भाकृअनुप
ICAR

Azadi Ka Amrit Mahotsav

Centenary Celebration

ISO 9001:2015
1924-2024

ICAR-CIRCOT
ANNUAL REPORT
2022

भा.कृ.अनु.प. - केंद्रीय कपास प्रौद्योगिकी अनुसंधान संस्थान, मुंबई

ICAR-Central Institute for Research on Cotton Technology, Mumbai

Towards Doubling Farmer's Income through Sustainable Processing Technology & Value Addition to by-produce

ICAR-CIRCOT 1

ANNUAL REPORT 2022 1

Centenary Celebration

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1924-2024

ICAR-Central Institute for Research on Cotton Technology 1

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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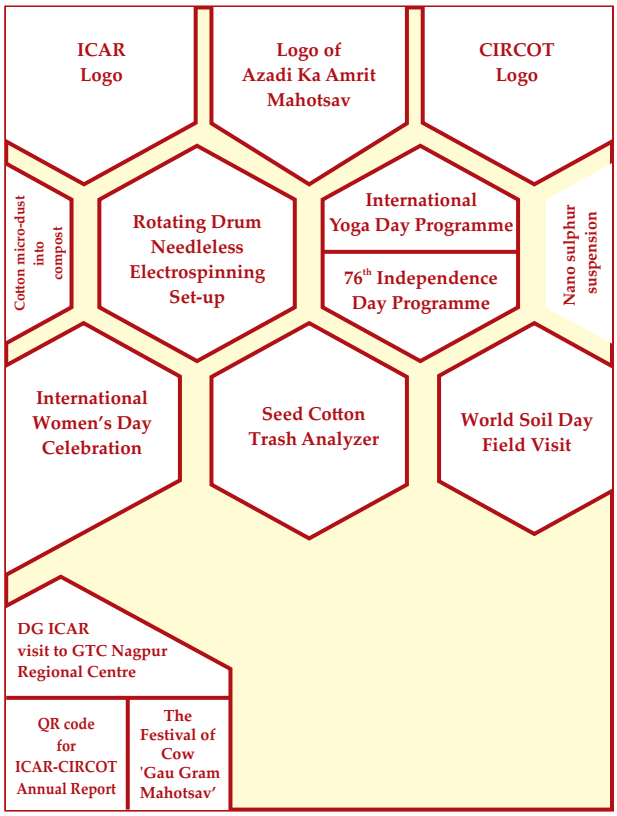


Printed at : **TOP COLOUR DROP, MUMBAI** 1

Citation : ICAR-CIRCOT Annual Report 2022. ICAR-Central Institute for Research on Cotton Technology, Mumbai.

CONTENTS

ABBREVIATIONS 1

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)
TAP	Technical Assistance Programme
TTD	Technology Transfer Division
USDA	United States Department of Agriculture
VJTI	VeermataJijabai Technological Institute

PREFACE 1

ICAR-CIRCOT, in the penultimate year of its Centenary Celebration, is addressing the needs of the stakeholders in the Cotton Sector with its basic and strategic research in processing of cotton & its agro residues, development of novel products and cotton quality assessment. The institute has established itself as a referral laboratory for Cotton fibres and has made a remarkable contribution in capacity building among the farmers and other stakeholders in the cotton value chain. Agri-Business incubation is yet another domain through which the institute offers a platform with necessary technological mentoring in networking mode, and facilitates financial support for the Start-ups with innovative and impact creating ideas in the agriculture and allied sector.

The institute has reoriented itself and has taken a perspective transformation to reiterate its relevance in the emerging context and focus on ensuring technology-led growth along with sustainability in the cotton value chain. The institute has been a front runner in adopting cutting edge technologies viz., nano technology, plasma technology in the past and is adapting itself to the new age technologies of application of Robotics, Artificial Intelligence/Machine learning, Internet of Things in the post-harvest processing of cotton, value addition and value creation to further the desirable transformation in the sector.

The Institute is nurturing the culture of collaborative research partnering with other ICAR institutes, public funded institutions and also with private organizations and industrial stakeholders. Institute has a pivotal role as the quality partner in the All India Coordinated Research Programme on Cotton. CIRCOT is also the nodal centre for the implementation of the Consortia Research Platform (CRP) project on Natural Fibres. The institute is part of major initiatives such as 'National Biomass Mission' of Ministry of Power aiming to

promote use of biomass as energy source in thermal power plants. The institute is also working in coordination with the Cotton Corporation of India and Maharashtra Cotton Marketing Federation towards improvement in the bale value of cotton.

CIRCOT is actively associated with the World bank funded 'Smart Cotton Initiative' of Government of Maharashtra aimed at capacity building among the farmers and community-based organizations for promoting world class cotton production. The institute is making a significant contribution in skill development of the farmers and industrial stakeholders in the post harvest processing of cotton and value addition to the by-produce.

The institute has well established Agri-business incubation centre and also hosts RAFTAAR-Agri-business incubator (RABI) funded by Department of Agriculture & Farmers Welfare. During the period 20 startups were provided the Grant in Aid support of ₹ 265.25 lakhs.

The institute is actively involved in providing various commercial services in the form of consultancy, contract research, commercial testing services and sale of the products that are outcome of the research activity. The institute has generated revenue of over ₹ 1.44 crores during the April-December 2022. The financial prudence of the institute is established with the 100% utilization of the funds allocated during 2021-22 and is poised for similar performance in 2022-23 as well.

The interaction of the institute with its stakeholders has improved with implementation of various programmes under the Azadi Ka Amrit Mahotsav, Swachhata Abhiyan 2.0, Mera Gaon Mera Gaurav programme implemented in 12 new villages and SCSP programe for targeted beneficiaries.

The institute is just a step close to celebration of the Centenary year and I wish to ensure that the institute will consistently deliver the output to the complete satisfaction of its stakeholders and march towards its vision of global excellence in cotton technology.

Sujata Saxena
Director (Acting)

EXECUTIVE SUMMARY 1

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 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 recognized as referral laboratory for cotton fibres.

ICAR-CIRCOT is functioning as bridge between the farmers and the industry to further the development of the cotton value chain benefitting all the stakeholders through its technological intervention.

The Institute undertakes research activities in the following 5 major 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 of cotton and its biomass & by-product utilization;
- Entrepreneurship and Human Resource Development;

The salient achievements made by the institute during 2022 are:

Research

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

Process technologies

- ICAR-CIRCOT process protocol for the synthesis of nano sulphur.
- Production of bio-enriched compost from spinning waste.
- Biopolymer based coating formulations to impart functionality to paper.
- Production of thermostable and alkali tolerant microbial xylanase enzyme from cottonseed hull.
- Rosemary extract- A natural antioxidant to improve the stability of refined cottonseed oil.

Machineries / value added products

- Development of cotton covered electro-spun nanofibre-based micronutrient sachet for agriculture applications.
- Development of Replaceable Nanofibre filter cartridge for face mask.
- Development of 100 % Cotton Engineered fabric structure for face mask application.
- Nanofibrebased Micronutrient Sachet for Plant Germination.
- Cotton based multi-layered fabric for cut resistance gloves.
- Indigenous high production Profiled rotating Drum needleless Electrospinning System (PDES).

Technology Impact assessment

- Value addition to cotton biomass (Briquetting & Pelleting).

Technologies Commercialized

- Production Technology for Nano-Zinc suspension.
- Compact and Energy Efficient Cottonseed Dryer.

- Augmented Process for preparation of bio-enriched compost from cotton micro-dust.
- ICAR-CIRCOT trapezoidal shaped rapid burning briquette-based crematorium.
- Miniature ginning machine (renewal).

Publications

- Published 48 research papers in peer reviewed journals; 16 Conference papers; 14 Book chapters, and 14 popular articles.

Skill Development initiative

- Thirty Seven skill development programmes were organized benefitting 6824 stakeholders including 6099 farmers under the smart cotton initiative.
- Revenue generated from training during 2022 was ₹ 34.10 lakhs.

Technology Management and Popularisation

- Three patents have been filed and 13 consultancy projects were implemented during the period. Fifteen MoUs were signed for academic cooperation, research collaboration and technology commercialization and 13 MoAwere signed with Start-Up for incubation under CIRCOT RKVY-RAFTAAR Agri-Business Incubator.
- One Technology & Machinery Demonstration Mela and 8 awareness cum demonstration programme was organized. Participated in three exhibitions, and the institute scientists participated in various meetings, seminars, workshops and conferences for 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. Under the Azadi ka Amrit Mahotsav programme a total of 60 programmes including e-Gosthis, webinar, online training & fit India, were organised benefitting over 9002 participants.
- Three Radio talks on All India Radio, Asmita Vahini, Mumbai were delivered by institute scientists.

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 was renewed for 2 years from March 2, 2022.

Commercial Services

- ICAR-CIRCOT continued as Approved Assayer with Indian Clearing Corporation Ltd. and Multi Commodity Exchange of India Ltd.
- During 2022, a total of 7013 samples were tested at Mumbai headquarters, GTC Nagpur and other regional units generating a total revenue of ₹ 72,59,828/- through commercial testing.
- ICAR-CIRCOT calibration cotton (an import substitute for USDA standards for calibrating textile testing equipment) -104 containers sold to stakeholders generating revenue of ₹ 98,514/- during the year 2022.
- ABI centre at ICAR-CIRCOT: One new entrepreneur admitted for incubation, Two incubatees graduated and six incubations are in progress. Three new products have been developed by the incubatees.
- RAFTAAR - Agri Business Incubator (R-ABI) of RKVY funded by the Department of Agricultural and Farmers

welfare is functioning at ICAR-CIRCOT. During the period the Centre of Excellence Incubation Committee (CIC) meeting was organized for the start-ups of the 3rd 1, 4th and 5th Cohort recommended by the RAFTAAR Incubation Committee (RIC) of the CIRCOT R-ABI. In these three cohorts, 8 start-ups under pre-seed stage funding and 12 start-ups under seed stage funding were sanctioned a grant in aid funding of ₹ 40.00 lakh and ₹ 225.25 lakhs respectively.

Financial Management

- All transactions in the Institute are 100% digital and cashless.
- The Institute ensured complete utilization (100%) of the sanctioned budget allocation during 2021-22 and 79.94% during 2022-23 (up to 31st of December 2022).
- The revenue generation was ₹ 253 lakhs during the year 2021-22 and ₹ 144 lakhs during April-December 2022.

Other activities

- Implemented Swachh Bharat Abhiyan programme by organising campaigns and spreading awareness among the public.
- Observed World Cotton Day, World Soil Day, World Food Day, World Water Day, Mahila Kisan Diwas, International Yoga Day, International Women's Day, National Handloom Day, Parthenium Awareness Week, National Unity Day, Vigilance Awareness week etc.

1. Introduction 1

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

At present,*ICAR-Central Institute for Research on Cotton Technology (CIRCOT)* is one of the premier constituent institutes of 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. The Institute is only one of its kind in the world conducting R&D on the utilization of every part of the cotton plant and functions as referral laboratory for cotton fibres. Since inception of the All India Coordinated Cotton Improvement Programme, the institute is providing technological support for fibre quality oriented breeding. The institute is working towards capacity building of the farmers & other stakeholders in the sector through its Skill Development programme besides offering Agri-business incubation service and other commercial services viz., 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 17025:2017***) for *Mechanical and Physical testing*.

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-Central Institute for Research on Cotton Technology, Mumbai is the recipient of the prestigious *Sardar Patel Best ICAR Institution Award* in the year 2004 and again in 2019 (in small institute category).

ICAR-CIRCOT is having its headquarters at Mumbai with its regional units spread across the north, central and southern zones of cotton production. 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. There are four research divisions namely,

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

The Ginning Training Centre at Nagpur is under administrative control of Mechanical processing Division, while 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 like testing, consultancy and Incubation in the domain 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 research programmes of the institute are carried out under the following five broad 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

Besides, ICAR-CIRCOT is the Lead institute and the Nodal Centre for implementing the ***Consortia Research Platform (CRP) on Natural Fibres***.

The aims of CRP on Natural Fibres project is

- *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 is one of its kind in the World to carry out research solely on Cotton utilization of biomass & by-produce. The contribution of the Institute to the progress of post-harvest processing of cotton and value addition to cotton by-produce and biomass over the past nine and half decades of its existence is phenomenal. The institute has also played a pivotal role under the Technology Mission on Cotton (TMC) in Modernization of the Ginning Industry in the country. The significant contributions in the area of ginning machinery research have helped the country to be self-reliant and also become net exporter of ginning machinery. The Ginning machinery is now being exported to the Afro-Asian countries earning precious foreign exchange for the country. ICAR-CIRCOT is also supporting the private sector in its R&D efforts for development of machineries in the post-harvest processing of cotton and value addition to agro-biomass. The institute has successfully commercialised machines and products developed in the institute. On-board pre-cleaner for cotton stripper, saw band pre-cleaner 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

etc. are worth mentioning. Many process technologies for the value addition of cotton fibres and cotton biomass are also developed and demonstrated by the Institute. In its efforts to promote effective utilization of the cotton stalks, the institute has developed low-cost green crematorium and continuously feeding pellets stove, that uses cotton stalk-based briquettes and pellets respectively, and has commercialised through technology licensing.

The Institute has worked towards enhancing the diversified application of cotton and developed many products and processes like cotton rich blended fabrics for sportswear, application of cotton in technical textiles especially medical textiles. CIRCOT also explored the development of naturally coloured cotton products and value-added products from banana pseudostem fibres. The institute has contributed towards making the chemical processing and finishing of cotton textiles eco-friendly. In this context lot of work has been carried out on extraction and application of natural dyes to cotton textiles, Eco friendly finishing for textile materials using natural extracts, salt free dyeing technology etc. The institute is actively participating in formulation of BIS and ISO standards for identification of natural dyes. The institute has developed the solvent extraction process and also microbial process for removal of gossypol present in cottonseed meal to enable its utilization as non-ruminant feed.

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

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

Quality Assessment

The institute has made a significant contribution to Country's Cotton breeding Programme in varietal development by providing objective quality assessment of cotton fibres and it's processability along the value chain. The Institute is playing an important role as the technology partner under the All India Coordinated Research Project (AICRP) on Cotton and is designated as Principal Investigator for Quality Research in

the programme. The institute has developed an indigenous Standard Reference Material, "ICAR-CIRCOT Calibration Cotton", which is an import substitute for the USDA reference material used for calibrating fibre testing instruments such as High-Volume Instrument (HVI). ICAR-CIRCOT is empaneled as an approved assayer by Indian Clearing Corporation for quality assessment of cotton in commodity market.

Skill Development

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

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

Incubation Service

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

CIRCOT RKVY RAFTAAR Agri Business Incubator (CIRCOT-R-ABI) was sanctioned by RKVY Division, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Govt. of India in January 2019. This incubator is providing funding support as grant-in-aid to Agripreneurs in product development, commercialization and scaling up.

Commercial Services

ICAR-CIRCOT is one of the most recognized laboratories for testing of cotton fibres, yarn and textiles made of cotton and cotton blends with other fibres. It provides commercial services for the stakeholders in the cotton value chain. Many testing facilities in the institute are accredited with ISO 17025:2017 by the National Accreditation Board for Testing and Calibration of Laboratories (NABL) since 1999.

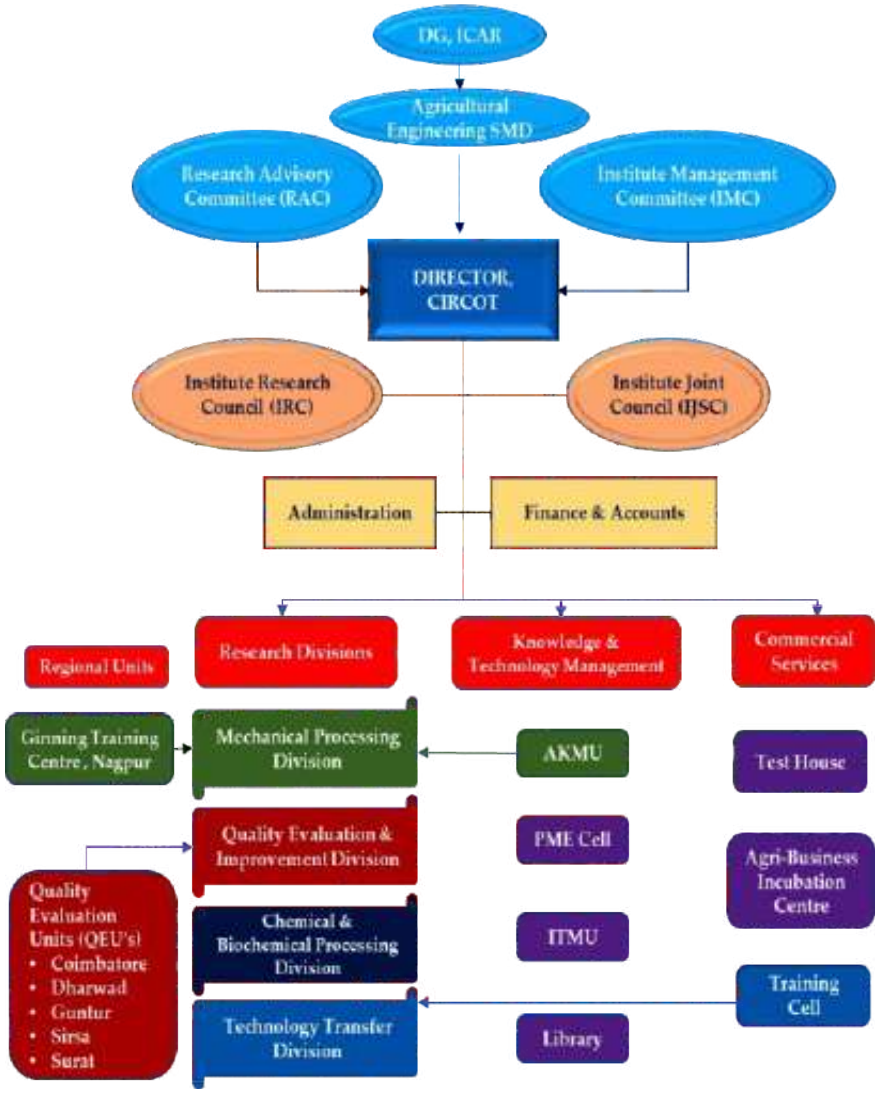
The Institutes is also accredited with ISO 9001:2015 for Quality Management System by the Bureau of Indian Standards (BIS).

Research Management &Administration

The Director is the Head of the Institute and is assisted by the Heads of the Divisions, administration and finance &accounts sections.The Research Advisory Committee (RAC) constituted by the Council, guides the Director in streamlining the research programmes of the institute. The Institute Management Committee provides necessary support in the management of the institute affairs.

The Director oversees the progress of the institute research activities through the Institute Research Council that meets twice in a year. The Priority-setting, Monitoring and Evaluation (PME) Cell assists the Director in assessing the performance of various research projects, handling communications with the council etc.

The commercial testing activities undertaken in the institute are executed through the Test House that ensures confidentiality in the services rendered.



Organogram of ICAR-CIRCOT, Mumbai

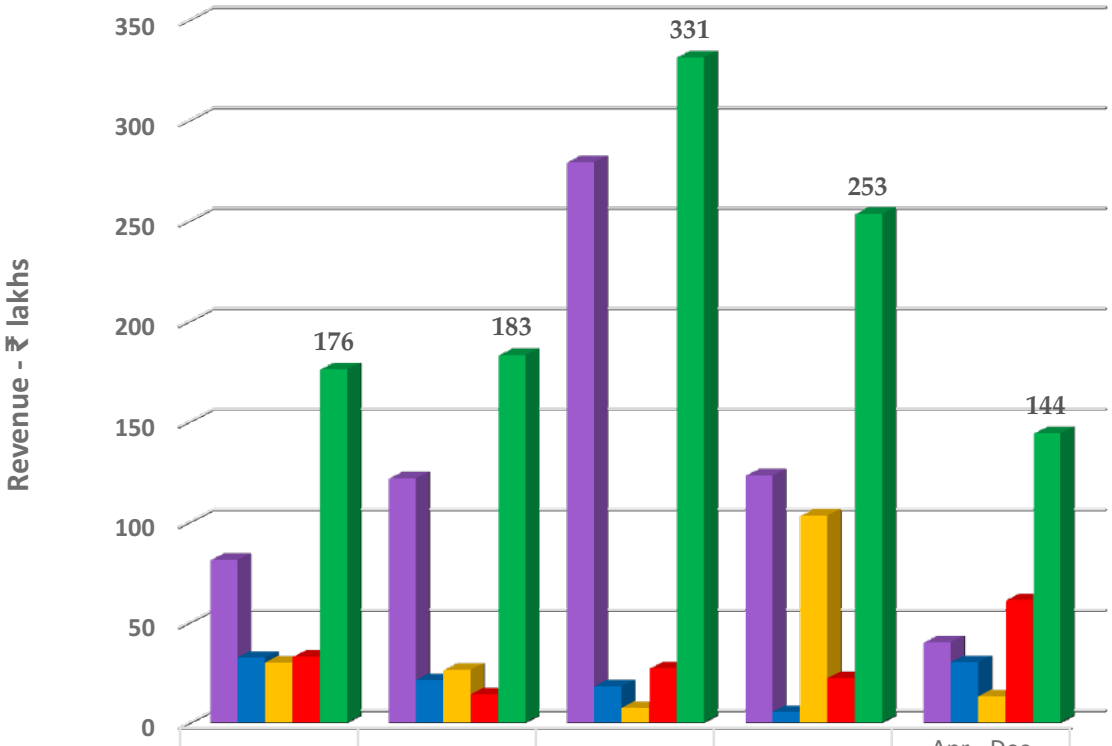
Table 1.1 Staff Position as on 31.12.2022

Category	Sanctioned	In-Position	Vacant
Scientific	48	29	19
Technical	112	55	57
Administrative	37	21	16
Skilled Supporting	36	24	12
Total	**233**	**129**	**104**

Finance Management

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

Fig 1.1 Internal Resource Generation



	2018-19	2019-20	2020-21	2021-22	Apr - Dec 2022
Testing	81	122	279	123	40
Training	32	21	18	5	30
Consultancy	30	26	7	103	13
Other	33	14	27	22	61
Total	176	183	331	253	144

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

Head of Expenditure		FY 2021-22			2022-23 (Apr-Dec, 2022)	
		Allocation	Expenditure	Utilization	Allocation	Expenditure
Grant-in-Aid- Capital		129.63	129.63	100 %	129.89	54.84
Grant-in-Aid- Salaries		1887.10	1887.10	100 %	1975.10	1698.15
Grant-in-Aid-General	Pension only	259.00	259.00	100 %	615.00	434.25
	Other than Pension	518.13	518.13	100 %	440.57	339.35
Total		**2793.86**	**2793.86**	**100 %**	**3160.56**	**2526.59**

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

Head of Expenditure	FY 2021-22		2022-23 (Apr-Dec, 2022)	
	Allocation	Expenditure	Allocation	Expenditure
Grant-in-Aid- Capital	10.67	10.67	11.14	2.00
Grant-in-Aid-General (other than pension)	43.68	43.68	37.15	28.43
Total	**54.35**	**54.35**	**48.29**	**30.43**

2. Salient Research Achievements 1

2.1 CORE AREA – I PRE-GINNING AND GINNING

2.1.1 Device for seed cotton ginning percentage measurement

The aim of the project was to develop rapid, portable and non-destructive device to measure the ginning percent of seed cotton varieties/hybrids available in India.

The seed cotton samples were received from different cotton research stations including those operating under AICRP on Cotton, Coimbatore. Ninety samples, (15 *G. arboreum*, 15 *G. herbaceum*, 1 is of *G. barbadense*, and remaining 59 *G. hirsutum* or the hybrids of *hirsutum* and *barbadense)*, with varying ginning percent / GOT were evaluated. The range of ginning percent observed was 33.4-44.6 (*G. arboreum*); 33.1-44.8 (*G. herbaceum*), and 30.1 – 42.3 (*G. hirsutum* / it's hybrids).

An experiment was conducted to ascertain the effect of moisture on absorption-desorption behaviour of seed cotton, lint and seed, at varying relative humidity conditions (80, 50 and 33 % at 25 °C) maintained in environmental control chamber. Each sample was weighed and kept at the RH condition till constant weight was obtained, after reaching to equilibrium moisture content (EMC). Cotton varieties / cultivars *viz*. Phule Dhanawantari (RHARB-02-1) and Sarnam (short staple), Phule Yamuna (RHC 0717) (medium long staple), and CICR Hybrid variety CICR Suraj (CCH 510-4) (long staple) were used in the experiment. Besides three trade varieties namely DCH32 (extra-long staple), Bunny (long staple), J34 (medium long staple), and a commercial cultivar (Yuva) was also studied and the results are presented in Table 2.1 The results show that among the three components, seed holds the maximum moisture, followed by seed cotton and minimum by lint. Moisture content of the seed cotton is an important parameter and the ginning percent should be expressed at the respective MC. To identify the seed cotton properties varying with ginning percentage, seed cotton, seed and lint samples were subject to the application of microwave.

Initial trials showed that in comparison to lint, there was around 50% loss in the microwave at 2400 kHz band when transmitted through seed. The possibility of development of device to measure the ginning percentage will be explored based on further trials at different microwaves.

Table 2.1 Equilibrium Moisture Content at Different Relative Humidity (EC Chamber)

Variety	Component	IMC, %	EMC, %		
			RH 33 ±2 %	RH 50 ±2 %	RH 80 ±2 %
Phule Dhanawantari (RHARB-02-1)	Seed cotton	7.14	7.12	8.54	13.82
	Lint	4.44	7.60	7.00	11.61
	Seed	7.34	6.79	7.91	13.52

Variety	Component	IMC, %	EMC, %		
			RH 33 ±2 %	RH 50 ±2 %	RH 80 ±2 %
Phule Yamuna (RHC 0717)	Seed cotton	9.95	5.10	8.10	12.16
	Lint	5.21	4.88	6.69	11.38
	Seed	8.70	7.82	9.95	15.05 1
CICR Suraj (CCH 510-4)	Seed cotton	10.66	4.30	8.40	11.20
	Lint	8.59	4.83	7.00	9.49
	Seed	8.70	7.82	9.95	15.05
SARNAM	Seed cotton	9.67	4.46	7.57	11.36
	Lint	10.91	7.06	6.72	10.96
	Seed	9.33	5.22	8.88	14.94
YUVA	Seed cotton	11.94	6.26	8.59	11.37
	Lint	3.64	6.17	6.88	10.70
	Seed	7.13	7.71	9.44	10.46
DCH32	Seed cotton	8.85	6.98	8.03	11.20
	Lint	3.85	7.53	6.92	10.74
	Seed	6.77	6.86	8.83	12.20
Bunny	Seed cotton	11.35	5.43	7.86	12.94
	Lint	11.20	5.84	7.54	10.90
	Seed	9.59	5.52	9.48	10.76
J34	Seed cotton	8.81	4.28	8.67	12.58
	Lint	6.72	4.23	6.41	11.97
	Seed	9.44	4.60	8.56	15.21

2.1.2 Optimization of groove profile and diameter of chrome leather roller for enhancing the performance of Double Roller Gin

The main objective of the project was optimisation of groove profile and roller diameter for the chrome leather roller to enhance the performance of DR gin. Therefore, rollers with modified groove profile were used to carry out ginning experiments.

The experiments were conducted with Rashi-659 variety (BGII) at GTC Nagpur. The chrome leather rollers with suitable diameter, groove spacing and width according to experimental design were provided by M/s. Bajaj Steel Industries Ltd, Nagpur. One gin stand was used to conduct the ginning experiments to control the variations in the results due to machine. Full factorial method was used to design the experiments for two variables (groove spacing and roller diameter) with

different levels each resulting in 60 experiments. It was observed from the ginning trials that, the lint outturn varied from 54.0 kg/h to 78.6 kg/h. The lowest outturn was recorded using roller having 12 numbers of grooves and 130 mm roller diameters while the highest outturn was recorded by mounting roller having 22 numbers of grooves with 160 mm roller diameter. The lint quality parameters were also studied using HVI and AFIS system of measurements. The ranges of different dependent parameters observed during experiments are presented in Table 2.2.

Table 2.2. Values of responses observed during ginning experiments

S No	Response	Units	Min	Max	Mean	Std. Dev.
1	Lint outturn	Kg/h	54.0	78.6	10.80	7.67
2	UHML	mm	26.3	29.6	28.18	0.63
3	UI	%	80	84	82.57	1.09
4	MIC	µg / inch	2.7	4.1	3.46	0.30
5	Tenacity	g/tex	25.7	30.8	28.03	1.09
6	Elongation	%	4.6	5.6	5.08	0.21
7	Rd	-	69.6	77.2	72.82	2.06
8	+b	-	8	11.9	9.65	0.77
9	Trash	%	1.6	5.6	3.15	0.84
10	Total Nep	%	69	242	130.67	38.94
11	Nep mean sixe	cnt/g	647	884	766.05	41.79
12	Fiber Nep	µm	50	224	110.12	37.48
13	SC Nep	cnt/g	12	54	20.73	6.72
14	Fiber L (w)	cnt/g	21.9	26.2	24.37	0.87
15	SFC (w)	mm	6.8	13.2	9.48	1.52
16	Fiber L (n)	%	17.2	21.1	19.31	0.92
17	SFC (n)	mm	21.4	34.5	27.25	3.21
18	Fineness	%	123	161	152.70	5.30
19	Maturity ratio	-	0.77	0.88	0.83	0.024
20	IFC	(%)	4.2	8.2	5.67	0.77

Statistical analysis of the data was done using Design Expert 11.0 software. It was observed that *ginning outturn*, *UHML* and *neps*, varied significantly with experimental variables (roller diameter and groove spacing). All the other quality parameters were found to have non-significant relationship with experimental variables. The results were confirmed by ANOVA test. The interactive effect of roller diameter and number of grooves on lint outturn and UHML is visualised using the 3D surface plots presented in Fig. 2.1.

Numerical as well as graphical optimization for increased productivity of DR gin with the process variables was done. The result of optimization shows that, maximum lint

outturn of 12.86 kg/10 min was observed with chrome leather roller having 20 numbers of grooves and 170 mm diameter. Other lint quality parameters were found in acceptable range at optimized levels of experimental variables (Table 2.3). The 3D surface plot of optimization was drawn to pick the best compromise of response for optimal process variables as illustrated in Fig 2.2. The results of numerical optimization can be confirmed from the graph of optimization.

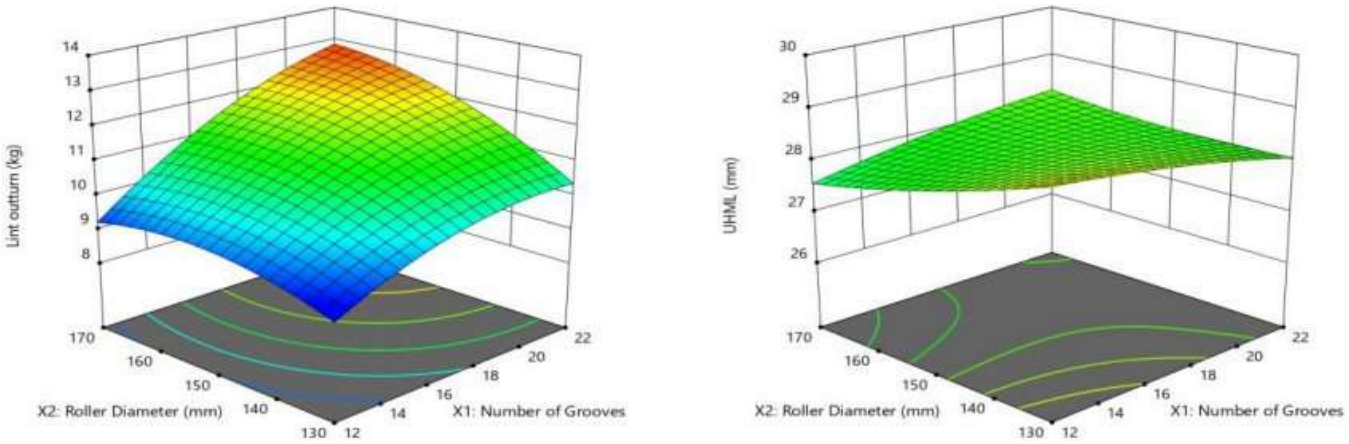


Fig 2.1. Effect of independent variables on a) lint outturn and b) UHML 1

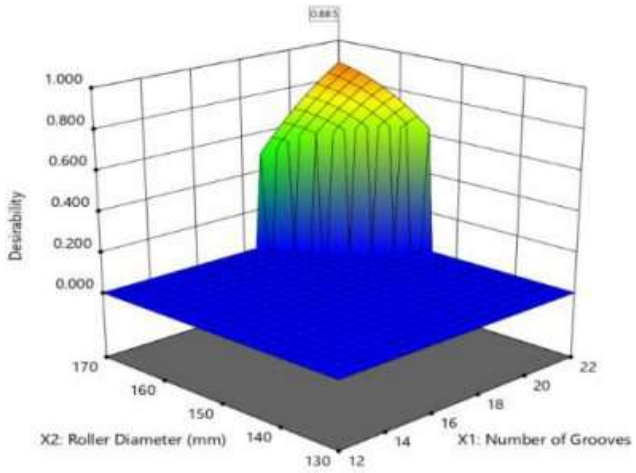


Fig 2.2. 3D Surface plot of optimization 1

Table 2.3 Numerical optimization 1

Independent variables		Responses		
No. of grooves	Roller dia (mm)	Lint outturn (kg/10 min)	UHML	Nep
20	170	12.86	28.27	104

2.1.3 Development of a seed cotton trash content analyser based on pneumatic fractionation methodology

- A seed cotton trash analyser of 20-25 samples/h testing capacity based on pneumatic fractionation methodology has been developed and optimised.
- The developed system consists of a rectangular chamber measuring 457x610x203 mm height, width and depth, respectively. It has rounded ends at the top and bottom.
- There is provision to supply compressed air from eight jets situated across the back of the chamber to cause the tumbling and flow of cotton around the perimeter of the chamber.
- The foreign matter in the designed system is collected on a series of two sieves 3.3 mm opening and 75-µm opening.
- A pneumatic line pressure of 3-8 bar is employed for suction of trashes from seed cotton.
- Air pressure 6 bar and 75 s duration are found as optimum operating conditions for determining trash content from mechanically harvested cotton.
- A total 3½-4 min duration is required for testing and measuring of the trash content of a mechanically harvested cotton sample against 30 min duration for measurement of trash content using Shirly trash analyser. However, about 30% trash remains in the raw cotton cleaned using pneumatic fractionation methodology.
- The leaf content which are tightly attached with fibre could not be separated in this equipment.
- The developed system can be used for quick assessment of trash of a machine harvested cotton in ginneries/market yards.

Seed Cotton Trash Analyzer

Sieve for Trash Collection

Perforation for Trash Collection 1

2.1.4 Assessment of field performance and effectiveness of hand-held mechanical cotton picker 1

Field performance trials on Hand-held Mechanical Cotton Picker (HHMCP) in comparison to hand picking were conducted to assess its effectiveness, drudgery to workers and suitability for cotton picking. The evaluation was carried at the cotton farms in ICAR-CICR, Nagpur. Performance testing was carried out jointly by team of scientists from ICAR-CIRCOT, Mumbai, ICAR-CICR, Nagpur, ICAR-CIAE, Bhopal and representatives from SIMA-CDRA, Coimbatore. Field trials were conducted during first picking of cotton (RASI- Magic 386 BG-II cultivar), wherein around 50% bolls were fully opened. Experimental trials were conducted with three male and three female workers with three replications. Altogether 36 experiments were conducted for the assessment study. Data pertaining to field capacity, picking efficiency, pre- and post-harvest losses, physiological work load, posture, hand stress, safety, health aspects of workers engaged during cotton picking, cotton quality and trash content, machine problems encountered during picking and feedback from farmers etc. was collected and analyzed.

Hand held mechanical cotton picker was found to perform the intended function of cotton picking; however, its picking efficiency in terms of productivity, drudgery to workers and quality of cotton was significantly lower as compared to the hand picking. On an average, a male worker could pick around 4.3 kg/h with mechanical cotton picker as against 6.3 kg/h with hand picking resulting in around 30% reduction in productivity of the male workers. Similarly, on an average, a female worker could pick around 3.5 kg/h with mechanical cotton picker as against 6.3 kg/h with hand picking resulting in around 44% reduction in productivity of the female workers. Reduction in picking efficiency with HHMCP was mainly attributed due to the use of one hand for holding the plant and operating the machine with another hand. While in case of hand-picking, workers used both hands at a time for cotton picking. Also, the HHMCP requires more time to pick cotton from one boll as all locules from one boll cannot be picked at a time. It was noted that picking cylinder has to be taken near to opened bolls for two to three times to ensure picking of all locules from one boll. Whereas in case of hand picking, most of the time all locules in a boll can be picked at a time. The post-harvest losses with HHMCP was found to be two to three times higher than hand picking because in machine picking, some cotton bolls were partially picked or left completely unpicked and some cotton had fallen on the ground while picking.

Picking cotton with the HHMCP required more efforts compared to hand picking. It is reflected from increased heart rate of the workers. The heart rate of both male and female workers increased by about 10-15% in machine picking as against hand picking. Workers could not continue picking cotton for more than one hour due to discomfort and drudgery caused by stationary weight of the HHMCP and dynamic weight of the picked cotton collected in the picking bag. Workers observed to be fatigued early and got tired and discontinued picking with machine early as compared to hand picking. Picking cotton with the machine caused strain on the wrist and arm due to holding of the picker machine and on the mid back and lower back due to holding of weight of the battery and seed cotton picking bags. Machine picking operation found more strenuous to pick cotton, especially for women

workers as compared to male workers. In case of hand-picking, workers can pick cotton continuously for more than one and half hour without taking rest.

On field demonstrations, hands on training and field trials on HHMCP were conducted at Hardoli village, Nagpur and in cotton farm at ICAR-CICR Nagpur to create awareness about mechanical picking among workers and farmers. Around 50 farmers benefitted out of the demonstrations and training.

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

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

The recycled fibre-based yarn was produced from recycled cotton fibre (RF) by blending with virgin cotton (VC) fibre in different blend proportions such as 90VC/10RC, 80VC/20RC, 65VC/35RC and 100%VC through full spinning mode. Since recycled cotton fibres are short fibre, it is very difficult to spin 100% recycled fibre alone. It requires minimum 10% of long fibres for transportation or holding the short fibre when its transfer between the rollers and yarn forming time. The sample weight of 5kg was taken for all the blend ratios and the lap formation was done on the conventional blow room machine. During the blow room and carding process the fibre loss was around 20 to 30 percent. The whole sliver is weighed carefully and the sliver length is taken with the help of the wrapping drum and the carding hank was calculated. The whole sliver is cut into 6 equal parts with the help of a wrapping block and the 6 ends are fed to the miniature drawing machine to get uniform parallel fibre sliver. The sliver was converted into roving by speed frame and spun with ring spinning

machine in the count range of 16s, 20s, 30s, 40s and 50s. The lea strength test was carried out on computerized lea strength tester (Model Spinsoft MAG version 3.3.12).

The effect of recycled fibre proportion and count on yarn CSP and single yarn strength were studied and reported in Fig. 2.3 & 2.4. It was observed that the CSP value of 100% virgin cotton is higher in all the count proportions and blend proportions. The maximum CSP value of 2218 was found in the medium counts such as 20s, 30s and 40s. A slight decrease in CSP around 2080 for higher count of 50s was observed. The CSP value of yarn drastically reduced when increasing the proportion of recycled fibre. The lower CSP of around 1694 for blend proportion of 65VC/35RC was observed. Similarly increasing the count range, the CSP of the yarn decreased. The lowest CSP values was found at 50s count of 65VC/35RC blend proportion. The better CSP values of recycled blended yarn were achieved in the lower count range from 16s to 30s. In case of single yarn, strength was increased when increasing recycled fibre blend proportion only in case of coarser count of 16s, but when we are increasing count range the single yarn strength drastically reduced.

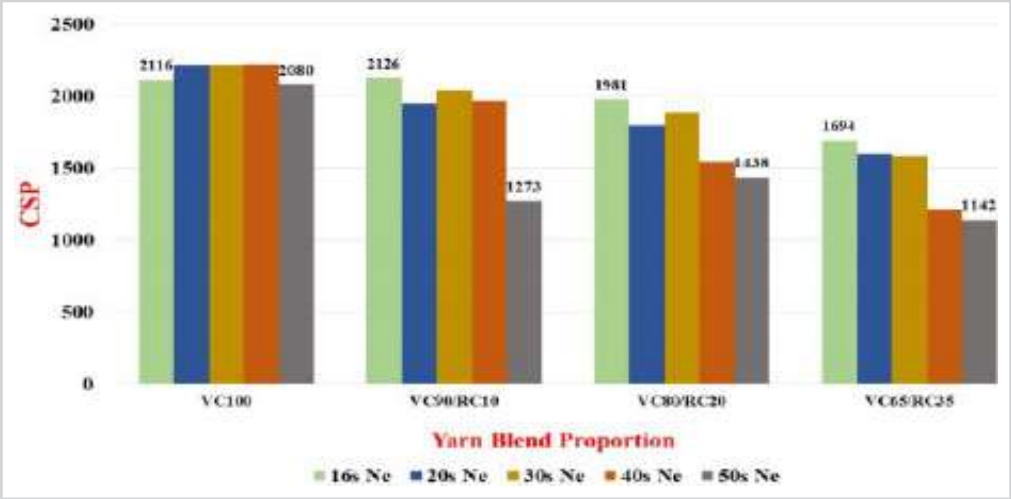


Fig 2.3. Effect of recycled fibre proportion and count on yarn CSP 1

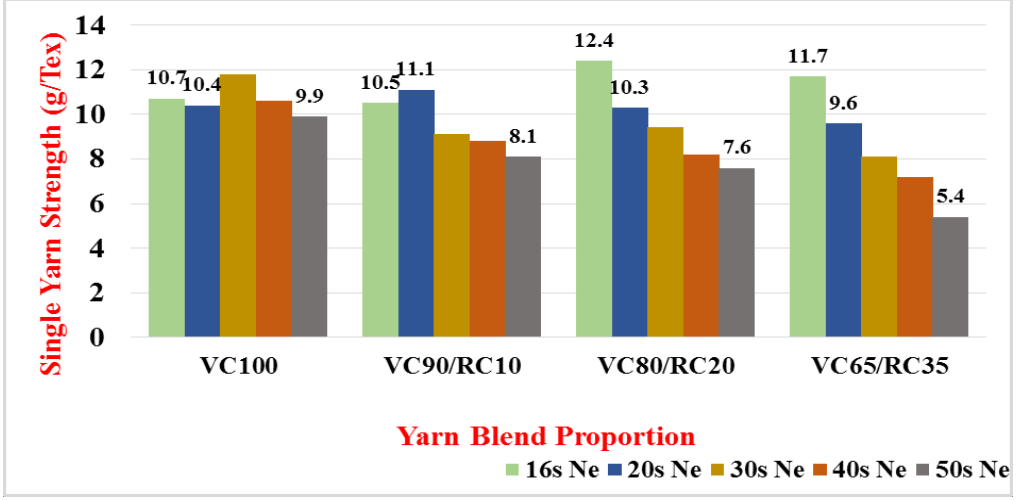


Fig 2.4. Effect of recycled fibre proportion and count on Single yarn Strength 1

2.2.2 Development of cellulosic nanofibre based micronutrient delivery system for urban farming

High production Profiled Rotating Drum Needleless Electrospinning System (PDES)

The indigenous high-production Profiled Rotating Drum Needleless Electrospinning (PDES) System was successfully designed and fabricated (Fig.2.5). The developed prototype has a higher production capacity of around 6-8 times compared to the conventional single-needle electrospinning system. It also provides uniform Taylor cone formation and positive feeding of solution through drum profile arrangements. More than 800 profiles were created on the drum surface for the continuous production of nanofibres. The drum speed can be controlled according to polymer viscosity, through an electronic control unit.

Fig: 2.5 Fabricated profiled rotating drum needleless electrospinning set-up 1

Electrospun nanofibre sachet nutrient leaching behavior analysis

The process protocol for nanofibre nutrient encapsulation using the multi-phase electrospinning machine was optimized. The nutrient-releasing behavior of the nanofibre sachet, loaded with nutrient, was analyzed at different time intervals. Three treatments like T1–PVA + 5 % Zn mat, T2 – PVA + 10 % Zn mat, and T3 –Control PVA 10 % mat (Fig. : 2.6 a) were used. The weighed filter paper was directly placed on the petridish and zinc loaded electrospun mat sachet was kept on the filter paper. The filter paper and nutrient sachet were moisturized with 5 ml of distilled water every day for 8 days. It was found that the gradual release of nutrients was noticed from 1st day to 8th day for both 5% and 10% loaded electrospun mat. The highest zinc release 94.4 % was noticed in 10 % zinc loaded mat within eight days whereas the lowest release 82.2 % was recorded in 5% zinc loaded electrospun mat (Fig. : 2.6 b).

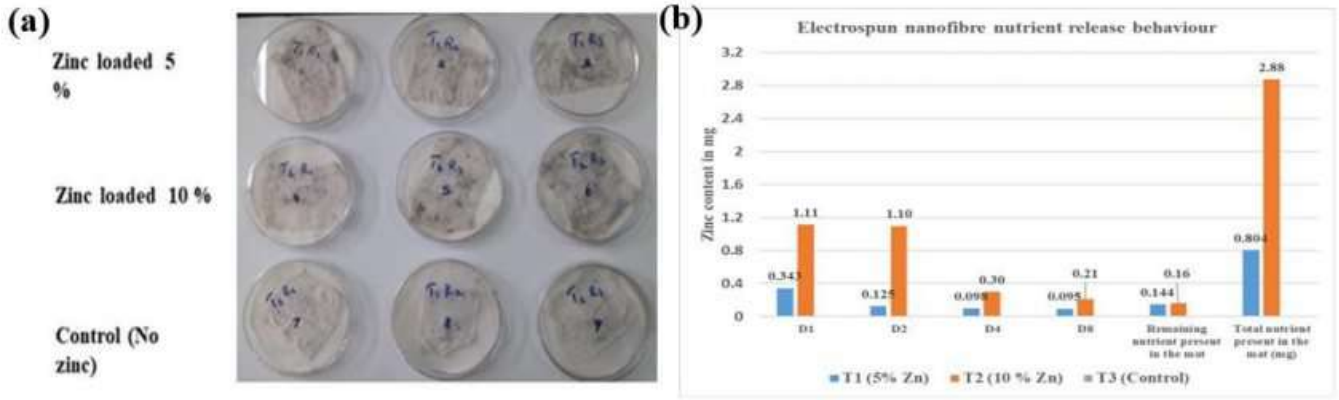


Fig:2.6 a. Electrospun nanofibre mat Nutrient releasing analysis b. Releasing behavior of zinc from zinc loaded electrospun mat at different time intervals 1

Nanofibre Based Micronutrient Sachet for Plant Germination

An *in-vitro* seed germination experiment was conducted with black gram (Co7) (Fig. 2.7). The treatments namely T1– Absolute Control (No mat), T2 – Control PVA 10 % mat (without nutrient), T3 –10 % PVA + 5 % Zn mat, T4 –10 % PVA+ 10 % Zn mat were replicated 5 times. Fifteen seeds were directly placed on a zinc sulphate nutrient-loaded sachet which was kept on weighed filter paper. The fabric was moistened with 5 ml of distilled water every day, ensuring that the sachets were wetted fully. The germination period was 8 days. The rate of germination was calculated based on the dry weight (biomass) of the sample and elemental analysis to understand the nutrient uptake by seed. The 5% nutrient-loaded zinc (T3) sachet trial outperformed by giving the highest mean weight of biomass of 0.672 g as compared to control biomass of 0.579 g (T1) and positive control 0.592g (T2) treatments and the same was confirmed with the elemental analysis where T3 treatment containing black gram seeds absorbed more zinc nutrient (2.23 mg) compared to T1 (1.68 mg) and T2 (1.94 mg).

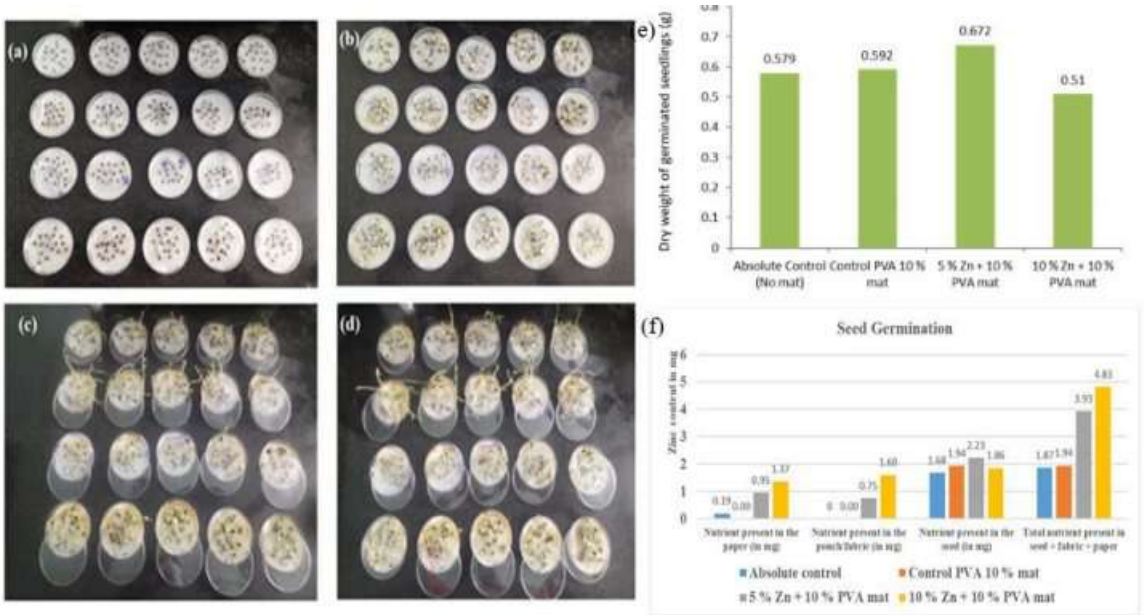


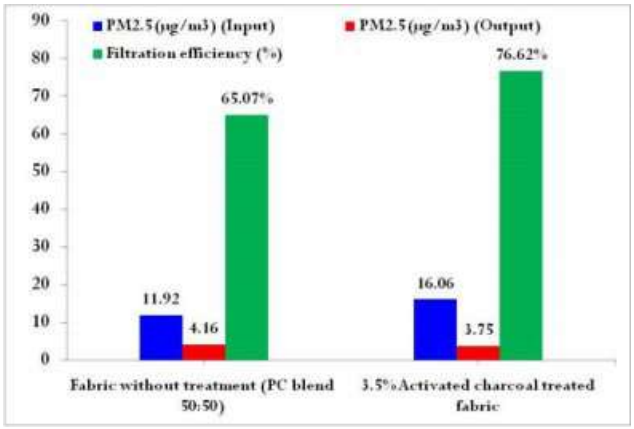
Fig 2.7. Germination analysis of plant growth (a) 1st day, (b) 3rd Day, (c) 6th day, (d) 8th day; (e) Germinated seed dry weight; (f) Seed Germination and nutrient absorption elemental analysis

2.2.3 Development of filter fabric for indoor decontamination

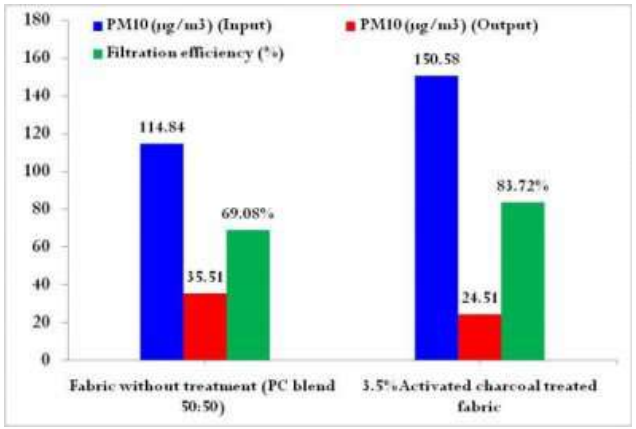
Equipment for air filtration evaluation of the fabrics has been fabricated to filter out the hazardous substances in which four different sensors (CO_2, PM 2.5 & PM 10, VOC and formaldehyde sensor) were used (Fig. 2.8).The air was passed at one end of the instrument and collected at the other end. The fabric sample was mounted in between the input and output of the air passage, the sensor measures the pollutant level present at the both input and output chambers.

Fig. 2.8. Equipment for air filtration evaluation of the fabrics

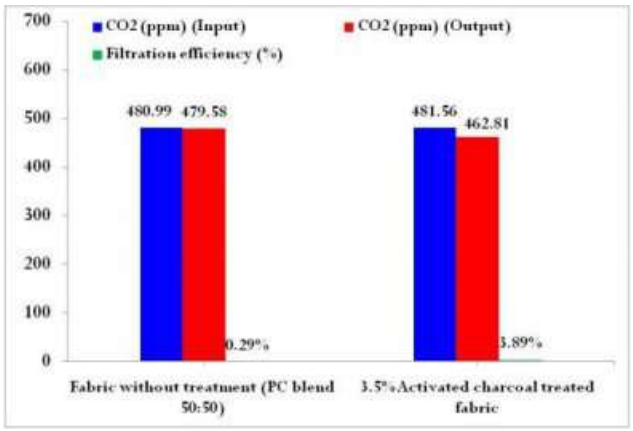
From the Fig. 2.9 a-d, it was observed that PC blend fabric treated with 3.5% activated charcoal showed better filtration efficiency (PM 2.5, PM 10, CO_2 and VOC concentration) than fabric without treatment.



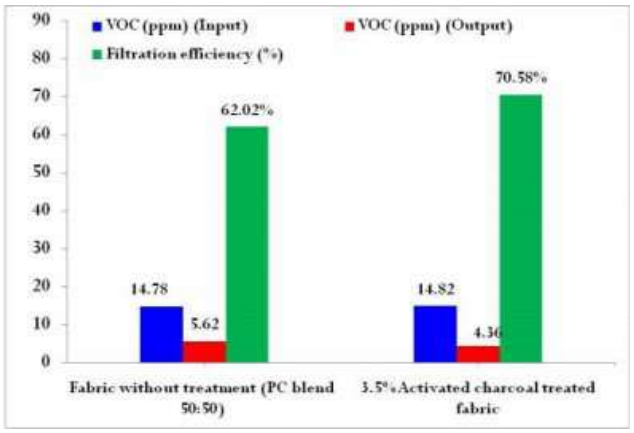
a. PM 2.5 Concentration



b. PM 10 Concentration



c. CO2 concentration



d. VOC concentration

Fig. 2.9 Concentration of different components in the input and output chamber

2.2.4 Development of cut-resistant fabric using 3D weaving

A single layer of high-performance fabric cannot protect against the sharp tool object accident and make up a significant percentage of injuries. As a result, adhesion or stitching must bind multiple fabric layers together for structural integrity and prevent delamination, which increases the stiffness of the products, reduces mobility or movement, and creates discomfort to the wearer. The multilayer weaving technique has been used in this work to overcome the above problem. Multilayer weaving structures were developed using two types of plain and twill weave. It consists of three layers of warp yarns of dyneema (420 D) on the top layer, polyester (420 D) on the middle, and bottom layer. Four different types of wefts have been used in the fabric, i.e. core spun Cotton/Nylon, core-spun cotton/steel, dyneema and polyester multi-filaments. The multilayer fabric produced with 72 ends per inch & 86 picks per inch were used for core

Fig 2.10 Multilayer Fabric weaving in a 2D weaving machine 1

spun yarns, and 172 picks per inch for Dyneema and polyester with 12 heald frames. The core-spun technology, cotton roving has been wrapped over the nylon(420D), and steel wire (0.12mm)were used as a core with optimized process parameters, and a 6 Ne yarn was produced and used as weft 86 picks per inch. The tests were performed for the plain and twill weave fabric as per *EN 388 standards*, and results are given in Tables 2.4 and 2.5. The results found that the core-spun cotton/nylon used in the weft yarn performed better on all the tests than other samples. The polyester and Dyneema-based weft yarn showed low abrasion resistance. The cotton/steel wire used in the weft also showed promising results, but the dimensional stability of the fabric is poor. When comparing the two weave patterns, the plain weave-based fabrics showed good results than the twill weave, especially in the puncture resistance test. It may be because the floating threads will be more in the twill weave so that yarns will slide easily during the testing.

Table 2.4. Plain weave Multilayer fabric and its properties 1

Sr. No	Weft	GSM	Abrasion Resistance	Coupe Test	Tear Strength	Puncture Resistance
1.	Core-spun cotton/nylon	650	Level 2	Level 2	Level 5	Level 2
2.	Core-spun cotton/Steel wire	702	Level 2	Level 1	Level 5	Level 2
3.	Polyester	496	Level 1	Level 2	Level 5	Level 1
4.	Dyneema	461	Level 1	Level 2	Level 5	Level 2

Table 2.5. Twill Weave Multilayer Fabric and its properties 1

Sr. No	Weft	GSM	Abrasion Resistance	Coupe Test	Tear Strength	Puncture Resistance
1.	Core-spun cotton/nylon	656	Level 1	Level 2	Level 5	Level 1
2.	Core-spun cotton/Steel wire	734	Level 2	Level 2	Level 5	Level 1
3.	Polyester	530	Level 1	Level 1	Level 5	Level 1
4.	Dyneema	480	Level 1	Level 2	Level 5	Level 1

2.2.5 Optimization trial of the ICAR-CIRCOT Kawadi Opener at Factory Level

Seed cotton when harvested may contain immature and unopened cotton bolls, called 'kawadi cotton', separated as waste during pre-cleaning operation in Indian ginneries. Annually about 2% of seed cotton i.e., 3-5 lakh-tonnes of kawadi cotton is reported, incurring huge losses to ginners. However, if properly processed using boll opener machines, good quality lint can be recovered, yielding additional economic benefits to the ginners. Without proper opening and cleaning, kawadi 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 the gin rollers.

Cotton Boll Opener machine has been designed and developed for opening up of cotton fibres from such unopened cotton balls to further extract and recover usable lint from kawadi cotton. The opened and cleaned raw cotton is delivered at the discharge-end. There is no damage to cotton fibres in the process.

The new paddle type cotton boll opener has operations for opening up of fibres by air turbulence and 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 kawadi cotton which is collected at the output end of the machine. The new design has centrally mounted paddle type beater assembly, motor drive, feed hopper and concave screen sections of sizes 12, 16 and 20 mm.

The ICAR-CIRCOT Boll Opener has overall dimensions of about 3.5 x 1.5 x 1 m, 500 kg weight and connected total power of 5 HP. It can process about 6-8 Q/h of raw kawadi cotton with an efficiency of 80%, yielding 5-6 Q/h of opened and cleaned kawadi cotton that can be ginned on double roller gin to extract lint and cottonseed.

Fig. 2.11. ICAR-CIRCOT Boll Opener machine processing kawadi cotton

2.2.6 Evaluation, Optimization and Standardization of different types of lint cleaners used in Ginneries

Questionnaire has been prepared to collect information on lint cleaner and visited few ginning industries near Nagpur to collect information on Lint cleaners. MoU has been signed with M/s Bajaj Steel Industries Limited, Nagpur for evaluation, optimization, and standardization of different types of lint cleaners used in Ginneries.

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

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

The mandate of All India Coordinated Research Project on Cotton is principally applied research with the objective of increasing productivity, sustainability and profitability of cotton. Genetic enhancement programmes on *hirsutum* cottons especially for fibre quality improvement and resistance to drought, pests and diseases have received adequate attention to fulfill the requirements of farmers and the industry. The challenges in crop improvement are complex and significant efforts are made to further increase the productivity and fibre quality to enable sustainability and improve the competitiveness of cotton farming and textile industry. ICAR-CIRCOT undertakes the fibre and yarn quality assessment of ICAR-AICRP on Cotton samples and presented in the Annual Technological Report. Quality parameter data was generated on the cotton samples received from the cotton breeders throughout the country from breeders pertaining to the ICAR-AICRP on Cotton Zonal Trials (North Zone, Central Zone and South Zone) and National Trials. In all, the technological data on 2611 samples have been reported. Under Agronomy trial, 32 samples were received for spinning performance along with fibre quality assessment. The quality parameters of all cotton fiber samples were measured by using the High-Volume Instrument operated in the HVI Mode. The data was analyzed and reported. Analysis of some of the national trials is given in this report

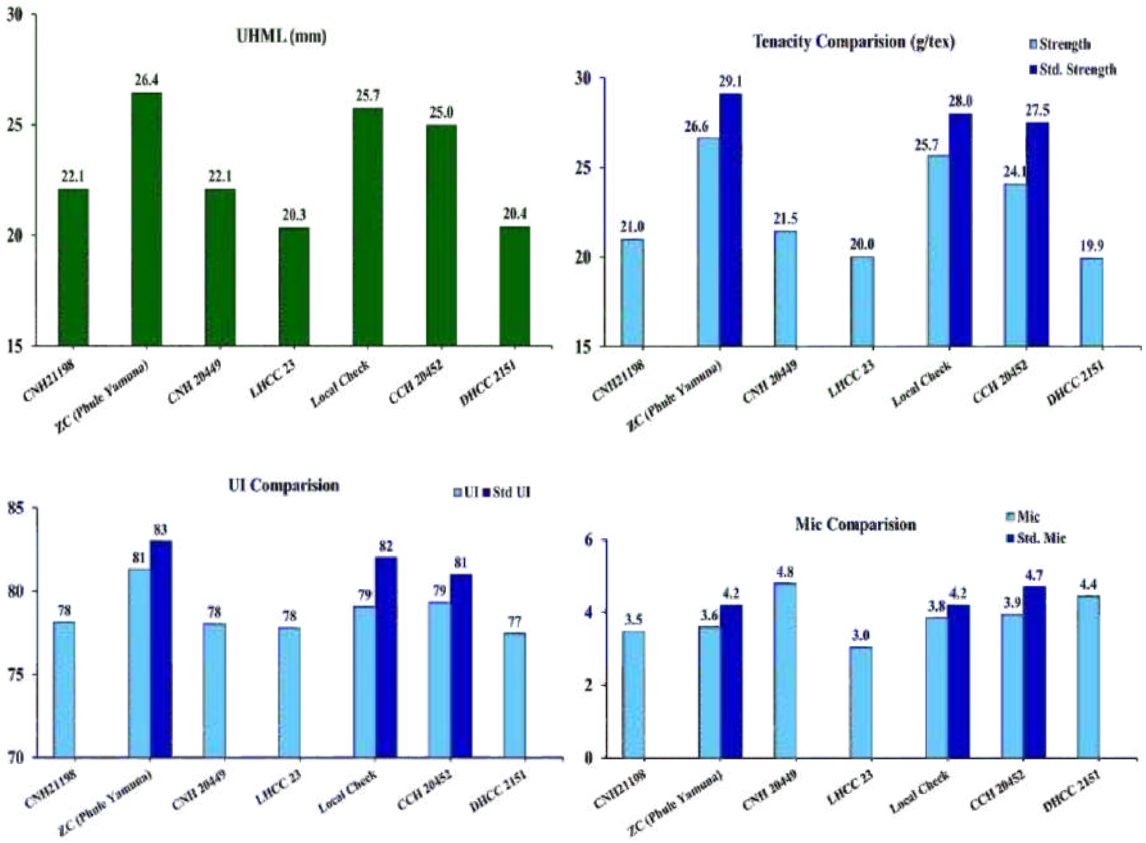


Fig. 2.12 G. hirsutum - Coloured Cotton (Irrigated/Rainfed) - Br02 a/b CC - IET 1

Entry CCH 20452 (UHML 25mm, Strength 24.1 gpt, UI 79 and micronaire 3.9) has performed well. 1

Table 2.6: Number of samples evaluated under different trails in AICRP on Cotton 1

Trial	2019-20	2020-21	2021-2022
National	1457	1163	161
North Zone	154	110	208
Central Zone	535	449	266
South Zone	425	415	192
Agronomy	46	62	32
Bt	1147	1297	1749
Total	3764	3496	2611

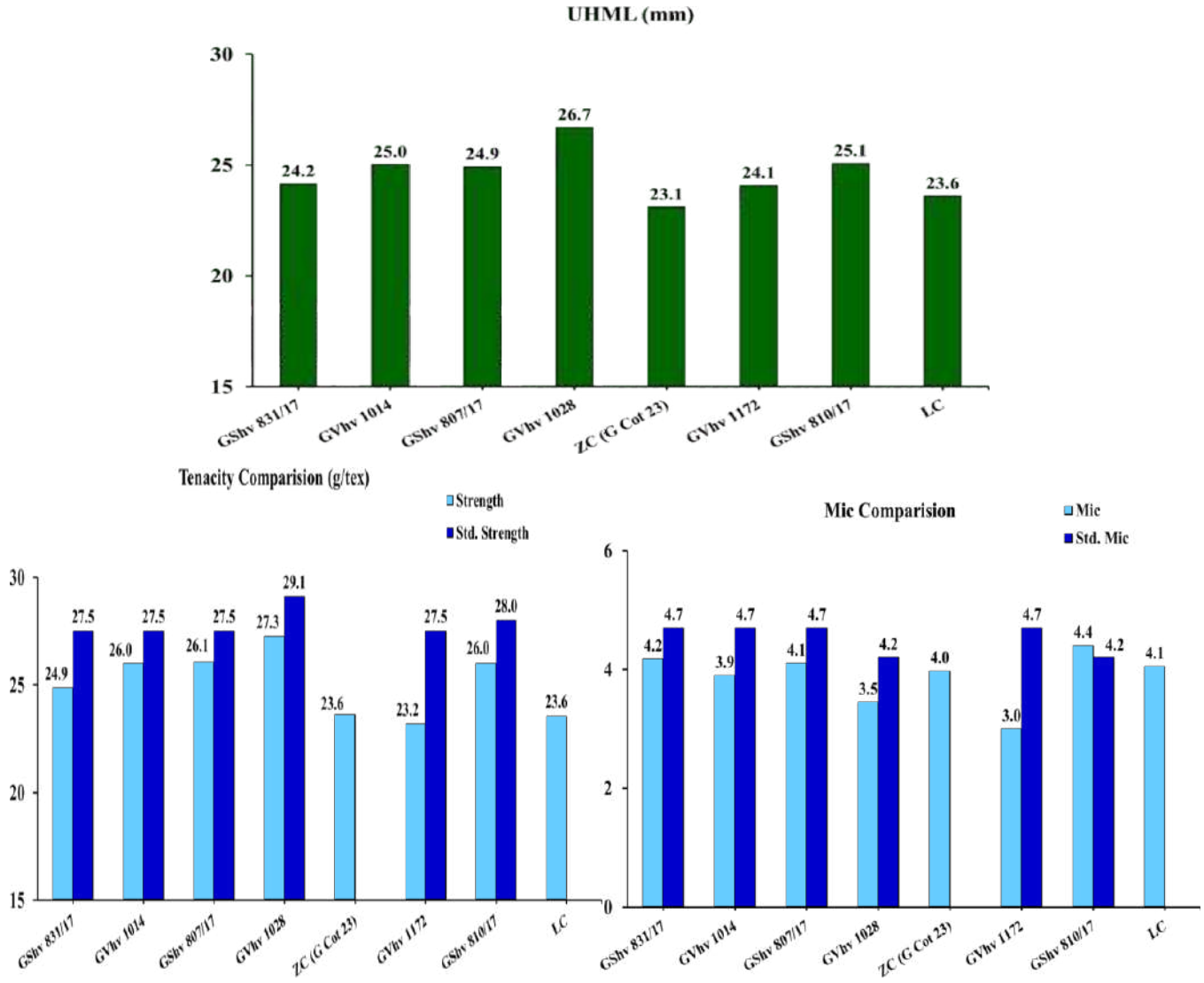


Fig 2.13 *G.herbaceum* - Br.32b of IET 1

Entry GVhv 1028 (UHML26.7 mm, Strength 27.3 gpt, UI 83 and micronaire 3.5) has performed well 1

Table 2.7: North Zone Trails 1

S.No	Trial	Entries	Best
1	Br.22 a/b Initial Evaluation Trial *G.arboreum*	12	FDK 315 *(UHML 21 mm, Strength 20.3 gpt, UI 78 and micronaire 6.6)*
2	Br.25 a/ Preliminary Hybrid Trial – Desi Hybrid	9	CISAA 20-1 *(UHML 20.6 mm, Strength 19.8 gpt, UI 79 and micronaire 6.7)*
3	Br04 a – Coordinated Variety Trial of *G.hirsutum*	9	PBH-79 *(UHML 27.6 mm, Strength 28.5 gpt, UI 81 and micronaire 4.1)*
4	Br-24a – Coordinated Variety Trial of *G.arboreum*	6	FDK 312 *(UHML 21.6 mm, Strength 22 gpt, UI 78 and micronaire 6.4- absorbent cotton)*
5	Br.25a – Coordinated Desi Hybrid Trial	7	CISAA 19-3 *(UHML 23.1mm, Strength 23.5 gpt, UI 78 and micronaire 6.0)*

Table 2.8 Central Zone Trails 1

S.No	Trial	Entries	Best
1	Br03a/b – PVT Coloured Cotton Irrigated	8	No entry performed well
2	Br04a – CVT – Irrigated	8	TCH 1941 *(UHML 28.7 mm, Strength 27.8 gpt, UI 83 and micronaire 4.4)*
3	Br04b – CVT – Rainfed	8	CNH 119 *(UHML 28.6 mm, Strength 26.0 gpt, UI 82 and micronaire 4.6)*
4	Br-24 b CVT – *G.arboreum*	17	PA 873 *(UHML 27.9 mm, Strength 27.4 gpt, UI 83 and micronaire 5.0)*
5	Br-24b – CVT Coloured Cotton – *G. arboreum*	10	CNA 18563 *(UHML 25.1mm, Strength 25.9 gpt, UI 81 and micronaire 5.5)*

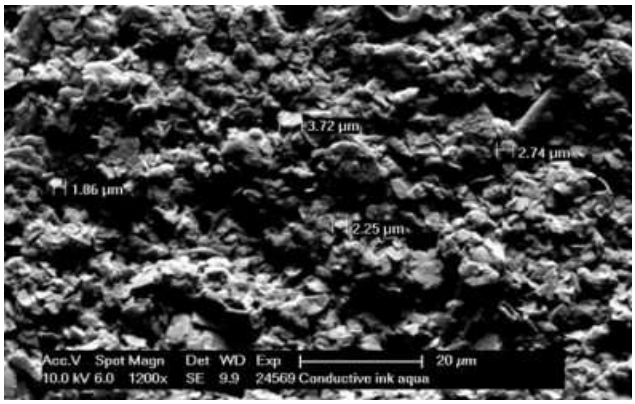
Table 2.9 South Zone Trails 1

S.No	Trial	Entries	Best
1	Br03 a/b (CC) – PVT Colour Cotton – Irrigated	11	CCHC 19-2 (UHML 27.8 mm, Strength 25.6 gpt, UI 82 and micronaire 3.6
2	Br04a – CVT – Irrigated	13	No Entry has performed better than ZC
3	Br14a – CVT *G.barbadense*	9	No entry has performed better than ZC.
4	Br04b – CVT – Rainfed	9	CCH-19 2 (UHML 31.8 mm, Strength 32.2 gpt, UI 87 and micronaire 3.6
5	Br24b– CVT - *G.arboreum*	14	CNA 2035 (UHML 28.8 mm, Strength 26.2 gpt, UI 83 and micronaire 4.9
6	Br24 a/b-CVT *G.arboreum* (CC) - Rainfed	6	No entry has performed well

- The CVIC meeting was held on 7th April 2022 and proposals for 74 Bt. and 24 non-Bt. Cotton were screened on the basis of fibre quality. In national trial *G.herbaceum* trial performed better than local and zonal checks
- Natural coloured cotton trial (*G. hirsutum*) of south zone resulted in improved fibre length and strength
- Natural coloured cotton trial (*G. arborium*) of central zone resulted in improved fibre length and strength
- In *G.hirsutum* CVT trial of both central and south zones entries had not performed better than quality check
- In most of the trial tenacity and micronaire are not meeting standard requirement

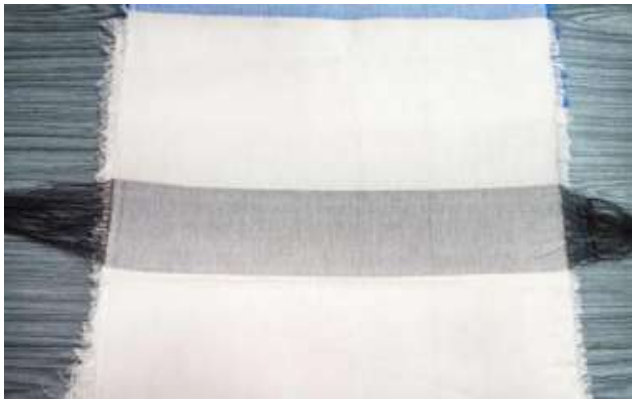
2.3.2 Development of Electrically Conductive Cotton Materials 1

Under this project, electrically conductive paste was developed. The resistance of the developed conductive paste was measured to be 20-30 ohms/cm. The conductive paste was developed for cotton substrate, which is also suitable for cotton blended materials. The conductive paste was developed using graphite power as major ingredient along with silica-based binders. The developed conductive paste can be used for various applications like printing the circuit board on fabric, produce the electrically conductive yarn or sewing threads, developing the RF protective fabrics etc.



(a) 1

(b) 1



(c) 1

(d) 1

Figure 2.14: (a) SEM photograph of conductive paste (b) Conductive paste coated cotton yarn (c) Woven fabric using conductive yarn (d) Conductive paste coated cotton fabric

2.3.3 Development of Machine Learning Model for Trash Content Analysis based on High Volume Instrument and Gravimetric Method of Trash Content Estimation

Trash content in cotton has significant impact on all phases of cotton value chain. It plays an important role in fair valuation of growers' cotton through services provided by classing operation. In the gins, it assists with optimization of the ginning process. In spinning, it influences major quality and cost factors in yarn production. In many of the grading systems of classifying cotton, as percentage of trash increases the quality decreases. But the amount of trash is never accepted as the sole criteria of grading. Most commonly used method for assessment of trash content is by Shirley trash analyser. In this instrument, the separation of cotton lint and trash depends upon pneumatic flotation. High Volume Instrument (HVI) has a module, which measures colour and trash content of cotton by using image processing. The measurement is based on a viewing area measuring 9 cm^2. Trash area is given by the percentage of sample viewing area occupied by trash. Trash count reports the number of trash particles whose diameter is ≥ 0.025 cm. Five samples of fixed (known) trash content of 1 to 5% each were prepared. A protocol has been developed for uniform mixing of trash with cotton to prepare sample of known trash content. Sample with different trash content for long fibre was prepared and trash analysis using HVI and gravimetric method was done for the same to prepare the data set. To make the data set more robust for machine learning application, commercial and AICRP samples of trash content is also being included.

2.3.4 Development of AI based Prediction Model for Yarn Quality Characteristics 1

HSC index modelling using AICRP data

ICAR-CIRCOT conducts fibre quality evaluation of cotton samples received from breeders and also performs spinning of agronomy experiment samples which were in the final stage of release for commercial cultivation. Data on the results of quality evaluation are presented annually in AICRP workshop and published as cotton technological report. In this study, data for the period 2015-16, 2016-17, 2017-18, 2018-19, 2019-20, 2020-21, 2021-22 pertaining to agronomy trials were collected from AICRP cotton technological reports and used for the development of models. Highest spinnable count was calculated using an ICAR-CIRCOT developed algorithm. Multiple regression equation was developed using backward regression using SPSS software. In the regression, variable HSC was used as the independent and UHML, UI, mic, strength, and elongation were used as dependent variables. Similarly, machine learning models were developed using Automl of H_2O platform. In the machine learning, fibre parameters are kept as input variable and HSC was used as response variables.

Summary of data of fibre and yarn properties are given at Table 2.10. Total number of data used in the study are 244. This study included a minimum UHML of 20.8 mm. UI of cotton used in this modelling covered the entire spectrum of UI, that is very low to very high.

Table 2.10: Summary of cotton fibre and yarn properties 1

Parameters	Minimum	Maximum	Mean 1
Upper Half Mean Length (mm)	20.8	36.9	27.9 1
Uniformity Index	77.0	89.0	83.2 1
Micronaire (µg/inch)	2.7	5.9	4.2 1
Bundle strength (g/tex)	20.3	41.2	28.0 1
Elongation (%)	3.7	6.9	5.7 1
Yarn count_1 (Ne)	12.0	95.7	35.5 1
Count Strength Product_1 (CSP)	1529	2915	2260 1
Yarn count_2 (Ne)	16.0	120.0	46.6 1
Count Strength Product_2 (CSP)	1400	2608	2040 1
Highest Spinnable Count index (Ne)	2.3	91.1	38.8 1

It can be seen at Table 2.10 that a maximum count of 120s Ne was spun from a cotton having a minimum micronaire of 2.3. Cotton fibre strength used in this study were in the range of 20.3 g/tex to 41.2 g/tex. It is to note here that fibre parameters used in this study were measured in HVI mode. In addition to using fibre strength as input variable, two additional parameters viz SL ratio and SLSTR. Integration parameter of strength and length were calculated by dividing fibre length by strength and called it as SL ratio. Similarly, another parameter namely SLSTR is calculated by multiplying SL and STR. Cotton normally has an elongation % in the range of 6-9%. In this study elongation found to vary from 3.7 to 6.9.

Correlation coefficient matrix is given at Table 2.11. HSC is having signification correlation with all the input variables namely UHML, UI, mic, str and E. Highest significant correlation coefficient of 0.815 is observed for UHML indicating that it is the most important variable in the prediction of HSC. Higher fibre length is associated with finer count. Except micronaire, all the other fibre parameters are positively correlated with HSC. Micronaire being indication of fibre linear density, higher micronaire will result in less number of fibres in yarn cross section and hence higher micronaire cotton may not offer required number of fibres per yarn cross section for optimum spinning. UHML is found to have significant correlation with all the variables. Elongation found to be unrelated with UI and strength showing non-significant correlation co-efficient.

Table 2.11: Correlation between cotton fibre parameters and HSC 1

Parameter	UHML	UI	Mic	Str	E	HSC 1
UHML	1	.712**	-.393**	.753**	.199**	.815**
UI	.712**	1	-.087	.648**	-.004	.592**
Mic	-.393**	-.087	1	-.169**	-.307**	-.534**
Str	.753**	.648**	-.169**	1	.050	.718**
E	.199**	-.004	-.307**	.050	1	.230**
HSC	.815**	.592**	-.534**	.718**	.230**	1

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

Backward regression performed on the data resulted in 3 models (Table 2.12). Model 1 includes all five input variables, model 2 with four input variables except elongation and model 3 with three variables except elongation and UI. A backward-elimination rule starts with all possible explanatory variables and then discards the least statistically significant variables, one by one. The discarding stops when each variable remaining in the equation is statistically significant. Even though all the models are significant, the model with all five variables (Model 1) are selected for studying the effect of individual variables on HSC.

Table 2.12: Regression models summary

				Std. Error	Change Statistics				
Model	R	R Square	Adjusted R Square	of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.876[a]	.767	.762	7.8793	.767	156.904	5	238	.000
2	.875[b]	.766	.762	7.8891	-.002	1.599	1	238	.207
3	.874[c]	.763	.760	7.9141	-.002	2.519	1	239	.114

a. Predictors: (Constant), E, UI, Mic, Str, UHML, b. Predictors: (Constant), UI, Mic, Str, UHML,

c. Predictors: (Constant), Mic, Str, UHML, d. Dependent Variable: HSC

$$HSC = (2.095 \times UHML) + (0.67 \times UI) + (-7.686 \times Mic) + (1.777 \times str) + (1.175 \times E) - 99.829 \quad \text{Model 1}$$

Percentage relative contribution of each variable towards HSC was studied using the formula given as equation 1: Where, Bi is the standardized coefficient of i^{th} value (i = 1,2,3.....k) and R^2 is the coefficient of determination.

$$100\left(\frac{B_i}{\sum_1^k B_i}\right) R^2 \text{----------Eq.1}$$

It is observed that the contribution of UHML is the maximum (33.9%) followed by Str at 28% and Mic at 27% (Fig. 2.15). The least influencing variables are UI and elongation. The regression model is able to explain 76% of the variation of in HSC.

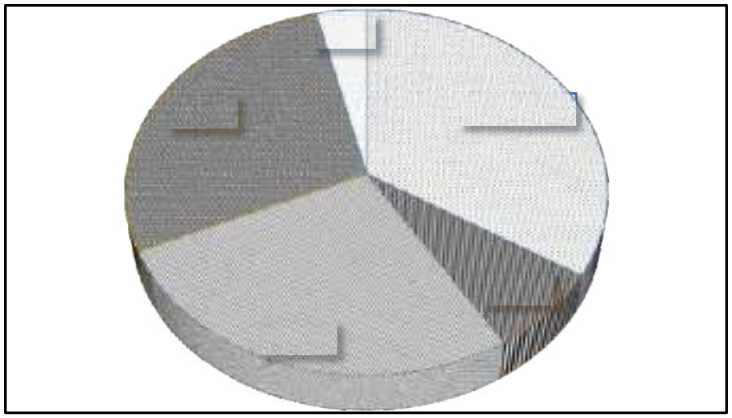


Fig. 2.15: Importance of difference fibre properties on HSC 1

In order to compare with effect of interaction parameters of SL and str, 2 integrated properties namely SLstr ratio and SLSTR multiplication factor also studied using them as input variables. It was observed that use of SLratio dropped the R^2 value by 22% from 0.76 to 0.59. On the contrary, use SLSTR integration parameter gave the coefficient of determination value (R^2) equivalent to that of all input variable model that is 0.76.

Auto machine learning systems are available in the commercial and open-source platforms include BigML.com, Wise.io, H_2O.ai, feedzai.com, RapidMiner.com, Prediction.io, DataRobot.com, Microsoft's Azure Machine Learning, Google's Cloud Machine Learning Engine, and Amazon Machine Learning. Among these machine learning platforms, H_2O AutoML produces high quality models that are suitable for deployment in an enterprise environment. H_2OAutoML was used to develop models by keeping all the five cotton fibre parameters as input and HSC as output.

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

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

The toxicological study of the developed nano-Zn suspension was carried out in this project. In case of seed toxicity assay, the stunting of roots in germinating wheat after exposure to 400 ppm Nano-Zn suspension was observed as compared to control wheat, in addition to denser root-hair production. Lower concentration of nano-Zn did not show any significant changes in the seed germination. Moong seeds did not show any variation in germination even at 400 ppm concentration of nano-Zn suspension.

The antimicrobial potency of Nano-Zn suspension was analysed by broth dilution method against biofilm causing algae. All flasks (having nano-Zn concentration less than 400 ppm) showed uniform algal growth while the flask with 400 ppm Nano Zn suspension showed visibly lesser growth (Fig 2.16). The nano-Zn does not show any antifungal activity against *Alternaria* spp, which is a ubiquitous fungus in the environment and it was found to enhance the growth of the fungus. For cytotoxicity against yeast, all the experiments except the negative control showed good growth of the yeast indicating that nano-Zn does not show any cytotoxicity towards yeasts at the analysed levels.

In case of toxicity against phosphate solubilising bacteria, *P. aeruginosa* showed phosphate solubilization upto 1,20,000 ppm of nano-Zinc. However, the activity decreased in a dose dependent manner. Phosphate solubilizing activity of *P. putida* and *B. megaterium* was affected significantly even at 5000 ppm of nano-Zn. Bacteria exposed to higher dosages of nano-Zn also had a relatively short exponential phase as compared to that of control, suggesting bacteriostatic effect. In case of MTT assay, it was observed that nano-Zn reduced the cell viability in a dose dependent manner. After 24 h, no growth was observed at 2,00,000 ppm suggesting that the MIC of nano-Zinc against *P. putida* is 2,00,000 ppm. Cell viability of bacteria exposed to 50,000 ppm of nano-Zn was at par with the control. Based on these outputs, the safe level of nano-Zn suspension was identified as 200 ppm and the same will be recommended for foliar application in field crops.

Fig 2.16 Effect of Nano-Zn on growth of algae

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

Determination of physicochemical properties of vegetable oils and blends

Cottonseed and other common vegetable oils *viz*. groundnut oil, sesame oil, coconut oil and palm oil were procured from the local market. Except cottonseed and palm oil which were refined, other oils were of cold pressed type and contained no added antioxidant. These were analyzed for their physicochemical properties such as color, density, viscosity and free fatty acids. Knowledge of physical properties of oils is of great practical interest when modifying oils using blending in order to find a suitable blend.

Visual monitoring of pure vegetable oils displayed difference in colour with coconut oil being the least pale followed by cottonseed oil, groundnut oil and palm oil with sesame oil being the most yellow. The blends prepared by mixing different ratios of cottonseed oil with other oils showed moderate colours and the same observation was confirmed by colour matching instrument.

Density of vegetable oils and their blends with CSO was determined and presented in Table 2.13. The density differs between the oils according to the nature of fatty acids that compose the oil. Density was found to vary from 0.898 for CSO & sesame oil blend to 0.911 for CSO & groundnut oil blend.

Table 2.13. Density, viscosity and FFA value of unblended vegetable oils and blends

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

Viscosity of the vegetable oils and their blends with CSO was determined using Ostwald viscometer at 25°C. The flow time of the fixed volume of oils was measured by letting them flow through a capillary tube. The viscosity is

proportional to the flow time of oil and expressed in centipoise. The viscosity of edible oils is a parameter used to describe quality. Oil viscosity is also important in design of process equipment for the edible fat and oil industry. Viscosity values of different oils shows that palm oil was most viscous (50.48cps) followed by groundnut oil (41.55 cps) while CSO was least viscous (30.67cps) and blending with CSO considerably reduced the viscosity of both these oils. Free fatty acid (FFA) value of the oils was also determined by using AOCS methods and is presented in Table 2.13. It is observed that CSO had lowest FFA content and blending with it has reduced the FFA content of sesame oil from 2.11 to 0.12 which is lowest among the blends.

Oxidative stability

Oxidative stability of the vegetable oils and their blends was determined by keeping 100g mixture of CSO and other vegetable oils in 250-mL beakers at 60 ˚C for 28 days and evaluating the peroxide value (PV) and anisidine value (AV) after every 7 days. Oxidative stability was determined by observing the difference in initial and final readings of the oil samples.

Oxidative stability of individual oils and oil blends indicated that apart from inherent natural antioxidants in oil, PUFA content is an important factor influencing their oxidative stability. Oxidative stability index (OSI) was inversely proportional to PUFA content and the oxidative stability of high PUFA oil (CSO) increased by blending with high SFA and MUFA oil. Peroxide values and anisidine values of the oils and blends reveal that PV of oils and blends increased with storage duration. Among all oils, CO was least prone to peroxide formation, while CSO had greater rate of peroxide formation. As the percentage of CO increased in the CSO-CO blends from 20 to 50%, PV value declined. CSO-CO blends showed the least PV after 28 days of storage at high temperature (60 ˚C) thus indicating that CO provided oxidative stability to its blends. CO, to a certain extent inhibited peroxide formation in the oil blends. Therefore, it can be concluded that the presence of CO in the oil blends was responsible for the decrease in the rate of peroxide formation. Other oils also inhibited peroxide formation when their proportion was increased in the blends. Para-anisidine value of CSO-CO, CSO-PO, CSO-SO and CSO-GO blends ranged between 4.8-10.16, 11.80-12.13, 10.68-11.62, 8.97-11.82 (units) respectively. The unblended CSO, SO, PO and GO oils showed para-anisidine values of 10.18, 11.23, 14.51 and 12.87 respectively.

2.4.3 Development of Health Drink from cottonseed 1

The cottonseed milk powder was produced under this project from non-Bt variety Vihani-161 (north region) and Phule Dhanwantri (central region). The variety is evaluated for various biochemical parameters such as crude protein, free gossypol, and total gossypol. The parameters are considered important for getting a good quality cottonseed milk powder.

The preparation of cottonseed milk was standardized and same was lyophilized to get cottonseed milk powder. We achieved 18% cottonseed milk powder on dry weight basis from 200 g of cottonseeds. Biochemical analysis showed that obtained cottonseed milk powder have high content of crude protein (39%) (Fig. 2.17).

Fig. 2.17. cottonseed Milk Powder

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

Cotton seed hulls (CSH) is lignocellulosic biomass and mostly contain cellulose, hemicellulose and lignin as chief constituents, along with a considerable high amount of xylan (27-30 %) in its hemicellulose polymer. To the best of our knowledge, the use of CSH as a substrate in the microbial enzyme production have been not reported. With this background, we assessed the potential of CSH as a promising substrate for the production of thermostable and alkali tolerant xylanase and the effect of xylanase on structural features and morphology of CSH using FTIR and SEM analysis.

For the first time, the process protocol to project CSH (1 % w/v) as a potential substrate for production of thermostable and alkali tolerant microbial xylanase was reported. Proximate analysis of CSH revealed that content of holocellulose, alpha-cellulose, hemicelluloses, and lignin, were 65.6%, 38.8%, 24.5%, and 18.5%, respectively. Based on the earlier investigation, two promising xylanolytic bacteria namely *Bacillus pumilus* (MTCC 10414) and *Bacillus lichiniformis* were selected for producing thermostable and alkali tolerant xylanase using CSH as a substrate. The ability of CSH to support the production of thermostable and alkali tolerant microbial xylanase by these bacteria was estimated by measuring reducing sugar released from substrate. Compared to control (97. 15 ug/ml), the significant amount of reducing sugar was released when *B. pumilus* (1175 ug/ml) and *B. lichiniformis* (1278 ug/ml) hydrolyzed CSH, indicating the suitability of CSH for growth and production of xylanase by these bacteria. Concerning thermostability and alkali stability, xylanase produced by both bacteria were thermotolerant, with corresponding activity of 15.69 µmol /ml/min (for *B. pumilus*) and 14.71 µmol/ml/min (for *B. lichiniformis*) at 55^0C. Likewise, bacterial xylanase was also stable at alkaline pH ranging from 7-9. We also performed FTIR analysis to acquire the changes in structural (both qualitative and quantitative) components in biomass and predict biomass digestibility after xylanase enzymatic hydrolysis**.** FTIR analysis showed the stretching and deformation of inter and intermolecular bonds of different components of CSH biomass (Fig 2.18a). The band around 3318 cm^{-1} corresponds to O–H stretching of lignin and hemicelluloses polymer and peak around 2950-2850 cm^{-1}corresponds to aromatic C–H deformation (present in cellulose, hemicellulose and lignin). The band around

1635 cm^{-1} and 1508 cm^{-1} corresponds to un-conjugated aromatic C–O stretching and stretching and vibration in the C-C-C aromatic ring present in lignin components of CSH biomass. Likewise. Scanning Electron Microscopic (SEM) analysis revealed that CSH subjected to the crude xylanase showed increase in surface smoothness, cleanliness and presence of cracks/grooves on its surface, possibly due to xylanolytic action on hemicellulose and lignin of the CSH. Briefly, these all studies indicate the promising potential of CSH as a substrate for production of thermostable and alkali tolerant bacterial xylanase. The produced thermostable and alkali tolerant enzyme is useful for the biobleaching of lignocellulosic based paper pulp in order to reduce bleaching chemical use and environmental pollution from paper and pulp industry.

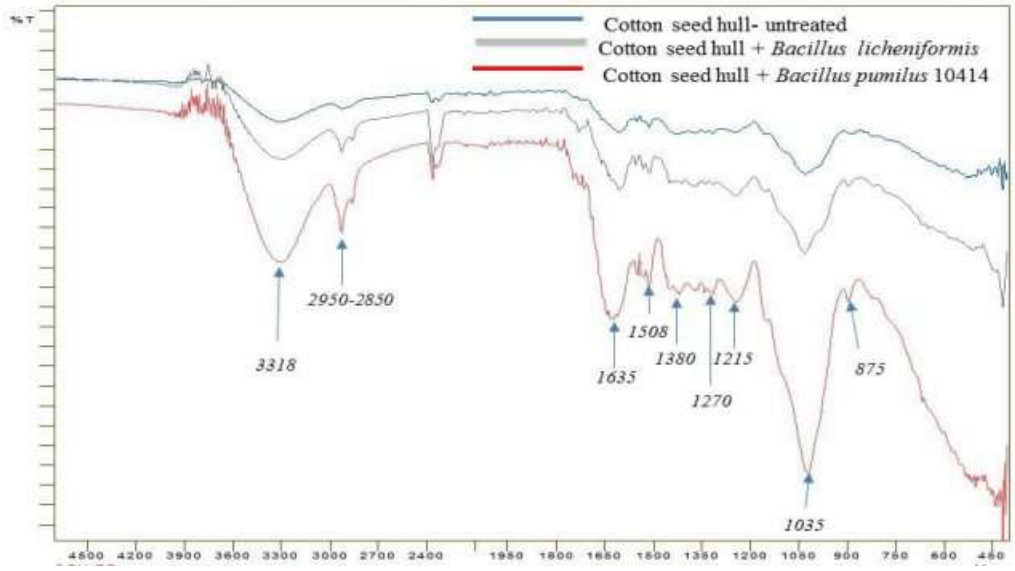


Fig. 2.18 a. FTIR spectral (600–4000 cm^{-1}) analysis of xylanase producing bacterial treated cotton seed hull

Optimization of fermentation process for production of microbial xylanase using cotton seed hull (CSH) as a substrate

Based on the initial substrate screening and microbial germplasm evaluation, cottonseed hull as a best suitable substrate and *Bacillus pumilus* and *Bacillus licheniformis* as a best xylanase producing bacterial strains were selected further for the standardization of process parameters for production of bacterial xylanase using cotton seed hull (CSH) as a substrate. CSH Being a rich in hemicellulose (24.5 %), it is potential substrate for the production of hemicellulose breaking and utilizing microbial enzymes such as xylanase (referred as hemicellulases enzyme). Keeping this in mind, different fermentation parameters such as substrate(CSH)concentration (% w/v), pH of media (5,6, 7, 8, 9, and 10), incubation temperature (30, 35, 40, 50, and 60^{0}C), time of incubation (24h, 48h and 72h), bacterial inoculamrate (% v/v), source of nitrogen, and different enzyme-substrate incubation time were optimized. Experimental result indicted that 0.5% and 0.2% CSH as substrate was found optimum for the enhanced xylanase activity by *B. pumilus*(401.36±2.47umole/ml)and *B. licheniformis* (209.77±6.80umole/ml), while, growth media with neutral pH(pH-7) yielded maximum xylanase production by both *B. pumilus*and *B. licheniformis.* Concerning the incubation temperature, an incubation temp of

35^{0} and 40 ^{0}C was optimum for the highest xylanase production by *B. pumilus*and *B. licheniformis,* respectively (Fig 2.18). In regards to nitrogen source, ammonium sulphate yielded highest xylanase. An economic process for production of microbial xylanase using CSH as a substrate was standardized.

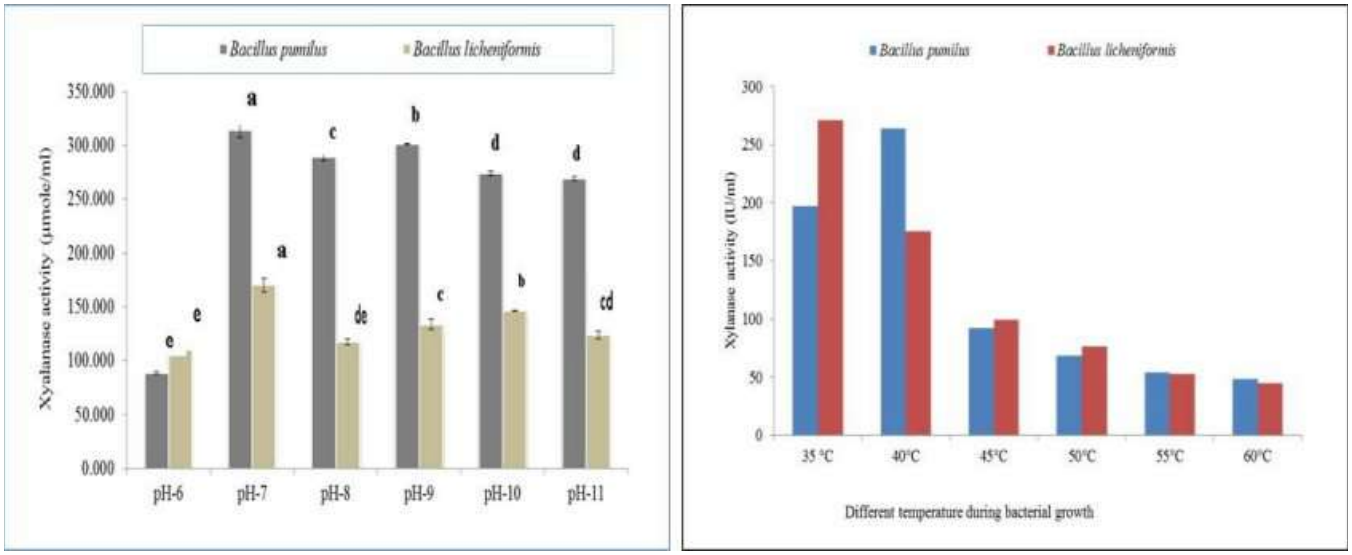
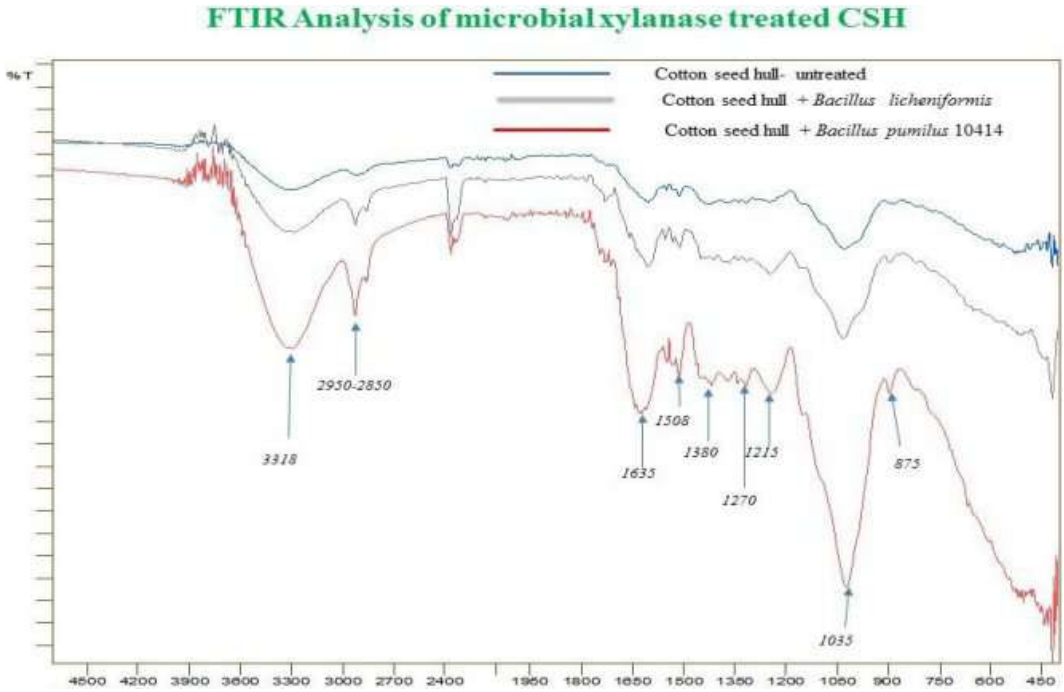


Fig 2.18 b. Effect of different pH of growth media (5, 6, 7, 8, 9, and 10) and incubation temperatures (30, 35, 40, 50, and 600C) on the production of xylanase by B. pumilusand B. licheniformis 1



2.4.5 Isolation of Gossypol from cottonseed and its evaluation as a botanical fungicide

Optimization of the process for gossypol extraction from cottonseed meal.

The parameters identified for optimization of the process to extract gossypol from the cottonseed meal are acetone: water ratio, extraction time and temperature. Cottonseed meal (10 g) was soaked in 100 mL of solvent in a conical flask and kept under shaking

conditions at 30°C for 4 h. After that the extract obtained was filtered through Whatman filter paper and kept at 4°C in the refrigerator. The cottonseed meal left after solvent extraction was dried and evaluated for the residual gossypol. Three different ratios of acetone: water solvent was used for the extraction in order to find the optimum solvent providing maximum gossypol recovery.

Fig. 2.19 Illustration of gossypol extraction from cottonseed meal 1

Standard gossypol acetic acid (4 mg/mL DMSO) was evaluated for antifungal activity against phyto-pathogenic fungus *Alternaria alternata* by poison food method. But no significant inhibitory activity was observed. Although the fungal growth was lower than the control but no significant difference was observed in the plates with only DMSO and with DMSO + gossypol acetic acid.

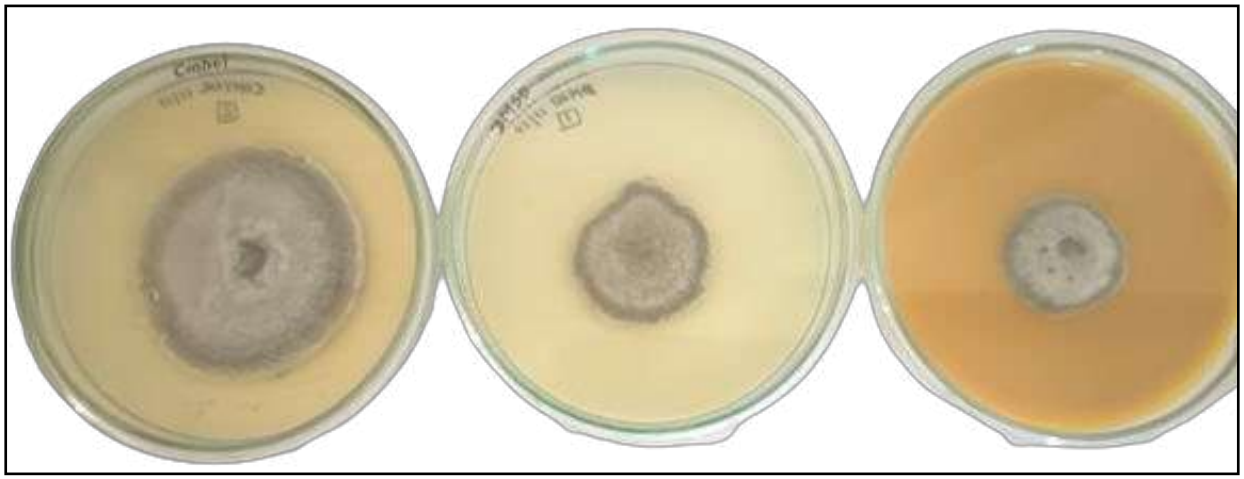


Fig. 2.20 Antifungal activity of standard gossypol acetic acid against A. Alternata.

2.4.6 Development of functional edible coating for preservation of fruits

Fruits and vegetables are enriched with vitamins & minerals, so they are considered a major source of nutrients for humans and animals. Around 45% of the fruits harvested are lost annually due to spoilage caused by contaminated growth environments, inappropriate harvesting conditions, unsafe handling, and storage processes, and incorrect methods of display. Edible coatings on fresh fruits and vegetables prolong the shelf life by

reducing quality changes and quantity losses through modification and control of the internal atmosphere of the individual fruit or vegetable. The efficacy of edible coating depends upon the coating materials selected so that a desirable internal gaseous atmosphere can be obtained. Functional nanocomposite coating containing naturally-derived bioactive substances with excellent antioxidant and antimicrobial properties can result in improved barrier and mechanical properties of coatings, while additionally ensuring the quality and safety of the fruits.

In order to formulate functional edible coating for fruits, five essential oils (EO) *viz*. cinnamon, clove, thyme, tea tree, and ajwain EOs were evaluated for their antimicrobial and antioxidant activities. Owing to the high antioxidant activity and antifungal properties, thyme and clove EOs were used to formulate the functional coating.

Seven formulations were prepared at different concentrations of EOs (0.05% & 0.1% Thyme EO, 0.05% & 0.1% Clove EO, 0.025% & 0.05% of Thyme and Clove EO each, control without EO). Sodium alginate was the primary biopolymer and crystalline nanocellulose was incorporated in order to prepare pickering nanoemulsion. The emulsion and dried films were evaluated for particle size, creaming index (stability), thickness, opacity, and water vapour permeability for characterization. Formulation containing both thyme and clove EOs at 0.025% concentration resulted in optimum antimicrobial and antioxidant properties. The DPPH radical scavenging activity was 64.5%, and average particle size was 430.5 nm in the optimum nanoemulsion. Better performance upon coating guava fruits was also observed with the same formulation.

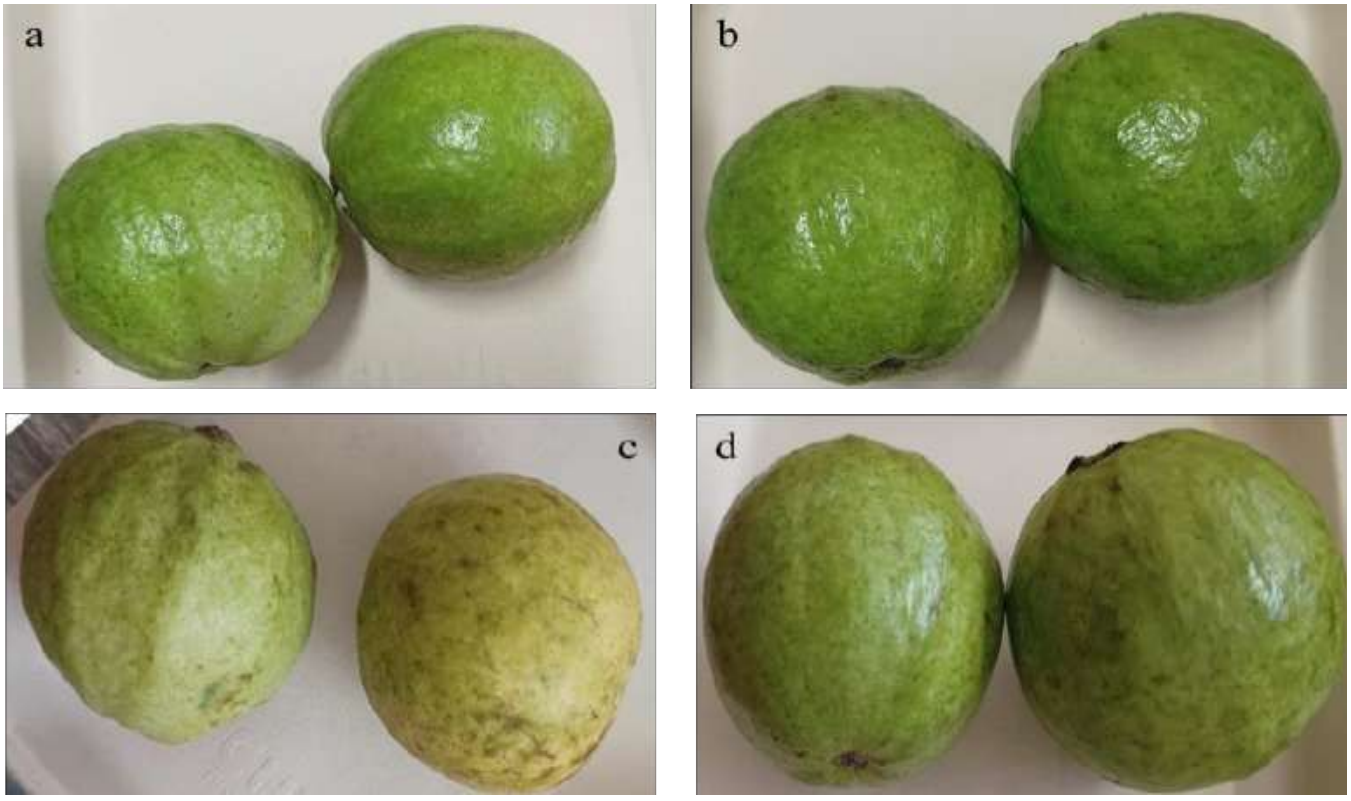


Fig. 2.21 Guavas (a) uncoated, 0 day (b) coated, 0 day (c) 5 days storage (d) 5 days storage under ambient condition 1

2.5 CORE AREA V: ENTREPRENEURSHIP AND HUMAN RESOURCE DEVELOPMENT

2.5.1 Refinement and popularization of nutrient-enriched compost production from cotton micro-dust

In the project, attempts were made to identify cellulolytic microorganisms which can tolerate high temperatures for their exploitation in composting of cotton micro-dust. A total of twenty microbial isolates were obtained and they were screened for production of cellulase enzyme on Reese's mineral medium supplemented with 1% (w/v) CMC at 55 °C. The colonies which showed orange halo zone around their growth indicated positive for cellulase enzyme production. Among 20 isolates, 5 isolates were found to be produce cellulase enzyme at thermophilic temperature (55 °C).

Qualitative and quantitative screening of isolates showed that two isolates, M-10 and M-12 were able to produce high solubilization index at both 30°C and 55°C. These two promising isolates were selected for further studies and a compatibility among these two were studied on NA medium. The results revealed that these two isolates were compatible with each other. Based on the above observation, a microbial consortium comprising of these two isolates was developed.

Two bacterial isolates were molecularly identified as *Bacillus tequilensis* and *Bacillus piscis*. These two isolates were deposited in National Agriculturally Important Microbial Culture Collection (NAIMCC), ICAR-National Bureau of Agriculturally Important Microorganisms (NBAIM), Mau and their accession numbers are: *Bacillus piscis* M-12: NAIMCC-B-3060; b. *Bacillus tequilensis* M-10: NAIMCC-B-3061

In case of temperature optimization, it was found that at 30°C, isolate M-10 showed maximum growth and biomass yield (O.D. – 1.935; 0.035 g) which was declined at 40°C and 50°C. At 40°C, isolate M-12 showed maximum growth and biomass yield (O.D. – 1.847; 0.027 g) and reduced at both 30°C and 50°C. At 40°C, both M-10 and M-12 resulted in minimal growth and yield as compared to remaining temperatures. The results showed that the optimum temperature for M-10 and M-12 were 30 °C and 40 °C, respectively (Table 2.14).

Table 2.14 Temperature optimization of selected microbial isolates grown in nutrient broth (NB) for 48 h under shaking condition at 120 rpm 1

Temperature	30 °C			40 °C			50 °C		
Duration (h) / Dry wt. (g)	24	48	Dry wt.	24	48	Dry wt.	24	48	Dry wt.
M-10	1.528	1.935	0.035	**1.257**	1.321	0.025	**0.835**	0.756	0.016
M-12	**1.177**	1.485	0.025	**1.538**	1.847	0.027	**1.660**	0.950	0.017

Screening of isolates for plant growth promoting properties showed that both isolates were able to solubilize phosphates while negative for solubilization of K. The composting process of micro-dust using developed microbial consortium was optimized. For this, six treatments were conducted *(T1 – 1% MC + 20% CD; T2 – 2% MC*

+20% CD; T3 – 1% MC + 25% CD; T4 – 2% MC + 25% CD; T5 – 20% CD; T6 – 25% CD where MC – Micro-dust and CD – Cow dung). It was found that 1% microbial inoculum with 25% (w/w) cow dung showed higher efficiency in terms of physico-chemical and biological properties of developed compost (Table 2.15).

Table 2.15 Optimization of parameters such as microbial consortium and cow dung in composting process of cotton micro-dust 1

Treatments	Org. Carbon (%)	Total N (%)	C:N Ratio	Ash (%)
T-1	22.1	1.3	17.0	13.9
T-2	22.3	1.35	16.5	14.0
T-3	21.1	1.46	14.5	14.5
T-4	21.0	1.5	14.0	14.4
T-5	24.5	1.2	20.4	14.0
T-6	23.8	1.25	19.0	15.2

The results revealed that the organic carbon, nitrogen and C: N ratio were found similar in treatments T-3 and T-4. Hence, the optimized parameters for composting of cotton micro-dust are 1% microbial consortium and 25% cow dung.

The physico-chemical and biological properties of compost obtained from cotton micro-dust was evaluated and the details are presented in Table 2.15. The cellulolytic enzyme (Endo-glucanase) activities are higher during the initial duration of composting which tend to decrease during the maturity of composting. The exo-glucanase activity increased at later stage of composting. It is attributed to the endo-glucanase that acts upon native cellulose which provide reactive sites for exo-glucanase and other enzymes for further course of action.

Table 2.15. Physico-chemical and biological properties of compost produced from cotton micro-dust after 30, 60 days. 1

Duration	Org. Carbon (%)	Total N (%)	C:N Ratio	Ash (%)	pH
30 Days	22.9	1.4	16.4	16.9	7.8
60 days	20.4	1.45	14.1	13.8	7.5
	Endo-glucanase (IU/ml)	Exo-glucanase (IU/ml)	β-glucosidase (IU/ml)	Xylanase (IU/ml)	Dehydrogenase (µg TPF/g/day)
30 Days	0.81	0.81	0.01	1.31	141.2
60 days	0.52	1.20	0.24	3.15	128.9

Fig. 2.22 Bioconversion of cotton micro-dust into bio-enriched compost 1

Microbial formulations have been prepared using following cell protectants, surfactants and preservatives :

1. Cell protectants : PVP – Poly-vinyl-pyrrolidone (2%), PEG - Polyethylene glycol (1%), Gly - Glycerol (0.5%), GA - Gum Arabic (1%), Tre -Trehalose (15 mM)
2. Adjuvant: CMC - Carboxymethyl cellulose (0.1%)
3. Surfactant: Tx - Triton x-100 (0.5%)
4. Preservative: PS - Potassium sorbate (0.2%)

A total of 15 treatments, including control, of microbial formulations were prepared and kept under storage for 6 months to determine the viability of each formulation.

Among treatments, T-19 has shown the maximum microbial population (130 x 10^8) after 6 months of storage at room temperature followed by T-2 (74 x 10^8).

2.5.2 Development of process protocol for synthesis of nano-sulphur and its application in agriculture 1

The process protocol of synthesizing nanosulphur suspension was standardized using elemental sulphur, water, and SPAN 85. Chemo-mechanical approach was adopted for the synthesis, keeping in view requirement of higher output recovery and cost economics of the overall process. The formulation containing elemental sulphur, water and surfactant was stirred using a rotary stirrer for 60 min at a rotational speed of 2000-3000 rpm. This stirring will help in uniform mixing of the constituents and doesn't allow the possible agglomeration of sulphur particles prior to size reduction. After 60 min, the obtained pre-mix was poured in super mass colloidar for size reduction by gradually reducing the scale of diminution.

The machine consists of two ceramic non-porous grinding stones among which the top plate is fixed and the bottom plate is rotating for ensuring better grinding efficiency. The scale of diminution was set using the dial gauge and handle fixing screw. Consequent upon feeding of the material, the distance between the grinding stones was gradually reduced by a scale (where 1 scale =10 microns). The particle size reduced after each pass resulted in the increased viscosity of the suspension and accordingly appropriate amount of water was added for smooth flow and requisite grinding of the mixture. The mixture was fed for 3 times at a particular scale. The size estimation of the representative sample was performed using Dynamic light scattering particle size analyzer. It was analyzed by repeated experiments that grinding at minus 9 scale resulted in the required size of sulphur nano particles i.e.500-800 nm. The characterization (particle size,

SEM, TEM, viscosity) techniques confirmed the particle size and stability of the suspension. The optimized process protocol for chemo-mechanical synthesis of sulphur nano particles is presented in figure 2.23.

Fig. 2.23 : Process protocol for chemo-mechanical synthesis of nano sulphur

The representative samples from each suspension (50 ml) after specified scale of diminution in mass colloidar were taken and evaluated for viscosity using a programmable rheometer (M/s Brookfield, Model: LVDV-III,USA). The LV3 spindle was utilized to estimate the viscosity of samples at 100 rpm. Increase in the viscosity with size reduction of the sulphur particles was observed as represented in Fig. 2.24.

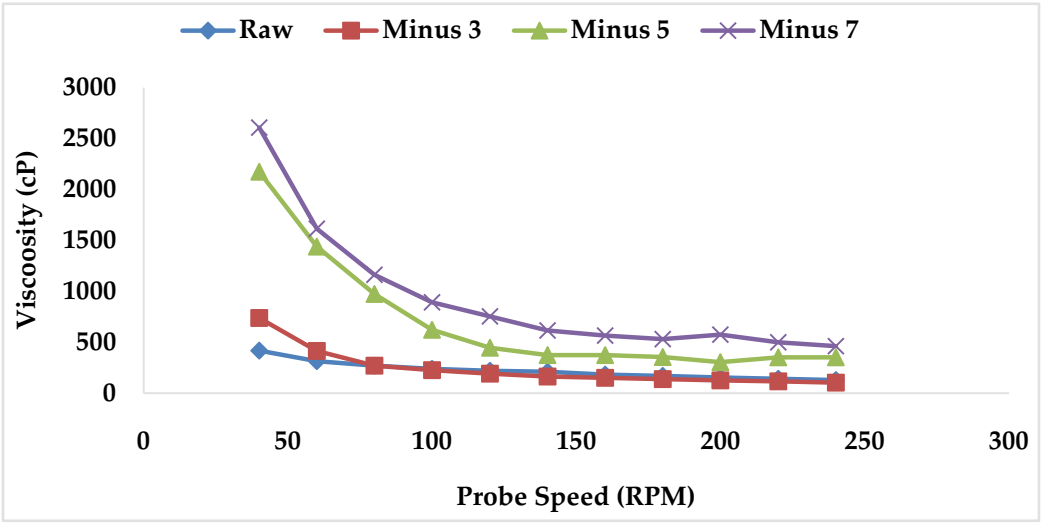


Fig. 2.24 : Variation in the viscosity of nano sulphur suspension with particle size reduction 1

(a) (b) (c) 1

Fig. 2.25 Logo of ICAR-CIRCOT nano sulphur in English (a) in Hindi (b) nano sulphur suspension(c) 1

2.5.3 Impact Assessment of CIRCOT technologies

Value addition to Cotton Biomass (Briquetting and Pelleting)

The focus is to ascertain the economic, social and environmental impact of the technology developed by the institute for Value addition to cotton biomass (briquetting and pelleting): These technologies promote commercial utilization of the cotton stalks that will benefit the farmers through additional income for the supply of cotton stalks as raw material and serve as renewable source of industrial raw material for the briquetting and pelleting industries and its users.

The data pertaining to the use of cotton stalks as the raw material in the briquetting and the pelleting industry was collected and compiled. There is a huge prospect of the economic and social benefit due to the technology of value addition to the cotton stalks for manufacture of briquettes and pellets. If the stalks are sold at farmer's field, they get ₹ 1000 per tonne and if the same is supplied at the factory gate in chipped form they fetch ₹ 2400 per tonne. This is comparatively cheaper than the other raw material used for this process (Sawdust ₹ 3500/t; groundnut shell ₹ 3500/t and soybean husk ₹ 2500/t).

Briquetting plant working with 20 tonnes production per day capacity generated employment equivalent to 1050 man-days per month with a remuneration of ₹ 15,000/ man month. The cost of production of briquettes is ₹1200 per tonne and that of pellets is ₹ 2200/tonne. The net value addition to the biomass on an average is ₹ 3300/ tonne in case of briquettes and ₹ 4500/tonne for pellets. In case of the briquettes, use of briquettes in industrial boilers would fetch ₹ 4800-5200 per tonne, while use of pellets in certain industry (Haldirams) fetch ₹ 7200/tonne.

The demand for briquettes and pellets is increasing but the challenges faced in sourcing the cotton stalk as a raw material are that it is seasonal and it has to be collected from the farmer's field directly.

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

The preliminary trails on the development of silage from green cotton biomass were conducted on the farmer's field at Village Gevrai, Tal. Mantha, Dist. Jalna and at Ginning Training Centre, Nagpur. The primary objective of these trails was to assess the suitability of green cotton biomass obtained after third picking of cotton for silage making. Cotton plants were uprooted manually with the help of hand-held cotton plant puller. The biomass were then chopped to size of 1-3 cm. The additives like molasses, urea solution and bacterial inoculum was added uniformly to the chopped biomass. The mix is then transfered to respective drums according to treatment given to cotton biomass and pressed manually to remove oxygen from the drums. The ensiled biomass was then covered with polythene sheet, and the drums were covered with lid to avoid entry of outside air (Fig. 2.26). The qualitye valuation of the silage was done after 45 days.

Fig. 2.26 : Preliminary silage protocol

Quality of silage from green cotton biomass

The quality of cotton silage was assessed using three major techniques viz. physical, microbial and chemical assessment. Physical assessment show that characteristics such as colour, flavour and texture of ensiled cotton biomass are acceptable and are free from any fungal growth. Similarly, *Lactobacillus* count also found to increase in the silage which shows proper fermentation and favourable lactic acid formation in the silage which is indicator of good quality silage (Table 2.16). Also, protein and nitrogen values also found to increase which validate the improvement in nutritional quality of ensiled green cotton biomass (Table 2.17). Hence, the results of preliminary experiments shows the green cotton biomass can be converted into good quality silage.

Table 2.16 Microbial assessment of silage from green cotton biomass

Treatments	Bacterial count (× 10^4cfu/g)		*Lactobacillus* count (× 10^4cfu/g)		Fungal count (× 10^4cfu/g)	
	Initial	Final	Initial	Final	Initial	Final
Control	83	40	3	23	41	0
Urea +molasses (M)		136		117		0
Bacterial inoculum (BI)		4		10		0
Urea +M+BI		31		79		0

Table 2.17 Chemical assessment of silage from green cotton biomass 1

Treatments	Moisture(%)	Ash (%)	Protein (%)	Nitrogen(%)
Initial values	36.57	5.6	4.51	0.72
Control	61.82	8	9.07	1.45
Urea + molasses (M)	61.95	7	9.68	1.55
Bacterial inoculum (BI)	57.82	6.5	9.79	1.57
Urea + M + BI	60.64	6	6.28	1.00

2.6 INTER INSTITUTIONAL PROJECTS

2.6.1 Efficacy evaluation of ICAR-CIRCOT Nano-ZnO as nanofertilizer in field crops [with IIPR, Kanpur & NIASM, Baramati]

This project is being carried out to establish the efficacy of nano-ZnO and nano-Zn suspension as a fertilizer for field crops. As a lead institute, ICAR-CIRCOT, Mumbai is preparing the different nano formulations of zinc micronutrient, characterize them and supply to other collaborating Institutes for field evaluation. Zinc is one of the essential micronutrients required by the plants and also an important constituent of enzymes and proteins. Though required in very less quantity, it is crucial to plant development. Commercial sources of zinc fertilizer include inorganic compounds like zinc sulphate, synthetic chelates like Zn-EDTA and natural organic compounds like zinc ligno-sulfonates. To add a new dimension, ICAR-CIRCOT developed a Nano-Zn suspension formulation for enhanced performance.

ICAR-IIPR, Kanpur carried out a field experiment at new research farm to study the effect of nano zinc oxide as nano-fertilizer in pulses. In the first year of experiment, IPC 11-112 genotype was tested with different zinc management practices including nano-ZnO formulation supplied by ICAR-CIRCOT, Mumbai. In this experiment, distinct variations were visualized among different treatments. Nano-ZnO spray @ 50 mg/L (At Pre-F and Pod F) has recorded a higher yield of 2300 kg/ha which is 21% higher than the control. This experiment will be repeated in the next *rabi* season to confirm these results of first year and with increased dosage of nano-ZnO.

ICAR-NIASM, Baramati is carrying out research with paddy crop (Panvel-2) in plastic pot filled with 1.5kg soil rite media and varying basal dose application of Nano-ZnO powder through fertigation *viz*. 0%, 1%, 5%, 10%, 25%, 50%, 75%, 100% of the recommended Zn application (i.e. 25kg/ha Zinc sulphate heptahydrate having 21% Zn). Side by side ***check pots*** with recommended Zinc sulphate heptahydrate ($ZnSO_4 7H_2O$) and native black soil were also maintained in triplicate. No visual symptoms of zinc deficiency was observed in any treatments however nitrogen deficiency in black soil check pots was observed. Therefore, no foliar spray was given. Zn requirement in crop may have fulfilled with irrigation water and so sampled the irrigation water too for zinc analysis. Till flowering, plant growth in all the treatments was found normal but no proper grain filling in kernels or irregular grain filling was observed. Soil (before and after crop season) and plant sample were collected from each treatment. Sample processing like air drying, oven drying, plant root and shoot grinding has completed. Digestion of soil and plant parts is going on through microwave digester. Zinc analysis in all the samples through Atomic Absorption Spectrophotometer is remaining to be done. For the next season, wheat and chickpea crop is planned to be taken for evaluation.

ICAR-CICR, Nagpur and Coimbatore are carrying out experiments using nano-zinc formulations for cotton crops. As per the suggestions from ICAR-CIRCOT, the maximum concentration of nano-ZnO was kept as 200 ppm for foliar application. The pot culture experiments were carried out by factorial completely randomized design, with three replications. The time for foliar application was 45 DAS (Square formation

stage) and 75 DAS (Flowering stage). Zinc sulphate was used for comparative study. This was followed by field study wherein Suraj variety of cotton was used and RBD design was followed. The basal fertilizer was applied 10 days after sowing, foliar application of nano-ZnO (200 ppm) and nano-Zn suspension (200 ppm) along with surfactant (1 %) were done for T4 , T5 ,T6, T8 & T10 at square formation stage (45 DAS). *Fig. 2.27* shows the foliar application of nano-Zn suspension for cotton plants in the field at Coimbatore. Samples were collected and are being subjected to various analyses.

Fig. 2.27 Foliar application of nano-Zn in cotton

2.6.2 Development and evaluation of Non-steroidal anti-inflammatory drugs (NSAIDs) loaded nanocellulosic hydrogels [GMIPSR, Karnataka]

Nanocellulose based hydrogels for targeted drug delivery

In this study, the method for hydrogel formulation was optimized by using nanocellulose (NC) and Carbopol 940 as gelling agent and Sodium hydroxide as a crosslinker. The NC was synthesized by TEMPO-oxidation of cotton linters. For drug loading studies, Aceclofenac, a nonsteroidal anti-inflammatory drug (NSAID) was used. Four different drug loaded hydrogel formulations were prepared. The loading of drug was kept constant as 1. 5% w/w (which is equivalent to commercially available gels in the market e. g. Hifinac Gel – Intas). The amount of Carbopol 940 and NC were varied from 0.5 to 2% and 0.2 to 0.4% respectively.

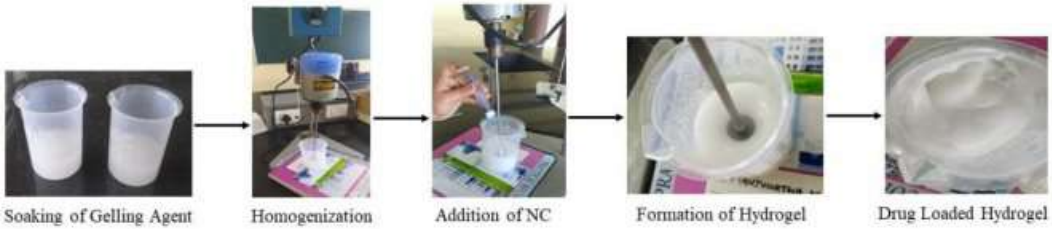
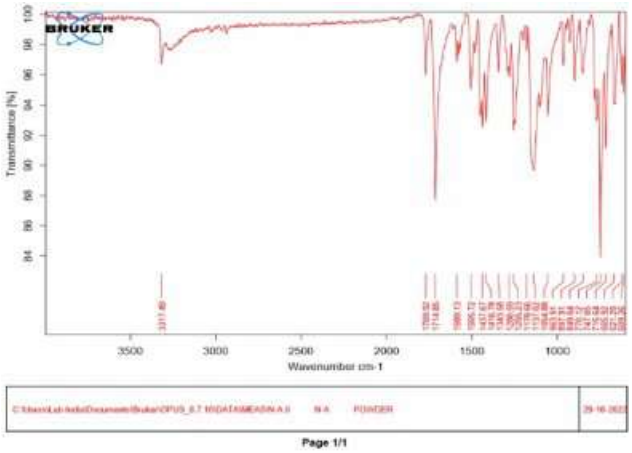
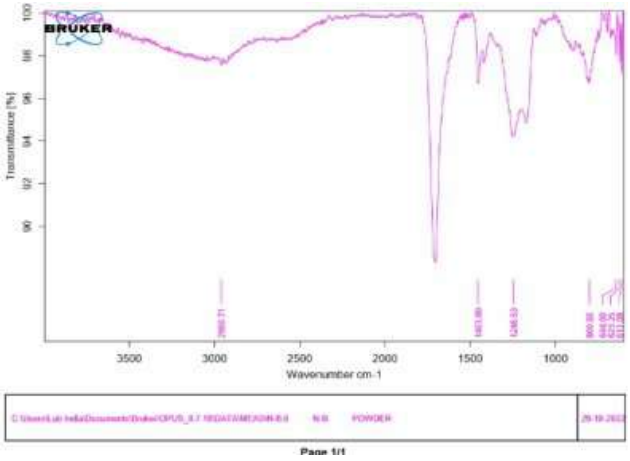


Fig. 2.28 Formulation of drug loaded nanocellulose hydrogel 1

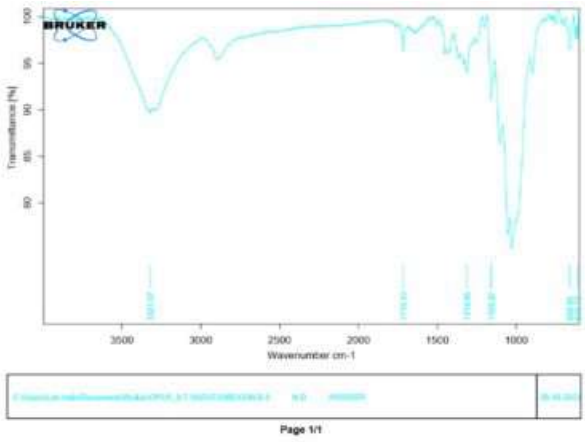
Compatibility studies were carried out to find out the interaction between polymer like NC, Carbopol, and Aceclofenac. As per the FTIR results there is no interaction between the polymer and drug. As the prominent peaks like N-H stretching at 3317 cm^{-1}, C=O Stretching at 1714 cm^{-1}, C-C stretching at 1589 cm^{-1}, O-H Plane bending stretch, C-N aromatic amine at 1280 cm^{-1}, Aromatic ring stretch at 1437 cm^{-1}, Aromatic out plane bending for C-H at 747 cm^{-1} were prominent in polymeric mixture and pure drug.



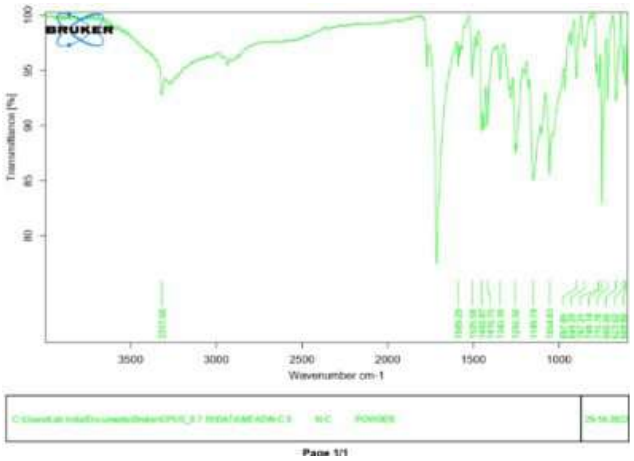
Pure Aceclofenac 1



Carbopol 940 1



NC



Nanocomposite Aceclofenac hydrogel 1

Fig. 2.29 FTIR studies of Aceclofenac, Carbopol 940, NC and Aceclofenac loaded hydrogel 1

Evaluation of drug loaded hydrogel :

Based on the consistency of the hydrogel, the formulation containing 1.5% Aceclofenac, 1.5% Carbopol 940 and 0.4 % NC was optimized. The evaluation of optimized formulation was done in terms of pH, drug content, washability, spreadability etc. Hydrogel was suspended in 50 ml of 7.4 pH Phosphate buffer for the determination of pH. The pH was found to be 6.63 at room temperature, which matches to the skin pH so irritation on application was not observed. The drug content of hydrogel was estimated by using UV spectrophotometry (UV 1900). It was observed that each batch showed uniform drug content with the variability of only 5-15 % (within acceptable range). It indicated the uniform dispersion of drug throughout the hydrogel. To evaluate

washability, the hydrogel formulations was applied on the skin and then ease of washing with water was checked manually. The applied hydrogel was easily washed without the soap. One of the criteria for a gel to meet the ideal quantities is that it should possess good spreadability. The therapeutic efficacy of a formulation also depends upon its spreadability, which was measured in terms of time in seconds taken by two slides to slip off from the gel and placed in between the slides under the direction of certain load. Lesser the time taken for separation of two slides, better the spreadability. The results showed good spreadability of the optimized drug formulation.

Fig. 2.30 Nanocellulosic hydrogel loaded with Aceclofenac 1

Drug release studies :

In-vitro drug release studies are under process. The permission for *In-vivo* drug study in rat model is obtained from the Institutional Animal Ethics Committee (IAEC) of B.V.V.S.H.S.K. College of Pharmacy, Bagalkote, Karnataka.

2.6.3 Development of eco-friendly fruit protection bags for quality enhancement [with ICAR-NRC for Grapes, Pune]

Kraft paper from cotton linters and banana fibre

Paper sheets (50 ± 2 g/m^2) using banana pseudostem fibres and cotton linters were developed using different combinations (100:0, 90:10, 80:20, 70:30, 60:40, 50:50). The physical, mechanical and barrier properties of hand-made sheets were tested. It was observed that bursting index (kPa.m^2/g), tearing index (mN.m^2/g), tensile index (Nm/g), breaking length (m) (Table 2.18), and double folds (Table 2.19) decreased with the addition of linters. Cobb 60 value, a measure of water absorbency was found inconsistent with the proportion of linters, that may be due to variation in linter dispersibility and grammage of paper sheets. Smoothness (ml/min) of paper was reduced with the addition of linters, and porosity initially decreased with a slight increase at higher concentration (Table 2.19).

Table 2.18 Physical properties of banana fibre-cotton linter handsheets 1

Sl. No.	Banana fibre-Cotton linter	Bursting index (kPa.m^2/g)	Tearing index (mN.m^2/g)	Tensile Index (Nm/g)	Breaking length (m)
1	100% banana fibre	6.4	9.22	40.4	4124
2	90:10	3.6	8.84	31.8	3242
3	80:20	3.5	8.84	30.8	3148
4	70:30	3.4	8.03	28.1	2868
5	60:40	3.3	8.10	25.8	2633
6	50:50	2.8	8.04	25.7	2623

Screening of different antimicrobial agents

The antimicrobial (qualitative) activity of methyl salicylate and essential oils (Clove oil, Lemongrass oil, Neem oil) (Fig. 2.31) and different Generally Recognized As Safe chemicals (GRAS) (Fig. 2.32) was evaluated against *Alternaria* species. All chemicals except neem oil showed good activity against *Alternaria* species (Fig. 2.31).

Table 2.19 Physical properties of banana fibre-cotton linter handsheets

Sl. No.	Cobb$_{60}$ (%)	Double folds (nos.)	Smoothness (ml/min)	Porosity (ml/min)
1	100	2636	277	1300
2	120	1062	247	1281
3	111	594	222	1283
4	77	518	211	1293
5	109	118	213	1317
6	94	109	208	1320

Fig. 2.31 Activity of essential oils against Alternaria species: (a) Control (b) Clove oil (c) Methyl salicylate (d) Lemongrass oil (e) Neem oil after 48 h

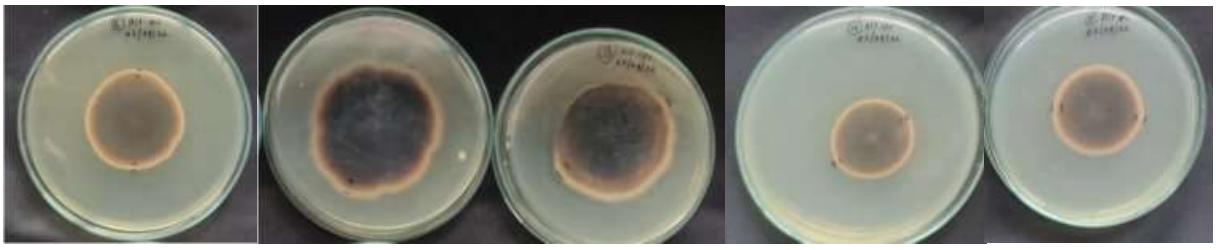


Fig.2.32 Activity of GRAS chemicals against Alternaria species: (a) Control (b) Potassium carbonate (c) Sodium bicarbonate (d) Sodium benzoate (e) Sodium propionate after 8 days

Natural wax based functional emulsions for paper coating:

Emulsion of chitosan (C) and natural wax (SW) were prepared using different proportions (1:5, 1:10, 1:15) along with antimicrobial agent (@ 1 wt%) and surfactant. The quantity of surfactant was kept constant based on weight of solids in aqueous system. To calculate creaming stability, emulsions were stored in glass test tube (15 mm diameter) for 1 month and creaming height was measured as an indicator of stability. Particle size of emulsions varied from 291 ± 25 to 573 ± 54 nm and creaming stability from 25 to 73%.

2.6.4 Development of bionanocomposite films using extrusion process [CIPET: SARP-LARPM, Bhubaneswar]

TEMPO-oxidized cellulose nanofibers from cotton linters

A process protocol for extraction of nanofibres from cotton linters by TEMPO (2,2, 6,6-Tetramethylpiperidin-1-oxyl) mediated oxidation was optimized. The main purpose of this activity was to produce the functionalized cellulose fibres for utilization in bio-nanocomposite films as a filler. For surface oxidation, the bleached cotton linters were suspended in water (MLR= 1:25) and the known amount of TEMPO reagent and sodium bromide were added to it. TEMPO-mediated oxidation was initiated by treating the fibres with 13% sodium hypochlorite solution (1mmol/g of fibres) under continuous stirring. The reaction was carried out for 1 h at room temperature and 10-10.5 pH. The TEMPO-oxidized fibres were then filtered and washed several times with water and evaluated for their surface morphology, degree of polymerization (DP) and Fourier Transform Infrared (FTIR) analysis.

SEM analysis showed unfolding and flattening of cotton fibres after TEMPO oxidation (Fig. 2.33). FTIR spectra of TEMPO-oxidized fibres indicated a prominent peak at 1600.92 cm^{-1} corresponds to the symmetrical vibrations of carboxyl groups (Fig. 2.34). TEMPO oxidation caused significant decrease (from 1204 to 246) in DP values of cotton fibres, depicting the dissolution of amorphous regions.

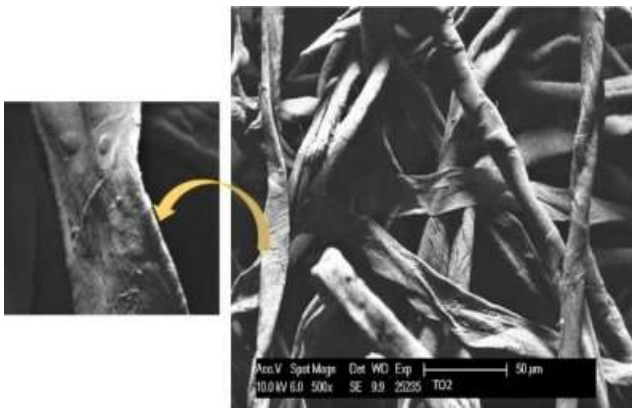


Fig. 2.33 Surface morphology of TEMPO-oxidized cotton fibres 1

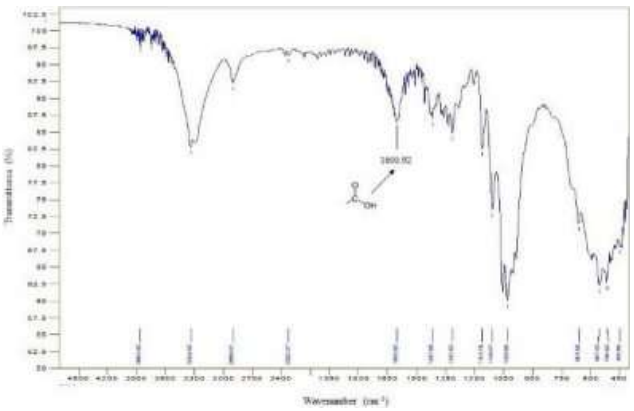
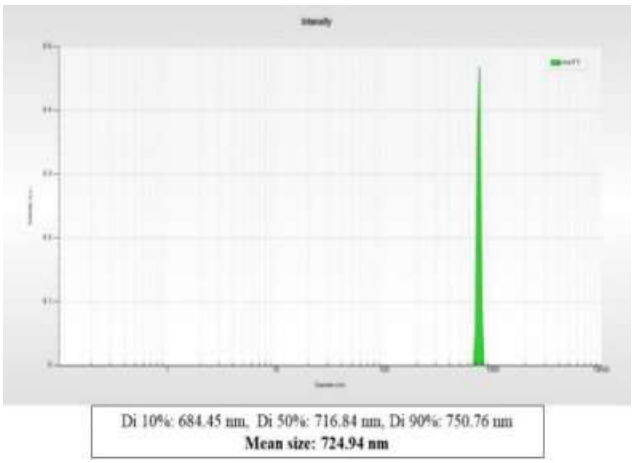


Fig. 2.34 FTIR analysis of TEMPO-oxidized cotton fibres 1

For synthesis of nanofibrils, the TEMPO-oxidized cotton fibres were subjected to mechanical processing using mass colloider and ultra-high-pressure homogenizer. During processing, the clearance between the grinding plates of mass colloider was reduced down from 0 µm to -100 µm with 5 passes at each level. The viscous suspension obtained then passed 3 times through high pressure homogenizer to get nanofibres of desiredsize range. The nanofibres produced using this protocol showed the size in the range of 684-750 nm. Rheological studies revealed high gel strength of nanofibres produced from TEMPO oxidized cotton linters. These surface functionalized cellulose nanofibres will be used as a reinforcement in starch and PLA based bio-composite films.



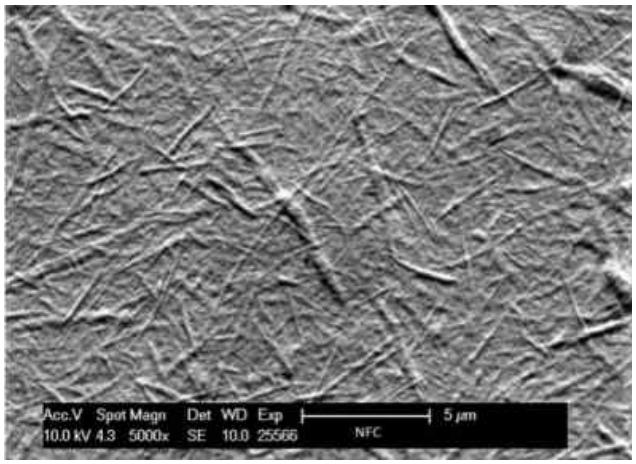


Fig. 2.35 Particle size analysis (a) & SEM image (b) of TEMPO-oxidized cellulose nanofibres

2.6.5 Efficacy evaluation of ICAR-CIRCOT Nano-Sulphur as fertilizer formulation for different field crops [DOGR Pune, IISS, Bhopal, MPKV Rahuri]

Nano sulphur (20% w/v) was synthesised using the standardised process protocol and supplied to the different collaborative institutes to conduct field trials. The amount of material sent to different institutions during the reporting period was 10 litres to ICAR-Directorate of Onion and Garlic Research (DOGR), Rajgurunagar; 10 litres to ICAR-Indian Institute of Soil Science (IISS), Bhopal; 10 litres to MPKV, Rahuri and 20 litres to M/s Devdhar Chemicals Pvt. Ltd, Pune.

Fig. 2.36 Nano sulphur suspension

Field trials

The institutes have cultivated maize as exhaust crop so as to remove the sulphur present in the soil. This was done to precisely analyse the effect of different sulphur treatments on the crop. The field experiments done at different collaborating centres are given below:

Fig. 2.37 Trials of Maize crop at ICAR-DOGR, Rajgurunagar 1

Fig. 2.38 Trials at ICAR-IISS Bhopal 1

2.7 CRP ON NATURAL FIBRES

2.7.1 Development of cotton incorporated Personal Protective Equipment (PPE) body suit for health care workers with enhanced comfort

PPE suit with cotton non-woven for inner layer was developed to provide more comfort to the wearer. In addition, a cooling belt with smart air circulator system was made as an attachment to the PPE suit to enhance the comfort of the wearer. It is a mini air conditioning system which can create comfort zone into the internal environment between the human body and the PPE suit. The cooling system consists of an aluminium heat sink with maximum surface area to cool the hot air and circulate them within the PPE suit. 3D print models were created using PLA (biodegradable) and optimized the box volume for better air circulation system. It was observed that the temperature reduced from 31°C to 26°C within 15 minutes time interval, and it was maintained throughout the wearing time. A normal 10Ah power bank is used to operate complete system with 5 to 12V power supply which can withstand up to 8 hours of continuous function.

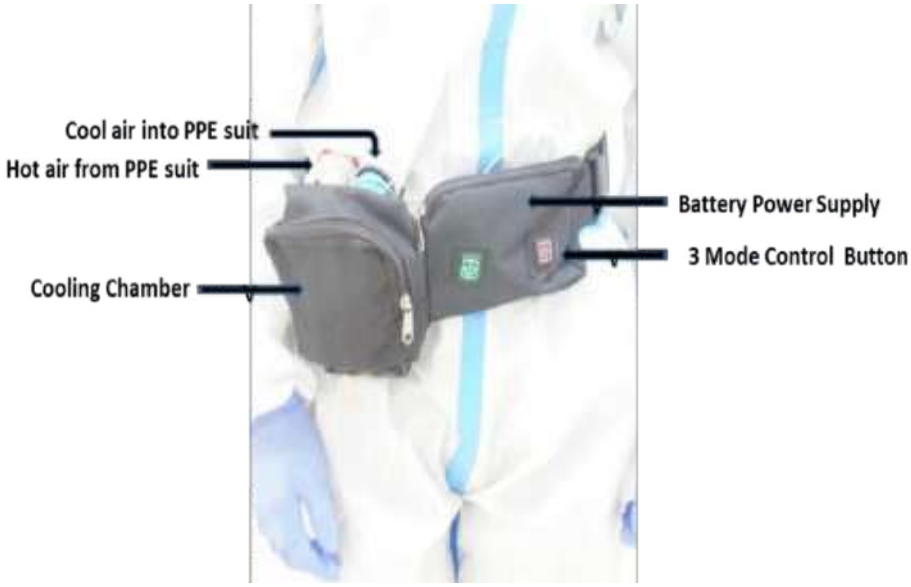


Figure 2.39 Developed cooling belt on PPE suit 1

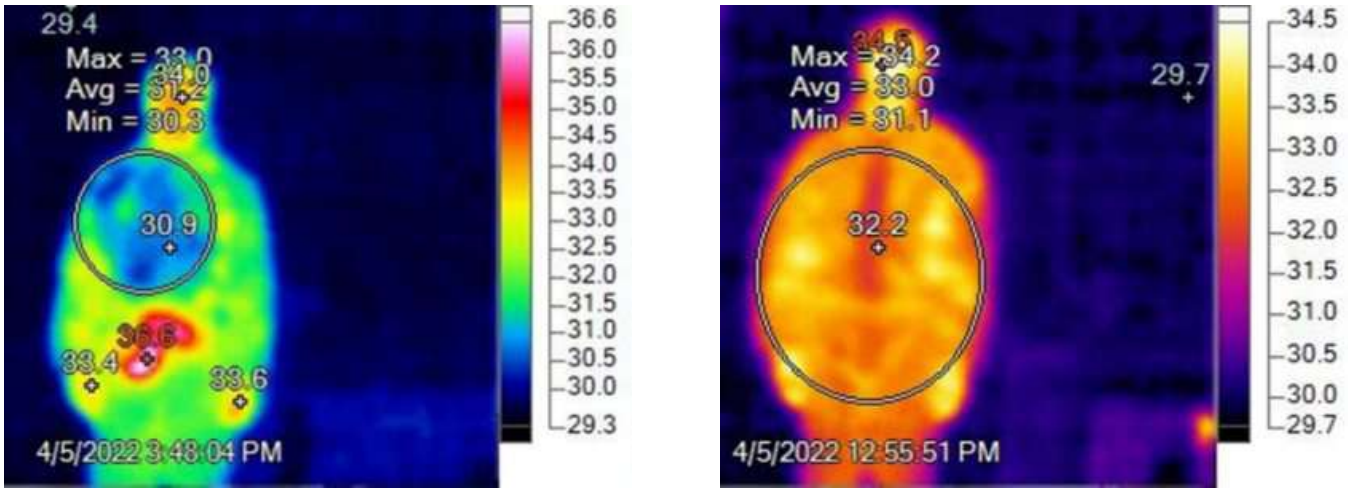


Fig. 2.40 Thermal Image of PPE suit with and without cooling belt 1

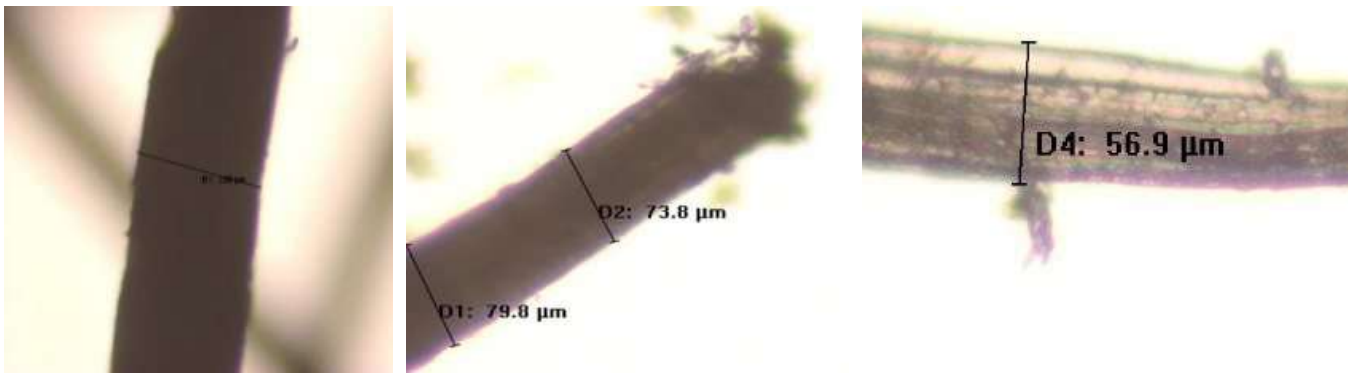
2.7.2 Development of Building Materials using Natural fibres and other fibrous crop residues (CIRCOT Centre)

The initial study on fibre-reinforced concrete compressive strength was carried out for the two fibres, i.e., banana and coir fibres, with a proportion of 0.5% by varying its length from 1 cm to 5 cm. As the length of fibre increases above 5 cm, it's difficult to prepare concrete and fibres get agglomerated during the process. The compression strength test of fibre-reinforced concrete was carried out for 7 days, 14 days and 28 days of curing as per the IS 456 standards. The results revealed that banana fibre-reinforced concrete, at 0.5% proportion, showed a reduction in compressive strength on decreasing fibre length from 5 cm to 1 cm. The highest compressive strength, 19.4 N/mm^2 was obtained for a 5 cm fibre length for 28 days of curing; however, it failed to meet the standard requirement.

In contrast, in the coir fibre-reinforced concrete at 0.5% proportion, the compressive strength of the concrete increases as the fibre length decreases from 5 cm to 1 cm. The maximum compressive strength obtained at 0.5% fibre proportion at 1 cm length was 29.8 N/mm^2 for 28 days of curing. Based on the above results, the coir fibre of length 1 cm was selected for further study by varying its proportions from 0.5 to 1.5%. The compressive strength increased up to the fibre proportion of 0.75% and then decreased. At about 32 N/mm^2, a 6-8% increase in compressive strength was noticed compared to the control sample.

Effect of Fibrillated Coir fibre on Concrete Reinforcement

The effect of coir fibre was studied by reducing the coir fibre diameter using the disc refiner with two different settings i.e.10 thou and 7 thou. The average fibre diameter for the control coir fibre was 175 µm, whereas, in the case of 10 thou and 7 thou setting, the coir fibre diameter was 73 µm and 58 µm, respectively, as showed in fig 2.41. It showed about 37% and 51% reduction in the coir fibre diameter for 10 thou and 7 thou, compared to the control coir fibre diameter, respectively.



(a) (b) (c)

Fig 2.41. (a) The diameter of control coir fibre, (b) the diameter of coir fibre 10thou, (c) the diameter of coir fibre 7thou.

De-moulding of Concrete Cubes

Curing of Concrete Cubes

Compression Testing

The 1% fibrillated coir fibre (10 Thou) used as reinforced concrete showed about 8 % increase in the compressive strength (32.5N/mm^2), and above 1%, the compressive strength decreases. As the proportion of fibre increases, it reduces the workability and formation of voids in the concrete cube, which affects the compressive property. Whereas, 7 thou fibrillated coir fibre used as reinforced concrete does not meet compressive strength as per the standards.

2.7.3 Development of cotton-based face mask with improved particle filtration efficiency and breathability using electro spun nano materials and antiviral coatings

Development of 3D Multilayer Fabric for Production of High-Performance Mask

Currently, cotton based reusable masks have to be layered to get required particle filtration efficiency of 50-60%. The layering of cotton fabric leads to increase in the air resistance and reduces the breathability. In order to solve this issue, single layer of fabric which has multi weave structure was developed using 90s count cotton yarn and 50 denier polyester yarn. Attempt has been made to develop 3 D fabric using conventional power loom machine which will give higher filtration efficiency

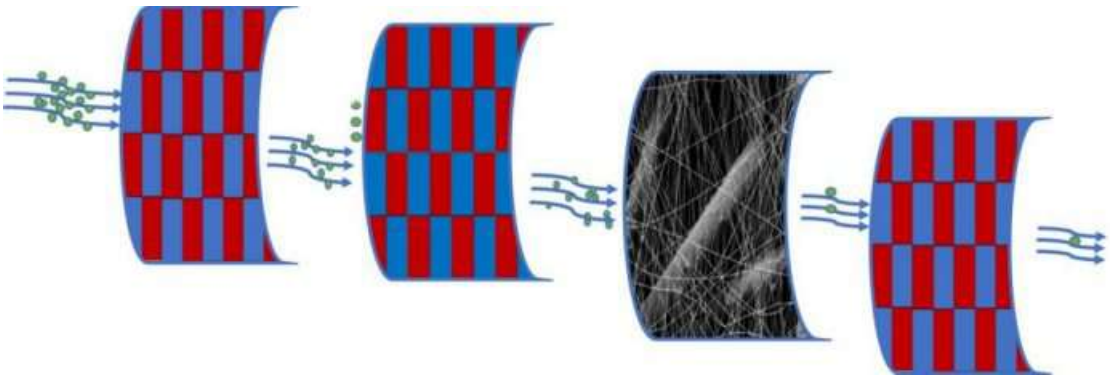


Fig:2.42 Schematic diagram of engineered fabric structure with nanofibre cartridge and air flow movement

Four different types of fabrics were developed with the GSM range of 142, 115, 102 and 102 gms respectively. The air resistivity, permeability and filtration efficiency of the fabrics were tested using air permeability tester and particle filtration efficiency testers respectively. The results indicated that the single layer fabric of sample no 1 & 3 have

particle filtration efficiency of 54 & 51% with air resistance of 0.08 & 0.04. The air resistivity value is very less which will provide higher breathability to the wearer along with more than 50% particle filtration efficiency.

Cotton fabric mask with nanofiber cartridge

The nanofiber cartridge can be used along with engineered 3 layered mask and it enhance the particle filtration efficiency up to 95 % (Fig, 2.42).

Table 2.20 : The particle filtration efficiency of the 3 layer cotton face mask with Nano cartridge

S. No	Sample Details	Particle Filtration Efficiency %	Air resistance Pa/cm2
1	3 Layer Engineered cotton Mask fabric	41.17	19.91
2	3 Layer Engineered cotton Mask fabric with Nano fibre cartridge	94.50	36.30
3	4 layered Mask	49.82	27.80
4	4 layered Mask with nano filter	92.95	46.76
5	5 layered Mask	51.93	34.18
6	5 layered Mask with nano filter	92.45	58.10

2.7.4 Development of Natural Fibre Based composites for the selected automotive applications

Natural fibre composite material was prepared by using banana fibre and poly propylene staple fibre using needle punching technique. Banana fibre was cut into a uniform size of 50-60 mm. Banana fibre and 100mm staple poly propylene fibre of 6 denier was mixed in the blend ratio of 50:50. It was observed that due to the stiffness of banana fibre it did not mix well during the non-woven production process and uniformity of the fabric was not good The optimum blend ratio of banana: poly propylene to develop a good non-woven material was found to be 25:75.

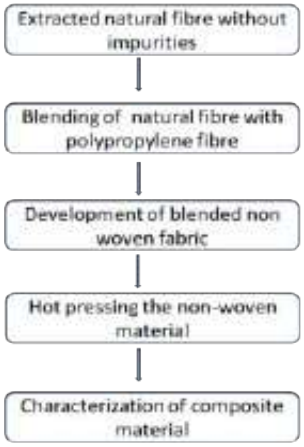


Fig. 2.43 Banana fibre based non-woven composite 1

From the FTIR and chemical composition analysis it was found out that sodium hydroxide treatment was found to be effective in removing lignin from banana fibres and improve the softness. *Thermal stability of the treated banana fibre* was found to be improved due to the removal of lignin.

Table 2.21. Chemical composition of Banana fibre treated with 7% Sodium Hydroxide and Sodium Carbonate. 1

Samples	Lignin %	Holocellulose %	Moisture %	Ash %
Control	13.41	67.15	14.08	6.73
NaOH	8.24	74.13	13.13	4.90
Na_2CO_3	10.20	70.41	13.95	5.18

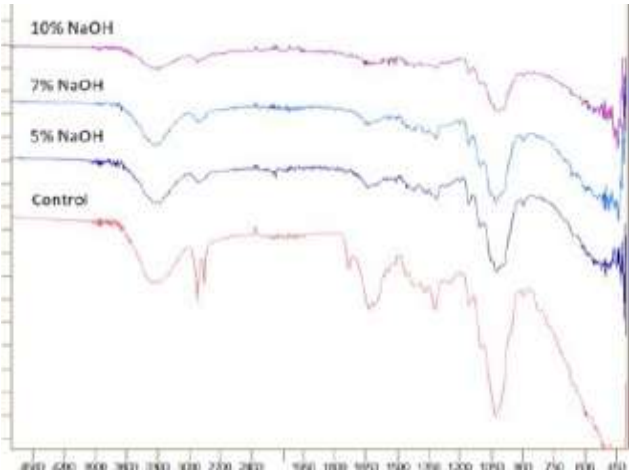


Fig. 2.44 FTIR analysis of NaOH treated banana fibre samples

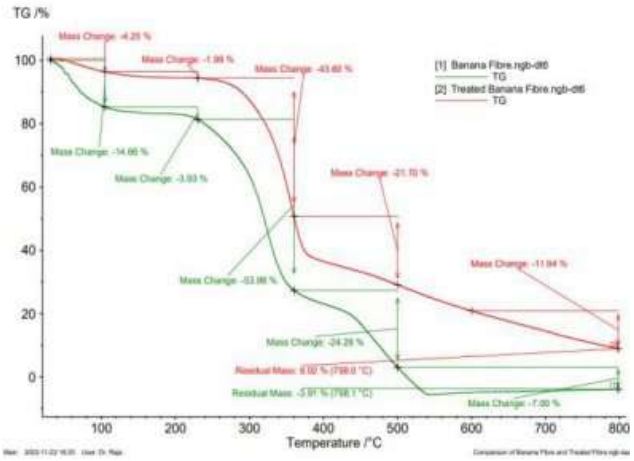


Fig. 2.45 Thermal stability of the treated banana fibre

2.8 EXTERNALLY FUNDED PROJECTS

2.8.1 Agri-Business Incubation Centre at ICAR-CIRCOT, Mumbai (NAIF) 1

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

Product Development : M/s. Fumalabs Private Limited, Gwalior, CIRCOT ABI incubate, has developed particle boards from one ton sugarcane bagasse with innovative adhesive using the pilot scale facility for preparation of particle board at Ginning Training Centre, Nagpur in July 2022. About 50 boards of 18 mm thickness were prepared by the incubate.

During the period one new entrepreneur has been admitted for incubation

S. No.	Incubatee	Technology
1.	M/s. Devdhar Chemicals Private Limited, Pune	ICAR-CIRCOT Nano sulphur as Fertilizer and Pesticide

2.8.2 Remunerative Approaches for Agriculture and allied Sectors Rejuvenation (RAFTAAR) Agri Business Incubator (R-ABI)

ICAR-CIRCOT is one among the 29 RKVY-RAFTAAR Agri-business Incubators functional across the nation since 31st 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 agri-startups to translate innovative ideas into workable prototype and (ii) ***Ankur,*** *seed stage funding program*, with *grant-in-aid* support of upto 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 three cohorts were conducted during the year 2022.

Grant-in-Aid Facilitation

CIRCOT R-ABI has been successful in facilitating grant-in-aid support to the start-ups during different cohorts. The RC committee meeting for evaluation of incubatees from 3rd / 4th /5th cohorts for pre-seed stage and seed stage funding were held on 02/06/2022, 03/06/2022 and 29/11/2022 under the chairmanship of Dr. P. Chandra Shekara, Director General, National Institute of Agricultural Extension Management (MANAGE).

Fourth cohort: Out of 116 applications (47 for pre-seed and 69 for seed stage funding), Nineteen (19) Agri-startups (08 for pre-seed and 11 for seed stage funding) were selected and admitted for the AOP & SAIP programme from *08/02/2022 to 08/04/2022*.

Fifth cohort: Out of 65 applications (37 for pre-seed and 28 for seed stage funding), Eight (8) Agri-startups (03 for pre-seed and 05 for seed stage funding) were selected and admitted for the AOP & SAIP programme from *24/05/2022 to 24/07/2022*.

Sixth Cohort: Out of 31 applicants (12 for Pre-seed stage funding and 19 for Seed stage funding), Fifteen (15) Agri-startups (6 for pre-seed stage funding and 9 for Seed stage funding) were selected for AOP and SAIP programme. The programme commenced on *23/12/2022*.

Third Cohort : Eight (08) Agri-startups were sanctioned grant-in-aid of ₹ 97.75 Lakh and were disbursed 1st instalment of ₹ 33.9 (Pre-seed stage funding ₹ 06 Lakh and Seed stage funding ₹ 27.9 Lakh) during the reporting period.

Grant in Aid support (3rd Cohort)

Sr. No	*Name of Startup*	*Idea/Concept*	*Sanctioned Amount (Lakhs)*
		Pre-seed Stage Funding	
1	M/s Ocean Farms (Mr. Akshay Jadhav)	Seaweed Cultivation & Development of seaweed-based products	5.00

2	M/s Tejasvi Agro Industries (Mr. Vilas Rajole)	Value chain of Tamarind processing	5.00
3	M/s One Stop Digital Agri solutions Private Ltd. (Mr. Pratapsinh Chavan)	One stop digital agri-solutions platform	5.00
Total (Pre-seed Stage funding)			15.00
Seed Stage Funding			
1	M/s.VRSS Agro Engineering LLP. (Mr.VinodAtkari Mr. Rajendra Kolhe)	Innovative food grain dtorage silo for farmers, FPOs & farmers groups	18.75
2	M/s Rajwardhini Nutricare and Foods (Ms. Pradnya Rane)	Naturally fortified affordable baby foods	17.00
3	M/s Biological Research Innovation Centre and Solutions LLP (Mr. Ravishankar Bhat)	Development of textile fabric stain remover using plant-based constituents.	19.00
4	M/s Baseline Engineering LLP (Mr. Arvind Gadge)	Desalinated sea water for drinking	13.00
5	M/s Arde Patil Pharma Pvt Ltd. (Mr. Sarjerao Patil)	Extraction of medicinal plant extracts and its use	15.00
Total (Seed Stage funding)			82.75
Total Grant-in-Aid Support (Pre-seed + Seed) under 3rd Cohort			**97.75**

Fourth cohort : Seven (07) Agri-startups were sanctioned grant-in-aid of ₹ 102.5 Lakh and were disbursed 1st instalment of ₹ 43 Lakh (Pre-seed stage funding ₹ 06 Lakh and Seed stage funding ₹ 37 lakh) during the reporting period.

Grant-in-Aid support (4th Cohort)

Sr. No.	*Name of Startup*	*Idea/Concept*	*Sanctioned Amount (Lakhs)*
Pre-seed Stage Funding			
1	M/s Veganscare Bio-Tech LLP (Dr. Anup B Sonawane Mr. Sachin R. Adsare)	Rapid detection kit for determining viable and non - viable onion seeds	5.00

2	M/s HN Automatic Pvt Ltd (Mr.Himanshu Vinayak Dixit)	Automated solo machine for soil intercrop cultivation	5.00
Total (Pre-seed Stage funding)			10.00
Seed Stage Funding			
1	M/s Smaran Udyog (Mr. Mahesh Maruthi Borhade)	Extraction of essential oil and value addition to byproduct for use in food, pharma and cosmetics.	15.00
2	M/s Forecast Agrotech Innovations Pvt Ltd (Mr. Santosh Harishchandra Sahane)	Sustainable conversion of bio digested sludge into bio fertilizer and bio-slurry.	15.00
3	M/s Pimani India Pvt Ltd. (Mr. Nitin PralhadKhade)	Novel process of dehydration of vegetables and fruits	20.50
4	M/s Vishwa Natural Fab Prints (Dr.A.Sarada Devi)	Direct Natural Dye printed fabrics	25.00
5	M/s Gao Shivar Krishi Paryatan Kendra ani Adivashi Jan-Jeevan (Mr. Ganesh Lavankush Jadhav)	Generate sustainable income through agro tourism module	17.00
Total (Seed Stage funding)			92.50
Total Grant-in-Aid Support (Pre-seed + Seed) under 4thCohort			102.50

Fifth cohort : Five (5) Agri-startups were sanctioned for a funding of ₹ 65.00 Lakhs. (Pre-seed stage funding ₹ 15 Lakh and Seed stage funding ₹ 50 lakh) during the reporting period.

Grant-in-Aid support (5th Cohort)

Sr. No.	*Name of Startup*	*Idea/Concept*	*Sanctioned Amount (Lakhs)*
Pre-seed Stage Funding			
1	M/s. Kapra Enerprises, (Mr. Sunil Prakash Bhalerao)	Low-cost egg incubator for farmers	5.00
2	M/s. Silky Cocoon Handicrafts, (Mr. Adhikrao Dhanaji Jadhav)	Value addition to waste silk cocoons	5.00
3	M/s. Kaya Enterprise, (Dr. Krushi Hingurao)	Oyster Mushroom based healthy Puffs (Fryums)	5.00

Total (Pre-seed Stage funding)			15.00
Seed Stage Funding			
1	M/s. Nutrivms Biochem Pvt. Ltd., Pune, Maharashtra (Dr. Sachin Bhikaji Jadhav)	Amino acid rich fertilizer from poultry feather waste	25.00
2	M/s. F-Square Agri Labs Pvt. Ltd., Kolhapur, Maharashtra (Mr. Vinayak Dattatray Fasake)	Low-cost seeder for small size seeds	25.00
Total (Seed Stage funding)			50 Lakhs
Total Grant-in-Aid Support (Pre-seed + Seed) under 5thCohort			65 Lakhs

Sixth Cohort: The focus of selection is on innovation in the technology, social impact and benefit to the farmers in the agricultural chain. Majority of the Startups showed direct benefit to farmers and in few cases, it was assumed that in a larger perspective of up-scaling of the model would create indirect jobs. It was emphasized that there will be value addition in the chain all the way from backward integration to market positioning. The Startup ideas selected for mentoring for Pre-Seed stage and seed stage funding are

Sr. No.	*Name of Agripreneurs*	*Concept (Pre-seed Funding)*
1	Mr. Darshan Chetan Khaire	Cerago wine
2	Mr. Hariram Deoram Thavli	Agro-tourism and preservation of indigenous species (Flora & Fauna)
3	Mr. Bharat Chandrakant Honmane	Liquid fertigation system unit by using Forward Osmosis Technology
4	Mr. Vighnesh Dattatray Madane	Iron boost chocolate Alternate for iron tablet
5	Mrs. Leena Sawant	Nutri Bar; Grape pomace chocolate
6	Mr. Harshal Ishwar Patil	Valorization of textile waste for seed tape sowing
Sr. No	*Name of Agripreneurs*	*Concept (Seed Funding)*
1	Mrs. Pradnya Dayaram Meshram	Cordyceps militaries cultivation (Himalayan Mushroom)
2	Mr. Adeenay Devarajan	Ezee-PD an Easy to perform onsite urine based early pregnancy detection kit for Livestock
3	Mrs. Priyanka Digvijay Patil	Spirulina cultivation & products based on spirulina

4	Mrs. Seema Ramdas Garje	Flavoured and essential mineral fortified Amrutprash
5	Mr. Suraj Kaple	Apparatus for zero spillage milking machine
6	Mr. Amey Amol Suryavanshi	Novel approach for the preservation of sugarcane juice
7	Mrs. Kajori Jain	Plant based antibacterial sanitary Pads
8	Mr. Sujit Manik Kudale	Making of jam & mouth freshener from waste/low grade raisins
9	Mrs. Pratibha Rao	IOT based Precision farming

OCEAN FARMS
Reimagining Agriculture

M/s. Ocean Farms, Palghar, Thane
(Seaweed cultivation & processing)

M/s. Tejasvi Agro Industries, Nashik
(Tamarind value chain)

VRSS AGRO ENGINEERING LLP
Perfection is our priority

M/s.VRSS Agro Engineering LLP, Pune
(Low-capacity grain storage silo)

M/s. One Stop Digital Agri Solutions Pvt Ltd., Pune
(e-platform for pomegranate & grape farmers)

Rajwardhini
Nutricare and Foods

M/s. Rajwardhini Nutricare and Foods, Nashik
(Baby food products)

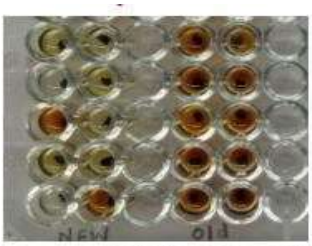
BRICS
RETHINK TO REBUILD

M/s Biological Research Innovation Centre and Solutions LLP, Banglore (Fabric stain remover)

M/s Atwater Engineers India Pvt. Ltd., Navi Mumbai
(Desalination of sea water to potable water)

ardepatil
PHARMA

M/s. Arde Patil Pharma Pvt Ltd., Kolhapur
(Contract farming and processing of medicinal plant)



M/s Veganscare Bio-Tech LLP, Mumbai
(Rapid detection kit for viability of onion seeds)

hN
HN AUTOMATICS PVT.LTD

M/s HN Automatics Pvt. Ltd.
(Automated solo machine for intercrop opertaions)

SMARAN UDYOG

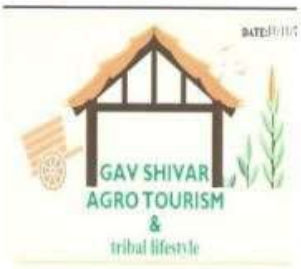
M/s Smaran Udyog Pvt Ltd, Pune
(Geranium contract farming and essential oil extraction)

FORECAST AGROTECH

M/s Forecast Agrotech Innovations Pvt Ltd, Pune
(Biofertilizer & bio-slurry from cattle dung and agro-waste)

PIMANI
UDYOG INDIA PRIVATE LIMITED

M/s Pimani India Pvt Ltd, Sangli
(Dehumidifier for accelerated dehydration of fruits & vegetables)



M/s Gao Shivar Krishi Paryatan Kendra ani Adivashi Jan-Jeevan, Nashik
(Agro-tourism module in tribal area)

VISHWA NATURAL FAB PRINTS
Committed to Environmental Safety

M/s Vishwa Natural Fab Prints, Hyderabad

2.8.3 Design and Development of Pilot Plant for Extraction of Proteinfrom De-oiled Cotton Cake and Value Addition (/By-Products Utilization) (DST/TDP)

Microwave pre-treatment has showed positive results in reduction of gossypol concentration in cottonseed meal (CSM). The best optimized condition was obtained from Box Behnken Design (BBD) response surface methodology (RSM) and the critical values of the selected parameters for microwave pre-treatment of CSM was 26% moisture content, 900 W microwave power level and 6 min time of microwave treatment.

Further studies were carried out on optimization of protein extraction process from defatted meal using four variables - alkali to

sample ratio, extraction time, pH of solvent and concentration ratio of NaCl and Na_2SO_3. Addition of sodium sulphite (Na_2SO_3) was done to prevent phenolic oxidation and to improve color and flavor of the protein. Optimized condition obtained for protein extraction was - alkali: sample ratio 33:1 [v w−1], NaCl concentration 0.15 mol/L, 0.27% Na_2SO_3 and time 147.5 min (Fig.2.46).

Protein recovery was found to be 57%. The protein content of the extracted protein from defatted meal and microwave pre-treated meal was found to be 86.265 ± 0.712 and 92.790 ± 0.953 respectively. Alleviation was noted in free gossypol (FG) and total gossypol (TG) values of cottonseed protein concentrate (CSPC) and microwave treated cottonseed protein isolate (MW-CSPI). This is due to hostility of alkaline environment towards gossypol molecule during extraction.

Functional properties of protein play paramount role in imparting desired technological purpose in food. The extracted CSPC and MW-CSPI was evaluated for their functional properties. Study revealed CSPC performed well in terms of functional properties (Fig. 2.47 a-e). (*: Protein pallets drying under ambient condition for 7-8 hrs **: Protein pallets drying under ambient condition for 2-3 hrs)

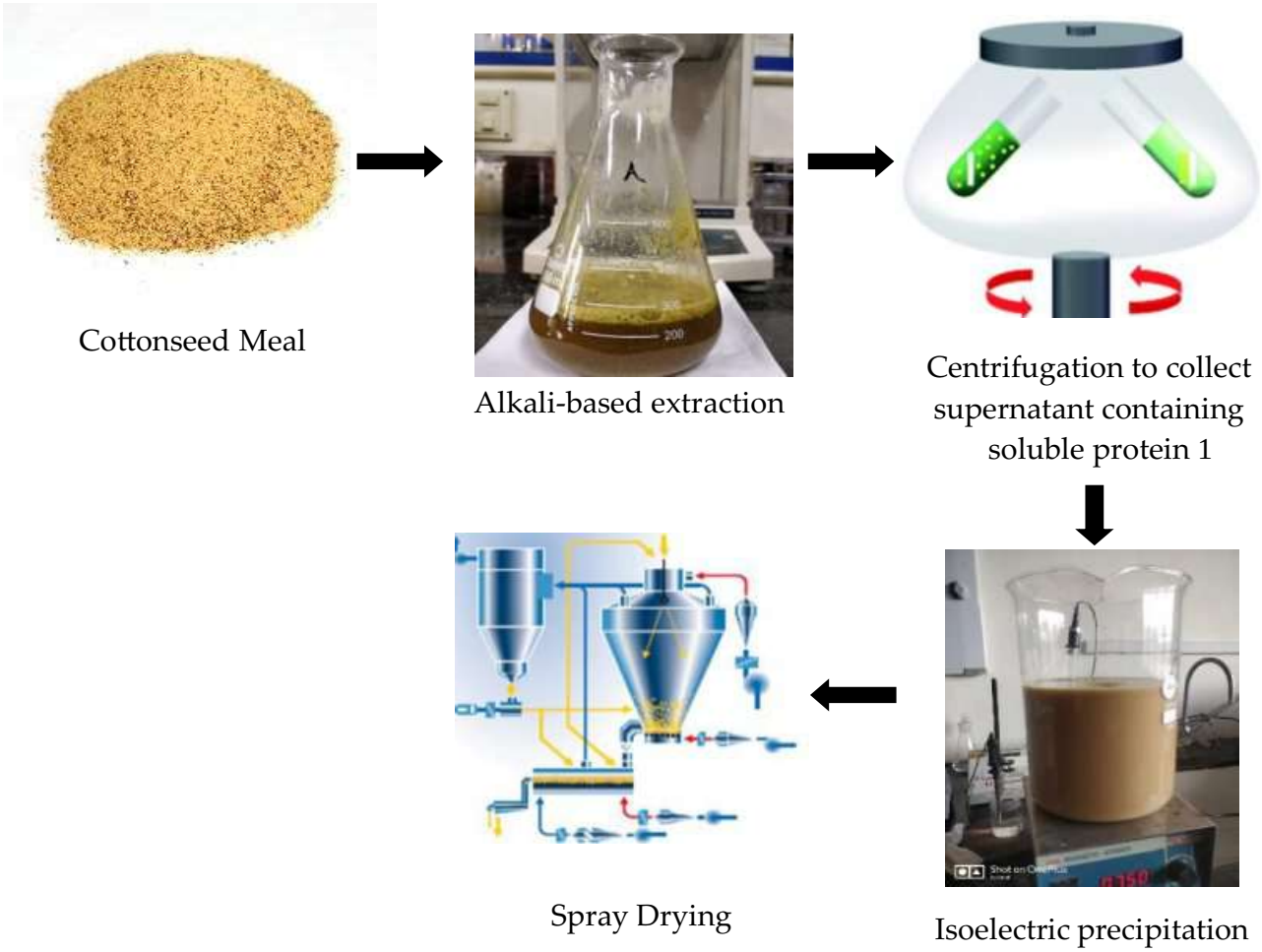


Fig. 2.46 Alkali salt assisted protein extraction process

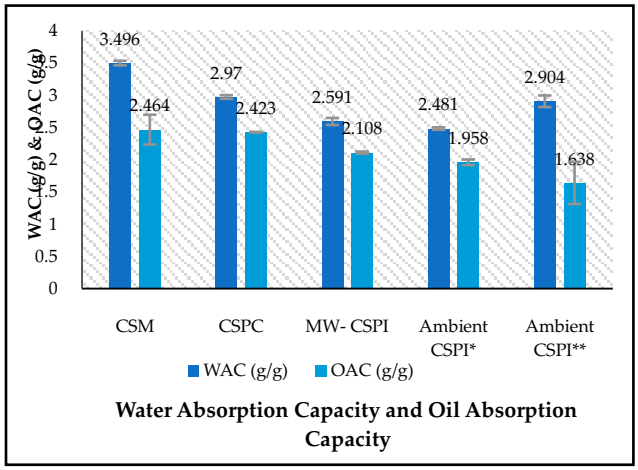
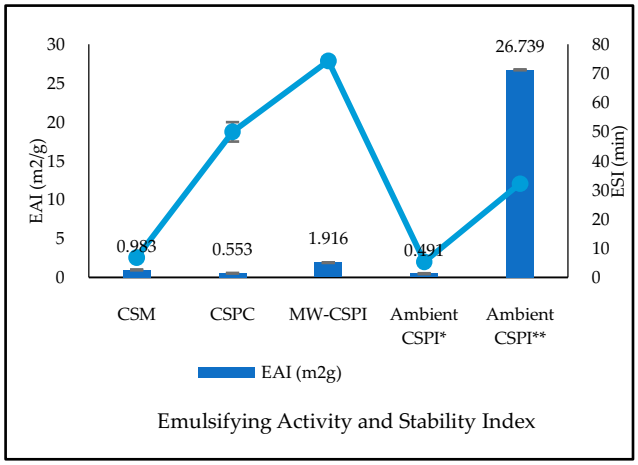
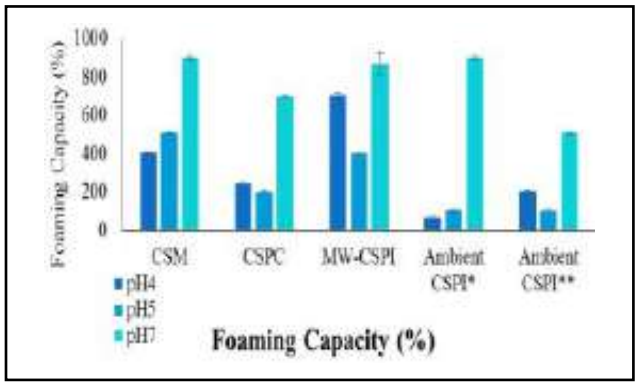


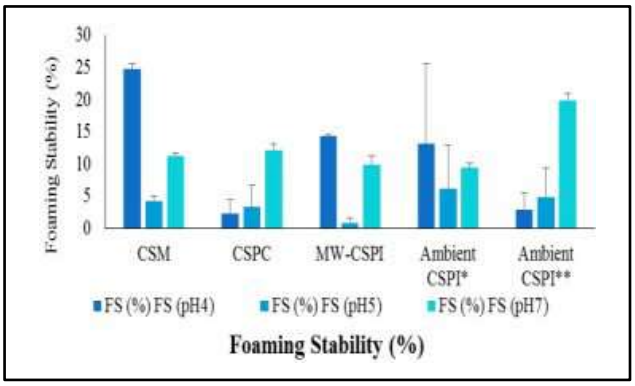
Fig. 2.47. a. Graphical representation of water absorption and oil absorption capacity



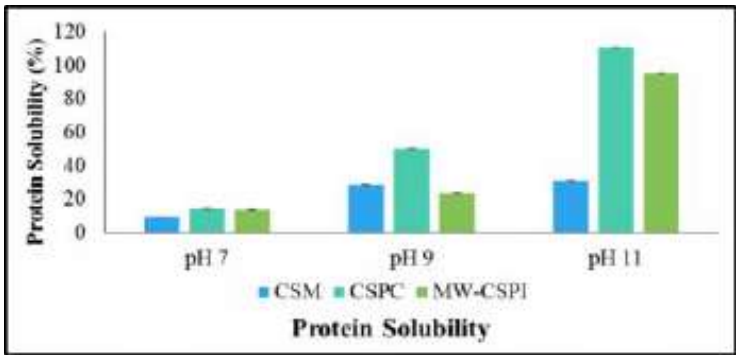
b. Graphical representation of emulsifying activity and stability index



c. Graphical representation of foaming capacity



d. Graphical representation of foaming stability 1



e. Graphical representation of protein solubility

Fig. 2.48 Cottonseed Protein rich multigrain biscuits

To compute accurately the impact of heating/ electromagnetic wave on functional and structural attributes of protein are quite tricky. Additional, one preliminary study was conducted on ambient drying technique of protein pellets. Protein rich multigrain biscuits were developed incorporating 5% cottonseed protein in the premix formulation (Fig. 2.48). Result showed in the value of FG and TG in premix as well as biscuit was below permissible limit i.e., 0.04% for FG. Protein content of our biscuits are comparable to the biscuits available commercially in the market.

2.8.4 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, Ministry of Power, GoI)

Analysis of biomass materials

Agro-residues viz. paddy straw (6 tonnes), soybean stalks (3 tonnes), bamboo dusts (1.5 tonnes), groundnut shells (3.5 tonnes) and cotton stalks (2 tonnes) were procured and stored at Ginning Training Centre, Nagpur of ICAR-CIRCOT. These were analyzed for ash, hot water solubles, lignin, cellulose, etc. as per standard methods. It was observed that all these residues are lignocellulosic in nature and paddy straw has very high amount of ash as compared to other agro residues. Gross Calorific Value (GCV) of these materials was also determined which was found to be highest for cotton stalks followed by groundnut shell and bamboo dust, while it was lowest for soybean stalk.

Table-2.22 Chemical composition of different agro residues

Nature of parameter	Cotton stalk	Paddy straw	Groundnut shell	Bamboo dust	Soybean stalk
Moisture %	10.1	9.9	9.7	5.9	10.0
Ash %	4.6	15.7	9.7	2.1	5.1
Hot Water soluble %	5.8	6.8	3.6	5.3	7.5
Lignin %	23.9	19.3	25.4	22.9	24.0
Holo cellulose %	60.5	70.3	65.4	64.0	64.5
Alpha cellulose %	36.1	43.1	33.7	39.2	39.7
GCV (cal/gm)	3928	3318	3792	3578	3101

Laboratory studies on torrefaction of biomass

Biomass materials are hygroscopic and have low calorific value. Torrefaction can improve these properties. Collected biomass materials were shredded, then ground and were torrefied using flat bed reactor in closed containers with limited quantity of air at *temperature* ranging from 200-350 °C for 30 min. Weight loss in biomass samples during torrefaction was determined and is presented in Fig 2.49. It is seen from the figure, that there is a gradual increase in the weight loss of the biomass materials with increase in temperature of torrefaction and these values differ for different materials.

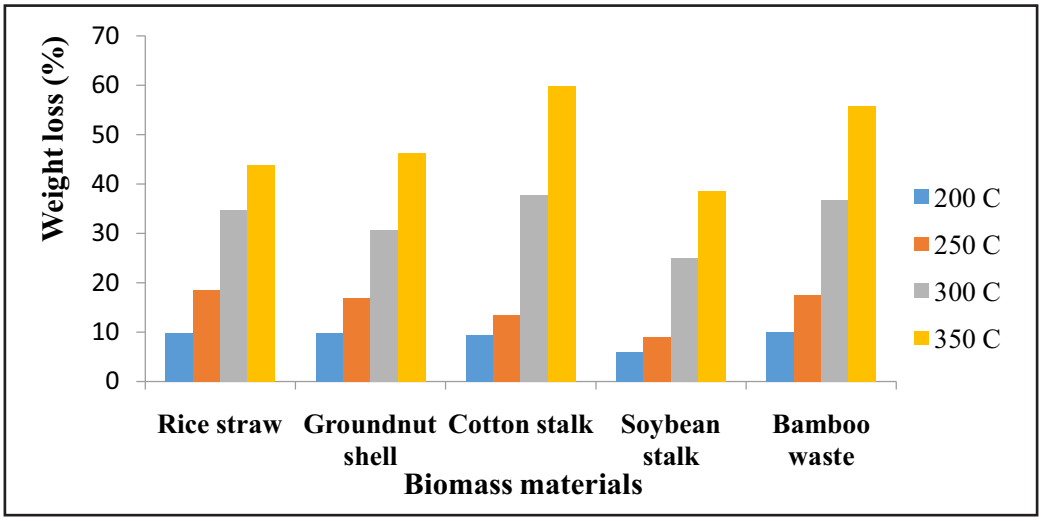


Fig 2.49-Weight loss of biomass materials torrefied at different temperatures

Total carbon analysis of paddy straw

Raw and torrefied paddy straw powder were analysed for Total Carbon content at 200, 250, 300 and 350 °C and it was found that the value of total carbon increased with increase in temperature of torrefaction from 200-350 °C.

Table 2.23 Total carbon content of paddy straw samples

Sample	Total Carbon (%)
Raw paddy straw powder	33.71
Torrefied paddy straw at 200 °C	36.16
Torrefied paddy straw at 250 °C	40.45
Torrefied paddy straw at 300 °C	41.79
Torrefied paddy straw at 350 °C	48.12

Thermogravimetric analysis (TGA) of biomass materials

TGA of collected biomass samples was carried out to study the weight loss pattern in relation to temperature (Fig 2.50). It was observed that there is only a small change in weight up to 220 °C which mainly corresponds to the loss of moisture. The rate of weight loss in biomass samples steadily increases thereafter and a sharp increase is observed after 300°C. Therefore, temperature of 250-300°C temperature was found to be optimum for the torrefaction of biomass materials. Cotton stalk showed the highest and soybean stalk showed lowest weight loss as compared to other biomass samples.

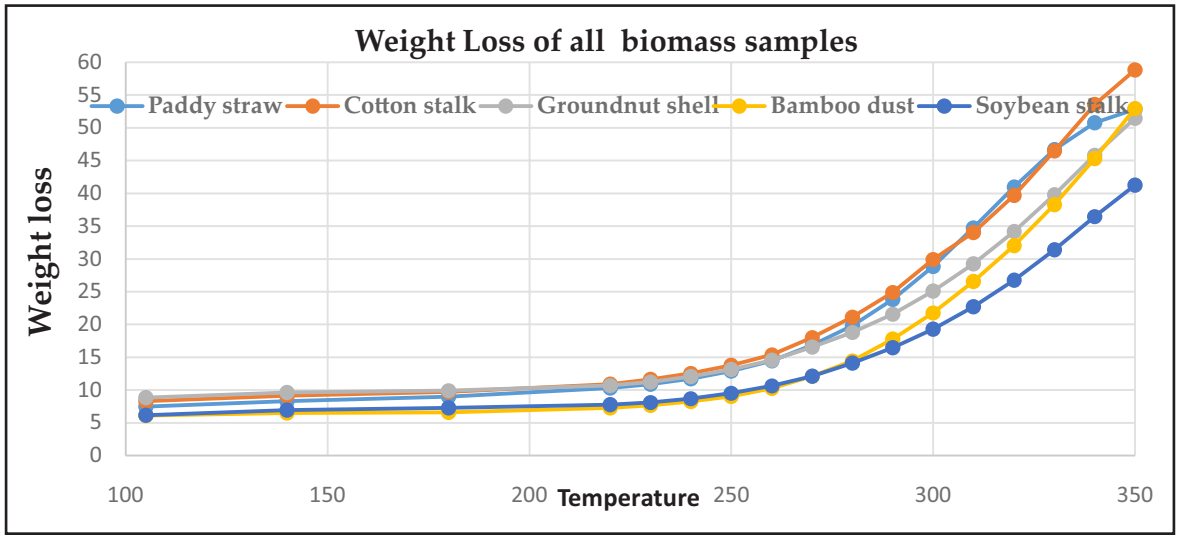


Fig 2.50 TGA pattern of various biomass samples

Preparation of pellets

Pellets of paddy straw were prepared at GTC by varying the moisture content (MC) from 15-19% and it was found that 17% MC gave better results in terms of durability index and fines (Table 2.24)

Table 2.24- Characteristics of paddy straw pellets made at varying moisture levels

Sr No.	*MC % of powder*	*Pellet MC (%)*	*Ash content (%)*	*Length (cm)*	*Bulk Density (kg/m3)*	*Durability index (%)*	*Fines (%)*
1	15	11.54	14.58	3.12	556	90.6	0.22
2	17	11.91	14.40	3.0	594	96.32	0.14
3	19	12.97	14.25	2.06	401	88.28	0.86

Pellets of paddy straw were also prepared by using 5% Sal DOC (De-oiled cake) as binder using 13-19 % moisture levels. Moisture content of 15% was found to be optimum for the preparation of pellets from paddy straw in this experiment as the bulk density improved by 9.4% and reduction in fines by 57% was observed. The addition of binder resulted in improved flowability of the material due to the presence of oil in it. The characterization of the pellets was carried out and the results are presented in table 2.25.

Table 2.25 Characteristics of paddy straw pellets made using binder

Sr No.	*Initial MC*	*Pellet MC (%)*	*Ash Content (%)*	*Length (cm)*	*Bulk density (kg/m3)*	*Durability index (%)*	*Fines (%)*
1	17	11.64	15.36	2.8	582	95	0.085
2	16	10.24	16.48	3.3	656	96	0.05
3	15	10.10	15.10	3.2	650	96.4	0.06
4	14	9.61	15.58	3.3	645	96.3	0.05
5	13	9.44	15.77	2.9	552	93	0.134

Preparation of pellets using a combination of paddy straw and other agro-residues

Experimental design (Simple lattice design) using JMP software was prepared for the preparation of pellets in different combinations of paddy straw and other agro-residues (cotton stalks, groundnut shell, soybean straw and bamboo dust). A total of 126 combinations of these agro-residues were obtained. Out of these, 13 experiments were conducted and prepared pellets were analyzed for GCV and ash content (Table 2.26). It is seen from the table that combinations with higher amount of cotton stalk/ groundnut shell or bamboo dust had higher GCV and lower ash content. It was found that as cotton stalk percentage increases ash content decreases. Blending of paddy straw in the pellet in general increased the ash content and reduced the GCV.

Table 2.26 Characteristics of Pellets made using a combination of biomass materials 1

SN	*Trial No.*	*Combinations*					*Pellet M.C.*	*CV (Cal/g)*	*Ash %*
		Paddy straw	*Cotton stalk*	*Groundnut shell*	*Soybean stalk*	*Bamboo dust*			
1	1	0.4	0	0	0.4	0.2	10.7	3805	8.08
2	2	0.4	0.6	0	0	0	11.05	3772	5.14
3	3	0	0	0.6	0.2	0.2	12.15	3989	4.46
4	4	0	0	0	0.8	0.2	10.6	3979	5.67
5	5	0.4	0	0.2	0.4	0	12	3696	9.10
6	6	0	0.8	0	0.2	0	11.4	3882	4.78
7	7	0	0.6	0.2	0	0.2	12.62	3998	4.52
8	8	0.2	0.2	0.4	0	0.2	12.3	3620	5.6
9	9	0.4	0	0	0.6	0	12.7	3624	8.05
10	10	0.4	0.2	0.4	0	0	13.13	3697	10.1
11	18	0	0.6	0	0	0.4	6.35	4121	3.71
12	24	0	0.8	0	0	0.2	9.15	3987	3.7
13	34	0.2	0.2	0	0	0.6	9.7	3823	5.6

As torrefaction has been reported to reduce the moisture absorption by the biomass, studies on moisture uptake by torrefied biomass upon storage are being planned. Paddy straw sample of different varieties from various geographical locations in the country have been collected to develop a database of their properties in order to devise a method for determination of paddy content in pellets of unknown composition.

3. Technology Management 1

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, 2 patents have been filed, thirteen consultancy projects have been handled and processed through Institute Technology Management Unit (ITMU).

Patent filed

Sr. No.	Title	Filing No.	Date	Inventors
1.	Novel Chemo-mechanical Method for Preparation of Nanosulphur	202210113740	11.03.2022	A. K. Bharimalla, M. K. Mahawar, N. Vigneshwaran, Arputharaj A., J. Dhakane-Lad, Sujata Saxena
2.	Air cooling and circulating system for improving thermal comfort of impermeable apparels	202221044541	04.08.2022	P. Jagajanantha, P. K. Mandhyan, A. S. M. Raja, A. Arputharaj, Kirti Jalgaonkar, Sharmila Patil, A. K. Bharimalla, Sujata Saxena
3.	Woven Fabric architecture for enhanced particle filtration in face mask fabric	202221074766	23.12.2022	G.T.V.Prabu, A.S.M.Raja, N. Vigneshwaran, T. Senthilkumar, G. Krishnaprasad, A.K. Bharimalla, Sundaramoorthy C, Sujata Saxena

3.2 Consultancy Projects (13) 1

Sr. No.	Consultancy Project No	Title of Project	Name of Organisation to which Consultancy offered
1	CP-10/21-22	Tensile Testing of woven cotton samples using Kawabata (KES FB-1A)	Prof. Ashwini K. Agrawal, New Delhi
2	CP-11/21-22	Calibration Check of moisture meters	M/s. Cotton Corporation of India Ltd, Mumbai
3	CP-12/21-22	Design and manufacturing of pre-cleaner, double roller gin, baling presses and feeding systems	M/s. Bajaj Steel Industries Ltd, Nagpur
4	CP -1/22-23	Analysis of Tensile properties of Woven cotton samples using Kawabata	Department of Textile& Fibre Engg., IIT Delhi
5	CP -2/22-23	Spinning of Isora Fibre andits blend withCotton	Goa College of Home Science, Panaji
6	CP -3/22-23	Nonwovens testing with Kawabata	Jindal Polyfilms Ltd., (Division Global Nonwovens), Igatpuri, Nashik
7	CP -4/22-23	Consultancy for KES Analysis	Department of Textile& Fibre Engg., IIT Delhi
8	CP -5/22-23	Consultancy for KES Analysis for strength properties	Department of Textile& Fibre Engg., IIT Delhi, New Delhi
9	CP -6/22-23	Analysis of Kosa/Hemp combination fabric using KES	NIFT, Mumbai
10	CP -7/22-23	Spinning of Sisal and Cotton fibre blends	Dept. of Apparel and Textile Science, PAU, Ludhiana
11	CP -8/22-23	Technical Consultancy to suggest some measures to reduce the effluent load from their manufacturing process	Director, Rishabh Texco Pvt Ltd, Village Sanodiya, Bhilwara, Rajasthan
12	CP -9/22-23	SEM Analysis of Fabric and Yarn	Unilever Industries Pvt. Ltd., Andheri (East), Mumbai
13	CP -10/22-23	"Development of Nano-cellulose as a carrier for plant nutrients	M/s Biofac Inputs Pvt. Ltd., Hyderabad, Telangana

3.3 Technologies Commercialized

1. M/s. Biofac Inputs Private Limited, Telangana - "*Nano Zn suspension production technology*"
2. M/s. Bajaj Steel Industries Ltd. Nagpur - "*Compact and Energy Efficient Cottonseed Dryer*"
3. M/s. PRB Textiles India Pvt. Ltd, Nagpur - "*Augmented process for preparation of bio-enriched compost from cotton micro-dust*"
4. M/s. Super Hygienic Disposal India Pvt Ltd, Nagpur -"*ICAR CIRCOT trapezoidal shaped rapid burning briquette based crematorium*"
5. Renewal of MoU for technology commercialization with M/s. Precision Tooling Engineers, Nagpur for "*Miniature Ginning Machine*"

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 from 31st January 2019 at the institute.

The CIRCOT R-ABI has completed 5 cohorts and has organised the Agripreneurship Orientation Programme and Start-Up Incubation Programme (AoP/SAIP) for Agripreneurs with the innovative ideas.

During the current year, AoP/SAIP training and the CIC meeting of the three cohorts (3rd4thand 5th cohort) were completed. Fifteen start-ups under 3rd and 4th cohort were sanctioned with a grant-in-aid support of Rs. 200.25 lakhs. Seven start-ups under the 5th Cohort has completed their CIC successfully and awaiting the sanction order from the RKVY Division of the Department of Agriculture & Farmers Welfare.

3.5 Awareness Meet & Demonstration

- An awareness programme on "Management of contamination in seed cotton in ginning" was organised for the farmers of Mandvi Village, Mohapa, Kalmeshwar, Nagpur on 23rd February 2022.
- "Technology and Machinery Demonstration Mela-2022" was organized at Ginning Training Centre (GTC) of ICAR-CIRCOT at Nagpur in association with Confederation of Indian Textile Industry-Cotton Development and Research Association (CITI-CDRA), Mumbai on 21st March 2022. In this programme, over 200 farmers and other stakeholders from

Nagpur, Wardha and Chandrapur Districts of Maharashtra participated.

- An awareness programme on "Compost and Mushroom production using Cotton Stalks for Empowerment of Women in Agriculture" to women Self Help Groups (SHGs) was organized by GTC, ICAR-CIRCOT, Nagpur on 24th March 2022.

- Demonstration of ICAR- CIRCOT's technology and products was organised at GTC Nagpur, to the delegates of NABARD-Bankers Institute of Rural Development, Lucknow on 24th March 2022. About 25 delegates participated in the programme.
- Demonstration of CIRCOT's technology and products related to value-addition to cotton stalks and other agro-residues was organised to the farmer trainees of Dr. PDKV, College of Agriculture, Nagpur at GTC of ICAR-CIRCOT, Nagpur on 25th March 2022.About 30 farmers attended the programme.
- Demonstration of Institute's technologies and products for the stakeholders were arranged during the 'Stakeholders Interface Workshop - Pre kharif consultation on technologies and best practices for enhancing cotton productivity' on 7th May 2022 at GTC, Nagpur.
- An awareness programme on Mushroom Cultivation using cotton stalks was organized for Women Self Help Groups (SHG) on 18th June 2022 by GTC, Nagpur. About 35 participants attended the programme.
- A One Day On-farm Training Camp–cum-Demonstration on Clean Cotton Picking was organized at village Shahpur Begu in Sirsa District (Haryana) on 30th September 2022 by Quality Evaluation Unit of the Institute. Dr. Hamid Hasan, Officer In-charge, QEU demonstrated clean cotton-picking technology and imparted training to participating farmers followed by on-farm live demonstration in the field of Shri Raja Ram Karadawal, a progressive farmer in Sirsa district. The farmers were provided clean cotton-picking aids viz. apron, headgear, cotton collection sheets, cotton bags etc. In all, 20 farmers including Progressive Women Farmers participated in the training programme.
- An awareness programme on 'Quality based Cotton Marketing' in village Mandavgaon, Tehsil Hingna, Nagpur was organized on October 17, 2022. About 100 farmers participated in the programme.

3.6 Exhibitions and Agri-Fair

- The 'Gau Gram Mahotsav - the Festival of Cow' organized at the Sanmitra Ground, Goregaon, Mumbai from 12-18 October, 2022 was inaugurated by Shri Bhagat Singh Koshyari, Hon'ble Governor of Maharashtra as Chief Guest on 12th October 2022. In this Mahotsav, a startup company of ICAR-CIRCOT-RKVY RAFTAAR-ABI (ICAR-CIRCOT R-ABI), Mumbai M/s. Forecast Agrotech Innovations Pvt. Ltd., Pune, showcased its products GoRAS & GoPROM (Phosphate rich organic manure) from biological wastes generated at different Gaushalas. In this event, Dr. Sujata Saxena, Director, ICAR-CIRCOT and Dr. A. K. Bharimalla, Senior Scientist, PI & CEO of CIRCOT R-ABI were felicitated at the hands of Hon'ble Governor Shri Bhagat Singh Koshyari for the efforts made by ICAR-CIRCOT-R-ABI towards promoting Agri Startups.

- ICAR-CIRCOT participated in an exhibition organised on the occasion of inauguration of cotton association of India (CAI) centenary year celebrations on 18th October 2022 at Jio world Convention centre, Mumbai. Various technologies & products developed by the institute were exhibited to the visitors including dignitaries from CAI, Cotton Corporation of India and other stakeholders. Notable among them were Sh. Rajiv Jalota, Chairman, Mumbai Port Authority; Smt. Roop Rashi, Textile Commissioner, Sh. Atul S Ganatra, Chairman, CAI, Sh. Suresh Kotak, President Textile Advisory Group, GOI; and Dr. C. D. Mayee, Former Chairman, ASRB. More than 500 delegates visited the stall of ICAR-CIRCOT.

- ICAR-CIRCOT-R-ABI team along with 9 startups participated in PM Kisan Samman Sammelan 2022 and Agri Startup Conclave during 17-18 October, 2022 at ICAR-IARI Mela, New Delhi. Shri Narendra Singh Tomar, Hon'ble Union Minister of Agriculture and Farmers Welfare and other dignitaries visited ICAR-CIRCOT-R-ABI startup stalls.

3.7 Television / Radio Talks

- A Radio interview of Dr. P. S. Deshmukh explaining "Use of machinery for

agricultural cultivation" was broadcast on All India Radio on 24th May 2022 (in Marathi).

- A Radio talk on "Murghas Nirmiti Tantradnyan" was delivered by Dr Sheshrao Kautkar, Scientist and was broadcast on 16th June 2022 at 7:30 PM during Agriculture Programme-*Maze Awaar Maze Shivaar* on Marathi channel Asmita of All India Radio
- Dr. Jyoti Dhakane-Lad, Scientist, ICAR-CIRCOT delivered a Radio Talk on "Funding for Innovative Ideas under Rashtriya Krishi Vikas Yojana (in Marathi) (राष्ट्रीय कृषी योजने अंतर्गत नव कल्पनांसाठी अर्थसहाय्य)" which was broadcast on 4th October, 2022 at 7:30 pm on All India Radio: Mumbai (Asmita channel).

Kisan Bhagidari Prathamikta Hamari 1

CIRCOT R-ABI celebrated Campaign on "Kisan Bhagidari Prathamikta Hamari" under Azadi Ka Amrit Mahotsav, India @75, at different locations with agri business startups funded under RKVY RAFTAAR Scheme of DA&FW, Ministry of Agriculture, Govt. of India New Delhi during April 2022. The total number of participants for the programme across different locations was 245.

M/s. Mystic Herbal, Dhulgaon, 1
Taluka : Tasgaon, District : Sangli, Maharashtra 1

M/s. Energy Chakra, SaroleKhurd,
Taluka : Niphad, District : Nasik, Maharashtra 1

M/s. VaradVishwa Automation LLP, Lonand, Taluka: Phaltan, District: Satara, Maharashtra

M/s. Rubber Engineers Enterprises Thrissur, Kerala

M/s. Prafulla Winery & Hospitality Pvt. Ltd. 1 Kodoli, Taluka: Panhala, District: Kolhapur, 1 Maharashtra 1

M/s. Forecast Agrotech Innovations Pvt. Ltd. 1 Tikekarwadi, Taluka: Junnar, District: Pune, Maharashtra 1

M/s. SR Foods and Breweries 1 Roha, Dist. Raigad, Maharashtra 1

M/s. Siddaganga Bio Products 1 Tumkur Village, Karnataka 1

4. Skill Development and Capacity Building 1

Skill development in the area of post-harvest processing of cotton and value addition to its biomass is one of the major mandates of ICAR-CIRCOT. Skill upgradation of the workforce with latest developments is also very important in their respective fields so as to enable them to maximise their output.

Skill development and upgradation programmes are organised by the institute for the farmers and other stakeholders including ginners, academicians, personnel from cotton trade and industry throughout the year. These programmes cover diverse areas of cotton processing.

Ginning Training Centre (GTC) of the Institute at Nagpur regularly conducts skill development and upgradation programme for the farmers covering fibre quality parameter, post-harvest processing of cotton and utilisation of cotton biomass for value added products. Training courses for Gin fitters and other workers in the ginning industry on technologies for production of clean quality cotton, maintenance of various ginning and allied machines are also organized regularly by GTC.

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

4.1 Capacity building of Staff

Institute staff are trained as per the training need assessment plans for the years 2021-2022 and 2022-23 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 programmes are also carried out after a period of one year to analyse the outcome. The percent realization of trainings planned during the financial year 2021-22 was 164 %.

Scientists underwent training in diversified fields like Data Visualization using R, Artificial Intelligence in Agricultural, Leadership Development (A Pre-RMP Programme), Mechanical Processing of Natural Fibres, Analysis of Experimental Data. Capacity building programme for Technical, Administrative and skilled staff members include strategies for pest management, Emotional and Social Intelligence. Administrative staff were trained in Pension & Retirement Benefits. During the current year (2022-23), all the staff members are participating in ongoing training programmes as per the Annual Training Plan (ATP) of the Institute.

Table 4.1 Skill Development of Institute Staff during 2022 1

Programme Title	Duration	Venue	Name(s)
Scientific Staff			
Online training program on 'Intellectual Property Rights in Agricultural Research'	January 10-15, 2022	ICAR-CISH Lucknow	Dr. Manoj Kumar Mahawar
Artificial Intelligence in Agriculture	February 15 - March 07 2022	ICAR-IASRI, New Delhi	Shri Himanshu Shekhar Chaurasia
Competency Enhancement Programme for Effective Implementation of Training Functions for HRD Nodal Officers of ICAR	February 21-23, 2022	ICAR-NAARM, Hyderabad	Dr. T. Senthilkumar
Data Visualization using R	March 09 - 11, 2022	ICAR-NAARM, Hyderabad	Dr. S.K. Shukla Dr. Sundaramoorthy C Dr. Arude V.G
Training for implementation of SPARROW (online APAR)	March 22, 2022	ICAR-IASRI, New Delhi Online	Shri Himanshu Shekhar Chaurasia
Online Training on Application of Rheology, Texture and Structural Properties in Food Industries	April 26, 2022	Indian Institute of Food Processing Technology (IIFT), Thanjavur, Tamil Nadu	Dr. Manoj Kumar Mahawar
Feasibility of Manufacturing Reusable PPE and Sustainable Solutions for Recycling of Disposable PPE Products	May 24 - 25, 2022	Indian Technical Textile Association, Mumbai	Dr. A.S.M. Raja
Training course on Introductory course on Internet of Things (IoT)	June 13-18, 2022	IIT, Mumbai	Shri Himanshu Shekhar Chaurasia
Leadership Development (a Pre-RMP Programme)	June 14-25, 2022	ICAR-NAARM, Hyderabad	Dr. N. Shanmugam

Programme Title	Duration	Venue	Name(s)
Orientation Workshop for Nodal Officers of Disaster Management of Ministries/ Departments of Government of India	June 27 - 28, 2022	NIDM, New Delhi	Dr. Ajinath Dukare
5 days online training Program on, 'Drones for Agricultural Development'	July 11-15, 2022	MANAGE, Hyderabad	Dr. Sheshrao Kautkar
Three days Online Short Course on 'Entrepreneurship Development in Food Processing`	July 20 - 22, 2022	National Institute of Food Technology, Entrepreneurship and Management (NIFTEM) – Thanjavur, Tamil Nadu	Dr. Sharmila Patil
Workshop on Response Surface Methodology	August 18 - 20, 2022	ICAR-NAARM Online	Dr. Kanika Sharma
Mechanical Processing of Natural Fibres	October 11 - 20, 2022	ICAR-NINFET, Kolkata	Dr. P. Jagajanantha
Analysis of Experimental Data (On-line Mode - Staggered)	December 19 - 28, 2022	ICAR-NAARM, Hyderabad	Dr. A. Arputharaj Dr. G. Krishna Prasad Dr. K. Pandiyan Dr. Archana Mahapatra Dr. Kanika Sharma Shri Himanshu Shekhar Chaurasia
Technical Staff			
Capacity building programme for Technical, Administrative and skilled staff members	February 16 - 18, 2022	ICAR-CIRCOT, Mumbai	Shri D.U.Patil Smt. Binu Sunil Shri D.G.Gole Shri A.F.Guddadur Shri SuhasTondse Shri S.S.Surkule
Adaption strategies for pest management in climate change scenarios	February 17 - 19, 2022	ICAR-CRIDA & MANAGE, Hyderabad	Dr. N.M.Astaputre Dr. C.P.D'Souza

Programme Title	Duration	Venue	Name(s)
Quality Improvement Programme on "Advances in Chemical Processing & Finishing Techniques of Natural Fibre based Textiles" (Online Mode)	February 24 - 26, 2022	ICAR-NINFET, Kolkata	Shri R.R.Chaggani Smt. Bindu Venugopal
Capacity building programme for CJSC Member of ICAR Institutes	November 15 - 19, 2022	ICAR-NAARM, Hyderabad	Shri Mahabir Singh
Emotional and Social Intelligence at Workplace	December 13 - 15, 2022	ICAR-IIWBR, Karnal	Shri K. Thiagarajan Shri Chandrika Ram
Administrative Staff			
Pension & Retirement Benefits	January 12 -14, 2022	ICAR-NRRI, Cuttack	Shri S.S.Angane
Capacity building programme for Technical, Administrative and skilled support staff	February 16 - 18, 2022	ICAR-CIRCOT, Mumbai	Smt. U.N.Bandari Smt. V.R.Naik Shri D.K.Kasar Shri S.M.Chandanshive
Training for implementation of SPARROW (online APAR)	March 22, 2022	ICAR-IASRI, Online	Shri Sunil Kumar, Smt. T.P.Mokkal, Smt. R.R. Tawade, Shri Avinash Aman, Shri Sainath N Sahane, Shri Kalpesh Gawade
Online training on, 'Pension & Retirement Benefits'	April 18-20, 2022	ICAR-NRRI, Cuttack	Shri Sainath Sahane
Skilled Support Staff			
Capacity building programme for Technical, Administrative and skilled support staff members	February 16 - 18, 2022	ICAR-CIRCOT, Mumbai	Shri H. B. Vesmiya Shri J. D. Sakpal Shri S. K. Bobate Shri R. G. Tak Shri R. P. Karkate Shri S. B. Worlikar Shri M. K. Prabulkar Shri V. Murugan Shri S. D. Magar

Programme Title	Duration	Venue	Name(s)
			Shri M. G. Sosa Shri V. Subbiah Shri Suhas R. Tondse Shri S. P. Naik Shri M. N. Kamble Smt. Kamala Murugan Shri D. R. Gawde Shri P .E. Gurav Shri M. C. Solanki Smt. M. M. Bhandakkar Shri Thapa Gorkha Bahadur Ovilal

4.2 Skill Development Programme organised for stakeholders 1

Regular skill development programmes are being organised by the institute for students, farmers, entrepreneurs and personnel employed in cotton and ginning sectors. Training programmes related to characterisation of textile materials, Value addition to cottonseed and Nano-technology, Composite materials, knitting and electrospinning are conducted at Mumbai headquarters. At Ginning Training Centre, Nagpur, skill development programmes on Double Roller Ginning Technology and Basics of Cotton Grading, Cotton Quality Evaluation and Grading, DR Gin Setting and Maintenance, Best Cotton Picking, Grading, Storage and Handling Practices for farmers were conducted.

A total of 37 Skill Development Programmes were organised benefiting 6824 stakeholders including 6099 farmers. The institute earned a revenue of ₹ 34.10 lakhs through organization of skill development programmes for the stakeholders.

Table 4.2 Skill Development Programmes organised during 2022

National

Programme Title	Duration	No. of Participants	Participants' Profile
ICAR-CIRCOT, Mumbai			
Capacity building programme for Technical, Administrative and skilled support staff	January 05-07, 2022	20	ICAR-CIRCOT staff
Training Program on Nanotechnology & its Advanced Applications	December 05-09, 2022	22	Academician, Industrialist, Others
Training Program Quality Evaluation of Cotton	December 12-16, 2022	12	CCI Traders

Programme Title	Duration	No. of Participants	Participants' Profile
GTC, Nagpur			
DR Gin setting & Maintenance	March 02-05,2022	26	Under SCSP
Cotton Quality Evaluation & Grading	March 02-05,2022	36	Under SCSP
Double Roller Ginning Technology & Basics of Cotton Grading	May 9-14, 2022	13	Graders & Ginners
Double Roller Ginning Technology & Basics of Cotton Grading	July 11-16, 2022	11	Graders & Ginners
Cotton Quality Evaluation & Grading	August 17-20, 2022	25	Under SCSP
DR Gin setting & Maintenance	August 17-20, 2022	35	Under SCSP
Double Roller Ginning Technology & Basics of Cotton Grading	August 22-27, 2022	15	Graders & Ginners
Post-harvest processing of cotton and Value addition to its by-produce	September 12-15, 2022	45	Farmers (ATMA)
Best Post- Harvest Management Practices for Production of World Class Bales from Indian Cotton	September- December, 2022 (Ten Batches)	543	Lead Resource persons, farmers and Multi- tasking Graders (SMART COTTON)
Best pre-picking practices for cotton harvesting	September- October, 2022 (15 Batches)	6000	Farmers (under SMART project)
Cotton Quality Evaluation & its By-Product Utilization	December 12-15, 2022	21	FPO members of Gujarat

Total number of training programmes	Number of beneficiaries	Revenue generated (Rs. Lakhs)
37	6824	34.10

4.3 HRD Achievements

HRD Targets & Achievements for April 2021 to March 2022

Category	*Total No. of Employees*	*No. of trainings planned for each category during 2020-21 as per ATP**	*No. of employees undergone training during April 2020 to March 2021*	*% realization of trainings planned during 2021-22*
Scientist	30	8	15	187
Technical	62	15	23	153
Admn.& Finance	27	11	16	145
SSS	25	11	20	181
Total	143	45	74	164

ATP - Annual Training Plan

HRD Targets & Achievements for April 2022 to December 2022 1

Category 1	*Total No. of Employees*	*No. of trainings planned for each category during 2022-23 as per ATP**	*No. of employees undergone training during April-Dec 2022*	*% realization of trainings during April to Dec. 2022*
Scientist 1	30	13	09	69
Technical 1	62	19	03	16
Admn. & Finance 1	26	09	0	0
SSS	25	08	0	0
Total 1	143	49	12	21

4.4 Education

Dr. N. Vigneshwaran, Principal Scientist, supervised two PhD scholars in Microbiology (under permanent affiliation from University of Mumbai).

Name of Student	**Year of Admission**	**Registration No. & date**	**Research Topic**	**Remarks**
Mrs. Sangeeta M. Chavan	2012	13/10-10-2012	Effect of silver, zinc oxide and titania nanoparticles on nitrogen fixing, phosphate solubilizing and biofilm forming bacteria found in soil ecosystems.	Completed

Name of Student	Year of Admission	Registration No. & date	Research Topic	Remarks
Ms. Komal Saraf	2012	14/19-11-2013	Preparation of nanofibre mats of alginate and pullulan by electro spinning and its application as nanosensor for detection of food spoilage	Thesis submitted

Dissertation work of PG Students

The following students are undergoing internship for their M.Sc. Dissertation work

Students	*Guide*
Ms. Akanksha Pawar	Dr. Sujata Saxena
Ms. Athulya Mavila	Dr. N. Vigneshwaran
Ms. Bhagyashree Rajesh More	Dr. A. Arputharaj
Ms. Akansha Akoda	Dr. Ajinath Dukare

Staff Induction Training Programme

Two-month Induction training programme on "Extraction and Characterization of cotton seed meal protein along with preparation and characterization of nanoparticles" for Dr Preeti Goyal, Assistant Professor, Punjab Agricultural University, Ludhiana was organised during 23rd August to 22nd October 2022. Dr Dattatreya M. Kadam, Principal Scientist and Head I/c. TTD was co-ordinator for this programme

5. Linkages & Collaboration 1

ICAR-CIRCOT has established a good linkage with International organizations, National institutions, public & private sector organizations and start-ups for the benefit of the cotton sector in general and its stakeholders in particular. ICAR-CIRCOT has its Regional Quality Evaluation (QE) units located within the premises of other ICAR institutes and agricultural universities in the major cotton growing areas of the country. The main functioning of these units is as extension wings of the Institute. In addition to this, these units also facilitate linkages and collaboration with the host institutes and other organizations.

The network with various organizations at national and international level are in the domains of research, education, skill development, incubation, extension and commercial services. These linkages helps 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: 1

Private Sector Linkages 1

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. The institute is also a part of the Central Variety Release Committee and 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 linkage 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) since last five years.

MoU Signed

Research Collaboration (9)

1. MoU signed with ***GM Institute of Pharmaceutical Sciences & Research (GMIPSR), Davangere, Karnataka*** for"Development and evaluation of Non-steroidal anti-inflammatory drugs (NSAIDs) loaded nanocellulosic

hydrogels" on 10th January 2022.

2. MoU signed with ***Central Institute of Petrochemicals Engineering & Technology (CIPET): School for Advanced Research in Petrochemicals (SARP) – LARPM, Bhubaneswar for*** "Development of bionanocomposite films using extrusion process" on 20th January 2022.
3. Non-Disclosure Agreement (NDA) signed between ICAR-CIRCOT & ***M/s. Reliance Industries Limited, Mumbai*** for the research on "Production of Nanocellulose from Algae produced by Reliance" on 22nd February 2022
4. MoU signed with ***Central Power Research Institute, Bangalore*** for execution of the project under Research Scheme on Power for R & D in Indian Power sector, titled "Characterization and utilization of paddy straw and other agro residues for conversion into pellets for co-firing in thermal power plants (TPP) (Activity No.1,2,3,4,5,6)" on 28th March, 2022.
5. MoU signed with ***Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri***, Maharashtra for Collaborative Research on "Efficacy Evaluation of ICAR-CIRCOT Nano-Sulphur as Fertilizer Formulation for different Field Crops" on 31st March 2022.
6. MoU signed with ***College of Community and Applied Sciences, Maharana Pratap University of Agriculture and Technology, Udaipur*** for academic and scientific cooperation and join collaborative research on 4th June, 2022.
7. MoU signed with ***M/s Bajaj Steel Industries Limited (BSIL), Nagpur*** for collaborative research work for optimisation of ICAR-CIRCOT Kawadi Cotton Opener on 26th June, 2022.
8. MoU signed with ***Institute of Chemical Technology (ICT), Mumbai*** for "Creation of a framework for collaboration between ICAR-CIRCOT and ICT" on 14th July, 2022.
9. MoU signed with ***M/s Bajaj Steel Industries Limited, Nagpur*** for research collaboration on Evaluation, Optimization and Standardization of different types of lint cleaners used in Ginneries.

Technologies Commercialized (4)

1. MoU signed with ***M/s Superb Hygienic Disposal India Pvt. Ltd. (SHDIPL), Nagpur*** for technology transfer, manufacturing and marketing rights of *ICAR-CIRCOT Trapezoidal Shaped Rapid Burning Briquette Based Crematorium* on 26thJune, 2022.
2. MoU signed with ***M/s. Biofac Inputs Private Limited, Hyderabad*** on 9th December 2022 for *commercialization of Nano-Zn suspension production technology*.
3. MoU signed with ***M/s Bajaj Steel Industries Limited, Nagpur*** for commercialization of *Compact and Energy Efficient Cotton Seed Dryer technology* on 3rd December, 2022.
4. MoU signed with ***M/s Precision Tooling Engineers, Nagpur*** for marketing & Manufacturing of *Miniature Ginning machine viz Lilliput gin, CIRCOT Laghu Otai Yantra (CLOY-Gin), Modified Lab Gin SR 500, Hipro Lab Model DR Gin* on 3rd December, 2022.

Technology Incubation under RKVY-RAFTAAR programme : (13)

Thirteen Memorandum of Agreements (MoA) was signed with agri startups of the Third & Fourth cohort of CIRCOT R-ABI for the release of Grant-in-Aid sanctioned under the RKVY-RAFTAAR programme.

1. *M/s Tejasvi AgroIndustries* (Addressing complete value chain of Tamarind processing)

2. *M/s One Stop Digital-Agri solutions Private Ltd.* (Onestop digital agri-solutions platform for grape farmers)
3. *M/s.VRSS Agro Engineering LLP* (Innovative Food Grain Storage Silo for Farmers, FPOs & Farmers groups)
4. *M/s Rajwardhini Nutricare and Foods* (Naturally fortified affordable baby foods)
5. *M/s Biological Research Innovation Centre and Solutions LLP* (Development of textile fabrics stain remover using plant-based constituents.)
6. *M/s Arde Patil Pharma Pvt Ltd.* (Extraction of medicinal plant extracts and its use)
7. *M/s Veganscare Bio-Tech LLP* (Rapid Detection Kit for Determining Viable and non-viable Onion Seeds)
8. *M/s HN Automatic Pvt Ltd*(Novel approach to produce an automated solo machine for soil intercrop cultivation needs of farmers)
9. *M/s Smaran Udyog* (Innovative process protocol for extraction of essential oil and value addition to byproduct for use in Food, Pharma and Cosmetic)
10. *M/s Forecast Agrotech Innovations Pvt Ltd* (Sustainable conversion of bio-digested sludge into bio-fertilizer and bio-slurry)
11. *M/s Pimani India Pvt Ltd.* (Novel process of dehydration of vegetables and fruits)
12. *M/s 1Vishwa Natural Fab Prints* (Direct Natural Dye printed fabrics)
13. *M/s Gao Shivar Krishi Paryatan Kendra ani Adivashi Jan-Jeevan* (Agro tourism module to generate sustainable income source to villagers)

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 144 tests on different textile materials and cotton by-products. These facilities are extended to various stakeholders. Besides regular tests, special tests were also carried out as per demand on samples received from various government/ private organisations and universities.

During the year 2022 a total number of 7013 samples were tested at headquarters in Mumbai, GTC, Nagpur and quality evaluation units at Coimbatore, Dharwad, Guntur, Sirsa and Surat. Total revenue generated through commercial testing during the year 2022 was ***₹ 72,59,828/-***

The Institute maintains liaison with different institutions including private organizations and entrepreneurs and strives to meet their technological needs by offering various need-based services and generates additional revenue through the activity.

Table 5.1 Number of Paid Samples Tested and Revenue Generated 1

Test Centre	No. of Samples Tested	Revenue Generated (₹)
Mumbai	3906	29,24,419
Nagpur	1711	37,64,586
Coimbatore	1147	2,26,985
Dharwad	33	39,396
Guntur	201	42,008
Sirsa	15	2,17,841
Total	7013	72,59,828

Table 5.2 Tests Conducted and Clientele 1

Test	Clientele
AFM Imaging	♠ ICAR-NINFET, Kolkata ♠ Institute of Chemical Technology, Mumbai
Content of Zinc Oxide	♠ Medii Heal Solutions, Nagpur
FTIR Scanning	♠ J.D. Birla Institute, Kolkata ♠ ICAR-CIFE, Mumbai ♠ Eco Vegan Leather Private Ltd., Kolkata ♠ VJTI, Mumbai ♠ The Synthetic & Art Silk Mills Research Association (SASMIRA), Mumbai
K/S value (L,a,b, delta E)	♠ ICAR-National Institute of Natural Fibre Engg.&Tech, Kolkata
Particle Size Analysis	♠ Div. of Plant Biotechnology SKUAST-K, J& K ♠ Mumbai Veterinary College, Parel, Mumbai ♠ Rashtriya Chemicals and Fertilizers Ltd, Mumbai ♠ ICAR-NINFET, Kolkata
SEM Analysis	♠ Watson Pharma Pvt Limited, Mumbai ♠ Institute of Bioresources and Sustainable, Manipur ♠ ICAR-National Institute of Natural Fibre Engg.&Tech, Kolkata ♠ TUV SUD South Asia Pvt. Ltd., Mumbai ♠ Novo Excipients Pvt. Ltd., Navi Mumbai ♠ Vijay Kiran Goregaonkar, Mumbai ♠ Kirsten Lobo, Mumbai ♠ Vignan's Lara Institute of Technology & Science, Vadlamudi ♠ Jindal Poly Films Ltd (Division Global Nonwovens), Nashik ♠ Reliance Industries Ltd., Navi Mumbai ♠ ICAR-Central Institute of Agricultural Engineering, Bhopal
Surface Tension	♠ Alps Chemicals Pvt. Ltd, Ahmedabad
TGA Scan	♠ ICAR-NINFET, Kolkata
Total Gossypol	♠ Thakurji Solvex Pvt. Ltd., JALNA
Ultra-Violet Protection Factor	♠ D.K.T.E., Ichalkarnaji ♠ K.S.Ramasamy College of Technology, Tiruchengode ♠ V.J.T.I Textile Department, Mumbai ♠ Assam Agricultural University, Jorhat ♠ J.D. Birla Institute, Kolkata ♠ Colorband Dyestuff (P) Ltd., Navi Mumbai

5.3 Contract Research Projects

M/s. Bank Note Press Mill, Mysuru :

A Collaborative project funded by M/s. Bank Note Paper Mill (BNPM) India Private Limited Mysuru, was carried out fromAugust 2019 to December 2022to develop new biocide formulation for efficient control of biofilm formation in pulp & paper production line and to develop nano-based antimicrobial additive for PVA coating of cotton-based paper.

In the year 2022, a novel biocide coating formulation was standardized to coat on the surface of cotton paper to impart antibacterial and antifungal activities. The developed formulation was demonstrated successfully in the lab scale by coating on the surface of cotton-based paper along with PVA that showed excellent antibacterial and antifungal activities as analysed using the standard test procedures. The recommended biocide formulations significantly reduced the number of wash-ups required, thereby reducing the total downtime of the machine line to 320 min. Also, the average rejection rate was less than the standard requirement of 5 %.

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)

6. Awards & Recognition

Awards

Rajbhasha Shield for outstanding work in implementation of Official Language

The Town Official Language Implementation Committee of Central Government Offices constituted under the chairmanship of the General Manager, Western Railway under the guidelines of the Government of India, Ministry of Home Affairs held a half yearly meeting on May 25, 2022. Amongst 99 member offices in Mumbai, ICAR-CIRCOT was awarded with Official Language Shield and Citation for doing remarkable work in the implementation of Official Language during the year 2021-22.

Dr. Sujata Saxena, Director (Acting), ICAR-CIRCOT received this shield and citation at the hands of Mr. Prakash Butani, President, NARAKAS and General Manager (WR). On this occasion, Shri. Sunil Kumar, Chief Administrative Officer, Smt. Trupti Mokal, In-charge, Rajbhasha Cell and Smt. Prachi Mhatre, Assistant In-charge, Rajbhasha Cell were present.

Ashirvad Award 1

ICAR-CIRCOT, Mumbai's home magazine 'Amber' was awarded first Prize by Mumbai's literary-cultural-social organization Ashirwad for the year 2021-22 out of the various home magazine published by Central Government Offices of India, Public sector Undertakings and Nationalized Banks. The award was given by Hon'ble Governor of Maharashtra Shri Bhagat Singh Koshyari in the Rajbhasha Puraskar Ceremony held at Rajbhavan on September 20, 2022.

Professional Excellence Award

Dr. Sujata Saxena, Director (Acting), ICAR-CIRCOT received "Professional Excellence Award" from Cotton Research and Development Association (CRDA), CCS Haryana Agricultural University, Hisar during National Symposium on "Paradigm Shift in Cotton Cultivation" held during August 8-10, 2022 at Maharana Pratap University of Agriculture and Technology (MPUAT), Udaipur

Recognition from BIS

Dr. Sujata Saxena, Principal Scientist received appreciation letter from BIS for contribution made in the work of the Textiles Speciality Chemicals and Dyestuffs Sectional Committee. (TXD-07)

Sectional Committee TXD-31 chaired by Dr. P. K. Mandhyan, Principal Scientist of the institute received committee of the year award from BIS..

"CRDA Fellow 2021" award

Dr. V.G. Arude, Senior scientist received "CRDA Fellow 2021" award from Cotton Research and Development Association (CRDA), CCS Haryana Agricultural University, Hisar during National Symposium on "Paradigm Shift in Cotton Cultivation" held during August 8-10, 2022 at Maharana Pratap University of Agriculture and Technology (MPUAT), Udaipur

Young Scientist Award

Scientist	Award	Organization/ Institution/ Prof.Society	Event / Occasion
Dr. Kirti Jalgaonkar	Young Scientist Award	The Institution of Engineers (IEI)	35th National Convention of Agricultural Engineers held at Hosur during 16-17 September, 2022

Best Paper Award 1

Publication / Presentation	Seminar/Conference /Journal	Organised by (period)	Authour (s)	Award
"Agri -Business Incubation at ICAR-CIRCOT: Fostering Agri-partnership for Sustainable Start-up Ecosystem"	National e-conference on "Agro-Entrepreneurship: A Way to Boost Startup Ecosystem in Agriculture	PDKV Research and Incubation Foundation, Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola	Sundaramoorthy C, Sharmila Patil and Ashok Kumar Bharimalla	Best Paper Award

Recognitions

Lead / Invited Presentations

Topic	Event / Organizer / Venue	Delivered by
Invited talk on "Cotton Scenario"	Webinar on Demand Projection of Fibres in Current Scenario organized by the Textile Association of India on 2nd July, 2022	Dr. Sujata Saxena
Invited paper on "Significance of scientific processing of cottonseed in cotton value chain"	National Symposium on "Paradigm Shift in Cotton Cultivation" jointly organized by the CRDA, CCS HAU, Hisar and MPUAT, Udaipur in Collaboration with ICAR, New Delhi during 8th-10th August, 2022 at MPUAT, Udaipur	Dr. V. G. Arude
Invited Lecture on "Nanotechnology for Business Development in Medical and Aromatic Plants"	Entrepreneurship Orientation Program on Medicinal and Aromatic Plants (EOPMAP)[05-25 January, 2022] organized by ICAR-DMAPR in association with Medi-Hub TBI on 19th January	Dr. N. Vigneshwaran
Invited lecture on "Data Analysis using Open-Source Software"	Refresher Course on "Research Methodology" organised by UGC – Human Resource Development Centre at Pondicherry University on 18th May 2022	Dr. C. Sundaramoorthy
Invited lecture on "Recent Developments in Natural Fibre Composites"	PSG College of Technology on 6th January, 2022	Dr. T. Senthil Kumar

Expert member in Distinguished Committees 1

Name	*Position in Committee*
Dr. Sujata Saxena	▪ *Member, Textiles Speciality Chemicals and Dyestuffs Sectional Committee, (TXD 07), BIS* ▪ *Member, Chemical Methods of Tests Sectional Committee (TXD 05), BIS* ▪ *Member, ISO/TC-38 (Textiles) Committee* ▪ *Member BOS Textiles & Apparel Design, SNDT Women's University, Mumbai*
Dr. A.S.M. Raja	▪ *Member, IMC of ICAR-NINFET, Kolkata* ▪ *Member, ASTM Committee on Textiles (D13-7.02)*
Dr. N. Vigneshwaran	▪ *Member, Technical Textiles for Agrotech Applications (TXD 35), BIS*
Dr. V.G. Arude	▪ *Member, Agriculture and Food Processing Equipment Sectional Committee (FAD 20), BIS* ▪ *Member, Textile Machinery & Accessories Sectional Committee (TXD 14), BIS*
Dr. A. Arputharaj	▪ *Member, Physical methods of Test Sectional committee (TXD 01), BIS*
Dr. T. Senthilkumar	▪ *Member, Physical methods of Test Sectional Committee (TXD 01), BIS* ▪ *Member, Textile Machinery & Accessories Sectional Committee (TXD 14), BIS* ▪ *Member, Technical Textile for Clothtech Applications Including Narrow Fabrics and Braids Sectional Committee (TXD 39), BIS*
Dr. Krishna Prasad	▪ *Member, Technical Textiles for Mobiltech Applications, (TXD 38), BIS*

7. Publications

7.1 Research Articles

1. Arude, V. G.; Shukla, S. K and Chinna Babu Naik, V. (2022) Mechanical gin trash treatment system to prevent transmission of pink bollworm from cotton ginneries. *Journal of Cotton Research and Development*. 36(1), 111-119 (NAAS Rating: 4.78)

2. Arude V. G.; Shukla S. K. and Deshmukh P. S. (2022) Development and evaluation of digital ginning percentage indicator for portable cotton gin. *Journal of Cotton Research and Development*, Vol. 36 (2), 136-144, (NAAS Rating: 4.78)

3. Arude V. G, Shukla S. K., Patil P. G. and Deshmukh P. S. Sustainable Development in cotton sector through Industrial Applications of Value-added Products from Cotton Stalk *Cotton Research Journal*, 10 (1), January-June 2019: 47- 52.

4. Arude V. G., Shukla S. K. and Kautkar S (2022) Adoption and assessment of suitability of seed cotton contamination cleaner for contamination control in the Indian ginning industry, *Multilogic in Science*. Vol. XII, Issue XXXXIV: 310-313 (Oct 2022). (NAAS Rating: 4.51).

5. Basak S, Saxena Sujata, Raja A. S. M., Patil P. G., Krishnaprasad G., Narkar R. S., Kambli N. D.- Cotton based Fragrance packet for well-being applications. *Cotton Research Journal*, 10 (1), January-June 2019: 27-32.

6. Bhambure Shilpa S., Rao Addanki S. & Senthilkumar T(2022) Characterization of Control and Chemically Modified Kenaf Fiber, *Journal of Natural Fibers*, 19:15, 10320-10330, (NAAS Rating: 9.51)DOI: 10.1080/15440478.2021.1993500

7. Shilpa Bhambure, A S Rao and T Senthilkumar, Effect of chemical treatments on physical properties of kenaf bast fibres, *Indian Journal of Fibre & Textile Research*, Vol.47, December 2022, pp. 432-436, DOI: 10.56042/ijftr.v47i4.52876 (NAAS Rating 6.83)

8. Bharimalla, Ashok Kumar; Deshmukh, SP; Patil, Sharmila; Nadanathangam, Vigneshwaran; Saxena, Sujata; (2022). Development of energy efficient nanocellulose production process by enzymatic pretreatment and controlled temperature refining of cotton linters, Cellulose, 1-15.(NAAS Rating 12.12)

9. Bibwe, B. Mahawar, M. K. Jalgaonkar, K.Meena, V. S. & Kadam, D. M. (2022). Mass modelling of guava (cv. *Allahabad safeda*) fruit with selected dimensional attributes: Regression analysis approach. *Journal of Food Process Engineering*, 45 (3),e13978,(NAAS Rating: 8.89) https://doi.org/10.1111/jfpe.13978

10. Blaise, 1D; Kranthi, K; Saxena, Sujata; Venugopalan, M. V. and Mohan, P. (2022) Productivity and fibre attributes of absorbent Asiatic cotton (*Gossypium arboreum*) cultivars in rainfed central India. *Indian Journal of Agricultural Sciences*, 92 (3), 300-304 (NAAS Rating: 6.37)

11. Dhunde AD, VG Naik, DB Malve, JR Kadam, JS Dhekale, SR Torane, C Sundaramoorthy (2022) An Evaluation of Organic and Conventional Cotton Production in Maharashtra, India, *International Journal of Environment and Climate Change, Vol. 12(12), 1780-1785.* (NAAS rating- 5.3)

12. Dhunde AD, VG Naik, DB Malve, JR Kadam, JS Dhekale, SR Torane, C Sundaramoorthy (2022) Economic Assessment of Sustainable Cotton Production in Maharashtra, India, *International Journal of Environment and Climate Change, Vol. 12(12), 1812-1818.* (NAAS rating- 5.3)

13. Dukare, A. S.; Samota, M. K.; Bibwe, B; Dawange, S. (2022) Using convective hot air drying to stabilize mango peel (Cv-Chausa): evaluating effect on bioactive compounds, physicochemical attributes, mineral profile, recovery of fermentable sugar, and microbial safety, *Food Measurement*. 16, 3897–3909. https://doi.org/10.1007/s11694-022-01496-x(NAAS Rating 9.01)

14. Dukare, A.; Bibwe, B.; Samota, M. K.; Dawange, S.; Kumar, M. and Lorenzo, J. M. (2022). Assessment of Bioactive Compounds, Physicochemical Properties, and Microbial Attributes of Hot Air–Dried Mango Seed Kernel Powder: an Approach for Quality and Safety Evaluation of Hot Air–Dried Mango Seed Kernel Powder. *Food Analytical Methods*. (NAAS Rating: 9.50)https://doi.org/10.1007/s12161-022-02318-y

15. Nath, P., Dukare A, Kumar, S. Kale S and Kannaujia, P (2022). Black carrot (Daucuscarota subsp. sativus) anthocyanin-infused potato chips: Effect on bioactive composition, color attributes, cooking quality, and microbial stability. *Journal of Food Processing and Preservation* (IF-2.6), 46:e16180. (NAAS Rating: 8.61) https://doi.org/10.1111/jfpp.16180

16. Kumar, M., Zhang, B., Potkule, J., Sharma, K., Hano, C., Sheri, V., ... & Lorenzo, J. M. (2022). Cottonseed Oil: Extraction, Characterization, Health Benefits, Safety Profile, and Application. *Food Analytical Methods*, 1-15. (NAAS-9.50).

17. Sharma, K., Kumar, M., et al. (2022). Moringa (Moringa oleifera Lam.) polysaccharides: Extraction, characterization, bioactivities, and industrial application. International Journal of Biological macromolecules. 209, 763-778. (NAAS rating- 14.03)

18. Alaji, O., Sagar, V.R., Kaur, C., Rudra, S.G., Vasudev, S., Chandran, D., Sharma, K., Kumar, M., Lorenzo, J.M. (2022). Chemical Characterization of Apricot Kernel: Nutraceutical Composition, Amino Acid, and Fatty Acid Profle. *Food Analytical methods*. (NAAS Rating-9.50)

19. Dukare, A.; Mhatre, P.; Maheshwari, H. S.; Bagul, S.; Manjunatha, B. S.; Khade, Y.; Kamble U. (2022) Delineation of mechanistic approaches of rhizosphere microorganisms facilitated plant health and resilience under challenging conditions. *3 Biotech* 12, 57. https://doi.org/10.1007/s13205-022-03115-4(NAAS Rating: 8.89)

20. Jalgaonkar K, Mahawar MK, Vishwakarma RK (2022). Destalking of dry red chillies (Capsicum annum L.) and its characterization. Journal of Food Science & Technology,(NAAS Rating: 9.12) https://doi.org/10.1007/s13197-022-05627-6

21. Jalgaonkar K, Mahawar MK, Girijal S, Geeta HP (2022). Post-harvest profile, processing and value addition of dried red chillies (Capsicum annum L.). Journal of Food Science & Technology. (NAAS Rating: 9.12) https://doi.org/10.1007/s13197-022-05656-1

22. Kadam, D. M., Kaur, A., & Kasara, A. (2022). Characterization of natural fibre-based nano-composite materials: A review. Journal of Agricultural Engineering, 59(2), 159-178. (NAAS Rating 4.79)

23. Kawlekar, S. R.; Raja, A. S. M.; Saxena, Sujata; Gurjar, R. M. (2022) Eco-friendly dyeing of cotton fabric with tender green coconut soft husk, *Indian Journal of Fibre & Textile Research*, 47, pp. 227-233 (NAAS Rating 6.83)

24. Krishna Prasad, G.; Guruprasad, R.; Senthilkumar, T.; Prabu, G. T. V.; Raja, A. S. M. (2022) Development of biodegradable tri-blended fabrics with improved moisture management properties using cotton/polylactic-acid/bamboo-viscose fibres, *Indian Journal of Fibre & Textile Research*, 47, pp. 161-165 (NAAS Rating 6.83)

25. Kumar, M., Chakdar, H., Pandiyan. K., Thapa, S., Shahid, M., Singh, A., Srivastava, A.K., Saxena, A.K. (2022). Bacterial Chitinases: Genetics, Engineering and Applications. World *Journal of Microbiology and Biotechnology*. 38: 252(NAAS Rating 9.28) (https://doi.org/10.1007/s11274-022-03444-9)

26. Kumar Manoj, Potkule Jayashree, Saxena S.- Extraction and Functional Group analysis of Gossypol from Cottonseed Meal. *Cotton Research Journal*, 10 (1), January-June 2019: 39-41.

27. Kumar, R., Priyadarshini, S., Moury, P.K., Kumar, V., Yadav, S.K., Khan, M. A., Kumar, D., ***Chaurasia, H.***, Ahmed, B., Kumar, P. and Chaudhari, R.H., (2022). Construction of Polygonal designs for sampling from circularly ordered populations. *The Pharma Innovation Journal*, sp-11(1), 704-708.(NAAS Rating 5.23)

28. Manjunatha, B. S.; Nivetha, N.; Krishna, G. K.; Elangovan, A.; Pushkar, S.; Chandrashekar, N.; Aggarwal, C.; Asha, A. D.; Chinnusamy, V.; Raipuria, R.K.; Anshul, W.; Bandeppa, S.; ***Dukare, A. S.*** and Paul S. (2022). PGPR *Shewanellaputrefaciens* and *Cronobacterdublinensis*enhance drought tolerance of pearl millet by modulating hormones and stress-responsive genes. *Physiologia Plantarum*, 174(2), e13676. Doi: 10.1111/ppl.13676(NAAS Rating: 11.08)

29. Manoj Kumar, Jayashree Potkule, Sharmila Patil, Vellaichamy Mageshwaran, Radha, Varsha Satankar, Mukesh K Berwal, Archana Mahapatra, Sujata Saxena, Nandita Ashtaputre, Charlene D' Souza. Evaluation of detoxified cottonseed protein isolate for application as food supplement. *Toxin Reviews*. 41(2), 412-419 (2022)(NAAS Rating 9.17)

30. Manoj Kumar, Maharishi Tomar, SnehPunia, Jyoti Dhakane-Lad, Sangram Dhumal, Sushil Changan, MarisennayyaSenapathy, Mukesh K Berwal, VellaikumarSampathrajan, Ali AS Sayed, Deepak Chandran, R Pandiselvam, Nadeem Rais, Dipendra Kumar Mahato, Shashikant Shiddappa Udikeri, Varsha Satankar, T Anitha, Surinder Singh, RyszardAmarowicz, John F Kennedy. Plant-based proteins and their multifaceted industrial applications, *LWT*. Volume 154 (2022).(NAAS Rating 12.06)

31. Manoj Kumar, Swati Kapoor, Sangram Dhumal, Joanna Tkaczewska, Sushil Changan, Vivek Saurabh, Mohamed Mekhemar, Nadeem Rais, Varsha Satankar, R Pandiselvam, Ali AS Sayed,

MarisennayyaSenapathy, T Anitha, Surinder Singh, Maharishi Tomar, Abhijit Dey, GokhanZengin, RyszardAmarowicz, Deep Jyoti Bhuyan. Guava (Psidium guajava L.) seed: A low-volume, high-value by-product for human health and the food industry. *Food Chemistry*. (2022)(NAAS Rating 15.23)

32. Manoj Kumar, 1Muzaffar Hasan, Prince Choyal, Maharishi Tomar, Om Prakash Gupta, MinnuSasi, Sushil Changan, José M Lorenzo, Surinder Singh, VellaikumarSampathrajan, Sangram Dhumal, R Pandiselvam, Kanika Sharma, Varsha Satankar, Roji Waghmare, MarisennayyaSenapathy, Ali AS Sayed, Abhijit Dey, RyszardAmarowicz, John F Kennedy. Cottonseed feedstock as a source of plant-based protein and bioactive peptides: Evidence based on biofunctionalities and industrial applications. *Food Hydrocolloids*. (2022)(NAAS Rating 17.50)

33. Murmu, 1S., ***Chaurasia, H.***, Guha Majumdar, S., Rao, A.R., Rai, A. and Archak, S., (2022). Prediction of protein-protein interactions between anti-CRISPR and CRISPR-Cas using machine learning technique. *Journal of Plant Biochemistry and Biotechnology*, 1-13.(NAAS Rating 7.53)

34. Palve S. M., WaghmareV. N., MandhyanP. K. and Kate N. "Assessment of yield components and fibre quality traits in an introgressed population derived from Gossypiumhirsutum and G. barbadense"*Electronic Journal of Plant Breeding*, Vol 12(4):1195 – 1200, https://doi.org/10.37992/2021.1204.164 (NAAS Rating: 5.14)

35. Palve, S. M., Waghmare V. N., Mandhyan P. K. and Kate N.- Analysis of Fibre Quality in a Gossypiumhirsutum G. barbadense Backcross Introgression Population- *Cotton Research Journal*, 10 (1), January-June 2019: 16-20.

36. Pandey, Ritu; Krishna Prasad, G.; Dubey, Amarish; Arputharaj, A; Raja, A. S. M.; Sinha, Mukesh Kumar; Jose, Seiko (2022) Tellicherry Bark Microfiber: Characterization and Processing, *Journal of Natural Fibers*. https://doi.org/10.1080/15440478.2022.2089432. (NAAS Rating 9.51)

37. Patil, 1Sharmila; Bharimalla, A. K.; Vigneshwaran Nadanathangam; Dhakane-Lad, Jyoti; Mahapatra, Archana; Jagajanantha, P; Saxena Sujata (2022). Nanocellulose reinforced corn starch-based bio composite films: Composite optimization, characterization and storage studies. *Food Packaging and Shelf Life*, 33, 100860.(NAAS Rating: 14.75).

38. Poonia, Neenu, Vinod Kadam, Neelam M. Rose, Saroj Yadav, and N. Shanmugam. "Effect of Fiber Chemical Treatments on Rice Straw Fiber Reinforced Composite Properties." Journal of Natural Fibers, September 2, 2022, 1–11. https://doi.org/10.1080/15440478.2022.2114979.(NAAS Rating 9.51)

39. Prabu, 1G. T. V.; Guruprasad, R.; Sundaramoorthy, C.; Vigneshwaran, N. (2022) Process optimization and modelling the BET surface area of electrospun cellulose acetate nanofibres using response surface methodology, *Bulletin of Material Science*, 45 (3), 133 (NAAS Rating 7.88)

40. Sangeeta, Chavan; Vishwas, Sarangdhar; Vigneshwaran, Nadanathangam; Nanopore-based metagenomic analysis of

the impact of nanoparticles on soil microbial communities, Heliyon, e09693, 2022(NAAS Rating 9.78)

41. Sanjay Kumar Singh, Sheshrao Kautkar, P. K. Pathak and Amit Kumar Patil (2022). Moisture Dependent Physical Properties Assessment of Deenanath Grass Seeds, Ecology, *Environment and Conservation*, 28 (2):747-751.(NAAS Rating: 5.41)

42. Sanjay Kumar Singh., Patil, A. K., Kautkar, S., Dwivedi, P. N. and Singh, A. K. (2022). Development and performance evaluation of evaporative cool hydroponic fodder production Chamber, *Range Mgmt. & Agroforestry* 43(1):132-138. (NAAS Rating: 6.58)

43. Shanmugam, N; Kadam, D. M.; Prabu, G. T. V.; Jagajantha, P. and Chaurasia, H. (2022) Application of artificial intelligence in mechanical processing of cotton for ring and open-end spinning, *Journal of cotton research and development*, 36(2), 145-154, (NAAS Rating 4.78)

44. Sharma, 1K., Kumar, M**.,** Lorenzo, J.M., Guleria, S., **Saxena, S.** - Manoeuvring the physicochemical and nutritional properties of vegetable oils through blending, 2022. *Journal of American Oil Chemists' Society* 10.1002/aocs.12661 (NAAS Rating 7.85)

45. Singh, 1A., Kumar, M., Chakdar, H., Pandiyan, K., Kumar, S.V., Zeyad, M.T., Singh, B.N., Ravikiran, K.T., Mahto, A., Srivastava, A.K., Saxena, A.K. (2022). Influence of Host Genotype in Establishing Root Associated Microbiome of indica Rice Cultivars for Plant Growth Promotion. *Frontiers in Microbiology* 13:1033158. (https://doi.org/10.3389/fmicb.2022.1033158).(NAAS Rating 12.06)

46. Shukla S. K., Arude V. G., Patil P. G., Raja A.S.M., Bharimalla A. K., Patil D. U.- Design, Development and Performance Evaluation of ICAR-CIRCOT Briquette Based Crematorium. *Cotton Research Journal*, 10 (1), January-June 2019: 42 - 46.

47. Sofi Asif Hassan, Wani Sarfaraz A., Jose Seiko, Kamboj Arpana, Shakyawar D. B., Shanmugam N., Tahir Nazir &Rafeh Ahmad (October 2022) A Comparative Study on the Dyeing Efficiency of Pashmina and Pashmina Blended Knitwear with Acid Dyes, Journal of Natural Fibres, DOI: 10.1080/15440478.2022.2131690. (NAAS Rating: 9.51)

48. Vigneshwaran N., Saraf K. "Paper from Cotton Linters as substrate for Ammonia Nanosensor using Electrospun Alginate Nanofibers". *Cotton Research Journal*, 10 (1), January-June 2019: 33-38

7.2 Review Article

1. Ajay Yadav, Nishant Kumar, Ashutosh Upadhyay, Olaniyi Amos Fawole,Manoj Kumar Mahawar, Kirti Jalgaonkar, Deepak Chandran, Sureshkumar Rajalingam,GokhanZengin, Manoj Kumar, and Mohamed Mekhemar (2022): Recent Advances in Novel Packaging Technologies for Shelf-Life Extension of Guava Fruits for Retaining Health Benefits for Longer Duration. Plants 2022, 11, 547. https://doi.org/10.3390/plants11040547.(NAAS Rating 9.94)

2. Jalgaonkar, K.; Mahawar, M. K.; Patil, Sharmila; Dhakane-Lad, Jyoti (2022) Improving the nutritional and functional properties of pearl millet pasta: A Review, *Turkish Journal of Agricultural Engineering*

Research, 3(1), pp. 194-203. https://doi.org/10.46592/turkager.1065108

3. Gupta, A., Singh, U.B., Sahu, P.K., Paul, S., Kumar, A., Malviya, D., Singh, S., Pandiyan, K., Singh, P., Paul, D., Rai, J.P., Singh, H.V., Manna, M.C., Crusberg, T.C., Kumar, A., Saxena, A.K. (2022). Linking soil microbial diversity to modern agriculture practices: A Review. *International Journal of Environmental Research and Public Health*. 19 (5): 3141 (https://doi.org/10.3390/ijerph19053141).(NAAS Rating 10.61)

4. Manoj Kumar, Mrunal D Barbhai, Muzaffar Hasan, SnehPunia, Sangram Dhumal, Nadeem Rais, Deepak Chandran, R Pandiselvam, AnjineyuluKothakota, Maharishi Tomar, Varsha Satankar, MarisennayyaSenapathy, T Anitha, Abhijit Dey, Ali AS Sayed, Farouk M Gadallah, RyszardAmarowicz, Mohamed Mekhemar. Onion (Allium cepa L.) peels: A review on bioactive compounds and biomedical activities. *Biomedicine & Pharmacotherapy*. 146 (2022).(NAAS Rating 13.42)

5. Mohammed M. Alshehri, Cristina Quispe, Jesús Herrera-Bravo, Javad Sharifi-Rad, SenaTutuncu, ElifFeyzaAydar, CansuTopkaya, Zehra Mertdinc, BeraatOzcelik, Mahima Aital, N. V. Anil Kumar, NatalliaLapava, Jovana Rajkovic, Andrea Ertani, Silvana Nicola, Prabhakar Semwal, Sakshi Painuli, Carlos González-Contreras, Miquel Martorell, Monica Butnariu, Iulia Cristina Bagiu, Radu VasileBagiu, Mrunal D. Barbhai, **Manoj Kumar**, SevgiDurnaDaştan, Daniela Calina, and William C. Cho (2022): A Review of Recent Studies on the Antioxidant and Anti-Infectious Properties of Senna Plants. Oxidative Medicine and Cellular Longevity, Volume 2022, Article ID 6025900, 38 pages, (NAAS Rating 13.31) https://doi.org/10.1155/2022/6025900

6. Monica Butnariu, Cristina Quispe, Jesús Herrera-Bravo, Marius Pentea,IoanSarac, Aylin SeylamKüşümler, BeraatÖzçelik, Sakshi Painuli, Prabhakar Semwal, Muhammad Imran, Tanweer Aslam Gondal, SiminEmamzadeh-Yazdi, NatalliaLapava, Zubaida Yousaf, **Manoj Kumar**, Ali Hussein Eid, Yusra Al-Dhaheri, Hafiz Ansar Rasul Suleria, María del Mar Contreras, Javad Sharifi-Rad, and William C. Cho (2022): Papaver Plants: Current Insights on Phytochemical and Nutritional Composition Along with Biotechnological Applications. Oxidative Medicine and Cellular Longevity Volume 2022, Article ID 2041769, 23 pages, https://doi.org/10.1155/2022/2041769 (NAAS Rating 13.31)

7. Rajib Hossain, Cristina Quispe, Jesús Herrera-Bravo, Jorge F. Beltrán, Muhammad Torequl Islam, Shabnum Shaheen, Natália Cruz-Martins, Miquel Martorell, **Manoj Kumar**, Javad Sharifi-Rad, Fethi Ahmet Ozdemir, William N. Setzer, Mohammed M. Alshehri, Daniela Calina and William C. Cho (2022): Neurobiological Promises of the Bitter Diterpene Lactone Andrographolide. Oxidative Medicine and Cellular Longevity, Volume 2022, Article ID 3079577, 9 pages, (NAAS Rating 13.31) https://doi.org/10.1155/2022/3079577

7.3 Book

1. Handbook on Nanotechnology and its Applications ***(ISBN: 978-93-5777-411-6)***

2. FAQ on Sulphur and its Nano formulation ***(ISBN.: 978-93-5786-096-3)***

7.4 Book Chapters

1. Dattatreya M. Kadam and Mrunal D. Barbhai (2022). Biobased Material for Food Packaging. In: Biobased Materials. Edited by A. K. Mishra, C. M. Hussain, Springer, Singapore. https://doi.org/10.1007/978-981-19-6024-6_1 pp: 1-15.

2. Gopal R.K., Raj, P.P., Dukare, A. and Kumar, R. (2022). Metabolic Engineering of Methanogenic Archaea for Biomethane Production from Renewable Biomass. In***: Biomethane (First Edition),*** Apple Academic Press, Pages, 43-60.

3. Guru PN, Mridula D, Dukare AS, Ghodki BM, Paschapur AU, Samal I, Nikhil Raj M, Padala VK, Rajashekhar M and Subbanna ARNS (2022) A comprehensive review on advances in storage pest management: Current scenario and future prospects. Frontiers in Sustainable Food Systems. 6:993341. doi: 10.3389/fsufs.2022.993341

4. Mageshwaran V., **Pandiyan K**. (2022) Isolation and Characterization of Enterobacter, Klebsiella, and Clostridium. In: Amaresan N., Patel P., Amin D. (eds) Practical Handbook on Agricultural Microbiology. Springer Protocols Handbooks. Humana, New York, NY. https://doi.org/10.1007/978-1-0716-1724-3_8

5. 1 **Pandiyan, K.,** Kushwaha, P., Srivastava, R., Kashyap, P.L. (2022). Meta transcriptomics of Plant Rhizosphere: A promising tool to decipher the role of microorganisms in plant growth and development. In: Singh, U.B., Rai, J.P., Sharma, A.K. (eds) Re-visiting the Rhizosphere Eco-system for Agricultural Sustainability. Rhizosphere Biology. Springer, Singapore. https://doi.org/10.1007/978-981-19-4101-6_24.

6. Prabu, GTV; Vigneshwaran, N; Electrospinning Lab to Industry for Fabrication of Devices, In: Electrospun Nanofibers from Bioresources for High-Performance Applications, Edited by: Praveen, K M; Murickan, R T; Joy Jobin; Maria H J; Haponiuk J T; Thomas, S, 253 (12 pages), 2022, CRC Press.

7. Pradhan, A.K., Chaurasia, H., Kumar, D. and Murmu, S., (2022). Application of Artificial Intelligence (AI) and Internet of Things (IoT) in Food Processing. In: Futuristic Trends in Agriculture Engineering and Food Sciences, IIP proceedings, Volume 2, Book 9, Part 1.

8. Pradhan, A.K., Chaurasia, H., Kumar, G.A.K., Mishra, S.K., Mondal, B., Jambhulkar, N.N. and Paul, S., (2022). Information and Communication Technologies (ICTs) interventions for Climate Resilient Agriculture, In: Climate Resilient Technologies for Rice Based Production System in Eastern India (P Bhattacharyya, K Chakraborty, K A Molla, A Poonam, D Bhaduri, R P Sah, S Paul, P S Hanjagi, B Gowda, P Swain Eds.), pub. ICAR-National Rice Research Institute, Cuttack, 400-408.

9. Raja, A. S. M., A. Arputharaj, G. Krishna prasad, T. Senthil Kumar, and P. G. Patil. "Nanotechnology Applications for the Management of Textile Effluent." Fundamentals of Nano–Textile Science (2022): 277-298

10. Rajavat, 1A.S., Mageshwaran, V., Bharadwaj, A., Tripathi, S., ***Pandiyan, K.***

(2022) Spent mushroom waste: An emerging bio-fertilizer for improving soil health and plant productivity. In: Singh, H.B., and Vaishnav, A. (eds) New and Future Developments in Microbial Biotechnology and Bioengineering – Sustainable Agriculture: Revitalization through Organic Products. Elsevier, ISBN No. 9780323855792, PP: 345-354. https://doi.org/10.1016/B978-0-323-85579-2.00010-1

11. Sharma, K., Kumar, M., Chandran, D. Ameliorative Effects of Phenolics in Oxidative Stress Management in Plants. (2022). In Ed: Plant Phenolics in Abiotic Stress Management. https://doi.org/10.1007/978-981-19-6426-8_17.

12. Singh, D., Thapa, S., **Pandiyan, K.**, Das, M.K., Pramanik, A., Chakdar, H. (2022). Microbial Adaptations Under Low Temperature. In: Goel, R., Soni, R., Suyal, D.C., Khan, M. (eds) Survival Strategies in Cold-adapted Microorganisms. Springer, Singapore. https://doi.org/10.1007/978-981-16-2625-8_9.

13. Vigneshwaran, N.; Arputharaj, A.; Ashtaputre, N.M.; Souza, Charlene D'; Application of nanocrystals as antimicrobials, In: Industrial Applications of Nanocrystals, Edited by: Mallakpour, Shadpour; Hussain, C M, pages - 315-328, 2022.

14. Vigneshwaran, Nadanathangam; Komal, Saraf; Production and Application of Nanofibres from Pullulan, In: Fungal Biopolymers and Biocomposites, Edited by: Deshmukh, S K; Deshpande, M V; Sridhar, K R, pages - 73-83, 2022.

7.5 Popular /Technical Articles

1. अर्चना महापात्र, मनोज कुमार महावर, ज्योति ढाकणे-लाड, शर्मिला पाटिल और अशोक कुमार भारीमल (2021). खाद्य कोटिंग से फल भंडारण गुणवत्ता में वृद्धि. फल फूल, 42(6): 57-58.

2. अशोक कुमार भारीमल, मनोज कुमार महावर, पी.जी. पाटील, प्राची म्हात्रे (2022). प्राकृतिक रेशायुक्त रबराइज्ड गमले एवं फूलदान. फल फूल. 43(1): 51.

3. किर्ती जलगांवकर, पी जगज्जानंथा, शर्मिला पाटील, ज्योती ढाकने-लाड, अर्चना महापात्रा एवं मनोज कुमार महावर (2022). कपड़ा उद्योगों में एक्टिवेटेड कार्बन के अनुप्रयोग. International Journal of Applied Research. 8(1): 223-226

4. Jagajanantha P, Mageshwaran V, Mahawar MK, Jalgoankar K, Patil S, Dhakane-Lad J, Prasad KG (2022). Heat generating textile products for human clothing. 3(1): 327-329. https://agrosciencetoday.com/index.php/magazine/article/view/175

5. Raja, A. S. M & Saxena, Sujata (2022) "Salt Free Dyeing Technology for Cotton Textiles" *Cotton Innovation*, Vol 1(Issue 12) 29-32. www.icracotton.org

6. Saxena, Sujata, Senthilkumar T., Krishna Prasad G., Raja, A. S. M. and Kawlekar, Sujata R. (2022) Preparation of Activated Carbon from Cotton Stalks" *Cotton Innovation*, Vol.1 (Issue 12) 33-35.

7. किर्ती जलगांवकर, जी कृष्णप्रसाद, सेंथिलकुमार टी, अजिनाथ डुकारे, मनोज कुमार महावर, पीजगजानंथा (2022) निर्माण सामग्री के विकास मेंकृषिअपशिष्टोंकी भूमिका. *International Journal of Applied Research* 8(5): 161-163

8. Patil S, Jalgaonkar K, Jagajanantha P, Dhakane-Lad J, Mahapatra A, Mahawar MK (2022) on "Application of phase change materials for textiles" Agri Journal world,

2(4): 1-6

9. G. Krishna Prasad, A. S. M. Raja, T. Senthilkumar, G. T. V. Prabu, P. Jagajanantha and Sujata Saxena, (2022) "Development of electrospun Nano fibre mat through needleless electrospinning as a filtration layer for cotton-based face mask", *Innovative Textile Materials* published by The Institute of Engineering (I), conference Proceedings, pp. 25-29.

10. Dr. P. Jagajanantha P & Dr. P.K. Mandhyan (2022). Published a magazine on "Cotton Quality Requirement and Its By-product Utilisation", in *Cotton Statistics & News* published by Cotton Association of India.

11. Shesrao 1Kautkar and Rehana Raj. Importance of women's empowerment for the nation's development, Sasthra, The Indian Journal of Science and Technology, 2022, 3(3):6-9

12. Murmu, S., Pradhan, A.K., Chaurasia, H., Kumar, D. and Samal, I., (2022). Impact of Bioinformatics advances in agricultural sciences. *AgroScience Today*, 3(9), 480-485

7.6 Newspaper Articles/ Reports

1. A newspaper article in Nagpur Bhaskar on ICAR-CIRCOT technology for using cotton pellets as biomass "**केंद्रीय कपास प्रौद्योगिकी अनुसंधान संस्थान का प्रोजेक्ट: गैस नहीं, बायोमास पेलेट्स से बनेगा खाना**"was published on 1st January 2022.

2. An article on ICAR-CIRCOT-RABI was published in weekly Marathi newspaper "ShetkaryachaAsud" dated 8thMarch 2022 on occasion of International Womens' Day.

3. ICAR-CIRCOT, RABI incubatee M/s. Forecast Agrotech Innovations Private Limited briefed 70 farmers about Sustainable Conversion of Bio Digested Sludge into Bio Fertilizer and Bio-Slurry at Junnar, Pune (MS). This event was published in the Marathi newspaper 'Sakal' (pune edition) on 29th April 2022.

4. News article on ICAR-CIRCOT bagging "Official Language Shield and Citation" by City Official Language Implementation Committee, Mumbai for doing remarkable work in the Official Language implementation in the Institute for the year 2021 was published in all leading Hindi newspapers

5. Dr. V. G. Arude and Dr. Sujata Saxena. An article entitled "**शेतक-यांच्या हितासाठी रुईच्या उता-यानुसार कपासाचे वर्गीकरण आणि विपणन करणे आश्यक"** was published in Marathi Weekly Newspaper " ShetkaryanchaAsud" in a special issue brought out on the Occasion of World Cotton Day on **7**th Oct **2022.**

7.7 Other Publications

1. Annual Report 2020 (Hindi)
2. Annual Report 2021 (English)
3. Cotton Technological Report (2021-22) of AICRP on Cotton
4. Booklet: Agri Start-up Ecosystem at ICAR-CIRCOT
5. Booklet 'Glimpses on ICAR-CIRCOT Nano Sulphur and its Application in Field Crops'.
6. Manual: FAQ Sulphur and its Nano formulation
7. e-Newsletter "UDAAN" (Jan - June 2022) - Half yearly publication of CIRCOT R-ABI
8. Book of papers on "Balanced and Efficient use of fertilizers" (Hindi Sangoshthi)
9. "Amber- 2021" (in Hindi).

10. **"कपास प्रौद्योगिकी शब्दावली"** (Glossary on Cotton Technology) English to Hindi

7.8 Paper Presentations

International Conferences /Seminars (3)

International Conference on "Sustainable Materials, Management and Innovative Technologies" (ICSMMIT'2022)" held on 23 & 24 June 2022 organized by Kumaraguru College of Technology, Coimbatore.

- Dr GTV Prabu Presented the paper on "Pheromone encapsulated nanofiber production through profiled multi-pin electrospinning set-up for insect trap application"

4th Indonesian Textile Conference held online on 28th July 2022.

- P. Jagajanantha, G. Krishna Prasad, G. T. V. Prabu, Sharmila Patil, V. Mageshwaran (2022) "Heat generating smart garment using conductive yarn"

International Conference "ICAATAS-2022: 5th International Conference on Advances in Agriculture Technology and Allied Sciences at Centurion University during June 4-5, 2022.

- Pandiyan, K., Kautkar, S.S., Shukla, S.K., Rajavat, A.S., Kumar, M. (2022). Characterization of thermotolerant cellulolytic bacteria isolated from cotton micro-dust compost

National Conferences /Seminars (13)

National e-conference on "Agra-Entrepreneurship: A Way to Boost Start-up Ecosystem in Agriculture" organized by PDKV Research and Incubation Foundation, Dr PDKV, Akola (February 23-24, 2022)

- Sundaramoorthy C, Sharmila Patil and Ashok Kumar Bharimalla, presented a paper on "Agri-Business Incubation at ICAR-CIRCOT: Fostering Agri-partnership for Sustainable Start-up Ecosystem"
- K. Bharimalla, Sujata Saxena, Saswati Mukherjee "Role of Incubation Centres in nurturing Agri-Start-ups"

ICAR-AICRP on Cotton Annual Group Meeting 2022 & "Fifty Years (golden jubilee) of Cotton Hybrid Technology" (6-8 April 2022) at Tamil Nadu Agricultural University, Coimbatore

- Dr. P. K. Mandhyan, Dr. A. S. M. Raja and Dr. A. Arputharaj presented invited paper on "Changes in fibre quality traits brought by hybrid seeds" in the special session on Cotton Hybrids: Historical perspective

National Hindi Sangoshti on "Balanced and Efficient use of Fertilizers" held on 21st June 2022 at ICAR-CIRCOT, Mumbai

- नैनो उर्वरकों का कृषि में अनुप्रयोग और संभावनाये: भा.कृ.अनु.प.–सिरकॉट का योगदान by Dr. Manoj Kumar Mahawar
- टिकाऊ कृषि के लिए जीवाणु खाद का उपयोग एवं कपास डंठल से जैव समृद्ध कम्पोस्ट by Dr. Ajinath Dukare.

Webinar on Demand Projection of Fibres in Current Scenario organized by the Textile Association of India on July 2, 2022.

- Dr. Sujata Saxena, Director, presented an invited paper on "Cotton Scenario"

National Symposium on "Paradigm Shift in Cotton Cultivation" jointly organized by the Cotton Research and Development Association (CRDA), CCSHAU, Hisar and MPUAT, Udaipur in Collaboration with Indian Council of Agricultural Research (ICAR), New Delhi

during August 8-10, 2022 at MPUAT, Udaipur.

- Arude V. G. "Significance of scientific processing of cottonseed in cotton value chain" *(Invited lecture)*
- Arputharaj A., Mandhyan P. K., Raja A. S. M. and Saxena Sujata, "Indian cotton fibre quality: Growth, challenges and way forward"
- Sharma, Kanika; Kumar, Manoj; "Gossypol as botanical pesticide: An innovative way to improve crop productivity"

34th National Convention of Textile Engineers and National Seminar on Innovative Textile Materials jointly organized by Institute of Engineers (I) and Textile Association India on the 10th to 11th September 22, at IIT Kanpur.

- Dr. G. Krishna Prasad presented a paper on "Development of electrospun Nano fibre mat through needleless Electrospinning as a filtration layer for cotton-based face mask"

I-LISS International conference- 2022 at NIT Warangal, Telangana state during 13-14 October 2022

- Dr. V. G. Arude, Senior Scientist made a presentation on 'ICAR-CIRCOT's Research Efforts in Development of Cleaning System for Mechanically Harvested Cotton' in an *'Virtual meeting on Mechanization of HDP cotton planting and picking*' chaired by Dr. Himanshu Pathak, Secretary DARE and DG, ICAR and Mrs. Prajkta Verma, Joint Secretary, Ministry of Textiles, GoI, on August 22, 2022.
- Dattatreya M. Kadam*, Sayali Suresh Parab and Akansha Kasara.. "Alkali- Salt Assisted Protein Concentrate Extraction from De-Oiled Cottonseed Meal" *Oral Paper Presentation* in the ISAE convention at TNAU, Coimbatore during Nov 9-11, 2022.
- Paper entitled "Open access initiatives of Indian Council of Agricultural Research Research (ICAR) was presented by Harish Kumar Tripathi and Medha Kamble

8. IMC, RAC & IRC Meeting 1

8.1 Institute Management Committee (IMC)

Eightieth IMC meeting of the institute was held on April 11, 2022 in hybrid mode under the chairmanship of Dr. Sujata Saxena, Director (Acting). The following members attended the meeting.

1. Dr. Sujata Saxena, Director (Acting), ICAR-CIRCOT, Mumbai, Chairman
2. Dr.A.K.Thakur,Principal Scientist (PE),Agricultural Engineering Division, ICAR, New Delhi,Member
3. Dr.Sharad Gadakh,Director of Research, Mahatma Phule Krishi Vidhyapeeth (MPKV), Rahuri, Member
4. Dr.L.K.Nayak, Principal Scientist(AS&PE), ICAR-NINFET, Kolkata, Member
5. Dr. G. Balasubramani, Principal Scientist, ICAR-CICR, Nagpur, Member
6. Shri Sunil Kumar, Chief Administrative Officer, ICAR-CIRCOT, Mumbai, Member Secretary
7. Shri M.Radhakrishnan, Sr. Finance & Accounts Officer, ICAR-CIRCOT, Mumbai, Invitee
8. Shri P.N. Shahane, A.C.T.O., Engineering Section, ICAR-CIRCOT,Mumbai, Invitee

The Chairman welcomed all the members and briefed the committee about the activities of the institute, infrastructural developments, revenue generation and fund utilization status of the institute during 2020-21. IMC members appreciated 100% budget utilization and the efforts made by the institute to procure the equipment under GeM. The requirement of additional funds was discussed in detail and the IMC recommended the sanction of special grant of Rs.24.00 crore to meet the expenditure towards the centenary year celebration of the institute.

8.2 Research Advisory Committee (RAC)

XXVIII Meeting of the Research Advisory Committee was held during May 9-10, 2022 under the chairmanship of Dr. N. C. Patel. The members of the RAC Dr.Narendra G Shah, Dr. M.K.Sharma, Dr. S.R. Shukla, Dr. U.J. Patil, Dr. N.N. Mahapatra and Dr. A.K. Thakur attended the meeting.

The meeting began with the ICAR song and welcome address by Dr.Sujata Saxena, Director (Acting). On this occasion, the following two publications were released:

1. Frequently Asked Questions (FAQ) on Sulphur and its Nano formulation
2. Agricultural Startup Ecosystem at ICAR-CIRCOT

The ATR on the recommendation of the previous RAC was presented by Dr. V.G. Arude, Member Secretary, RAC. The research achievements of the institute during the period 2021-2022 were presented core areas wise by respective Heads of Division and Officers In-charge.

The Chairman appreciated the good work done and also appreciated the interaction with the industries. He suggested that the institute should prioritise its research keeping in mind the budget constraint. Dr. S.R. Shukla, Member RAC, delivered a lecture on "Relevance of Interdisciplinary Research" during the second day of the meeting.

8.3 Institute Research Council (IRC)

8.3.1. 122nd Annual IRC Meeting

The 122nd Annual Institute Research Council Meeting was held on May 25-26, 2022 under the chairmanship of Dr. Sujata Saxena, Director. All the HoDs, Scientist and Technical Officers (ACTO & above) attended the meeting. The scientists and technical officers from regional units joined through virtual mode.

The progress of the research of 22 on-going projectswere discussed and four new project proposals were presented for consideration in the meeting. Chairman suggested that research should be need based and prioritized in the context of the resource constraint but without compromising on research outcome and the quality of the service offered to the stakeholders.

8.3.2. Half-yearly IRC Meeting

The Half-yearly Institute Research Council Meeting (IRC) was held during December 16-17, 2022 in the Conference Hall of the Institute. The meeting was organised in Hybrid Mode, where the scientist and technical officers from regional units joined in online mode. The IRC meeting was Chaired by Dr. S. K. Shukla, Director, ICAR-CIRCOT, Mumbai. All the Heads of Division, Scientists and Technical Officers attended the meeting.

The progress made in the Research projects were presented Core-area wise, followed by presentation of the projects under CRP on Natural Fibres and Externally Funded Projects by the respective Principal Investigators. The Chairman in his concluding remarks, suggested that the end use of the research output should be explored and the linkage with the stakeholders should be strengthened. The Vote of Thanks was delivered by Dr. Sundaramoorthy C, Principal Scientist & In-charge PME Cell.

9. Participation in Seminars/Conferences/ Meetings/Workshop

Participation in Conferences

Name of the Conference	*Participants*
National e-Conference on "Agro Entrepreneurship: A way to Boost Start up Ecosystem in Agriculture" held on 23-24 *February, 2022* organized by PDKV Research & Incubation Foundation, Akola.	Dr. C. Sundaramoorthy Dr. A.K. Bharimalla
International Conference on "*Technical Textiles Creating the Winning Leap in Technical Textiles*" organized by Confederation of Indian Industry (CII) in partnership with the Ministry of Textiles on 12th March 2022, (Hybrid Event)	Dr. Sujata Saxena Dr A S M Raja Dr G. Krishna Prasad
5th International Conference on *"Advances in Agriculture Technology & Allied Sciences"* organized by Society of Agriculture Research & Development & MS Swaminathan School of Agriculture, Centurion University of Technology & Management during 4-5 June, 2022 (virtual platform).	Dr. K. Pandiyan
5th National Conclave on *"Standards for Technical Textiles-Building Standards for India@2047"* organized by FICCI and BIS India on June 10, 2022 New Delhi (virtual mode)	Dr. A S M Raja
5th International Conference on "Sustainable Materials, Management & Innovative Technologies (ICSMMIT)- 2022 at Kumaraguru College of Technology, Coimbatore during 23-24 June, 2022	Dr. G.T. V. Prabu
"National Conference on Biomass Pellets co-firing" organized by SAMARTH Mission Power Management Institute (PMI) at Noida during 29-30 June, 2022	Dr. S.K. Shukla
4th International Textile Conference 2022 organized by Politeknik STTT Bandung – Saxion University of Applied Sciences, Indonesia through online mode on 28th July 2022	Dr. G.T. V. Prabu Dr. P. Jagajanantha
International Conference on *"Sustainable Approaches in Food Engineering and Technology (SAFETy-2022)"* organized by Tezpur University, Assam, India in collaboration with the Association of Food Scientists & Technologists (India) Tezpur Chapter & Sultan Qaboos University, Oman) during August 8-10, 2022 (Virtual Mode)	Dr. Jyoti Dhakane-Lad

"Conference on Climate change, Agriculture, Horticulture processing, Irrigation" organized by Maharashtra State Mango Growers Association on October 12, 2022 at Fort, Mumbai	Dr. P. S. Deshmukh
The International Conference on *"Digitalization – A Step Towards Textile 4.0"* organized by Textile Association of India, Mumbai on October 14, 2022 at Hotel The Lalit, Mumbai	Dr. A. S. M. Raja Dr. N. Shanmugam Dr. A. Arputharaj Dr. P. Jagajanantha Mr. Himanshu Chaurasia
2nd Edition of *"Global Cotton Conference"* held on November 23, 2022 (Virtual mode)	Dr. S.K. Shukla Dr. Sujata Saxena
"Curtain Raiser of Technotex 2023" held at Trident Hotel, Nariman Point, Mumbai on December 5, 2022.	Dr. N. Shanmugam

Participation in Seminars/ Symposium

Name of the Conference	*Participants*
Seminar on "Technical Textile Need of Today and Tomorrow" organized by The Textile Association (India), Mumbai Unit on *26 March, 2022*	Dr. N. Shanmugam Dr. Krishana Prasad Dr. P Jagajanantha
Seminar on Fifty Years (Golden Jubilee) of Cotton Hybrid Technology organized by Indian Society for Cotton Improvement in association with AICRP on Cotton and TNAU, Coimbatore on 6th April, 2022	Dr. (Smt.) Sujata Saxena Dr. P.K. Mandhyan Dr. A.S.M. Raja Dr. A. Arputharaj Mr. B.R. Pawar
National Seminar in Hindi on *"Balanced and Efficient use of Fertilizers"* was organized by ICAR-CIRCOT on June 21, 2022. (Hybrid mode)	All Staff
National Symposium on *"Paradigm Shift in Cotton Cultivation"* Jointly Organized by the MPUAT, Udaipur & Cotton Research and Development Association (CRDA), Hisar in collaboration with ICAR, New Delhi during 8-10 August, 2022 at MPUAT, Udaipur	Dr. Sujata Saxena Dr. V.G. Arude Dr. A. Arputharaj Dr. Kanika Sharma
The 34th National Convention of Textile Engineers and National Seminar on *"Innovative Textile Materials"* organized by the Institute of Engineers (India) in Association with Textile Association (India), UP Unit at IIT, Kanpur during September10-11, 2022.	Dr. G. Krishnaprasad

Symposium on *"Technology and Innovation"* organized by Project on Climate Resilient Agriculture (PoCRA) in Maharashtra on November 24, 2022.	Dr. A S M Raja
Seminar on the theme "Emerging Global Trends in Laboratories for Atma Nirbhar Bharat" on 3rd November 2022	Dr. S.K. Shukla
National Seminar on *"Processing and Value Addition of Cotton, other Natural fibres and Agro residues"* was organized by CIRCOT in collaboration with Indian Society for Cotton Improvement (ISCI) and Indian Fibre Society (IFS) on 99th Foundation Day and Agricultural Education Day on December 3, 2022.	All Staff

Participation in Workshop/Stakeholders Meet

Name of the Conference	*Participants*
*Workshop on "Scientific Writing"*organized by ICAR-CIRCOT in collaboration with Central Ayurveda Research Institute, Mumbai during *26-27 March 2022*	Dr. Arputharaj Dr. T. Senthil Kumar Dr. Kanika Sharma Dr. A. Dukare Mr. H. Chourasia
Annual Group Meet of AICRP on Cotton organized by ICAR-All India Coordinated Research Project (AICRP) on Cotton, in collaboration with Tamil Nadu Agricultural University (TNAU), Coimbatore during 7-8 April, 2022.	Dr. (Smt.) Sujata Saxena Dr. P.K. Mandhyan Dr. A.S.M. Raja Dr. A. Arputharaj Mr. B.R. Pawar
The *Central Varietal Identification committee* (CVIC) of Bt and Non Bt cotton meeting held on April 7, 2022 at TNAU Coimbatore.	Dr. Sujata Saxena Dr. P.K. Mandhyan Dr A S M Raja
International Workshop on *"Nano fibre Based Biomedical Healthcare Materials for Infection Control"* organized by the Department of Fashion Technology and Biotechnology, Kumara guru College of Technology, Coimbatore, and co-hosted by National University of Singapore, Singapore and Singapore Eye research Institute, Singapore, and Anna University Chennai during April 20-22, 2022	Dr. G. Krishna Prasad Dr. T. Senthilkumar
Brainstorming workshop on, *'ICAR-CIRCOT Nano Sulphur Application in Different Crops Under Various Field Conditions'*organized by ICAR-CIRCOT Mumbai on June 14, 2022.	Dr. Sujata Saxena Dr. A.K. Bharimalla Dr. Manoj Mahawar Dr. Jyoti Dhakane

ICAR-SAU-NAAS Stakeholders Interface meeting at NIASM, Baramati on June 17, 2022 (Virtual mode)	Dr. A. S. M. Raja
Meeting organised by the Textile Commissioner, Mumbai on *"Improving of Ginning efficiency"* on June 20, 2022 (Virtual mode)	Dr. S. K. Shukla
"Orientation workshop for nodal officers of disaster management of Ministries and Departments of Government of India" organized by National Institute of Disaster Management, Ministry of Home Affairs, Govt. of India. during 27th -28th June 2022	Dr. Ajinath Dukare
Lecture on *"Improved Sustainable, Environment Friendly, Green Technology for Textile Dyeing using Supercritical Fluid"* organized by Textile Association of India, Mumbai on July 22, 2022	Dr. A. S. M. Raja Dr. A. Arputharaj Dr. G. T. V Prabu
"Mechanization of HDP cotton Planting and Picking" chaired by Joint Secretary (Textiles) and DDG (Engineering) on August 23, 2022	Dr. V.G. Arude
Textile Advisory Group (TAG) 4th Review Meeting held at Vanijya Bhavan, New Delhi on November 7, 2022 under the Chairmanship of Hon'ble Minister of Textiles. Govt. of India.	Dr. V. G. Arude
QUALMACON-2022 (*Conclave for Personnel responsible for the Quality Management Systems*) organized at Thakur College of Engineering & Technology, Kandivali East, Mumbai,on November 18, 2022	Dr. P. Jagajanantha
Brainstorming Workshop on *"Bioplastics: Its Developmental Strategies and the Role of Natural Fibres in Developing Durable Biodegradable Polymers for Sustainable Packaging Materials"* organized by ICAR-National Institute of Natural Fibre Engineering and Technology (NINFET), Kolkata on November 22, 2022 (Virtual mode)	Dr. N. Vigneshwaran Dr. Sharmila Patil
50th AGRESCO Meeting held at Dr. BSKKV University, Dapoli on December 14, 2022.	Dr. A. Arputharaj

Participation in Expert Committee Meetings

Name of the Conference	Participants
Technical textiles for Mobiltech Application sectional committee(*TXD 38)* organized by BIS, New Delhi,on 12.01.2022	Dr. G. Krishna Prasad
22nd meeting Physical methods of Test sectional committee *(TXD 01)*, Organized by BIS, New Delhi, on 11.03.2022.	Dr. T. Senthilkumar
17th Meeting of Textiles Speciality Chemicals and Dyestuffs Sectional Committee, (*TXD 07*) on 11th May 2022.	Dr. Sujata Saxena
18th Meeting of Textile Machinery and Accessories Sectional Committee, (*TXD 14*), organized by Bureau of Indian Standards on 17.06.2022	Dr. V.G. Arude Dr. T. Senthilkumar
5th Meeting of Technical Textile for Clothtech applications including Narrow fabrics and braids sectional committee (*TXD 39*) was Organized by Bureau of Indian Standards on 25.06.2022.	Dr. T. Senthilkumar
5thmeeting of Technical Textiles for Mobiltech Applications, (*TXD 38*) on 06.07.2022 organized by BIS.	Dr. G. Krishna Prasad
22nd Meeting of Man-made fibres, cotton and their products sectional committee (*TXD 31*), Organized by Bureau of Indian Standards, New Delhi, on 02.08.2022	Dr. T. Senthilkumar
23rd Meeting Physical methods of Test sectional committee (*TXD 01*), Organized by Bureau of Indian Standards, New Delhi, on 22.09.2022.	Dr. T. Senthilkumar Dr. A. Arputharaj
23rd Meeting of Man-made Fibres, Cotton and their Products Sectional Committee, (*TXD 31*), organized by Bureau of Indian Standards (BIS) on 21.11.2022	Dr. T. Senthilkumar

Participation in Meetings by Director

Dr. Sujata Saxena, Director (Acting)

- Central Zonal Conference Gati Shakti meeting on 14th January 2022
- Meeting with Mr. Mahendra Gaikwad, Mahila& Bal Kalyan Adhikari, Thane District, Govt. of Maharashtra regarding training on Surgical Cotton and establishment of surgical cotton plant on 1stand 23rdFebruary 2022
- Quarterly meeting of Rajbhasha Karyanvayan Samiti on 16th February 2022
- AICOSCA webinar on Decorticated Cotton Seed Meal (A rich source of protein) for Milch cattle, Poultry & Aqua on 18th February 2022.
- Stakeholders meeting and COCPC meeting organized by the office of the Textile Commissioner on 22nd March 2022

- Chaired the brainstorming cum interaction meeting between ICAR-CIRCOT scientists with Dept. of Mech. Engg., IIT, Mumbai held in virtual mode on 23rd March 2022 to discuss areas of collaborative research.
- Celebration of 50 years (Golden Jubilee) of Cotton Hybrid Technology & Annual Group Meeting 2022 organised by ICAR-AICRP on Cotton and ISCI Mumbai on 6th April 2022
- Director's Conference at ICAR, New Delhi on 13th April 2022.
- ICAR-Regional Committee I meeting on 22nd April 2022 (online)
- 5th meeting of the Sub-Group-1 under National Mission on use of Biomass in coal fired Thermal Power Plants on 18th May 2022.
- Visit to the biomass torrefaction demonstration plant at CIAB, Mohali on 19th May 2022
- Grain Storage Working Group 7thMeeting at New Delhi on 20thMay 2022
- Meeting with Office of Textile Commissioner for Stakeholders & Committee on Cotton Production and Consumption on 23rd May 2022.
- National Symposium on Indian Agriculture after independence on 24th May 2022
- One day research conclave organized by Textile Department of VJTI-Mumbai and India ITME Society on the theme of "Indigenous Technology Development for Speciality Textiles" on 1st June, 2022 at VJTI, Mumbai
- ICAR-SAU-NAAS stakeholders interface meeting at NIASM, Baramati on 17th June 2022
- Meeting organised by the Textile Commissioner, Mumbai on improving of Ginning efficiency on 20th June 2022
- Stakeholders Meeting of the Committee on Cotton Production and Consumption (COCPC) conducted by the O/o Textile Commissioner, Mumbai on 01-07-2022.
- Second interactive meeting held by Hon'ble Union Minister of Textiles, Government of India Shri Piyush Goyal along with Hon'ble Union Minister of State for Textiles Smt. Darshana V. Jardosh with the Textile Advisory Group, held in the Worli, Mumbai on 14-07-2022.
- Meeting regarding Standardized Training Modules for farmers - Agricultural Engineering Division, ICAR on 19-07-2022
- Interactive meeting of stakeholders of Cotton Textile Value Chain with Hon'ble Union Min. of Textiles in presence of Hon'ble Union Min. of Agriculture on cotton production, productivity, quality and testing held on 24thJuly, 2022 at Vanijya Bhavan, New Delhi.
- COCPC meeting organized by Textile Commissioner's Officeon 2nd August 2022
- Meeting organized by Textile committee on issue in organic cotton certification on 10th August 2022
- Deliberation on approaches for use of coloured fertilizer bags to avoid contamination in cotton hosted by Office of Textile Commissioner, Mumbai on 11th August 2022
- First meeting of the committee to discuss the issues related with production &

productivity of Cotton Crop organized by Ministry of Agriculture and Farmers' Welfare on 12th August 2022 in online mode

- "Mechanization of HDP cotton planting and picking" organized by ICAR-CIAE, Bhopal under the chairmanship of Secretary DARE and DG, ICAR to discuss the strategies and way forward in respect of R&D issues in mechanization of cotton planting and cotton picking on 23rd August 2022.
- Interaction with DG, ICAR on 30th August, 2022.
- Two virtual meetings on Identification and De-Notification of Redundant Cottonseed Varieties and issues relating to Fibre quality of cotton organised by Dept. of A&FW on 1st Sept, 2022
- 62nd AGM and Awards Function of AICOSCA with the theme Increasing Prosperity of Cotton Value Chain Stake holders on 3rd September, 2022 as Guest of Honour at Mumbai
- Virtually attended a meeting of stakeholders of the Jute, Textiles and Leather sector organised by BIS on 14th September, 2022
- Meeting of the subgroup on Issues pertaining to organic Cotton Certification at Textiles Committee, Mumbai on 15th September, 2022
- Stakeholders meeting & Cotton consumption and production committee meeting at Office of Textile Commissioner on 20th September, 2022
- Virtual meeting of the Sub-Group-1 of the SAMARTH Mission on 21st September, 2022 and presented the progress of the project undertaken by the institute under the Mission
- Visit to M/s Nugreen Energy Pvt Ltd, DN. Delhi in connection with Biomass Torrefaction and design of with design of pilot scale unit on 23rd September, 2022
- XXVI Regional Committee Meeting II on 14th October 2022 in online mode
- Nagar Rajbhasha Karyanvayan Samiti Meeting on 19th October 2022 at W.R. HQ, Mumbai
- Sustainable technology in Textile Sector-sub group meeting organized by Textiles Committee member on 20th October 2022 in online mode

Dr. S. K. Shukla,Director

- Seminar on the theme Emerging Global Trends in Laboratories for AtmaNirbhar Bharat on 3rd November 2022 in online mode
- Presentation by Secretary, DARE & DG, ICAR on "Revitalizing ICAR: Aspirations and Action Plan on 11th November 2022 in online mode
- Presentation by DDG (CS) on activities and aspirations of ICAR on 14th November, 2022 in online mode
- Meeting with Case New Holland (CNH), NCR, New Delhi on Development of Robotic arm for cotton picking on 14th November 2022 in online mode

- Dr. S. K. Shukla, Director and Dr. A. S. M. Raja, Principal Scientist and Head I/c, QEID made a presentation (virtual mode) about the consultancy project on "Cotton quality analysis" on 16th November, 2022 with the officials of MATERRA India Private Limited, Ahmedabad.
- Dr. S. K. Shukla, Director and Dr. A. S. M. Raja, Principal Scientist and Head I/c, QEID attended a project discussion meeting on "SMART Cotton Project" with the officials from Hon. Balasaheb Thackeray Agribusiness and Rural Transformation (SMART) Project, Pune on 17th November 2022.
- 2nd edition of Global Cotton Conference held on 23rd November 2022 in online mode.
- Meeting with Case New Holland (CNH), NCR, New Delhi regarding Development of Robotic arm for cotton picking on 19th December 2022 in online mode.
- ICAR Regional Committee No. VII meeting on 12th December 2022 in online mode
- Textile Advisory Group (TAG) meeting under the Chairmanship of Hon'ble Minister of Textiles held on 15th December, 2022 at Deen Dayal Hast Kala Sankul, Varanasi in offline mode.
- Meeting of Subgroup I - Project on Cotton on 1st December 2022 at Delhi in offline mode, meetings on 9th & 21st December 2022 in online mode.

10. Events Organized 1

Workshops / Brainstorming Session

National Workshop

National Workshop on "Increasing Farm Income through Value-addition to Cotton Stalks and Other Agro-Residues" was organized in association with Confederation of Indian Textile Industry-Cotton Development and Research Association (CITI-CDRA), Mumbai during Technology and Machinery Demonstration Mela-2022 on March 21, 2022 at GTC, Nagpur.

The focal point of discussion in the workshop was related to value addition of cotton stalks and other agro-residues. Scientist and delegates from briquetting & pelleting industries shared the views in their respective domains. Deliberation on various government funded schemes and subsidies available for entrepreneurship development in the state were also highlighted in the workshop.

Over 200 farmers and other stakeholders from Nagpur, Wardha and Chandrapur Districts of Maharashtra participated in this programme. The machinery for cotton processing, pellet and briquette preparation, etc. were exhibited during the programme.

Annual Review Workshop: CRP on Natural Fibres

The Annual review workshop of CRP on Natural Fibre was held on March 25, 2022 under the chairmanship of Dr S.N. Jha, DDG (Agricultural Engineering). Dr. K.K. Singh ADG (AE), Director, ICAR-NINFET,Principal Scientists of SMD, and PIs & Co-PIs of projects under CRP on Natural Fibres were present during the meeting. Dr. Sujata Saxena, Director (Acting) ICAR-CIRCOT welcomed the participants and briefly informed about the overall progress of the project. Dr A.S.M. Raja Principal Scientist and Lead Centre Project Co-coordinator made brief presentation about the on-going projects and the new projects initiated during 2021-22. The presentations were made by individual PIs/Co-PIs and their progress was reviewed in the workshop. It was decided that suitable MoU should be signed with the participating institutes (outside the NARS system) as per the ICAR guidelines.

Workshop on Scientific Writing

A workshop on scientific writing was organized in collaboration with Central Ayurveda Research Institute in Mumbai during March 26-27, 2022 for sensitizing and capacity building of the scientists.

Brainstorming workshop on Nano Sulphur

A brainstorming workshop on, "ICAR-CIRCOT Nano Sulphur application in different crops under various field conditions" was conducted at ICAR-CIRCOT Mumbai on June 14, 2022. The session was chaired by Dr. Sujata Saxena, Director (Acting), ICAR-CIRCOT Mumbai and co-chaired by Dr. K.P. Patel,

Former Principal and Dean, Faculty of Agriculture, AAU, Anand. The scientists from ICAR-CIRCOT Mumbai, ICAR-IISS Bhopal, ICAR-DOGR Rajgurunagar, MPKV Rahuri and private partner M/s Devdhar Chemicals Ltd. Pune participated in the workshop. The activities undertaken by the participating centres were presented and the technical programme was revisited and future course of project activities were streamline in the workshop.

On the occasion, a booklet titled, 'Glimpses on ICAR-CIRCOT Nano Sulphur and its Application in Field Crops' was released.

Stakeholders' interface meeting

A stakeholders' interface meeting was held in the Video conference room of ICAR-CIRCOT on July 13, 2022 under the chairmanship of Dr. S. N. Jha, Deputy Director General (Agricultural Engineering), ICAR, New Delhi. Officials from Cotton Corporation of India, Cotton Association of India, National Textile Corporation, HVI machine manufacturers, incubatees of ICAR-CIRCOT and former Directors of the institute participated in the meeting.

Dr. S. N. Jha, in his speech, mentioned that ICAR-CIRCOT is celebrating its centenary in 2024 and all the stakeholders of cotton should be a part of the celebration. He also proposed to showcase the importance of cotton and contribution of the institute in the development of cotton with the support of the stakeholders. He stressed on the need and importance for more cooperation between the institute and stakeholders and devised a plan on "How to share, how to support each other".

Brainstorming session with ICAR-DFR

A brainstorming session for inter-institutional collaborative research in the fields of agro-textiles and bio-composites was held on August 3, 2022 at ICAR-CIRCOT, Mumbai under the chairmanship of Dr. Sujata Saxena, Director (Acting), and Dr. K.V. Prasad, Director, ICAR-DFR. Team of scientists from both the institutions participated in this brainstorming session.

Dr. Prasad presented the challenges being faced by the nursery farmers and floriculture industry in the face of nationwide plastic ban and the requirement of scientific interventions to replace plastic-based nursery seedling trays, nylon nets, nursery polybags, synthetic plant protection paper and sphagnum moss sticks.

The possibilities of using cotton-based textile and paper materials to replace the plastics and the potential use of nano finished cotton fabrics for flower packaging and nano finished cotton threads for plant supports were discussed.

Webinars/Seminars

Webinar on National Girl Child Day

National Girl Child Day was celebrated on January 24, 2022. On this occasion, an online webinar on "Improving the personality of the girl child through yoga" was organized. Around 100 participants attended the programme in a hybrid mode.

Webinar on Solid Waste Management

A Webinar on "Solid Waste Management (Crop Residues)" was organised on March 2, 2022, under the celebration of Azadi Ka Amrit Mahotsav.

Dr. Sujata Saxena, Director in her inaugural address stressed on the importance of solid waste management both in urban and rural scenario. She highlighted the efforts being taken at the Institute to develop value creation from this crop residue, supporting budding entrepreneurs and start-ups in establishing compost-based technologies in line with Natural / Organic Farming Mission of Government of India.

Dr. R. H. Balasubramanya, former Emeritus Scientist, ICAR-CIRCOT delivered the lecture on "Solid Waste Management (Crop Residues)". He elaborated upon the need for solid waste composting in cities / towns and crop residue composting in the farming sector. He highlighted the current scenario of solid waste availability in various states and the managerial problems being faced by the regulatory authorities in handling them.

He guided the young researchers and entrepreneurs to focus on developing novel composting technology, mimicking the digestive system of ruminant animals.

Dr. A.J. Shaikh, Former Director, Dr. B.M. Khadi, Former Director, ICAR-CICR, Nagpur also participated in this webinar.

Webinar on Balanced and Efficient use of Fertilizers

A Hindi Webinar on "Balanced and Efficient Use of Fertilizers" was organised on June 21, 2022 for sensitizing the audience regarding balanced use of fertilizers with special reference to ICAR-CIRCOT Nano fertilizer and

Cotton Stalk compost. A lecture on the topic "Applications and future prospects of nano-fertilizers in agriculture" was delivered by Dr. A.K. Bharimalla, Dr. Manoj Mahawar and Dr. Jyoti Dhakane. Dr. Manoj Mahawar, Scientist explained in detail the importance of fertilizers in bringing green revolution and also discussed the problems associated with over-use of fertilizers. Dr. Ajinath Dukare delivered a lecture on "Biofertilizers for sustainable agriculture & Bio-enriched cotton stalk compost". He explained about different types of biofertilizers, their advantages, mode of application and the beneficial microbial strains that are involved in nitrogen fixing, phosphorus solubilization and potassium mobilization. He also explained the ICAR-CIRCOT's composting technology and discussed the environmental and economic benefits of cotton stalk compost.

Dr. K.P. Patel, Former Principal and Dean, Anand Agricultural University, Gujarat highlighted the current agricultural scenario in India and explained how excessive use of fertilizers is harming soil. He emphasized that the use of fertilizers should be customized according to soil type, crop type and climate because of different requirements. He also stressed upon the use of right fertilizer at right rate, right time and at the right place (4 R) and emphasized the monitoring of soil health before fertilizer application.

The webinar was attended by more than 120 participants including 70 farmers.

Webinar on World Cotton Day

World Cotton Day was celebrated in the institute on October 7, 2022 by organizing a webinar on "Cotton for Economical and Social benefits" in association with Indian Fibre Society (IFS), Mumbai at the conference hall of ICAR-CIRCOT, Mumbai.

Dr Sujata Saxena, Director (Acting) in her welcome address highlighted the importance of cotton in the economy and in providing livelihoods to poor. Dr. R.P. Nachane, President, IFS, elaborated about the uniqueness and eco-friendly characteristics of this textile fibre. Dr S. Sreenivasan, Former Director, ICAR-CIRCOT, Mumbai in his address as the Chief Guest emphasized on the need to reprioritise the research in view of the sustainability and environmental requirements in Textile value chain.

Two lectures were delivered on the occasion. Dr. P.K. Mandhyan, former Principal Scientist, CIRCOT delivered a lecture on "Cotton Fibre Length-its economical impact" highlighting developments in the cotton length measurement techniques over the years and the prominent economic impact of this quality parameter in trade. Dr. A.S.M. Raja, Principal Scientist, & Head I/c QEID, ICAR-CIRCOT delivered a lecture on "Technical Textiles from Cotton" covering the present status of usage of cotton in this field and the research and development activities undertaken by the institute in this area.

The webinar was attended by more than 130 participants that include cotton researchers, students, stakeholders from the industry and trade.

National seminar on Women and Law

Internal Committee of ICAR-CIRCOT in collaboration with Dr. BMN college of Home Science, Matunga organized a National seminar on Women & Law on October 10, 2022 at Shri. Visanji Ravji Auditorium, Smt. Parmeshwari Devi Gordhandas Garodia Educational Complex, Matunga. Adv. Manisha Tulpule was the speaker. The programme was physically attended by around 15 women staff members of the institute.

National Seminar on "Processing and Value Addition of Cotton, Other Natural Fibres and Agro-Residues"

National Seminar on "Processing and Value Addition of Cotton, Other Natural Fibres and Agro-Residues" was organized in collaboration with the Indian Society for Cotton Improvement and Indian Fibre Society on the occasion of the 99th Foundation Day of the institute. The participants include Scientists & technical staff of the Institute, Agri-start-ups and other stakeholders. Two technical sessions were organised during the seminar.

Technical session – I was on "Value Addition to Cotton and its Biomass" and the Technical session –II was on "Recent Advancements & Issues in Natural Fibres". Dr. N. Vigneshwaran, Principal Scientist was the Organising secretary of the seminar.

Meetings/Lectures

Releasing PM Kisan Samman Nidhi Fund

A staff meeting was arranged on January1, 2022 in the institute to view the live streaming of Hon'ble PM releasing PM Kisan Samman Nidhi Funds to the farmers through virtual mode.

Lectures

- A lecture on "Relevance of Interdisciplinary Research in Textile" by Prof. (Dr.) S. R. Shukla, former professor, Institute of Chemical Technology, Mumbai was held on May 10, 2022 in hybrid mode for all the scientists and technical staff in the institute.

- ICAR-CIRCOT and Indian Fibre Society (IFS), Mumbai arranged a lecture on "Post-consumer textile waste: Opportunities and Challenges" by Dr. Suman Mundkur, Former Associate Professor, SVT College of Home Science (Autonomous), SNDT Women's University, Mumbai at conference Hall of ICAR-CIRCOT, Mumbai on August 26, 2022

Accreditation 1

NABL Accreditation

NABL external audit was conducted at ICAR-CIRCOT, Mumbai. The audit was carried out in online mode by Mr. Neeraj Pandey (Auditor) and Mr. Mitul Saha (Technical assessor) for the Mechanical Processing and Chemical Processing laboratories. The institute was assessed and accredited in accordance with the standard ISO/IEC 17025:2017 in the field of testing. The Certificate of Accreditation was issued for two years from March 2, 2022 to March 1, 2024. Dr. Manoj Kumar, Quality Manager and Dr. P. Jagajanantha, Deputy-Quality Manager co-ordinated the NABL external audit at ICAR-CIRCOT, Mumbai.

ISO 9001:2015 Audit by Bureau of Indian Standards

The Bureau of Indian Standards organized a 2 days surveillance audit at the institute for the license given under ISO 9001:2015 during 6th-7th September, 2022. During the audit opening meeting, Dr. Sujata Saxena, Director briefed about important new initiatives taken by the institute for the implementation and maintenance of the ISO standard.

Mr. P.K. Kush, the auditor from BIS conducted the surveillance audit of the Top management & Management Representative (MR), Quality Evolution and Improvement Division (QEID), Chemical and Biochemical Processing Division (CBPD), Administration and Engineering Section. On 7th September, an audit closing meeting was conducted. The auditor has recommended that the institute has implemented the ISO 9001:2015 standard satisfactorily and the license will continue for another year. Dr A. S. M. Raja, Management Representative and Dr. A. Arputharaj, deputy MR coordinated the surveillance audit.

Foundation Day

Celebration of 99th Foundation Day

The ICAR-Central Institute for Research on Cotton Technology, Mumbai celebrated its 99th Foundation Day on December 3, 2022 in combination with the Agricultural Education Day. Dr. S. K. Shukla, Director, ICAR-CIRCOT delivered the welcome address and presented the achievements of the Institute.

Delivering his inaugural address, the Chief Guest, Dr. S. N. Jha, DDG (Engg), ICAR, New Delhi applauded the Institute's achievements since its inception from 1924. Dr. Jha urged the Institute's Scientists and Staff Members to work more focused on the stakeholders' requirements so that the existing technical knowledge can be used to meet the needs of the farmers, industries and other stakeholders. Also, he insisted to work on the latest technologies and generate more revenue to become self-sufficient in the long run.

The Guests of Honour on the occasion was Dr. C. D. Mayee, Former Chairman, ASRB; Dr. P. G. Patil, Vice Chancellor, MPKV, Rahuri; Dr. R. P. Kachru, Former ADG (PE), ICAR, New Delhi; Shri. Suresh Kotak, Director, M/s. Kotak Commodities and Dr. Narsaih Kairam, ADG (PE), ICAR New Delhi. Directors of the Institutes under Engineering SMD and former Directors of ICAR-CIRCOT graced the occasion.

Three MoU's were signed on this occasion with the industry partners. Three publications, (i) *Handbook on Nanotechnology and its Applications* (ii) *कपास प्रौद्योगिकी शब्दावली' Glossary on Cotton Technology*' and (iii) *E-Newsletter of CIRCOT-R-ABI* were released during this occasion. On this occasion, 'Best employee Award for the year 2022' was conferred to the staff of the Institute by the dignitaries.

The "CIRCOT-R-ABI Agri-Startups Demo Day" was inaugurated on this occasion and the budding entrepreneurs who participated in this exhibition were felicitated.

To commemorate this occasion, a one-day National Seminar on "Processing and Value Addition of Cotton, Other Natural Fibres and Agro-Residues" was organized in collaboration with the Indian Society for Cotton Improvement and Indian Fibre Society.

The Foundation Day Programme organized in a hybrid mode, registered participation by both the retired and serving staff members of the Institute, budding entrepreneurs, industrialists, scientists from Engineering SMD institutes of ICAR, faculties & students from local engineering and textile institutes, researchers and students from the various parts of the country.

Other Events

Vigilance Awareness week

Vigilance Awareness week was observed by ICAR-CIRCOT during October 31, 2022 to November 6, 2022. Banner on the theme of the year "Corruption-free India for a developed Nation"was displayed in the office premises during the week. Vigilance pledge to the staff was administered by Dr. Sujata Saxena, Director (Acting) on October 31, 2022.

On November 7, 2022, a lecture by Shri. Divyanshu Dagar, Police Inspector, CBI, Anti-Corruption Branch, Mumbai was arranged to create awareness among the staff members of the Institute regarding the types and nature of corruption and the means to have an end to corruption to make India a developed nation. Dr. S. K. Shukla, Director, ICAR-CIRCOT welcomed the gathering and sensitized the staff members about the requirement for bringing discipline in routine activities to achieve excellence in all spheres of life.

Dr. N. Vigneshwaran, Vigilance Officer of the Institute presented the activities being carried out by the Vigilance section during the Vigilance Awareness Week and the three-month campaign for Preventive Vigilance cum Internal Housekeeping activities.

National Unity Day

National Unity Day (Rashtriya Ekta Diwas) is observed on October31, every year since 2014, to commemorate the birth anniversary of Sardar Vallabhbhai Patel, a visionary freedom fighter-leader who played an important role in national integration after the independence of India. This year, the pledge for National Unity Day was administered to all staff members by Dr. Sujata Saxena to mark this day.

International Women's Day

International Women's Day was celebrated on March 8, every year to commemorate the cultural, political, and socio-economic achievements of women. The day also calls for action to accelerate women's equality. This year, the International Women's Day theme was *"Gender equality today for a sustainable tomorrow"#Break the bias*.

Dr. (Smt.) Sujata Saxena, Director (Acting), in her address congratulated all the women staff members and opined that every woman must not forget to appreciate herself for the roles she is playing while balancing her family, her workplace and society. Talking about the year's theme, she stressed upon the key role that parents especially a mother can play in inculcating the concept of gender equality among their children.

The guest speaker Dr. Sujata Chavan, Assistant Professor at Advanced Centre for Women Studies, School of Development Studies, Tata Institute of Social Sciences, Mumbai delivered a talk on "Women in Dual Role: A Sociological Perspective" through online mode. In her lecture, she accentuated that the woman of new era can perfectly balance her working life by stress, time and relationship management as

well as by adopting three "A" formula (Acceptance, Adjustment, and Appreciation). 1

The program was attended by all staff members at Head Quarters as well as regional units of the institute through hybrid mode.

International Yoga Day

ICAR-CIRCOT celebrated International Yoga Day on June 21 under Azadi Ka Amrit Mahotsav. On this occasion Yog Guru, Sh. Sudhir Sawant and his team from AmbicaYogKutir (Ghatkopar branch) visited ICAR-CIRCOT and taught about different types of asana and the benefits associated with each one of them. They also gave a live demonstration of yoga asana and then participants practiced yoga by following the instructions. Sh. Sudhir Sawant highlighted the importance of yoga in daily life and also instructed the participants about the proper procedure and routine for practicing yoga asana.

World Soil Day

On the occasion of the World Soil Day on December 5, 2022, Ginning Training Centre of ICAR-CIRCOT at Nagpur organized a field awareness programme for 25 farmers on cotton picking practices. During this programme, scientists and technical staff of the Institute created awareness about the benefits of use of compost (derived from ginnery waste) on soil health and advocated to the farmers for sustainable management of soil resources.

Azadi Ka Amrit Mahotsav 1

ICAR-CIRCOT organised a series of events as part of the DARE-ICAR commemorative celebration of India@75 under Government of India's Commemoration of 75 years of India's Independence celebration program 'Azadi ka Amrit Mahotsav (AKAM)'. In total 60 events including "Har Ghar Tiranga" event on 12th August, 2022 were organized under AKAM.

Type of Event	No. of Events	No. of Participants
E Goshtis/ Workshop	23	5721
Webinar	32	2984
Online Training	1	200
Fit India	4	97
Grand Total	**60**	**9002**

Sectoral campaign on Processing and Storage of Food grains and Pulses

An event under Azadi Ka Amrit Mahotsav was celebrated at ICAR-CIRCOT, Mumbai on January 22, 2022 to commemorate - Sectoral campaign on Processing and Storage of Foodgrains and Pulses. Poster on general processing & storage and Processing of Pulses (in English and Hindi) were displayed to spread awareness among staff and other stakeholders visiting the institute.

Kisan Bhagidari, Prathmikta Hamari

During celebration of Kisan Bhagidari, Prathmikta Hamari campaign under Azadi ka Amrit Mahotsav, ICAR-CIRCOT organized live demonstration at different places to sensitize the farming community and other stakeholders on Value addition to Agricultural Products, Natural Farming and Waste to Wealth technologies.

The following demonstrations were organised in association with incubatte of ICAR–CIRCOT–RAFTAAR-ABI on April 26, 2022

- M/s. Varadvishwa Automation LLP, agri start-up incubated in CIRCOT RABI demonstrated their innovative technology of Automatic Spraying Machine to farmers.
- M/s. Mystic Herbal from Tasgaon, Sangli (MS) promoted Chemical Free Extraction of Essential Oil from Turmeric, Ginger & Value Addition to its byproducts. Participants: 25.
- M/s. Energy Chakra exhibited solar cum electricity dryer (hybrid) to dehydrate perishable farm produce to 50 farmers at Niphad, Nasik (MS)
- M/s. Rubber Engineers Enterprises promoted their Fibre Reinforced Natural Rubber Based Garden Pots at Thrissur, Kerala to 50 farmers.
- M/s. Forecast Agrotech Innovations Private Limited briefed 70 farmers about Sustainable Conversion of Bio Digested Sludge into Bio Fertilizer and Bio-Slurry at Junnar, Pune (MS).
- M/s. Prafulla Winery & Hospitality Private Limited promoted Healthy Beetroot Wine made by them at Kodoli, Kolhapur (MS) to 30 farmers

On April 28, 2022 three demonstrations were organised

- M/s. Vasundhara Shashwat Shetimaal Utpadak & Prakriya Sanstha from Sangli (MS) organized a programme to showcase their end-to-end organic process for making jaggery to farmers and promoted chemical free jaggery and other value-added products at five different villages in Kolhapur and Sangli districts of Maharashtra. Around 150 farmers participated in this programme.

- M/s. SR Foods and Breweries, from Roha, Maharashtra showcased innovative processing technique for extraction of cashew apple juice and endorsed value addition to cashew apple pomace fibres by preparing cookies. 50 farmers participated in this event.

- M/s Siddaganga Bio Products, arranged demonstration on Agro Waste Byproduct Utilization for 50 farmers of Tumkur village in Karnataka. Biodegradable and compostable products developed from sheaths of Areca plant were shown to 50 farmers.

Garib Kalyan Sammelan

Hon'ble Prime Minister Shri Narendra Modi interacted with beneficiaries of public welfare scheme during Garib Kalyan Sammelan organised at BPCL Sports Complex, Mumbai on May 31, 2022. Over 3000 farmers including fish farmers participated in the programme. Hon'ble Union Minister of State, Panchayat Raj, Shri Kapil Moreshwar Patil and Shree Devendra Fadnavis, Ex- Chief Minister and Leader of Opposition in Maharashtra Legislative Assembly. Shri Chandrakant Dada Patil, Ex- Minister of PWD & Revenue, GoM, Shree Gopal Shetty M, Member of Parliament directly interacted with beneficiaries of various public welfare schemes. Prime Minister also released the 11th instalment of financial benefit under the Pradhan Mantri Kisan Samman Nidhi (PM-KISAN), an amount of around Rs. 21,000 Crore to more than 10 Crore beneficiary farmer families. Programme was jointly organised by Bharat Petroleum Corporation Limited, ICAR-Central Institute of Fisheries Education, Mumbai, ICAR-Central Institute for Research on Cotton Technology, Mumbai.

Scientist, I/c and other officials from Ginning Training Centre of ICAR-CIRCOT at Nagpur also participated in Garib Kalyan Sammelan organised by ICAR-CICR, Nagpur where in 800 farmers participated.

Sensitization Programme on the Balanced and Effective use of Fertilizers

ICAR-CIRCOT organized a series of two events on June 21, 2022 under Azadi Ka Amrit Mahotsav, India @75 mass awareness campaigns for sensitization on the balanced and effective use of fertilizers. The first event was a field demonstration at ICAR-CIRCOT's premises on “Benefits of Composting” by Dr. N. Vigneshwaran, Principal Scientist and Dr. Charlene D'Souza, STO. They explained the composting process and also highlighted the benefits and applications of compost such as improving soil health, enhancing water holding capacity of soil, mushroom cultivation and many others. They also highlighted the role of composting in reducing environmental pollution.

Har Ghar Tiranga campaign

ICAR-CIRCOT organized "Har Ghar Tiranga" campaign on August 12, 2022 on the eve of Independence Day celebrations. It was the 60th campaign under Azadi ka Amrit Mahotsav (AKAM) India@75 and marked the end of a series of programmes that started at the institute on 16th April, 2021. The programme conducted in hybrid mode was attended by all the staff members from the institute's headquarters physically and staff of the Ginning Training Centre of Nagpur and regional stations in virtual mode. Ms. Prachi Mahatre (Secretary, AKAM) presented the journey of the institute through various events of Azadi ka Amrit Mahotsav. The presentation reflected the joint efforts of the institute's staff in making the events successful and also the motivation behind each event. Dr. Sujata Saxena, Director(Acting) applauded the contributions made by the staff members in the successful organization of all events. She apprised the staff members about the Government initiative of hoisting tricolour on every home and explained its significance. She reminded the attendees that the nation's progress depends on the efforts made by its citizens and hence they should be aware of their duties and responsibilities for the country. After that National flags were distributed to the respective Heads of Division and the staff members by the Director for hoisting at their respective homes.

76th Independence Day

ICAR-CIRCOT, Mumbai celebrated the 76th Independence Day on August 15, 2022. Dr. Sujata Saxena, Director (Acting) hoisted the National Flag and accepted the salute and Guard of Honour. In her speech, she greeted everyone for entering into the auspicious era of Amrita kaal of Indian democracy and invoked everyone to look back and reflect on what we have achieved in the last seventy-five years and where we want to reach in next twenty-five years when the country will celebrate centenary of its independence. She applauded the Institute technologies that benefitted Cotton producers and processors in the last 97 Years of its establishment and remarked that it is time for everyone to gear up and take up the challenges faced by cotton farmers and cotton industry through focused R&D projects and develop technologies which will help in removing drudgery from the life of cotton farmers and stakeholders in the value chain.

11. Hindi Implementation

Meeting of Official Language Implementation Committee

A total of 4 meetings of the Official Language Implementation Committee were held during the year. Three meetings were held under the chairmanship of Dr. (Mrs.) Sujata Saxena, Director (Acting) on 16.02.2022, 08.06.2022 & 29.07.2022 and one meeting was held under chairmanship of Dr. S. K. Shukla, Director, on 06.12.2022.

Hindi workshops

During the period from 1-1-2022 to 31-12-2022, 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.	15.03. 2022	The use of Unicode in official work.	Dr. Anant Shrimali, former director, Hindi Teaching Scheme	80
2.	09.06.2022	Why and how to do work in Hindi?	Ms. Seema Chopra, Director (Official Language), ICAR New Delhi	65
3.	13.09.2022	Official Language Implementation Problems and Solutions in Current Perspective.	Dr. RajeshwarUniyal, Former Deputy Director (Official Language), CIFE, Mumbai	49
4.	19.12.2022	Annual program goals and their fulfillment.	Dr. Sushil Kumar Sharma, Deputy General Manager, Western Railway and Member Secretary (NARAKAS)	47

Official language implementation Inspection

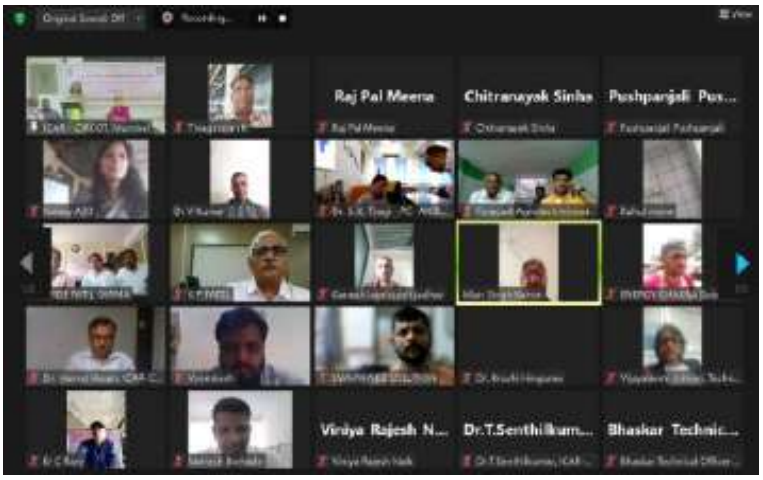
- On 18.05.2022, Dr. Kanchan Kumar Singh, Assistant Director General (Process Engineering), ICAR, New Delhi and on 12.07.2022, Dr. S. N. Jha, Deputy Director General (Agriculture Engineering), ICAR, New Delhi inspected the work related to the implementation of the official language being done in the institute.

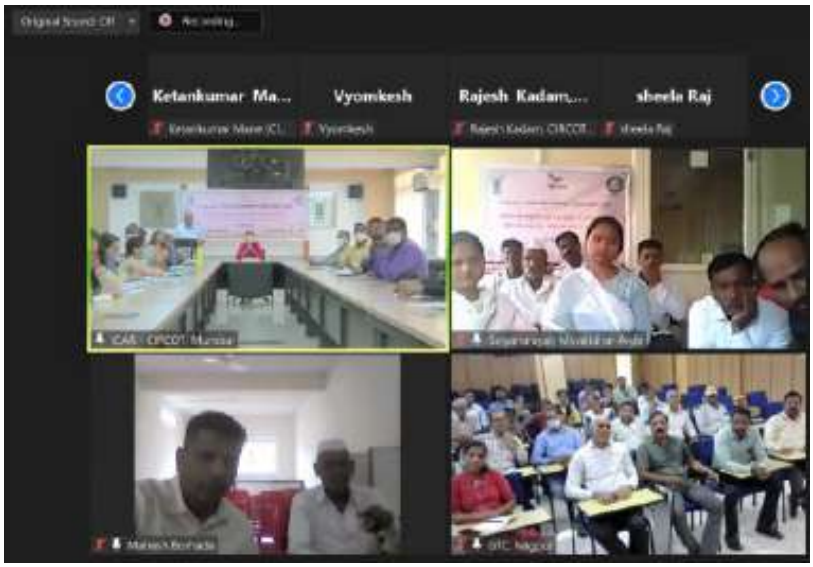
- During September 6-7, 2022, Dr. Pramod Kumar Kush, Auditor, Bureau of Indian Standards inspected the work related to the implementation of the official language in the Institute.

National Seminar - Hindi Webinar on "Balanced and Efficient Use of Fertilizers in a hybrid mode. 1

Hindi Webinar on "Balanced and Efficient Use of Fertilizers with special reference to ICAR-CIRCOT Nano fertilizer and Cotton Stalk compost" was organized for farmers, start-ups and other stakeholders. Dr. Sujata Saxena, Director, ICAR-CIRCOT, Mumbai gave an overview of the technologies developed by ICAR-CIRCOT and highlighted the importance for sensitization of audience about balanced fertilizer use. Dr. A.K. Bharimalla, Dr. Manoj Mahawar and Dr. Jyoti Dhakane gave a lecture on the topic "Applications and future prospects of nano-fertilizers in agriculture" with special reference to nanotechnology work of ICAR-CIRCOT. Dr. Ajinath Dukare gave a lecture on "Biofertilizers for sustainable agriculture" and "Bioenriched cotton stalk compost" highlighting the advantages and beneficial microbial strains for nitrogen fixing, phosphorus solubilization and potassium mobilization. ICAR-CIRCOT's composting technology and its environmental and economic benefits were also elucidated to the participants.

Dr. K.P. Patel, Former Principal and Dean, Anand Agricultural University, Gujarat highlighted the current agricultural scenario in India and explained how excessive use of fertilizers is harming soil. He emphasized that the use of fertilizers should be customized according to soil type, crop type and climate because of different requirements.





The webinar was attended by more than 120 participants including 70 farmers, former Directors and HoDs of ICAR institutes, project coordinators, Scientists of various ICAR institutes, incubatees, institute staff from Headquarter, Ginning Training Centre, Nagpur and other regional units.

Celebration of Hindi Day/Fortnight and Hindi Chetna Maas 2022

Hindi Chetana Month to honour Hindi as the Official Language was observed from 14th to 30th September, 2022. Various competitions such as poetry recitation, essay writing, technical words, unicode typing, crossword and poster presentation on the topic 'Opportunities and challenges for youth in modern agriculture' were organized.

On 14th September, 2022 Dr. (Mrs.) Sujata Saxena, Director presided over the Hindi day celebration and Dr. Pramod Kumar Kush, litterateur & poet and Dr. Pratap Shamrao Deshmukh, former Head of Department, Plant Physiology, Indian Agricultural Research Institute, Pusa were the guests. The opening ceremony and poetry recital competition was organized through virtual mode. In the inaugural function, the official language pledge of Hindi Day was administered to all the staffs. Chief Guest Dr. Pramod Kumar Kush in his address appreciated the implementation of the official language in the institute and presented his Hindi songs and Ghazals.

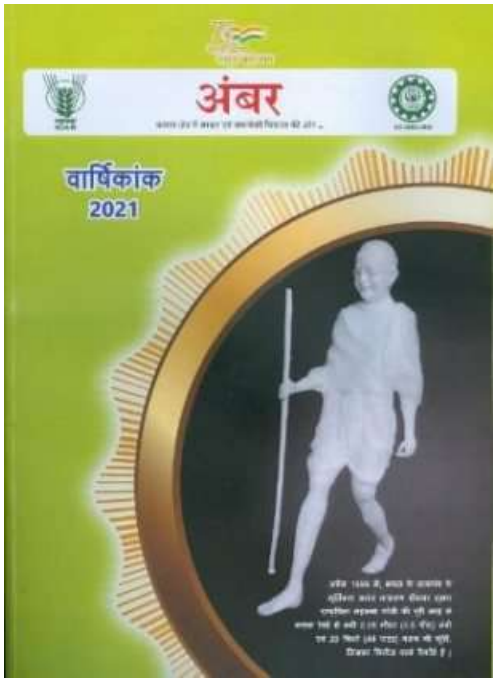
On September 29, 2022, the closing ceremony was held under the chairmanship of Dr. (Mrs.) Sujata Saxena, Director. Chief guest on the occasion, Dr. Manju Lodha, writer, poetess and social worker, in her address congratulated all the employees for the dissemination of technical work being done in the Institute through the official language Hindi and asked them to continue doing this work. On this occasion, she also recited self-composed poems.

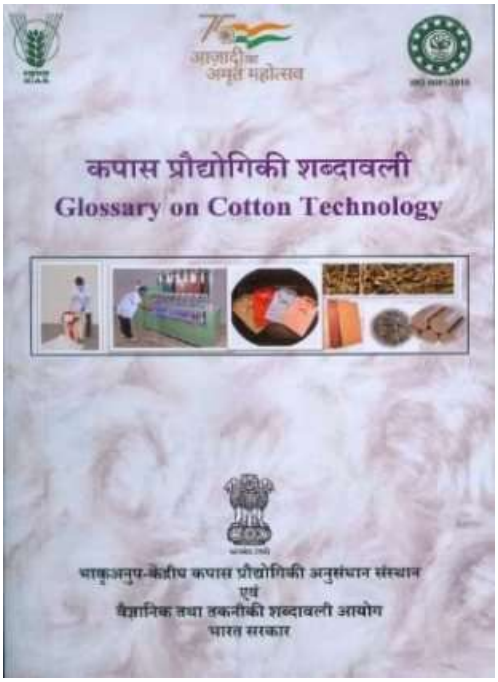
The chairman of the Pakhwada Organizing Committee, Dr. P.S. Deshmukh Principal Scientist presented a brief report of various competitions organized during the fortnight. A total of 7 competitions were organized in which a total of 106 officers/employees of the Institute

actively participated. Mrs. Trupti P. Mokal, Assistant Administrative Officer and In-charge, Rajbhasha Cell, briefed on achievements in Hindi implementation during the year.

Awards for the year 2021-22 were given to the employees participating in the incentive scheme being run for commenting/drafting in Hindi in official work. In the closing ceremony, the Rajbhasha Chal-Vyjayanti Shield, for the best Hindi implementation for the year 2021-22, was given to Quality Evaluation and Improvement Division in Scientific Research Departments and Administration I (Personnel Section) under the Administrative Sections category.

GTC, Nagpur: Hindi Week celebrations were organized at the Institute's Ginning Training Center, Nagpur from 14th September, 2022 to 30th September, 2022 in which a total of 5 competitions were organized and all the employees of the center participated enthusiastically.





Meetings of the Town Official Language Implementation Committee 1

The Director of the Institute, Dr. (Mrs.) Sujata Saxena participated in the half yearly meetings of the Town Official Language Implementation Committee, Mumbai, held on 25.05.2022 and 19.10.2022.

Story writing competition in Hindi by viewing pictures 1

ICAR- Central Institute for Research on Cotton Technology, Mumbai and the Town Official Language Implementation Committee of Central Government Offices constituted under the chairmanship of the General Manager of Western Railway, Mumbai with the aim of promoting and increasing the use of official language in the member offices organized "Story writing competition in Hindi by viewing pictures" on April 21, 2022. Total 24 officers and employees of the Central Government participated in this competition.

Felicitation ceremony and Kavya Sandhya

A special felicitation ceremony and a special Kavya Sandhya was organized on October 15, 2022 (Saturday) in the auditorium of Central Cotton Technological Research Institute, Matunga, Mumbai as a tribute to the holy memory of Kirti Shesh great poet Dr. Kunwar Bechain and emotional tribute to Mrs. Shakuntala Sharma and Mr. Ravidutt Sharma. It was done in a grand literary environment in which eminent poets, lyricists and ghazalkars presented their affectionate presence and excellent compositions.

Well-known Veena player and musician respected Suvir Mishra, IRS (Chief Guest), former president of Maharashtra State Hindi Sahitya Akademi, respected Dr. Sheetla Prasad Dubey (special guest), respected Manju Lodha, well-known social worker and writer and Dr. Sujata Saxena, Director, CIRCOT graced the event.

Dr. Pramod Kush 'Tanha', founder and National president of All India Contract Foundation, placed the Sankalp Patra of the organization and made the atmosphere of the auditorium emotional by sharing some important incidents related to Dr. Kunwar Bechain.

Well-known poets and poetesses Mr. Omprakash Nautiyal from Baroda, Mr. Zakir Hussain from Mumbai, Mr. Jawahar Lal Nirjhar, Dr. Mukesh Gautam, Mr. Devdutt Dev, Mr. Satish Shukla 'Raqib', Mr. Gulshan Madan, Ms. Anamika Sharma, Ms. Reema Singh, Dr. Pooja Alapuria, Ms. Ritu Bhansali, Ms. Shashi Purwar, Ms. Alka 'Sharar' and Dr. Pramod Kush 'Tanha' presented their creative poetry during the poetry evening.

Awards

The best home magazine for the year 2021-22

Mumbai's literary-cultural-social organization, Ashirwad, Mumbai has awarded ICAR-CIRCOT, Mumbai's home magazine 'Ambar' with first Prize for the year 2021-22 out of the various home magazine published by Central Government Offices of India, Public sectors, Undertakings and Nationalized Banks. Director of the Institute, Dr. (Mrs.) Sujata Saxena received this award from the Hon'ble Governor of Maharashtra Shri Bhagat Singh Koshyari in a function organized at 'Raj Bhawan' on September 20, 2022. Smt. Trupti Mokal, Assistant Administrative Officer and In-charge, Rajbhasha Cell was also present.

Rajbhasha Shield for outstanding work in implementation of Official Language during the year 2021-22.

The Town Official Language Implementation Committee of Central Government Offices constituted under the chairmanship of the General Manager, Western Railway under the guidelines of the Government of India, Ministry of Home Affairs held a half yearly meeting on 25.05.2022. Amongst 99 member offices, ICAR-CIRCOT was awarded with Official Language Shield and Citation for doing remarkable work in the implementation of Official Language during the year 2021-22. Dr. Sujata Saxena, Director, ICAR-CIRCOT received this shield and citation by the hands of Mr. Prakash Butani, President, NARACAS and General Manager (WR). Shri. Sunil Kumar, CAO, Smt. Tripti Mokal, In-charge, Rajbhasha Cell and Smt. Prachi Mhatre, Assistant In-charge, Rajbhasha Cell were present.

12. Distinguished Visitors

Dr. Trilochan Mohapatra, Secretary (DARE) & DG (ICAR)

Dr. Trilochan Mohapatra, Secretary (DARE) & DG (ICAR), Dr. S. K. Chaudhari, Deputy Director General (NRM), ICAR, Dr. C. D. Mayee, Former Chairman, ASRB, Dr. B. S. Dwivedi, Director, ICAR-NBSS&LUP; Dr. Y. G. Prasad, Director, ICAR-CICR and Dr. D. K. Ghosh, Director, ICAR-CCRI visited Ginning Training Centre (GTC), ICAR-CIRCOT, Nagpur on 26th June 2022.

Dr. S. N. Jha, DDG (Agricultural Engineering), ICAR

Dr. S. N. Jha, Deputy Director General (Agricultural Engineering), ICAR visited ICAR-CIRCOT during July11-13, 2022. He inaugurated the National Laboratory for Assessment of Trash and Contamination in Cotton (NLATCC) in the presence of Dr. Sujata Saxena, Director (Acting), ICAR-CIRCOT on 12th July 2022.

Dr. K.V. Prasad, Director, ICAR-DFR, Pune

Dr. K.V. Prasad, Director, ICAR-DFR. Pune visited ICAR-CIRCOT, Mumbai on 3rd August 2022 and participated in brainstorming session for inter-institutional collaborative research in the fields of agro-textiles and biocomposites with team of scientists from both the institutions.

Dr. Indra Mani Mishra, Vice Chancellor, VNMKV, Parbhani

Dr. Indra Mani Mishra, Vice Chancellor, VNMKV, Parbhani visited ICAR-CIRCOT on 20-08-2022. Dr. A. J. Shaikh, former Director, Dr. C. D. Mayee, Shri Suresh Kotak, etc. were also present on the occasion. Dr. Indra Mani has also visited GTC of ICAR-CIRCOT, Nagpur on 12th September, 2022.

Shri Sudip Nag

Shri Sudip Nag, Mission Director, National Mission on Use of biomass in coal-based power plants & Executive Director, NTPCLtd., visited GTC, Nagpur on 13th October, 2022.

Dr. K. Narsaiah. ADG (Process Engineering), ICAR

Dr. K. Narsaiah, ADG(Process Engg), ICAR, New Delhi visited Quality Evaluation Unit (QEU), Coimbatore of ICAR-CIRCOT on 11th November, 2022. He was briefed about activities carried out in the Center by Shri K. Thiagarajan, CTO & I/c. QEU, Coimbatore. ADG was accompanied by Dr. D.M. Kadam, Head I/C, TTD.

Dr. K. Srinivas, ADG(Intellectual Property & Technology Management), ICAR

Dr. K. Srinivas, Assistant Director General(IP&TM)visited ABI Centre at ICAR-CIRCOT, Mumbai on 24th November 2022. Dr. A. K. Bharimalla, PI, of ABIC gave a brief presentation on the activities of ABIC/ITMU. He visited the facilities created under ABI/ITMU fund and had a discussion with Dr. S. K. Shukla, Director, ICAR-CIRCOT on incubation facilities available in the institute. He was also appraised about the products made by incubatees and startups of the institute.

Delegates from International Cotton Association and CAI

A delegation of the International Cotton Association visited ICAR-CIRCOT, Mumbai on 6thMay 2022 along with Cotton Association of India, Mumbai office bearers. Dr. Sujata Saxena, Director (Acting) welcomed delegates and presented detailed information related to the contribution of ICAR-CIRCOT in the development of the cotton sector in India. The delegates visited different laboratories and had discussions with the scientists.

Dr. S.N. Jha, DDG (Agricultural Engineering) visited QEU, Coimbatore

Dr. S. N. Jha, DDG (Ag. Engg.) visited Quality Evaluation Unit (QEU) of ICAR-CIRCOT at Coimbatore on 10th November 2022. Shri K. Thiagarajan, CTO & I/c. QEU, Coimbatore showed him different cotton fibre testing facilities available over there and demonstrated fibre testing using High Volume Instrument (HVI) and Advanced Fibre Information System (AFIS).

13. Swachh Bharat Abhiyan 1

The institute implemented Swachhta Action Plan (SAP) from 2.10.2022 to 31.10.2022 during which 100 old physicals files were identified, digitised and weeded out and the space was freed.

During Swachhta Pakhwada celebration from 16th to 31st December 2022, the institute conducted cleanliness drive activities on daily 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, and nearby tourist spots. During the year 2022, an amount of Rs. 13.6 lakhs was utilised for implementation of Swachhta Pakhwada and Swachhta Action Plan to conduct 75 activities for cleaning and beautification of surrounding areas.

Sr. No.	Name of activities as per theme	Site of Activity Undertaken	No. of Participants
16.12.2022	Display Banner at prominent places	ICAR-CIRCOT, Mumbai and nearby area	115
	Taking Swachhta pledge, Stock Taking and briefing of the activities to be organized during the Pakhwada,	ICAR-CIRCOT,Mumbai	100
17.12.22	Stock taking on digitization of office records/	ICAR-CIRCOT, Mumbai	2
	e-office Implementation.	ICAR-CIRCOT, Mumbai	3
	Cleanliness drive including cleaning of offices and premises	ICAR-CIRCOT,GTC NAGPUR	10
	Review of progress on weeding out old records	ICAR-CIRCOT, Mumbai	3
18.12.22	Taking Swachhta pledge at GTC, Nagpur	ICAR-CIRCOT,GTC NAGPUR	14
	Cleanliness and sanitation drive in the village adopted under the Mera Gaon Mera Gaurav Programme	VILLAGE: MOHAPA TALUK: KALMESHWAR DISTRICT : Nagpur	25

19.12.22	Cleanliness drive within campus	ICAR-CIRCOT,Mumbai.(QEID Division)	15
20.12.22	Composting of kitchen and home waste materials.	ICAR-CIRCOT, Mumbai	30
	Promoting clean & green technologies	ICAR-CIRCOT, Mumbai	25
	Cleanliness drive	ICAR-CIRCOT, Mumbai	12
21.12.22	Taking Swachhta pledge at ICAR-CIRCOT, Surat	ICAR-CIRCOT, Surat	03
	Cleanliness and sanitation drive within campuses	ICAR-CIRCOT, Surat	08
22.12.22	Textile waste to wealth campaign and cleaning at spinning section of the Mechanical processing division	ICAR-CIRCOT, Mumbai	15
23.12.22	Celebration of Special Day – Kisan Diwas(Farmer's Day).	Isapur Village, Saoner Taluk, District, Nagpur	100
	CIRCOT staff attending Celebration of Kisan Diwas by Shri. Narendra Singh Tomar, Hon'ble Minister of Agriculture and Farmers Welfare	ICAR-CIRCOT	70
24.12.22	Taking Swachhta pledge at ICAR CIRCOT, Coimbatore	ICAR-CIRCOT, Coimbatore	02
	Swachhta Awareness at local level.	ICAR-CIRCOT, Coimbatore	03
25.12.22	Cleaning of public places, and nearby tourist spots	Veer Abhimanyu Udyan, Mahim, Mumbai	25
	Cleaning of residential places	Mahim quarters, Mumbai	25
26.12.22	Organising competition for school children (Drawing competition on the topic "Bharat")	ICAR-CIRCOT, Mumbai	5

27.12.22	Plastic Waste Shramdan. Awareness on Plastic Waste Management.	ICAR-CIRCOT, Mumbai	8
28.12.22	Cleanliness, water harvesting, recycling of waste water and conversion of agro waste to wealth.	ShapurBegu Village, Sirsa District, Haryana	20
29.12.22	Taking Swachhta pledge at ICAR - CIRCOT, Guntur and cleanliness	ICAR-CIRCOT, Guntur	02
	Visits of community waste disposal sites/composts pits	ICAR-CIRCOT, Guntur	04
30.12.22	Involvement of Dignitaries in Swachhta Activities	ICAR-CIRCOT, Mumbai	100
31.12.22	Organisation of meeting for highlighting the activities of Swachh Bharat Pakhwada	ICAR-CIRCOT, GTC, NAGPUR	20

Compost (wet and dry waste) was used to plant new saplings at the hands of Dr. S. K. Shukla, Director and other officials on December 20, 2022

"National Farmers Day and Swachhta Pakhwada" at Isapur village, Katol, Nagpur on December 23, 2022

Massive weeding exercise was organised over the past month, as part of a special campaign for disposal of pendency from the government of India, ICAR-CIRCOT has weeded out 100 unwanted physical files and freed up space in the office.

Before

After

Record room in Yashwantrao Chavan building at ICAR-CIRCOT, Mumbai 1

14. Mera Gaon Mera Gaurav (MGMG)

ICAR-CIRCOT has adopted 12 villages of Nagpur District for the implementation of the MGMG programme. The Villages include Mohapa, Masepathar, Gholi, Ghorad, Ubali, Mandavi, Khumari, Savangi (Mohagaon), Wathoda, Savandri, Kondhali and Pipla (Kinkhede). The selected villages are having mainly cotton growing farmers and is situated 60 km from Ginning Training Centre, Nagpur. The major activities identified for implementation of the programme are to conduct farmers meet, awareness programme, field demonstration, technology demonstration mela etc.

Sr. No.	Activity	Place	Date	No. of Participants
1.	Field visit to guide farmers in post-harvest management practices	Khumari and Mandavi villages, Taluka: Kalmeshwar, Nagpur District	5th Aug 2022	25
2.	Cleanliness and sanitation drive	Mohapa Village, Taluka: Kalmeshwar, Nagpur	18th Dec 2022	40
3.	National Farmers Day & Swachhta Pakhwada celebration	Isapur, Taluka: Katol, Nagpur	23rd Dec 2022	110

Field Visit Khumari and Mandavi villages, Taluka: Kalmeshwar, Nagpur District 1

Cleanliness and sanitation drive at Mohapa Village, Taluka: Kalmeshwar, Nagpur 1

National Farmers Day Celebration at Isapur village, Katol, Nagpur 1

15. Infrastructural Facilities 1

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.

Some of the facilities available in the Institute include

- ***Fibre, Yarn and Fabric Testing Laboratory:*** *(With High Volume Instrument and Advanced Fibre Information System)*: The laboratory has all the instruments for analysing the quality parameters of the Cotton and other fibres, yarn and fabrics. Besides research, this service is also provided to the traders and other stakeholders in the cotton value chain.
- ***Nanocellulose Pilot Plant Facility***: Capacity to produce 10 kg of Nanocellulose per day. The Service is extended to Research organizations, Industrial stakeholders for carrying out studies on application of nanocellulose.
- ***National Laboratory for Advanced Material Characterization:*** To support research, testing and incubation needs of start-ups, students, researchers, entrepreneurs and industries, the laboratory is adequately equipped with sophisticated instruments like X-ray Diffractometer, X-ray fluorescence spectrometer, Weather-O-meter, Automatic single yarn tensile strength tester, Particle size analyser, Goniometer, Polarized light microscope and Security Feature Detection System etc.
- Other Unique research and instrumentation facility available at the institute include Scanning Electron Microscopy (SEM); DREF Spinning Machines; Kawabata Evaluation System (KES); Atomic Force Microscopy (AFM); Thermo Gravimetric Analyser; Fourier Transformation Infrared Spectrometer; Atomic Absorption Spectrometer; Ultra High-Pressure Homogenizer; Particle size analyser; Gas Chromatography with Mass Spectrometer:
- ***Electrospinning Facility***
- ***Computerised sample Weaving Facility***
- ***Composite Lab facility***
- ***Modern Ginning and Pressing Plant***
- ***Cottonseed Processing Plant***
- ***Particle Board Manufacturing Plant***: One tonne per day production capacity plant is established in Nagpur.
- ***Pelleting Plant***

New Facilities created in the institute during the current year :

Medical Textile Testing Facility

Medical textile testing facilities like Particle filtration efficiency tester, Synthetic blood penetration analyzer have been introduced to the National Laboratory for Advanced Material Characterization.

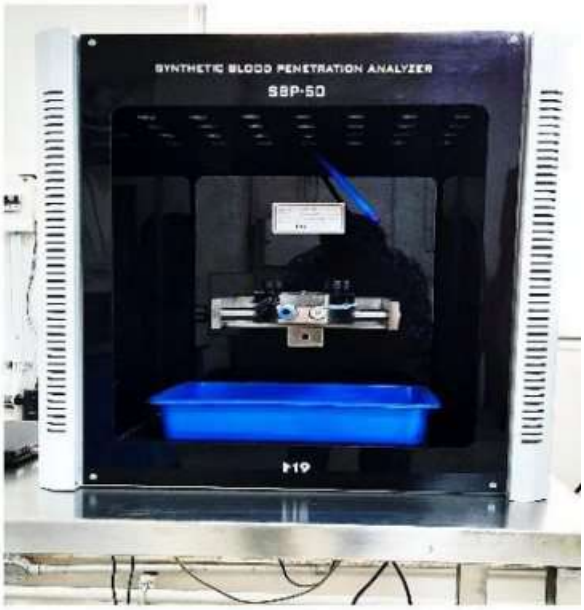
Particle Filtration Efficiency Tester (T443, SATATON)

It is used for testing the effectiveness of protective masks and other types of masks against particulate matter. It can also be used to determine the efficiency of air filter, flat sheet filter media or filter elements according to particle counting method. With compact structure and easy operation system, the tester provides better testing usage and satisfies more applications. Applicable standards: IS16289, ASTMF2299

Particle Filtration Efficiency Tester (T443, SATATON)

Synthetic Blood Penetration Analyzer (SBP-50)

It measures the resistance of coated/laminated fabrics, medical textiles and non-woven to blood penetration by means of dynamic test method. The automated control system applies controlled dynamic (incremental) force until 3 points of leakage occurs. The instrument measures and calculates the average hydrostatic pressure in mBar, psi in addition to producing binary results (i.e. Pass or Fail) as specified by ASTM, AATCC and ISO.



Synthetic Blood Penetration Analyzer (SBP-50)

National Laboratory for Assessment of Trash and Contamination in Cotton

Dr. S. N. Jha, Deputy Director General (Agricultural Engineering), ICAR inaugurated the National Laboratory for Assessment of Trash and Contamination in Cotton (NLATCC) in the presence of Dr. Sujata Saxena, Director (Acting), ICAR-CIRCOT on 12th July 2022.

This lab has been established for quantitative evaluation of the trash and contamination in cotton and has the capability of measuring trash content of about 300 samples per 8 hr shift as per standard methods. This facility aims to facilitate cotton quality assessment and reduce contamination level in Indian Cotton.

High Production Needleless Electrospinning Set-up

Indigenous needleless electrospinning machine was designed and fabricated. It is a kind of high production needleless electrospinning set-up, with the production capacity of 6-8 times higher than the single needle electrospinning set-up. More than 600 profiles can be created on the drum surface for the continuous production of nanofibers. It has the potential for textile and agro-textile applications.

Computerised Colour Matching System 1

The main function of the instrument is to predict the colour of the sample and to match the shade of the sample. CCMS makes it easy to match the shade quickly by measuring the reflectivity of a target colour with a Spectro-colorimeter and calculates the blend ratio of colour materials and assist to reproduce the colour. It helps for determining colour recipe prediction, colour difference calculation, metamerism determination & sample pass/fail prediction system.

Open-End Rotor Spinning System

Rotor Spinning is a form of open-end spinning where the twist is introduced into the yarn without the need for package rotation enabling higher twisting speeds with a relatively low power cost. The number of rotor heads are 10 with maximum rotor speed of 50000rpm. The yarn count range from 4s Ne to 40s Ne can be spun by this rotor spinning system. The production rates of rotor spinning are 6-8 times higher than that of ring spinning.

Experimental Set-up for Making Pellets

Pellet Machine

Mixer

Hammer Mill 1

Pellet Machine: Capacity: 125-150 kg/h
Mixer: Capacity: 100-300 kg/h
Hammer Mill: Capacity: 30-200 kg/h

Annexure 1

List of Ongoing Research Projects

Institute Funded Projects

Code	Title	Investigators	Duration
Core Area I: Pre-Ginning and Ginning			
MP.91	Development of Digital Ginning Percentage Indicator for Portable Cotton Gins	Dr. V.G. Arude (PI) Dr. S.K. Shukla Dr.P.S.Deshmukh	2020-22
MP.93	Device for seed cotton ginning percentage measurement	Dr. P.S. Deshmukh (PI) Dr. V.G. Arude Dr. Manoj Kumar Mahawar	2020-23
MP.94	Optimization of groove profile and diameter of chrome leather roller for enhancing the performance of double roller gin	Dr. Sheshrao Kautkar (PI) Dr. S.K. Shukla Dr. S.V. Ghadge Dr. V.G. Arude	2020-22
MP.98	Development of a seed cotton trash content analyser based on pneumatic fractionation methodology	Dr. S.K. Shukla (PI) Dr. S.V. Ghadge Dr. V.G. Arude	2021-23
MP.100	Optimization trial of the ICAR-CIRCOT Kawadi Opener at Factory Level	Dr. S.V. Ghadge (PI) Dr. S.K. Shukla Dr. Varsha Satankar	2022-23
MP.101	Evaluation, Optimization and Standardization of different types of lint cleaners used in Ginneries	Dr. Varsha Satankar(PI) Dr. S.K. Shukla Dr. S.V. Ghadge Dr. D.K. Pandiyan	2022-23
MP. 103	Assessment of field performance and effectiveness of hand-held mechanical cotton picker	Dr. V.G. Arude (PI) Dr. S.K. Shukla Dr. P.S. Deshmukh Dr. Varsha Satanakar	2022-24

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) Dr. G. Krishna Prasad Dr. V.G. Arude Dr. A.S.M. Raja	2020-23
MP.96	Development of cellulosic nanofibre based micronutrient delivery system for urban farming	Dr. G.T.V. Prabu(PI) Dr. N. Vigneshwaran Dr. T. Senthilkumar Dr. K. Kanjana (ICAR-CICR)	2020-22
MP.97	Development of filter fabric for indoor decontamination	Dr. Kirti Jalgaonkar(PI) Dr. P. Jagajanantha	2020-23
MP.99	Development of cut-resistant fabric using 3D weaving	Dr. Krishna Prasad (PI) Dr. T. Senthilkumar Dr. A.S.M. Raja	2021-24
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. P.K. Mandhyan (PI up to Sept 2022) Dr. A.S.M. Raja (PI) (from Oct 2022) Dr. A. Arputhraj Dr. P. Jagajanantha Dr. G.T. V. Prabu	2021-24
QE.111	Development of Electrically conductive cotton materials	Dr. P. Jagajanantha (PI) Dr. G.T. V. Prabu Dr. Kirti Jalgaonkar Dr. Sharmila Patil	2021-23
QE.112	Development of Machine Learning Model for Trash Content Analysis based on High Volume Instrument and Gravimetric Method of Trash Content Estimation	Mr. Himanshu Chaurasia (PI) Dr. T. Senthilkumar Dr. P. Jagajanantha	2021-23
QE.113	Development of AI based prediction model for yarn quality characteristics	Dr. N. Shanmugam (PI) Dr. D.M. Kadam Dr. P. Jagajanantha Dr. G.T. V. Prabu Mr. Himanshu Chaurasia	2022-25

Code	Title	Investigators	Duration
Core Area IV: Chemical and Biochemical Processing and Biomass & By Products Utilisation			
CH.98	Toxicological and Environmental impact of ICAR-CIRCOT's nanomaterials (Nanocellulose, Nano silver, Nano-ZnO and Nano-sulphur)	Dr. N. Vigneshwaran (PI) Dr.A.K. Bharimalla Dr. A.S.M. Raja Dr. A. Arputhraj 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) Dr. Manoj Kumar Dr. Kanika Sharma	2020-23
CH.100	Development of Health Drink from cottonseed	Dr. Manoj Kumar (PI) Dr. Sujata Saxena Dr. Kanika Sharma	2021-22
CH.101	Development of microbial xylanase enzyme-based process for eco-friendly bleaching of paper pulp	Dr. Ajinath Dukare (PI) Dr. Kanika Sharma Dr. N. Vigneshwaran Dr. Sujata Saxena	2021-23
CH.102	Isolation of Gossypol from cottonseed and its evaluation as a botanical fungicide	Dr. Kanika Sharma (PI) Dr. Manoj Kumar Dr. N. Vigneshwaran Dr. Ajinath Dukare Dr. Sujata Saxena	2022-24
CH.103	Development of nanocellulose based functional coating for fruits	Dr. Archana Mahapatra(PI) Dr. Jyoti Dhakane Lad Dr. A.K. Bharimalla	2022-23
Core Area V: Entrepreneurship and Human Resource Development			
TT.10	Refinement and popularization of nutrient-enriched compost production from cotton micro-dust	Dr. K Pandiyan (PI) Dr. S.K. Shukla Dr. S.S. Kautkar	2020-22

Code	Title	Investigators	Duration
TT.11	Development of process protocol for synthesis of nano-sulphur and its application in agriculture	Dr. M.K. Mahawar (PI) Dr. A.K. Bharimalla Dr. N. Vigneshwaran Dr. A. Arputhraj	2020-23
TT.12	Impact Assessment of CIRCOT technologies	Dr. Sundaramoorthy C. (PI) Dr. A.K. Bharimalla 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) Dr. Ajinath Dukare A.K. Bharimalla Dr. Varsha Satankar Dr. K. Pandiyan	2022-24
Inter-Institutional Projects			
II.01	Development of biocompatible nano-clay polymer composites and nanoparticles with reference to retention and release of iron and zinc in Grape (Vitis Vinifera L.) [Collaborating Institute: ICAR-NRC for Grapes, Pune]	Dr. P.K. Mandhyan (PI up to Sept 2022) Dr. Sharmila Patil (PI from Oct 2022)	2019-23
II.02	Efficacy evaluation of ICAR-CIRCOT Nano-ZnO as nano fertilizer in field crops [Collaborating Institutes: ICAR-IIPR Kanpur, ICAR-CICR Nagpur and ICAR-NIASM, Baramati]	Dr. N. Vigneshwaran (PI) Dr. A.K. Bharimalla Dr. A. Arputhraj	2021-24
II.03	Development and evaluation of Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) loaded nanocellulosic hydrogels [Collaborating Institute: GMIPSR, Karnataka]	Dr. Sujata Saxena (PI) Dr. A.K. Bharimalla Dr. N. Vigneshwaran Dr. Sharmila Patil	2022-23
II.04	Development of eco-friendly fruit protection bags for quality enhancement [Collaborating Institute: ICAR-NRC for Grapes, Pune]	Dr. Jyoti Dhakane Lad (PI) Dr. Manoj Kumar Mahawar Dr. P. Jagajanantha Dr. Kirti Jalgaonkar Dr. A.K. Bharimalla	2021-23

Code	Title	Investigators	Duration
II.05	Development of bionanocomposite films using extrusion process [Collaborating Institute: CIPET: SARP-LARPM, Bhubaneswar]	Dr. Sharmila Patil (PI) Dr. A.K. Bharimalla Dr. Kirti Jalgaonkar Dr. Manoj Kumar Mahawar Dr. Jyoti Dhakane-Lad Dr. A.S.M. Raja Dr. Sujata Saxena	2021-23
II..06	Efficacy evaluation of ICAR-CIRCOT Nano-Sulphur as fertilizer formulation for different field crops [Collaborating Institutes: DOGR, Pune, MPKV, Rahuri, IISS, Bhopal]	Dr. A.K.Bharimalla (PI) Dr.Manoj Kumar Mahawar Dr. N. Vigneshwaran Dr. A. Arputhraj Dr. Jyoti Dhakane-Lad Dr. A.S.M. Raja Dr. Sujata Saxena	2021-24
Consortia Research Platform (CRP) on Natural Fibres			
CRP CIRCOT 07	Development of cotton incorporated Personal Protective Equipment (PPE) body suit for healthcare workers with enhanced comfort	Dr. P.K. Mandhyan (PI) Dr. A.S.M. Raja Dr. A. Arputhraj Dr. P. Jagajanantha Dr. Kirti Jalgaonkar	2020-22
CRP NINFET 07	Development of Building Materials using Natural fibres and other fibrous crop residues (CIRCOT Centre)	Dr. Krishna Prasad (PI) Dr. T. Senthilkumar Dr. Kirti Jalgaonkar Dr. Ajinath Dukare	2021-24
CRP CIRCOT 08	Development of Cotton Based face mask with improved particle filtration efficiency and breathability using electro spun nano materials and antiviral coatings	Dr. A.S.M. Raja (PI) Dr. T. Senthilkumar Dr. Krishna Prasad Dr. G.T. V. Prabu Dr. N. Vigneshwaran Dr. C. Sundaramoorthy Dr. A.K.Bharimalla Dr. P.K. Mandhyan	2020-22

Code	Title	Investigators	Duration
CRP CIRCOT 09	Development of Natural Fibre Based composites for the selected automotive applications	Dr. A. Arputharaj (PI) Dr. A.S.M. Raja Dr. Senthil Kumar Dr. Sharmila Patil	2022-24

Externally Funded Projects 1

40413160 009	Agri Business Incubation Centre at ICAR – CIRCOT, Mumbai (NAIF -Incubation Fund)	Dr. A. K. Bharimalla (PI) Dr. N. Vigneshwaran Dr. C. Sundaramoorthy Dr. K. Pandiyan Dr. Sharmila Patil Dr. Krishna Prasad Dr. Jyoti Dhakane-Lad Mr. Bharat R. Pawar Mrs. Prachi R. Mhatre	2015-25
1010811	Remunerative Approaches for Agriculture and Allied Sectors Rejuvenation (RAFTAAR) - Agribusiness Incubation Centre (R-ABI) (DA&FW)	A. K. Bharimalla (PI) Dr. P.S. Deshmukh Dr. C. Sundaramoorthy Dr. Sharmila Patil Dr. S.S. Kautkar Dr. Jyoti Dhakane-Lad Mrs. Prachi Mhatre	2019-23
1011105	Design and Development of Pilot Plant for Extraction of Protein from De-oiled Cotton Cake and Value Addition(By-Products Utilization) (DST)	Dr. D.M. Kadam (PI) Dr. V.G. Arude Dr. Manoj Kumar	2021-23
40413210 004	Characterization and utilization of paddy straw and other agro residues for conversion into pellets for co-firing in thermal power plants (TPP)	Dr. Sujata Saxena (PI) Dr. S.K. Shukla Dr. A.S.M. Raja Dr. A. Arputhraj Dr. T. Senthil Kumar Dr. K. Pandian Dr. Varsha Satankar	2022-25

Annexure II 1

PERSONNEL 1

(As on December 31, 2022)

DIRECTOR 1

Dr. S. K. Shukla
M. Tech., Ph.D. (Agricultural Process Engineering)

SCIENTIFIC STAFF

HQ, MUMBAI

PRINCIPAL SCIENTIST

1. Dr. P. G. Patil, M. Tech. (P.H.E.), Ph.D. (Engg.), F.T.A., FISAE., FIE (on deputation for 5 years as VC, MPKV, Rahuri)
2. Dr. (Smt.) Sujata Saxena, M.Sc.,Ph.D. (Organic Chemistry) Head I/c, Chemical and Biochemical Processing Division
3. Dr. Dattatreya M. Kadam, M.Tech, Ph.D (Agricultural Process Engineering) Head I/c, Technology Transfer Division
4. Dr. N. Shanmugam, M. Tech., MIE, D.TT., Ph.D. (Textile Manufacture & Technology) Head I/c, Mechanical Processing Division
5. Dr. A. S. M. Raja, M. Sc., Ph.D. (Textile Chemistry) Head I/c, Quality Evaluation and Improvement Division
6. Dr. N. Vigneshwaran, M.Sc. (Agri.), M.B.A., Ph.D. (Agricultural Microbiology)
7. Dr. P. S. Deshmukh, M. Tech., Ph.D., LL.B., FIE. (Farm Machinery & Power)
8. Dr. C. Sundaramoorthy, M.Sc., Ph.D. (Agricultural Economics)

SENIOR SCIENTIST

1. Dr. (Mrs.) Jyoti M. Nath, M.Sc., Ph.D. (Electronics & Instrumentation) (Scientist Resigned)
2. Dr. A. K. Bharimalla, M. Tech., Ph.D. (Composite)
3. Dr. V. G. Arude, M. Tech. Ph.D. (Farm Machinery & Power)
4. Dr. A. Arputharaj, M.Sc., M. Tech., Ph.D. (Textile Chemistry)
5. Dr. T. Senthilkumar, M. Tech., Ph.D. (Textile Manufacture)

SCIENTIST

1. Dr.G. T. V. Prabu, M. Tech., M.B.A., Ph.D (Textile Manufacture) 1
2. Dr. G. Krishna Prasad, M. Tech., Ph.D. (Textile Manufacture) 1
3. Dr. Jalgaonkar Kirti Ramesh, M.Sc. (PHT), Ph.D. (Agricultural Structures and Process Engineering)
4. Dr. Manoj Kumar Mahawar, M.Tech. Ph.D. (DPHT)(Agricultural Structures and

Process Engineering)

5. Dr. P. Jagajanantha, M. Tech., Ph.D. (Textile Chemistry) 1
6. Dr. Dukare Ajinath Sridhar, M.Sc., Ph.D (Agricultural Microbiology) 1
7. Dr. Kautkar Sheshrao Sakharam, M.Sc. Ph.D. (Agricultural Structures and Process Engineering)
8. Dr. (Smt.) Sharmila Patil, M.Sc. (P.H.T.), Ph.D. (Agricultural Process Engineering)
9. Dr. (Smt.) Archana Mahapatra, M.Tech., Ph.D. (Agricultural Process Engineering)
10. Dr. Manoj Kumar, M.Sc., Ph.D. (Plant Biochemistry)
11. Dr. (Smt.) Jyoti Dhakane- Lad, M.Tech., Ph.D. (Agricultural Process Engineering)
12. Dr. Kanika Sharma, M.Sc., Ph.D. (Plant Biochemistry)
13. Shri Himanshu Shekhar Chaurasia, M.Sc. (Computer Application & IT)

GTC, NAGPUR

OFFICER-IN-CHARGE

Dr. K. Pandian 1
M.Sc. Ph.D. (Agricultural Microbiology) 1

PRINCIPAL SCIENTIST

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

SCIENTIST

1. Dr. 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. 1
2. Dr. (Smt.). N. M. Ashtaputre, M.Sc., Ph. D.
3. Shri R. S. Prabhudesai, M.Sc., D.C.M. 1
4. Shri S. Banerjee, M.Sc.
5. Shri B. R. Pawar, M. Sc., LL.M.
6. Shri R. K. Jadhav, M.Sc.
7. Shri R. R. Chhagani, M.Sc.
8. Shri H. S. Koli, M.Sc., LL.B.
9. 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. 1
2. Smt. P. S. Nirhali, M.Sc. 1
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. Shri N. D. Kambli, M.Sc.

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, B.A., B.Lib.
5. Shri R. P. Kadam, M.Sc.
6. Smt. M. P. Kamble, B.A., M.Lib.
8. Shri A. R. Jadhav, B.Sc.

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. Agrl. Sci.

SENIOR TECHNICIAN

1. Shri M. M. Kadam
2. Shri S. G. Phalke
3. Shri Yogesh Nagpure

TECHNICIAN

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

GTC, NAGPUR

CHIEF TECHNICAL OFFICER

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

ASSISTANT CHIEF TECHNICAL OFFICER

1. Shri U. D. Devikar, M.Sc.
2. Shri S. L. Bhanuse, M.Sc.
3. Shri S. N. Hedau, B.Sc.

SENIOR TECHNICAL OFFICER 1

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

TECHNICAL OFFICER

1. Shri Anil Kumar Kulsange

QE UNIT, COIMBATORE

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

QE UNIT, DHARWAD

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

QE UNIT, GUNTUR

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

QE UNIT, SIRSA

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

QE UNIT, SURAT

1. Shri D. J. Dhodiya, Senior Technician

ADMINISTRATIVE STAFF

HQ, MUMBAI

CHIEF ADMINISTRATIVE OFFICER : Shri Sunil Kumar, B.A. (Hons.) 1

Sr. FINANCE & ACCOUNTS OFFICER : Shri M. Radhakrishnan 1

ADMINISTRATIVE OFFICER : Smt. Sujata Koshy, B.Com. 1

ASSISTANT ADMINISTRATIVE OFFICER : Smt. T. P. Mokal, M.A.(Hindi) 1

ASSISTANT

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

UPPER DIVISION CLERK 1

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

LOWER DIVISION CLERK

1. Shri S. N. Sahane
2. Shri D. K. Kasar
3. Shri S. M. Chandanshive

PRIVATE SECRETARY : Smt. U. N. Bhandari 1

PERSONAL ASSISTANT 1

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. 1

SKILLED SUPPORT STAFF

HQ, MUMBAI

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

GTC, NAGPUR

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

QE UNIT, COIMBATORE

1. Shri V. Subbaiah

QE UNIT, SURAT

1. Shri M. G. Sosa

APPOINTMENTS

1. Shri Ashish Chobey, on deputation for three years joined as AAO on 08-02-2022.
2. Shri Sunil Kumar who has been promoted to the post of Chief Administrative Officer has taken over the charge in this Institute w. e .f. 22nd April, 2022 (FN).
3. Dr. S. K. Shukla, appointed as Director on October 28, 2022.

SCIENTIST PROBATION COMPLETION

Shri Himanshu Shekhar Chaurasia has cleared his probation effective from 06.01.2022

PROMOTIONS 1

Sr. No.	Name of Staff	Grade to which Promoted	Effective Date of Promotion
1.	Dr. A. Arputharaj	Senior Scientist*(Level-11, RGP 8000)*	15-12-2019
2.	Dr. T. Senthilkumar	Senior Scientist*(Level-11, RGP 8000)*	15-09-2020
3.	Dr. Varsha Satankar	Scientist *(Level-11, RGP 7000)*	01-01-2019
4.	Dr. Archana Mahapatra	Scientist *(Level-11, RGP 7000)*	05-07-2020
5.	Dr. Sharmila Patil	Scientist *(Level-11, RGP 7000)*	05-07-2020
6.	Dr. Manoj Kumar	Scientist (*Level-11, RGP 7000)*	05-07-2020
7.	Dr. Jyoti Dhakane Lad	Scientist (*Level-11, RGP 7000)*	05-01-2021
8.	Shri M. G. Ambare	Senior Technical Officer (T-6)	01-08-2020
9.	Smt. V. G. Udikeri	Senior Technical Officer (T-6)	04-08-2020
10.	Dr. N. D. Kambli	Senior Technical Officer (T-6)	28-12-2020
11.	Shri V. D. Kalsekar	Senior Technical Officer (T-6)	29-04-2021
12.	Smt. H. R. Pednekar	Technical Officer (T-5)	14-06-2019
13.	Shri R.P. Kadam	Technical Officer (T-5)	29-06-2019
14.	Smt. M. P. Kamble	Technical Officer (T-5)	16-10-2019
15.	Shri A. R. Jadhav	Technical Officer (T-5)	19-04-2021
16.	Shri Krishna Bara	Technical Officer (T-5)	11-05-2021
17.	Shri D. A. Salaskar	Senior Technical Assistant (T-4)	07-11-2018
18.	Shri S. V. Kokane	Technical Assistant (T-3) (Driver)	02-06-2015
19.	Shri S. V. Kokane	Senior Technical Assistant (T-4)	02-06-2020
20.	Shri. Mahabir Singh	Senior Technician (T-2)	25-09-2003
21.	Shri. Mahabir Singh	Senior Technical Assistant (T-4)	25-09-2018
22.	Shri S. S. Angane	Assistant	26-04-2022
23.	Shri H. S. Koli	Chief Technical Officer	13-10-2018
24.	Shri R. R Chhagani	Chief Technical Officer	05-08-2018
25.	Dr. S. R. Kawalekar	Chief Technical Officer	07-05-2019
26.	Shri C. M. More	Chief Technical Officer	01-01-2018
27.	Shri R. S. Narkar	Assistant Chief Technical Officer	29-07-2019
28.	Miss C. P. D'Souza	Assistant Chief Technical Officer	30-06-2019
29.	Shri Jal Singh	Assistant Chief Technical Officer	01-01-2018
30.	Smt. P. R. Mhatre	Assistant Chief Technical Officer	01-09-2019

TRANSFERS

Technical

1. Shri S. N. Hedau, ACTO transferred from QEU of CIRCOT, Guntur to GTC, Nagpur w. e. f. 13-06-2022
2. Shri. Paresh P. Thakur, Technical Assistant transferred from GTC, Nagpur to QEU of CIRCOT, Guntur w. e. f. 18-05-2022.
3. Shri D. J. Dhodiya, Senior Technician transferred from ICAR-CIRCOT, Mumbai to Q. E. Unit of CIRCOT, Surat w. e. f. 15-03-2022
4. Shri. Anil Kumar Kulsange, Technical Officer (T-5), transferred from ICAR-CIFE, Mumbai joined GTC of ICAR-CIRCOT, Nagpur on 13-06-2022
5. Shri Krishna Bara, Technical Officer (T-5), transferred to ICAR Research Complex for Eastern Regional Station, Ranchi relieved from ICAR-CIRCOT on 23-07-2022.
6. Shri Narayanan. K, ACTO, Transferred from ICAR-CIRCOT, Mumbai to Q. E. Unit of CIRCOT, Coimbatore w. e. f. 10-11-2022.

Administrative

1. Shri Avinash Aman, LDC, Transferred to ICAR-IISR, Lucknow relieved from ICAR-CIRCOT on 19-04-2022
2. Shri Ashish Chobey, on his promotion as AO,relieved from ICAR-CIRCOT on 31-05-2022 to join ICAR-CMFRI, Kochi

RETIREMENTS

1. Shri V. D. Kalsekar,Sr. Tech. Officer, retired from service voluntarily on 03-01-2022
2. Smt. N. M. Deshmukh, AAO, Superannuated on 31-03-2022
3. Shri T. Venugopal, CTO, Superannuated on 30-04-2022
4. Shri C. M. More, ACTO, Superannuated on 31-05-2022
5. Shri B.V. Shirsath, Technical Officer, GTC, Nagpur Superannuated on 31-05-2022
6. Shri M. B. Patel, Senior Tech. Officer, QE Unit, Surat Superannuated on 31-05-2022
7. Shri S. D. Ambolkar, AAO, retired from service voluntarily on 23-08-2022
8. Shri S. A. Telpande, AAO, Superannuated on 31-08-2022
9. Dr. P. K. Mandhyan, Principal Scientist Superannuated on 30-09-2022
10. Shri D. M. Raje, Technical Assistant, Superannuated on 30-09-2022
11. Shri V.M. Sable, Assistant Superannuated on 31-12-2022

OBITUARY

Dr (Mrs.) Vatsala Iyer retired Principal Scientist expired on 6th January, 2022.

Dr. (Mrs.) Janaki K Iyer retired Principal Scientist expired on9thJuly 2022.

Shri R.G. Tak, Skilled Support Staff expired on 13th November, 2022.

Shri Narayanan. K, Assistant Chief Technical Officer (T-7/8) Expired on 21st November, 2022.

Annexure III 1

LIST OF COMMITTEES 1

Institute Management Committee (IMC) 1

Dr. S. K. Shukla	
Director, ICAR-CIRCOT	Chairman
Dr. A. K. Thakur,	
ADG (PE), ICAR, New Delhi	Member
Dr. L.K. Nayak,	
PS, ICAR-NINFET, Kolkata	Member
Dr. G. Balasubramani,	
PS, ICAR-CICR, Nagpur	Member
Dr. Abhijit Kar,	
PS, ICAR- IARI, New Delhi	Member
Dr. Sharad Gadakh,	
DoR, MPKV, Rahuri	Member
Director of Agriculture,	
Govt. of Maharashtra	Member
Director of Agriculture,	
*Govt. of Karnataka*Member	
Shri Sunil Kumar,*CAO*	Member Secretary

Research Advisory Committee (RAC)

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

Project Monitoring and Evaluation Committee (PMC)

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

Priority-setting, Monitoring & Evaluation (PME) Committee

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

Priority-setting, Monitoring & Evaluation (PME) Cell

Dr. C. Sundaramoorthy, 1
Principal scientist (In-Charge*) 1
Dr. GTV Prabu, *Scientist* (Nodal Officer) 1
Shri K. Narayanan*ACTO* 1
Smt. H. R. Pednekar, *Technical Officer* 1
Shri Anand R Jadhav*Technical Officer* 1
*(*Dr. A.S.M. Raja was in-charge upto August 2022)* 1

Institute Technology Management Committee

Dr. S. K. Shukla Director, ICAR-CIRCOT	Chairman
Dr. Sujata Saxena *Principal Scientist & I/c. Head, CBPD*	Member
Dr. N. Shanmugam *Principal Scientist & I/c. Head, MPD*	Member
Dr. A. S. M. Raja *Principal Scientist, &, I/c QEID*	Member
Dr. C. Sundaramoorthy *Principal Scientist, TTD*	Member
Dr. B.B. Nayak *Principal Scientist, CIFE, Mumbai*	Member
Dr. K. Pandian *Scientist, GTC, Nagpur*	*Member*
Dr. A.K. Bharimalla *Senior Scientist, CBPD*	Member Secretary

Institute Technology Management Unit (ITMU)

Dr. A.K. Bharimalla *Senior Scientist, CBPD*	Officer-In-charge
Dr. P.K. Mandhyan *Principal Scientist (upto30.09.2022)*	Member
Dr. N. Vigneshwaran *Principal Scientist*	Member
Dr. C. Sundaramoorthy *Principal Scientist*	Member
Dr. Nishant D. Kambli *Technical Officer*	Member Secretary

Institute Joint Staff Council

Dr. Sujata Saxena, *Director(Acting)*	Chairperson
Dr. P.S. Deshmukh,*Principal Scientist*	*Member*
Shri Sunil Kumar,*CAO*	*Member*
Shri. M. Radhakrishnan,*SFAO*	*Member*
Shri R. R. Chhangani,*CTO*	*Member*
Shri S. A. Telpande,*AAO*	*Member*
Shri Mahavir Singh, *Sr. Technician (Technical Cadre)*	*CJSC Member*
Shri Yogesh Nagpure, *Tech. Assistant (Technical Cadre)*	*Member*
Smt. Smita Paiyala, 1 *Assistant (Administrative Cadre)*	*Member* 1
Smt. Bharati Kherodkar, 1 *UDC (Administrative Cadre)*	*Member*
Shri S.D. Magar, *SSS, Staff side member (SSS cadre)*	*Member*
Shri S. P. Naik, *SSS,* *Staff side member (SSS cadre)*	*Member*

Internal Complaints Committee

Dr. (Smt.) Sharmila Patil, *Scientist, QEID*	Chairperson 1
Smt. Shilpa Charankar, *Former Principal, Dr. BNM college of Home science, Matunga,*	External Member 1
Dr. P. S. Deshmukh, *Principal Scientist*	Member 1
Dr. N. Ashtaputre, *CTO*	Member 1
Smt. Prachi Mhatre, *ACTO*	Member 1
Smt. Sujatha Koshy, *AO*	Member Secretary 1

Purchase Committee

Dr. N. Shanmugam, *Principal Scientist & in-charge Head MPD*	Chairman*
Dr. A. K. Bharimalla *Senior Scientist, CBPD*	Member
Dr. G. Krishna Prasad *Scientist, MPD*	Member
Dr. P. Jagajanantha *Scientist, QEID*	Member
Shri Sunil Kumar *SAO*	Member

Shri. M. Radhakrishnan *SFAO* Member
Smt. Sujatha Koshy *AO* Member Secretary
] *Dr. P.K.Mandhyan was in the chair up to 30.09.2022*

Technical Evaluation Committee

Dr. A. S. M. Raja, *Principal Scientist* Chairman
Dr. T. Senthilkumar, *Senior Scientist* Member
Dr. P. Jagajanantha, *Scientist* Member
Smt. Sujatha Koshy, *AO* Member Secretary

Rajbhasha Committee

Dr. S. K. Shukla,
Director, ICAR-CIRCOT Chairman
Dr. Sujata Saxena, *Principal Scientist, Incharge, CBPD* Member
Dr. D. M. Kadam, *Principal Scientist, Incharge, TTD* Member
Dr. A. S. M. Raja, *Principal Scientist, Incharge QEID* Member
Dr. N. Shanmugam, *Principal Scientist, In-charge, MPD* Member
Shri Sunil Kumar, *CAO* Member
Shri B. R. Pawar, *ACTO* Member
Smt. S. Koshy, *AO* Member
Shri M. Radhakrishnan, *SFAO* Member
Smt. P. R. Mhatre, *ACTO* Member
Smt. T.P. Mokal, *AAO,* Member Secretary

Grievance Committee

Dr. Sujata Saxena, *Director (Acting)* Chairperson
Nominated Members
Dr. P. K. Mandhyan, *Principal Scientist (upto 30.09.2022)*
Shri Sunil Kumar, *CAO*
Shri M. Radhakrishnan, *SFAO*
Shri S. A. Telpande, *Member Secretary (upto 31.08.2022)*
Elected Members
Dr. P.S. Deshmukh, *Pr. Scientist (Scientific Category)* 1
Shri C. V. Shivgan, *TO (Technical Category)* 1
Shri Sainath Sahane, *LDC (Administrative Category)* 1
Shri. S. B. Worlikar, *S.S.S (SSS Category)* 1

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,
Whole Time Director & CEO, BSIL Member
Dr. A. K. Bharimalla,
PI, ABI, Member-Secretary

RAFTAAR-Incubation Committee (RIC) of CIRCOT RABI

Dr. S. K. Shukla,
Director, ICAR-CIRCOT Chairman 1
Prof. (Dr.) A. S. Vastrad, *Professor and Dy. Director, Student Welfare, University of Agricultural Science (UAS), Dharwad* Member 1
Dr. G. R. Anap, *Former International Cotton Consultant, World Bank Project (Africa)* Member 1
Shri. Abasaheb K. Haral, *Rtd. Joint Director Agriculture and chief coordinator (PPP-IAD), Dept. of Agriculture, Govt. of Maharashtra* Member 1
Prof. (Dr.) V. D. Gotmare, *Former HOD, Textile Manufacture Department, VJTI, Mumbai* Member 1
Mr. Ramesh. R Kadam, *RTD, General Manager, Bank of India, Member (Representative of Bank)* Member 1
Dr. Ashok K. Bharimalla, *Senior Scientist, PI-CEO: CIRCOT R-ABI* Member Secretary 1

Works Committee

Dr. A. K. Bharimalla *Senior Scientist*	Chairman
Dr. A. Arputharaj *Senior Scientist*	Member
Shri B.R. Pawar, *CTO*	Member
Shri Sunil Kumar, *CAO*	Member
Shri M. Radhakrishnan, *SFAO*	Member
Shri P.N. Sahane, *Officer in-charge Engg*	Member
Shri S.N. Patil,	Member Secretary

Swachhata Mission Committee

Dr. S. K. Shukla, Director, ICAR-CIRCOT	Chairman
Dr. D. M. Kadam, *Principal Scientist, Head Incharge, TTD*	Member
Dr. Ajinath Dukare, Scientist	Member
Dr. Manojkumar Mahawar, Scientist	Member
Dr. Krishna Prasad, Scientist	Member
Dr. K. Pandiyan, Scientist	Member
Shri S.V. Kokane, Security Officer	Member
Smt. T.P. Mokal, AAO	Member
Shri Manoj Ambare, Sr. Technical Officer	Member Secretary

CRP on Natural Fibres PIU

Dr. S. K. Shukla, Director, ICAR-CIRCOT	Nodal Officer 1
Dr. A. S. M. Raja, *Principal Scientist,*	Lead Center 1 Project Coordinator
Dr. C. Sundaramoorthy, *Principal Scientist*	Member
Dr. C. Sundaramoorthy, *Principal Scientist*	Member
Dr. G. Krishna Prasad, *Principal Scientist*	Member
Shri Sunil Kumar, *CAO*	Member
Shri M Radhakrishnan, *SFAO*	Member
Smt. Sujatha Koshi, *AO*	Member

ISO-9001:2015 Management Committee

Dr. S. K. Shukla, *Director,*	Chairman
Dr. A. S. M. Raja, *Principal Scientist, Head I/c, QEID*	Management Representative
Dr. Sujata Saxena, *Principal Scientist, Head I/c, CBPD*	Member
Dr. N. Shanmugam, *Principal Scientist, Head I/c, MPD*	Member
Dr. D. M. Kadam, *Principal Scientist, Incharge, TTD*	Member
Dr. A.K. Bharimalla, *Senior Scientist, I/c, ITMU & ABI*	Member
Dr. V.G. Arude, *Senior Scientist, MPD*	
Shri. Sunil Kumar, *CAO*	Member
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, *(Mechanical)*	Laboratory Manager
Shri R.R. Chhagani, *(Chemical)*	Laboratory Manager
Shri C.M.More, *(Mechanical)*	Deputy Laboratory Manager
Dr. S.R. Kawlekar, *(Chemical)*	Deputy Laboratory Manager

Committee for Azadi ka Amrit Mahotsav Celebration

Dr. A. K. Bharimalla, *Sr. Scientist, QEID,*	Chairman
Dr. G. T. V. Prabu, *Scientist, MPD,*	Program Coordinator
Dr. Kirti Jalgaonkar, *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, *AO*	Member
Smt. Medha Kamble, *TO, Library*	Member
Shri Anand Jadhav, *TO, PME*	Member
Smt. Prachi Mhatre, *ACTO, Library*	Member Secretary

CITIZEN'S/CLIENT'S CHARTER 1

ICAR – Central Institute for Research on Cotton Technology 1
Adenwala Road, Matunga, Mumbai – 400 019 1
Phone: (022) 24124146002 Website: www.circot.icar.gov.in 1

ISO 9001:2015

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** Asst. Chief Technical Officer In-charge, Test House, ICAR-CIRCOT, Mumbai Phone: 022-24146002 Extn: 209/210 Email:cottontest@rediffmail.com, circottest@gmail.com, test.circot@gmail.com
2.	Imparting Training to Stakeholders	**Dr. D.M. Kadam,** Principal Scientist & Head,Technology Transfer Division ashokbhari72@gmail.com Phone: 022-24146002 Extn: 118 Email: dmkadam11k@gmail.com **Dr. K. Pandiyan** Scientist & OIC, GTC, Nagpur Phone: 022-24146002 Extn: 503 Email: gtc_ngp@rediffmail.com, Pandiyan.k@icar.gov.in
3.	Supply of Calibration Cotton	**Dr. A.S.M. Raja** Principal Scientist & Head,Quality Evaluation and Improvement Division Phone: 022-24146002 Extn: 401 **Email: asm.raja@icar.gov.in**

4.	Technology Transfer	**Dr. D.M. Kadam,** Principal Scientist & Head,Technology Transfer Division ashokbhari72@gmail.com Phone: 022-24146002 Extn: 118 Email: dmkadam11k@gmail.com
5.	Consultancy and Agri-incubation activities	**Dr. A.K. Bharimalla** Senior Scientist, Chemical & Biochemical Processing Division Phone: 022-24146002 Extn: 211 Email: ashokbhari72@gmail.com, abicircot@gmail.com

Public Grievance Officer 1

Shri Sunil Kumar,Chief Administrative officer 1

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सूचना का अधिकार
RIGHT TO INFORMATION

हमारा उद्देश्य
OUR MOTIVE

पारदर्शिता को बढ़ावा देने के लिए
To Promote Transparency

जवाबदेही को बढ़ावा देने के लिए
To Promote Accountability

सूचना का अधिकार अधिनियम, 2005 की घोषणा के अनुसरण में निम्नलिखित अधिकारियों को इस संस्थान में जनसूचना अधिकारी, सहायक जनसूचना अधिकारी और 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 **Central Public Information Officer** **Shri Sunil Kumar** Chief Administrative Officer, ICAR-CIRCOT E-mail : director.circot@icar.gov.in : sunil.kumar@icar.gov.in Phone : 022-24146002 Extn: 126 सहायक केन्द्रीय लोक सूचना अधिकारी **Assistant Central Public Information Officer** **Smt. Sujata Koshy** Administrative Officer, ICAR-CIRCOT E-mail : director.circot@icar.gov.in : sujata.koshy@icar.gov.in Phone : 022-24146002 Extn : 140	अपीलीय प्राधिकारी **Appellate Authority** **Dr. S. K. Shukla** Director, ICAR-CIRCOT E-mail:director.circot@icar.gov.in Phone: 022-24146002 Extn: 133

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