 120 rpm for 4 hrs. The sugar analysis results are given in the following table.

*Table 13. Sugar Analysis of the Cotton Linters*

| S. No. | Treatment | Glucose released (mg/ml) – DNS Assay | Glucose released (mg/ml) - HPLC | Galactose released (mg/ml) - HPLC | xylose released (µg/ml) - HPLC |
|---|---|---|---|---|---|
| 1 | T1 | 4.51 | 3.81 | 0.067 | 0.15 |
| 2 | T2 | 4.10 | 3.56 | 0.087 | 0.11 |

From the table, it is concluded that the T1 at 50 °C released maximum concentration of sugars i.e. 4.51 mg/ml while T2 released comparatively less sugars (4.10 mg/ml) at 50 °C. This may be attributed to the concentration of enzyme available in the enzyme mixture 50% as compared to 20% enzyme loading applied in the reaction mixture. Similar results were obtained from the HPLC analysis of sugars. In this, we observed the presence of galactose in the mixture which might be due to the residual sugars present in the enzyme mixture. The presence of xylose could be attributed to the residues present in the seeds. Since 2 g seeds suspended in 20 ml of Sodium citrate buffer, the glucose concentration is estimated at 90.2 mg for T1 (4.51 mg/ml) and 82.0 mg for T2 (4.1 mg/ml). Cotton seed has 5 to 8 % linters, 2 g seeds would contain 100 to 160 mg linters (cellulose). Accordingly the quantity of glucose (conversion of cellulose to glucose, we multiply the cellulose with the factor 0.9) is estimated at 90 – 144 mg.

## 2.4.11 Characterization and utilization of paddy straw and other agro residues for conversion into pellets for co-firing in Thermal Power Plants (TPP) [Externally Funded Project – National Biomass Mission of Ministry of Power]

**Characterization of biomass samples**

All five biomass samples procured viz. cotton and soybean stalks, bamboo dust, groundnut shells and paddy straw were analysed for chemical composition (lignin, cellulose and hemicellulose). However some of these, especially paddy straw had very high ash content, hence these values were analysed again with ash corrections and corrected values are presented in Table 14. It is seen from the Table that bamboo dust had highest lignin and cellulose content and groundnut shell had highest hemicellulose content. Lignin content was lowest for paddy straw.

*Table 14. Chemical composition of biomass samples (with ash correction)*

| Parameter | Paddy straw | Cotton stalk | Groundnut shell | Bamboo dust | Soybean stalk |
|---|---|---|---|---|---|
| **Lignin (%)** | 17.23 | 23.56 | 21.0 | 27.9 | 22.46 |
| **Cellulose (%)** | 29.21 | 35.5 | 25.33 | 41.1 | 39.5 |
| **Hemicellulose (%)** | 28.09 | 25.44 | 37.78 | 23.02 | 24.62 |

Ultimate analysis (CHNSO) of these five biomass samples and tur stalks was carried out at IIT, Bombay and the results revealed that sulphur was below detection limit in all of these. Hence their use for co-firing can significantly reduce the emission of sulphur oxide from thermal power plants. Percentage content of other four elements are graphically presented in Fig. 38. It is seen from the figure that Nitrogen content of the biomass materials is also very low. Carbon content which is responsible for energy generation from the biomass followed the order: Bamboo dust > Tur stalk > Groundnut shell > Soybean stalk > Cotton stalk > Paddy straw which explains the higher GCV observed for pellets made using combinations with higher amount of cotton stalk/groundnut shell / bamboo dust.

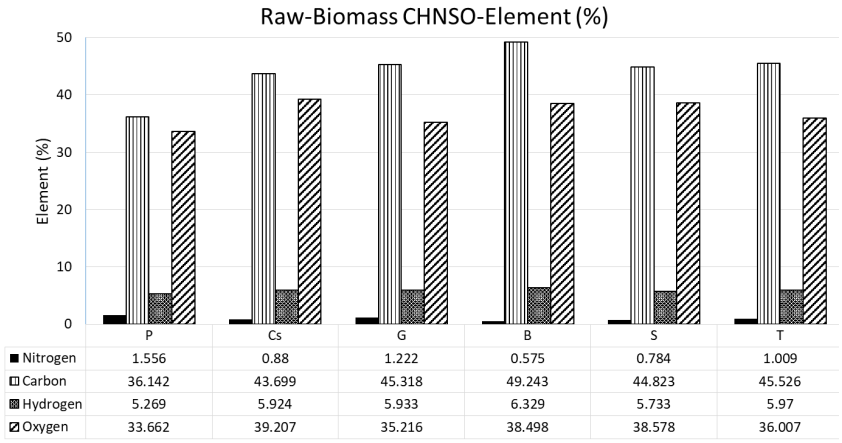



*Fig. 38 CHNO content of different biomass materials*

Samples (39) of paddy straw of different varieties obtained from different geographical locations of the country last year were analysed for ash and acid insoluble ash content and it was observed that the ash percentage in different varieties ranged from a low of 10.6% in Pusa Basmati 1885 to a high of about 20.1% in HUR 105. The same varieties had lowest and highest acid insoluble ash content of 5.3% and 15.8% respectively. These values being much higher than other biomass materials, can be used to find out the paddy content of biomass pellets. This year also, 21 paddy straw samples of different varieties have been collected from Punjab and Haryana states and these will also be taken up for study.

ICP-MS and accessories were procured, installed and standard operating protocol for acid digestion and subsequent analysis of biomass materials for elemental composition was finalized. Mineral composition analysis (excluding silica) of five types of biomass procured in bulk as also the pellets made from these respective materials by using ICP-MS was completed. Lot of variability in mineral content of replicates of a sample was observed due to non-uniform character of biomass and the small sample size recommended for ICP-MS analysis. It could still be inferred that paddy straw had high content of, Sodium, Potassium and Manganese as compared to other raw biomasses and the similar trend was also observed for the pellets made from these biomass materials. The results are presented in Table 15. It is seen that in general, potassium, calcium and magnesium are abundantly present in the agro-residues. It may be noted that bamboo dust is a processing waste and not an agro-residue.

*Table 15. Elemental composition (ICP MS) of biomass materials and Pellets*

| Material | Element Concentration (ppm) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Na | Mg | Al | K | Ca | Mn | Fe | Cu | Zn | Pb |
| Paddy Straw | 1107.61 | 2147.52 | 30.04 | 30863.35 | 3893.02 | 738.79 | 66.51 | 5.88 | 24.05 | 5.02 |
| Paddy Straw Pellet | 1584.68 | 2526.00 | 314.89 | 31631.87 | 3984.89 | 666.91 | 1832.36 | 4.37 | 55.45 | 0.00 |
| Cotton Stalk | 337.25 | 1475.56 | 317.86 | 12944.81 | 3925.25 | 46.84 | 579.14 | 8.11 | 18.46 | 5.69 |
| Cotton Stalk Pellet | 980.87 | 1933.08 | 728.57 | 12386.76 | 5872.30 | 57.85 | 1369.52 | 9.24 | 64.18 | 0.00 |
| Groundnut Shell | 577.77 | 2095.84 | 2431.16 | 5352.08 | 4367.13 | 109.49 | 2709.65 | 13.16 | 14.03 | 3.48 |
| Groundnut Shell Pellet | 1455.57 | 3099.93 | 1535.71 | 3863.42 | 5950.37 | 88.50 | 2394.40 | 12.38 | 202.49 | 0.43 |
| Soybean Stalk | 0.00 | 1772.13 | 1469.39 | 8180.54 | 4449.06 | 63.49 | 1788.00 | 9.20 | 11.48 | 2.92 |
| Soybean Stalk Pellet | 101.06 | 2613.23 | 1734.50 | 9805.54 | 5351.10 | 140.57 | 2786.85 | 8.99 | 39.22 | 0.00 |
| Bamboo Dust | 107.71 | 171.68 | 0.00 | 3033.53 | 24.58 | 50.23 | 27.49 | 3.09 | 17.12 | 4.56 |
| Bamboo Dust Pellet | 0.00 | 746.99 | 331.23 | 6104.68 | 787.14 | 100.07 | 828.51 | 6.85 | 33.31 | 1.52 |
| Tur Stalk | 0.00 | 733.60 | 17.32 | 4621.55 | 2824.51 | 7.95 | 12.59 | 3.53 | 2.49 | 0.51 |

**Preparation and characterization of pellets of different biomass combinations**

Pellets of five different biomass materials viz. paddy straw, cotton and soybean stalks, bamboo dust and groundnut shells using all designed 126 different combinations were made in the in-house pelleting plant at GTC Nagpur using Sal DOC binder (5%) and adding appropriate amount of water. About 15-20 kg pellets were made for each combination. Pellets thus made were analyzed for GCV, moisture and ash contents at GTC, Nagpur and following inferences could be made:

- GCV value for biomass pellets ranged from 2743 to 4356 (Cal/g)
- Pellets with higher amount of cotton stalk / groundnut shell / bamboo dust had higher GCV
- Low ash contents were observed for the pellets which did not contain paddy straw
- Addition of paddy straw in general, increased ash content and reduced the GCV of pellets

All these pellets were also analyzed for physical parameters such as durability index, bulk density and fines (%). It was seen from the results that the Durability Index (%) ranged from 96.14 to 99.54%, Bulk Density (Kg/m3) varied from 555.6-678.21 (Kg/m3) and Fines (%) ranged from 0.04-0.9%.

Mineral composition analysis (excluding silica) of these126 pellets using ICP-MS has been completed. Variations in replicates of the same samples were little higher due to small sample size recommended for ICP-MS and non-uniform nature of the biomass materials. Results revealed that content of various minerals in the pellet varied with changes in the biomass composition of the pellets.

**Storage studies on biomass and biomass pellets**

All five procured chipped biomass materials have been stored under the shade in heaps at GTC, Nagpur and did not show any visible signs of deterioration.

Ash and acid insoluble ash analysis of biomass pellets with paddy content varying from 50-100% has been carried out twice after a gap of about 8 months and almost similar results were obtained.

Out of the total 126 types of pellets made (15-20 kg each) using varying combinations of biomass, three types of pellets were selected for storage study. First type consisted of the Top 10 samples which had higher GCV and lower ash content (Total samples 10), second type of pellets were those which had 50% or above paddy content (Total samples 15) and third type of pellets were the pellets made from individual biomasses (Total no. of samples 5). Thus the total number of samples selected for the storage study was 30. These samples have been analysed for GCV, ash content and moisture content with 3 replications each and kept in three different environments namely "open environment", "PP bag" and "air tight bag". Samples of these pellets will be taken and analysed for these parameters again after every two months. As it is not possible to analyse 270 samples in a month, the samples have been kept in different environments on different dates with a time gap to facilitate on time analysis.

**Torrefaction Studies on biomass materials**

Earlier studies showed that a temperature between 250-300°C was better for the torrefaction of experimental biomass samples. Hence a temperature of 280°C was used for torrefaction of these biomass samples in fixed bed reactor and

torrefied biomass was analysed for GCV. Torrefaction increased the GCV with highest increase (46%) observed for bamboo dust which was also found to have the highest GCV among all torrefied materials. Cotton and soybean stalks showed about 25% and 21.6% increase in GCV whereas increase in GCV for groundnut shell and paddy straw was lower, only 13% and 11.4% respectively. Torrefied material also showed lower moisture absorption compared to raw biomass and the equilibrium moisture content upon exposure to different relative humidity environments was lower for torrefied biomass. No microbial growth was seen even after prolonged exposure to 85 and 95% RH atmosphere whereas extensive microbial growth was seen in all untorrefied biomass materials at these RH levels just after 3-4 days.

Chemical composition of biomass materials torrefied in fixed bed reactor at 280°C was determined using TAPPI methods with ash correction and the values are shown in Table 17. A comparison of these values with untorrefied biomass in Table 16 reveals that lignin content of these materials has increased after torrefaction and hemicellulose content has decreased. In case of paddy straw, a lot of mineral material was found in the lignin fraction and subtracting this matter showed the real amount of lignin present in torrefied paddy straw to be much lower in comparison to other torrefied biomass materials. It may also be responsible for the lower GCV observed for torrefied paddy straw in comparison of other biomass materials.

*Table 16. Chemical composition of torrefied biomass samples (with ash correction)*

| Parameter | Paddy straw | Cotton stalk | Groundnut shell | Bamboo dust | Soybean stalk |
|---|---|---|---|---|---|
| **Lignin (%)** | 29.01 | 63.13 | 51.49 | 58.89 | 36.79 |
| **Cellulose (%)** | 15.55 | 28.39 | 38.08 | 37.64 | 18.37 |
| **Hemicellulose (%)** | 23.56 | 27.37 | 8.86 | 29.36 | 13.77 |

Torrefaction trials for all five biomass materials were also conducted in Fluidized Bed Reactor at three temperatures viz. 260, 280 and 300°C for 30 min. with nitrogen gas being used for fluidisation. Trials were completed for paddy straw, bamboo dust, cotton stalks and groundnut shell. Weight loss in biomass samples upon torrefaction was determined and the values are presented in Table 17. It was observed that the weight loss was much higher than that observed for fixed bed reactor due to good movement of material facilitated by nitrogen gas supply. A gradual increase in the weight loss of the biomass with increase in torrefaction temperature was observed with the weight loss values differing for different biomass materials. GCV of torrefied materials are being determined.

*Table 17. Percent Weight Loss during torrefaction of biomass*

| Biomass | Fixed Bed Reactor 280°C | Fluidised Bed Reactor | | |
|---|---|---|---|---|
| | | 260°C | 280°C | 300°C |
| Paddy Straw | 26.62 | 37.9 | 47.1 | 52.86 |
| Cotton Stalk | 32.82 | 47.48 | 52.03 | 0.06 |
| Groundnut Shell | 21.89 | 45.01 | 52.63 | 62.69 |
| Bamboo Dust | 33.3 | 43.04 | 45.15 | 53.0 |
| Soybean Stalk | 18.68 | 9.87 | 5.21 | 58.51 |

- Analysis of ash and acid insoluble ash content of both Fixed bed and Fluidised-bed reactor torrefied biomass samples revealed an increase in these parameters on account of weight loss due to loss of volatiles during torrefaction.
- Thermo gravimetric analysis (TGA) of biomass samples torrefied in both Fixed-bed and Fluidised-bed reactors has been completed and graphs obtained are being analysed.
- Torrefaction trials at 280°C in flat bed reactor were run in several batches to collect one kg torrefied material of all five biomass samples. Pellets were successfully made from these torrefied biomass materials after addition of required amount of water with Sal DOC (5%) as binder. Characterization of these pellets is in progress.
- Work order for development, installation and commissioning of pilot level and a prototype torrefaction unit has been placed on 13th December and the prototype is likely to be ready by the end of March, 2024.

## 2.4.12 Design and Development of Pilot Plant for Extraction of Protein from Deoiled Cotton cake and Value Addition / By-Product Utilization.

**Development of Protein Bar**

After reviewing previous studies on cottonseed protein-formulated biscuits, we began developing protein bars that incorporate microwave-pretreated cottonseed protein isolates. We developed protein bars with microwave-pretreated cottonseed protein isolates, almonds, pumpkin seeds, brown rice crisps, rolled oats, dried cherries, raisins, acacia gum powder, and salt. We melted peanut butter, date syrup, honey, and sugar syrup and added in pea protein isolate and microwave-pre-treated cottonseed meal protein isolate, and mixed everything well. We shaped the mixture into rectangular bars, froze them for 1 hour, and packaged them in silver foil and transparent polythene bags. Variants were prepared according to Table 18. The bars were ready for the dietary intervention study (Fig 39).

*Table 18. Protein bars formulation*

| Ingredients | Quantity (100 g) |
|---|---|
| Microwave pre- treated cottonseed protein isolates | 5 |
| Pea protein | 15 |
| Rolled oats | 4.5 |
| Roasted almonds | 3 |
| Roasted pumpkin seeds | 2 |
| Brown rice crisp | 8 |
| Cocoa powder | 4 |
| Dried cherries | 2 |
| Raisins | 0.75 |
| Acacia gum | 4 |
| Salt | 0.25 |
| Peanut butter | 15 |
| Dates syrup | 12 |
| Honey | 3 |
| Sugar syrup | 20 |
| Soya lecithin | 1.5 |

*Fig. 39 Microwave pre-treated cottonseed protein isolate incorporated protein bar*

Commercial protein bars typically contain 15-45% protein, 10-50% carbohydrates, and 10-15% fat. Our cottonseed protein bar has 31.716% protein, 40.365% carbohydrates, and 9.215% fat. Protein bars are low in moisture, and our analysis shows our bar remained below the permissible limit for moisture during a 90-day storage study.

The water activity of protein bars was analyzed over 90 days, with readings ranging from 0.62 to 0.927 (Fig. 40). Typically, it falls within the safe range of 0.5-0.9. The water activity increased as storage time increased, regardless of packaging and storage conditions. A low water activity is important to prevent microbial growth and ensure safety in high-protein nutrition bars. An increase in water activity indicates the movement of water molecules from the intermediate to the bulk phase, causing the proteins to fragment. The texture of bars softened, but the water initially

available to act as a plasticizer became free water over time, leading to an elevated rate of bar hardening and explaining the increase in water activity.

The color of low-calorie protein bar is essential, but it fades over time due to pigment oxidation caused by exposure to high temperatures during storage. The L* values increase until day 60 and then decrease (Table 19). The a* and b* values vary during storage, and there is an overall loss of color from 0 to 90 days. The L* values may be linked to enzymatic or non-enzymatic browning, while the a* and b* values are related to pigment presence, which can change over time.

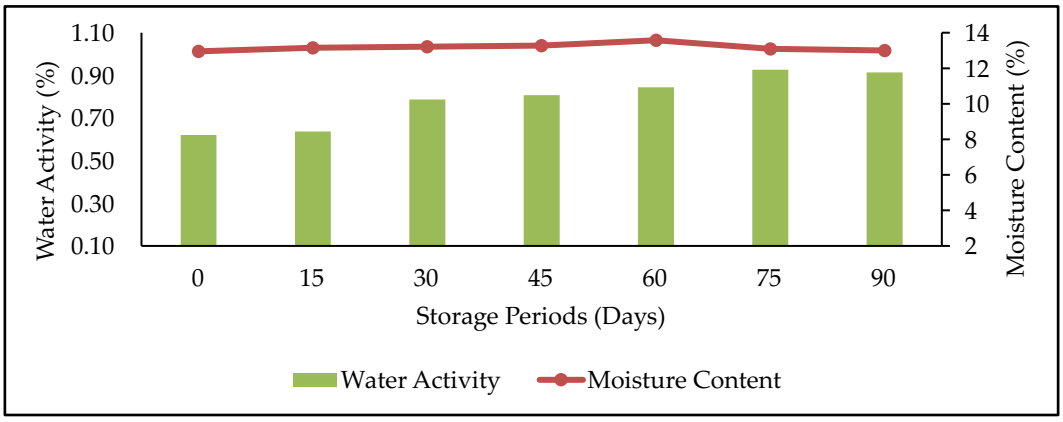



*Fig. 40 Relationship between moisture content and water activity of protein bar*

*Table 19. Colour values of microwave pre- treated cottonseed protein infused bar*

| Days | L* | a* | b* |
|---|---|---|---|
| **0 Day** | 8.01 | 29.97 | 13.65 |
| **15 Day** | 7.66 | 30.64 | 13.06 |
| **30 Day** | 9.07 | 30.67 | 15.47 |
| **45 Day** | 24.81 | 24.9 | 42.18 |
| **60 Day** | 33.23 | 8.89 | 13.13 |
| **75 Day** | 22.01 | 17.38 | 35.08 |
| **90 Day** | 33.16 | 9.4 | 13.79 |

Figure 41 shows how different proteins affect the hardness of protein bars. Hardness is the force required to compress bars. Fresh samples are less hard, but get harder with time. Large particle proteins increase hardness, while fine-grained proteins result in a soft product structure. High-protein bars harden in two stages. Physicochemical changes cause protein bars to become harder over time, resulting in differences in hardness. However, the texture is essential to consumers, and hardness should not be a barrier to consumption.

The microbial count of food must be analyzed to ensure its safety for consumption. Initial analysis showed a TBC colony count of 0.8 x 102 cfu/ml, which increased to 0.23 x 103 cfu/ml after 90 days . The protein bar was found to be microbial-safe for three months, except for TBC. The total bacterial count was within the normal safe range of 1,000,000 CFU throughout the 90-day period. Changes in microbial count may be due to variations in water activity during storage time.

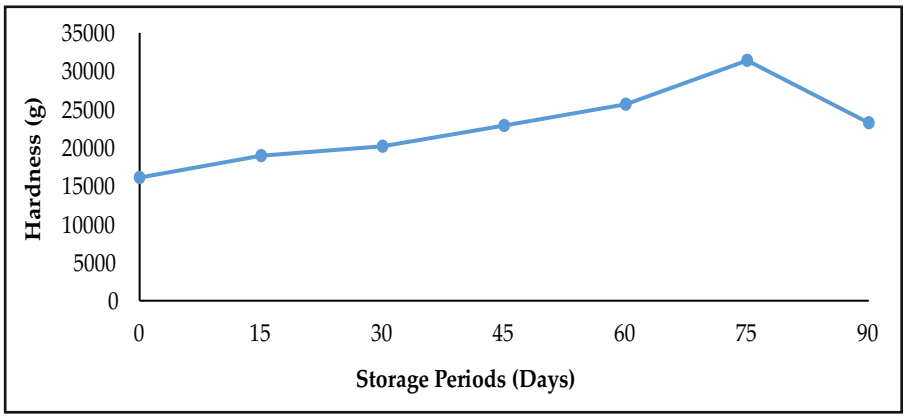



*Fig. 41 Textural analysis of microwave pre-treated cottonseed infused protein bar*

*Table 20. Microbial load (cfu/g) in packed cottonseed protein infused bar*

| Days | TBC (cfu/g) |
|---|---|
| 0 | $0.8 \times 10^2$ |
| 15 | $1.1 \times 10^2$ |
| 30 | $1.3 \times 10^2$ |
| 45 | $1.6 \times 10^2$ |
| 60 | $1.9 \times 10^2$ |
| 75 | $2.1 \times 10^2$ |
| 90 | $2.3 \times 10^2$ |

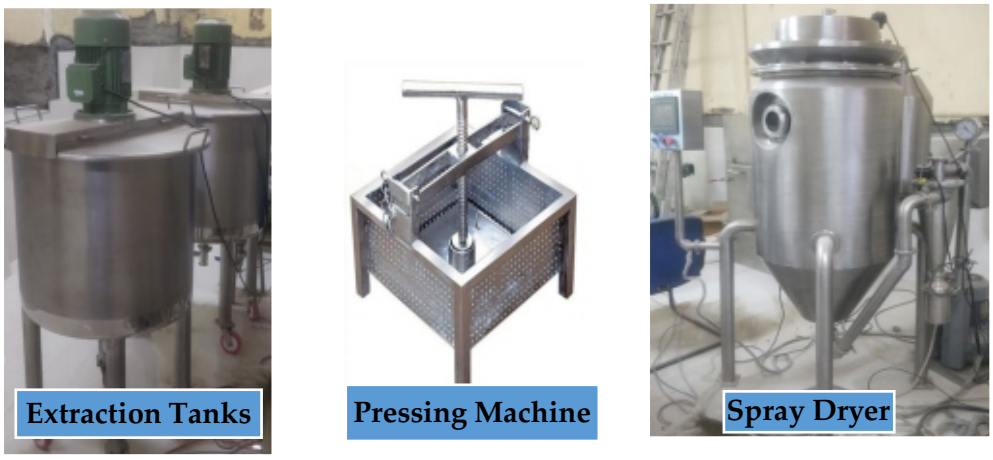



*Fig 42. Pilot Plant for the extraction of protein from cottonseed*

## 2.5 CORE AREA V
## ENTREPRENEURSHIP AND HUMAN RESOURCE DEVELOPMENT

### 2.5.1 Impact Assessment of ICAR-CIRCOT Technologies

During the reporting period the Impact assessment of Portable ginning machine developed by the institute was taken for the analysis. The technology was licensed to M/s. Precision Tooling Engineers, Nagpur during the year 2000. The developed technology comprises of leather roller, fixed knife, moving knife, seed grid and feeder and is operated by 0.75 kW single phase electric motor. The technology licensee manufactures varied portable ginning machines (CLOY gin, Lilliput gin, SR 600 single roller gin) and the recent one developed is SR 700 SR Gin. Ginning capacity varies from *5 - 25 kg seed cotton/hour and now upto 50 kg seed per hour.*

***Technology Adoption:*** The technology was adopted in market yards, by cotton breeders and seed companies. Moreover, the Lab model gin is an essential machinery for establishment of a modern ginnery in India under Technology Mission on Cotton. The manufacturer has sold more than 500 lab model gins of different variants, which are in use now and also exported to USA, Afghanistan and several African nations

***Economic Benefit:*** The technology licensed accounted for about 3% of the total production capacity of the licensee and the total turnover is about Rs.5 lakh per annum. The technology has created an employment opportunity of about 1500 man-days per annum. On an average the annual sales is around 22 machines. The technology has created an opportunity to promote Ginning Outturn (GOT) based marketing of cotton augmenting the farmers income by enabling them to fetch Rs.100 per quintal for every 1% increase in GP over and above 34%.

## 2.5.2Study on Utilization of Green Cotton Biomass for Production of Silage as Livestock Feed

***Standardization of process protocol for development of silage from green cotton biomass:*** On the basis of encouraging results of preliminary trials, the detailed experiments were conducted to standardize the process protocol for the development of silage from green cotton biomass (GCB) at Ginning Training Centre, Nagpur. Rashi-659 variety was collected from a farmer's field of Lava, Nagpur for silage experiments. The collected GCB were chopped to 1-3 cm in size using handheld knife. Eight different treatments were given as shown in process flow chart (Fig 43). Additives like molasses (M), urea solution (U) and microbial inoculum (MI) were added uniformly to the chopped biomass and mixed thoroughly. The mixture is then shifted to respective drums and pressed manually to remove entire oxygen from the drums. The ensiled biomass was then covered with polythene sheet, pressed and covered with the lid. The drums were stored at fresh, cool and dry place for 60 days to allow ensiling.

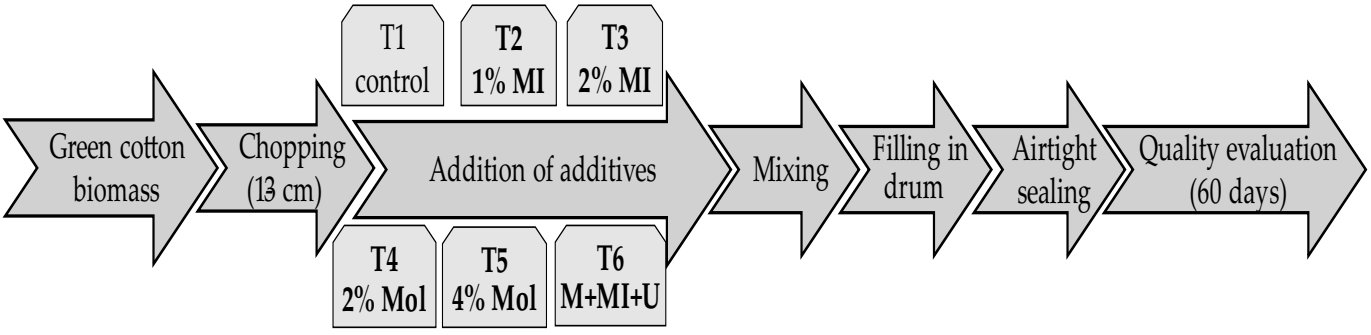



*Fig. 43: Process flow chart of preparation of green cotton biomass silage*

***Quality evaluation of silage from green cotton biomass:*** The quality of cotton silage was assessed after 60 days of ensiling GCB. The silage was analyzed using physical, microbial and chemical quality analysis. Physical evaluation of silage showed that silage treated with 1% MI, 2% M and 2% U shows acceptable characteristics of silage with yellowish green colour, pleasant sour and sweet flavour, fresh like texture and no visible fungal contamination. The microbial evaluation of the silage sample shows that, the Lactobacillus count was more in silage treated with MI which is an indicator of favourable anaerobic fermentation and good quality of silage. Protein content of the silage was also evaluated and it was found that the protein content in combined treatment was more (7.28%) than other treatments mainly because of addition of feed grade urea. The FTIR analysis of green cotton biomass silage confirms breaking of lignocellulosic bond and considerable decomposition in treated silage samples over control treatment

*Table 22. Microbial evaluation of silage*

| Treatments | Lactobacillus count (× 104 cfu/g) | Bacterial count (× 104 cfu/g) |
|---|---|---|
| Control | 17 | 13 |
| 1 % MI | 59.5 | 21 |
| 2 % MI | 71 | 29 |
| 2% Mol | 44 | 32 |
| 4% Mol | 51.5 | 36 |
| 1% MI+2% Mol+2%U | 84 | 44 |

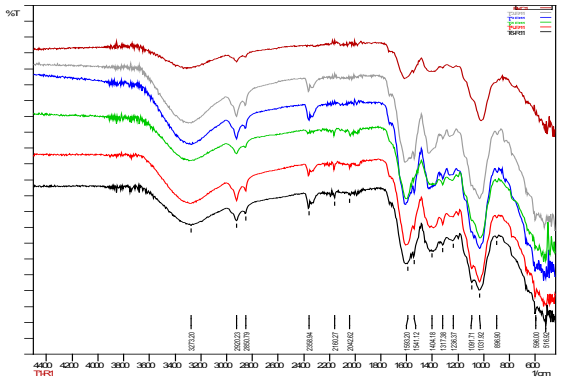


*Fig. 44: FTIR analysis of cotton biomass silage*

### 2.5.3 Development of Project Profile, data bank and entrepreneurship in cotton processing

Development Project Profile on post-harvest processing technologies of Cotton and its by-products has been taken up. During the period, an excel based programme was developed to calculate cost benefit analysis of different bankable projects. Biomass briquetting DPR was prepared as model DPR. The DPR of the technology includes

- Cost Benefit Analysis
- List of machinery required
- Cost of machineries
- Machinery manufactures/ Suppliers Data base

DPR will help to increase the awareness about establishing technology based commercial enterprises/Production units.

## 2.5.4 Agri-Business Incubation Centre of ICAR-CIRCOT [Externally Funded Project – NAIF, ICAR]

**New entrepreneurs admitted for incubation-4**

| Sr. No. | Incubatee | Technology |
|---|---|---|
| 1. | Mr. Saneesh K. M. , Kerala | Preparation of value-added products using banana leaf pseudostem |
| 2. | Dr. Deepa Bhajekar, Thane | Extraction of cellulose from Biomass |
| 3. | M/s. Nanospin Technologies LLP, Gujarat | Development of value-added product using electrospinning technologies |
| 4. | M/s Forecast Agrotech Innovation Pvt Ltd., Pune | Nano formulation of rock phosphate for making Phosphate Rich Organic Manure (PROM) and its field trials |

**Incubatees graduated-2**

| Sr. No. | Incubatee | Technology |
|---|---|---|
| 1. | M/s. Vishwa Natural Fab Prints, Hyderabad | Sustainable natural dyed and direct printed textiles |
| 2. | M/s. Biological Research Innovation Centre and Solutions LLP, Karnataka | Development of textile fabric stain remover using plant-based constituents |

**New product developed-1**

M/s. Biological Research Innovation Centre and Solutions LLP, Karnataka:- Fabric stain remover


**Number of conferences/seminars/workshops organized: 4**

| Sl. No. | Name of Event | Programmes Organized for Technology Commercialize/ Transfer* | No. of Participants | Venue of Event |
|---|---|---|---|---|
| 1 | Workshop | ABI Orientation Program on "Synergy of Innovation and Incubation" at Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, Dated on 16/02/2023 | 30 | VNMKV, Parbhani |
| 2 | Training | Sensitization of farmers on ginning, clean cotton picking and lint quality parameters 23 Feb 2023 | 40 | Ginning Training Centre, Nagpur |
| 3 | Sensitization programme | Sensitization of farmers on silage preparation from green cotton biomass on 24 02-2023 | 20 | Ginning Training Centre, Nagpur |
| 4 | Workshop | Workshop on 'Synergy of Innovation and Incubation in Agri Start-up Ecosystem' was organized on 13/03/2023 at ICAR-NRCG, Pune. | 50 | NRCG, Pune |

Orientation Program at VNMKV, Parbhani

Training programme at GTC, Nagpur

Sensitization programme at GTC, Nagpur

Workshop at ICAR-NRCG, Pune

### 2.5.5 RKVY-RAFTAAR Agri-Business Incubator [Externally Funded Project – DA&FW, MoA&FW)]

ICAR-CIRCOT is one among the 29 RKVY-RAFTAAR Agri-business Incubators functional across the nation since January, 2019. CIRCOT R-ABI provides two programmes:

(i) *Uday, pre-seed funding program, with grant-in-aid support up to Rs 5 lakhs (to translate innovative ideas into workable prototype)*

(ii) *Ankur, seed stage funding program, with grant-in-aid support of up to Rs 25 lakhs to agri-startups to commercialize their minimum viable product (MVP) or to scale up their business activity.*

Agripreneurship Orientation Program (AOP) and Startup Agri Incubation Program (SAIP): Two months Agripreneurship Orientation Program (AOP) for Agri-startups of pre-seed funding and Startup Agri Incubation Program (SAIP) for Agri-startups of seed funding selected under two (6th and 7th) cohorts were conducted during the year 2023.

Grant-in-Aid Facilitation CIRCOT R-ABI has been successful in facilitating grant-in-aid support to the start-ups during different cohorts. The startups (6th Cohort) under pre-seed and seed programme recommended by CIC for Funding are:

| Sl. No. | Name of Startup | Idea/Concept | Amount (Lakhs) |
|---|---|---|---|
| **Pre-Seed Stage Funding Program (UDAY)** | | | |
| 1 | M/s. Nutridhara Foods LLP<br>Mrs. Leena Sawant | Nutri Bar; Grape pomace chocolate | 5.00 |
| 2 | M/s Agro किसान<br>Mr. Suraj Kaple | Apparatus for zero spillage milking machine | 5.00 |
| **Seed Stage Funding Program (ANKUR)** | | | |
| 1 | M/s. Riga Industries<br>Mr. Amey Amol Suryavanshi | Novel approach for the preservation of sugarcane juice | 25.00 |
| 2 | M/s. Agriotics technologies Pvt Ltd.<br>Mrs. Pratibha Rao | IOT based Precision farming | 25.00 |
| 3 | M/s. Ranzopadi – Agro Tourism<br>Mr. Hariram Deoram Thavil | Agro-Tourism and Preservation of indigenous species (Flora & Fauna) | 18.00 |

### 2.5.6 CCI-CICR Pilot Plant on "Awareness and Extension Services on Best Farm Practices for Cotton Farmers to Improve Quality, Yield and Sustainability [Externally Funded Project - CCI]

- Developed Clean Cotton-Picking Kits (40) for distribution to farmers during field demonstration. Each kit contains 15 items. It comprises of Cotton-picking bag, Cotton filling bag, Cotton cloth for unloading cotton and Cotton Scarf for covering head.

- Distributed clean cotton-picking kits as critical inputs to selected 37 project farmers (12 from Sirsa, 13 from Nagpur and 12 from Coimbatore). Conducted on field demonstrations on clean cotton picking for these farmers.

- Altogether conducted 22 number of special training programmes and on field demonstrations wherein 1081 participants benefited.

- Conducted 9 numbers of field demonstrations on clean cotton picking at selected villages of Sirsa, Nagpur and Coimbatore. Around 305 farmers benefited by these demonstrations.

- Organized 9 numbers of Training cum Awareness Programme for Farmers on 'Cotton Fibre Quality, Clean Cotton Picking and Crop Residue Management' at different villages of Sirsa, Nagpur and Coimbatore. Around 548 farmers benefited out of these training programmes.

- Organized 4 numbers of Training cum Awareness Programme for Ginning Industry on 'Best Management Practices to Prevent Cotton Contamination and Preserve Fibre Quality" at Sirsa, Nagpur and Coimbatore. Around 228 personnel engaged in ginning industry benefited out of these training programmes

- Developed 16 IEC products such as leaflets on Best Farm Practices on Clean Cotton Picking, Best Farm Practices on Transportation and Storage of Cotton, Best Management Practices at Market Yard and Ginning Factory, Best Farm Practices for Cotton Crop Residue Management in Hindi, English, Marathi and Tamil languages for distribution among farmers during field demonstration and training programs in order to create awareness.

- Developed one video on clean cotton picking to create awareness among farmers and other stakeholders.

- Developed 15 Voice SMS contents of about 30 second duration each in three languages such as Marathi, Hindi and Tamil languages. The voice SMS contents dealt with Use of clean cotton-picking kit for contamination control and fetching better prices; Best farm practices for picking clean cotton, Best farm practices for transportation and storage of cotton, Best farm practices on cotton stalk management at farm and Value addition to cotton stalk for earing additional income. Delivered 5 lakh voice SMS to farmers across India.

- Wide publicity was given through print media to the activities conducted by ICAR-CIRCOT under CCI-CICR Pilot project. Published 21 news articles in various national and local newspapers in Hindi and Marathi.

# 3. Technology Management

## 3.1 Intellectual Property Management

Institute Technology Management Unit (ITMU) is entrusted with the responsibility of the protection of intellectual property of the technologies developed in the Institute. The ITMU is also accountable for the evaluation of commercial values of different consultancy projects and also the licensing of technology. During this year, one patent has been filed, ten consultancy projects have been handled and processed through Institute Technology Management Unit (ITMU).

### Patent filed & Granted

| Patent Application No | Technology / Innovation | Name of Inventors |
|---|---|---|
| ***202321072276*** *(Date: 23.10.2023* | Novel One-time Deep Grooved Chrome Leather Rollers used in Cotton Ginning Industries | S. S. Kautkar<br>S. K. Shukla<br>V. G. Arude<br>D. U. Patil<br>M. K. Sharma<br>P. G. Bhatke |
| *Patent Granted 367/Mum/2009 No. 422638* | Process for Dyeing of Textiles using Solvent Extracted Marigold Flower Waste | Sujata Saxena<br>P. V. Varadarajan<br>R. R. Mahangade<br>R. S. Narkar |

## 3.2 Consultancy Projects (10)

| S. No. | Consultancy Project No | Title of Project | Organization to which consultancy offered |
|---|---|---|---|
| 1 | CP1/23-24 | "Evaluation of Handle and Thermal Comfort of Tasar Silk fabric | Central Silk Technological Research Institute, Central Silk Board, Bengaluru |
| 2 | CP2/23-24 | "Study on weight change in cotton bales stored in different geographical locations of CCI warehouses" | The Cotton Corporation of India Ltd, Navi Mumbai |
| 3 | CP3/23-24 | Technical Assistance in interpreting test reports detailing various parameters related to quality and characteristics of cotton, seed and yarn samples | North East Initiative Development Agency, Kowma, Nagaland |
| 4 | CP4/23-24 | Preparation of value-added products using banana pseudostem | Mr. Saneesh Manoharan, Banana growing farmer, Krishna Veterinary farm products, Thrissur, Kerala |

### 3.2 Consultancy Projects (10)

| S. No. | Consultancy Project No | Title of Project | Organization to which consultancy offered |
|---|---|---|---|
| 5 | CP5/23-24 | Development of value-added products using electrospinning technology | M/s. Nanospin Technology LLP, Ahmedabad |
| 6 | CP6/23-24 | "Design and manufacturing of pre-cleaner" | M/s. Bajaj Steel Industries Ltd, Nagpur |
| 7 | CP7/23-24 | "Providing Cost Norms, Specifications, Protocols for establishment of G & P Industry with 18/24 DR Gins" | SMART PIU Agriculture & Director ATMA, Pune |
| 8 | CP8/23-24 | "Extraction of Cellulose from Biomass" | M/s. D Technology Pvt. Ltd., Pimplas, Thane |
| 9 | CP9/23-24 | Technological mentoring for making specialty filter paper from bleached cotton linter | M/s. Molbio Diagnostics Pvt. Ltd., Bengaluru |
| 10 | CP10/23-24 | Calibration checkup of moisture meters | The Cotton Corporation of India Ltd, Navi Mumbai |

### 3.3 Technologies Commercialized:

1. M/s. PRB Textiles Pvt. Ltd, Nagpur "Augmented process for preparation of bio-enriched compost from cotton micro-dust".
2. M/s Vidarbha Sales, Nagpur, "ICAR CIRCOT Green Crematorium".

### 3.4 Technology Incubation:

### Agri-Business Incubation Centre (ABIC)

Agri-Business Incubation (ABI) Centre funded under 12th Plan Scheme of National Agriculture Innovation Fund (NAIF) (Component II) –Incubation Fund, is operational at the institute. The centre provides the platform for technological mentoring and other incubation support for the benefit of prospective entrepreneurs who wish to start their business using Institute technologies on post-harvest processing of cotton and value addition to its by-products. This centre also 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 year, one new incubate has been admitted, three are under incubation with technological mentoring from the experts in the institute and two start-ups have been graduated.

### RKVY RAFTAAR Agri Business Incubator (CIRCOT-R-ABI)

CIRCOT RKVY RAFTAAR Agri Business Incubator (CIRCOT-R-ABI) funded by RKVY

Division, Department of Agriculture and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Govt. of India, is functioning since 31st January 2019. During the reporting period 6th and 7th Cohort of ICAR-CIRCOT R-ABI programme were under progress.

***6th Cohort:*** The two months Agripreneurship Orientation Programme (AOP) and Start-Up Agri-Incubation Programme (SAIP) for 33 Start-ups (18 Pre-seed stage & 15 seed stage) concluded on 30th March 2023. The RKVY-RAFTAAR Incubation Committee (RIC) recommended 9 start-ups for Centre of Excellence Incubation Committee (CIC). The CIC has recommended three seed stage and two pre-seed stage Start-ups for funding of Rs. 68.00 lakhs and Rs.10.00 Lakhs respectively.

***7th Cohort:*** Thirty-five Start-ups were admitted during July-September, 2023. The RIC has recommended 9 Start-ups to CIC committee for consideration for funding under the Programme.

### 3.5 Technology Certification:

Starting from the year 2023, Indian Council of Agricultural Research (ICAR) has initiated certification for Products/ Technologies/ Process/ Methodology/ Model/ Protocol/ Policy etc. under each Subject Matter Division (SMD) of ICAR.

Under the Agricultural Engineering Division SMD, the following **twelve technologies from ICAR-CIRCOT were certified in 2023,** and the certificates were distributed during the 95th ICAR Foundation cum Technology Day Celebration held on July 16, 2023 at New Delhi, in presence of Hon'ble Union Agriculture and Farmers Welfare Minister Shri Narendra Singh Tomar, Hon'ble Union Fisheries, Animal Husbandry and Dairy Minister Shri Parshottam Rupala, Hon'ble State Agriculture and Farmers Welfare Minister Shri Kailash Chaudhary & Dr. Himanshu Pathak, Secretary (DARE) and Director General (ICAR).

| S. No. | Title | Category |
|---|---|---|
| 1 | Heat Generating Smart Textiles Products | Product |
| 2 | Biocide formulation for pulp and paper industry | Technology |
| 3 | Antimicrobial paper coating technology for cotton paper | Technology |
| 4 | Augmented process for preparation of bio-enriched compost from cotton micro-dust | Technology |
| 5 | Processing of bleached cotton linters for filter making applications | Technology |
| 6 | Eco-friendly, efficient and rapid burning crematorium using cotton stalk/biomass briquettes | Technology |
| 7 | ICAR CIRCOT trapezoidal shaped rapid burning briquette-based crematorium | Technology |
| 8 | Compact and Energy efficient Cottonseed dryer | Technology |
| 9 | A process to improve the bleaching of cotton comber noil pulping for currency paper production | Technology |

| S. No. | Title | Category |
|---|---|---|
| 10 | Gin trash treatment system to destroy pink boll worm from cotton ginneries | Technology |
| 11 | Kawadi Cotton Opener | Technology |
| 12 | Engineered Cotton Fabric Face Mask | Product |

Also, ***'Cotton based heat generating textiles technology' of ICAR-CIRCOT was selected under the Top 5 technologies*** under the Agricultural Engineering SMD for the year 2023, during this event.

### 3.6. Technology Popularization & Promotion:

**Events attended:**

**Participation in 108th Indian Science Congress (ISC), held at Rashtrasant Tukadoji Maharaj Nagpur University (RTMNU), Nagpur**

ICAR-Central Institute for Research on Cotton Technology (CIRCOT), Mumbai participated in the stall exhibition titled "Pride of India" Mega Expo in 108th Indian Science Congress - 2023 ("Science and Technology for sustainable development with women empowerment") held at Nagpur during January 03-07, 2023 and inaugurated by Hon'ble Prime Minister, Shri Narendra Modi via video conferencing on January 03, 2023.

During the exhibition, various technologies and value-added products developed by ICAR-CIRCOT along with different start-ups incubated at CIRCOT RKVY RAFTAAR ABI, were displayed. The stall was visited by farmers, industries, students etc. and were enlightened about the ICAR-CIRCOT technologies in the cotton sector.


**Participation in the 108th Indian Science Congress at Nagpur**

- Three Agri startups of ICAR CIRCOT R ABI participated in Krishi Samriddhi Mela cum National Seminar-2023 organized by Dhaanyaganga Krishi Vigyan Kendra, RKMA, Sargachhi, Murshidabad, West Bengal to commemorate 125th year of the Ramkrishna Mission Ashram during January 12-16, 2023. Dr. Himanshu Pathak, DG, ICAR visited ICAR-CIRCOT exhibition stall and appreciated the progress of CIRCOT R-ABI startups.

- ICAR-CIRCOT-RABI team and startups participated in the 'Krishi-Mahotsav: Pradarshani evam Prashikshan' on January 24-25, 2023, at Dussehra Ground, Kota, Rajasthan organized by DA&FW, Government of India in association with the Dept. of Agri., Government of Rajasthan. Mr. Om Birla, Lok Sabha Speaker and Shri. Kailash Choudhary, Union Minister of State for A&FW visited the CIRCOT R-ABI Startups stalls and appreciated the innovative products.

**Krishi-Mahotsav on January 24-25, 2023, Kota, Rajasthan**

- ICAR-CIRCOT-RABI incubatees participated in Innovation festival 2023 (Western India Science Fair) organized by Nehru Science Centre (Ministry of Culture, Govt. of India), Worli, Mumbai from February 01-03, 2023.

**At Innovation Festival 2023, Mumbai**

- Dr. Ashok Kumar Bharimalla, Principal Scientist attended the meeting of Agricultural Chief Scientists of G-20 countries and showcased the achievements of ICAR-CIRCOT to scientists of different countries as well as interacted with DG and DDG of ICAR at Varanasi on April 19, 2023.


**CIRCOT RABI at G-20 meet at Varanasi**

- CIRCOT R-ABI team attended 19th Foundation Day of Society for Innovation & Entrepreneurship (SINE), Indian Institute of Technology Bombay, Mumbai on April 13, 2023 and canvassed for ICAR-CIRCOT incubation services

- CIRCOT R-ABI team with the Director, CIRCOT participated in CIPHET-IIFA 2023, an industry interface fair on agro-processing, hosted by CIPHET in Ludhiana during October 03-05, 2023. Cotton based heat-generating textiles from ICAR-CIRCOT was one of the stand-out technologies showcased on the second day of CIPHET-IIFA 2023.

**Exhibition at Ludhiana & Delhi**

- CIRCOT R-ABI team participated in World Cotton Day Exhibition at Le Meridien New Delhi during October 06-07, 2023.

- CIRCOT R-ABI team along with their startups M/s Pimani Udyog India Pvt Ltd & M/s Pawak food, have participated in 'World Food India 2023, Exhibition held at Pragati Maidan, Delhi from November 03-05, 2023.


**World Food India Exhibition 2023**

- CIRCOT R-ABI along with the startup M/s Forecast Agro innovation Pvt Ltd., participated in exhibition arranged during 81st Plenary Meeting of the International Cotton Advisory Committee (ICAC), at the Jio World Convention Centre, Mumbai, from December 02-07, 2023. The event was inaugurated by Shri Piyush Goyal, Union Minister of Textiles, Consumer Affairs.

- CIRCOT R-ABI, participated in the 14th foundation day of ICAR-DFR Pune, on December 10, 2023 and pitched about CIRCOT R-ABI activities & opportunities


- Young entrepreneurs were pitched to apply under 7th Cohort of CIRCOT R-ABI, Mumbai at Young Entrepreneurship Conclave- 2023 during January 31 to February 01, 2023 organized by and at ICAR-CCARI, Goa.
- Attended the marathon and Sensitization programme of Millets organized by CIRCOT-RABI startup at Pune on February 12, 2023, to promote millets.
- ICAR-CIRCOT participated and exhibited products developed by RABI incubatee in the Manthan 2023, an Annual Management & Cultural Festival of Tata Institute of Social Sciences (TISS), Mumbai during February 17-18, 2023.
- Pitching cum awareness programs on CIRCOT-R-ABI for the students of College of Fisheries Science, MAFSU, Nagpur, on February 17, 2023. About 50 students attended the event.
- Awareness programs on CIRCOT-R-ABI conducted on February 21, 2023, for the students of College of Agriculture, Nagpur, about 60 participants attended the programme.
- Pitching cum awareness programs on CIRCOT-R-ABI for the students and incubates on February 22, 2023 at Indian Institute of Information Technology (IIIT), Nagpur, about 80 participants attended.
- Pitching cum awareness programs for the farmers of Madhya Pradesh and Gujarat at Ginning Training Centre (GTC), Nagpur on February 22, 2023 (45 farmers participated).
- Pitching cum awareness programs for eight participants, conducted on February 23, 2023 at Indian Institute of Management (IIM), Nagpur.
- Introduction to ICAR-CIRCOT R-ABI and Emerging opportunities for entrepreneurs in floriculture on December 10, 2023, at ICAR-DFR, Pune.
- Industry meet on Agri business in Alliums: Innovation, promotion and sustainability in Pune and delivered session on Introduction to ICAR-CIRCOT R-ABI and Emerging opportunities for entrepreneurs in Onion and garlic during December 20-21, 2023 at Pune.

**Lecture Organised:**

*Expert Lecture*

(i) "How to commercialise innovation" by Mr. Jagadeesh Sunkal, independent consultant on February 09, 2023

(ii) "Digital media marketing: Facebook" by Dr. Ranjit Bijoor, March 09, 2023.

(iii) "How to promote startup/product" through digital platform by Dr. Ranjit Bijoor, Head (Asia Pacific) British Learning on March 15, 2023

**Other Events**

- ICAR-CIRCOT participated in an exhibition 'Sharing Rich History of Maritime Cotton Trade' organised by Mumbai Port Authority (MbPA) and Cotton Association of India (CAI) during April 13-15, 2023 at Gateway of India,

Mumbai. ICAR-CIRCOT displayed small-scale models of machines relating to the processing of cotton and textile manufacturing. Shri Shripad Naik, the Hon'ble Minister of State for Tourism and Ports, Shipping and Waterways inaugurated the exhibition.

**Exhibition at Gateway of India**

- ICAR-CIRCOT participated in the exhibition organized during Agriculture Minister Meeting on the occasion of G20 summit during June 15-17, 2023 at Hyderabad, Telangana.

- ICAR-CIRCOT participated in the 21st Annual Agro + Organic India World Expo & Conference held at the Bombay Exhibition Centre, NESCO, Goregaon, Mumbai from August 24-26, 2023.

- Ginning Training Centre, ICAR-CIRCOT, Nagpur participated and exhibited CIRCOT technologies in Agro vision organized at PDKV ground, Dabha, Nagpur during November 24-27, 2023.

- **ICAR-CIRCOT at the 95th ICAR Foundation cum Technology Day**
  ICAR-CIRCOT participated in the celebration of the 95th ICAR Foundation cum Technology Day organized at New Delhi from July 16-18, 2023 and in exhibition organized at Dr. C. Subramaniam Auditorium of NASC Complex in New Delhi. An exhibition showcasing innovative technologies developed by 113 ICAR research institutes was also organized, in which ICAR-CIRCOT had put up a stall of products made using environment-friendly technologies developed by the Institute and by the startups incubated by the Institute. Senior officials from ICAR Headquarters, Directors of ICAR Institutes, Vice Chancellors of State Agricultural Universities, Scientists and farmers, agri-entrepreneurs and school students visited the stall and were appreciative of the technologies and products exhibited. Products of the institute were also on sale and was bought by many visitors.

**Hon'ble Agriculture Minister & DG, ICAR visiting the CIRCOT stall**

**Other visitors including students at the CIRCOT stall**

**Radio/TV Talks:**

- "ICAR-CIRCOT documentary" (in Marathi) was broadcast in 'Apla Maharashtra' programme on DD Sahyadri channel of Doordarshan on January 07, 2023.

- TV talk on "RKVY-RAFTAR scheme of Central Government" (in marathi) by Dr. S. Kautkar, Scientist was broadcast on 'Krishidarshan' programme on DD Sahyadri on January 24, 2023 and was re-telecast on January 25, 2023.

- Dr. S. S. Kautkar, Scientist delivered a radio talk on "नवीन कृषी उद्योगांना चालना देणारी RKVY रफ्तार आर्थिक सहायता योजना" on Akashwani, All India Radio, Mumbai on May 16, 2023.


**Dr. Kautkar on the radio talk**

- Dr. P. S. Deshmukh, participated in the Akashwani (AIR) Mumbai, Asmita Channel Agriculture Programme "Hello Shankha Samadhan" and gave answers to the farmers questions on" Sheteetil Yantrikikaran" (Farm Mechanisation) through phone-in mode. Broadcast was on August 30, 2023 in AIR Asmita Vahini programme.

- The 9th ACRDN Meeting and International Conference Inaugural function held on December 06, 2023 at ICAR-CIRCOT premises Mumbai, was aired on DD Sahyadri News on December 07, 2023 in the segment 'Akrachya Batmya' (In Marathi—translated as 'News at 11 AM').

# 4. Skill Development and Capacity Building

## 4.1 Capacity building of Staff

Institute staff are trained as per the devised training need assessment plans, to keep pace with the latest technological advancements 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 are also carried out after a period of one year to analyse the outcome. The percent realization of trainings planned during the annual year 2023 was 109 % & for the financial year 2022-23 was 105 %. Scientists underwent training in diversified fields like Statistical techniques, NABL Laboratory Assessor's, Executive development programme on Leadership Development, Capacity building programme for Technical, Administrative and skilled staff members include stress management, positive thinking and team building.

The employees are regularly trained in various advanced areas as per the designed Annual Training Plan (ATP).

**Table 4.1 Skill Development of Institute Staff during 2023**

| Programme Title | Duration | Conducted by | Name(s) |
|---|---|---|---|
| *Scientific Staff* | | | |
| Data Visualization using R' | 9-11th March, 2023 | ICAR-NAARM, Hyderabad | Dr. S. K. Shukla<br>Dr. V. G. Arude |
| Recent Trends and Innovation in High Voltage Engineering | 27th March to 1st April, 2023 | KSR College of Technology, Namakkal, Tamil Nadu | Dr. G. T. V. Prabu |
| Laboratory Assessor's Training Course | 15-19th May, 2023 | NABL, Gurugram & ICAR-CIFE, Mumbai | Dr. P. Jagajanantha |
| Executive development programme on Leadership Development | 22-27th May, 2023 | ICAR-NAARM, Hyderabad | Dr. S. K. Shukla |
| Online workshop on Liaison officer (SC/ST) | 17-18th August, 2023 | ISTM, New Delhi | Dr. A. Arputharaj<br>Dr. T. Senthilkumar |
| Associate Program ICAC-RAP 2023 | 10-21st September, 2023 | ICAC, USA | Dr. Manoj Kumar Puniya |

| Programme Title | Duration | Conducted by | Name(s) |
|---|---|---|---|
| Hands-on training MATLAB (Online mode) | 05-16th October, 2023 | Spark Institute of Advanced Science (SIAS) Research Forum, Kozhikode, Kerala. | Dr. Manoj Kumar Mahawar<br>Dr. Sharmila Patil<br>Dr. Jyoti Dhakane-Lad |
| Genomics Assisted crop Improvement and Management | 04-19th December, 2023 | UniSA STEM, Mawson Lakes University of South Australia, Mawson Lakes, South Australia | Dr. Himashushekhar Chaurasia |
| *Technical Staff* | | | |
| E-Governance Applications in ICAR for Technical Personnel (online mode) | 22-28th February, 2023 | ICAR-IASRI, New Delhi, | Dr. Sheela Raj<br>Dr. Sujata R. Kawlekar<br>Shri. Sharad Kokane<br>Smt. Binu Sunil<br>Shri. Rajesh Narkar<br>Shri. Bhaskar<br>Shri. S. N. Patil |
| Skill development programme for Technical, Administrative and skilled supporting staff members | 01-03rd March, 2023 | ICAR-CIRCOT, Mumbai, | Smt H. R. Pednekar<br>Shri C. V. Shivgan<br>Shri R. P. Kadam<br>Shri S. K. Parab<br>Shri P. G. Gavhale<br>Shri M. M. Kadam<br>Shri P. P. Patil<br>Shri D. G. Gole |
| Short course training programme on Advances in heavy metals and micro | 11-15th December, 2023 | ICAR-CIFRI, Barrackpore, Kolkata | Mr. Rajesh Narkar |
| *Administrative Staff* | | | |
| Skill development programme for Technical, Administrative and skilled supporting staff members | 01-03rd March, 2023 | ICAR-CIRCOT, Mumbai | Smt. R. R. Tawde<br>Smt. Viniya R. Naik<br>Smt. S. P. Paiyala<br>Smt. S. G. Parab<br>Smt. V. N. Walzade<br>Shri S. N. Sahane<br>Shri D. K. Kasar<br>Shri S. Chandanshive |

| Programme Title | Duration | Conducted by | Name(s) |
|---|---|---|---|
| Pre- Examination training for Limited departmental audit & Accounts Examination (online mode) | 20th July to 06th October, 2023 | ICAR-NIASM, Baramati | Mr. S. N. Sahane |
| *Skilled Support Staff* | | | |
| Skill development programme for Technical, Administrative and Skilled supporting staff members | 01-03rd March, 2023 | ICAR-CIRCOT, Mumbai | Shri. Suhas Tondse<br>Shri. S.S. Surkule<br>Shri. H.B. Vesmiya<br>Shri. S.K. Bobate<br>Shri. R. Karkate<br>Shri. M.K. Prabhulkar<br>Shri. J.D. Sakpal<br>Shri. V. Murugan<br>Smt. Kamala Murugan<br>Shri. D.R. Gawade |

| Total Staff strength | Total number of training programmes | Number of beneficiaries | | | |
|---|---|---|---|---|---|
| | | Scientific | Technical | Administrative | SS |
| 144 (2022-23) | 12 | 10 | 19 | 09 | 10 |
| 125 (2023-24) | 13 | 11 | 13 | 07 | 07 |

## 4.2 HRD Achievements

**HRD Targets & Achievements for April 2022 to March 2023**

| *Category* | *Total No. of Employees* | *No. of training planned for each category during 2022-23 as per ATP* | *No. of employees undergone training during April 2022 to March 2023* | *% realization of training planned during 2022-23* |
|---|---|---|---|---|
| Scientist | 30 | 9 | 10 | 111 |
| Technical | 62 | 19 | 21 | 110 |
| Admn. & Finance | 27 | 9 | 9 | 100 |
| SSS | 25 | 8 | 8 | 100 |
| **Total** | **144** | **45** | **38** | **105** |

**HRD Targets & Achievements for April 2023 to December 2023**

| *Category* | *Total No. of Employees* | *No. of training planned for each category during 2023-24 as per* ATP | *No. of employees undergone training during April-Dec 2023* | *% realization of training during April-Dec 2023* |
|---|---|---|---|---|
| Scientist | 28 | 8 | 11 | 137 |
| Technical | 54 | 13 | 13 | 100 |
| Admn. & Finance | 19 | 7 | 7 | 100 |
| SSS | 24 | 7 | 7 | 100 |
| **Total** | **125** | **35** | **38** | **109** |

## 4.3 Education

The Institute is affiliated to Mumbai University for offering Ph.D. programme in Microbiology. At present, for the academic year 2023-24 three students are registered/admitted for undergoing the Ph.D. (Microbiology) at ICAR-CIRCOT.

The Ginning Training Centre (GTC) of the Institute at Nagpur is also part of ICAR-CICR, Nagpur Education Hub of IARI Mega University. Four students are admitted for M. Sc. course and three students are admitted for Ph. D. programme for the academic year 2023-24.

## 4.4. Skill Development Programmes organised for Stakeholders

| **Programme Title** | **Duration** | **No. of participants** | **Participant's profile** |
|---|---|---|---|
| ***ICAR-CIRCOT, Mumbai*** | | | |
| Composite Material | February 7-9,2023 | 15 | Students |
| Electrospinning for Nanofibre Production | February 22-24, 2023 | 6 | Students |
| Advanced characterization of cotton quality and its spinning & Dyeing performance for SC beneficiaries | March 13-15, 2023 | 15 | Students |
| In-plant training to students from the Agriculture, Post-harvest and allied sectors to 10 students, out of the ten students six are B. Tech (Agril. Eng.) students from DMCAET, Karad, Dist. Satara and four are M.Sc. (PHM-PV&F) students from Dr. BSKKV, Dapoli, Maharashtra. | September 1-30, 2023 | 10 | Students |

| Programme Title | Duration | No. of participants | Participant's profile |
|---|---|---|---|
| Training on Advanced Characterization of Cotton Quality and its Spinning and Dyeing Performance under the SCSP scheme. | September 25-27, 2023 | 9 | Students |
| Dr (Mrs) Anagha Vaidya Soocheta, Senior Lecturer, University of Mauritius joined at the institute as senior fellow on 09 October, 2023 under CV Raman International Fellowship for African Researchers Program 2022 to work on the project Design and Development of Prototypes using Natural Dyed Banana Fibres for Entrepreneurial Prospects. | October 9 - November 11, 2023 | 1 | Student |
| Ms. Darshini, Ph.D scholar from Vellore Institute of Technology (VIT), Vellore Campus, Tamilnadu joined for two month internship training on Nano-fibre technology for Filtration Application under mentorship of Dr. G. T. V. Prabu, Senior Scientist. | October – November 2023 | 1 | Student |
| Advances in Applications of Nanotechnology | October 30- November 11, 2023 | 18 | Academician, Industry |
| Ms. Bhumika Ambadkar, Ph.D scholar from The Institute of Science, Mumbai joined for one month internship training on 'Preparation of silver nano particle encapsulated nanofiber for wound dressing applications', under mentorship of Dr. G. T. V. Prabu, Senior Scientist. | November 01-30, 2023 | 1 | Student |
| Electrospinning for Nanofibre Production | December 18-20, 2023 | 9 | Students, Academicians |

| Programme Title | Duration | No. of participants | Participant's profile |
|---|---|---|---|
| *GTC, Nagpur* | | | |
| Four days training programme under Scheduled Caste Sub Plan (SCSP) Scheme each on "Cotton quality evaluation" and "Grading and DR gin setting & maintenance" | February 20-23, 2023 | 51 | Students |
| Post harvest porcessing of cotton and value addition to its byproduce | April 17-20, 2023<br>April 24-27, 2023 | 64 | Farmers |
| 3-days training on "Best Post-harvest Management Practices for Production of Premium Cotton Bales" under SMART Cotton. | July 17-19, 2023<br>July 20-22, 2023<br>July 24-26, 2023<br>July 27-29, 2023 | 161 | Industry |
| Double Roller Ginning Technology & Basics of Cotton Grading for Ginners and Graders | August 7-12, 2023 | 12 | Farmers |
| Farmers training for ATMA farmers, Wardha dist. on "Post Harvest Processing of Cotton and Value Addition to its By-produce" for farmers | September 25-27, 2023 | 35 | Industry |
| Five training programs were conducted under CCI-CICR-CIRCOT Pilot Project entitled' "Awareness and Extension Services on Best Farm Practices for Cotton Farmers to Improve Quality, Yield and Sustainability" for 300 farmers | September 27-29, 2023 | 300 | Farmers |
| Training under SMART Cotton on "Best Post-harvest management practices for production of world class bales from Indian Cotton" | October 25-27, 2023 | 35 | Farmers |

| Programme Title | Duration | No. of participants | Participant's profile |
|---|---|---|---|
| Ginning Training Centre, Nagpur of ICAR-CIRCOT organized four training programs for Lead Resources Persons (LRP) on "Best Post-Harvest Management Practices for Production of Premium Cotton Bales under SMART Cotton" Trainees from different locations such as Chandrapur, Wardha, Nagpur, Bhid, Parbhani, Jalgaon, Amravati, Akola, Buldhana, Jalna participated in the training programs | October 30-November 01, 2023<br>November 20-22, 2023<br>November 23-25, 2023<br>November 28-30, 2023 | 155 | Farmers |
| Three days skill development programme for Schedule Caste Students (SCSP) on "Gin setting and Maintenance" | December 18-02, 2023 | 26 | Students |

| Total number of training programmes | Number of beneficiaries | Revenue generated |
|---|---|---|
| 30 | 924 | Rs. 40.00 Lakh |

# 5. Linkages & Collaboration

ICAR-CIRCOT has a good linkage with International Organizations, National institutions, Public & Private sector organizations, Universities, Engineering & Technology hubs and start-ups for collaborative research, technology incubation & professional services, benefitting all stakeholders. Further, ICAR-CIRCOT has its Regional Quality Evaluation (QE) units strategically located within the premises of other ICAR institutes and agricultural universities in the major cotton growing areas of the country. The units function as extension wings of the Institute and also facilitate linkages and collaboration.

The network with various organizations at national and international level are in the domain of research, education, skill development, incubation, extension and commercial services. These linkages help to foster research, enhance technology assessment and refinement, capacity building and eases the transfer of technology from lab to the land.

**International Agencies / organizations**

**National level institutions/organizations/public sector:**

**Private Sector Linkages**


## 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 Universities involved in cotton breeding programmes and is part of the Central Variety Release Committee. Adhering to ICAR-CIRCOT quality norms is a pre-requisite for release of the cotton varieties. The quality evaluation of the Bt cotton trials of both public institutions and private sector seed companies for variety release are carried out at the Institute.

***Contract Research:*** The Institute's initiative to include industrial stakeholders at the project initiation stage has led to development of linkages with industrial stakeholders through signing of Memorandum of Understanding (MoU) for carrying out collaborative research in Public Private Partnership (PPP) mode.

***CRP on Natural Fibres:***

The institute is the nodal agency for implementation of the Consortia Research Platform project on Natural Fibres. The other institutions linked under this umbrella are ICAR-CSWRI, ICAR-NINFET & TNAU, Coimbatore.

***Platform for Cotton Quality Evaluation:***

Institute also participates regularly in the Round Robin tests for evaluation of cotton fibre quality conducted by Bremen Institute and USDA. 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 for Research Collaboration (05)

| Sr. No. | Name of Organisation | Particulars | Date of Signing of MoU |
|---|---|---|---|
| 1. | Vasantrao Naik Marathwada Kirshi Vidyapeeth, Parbhani | Sharing of scientific expertise and exchange of research ideas in the form of long-term collaborative research | 16-02-2023 |
| 2. | M/s Bajaj Steel Industries Limited, Nagpur | Design and development of high capacity double roller gin to enhance ginning efficiency | 03-05-2023 |
| 3. | M/s Bajaj Steel Industries Limited, Nagpur | Development & evaluation of pre-grooved chrome leather rollers and automatic deep-cut-grooving machine for double roller gin | 09-05-2023 |
| 4. | M/s Forecast Agrotech Innovation Pvt Ltd | Nano formulation of rock phosphate for making Phosphate Rich Organic Manure (PROM) and its field trials | 02-11-2023 |
| 5. | M/s Bajaj Steel Industries Limited, Nagpur | Development of Cotton Testing Instruments | 02-11-2023 |

## MoU for Technology Commercialisation (02)

| Sr. No. | Name of Organisation | Particulars | Date of Signing of MoU |
|---|---|---|---|
| 1. | M/s. PRB Textiles Pvt. Ltd, Nagpur | Augmented process for preparation of bio-enriched compost from cotton micro-dust | 02-04-2023 |
| 2. | M/s Vidarbha Sales, Nagpur | ICAR CIRCOT Green Crematorium | 02-11-2023 |

## MoU for Technology/Research Consultancy (04)

| Sr. No. | Name of Organisation | Particulars | Date of Signing of MoU |
|---|---|---|---|
| 1. | M/s Materra India Pvt. Ltd, Ahmedabad | Input on quality analysis of cotton samples developed by climate-resilient agriculture, conversion of their cotton in to yarn using miniature spinning and weaving using samples loom and quality analysis of fabric with the facility available with ICAR-CIRCOT | 03-03-2023 |
| 2. | Dr. Deepa Bhajekar, Thane | Extraction of cellulose from Biomass | 20-06-2023 |
| 3. | M/s Bajaj Steel Industries Limited, Nagpur | ICAR-CIRCOT intends to extend the technical knowhow and advice as a consultancy for "Design and Manufacturing of pre-cleaner, double roller gin, bailing presses and feeding systems" | 27-06-2023 |
| 4. | M/s The Cotton Corporation of India Ltd (CCI), Navi Mumbai | Evaluation and analysis of fibre quality and trash content of cotton samples of Fully Pressed (FP) Bales | 01-11-2023 |

## MoU for Contract Research/Service (02)

| Sr. No. | Name of Organisation | Particulars | Date of Signing of MoU |
|---|---|---|---|
| 1. | M/s Bajaj Steel Industries Limited, Nagpur | Assessment of Rotobar Ginning factories parameters manufactured and supplied by party no. 2 Egypt by party no. 1 (Contract service) | 17-04-2023 |
| 2. | M/s. CNHi and ICAR-CICR, Nagpur | Field evaluation and optimization of robotic cotton harvester (Contract Research) | 25-07-2023 |

## MoU for Technology Incubation (03)

| Sr. No. | Name of Organisation | Particulars | Date of Signing of MoU |
|---|---|---|---|
| 1. | ICAR-National Academy of Agricultural Research Management (NAARM), Hyderabad | Organizing co-hosting the events / programme / activities related to agriculture startups, co-incubation, value added services, co-networking opportunities | 25-05-2023 |
| 2. | Mr. Saneesh K. M. Kerala | Preparation of value-added products using banana leaf pseudostem | 19-06-2023 |
| 3. | M/s. Nanospin Technologies LLP, Gujarat | Development of value added product using electrospinning technologies | 23-08-2023 |

## Memorandum of Agreement with start ups (MoA) (05)

| Sr. No. | Name of Startup/ Agripreneur | Idea/Concept | Date of Signing of MoU | Sanctioned Amount in Lakhs |
|---|---|---|---|---|
| 1. | M/s Kapra Enterprises, Nashik, Maharashtra | To develop low-cost egg incubator for farmers | 27-03-2023 | 5 lakhs |
| 2. | M/s Silky Cocoon Handicrafts, Kolhapur, Mahrashtra | Value addition to waste silk cocoons | 27-03-2023 | 5 lakhs |
| 3. | M/s Kaya Enterprise, Vadodara, Gujarat | Development of Oyster Mushrooms based healthy puffs (Fryums) | 31-03-2023 | 5 lakhs |
| 4. | M/s. Nutrivms Biochem Pvt. Ltd., Pune, Maharashtra | Development of amino acid rich fertilizer from poultry feather waste | 28-03-2023 | 25 lakhs |
| 5. | M/s. F-Square Agri Labs Pvt. Ltd., Kolhapur, Maharashtra | Development of the low-cost seeder for small size seeds | 27-03-2023 | 25 lakhs |

## 5.2 Commercial Testing Services

ICAR-CIRCOT is an acclaimed NABL accredited cotton testing laboratory in India. The Institute has facilities for conducting more than 197 tests on different textile materials and cotton by-products, for its stakeholders. Besides regular tests, special tests were also carried out as per demand from the stakeholders.

During the year 2023 a total number of 8642 samples were tested at headquarters in Mumbai, GTC-Nagpur and quality evaluation units at Coimbatore, Guntur, Sirsa and Surat. Total revenue generated through commercial testing during the year 2023 was Rs. 49,75,488/-

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 revenue through the activity.

### Table 5.1 Number of Paid Samples Tested and Revenue Generated

| Test Centre | No. of Samples Tested | Revenue Generated (Rs) |
|---|---|---|
| Mumbai | 3215 | 28,80,735 |
| Nagpur | 1492 | 13,26,158 |
| Coimbatore | 1832 | 3,04,568 |
| Sirsa | 1060 | 4,28,438 |
| Guntur | 193 | 16,284 |
| Surat | 850 | 19305 |
| **Total** | **8642** | **49,75,488** |

### Table 5.2 Tests Conducted and Clientele

| Test | Clientele |
|---|---|
| Kawabata Testing | • PSG College of Technology, Coimbatore<br>• VJTI, Mumbai<br>• Govt. S.K.S.J.T. Institute, Bangalore<br>• DJFT, University of Calcutta, Punjab<br>• D.K.T.E.S, Textile & Engineering Institute, Kolhapur<br>• ICAR-NINFET, Kolkata<br>• ICAR-CSWRI, Avikanagar<br>• Central Silk Technological Research Institute, Bengaluru |
| SEM Analysis | • Watson Pharma Pvt Limited, Mumbai<br>• Institute of Bioresources and Sustainable, Manipur<br>• TUV SUD South Asia Pvt. Ltd., Mumbai<br>• Novo Excipients Pvt. Ltd., Navi Mumbai<br>• Vijay Kiran Goregaonkar, Mumbai |

| Test | Clientele |
|---|---|
| | • Kirsten Lobo, Mumbai<br>• Vignan's Lara Institute of Technology & Science, Vadlamudi<br>• Jindal Poly Films Ltd (Division Global Nonwovens), Nashik<br>• Reliance Industries Ltd., Navi Mumbai<br>• ICAR-CIAE, Bhopal<br>• ICAR-NINFET, Kolkata |
| AFM Imaging | • Institute of Chemical Technology, Mumbai<br>• ICAR-NINFET, Kolkata |
| UPF | • D.K.T.E., Ichalkarnaji<br>• K.S.RANGASAMY College of Technology, Tiruchengode<br>• V.J.T.I Textile Department, Mumbai<br>• Banashree Handique, Jorhat<br>• Yamini Dhanania, Kolkata<br>• Colorband Dyestuff (P) Ltd., Navi Mumbai<br>• Smita Bhuyan, Assam<br>• Manashree Saikia, Assam |
| FTIR | • Yamini Dhanania, Kolkata<br>• Surya Teja Samanthula, Mumbai<br>• Eco Vegan Leather Private Limited, Kolkata<br>• Mugdha Dongre, Mumbai<br>• The Synthetic & Art Silk Mills Research Association (SASMIRA), Mumbai |
| Test on cotton seed | • MPKV, Rahuri<br>• Lady Bamford Foundation, Rajasthan<br>• Thakurji Solvex Pvt. Ltd., Jalna |
| Paper testing | • Medii Heal Solutions, Nagpur<br>• Mateshwari Enterprises, Aurangabad<br>• Murbadkar Business Industries, Kalyan<br>• Lords wear Pvt. Ltd, Nagpur<br>• RITES Limited, Mumbai |
| Test on Absorbent Cotton | • Mateshwari Enterprises, Aurangabad<br>• Dr Trust Medicative Cottons Absorbent Agro Cotton wool, Jalgaon<br>• M/s. Alphra Surgical LLP, Sangli |
| Test on Cotton Linters | • Milan Ginning Pressing Pvt.Ltd, Gujrat<br>• Tirumala Cotton & Agro Products Pvt. Ltd., Guntur<br>• Shankar Cotton Industries, Rajasthan |
| Particle Size Analysis | • SKUAST-K, Jammu and Kashmir<br>• Mumbai Veterinary College, Parel, Mumbai<br>• Rashtriya Chemicals and Fertilizers Ltd, Mumbai<br>• ICAR-NINFET, Kolkata |

### 5.3 Contract Research Projects:

1. With M/s Bajaj Steel Industries Limited (BSIL), Nagpur, to assess the performance parameters and provide technical service related to rotobar ginning plants by BSIL to the ginning factories in Egypt.
2. With M/s. CNHi and ICAR-CICR, Nagpur, for technological support in field evaluation and optimization of robotic cotton harvester (Fully sponsored Contract Research)

### 5.4 Linkage with BIS

The Scientific team of the institute have been contributing to the development and review of the test methods & standards in the field of Agricultural Machinery and textiles as chairman /member in various committees of the Bureau of Indian Standards (BIS) as listed below:

- Agriculture & Food Processing Equipment (FAD 20)
- Physical Method of Test (TXD 01)
- Chemical Method 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)
- Handloom & Khadi Sectional Committee (TXD 08)

# 6. Awards & Recognition

## Awards & Honours

### Best Scientist Award

- Dr. Jyoti Dhakane-Lad, Scientist, CBPD received Outstanding Young Scientist National Award 2023 by Kamarajar Institute of Education and Research, Tamil Nadu on May 21, 2023.


### NAAS Award

- Dr. N. Vigneshwaran, Principal Scientist has been awarded with the Fellowship of the National Academy of Agricultural Sciences (NAAS), at a function organized by NAAS at its foundation day celebration during June 04-05, 2023


- Dr. Manoj Kumar, Scientist has been awarded with the Young Scientist Award by National Academy of Agricultural Sciences (NAAS), at a function organized by NAAS at its foundation day celebration during June 04-05, 2023.

### Best Paper Award

- Dr. G. Krishna Prasad, Dr. T. Senthilkumar, Dr. P. Jagajanantha, Dr. A. S. M. Raja, Dr. N. Vigneshwaran, Dr. N. Shanmugam, received Best Paper Award for the paper, "Development of Cotton Nonwoven Based High Performance Secondary Wound Dressing Material" in Second International Conference on -Integration of Advanced Technologies for Industry 4.0 (ICIATI 2023) organized by KCG College of Technology, Chennai, during June 23-24, 2023.

- Dr. T. Senthilkumar, Dr. G. Krishna Prasad, Dr. A. S. M. Raja, Dr. V. G. Arude, Dr. P. Jagajanantha, Dr. N. Shanmugam received Best Paper Award for the paper, 'Sustainable approach: process protocol for spinning of recycled cotton/polyester blended yarn', in "Second International Conference on - Integration of Advanced Technologies for Industry 4.0 (ICIATI 2023) organized by KCG College of Technology, Chennai, during June 23-24, 2023.

- Dr. Sheshrao Kautkar, received the best paper award in oral presentation (third) for the paper "Silage from Green Cotton Biomass: An Alternative Source of Animal Feed" in 35th National Convention of Agricultural

Engineers & National Seminar on Emerging Technologies for Advances in Agriculture & Horticulture" held during September 12-13, 2023 at College of Agricultural Engineering, JNKVV, Jabalpur (MP).

### AICOSCA Award

- Dr. D.M. Kadam, Principal Scientist and Head of Division, ETTD & Principal Scientist and Dr. Manoj Kumar, Scientist were honoured with the prestigious "Shri Nilesh Patel (N.K. Proteins) Innovation Award for Cottonseed & Cottonseed Oil Supply Chain" at the 4th SEA-AICOSCA Cottonseed, Oil & Meal Conclave 2023 at Aurangabad during July 07-08, 2023. The awards were bestowed upon them by Shri Abdul Sattar, the Agriculture Minister of Maharashtra.


### Technology Award

- Technology developed by Dr. P. Jagajanantha, "Heat generating smart cotton textiles", is in the 'Top 5 Technologies' among Engineering SMD of ICAR.

- Dr. C. Sundaramoorthy, Principal Scientist was conferred the Dr. A. B. Joshi Young Scientist Award by Indian Society for Cotton Improvement (ISCI), Mumbai during the Ninth Asian Cotton Research and Development Network (ACRDN-9) meet, jointly conducted by ICAC, ISCI, ICAR-CIRCOT & IFS, on December 06, 2023, at ICAR-CIRCOT, Mumbai.

- Dr. S. K. Shukla, Director, ICAR-CIRCOT was elected as the New Chair of Asian Cotton Research and Development Network (ACRDN) by the International Cotton Advisory Committee (ICAC), for 2023-25, during the ACRDN-9, held from December 06-08, 2023 at ICAR-CIRCOT, Mumbai.

### International (sponsored) visits

- Dr. Manoj Kumar participated in the Associate Program (ICAC-RAP 2023) of International Cotton Advisory Committee, held at USA during September 10-21, 2023, funded by SERB.

- Dr. Himanshushekhar Chaurasia participated in the 6th International Rice Congress, at Manila, Philippines, during October 16-19, 2023 and gave an oral presentation on "Detection of Paddy Pannicle Stages using Deep Learning" under theme "AI and Machine Learning".



- Dr. Sujata Saxena, Principal Scientist, led the Indian delegation representing the National Standardisation Body, Bureau of Indian Standards (BIS), and attended the 24th Plenary meeting of the ISO/TC 38 'Textiles' and its subcommittees during October 29 to November 03, 2023 held at Seoul, Republic of South Korea.

- Dr. Himashushekhar Chaurasia, Scientist was deputed for attending Overseas training under National Agriculture Higher Education Project-Centre for Advanced Agricultural Science & Technology (NAHEP-CAAST) funded project on Genomics Assisted Crop Improvement and Management, at UniSA STEM, Mawson Lakes, University of South Australia, Adelaide, Australia from December 03-20, 2023.


- Dr. S. K. Shukla, Director visited Rotobar Ginning Factories located at Fayoum, Egypt during December 15-22, 2023 to assess the performance parameters and provide technical service related to rotobar ginning. This visit is part of an MOU signed between ICAR-CIRCOT and Bajaj Steel Industries Limited (BSIL) Nagpur for assessing the performance evaluation of rotobar ginning plants supplied by BSIL to the ginning factories in Egypt.

## Recognitions: Lead paper / Invited talk

| Topic/Date | Event / Organizer / Venue | Recognition to |
|---|---|---|
| Paper on "Energy from Agro Biomasses in India: Current status, Challenges and proposals", on January 03, 2023 | National conference on "Natural fibre for sustainable societal development" at ICAR-NINFET, Kolkata | Dr. S. K. Shukla |
| Invited lecture on "Role of nanotechnology in abiotic stress management" on January 20, 2023 | Winter School on "Climate Change & Abiotic Stresses Management Solutions for Enhancing Water Productivity, Production Quality and Doubling Farmers Income in Scarcity Zones" during January 05-25, 2023 organized by ICAR-NIASM, Baramati | Dr. N. Vigneshwaran |
| Invited lecture on "Technologies for secondary processing of the fruits and vegetables for enhancing farmers income" on January 20, 2023 | Winter School on "Climate Change & Abiotic Stresses Management Solutions for Enhancing Water Productivity, Production Quality and Doubling Farmers Income in Scarcity Zones" during January 05-25, 2023 organized by ICAR-NIASM, Baramati | Dr. M. K. Mahawar |
| Lecture on "Global cotton production, processing scenario and road ahead", on February 18, 2023 | Tattvabodh speaker conclave at Tata Institute of Social Sciences (TISS), Mumbai | Dr. S. K. Shukla |
| Invited Talk on, "Valorization of Cotton by-product for improving livelihood of cotton farmers", under session on Resilient Agriculture, on February 18, 2023 | International Conference on "Sustainable and Resilient Environment Development-2023 (ICSRED-23), at CSIR-NEERI, Nagpur | Dr. K. Pandiyan |
| Presentation on "Technology for processing of mechanically harvested cotton", on February 25, 2023 | National Workshop on 'Enabling Technological and Policy Interventions to Increase Cotton Productivity and Stimulate Industrial Growth' organized by Trust for Advancement in Agricultural Sciences (TAAS), New Delhi, in collaboration with the Indian Council of Agricultural Research (ICAR) and National Academy of Agricultural Sciences (NAAS) at NASC Complex, Pusa Campus, New Delhi | Dr. S. K. Shukla |

| Topic/Date | Event / Organizer / Venue | Recognition to |
|---|---|---|
| Invited Paper entitled "Accelerating Scientific Processing of Cottonseed in India", on July 07-08, 2023 | 4th SEA-AICOSCA Cottonseed, Oil & Meal Conclave 2023 at Aurangabad | Dr. V. G. Arude |
| Lead paper on "Sustainable Processing of Cotton for Fashion System", on July 18, 2023 (digital mode) | Professional Development Program on 'Innovative Approaches in Fashion System', conducted by Amity University Chhattisgarh | Dr. A. S. M. Raja |
| Invited as Lead Speaker on July 31, 2023 | 53rd Foundation Day celebration of Cotton Corporation Limited, Navi Mumbai | Dr. S. K. Shukla |
| Invited talk on "Sustainable fibre, recycling of fabric waste and textile processes", on August 01, 2023 (virtual mode) | To post-graduate students of Department of Textile and Apparel Design", National Institute of Design (NID), Madhya Pradesh | Dr. T. Senthilkumar |
| Invited as Guest of Honour on August 17, 2023 | At conference on Agriculture, Horticulture, Irrigation, Food, Warehousing & Cold chain organized by Maharashtra State Mango Growers Association, Mumbai | Dr. Sujata Saxena |
| Guest lecture on "Smart Textiles and Its Applications' on August 18, 2023 | B. Tech Textile students, Department of Textile Technology, Kumaraguru College of Technology, Coimbatore | Dr. P. Jagajanantha |
| Keynote address titled, "Need for Implementing 2nd phase of TMC Modernisation for Production of Trash and Contamination Free Traceable Bales", during September 09-10, 2023 | At Maharashtra Cotton Conference 2023, organized by The Maharashtra Cotton Brokers Association at Akola | Dr. S. K. Shukla |
| Guest lecture on the topic 'Smart Garments & 3D Printing', on September 15, 2023 | Department of Fashion Technology, Sona College of Technology, Salem, Tamil Nadu | Dr. P. Jagajanantha |

| Topic/Date | Event / Organizer / Venue | Recognition to |
|---|---|---|
| Chief guest at National seminar (Hybrid mode) on revolutionizing Fashion: Exploring AI and Big Data Analytics in the Fashion Industry, on October 06, 2023 | At SONA college of Technology, Department of Fashion Technology, Salem, Tamil Nadu | Dr. A. Arputharaj |
| Invited talk (online mode) on World Cotton Day, titled "Glory of Cotton Fibres", on 07 October, 2023 | At Department of Textile Technology, K.S, Rangaswamy College of Technology, Namakkal, Tamil Nadu. | Dr. T. Senthilkumar |
| Lead paper on "Holistic utilization of cotton plant - Opportunities for Small holder farmers", during December 02-05, 2023 | Presented at 81st ICAC Plenary Meeting under the theme "Cotton Value Chain: Local Innovations for Global Prosperity", held at the Jio World Centre in Mumbai | Dr. S. K. Shukla |
| Lead paper on "Advances in DNA technologies for traceability", during December 02-05, 2023 | Presented at 81st ICAC Plenary Meeting under the theme "Cotton Value Chain: Local Innovations for Global Prosperity", held at the Jio World Centre in Mumbai | Dr. Manoj Kumar |
| Presented expert lecture (online mode) on Identification of Blend Composition of Pashmina Products by Chemical Methods on November 28, 2023 | During MSME sponsored training programme on Quality Assurance of Pashmina and Pashmina products, organized by Division of Livestock product Technology, Sher-e-kashmir University of Agricultural Science and Technology of Kashmir, Srinagar | Dr. A S M Raja |
| Lecture on Value Chain Management in Cotton and by-product Utilization on November 24, 2023 | In on-line training programme on "Value chain Management in Natural Fibres", sponsored by MANAGE, Hyderabad at ICAR-NINFET, Kolkata | Dr. A S M Raja |
| Chaired Session on Theme, "AI & Machine Learning for Sustainability", on December 09, 2023 | In 2nd International Conference on "Sustainability in Fashion Designing and Manufacturing–(SIFDM)-2023" (Online Mode), by Department of Fashion Technology, PSG College of Technology, Coimbatore. | Dr. G. Krishna Prasad |

| Topic/Date | Event / Organizer / Venue | Recognition to |
|---|---|---|
| Co-Chair in Session "Processing and Post-Harvest Management" on December 20-22, 2023 | National Symposium cum Industry Meet (NSIM) 2023 on "Agri-Business in Alliums: Innovation, Promotion and Sustainability" MCCIA, Pune organised by DOGR, Pune. | Dr. Dattatreya M. Kadam |
| Lead Paper on "Business Opportunity to Establish Onion and Garlic Processing Industry for Dried Flakes and Powder and Masala Pastes", on December 20-22, 2023 | National Symposium cum Industry Meet (NSIM) 2023 on "Agri-Business in Alliums: Innovation, Promotion and Sustainability" MCCIA, Pune organised by DOGR, Pune. | Dr. Dattatreya M. Kadam |

# 7. Publications

## 7.1 Research Articles

1. Basak S, ASM Raja (2023). Combustion properties of paper treated with chicken egg shell: A potential solid waste. *Sustainable Chemistry and Pharmacy, 32 100930.*

2. Bharimalla A.K., Deshmukh, S.P., Patil Sharmila., Nadanathangam, V., Saxena Sujata. (2023) Development of energy efficient nanocellulose production process by enzymatic pretreatment and controlled temperature refining of cotton linters. *Cellulose, 30 (2), 833-847, (NAAS: 12.12)*

3. CS, Sahay, DS Thorar, SS Kautkar, AK Patil and PK Pathak. (2023). Grass Seed Harvesting: Methods, Machines and Aspects. *Research Journal of Agricultural Sciences, 14(02):512-515. (NAAS: 4.50)*

4. Dattatreya M. Kadam, Sayali Suresh Parab, Akansha Kasara, Mohini M. Dange, Manoj Kumar Mahawar, Manoj Kumar, V.G. Arude (2023). Effect of microwave pre-treatment on protein extraction from de-oiled cottonseed meal and its functional and antioxidant properties, *Food and Humanity, Vol. 1, 263-270.*https://doi.org/10.1016/j.foohum.2023.05.016

5. Dukare, A., Sharma, K., Nadanathangam, V., Nehete, L., & Saxena, S. (2023). Valorization of Cotton Seed Hulls as a Potential Feedstock for the Production of Thermostable and Alkali-Tolerant Bacterial Xylanase. *Bio Energy Research, 1-14. (NAAS: 9.85)*

6. Ghadge, S.V., Shukla, S.K., Satankar, V., Patil, D.U. (2023) Design and Development of Boll Opener Machine for Processing of Kawdi Cotton in Indian Ginneries. *Cotton Research Development 37 (1), 159-165.*

7. Govindaraj O., Gopal N.O., Raja A. S. M. and Sivakumar U. (2023). Influence of Novel EnZolv Pretreatment on the Release of Reducing Sugar and Proximate Content of Banana Fiber. *Indian Journal of Microbiol. https://doi.org/10.1007/s12088-023-01130-4 (NAAS: 9.0)*

8. Govindaraj, O., Olaganathan, G.N., Raja ASM, Sivakumar Uthandi, (2023). An eco-friendly EnZolv pretreatment optimization in banana fiber biomass using response surface methodology (RSM) and its structural characterization. *Biomass Conv. Bioref. . https://doi.org/10.1007/s13399-023-04829-y. (NAAS: 10.05)*

9. Govindaraj, O., Uthandi, S., Gopal, N. O., & Raja ASM (2023). Optimization of hydrothermal-assisted alkali process for enhanced xylan recovery from banana fiber biomass. *Journal of Applied and Natural Science, 15(3), 1308–1314.* https://doi.org/10.31018/jans.v15i3.4906. *(NAAS: 4.28)*

10. Jalgaonkar, K., Mahawar M.K., Vishwakarma, R.K. (2023) Destalking of dry red chillies (Capsicum annum L.) and its characterization (2023) *Journal of Food Science and Technology, 60: 404-418 (NAAS: 9.12)*

11. Jyoti Dhakane-Lad, Abhijit Kar & Avinash Singh Patel (2023). SC-CO2 extraction of lycopene from red papaya using rice bran oil as a co-solvent lessens its degradation during storage. *Separation Science and Technology, DOI: 10.1080/01496395.2023.2255738. (NAAS: 8.8)*

12. Kadam, D. M., Kasara, A., Parab, S. S., Mahawar, M. K., Kumar, M., & Arude, V. G. (2023). Optimization of process parameters for degossypolisation of de-oiled cottonseed cake by response surface methodology (RSM). *Food and Humanity, Vol. 1, 210–218. https://doi.org/10.1016/j.foohum.2023.05.013*

13. Kale, S., Indore, N., Nath, P., Kannaujia, P., & Dukare, A. (2023). Low-cost inorganic phase change material improves the storage conditions of on-farm storage chamber. *Journal of Food Process Engineering, e14395. https://doi.org/10.1111/jfpe.14395 (NAAS- 8.89)*

14. Kannaujia, P., Dukare, A., Kale, S., Nath, P., and Singh R. K. (2023). Effect of mulch type on physico-chemical quality of tomato *(Solanum lycopersicum) in semi-arid region of India. Indian Journal of Agricultural Sciences. 93 (6): 676-679. (NAAS: 6.37)*

15. Mahawar M.K., Bharimalla A.K., Arputharaj A., Palkar J., Dhakane-Lad J., Jalgaonkar.K., Vigneshwaran N. (2023). Response surface optimization of process parameters for preparation of cellulose nanocrystal stabilized nanosulphur suspension. *Scientific Reports, 13(1), 20678 (NAAS: 11)*

16. P. Gracy, K.M. Pachiyappan, T Murugan, T Senthilkumar, G Krishna Prasad, Senthil Kumar (2023). "Dynamic mechanical behavior of coir fiber composite using Taguchi's parametric design approach". *Biomass Conv. Bioref. https://doi.org/10.1007/s13399-023-04605-y. (NAAS: 10.05)*

17. Prakash, S., Kumar, M., Radha, Kumar, S., Jaconis, S., Parameswari, E., & Zhang, B. (2023). The resilient cotton plant: uncovering the effects of stresses on secondary metabolomics and its underlying molecular mechanisms. *Functional & Integrative Genomics, 23(2), 183. (NAAS: 9.67)*

18. Prashant Sampatrao Deshmukh, Vishnu Govind Arude, Manoj Kumar Mahawar, D.M. Kadam, Chandrika Ram (2023). Effect of in-situ moisture on absorption and desorption behaviour of seed cotton and it's components. *Cotton Research Journal, 13:10-14.*

19. Rajavat, A.S., Srivastava, N., Choudhary, P., Pandiyan, K., Chakdar, H., Mageshwaran, V., Karthikeyan, N., Agnihortri, A. (2023). Valorization of agro-residues for production of ligninolytic enzymes from Pleurotus spp. and their deployment in dye decolorisation. *Biomass Conversion and Biorefinery. (https://doi.org/10.1007/s13399-023-05004-z). (NAAS: 10.05)*

20. Senthilkumar, T., Selvakumar, A. & Senthilkumar, B. (2023). Fabrication and optimization of activated carbon using sisal fiber biomass through Box–Behnken experimental design. *Biomass Conv. Bioref. 1-10. https://doi.org/10.1007/s13399-023-04185-x. (NAAS: 10.05)*

21. Shanmugam, N., Prabhu, G. T. V., Jagajanantha, P. & Chaurasia, H. (2023). Developing AI model using auto machine learning platform for highest spinnable count prediction from cotton fibre properties. *Journal of Cotton Research and Development, Jan. 37(1):134–141. doi:10.1201/9781003277316-7. (NAAS: 4.78)*

22. Sharma, K., Guleria, S., Salaria, K. H., Majeed, A., Sharma, N., Pawar, K. D., ... & Gupta, V. K. (2023). Photocatalytic and biological properties of silver nanoparticles synthesized using Callistemon lanceolatus leaf extract. *Industrial Crops and Products, 202, 116951. (NAAS: 12.45)*

23. Sharma, K., Kumar, M., Lorenzo, J. M., Guleria, S., & Saxena, S. (2023). Manoeuvring the physicochemical and nutritional properties of vegetable oils through blending. *Journal of the American Oil Chemists' Society, 100(1), 5-24. (NAAS – 7.95)*

24. Sheri, V., Kumar, M., Susan Jaconis, Zhang, B. (2023). Antioxidant defense in cotton under environmental stresses: Unraveling the crucial role of a universal defense regulator for enhanced cotton sustainability. *Plant Physiology and Biochemistry 108141. (NAAS: 11.44)*

25. Shilpa S. Bhambure, Addanki S. Rao & Thambiannan Senthilkumar (2023) Analysis of Mechanical Properties of Kenaf and Kapok Fiber Reinforced Hybrid Polyester Composite, *Journal of Natural Fibers, 20:1, 2156964, DOI:10.1080/15440478.2022.2156964. (NAAS: 9.51)*

26. Singh, S. K., Pathak, P. K., Gurjar, B and Kautkar, S. (2023). Design and development of a defluffing machine for dinanath grass seeds *(Pennisetum pedicellatum). Agricultural Mechanization in Asia, Africa and Latin America, 54(1):42-48 (NAAS: 6.29)*

27. Subramaniam, S., Karunanandham, K., Raja, A. S. M., & Uthandi, S. (2023). Delignification of the cotton stalk and ginning mill waste via EnZolv pretreatment and optimization of process parameters using response surface methodology (RSM). *Bioresource Technology, 129655. (NAAS: 17.89)*

28. Thappa, C., Guleria, S., and Sharma, K. (2023). Protein profile analysis by SDS-PAGE in different elicited edible sprouts. *Journal of Stress Physiology & Biochemistry, Vol. 19, No. 3, pp. 102-109.*

29. V. G. Arude, 2023. Significance of Scientific Processing of Cottonseed in Cotton Value Chain. *Journal of Cotton Research and Development. Vol. 37 (91): 115-126. (NAAS Rating: 4.78)*

30. Vellaichamy Mageshwaran., Varsha Satankar., Surinder Paul. (2023). Soild-state Fermentation for Gossypol Detoxification and Nutritive Enrichment of Cottonseed Cake: A Scale-Up of batch Fermentation Process. *Bioresources, 19 (1), 1107-1118. (NAAS: 7.75)*

## 7.2 Review Article

31. Dukare, A., Sharma, K., Kautkar, S., Dhakane-Lad, J., Yadav, R., Nadanathangam, V. & Saxena, S. (2023). Microbial xylanase aided bio-bleaching effect on multiple components of lignocelluloses biomass-based pulp and paper: A review. *Nordic Pulp & Paper Research Journal. (NAAS: 6.9)*

32. Gupta, A., Kumar, M., Zhang, B., Tomar, M., Walia, A. K., Choyal, P., ... & Tran, L. S. P. (2023). Improvement of qualitative and quantitative traits in cotton under normal and stressed environments using genomics and biotechnological tools: A review. *Plant Science, 111937. (NAAS: 11.36)*

33. Kumar, M., Barbhai, M. D., Puranik, S., Natta, S., Senapathy, M., Dhumal, S., & Lorenzo, J. M. (2023). Combination of green extraction techniques and smart solvents for bioactives recovery. *TrAC Trends in Analytical Chemistry, 117286. (NAAS: 20)*

34. Kumar, M., Hasan, M., Sharma, A., Suhag, R., Maheshwari, C., Chandran, D., Sharma, K., Dhumal, S., Senapathy, M., Natarajan, K. and Punniyamoorthy, S., 2023. Tinospora cordifolia (Willd.) Hook. f. & Thomson polysaccharides: A review on extraction,

characterization, and bioactivities. *International Journal of Biological Macromolecules, 229, 463-475 (NAAS – 14.03).*

35. Kumari, N., Kumar, M., Rais, N., Puri, S., Sharma, K., Natta, S., & Kennedy, J. F. (2023). Exploring apple pectic polysaccharides: Extraction, characterization, and biological activities - A comprehensive review. *International Journal of Biological Macromolecules, 128011. (NAAS – 14.03).*

36. Soni, S., Babel, R., Srivastava, M., Saxena, S., Arputharaj, A. (2023). Review on Recent Developments in Fabric Softeners: Focus on Improvement in Functionalities and Sustainability, *Journal of Community Mobilization and Sustainable Development 18 (2), 399-406 (NAAS- 5.67).*

## 7.3 Book:

1. A Century of ICAR-CIRCOT Research
2. ICAR-CIRCOT Promising Technologies & Consultancies
3. ICAR-CIRCOT Annual Report 2022
4. Cotton Technology Report 2022-23
5. Annual Report of CRP on Natural Fibers

**Books Edited:**

1. N. Vigneshwaran, A.K. Bharimalla, A. Arputharaj, G.T.V. Prabu and T. Senthilkumar, edited book titled *"Handbook on Nanotechnology and its Applications" (ISBN978-935777-411-6)*
2. A.K. Bharimalla, A. Arputharaj, T. Senthilkumar, P. Jagajanantha and Manojkumar Mahawar, edited book titled on *"Advanced Characterization of Cotton Quality and its Spinning and Dyeing Performance"*, Published by ICAR-CIRCOT, Mumbai (ISBN 978-93-5890-805-3)
3. Souvenir of 9th ACRDN Meeting and International Conference
4. Book of Abstracts-9th ACRDN Meeting and International Conference

## 7.4 Training Manual

1. Training Manual on "Electrospinning for Nanofibre Production" Published by ICAR-CIRCOT, 2023, total pages 1-135
2. Training Manual on "Composite Materials" Published by ICAR-CIRCOT, 2023, Total pages 1-145.
3. SMART Resource Manual on "Marketing, Processing & Value Addition to Cotton & it's By-Produce" (English)
4. SMART Resource Manual on "Marketing, Processing & Value Addition to Cotton & it's By-Produce" (Marathi)

## 7.5 Booklets

1. Amber 2022
2. ICAR-CIRCOT Revised Test Fee Schedule 2023
3. "कपास प्रौद्योगिकी शब्दावली" (Glossary on Cotton Technology) English to Hindi

## 7.6 Leaflet / Pamphlet

1. ***"Nanofibre Cartridge for Filtration Applications",*** *compiled by* GTV. Prabu, ASM. Raja, N. Vigneshwaran, G. Krishna Prasad, T. Senthilkumar, and N. Shanmugam.
2. ***"Engineered Cotton Fabric Face Mask",*** *compiled by* GTV. Prabu, ASM. Raja, N. Vigneshwaran, G. Krishna Prasad, T. Senthilkumar, and N. Shanmugam.
3. ***"High Performance Cotton-Based Wound Dressing Material",*** *compiled by* G. Krishna

Prasad, T. Senthilkumar, N. Vigneshwaran, ASM. Raja, and N. Shanmugam.

4. ***"Heat Generating Smart Textile Products"***, *compiled by* P. Jagajanantha, A. S. M. Raja, G. Krishna Prasad, Sharmila Patil, & Kirti Jalgaonkar.

5. ***"Augmented process for preparation of bio-enriched compost from cotton micro-dust"*** *compiled by* K. Pandiyan, Sheshrao Kautkar, A. K. Bharimalla and N. Shanmugham. 2023.

6. "मार्केट यार्ड और जिनिंग फैक्ट्री में सर्वोत्तम प्रबंधन प्रथाएँ" *compiled by* व्ही. जी. अरुडे, एस.एस. काऊतकर, वर्षा सातनकर एवं एस के शुक्ला. 2023.

7. "स्वच्छ कपास चुनने की सर्वोत्तम कृषि पद्धतियाँ" *compiled by* व्ही. जी. अरुडे, एस.एस. काऊतकर, वर्षा सातनकर एवं एस के शुक्ला. 2023

8. "कपास के परिवहन और भंडारण पर सर्वोत्तम कृषि पद्धतियाँ" *compiled by* व्ही. जी. अरुडे, एस.एस. काऊतकर, वर्षा सातनकर एवं एस के शुक्ला. 2023.

9. "कपास फसल अवशेष प्रबंधन के लिए सर्वोत्तम कृषि पद्धतियाँ". *compiled by* व्ही. जी. अरुडे, एस.एस. काऊतकर, वर्षा सातनकर एवं एस के शुक्ला. 2023.

10. ***"Deep-Grooved Chrome Leather Rollers for Double Roller Gin".*** *compiled by* Sheshrao Kautkar, S K Shukla, V G Arude and D U Patil. 2023.

11. ***"Recommendations on Groove Profile of Chrome Leather Rollers For Efficient Ginning In Indian Ginneries"*** *compiled by* Sheshrao Kautkar, S K Shukla, V G Arude and D U Patil. 2023.

12. ***"Best Farm Practices on Clean Cotton Picking"*** *compiled by* V. G. Arude and S. K. Shukla (in English & Translated in Tamil)

13. ***"Best Farm Practices on Transportation and Storage of Cotton"*** *compiled by* V. G. Arude and S. K. Shukla (in English & Translated in Tamil)

14. ***"Best Management Practices at Market Yard and Ginning Factory"*** *compiled by* Dr. V. G. Arude and Dr. S. K. Shukla (in English & Tamil)

15. ***"Best Farm Practices for Cotton Crop Residue Management"*** *compiled by* V. G. Arude and S. K. Shukla (in English & Translated in Tamil)

16. ***"Market Yard Aur Ginning Factory Mein Sarvottam Prabandhan Prathayen"*** *compiled by* V. G. Arude, S. S. Kautkar, Varsha Satankar and S. K. Shukla

17. ***"Swachh Kapaas Chunane Ki Sarvottam Krishi Padhatiyaan"*** *compiled by* V. G. Arude, S. S. Kautkar, Varsha Satankar and S. K. Shukla

18. ***"Kapaas Ke Parivahan Aur Bhandarann Par Sarvottam Krishi Padhatiyaan"*** *compiled by* V. G. Arude, S. S. Kautkar, Varsha Satankar and S. K. Shukla

19. ***"Kapaas Fasal Avashesh Prabandhan Ke Liye Sarvottam Krishi Padhatiyaan"*** *compiled by* V. G. Arude, S. S. Kautkar, Varsha Satankar and S. K. Shukla

## 7.7 Book Chapters

1. Bhushan B, Mahawar MK, Jalgaonkar K, Kumar S, Nishani S, Mahapatra A, Patil S. (2023). *Engineering the Nano based Packaging Materials for the Postharvest Storage.* In: Radhakrishnana F.K., Jose A, Pareek S (Eds.) *In Postharvest Nanotechnology for Fresh Horticultural Produce.* pp 1-20.

2. Kumar A, Shakyawar D. B., Jose S, Kadam V & Shanmugam N *Nano finishing on woolens,*

*Fundamentals of nano textile science* 101-125 (Apple Academic Press, 2023). doi:10.1201/9781003277316-7.

3. Kumari, N., Dukare, A., Prakash, S., Sharma, N., Radha, Chandran, D., Dey, A., Lorenzo, J.M., Dhumal, S and Kumar, M. (2023). *Green Extraction and Modification of Proteins from Traditional and Novel Sources, In: Reference Module in Food Science,* Elsevier, https://doi.org/10.1016/B978-0-12-823960-5.00088-3

4. Asha, A.D. Nivetha, N., Lavanya, A.K., Vikram, K.V. Dukare, A.S., Bandeppa, Manjunatha, B.S. and Paul, S. (2023). *Microbial Mitigation of Abiotic Stress in Crops.* In: Singh, N., Chattopadhyay, A., Lichtfouse, E. (eds) *Sustainable Agriculture Reviews,* Vol 60. Springer, Cham. https://doi.org/10.1007/978-3-031-24181-9_9

5. Patil, A.K., Singh, N. Singha, P. S., Satankar, M., Kautkar, S., Singh, S. K. & Pathak P. K. (2023). *Engineering Interventions for Climate-Resilient Forage Production.* In: Singhal, R.K., Ahmed, S., Pandey, S., Chand, S. (eds) *Molecular Interventions for Developing Climate-Smart Crops: A Forage Perspective.* Springer, Singapore. Pp 215-228. https://doi.org/10.1007/978-981-99-1858-4_12.

6. T. Senthilkumar, K. Hema Latha, G. Krishna Prasad, R. Sridevi, S. Srayaa, R. Sruthi, Arun Sowmya, S. Vinitha, G.T.V. Prabu and P. Jagajanantha, *"Valorization of agricultural waste for activated carbons", Valorization of wastes for sustainable development,* pp. 395-412, Elsevier, ISBN: 978-0-323-95417-4.

7. Ammayappan, G. Krishna Prasad, T. Senthilkumar, G.T.V. Prabu, S. Basak and N.K. Jha *"Introduction to wool fiber technology: a brief introduction and its processing technology", In The Wool Handbook Morphology, Structure, Properties, Processing, and Applications,* Elsevier Publication 2023, Page 1-23. ISBN: 978-0-323-99598-6

8. Malathi, V.M., Sharma, K., Jinu, J., Venkateswarlu, R., Deepa, M., Rohini, A. (2023). *Phenolic phytochemicals from Sorghum, Millets and Pseudocereals and their role in Human Health. In Nutriomics of Millet crops.* Taylor and Francis.

## 7.8 Popular/Technical Articles

1. A.S.M. Raja A. Arputharaj, Sujata Saxena & P.G. Patil (2023). Chemo-Enzymatic Processes for Preparation of Absorbent Cotton, *Cotton Innovations, 3(1), 23-29.*

2. Reddy, A.R., Ramkrushan, G.I. and Sundaramoorthy, C. Cotton Marketing in Maharashtra – Issues and Way Forward. *Cotton Statistics and News 38 (2022-23): pg. 1-6.*

3. An article in Hindi- Prakritik Ranjak: Sooti vastron ke liye ek paryavaran anukul vikalp by Sujata Saxena was published in ICAR-CIRCOT Hindi magazine *'Ambar'*

4. Ajinath, Dukare; Sheshrao, Kautkar; Kanika, Sharma; Vigneshwaran, Nadanathangam; Sujata, Saxena; Manoj, Ambare; Microbial Mediated Biological Pulping of Lignocellulosic Biomass, *Vigyan Varta An International E-Magazine for Science Enthusiasts, 4(1), 110-114, 2023.*

5. Sharma K., Dukare A., Saxena S. and Chaurasia, H. S. (2023). Cottonseed Oil: Physicochemical Attribute, Health Benefits and Applications. *Vigyan Varta 4(1): 127-129.*

6. S. Basak, A S M Raja, S. Saxena, D.B. Shakyawar, Kartick K. Samanta, S. Debnath, M. Bhowmick and Niranjan Kumar. (2023). Cotton and Other Natural Fibre based Sustainable products for Futuristic Application. *Cotton innovations. 2 (12), 12-23.*

7. In Marathi, Popular article in *"Shetkari"* magazine a publication of Agriculture Department, Government of Maharashtra entitled "हायड्रोपोनिक तंत्रज्ञान: उन्हाळ्यातही हिरवा चारा उत्पादनाचा लाभदायी मार्ग " शेषराव काऊतकर आणि डॉ. आजिनाथ डुकरे, Shetkari, Vol. 23 Issue 2: May, 2023.

8. टी. सेंथिलकुमार, जी. कृष्णा प्रसाद, जी. टी. वी. प्रभु और पी. जगजनंथा , पूर्व और पश्च उपभोक्ता अपशिष्ट से पुनर्चक्रित रेशों का परिदृश, अंबर-2022, पृष्ठ सं. 20-23.

9. जी. कृ ष्ण प्रसाद, जी. टी. वी. प्रभु, टी. सेंथिलकुमार, पी. जगजानंथा, कट-प्रतिरोधी कपड़ा- महत्व और इसके विकास के अवसर, गृहपत्रिका-अंबर-2022, पृष्ठ सं.18-19.

10. ज्योती ढाकणे-लाड, किर्ती जलगांवकर, अशोक कुमार भारीमल्ल, मनोज महावर, अजिनाथ डुकरे, पी. जगजानंथा, शर्मीला पाटिल. (2022). फल संरक्षण बैग: फलों की गुणवत्ता में सुधार लाने और तुड़ाईपूर्व होने वाले नुकसान को कम करने के लिए एक ग़ैर-रासायनिक उपाय. अंबर, भाकृअनुप-केन्द्रीय कपास प्रौद्योगिकी अनुसंधान संस्थान, मुंबई.

11. शेषराव काऊतकर, आजिनाथ डुकारे, के.पांडियन, वर्षा साटनकर, अशोक कुमार भारीमल्ला, एवं मेधा कांबळे. 2022. हरा कपास जैवमात्रा: पशु चारे के रूप में साइलेज का एक वैकल्पिक स्रोत. अंबर, अंक 6, वार्षिकांक 2022

12. एस के शुक्ल, वर्षा सातनकर, के पांडियन, एस व्ही घाडगे, मनोज माहवार, शेषराव काऊतकर एवं डी यु पाटिल. 2022. कपास के डंठलों की आपूर्ति के लिए व्यवस्था. अंबर, अंक 6, वार्षिकांक 2022

13. वर्षा सातनकर, के पांडियन, शेषराव काऊतकर, मनोज माहवार,व्ही जी अरुडे एवं एस के शुक्ल. 2022. कपास के डंठलों के विभिन्न प्रयोग. अंबर, अंक 6, वार्षिकांक 2022

14. वर्षा सातनकर, मनोज कुमार पुनिया, के पांडियन, शेषराव काऊतकर एवं मनोज माहवार 2022. तेलरहित बिनौला खली से एक्सट्रुडेड उत्पाद की निर्मिति और उसके गुणों का परीक्षण. अंबर, अंक 6, वार्षिकांक 2022

15. "Cotton plant Stalks: A valuable industrial raw material" by Sujata Saxena in the Souvenir of the "COTTON INDIA 2023-24" Conference, organized by Cotton Association of India at Hyderabad from 28-29 October 2023.

16. "Natural Dyes: An eco-friendly option for cotton", by Sujata Saxena in the Souvenir of the 81st Plenary Meeting of the International Cotton Advisory Committee (ICAC) held during December 02-05, 2023

17. Jalgaonkar K., Mahawar M. Patil S., Dhakane-Lad J., Jagajanantha, P. (2023). घर के आंतरिक वाय प्रदषूण के कारण एवं नियंत्रण के उपाय . विज्ञान प्रगति Magazine, 41-42.

## 7.9 Newspaper Articles/ Reports

1. A newspaper article by Dr. S. K. Shukla, Director, ICAR-CIRCOT on "ग्लोबल वार्मिंगवर मात करण्यासाठी सेंद्रीय शेती महत्वाची" (Importance of Natural farming for to fight global warming) *in Marathi newspaper Punyanagari on 6 February 2023.*

2. News article on MoU signing ceremony with Dr. Indra Mani Sir, Honorable Vice Chancellor, VNMKV Parbhani on 16 February 2023 was published in *Lokmat, Marathwada and other leading Marathi newspapers.*

3. A newspaper article on "Workshop on Synergy of Innovation and Incubation in Agri start-up Ecosystem" organized on 13th March 2023 conducted at ICAR-NRC for Grapes, Pune was published in *Pudhari newspaper (Pune edition) on 14 March 2023*

4. ICAR-CIRCOT technology on "Preparation of value-added products using banana leaf and pseudostem" was published in *Tarun Bharat (Marathi newspaper) on 03 July,2023.*

5. Report titled, "Advancing Cottonseed Industry: ICAR-CIRCOT's Significant Presence at 4th SEA-AICOSCA Conclave 2023, was reported in *Free Press Journal, Mumbai edition dated 13 July 2023.*

6. A report on the technology of "Heat generating smart cotton textiles" developed at ICAR-CIRCOT was reported in *Free Press Journal, Mumbai edition on 18 July 2023.*

7. "ICAR-CIRCOT holds Skill Development Programme" was published in *Hitvada Newspaper (in English) in the Nagpur edition dated 12 August, 2023.*

8. "Kapas Kheti par Koushal Vikas Karyakam Mein Kisaano Ke Samasyaaon Ka Hua Samadhaan" was reported in the *Dainik Bhaskar Newspaper (in Hindi), in the Nagpur edition dated 12 August, 2023.*

9. Article on "77th Independence Day celebration held at ICAR-CIRCOT Mumbai" Headquarters was published in *Free Press Journal, Mumbai edition dated 16 August, 2023.*

10. "Kendriya Kaapus Tantragyan Sanshoodhan Sansthechi Antarrashtriya Kapus Baithak December Madhe" (A brief about the upcoming 9th ACRDN meeting and International Conference was reported in the *Tarun Bharat Mumbai Edition [in Marathi] on 28 August, 2023.*

11. Article 'Heat-generating cotton fabric hogs the spotlight on Day 2' was reported by the *Hindustan Times Ludhiana on 05 October, 2023*

12. Another article titled (in Hindi), 'Kadake Ki Thand Mein Kapas Aadharit Vastra Denge Garmahat', was reported in the *Dainik Jaagran, Ludhiana edition, in October 2023*

13. An article about Heat-generating cotton textile was reported in *Punjabi Jaagran newspaper, Ludhiana edition on 06 October, 2023*

14. Mumbai-it saajare honaar kendriya kapus tantragyan sanshodhan sanstheche Shatabdi varshKendriya Kaapus Tantragyan Sanshoodhan Sansthechi Antarrashtriya Kapus Baithak December Madhe" (A brief about the centenary year of ICAR-CIRCOT and the upcoming 9th ACRDN meeting and International Conference during 06-08, December 2023) was reported online at www.mahamtb.com [in Marathi]

15. "Mumbai-it 3 divsiiy kapus parishad" (A brief about the upcoming 9th ACRDN meeting and International Conference during 06-08, December 2023) was reported in the *Tarun Bharat Mumbai Edition [in Marathi] on 27 November, 2023.*

16. Kendriya kapus tantragyan shashodhan sansthechi shatabdi-Mumbaitil parishadeth jagbharatil namvant kapus shanshodhak bahumulya margadarshan karnaar' (A brief about ICAR-CIRCOT centenary year and the upcoming 9th ACRDN meeting and International Conference during 06-08, December 2023) was reported in the *Vrittamanas Newspaper, Mumbai Edition [in Marathi] on 28 November, 2023.*

17. An article (in Marathi) titled, "Kendriya Kapus Shanshodhan Sansthecha Shatabdi Varshanimmitte 9th Aashiyayi Cotton Research & Development Network Parishad Mumbai it –Karyakramasaathi Uprashtrapati Mananniya Jagdeep Dhankad Pramukh Pahune", was published in Solapur 24 *Tass News (online in Marathi) on November 28, 2023*

18. Article titled, ICAR-Central Institute for Research on Cotton Technology Organises 9th Asian Cotton Research & Development Network, International Conference, was published in *Mumbai News Express on December 08, 2023.*

19. Article (in Marathi) "Kendriya Kapus Tantragyan Shanshodhan Sansthan, Mumbai chya Shatabdi Varshanimmitte Aashiyayi Kapus Parishad", was published in Marathi Newspaper 'Vrittamanas'- Mumbai/Palghar Edition on December 13, 2023.

20. An article on National Farmers' Day celebration by Ginning Training Centre (GTC) of CIRCOT and CITI-CRDA was published in *Marathi newspaper "Dainik Toofan" on December 24,2023 (Nagpur edition).*

## 7.10 Paper Presentations

**International Conferences / Seminars**

- At the Second International Conference on - Integration of Advanced Technologies for Industry 4.0 (ICIATI 2023) organized by KCG College of Technology, Chennai, during 23-24 June 2023, following two papers were presented.

1. Dr. G. Krishna Prasad presented a paper on "Development of Cotton Nonwoven Based High Performance Secondary Wound Dressing Material".

2. Dr. T. Senthilkumar presented a paper on 'Sustainable approach: process protocol for spinning of recycled cotton/polyester blended yarn'.

3. Dr. A. Arputharaj participated and presented (in virtual mode) a research paper titled "Harnessing Antimicrobial and UV Protection Abilities of Nano Zinc Oxide for Designing Multifunction Silicone and Cationic Softener Formulation" at Atlas International Design Conference organized by ATLAS Skilltech University, Mumbai during 01-02 September, 2023.

4. Shri Himanshushekhar Chaurasia (Scientist pursuing Ph.D. at IASRI, New Delhi) presented a paper titled "Detection of Paddy panicle Stages using Deep Learning", in the 6th International Rice Congress-2023 held at Manila, Philippines from 16-19 October, 2023

- At the 9th Asian Cotton Research & Development Network (ACRDN) Meeting & International Conference on "Innovations for Sustainable and Resilient Cotton Production and viable Value Chain" held during December 06-08, 2023 at ICAR-CIRCOT, Mumbai, the following 20 papers were presented.

5. Dr. V G Arude, presented on "Validation of Hand-held mechanical Cotton Picker for suitability and acceptability by smallholder Indian Cotton Farmers"

6. Dr. G. Krishna Prasad, presented on "Development of Cotton-Based Multilayered Protective Clothing for Motorbike Riders"

7. Dr. T. Senthilkumar, presented on "Spinning performance and yarn properties of Cotton/Indian hemp fibre blends"

8. Dr. G. T. V. Prabu, presented on "Engineered Cotton Fabric Face Mask with High Filtration and Breathable Properties"

9. Dr. Jyothi Dhakane-Lad, presented on "Amelioration in mechanical and barrier properties of cotton fabric through bio-coatings"

10. Dr. K. Pandiyan, presented on "Utilization of cotton micro-dust as substrate for production of cellulolytic enzymes by a thermophilic fungus, Aspergillus fumigatus CF-T"

11. Dr. Varsha Satankar presented on "Performance Evaluation of Lint Cleaners used in Indian Ginneries"

12. A S M Raja, G Krishna prasad, T Senthilkumar, G T V Prabu, C Sundaramoorthy, presented on "Cotton-based reusable face mask with breathability, antimicrobial and repellent properties"

13. P. Jagajanantha, G. Krishna Prasad, S. Patil, K. Jalgaonkar, T. Senthilkumar, J Dhakane-Lad, S kautkar and A S M Raja, presented "Heat Generating Smart Textile Products using Cotton/Carbon Conductive Yarn"

14. S Patil, H. K. Pradeep, Saxena S, Bharimalla A, Bolakatti G, Chandragirivar P, presented a paper "Functionalized nanocellulose fibres from cotton linters and its application in hydrogels,"

15. Sheshrao Kautkar, S. K. Shukla, V. G. Arude and S. V. Ghadge, presented on Optimization of Groove Profile of Chrome Leather Roller for Improving Ginning Outturn of Double Roller Gin"

16. K Jalgaonkar, P Jagjanantha, S. Patil, J Dhakane-Lad, presented paper "Activated charcoal embedded multi-layer fabric for indoor air decontamination"

17. Dr. Sujata Saxena, presented on "Bio-materials for eco-friendly chemical processing of cotton textiles"

18. Dr. A. Arputharaj presented on "Enhancing Traceability in the Cotton value chain: Current Challenges and Future Imperatives".

19. Dr. N. Vigneshwaran presented on "Application of nanotechnology in cotton textiles – Enhancing the performance of future fabrics".

20. Dr. Manoj Kumar presented on "Harnessing Cottonseed's Potential: A Sustainable Approach to Utilize Protein in Combating Malnutrition – A Step Towards the Circular Economy"

21. Dr. Ajinath Dukare presented on "Cost-effective production of thermoalkali tolerant bacterial xylanase using cottonseed hull as substrate and its application for bio-bleaching of lignocellulosic based paper pulp".

22. Dr. Kanika Sharma presented on "Synthesis of silver nanoparticles using Cottonseed extract and antibacterial evaluation".

23. Mahawar MK, Bharimalla AK, Arputharaj A, Palkar J, Dhakane-Lad J, Jalgaonkar K, Vigneshwaran N (2023). presented "Process optimization of cellulose nanocrystal stabilized nanosulphur synthesis using response surface methodology"

24. Deshmukh PS, Mahawar MK, Arude VG, Ram C (2023). presented on "Absorption-desorption behaviour (in-situ) of seed cotton, seed and lint and its importance in ginning percent"

25. Dr. G. Krishna Prasad, presented on "Development and Characterization of Cut-Resistance Gloves using Cotton: Recycled Aramid Fibre Blended Yarns" in 7th International Conference on Technical Textiles and Nonwovens, held from on December 12-14, at IIT Delhi.

- At the 57th Annual Convention of Indian Society of Agricultural Engineers (ISAE) on "Agri-Food systems' Transformation through Engineering Innovations" and International Symposium on "Engineering Interventions for Making Millets a Global Food" held during 06-08 November 2023 at CAE, UAS, Raichur, Karnataka, the following 04 papers were presented.

26. Sheshrao Kautkar, S. K. Shukla and V. G. Arude, presented a paper on "Effect of Continuous Ginning on the Diameter and Performance Chrome Leather Rollers in Ginning Industries."

27. Dattatreya M. Kadam, Sayali S Parab, Kshama Katkar, Akansha Kasara presented an oral paper on "Development and Shelf-life Studies of Microwave Treated Cottonseed Protein Isolate Infused Bar"

28. Deshmukh PS, Arude VG, Mahawar MK, Kadam DM, Ram C presented a paper on "Seed cotton response to humidity vis-a-vis moisture content and its importance in prospective development of instrument for ginning percent measurement".

29. Varsha Satankar, Mohan Singh, S. K. Shukla, K. Pandiyan, Manoj Kumar, Durwesh Jhodkar, S. Kautkar presented a paper on "Cotton-seed Processing for Production of Protein-rich Cottonseed Flour for Feed and Food Applications"

**National Conferences / Seminars**

30. Dr. Sujata Saxena & Dr. A. Arputhraj presented a paper on "Sustainable Crop Residue Management Solutions (Farmers)" in Regional Level Workshop on 'Use of Biomass in Thermal Plants under National Mission Samarth' organized by MAHAGENCO at Pune on 28 March 2023.

31. A.S.M. Raja, Principal Scientist presented "Research achievement of Cotton Quality research" during AICRP on Cotton Annual Group Meeting held at Punjab Agricultural University, Ludhiana during 6-7 April 2023.

- 4th SEA-AICOSCA Cottonseed, Oil & Meal Conclave 2023 at The Fern Residency, CIDCO, Aurangabad during 7-8 July, 2023,

32. Dr. Manoj Kumar presented his research titled, "Protein Reinvention: Revolutionizing the Cottonseed Protein Industry with Ultra Low Gossypol Protein".

33. Dr. D.M. Kadam presented his research work titled, "Design and development of a pilot plant for the extraction of protein from de-oiled cotton cake and its value addition."

34. Dr. Sheshrao Kautkar participated and presented a paper titled "Silage from Green Cotton Biomass: An Alternative Source of Animal Feed" in 35th National Convention of Agricultural Engineers & National Seminar on Emerging Technologies for Advances in Agriculture & Horticulture" held on 12-13 September, 2023 at College of Agricultural Engineering, JNKVV., Jabalpur (MP).

35. Dr. P. Jagajanantha gave a presentation as a resource person on the topic 'Smart Textile & 3D Printing" in a National Seminar on "Smart Textile & 3D Printing and Apparel Industrial Exporting" organised by "Fashion Club" Department of Textile and Fashion Designing at Sri Kailash Women's College, Salem, TN on 12 September, 2023.

36. Dr. S. K. Shukla, Director gave a presentation "CIRCOT Technologies for adoption in Industries", at the industry interface meeting on the theme 'Weaving the Future-Natural Fibres Processing Symposium' at CIPHET, Ludhiana on 04 October, 2023, during the event CIPHET-IIFA 2023, at Ludhiana from 03-05 October, 2023.

## 7.11 Other Publications

- *ICAR-CIRCOT News – Monthly e-Newsletter (12 issues)*

  *UDAAN – Six Monthly Newsletter of CIRCOT R-ABI (2 issues)*

# 8. IRC, RAC, QRT, IMC Meetings

## 29th RAC Meeting

- Institute's 29th Research Advisory Committee (RAC) meeting was held during April 19 -20, 2023. Dr. S. K. Shukla, Director, highlighted technologies developed, commercialized, skill development and commercial services undertaken and revenue generated by the Institute. He briefed about the future challenges in the research on post- harvest processing of cotton and priorities of Institute. Leaflets on technologies and training activities & Annual Report of CRP on Natural Fibres were released. The members reviewed the progress of research and other activities and offered their valuable suggestions & recommendations.

RAC Meeting in hybrid mode

RAC members visit to the different laboratories & facilities in Institute

Prof (Dr.) Gopal P. Agarwal, former professor, IIT, New Delhi and Member, RAC of ICAR-CIRCOT, delivered a lecture on "Lignocellulosic Biomass Conversion to Ethanol- the Current Status" on the occasion.

An interactive meeting of all scientists with Dr. K. Narsaiah ADG (PE) was organized on April 20, 2023.

## 123rd Institute Research Committee meeting

- The 123rd Institute Research Committee meeting was held during May 02-03, 2023. The Director reviewed the progress of projects. He provided suggestions for further improvement of project work and commented on the progress achieved. New frontier areas of research were discussed and the scientists were encouraged to take up projects in those areas.

IRC Meeting in hybrid mode

## Institute Management Committee Meeting

- 81st IMC of the institute took place on July 20, 2023 in hybrid mode.

  The R&D projects, achievements, technology commercialization, work progress, functioning of the administration & accounts, ISO systems etc. were reviewed and improvements were suggested.

IMC Meeting in hybrid mode

## CIRCOT QRT (2017-22)

- The introductory meeting of the QRT was held in presence of Dr. S.N. Jha, Deputy Director General (Agri. Engg.) in his office at ICAR, KAB-II, New Delhi on 31.01.2023 and attended by Dr. K. K. Singh, Chairman, QRT, Dr. K. Narsaiah, Assistant Director General (Process Engg.) and Dr. S.K. Shukla, Director, ICAR-CIRCOT, Mumbai. In this meeting, the composition of the committee was decided.

- The committee members are as follows, Dr. K. K. Singh (Chairman), Vice Chancellor, Sardar Vallabhbhai Patel University of Agriculture & Technology, Modipuram, Meerut, Dr. G. S. Nadiger, Research Advisor (SASMIRA) & Former Director of Laboratories (Textile Committee), Dr. A. J. Shaikh, Former Director, ICAR-CIRCOT, Mumbai, Dr. Kanchan K. Singh, Dean, SOA Sanskrit University, Mathura, Dr. S. Patel, Professor & Former Head, Agricultural Processing & Food Engg, IGKV, Raipur, Mr. Prashant Kumar Mohota, Managing Director (MD), Gimatex Industries Pvt Ltd., Hinganghat, Wardha, Dr. A. S. M. Raja, Principal Scientist & Head, QEID, ICAR-CIRCOT, Mumbai is Member-Secretary.

The QRT conducted its meetings as below,

| Name of Meeting | Conducted on | Conducted at |
|---|---|---|
| The Planning Meeting of the QRT (second meeting) | June 06, 2023 | ICAR-CIRCOT, Mumbai |
| Third Review Meeting | July 24-25, 2023 | ICAR-CIRCOT, Mumbai |
| Fourth Review Meeting | October 10-11, 2023 | Ginning Training Centre (GTC), ICAR-CIRCOT, Nagpur |
| Fifth Review Meeting | December 05, 2023 | ICAR-CIRCOT, Mumbai |

Planning Meeting of QRT on June 06, 2023

Third QRT meeting on July 24-25, 2023

# 9.Participation in Seminars/Conferences/ Meetings/Workshop

## 9.1 Participation in Conferences

| *Name of the Conference* | *Participant/s* |
|---|---|
| National conference on "Natural fibre for sustainable societal development" from January 02-05, 2023 at ICAR-NINFET, Kolkata | Dr. S. K. Shukla |
| The Conference and Exhibition on Reinforced Plastics (ICERP 2023) held at Bombay Exhibition Centre, Mumbai from January 18-20, 2023 | Dr. T. Senthilkumar<br>Dr. G. Krishna Prasad |
| International Conference on "Sustainable and Resilient Environment Development – 2023 (ICSRED-23)" held at CSIR-NEERI, Nagpur from February 17-18, 2023 | Dr. K. Pandiyan |
| Young Entrepreneurship Conclave- 2023 organized by ICAR-CCARI, Goa during January 31 to February 01, 2023 | Dr. Jyoti Dhakane-Lad<br>Mrs. Prachi Mhatre |
| Conference on "Agriculture, Horticulture, Biofertilizers, Processing & Irrigation", conducted by Maharashtra State Mango Growers Association, at Mumbai on February 01, 2023 | Dr. S. K Shukla |
| Global Millets (Shree Anna) Conference held at New Delhi on March 18-19, 2023 | Dr. Sujata Saxena |
| International Conference on "Blended Learning Ecosystem for Higher Education in Agriculture" during March 21-23, 2023 in a virtual mode. | Dr. N. Vigneshwaran<br>Dr. N. Shanmugam |
| Conference on Synergistic strategies for enhancing textile value chain, organized by ICT, Mumbai in collaboration with Textile Association of India (Mumbai unit) on May 12, 2023. | Dr. T. Senthilkumar<br>Dr. G. T. V Prabu<br>Dr. A. Arputharaj |
| Second International Conference on - Integration of Advanced Technologies for Industry 4.0 (ICIATI 2023) organized by KCG College of Technology, Chennai, during June 23-24, 2023 (virtual mode). | Dr. T. Senthilkumar |
| 4th SEA-AICOSCA Cottonseed, Oil & Meal Conclave 2023 held at Aurangabad during July 07-08, 2023. | Dr. S. K. Shukla<br>Dr. D. M. Kadam<br>Dr. V. G. Arude<br>Dr. Manoj Kumar |

| Name of the Conference | Participant/s |
|---|---|
| Conference on Agriculture, Horticulture, Irrigation, Food, Warehousing & Cold chain organized by Maharashtra State Mango Growers Association, Mumbai as Guest of Honour on August 17, 2023. | Dr. Sujata Saxena |
| Maharashtra Cotton Conference 2023 organized by The Maharashtra Cotton Brokers Association at Akola from September 09-10, 2023. | Dr. S. K. Shukla |
| 2nd International Conference on 'Prospects & Challenges of environmental and biological sciences in food production system for livelihood security of farmers (ICFPLS-2023) during September 18-20, 2023 (in virtual mode) conducted by ICAR-CIARI, Port Blair Andaman & Nicobar Island | Dr. Manoj Kumar Mahawar |
| The International Conference on" Scope and Opportunities in Medical Textiles" organized by SITRA Coimbatore at Jio World Convention Centre, BKC, Mumbai during September 13, 2023 | Dr. G. T. V. Prabu |
| 'Intexcon 2023' an International Denims conference under theme DENIMS INNOVISION on October 03-04, 2023 at Ahmedabad Management Association, ATIRA Campus, Ahmedabad. | Dr. A. Arputharaj |
| The Second International Conference on Integration of Advanced Technologies for Industry 4.0 (ICIATI 4.0) on June 23-24, 2023 at KCG College of Technology, Karapakkam, Chennai, Tamilnadu. | Dr. T. Senthilkumar<br>Dr. G. Krishna Prasad |
| The 7th International Conference on Technical Textile and Nonwovens (ICTN) organized by IIT, Delhi during December 12-14, 2023 at New Delhi. | Dr. G. Krishna Prasad |
| International Conference of Agricultural Librarians and Users Community (ICALUC-2023) on Agricultural Libraries and Sustainable Development Goals: The way forward Jointly organized by Mohinder Singh Randhawa Library, Punjab Agricultural University, Ludhiana and Association of Agricultural Librarians & Documentalists of India (AALDI) during October 05-06, 2023 at PAU, Ludhiana Campus | Mrs. Medha Kamble |
| The 61st Joint Technological Conference Jointly Organized by ATIRA, BTRA, SITRA & NITRA during December 14-15, 2023 at BTRA, Mumbai. | Dr. N. Shanmugam<br>Dr. G. T. V. Prabu |

## 9.2 Participation in Seminars/Symposium

| *Name of the Seminar* | *Participants* |
|---|---|
| Seminar on India ITME 2022-Glimpses, jointly organized by Textile Association of India, Mumbai and VJTI Mumbai on February 16, 2023. | Dr. T. Senthilkumar<br>Dr. G. T. V. Prabu |
| National Seminar on "Smart Textile & 3D Printing and Apparel Industrial Exporting" organised by "Fashion Club" Department of Textile and Fashion Designing at Sri Kailash Women's College, Salem, Tamil Nadu on September 12, 2023. | Dr. P. Jagajanantha |

## 9.3 Participation in Webinar

| *Name of the Webinar* | *Participants* |
|---|---|
| Webinar on "Sustainable Application in Mission Approach through Research & Technology based Holistic Interventions (SAMARTH)" organized by Ministry of Agriculture and Farmers Welfare, Govt. of India on February 24, 2023 (in online mode) | Dr. Kirti Jalgaonkar<br>Dr. Sharmila Patil<br>Dr. Jyoti Dhakane-Lad |
| Awareness and implementation webinar on "Cotton bales as per IS 12171: 2019", organized by Bureau of Indian Standards on August 06, 2023. | Dr. A. S. M. Raja<br>Dr. Sheshrao Kautkar |

## 9.4 Participation in Workshop/Stakeholders Meet/Lecture

| *Name of the Workshop/Meet* | *Participants* |
|---|---|
| A workshop on 'Synergy of innovation and incubation' was organized at VNMKV Parbhani during February 16-17, 2023 by ICAR-CIRCOT Mumbai in collaboration with VNMKV Parbhani. | Dr. Ashok Kumar Bharimalla<br>Dr. Manoj Kumar Mahawar<br>Dr. Jyoti Dhakne-Lad |
| National Workshop on Enabling Technological and Policy Interventions to Increase Cotton Productivity and Stimulate Industrial Growth organised by Trust for Advancement in Agricultural Sciences (TAAS), New Delhi in collaboration with the Indian Council of Agricultural Research (ICAR) and National Academy of Agricultural Sciences (NAAS) at NASC Complex, Pusa Campus, New Delhi on February 25, 2023 | Dr. S. K. Shukla<br>Dr. C. Sundaramoorthy<br>Dr. Sharmila Patil<br>Dr. Kanika Sharma |

| Name of the Seminar | Participants |
|---|---|
| A workshop on 'Synergy of Innovation and Incubation in Agri Start-up Ecosystem' was organized on March 13, 2023 at ICAR-National Research Centre for Grapes, Pune in joint collaboration of ICAR-CIRCOT, Mumbai; ICAR-DOGR Pune and ICAR-DFR, Pune. | Dr. C. Sundaramoorthy<br>Dr. Ashok Kumar Bharimalla<br>Dr. Jyoti Dhakne-Lad |
| Regional Level Workshop on 'Use of Biomass in Thermal Plants under National Mission Samarth' to be organized by MAHAGENCO at Pune on March 28, 2023 | Dr. Sujata Saxena<br>Dr. A. Arputharaj |
| Annual Group Meeting of ICAR-AICRP on Cotton during April 06-07, 2023 at Punjab Agricultural University, Ludhiana | Dr. S. K. Shukla<br>Dr. A. S. M. Raja<br>Dr. A. Arputharaj<br>Shri R. K. Jadhav<br>Shri S. Banerjee |
| 6th meeting of the Textile Advisory group (TAG) with stakeholders held at Rajkot on April 22, 2023 | Dr. Sujata Saxena |
| 51st Joint AGRESCO 2023 Jointly organize by Mahatma Phule Krishi Vidyapeeth, Rahuri & Maharashtra Council of Agricultural Education & Research, Pune during May 25-27, 2023 at the Central Campus, MPKV, Rahuri, Ahmednagar | Dr. P. S. Deshmukh |
| Workshop on Liaison officer (SC/ST), organized by ISTM, New Delhi, during August 17-18, 2023 through virtual mode. | Dr. T. Senthilkumar |
| 7th interactive meeting of the Textile Advisory Group and The Asian Textile Convention ATEXCON at Coimbatore on August 31, 2023. | Dr. Sujata Saxena |
| An interactive meeting with TEXPROCIL on September 05, 2023 | Dr. S.K. Shukla |
| The 35th National Convention of Agricultural Engineers & National Seminar on "Emerging Technologies for Advances in Agriculture and Horticulture organized by the Institution of Engineers (India) & ICAR-NAHEP during September 12-13, 2023 at JNKVV, Jabalpur. | Dr. Sheshrao Kautkar<br>Dr. Manoj Kumar Mahawar |
| Industry-Interface meeting on the theme 'Weaving the Future-Natural Fibres Processing Symposium' organized at CIPHET, Ludhiana on October 04, 2023. | Dr. S. K. Shukla |

| Name of the Seminar | Participants |
|---|---|
| The 57th Annual Convention of ISAE on "Agri-Food Systems Transformation through Engineering Innovations & International Symposium on Engineering Interventions for making millets as global foods", jointly organized by Indian Society of Agricultural Engineers, New Delhi & University of Agricultural Sciences Raichur Karnataka held during November 06-08, 2023. | Dr. D. M. Kadam<br>Dr. P. S. Deshmukh<br>Dr. Sheshrao Kautkar<br>Dr. Manoj Kumar Mahawar<br>Dr. Varsha Satankar |
| 6th Late Prof W. B. Achwal Oration endowment lecture entitled 'Clothing 8 Billion: Challenges to People, Planet and Profits' delivered by Mr. Ulhas Nimkar, Chairman, NimkarTek Technical Services Pvt. Ltd on March 10, 2023 at Institute of Chemical Technology (ICT), Mumbai. | Dr Sujata Saxena<br>Dr. A. Arputharaj |

## 9.5 Participation in Expert Committee Meetings

| Meeting | Participant/s |
|---|---|
| The 30th meeting of TXD 05 subcommittee of BIS on January 12, 2023 | Dr. Sujata Saxena |
| The meeting of the TXD 07 subcommittee of BIS on January 24, 2023. | Dr. Sujata Saxena |
| The 6th Meeting of Technical Textiles for Mobiltech Applications Sectional Committee, TXD 38, organised by BIS on March 17, 2023. | Dr. G. Krishna Prasad |
| 24th Meeting of TXD01 'Physical Methods of Tests Sectional Committee' organized by BIS, New Delhi on April 06, 2023 | Dr. T. Senthilkumar |
| 25th Meeting of TXD31 'Man-Made Fibres, Cotton and their products sectional committee' organized by BIS, New Delhi on April 06, 2023 | Dr. T. Senthilkumar |
| 26th Meeting of TXD31 'Man-Made Fibres, Cotton and their products sectional committee organized by BIS, New Delhi on May 15, 2023 | Dr. T. Senthilkumar |
| Textile Division Council meeting of the BIS on May 19, 2023 in online mode | Dr. S. K. Shukla<br>Dr. Sujata Saxena |
| The BIS TXD 01 "Physical Testing of Textiles" Sectional committee review meeting on July 06, 2023 through online mode organized by BIS, New Delhi. | Dr. T. Senthilkumar |

| Meeting | Participant/s |
|---|---|
| The Central Variety Identification Committee meeting for ICAR-AICRP on Cotton on July 31, 2023 as an Expert (Fibre Technology) | Dr. S. K. Shukla<br>Dr. A. S. M. Raja |
| 20th Meeting of Textile Machinery and Accessories Sectional Committee (TXD 14), organized by BIS, New Delhi, on August 07, 2023. | Dr. T. Senthilkumar |
| 14th meeting of the Technical Committee on Thermal Research, in online mode on August 24, 2023 and presented the progress of work done at the institute. | Dr. Sujata Saxena |
| 19th meeting of the Dyestuffs and Auxiliaries' Sectional Committee of the BIS -TXD 07 held in online mode on September 20, 2023. | Dr. Sujata Saxena |
| 25th sectional committee meeting of the Physical Testing of Textile Material (TXD01) on October 04, 2023 organized by BIS, New Delhi. (Online Mode) | Dr. T. Senthilkumar |
| 24th Plenary meeting of the ISO/TC 38 'Textiles' and its subcommittees during October 29, 2023 to November 03, 2023 held at Seoul, Republic of South Korea, representing India. | Dr. Sujata Saxena |
| 18th meeting of Handloom and Khadi Sectional committee TXD 08, on November 29, 2023 | Dr. Sujata Saxena |
| 33rd online meeting of the TXD 05 Chemical Method of Tests subcommittee of the BIS on November 09, 2023. | Dr. Sujata Saxena |
| 30th Meeting (online) of TXD31 Man-made fibres, cotton and their products sectional committee, organized by BIS, New Delhi, on November 09, 2023 | Dr. T. Senthilkumar |
| 21st Meeting (online) of TXD14 Textile Machinery and Accessories Sectional Committee, organized by BIS, New Delhi, on November 10, 2023 | Dr. T. Senthilkumar |
| TXD38-Technical Textiles meeting (online) for Mobiltech Applications Sectional Committee, organized by BIS, New Delhi, on November 16, 2023 | Dr. G. Krishna Prasad |
| 20th online meeting of the TXD 07 subcommittee of the BIS held on November 17, 2023 | Dr. Sujata Saxena<br>Dr. A. S. M. Raja |
| BIS TXD: 01 sectional committee meeting on November 23, 2023 as Chairman (online mode). | Dr. A. S. M. Raja |

## Other Meetings attended by Dr. S.K. Shukla Director, CIRCOT

- Participated in 86th foundation day celebration of ICAR-NINFET, Kolkata and two day National Conference on "Natural fibre for sustainable societal development" from January 02-05, 2023.
- Meeting with stakeholders from, in and around Nagpur to discuss about cost norms for establishment of ginning plant and machineries, under the SMART COTTON project at GTC, Nagpur, from February 03-06, 2023.
- Attended stakeholders meeting organized by Textile Commissioner Office, Mumbai on February 09 & February 20, 2023.
- Participated in the ICAR- Industry stakeholders consultation meet on March 06, 2023.
- Attended the COCPC meeting in the office of Textile Commissioner Office, Mumbai on March 24, 2023.
- Participated in the AICRP Meeting at Ludhiana on April 06-07, 2023.
- Participated as Member in the Research Advisory Committee meeting of MGIRI, Wardha (online) on April 20, 2023.
- Participated as Chairman in the meeting of the Judging committee of Best Farm Manager at MPKV, Rahuri on May 04 & 07, 2023.
- Attended the joint meeting of CMD, CCI, Director, DoCD and ICAR-CIRCOT on May 08, 2023.
- Participated in SMART project online meeting on cost norms for establishment of the Ginning & Pressing unit for cotton on May 17, 2023.
- Attended BIS – LIMS meeting on May 18, 2023. (online mode)
- Attended the Nagar Rajbhasha Karyanvayan Samiti meeting at Western Railway, Mumbai on May 30, 2023.
- Participated in a meeting of stakeholders at Office of the Textile Commissioner Office, Mumbai on June 01, 2023.
- Attended the NaaVic Regional committee meeting on June 21, 2023.
- Attended the SMART project meeting on June 23, 2023.
- Attended the 4th SEA-AICOSCA Cottonseed, Oil & Meal Conclave 2023 at Aurangabad during July 07-08, 2023.
- Participated in the review meeting regarding the implementation of special project on cotton of ICAR-CICR under the Joint Chairpersonship of Secretary (A&FW), Secretary (Textiles) and Secretary (DARE) & DG (ICAR) on July 19, 2023. (online mode)
- Attended the Central Variety Identification Committee meeting for ICAR-AICRP on Cotton, as a member on July 31, 2023.
- Attended the XXVII Meeting of ICAR Regional Committee VII at ICAR-CIAE, Bhopal, on August 18, 2023.
- Participated in the Foundation Day celebration of ICAR-NBSS&LUP, Nagpur on September 01, 2023.
- Attended an interactive meeting with TEXPROCIL on September 05, 2023 to discuss and explore the possibilities of research cooperation with CIRCOT, at Mumbai.

- Participated in the Foundation Day celebration of ICAR-NISA, Ranchi on September 20, 2023.
- Attended meeting chaired by Joint Secretary, Ministry of Textiles on September 22, 2023 at Jio World Convention Centre, Bandra Kurla Complex, Mumbai to discuss about ICAC plenary meeting and organizing of the 9th ACRDN at ICAR-CIRCOT.
- Attended Industry-Interface meeting on the theme 'Weaving the Future-Natural Fibres Processing Symposium' organized at CIPHET, Ludhiana on October 04, 2023.
- Attended the ICRA-EC meeting on November 06, 2023 at Mumbai.
- Participated in the stakeholders Meeting about District Agro-Meterological Units (DAMUs) on November 17, 2023 at Krishi Bhavan, New Delhi.
- Participated in a consultative Meeting on November 22, 2023, regarding augmenting the cultivation of organic cotton on cluster-based approach. (online mode)

# 10. Events Organized

## 10.1 Foundation Day Celebration

On December 03, 2023, the 100th foundation day was celebrated with traditional grandeur and enthusiasm. Dr. T. R. Sharma, DDG (Crop Science), ICAR, New Delhi was the Special Guest who officially inaugurated the celebrations and Dr. S. N. Jha DDG (Agril. Engg.), ICAR, New Delhi was the Chief Guest at the event.

Dr. S. K. Shukla, Director, CIRCOT welcomed the other esteemed Guests of Honour, Dr. Narsaiah Kairam, ADG (PE), ICAR, New Delhi, Dr. Y. G. Prasad, Director, ICAR-CICR, Nagpur, Dr. C. D. Mayee, Former Chairman, ASRB, New Delhi, Dr. K. R. Krishna Iyer, Dr. S. Sreenivasan, Dr. A. J. Shaikh, all ex-Directors of CIRCOT, Shri Suresh Kotak, Director, M/s Kotak Commodities, following which he highlighted the achievements of ICAR-CIRCOT. Dr. K. R. Krishna Iyer, Former Director of CIRCOT gave a talk on the 'Journey of ICAR-CIRCOT-100 years.

All the Guests of Honour also addressed the gathering and shared their impressions about CIRCOT.

Release of publications such as Hindi magazine, Amber 2022 and ICAR-CIRCOT revised Test Fee schedule, was followed by address by the Special Guest, Dr. T. R. Sharma and then by the Chief Guest, Dr. S. N. Jha.

CIRCOT was blessed with the presence of many of its ex-employees during the celebration. Shri H.R. L. Venkatesh, a very senior staff who retired in 2004, and has been passionate and active even after his retirement in the promotion of cotton through innumerable articles in social media/academic fora such as Wikipedia, Facebook, was honoured during the celebration.

## 10.2 Conference/Workshops Organised

**• 9th Asian Cotton Research & Development Network Meeting (9th ACRDN)**

ICAR-CIRCOT hosted the 9th Asian Cotton Research & Development Network Meeting (9th ACRDN) and International Conference on the theme, "Innovations for Resilient and Sustainable Cotton Production and Viable Value Chain" from December 06-08, 2023 at ICAR-CIRCOT Mumbai. This event is the first activity in the year long activities planned during this centenary year.


Publication released during the 9th ACRDN Meeting and International Conference held from December 06-08, 2023 at ICAR-CIRCOT, Mumbai are,

- *Souvenir of 9th ACRDN Meeting and International Conference*
- *Book of Abstracts-9th ACRDN Meeting and International Conference*
- *Special Issue of Cotton Research Journal*



An exhibition was also arranged during 9th ACRDN, in the ICAR-CIRCOT premises at Mumbai. Sixteen agri startups which are being incubated under RKVY RAFTAR-ABI at ICAR-CIRCOT exhibited and sold products developed by them.

**• Workshop at Parbhani**

ICAR-CIRCOT Mumbai in collaboration with VNMKV Parbhani organized workshop on "Synergy of innovation and incubation' at Parbhani on 16 & 17 February, 2023

**• Review Workshop of CRP on NF**

ICAR-CIRCOT organized Annual Review of CRP on Natural Fibre under the chairmanship of DDG (Agri. Engg.) on 28 February 2023

**• Industry Interface meeting organised by CIRCOT**

The ICAR-Central Institute for Research on Cotton Technology, Mumbai organized an "Industry Interface Meeting" on 7 June 2023, Mumbai. The meeting was presided over by Dr. S. N. Jha, DDG (Agril. Engg), ICAR, New Delhi. Dr. K. Narasaih, ADG (PE) and Dr. S. Patel, Member, QRT (2017-22) of ICAR-CIRCOT were also present on this occasion. The major focus was on establishing linkages between various engineering institutes under ICAR with the industries / start-ups for faster and efficient development and adoption of engineering technologies in the farm. This interface meeting was attended by 60 representatives from Tractor Manufacturing companies, Fertilizer industries, Textile industries, Food industries, Chemical industries, Briquettes and Pellets manufacturing industries along with other cotton value chain stakeholders.

**• Review meeting**

- 2nd Inter Institutional review Meeting (online mode) on "Efficacy evaluation of ICAR-CIRCOT Nano Sulphur as fertilizer formulation for different field crops ", held on April 28, 2023 at ICAR-CIRCOT
- Inter-Institutional meeting in online mode was organized by ICAR-CIRCOT on 5 July, 2023 to discuss on "Efficacy evaluation of ICAR-CIRCOT Nano-ZnO as nanofertilizer in field crops", which was attended by scientists from ICAR-IIPR, Kanpur; ICAR-CICR, Nagpur and ICAR-NIASM, Baramati.

**• Interactive meeting with the officials of International Cotton Advisory Committee**

The institute organized in its Mumbai premises, an interactive meeting with the officials of International Cotton Advisory Committee (ICAC), Washington DC, USA, August 22, 2023.

The ICAC, which provides a forum for discussion of cotton issues of international significance, was represented by Mr. Eric Trachtenberg, Executive Director and Dr. K. R. Kranti, Chief Scientist.

Dr. S. K. Shukla, Director ICAR-CIRCOT, welcomed the officials and apprised the delegates about the contribution of ICAR-CIRCOT through its R&D, benefitting the various stakeholders, both within and outside of the country. Mr. Eric Trachtenberg congratulated the Institute for

carrying out cutting-edge research in the field of cotton research and invited the scientists of the Institute to collaborate in various activities of ICAC. Dr. K. R. Kranti elaborated about ICAC's vision for prosperity throughout the cotton industry, by its activities across the globe. The delegates later visited various facilities of the Institute.

**Visit of ICAR officials at ICAR-CIRCOT**

**• Inspection by Parliamentary Committee**

Inspection of the institute by 2nd sub-committee of Parliamentary committee on official language implementation was carried out on 17th January 2023.

**• Kasturi Cotton Programme**

ICAR-CIRCOT became "Associate Member" with the Kasturi Cotton programme of TEXPROCIL on December 02, 2023.

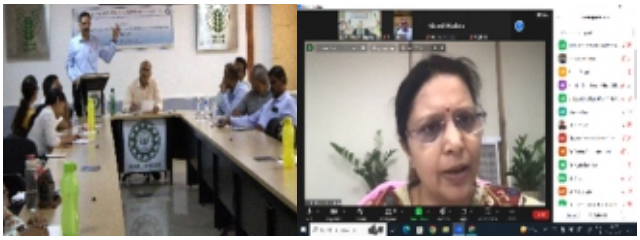
ICAR-CIRCOT has provided the protocol for "Kasturi cotton" branding and also empanelled laboratory for testing and conformity assessment of Kasturi Cotton.

KASTURI COTTON BHARAT

**Events organised under Azadi ka Amrit Mahostav (AKAM), DARE-ICAR Campaign for India@75**

• Online workshop on "IPR, Patents and Design filing" by Dr. Bharat N. Suryawanshi, Asst. Controller of Patents & Designs, RGNIIPM, Nagpur was organised under the joint aegis of Rajiv Gandhi National Institute of Intellectual Property Management, Nagpur (RGNIIPM) and ICAR-CIRCOT, Mumbai under the National Intellectual Property Awareness Mission (NIPAM) to strengthen the Intellectual Property Management System of our country and to realise the "Creative India, Innovative India" objective of the National IPR Policy on April 21, 2023. Around 100 participants attended the event in hybrid mode.

• A Workshop (in hybrid mode) was organized by CIRCOT ITMU & ABIC on "Role of Design, Copyright and Trademark: Scientific and Entrepreneurial Perspective" on May 16, 2023. Dr. Neeru Bhooshan, Assistant Director General (Intellectual Property and Technology Management) ICAR, New Delhi attended in virtual mode. On this occasion, two experts, Dr. Ashwini Siwal, Assistant Professor, Faculty of Law, University of Delhi spoke on different aspects of IPR such as Novelty, No obviousness, Inventive steps, Industry applications, importance of First to File. and Dr. Vikram Singh, Senior scientist, IP&TM Unit, ICAR, New Delhi deliberated on IPR portfolio management and its impact on agriculture research. More than 120 participants attended.



Workshop of May 16, 2023

**• Cancer Awareness Program**

'Common Cancer Awareness Program' was organised in collaboration with Department of Preventive Oncology, Tata Memorial Hospital, Mumbai on May 25, 2023 in hybrid mode. About 100 people participated in the programme in physical and online mode.

**• World Environment Day**

Ginning Training Centre (GTC) of ICAR-CIRCOT (Mumbai), Nagpur organised an Awareness programme on mission Lifestyle for Environment (LiFE) and theme "Beat Plastic Pollution" and conducted Tree Plantation campaign in association with AICRP on Agroforestry, College of Agriculture, Nagpur, Dr. Panjabrao Deshmush Krishi Vidyapeeth, Akola on World Environment Day on June 05, 2023 at Salaimendha village, Hingna Taluk, Dist - Nagpur. Dr. Prashant Raut, Associate Professor, CoA briefed about the programme and Dr. Vinod Khadse, Extension Agronomist, explained the importance of forest cover and trees in safeguarding the environment and climate change challenges. The farmers were instructed about the role of trees in combating climate change and urged to plant more trees for improved air quality and to reduce pollution. The farmers were also encouraged to avoid use of plastic in their day-to-day life and sensitized about various forest trees playing vital role in environment. Books on agricultural practices, tool kits and planting materials of various trees including bamboo, bael, mahua, Nagpur mandarin and acid lime were distributed to the farmers and planted on boundaries on the farmland of the village Salaimendha and in the GTC premises.

**World Environment Day- Awareness Program**

**• Industry Interface Meeting**

The ICAR-Central Institute for Research on Cotton Technology, Mumbai organized an "Industry Interface Meeting" under Azadi ka Amrit Mahotsav India@75 on June 07, 2023.

**• Blood Donation Camp**

A "Blood Donation Camp" was organized on the occasion of 'World Blood Donors Day on June 14, 2023. An expert team led by Dr. Sachin Chaudhari (BTO) and Mrs. Pratibha Ghorpade (PRO) from Sir J. J. Mahanagar Raktpedhi, J.J. Hospital, Mumbai conducted the camp in the Institute premises. Total 35 staff donated blood and made this event successful.

**• International Yoga Day**

ICAR-Central Institute for Research on Cotton Technology, Mumbai celebrated International Yoga Day with the theme "Vasudhaiva Kutumbakam" on June 21, 2023. On this occasion Yoga guru Shri. Sudhir Sawant and his team from Ambika Yoga Kutir (Ghatkopar branch) conducted a workshop yoga practice. He highlighted the importance of yoga in daily life, about the different types of asanas and their associated benefits and also enlightened the participants about the proper procedure of practicing different asanas. Director Dr. S. K. Shukla led the staff members in this event.

**Event on Yoga Day, June 21, 2023 at CIRCOT**

**• Visit by Industry/Private parties**

Dr. Jothi Kandaswamy, Director, Uniqlo Production (India), which is a Japanese retailing firm, along with delegates from USA and Japan visited the institute on January 20, 2023 and interacted with the scientists of ICAR-CIRCOT and ICAR-CICR (in online mode), regarding collaborative work for improvement in quality of Indian cotton.

**Delegates from UNIQLO Production, ICAR CIRCOT Mumbai HQ**

The delegates from UNIQLO Production (India), then visited the Ginning Training Centre, ICAR-CIRCOT, Nagpur on February 14, 2023.

**UNIQLO delegates visit at GTC, Nagpur**

Dr. Ajit Satapathy, Senior Manager from M/s. Reliance Industries Limited, Navi Mumbai alongwith his team visited on February 17, 2023 to discuss about the project on 'Production of Nanocellulose from Algae produced by Reliance'.

**Reliance Team at ICAR-CIRCOT**

**• NGO Fairtrade visit**

A team from Fairtrade (NGO), Bangalore visited Ginning Training Centre, ICAR-CIRCOT, Nagpur on March 17, 2023.

**• Textile Committee Member Visit**

- Mr. Punit Khimasia, Member, Textile Committee, Maharashtra visited to discuss about incubation and collaboration work with ICAR-CIRCOT, Mumbai on May 12, 2023

**National Days Celebration—National Pride**

**Republic Day**

The 74th Republic Day was celebrated at the institute on January 26, 2023, with the hoisting of the tricolour by the Director. Staff with their families, especially children participated. Sweets were distributed on the occasion.

**Independence Day**

ICAR-CIRCOT, Mumbai celebrated the 77th Independence Day on August 15, 2023 with full enthusiasm and active participation by the staff. The institute was honoured to have the presence of Sh. Chaudhary Udaybhan Singh, Former Minister of State, Govt. of Uttar Pradesh, as the Chief Guest, who hoisted the National Flag and accepted the salute and guard of honour. Thereafter, there was a rendition of patriotic songs by the staff and the National Flag was distributed to the staff and children. The staff members actively participated in the Har Ghar Tiranga campaign from August 13-15, 2023 by uploading of their selfies with the National Flag on http://harghartianga.com/ website of Government of India, and also on social media platforms.

*Har Ghar Tiranga Shapath (Oath)*

On the eve of the 77th Independence Day, the Har Ghar Tiranga Shapath (Oath) was administered to the staff by the Director.

*Har Ghar Tiranga Shapath on August 14, 2023 at CIRCOT Mumbai HQ*

**Remembering National Icons**

Chhatrapati Shivaji Maharaj Jayanti and Dr. Babasaheb Ambedkar Jayanti was celebrated in the Institute on April 17, 2023. Staff members gathered, to remember these great national icons and shared thoughts and information about their lives and their role in shaping our great nation.

**Other Events**

***World Intellectual Property Day***

ICAR-CIRCOT celebrated World Intellectual Property Day with a webinar on the theme Women and IP: Accelerating Innovations and Creativity on April 26, 2023.

***Awareness programme on 'Value addition to Cotton Biomass'***

An awareness programme on 'Value addition to Cotton Biomass', was conducted at Akolanagar, Yavatmal on April 28, 2023, by the Ginning Training Centre (GTC) of ICAR-CIRCOT, at Nagpur, in association with CottonGold Farmer Producer Company Ltd., Ghatanji, Yavatmal district. About 50 farmers participated in the programme. Sh. Amal Kumar Gohane, represented the CottonGold, Yavatmal, while Dr. Pandiyan, Officer in-charge, GTC, Nagpur represented ICAR-CIRCOT. Shri Jitendra Choudhari was from Reliance Foundation, Ghatanji attended. Dr. Pandiyan congratulated the farmers for purchase of farm machineries such as tractor, cotton chipper and rotavator purchased under the FPO scheme and explained in detail about the various avenues for value addition to the cotton biomass with special emphasis on bioconversion of cotton stalks into compost using microbial consortium. Shri Choudhari stressed upon the adoption of new technologies for cultivation and diversification towards sustainable agriculture.

***Parthenium Awareness Week***

On August 22, 2023, the Ginning Training Centre (GTC) of ICAR-CIRCOT (Mumbai), Nagpur organised an Awareness programme on "Parthenium: Problems and Solutions", during the 18th Parthenium Awareness week from August 16 – 22, 2023, at the Mera Gaon Mera Gaurav adopted village at Masepatar, Kalmeshwar Taluka, Dist – Nagpur, graced by Mr. Shankar Khubde, President, Masepatar Panchayat as Chief Guest. The farmers were made aware of Parthenium invasion in the country and the menace it causes to human and animals besides negatively impacting the crop productivity. Then various methods for

management of Parthenium weeds including composting were discussed with the farmers by the GTC scientists and technical staff. Further, various quality parameters of cotton were also discussed and the importance to preserve the quality of fibres after harvesting was stressed upon. The farmers were also sensitized about ill effects of burning of cotton stalks and enlightened about the various value-added products produced from cotton stalks.

*18th Parthenium Awareness Week organised by GTC, CIRCOT*

### *International Womens Day*

The International Women's Day was celebrated in the Institute on March 08, 2023, on the theme, "DigitALL: Innovation and technology for gender equality". The importance of women embracing the digital technology in the day-to-day lives, both professionally and personally was emphasized upon and examples about how the digital knowledge has revolutionised the space for women and helped in gender equality was deliberated upon by the female staff of the institute.


### *Hindi Chetna Maas and Hindi Pakhwada*

The Hindi Chetana Maas was celebrated from September 01-30, 2023 and Hindi Pakhwada was from September 14-30, 2023 at Mumbai Headquarters.

On September 15, 2023, a workshop in Hindi titled "Rajbhasha Neeti Mein Hindi Karyaanvayan" was conducted. Various other activities were also conducted as part of the Hindi Pakhwada. The concluding function was held on Spetember 27, 2023. The Hindi Saptah from September 14-20, 2023, was held at Ginning Training Centre, Nagpur.

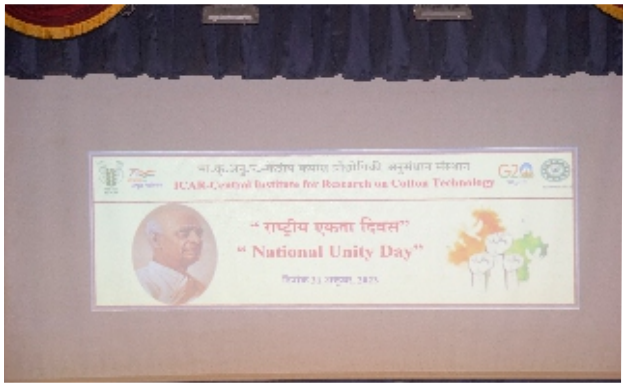
*Hindi Chetna Maas at CIRCOT*

### *Communal Harmony Campaign and Fund Raising Week*

The Communal Harmony Campaign and Fund-Raising Week was observed from November 19-25, 2023 and on the last working day of that week, i.e., on November 24, 2023 the Flag Day was observed at the Institute. The staff were administered the oath by the Director and a fund collection drive was organised to support widows, children and war victims.

### *National Unity Day*

National Unity Day (Rashtriya Ekta Diwas) was observed on October 31, 2023, to commemorate the birth anniversary of Sardar Vallabhbhai Patel, the great freedom fighter, brilliant administrator and the first Home Minister of independent India whose untiring efforts had resulted in the unification of princely states into the country INDIA, as we see today.




Remembering this great icon of National Unity, the pledge for National Unity, was taken by all staff members led by Dr. S. K. Shukla, Director, CIRCOT.

### *Vigilance Awareness Campaign*

The institute conducted Vigilance Awareness Campaign during which an awareness campaign for PIDPI was conducted by displaying about eight posters on the subject at various locations at the Mumbai HQ premises and also at GTC, Nagpur and Quality Evaluation Unit of CIRCOT at Sirsa. These posters were in three languages, viz: English, Marathi & Hindi. Further the PIDPI poster was uploaded on the ICAR-CIRCOT website & Facebook page.

Around 50 staffs were administered integrity pledge in the institute on October 30, 2023.

Also, on November 03, 2023, a special lecture on the Theme "Say no to corruption commit to nation" was organised. Two awareness programme were also organised during campaign.

### *World Soil Day*

On the occasion of World Soil Day on December 05, 2023 Dr. N. Vigneshwaran, Principal Scientist, provided a demonstration to all the staff members on "Use of compost for Soil Health".

### *Sports Meet Participation*

A team of ICAR-CIRCOT staff attended ICAR west zone sports meet during December 16-19, 2023 at ICAR-IGFR, Jhansi. ICAR-CIRCOT bagged 08 Gold and 06 Silver medals.

The winners were later felicitated for their achievement at the Institute.

# 11. Hindi Implementation

## Meeting of Official Language Implementation Committee

A total of 4 meetings of the Official Language Implementation Committee were held under the chairmanship of Dr. S.K. Shukla, Director ICAR CIRCOT during 06.02.2023, 27.04.2023, 27.07.2023 and 26.10.2023.

## Hindi workshops

During the period from 1-1-2023 to 31-12-2023, a total of 4 workshops were organized in the institute, in which the scientists, technical, administrative and skilled support staff of the institute were given training to work efficiently in Hindi. The details of the workshops are given in the table.

| Sr. No. | Date | Subject | Lecturer | Total no. of employees participated |
|---|---|---|---|---|
| 1. | 17.03. 2023 | Problems faced in Hindi work and their solutions | Dr. Mahendra Jain, Professor, Hindi Teaching Scheme | 57 |
| 2. | 14.06.2023 | Importance of official language Hindi in official work | Manoj Kumar Pandey, Assistant Professor, Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur | 68 |
| 3. | 15.09.2023 | Hindi implementation in official language policy | Dr. Rajeshwar Uniyal, former Deputy Director (Official Language). mother. Shi. No., Mumbai | 61 |
| 4. | 28.12.2023 | Annual program goals and their fulfillment. | Dr. Indu Ghotia, Chief M.H.D. women's college | 60 |

## The inspection meeting of the Parliamentary Official Language Committee with ICAR-Central Cotton Technology Research Institute was held on 17 January 2023.

"Second Sub-Committee of the Committee on Official Language of Parliament" held an inspection meeting related to the implementation of Official Language (Hindi) with ICAR-Central Institute for Research on Cotton Technology, Mumbai on 17.01.2023.

On behalf of the Parliamentary Official Language Committee, the meeting was chaired by Professor Rita Bahuguna Joshi, Honorable Member of Parliament (Lok Sabha), Smt. Sangeeta Yadav conducted inspection review related to the implementation of official language (Hindi) in the

institute. In this meeting, Dr. K. Narsaiah, ADG (PE) was present on behalf of the Indian Council of Agricultural Research. Mr. Ram Dayal Sharma, Deputy Director (Official Language) and Shri B. S. Parswal, Asst. Chief Technical Officer (Official Language) participated. Dr. S. K. Shukla, Director, CIRCOT, led the team from ICAR-CIRCOT at the meeting.

## Celebration of Hindi Day/Fortnight and Hindi Chetna Maas 2023

ICAR-Central Institute for Research on Cotton Technology, Mumbai celebrated 'Hindi Pakhwada' during September 14-29, 2023 and 'Hindi Chetana Mass' during September 1-30, 2023. Different competitions like essay, noting, quiz, poster presentation, typing, translation of scientific terminologies and noting & drafting (for staff members from states under Region C) on different themes were organized in which all the scientific, administrative, supporting staff and students of the Institute actively participated. Speaking on the closing day event, Dr. S. K. Shukla, Director mentioned that Hindi as a language unites the people across the country and helps the staff to work with deep involvement. The Chief Guest of this event, Dr. Arvinda Sharma Rahi, Member of Maharashtra Sahitya Hindi Academy, congratulated the excellent work being done by the Institute in use of Hindi for routine official work. He also sensitized the participants about the requirement to use mother tongue for the benefit and improvement of the entire society. Special competition on noting & drafting in hindi was arranged for staff members from the states covered under 'Region C'. The winners of the competitions were awarded cash prizes and certificates during this event.

GTC, Nagpur: Hindi Week celebrations were organized at the Institute's Ginning Training Center, Nagpur from 14-20 September, 2023 in which a total of 5 competitions were organized and all the employees of the center participated enthusiastically.

## Publications

Published the institute's annual report 2022 (Hindi) and in-house magazine 'Amber'.



## Meetings of the Town Official Language Implementation Committee

Dr. S.K. Shukla, Director of the Institute participated in the half yearly meetings of the City Official Language Implementation Committee, Mumbai held on 30.05.2023 and 18.10.2023.

# 12. Distinguished Visitors

## Visit By Secretary (DARE) DG, ICAR

Dr. Himanshu Pathak, Secretary (DARE) & Director General (ICAR) along with Dr. C. N. Ravishankar, Director, ICAR-CIFE visited ICAR – CIRCOT on March 20, 2023.

He inaugurated the Advanced Biomass Characterization Laboratory, Nanoparticle Characterization Laboratory and Cotton Fibre Processing Facility

He also visited the existing infrastructural facilities of the Institute. Later during an interaction meeting with the scientists and technical staff of the Institute, Dr. Pathak appreciated the performance of the Institute in terms of sophisticated facility creation, technology development & licensing, revenue generation and incubation & start-up funding activities.

## Visit of DDG (Agril. Engg.), ICAR

Dr. S. N. Jha, DDG (Agril. Eng.) visited the institute on June 07, 2023. During his visit he presided over an "Industry Interface Meeting" arranged by the institute at its Mumbai HQs premises and also inaugurated the Type IV residential quarters CIRCOT at Mahim, Mumbai.

## Visit of ADG (FE), ICAR, New Delhi

Dr. K. P. Singh, ADG (FE), visited the institute on November 17, 2023

*Dr. K. P. Singh visited Mumbai HQ*

## Visits by Government officials

Smt. K. Anitha, Principal Secretary to Govt. of Andhra Pradesh accompanied by Smt. S. Tanuja Rani, General Manager, APCO and Sh. Jayesh Mahajan, Nodal Officer, SMART Cotton Project, visited Ginning Training Centre of ICAR-CIRCOT, Nagpur on 18 January 2023 and discussed on ways to address low cotton production in the Andhra Pradesh and high level of contaminants in the seed cotton.

*Smt. K. Anitha and team at GTC, Nagpur.*

Dr. R. Selvarajan, Director, ICAR-NRC for Banana, Tamil Nadu visited ICAR-CIRCOT on 10 February 2023 to discuss about the Utilisation of Banana fibre and banana wastes for products making.

*Dr. R. Selvarajan, Director, ICAR-NRC for Banana, Tiruchirapalli, Tamilnadu*

Dr. K Sammi Reddy, Director, ICAR-National Institute for Abiotic Stress Management (NIASM), Baramati alongwith Dr. N. G. Patil, Director, ICAR-NBSS & LUP, Nagpur, visited the Ginning Training Centre (GTC) of ICAR-CIRCOT at Nagpur on July 07, 2023.

*Visit of Dr. K Sammi Reddy & Dr. N.G. Patil*

### Visit of Former MLA, Shri Pasha Patel to ICAR-CIRCOT

Shri Pasha Patel, Former MLA visited CIRCOT Mumbai HQ on October 12, 2023 and had an interaction with the Director, Dr. S. K. Shukla

*Former MLA Shri Pasha Patel at ICAR-CIRCOT*

# 13. Swachh Bharat Abhiyan

The institute implemented two major activities as directed by the Council/Ministry under the Swachha Bharat Abhiyan, viz, Swachhata Hi Seva (SHS) Campaign held during September 15 to October 02, 2023 and the Swachhta Pakhwada activities during December 16-31, 2023. Besides these, other Swachhata programmes were conducted during which old physical files were identified, digitised, weeded out and space was freed.

The institute also conducted cleanliness drive activities on regular basis including cleaning of offices and surrounding premises, cleanliness and sanitation drive in the village adopted under the Mera Gaon Mera Gaurav Programme, Composting of kitchen and home waste materials, promoting clean & green technologies, Cleaning of public places, nearby gardens and religious places, conducting quiz competitions, walkathons, felicitation of 'Safai Mitra' and expressed gratitude to them, awareness programmes for students etc. A seminar was also organised on the theme, 'Conversion of Waste to Wealth' with an informative lecture on 'Composting Techniques'.

| Sr. No. | Activity on Date | Activity Undertaken at | Participants |
|---|---|---|---|
| 1. | In March 2023, as a part of cleanliness drive, 100 physical files were reviewed and weeded out.<br>Scrap weighing 14,620 Kg was disposed to earn Revenue of Rs. 7.76 lakh.<br>Around 4000 sq. ft space was freed. | ICAR-CIRCOT, Mumbai | All staff |
| 2. | Around 3.5 tonne scrap was disposed during a cleanliness drive on May 18, 2023. | ICAR-CIRCOT, Mumbai | All staff |
| 3. | In June 2023, Swachh Bharat campaign was conducted, during which scrap of worth Rs. 60,000/- was sold and around 450 sq. ft. space was made free. | ICAR-CIRCOT, Mumbai | All staff |
| 4. | A Cleanliness drive was conducted in the ICAR-CIRCOT Premises at Mumbai on August 14, 2023 | ICAR-CIRCOT, Mumbai | All staff |
| 5. | **Swachhata Hi Seva (SHS)Campaign:**<br>Cleanliness drive under SHS was conducted at ICAR-CIRCOT Mumbai Headquarters from September 17 till October 02, 2023.<br>Various activities conducted during the campaign are listed in columns below, | ICAR-CIRCOT, Mumbai & Regional QEU units of CIRCOT | All staff |

| Sr. No. | Activity on Date | Activity Undertaken at | Participants |
|---|---|---|---|
| 6. | Cleanliness drive conducted at CIRCOT, Mumbai premises on September 17, 2023. | ICAR-CIRCOT, Mumbai | All staff |
| 7. | Cleanliness drive conducted in the Chemical and Biochemical Processing Division (CBPD) on September 18, 2023. All the waste and e-waste material were segregated and stored for proper disposal. | CBPD, ICAR- CIRCOT, Mumbai | All staff of CBPD |
| 8. | A cleaning drive was organized at the Nanocellulose Pilot Plant located at ICAR-CIRCOT premises on September 19, 2023. A thorough cleaning of the machineries and the pilot plant premises was done. | Nanocellulose Pilot Plant located at ICAR-CIRCOT | Staff & Incharge of Nanocellulose Pilot Plant |
| 9. | A cleaning drive was conducted in the Quality Evaluation and Improvement Division (QEID) on September 20, 2023 | QEID, ICAR-CIRCOT, Mumbai | Staff of QEID |
| 10. | SHS was conducted in the Mechanical Processing Division (MPD) and the Institute Guest house premises on September 21, 2023. | Mechanical Processing Division (MPD) and the Institute Guest house, ICAR-CIRCOT | Staff of MPD & Housekeeping staff |
| 11. | SHS drive was conducted in the regional Unit of CIRCOT at Surat on September 22, 2023 | QEU, Surat, ICAR-CIRCOT | All staff |
| 12. | Cleaning drive was conducted at ICAR-CIRCOT Mumbai Store room and guest house on September 24, 2023. | ICAR-CIRCOT, Mumbai | All Admin (Stores section) staff & Housekeeping staff |
| 13. | Awareness about cleanliness conducted by arranging a Quiz competition for. by CIRCOT Regional Unit, Sirsa on 25 September, 2023. | QEU, CIRCOT Regional Unit, Sirsa | Farmers, labourers, students etc |
| 14. | Swachhata Pledge was administered to the staff at Mumbai on September 26, 2023. | ICAR-CIRCOT, Mumbai | All staff |

| Sr. No. | Activity on Date | Activity Undertaken at | Participants |
|---|---|---|---|
| 15. | Cleanliness drive was arranged by ICAR-CIRCOT, Mumbai staff to clean up plastic waste on September 27, 2023. | Five Gardens and surroundings roads at Matunga East, Mumbai | All staff |
| 16. | Walkathon for spreading awareness about cleanliness was conducted on September 28, 2023. | Areas around ICAR-CIRCOT Mumbai premises | 50 |
| 17. | SHS cleanliness drive conducted at ICAR-CIRCOT Regional Unit, Guntur on September 28, 2023. | ICAR-CIRCOT Regional Unit, Guntur | Staff of QEU, Guntur |
| 18. | Demonstration activity on composting of kitchen and home waste materials titled, 'Waste to Wealth' was carried out on September 29, 2023. | ICAR-CIRCOT, Mumbai premises | 30 |
| 19. | Cleaning drive in religious places around Dadar Chowpatty was conducted by ICAR-CIRCOT, Mumbai with the help of school children on September 30, 2023, to spread awareness among students. | Religious places around Dadar Chowpatty area, Mumbai | 100 students |
| 20. | A Swachhata Hi Seva slogan competition was organized at ICAR-CIRCOT for the youth from villages studying in Mumbai colleges on October 01, 2023, as part of awareness programme under the SHS campaign. | ICAR-CIRCOT, Mumbai premises | 10 students |
| 21. | On October 02, 2023, Gandhi Jayanti Day, a 'Thank You Safai Mitra' campaign to felicitate sanitation workers was organized. The workers involved in cleaning were felicitated and gratitude towards their noble work was expressed.<br>Later cotton clothes were distributed to them during the felicitation. | Ginning Training Centre, ICAR-CIRCOT Nagpur | Safai Mitra's & GTC staff |

| Sr. No. | Activity on Date | Activity Undertaken at | Participants |
|---|---|---|---|
| 22. | Seminar on conversion of Waste to Wealth was organised on December 22, 2023, lecture on Composting delivered by Dr. V. Mageshwaran, Senior Scientist, ICAR-NBAIM (National Bureau of Agriculturally Important Microorganisms), Mau, Uttarpradesh | ICAR, CIRCOT, Mumbai | All staff |
| 23. | Under the special Swachhata Campaign 3.0, Pendency Identification and Achievement Status Report have been send to the SMD on October 03, 09, 16 and 23, 2023. | ICAR, CIRCOT, Mumbai | All staff |
| 24. | Cleaning drive under Swachhata Hi Seva, at CIRCOT Quality Evaluation Unit, Guntur on October 28, 2023. | QEU, Guntur, ICAR-CIRCOT | Staff at Guntur |
| 25. | **Swachhta Pakhwada** was celebrated during December 16-31, 2023. All the staff of ICAR-CIRCOT and its regional units are participating in cleanliness drives. | ICAR-CIRCOT, Mumbai & it's Regional Units | All staff of ICAR-CIRCOT and regional units. |

Slogan competition for students

Cleanliness drive at Mahim staff quarters premises



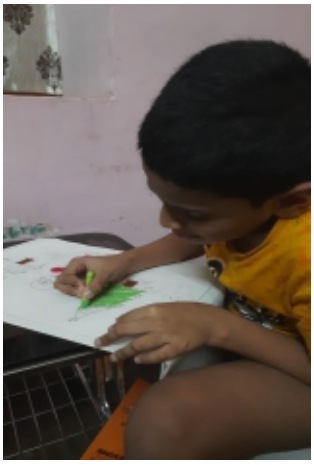


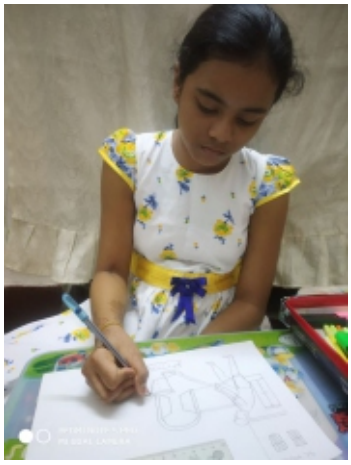
**Awareness about cleanliness campaign in ICAR-CIRCOT Mahim Staff Quarters premises**




**Glimpses of Swachhata Abhiyan Activities-2023**

## Drawing competition for children about Swachhata campaign



# 14. Mera Gaon Mera Gaurav (MGMG) & Awareness Programmes

In 2022, ICAR-CIRCOT had adopted 12 villages of Nagpur District, having cotton growing farmers under the MGMG programme, namely Mohapa, Masepathar, Gholi, Ghorad, Ubali, Mandavi, Khumari, Savangi (Mohagaon), Wathoda, Savandri, Kondhali and Pipla (Kinkhede). In 2023 also, various activities such as awareness programmes, interface meetings etc. were organised for the benefit of farmers under the programme.

## Activities organised under MGMG:

| S. No. | Name of activity | 2023-24 | |
|---|---|---|---|
| | | No. of activities conducted/ provided | No. of farmers participated & benefitted |
| 1. | Visit to village by all teams | 05 | 110 |
| 2. | Interface meeting/ *Goshthies* | 01 | 125 |
| 3. | Awareness programmes | 03 | 110 |
| | **Total** | **09** | **345** |

## Awareness programmes under MGMG and others conducted during the year:

| Date | Awareness Programme | Place | No. of Participants |
|---|---|---|---|
| 09.01.2023 | Demonstrations on hand held cotton picker for the delegates from M/s. CNHi Tractors Ltd, Gurgaon | CICR farm, Nagpur | 10 |
| 12.01.2023 | Demonstration cum awareness programme and field trials of hand-held mechanical cotton picker and hand picking | At Village Adhasa, Tal-Kalmeshwar Dist. - Nagpur | 50 |
| 15.02.2023 | Field day cum sensitization program for cotton farmers and other stakeholders on "Utilization of green cotton biomass as silage" | GTC, Nagpur | 25 |
| 17.02.2023 | Technology demonstration and sensitization of stakeholders on Double roller gin setting and ginning" | GTC, Nagpur | 30 |
| 20.03.2023 | Program under MGMG to create awareness among the farmers on "Importance of timely harvesting and safe storage of cotton to maintain the quality, to avoid the losses and damage to crop due to unseasonal rain and storm | GTC, Nagpur | 20 |

| Date | Awareness Programme | Place | No. of Participants |
|---|---|---|---|
| 28.04.2023 | Awareness programme on "Value addition to Cotton Biomass" | GTC, Nagpur | 50 |
| 16.05.2023 | Demonstration cum awareness program on "Gin setting, importance of perfect grooving and tips for quality lint production" for the fitters/technicians | GTC, Nagpur | 20 |
| 22.08.2023 | "Parthenium: Problems and Solutions" during the Parthenium Awareness Week under MGMG | At Masepatar Village (MGMG adopted village) | 20 |
| 09.09.2023 | Training cum awareness program for farmers on "Cotton Fibre, Clean Picking and Crop Residue Management" | At village Telkamthi, Taluka Kalmeshwar, Dist. Nagpur | 30 |
| 27.09.2023 | Awareness programme for farmers from ATMA, Seoni, Madhya Pradesh about post-harvest processing of cotton and value addition to it biomass and by-products | GTC, Nagpur | 30 |
| 27-29.10.23 | Demonstrations on clean cotton picking to prevent contamination and improve fibre quality | QEU, Sirsa | 12 |
| 07.11.2023 | Awareness programme on "Best Management Practices to Prevent Cotton Contamination and Preserve Fibre Quality" | At M/s. Mahalaxmi Ginning Industry, Kalmeshwar, Dist-Nagpur | 40 |
| 08.11.2023 | Awareness programme on "Best Management Practices to "Cotton Fibre Quality, Clean Cotton Picking and Crop Residue Management" | At Village-Telkamthee, Tal-Saoner, Dist-Nagpur | 70 |
| 09.11.2023 | Awareness programme on "Cotton Fibre Quality, Clean Cotton Picking and Crop Residue Management" | At Village-Bhadangi, Tal-Saoner, Dist-Nagpur | 100 |
| 23.11.2023 | An awareness cum demonstration program on cotton quality and value addition to cotton by-produce under MGMG | At Village Ubali and Pipla, Tal Kalmeshwar, Nagpur | 35 |
| 18.12.2023 | Awareness to encourage practices for clean cotton picking and quality-based marketing of cotton to the farmers. | At Khumari Village, Nagpur | 40 |

| Date | Awareness Programme | Place | No. of Participants |
|---|---|---|---|
| 23.12.2023 | National Farmers' Day in association with Confederation of Indian Textile Industry-Cotton Development Research Association (CITI-CDRA), Mumbai under MGMG | GTC, Nagpur | 50 |

**Farmers' & FPO visit**

- SMART Cotton Initiative

  State Agricultural Officers (AOs) of Govt. of Maharashtra undergoing training at Vasantrao Naik State Agriculture Extension Management Training Institute, Nagpur and Agricultural Assistants of Govt. of Maharashtra undergoing training at Regional Agricultural Management and Extension Institute, Nagpur under the "SMART COTTON" programme visited Ginning Training Centre (GTC), Nagpur on 01 February 2023. They were enlightened about the importance of clean cotton picking and appropriate practices for handling, transportation and storage of harvested cotton to improve the fibre quality.


*Training of State Agricultural Officers, Govt. of Maharashtra at GTC, Nagpur*

- Lead farmers and FPOs from Andhra Pradesh visited GTC, Nagpur during January 19, 2023 and witnessed the fibre testing facility, demonstration plant such as Ginning, Particle Board and Oil mill.


*Visit of farmers from Andhra Pradesh*

- 16 farmers (cotton growers) from Avinashi Block, under the training programme "Integrated Crop Management (ICM) in cotton, organised by ICAR-CICR, Coimbatore; visited ICAR-CIRCOT Regional Unit at Coimbatore on 07 February 2023. They were briefed about clean cotton picking and importance in achieving trash free cotton from fields.

- A group of 26 farmers from Institute of Horticultural Technology, Gujarat visited Ginning Training Centre (GTC) of ICAR-CIRCOT, Nagpur on February 20, 2023.. Another group of 23 farmers from the same place visited GTC, Nagpur on March 14, 2023. They all were demonstrated the facilities available in the GTC


***Visit of Farmers from Institute of Horticulture, Gujarat***

A group of 16 farmers from Office Project Director, ATMA, Narsinghpur, Madhya Pradesh visited Ginning Training Centre, ICAR-CIRCOT, Nagpur on February 21, 2023.


***Visit of farmers from Madhya Pradesh to GTC, Nagpur***


Parthenium Awareness Programme at Masepatar village

National Farmers' Day celebration


Awareness programme at Village Ubali & Pipla under MGMG


Awareness programme at Village Khumari

# 15. Infrastructural Facilities

ICAR-CIRCOT is recognised as *Referral Laboratory* for cotton fibres and is an NABL accredited Laboratory for Mechanical and Chemical test. The Institute is equipped with state-of-the-art facilities for conducting research in post-harvest processing of cotton & allied fibres and value addition to crop residues and also provide commercial services to the stakeholders.

**New Facilities created in the institute during the current year:**

***Tearing Strength Tester:***

The instrument works as per the Indian Standard Method for determination of tear strength of woven fabrics by Elmendorf Tester IS: 6489. In this method the fabric specimen is subjected to ballistic tearing force.

**Tumble Pilling Tester**

Pilling is formation of small balls of entangled fibres adhering to the surface during the wear and washing of the fabrics under the influence of the rubbing action. The Tumble pilling tester simulates wear conditions & helps to assess its effect on fabric.

The instrument satisfies Indian standard 10971-1: Textiles- Determination of Fabric Propensity to Surface Fuzzing and to Pilling, Part 1: PILLING BOX METHOD.


**Upgradation of AV System & Audio System of Committee room**

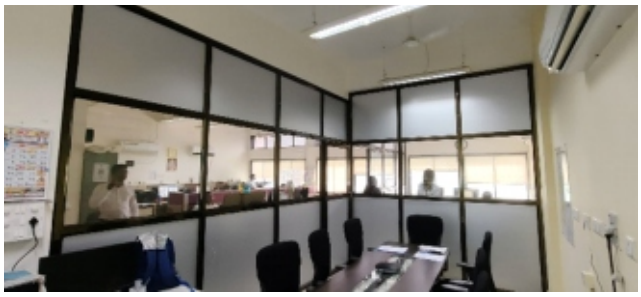
ICAR-CIRCOT Mumbai has two meeting halls i.e. Dr. V Sundaram Committee Room and Dr. SN Pandey Conference Hall, with the sitting capacity of around 25 and 40 people respectively. The audio and video facility in both the halls have been upgraded to smoothly conduct various online/offline meetings, lectures, trainings, etc.

## Advanced Biomass Characterization Laboratory

***Inductively coupled Plasma Mass Spectrometry (ICP-MS)*** is an advanced analytical technique used for detecting & quantifying trace elements and isotopes in various samples such as water, textiles, biological etc. It offers high sensitivity, precision, and the ability to analyze multiple elements simultaneously, making it valuable in environmental, biological and industrial applications. ICP-MS is particularly beneficial for monitoring heavy metals and other contaminants, ensuring compliance with safety and regulatory standards

## Mini Conference facility at Incubation centre

The conference room facility was developed to interact with stakeholders through online workshops and organize networking sessions.



## Fully Automatic High Volume Cotton Testing g Equipment (HVI Machine)

Fibre testing laboratory of Ginning Training Centre, ICAR-CIRCOT, Nagpur renders services for commercial testing of fibres to various stakeholders including Cotton Corporation of India (CCI), Maharashtra State Co-cooperative Cotton Growers and Marketing Federation (MSCCGMF) Ltd., and other private firms. During the year 2023, a fully automatic high volume cotton testing equipment "MAG HVT Genius 2" was commissioned at Fibre testing laboratory of GTC.

## Establishment of Microbiology Laboratory at GTC, Nagpur

Value-addition to the cotton by-produce is vital in order to have sustainable agriculture. ICAR-CIRCOT has pioneered in development of various value-added products from cotton stalks. In order to conduct research experiments and testing of biomass and other samples, a microbiology lab was established at Ginning Training Centre, ICAR-CIRCOT, Nagpur.

## Cotton fibre Processing facility

Facility created for scouring and bleaching of cotton to produce value-added products, was inaugurated by Dr. Himanshu Pathak at ICAR-CIRCOT.

## Cotton Stalk Chippers

Vidarbha region, having approximately 17 million hectares of land, contributes significantly in India's total cotton production. Large fraction of cotton stalks generated after cotton picking are being burnt Cotton stalk chipping machines (3 Nos.) were procured to create awareness among the cotton farmers and demonstrate them the benefits of adding value to the cotton stalk.

*Annexure 1*

# LIST OF ONGOING RESEARCH PROJECTS

| Pr. Code | Title | Investigators | Duration |
|---|---|---|---|
| **Core Area I: Pre-ginning And Ginning** | | | |
| MP 98 | Development of a seed cotton trash content analyser based on pneumatic fractionation methodology | Dr. S.K. Shukla (PI)<br>Dr. S.V. Ghadge<br>Dr. V.G. Arude | 2021-23 |
| MP 93 | Device for Seed cotton ginning percentage measurement | Dr. P.S. Deshmukh (PI)<br>Dr. V.G. Arude<br>Dr. Manoj Kumar Mahawar | 2020-23 |
| MP 100 | Optimization trial of the ICAR-CIRCOT Kawadi opener at factory level | Dr. S.V. Ghadge (PI)<br>Dr. S.K. Shukla<br>Dr. Varsha Satankar | 2022-23 |
| MP 101 | Evaluation, Optimization and Standardization of different types of lint cleaners used in Ginneries | Dr. Varsha Satankar (PI)<br>Dr. S.K. Shukla<br>Dr. S.V. Ghadge<br>Dr. K. Pandian<br>Er. D.U. Patil | 2022-24 |
| MP 104 | Development of Standard Protocol for determination of ginning percentage of seed cotton | Dr. Sharmila Patil (PI)<br>Dr. V.G. Arude<br>Dr. Kirti Jalgaonkar<br>Dr. Varsha Satankar | 2020-25 |
| MP 105 | Assessment of processing losses in Indian Cotton Ginning Industries | Dr. Manoj Kumar Mahawar (PI)<br>Dr. V.G. Arude<br>Dr. Sheshrao Kautkar<br>Dr. C. Sundaramoorthy<br>Dr. Jyoti Dhakane-Lad | 2023-25 |
| 1014419 (CRP-CIRCOT-10) | Design & Development of High-Capacity Double Roller Gin to Enhance Ginning Efficiency | Dr. V.G. Arude (PI)<br>Dr. S.K. Shukla<br>Dr. Kirti Jalgaonkar<br>Dr. Varsha Satankar | 2023-26 |
| 1014417 (CRP-CIRCOT-11) | Development & Evaluation of Pre-grooved Chrome Leather Roller and Automatic Deep-cut-grooving Machine for Double Roller Gin | Dr. Sheshrao Kautkar (PI)<br>Dr. S.K. Shukla<br>Dr. V.G. Arude<br>Er. D.U. Patil | 2023-25 |
| II.07 | Assessment of field performance and effectiveness of hand-held mechanical cotton picker [ICAR-CICR, Nagpur; ICAR-CIAE, Bhopal] | Dr. V.G. Arude (PI)<br>Dr. S.K. Shukla<br>Dr. P.S. Deshmukh<br>Dr. Varsha Satankar | 2022-24 |

| Pr. Code | Title | Investigators | Duration |
|---|---|---|---|
| **Core Area II: Mechanical Processing, Technical Textiles and Composites** | | | |
| MP 95 | Evaluation of Spinnability and Formulation of Guidelines for Spinning of Recycled fibre from fabric waste and Develop Value Added Products | Dr. T. Senthilkumar (PI)<br>Dr. G. Krishna Prasad<br>Dr. V.G. Arude<br>Dr. A.S.M. Raja | 2020-23 |
| MP 97 | Development of filter fabric for indoor decontamination | Dr. Kirti Jalgaonkar (PI)<br>Dr. P. Jagajanantha | 2020-23 |
| MP 99 | Development of cut-resistant fabric using 3D weaving | Dr. Krishna Prasad (PI)<br>Dr. T. Senthilkumar<br>Dr. A.S.M. Raja | 2021-24 |
| MP 102 | Evaluation of Electrospun nanofiber-based multi nutrient fertilizer sachet for high- value crops | Dr. G.T.V. Prabu (PI)<br>Dr. N. Shanmugam<br>Dr. Kanika Sharma<br>Dr. Sujata Saxena<br>Dr. Manoj Kumar Mahawar | 2023-26 |
| II 04 | Development of eco-friendly fruit protection bags for quality enhancement<br>[ICAR-NRC for Grapes, Pune] | Dr. Jyoti Dhakane Lad (PI)<br>Dr. Manoj Kumar Mahawar<br>Dr. Dr. P. Jagajanantha<br>Dr. Kirti Jalgaonkar<br>Dr. A.K. Bharimalla | 2021-24 |
| II 05 | Development of bio nano composite films using extrusion process<br>[CIPET: SARP-LARPM, Bhubaneswar] | Dr. Sharmila Patil (PI)<br>Dr. A.K. Bharimalla<br>Dr. Kirti Jalgaonkar<br>Dr. Manoj Kumar Mahawar<br>Dr. Jyoti Dhakane-Lad<br>Dr. A.S.M. Raja<br>Dr. Sujata Saxena | 2021-23 |
| 1013337 (CRP NINFET 07) | Development of Building Materials using Natural fibres and other fibrous crop residues (CIRCOT Centre) | Dr. Krishna Prasad (PI)<br>Dr. T. Senthilkumar<br>Dr. Kirti Jalgaonkar<br>Dr. Ajinath Dukare | 2021-24 |
| 1014416 (CRP-CIRCOT 12) | Optimization of spinning process parameters for Cotton/Hemp blends and develop value added products | Dr. T. Senthilkumar (PI)<br>Dr. N. Shanmugam<br>Dr. A.S.M. Raja | 2023-25 |
| NASF | Development of smart foods, bio-composites, green packaging and bio-energy from agro biomass | Dr. A. Arputhraj (PI)<br>Dr. A.S.M. Raja<br>Dr. N. Vigneshwaran<br>Dr. T. Senthilkumar<br>Dr. Sharmila Patil | 2023-27 |

| Pr. Code | Title | Investigators | Duration |
|---|---|---|---|
| **Core Area III: Characterisation of Cotton and other Natural Fibres, Yarns and Textiles** | | | |
| A 1 | All India Coordinated Research Project on Cotton (Quality Research) | Dr. A.S.M. Raja (PI)<br>Dr. A. Arputhraj<br>Dr. P. Jagajanantha<br>Dr. G.T. V. Prabu | 2021-25 |
| QE 111 | Development of Electrically Conductive Yarn | Dr. P. Jagajanantha (PI)<br>Dr. G.T. V. Prabu<br>Dr. Kirti Jalgaonkar<br>Dr. Sharmila Patil | 2021-23 |
| QE 113 | Development of AI based prediction model for yarn quality characteristics | Dr. N. Shanmugam (PI)<br>Dr. D.M. Kadam<br>Dr. P. Jagajanantha<br>Dr. G.T. V. Prabu<br>Mr. Himanshu Chaurasia | 2022-25 |
| QE 114 | Development of viscose-based marker fibre for the traceability of cotton | Dr. A. Arputhraj (PI)<br>Dr. A.S.M Raja<br>Dr. N. Vigneshwaran<br>Dr. G.T. V. Prabu | 2023-25 |
| QE 115 | Development of Portable instrument to measure the colour grade of cotton | Dr. P. Jagajanantha (PI)<br>Dr. A.S.M. Raja<br>Dr. Kirti Jalgaonkar<br>Dr. Jyoti Dhakane-Lad | 2023-25 |
| **Core Area IV: Chemical & Biochemical Processing and Biomass & By-product Utilisation** | | | |
| CH 98 | Toxicological and Environmental impact of ICAR-CIRCOT's Nanomaterials (Nanocellulose, Nano Silver, Nano ZnO and Nano Sulphur) | Dr. N. Vigneshwaran (PI)<br>Dr. A.K. Bharimalla<br>Dr. A.S.M. Raja<br>Dr. A. Arputhraj<br>Dr. Kanika Sharma | 2020-23 |
| CH 99 | Development of a healthier cottonseed-based cooking oil by blending with other vegetable oils | Dr. Sujata Saxena (PI)<br>Dr. Manoj Kumar<br>Dr. Kanika Sharma | 2020-23 |
| CH 101 | Development of microbial xylanase enzyme-based process for eco-friendly bleaching of paper pulp | Dr. Ajinath Dukare (PI)<br>Dr. Kanika Sharma<br>Dr. N. Vigneshwaran<br>Dr. Sujata Saxena | 2021-23 |
| CH 102 | Isolation of Gossypol from cottonseed and its evaluation as a botanical fungicide | Dr. Kanika Sharma (PI)<br>Dr. Manoj Kumar<br>Dr. N. Vigneshwaran<br>Dr. Ajinath Dukare<br>Dr. Sujata Saxena | 2022-24 |

| Pr. Code | Title | Investigators | Duration |
|---|---|---|---|
| CH 104 | Effects of process parameters on cottonseed oil extraction | Dr. Jyoti Dhakane (PI)<br>Dr. Kirti Jalgaonkar<br>Dr. Kanika Sharma<br>Dr. Sujata Saxena<br>Dr. Sujata Kawlekar | 2023-25 |
| CH 105 | Evaluation of cotton based lignocellulosic biomass for production of furfural for production of furfural | Dr. Manoj Puniya (PI)<br>Dr. Kanika Sharma<br>Dr. Sujata Saxena<br>Dr. Ajinath Dukare<br>Dr. Charlene D' Souza | 2023-24 |
| CH 106 | Development of Microbial enzyme-mediated delinting process from cottonseeds | Dr. K. Pandiyan (PI)<br>Dr. Varsha Satankar<br>Dr. Ajinath Dukare<br>Dr. Sheshrao Kautkar | 2023-25 |
| II 02 | Efficacy evaluation of ICAR-CIRCOT Nano-ZnO as nano fertilizer in field crops<br>[IIPR, Kanpur, ICAR-CICR, Nagpur & IIHR, Bengaluru] | Dr. N. Vigneshwaran (PI)<br>Dr. A.K. Bharimalla<br>Dr. A. Arputhraj | 2021-24 |
| II 06 | Efficacy evaluation of ICAR-CIRCOT Nano-Sulphur as fertilizer formulation for different field crops<br>[ICAR-NRC for Grapes, Pune, ICAR-IISS, Bhopal, MPKV, Rahuri] | Dr. A.K. Bharimalla (PI)<br>Dr. Manoj Mahawar<br>Dr. N. Vigneshwaran<br>Dr. A. Arputhraj<br>Dr. Jyoti Dhakane-Lad<br>Dr. A.S.M. Raja<br>Dr. Sujata Saxena | 2021-24 |
| 1013338 (CRP-TNAU-02) | Bioprocessing of natural fibres and agro residues for production of oligo-saccharides and lignin-derived aromatics | Dr. A.S.M. Raja (CCPI) | 2022-26 |
| 1013645 | Characterization and utilization of paddy straw and other agro residues for conversion into pellets for co-firing in thermal power plants (TPP) (National Biomass Mission of Ministry of Power) | Dr. Sujata Saxena (PI)<br>Dr. S.K. Shukla<br>Dr. A.S.M. Raja<br>Dr. A. Arputhraj<br>Dr. T. Senthilkumar<br>Dr. K. Pandiyan<br>Dr. Varsha Satankar | 2021-25 |
| 1012858 | Design and Development of Pilot Plant for Extraction of Protein from De-oiled Cotton cake and Value Addition / By-Product Utilization | Dr. D.M. Kadam (PI)<br>Dr. V.G. Arude<br>Dr. Manoj Kumar | 2021-23 |

| Pr. Code | Title | Investigators | Duration |
|---|---|---|---|
| **Core Area V: Entrepreneurship and Human Resource Development** | | | |
| TT 12 | Impact Assessment of ICAR-CIRCOT technologies | Dr. C. Sundaramoorthy (PI)<br>Dr. A.K. Bharimalla<br>Mr. Himanshu Chaurasia | 2020-25 |
| TT 13 | Study on Utilization of Green Cotton Biomass for Production of Silage as Livestock Feed | Dr. S.S. Kautkar (PI)<br>Dr. Ajinath Dukare<br>Dr. A.K. Bharimalla<br>Dr. Varsha Satankar<br>Dr. K. Pandiyan | 2022-24 |
| TT 14 | Development of project profile, data bank and entrepreneurship in cotton processing | Dr. D.M. Kadam (PI)<br>Dr. N. Shanmugam<br>Dr. P. S. Deshmukh<br>Dr. C. Sundaramoorthy<br>Dr. A.S.M Raja<br>Dr. G.T.V Prabu | 2023-24 |
| 1007815 (NAIF) | Agri-Business Incubation Centre at ICAR-CIRCOT, Mumbai | Dr. A. K. Bharimalla (PI)<br>Dr. N. Vigneshwaran<br>Dr. C. Sundaramoorthy<br>Dr. K. Pandiyan<br>Dr. Sharmila Patil<br>Dr. Krishna Prasad<br>Dr. Jyoti Dhakane-Lad<br>Mr. Bharat R. Pawar<br>Mrs. Prachi R. Mhatre | 2019-26 |
| 1011105 (DA&FW | Remunerative Approaches for Agriculture and Allied Sectors Rejuvenation (RAFTAAR) Agri Business Incubator (R-ABI) | Dr. A. K. Bharimalla (PI)<br>Dr. P.S. Deshmukh<br>Dr. C. Sundaramoorthy<br>Dr. Sharmila Patil<br>Dr. S.S. Kautkar<br>Dr. Jyoti Dhakane-Lad<br>Mrs. Prachi Mhatre | 2019-23 |
| 1014502 (CCI) | CCI-CICR Pilot Project on 'Awareness and Extension Services on Best Farm Practices for Cotton Farmers to Improve Quality, Yield and Sustainability' | Dr. V.G. Arude<br>Dr. K. Pandiyan<br>Dr. Varsha satankar<br>Dr. Hamid Hasan<br>Mr. K. Thiagarajan | 2023-24 |

*Annexure II*

# PERSONNEL

(As on December 31, 2023)

## DIRECTOR

**Dr. S. K. Shukla**

M. Tech., Ph.D. (Agricultural Process Engineering)

## SCIENTIFIC STAFF HQ, MUMBAI

### HEAD OF DIVISION

1. Dr. (Smt.) Sujata Saxena, M.Sc., Ph.D. (Organic Chemistry) Chemical and Biochemical Processing Division (CBPD)
2. Dr. Dattatreya M. Kadam, M. Tech, Ph.D (Agricultural Process Engineering) Engineering Technology Transfer Division (ETTD)
3. Dr. N. Shanmugam, M. Tech., MIE, D.TT., Ph.D. (Textile Manufacture & Technology) Mechanical Processing Division (MPD)
4. Dr. A. S. M. Raja, M. Sc., Ph.D. (Textile Chemistry) Quality Evaluation and Improvement Division (QEID)

### PRINCIPAL SCIENTIST

1. Dr. P. G. Patil, M. Tech. (P.H.E.), Ph.D. (Engg.), F.T.A., FISAE., FIE (on deputation as VC, MPKV, Rahuri)
2. Dr. N. Vigneshwaran, M.Sc.(Agri.) M.B.A., Ph.D. (Agricultural Microbiology)
3. Dr. P. S. Deshmukh, M. Tech., Ph.D., LL.B., FIE. (Farm Machinery & Power)
4. Dr. C. Sundaramoorthy, M.Sc., Ph.D. (Agricultural Economics)
5. Dr. A. K. Bharimalla, M. Tech., Ph.D. (Composite)
6. Dr. V. G. Arude, M. Tech. Ph.D. (Farm Machinery & Power)

### SENIOR SCIENTIST

1. Dr. Jyoti M. Nath, M.Sc., Ph.D. (Electronics & Instrumentation) (Scientist Resigned)
2. Dr. A. Arputharaj, M.Sc., M. Tech., Ph.D. (Textile Chemistry)
3. Dr. T. Senthilkumar, M. Tech., Ph.D. (Textile Manufacture)
4. Dr. G.T.V. Prabu, M.Tech.,M.B.A., Ph.D (Textile Manufacture)
5. Dr. G. Krishna Prasad, M. Tech., Ph.D.(Textile Manufacture)
6. Dr. Jalgaonkar Kirti Ramesh, M.Sc. (PHT), Ph.D., (Agricultural Structures and Process Engineering)
7. Dr. Manoj Kumar Mahawar, M.Tech. Ph.D. (DPHT)(Agricultural Structures and Process Engineering)
8. Dr. P. Jagajanantha, M. Tech., Ph.D. (Textile Chemistry)

### SCIENTIST

1. Dr. Dukare Ajinath Sridhar, M.Sc., PhD (Agricultural Microbiology)
2. Dr. Kautkar Sheshrao Sakharam, M.Sc. Ph.D. (Agricultural Structures and Process Engineering)
3. Dr. Sharmila Patil, M.Sc. (P.H.T.), Ph.D. (Agricultural Process Engineering)
4. Dr. Manoj Kumar, M.Sc., Ph.D.(Plant Biochemistry)
5. Dr. Jyoti Dhakane- Lad, M. Tech., Ph.D. (Agricultural Process Engineering)
6. Dr. Kanika Sharma, M.Sc., Ph.D, (Plant Biochemistry)
7. Shri Himanshu Shekhar Chaurasia, M.Sc. (Computer Application & IT)

## GTC, NAGPUR

### OFFICER-IN-CHARGE

Dr. K. Pandiyan, Senior Scientist
M.Sc. Ph.D. (Agricultural Microbiology)

### PRINCIPAL SCIENTIST

1. Dr. S. V. Ghadge, M.E. (Ag.) M.B.A., Ph.D. (Farm Machinery & Power)

### SCIENTIST

1. Dr. (Ms.) Varsha Satankar, M.Tech. Ph.D (Agricultural Structures and Process Engineering)

# TECHNICAL STAFF

## HQ, MUMBAI

### CHIEF TECHNICAL OFFICER

1. Dr. (Smt.) Sheela Raj, M.Sc., Ph.D.
2. Shri R. S. Prabhudesai, M.Sc., D.C.M.
3. Shri S. Banerjee, M.Sc.
4. Shri B. R. Pawar, M. Sc., LL.M.
5. Shri R. R. Chhagani, M.Sc.
6. Dr. (Smt.) S. R. Kawlekar, M.Sc., P.I.M.R., Ph.D.

### ASSISTANT CHIEF TECHNICAL OFFICER

1. Shri P. N. Sahane, D.I.F.T.
2. Smt. P. S. Nirhali, M.Sc.
3. Shri S. V. Kokane, M.A.
4. Shri D. U. Kamble, B.Sc.
5. Er. Chandrika Ram, M. Tech. (APFE)
6. Dr. (Ms.) C. P. D' Souza, M.Sc., Ph.D.
7. Shri R. S. Narkar, M.Sc., D.C.I.A.
8. Smt. P. R. Mhatre, B.Sc., M.Lib.

### SENIOR TECHNICAL OFFICER

1. Smt. Binu Sunil, M.Sc.
2. Smt. Bindu Venugopal, M.Sc.
3. Shri M. G. Ambare, M.Sc.
4. Dr. N. D. Kambli, M.Sc., Ph.D.

### TECHNICAL OFFICER

1. Shri C. V. Shivgan, Cert. Elec. Supr. PWD, Cert. M. & A.W. Technician
2. Shri S. N. Patil, B.E. (Civil)
3. Shri D. M. Correia, I.T.I., N.C.T.V.T. (Mechanic)
4. Smt. H. R. Pednekar, M.A. (Economics), M.Lib & I.Sc.
5. Shri R. P. Kadam, M.Sc.
6. Smt. M. P. Kamble, B.A., M.Lib.
7. Shri A. R. Jadhav, M.Sc. (Physics)

### SENIOR TECHNICAL ASSISTANT

1. Shri D. A. Salaskar, Driver
2. Shri S. V. Kokane, Driver
3. Shri Mahabir Singh

### TECHNICAL ASSISTANT

1. Shri S. K. Parab, Cert. Cot. Spin.
2. Shri P. G. Gavhale, B.Sc. (Agri.), Dip. Agri. Sci.
3. Shri M. M. Kadam
4. Shri S. G. Phalke

### SENIOR TECHNICIAN

1. Shri Yogesh Nagpure

### TECHNICIAN

1. Kum. Nevali S. Pathare
2. Shri P. P. Patil
3. Shri D. G. Gole
4. Shri V. Murugan

## 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. N. Hedau, B.Sc.
3. Shri R. G. Dhakate, B.Sc.

### TECHNICAL OFFICER

1. Shri Anil Kumar Kulsange

### TECHNICAL ASSISTANT

1. Shri P. P. Thakur, B. Tech. (Agri. Eng.)

## QE UNIT, COIMBATORE

1. Shri K. Thiagarajan, M.Sc., Chief Technical Officer
2. Shri M. Bhaskar, Dip. Ref. & Air-Cond., Senior Technical Officer
3. Shri Sahil Acharekar, Technician

## QE UNIT, DHARWAD

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

## QE UNIT, GUNTUR

1. Shri Sohel N. Shaikh, Technician

## QE UNIT, SIRSA

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

## QE UNIT, SURAT

1. Shri D. J. Dhodiya, Senior Technician
2. Shri M.G. Sosa, Technician

# ADMINISTRATIVE STAFF
## HQ, MUMBAI

### SENIOR ADMINISTRATIVE OFFICER
Smt. Sujata Koshy, B.Com.

### ADMINISTRATIVE OFFICER
Smt. T. P. Mokal, M.A. (Hindi)

### (ACTING IN CHARGE) FINANCE & ACCOUNTS OFFICER (Additional Charge)
Shri Anand Jadhav

### ASSISTANT

1. Smt. S. P. Paiyala
2. Smt. J. R. Chavkute
3. Smt. B. D. Kherodkar
4. Shri T. D. Dhamange, B.Com.
5. Shri S. N. Bandre

### UPPER DIVISION CLERK

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

### LOWER DIVISION CLERK

1. Shri S. N. Sahane
2. Shri D. K. Kasar
3. Shri S. M. Chandanshive
4. Shri Thapa Gorkha Bahadur Ovilal

**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 S. K. Bobate
5. Shri R. P. Karkate
6. Shri S. B. Worlikar
7. Shri M. K. Prabhulkar
8. Shri J. D. Sakpal
9. Shri S. D. Magar
10. Shri Sunil R. Tondse
11. Shri V. B. Poojari
12. Shri S. P. Naik
13. Shri M. N. Kamble
14. Shri Suhas R. Tondse
15. Shri S. S. Surkule
16. Smt. Kamala Murugan
17. Shri D. R. Gawade
18. Shri P. E. Gurav
19. Shri Mahesh C. Solanki

## GTC, NAGPUR

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

## QE UNIT, COIMBATORE

1. Shri V. Subbaiah

# APPOINTMENTS

1. Shri Sohel N. Shaikh, Technician (T-1) on compassionate ground w.e.f 11.04.2023 (F.N.)
2. Shri Sahil C. Acharekar, Technician (T-1) on compassionate ground w.e.f. 09.05.2023 (F.N.)

# SCIENTIST PROBATION COMPLETION

Dr. Kanika Sharma, Scientist has cleared her probation effective from 19.12. 2021

## PROMOTIONS

| Sr. No. | Name of Staff | Grade to which Promoted | Effective Date of Promotion |
|---|---|---|---|
| 1. | Dr. A.K. Bharimalla | Principal Scientist *(Level 14, RGP 10,000)* | 19.04.2021 |
| 2. | Dr. V.G. Arude | Principal Scientist *(Level 14, RGP 10,000)* | 03.01.2022 |
| 3. | Dr. G.T.V. Prabu | Senior Scientist *(Level 12, RGP 8000)* | 15.09.2021 |
| 4. | Dr. G. Krishna Prasad | Senior Scientist *(Level 12, RGP 8000)* | 15.09.2021 |
| 5. | Dr. K. Pandiyan | Senior Scientist *(Level 12, RGP 8000)* | 01.07.2022 |
| 6. | Dr. P. Jagajanantha | Senior Scientist *(Level 12, RGP 8000)* | 01.07.2022 |
| 7. | Dr. Kirti Jalgaonkar | Senior Scientist *(Level 12, RGP 8000)* | 01.01.2023 |
| 8. | Dr. Manoj Kumar Mahawar | Senior Scientist *(Level 12, RGP 8000)* | 01.01.2023 |
| 9. | Late Shri K. Narayanan | Chief Technical Officer | 17.05.2022 |
| 10. | Shri U.D. Devikar | Chief Technical Officer | 01.01.2022 |
| 11. | Smt. P. S. Nirhali | Chief Technical Officer | 20.11.2022 |
| 12. | Shri M.B. Patel (Since retired) | Assistant Chief Technical Officer | 01.01.2019 |
| 13. | Shri P.N. Sahane | Chief Technical Officer | 26.02.2022 |
| 14. | Shri B.V.Shirsath (Since retired) | Senior Technical Officer | 10.09.2021 |
| 15. | Shri M. Bhaskar | Senior Technical Officer | 21.09.2021 |
| 16. | Shri D.M. Raje (Since retired) | Senior Technical Assistant | 23.04.2022 |
| 17. | Shri M.M. Kadam | Technical Assistant | 18.10.2021 |
| 18. | Shri S.G. Phalke | Technical Assistant | 18.10.2021 |
| 19. | Smt. Sujata Koshy | Senior Administrative Officer | 15-03-2023 |
| 20. | Smt. Trupti Pravin Mokal | Administrative Officer | 24-04-2023 |
| 21. | Shri V. Murugan | Technician (T-1) | 31.08. 2023 |
| 22. | Shri M.G. Sosa | Technician (T-1) | 29.08.2023 |
| 23. | Shri S.N. Bandre | Assistant | 01.08.2023 |
| 24. | Shri Thapa Gorkha Bahadur Ovilal | Lower Division clerk | 27.12.2023 |

## TRANSFERS

**Scientist**

1. Dr. (Smt.) Archana Mahapatra, Scientist, transferred to ICAR- National Institute of Secondary Agriculture, Ranchi and relieved from ICAR-CIRCOT, Mumbai on 24.02.2023

## TRANSFERS

**Technical**

1. Shri P. N. Sahane, CTO transferred from CIRCOT, Mumbai HQ to GTC, Nagpur w.e.f. 10-07-2023
2. Shri. Paresh P. Thakur, Technical Assistant transferred from QEU of CIRCOT, Guntur to GTC, Nagpur w.e.f. 10-07-2023.

## RETIREMENTS

1. Shri Satish Sitaram Angane, Assistant, Superannuated on 31-01-2023
2. Dr. Jal Singh, Assistant Chief Technical Officer Superannuated on 31-01-2023
3. Dr. (Smt.) N.M. Ashtaputre, Chief Technical Officer, Retired from Service voluntarily on 08.02.2023
4. Shri Sunil Kumar, Chief Administrative Officer, Superannuated on 28-02-2023
5. Shri. M. Radhakrishnan, Senior Finance & Accounts Officer Superannuated on 30-04-2023
6. Shri R.K. Jadhav, Chief Technical Officer Superannuated on 31-05-2023
7. Shri Mohan Mavji Katpara, Skill Supporting Staff Superannuated on 31-05-2023
8. Shri Hiralal Soma Koli, Chief Technical Officer Superannuated on 31-05-2023
9. Smt. Sandhya Gurunath Parab, Assistant, Superannuated on 30-11-2023

## OBITUARY

Dr V.G. Munshi, Retd. Scientist expired on 19.05.2023.

Shri M. R. Nevrekar, Retd. Senior Technician (T-1-3) expired on 07.06.2023.

Mr. P.G. Oka, Retd. Scientist expired on 14.08.2023.

*Annexure III*

# LIST OF COMMITTEES

### Institute Management Committee (IMC)

| | |
|---|---|
| Dr. S. K. Shukla, *Director, ICAR-CIRCOT* | Chairman |
| Dr. A. K. Thakur, *ADG (PE), ICAR, New Delhi* | Member |
| Dr. D. P. Ray, *PS, ICAR-NINFET, Kolkata* | Member |
| Dr. Vinita Gotmare, *PS, ICAR-CICR, Nagpur* | Member |
| Dr. R. K. Vishwakarma, *PS, ICAR- CIPHET, Ludhiana* | Member |
| Dr. Blaise De'Souza, *PS, ICAR-CICR, Nagpur* | Member |
| Dr. Sharad Gadakh, *VC, PDKV, Akola* | Member |
| Shri M. M. Korde | Member |
| Shri Sachin Kulkarni | Member |
| *Director of Agriculture, Govt. of Maharashtra* | Member |
| *Director of Agriculture, Govt. of Karnataka* | Member |
| Shri R.K. Singh, Comptroller, *ICAR-CIFE, Mumbai* | Member |
| Smt. Sujata Koshy, SAO | Member Secretary |

### Research Advisory Committee (RAC)

| | |
|---|---|
| Dr. S. M. Ilyas, *Former Director, NAARM, Hyderabad* | Chairman |
| Dr. S. Sreenivasan, *Former Director, ICAR-CIRCOT* | Member |
| Dr. Pitam Chandra, *Former ADG (PE), ICAR, New Delhi* | Member |
| Dr. Gopal Agarwal, *Prof. IIT, Delhi* | Member |
| Dr. S. P. Borkar, *Professor, VJTI, Mumbai* | Member |
| Dr. R. V. Adivarekar, *ICT, Mumbai* | Member |
| Dr. K. Narsaiah, *ADG (PE), ICAR, New Delhi* | Member |
| Dr. S. K. Shukla, *Director, ICAR-CIRCOT* | Member |
| Dr. V.G. Arude, *Principal Scientist* | Member-Secretary |

### Project Monitoring and Evaluation Committee (PMC)

| | |
|---|---|
| Dr. S. K. Shukla, *Director, ICAR-CIRCOT* | Chairman |
| Dr. Sujata Saxena, *Head, CBPD* | Member |
| Dr. N. Shanmugam, *Head, MPD* | Member |
| Dr. D. M. Kadam, *Head, ETTD* | Member |
| Dr. A.S. M. Raja, *Head, QEID* | Member |
| Dr. C. Sundaramoorthy, *In-charge, PME Cell,* | Member Secretary |

### Priority-setting, Monitoring & Evaluation (PME) Committee

| | |
|---|---|
| Dr. C. Sundaramoorthy, *Principal Scientist & In-charge, PME Cell* | Chairman |
| Dr. N. Shanmugam, *Head Principal Scientist, MPD* | Member |
| Dr. N. Vigneshwaran, *Principal Scientist, CBPD* | Member |
| Dr. A. S. M. Raja, *Head Principal Scientist, QEID* | Member |
| Dr. A.K. Bharimalla, *Principle Scientist, ETTD* | Member |
| Dr. G.T.V. Prabu, *Senior Scientist, MPD* | Member Secretary |

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

| | |
|---|---|
| Dr. C. Sundaramoorthy, *Principal scientist* | (In-Charge) |
| Dr. GTV Prabu, *Senior Scientist* | (Nodal Officer) |
| Smt. Bindu Venugopal | Senior Technical Officer |
| Smt. H.R. Pednekar | Technical Officer |
| Shri Anand Jadhav | Technical Officer |

### Institute Technology Management Committee (ITMC)

| | |
|---|---|
| Dr. S. K. Shukla, *Director, ICAR-CIRCOT* | Chairman |
| Dr. Sujata Saxena, *Principal Scientist & Head, CBPD* | Member |
| Dr. D.M. Kadam, *Principal Scientist & Head, ETTD* | Member |
| Dr. N. Shanmugam, *Principal Scientist & Head, MPD* | Member |
| Dr. A. S. M. Raja, *Principal Scientist, & Head QEID* | Member |
| Dr. N. Vigneshwaran, *Principal Scientist, CBPD* | Member |
| Dr. C. Sundaramoorthy, *Principal Scientist, & I/C PME* | Member |
| Dr. Swadesh Prakash, *Principal Scientist, CIFE, Mumbai* | External Member |
| Dr. K. Pandiyan, *Senior Scientist, Officer I/C, GTC, Nagpur* | Member |
| Dr. A.K. Bharimalla, *Principal Scientist, ETTD & Principal Investigator, ICAR-CIRCOT-ABI Centre* | Member Secretary |

### Institute Technology Management Unit (ITMU)

| | |
|---|---|
| Dr. N. Vigneshwaran, *Principal Scientist, CBPD* | Chairman |
| Dr. C. Sundaramoorthy, *Principal Scientist, I/c, PME* | Member |
| Dr. A.K. Bharimalla, *Principal Scientist, ETTD & Principal Investigator, ICAR-CIRCOT-ABI Centre* | Member |
| Dr. G. Krishna Prasad, *Senior Scientist, MPD* | Member |
| Dr. (Smt.) Sharmila Patil, *Scientist, QEID* | Member |
| Dr. Nishant D. Kambli, *Sr. Technical Officer, QEID* | Member |
| Mrs. Prachi R. Mhatre, *ACTO & I/C, Library, ETTD* | Member Secretary |

### Institute Joint Staff Council (IJSC)

| | |
|---|---|
| Dr. S .K. Shukla, *Director* | Chairman |
| Dr. P. S. Deshmukh, *Principal Scientist, ETTD* | Member |
| Shri Sujata Koshy, *SAO* | Member |
| Shri R. R. Chhangani, *CTO* | Member |
| Shri Anand Jadhav, *TO* | Member |
| Shri Mahavir Singh *CJSC*, *Sr. Technician (Technical Cadre)* | Member |
| Shri Yogesh Nagpure, *Tech. Assistant (Technical Cadre)* | Member |
| Smt. Smita Paiyala, *Assistant (Administrative Cadre)* | Member |
| Smt. Bharati Kherodkar, *UDC (Administrative Cadre)* | Member |
| Shri S.D. Magar, *SSS, Staff Side Member (SSS Cadre)* | Member |
| Shri S. P. Naik, *Staff Side Member (SSS Cadre)* | Member |
| Smt. M.P. Kambale, *TO* | Member Secretary |

### Internal Complaints Committee

| | |
|---|---|
| Dr. Sharmila Patil, *Scientist, QEID* | Chairperson |
| Dr. Shilpa Charankar, *Former Principal, Dr. BNM college of Home Science, Matunga,* | External Member |
| Dr. P. S. Deshmukh, *Principal Scientist, ETTD* | Member |
| Smt. Prachi Mhatre, *ACTO* | Member |
| Smt. Sujatha Koshy, *Sr. Administrative Officer* | Member Secretary |

### Purchase Committee

| | |
|---|---|
| Dr. N. Shanmugam, *Principal Scientist & Head MPD* | Chairman |
| Dr. A. K. Bharimalla, *Principal Scientist, ETTD* | Member |
| Dr. G. Krishna Prasad, *Senior Scientist, MPD* | Member |
| Dr. P. Jagajanantha, *Senior Scientist, QEID* | Member |
| Shri A.R. Jadhav, *AFAO (Acting)* | Member |
| Smt. Sujatha Koshy, *Sr. Administrative Officer* | Member Secretary |

### Technical Evaluation Committee

| | |
|---|---|
| Dr. A. S. M. Raja, *Principal Scientist & Head QEID* | Chairman |
| Dr. T. Senthilkumar, *Senior Scientist* | |
| Dr. P. Jagajanantha, *Senior Scientist* | |
| Smt. Sujatha Koshy, *SAO* | Member Secretary |

### Rajbhasha Committee

| | |
|---|---|
| Dr. S.K. Shukla, Director | Chairman |
| Dr. Sujata Saxena, *PS & Head, CBPD* | Member |
| Dr. A.S.M. Raja, *PS& Head QEID* | Member |
| Smt. Sujatha Koshy, *SAO* | Member |
| Smt. P. R. Mhatre, *ACTO* | Member |
| Shri Rajesh Narkar, *ACTO* | Member |
| Smt. Medha Kambli , *TO* | Member |
| Shri Anand Jadhav , *AFAO* | Member |
| Smt. Trupti Mokal , AO | Member Secretary |

### Grievance Committee

| | |
|---|---|
| Dr. S.K. Shukla, Director *Nominated Members* | Chairman |
| Dr. A.S.M. Raja, *Principal Scientist* | Member |
| Smt. Sujatha Koshy, *SAO* | Member |
| Smt. Trupti Mokal, *AO* | Member |
| Shri Anand Jadhav Act. *AFAO* *Elected Members* | Member |
| Dr. P.S. Deshmukh, *Pr. Scientist (Scientific Category)* | |
| Shri C. V. Shivgan, *TO (Technical Category)* | |
| Shri Sainath Sahane, *LDC (Administrative Category)* | |
| Shri. S. B. Worlikar, *S.S.S (SSS Category)* | |

### ABI Advisory Committee

| | |
|---|---|
| Dr. S. K. Shukla, *Director, ICAR-CIRCOT* | Chairman |
| Dr. R. P. Kachru, *Former ADG (PE), ICAR, New Delhi* | Member |
| Dr. A. J. Shaikh, *Former Director, ICAR-CIRCOT, Mumbai* | Member |
| Prof. Narendra G Shah, *CTARA, IIT, Mumbai* | Member |
| Dr. M. K. Sharma, *Director & CEO, BSIL* | Member |
| Dr. A. K. Bharimalla, *Principal Scientist, ETTD* *PI: ICAR-CIRCOT-ABI centre (ICAR-CIRCOT-ABIC)* | Member-Secretary |

### RAFTAAR-Incubation Committee (RIC) of CIRCOT RABI

| | |
|---|---|
| Dr. S. K. Shukla, *Director* | Chairman |
| Dr. P.U. Krishnaraj, *Associate Director of Research, Chairman CIC and PI-of Krishik-Agri Busiiness Incubator, UAS, Dharwad* | Member |
| Dr. G. R. Anap, *International Ginning Consultant* | Member |
| Prof. (Dr.) V. D. Gotmare, *Former HOD, Textile Manufacture Department, VJTI, Mumbai* | Member |
| Shri. Abasaheb K. Haral, *Rtd. Joint Director Agriculture and chief coordinator (PPP-IAD), Dept. of Agriculture, Govt. of Maharashtra* | Member |
| Mr. Vasant U. Mhaske, *Retired General Manager, Bank of Maharashtra* | Member |
| Dr. Ashok K. Bharimalla *Principal Scientist, ETTD* *PI-CEO: ICAR-CIRCOT R-ABI Centre* | Member Secretary |

### Works Committee

| | |
|---|---|
| Dr. N. Shanmugam, *Principal Scientist & Head MPD* | Chairman |
| Dr. Sharmila S. Patil, *Scientist, QEID* | Member |
| Shri S.V. Kokane, *ACTO, MPD* | Member |
| Smt. T.P. Mokal, *AO* | Member |
| Shri S.N. Patil, *Technical Officer* | Member |
| Shri Anand Jadhav, *Technical Officer & AFAO (Acting)* | Member |
| Shri B.R. Pawar, *CTO , I/C Eng. Section* | Member-Secretary |

### Test Fee Revision Committee

| | |
|---|---|
| Dr. Sujata Saxena, *PS & Head, CBPD* | Chairperson |
| Dr. A.S.M. Raja, *PS & Head QEID* | Member |
| Dr. N. Shanmugam, *PS & Head MPD* | Member |
| Dr. N. Vigneshwaran, *Principal Scientist* | Member |
| Shri B. R. Pawar, *CTO* | Member |
| Smt. P. S. Nirhali, *ACTO* | Member Secretary |

### Deputation Committee

| | |
|---|---|
| Dr. S.K. Shukla, *Director* | Chairman |
| Dr. Sujata Saxena, *PS & Head CBPD* | Member |
| Dr. D.M. Kadam, *PS & Head, ETTD* | Member |
| Dr. N. Shanmugam, *PS & Head, MPD* | Member |
| Dr. A.S.M. Raja, *PS & Head, QEID* | Member |
| Smt. Sujatha Koshy, *S.A.O* | Member |
| Mr. Anand Jadhav, *AFAO (Acting)* | Member |
| Dr. Sheshrao Kautkar, *Scientist* | Member Secretary |

### Swachh Bharat Mission Committee

| | |
|---|---|
| Dr. S.K. Shukla, *Director* | Chairman |
| Dr. D. M. Kadam, *Principal Scientist, Head, ETTD* | Member |
| Dr. Ajinath Dukare, *Scientist* | Member |
| Dr. Manojkumar Mahawar, *Senior Scientist* | Member |
| Dr. Krishana Prasad, *Senior Scientist* | Member |
| Dr. K. Pandiyan, *Senior Scientist* | Member |
| Shri S.V. Kokane, *Security Officer* | Member |
| Smt. T.P. Mokal, *AO* | Member |
| Shri Manoj Ambare, *STO* | Member Secretary |

### CRP on Natural Fibres PIU

Dr. S.K. Shukla, *Director*
Dr. A. S. M. Raja, *Principal Scientist, Nodal Officer*
Dr. C. Sundaramoorthy, *Principal Scientist*
Smt. Sujatha Koshy, *SAO*

### QRT Committee

| | |
|---|---|
| Dr. K. K. Singh *Vice Chancellor, SVPUAT, Meerut* | Chairman |
| Dr. G. S. Nadiger *Research Advisor (SASMIRA) & Former Director of Laboratories (Textile Committee)* | Member |
| Dr. A. J. Shaikh *Former Director (ICAR-CIRCOT)* | Member |
| Dr. Kanchan K. Singh *Dean, SOA Sanskrit University* | Member |
| Dr. S. Patel *Professor & Former Head, IGKV, Raipur* | Member |
| Mr. Prashant Kumar Mohota *Managing Director (MD), Gimatex Industries* | Member |
| Dr. A. S. M. Raja *PS & Head, QEID* | Member Secretary |

### ISO-9001:2015 Management Committee

| | |
|---|---|
| Dr. S. K. Shukla, *Director,* | Chairman |
| Dr. Sujata Saxena, *Principal Scientist, Head, CBPD* | |
| Dr. A. S. M. Raja, *Principal Scientist, & Head I/c, QEID & (Management Representative)* | |
| Dr. D.M. Kadam, *Principal Scientist & Head, ETTD* | |
| Dr. N. Shanmugam, *Principal Scientist & Head, MPD* | |
| Dr. A.K. Bharimalla, *Principal Scientist, I/C, ITMU & ABI* | |
| Dr. V.G. Arude, *Principal Scientist, MPD* | |
| Smt. Sujata Koshy, *SAO* | |
| Shri A. Arputharaj, *Senior Scientist, CBPD,* | (Deputy MR & Member Secretary) |

### NABL Committee

Dr. Manoj Kumar Puniya, *Quality Manager*
Dr. P. Jagajanantha, *Deputy Quality Manager*
Shri Prabudesai, *Laboratory Manager (Mechanical)*
Shri R.R. Chhangani, *Laboratory Manager (Chemical)*
Dr. S.R. Kawlekar, *Deputy Laboratory Manager (Chemical)*

### Library Committee

| | |
|---|---|
| Dr. D. M. Kadam, *Head, ETTD* | |
| Dr. A. S. M. Raja, *Head, QEID* | |
| Dr. N. Vigneshwaran, *Principal Scientist, CBPD* | |
| Dr. C. Sundaramoorthy, *Principal Scientist & I/c PME* | |
| Dr. A. K. Bharimalla, *Principal Scientist, CBPD* | |
| Smt. Sujata Koshy, *SAO* | |
| Shri Anand Jadhav, *AFAO (Acting)* | |
| Smt. Prachi Mhatre, *ACTO, I/C, Library* | Member Secretary |

### Committee for Azadi ka Amrit Mahotsav Celebration

| | |
|---|---|
| Dr. A. K. Bharimalla, *Principal Scientist,* | Chairman |
| Dr. G. T. V. Prabu, *Senior Scientist, MPD,* | Program Coordinator |
| Dr. Kirti Jalgaonkar, *Senior Scientist, QEID* | Member |
| Dr. Kanika Sharma, *Scientist, CBPD* | Member |
| Dr. Charlene D'Souza, *ACTO, CBPD* | Member |
| Shri B. R. Pawar, *CTO, QEID* | Member |
| Shri S. V. Kokane, *ACTO & Security Incharge* | Member |
| Smt. Sujata Koshy, *SAO* | Member |
| Smt. Medha Kamble, *TO, Library* | Member |
| Shri Anand Jadhav, *AFAO (Acting)* | Member |
| Smt. Prachi Mhatre, *ACTO, Library* | Member Secretary |

# CITIZEN'S/CLIENT'S CHARTER

**ICAR – Central Institute for Research on Cotton Technology**
**Adenwala Road, Matunga, Mumbai – 400 019**
**Phone: (022) 2414 6002**
**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, etc. | **Mrs. P.S. Nirhali**<br>Assistant Chief Technical Officer<br>In-charge, Test House<br>test.circot@icar.gov.in<br>cottontest@rediff.com |
| 2. | Imparting Training to Stakeholders | **Dr. D.M. Kadam**<br>Engineering Technology Transfer Division<br>dmkadam11k@gmail.com<br>and<br>**Dr. K. Pandiyan**<br>Ginning Training Centre, Nagpur<br>pandiannkl@gmail.com<br>Phone (0712) 2500592 , 2500289 |
| 3. | Supply of Calibration Cotton | **Dr. A.S.M. Raja**<br>Quality Evaluation and Improvement Division<br>asmraja16475@gmail.com |
| 4. | Consultancy and Technology Transfer | **Dr. A.K. Bharimalla**<br>In-Charge ITMU & PI, ABI Centre<br>ashokbhari72@gmail.com |

**Public Grievance Officer**

**Smt. Sujatha Koshy,** Senior Chief Administrative officer
Phone: 022-24127627, E-mail nayarsujatha14@gmail.com, Ext 138

**For Further Information, Contact**

Dr. S.K. Shukla, Director, ICAR-CIRCOT, Mumbai, Email:director.circot@icar.gov.in


## हमारा उद्देश्य
## OUR MOTIVE

**पारदर्शिता को बढ़ावा देने के लिए**
**To Promote Transparency**

**जवाबदेही को बढ़ावा देने के लिए**
**To Promote Accountability**

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**सूचना का अधिकार अधिनियम, 2005 की घोषणा के अनुसरण में निम्नलिखित अधिकारियों को इस संस्थान में जनसूचना अधिकारी, सहायक जनसूचना अधिकारी और अपीलीय 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.**

| | |
|---|---|
| **केन्द्रीय लोक सूचना अधिकारी**<br>**Central Public Information Officer**<br>**श्रीमती. सुजाता कोशी**<br>वरिष्ठ प्रशासनिक अधिकारी, भा.कृ.अनु.प.-के.क.प्रौ. अनु. सं.<br>E-mail : sujata.koshy@icar.gov.in<br>: nayarsujatha14@gmail.com<br>Tel : 022-24146002 Ext-138<br><br>**सहायक केन्द्रीय लोक सूचना अधिकारी**<br>**Assistant Central Public Information Officer**<br>**श्रीमती. तृप्ती मोकल**<br>प्रशासनिक अधिकारी, भा. कृ. अनु. प. - के. क. प्रौ. अनु. सं.<br>E-mail : Tp.Mokal@icar.gov.in<br>Tel : 022-24146002 Ext-141 | **अपीलीय प्राधिकारी**<br>**Appellate Authority**<br>**डॉ. एस.के. शुक्ला**<br>निदेशक, भा. कृ. अनु. प. - के. क. प्रौ. अनु. सं.<br>E-mail : director.circot@icar.gov.in<br>Tel : 022-2414 6002 Ext-130 |