वार्षिक प्रतिवेदन

ANNUAL REPORT I 2023

भाकृअनुप - केन्द्रीय पटसन एवं समवर्गीय रेशा अनुसंधान संस्थान

ICAR-Central Research Institute for Jute and Allied Fibres

Barrackpore, Kolkata-700121

MS CERT

Certificate Of Registration

QUALITY MANAGEMENT SYSTEM

This is to Certify that the Quality Management System
of
ICAR-CENTRAL RESEARCH INSTITUTE FOR
JUTE AND ALLIED FIBRES

Address:
Barrackpore Barasat Road, Nilganj, Kolkata-700 121, West Bengal, India.
has been assessed and found to comply with the requirements of:

ISO 9001:2015
(Quality Management System)

Scope of Certification:
Provision of Training and Extension Services, Research and Development Related to Jute and Allied Fibre Crops.

Sector Code: (M-74.90)
Certificate Number: IN/QMS/01396/8654
Issue no.: 01
Date of approval : 14.09.2021 Valid until : 13.09.2024
Revision no: nil Revision date : nil

Original Certification Date: 14.09.2021

July 2022
Surveillance Audit 1st Year

S. Dutta
Managing Director

July 2023
Surveillance Audit 2nd year

MEMBER OF MULTILATERAL RECOGNITION ARRANGEMENT IAF
IAS ACCREDITED Product Certification Agency
MS CERT
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Eco-friendly Natural Fibre

for supporting livelihood, soil fertility, Industrial use

and Making Clean & Green environment

https://crijaf.icar.gov.in

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ANNUAL REPORT

2023

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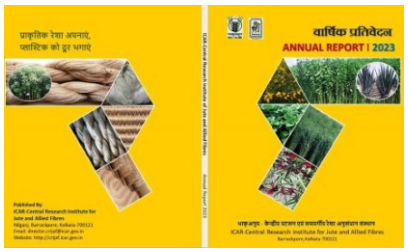

Front Cover Legend:

Fibre crop of Jute, Sunnhemp, Roselle, Flax, Ramie and Sisal

Back Cover Legend:

Fibre of Jute and Allied Fibres and Kenaf crop

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Mandate

- Basic and strategic research on improvement of jute and allied fibre crops for biotic and abiotic stresses, yield and quality.
- Development of economically viable and sustainable production technology, cropping systems and post-harvest technology.
- Co-ordination and monitoring of applied research on national and regional issues to develop improved varieties and technologies .
- Dissemination of technologies and capacity building .

Preface

ICAR-CRIJAF is a unique and only institute under the aegis of NARS spearheading R&D on jute and allied fibre crops since pre-independence. Jute and allied fibre (JAF) crops are important for sustainable societal development as they provide an eco-friendly, renewable, and sustainable material that can be used in many applications. JAF crops are biodegradable, meaning they do not contribute to environmental pollution. This is an important factor as it allows for a sustainable production cycle and reduces the amount of waste sent to landfills. Additionally, these fibres can be used in a variety of ways, including clothing, furniture, insulation, packaging and also have the ability to absorb moisture, making them ideal for use in furniture, bedding, and other items, reducing the need for plastic and synthetic materials. Being much more ideal for soil conservation, carbon sequestration, and fertility restoration, the JAF crops can also play a role to make sustainable environment. JAF crops and their by-products can also be sources of bio-energy and can act as environmental cleaning. These crops have a dominant role in sustaining inclusive growth and especially enhance the farm income of small and marginal farmers in India and the sub-continent. In future jute is going to be one of the key determinants towards green environment due to its biodegradable fibres. Its commercial value will further enhance because of continuous enhancement in export demand. The export of Indian jute products during last 7 years grew at a CAGR of 9%. In 2021-22, USA was the leading importer of jute products with 26.3 % increase over the previous year followed by UK and Germany. The export trends have shown a continuous rise in the period from 2015 - 2022 and have currently reached to Rs. 4043 crores per annum.

In 2023, the institute has made some significant achievements in research and development like release of jute genotype, JROBA 3 (resistant to pre-flowering), and JRCP 5 (tolerant to stem rot and yellow mite); quantification of ranges of fibre strength and fibre fineness in Indian jute varieties; standardization of *in vitro* root regeneration and acclimatization system in *Corchorus capsularis;* QTLs for root system architectural traits and root nitrate reductase activity in tossa jute; single-stranded guideRNA sequences for genome editing in flax; land use mapping of the Sundarbans region; improvement in crop and water productivity through sprinkler irrigation in jute-rice-flax system; identification of waterlogging resistant jute variety (JRCJ 11); lowering GHG emissions by introducing biothanol produced from jute and kenaf biomass; improving crop yield through INM, organic and natural farming system; optimization of saccharification condition for maximum ethanol yield; power-operated jute ribboner machine and weeder; income enhancement through up-scaling of jute-based diversified products; nano-sulphur for controlling mite; carbon nanotubes to improve the salinity stress tolerance of jute seedlings; IPM modules for stem rot disease and sucking and leaf-eating insect pests of jute; high-throughput screening technique to overcome present bottlenecks of screening against stem rot; identification of germplasms of jute (OIN-852, OIN-148, OIN-201, OIN-159, OIN-113, OIN-118) against stem rot, etc. The emergence of new age technologies like Artificial Intelligence (AI), Cloud Machine Learning, Satellite Imagery and advanced analytics are creating an ecosystems for smart jute and allied fibre crop farming. Fusions of all these technologies are being introduced for achieving higher average yield through better utilization of the farm inputs and natural resources.

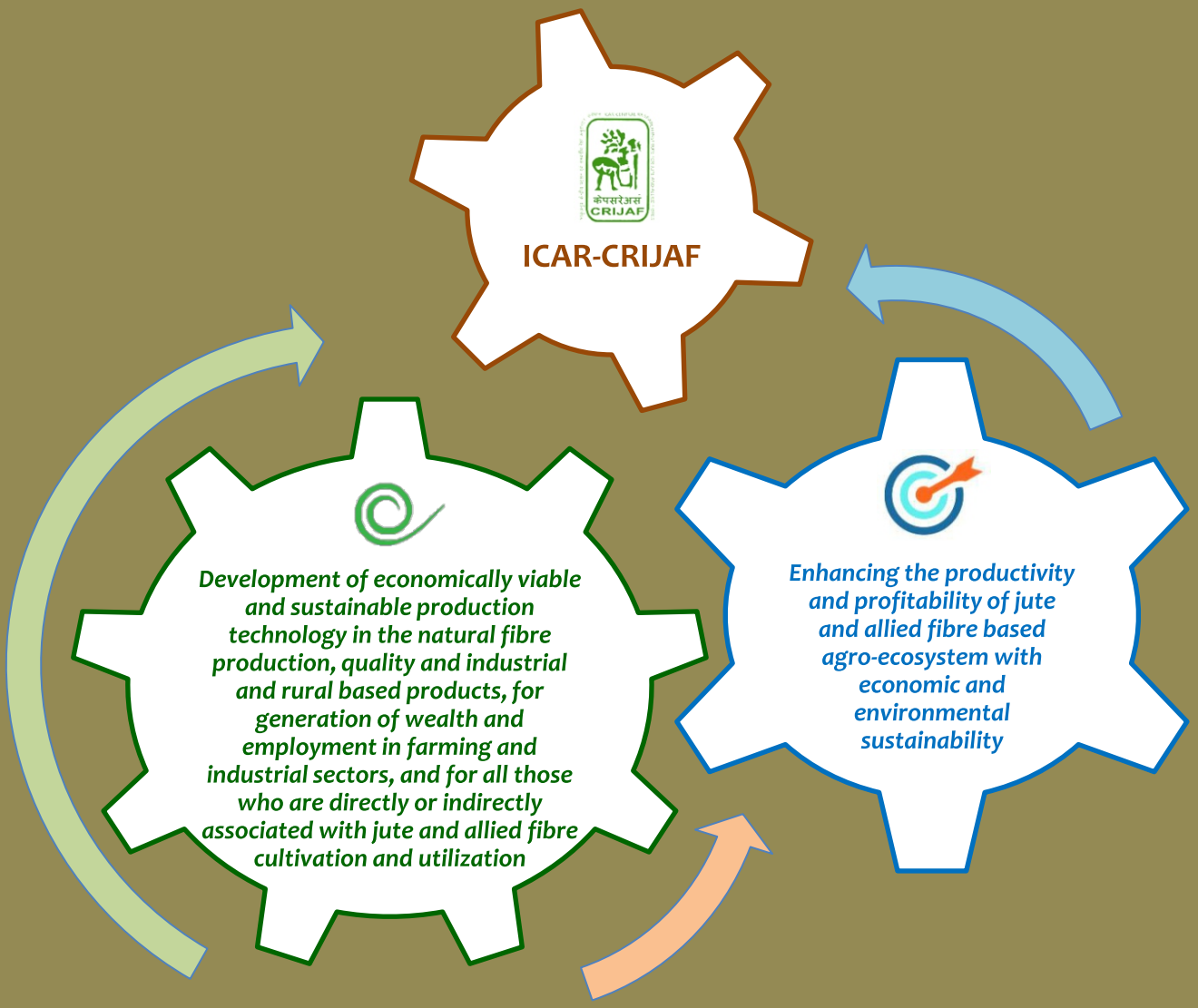
The coordinated efforts of scientists, extension specialists, and farmers has resulted in a very positive impact among all the stakeholders and the jute and allied fibre sector. We have successfully outreached the technology to the stakeholders through various programmes meant for specific target groups. The positive impact of adoption of CRIJAF technologies has been evidenced by an increase in average productivity, fibre quality and additional return across the beneficiary areas. The policy making institutes like NJB, JCI, and the state agriculture department have acknowledged and supported the promotion of these technologies. Regularly, the institute organises capacity building programs for SHGs on jute based handicrafts and value-added products for off-farm income. During this period, 30 scientists participated in international, national webinars, seminars, conferences, and other HRD programs. Also, our institute was recognised in national and international scientific forums and received 10 Awards & Recognition. Scientists have published research papers in high-ranking peer-reviewed journals. ICAR-IARI, New Delhi, has also recognized ICAR-CRIJAF as one of IARI-Mega University Hubs to initiate UG/PG/PhD teaching in agriculture in association with 8 sister ICAR institutes.

We thankfully acknowledge all our stakeholders and farmers who have supported us, and their trust in our mission enables our effort. I am highly grateful to Dr. Himanshu Pathak, Secretary, DARE, Govt. of India and Director General of ICAR, for his dynamic leadership and guidance. I express my sincere gratitude and thanks to Dr. T. R. Sharma, Deputy Director General (Crop Science) and Assistant Director General (Commercial Crops), ICAR, New Delhi, for their constant encouragement and support. I express my sincere gratitude and thanks to Dr. S.K. Dutta, Chairman (RAC & QRT) and his team for their constant encouragement and support. I also acknowledge the efforts of the editorial team and scientists of the institute who have done a commendable job of accomplishing the volume of research, extension, and documentation work successfully and publishing the report on time.

Place: Barrackpore
Date: 31.12.2023

(Gouranga Kar)
Director, ICAR-CRIJAF

Vision & Mission



ORGANOGRAM OF ICAR-CRIJAF

Director General
ICAR

Deputy Director General
Crop Sciences, ICAR

Research Advisory Committee
RAC

Director
ICAR-CRIJAF

Institute Management Committee
IMC

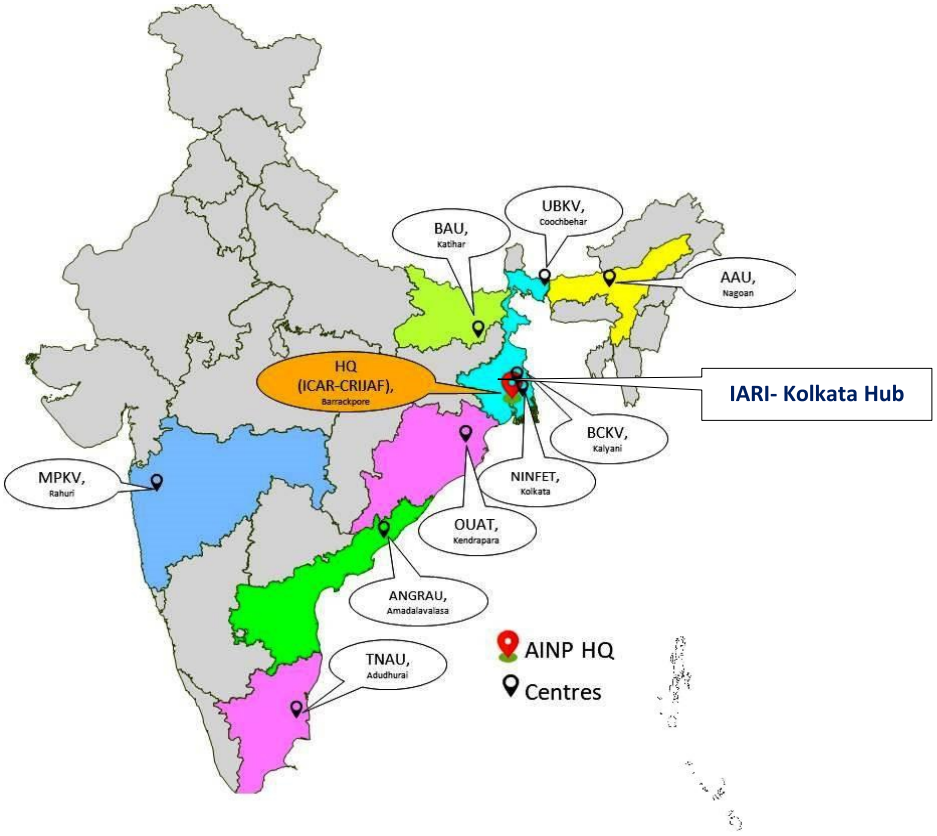
Research & Education Division
- Crop Improvement
- Crop Production
- Crop Protection
- IARI Kolkata Hub

AINP-JAF
7 States
9 Centres

Research Station
- Sunnhemp Research Station, Pratapgarh, U.P.
- Ramie Research Station, Sorbhog, Assam
- Sisal Research Station, Bamra, Odisha
- Central Seed Research Station for JAF, Budbud, W.B.

Service Section
- Administration
- Finance & Accounts
- AKMU Cell
- HRD Cell
- Library
- Farm & Building

KVK
1. Purba Bardhaman
2. North 24 Parganas (Additional)



विशिष्ट सारांश

भाकृअनुप-क्रिजैफ (ICAR-CRIJAF) को भारत में पटसन एवं समवर्गीय रेशा फसलों के उत्पादन, उत्पादकता और स्थिरता को बढ़ाने के उद्देश्य से बुनियादी, रणनीतिक और व्यावहारिक अनुसंधान करने की ज़िम्मेदारी है। संस्थान के अनुसंधान कार्यक्रम तीन प्रमुख विषय क्षेत्रों पर किया जाता है:- फसल सुधार, फसल उत्पादन और फसल संरक्षण। नई विकसित प्रौद्योगिकियों को पटसन एवं समवर्गीय रेशा पर अखिल भारतीय नेटवर्क परियोजना (एआईएनपी-जेएएफ) द्वारा अनुशंसित करने के पश्चात विस्तार और संवर्धन कार्यक्रमों के माध्यम से किसानों और हितधारकों के बीच बढ़ाया जाता है । वर्ष 2023 के दौरान, संस्थान ने अनुसंधान में महत्वपूर्ण उपलब्धियां हासिल कीं और विभिन्न कार्यक्रमों के माध्यम से पटसन और संबद्ध रेशा उगाने वाले किसानों को प्रौद्योगिकियों का प्रदर्शन किया। वर्ष 2023 में भाकृअनुप-क्रिजफ के पास 39 इन-हाउस प्रोजेक्ट और 15 बाहरी संस्था से वित्त पोषित परियोजनाएं चल रही थीं। वार्षिक प्रतिवेदन का कार्यकारी सारांश नीचे प्रस्तुत किया गया है।

फसल सुधार

- आई सी ए आर- क्रिजैफ में पटसन एवं संबद्ध रेशा जर्मप्लाज्म की 556 एकत्रित लाइनों को पुनर्जीवित किया गया। ऑलिटोरियस जर्मप्लाज्म की 150 में से सात ने समय से पहले पुष्पण के प्रति सहनशीलता का प्रदर्शन किया। संस्थान के मध्यम अवधि भंडारण इकाई में कुल 5914 जर्मप्लाज्म संरक्षित किए गए। फील्ड जीन बैंक में रेमी के 80 जर्मप्लाज्म लाइनों को संरक्षित किया गया। पटसन एवं संबद्ध रेशा जर्मप्लाज्म की कुल 269 लाइनों का वितरण किया गया। पश्चिम बंगाल और आंध्र प्रदेश से 44 जर्मप्लाज्म लाइनों को एकत्र किया गया।
- मुक्त बहने वाले जल में सड़न के दौरान CRIJAF-SONA के साथ ऑलिटोरियस के कुल 23 किस्मों और कैप्सुलरिस के 22 किस्मों का मूल्यांकन रेशा शक्ति और महीनता के लिए किया गया। ऑलिटोरियस किस्मों की रेशा महीनता 2.73 - 3.96 टेक्स तक पाई गई जबकि सी. कैप्सुलरिस किस्मों की रेशा महीनता 1.22 - 2.47 टेक्स तक थी। ऑलिटोरियस किस्मों की रेशा शक्ति 19.51 - 27.05 ग्रा./टेक्स तक थी। कैप्सुलरिस किस्मों की रेशा शक्ति 15.58 -24.56 ग्रा./टेक्स तक थी। रेशा गुणवत्ता लक्षणों हेतु ऑलिटोरियस के 46 जर्मप्लाज्म के छानबीन से 1.1 टेक्स जितनी कम महीनता वाली रेशा की प्राप्ति हुई।
- तोषा पटसन में अधिकतम रेशा उपज के लिए रेशा की महीनता को छोड़कर पौधे की ऊंचाई, डंठल का वजन, हरित भार और उच्च रेशा शक्ति जिम्मेदार थी। महीन-रेशा जर्मप्लाज्म लाइनों को उच्च उपज देने वाले मोटे रेशा किस्मों के साथ क्रास किया गया।
- आगे की पीढ़ीगत प्रगति के लिए वर्ष 2023-24 रबी सीज़न में सात क्रॉस से 12 F_6 लाइनों का मूल्यांकन किया गया। मूल्यांकन और चयन के उद्देश्य से F_4 और F_5 की चार-चार लाइनें भी बोई गई। कुल 357 जर्मप्लाज्म लाइनों (90 विदेशी परिग्रहणों सहित) का रखरखाव प्रजनन के अधीन किया गया। फ्यूज़ेरियम विल्ट के प्रति सबसे कम संक्रमण एल. यूसिटाटिसिमम के FTT-999 और FT-1006 और एल. टेनस की एक पंक्ति हुई। जबकि फ्यूज़ेरियम विल्ट के प्रति एल. यूसिटाटिसिमम के IC-96565 और IC-96560 अतिसंवेदनशील थे।
- DUS परीक्षण में तीन कैप्सुलरिस किस्मों का परीक्षण 17 DUS विशिष्टता के लिए किया गया जो रेशा शक्ति के आधार पर एक दूसरे से भिन्न थे। DUS परीक्षण में 17 DUS विशिष्टता के लिए तीन ऑलिटोरियस किस्मों का परीक्षण किया गया। बीज के रंग के आधार पर ये किस्में एक-दूसरे से भिन्न थीं। पटसन संग्रह के रख-रखाव हेतु तोषा पटसन की 30 किस्मों और सफेद पटसन की 21 किस्मों को पुनर्जीवित किया गया। महत्वपूर्ण 17 गुणों की टिप्पणियों की रिकॉर्डिंग के आधार पर संदर्भ संकलन का एक डेटा बेस तैयार किया गया।
- मेस्ता के DUS परीक्षण के दौरान 32 विशिष्टताओं में से 22 विशिष्टता को क़िस्मों की विशिष्टता निर्धारण के किए उपयोगी पाया गया। DUS परीक्षण दिशा-निर्देश का एक मसौदा 22 डिस्क्रिप्टरों के आधार पर तैयार किया गया।
- (JRO-204 × OIJ-161) × JRO-204 के बैक क्रॉस संतति से अधिकतम शुष्क रेशा भार वाले ऊँचे पौधे की प्राप्ति हुई। तोषा पटसन के 70 जर्मप्लाज्म की जांच पीली मकड़ी (संख्या/से.मी.^{2} पर्ण क्षेत्र) के संक्रमण के प्रति गई। इनमें से OIJ-295, OIN-082, OIJ-98 और OEX-032 ने पीली मकड़ी के प्रति सहनशीलता प्रदर्शित किया। इसी प्रकार तना सड़न रोग के प्रति तोषा पटसन के सभी 70 जर्मप्लाज्म के जांच में केवल OMU-42 और OIJ-143 ने तना सड़न रोग के प्रति अर्थपूर्ण सहनशीलता प्रदर्शित किया।

- तोषा पटसन को EMS @ 1% सांद्रता से 4 घंटे तक उपचारित करने पर LD_{50} पाया गया। उपचार की अवधि और उत्परिवर्तजन की सांद्रता बढ़ाने से घातकता में वृद्धि देखी गई।
- कोरकोरस कैप्सुलरिस में इन विट्रो रूट पुनर्जनन और अनुकूलन प्रणालियों का मानकीकरण किया गया। शूटलेट्स को 14-20 दिनों के बाद बढ़ने पर रूटिंग माध्यम (½ MS + NAA और कम सुक्रोज) में स्थानांतरित किया गया। ZN5 और BNSTS के ठोस रूप पटसन में परागकोशों से कैलस उत्पन्न करने में सक्षम थे।
- पटसन के 117 SSR मार्करों में से 12 मार्करों ने जनकीय बहुरूपता दिखाई। आनुवंशिक मानचित्रण के लिए जीनोमिक DNA को 178 F_2 पौधों से अलग किया गया ।
- $F_{2:3}$ इंटरक्रॉस (सी. ऑलिटोरियस cv. सूडान ग्रीन' सी. ऑलिटोरियस एमटी. बीएफएस) के 176 जनसंख्या में पटसन के जड़ लक्षणों की आनुवांशिकता में 30-100% तक भिन्नता पाई गई। जड़ प्रणाली के वास्तुशिल्प लक्षण और जड़ नाइट्रेट रिडक्टेज गतिविधि के लिए कुल 61 QTL की पहचान की गई। इस प्रकार जड़ लक्षण के आधार द्वारा चयन से पटसन रेशा की उपज में सार्थक सुधार संभव है ।
- HFS और NAC-डोमेन जीन के क्लोन बनाने के लिए तथा एराबिडोप्सिस व फ्लैक्स में ओवर एक्प्रेशन हेतु पूर्ण लंबाई के जीन अनुक्रमों को cDNA (ऊष्मा दाब सहिष्णु रेशा फ्लैक्स किस्म) से प्रवर्धित किया गया था। JRF-2 को कोलाई कोशिका में pJET 1.2 प्लास्मिड में शुद्धिकृत और क्लोन किया गया। जीन ऑफ ईण्ट्रेस्ट (GOI) के साथ पाजिटीव कॉलोनी की पुष्टि कॉलोनी PCR और प्रतिबंध पाचन के माध्यम से की गई।
- तीन सिंगल-स्ट्रैंडेड गाइड RNA (sgRNA) अनुक्रम LuHSFA2a, LuHSFA2b, और LuNAC००3 जीन को लक्षित करते हुए डिज़ाइन किया गया। इसे चावल U6 प्रमोटर द्वारा संचालित pRGEB31 वेक्टर में क्लोन कर कोली में बदल दिया गया। क्लोन किए गए sgRNA अनुक्रम को प्लास्मिड के साथ अलग किया गया जिसकी पुष्टि प्रतिबंध एंजाइम पाचन के माध्यम से की गई।
- अगले सीज़न के लिए ब्रीडर बीजों के स्रोत सामग्री के रूप में पटसन के न्यूक्लियस बीज (31 क़िस्मों के 195.5 कि.ग्रा.), मेस्ता (19 क़िस्मों के 109.5 कि.ग्रा.), सनई (5 क़िस्मों के 50 कि.ग्रा.) और फ्लैक्स (1 किस्म JRF -2 के 5.0 कि.ग्रा.) का उत्पादन किया गया।
- DAC & FW भारत सरकार के इंडेंट (माँगपत्र) 7.79 क्विं. पटसन के ब्रीडर बीज के अनुरूप 16 क़िस्मों के 8.29 क्विं. (12 कोरकोरस ओलिटोरियस और 4 कोरकोरस कैप्सुलरिस) का उत्पादन किया गया। DAC & FW भारत सरकार के इंडेंट 8.90 क्विं. सनई के ब्रीडर बीज के आपूर्ति हेतु 4 किस्मों के कुल 8.90 क्विं. बीजोत्पादन किया गया।
- विभिन्न फसलों के कुल 1060.07 क्विं. बीज (40.6 क्विं. फाउंडेशन, 984.01 क्विं. प्रमाणित और 35.46 क्विं. TL) का उत्पादन किया गया। इनमें से आधारी बीज के रूप में 35.80 क्विं धान और 4.8 क्विं. पटसन का उत्पादन किया गया। प्रमाणित बीज के रूप में धान और पटसन के क्रमशः 981.75 क्विं और 2.26 क्विं.का उत्पादन हुआ।

फसल उत्पादन

- भारत के पश्चिम बंगाल राज्य के सुंदरवन क्षेत्र का भूमि उपयोग, भूमि कवर विश्लेषण और मानचित्रण किया गया। यह भारतीय सुंदरवन क्षेत्र में सतत विकास लक्ष्य के पूर्ति हेतु समय-समय पर कृषि पारिस्थितिकी तंत्र, वन रूपांतरण, सतही जल निकायों आदि की अस्थायी गतिशीलता की निगरानी करेगा।
- पटसन (cv. JRO 204) की अधिकतम रेशा उपज (34.2 क्विं/हे.)100% NPK+FYM के प्रयोग से दर्ज की गई। यह 150% NPK (32.8 क्विं/हे.) के समतुल्य था। परन्तु ये दोनों ही उर्वरकों के प्रयोग अन्य सभी उर्वरकों के प्रयोग से सार्थक रूप से बेहतर थे। अधिकतम उपलब्ध N (350 कि.ग्रा./ हे.) 100% NPK+FYM उर्वरकों के प्रयोग से दर्ज किया गया। जबकि 150% NPK उर्वरकों के प्रयोग से मिट्टी में अधिकतम P (80 क्विं/हे.) और K (285 क्विं/हे.) की उपलब्धता दर्ज की गई। लंबे समय में FYM के साथ 100%NPK का एकीकृत उपयोग से न केवल फसलों की टिकाऊ पैदावार प्राप्त हुई बल्कि मिट्टी की उर्वरता में भी सुधार हुआ।
- पटसन (cv. JROM-1) और लहसुन (स्थानीय किस्म) के लिए पोषक तत्वों की आवश्यकता, मिट्टी, उर्वरक और जैविक दक्षता के बुनियादी डेटा के साथ-साथ मिट्टी परीक्षण IPNS-आधारित लक्षित उपज समीकरण विकसित किए गए। ST-TY के अनुसार अजैविक उर्वरकों के प्रयोग से (+) 4.1% विचलन के साथ 40 क्विं/हे. पटसन रेशा की लक्षित उपज प्राप्त हुई। अजैविक उर्वरक को FYM के साथ एकीकृत करने से लक्षित पटसन रेशा उपज 40 क्विं/हे. से बढ़कर 43.25 क्विं/हे. हो गई। इसमें अधिक स्पष्ट विचलन (+) 8.13% के साथ B:C का अनुपात 2.0 था।

- पटसन-धान–फ्लैक्स फसल प्रणाली में विभिन्न पौधों की वृद्धि और उपज मापदंडों के लिए स्प्रिंकलर सिंचाई का मूल्यांकन किया गया। पटसन स्प्रिंकलर सिंचाई में 50% DASM (15 मि.मी. प्रति प्रयोग) और 75% DASM (20 मि.मी. प्रति प्रयोग) से बेहतर पौधे की वृद्धि और उपज मापदंड की प्राप्ति हुई। 50% DASM पर स्प्रिंकलर सिंचाई के परिणामस्वरूप कंट्रोल की तुलना में कुल जल उत्पादकता में 21% की वृद्धि हुई।
- जलजमाव की स्थिति में JRO 204 की तुलना में 30 DAS और 45 DAS पर किस्म JRCJ 11 में बेहतर पौधे की ऊंचाई दर्ज की गई। 30 DAS पर जलजमाव होने पर JRO 204 और JRCJ 11 की रेशा उपज में 39 - 44% की कमी आई। जबकि 45 DAS पर दोनों ही क़िस्मों के रेशा उपज में 17-21% की कमी हुई। रेशा उपज में न्यूनतम कमी (4-9%) 60 DAS पर जलजमाव की स्थिति से हुई। JRO 204 में जलभराव से रेशा पैदावार में अधिक कमी देखी गई। बाद के विकास के चरणों में दोनों ही किस्में थोपे गए (imposed) जलभराव को सहन करने में सक्षम थीं।
- फसल उत्पादन तथा पटसन व केनाफ इथेनॉल के जैव-रिफाइनरी से शुद्ध GHG उत्सर्जन क्रमशः 3.45 ग्रा./मेगा जूल और 5.88 ग्रा./मेगा जूल था। जीवन चक्र मूल्यांकन (LCA) विश्लेषण से पता चला कि पटसन व केनाफ सेल्युलोसिक बायोमास से उत्पादित इथेनॉल कम GHG उत्सर्जन करता है। यह जीवाश्म ईंधन की तुलना में GHG उत्सर्जन में 78-81 प्रतिशत तक की कमी कर सकता है। पटसन व केनाफ बायोमास सामग्री से प्राप्त बायोएथेनॉल का पर्यावरण और संसाधन के कमी पर न्यूनतम नकारात्मक प्रभाव पड़ता है।
- 1983-2018 की आधारभूत अवधि और 2030-2090 की भविष्य की अवधि हेतु IGP क्षेत्र के लिए वर्षा और परिवेश के एम्बिएंट तापमान (T_{max}, T_{min}) द्वारा जलवायु परिवर्तन परिदृश्य बनाने के लिए दो RCP परिदृश्यों (RCP 4.5 और RCP 8.5) का उपयोग किया गया। दोनों ही परिदृश्य RCP4.5 और RCP8.5 ने वर्षा परिवर्तन के समान स्थानिक पैटर्न को प्रदर्शित किया। परिणाम से यह मालूम हुआ कि IGP क्षेत्र में GHG सांद्रता का वर्षा और तापमान के पैटर्न पर अर्थपूर्ण प्रभाव पड़ेगा।
- सतह ऊर्जा संतुलन (SEB) के तात्कालिक पैटर्न और पटसन-धान-गेहूं फसल क्रम के वनस्पति आवरण के प्रभाव को SEB पर समझने के लिए फसलों के विभिन्न विकास चरणों में शुद्ध विकिरण प्रवाह (Rn), संवेदनशील ऊष्मा प्रवाह (H), मिट्टी ऊष्मा प्रवाह (G) और गुप्त ऊष्मा प्रवाह (LE) के मापन हेतु 'द ओपेन पाथ एडी कोवारिएन्स' तकनीक का उपयोग किया गया। यह भारत के साथ-साथ दुनिया भर में एडी कोवारिएन्स तकनीक उपयोग के द्वारा पटसन-चावल-गेहूं फसल प्रणाली में ऊर्जा संतुलन की पहली रिपोर्ट है। यह सतही ऊर्जा बजटिंग और जलवायु अनुसंधान में आगे के शोध के लिए बहुत ही उपयोगी है।
- एकीकृत पोषक तत्व प्रबंधन से पारंपरिक या अजैविकक पोषक तत्व प्रबंधन की तुलना में अधिक पटसन रेशा उपज (3.54 टन/हे.) दर्ज की गई। जबकि रेशा उपज जैविक पोषक तत्व से 2.98 टन/हे. और प्राकृतिक पोषक तत्व 2.59 टन/हे. थी। जैविक पोषक तत्व प्रबंधन द्वारा पारंपरिक पोषक स्रोत (3.41 टन/हे.) की तुलना में 12.7% कम उपज दर्ज की गई। किसानों के खेतों के परिणामों से पता चला कि लगभग 50-60% किसान कीटों व बीमारियों के प्रबंधन हेतु 15-30 दिनों के अंतराल पर नीम की पत्ती का अर्क प्रयोग करते थे। इसी प्रकार 50-60% किसान लहसुन के मिश्रण का उपयोग कर रहे थे, जिससे 2.91 - 3.06 टन/हे. पटसन रेशा उपज की प्राप्ति हुई।
- उर्वरक के किसी भी खुराक के परवाह किए बिना सिसलाना सीसल के मामलों में बड़े सकर्स (1059.8 कि.ग्रा./हे.) से अधिकतम रेशा उपज की प्राप्ति हुई। इसी प्रकार, आकार की परवाह किए बिना उच्चतम उर्वरक खुराक (942.4 कि.ग्रा./हे.) के साथ अधिकतम रेशा उपज दर्ज की गई। अंतः क्रिया प्रभाव में उच्चतम रेशा उपज एक बड़े आकार के सकर X उच्चतम उर्वरक खुराक (1175 कि.ग्रा./हे.) से प्राप्त हुई।
- पटसन और फ्लैक्स रेशा उत्पादन के लिए 50:50 के अनुपात में खाद (BSC/BGSC) और रासायनिक NPK के प्रयोग को 100% NPK उर्वरकों की अनुशंसित खुराक के विकल्प के रूप में माना जा सकता है। रेमी में 100% NPK अकार्बनिक उर्वरक उपचार से अधिकतम कुल (चार कटाई से) से रेशा उपज (21.69 क्विं/हे.) दर्ज किया गया। सांख्यिकीय रूप से यह उपज 50% BSC + 50% NPK से दर्ज की गई उपज (19.14 क्विं/हे.) के समकक्ष थी।
- 50 DAS पर दस दिनों की गर्मी की लहरों (39-42°C) और ओलावृष्टि के प्रभाव का आकलन करने के लिए एक अध्ययन किया गया। पटसन-मूंग अंतरफसल के लिए पटसन समतुल्य उपज (JEY) 38.5 क्विं/हे. थी, जबकि केवल विशुद्ध पटसन तथा धान के पलवार @ 5 टन/हे. में रेशा उपज क्रमशः 20.2 क्विं/हे. और 22.6 क्विं/हे. थी। पटसन-मूंग अंतरफसल को बदलती जलवायु, पोषण सुरक्षा (13.4 क्विं/हे. मूंग बीज उपज), 2.5 टन/हे. N-समृद्ध जैविक पदार्थ के अतिरिक्त मृदा स्वास्थ्य में सुधार, खरपतवारों को दबाकर जैविक खरपतवार प्रबंधन, उच्च मौद्रिक लाभ, उच्च अंबिएंट तापमान और ओलावृष्टि की स्थिति में बीमा फसल के रूप में लचीली फसल प्रणालियों के अनुकूल पाया गया।

- आईपीफेनकार्बाज़ोन @ 90 ग्रा./हे. (PE) + 21 DAS पर सिंगल व्हील पटसन वीडर के प्रयोग से 35.5 क्विं/हे. रेशा का उत्पादन हुआ। यह आईपीफेनकार्बाज़ोन @ 90 ग्रा./हे. (PE) + 14 DAS पर नेल वीडर के प्रयोग से प्राप्त रेशा उपज 35.4 क्विं/हे. के समतुल्य थी।
- फ्लैक्स में INM उपचार आपस में सांख्यिकीय रूप से 100% RDN से प्राप्त पौधे की ऊंचाई, कटाई के समय शुष्क पदार्थ (63.11 क्विं/हे.) और फसल की रेशा उपज के बराबर था। इसने अनुशंसित उर्वरक N खुराक की तुलना में 50% का बचत किया। 50% RDN+FYM @ 10 टन/हे.+एज़ोटोबैक्टर के प्रयोग से सर्वाधिक पौधे की ऊंचाई (119.83 से.मी.), कटाई के समय शुष्क पदार्थ (63.11 क्विं/हे.) और फ्लैक्स रेशा उपज (20.07 क्विं/हे.) दर्ज की गई।
- Jute-ICARE परियोजना स्थानों से Google-आधारित फॉर्म JAF किसान के माध्यम द्वारा पश्चिम बंगाल, असम, बिहार, ओडिशा और मेघालय से ऑन-फील्ड जानकारी एकत्र की गई। राज्यों के जिलों के मध्य तकनीकी उपज का अंतर 3.42 क्विं/हे. (नदिया, पश्चिम बंगाल) से 7.58 क्विं/हे. (तुरा, मेघालय) तक था। बिहार में प्रसार का अंतर 4.07 क्विं/हे. (मधेपुरा) से 7.08 क्विं/हे. (सुपौल) था।
- कृषक महिलाओं के बीच पटसन आधारित खेती में प्रथाओं के सर्वोत्तम पैकेज (उन्नत किस्में JRO BA3 और JRO 204; सिंगल व्हील पटसन वीडर, बहु-पंक्ति बीज ड्रिल, क्रिजैफ सोना), पटसन में मूल्य श्रृंखला और उद्यमिता के प्रोत्साहन से अतिरिक्त शुद्ध आय रु.40,000/हे. की प्राप्ति हुई। परियोजना क्षेत्र की कुल 24 कृषक महिलाओं को गैर-कृषि गतिविधियों द्वारा आय बढ़ाने के उद्देश्य से पटसन-विविध उत्पाद निर्माण प्रशिक्षण भी दिया गया।
- Jute-ICARE परियोजना के IX चरण में वर्ष 2023-24 के दौरान NJB और JCI के सहयोग से विभिन्न पटसन और मेस्ता उत्पादक राज्यों के 200 ब्लॉकों में स्थित 1,85,000 हेक्टेयर क्षेत्र को कवर करते हुये 4.20 लाख किसानों को शामिल किया गया। पटसन कृषक समुदाय को लगभग 600 मीट्रिक टन प्रमाणित पटसन बीज (cv. JRO 204, JBO 2003H, CO-58, JBO-1, JROM-1, और JRC-532), 800 CRIJAF बहु-पंक्ति बीज ड्रिल और 800 CRIJAF सिंगल व्हील पटसन वीडर उपलब्ध कराये गए। फसल अवधि में पटसन और मेस्ता के उन्नत सड़न के लिए 600 मीट्रिक टन क्रिजैफ सोना कृषक समुदायों को प्रदान किया गया। संस्थान में दो दिनों की अवधि वाले आठ प्रशिक्षण कार्यक्रम "बेहतर पटसन उत्पादन तकनीक" 190 ब्लॉक पर्यवेक्षकों, मास्टर प्रशिक्षकों (MTs) और कृषि अधिकारियों के लिए आयोजित किए गए।
- परिपक्व पटसन के पौधों को यांत्रिक रूप से retting (काटना, कुचलना और चीरना) किए गए 200 ग्रा. पटसन उत्तकों को सामान्य जल में मिले हुये 1.0 मि.ली. माइक्रोबियल बीजाणु कंसोर्टियम (CRIJAF SONA®) के साथ डुबोया गया। प्रयोगशाला अध्ययन से यह निष्कर्ष निकला कि सड़न से पहले पटसन तना के अंदरूनी हिस्से में बीजाणुओं के प्रवेश के कारण पटसन में सड़न तेजी से होती है। पटसन की पारंपरिक सड़न की तुलना में मुक्त-प्रवाहित जल में एंजाइमेटिक गतिविधियाँ जैसे पोलुग्लैक्टुरोनेज़ (PG), पेक्टिन लाइसेज़ (PNL) और जाइलानेज़ तीन गुना से अधिक थी। पारंपरिक सड़न की तुलना में मुक्त-प्रवाहित जल में उच्चतर PG, PNL और ज़ाइलानेज़ गतिविधियों के कारण सड़न अवधि में कमी आई।
- पटसन बायोमास की उपज में सुधार हेतु क्षार से पूर्व-उपचार तथा सेकेरीफ़िकेशन को सतह पद्धति द्वारा नियोजित कर अनुकूलित करने के लिए एक अध्ययन आयोजित किया गया। इष्टतम स्थितियों में डिलिनिफिकेशन का अधिकतम प्रतिशत (80.42%) 55.8°C तापमान पर 5.9 घंटे की अवधि और 2.47% NaOH की सांद्रता पर था। इससे 79.8% लिग्निन और 34.2% हेमिकेलुलोज़ में कमी आई। किण्वन के 24 घंटे के बाद अनुकूलित सेकेरीफ़िकेशन से अधिकतम शर्कराकरण (76.48%) और अधिकतम इथेनॉल उपज (21.5 ग्रा./ली.) की प्राप्ति हुई। क्षार उपचार के बाद नमूनों में सेलूलोज़ की मात्रा 60.7% से बढ़कर 70.0% हो गई।
- ताजे कटे हुए पटसन के पौधों से पटसन रिबन निकालने के लिए विद्युत चालित पटसन रिबनर मशीन विकसित की गई जिसकी कार्यक्षमता 90% से अधिक थी। इसका उपयोग बहुत आसान है और इस मशीन को चलाने के लिए किसी विशेष कौशल की आवश्यकता नहीं है।
- ट्रैक्टर-चालित बहु-फसल बीज ड्रिल (पटसन और अन्य छोटे बीज वाली फसलों की सटीक बुआई के लिए) के कार्यात्मक प्रदर्शन का मूल्यांकन किया गया है। सीड ड्रिल मशीन की प्रभावी क्षेत्र क्षमता और क्षेत्र दक्षता क्रमशः 0.36 हे./घंटा और 83.72% पाई गई। पटसन की बुआई के लिए बीज दर 3.66 कि.ग्रा./हे. है। बीज गिराने की एकरूपता और कतार में दूरी क्रमशः 80-85% और 30-50 मि.मी. है।
- मौजूदा सिंगल-व्हील पटसन वीडर को संशोधित कर इसे रिचार्जेबल ड्राई सेल बैटरी द्वारा संचालित होने योग्य बनाया गया है। इस का स्प्रिंग मिट्टी में ऑपरेशन की गहराई को सुविधाजनक बनाता है। पूरी तरह से चार्ज की गई बैटरी लगभग 80 कि.मी. तक कार्य कर सकती है। खेत में मूल्यांकन करने पर 0.06-0.07 हे./घंटा की क्षमता पाई गई है।

- पटसन-आधारित विविध उत्पादों के निर्माण के माध्यम से कृषि आय में वृद्धि हेतु 48 कृषक महिलाओं को प्रशिक्षित किया गया। सबसे अधिक अर्जित कौशल और सामाजिक-आर्थिक परिणाम पाटरनी स्वयं सहायता समूह (नदिया) के बाद संकल्प स्वयं सहायता समूह (उत्तर 24 परगना) में पाया गया। पाटरनी स्वयं सहायता समूह में कौशल अधिग्रहण स्कोर 84.8 था, जबकि संकल्प स्वयं सहायता समूह के लिए यह 83.3 प्रतिशत था।

फसल सुरक्षा

- पटसन के रस चूसने वाले कीटों में नैनो-सल्फर (25 nm) के प्रति सार्थक विषाक्तता थी। प्रयोगशाला में नैनो-सल्फर @1.0 ppm के सामयिक प्रयोग से मिलीबग के दूसरे इंस्टार निम्फ में 88.37% मृत्यु दर्ज की गई। जबकि 3.0 ppm सांद्रता पर 100% मृत्यु दर देखी गई। खेत पर पटसन की पीली मकड़ी नैनो-सल्फर के प्रति अधिक संवेदनशील थी। इसके प्रयोग @ 0.01 ppm से पीली मकड़ी की आबादी 87% कम हो गई।
- कार्बन नैनोट्यूब (CNT-लंबाई 500 nm और व्यास 30 nm) @3 ppm उपचार से पटसन की पत्ती में प्रोलाइन और फ्लेवोनोइड का स्तर बढ़ने से लवणता के प्रति तनाव सहनशीलता में सुधार हुआ। प्रोलाइन का स्तर 350 mM NaCl और CNT उपचार के मामले में 3.29 µ मोल था, जबकि CNT विहीन उपचार में नगण्य (0.001 µ मोल से कम) था। इसी तरह अधिकतम फ्लेवोनोइड सामग्री (15.69 मि.ग्रा./ग्रा.) 250 nM NaCl और CNT उपचार के तहत दर्ज की गई।
- बुआई से 7 दिन पहले मिट्टी में ब्लीचिंग पाउडर @ 30 कि.ग्रा./हे. का प्रयोग बहुत ही आशाजनक था क्योंकि तना सड़न से केवल 5.7% पौधे संक्रमित हुये। मिट्टी का उपचार ब्लीचिंग पाउडर के साथ और पटसन बीज को कार्बेण्डाजिम (@ 2 ग्रा./कि.ग्रा.) + इमिडाक्लोप्रिड (@ 5 मि.ली./कि.ग्रा.) से करने पर तना सड़न रोग, विभिन्न चूसने और पत्ती खाने वाले कीटों को कम करने में महत्वपूर्ण योगदान था। यह बुआई पूर्व कम लागत वाली एक बीज उपचार रणनीति है।
- प्रक्षेत्र प्रयोग में मेस्ता की JBMP2 (एक पीली शिरा प्रतिरोधी किस्म) के प्रमुख बीमारियों और कीटों के प्रति छह IPM मॉड्यूल में से एक रासायनिक IPM मॉड्यूल (ब्लीचिंग पाउडर के साथ गहरी जुताई वाली मिट्टी का ब्लीचिंग पाउडर से उपचार, मेटालैक्सिल + क्लॉथियानिडिन के साथ बीजोपचार, एबामेक्टिन का 30DAS पर छिड़काव और 40-45 DAS पर इमिडाक्लोप्रिड का प्रयोग) सबसे ज्यादा प्रभावी था। इससे फुट व स्टेम सड़न, कॉलर सड़न के मामले में न्यूनतम क्षति (2.7%) देखी गई। कीटों के मामले में स्पाइरल बोरर (0.4%), मेस्ता फ्ली बीटल (0.1%), मिली बग (0.4%) और जैसिड्स (0.3%) द्वारा न्यूनतम क्षति दर्ज की गई। HS 4288 किस्म की रेशा उपज कृषक प्रथा (19 क्विं/हे.) की तुलना में IPM द्वारा अधिक (25.6 क्विं./हे.) थी।
- पटसन के छह IPM मॉड्यूल (JRO 204) के तुलनात्मक मूल्यांकन में रसायन आधारित IPM मॉड्यूल (जिसमें गहरी जुताई, ब्लीचिंग पाउडर का मिट्टी में प्रयोग, कार्बेन्डाजिम + इमिडाक्लोप्रिड के साथ बीजोपचार , 30 DAS पर स्पाइरोमेसिफेन का छिड़काव, 40-45 DAS पर λ-साइहलोथ्रिन और टेबुकोनाजोल) से न्यूनतम तना सड़न (5.7%), इंडिगो कैटरपिलर (1.3%), पीली मकड़ी (1.4%), सेमीलूपर (0.6%), रोमिल कैटरपिलर (0.8%) और एपियन (0.6%) की घटना देखी गई। इस विधि से सर्वाधिक रेशा (33 क्विं/हे.) प्राप्त हुआ जो कि चेक की तुलना में 63.6% ज्यादा था। इसके बाद कल्चरल मॉड्यूल (24.3 क्विं/हे.) और जैविक मॉड्यूल (23.2 क्विं/हे.) का स्थान था।
- पटसन पर आक्रमण करने वाले कीटों की तीन भिन्न आबादी, जैसे रोमिल कैटरपिलर (स्पिलोसोमा ओब्लिक), इंडिगो कैटरपिलर (स्पोडोप्टेरा लिटुरा) और सेमीलूपर (एनोमिस साबुलिफेरा) के लिए प्रोफेनोफोस का LC_{50} क्रमशः 279.3 ppm, 1218.7 ppm और 114.6 ppm था। जैव परख परिणामों से स्पष्ट हुआ कि ए. सबुलिफेरा आबादी की तुलना में एस. लिटुरा और एस. ओब्लिक आबादी में 10.63 और 2.43 गुना अधिक कीटनाशक प्रतिरोध था।
- एक पीढ़ी (F_2) में प्रतिरोध अनुपात के किए गए अध्ययन ने सभी 3 पटसन कीटों में एंजाइम सन्द्रता कार्बोक्सिलेस्टरेज़ (CarE), ग्लूटाथियोन-S-ट्रांसफरेज़ (GST's) और एसिटाइलकोलिनेस्टरेज़ (AchE) में वृद्धि को दर्शाया।
- स्क्रीनिंग तकनीक में मौजूद बाधाओं को दूर करने हेतु एक उच्च-थ्रूपुट स्क्रीनिंग तकनीक विकसित की गई है। अनुशंसित कृषि पद्धतियों का पालन करते हुए पौधों को खेत में उगाया जाता है। पौधे की मध्य लंबाई (>1.5 मी.) से 60-70 DAS पर तीन 7 से.मी. स्टेम-बिट हटा दिए जाते हैं और एक सुई से छाल को छेदकर मैक्रोफोमिना फेज़ियोलिना के बढ़ते हुए मायसेलियल किनारे वाले PDA प्लग का टीका लगाया जाता है। इन विट्रो स्थिति में विकसित घाव/चोट का निशान की लंबाई वैसे ही होते हैं जैसा कि अक्सर रोगग्रसित खेत में पाये जाते हैं।

- फ्लैक्स जर्मप्लाज्म के बीच राइजोक्टोनिया विल्ट के प्रति आनुवंशिक प्रतिरोध FT-999 और FT-1006 (दोनों एल. यूसिटेटिसिमम) और एल. टेनस की एक पंक्ति में देखा गया। इन विट्रो और फील्ड स्थिति दोनों में ही यह समान रूप से सबसे कम संक्रमित था।
- पटसन के 170 जर्मप्लाज्म में से OIN-852, OIN -148, OIN -201, OIN -159, OIN -113 और OIN -118 लाइनें मैक्रोफोमिना फेजोलिना जनित तना सड़न के प्रति रुग्ण प्लॉट,हॉट स्पॉट और कृत्रिम स्क्रीनिंग सबसे कम संवेदनशील थे।
- तापमान में 16-33°C के बीच वृद्धि से मिलीबग के अपरिपक्व चरणों के विकास दर में समानुपातिक रूप से वृद्धि हुई। अंडा से क्रॉलर चरण हेतु निचला तापमान सीमा (T_{min}) 10.59°C का अनुमान लगाया गया। जबकि II इंस्टार और III इंस्टार के लिए निचला तापमान सीमा यह क्रमशः 9.03 और 10.92°C था।
- क्रॉलर के विकास दर को 33°C से ऊपर के तापमान पर शार्प और डेमिशेल मॉडल द्वारा II-इंस्टार और III-इंस्टार को अच्छी तरह से समझा गया। II-इंस्टार के लिए सबसे तेज़ औसत विकास 31°C पर देखा गया, जबकि III-इंस्टार के लिए सबसे तेज़ विकास 36°C पर था।

कृषि प्रसार

- दो कृषि विज्ञान केन्द्र अर्थात् के वी के बर्दवान और के वी के उत्तर 24 परगना (अतिरिक्त) ने प्याज और पटसन में खरपतवार प्रबंधन, फूलगोभी में सूक्ष्म पोषक तत्व प्रयोग और YVMV-प्रतिरोधी भिंडी किस्मों पर 4 ऑन फार्म परीक्षण (ओएफटी) आयोजित किया।
- वर्ष 2023 के दौरान दोनों ही के वी के द्वारा पटसन, धान, मसूर, चना, प्याज, सब्जियां, केला और पोल्ट्री पर कुल 218 FLD (अग्रिम पंक्ति प्रदर्शन) आयोजित किए गए। पारंपरिक तरीकों की तुलना में उन्नत प्रथाओं के तहत सभी क्षेत्रीय फसलों और फलों की उत्पादकता में उल्लेखनीय वृद्धि हुई। घर के पिछवाड़े में कड़कनाथ प्रजाति मुर्गीपालन प्रदर्शन से आय में प्रति इकाई से 60% से अधिक की वृद्धि हुई।
- NFSM के तहत नवीनतम उच्च उपज देने वाली किस्मों (JRO 204, JRO 2407, JBO 1, JROM 1, और CO 58) और अन्य उन्नत उत्पादन तकनीकों (यांत्रिक खरपतवार प्रबंधन, CRIJAF पटसन सीडर द्वारा पंक्ति में बुआई) पर पश्चिम बंगाल के प्रमुख पटसन उत्पादक जिलों उत्तर 24 परगना, हुगली और नदिया जिला के विभिन्न ब्लॉकों में 294.40 हे. क्षेत्रफल में 759 किसानों के खेतों को कवर करते हुए अग्रिम पंक्ति प्रदर्शन आयोजित किए गए।
- सभी प्रदर्शन स्थलों पर JROBA 3 ने उच्चतम औसत उपज 39.10 क्विं/हे. के हिसाब से काफी बेहतर प्रदर्शन किया जो किसानों की किस्मों से 12 क्विं/हे. अधिक थी। पंक्ति में बुआई और यांत्रिक निराई ने क्रमशः 1:1.43 और 1:1.57 C:B अनुपात का प्रदर्शन किया। CRIJAF SONA के उपयोग से रेशा की गुणवत्ता में 1-2 ग्रेड का सुधार हुआ।
- आंध्र प्रदेश के श्रीकाकुलम और विजयनगरम जिलों के 20 मेस्ता उत्पादक कृषक के खेत पर 7.0 हे. क्षेत्रफल में उत्पादन तकनीक का प्रदर्शन (मेस्ता AMV 7 की उन्नत किस्म, पंक्ति में बुआई, एकीकृत खरपतवार और कीट प्रबंधन) में किया गया। प्रति हेक्टेयर रेशा की उपज 20.00 से 27.00 के बीच थी।
- NFSM (CC) के तहत ICAR-CRIJAF में उन्नत पटसन किस्मों के 6.81 क्विं. फ़ाउंडेशन और 2.26 क्विं. प्रमाणित बीज का उत्पादन किया गया। MPKV, राहुरी ने पटसन के 37.4 क्विं. फाउंडेशन बीज का उत्पादन किया। अमादलावलसा में मेस्ता के 10 क्विं. फाउंडेशन और नई किस्मों के 5 क्विं. प्रमाणित बीज का उत्पादन हुआ।
- अनुसूचित जाति उप-योजना (SCSP) गतिविधियों को उत्तर 24 परगना, दक्षिण 24 परगना, नदिया, बांकुरा, पुरुलिया और पूर्व बर्धमान जिलों के विभिन्न गांवों में क्रियान्वित किया गया।
- वर्ष 2023 के दौरान कुल 6 प्रशिक्षण कार्यक्रम, पटसन सड़न के बेहतर तरीकों पर 2 प्रक्षेत्र प्रदर्शन कार्यक्रम और 2 किसान सम्मेलन (मेगा इवेंट) आयोजित किए गए जिसमें अनुसूचित जाति के लगभग 4338 कृषक लाभान्वित हुये।
- पश्चिम बंगाल के विभिन्न जिलों के 11,547 से अधिक किसानों को कृषि आदान (इनपुट) जैसे पटसन बीज की उन्नत किस्में, धान के बीज, सब्जी बीज किट, उर्वरक, वर्मीकम्पोस्ट बेड, CRIJAF सोना, फसल सुरक्षा किट और कृषि उपकरण (CRIJAF सिंगल-व्हील पटसन वीडर, पटसन सीडर, बैटरी चालित स्प्रेयर आदि) वितरित किए गए।
- मेरा गांव मेरा गौरव (MGMG) कार्यक्रम में 43 गांवों के लोगों से निरंतर संपर्क बनाए रखा गया। उन्नत खेती के लिए कृषि आदान जैसे बीज, उर्वरक, रसायन, कृषि मशीनरी इत्यादि का वितरण किया गया। राष्ट्रीय महत्व के संवेदनशील मुद्दों के प्रति कृषकों को जागरूक करने के लिए स्वच्छ भारत अभियान, जलवायु परिवर्तन, जल संरक्षण, मृदा उर्वरता आदि परजागरूकता कार्यक्रम आयोजित किए गए।
- स्वच्छता गतिविधियों में पटसन और संबंधित रेशा फसलों पर ध्यान देने के साथ-साथ अपशिष्ट पुनर्चक्रण, वर्मीकम्पोस्टिंग,जैविक कृषि और सह-उत्पाद (by-product) उपयोग पर जोर दिया गया। कचरे से धनोपार्जन के उद्देश्य से कंपोस्टिंग विधि द्वारा संस्थान परिसर के अंदर उत्पन्न जैव विघटनशील कचरे से जैव उर्वरक का उत्पादन किया गया।

EXECUTIVE SUMMARY

ICAR- Central Research Institute for Jute and Allied Fibres (ICAR-CRIJAF) has the mandate to carry out basic, strategic and applied research aimed at enhancing production, productivity and sustainability of the jute and allied fibre crops in India. The research programmes of the institute are framed around three major theme areas: Crop Improvement, Crop Production and Crop Protection. The newly developed technologies are validated through the All India Network Project on Jute and Allied Fibres (AINP-JAF) and the validated technologies are scaled up among the stakeholders through extension and outreach programmes. During 2023, the institute made significant achievements in research and demonstrated the technologies to jute and allied fibre growing farmers through various programmes. ICAR-CRIJAF had 39 in-house projects and 15 externally funded projects in operation in the year 2023. The executive summary of the report is presented below.

Crop Improvement

- The germplasm pool of jute and allied fibre (JAF) crops was strengthened by new collection of 44 germplasm lines from West Bengal and Andhra Pradesh. Besides, 556 collected lines of JAF germplasm were regenerated. Seven out of 150 olitorius germplasm exhibited premature flowering tolerance. A total of 5914 germplasm were conserved at the medium-term storage and 80 ramie germplasm lines are maintained in the field gene bank. A total of 269 JAF germplasm lines were distributed among stakeholders.

- A total of 23 *olitorius* and 22 *capsularis* varieties were evaluated for fibre strength and fineness under retting in free-flowing water, along with CRIJAF-SONA. Fibre fineness of *olitorius* and *capsularis* varieties varied from 2.73 tex to 3.96 tex and 1.22 tex to 2.47 tex respectively. Fibre strength of *olitorius* and *capsularis* varieties varied from 19.51 g/tex to 27.05 g/tex, and 15.58 g/tex to 24.56 g/tex respectively. Out of 46 *olitorius* germplasm evaluated the fibre fineness of finest line was 1.1 tex.
- Greater values for plant height, stick weight, green weight, and fibre strength except fibre fineness have accounted for the high fibre yield in tossa jute. Fine-fibre germplasm lines have been crossed with high-yielding coarse-fibre varieties.
- In flax, 12 F_6 lines from seven crosses are being evaluated in 2023–24 Rabi season for further generation advancement. Four F_5 lines and four F_4 lines are under selection process. A total of 357 germplasm lines, including 90 exotic accessions, are under maintenance breeding. FT-999 and FT-1006 of *L. usitatissimum* and one line of *L. tenus* were the least susceptible to Fusarium wilt.

- Three *capsularis* varieties tested in the DUS trial for 17 DUS characters were distinct from each other on the basis of fibre strength. Three *olitorius* varieties tested in the DUS trial for 17 DUS character varieties were distinct from each other with respect to seed color. For the maintenance of the reference collection of jute, 30 varieties of tossa jute and 21 varieties of white jute were regenerated. A database of reference collections has been prepared after recording observations of 17 essential characters.
- A draft DUS test guideline for mesta has been prepared based on 22 descriptors.
- Backcross progeny from (JRO-204 × OIJ-161) × JRO-204 produced the highest dry fibre weight and plant height. Out of 70 germplasms of tossa jute screened for yellow mites (count/cm^2 leaf area), OIJ-295, OIN-082, OIJ-98, and OEX-032 exhibited significant tolerance. Out of 70 germplasms of tossa jute screened for stem rot disease, OMU-42 and OIJ-143 exhibited significant tolerance against the disease.
- LD_{50} of EMS of tossa jute is observed at a concentration of 1% of EMS treated for 4 hours. Lethality increased with an increase in the duration of treatment and the concentration of the mutagen.
- *In vitro* root regeneration and acclimatization systems in *C. capsularis* were standardized. After 14–20 days of elongation, shootlets were transferred to rooting medium (½ MS +.NAA and reduced sucrose). Solidified ZN5 and BNSTS were able to induce callus from anthers in jute.
- Out of 117 jute SSR markers, 12 markers showed parental polymorphism. Genomic DNA from 178 F_2 plants has been isolated for genetic mapping.
- In a population of 176 $F_{2:3}$ intercross (*C. olitorius* cv. Sudan Green' *C. olitorius* mt. bfs), the heritability of root traits in jute varied from 30 to 100%. A total of 61 QTL were detected for root system architectural traits and root nitrate reductase activity. The results suggest that jute fibre yield can be significantly improved by selecting for root traits.
- To clone HSF and NAC-domain genes for overexpression in Arabidopsis and flax, the full-length gene sequences were amplified from the cDNA of a heat stress-tolerant fibre flax variety JRF-2, purified, and cloned in the pJET 1.2 plasmid in *coli* cells. The positive colonies with the gene of interest (GOI) were confirmed through colony PCR and restriction digestions.
- Three single-stranded guideRNA (sgRNA) sequences targeting the LuHSFA2a, LuHSFA2b, and LuNAC003 genes were designed, cloned into the pRGEB31 vector driven by the rice U6 promoter, and transformed into *coli*. Plasmids with cloned sgRNA sequences were isolated and confirmed through restriction enzyme digestions.
- Nucleus seeds of 31 varieties of jute (195.5 kg), 19 varieties of mesta (109.5 kg), 5 varieties of sunnhemp (50 kg), and 1 variety of flax, JRF-2 (5.0 kg), were produced as the source material for breeder seeds for next season.
- Breeder seed (8.29 q) of 16 varieties of jute (12 *Corchorus olitorius* and 4 *C.capsularis*) was produced against DAC & FW, Govt. of India, indent of 7.79 q. A total of 8.90 q of breeder seed of four sunnhemp varieties was produced against DAC & FW, Govt. of India, indent of 8.90 q.
- A total of 1060.07 q of seed (40.6 q Foundation, 984.01 q Certified, and 35.46 q TL) of different crops were produced. Of these, foundation seed of 35.80 q paddy and 4.8 q jute were produced. 981.75 q certified paddy seed and 2.26 q jute seed were produced.

Crop Production

- The land use and land cover analysis and mapping of the Sundarbans region in the state of West Bengal were carried out as they will enable the monitoring of the temporal dynamics of agricultural ecosystems, forest conversions, surface water bodies, etc. on a timely basis for fulfilling the sustainable development goal in the Indian Sundarbans region.
- The maximum fibre yield of jute (cv. JRO 204) was recorded with 100% NPK +FYM (34.2 q/ha), which was at par with 150% NPK (32.8 q/ha), but both treatments were significantly superior over all other treatments. The 100% NPK +FYM treatment recorded the highest available N (350 kg/ha), while the 150% NPK treatment recorded the highest available P (80 kg/ha) and K (285 kg/ha) availability in the soil. The integrated use of 100% NPK with FYM not only maintains the sustainable yields of crops but also improves soil fertility status in long run.
- The basic data for nutrient requirement, soil, fertilizer, and organic efficiency, as well as the soil test IPNS-based targeted yield equations for jute (cv. JROM-1) and garlic (local variety), have been developed from the field experiment. The application of inorganic fertilizers as per ST-TY achieved the targeted yield of 40 q/ha jute fibre with a (+) 4.1% deviation. Integrating inorganic fertilizer with FYM further increased the jute fibre yield (43.25 q/ha) from the targeted yield of 40 q/ha, with a more pronounced (+) 8.13% deviation and a B:C ratio of 2.0.
- Sprinkler irrigation in the jute-rice-flax cropping system was evaluated for various plant growth and yield parameters. In jute, sprinkler irrigation at 50% DASM (15 mm per application) and 75% DASM (20 mm per application) obtained superior plant growth and yield parameters. Sprinkler irrigation at 50% DASM obtained 21% higher total water productivity compared with control.
- Variety JRCJ 11 recorded better plant height when subjected to waterlogging at 30 and 45 DAS than JRO 204. There was a decrease in the fibre yield of JRO 204 and JRC J11 by 39–44% when waterlogging was imposed at 30 DAS and 17–21% at 45 DAS, while the decrease was only 4-9% when waterlogging was imposed on 60 DAS. Waterlogging reduced fibre yield more in JRO 204, and both species were able to tolerate waterlogging imposed at later stages of growth.
- The net GHG emissions from crop production and bio-refinery from jute and kenaf ethanol were only 3.45 g/MJ and 5.88 g/MJ, respectively. Life cycle assessment (LCA) analysis revealed that ethanol produced from jute and kenaf cellulosic biomass can reduce GHG emissions by 78–81 percent when compared with fossil fuels. Bioethanol made from jute and kenaf biomass material has the least negative effects on the environment and resource depletion.
- The two RCP scenarios (RCP4.5 and RCP8.5) were used to create the climate change scenarios for precipitation and ambient temperature (T_{max}, T_{min}) for the IGP region for the baseline period of 1983–2018 and the future period of 2030–2090. Both RCP4.5 and RCP8.5 scenarios exhibit similar spatial patterns of rainfall change. The result suggests that GHG concentrations will have a significant impact on the pattern of precipitation and temperature in the IGP.
- To understand the temporal pattern of surface energy balance (SEB) and the influence of vegetative cover of the jute-rice-wheat cropping sequence on SEB, the open path eddy covariance technique was used to measure the net radiation flux (Rn), sensible heat flux (H), soil heat flux (G),

and latent heat flux (LE) at different growth stages of the crops to get various foliage coverage. This is the first report of energy balance in a jute-rice-wheat cropping system using the eddy covariance technique in India as well as around the world, which will be very useful for further research in surface energy budgeting and climate research.

- Integrated nutrient management recorded significantly higher jute fibre yield (3.54 t/ha) as compared to organic (2.98 t/ha) and natural (2.59 t/ha) nutrient supply. Organic nutrient management recorded a 12.7% lower yield as compared to conventional (3.41 t/ha). Results from farmers' fields revealed that about 50–60% of farmers are applying neem leaf extract at 15–30-day intervals for controlling pests and diseases. Similarly, 50–60% of farmers are treating with a garlic mixture, and the jute yield varied from 2.91 t/ha to 3.06 t/ha.
- Irrespective of fertilizer dose, the highest fibre yield of *sisalana* sisal was obtained in cases of large suckers (1059.8 kg/ha). Similarly, irrespective of sucker size, the highest fibre yield was recorded with the highest fertilizer dose (942.4 kg/ha). In the interaction effect, the highest fibre yield was obtained with a large sucker x highest fertilizer dose (1175 kg/ha).
- Application of compost (BSC/BGSC) and chemical NPK in a 50:50 ratio may be considered an alternative to using 100% of the recommended dose of NPK fertilizers for jute and flax fibre production. In ramie, the highest value (21.69 q/ha) of total fibre yield (sum of four cuts) was recorded with the ramie crop receiving 100% NPK inorganic fertilizer treatment, though the yield was statistically at par with the yield recorded (19.14 q/ha) with the 50% BSC + 50% NPK.
- A study was conducted to assess the impact of a ten-day spell of heat waves (39–42 °C) and hailstorms at 50 DAS. Jute equivalent yield (JEY) for jute-mung intercropping was 38.5 q/ha compared to the fibre yield of 20.2 and 22.6 q/ha in bare cultivation and rice straw mulch @ 5 t/ha application, respectively. Jute-mung intercropping was found ideal for resilient cropping systems under changing climates, nutritional security (mung seed yield of 13.4 q/ha), soil health improvement by addition of 2.5 t/ha N-rich organic matter, organic weed management by smothering of weeds, higher monetary advantage, and insurance crops under high ambient temperatures and hailstorm situations.
- Application of ipfencarbazone @ 90 g/ha (PE) + single wheel jute weeder at 21 DAS produced higher fibre yield (35.5 q/ha), closely followed by and at par with the fibre yield recorded with application of ipfencarbazone @ 90 g/ha (PE) + nail weeder at 14 DAS (35.4 q/ha).
- In flax, the INM treatments were statistically at par among them and also with the 100% RDN treatment with respect to plant height, dry matter at harvest (63.11 q/ha), and fibre yield of the crop, thereby indicating a 50% saving of the recommended fertilizer N dose. The maximum values of plant height (119.83 cm), dry matter at harvest (63.11 q/ha), and fibre yield (20.07 q/ha) of flax were recorded with the application of 50% RDN + FYM @ 10 t/ha + Azotobacter.
- On the basis of on-field information from the Jute-ICARE project locations in West Bengal, Assam, Bihar, Odisha, and Meghalaya collected through a Google-based form, JAF Kisan, the technology yield gap varied from 3.42 q/ha in Nadia, West Bengal, to 7.58 q/ha in Tura district, Meghalaya. Whereas the extension gap varied from 4.07 to 7.08 q/ha in Madhepura and Supaul districts, respectively, in Bihar.
- The best package of practices in jute-based farming (improved varieties JRO BA3 and JRO 204; single-wheeled jute weeder, multi-row seed drill, CRIJAF Sona), value chain in jute, and entrepreneurship among farm women were promoted with an

additional net income of Rs. 40000/ha. Altogether, 24 farm women from the project area were also trained on the making of jute-diversified products with the objective of enhancing their income through off-farm activities.

- Phase-IX of the Jute-ICARE project was carried out in 200 blocks under different jute and mesta growing states, covering an area of 1,85,000 ha and involving 4.20 lakh farmers during 2023–24, in collaboration with NJB and JCI. About 600 MT of certified jute seeds (cv. JRO 204, JBO 2003H, CO-58, JBO-1, JROM-1, and JRC-532) and 800 nos. each of CRIJAF multi-row seed drills and CRIJAF single-wheel jute weeders were distributed among the farmers. During retting season, 600 MT of CRIJAF Sona were distributed among the farming communities for improved retting of jute and mesta. Eight in-house trainings on "improved jute production technology" of 2 days each were conducted for 190 block supervisors, master trainers, and agricultural officers.
- From the laboratory-scale study, it can be concluded that the wounding of jute stems prior to retting helps in the entry of microbes into the inner portion of the stem, which results in faster retting of jute. The enzymatic activities like polugalacturonase (PG), pectin lyase (PNL), and xylanase activities were significantly higher by more than three times under free-flowing water retting compared to conventional retting of jute. The higher PG, PNL, and xylanase activities in free-flowing water retting lowered the retting duration compared to conventional retting.
- A study was conducted to optimize alkaline pre-treatment and saccharification conditions employing response surface methodology to improve the saccharification yield of jute biomass. Maximum percent delignification (80.42%) was obtained at the optimal conditions of 55.8 ◦C temperature, 5.9 h time duration, and 2.47% NaOH concentration, removing 79.8% lignin and 34.2% hemicellulose. The optimized saccharification condition yielded maximum saccharification (76.48%) and maximum ethanol yield (21.5 g/liter) after 24 hours of fermentation. The cellulose content of the samples increased from 60.7% to 70% after alkali treatment.
- The power-operated jute ribboner machine was developed for the extraction of jute ribbon from freshly harvested jute plants without breaking sticks. The ribbon extraction efficiency is more than 90%. The machine is very easy to use, and no specific skill is required to operate the machine.
- The functional performance of the tractor-drawn multi-crop seed drill (for precision sowing of jute and other small-seeded crops) has been evaluated. The effective field capacity and field efficiency of the seed drill machine were found to be 0.36 ha/h and 83.72%, respectively. The seed rate for jute sowing was found to be 3.66 kg/ha. The uniformity of seed dropping and spacing along the row was found to be 80–85% and 30–50 mm, respectively.
- A weeder operated by a rechargeable dry cell battery has been developed by modifying the existing single-wheel jute weeder. The spring facilitates control of the depth of operation. The fully charged battery can run up to 80 km (approx.). The field evaluation of the weeder showed field capacity in the range of 0.06-0.07 ha/h.
- Farm income enhancement through up-scaling of jute-based diversified products was done by training 48 farmwomen on the making of jute-diversified products. The skill acquired and socio-economic outcomes were highest among the Paatrani SHG from Nadia District, followed by the Sankalpa SHG from North 24 Parganas. The skill acquisition score was 84.8 for the Paatrani SHG, whereas it was 83.3 percent for the Sankalpa SHG.

Crop Protection

- Nano-sulphur (25nm) had significant toxicity against the sucking pests of jute. Under laboratory conditions, topical application of nano-sulphur @1.0 ppm caused 88.37% mortality in the 2nd instar nymph of mealybug; 100% mortality was achieved at 3.0 ppm concentration. Under field conditions, jute yellow mite was more susceptible to nano-sulfur; its application @ 0.01 ppm reduced the mite population by 87%.
- Carbon nanotubes (CNT-length 500 nm and a diameter 30 nm) treatment @ 3 ppm elevated the proline and flavonoid levels in jute leaf and improved the salinity stress tolerance. In the case of 350 mM NaCl and CNT treatment, the proline level was 3.29 µ moles, whereas it was negligible (less than 0.001 µ moles) in treatments devoid of CNT. Similarly, the highest flavonoid content (15.69 mg/g) was recorded under 250 mM NaCl and CNT treatment.
- Simultaneous treatment of both soil with bleaching powder and seed with both carbendazim (@ 2 g/kg) + imidacloprid (@ 5 ml/kg) had a significant effect on reducing stem rot disease and different sucking and leaf-eating insect pests of jute. It proved to be a low-cost pre-sowing seed and soil treatment strategy.
- In a field experiment with six IPM modules against major diseases and insect pests of yellow vein resistant mesta (JBMP2), chemical IPM module consisting of deep ploughing soil treatment with bleaching powder, seed treatment with metalaxyl + clothianidin, spraying of abamectin at 30 DAS, and imidacloprid at 40–45 DAS was most effective, with the lowest (2.7%) foot and stem rot, collar rot, along with minimum damage by spiral borer, mesta flea beetle, mealy bug, and jassids with the highest fibre yield (25.6 q/ha) compared to farmers' practice with HS 4288 (19 q/ha).
- In a comparative field evaluation of six IPM modules in jute (cv. JRO 204), the incidence of stem rot (5.7%), indigo caterpillar (1.3%), yellow mite (1.4%), semilooper (0.6%), hairy caterpillar (0.8%), and apion (0.6%) was lowest in the chemical-based IPM module consisting of deep ploughing, soil application with bleaching powder, seed treatment with carbendazim + imidacloprid, spraying of spiromesifen at 30 DAS, λ-cyhalothrin, and tebuconazole at 40–45 DAS yielded the highest fibre (33 q/ha), recording a 63.6% increase over check, followed by the cultural module (24.3 q/ha) and organic module (23.2 q/ha).
- The LC_{50} of profenophos deduced for the three pest populations, viz., the hairy caterpillar *Spilosoma oblique,* the indigo caterpillar, *Spodoptera litura,* and the jute semilooper *Anomis sabulifera* infesting jute, were 279.3 ppm, 1218.7 ppm, and 114.6 ppm, respectively. The bioassay results clearly indicated that the *S. litura* and *S. oblique* populations had 10.63- and 2.43-fold higher insecticide resistance ratios than the *A. sabulifera* population.
- The resistance ratios over one generation (F2) manifested the elevation in enzyme titres carboxylesterase (CarE), glutathione-S-transferase (GST's), and acetylcholinesterase (AchE) in all 3 jute pests studied.
- A high-throughput screening technique has been developed to overcome present bottlenecks in screening techniques. Plants are grown under field conditions, following recommended agronomic practices. At 60–70 DAS (>1.5 m plant height), three 7-cm stem-bits are removed from the mid-

length of a plant and inoculated by puncturing the bark with a needle and placing a PDA plug containing the growing mycelial edge of *Macrophomina phaseolina*. Lesion lengths developed under *in vitro* conditions are highly correlated with those under field conditions.

- Genetic resistance against *Rhizoctonia wilt* among the flax germplasm was observed in FT-999 and FT-1006 (both *L. usitatissimum*) and in one line of *L. tenus* which was consistently least infected both in *in vitro* and in field conditions.
- Out of 170 jute germplasms, OIN-852, OIN-148, OIN-201, OIN-159, OIN-113, and OIN-118 lines were least susceptible to stem rot caused by *Macrophomina phaseolina* when screened under sick plot, hot spot, and artificial screening conditions.
- The development rate of the immature stages of mealybug increased linearly with an increase in temperature between 16 and 33°C. The lower thermal threshold (Tmin) for the egg-to-crawler stage was estimated at 10.59 °C, while that for the II instar and III instar was 9.03 and 10.92°C, respectively. Above 33°C, the development rate was well described by the Sharpe and DeMichele models for crawler, II-instar, and III-instar. The fastest mean development times for crawler and II-instar were observed at 31°C, whereas for III-instar, the fastest development was observed at 36 °C.

Extension and Outreach

- Two KVKs, namely KVK Burdwan and KVK North 24 Parganas (Additional), conducted 4 On Farm Trials (OFTs) on weed management in onion and jute, micronutrient application in cauliflower and YVMV-resistant okra varieties.
- A total of 218 FLDs were conducted by both the KVKs during the year 2023 on jute, paddy, lentil, chickpea, onion, vegetables, bananas, and poultry. There were significant increase in productivity for all the field crops and fruit crops under improved practices over conventional methods. The demonstration on backyard poultry farming with Kadaknath breed increased the income by more than 60% per unit.
- Frontline demonstrations were conducted in a 294.40 ha area covering 759 farmers' fields under NFSM on the latest high-yielding varieties (JRO 204, JRO 2407, JBO 1, JROM 1, and CO58) and other improved production technologies (mechanical weed management, line sowing by CRIJAF Jute Seeder) was conducted in various blocks of major jute-growing districts, viz., North 24 Parganas, Hooghly, and Nadia in West Bengal.
- Across all the demonstration sites, JROBA 3 performed significantly better, with the highest average yield of 39.10 q/ha, which is 12 q/ha more than farmers' varieties. The line sowing technology and mechanical weeding showed a 1:1.43 and 1:1.57 C:B ratio, respectively. The use of CRIJAF SONA improved the fibre quality by 1-2 grades.
- Mesta production technologies were demonstrated in an area of 7.0 ha, involving 20 farmers in the Srikakulam and Vijayanagaram districts of Andhra Pradesh, with an improved variety of mesta AMV 7, line sowing, and integrated weed and pest management. Fibre yield was in the range of 20.00 to 27.00 q/ha.
- Under NFSM (CC), 6.81 q foundation and 2.26 q certified seeds of improved jute varieties were

produced at ICAR-CRIJAF. MPKV, Rahuri also produced 37.4 q foundation seeds of jute. In mesta, 10 q foundation and 5 q certified seeds of new varieties were produced at Amadalavalasa.

- Scheduled caste sub-plan (SCSP) activities were implemented in various villages in the North 24 Parganas, South 24 Parganas, Nadia, Bankura, Purulia, and Purba Bardhaman districts.
- During 2023, altogether, 6 training programs, 2 field demonstration programs on improved methods of jute retting, and 2 Kisan Sammelan (mega events) were conducted, and about 4338 SC farmers benefited from the programs.
- Various agricultural inputs, like improved varieties of jute seed, paddy seed, vegetable seed kits, fertilizers, vermicompost beds, CRIJAF Sona, crop protection kits, and farm implements and tools (CRIJAF single-wheel jute weeders, jute seeders, battery-operated sprayers, etc.), were distributed to more than 11, 547 farmers in various districts of West Bengal.
- The *Mera Gaon Mera Gaurav* (MGMG) program was implemented in 43 villages. Agricultural inputs like seed, fertilizer, chemicals, agricultural machinery, etc. were distributed for improved farming. Awareness programs were conducted to make them aware of the programs on sensitive issues of national importance, such as Swachh Bharat Abhiyaan, climate change, water conservation, soil fertility, etc.
- Swachhta activities emphasised waste recycling, vermicomposting, organic agriculture, and by-product utilization, with a focus on jute and related fibre crops. The best practice to recycle the biodegradable waste generated inside the premises was developed to produce biofertilizers through an efficient composting method to create wealth from waste.

ICAR-CRIJAF: at a Glance

ICAR-CRIJAF (Central Research Institute for Jute and Allied Fibres) is a premier research institute of Indian Council of Agriculture Research (ICAR) situated at Barrackpore, West Bengal (India). The institute mainly deals with six natural fibre crops viz., **Jute, Mesta, Sunnhemp, Sisal, Ramie and Flax**. To carry out research on various aspects of jute and allied fibres (JAF) the institute has three divisions namely, Crop Improvement, Crop Production and Crop Protection. Two sections namely All India Network Projects (AINP) on Jute and Allied Fibres, and Agricultural Extension is also supporting Research, Development and Transfer of Technology. The Institute spread its sphere of Research activities to the length and breadth of the Nation by establishing its Research Stations in Uttar Pradesh (Sunnhemp Research Station, Pratapgarh), Assam (Ramie Research Station, Sorbhog), Odisha (Sisal Research Station, Bamra) and West Bengal (Central Seed Research Station for JAF, Budbud). Besides, the Institute has nine State Agricultural University (SAU) based and six ICAR institute based collaborating centres for multi-locational testing and validation of the technologies under AINP on JAF. It has two Krishi Vigyan Kendra (KVK) working for the farming community of Burdwan and North 24 Parganas districts of West Bengal. The multi-disciplinary scientific team of the Institute is dedicatedly working towards development of highly productive varieties with high quality fibre which can meet the need to make high value diversified products. Scientists work for resource management in farming for better energy efficiency and economic input allocation, developing suitable agronomic practices supported with farm implements for minimizing climatic change related risks, soil degradation, drudgery, etc. and for socio-economic upliftment of farming community by improvement in agriculture production and efficient utilization of natural resources. Emphasis is also on development of eco-friendly methods for crop management and enhancing livelihood security of farmers through reducing the crop yield losses by management of diseases and insect-pests. Findings of the research activities are instrumental in providing recommendations for developing policies, programmes, models and approaches for sustainable jute and allied fibre production. The main strength of the institute is excellent well trained human resources. Presently the Institute has a total strength of 155 staff with 47 Scientists 43 technical staff 30 Administrative staff and 35 supporting staff.

History

The Indian Central Jute Committee (ICJC) was formed in 1936 in view of the economic importance of jute in the country. Subsequently Jute Agricultural Research Laboratory (JARL) was established in 1938 at Dhaka of undivided Bengal. After partition (1947), Jute Research Institute was shifted to Chinsura and then to Barrackpore, West Bengal and finally established as Jute Agricultural Research Institute (JARI) at Nilganj, Barrackpore in 1953. In 1966, ICJC was taken over by Indian Council of Agricultural Research (ICAR) and the Institute was renamed as Central Research Institute for Jute and Allied Fibres (CRIJAF) in 1990.

To carry out research on jute and allied fibres, the Institute established four research stations namely Central Seed Research Station for Jute and Allied Fibres at Budbud, West Bengal (1956), Ramie Research Station, at Sorbhog, Assam (1959) Sisal Research Station, at Bamra, Odisha (1962) and Sunnhemp Research, Station at Pratapgarh, Uttar Pradesh (1963). Besides, the Institute has nine SAU based and six ICAR institute based collaborating centres for multi-locational testing and validation of the CRIJAF technologies under All India Network Projects on Jute and Allied Fibres (AINP on JAF). Two KVKs under the administrative control of ICAR-CRIJAF was established in 2006 and 2017 at Burdwan and 24 Parganas (N) district of West Bengal, respectively.

Administration

The Institute is headed by the Director and supported by Divisional Heads, Sectional Incharges, Chief Administrative Officer and Finance & Accounts Officer for the execution and implementation of various research activities and other programmes. The Institute Management Committee (IMC) guides and supports the Director from time to time to review of programs. The Research Advisory Committee (RAC) and Institute Research Council (IRC) provide broad guidelines and assist in developing and implementing specific research programmes and projects.

Central Seed Research Station for JAF, BudBud (W.B.)

Sunnhemp Research Station, Pratapgarh (U.P.)

Sisal Research Station, Bamra (Odisha)

Ramie Research Station, Sorbhog (Assam)

Sub-stations of ICAR-CRIJAF

Research Areas

The selected areas of research in jute and allied fibre are- breaking yield barrier, bridging the yield gap and area expansion, improving fibre quality, ecosystem services like natural resource conservation, climate change mitigation, diversification, value addition, value chain, wealth from waste, profiling of immunity-boosting bioactive compounds for medicinal use of jute and allied fibres.

Research Laboratories and Facilities

- PCR based Genotyping
- Microscopy and Histology of plant samples
- Fibre fineness and strength testing
- Bio-Informatics using NGS
- Soil and plant Testing
- Biolog based bacterial identifications
- Virus Indexing of tissue culture raised plant
- Histo-Pathological studies of plant samples
- Neutron moisture meter
- Penitrologger based soil compactness study
- Photosynthesis rate measurement
- Virtual Library through CeRA platform
- Research farms for field experiments
- Agricultural Knowledge Management Unit
- Jute and Allied Fibre Museum
- Infrastructure (Auditorium, Guest House, Canteen, Clinic, Sports facilities)

Technology Evaluation & Dissemination

All India Network Project on Jute and Allied Fibres (AINPJAF): AINPJAF is being implemented by ICAR-CRIJAF since April, 1974. At present, this project has 14 centres including 8 SAU-based and 6 ICAR-institute based collaborative centres for multi-locational evaluation of the varieties, validation of production and protection technologies and quality evaluation of the fibres.

Krishi Vigyan Kendra: KVK, Purba Bardhaman (2005) and KVK-Addl, North 24 Parganas (2016) are functioning under ICAR-CRIJAF for capacity building through training and other promotional extension activities in jute based farming system. Both KVKs are well equipped with facilities like trainee's hostel, soil testing laboratory, seed production unit and demonstration units.

Education

IARI-Kolkata Hub: ICAR-IARI, New Delhi, has recognized 16 different institutes of ICAR as IARI-Mega University Hubs. ICAR-CRIJAF is one of these hubs entrusted by IARI to initiate UG/PG/PhD teaching in agriculture. In this session (2023-24), ICAR-CRIJAF is going to offer 20 seats for UG, 10 seats for PG, Plant Breeding-2, and Soil Science-4, and 4 seats for PhD Plant Breeding-1 and Soil Science-3. ICAR-CRIJAF, Kolkata hub is going to introduce these programs in association with 8 sister ICAR institutes, namely, ICAR-CIFRI, Barrackpore; ICAR-NINFET, Kolkata; ICAR-NBSSLUP, Kolkata Centre; ICAR-CSSRI, Canning Town Centre; ICAR-NDRI, Kalyani Centre; ICAR-IVRI, Kolkata; ICAR-CIFA, Rahara Centre; ICAR-CIFE, Kolkata Centre, and ICAR-CISH, Malda Town Centre as hub partners.

Regional Centre of National Agricultural Education Accreditation Board: On recommendation of the accreditation board of ICAR, this institute (ICAR-CRIJAF) has been selected as the nodal centre for eastern and north-eastern region for facilitating the submission of self-study reports (SSRs) of the agricultural universities, colleges and other modalities required for accreditation.

Human Resource Development Cell: The institute has been recognized for research work for M.Sc and Ph.D programmes by the Presidency University, Calcutta University, R.K.M. Vivekananda University and Adamas University. Besides, the cell also conducts short term summer training for M.Sc students of SAUs

and general universities. HRD cell develop the year wise training schedule for all categories of staff and monitor training programmes.

Management Unit

Agricultural Knowledge Management Unit (AKMU): AKMU facilitates the infrastructure for e-governance, manages research information and provides a stable internet facility. The unit is responsible for maintenance and updating of the institute website, operating the e-extension, mobile advisory, agro-advisory services and other activities

Institute Technology Management Unit (ITMU): ITMU deals with protection of intellectual properties (IPs), their maintenance and commercialization of the technologies developed by the institute. It also looks after consultancy, contract research, patents, technology protection protocols, licensing etc.

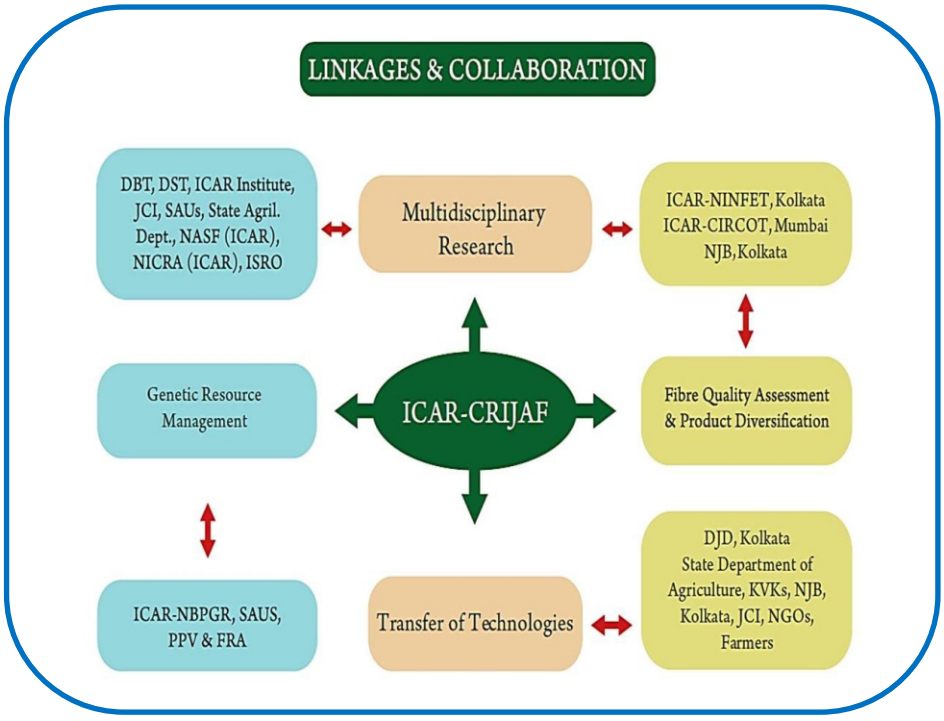
Management Cell

Prioritization, Monitoring and Evaluation (PME) Cell: PME of the Institute is working as "Single window" system for priority setting, research monitoring and evaluation, maintenance of databases related to projects, achievements, technologies developed, publication etc. PME cell coordinates in maintaining the information and documentation of all the in-house as well as externally funded projects.

Women Cell: The institute women cell addresses the issues related to grievances of women employees. This cell also organizes awareness programmes for the women for enhancing their income and the management of family and welfare of the society.

Linkages

The research programs are partly supported by grants-in-aid from the DBT, ISRO, NASF, SRD, NICRA, NJB, DST, and RKVY for extra-mural projects. Besides, collaborative programs are also conducted with SAUs, DJD, NINFET, JCI, NJB, PPV and FRA. The International organization like BJRI, Bangladesh is associated for R & D activities.



Unified Budget of ICAR-CRIJAF

Unified Budget of ICAR-CRIJAF for the year 2023

(in Lakh)

S. No.	Sub-Head	BE 2023-24	RE 2023-24 (Proposed)	Actual Expenditure (Apr-Dec 2023)
A)	GRANT FOR CREATION OF CAPITAL ASSETS (CAPITAL)			
1	Works - Office Building	30.00	30.00	14.21
2	Equipment	80.53	130.50	46.43
3	Information Technology	22.00	35.00	19.66
4	Furniture & Fixtures	7.00	20.00	6.50
5	Others	10.47	9.50	0.00
	Sub-Total (A)	150.00	225.00	86.80
B)	GRANTS IN AIDS - SALARIES (REVENUE)			
1	Establishment Expenses - Salaries	2501.00	2450.00	1958.99
	Sub-Total (B)	2501.00	2450.00	1958.99
1	Pension & Other Retirement Benefits	373.47	341.00	226.51
2	Travelling Allowances	25.00	26.00	15.77
3	Research & Operational Expenses	290.00	300.00	220.66
4	Administrative Expenses	405.00	396.00	268.82
5	Miscellaneous Expenses (HRD & Others)	65.00	62.00	42.80
	Sub-Total (C)	1158.47	1125.00	774.56
D)	TSP			
1	Capital	0.00	0.00	0.00
2	Revenue	41.00	40.37	25.03
	Sub-Total (D)	41.00	40.37	25.03
E)	NEH			
1	Capital	0.00	0.00	0.00
2	Revenue	30.00	30.00	12.37
	Sub-Total (E)	30.00	30.00	12.37
F)	SCSP			
1	Capital	20.00	20.00	6.29
2	Revenue	75.00	75.00	52.10
	Sub-Total (F)	95.00	95.00	58.39
GRAND TOTAL (A+B+C+D+E+F)			3975.47	3965.37

Financial Statement of AINPJAF and KVKs

Head	Target (B.E.)	Achievement (Apr-Nov 2021)
AINPJAF	631.89	417.97
KVK, Purba Bardhaman	212.00	171.35
KVK, North 24 Parganas (Addl)	126.00	96.67

REVENUE Generated upto December 2022

ICAR-CRIJAF Head Quarter, Barrackpore	CSRSJAF, Budbud	Ramie Research Station, Sorbhog	Sisal Research Station, Bamra	Sunnhemp Research Station, Pratapgarh	Total	Target
45.96	6.56	1.01	5.66	1.92	61.11	87.00

Staff Position

Position	Sanctioned	Filled	Vacant
Director (R.M.P.)	01	01	00
Head of Divisions	03	03	00
Principal Scientist	02	03	00
Senior Scientists	10	07	03
Scientists	40	26	14
Technical Officers / Technical Assistants	108	44	64
Sr. Administrative Officer	01	00	01
Sr. Finance and Accounts Officer	01	00	01
Administrative Officer	02	01	01
Assistant & Administrative Officer	07	07	00
Private Secretary	01	01	00
Personal Assistants	02	02	00
Assistants	18	10	08
Upper Divisional Clerks (UDC)	04	03	01
Lower Divisional Clerks (LDC)	05	02	03
Skilled Support Staff	46	20	26
Grand Total	251	130	122

CROP IMPROVEMENT

Overview

Jute and allied fibres (JAF) are important commercial crops all over the world, particularly in India. Maintaining low lignin and fibre fineness is becoming increasingly crucial for crop improvement in the face of changing climate, abiotic stress, new pathogens, drought, and water logging conditions. Germplasm from various agro-ecological and diversity-rich areas of India and abroad has been introduced through national and international efforts. The Division of Crop Improvement is successfully utilising these germplasm in breeding programs to improve the yield and quality of these natural fibres. It also serves as India's National Active Germplasm Site (NAGS) for jute and allied fibre crops. To improve the efficiency of varietal development, the Division has been regularly improving its research programmes, keeping in mind new breakthroughs in crop breeding and biotechnology.

Priorities & Thrust Areas

- Collection, characterization, evaluation, conservation and utilization of JAF germplasm
- Development of new varieties of JAF crops with high yielding potential, improved fibre quality with biotic and abiotic stress resistance through advanced breeding strategies
- Genetic enhancement in traits of economic importance through pre-breeding and molecular breeding
- Increasing breeding efficiency through genomic and transcriptomic interventions
- Production of breeder and nucleus seed of all the released varieties of JAF crops for indenters

Research Highlights of 2023

- Pre-mature flowering tolerant high yielding tosa jute variety JROBA-3 (CRIJAF Mukunda) has been released and notified vide Gazette of India notification no. 31.S.O.1056(E) dated 06.03.2023.
- High yielding white jute variety ICAR-CRIJAF Jute JRCP-5 (Pankaj) has been released and notified vide Gazette of India notification no. 31.S.O.1056(E) dated 06.03.2023.
- Ranges of fibre strength and fibre fineness in Indian jute varieties were quantified.
- *In vitro* root regeneration and acclimatization system in *Corchorus capsularis* was standardized.
- QTLs for root system architectural traits and root nitrate reductase activity were identified in tossa jute
- Three single-stranded guideRNA (sgRNA) sequences for genome editing in flax have been cloned.

1 Biotechnological Intervention

1.1 *In vitro* regeneration and haploidy induction in jute

S. Datta, K. Meena, K.N. Chaurasia, and R. Bhowmik

Project code: In- house project-JBT 4.9.

***In vitro* root regeneration and acclimatization system in *Corchorus capsularis*:** For a standardized *in-vitro* regeneration and transformation system in white jute (*Corchorus capsularis*) rooting, hardening and acclimatization protocols were tested. After around 14 to 20 days of elongation, shootlets were transferred to rooting medium (½ MS supplemented with NAA and reduced sucrose concentration). After about 10-15 days, root initiation began, and, gradually lateral roots started appearing (Fig. 1). After another 15-20 days, individual plantlets were transferred to autoclaved soil rite in pots for hardening. Hoagland solution was used for intermittent irrigation and nutrient supply.

Standardization of microspore culture: Flowers buds of JRC 212, JRO 524 and JRO 204 were collected at morning. The bud sizes were measured for standardization of the collection method and time (Fig. 2). For JRC 212 bud size varied from 0.7 -1 mm, and for JRO 524 & 204 bud sizes 1-1.2 mm. Initially, anthers were dusted on MS medium containing sucrose, BAP, and 2, 4-D. But no callusing was observed even after 90 days of inoculation either in liquid or solid media. Similarly, no callusing was obtained in liquid ZN5 and BNSTS media. However, solidified ZN5 and BNSTS was able to induce callus from anthers in jute. In JRO 204 BNSTS showed better and faster response than ZN5, we get 10 callus from BNSTS after 26 days of inoculation, where ZN5 gave only 6 callus after 46 days of inoculation. In JRO 524, both ZN5 and BNSTS responded equally, BNSTS gave 13 callus within 44 days after inoculation and Zn5 gave 7 callus in 13 days. In JRC 212, BNSTS gave 10 callus within 44 days after inoculation and Zn5 gave only 2 callus in 15 days after inoculation (Table 1). After 20 days of callus induction, calli were transferred in media for further growth. Although colorless initially, but after two rounds of subculturing, gradually colors turned greenish indicating healthy callus amenable to regeneration.

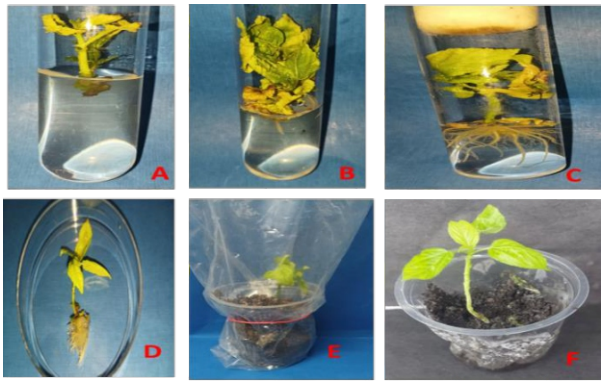


Fig. 1. In vitro rooting and hardening in jute; a) Individual shootlets transferred to the NAA medium at day 1; b) just root initiation starting after 10 days; c) vigorous rooting in test tube; d) rooted plantlets are out of tube for clearing of media adhering in root e) rooted individuals are hardened in autoclaved soil rite and wrapped with polyethene. f) hardened plants are acclimatized.

Table 1. Responses of jute genotypes in callus induction from anthers

Cultivar	Media BNSTS		Media ZN5	
	callus	days	callus	days
JRO 204	10	26	6	46
JRO 524	13	12-44	7	13
JRC 212	10	13-44	2	15

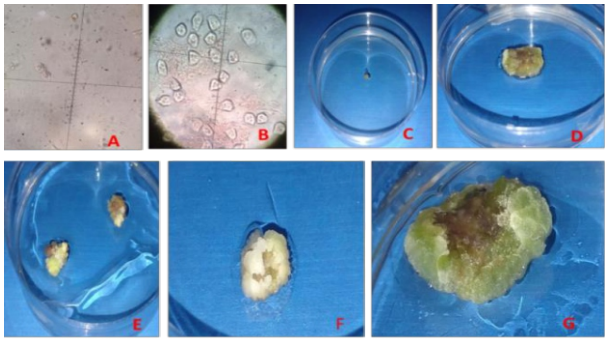


Fig. 2. Standardization of microspore culture in Corchorus spp. a) tetrad of JRO524; b) Tetrad of JRC 212; c) JRO 524 callus induction in ZN5 medium after 13 days of inoculation; d) JRC 212 callus proliferation in ZN5 media after subculture and after inoculation of 2 months; e&f) JRC 212 callus proliferation in BNSTS media after subculture and after inoculation of 2 months; g) JRO204 callus proliferation in BNSTS medium after 2 months.

1.2 Molecular mapping for stem rot resistance in jute

K. Meena, K. Mandal, S. Datta and Tribhuvan R.

Project code: In- house project-JBT 5.0

Genomic DNA was isolated from two contrasting parents, P_1 (resistant, WCIN 183A) and P_2 (susceptible, OIN 456), for stem rot resistance using the CTAB method. Purified DNA was subjected to Polymerase Chain Reaction (PCR) with 117 jute-specific markers involving Simple Sequence Repeats (SSR) and Major Intrinsic Proteins (MIPs) to study parental polymorphism among the two parents. Amplification was done under PCR conditions involving a single cycle of initial denaturation at 95 °C, followed by 35 cycles of final denaturation at 94 °C for 1 min, annealing temperature ranging from 57 to 60 °C for 45 sec (based upon the annealing temperature of the primer), and a single cycle of final extension for 10 min at 72 °C. Equivalent aliquots of each amplification reaction were separated on a 3% agarose gel in 0.5 X Tris-acetate-EDTA (TAE) buffer containing 0.5 µg/ml ethidium bromide at 80 V for 11/2 hr. The gel was exposed to UV under the gel documentation system and was photographed. In total, twelve markers showed polymorphism among the two parents (representative Fig. 3). Around 250 F_2 seeds were sown for generation advancement, and genomic DNA was isolated from 178 individual plants after 30 days of germination. A non-destructive *in vitro* method for screening the disease was standardized under laboratory conditions.

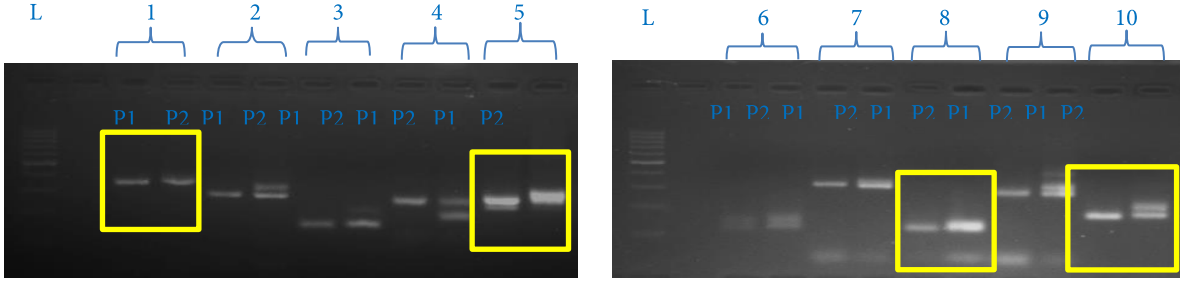


Fig. 3. Representative figure showing parental polymorphism with different SSR markers; Legends: L: 100 bp ladder; 1-10: profile of two parents with different SSR markers.

1.3 Mapping QTL for root system architecture and NUE in jute (*Corchorus olitorius* L.)

P. Satya, N.M. Alam, K. Mandal, B. Adhikary, S. Mitra, D. Saha, D. Sarkar and N. K. Singh

Project code: Externally Funded Project- ICAR-NPFGGM-3070

Earlier, the mapping of a root-weight (RW) QTL (*qRW-l1*)—that explained 9% of the phenotypic variance—to the fibre-yield-related QTL cluster indicated that root traits underpin bast fibre yield and yield components in jute (Kundu et. al. 2015. Mol Breed 35:19). Since that QTL was inconsistent across environments due to experimental errors associated with phenotyping mature field-grown plants, a robust and high-throughput lab. screen (hydroponics) as a proxy for field performance was employed to detect QTL for roots system architecture (RSA) and leaf/root nitrogen reductase activity (aka NUE).

With 176 $F_{2:3}$ intercross (*C. olitorius* cv. Sudan Green *C. olitorius* mt. *bfs*) individuals and their two founders (Kundu et. al. 2015). Mol Breed 35:19), the experiment was laid out in aCRD with six replications. A total of 12 root system architectural traits, such as average root diameter (ARD), hypocotyl diameter at the root-top (HDR), hypocotyl weight (HW), lateral root number (LRN), maximum root length (MRL), projected root area

(PRA), root density (RD), root surface area (RSA), root tissue angle (RTA), root volume (RV), root weight (RW) and total root length (TRL) together with leaf and root nitrate reductase activity (LRNRA/RNRA) were phenotyped using root-image analyses and biochemical estimations. Data heteroscedasticity was tested by plotting the histograms of trait values followed by Bartlett's and Levene's tests at P 0.05, and were transformed where required followed by the computation of one-way ANOVAs based on the model as defined by Kearsey and Pooni (1996). Narrow-sense heritability (h^2), additive genetic variance (VA) and coefficient of additive genetic variance (CV_A) were estimated (Table 2) according to Houle (1992). Mean values were used to map QTL using the Multiple QTL Model (MQM) as implemented in MapQTL 6.0.

Except for HDR and RTA, all traits showed varying degrees of differences between the two founders (Table 2). Both LNRA and RNRA had the maximum (100.0%) and RD (30.7%) and RTA (32.9%) the least h^2 estimates (Table 2). Expectedly, LNRA (77.0%) and RNRA (80.7%) had maximum CV_A, while HDR had the least (7.6%). A total of 61 QTL were detected for root system architectural traits and RNRA (QTL for LNRA not analyzed yet). Maximum numbers of QTL were detected for PRA (10), RSA (10) and TRL (8) across LG1-LG7 (Table 3). Whereas no QTL was detected for RTA, and a single QTL was identified for MRL on LG2. Of the three QTL detected for RNRA on LG1, two were in the repulsion phase (Fig. 4). Overall, the results suggest that jute fibre yield can significantly be improved by selecting for RSA and NUE.

Table 2. Means for root system architectural traits and leaf/root NUE for the two C. olitorius founders

Trait[a]	Sudan Green	bfs	Mid-parent value
TRL (mm)	366.5 ± 59.0[b]	183.9 ± 13.3	275.2
MRL (mm)	3.8 ± 0.4	2.9 ± 0.2	3.4
ARD (mm)	0.8 ± 0.04	0.7 ± 0.03	0.7
PRA (mm^2)	256.3 ± 25.8	115.9 ± 7.4	186.1
RSA (mm^2)	805.2 ± 81.0	364.1 ± 23.2	584.7
RV (mm^3)	144.4 ± 11.1	58.3 ± 4.7	101.4
RD	1.6 ± 0.1	1.1 ± 0.1	1.4
LRN	19.9 ± 1.6	11.7 ± 1.0	15.8
HDR (mm)	8.3 ± 0.1	8.3 ± 0.4	8.3
RTA	63.4 ± 1.5	63.2 ± 5.0	63.3
HW (mg)	65.0 ± 3.7	29.3 ± 2.5	47.1
RW (mg)	25.9 ± 2.3	11.9 ± 0.8	18.9
RNRA (μmol h^{-1} gFW^{-1})	0.75 ± 0.01	0.34 ± 0.02	0.55
LNRA (μmol h^{-1} gFW^{-1})	4.73 ± 0.08	2.38 ± 0.05	3.56

[a]For the trait acronyms; [b]Means are based on six replicates

Table 3. QTL detected for root system architectural traits and root nitrate reductase activity (RNRA) in C. olitorius

Trait	h^2 (%)	QTL	LG
TRL	78.9	8	1, 3, 6
MRL	68.2	1	2
ARD	49.0	4	3, 6
PRA	67.6	10	1, 2, 3, 6, 7
RV	54.7	3	1, 7
RD	30.7	4	2, 3
LRN	55.6	4	1, 3
HDR	44.8	6	1, 2, 3
RTA[b]	32.9	0	-
HW	85.2	3	1, 7
RW	75.5	5	1, 7
RNRA	100.0	3	1

[a]For the trait acronyms; [b]No definite QTL, with a genome-wide LOD significance (3.60); however, suggestive QTL were detected

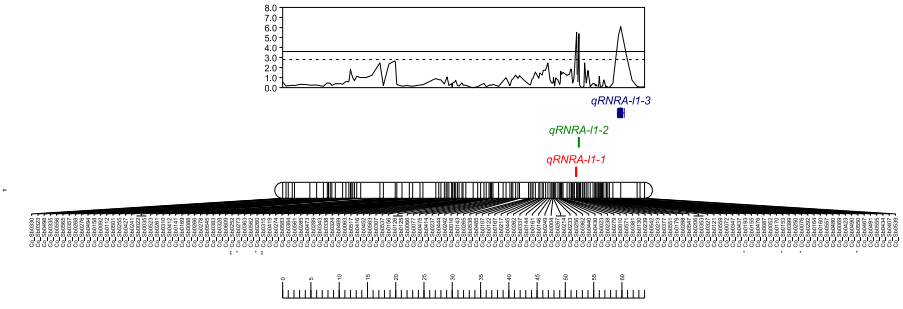


Fig. 4. Three RNRA QTL detected on LG1 in C. olitorius, with the two, viz., qRNRA-l1-1 (red) and qRNRA-l1-2 (green) being linked in the repulsion phase. The LG1 scale is in cM, while the Y-axis of the QTL chart represents the LOD scores

1.4 Genome editing in flax for heat stress response

A.K. Panda, S. Datta, and D. Saha

Project code: Externally Funded Project- SERB project

The cultivation of superior-quality fibre flax and its area expansion in Indian conditions are hindered by the poor adaptability of this crop to tolerate high temperatures. Identification and exploitation of genes responding to heat stress through genetic transformation and genome editing offers an immense opportunity to rapidly develop fibre flax varieties adaptable to Indian hot and humid conditions. Heat Shock Factors (HSFs) transcription factors such as LuHSFA2a and LuHSFA2b, and a NAC-domain from the flax genome were earlier reported to respond to high-temperature stress. Therefore, in the present study, overexpression and functional knockout of the three above genes were taken up (Fig. 5). In order to clone HSF and NAC-domain genes for overexpression in Arabidopsis and flax, the full-length gene sequences were amplified through polymerase chain reaction (PCR) from the cDNA of a heat stress-tolerant fibre flax variety JRF-2, purified, and cloned in the pJET 1.2 plasmid in *E. coli* cells. The positive colonies with the gene of interest (GOI) were confirmed through colony PCR and restriction digestions (Fig. 6a-b). These plasmids with GOI will be sequence verified and mobilized into the binary plant transformation vector pCAMBIA1301 in *Agrobacteirum* cells prior to floral dip or *Agrobacterium* co-cultivation transformations.

For the construction of genome editing vectors to edit HSF and NAC domain genes in flax through the CRISPR/Cas9 method, three single-stranded guideRNA (sgRNA) sequences targeting the LuHSFA2a, LuHSFA2b, and LuNAC003 genes were designed from the available flax genome using the CRISPOR webtool. These three sgRNA sequences were cloned into the pRGEB31 vector driven by the rice U6 promoter and transformed into *E.coli* cells. Plasmids with cloned sgRNA sequences were isolated and confirmed through restriction enzyme digestions (Fig. 7a-c).

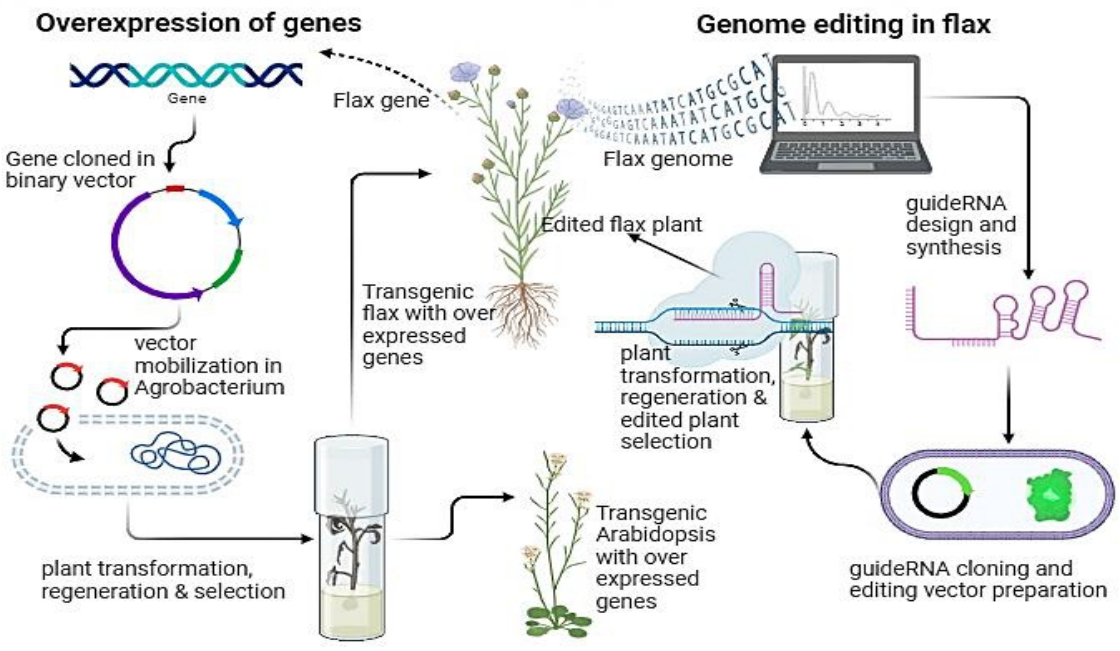


Fig. 5. Schematic diagram showing overexpression and genome editing of HSF and NAC domain genes in flax for functional study and variety development for heat stress tolerance. Figure produced using Biorender.com trial version.

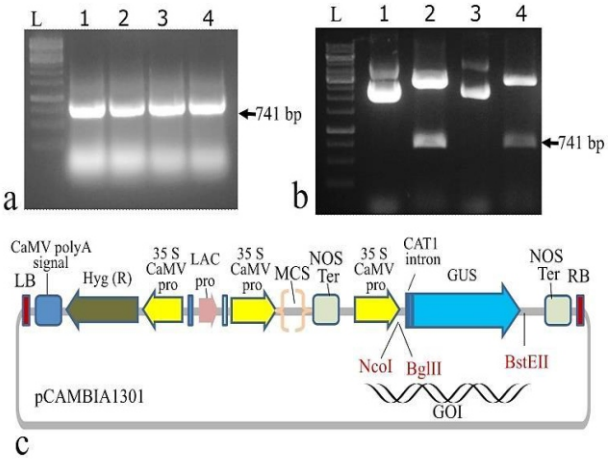


Fig. 6. Representative agarose gel showing colony PCR of full-length gene of flax (a) Lu-NAC gene in pJET1.2 vector in E.coli; (b) Representative agarose gel of restriction enzyme digestion pattern of cloned full-length NAC gene releasing the 741 bp cloned insert; (c) schematic diagram of overexpression plasmid vector pCAMBIA1301 for plant transformation.

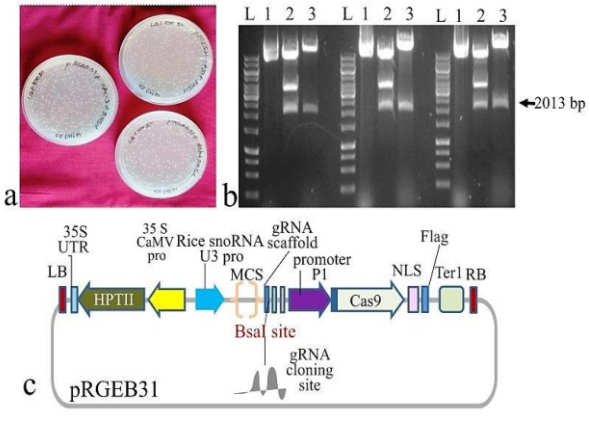


Fig. 7. (a) Colonies with sgRNA targeted to edit three genes, HSFA2a, HSFA2b, and NAC3 genes in flax were cloned in pRGEB31 vector and transformed into E. coli cells; (b) Agarose gel showing the restriction enzyme digestion of plasmids of HSFA2a, HSFA2b, and NAC3 genes with restriction enzymes Bsa I and SacI; (c) schematic diagram of the genome editing vector cloned with guideRNA sequence targeted to the GOI.

2 Breeding for Yield and Quality Improvement

2.1 Pre-breeding and breeding approaches for developing major biotic stress resistance in Jute

J.K. Meena, K.N. Chourasia, K. Mandal and S. Satpathy

Project code: In-house Project-JB 10.7

Four F_1's JRO-524 × OIJ-161, JRO-204 × OIJ-161, JRO-2407 × OIJ-161 and JROG1 × OIJ-161 were successfully backcrossed with JRO-524, JRO-204, JRO-2407 and JROG-1 recurrent parents to develop the Bc_1. Among these BC_1s (JRO-204 × OIJ-161) × JRO-204 produced highest dry fibre weight and plant height followed by (JRO-524 × OIJ-161) × JRO-524, (JROG1 × OIJ-161) × JROG1 and (JRO-2407 × OIJ-161) × JRO-2407. These BC_1s will be advanced to next breeding generation.

Recurrent parents	Donor parents
JRO-524	WCIN-136-1
JRO-204	WCIN-179
JRO-2407	
JROG1	
Cross combinations	
JRO-524 × WCIN-179	JRO-204 × WCIN-179
JRO-524 × WCIN-136-1	JRO-204 × WCIN-136-1
JRO-2407 × WCIN-179	JROG1 × WCIN-179
JRO-2407 × WCIN-136-1	JROG1 × WCIN-136-1

Based on preliminary evaluation trial of 70 germplasm of tossa jute for yellow mites (count/cm^2 leaf area) in field OIJ-295 (10.29/cm^2), OIN-082(10.43/ cm^2), OIJ-98 (10.84/cm^2) and OEX-032(10.97/cm^2) exhibited significant tolerance.

Back-Cross combinations	Number of crosses attempted	Seed set (%)
(JRO-524 × OIJ-161) x JRO-524	10	18(90)
(JRO-204 × OIJ-161) x JRO-204	10	17(85)
(JRO-2407 × OIJ-161) x JRO-2407	10	19(95)
(JROG1 × OIJ-161) x JROG-1	10	19(95)

OIN-092(54.77/cm^2), OIN-66 (66.77/cm^2) and OIN-057 (52.89/cm^2) were exhibited high susceptibility. Similarly, 70 germplasm of tossa jute were evaluated for stem rot (lesion length) in field. Among these OMU-42 (1.61cm) and OIJ-143 (1.55 cm) exhibited significant tolerance against stem rot disease. While, OMU-19 (3.96 cm), OIJ-249 (3.37cm), OIN-301(3.54 cm), OIN-212(3.64 cm),

OIN-120(3.34 cm), OIN-456(3.63 cm), OIN-503(3.53 cm), OIN-570(3.46 cm), OIN-577(3.63 cm), OIM-25(3.43 cm) and OIM-54(3.49 cm) exhibited high susceptibility for stem rot disease.

2.2 Maximizing fibre productivity in jute through genetic and agronomic approaches

K.N. Chourasia, J.K. Meena, J. Mitra, P. Satya, S. Sarkar, S. Mitra, S. Ghosh and R.K. De

Project code: In-house Project- JB 10.5

Characterization of germplasm for fibre yield and yield-contributing traits: The characterization of germplasm for fiber yield in jute plays a pivotal role in breaking the yield barrier. It enables targeted breeding efforts, adaptation to changing conditions, and the development of varieties that can withstand biotic and abiotic stresses, ultimately leading to increased and sustainable jute fiber production. A total of 50 *C. capsularis* germplasm was evaluated for fiber yield, plant height, and basal diameter. Plant height ranged from 85 cm (CIJ 166) to 352 cm (CIJ 027), whereas basal diameter varied from 11 mm (CIJ 165) to 24 mm (CIJ 038). The highest fibre yield was recorded in germplasm in CIJ 044 (14.7 gram/plant).

Hybridization in Jute: Continuous hybridization in jute breeding is an important task for the incorporation of valuable genes into elite material and to create genetic variation. JROBA 3, JROBA 4, and JRO 524 were used to cross 5 promising F_3 family populations. In total, 60 crosses were attempted, and among them, 37 were successful. Similarly, in white jute, JRC 517, JRCP 6 and JRCP 7 were used to cross 5 promising F_3 family populations.

Table 4. Range, mean and CV of F_3 progeny in *C. olitorius*

Characters	Range	Mean	CV(%)
Plant height (cm)	322-483	387	18.6
Basal Diameter (mm)	9.6-19.4	15	21.3
Fibre yield/plant (g)	09-28.5	20.4	23.5

Evaluation of segregating generation in jute: In *C. olitorius,* 220 single plant progenies of F_3 from ten crosses were evaluated; Table 4 provides the mean, range, and CV for important fiber-related characteristics. Similarly, in white jute, 195 single plant progenies of F_3 from ten crosses were evaluated. Plants of the F_3 generation exhibited a large variation in fibre yield. F_3 progenies exhibited promising traits such as stem rot resistance, non-branching, and non-flowering.

Genetic diversity analysis in white jute for seed characteristics: The current study was undertaken to analyse the genetic diversity of 47 white jute genotypes based on eight characters including seed yield and contributing characters. The result indicated that forty-seven genotypes (indigenous, exotic, and improved) were grouped into five clusters based on Mahalanobis' D^2 analysis. Seed yield contributed the most to diversity (47.27 percent), followed by pod length (12.21 percent) (Fig. 8). The germplasm line CIJ 44 produced the highest seed yield of 31.05 g per plant, with 64.5 pods per plant, a pod length of 9.75 cm, and a number of seeds per pod of 31.85.

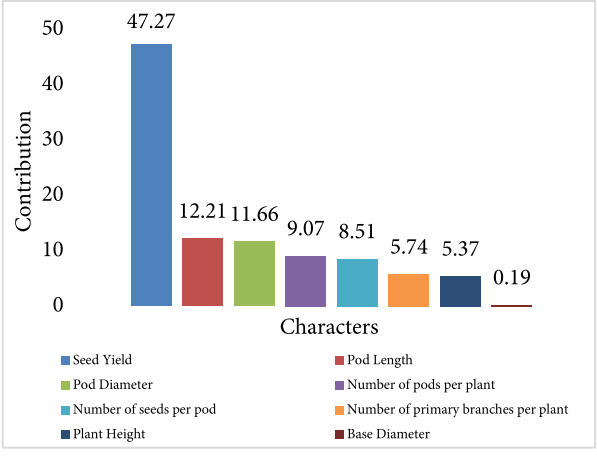


Fig. 8. Percent contribution of 8 characters towards diversity in white jute germplasm lines

2.3 Chemical mutagenesis for creating variability in tossa jute and roselle

N. Mohan, Thribhuvan R., and S.K. Pandey

Project code: In- house project-JB 10.9

Mutagenesis in tossa jute with Ethyl Methane Sulfonate: A chemical mutagenesis experiment was performed in tossa jute using ethlyl methane sulphonate (EMS) in order to create variability and obtain promising mutant lines by creating random mutagenic lesions in the genome of *Corchorus olitorius* (L.). The dose standardization experiment is conducted in jute by using JRO-524 at varying concentrations of EMS (1%, 1.25%, 1.5%, 2%, and 2.5%) treated for varying durations of chemical exposure (1 hour, 4 hour, and 8 hour). The seed mortality rate was taken as a criterion to determine the lethal dose of ethyl methane sulfonate. The experiment results reveal that there is an increasing trend in the seed mortality rate with an increase in the dose of chemical mutagen and enhanced hours of treatment duration (Table 5).

Table 5. Dose standardization results in tossa jute

Treatment	Duration and germination %		
	1 hour	4 hour	8 hour
Control	97	91	90
1% EMS	80.50	44.50	41
1.25% EMS	45	32.50	29
1.5% EMS	27	22.50	13.50
2% EMS	18.50	17	10
2.5% EMS	12	10	2.50

The lethal dose 50 value (Ld_{50}) of tossa jute is observed at a concentration of 1% of EMS treated for 4 hours. Validation of these results was done on popular tossa jute varieties, viz., JRO-204 and JROBA-3. Mutated seeds (M0) of treated JRO-524 were grown in the field to raise the M1 generation. Various morphological mutants were observed in the M_1 generation (Fig. 9).

Fig. 9. Various morphological variants observed in M1 generation of JRO 524

3 Genetic Resources and Crop Improvement

3.1 Introduction, maintenance, characterization and conservation of jute, mesta, sunhemp, flax and ramie germplasm

J. Mitra, Thribhuvan R., S.K. Sarkar, and A. Bera

Project Code: In-house Project-JB 1.1

Regeneration and evaluation: A total of 556 jute and allied fibre germplasm lines were regenerated, which include wild mesta (110), sunnhemp (258), roselle (14), mutant (28), exploration material (48), and wild jute (98). A total of 150 germplasm lines of *C. oliotorius* were assessed on February 15, 2023,

and March 1, 2023, sowing to determine their tolerance to pre-mature flowering. Out of these lines, about 7 exhibited pre-mature flowering tolerance, with less than five percent of the plants showing flowering at an early stage.

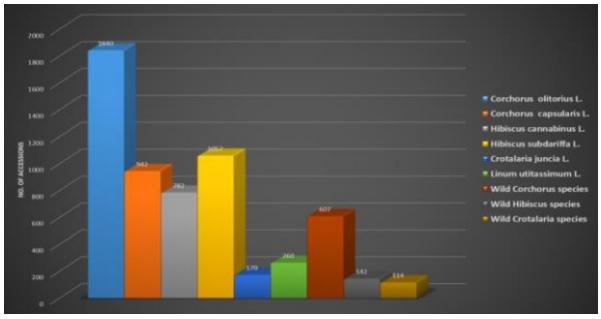


Fig.10. Species wise germplasm lines conserved at ICAR-CRIJAF

Maintenance: The medium-term storage facility at ICAR-CRIJAF, Barrackpore, now houses a collection of around 5914 germplasm lines of jute and associated fibers (Fig. 10). Around 80 Ramie germplasm lines are now being conserved in a field gene bank located at RAS, Sorbhog, Assam.

Distribution: A total of 269 jute and allied fibres germplasm lines were distributed to ICAR-CRIJAF scientists and other indenters (Table 6).

Table 6 . Species wise distribution status of jute and allied fibre germplasm to indenters

Crop/species	ICAR-CRIJAF	AINP-JAF	Others/SAU
C. olitorius	70	--	--
C. capsularis	74	--	--
Wild Corchorus spp.	14	--	--
Roselle	--	50	--
Mesta	--	50	--
Varieties	11	--	--
Grand total		269	

Collection: A field expedition was undertaken to explore and collect mesta and roselle, along with other allied fiber germplasm, from various regions within the districts of Purulia, Jhargram, Banduan in West Bengal, and East Singhbhum district of Jharkhand (Fig. 11). A total of 44 germplasm lines of roselle (16), wild corchorus (10), tossa jute (8), wild mesta (4), and sunhemp (2) were collected.

Fig. 11. (a) Survey Area for exploration (b) Jute and allied fibres germplasm collection from West Bengal and

3.2 Genetic enhancement of fibre quality traits in tossa jute (*Corchorus olitorius*)

Thribhuvan R., J.K. Meena, and R.K. Naik

Project Code: In-house Project-JB 10.8

Evaluating the fibre quality of the released varieties of jute: The process of objectively assessing the quality of the fibre was repeated, and the results obtained were consistent with those from the previous year. 23 olitorius varieties and 22 capsularis varieties were evaluated for fibre strength and

fineness under optimum conditions, i.e., retting under free-flowing water along with CRIJAF-SONA. The fibre fineness of *C. olitorius* varieties varied from 2.73 tex (JBO-1) to 3.96 tex (JRO-620) (Fig. 12), and fibre fineness of *C. capsularis* varieties varied from 1.22 tex (Monalisa) to 2.47 tex (Padma) (Fig. 13). Likewise, fibre strength of olitorius varieties varied from 19.51 g/tex (JRO-2407) to 27.05 g/tex (Tarun) (Fig. 14). The fibre strength of capsularis varieties varied from 15.58 g/tex (AAUCJ-2) to 24.56 g/tex (JRC-698) (Fig. 15).

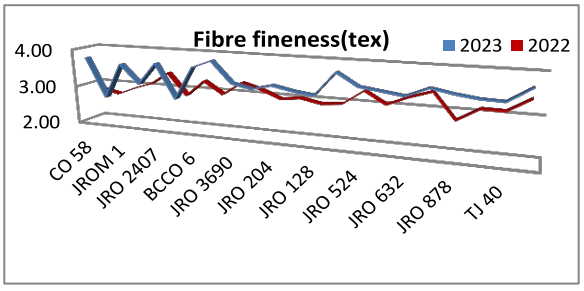


Fig. 12. Fibre fineness profile of olitorius varieties

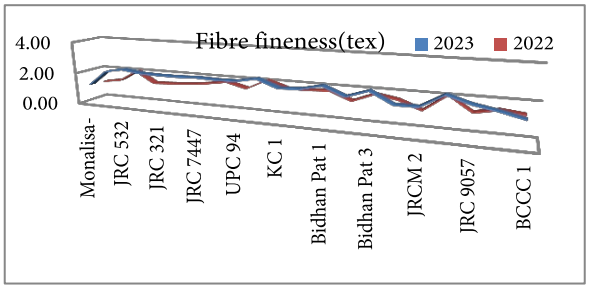


Fig. 13. Fibre fineness profile of capsularis varieties

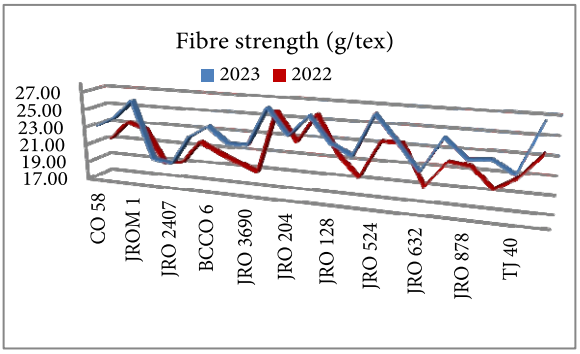


Fig. 14. Fibre strength profile of olitorius varieties

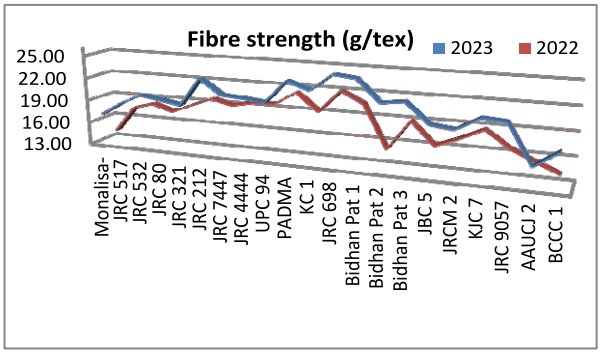


Fig. 15. Fibre strength profile of capsularis varieties

Evaluating for fibre yield and related traits: We used fibre yield and related traits data obtained from both olitorius and capsularis varieties to study the relationship between fibre yield and fibre quality. We found that greater values for plant height, stick weight, green weight, and fibre strength except fibre fineness have accounted for high fibre yield in tossa jute, while greater values for plant height, stick weight, green weight, including fibre fineness and strength, have accounted for high fibre yield in white jute (Table 7).

Table 7. Correlation among fibre yield and fibre quality traits in tossa jute and white jute

Characteristics	Green weight (g)		Plant height (cm)		Basal diameter (mm)		Dry stick weight (g)		Dry fibre weight (g)		Fibre fineness (tex)	
	tossa jute	white jute	tossa jute	white jute	tossa jute	white jute	tossa jute	white jute	tossa jute	white jute	tossa jute	white jute
Plant height (cm)	0.56	0.41										
Basal diameter (mm)	0.34	0.43	0.54	0.58								
Dry stick weight (g)	0.94	0.98	0.55	0.44	0.27	0.42						
Dry fibre weight (g)	0.93	0.89	0.59	0.43	0.38	0.41	0.88	0.87				
Fibre fineness (tex)	-0.12	0.10	-	0.32	-	0.28	-	0.12	-	0.17		
			0.06		0.15		0.04		0.06			
Fibre strength (g/tex)	0.28	0.18	0.07	0.39	0.01	0.39	0.26	0.16	0.34	0.28	0.21	0.59

Germplasm selection for making crosses based on fibre fineness: Screened 46 olitorius germplasm for fibre quality traits and found lines with fineness as low as 1.1 tex (OIN-885 and OIN-1106). Hybridization has been attempted during the year 2023 between agronomically superior, high-yielding varieties (JRO-7835, JRO-3690, JRO-204, and JRO-2407) with germplasm having very fine fibre (OIN-885, OIN-1106, OIN-923, OIN-1207, OIN-1181, OIN-1166 and OIN-1001).

3.3 Genetic improvement of flax (*Linum usitatissimum*) for higher fibre productivity and fibre quality

J. Mitra, D. Saha, and K. Mandal

Project Code: In-house project-JB 10.3

Evaluation of segregating generation in flax: An evaluation of 60 single plant progenies of F_5 from seven crosses was done during Rabi 2022–23 (Fig. 16). The mean, range, and CV% for important fibre-related traits are given in Table 8. Based on promising traits such as tall height, bold stems, fewer axillary branches, late flowering, and staying green, 12 superior lines were selected. Consequently, a total of 12 F_6 lines from seven crosses are being evaluated in the current 2023–24 Rabi season for further generational advancement. In addition, four F_5 lines and four F_4 lines have also been sown for evaluation and selection.

Table 8. Range, mean and CV% of F_4 progeny in flax

Characters	Range	Mean	CV (%)
Pl ht (cm)	96.3 – 160.9	110.3 ± 6.25	14.50
BD(mm)	1.0 - 6.3	2.6 ± 0.29	18.40
Green wt/pl (g)	10.0-190.3	54.7 ± 6.22	24.34
Fibre yield/pl (g)	0.3-6.7	1.7 ± 0.12	36.89

A total of 357 germplasm lines, including 90 exotic accessions, are under maintenance breeding.

Fig. 16. Evaluation of F 5 generation in flax during Rabi 2022-23

Screening germplasm for resistance to Rhizoctonia wilt: A total of 56 flax germplasm lines and four related species (*L. africanum*, *L. angustifollinum*, *L. tenus, and L. galicum)* were screened for *Rhizoctonia* wilt under the sick plot conditions. Among these, FT-999 and FT-1006 (both *L. usitatissimum*) and one line of *L. tenus* were the least affected. On the other hand, flax accessions IC-96565 and IC-96560, with 25.9% and 43.5% mortality, respectively, were susceptible to this disease.

3.4 Protection of jute varieties and DUS testing

A. Bera and H.R. Bhandari

Project code: Externally Funded Project- PPVRFA, DA&FW

Three varieties each of two species of *Corchorus,* i.e., *olitorius* (J2122-2, J2122-5, and J2122-6) and *capsularis* (J2122-1, J2122-3, and J2122-4), were tested in the DUS trial during 2022–23. During the entire crop growth period, 17 DUS characters were recorded following the DUS test guidelines. In the case of *capsularis* varieties, all three were uniform in their expressions of DUS characteristics. Stem colour (characteristic 6) was green, leaf shape (characteristic 7) was ovate-lanceolate, and time of flowering (characteristic 12) was late (>100 days) in all *capsularis* varieties. Pod pigmentation (characteristic 14) was green, seed size (characteristic 16) was large (3.1–3.5 g), and seed

colour (characteristic 17) was chocolate brown in all these varieties Fig. 17. However, these three varieties were distinct from each other on the basis of fibre strength (characteristic-10) (J2122-1: average and weak; J2122-3: fairly good; J2122-4: fairly average) at both centers.

In the case of *olitorius* varieties, stem colour (characteristic 6) was green, and leaf shape (characteristic 7) was ovate-lanceolate in all varieties. Plant height (characteristic 8) was medium (301-400 cm) in J2122-2 and tall (> 400 cm) in both J2122-5 and J2122-6. Fibre fineness (characteristic-9) was fine (2.8–3.2 tex) in J2122-2 and very fine (< 2.8 tex) in both J2122-5 and J2122-6, whereas fibre strength (characteristic-10) was fairly good (23.5-26.4 g/tex) in J2122-6 and fairly average (20.5-23.4 g/tex) in both J2122-2 and J2122-5 in both centers. However, all these varieties were distinct from each other with respect to seed color (characteristic 17) (J2122-2: black; J2122-5: black with red ridge and apex; J2122-6: steel grey).

For maintenance of reference collection of jute, thirty varieties of tossa jute, viz., JRO 204, IRA, JRO 632, JRO 3690, JRO 66, JRO 524, JRO 7835, JRO 878, JRO 8432, S-19, JRO 128, JRO 620, JRO 36 E, Chinsurah Green, Sudan Green, Tanganyika-1, JRO 2345, KOM 62, TJ 40, CO-58, JRO 2407, Tarun, JBO 1, JROG 1, NJ7010, NJ 7050, NJ 7055, Bidhan Rupali, JROM 1 and NJ 7005 and twenty one varieties of white jute, viz., JRC 212, JRC 80, JRC 698, JRC 7447, JRC 4444, Padma, JRC 321, Monalisa, UPC 94, Bidhan Pat 1, Bidhan Pat 2, Bidhan Pat 3, KC 1, KTC 1, D 154, JRC 517, JRC 532, JBC 5, JRCM 2, KJC 7, and JRC 9057 were sown through the plant-to-progeny row method at both ICAR-CRIJAF, Barrackpore, and ICAR-CSRSJAF, Bud Bud (Fig. 18). A database of reference collections has been prepared after recording observations of 17 essential characters. A first-cycle DUS trial for two candidate varieties sent by PPVFRA during 2023 has been initiated.

Fig. 17. Seed coat colour in J2122-2, J2111-5 and J2122-6

Fig. 18. Field plot of DUS testing trial

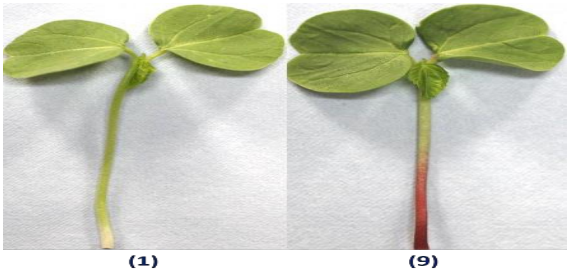
3.5 Development of DUS test guidelines for mesta (kenaf and roselle)

A. Bera and C.S. Kar

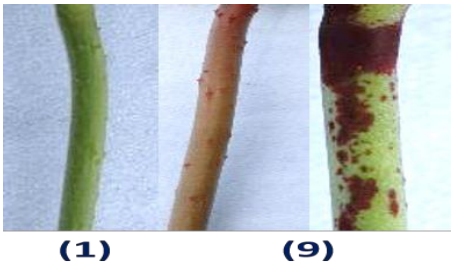
Project code: Externally Funded Project- PPVRFA, DA&FW

During the entire crop-growing season (2022–23), a total of 32 characters were recorded. Three characters cotyledonary leaf margin color, cotyledonary leaf collar pigmentation, and density of spine on stem did not show uniformity in expression over the locations and three characters. Flower eye zone extension, capsule dehiscence, and seed shape showed monomorphic expression at the species level. Again, three characters, *viz.*, leaf length width ratio, leaf blade angle, and days to 50% flowering, were not sufficiently diverse to classify them into separate groups, and 'flower bud colour' is

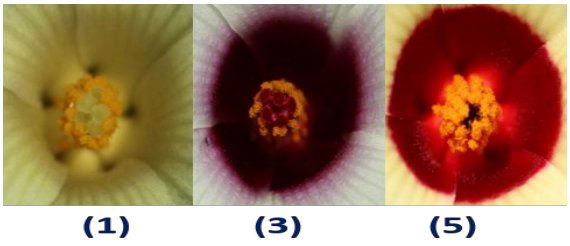
redundant with fruit colour, thus these 10 characters were not considered as DUS descriptors. Finally, based on uniformity and stability, out of 32 characters, 22 characters (hypocotyl pigmentation, leaf lobing pattern, leaf vein colour, leaf petiole pigmentation, leaf collar colour, leaf pubescence, stipule color, stem color, stem pubescence, presence of a spine on the stem, stem branching habit, plant height, fibre strength, fibre fineness, flower petal colour, flower eye zone colour, flower stigma colour, fruit colour, calyx length, fruit pubescence, seed coat colour, and thousand seed weight were found to be useful for establishing the distinctness of varieties.



Hypocotyl Pigmentation: Absent (1), Present (9)

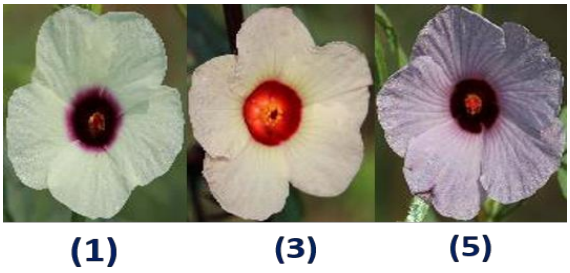


Leaf Petiole Pigmentation: Absent (1), Present (9)

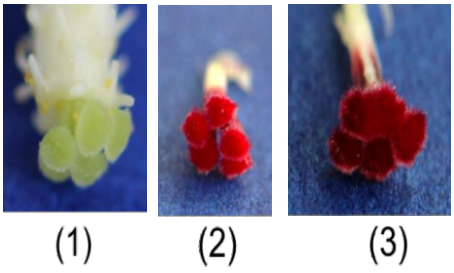


Flower Eye zone colour : Yellow (1), Purple (3), Red (5)

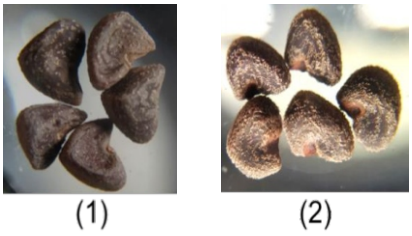
Stem colour: Green (1) Coppery red (3), Dark Red (5), Variegated (7), Other (9)



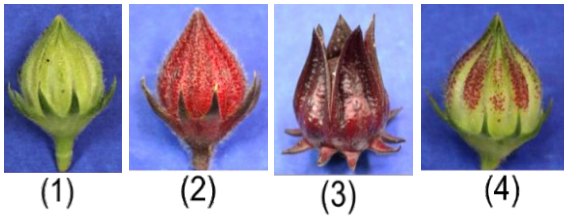
Flower Petal colour: Creamy Yellow (1), Pale yellow (2), Violet (3)



Stigma colour: Pale yellow (1), Red (2), Dark red (3)



Seed coat colour: Brownish Grey (1), Reddish Brown (2)



Fruit colour: Green (1), Red (2), Dark red (3), variegated (4)

Fig. 19. Descriptor states in mesta

In kenaf varieties, hypocotyl pigmentation was either absent (AMC-108) or present (MT-150). Plant height ranged from 3.58 m (JBMP 3) to 4.13 m (JBM 2004 D). The stem colour was either green (HC 583) or coppery red (JRHC 3). Stipule colour was either green (JBMP 2) or greyish-reddish orange (AMC 108). The fibre strength varied from 23.7 g/tex (JRM 3) to 28.23 g/tex (JBM 2004-D). The fibre fineness of kenaf varieties varied between 2.63 tex (JRM-3) and 3.62 tex (MT-150). Flower petal colour was either creamy yellow (JRM-5) or violet (JRHC-3), whereas stigma colour was either red (JRHC-3) or dark red (JBMP-2). Thousand-seed-weight varied between 24.61g (JRKM 9-1) and 32.01g (HC-583).

In Roselle varieties, leaf vein colour had three different states of expression, i.e., green (Balijipeta local), red (dark red roselle), and variegated (JRR-17). Leaf petiole pigmentation was either absent (Balijipeta local) or present (AMV-10) in roselle varieties. Leaf collar colour showed three different states of expression, i.e., green (Balijipeta local), red (JRHS-1), and variegated (HS-4288). Plant height ranged from 1.91 m (dark red roselle) to 4.30 m (AMV-2). Stem colour had four different states, i.e., green (Balijipeta local), dark red (JRHS-1), variegated (HS-7910), and others (green stem with red node) (HS-4288). Stipule colour was either (HS-4288) or variegated (HS-7910). The fibre strength of roselle varieties varied from 16.03 g/tex (dark red roselle) to 21.89 g/tex (JRR-17). The fibre fineness of roselle varieties varied from 3.01 tex (dark red roselle) to 3.79 tex (HS-7910). The stigma colour was either pale yellow (Balijipeta local) or dark red (AMV-7) in roselle varieties. Fruit colour showed four different states of expression, i.e., green (Balijipeta local), red (HS-7910), dark red (Dark red roselle), and variegated (HS 4288). Thousand seed weight varied between 19.86g (HS-4288) and 35.55g (Dark red roselle) in roselle varieties.

A draft DUS test guideline has been prepared based on 22 descriptors. The PPVFR Authority constituted one task force for the finalization of the DUS test guidelines for mesta.

4 Seed production

4.1 Quality seed production of Jute and allied fibre crops

C. S. Kar, H.R. Bhandari, A. Bera, and C. Chattopadhyay

Project code: Externally Funded Project- AICRP on Seed (Crops)

Nucleus Seed Production (NSP): A total of 360 kg of nucleus seeds of jute and allied fibres were produced (Table 9 to Table 10). Nucleus seeds of 31 varieties of jute (195.5 kg), 19 varieties of mesta (109.5 kg), 5 varieties of sunnhemp (50 kg), and 1 variety of flax, JRF-2 (5.0 kg), were produced (Table 11) as the source material for breeder seeds for next season (Kharif 2023).

Breeder seed production (BSP): During 2022–23, 8.29 q of breeder seed of 16 varieties of jute (12 *Corchorus olitorius* and 4 *C. capsularis*) was produced against DAC & FW, Govt. of India, indent of 7.79 q. Additionally, 0.14q of the Capsularis variety JRCM-2 was also produced to meet other requirements than DAC indent. For sunnhemp, 8.90 q of breeder seed of four varieties, namely, JRJ-610, SUN-3, SUIN-053, and SUIN-037, was produced against DAC & FW, Govt. of India, indent of 8.90 q. The seeds were distributed to various external agencies as per the allocation of the Department of Agriculture and Cooperation, Ministry of Agriculture, and Farmers' Welfare. The details of the indent and production are given in Table 12.

Table 9. Quantity of nucleus seed production in jute

Variety (C. Olitorius)	Quantity (Kg)	Variety (C. Capsularis)	Quantity (Kg)
JROBA3	2.5	BCCC-1	6.0
JROB2	4.0	AAUCJ-2	5.0
JBO2003H	6.5	Bidhanpat -2	10.5
JROMU-1	4.5	JRCM-2	5.0
JROG-1	4.5	JRC517	15.0
JROM-1	2.0	JRC 321	3.0
JRO2407	4.5	JRC80	9.5
CO-58	18.0	JRC 9057	6.5
JRO204	11.5	JRC 212	7.0
S-19	6.5	JRC 698	10.0
JRO128	6.5	JRCJ 11	21.0
JRO8432	3.0	JRC7447	3.5
JRO878	3.0	UPC94	2.0
JRO632	2.0	Bidhan pat 1	4.5
JRO3690	2.0	Total	108.5
KOM62	1.5		
JRO524	4.5		
Total	87.0	Total Jute	195.5

Table 10. Quantity of nucleus seed production in mesta

Variety (Kenaf)	Quantity (Kg)	Variety (Roselle)	Quantity (Kg)
JBMP-2	18.0	AMV-10	3.0
JBMP-3	2.0	AMV-9	4.0
JBMP-4	7.5	AMV-8	1.0
JBMP-5	7.5	AMV-7	3.5
HC583	6.0	AMV-5	4.5
JBM81	5.0	AMV-3	1.5
AMC108	8.0	JRR-17	4.5
JRKM9-1	4.5	CRIJAFR-2	7.5
Total	58.5	CRIJAFR-8	1.0
		HS4288	12.5
		HS7910	8.0
		Total	51.0
		Total Mesta	109.5

Table 11. Quantity of nucleus seed production in sunnhemp and flax

Variety		Quantity (Kg)
Sunnhemp		
	K12-yellow	0.5
	SUN053	20.0
	SUN03	15.0
	SUN037	9.0
	JRJ610	5.5
	Total	50.0
Flax	JRF-2	5.0

Quality seed production program (QSP): During 2022–23, a total of 1060.07 q of seed (40.6 Foundation, 984.01 Certified, and 35.46 q TL) of different crops were produced. Under foundation class, 35.80 q of 3 paddy varieties (MTU 7029, CR Dhan 800, and MTU 1153) and 4.8 q of 9 jute varieties (JROM 1, JRO 2407, JROB-2, JRO-524, JRO-204, JROMU-1, JROG-1, CO-58, and JBO 2003H) were produced. Under the certified class, 981.75 q of paddy (variety MTU 7029 and Shatabdi) and 2.26 q of jute varieties JRO-2407 and JROM-1 were produced.

Table 12. Breeder seed indent and production of jute and sunnhemp

Variety	DAC&FW indent (q)	Production (q)
Jute		
JROB-2	0.95	1.17
JRCJ-11	0.25	0.30
JROMU-1	0.50	0.72
JRO-2407	0.60	0.80
JROG-1	0.25	0.45
JRC-9057	0.10	0.20
CO-58	1.27	1.42
JRC-532	0.10	0.20
JBO-2003H	0.22	0.25
JRO-204	1.10	1.50
S-19	0.15	0.18
JRO-128	0.06	0.10
JRO-8432	0.02	0.05
JRO-524	1.90	0.50
JRO-878	0.10	0.20
JRC-212	0.22	0.25
	Other Indent	
JRCM-2	-	0.14
G Total	7.79	8.43
Sunnhemp		
JRJ 610	2.50	2.50
SUN-3	2.00	2.00
SUIN 053	3.20	3.20
SUIN 037	1.20	1.20
Total	8.90	8.90

Table 13. Seed production of jute, allied fibre and other crops

Crop	Quantity(q)
Jute(F)	4.80
Jute (C)	2.26
Jute (TL)	7.80
Paddy(F)	35.80
Paddy (C)	981.75
Mesta (TL)	2.18
Dhaincha(TL)	13.05
Sunn hemp (TL)	0.20
Mustard (TL)	3.97
Flax (TL)	0.60
Green gram (TL)	1.61
Wheat (TL)	6.05
Total	1060.07

In truthfully labeled class, 7.8 q of jute (19 varieties) were also produced. In allied fibre crops, 0.20q TL seed of sunnhemp (JRJ 610, SUN-3, SUIN-053, SULN-037), 2.18 q of Mesta (8 varieties: HC 583, AMC 108, JBMP 2, MT150, JBM 81, HS 4288, JRR-17, and HS 7910), and 0.60 q of Flax (JRF 2) were produced.

For other crops, 6.05 q of wheat (DBW 187), 3.97 q of mustard (B 9), and 13.05 q of dhaincha (local variety) TL seeds were produced. Regarding planting materials, 50 q ramie rhizome and 1 lakh bulbils of sisal were produced for supply to different government and private agencies (Table 13).

CROP PRODUCTION

Overview

JAF growing tracts of India are classified into nine agro-climatic zones comprising of the alluvial and red & lateritic soils and sandy loam to clay loam in texture. Alluvial soils are derived mainly from the deposition of the Ganges and the Brahmputra river systems and carry ample potash and phosphoric acid. They are, however, deficient in nitrogenous and organic compounds, resulting in low soil fertility and nitrogen use efficiency. JAF is predominantly grown as a rainfed crop by the marginal and small farmers. Drought, cyclone, insufficient quantity of retting water, and weed infestation are the most important issues in the changing climatic scenario, so, the Crop Production Division has been taken scientific research programmes aiming to develop economically viable and sustainable JAF production system.

Priorities & Thrust Areas

- Maintenance of soil health, recycling of organic wastes, and improvement in fertilizer use efficiency
- Microbial formulation for improved retting resulting in fibre quality to meet industrial requirement
- The carbon sequestration research for sustainable management of soil resources
- Integrated weed management, conservation agriculture, tillage and nutrient interactions
- Crop simulation modeling and remote sensing
- Farm mechanisation for energy efficient farming, economising cost of cultivation & drudgery reduction

Research Highlights of 2023

- The land use mapping of the Sundarbans region was done to monitor temporal dynamics of agril. and forest ecosystems.
- Balanced fertilizer application (100% NPK+FYM), the highest jute fibre yield (34 q/ha) under LTFE.
- The highest jute fibre yield (43 q/ha) was recorded under ST-TY+IPNS (target 40 q/ha) under STCR.
- Sprinkler irrigation in jute-rice-flax cropping system obtained superior plant growth and 21% higher water productivity.
- Jute variety JRCJ 11 recorded better plant height and fibre yield when subjected to waterlogging at 30-45 DAS than JRO 204.
- Ethanol produced from jute and kenaf cellulosic biomass can reduce GHG emissions by ~80% as compared with fossil fuels.
- INM recorded significantly higher jute fibre yield (3.54 t/ha) as compared to organic (3 t/ha) and natural (2.6 t/ha) farming.
- The large suckers and higher fertilizer dose yielded the highest fibre yield in sisal (1060 kg/ha).
- Leaf litter compost+50% NPK application may be an alternative to 100% NPK fertilizers for fibre crop production.
- Application of ipfencarbazone @ 90 g/ha (PE)+single wheel jute weeder at 21 DAS produced a higher fibre yield (35.5 q/ha).
- In flax, the INM treatments were statistically at par with the 100% RDN treatment with respect to plant height, dry matter and fibre yield of the crop, thereby indicating a 50% saving of the recommended fertilizer N dose.
- Phase-IX of the Jute-ICARE project was carried out in 200 blocks, covering an area of 1.85 lakh ha and involving 4.20 lakh farmers.
- From the laboratory-scale study, the wounding of jute stems prior to retting helps in the entry of microbes into the inner portion of the stem, which results in faster retting of jute.
- The optimized saccharification condition yielded maximum saccharification (76.48%) and maximum ethanol yield (21.5 g/l) after 24 hours of fermentation.
- The power-operated jute ribboner machine was developed for the extraction of jute ribbon from freshly harvested jute plants without breaking sticks.
- A weeder operated by a rechargeable dry cell battery has been developed by modifying the existing single-wheel jute weeder.
- Farm income enhancement through up-scaling of jute-based diversified products was done by providing training to farmwomen on the making of jute-diversified products.

1 Soil and Water Productivity

1.1 Land use and land cover mapping of the Indian Sundarbans region

D. Barman, S.K. Srivastava and G. Kar

Project Code: External Funded Project – APN Multinational Project

The Sundarbans, a UNESCO World Heritage Site, are the world's largest mangrove forest, composed of a network of low-lying conglomeration islands created from sediment loads deposited from Himalayan Rivers. These islands are mudflats with salt pans and natural levees that are separated by tidal creeks and provide the world's largest remaining habitat for the globally endangered Bengal tiger (*Panthera tigris tigris*). Sundarbans play a key role both ecologically by protecting the area from coastal erosion and for people's livelihoods by providing resources such as honey, fuelwood, and fish. This mangrove ecosystem, located in a tropical cyclone belt, demonstrates a complex interaction between social and ecological systems. The fluctuating water levels, temperature, and wind flow are affecting the topology of the area, making it prone to several natural hazards leading to the destruction of forest resources, especially under climatic change scenarios. The manual survey and interaction with local farmers revealed that the cultivation of jute was prominent in the localities of the Sundarbans regions, such as Canning, Sandeshkhali, and Sagar Island. Jute is still cultivated in some parts of the Sundarbans region, viz., Minakhan Block. Local farmers have reported that they were unable to cultivate jute and other crops as well after cyclonic events due to salt water intrusion into agricultural lands from the Bay of Bengal.

The Land Use Land Cover (LULC) analysis and mapping of the Sundarbans region in the state of West Bengal in India were carried out to provide information to help users understand the problems and prospects of the unique ecosystem. Survey. The Landsat data for the years 1988 and 2022 were used for LULC classification using the QGIS environment (Fig. 20). The Sundarbans region was classified into seven LULC classes, such as forest, vegetation, river, waterbody, fallow land, agricultural land, and built-up areas, for both years using the supervised classification method. The respective changes of these classes were -313.8, +139.0, -102.4, +259.0, +625.8, -1465.9, and +858.2 sq. km. The positive sign (+) denoted the increase of the area under a particular class, and the negative sign (-) denoted its decrease in the year 2022 from 1988. Over the past

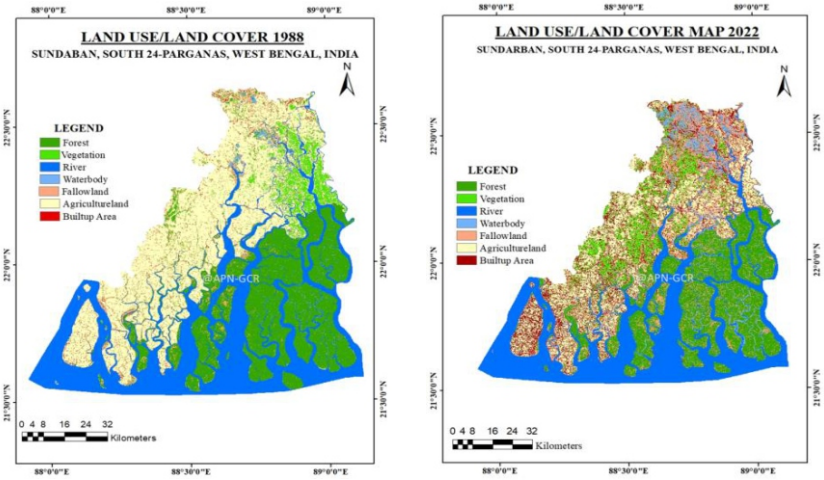


Fig. 20 . Land use and land cover maps of the Sundarbans region for the years 1988 and 2022

34 years, the lands under the forest, river, and agriculture classes have decreased substantially; however, the lands under other vegetation, waterbodies (other than rivers), fallow areas, and built-up areas have increased in the Sundarbans region. This LULC mapping will enable the monitoring of the temporal dynamics of agricultural ecosystems, forest conversions, surface water bodies, etc. on a timely basis for fulfilling the sustainable development goal in the Indian Sundarbans region.

1.2 Balanced application of fertilizer for maximizing jute fibre and grain yield in rice and wheat in a long-term fertilizer experiment

B. Majumdar and S.P. Mazumdar

Project code: Externally funded project-AICRP-LTFE

The long-term fertilizer experiment was initiated in 1971 with the objective of studying the effect of continuous application of various fertilizer treatments on the yield performance, nutrient removal, and physical, chemical, and microbial properties of the soil in a jute-rice-wheat cropping system. During the current year, application of 100% NPK recorded significantly higher fibre yield (26.1 q/ha) of jute over control, 50% NPK, and 100% N. The maximum fibre yield of jute (cv. JRO 204) was recorded with 100% NPK+FYM (34.2 q/ha), which was at par with 150% NPK (32.8 q/ha), but both treatments were significantly superior over all other treatments, including 100% NPK (Fig 21). Application of 100% NPK recorded significantly higher grain yields of rice (34.41 q/ha) and wheat (32.62 q/ha) over 50% NPK and imbalanced treatments like 100% N, 100% NP, and control. The maximum grain yield of wheat (cv. HD 2967) was recorded at 150% NPK (38.4 q/ha), which was at par with 100% NPK+FYM (37.9 q/ha), and both treatments were significantly superior over all other treatments, including 100% NPK (Fig. 3). In the case of rice (cv. IET4786/Shatabdi), the maximum grain yield was recorded with 100% NPK+FYM (41 q/ha), which was at par with 150% NPK (38.44 q/ha) but was significantly superior over all other treatments, including 100% NPK. Interestingly, no significant effect of Zn application on crop yields was noticed. The nutrient uptake pattern follows the same trend in all three crops as that of crop yield. The post-wheat soil analysis indicated that the incorporation of FYM with 100% NPK recorded the significantly highest organic carbon content (9 g/kg), while continuous cropping without any organic manure or chemical fertilizers resulted in the lowest organic carbon concentration in the control (6.1 g/kg) soil.

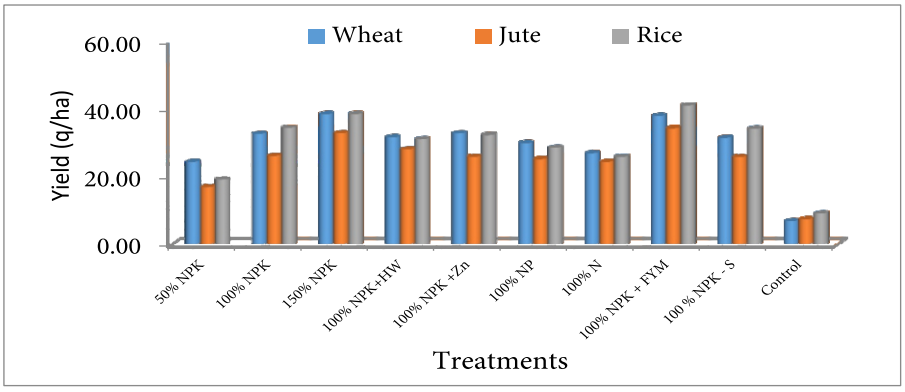


Fig 21. Effect of different fertilizer treatments on crop productivity of wheat, jute, and rice

Significant differences were noted among treatments in terms of nitrogen (N), phosphorus (P), and potassium (K) availability in the soil. The 100% NPK+FYM treatment recorded the highest available N (350.1 kg/ha), while the 150% NPK treatment recorded the highest available P (80 kg/ha) and K (285.4 kg/ha) availability in the soil. The integrated use of 100%NPK with FYM not only maintains the sustainable yields of crops but also improves soil fertility status in the long run.

1.3 Soil-test-based integrated plant nutrient supply system for sustainable jute-based cropping system

B. Majumdar, S.P. Mazumdar, S. Ghosh and N.M. Alam

Project code: External Funded Project-AICRP-STCR

The basic data for nutrient requirement (NR), soil, fertilizer, and organic efficiency, as well as the soil test IPNS-based targeted yield equations for jute (cv. JROM 1) and garlic (local variety), was developed from the field experiment conducted during the summer (2023) and rabi (2022-23) seasons. The targeted yield equations developed for mustard (cv. Kesari 5111) and jute (cv. CO 58) were previously verified under farmers' field conditions during 2022–23. The follow-up trials were conducted in Panchkahaniya village (Haringhata block, Nadia district, W.B.) at 6 locations covering about 1.7 ha area.

Table 14 Verification of IPNS fertilizer prescription equations for jute (cv. CO-58) in fields during the summer season of 2023 (mean value of six locations)

Treatments	Yield (q/ha)	Yield deviation	B:C Ratio
T1- Farmer's Practice	26.21	-	1.2
T2-RDF	30.42	-	1.4
T3-ST-TY1	37.04	(+)5.83	1.7
T4-ST-TY 2+ IPNS-1	39.54	(+)12.97	1.8
T5-ST-TY	41.63	(+)4.1	1.9
T6- ST-TY2+IPNS -2	43.25	(+)8.13	2.0

TY1- 35q/ha; TY2- 35q/ha

The application of inorganic fertilizers as per ST-TY achieved the targeted yield of 40 q/ha jute fibre with a (+) 4.1% deviation. Notably, integrating inorganic fertilizer with FYM further increased the jute fibre yield (43.25 q/ha) from the targeted yield of 40 q/ha with a more pronounced (+) 8.13% deviation and a B:C ratio of 2.0 (Table 14). Similarly, the verification trials of mustard achieved the targeted yield of mustard (12 and 15 q/ha) with the application of inorganic fertilizer on the basis of ST-TY with and without FYM. Specifically, ST-TY alone achieved the 15 q/ha mustard (cv. Kesari 5111) seed yield with a (+) 2.13% deviation, while integrating FYM with inorganic fertilizer exceeded the target yield (16.32 q/ha) with a notable (+) 7.47% deviation. The yields of jute and mustard from farmers' practices and the recommended dose of fertilizer application were significantly lower than the application of fertilizer on a ST-TY basis. These findings showed the efficacy of the proposed equations and highlighted the potential for integrated fertilizer strategies to optimize jute and mustard yields in the region.

1.4 Quantitative screening of the phosphate and potassium solubilization abilities of bacterial isolates in the culture medium

Lavanya A. K., S. Saha, S. Datta, S.K. Sarkar and D. Datta

Project code: In-house project-JA 8.7

A total of fifty-three rhizobacteria exhibited phosphate solubilization ability based on qualitative screening by dot culturing of single bacterial colonies on plates with Pikovskaya's medium

containing tricalcium phosphate (TCP) as the sole PO_4^{3-} source and eighteen rhizobacteria exhibited potassium solubilization ability based on qualitative screening by growing the dot culturing of single bacterial colonies on plates with Aleksandrov medium containing inorganic potassium alumino silicate as the K source.

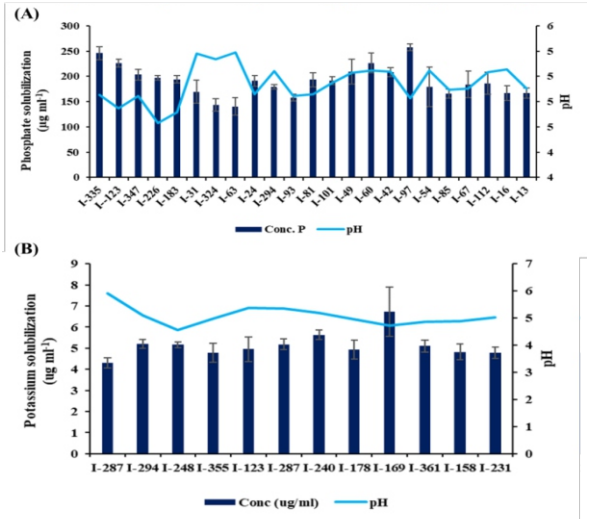


Fig.22. (A) Quantitative tricalcium phosphate solubilization ability of bacterial isolates and pH change in liquid Pikovskaya's medium after 10 days of incubation (B) Quantitative potassium alumino silicate solubilization ability of bacterial isolates and pH change in liquid Aleksandrov medium after 10 days of incubation

All these bacterial isolates were isolated from the rhizosphere soil of jute-growing fields in the Nadia, North 24 Parganas, Hooghly, and Murshidabad districts. Quantitative estimation of phosphate and potassium solubilization in Pikovskaya's and Aleksandrov broth, respectively, was carried out with the bacterial isolate (0.3 ml inoculum), and autoclaved un-inoculated medium served as a control. Available phosphorus and potassium in the culture supernatant were measured by following standard protocols, and the pH of the supernatant was measured using a pH meter. Among fifty-three phosphate solubilizing bacterial isolates, 23 isolates had higher phosphate solubilization ability; among them, 7 isolates exhibited the highest solubilization ability (>200 µg/ml): I-335, I-123, I-347, I-49, I-60, and I-42 (highest, I-97: 258 µg/ml), whereas among eighteen potassium solubilizing bacterial isolates, 6 isolates exhibited higher potassium solubilization ability (>5 µg/ml): I-294, I-248, I-287, I-240, and I-361 (highest, I-169: 6.72 µg/ml) (Fig.22). Based on the results, these bacterial isolates will be used for further studies.

1.5 Precision irrigation scheduling for augmenting yield, resource-use efficiency, and water productivity in Jute-based cropping systems

S. Ghosh, G. Kar, S. Mitra, A.K. Singh, T. Samajdar, R.K. Naik and D. Barman

Project Code: In-house Project- JA 8.8

Sprinkler irrigation in the jute-rice-flax cropping system was evaluated for various plant growth and yield parameters as well as soil physico-chemical properties. In the first year of study, flax under sprinkler irrigation (15 mm) at 50% depletion of available soil moisture showed superior crop biometric parameters throughout the growing period, which led to significantly higher fibre yield (14.2 q/ha) over conventional practice (surface irrigation 50 mm at 25, 45, and 75 DAS) (Fig. 23a). Sprinkler irrigation at 50% DASM (145 mm irrigation application) obtained 28% higher irrigation water use efficiency compared with conventional practice (Fig. 23b). In Jute during 2023, sprinkler irrigation at 50% DASM (15 mm per application) and 75% DASM (20 mm per application) obtained superior plant growth and yield parameters and was at par with surface irrigation at 75% DASM (40 mm per application). Sprinkler irrigation at 50% DASM showed 36% higher jute fibre yield compared with control (1 post-sowing irrigation) (Fig. 24). Irrigation application under different treatments, viz., sprinkler at 50% DASM, sprinkler at 75% DASM, surface irrigation at 75% DASM, and control (1 post-sowing irrigation), was 130 mm, 120 mm, 170 mm, and 50 mm,

respectively, while total rainfall during the jute growing period was 555 mm. Sprinkler irrigation at 50% DASM obtained 21% higher total water productivity (irrigation + rainfall) compared with control.

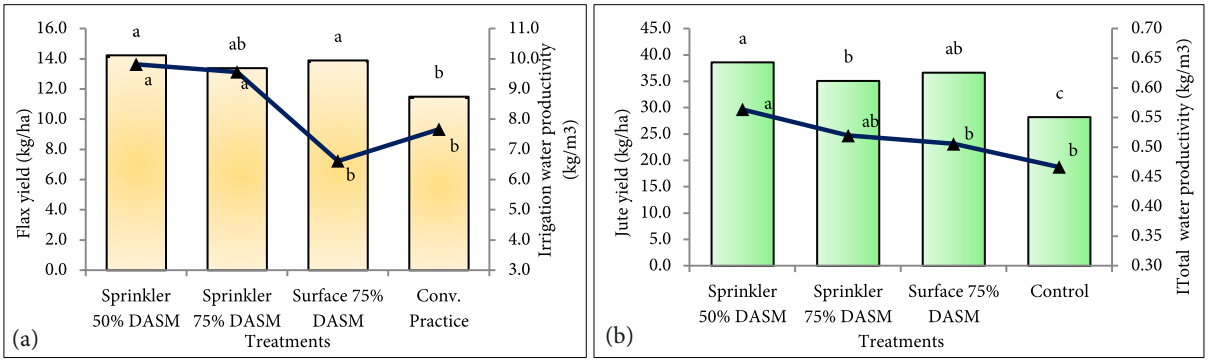


Fig. 23. Crop yield and water use efficiency of flax and jute under different irrigation methods

Fig. 24. Performance of sprinkler irrigation in flax and jute during 2022-23

1.6 Water management strategies for profitable and sustainable jute cultivation under rainfed and irrigated ecosystems

D. Datta, A.K. Singh, D. Barman, N.M. Alam, R.K. Naik and G. Kar

Project Code: In-house Project-JA8.5

A study was conducted to standardize irrigation scheduling in jute based on available soil moisture depletion (DASM) and crop evapotranspiration (ETc). Superior biometric observations were obtained under no stress control [field capacity (FC) throughout], followed by irrigation at 75% DASM with 100% ETc and 50% DASM with 75% ETc, while lower values coincided with stressed control (1 post-sowing irrigation) and farmers' practices. Among irrigation scheduling, maximum fibre yield was obtained under 75% DASM with 100% ETc, followed by 50% DASM with 75% ETc, while the lowest yield was observed in stressed control. Irrigation scheduling led to yield increments in the treatments by almost 15–22% in comparison to the stressed control. Water productivity in irrigation at 75% DASM with 100% ETc was 20–24% as compared to stressed plots.

Another objective of this project was to find the effect of waterlogging at different days after sowing on jute

ecotypes. Waterlogging was imposed at 30, 45, and 60 DAS for 15 days and was compared with a normal sowing condition with proper drainage (Fig. 25).

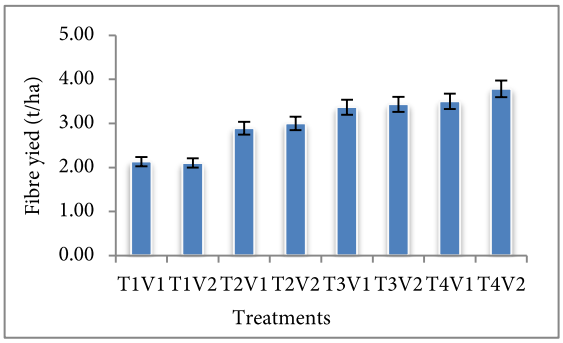


Fig. 25. T1 is waterlogging imposed at 30 DAS, T2 is waterlogging imposed at 45 DAS, T3 is waterlogging imposed at 60 DAS, T4 is normal sowing condition with proper drainage, V1 is JRCJ 11, and V2 is JRO 204

Two varieties were selected, viz., JRO 204 (*C. olitorius*) and JRC J11 (*C. capsularis*). A severe reduction in plant height by 30–35% was noticed when waterlogging was imposed on 30 days of seedling. However, when standing water was imposed at the relatively mature stage (60 DAS), plant height reduction was much less than before (11–15%). The waterlogging condition imposed on 30 days of seedling for 15 days reduced SPAD values by 10–12% in both *capsularis* and *olitorius*. Variety JRCJ 11 recorded better plant height when subjected to waterlogging at 30 and 45 DAS than JRO 204. There was a decrease in the fibre yield of JRO 204 and JRC J11 by 39–44% when waterlogging was imposed at 30 DAS and 17–21% at 45 DAS, while the decrease was only 4-9% when waterlogging was imposed on 60 DAS crops. Waterlogging reduced fibre yield more in JRO 204 and both species were able to tolerate waterlogging imposed at later stages of growth.

2 Climate Change and Resilient Agriculture

2.1 GHG emissions for bioethanol production from lignocellulosic biomass of jute and kenaf feedstock

A.K. Singh, L. Sharma, P. Satya and G. Kar

Project Code: External Funded Project – NICRA Project

Energy security and the transition to a thriving low-carbon economy are essential for a developing nation like India. GHG emission reductions, one of the main objectives of biofuel policy, have been researched for a variety of feedstocks used in biofuel, such as maize, rapeseed, soybean, sugar beet, sugarcane, rye, sunflower, wheat, palm oil, etc. There is no report on GHG emissions that covers all practices for the production of bioethanol from jute and kenaf biomass (cultivation to industrial processing). In this study, we examined the life-cycle greenhouse gas emissions (GHG) and environmental impact of bioethanol production from the fermentation of sugars made from jute and kenaf feedstock combining soil carbon changes in accordance with the Renewable Energy Directive.

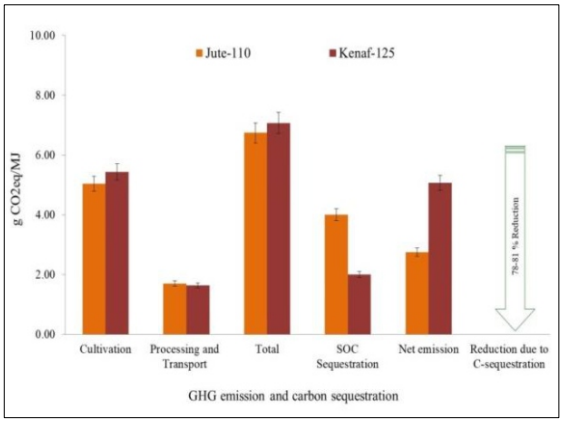


Fig. 26. GHG emissions for the production of bioethanol from jute and kenaf at the cultivation, bioethanol processing, and transport stages, along with soil carbon sequestration and saving of GHG emissions relative to fossil fuels

Life cycle assessment concept based on cradle-to-gate evaluation was used to estimate the GHG emissions as recommended by the International Organization for Standardization. System boundaries include four production steps: crop cultivation, ethanol processing, transports, and end uses. Additionally, emission reductions from soil carbon sequestration by jute and kenaf crop cultivation as well as emission reductions from surplus electricity co-generation were included. It was observed that net GHG emissions from crop production and bio-refinery from jute and kenaf ethanol were only 3.45 g/MJ and 5.88 g/MJ, respectively (Fig. 26). This result is much lower than any other feedstock like sugarcane bagasse, corn stover, rice straw, and wheat straw.

LCA analysis revealed that ethanol produced from jute and kenaf cellulosic biomass can reduce GHG emissions by 78–81 percent when compared with fossil fuels. Bioethanol made from jute and kenaf biomass material has the least negative effects on the environment and resource depletion. It might deliver approximately 70–75 percent of the ethanol requirement annually and may prove to be a workable technology for meeting ethanol-to-petrol blend targets, in addition to promoting ethanol as a domestic, non-polluting, environmentally friendly, and practically inexhaustible fuel.

2.2 Rainfall and temperature projections under climate change in the Indo-Gangetic Plains of India

G. Kar, A.K. Singh and D. Datta

Project Code: External Funded Project – DST-SEED Project

The two RCP scenarios (RCP4.5 and RCP8.5) were used to create the climate change scenarios for precipitation and ambient temperature (T_{max}, T_{min}) for the IGP region for the baseline period of 1983–2018 and the future period of 2030–2090. Both RCP4.5 and RCP8.5 scenarios exhibit similar spatial patterns of rainfall change. In the upper part of the IGP region, precipitation would be higher (6–8%) in the high emission scenario (RCP8.5) than under the RCP4.5 scenario. The Trans Gangetic Plain region (Punjab, Haryana) experienced the lowest rainfall according to the geostatistical analysis of normal rainfall data for the IGP, whereas the middle (Uttar Pradesh) and lower (Bihar, West Bengal) Gangetic Plain regions experienced more rainfall (Fig. 27). In contrast to the eastern half of the IGP (eastern Uttar Pradesh, Bihar, West Bengal), which has a humid climate with annual rainfall of 1000–1500 mm, the western portion of the IGP (Punjab, Haryana, western Uttar Pradesh) has a semi-arid climate with annual rainfall of 500–800 mm.

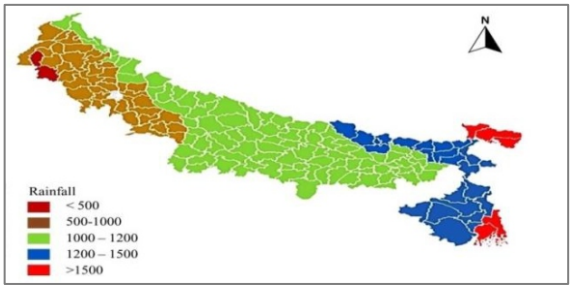


Fig. 27 .Normal rainfall distribution in the Indian Indo-Gangetic Plain

Crop production and farm returns likewise exhibit a downward trend from the western to the eastern IGP. The IGP's mean annual T_{max} exhibited an upward trend under both RCP scenarios. The temperature rise occurred in the upper and middle IGP, where T_{max} increased by 1.13 to 2.31 °C under RCP 4.5 and by 1.65 to 2.74 °C under RCP 8.5. Unlike the T_{max}, which increased more than the T_{min} under both scenarios, the T_{min} increased more under the two RCP scenarios at lower IGP. This suggests that GHG concentrations will have a significant impact on the pattern of precipitation and temperature in the IGP.

3 Crop Management

3.1 Surface energy balance measurement and its closure in tropical jute-rice-wheat cropping system using the eddy covariance technique

D. Barman, A. Chakraborty, A.K. Singh and G. Kar

Project Code: External Funded Project – ISRO National Carbon Project

The components of surface energy balance (SEB) and its closure are imperative to study global warming, climate change patterns, weather and climate forecasting, SEB modeling, etc. The SEB depends on many factors, such as thermal radiation received on the earth's surface; the surface characteristics, viz., wetness, vegetative cover, and albedo; and the characteristics of the overlying atmosphere, such as aerosols and greenhouse gases. To understand the temporal pattern of SEB and the influence of vegetative cover of jute-rice-wheat cropping sequence on SEB, the open path eddy covariance technique was used to measure the SEB components such as net radiation flux (Rn), sensible heat flux (H), soil heat flux (G), and latent heat flux (LE) at different growth stages of the crops to get various foliage coverage at the location of ICAR-Central Research Institute for Jute and Allied Fibres, Barrackpore, West Bengal (Fig. 28). To the best of our knowledge, this is the first report of energy balance in a jute-rice-wheat cropping system using the eddy covariance technique in India as well as around the world, which will be very useful for further research in surface energy budgeting and climate research.

During jute season (2018), daytime average Rn, G, H, and LE were 323.4 (±156), 9.0 (±8.4), 12.1 (±8.8), and 180.4 (±71.6), respectively.

The Rn was predominantly partitioned into LE (55.8%), followed by H (3.7%) and G (2.8%). The degrees of energy balance closure in the five consecutive growth stages varied from 58–65%, 63–65%, 57–60%, 59–63%, and 62–68%. Very strong positive correlations (R^2~0.94-0.98) between available and turbulent energy were observed in all five growth stages of jute.

In the rice ecosystem, diurnal and day-time SEB components were calculated at six different phenological stages, viz. vegetative, tillering to panicle initiation, reproductive stage, heading to flowering, ripening, and maturity. During daytime, the average Rn, G, H, and LE were 204.7 (±174.8), 10.4 (±19.3), 19.6 (±21.8), and 124.0 (±81.5) W m^{-2}, respectively. The Rn was principally partitioned into LE (60.6%), followed by H (9.6%), and G (5.1%). Day-time average Rn was highest in the reproductive stage (290.5± 200.0 W m-2) and lowest in the maturity stage (188.5± 155.6 W m-2). The energy balance closure was also computed for different phenophases of the rice crop. In the wheat ecosystem, diurnal and daytime SEB components were computed in eight different phenological stages, such as seedling, tillering, stem elongation, heading, flowering, milk, dough, and ripening stages. During daytime, the average Rn, G, H, and LE were 314.7 (±142.9), 14.2 (±20.3), 26.6 (±23.2), and 150.5 (±59.7) W/m^2, respectively.

Fig. 28 . Eddy covariance measurement of energy balance in a jute-rice-wheat cropping system at a research farm

The day-time average Rn was lowest (205.7 W/m^2) in the seedling stage and highest (385.0 W m^{-2}) in the ripening stage. The LE values were maximum in the maturity stage of jute, tillering to panicle initiation of rice, and flowering to milking stage of wheat. It implied that vegetative growth or above-ground active vegetation was at its peak on the ambient evaporative demands. This will help in formulating a water management strategy for the crops.

3.2 Standardization of organic and natural agriculture practices for jute-based agro-ecosystems

S.P. Mazumdar, G. Kar, S. Satpathy, S. Ghosh, B. Majumdar, S.K. Jha, R. Saha and S. Saha

Project Code: In-house Project JA 8.6

Natural and organic farming are considered to be effective procedures for the improvement of sustainable soil and environmental quality and the maintenance of ecosystem services in the soil. A study was initiated to evaluate the impact of low-cost natural farming, organic farming, conventional farming, and integrated farming on jute yield and soil properties. Different management practices significantly affected the yield attributes of jute. Yield attributes of jute were found to be highest under integrated nutrient management, followed by conventional, organic, and natural management. Integrated nutrient management, being on par with conventional or inorganic nutrient management, recorded significantly higher jute fibre yield (3.54 t/ha) as compared to organic (2.98 t/ha) and natural (2.59 t/ha) nutrient supply (Fig. 29a). Organic nutrient management recorded a 12.7% lower yield as compared to conventional (3.41 t/ha). The highest soil organic carbon, available N, P, and K, was found in organic management.

Integrated nutrient management, being at par with organic and conventional or inorganic nutrient management, recorded significantly higher rice yields as compared to natural means of nutrient supply (Fig. 29b). Performance of organic jute-based cropping systems was also examined. Primary information related to organic jute-based cropping systems was collected from 100 sample farmers in eight villages in the Baduria block of the North 24-Parganas district of West Bengal. The study area consisted of mainly three different cropping patterns: jute-rice-pulse, jute-rice-mustard, and jute-rice-vegetables. Higher numbers of farmers are applying FYM as compared to other organic fertilizers. Some farmers are applying mustard cake, and a few are applying vermicompost. About 50–60% of farmers are applying neem leaf extract at 15–30 days intervals for controlling pests and diseases. Similarly, 50–60% of farmers are treating with a garlic mixture, and jute yield varied from 2.91 t/ha to 3.06 t/ha.

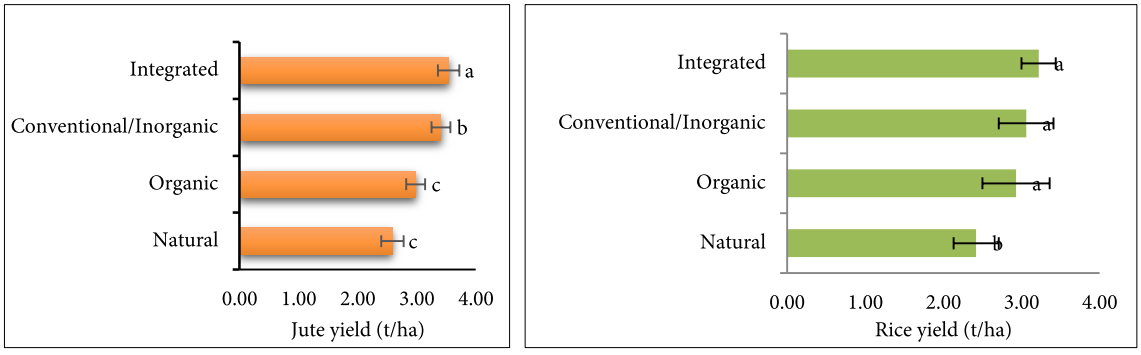


Fig. 29. Effect of nutrient management practices on (a) jute and (b) rice yield.

3.3 Growth and yield of sisal (*Agave sisalana*) and hybrid sisal as affected by planting materials and fertilizer levels

S. Sarkar, B. Majumdar and R.K. Naik

Project Code: In-house Project- SLA 1.7

Effect of sucker size and fertilizer level on Sisalana sisal: Irrespective of fertilizer dose, the highest number of leaves produced per plant was 45.9 in the case of a large sucker at planting, and irrespective of sucker size, the highest number of leaves produced was 45.0 in the case of the highest nutrient levels in Sisalana sisal. In the interaction effect, the highest number of leaf production was in the case of large sucker size at planting x highest fertilizer dose (47.8) (Fig. 30). From the recorded leaf parameters, it was noted that the mean leaf length of Sisalana sisal significantly varied with sucker size at planting and fertilizer dose. Irrespective of fertilizer dose, the longest leaf was produced by a large sucker at planting (108.9 cm); similarly, irrespective of sucker size, the longest leaf was produced by the highest fertilizer dose (106.8 cm). In the interaction effect of the two factors, the longest leaf (110.4 cm) was produced in large sucker x highest fertilizer dose, which was closely followed by and at par with the mean leaf length recorded in medium sucker x highest fertilizer dose (108.8 cm) (Fig. 31). Irrespective of fertilizer dose, the highest fibre yield of sisalana sisal was obtained in cases of large suckers (1059.8 kg/ha). Similarly, irrespective of sucker size, the highest fibre yield was recorded with the highest fertilizer dose (942.4 kg/ha). In the interaction effect, the highest fibre yield was obtained with a large sucker x highest fertilizer dose (1175 kg/ha) (Fig. 32).

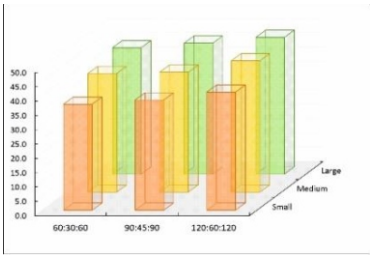


Fig. 30. Leaf number

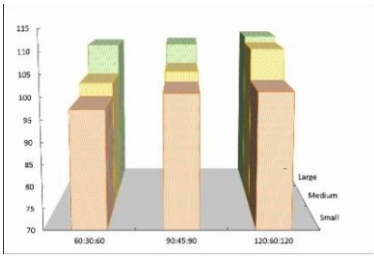


Fig. 31 . Leaf length (cm)

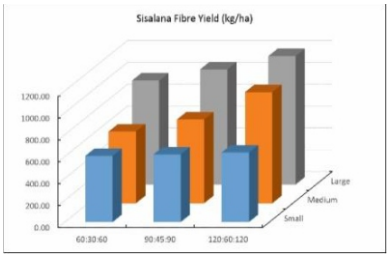


Fig. 32 . Fibre yield (kg/ha)

Effect of sucker size and fertilizer level on hybrid sisal: In the case of hybrid sisal, irrespective of fertilizer dose, the highest number of leaves per plant obtained was in a large sucker (64.5); similarly, irrespective of sucker size, the highest fertilizer dose produced the maximum number of leaves per plant (61.9). In the interaction effect, the highest number of leaves per plant (67.2) was recorded in large-sized sucker x highest fertilizer dose (Fig. 33). Irrespective of fertilizer dose, the longest leaf was produced by the large sucker at planting (92.2 cm); similarly, irrespective of sucker size, the higher nutrient levels produced the longest leaf (85.5 cm). In the interaction effect of the two factors, the longest leaf (94.6 cm) was produced by a large sucker x highest fertilizer dose (Fig. 34). It may be noted that just before harvesting the leaves of hybrid sisal in January 2023, the hybrid sisal plots were damaged (leaves eaten) by a herd of wild nocturnal animals (wild boar). Therefore, in general, the fibre yield was comparatively lower as compared to the previous year. Whatever fibre yield was obtained in different treatments is reported here. Irrespective of fertilizer leaves, the highest fibre yield was recorded with a

large sucker (693.2 kg/ha). Similarly, irrespective of sucker size, the highest fibre yield was recorded with the highest fertilizer dose (642.3 kg/ha). In the interaction effect of the two factors, the highest fibre yield was obtained with large sucker at planting x highest fertilizer dose (746 kg/ha), which was closely followed by the fibre yield obtained with large sucker x medium fertilizer dose (697 kg/ha) (Fig. 35).

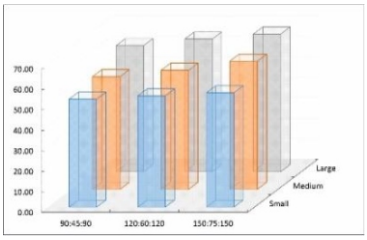


Fig. 33. Leaf number

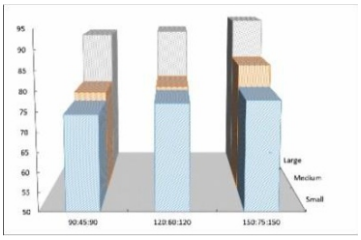


Fig. 34. Leaf length (cm)

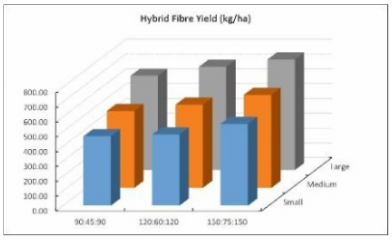


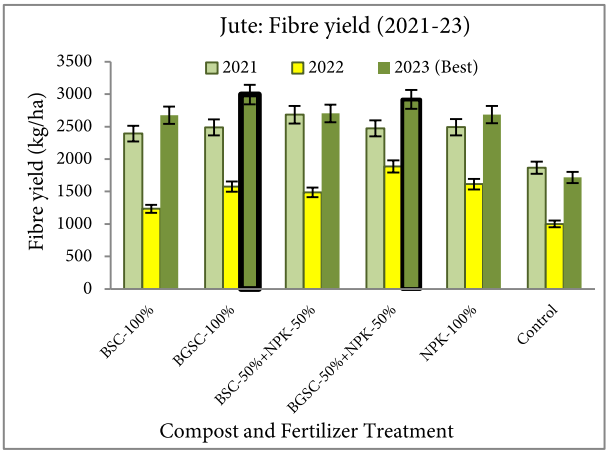
Fig. 35. Fibre yield

3.4 Effect of leaf litter composts on yield of jute, flax and ramie fibre crops

A.K. Singh, S. Mitra, B. Majumdar, M.L. Roy, S. Satpathy, S.K. Sarkar, and G. Kar

Project code: In-house project-JA 8.1

Tree leaf litter can be a potential source of plant nutrients if properly turned into compost by different bio-chemical decomposition methods to produce well-decomposed humus. A study was started in the years 2021–22 to decompose an admixture of tree leaf litter using effective microorganisms (BSC) and green sunnhemp plants (BGSC) under aerobic conditions and use it for fibre crop production. In the years 2022–23, this experiment was also repeated at ICAR-CRIJAF (Barrackpore) to observe the impact of two types of composts, BSC (leaf litter + effective microorganisms) and BGSC (leaf litter + fresh sunnhemp plants), alone or in combination with the 50% recommended dose of fertiliser NPK, on jute, flax, and ramie growth and fibre yield in South Bengal conditions. When compared to other compost treatments, the fibre yield of jute and flax was highest and at par with the application of NPK:compost (50:50) or with NPK 100% (Fig. 36.). Results indicate that application of compost (BSC/BGSC) and chemical NPK in a 50:50 ratio may be considered an alternative to using 100% of the recommended dose of NPK fertilizers for jute and flax fibre production.



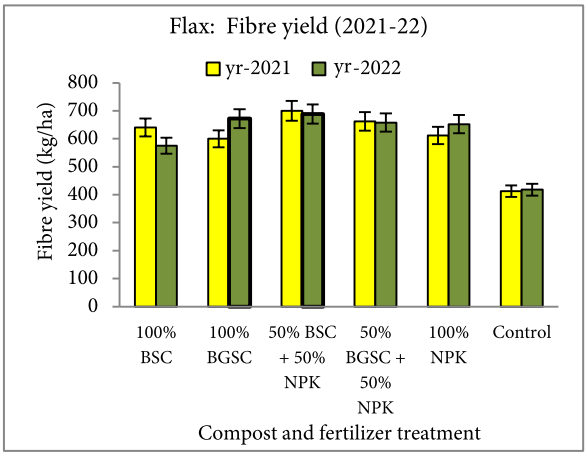


Fig. 36. Effect of compost and fertilizer on fibre yield of jute and flax

In the 2023 crop season, four cuttings of ramie could be taken at 60, 66, 61, and 59 days intervals, respectively, until mid-November. The highest value (21.69 q/ha) of total fibre yield (sum of four cuts) was recorded with the ramie crop receiving 100% NPK inorganic (T_5) fertilizer treatment, though the yield was statistically at par with the yield recorded (19.14 q/ha) with the 50% BSC + 50% NPK (T_3) (Fig. 37). All the fertilizer treatments (inorganic, organic, or combined) recorded significantly higher fibre yields of the crop over the control treatment (8.15 q/ha). An almost similar trend was recorded during the individual cuttings of ramie, where the highest fibre yields (3.82–6.69 q/ha) of the crop were recorded with the T_5 treatment, which was again statistically at par with both T_3 and T_4 except in the 2nd cut, when only the T_5 and T_3 treatments were statistically at par in this regard (Fig. 38).

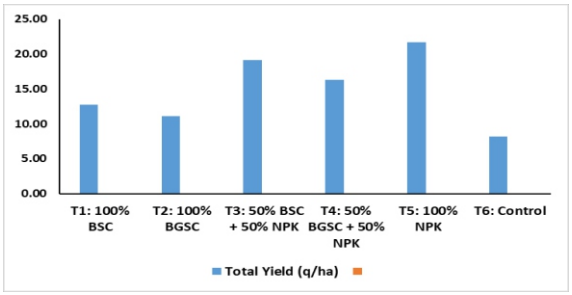


Fig. 37. Effect of INM on total fibre yield of ramie

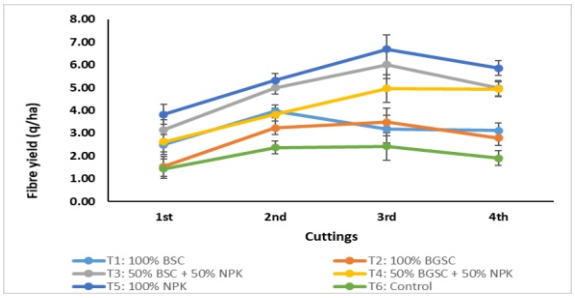


Fig.38. Effect of INM on fibre yield of ramie at different cuts

3.5 Effect of plant density and weed management practices on plant size composition and productivity of jute and modeling crop growth

A.K. Chakraborty, D. Datta, S.P. Mazumdar, N.M. Alam and R.K. De

Project Code: In-house Project –JST 6.3

To study the dynamics of jute plant size composition, an experiment was laid out in an RBD of 3×2 factorial treatment setup with 3 replications. The factors were weed control measures (rice straw mulch @ 5.0 t/ha+2HW (RSM), mungbean+1NW+1HW, and bare (2NW+2HW)) and jute plant population (3.5 and 5.0 lakh/ha with respective spacing of 30 cm×9.5 cm and 30 cm×6.6 cm). Jute (*cv.* JROBA 3) and mungbean (*cv.* Virat) were sown on March 10, 2023. A 10 days long heat wave (39–42°C) from April 10–20, 2023, turned a few mungbean leaves a coppery brown, but it did not damage flowers or pods in terms of number or size. A severe hailstorm on April 30 (50 DAS) caused significant crop damage by detopping jute plants (Fig. 39), leading to branching at 40–60 cm neck-height. The fibre yield was very low. Only the main effect of the weed control method significantly ($p<0.05$) influenced all the parameters under study. Cutting the jute branches (190-230 cm long) just above the branching node for maximizing fibre recovery was a tedious effort and caused fibre loss of 3.2 q/ha from the discarded 60-90 cm long bottom portions (Fig. 40). Hailstorm tattered mungbean leaves and stems and shredded a few flowers and pods. However, this extreme weather increased light incidence on mungbean plants to enhance seed yield (12.9–13.9 q/ha) in the intercropping system. Thus, mungbean became an ideal insurance crop in the jute-mung intercropping system under hailstorm duress. The sole mung yield was 15.2 q/ha. The incidence of *macrophomina* was recorded at 0.7% in RSM, 2.3% in mung intercrop, and 2.7% in bare cultivation.

The performance of new YMV-resistant green gram (Pusa 1431) and black gram varieties (PU 31, VBN 8, VBN 10, and VBN 11) under sole cropping and intercropping with jute (cv. JROBA 3) was explored in plots of size 3×4 m^2 sown on March 10, 2023. Green gram cv. Pusa 1431 yield was a little lower

than that of Virat in sole and jute intercropping. The black gram variety PU 31 matured in 65 days. Other black gram varieties (VBN 8, VBN 10, and VBN 11) matured late (84 days) and recorded seed yields of 12.08, 6.92, and 13.50 q/ha in sole cropping and 10.63, 8.50, and 10.63 q/ha in jute intercrop systems, respectively. The trial experienced heat waves and hailstorms, as detailed earlier. VBN 10 recorded a plant height of 30-35 cm in sole and 35-40 cm in intercropping and offered the least competition to jute plants (Fig. 41), unlike the green grams (Virat and Pusa 1431) and black grams (VBN 8 and VBN 11). PU-31 is also promising. These two new black gram varieties need further assessment. Another exploratory trial was conducted in small plots of 4 replications with 6 different spatial arrangements (square grids of 12 cm×12 cm and 16 cm×16 cm), rectangular grids of 25 cm×8 cm and 20 cm×10 cm, and broadcasting of jute seeds at 3.0 and 6.0 kg/ha, followed by two hand weedings. The effective plant population (plant height >300 cm) and medium (plant height 250- 300 cm) hovered around 3.5 lakhs/ha. Plants were harvested 113 days after sowing. Treatment variations did not significantly influence fibre yield. Effect of utilization of nitrogen added by mungbean residue and reduction in nitrogen application in the succeeding crop Sweet sorghum (CSH 22SS) in crop sequence was grown with two sowing methods (ridge-furrow and zero-till) along with two N doses of 75% and 100% of RD (80 kg/ha). Sweet sorghum was sown on July 22 and harvested on November 28, 2022. It attained 50% flowering 84 days after sowing (Fig. 42). The Brix values varied between 18.1 and 20.8, and the bioethanol concentration of sorghum juice (126 DAS) was 70.9 g/L; seed yield was nearly 6 t/ha; fodder yield at 90 DAS was nearly 80–85 t/ha; and stalk yield at 120 DAS was nearly 95 t/ha. Two other exploratory trials were conducted to assess the working efficacy of modified nail weeders.

Fig. 39. Damage of plants by hailstorm

Fig. 40. Bottom portions (60-90 cm long) of stem and collected fibre

Fig. 41. Black gram (cv. VBN 10) at 40 DAS in sole and intercropped with jute (cv. JROBA 3)

Fig. 42. Sorghum field at 50% flowering stage

3.6 Efficient weed management in jute by deploying herbicidal and mechanical methods

S. Sarkar, R.K. Naik, B. Majumdar and D. Datta

Project Code: In-house Project- JA 8.2

The highest *tossa* jute (cv. JRO 204) plant height (PH) at harvest (120 DAS) was recoded with two manual weeding treatments (357.5 cm). Among the herbicidal and mechanical weed management treatments, it was observed that ipfencarbazone @ 90 g/ha (PE) + nail weeder at 14 DAS produced the tallest jute pants (336.4 cm), closely followed by and at par with the PH obtained with ipfencarbazone @ 90 g/ha (PE) + single wheel jute weeder at 21 DAS (334.4 cm) (Fig. 43). Like PH, similar trends were observed in the case of jute basal diameter (BD) at harvest. The highest jute fibre yield was obtained with two manual weedings (37.9 q/ha). Among the herbicidal and mechanical weed management methods considered, application of ipfencarbazone @ 90 g/ha (PE) + single wheel jute weeder at 21 DAS produced a higher fibre yield (35.5 q/ha), closely followed by and at par with the fibre yield recorded with application of ipfencarbazone @ 90 g/ha (PE) + nail weeder at 14 DAS (35.4 q/ha) (Fig. 44). In both the efficacious combination treatments (herbicide and mechanical weeder), the fibre yield reduction due to competition from surviving weeds was only 6.5 and 6.7%, respectively, as compared to the fibre yield obtained in manual weeding treatment (Fig. 45). The stick yield of jute also followed the same pattern of fibre yield with the different weed management treatments. The obtained fibre was very good in terms of colour, strength, and fineness.

Study on soil enzymes activities at different days after application of herbicide in soil (same day after sowing) indicates that the Fluorescein diacetate hydrolyzing activity (FDHA) was initially reduced by about 44.8%, 26.4%, and 10.9% at 7, 15, and 30 DAS, respectively, in the ipfencarbazone 90 g/ha treatment. But the same enzyme activity was increased to about the initial value (1.508 µg fluorescein g/h) in the 90 g/ha treatment. However, in the ipfencarbazone 120 g/ha treatment, the same enzyme value was 18.7% less at 120 DAS (Fig. 46). The dehydrogenase activity was reduced by 58.9%, 53.0%, and 49.3% at 7, 15, and 30 DAS, respectively. At harvest (120 DAS), the said enzyme activity reached its normal level (5.195 µg TPF g/d) both in 90 and 120 g/ha herbicide treatments (Fig. 47). Due to the application of ipfencarbazone at 90 and 120 g/ha, the β-glucosidase activity was initially reduced. In the 90 g/ha treatment, the reduction was 34.1%, 31.6%, and 28.7% at 7, 15, and 30 DAS, respectively. The same enzyme value reached its initial value (12.92 µg pNP g/h) at 120 DAS (Fig. 48). The urease activity was not much affected by the application of ipfencarbazone at 90 or 120 g/ha (Fig. 49).

Fig. 43

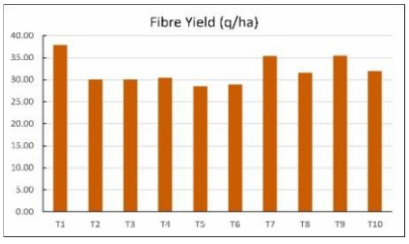


Fig. 44

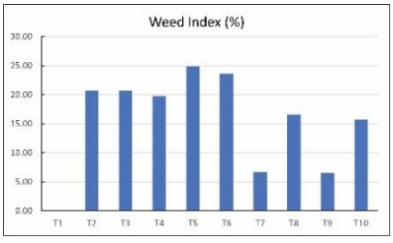


Fig. 45

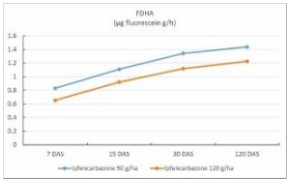


Fig. 46

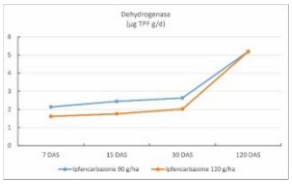


Fig. 47

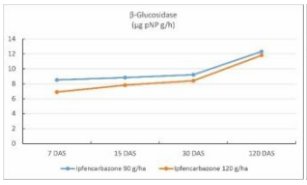


Fig. 48

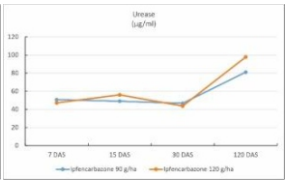


Fig. 49

3.7 Expansion of flax area in pilot scale with improved technologies

S. Mitra, J. Mitra, C.S. Kar, S. Sarkar, S.K. Jha, S.K. Pandey, R.K. Naik and S.P. Mazumdar

Project code: In-house Project-JA 8.4

The project was initiated to identify the suitable areas for flax cultivation in the country and to conduct demonstrations on improved flax cultivation in farmers' fields on a pilot scale to popularize the fibre flax crop among the farmers. The project also aimed at convincing the industry about the scope of commercial cultivation of flax crops in the country, which can ultimately reduce the import of flax fibre in India. Accordingly, a 'Research-Industry Interface Meeting on Flax Cultivation' was organized at ICAR-CRIJAF, Barrackpore on November 9, 2023, to sensitize the issues related to the possibility of large-scale commercial cultivation of flax in the country and to identify suitable industrial partners who can significantly contribute to take care of the production, processing, and consumption of raw flax fibre produced in the country (Fig. 50). The meeting was attended by 12 representatives from the industry, including M/s Champdani Industry, Jayshree International, EVE Fabrics, Gurunanak Enterprises, Chlorohemp Agritech, OG Hemp, WFB Baird & Company (India) Ltd., and Indetex India. The industry representatives agreed that the fibre from Indian variety JRF 2 is better than water-retted Egyptian fibre in terms of strength and fineness. They also emphasized the need for further research on further improvement in fibre quality of flax.

The pilot-scale farmers' participatory cultivation of fibre flax variety JRF 2 was initiated under the direct supervision of industry in the 2023–24 flax seasons in areas at Jhunjhunu, Sinthal, and Bikaner in Rajasthan, parts of Uttarakhand, and Barwala and Ludhiana in Punjab. About 2.5 q of TL seed of fibre flax (cv. JRF 2) was produced for pilot-scale demonstrations.

To develop location-specific technologies for augmenting fibre yield under farmers' field conditions, a field experiment was conducted at ICAR-CRIJAF, Barrackpore, to develop an integrated nutrient management schedule for flax for an increase in fibre productivity and also for the substitution of chemical N doses through organic sources like FYM and biofertilizer (*Azotobacter*). The experiment comprised seven treatments: T_1: control, T_2: 50% RDN, T_3: 50 % RDN + FYM @ 5 t/ha; T_4: 50% RDN + FYM @ 5 t/ha + *Azotobacter*; T_5: 50% RDN + FYM @ 10 t/ha; T_6: 50% RDN + FYM @ 10 t/ha + *Azotobacter;* and T_7: 100% RDN, respectively. The experimental data revealed that the INM treatments (T_4, T_5, and T_6) were statistically at par among them and also with the 100% RDN treatment (T_7) with respect to plant height, dry matter at harvest (63.11 q/ha), and fibre yield of the crop, thereby indicating a 50% saving of the recommended fertilizer N dose. The maximum values of plant height (119.83 cm), dry matter at harvest (63.11 q/ha), and fibre yield (20.07 q/ha) of flax were recorded with the application of 50% RDN+FYM @10 t/ha+*Azotobacter* (T_6). All the fertility treatments recorded significantly higher values over the control treatments (Fig. 50).

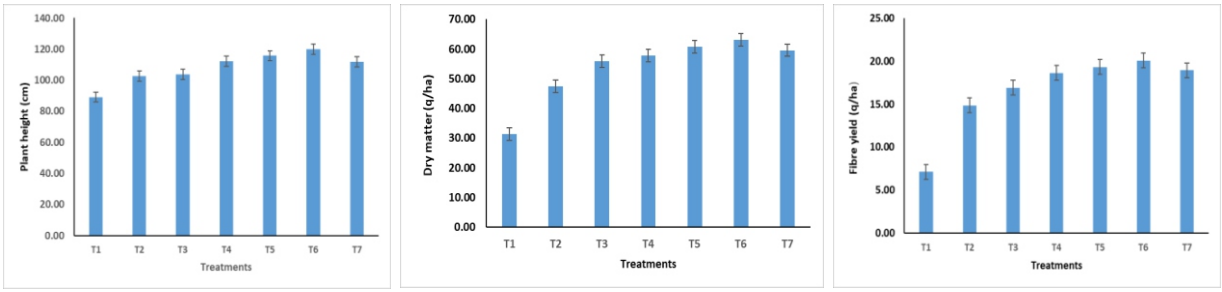


Fig. 50. Effect of INM on plant height dry matter and fibre yield of flax

3.8 Identifying the crop land and phenotypic traits of jute and allied fibres using multi-sensor unmanned aerial vehicle

D. Barman, P.K. Das, G. Kar, T. Kumar, S. Pathak, K. Mandal and S. Mitra

Project Code: Externa Funded Project - ISRO Drone Project

A study was carried out jointly by ICAR-CRIJAF, Barrackpore and RRSC-East, NRSC, ISRO, Kolkata to classify land use of the research farm of ICAR-CRIJAF using the multi-sensor UAV remote sensing images. The UAV based images over the research farm of ICAR-CRIJAF, Barrackpore were collected during jute growing season, in the month of May and July, 2023 (Fig. 51a). The multi-band images were used for generation of red-edge vegetation index (NDRE), using NIR and red-edge band information. The values were found to be varying between 0 and 0.85. The waterbodies having lowest NDRE values, whereas maximum values were observed over natural vegetation. The NDRE values over crop lands were within 0.4 to 0.7. The thermal band was utilized to provide information on surface temperature. The lowest values of around 26°C were observed over vegetation and maximum of on built-up areas (>60°C). Similarly, the spatial distribution of surface height information was also studied. The values over waterbodies were negative, whereas highest values were registered over tall trees, followed by buildings.

Subsequently, the surface height, thermal and vegetation information were used to classify the land use over the study area using support vector machine approach. The major classes were built-up, crop, grass lands, fallow, pond and road. The confusion matrix was generated and overall accuracy was found to be around 90% (Fig. 51b).

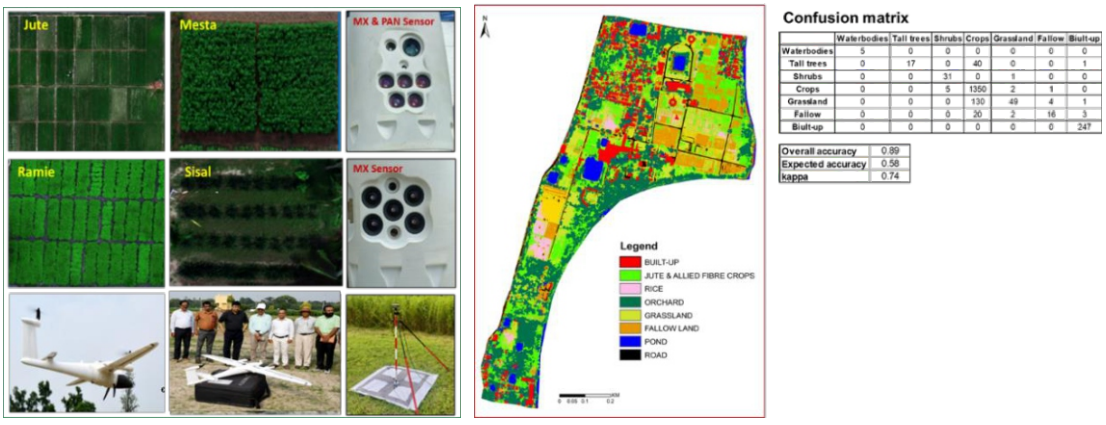


Fig. 51. (a) Drone based crop images, sensors and field photographs, (b) Land use classification and confusion matrix

3.9 Analysis of yield gap and contribution of production factors in cultivation of jute

S.K. Jha, M.L. Roy, S. Mitra, R. Saha, S.P. Mazumdar, R.K. Naik and A.K. Chakraborty

Project Code: In house-Project -JEXA 6.1

The study area involved the areas of operation under the Jute-ICARE program, viz., West Bengal, Assam, Bihar, Odisha, and Meghalaya. The on-field information from the project location was collected through a Google-based form, JAF Kisan. The link to this Google Form was provided to all the master trainers (MTs) under Jute-ICARE, trained to fill it up the information. The overall technology gap as well as the extension gap observed in West Bengal, Assam, Bihar, Odisha, and Meghalaya are presented

in Table 15 and Fig. 52 respectively. In West Bengal, the extension gap was found maximum at Murshidabad (6.92 q/ha) and Uttar Dinajpur (6.65 q/ha), while the technology gap was maximum at Malda (6.80 q/ha) and Dakhin Dinajpur (6.70 q/ha) districts. Similarly, in the case of Assam, the technology gap was found maximum at South Salmara (7.00 q/ha) and West Karbi Anglong (6.58 q/ha), while the extension gap was found maximum at Bongaigaon (6.71 q/ha), followed by South Salmara (6.67 q/ha) district. The technology gap was found maximum at Katihar (07.40 q/ha) and Madhepura (7.30 q/ha) in Bihar, while the extension gap was found maximum at Supaul (7.08 q/ha) and Araria (7.02 q/ha) districts. In the case of Odisha, the technology gap was found maximum at Cuttack (7.53 q/ha) district, while the extension gap was found maximum at Jajpur (6.41 q/ha) district. For Meghalaya state, the extension gap was 6.40 q/ha while the technology gap was found 7.58 q/ha in Tura district.

The observed technology gap may be attributed to variable soil moisture availability, soil nutrient availability, competition between jute and weed for water and nutrient uptake, etc. A wide extension gap emphasizes the need to educate farmers about using improved production technologies to reverse this trend. Hence, to narrow down the gap between the two types of yield, not only improved agro-technologies but also location-specific recommendations are very much necessary. Greater use of the latest, improved production technologies can subsequently bridge this extension gap between demonstration yield and farmer's yield. As a part of the strategy to mitigate the yield gap, farmers were also advised, through agro-advisory, to make drainage channels in the field and reduce the impact of water stagnation on crop growth.

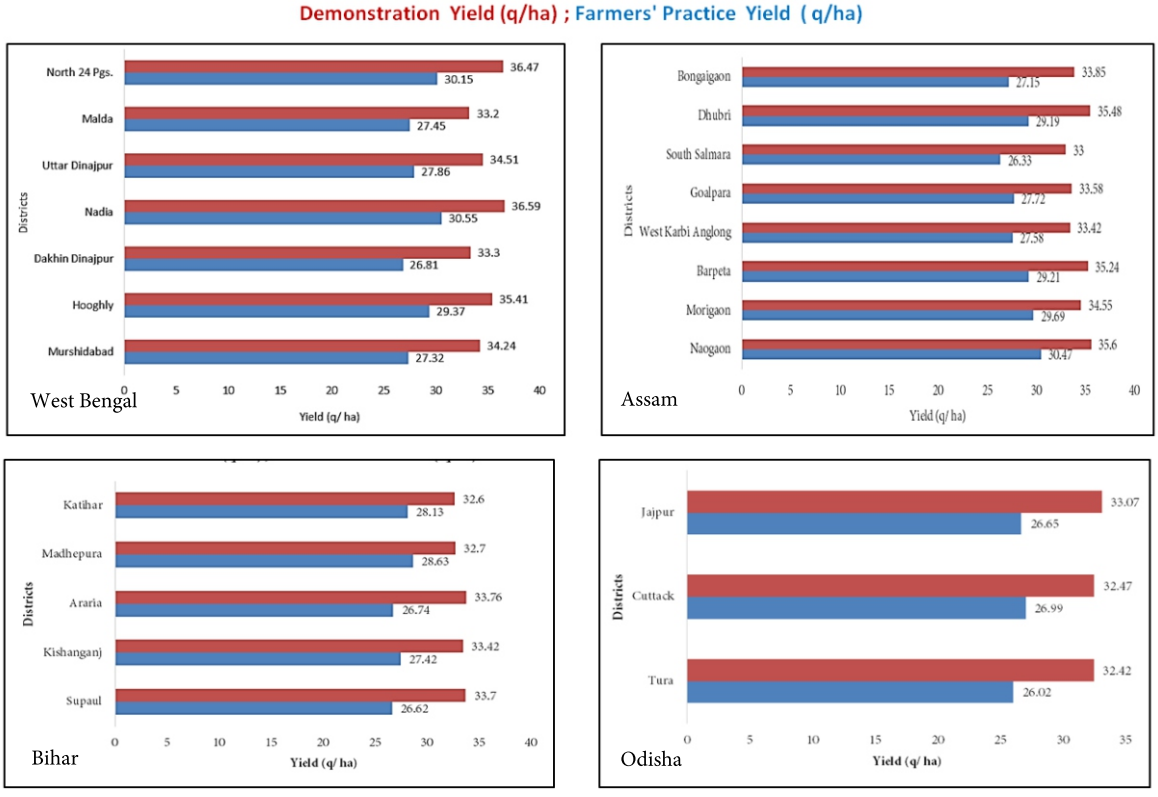


Fig. 52. Yield gap of jute in West Bengal, Assam, Bihar and Odisha

Table 1 5. Jute Yield gap at a glance in different jute growing states of India

District	Yield (q/ha)				
	practice	Demonstration	Potential	Technology	Extension
ASSAM					
Naogaon	30.47	35.60	40	4.40	5.13
Morigaon	29.69	34.55	40	5.45	4.85
Barpeta	29.21	35.24	40	4.76	6.03
West Karbi Anglong	27.58	33.42	40	6.58	5.83
Goalpara	27.72	33.58	40	6.42	5.85
South Salmara	26.33	33.00	40	7.00	6.67
Dhubri	29.19	35.48	40	4.52	6.29
Bongaigaon	27.15	33.85	40	6.15	6.71
BIHAR					
Supaul	26.62	33.70	40	6.30	7.08
Kishanganj	27.42	33.42	40	6.58	5.99
Araria	26.74	33.76	40	6.24	7.02
Madhepura	28.63	32.70	40	7.30	4.07
Katihar	28.13	32.60	40	7.40	4.47
MEGHALAYA					
Tura	26.02	32.42	40	7.58	6.40
ODISHA					
Cuttack	26.99	32.47	40	7.53	5.48
Jajpur	26.65	33.07	40	6.93	6.41
WEST BENGAL					
Murshidabad	27.32	34.24	40	5.76	6.92
Hooghly	29.37	35.41	40	4.59	6.04
Dakhin Dinajpur	26.81	33.30	40	6.70	6.50
Nadia	30.55	36.59	40	3.41	6.03
Uttar Dinajpur	27.86	34.51	40	5.49	6.65
Malda	27.45	33.20	40	6.80	5.75
North 24 Pgs.	30.15	36.47	40	3.54	6.32

3.10 Minimizing yield gap and maximizing the income of jute-based farm families through cluster-based approach-a case study

M. L. Roy, S. K. Jha, S. Kumar, Shamna A. and G. Kar

Project Code: In-house Project-JEXA 6.3

A cluster of around 50 ha in Chandigar village of Gaighata block (North 24 Parganas, W.B.) was selected for collecting information on soil type, land type, farm household, their educational status, family size, landholding, farming experience, existing cropping pattern, livestock profile, pond area, etc to find the technological gaps. The village is dominated by SC jute farmers. Constraints and factors affecting the yield gap in jute as perceived by the farmers were also noted. Then improved jute production technologies of ICAR-CRIJAF in the forms of improved jute varieties (JRO 204) for higher yield, line sowing of jute by CRIJAF Multi-row seed drill or CRIJAF Jute seeder for saving of inputs and labour in addition to robust crop stand for enhanced productivity, mechanical weed

management in jute fields by CRIJAF Nail weeder and/or Jute weeder for saving of labour and cost of weedicides, and retting accelerator (CRIJAF SONA- a microbial formulation) for producing quality jute fibre with higher grade and ensured return, were transferred to the jute farmers of cluster area. Field demonstrations and a farmer field school were conducted to sensitize the farmers. As this is the first year of intervention, the farmers are slowly adopting these technologies. The crop stand was initially very good, but due to the severe hailstorm that occurred in this village during the last week of April, it was severely damaged. The heads of the crops were broken, and branches were produced. Despite this serious damage at the early growth stage of the crop, a yield of 30-32 q/ha was reported by the farmers. The line-sown crops provide a higher yield compared to the crops sown by broadcasting. Five skill development trainings on the making of jute bags were conducted for the farm women of Chandigar and adjoining villages for their empowerment and off-farm income generation.

Field Demonstration

Farmer Field School

Initial crop stand

Glimpses of jute crops at maturity

Organization of Skill Development on jute bag making

4 Post-harvest Management and Value-addition

4.1 Jute-Improved Cultivation and Advanced Retting Exercise (Jute-ICARE)

B. Majumdar, S. Satpahty, S. Mitra, S. Sarkar, S.K. Sarkar, S.K. Jha, S. Datta, K. Mandal, A.K. Singh, R.K. Naik, Shamna A., M.L. Roy and G. Kar

Project code: Externally Funded Project- JUTE-ICARE

Phase-IX of the Jute-ICARE project was carried out in 200 blocks under West Bengal, Bihar, Assam, Odisha, Meghalaya, Jharkhand, Nagaland, Manipur, and Andhra Pradesh states, covering an area of 1,85,000 ha and involving 4.20 lakh farmers during 2023–24, in collaboration with the National Jute Board (NJB) and the Jute Corporation of India (JCI). About 600 MT of certified jute seeds (cv. JRO 204, JBO 2003H, CO-58, JBO-1, JROM-1, and JRC-532) and 800 nos. each of CRIJAF multi-row seed drills

and CRIJAF single-wheel jute weeders were distributed among the farming community. During retting season, 600 MT of CRIJAF Sona were distributed among the farming communities for improved retting of jute and mesta. For the second consecutive year, about 500 crops cutting experiments (CCE) were conducted in West Bengal, Assam, Bihar, and Odisha under the technical guidance and supervision of scientists of ICAR-CRIJAF in Jute-ICARE areas. Eight in-house trainings on "improved jute production technology" of 2 days each were conducted for 190 block supervisors, master trainers, and agricultural officers from the states of West Bengal, Bihar, Assam, Odisha, Meghalaya, Jharkhand, Nagaland, Manipur, and Andhra Pradesh working under Jute-ICARE by ICAR-CRIJAF at ICAR-CRIJAF, Barrackpore, during the year. Altogether, 500 demonstrations of sowing, weeding, and improved retting were conducted by the master trainers and block supervisors across the country under the technical supervision of scientists from ICAR-CRIJAF.

The regular agro-advisory issued by ICAR-CRIJAF was disseminated directly to the farming community under Jute-ICARE in different languages. The quality check of samples of CRIJAF SONA received from two licensed firms, Bengal Biotech and Research, Panskura, and Next2Nature, Guwahati, was carried out at ICAR-CRIJAF before the distribution of 600 MT of CRIJAF SONA to the farming community. During the year, about 500 composite soil samples (from farmers' fields) were collected from the Jute-ICARE areas in the states of Assam, Bihar, Odisha, and West Bengal with the objective of assessing the soil fertility status of the jute-growing areas under Jute-ICARE. The analysis of soil samples is in progress. About forty soil health cards for the North 24 Parganas district of West Bengal were distributed during the World Soil Day celebration this year.

Fig.53. Harvesting of jute crop in progress under Jute-ICARE in Meghalaya and distribution of CRIJAF SONA by the Rural Development Minister of the State of Jharkhand and application of CRIJAF SONA for improved retting

Fig. 54. The golden coloured jute fibre produced by the farming community using CRIJAF SONA

4.2 Development of a minimal water retting technology for jute

B. Majumdar, G. Kar, S. Datta, and D. Datta

Project code: Externally Funded Project- NASF project

Augmenting retting process with mechanically wounding in jute stem edge: A consortium of three pectinolytic strains of *Bacillus sp.* (PJBR1, PJBR2, and PJBR3), developed for biological retting under a water-retting system, were used for cell wall degradation of jute stems. Retting was performed in a sterilized retting tank (5 L capacity). Mature jute plants were cut and mechanically injured (cutting, threshing, and slit in) and immersed in normal water supplemented with 1.0 ml of microbial spore consortium (CRIJAF SONA®) for 200 g of jute tissue. The retting chambers were kept at room temperature (34 °C). Samples were collected for the transverse section after 3 days of immersion (3 DAI) and 5 DAI. After 7 days, the injured portion jute fibers are separated, but the control jute stem portion fibers are not separated. Jute stems are kept in a controlled condition without spore solution, and fibres are separated after 21 days. With the help of the endospore-based liquid formulation of CRIJAF SONA, the retting bacteria could easily enter the inner portion of the jute stem in ruptured jute stems, which helped in faster retting of jute, and the fibres were extracted after 9 days. In the control condition, where jute stems were not ruptured and no retting accelerator was used, the completion of jute retting required 21 days. So it can be concluded from the laboratory-scale study that the wounding of jute stems prior to retting helps in the entry of microbes into the inner portion of the stem, which results in faster retting of jute.

Effect of free-flowing water retting and conventional retting on water quality: Large-scale Free-flowing water retting and conventional retting of jute were carried out in replicated conditions at ICAR-CRIJAF, Barrackpore, during the retting season of 2023–24. The jute retting was completed in 10 days under free-flowing water retting with endospored-based liquid CRIJAF SONA, compared to 19 days in conventional retting without a retting accelerator. Replicated retting water samples were collected prior to and post-retting of jute from both systems. The physico-chemical analysis of pre- and post-retting water under both conditions revealed that the electrical conductivity, BOD, COD, bicarbonate content, chloride content, and hardness values were significantly higher in the post-retting water of conventional retting compared to free-flowing water retting. The higher BOD and COD in conventional retting indicate lower dissolved oxygen in the retting water as well as higher dissolving organic matter in the retting water, respectively. On the other hand, lower BOD and COD in the free-flowing water retting are because of the flowing action of water, which helped to increase the dissolved oxygen in the retting water and might have helped for proper microbial growth as well as higher enzymatic activities, resulting in a lower retting duration. The higher hardness content in conventional retting is because of the development of temporary as well as permanent hardness as a result of the higher presence of bicarbonate and Ca+ Mg. The post-retting water in both conditions recorded a higher nutrient status compared to the pre-retting water. The enzymatic activities like polugalacturonase (PG), pectin lyase (PNL), and xylanase activities were significantly higher by more than three times under free-flowing water retting compared to conventional retting of jute. The higher PG, PNL, and xylanase activities in free-flowing water retting lowered the retting duration compared to conventional retting.

4.3 Bioethanol from lignocelllulosic biomass (jute and kenaf-mesta

P. Satya, L. Sharma, A.K. Singh, G. Kar, S. Roy,
S. Ghosh, B. Majumder, and Lavanya A.K.

Project Code: Externally Funded Project- ICAR-NICRA project

Optimization of pretreatment: The presence of lignin (14–25 %) in jute biomass is a major hurdle for the cellulose degrading enzymes to access substrate. A study was conducted to optimize alkaline pretreatment and saccharification conditions employing response surface methodology to improve saccharification yield of jute biomass. The biomass is composed of cellulose (66.6 %), lignin (19.4 %) and hemicellulose (13.1 %). NaOH concentration exhibited significant effect on delignification during pretreatment. Maximum percent delignification (80.42 %) in the study was obtained at the optimal conditions of 55.8 ◦C temperature, 5.9 h time duration and 2.47% NaOH concentration removing 79.8% lignin and 34.2% hemicellulose from biomass, thereby increasing cell wall porosity and allowing better accessibility to saccharification enzyme.

Optimization of saccharification: During saccharification optimization, significant effects were observed for biomass loading, enzyme concentration, and temperature. The optimized saccharification condition yielded maximum saccharification (76.48%) when hydrolysis was performed at 6.9% biomass loading with an enzyme concentration of 49.52 FPU/g substrate at 51.05 °C for 74.46 hours. Validation of the model was performed with another set of 15 confirmation experiments using the previously defined parameters. Percent saccharification was improved when biomass loading was low, irrespective of enzyme concentration.

Fermentation: Optimum duration for fermentation (ethanol production) was standardized by fermentation with yeast (1 ml culture/ 10 ml substrate). Maximum ethanol yield (21.5 g/lit) was obtained after 24 h of fermentation, while at 72 h the ethanol yield was 19.8 g/lit.

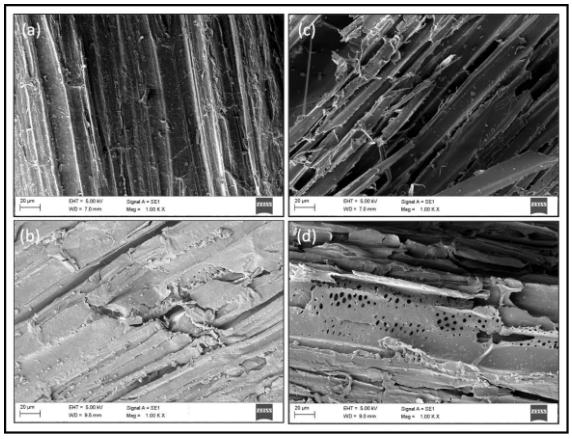


Fig. 55. Surface morphology of jute biomass using SEM analysis of raw (a,b) and alkali pretreated (c,d) jute biomass

Structural and compositional changes in biomass: Scanning electron microscopy revealed disrupted loose surface and segregated fibrous bundles of pre-treated jute biomass as compared to the rigid compact structure and smooth surface of untreated biomass, which clearly indicates that the biomass structure has been distorted as a result of pretreatment to create more accessible surfaces. Cellulose content of the samples increased from initial 60.7% to 70 % after alkali treatment. After saccharification, 42% cellulose was retained in the byproduct, indicating 28% cellulose was converted to reducing sugar for bioethanol production. Lignin content reduced from 23.64% in raw biomass to 17.7% in the alkali treated biomass. The saccahrified byproduct retained 16.1% of the lignin.

5 Mechanization and Energy Management

5.1 Development and performance evaluation of ribboner, seed drill and weeder

R.K. Naik, C.S. Kar, G. Kar, S. Mitra and S.K. Jha

Project Code: In-house Project-JAE 3.6

Jute ribboner: The power-operated jute ribboner machine was developed for the extraction of jute ribbon from freshly harvested jute plants without breaking sticks. It is powered by a single-phase 3 hp electric motor and can be operated by a 5 hp diesel engine with slight modifications. It consists of two sets of stick-breaker-cum-ribbon pulling units placed one above the other. It has two input chutes so that two operators can work simultaneously at a time. Five to six jute plants can be fed into one set of breaker units; 10–12 plants can be extracted at a time by two units. The principle involves feeding jute plants by butt end in between the upper breaking rollers, which crushes the stick about 5 cm, and then pulling the ribbon by the lower rollers at high speed and placing the ribbon on a conveyor belt for delivery at the front or side of the machine. The sticks of the feeding plants were ejected intact from the upper tray of the machine. The ribbon extraction efficiency is more than 90%. The machine is very easy to use, and no specific skill is required to operate or adjust the machine. The field demonstration of the machine was organized at village Kharddo, North 24 Parganas, in association with ATMA, Deganga. Around 100 farmers participated and witnessed the demonstration of jute ribboners for the extraction of ribbon from harvested jute plants and shared their views (Fig. 56).

Tractor-drawn multi-crop seed drill: A tractor-drawn multi-crop seed drill is developed for precision sowing of jute and other small-seeded crops (Fig. 57). The machine uses an inclined plate metering mechanism for precision placement of seeds in rows. The machine is driven by tractors through a 3-point linkage of the tractor drawbar (35 hp and above). Power transmission from the ground wheel to the metering mechanism is through a chain, sprocket, and bevel gear drive. The seed drill has 7 rows, and the row-to-row distance is 25 cm. The row distance can be adjusted as per the recommended spacing requirements of different crops. During the evaluation, the speed of the tractor was kept at 2.5–3.0 km/h for better seed delivery.

The effective field capacity and field efficiency of the seed drill machine were found to be 0.36 ha/h and 83.72%, respectively. The uniformity of seed dropping and spacing along the row was 80–85% and 30–50 mm, respectively. There is a reduction in seed rate of about 50%, (3.66 kg/ha), compared to broadcast sowing (7-8 kg/ha). Tractor-drawn seed drill not only reduces the drudgery but also the sowing time.

Fig. 56. Field demonstration of jute ribboner

Fig. 57. Tractor drawn multi-crop seed drill for small seeded crops

Battery operated weeder: A weeder operated by a rechargeable dry cell battery is developed by a slight modification of a single-wheel jute weeder (Fig. 58). The weeder consists of a frame, soil working unit, lugged drive wheel, battery (12 v), DC motor, chain and sprocket, wires, accelerator, etc. A spring-loaded soil cutting tool is attached to the frame for cutting the soil slice along with the grasses. The spring facilitates control of the depth of operation. The fully charged battery can run up to 80 km. The field evaluation showed field capacity in the range of 0.06-0.07 ha/h.

Fig. 58. Battery operated weeder

5.2 Technological and economic empowerment of SC farm families through jute based farming, value addition and value chain establishment

Shamna. A, G. Kar, R.K. Naik, N.M. Alam and S.P Mazumdar

Project Code: External Funded Project-DST SEED Project

The project was initiated in 2021 with the objective of improving the socioeconomic status of farmers during the post-COVID period by promoting the best package of practices in jute-based farming, value chain in jute, and entrepreneurship among farm women for undertaking activities in the value chain. For assessing the suitable jute production technologies, eight different jute varieties, like JRO 204, JRO BA3, JROMU1, JRO 524, JRO 2407, and CO-58, were demonstrated in the project area. All the varieties were sown in line using a multi-row seed drill. The jute variety JRO BA-3 yielded the highest (49.94 q/ha) among the different varieties demonstrated, followed by JROMU1 (46.22 q/ha), JRO 204 (45.14 q/ha), CO 58 (43.48 q/ha), JRO 2407 (42.30 q/ha), JRO 524 (41.37 q/ha), JROG 1 (36.8 q/ha), and JROM 1 (35.27 q/ha). Jute varieties JRO BA3 and JRO 204 were cultivated by most of the farmers, and the yield in the farmers field varied from 30 to 45 q/ha for JRO BA3 and 26.25 to 39 q/ha for JRO 204. Drudgery reduction in jute cultivation was given the main focus. Single-wheeled jute weeder was used for weeding, especially by farm women. Single-wheel jute weeder along with multi-row seed drill reduced the cultivation cost of the jute crop to the tune of ₹14000 to 15000/ha. CRIJAF Sona was adopted by the majority of the beneficiaries in jute retting for fibre quality improvement. It was found that the additional income the farmer could obtain by saving the cost and improving the yield was approximately ₹40000/ha. Altogether 24 farm women from the project area were also trained on the making of jute-diversified products.

Fig . 59. Jute fibre production activities in project area

5.3 Enhancing farm income through up-scaling of jute based diversified products as an alternative to plastics

Shamna A., S.K. Jha, S. Kumar and M.L. Roy

Project Code: In-house Project-JEXA 6.2

A study was undertaken to identify possible jute-based diversified products as a substitute for plastics and synthetics and impart skills among SHGs (Nadia and North 24 Parganas district, West Bengal) for developing jute-based products, entrepreneurship development, and socioeconomic empowerment. A total of 48 farmwomen were trained. Resource generation of ₹45500 was recorded from the sale of different value-added jute products made by farm women. The skills acquired by the farm women were studied following the Global Skill Development Index 2022. The skill acquired and socio-economic outcomes were highest among the Paatrani SHG (84.8%) followed by the Sankalpa SHG (83.3%) (Fig. 60). The economic outcomes of the groups were also studied, and it was found that there is a steep increase in income in Paatrani SHG, followed by Sankalpa SHG (Fig. 61). These groups also supply jute bags and other products for different events organized by state and central government organizations. The SHGs also successfully participated in the Kolkata Book Fair-2023, which is one of the biggest fairs in Asia, and could make sales to the tune of 4.2 lakh rupees.

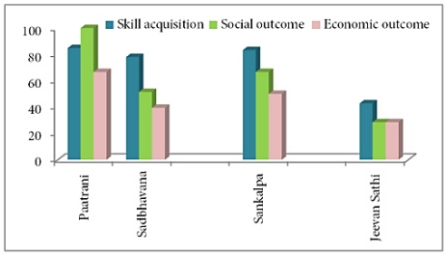
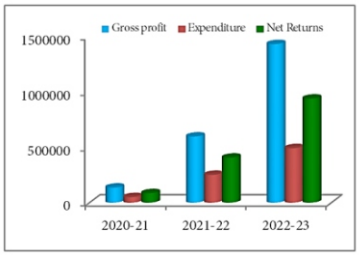


Fig 60. Skill development index of SHGs trained by ICAR-CRIAF



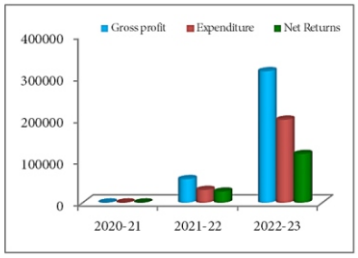


Fig 61. Economic growth of Paat Rani and Sankalpa SHGs

CROP PROTECTION

Overview

Productive agriculture systems are always vulnerable to hazards of climate, pests and diseases causing threat to crop production. In the changing climatic scenario, the crops are facing a wider range of pests and disease outbreaks and making the JAF crop production unstable. The Crop Protection Division takes up study on the incidence and crop losses caused by pests and pathogens, etiology and epidemiology of diseases, bio-ecology, biology of pests and developing integrated management schedules. The division is exploring new frontiers of research that may result into the development of appropriate technologies for jute and allied fibre crop protection which are effectively productive, eco-friendly, sustainable, and economically profitable.

Priorities & Thrust Areas

- Insect pests-plant interaction and the pathogen system in JAF crops
- Investigation on PGPR and biocontrol for pest and disease management in JAF crops
- Ecological behavioural and epidemiological studies on pests and diseases of JAF crops
- Standardization and validation of IPM technologies in JAF crops
- Exploring the ICT and related tools for pest management and pest forecasting in JAF crops.

Research Highlights of 2023

- Nano-sulphur (25nm) had significant toxicity against the sucking pests of jute. Under field nano-sulphur, can reduce the mite population by 87%.
- Carbon nanotubes (CNT-length 500 nm and a diameter 30 nm) treatment @ 3 ppm elevated the proline and flavonoid level in jute leaf and improved the salinity stress tolerance of jute seedlings.
- Simultaneous treatment of soil with bleaching powder and seed with carbendazim (@ 2g/kg) + imidacloprid (@5 ml/kg) had significant effect to reduce stem rot disease and different sucking and leaf-eating insect pests of jute.
- Indigo caterpillar, *Spodoptera litura* and hairy caterpillar, *Spilosoma oblique* population infesting jute had 10.63- and 2.43-fold higher insecticide resistance ratios than the *A. sabulifera* population.
- The resistance ratios over one generation (F2) manifested the elevation in enzyme titres carboxylesterase (CarE), Glutathione-S-transferase (GST's), and acetylcholinesterase (AchE) in all 3 jute pests studied.
- A high-throughput screening technique has been developed to overcome present bottlenecks of screening against stem rot. Lesion lengths developed by the pathogen inoculum under *in vitro* conditions are highly correlated with those under field conditions.
- OIN-852, OIN-148, OIN-201, OIN-159, OIN-113, and OIN-118 lines are least susceptible to stem rot under sick plot, hot spot and artificial screening condition.

1. Insect Pest and Disease Management

1.1Use of nanoparticles for managing pests and diseases in jute and carbon nanotubes for salinity tolerance

C. Biswas and V. Ramesh Babu

Project Code: In-house Project- JM 9.3

Effect of nanoparticles on jute mealybug: During the last ten years, mealybug (*Phenacoccus solenopsis*) has become an important pest of jute and mesta. Nano-silica (30 nm) and nano-sulphur (25 nm) were sprayed on mealybug 2nd instar nymph in different concentrations from 0.1 ppm to 10 ppm in Petri plates to assess their efficacy on mortality of this pest. Nano-silica (30nm) was not found effective against jute mealy bug. Application of nano-silica @ 3.0 ppm caused only 32.38% mortality. However, nano-sulphur (25nm) was found highly effective against mealybugs in jute. Application of nano-sulphur@1.0 ppm caused 88.37% mortality under laboratory conditions. Cent percent mortality was achieved at 3.0 ppm concentration (Fig. 62).

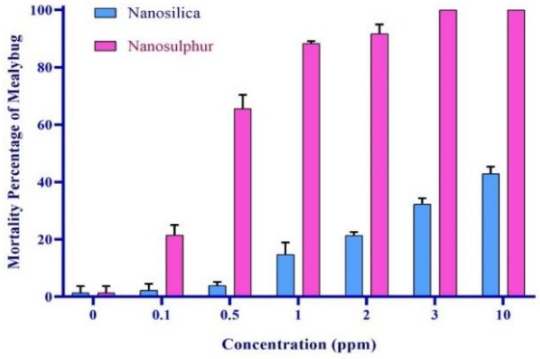


Fig. 62. Effect of nano-particles on jute mealybug *(Phenacoccus solenopsis)*

Effect of nano-sulphur on yellow mite in jute under field conditions: The effect of nano-sulphur (25 nm) against yellow mite (*Polyphagotarsonemus latus*) was already tested under laboratory conditions. In the present investigation, the efficacy of nano- sulphur against yellow mite was studied under field conditions. Mite-infested plants were randomly selected and tagged. The yellow mite population on selected plants was counted using magnifying glass. Then nano-sulphur was applied in different concentrations, from 0.00001 ppm to 0.1 ppm. After 48 hours, the treated as well as untreated leaves were again examined for live mite populations. Nano-sulphur was found highly effective against yellow mites in jute. Application of nano-sulphur @0.01 ppm reduced the mite population from 81.67 (pre-treatment) to 9.67 (post-treatment) per cm square of leaf area (Table 16).

Table1 6. Yellow mite population (per cm square) on jute leaf as affected by nano-sulphur

Concentration (ppm)	Pre-treatment	Post-treatment
0.01	81.67	9.67
0.005	78.33	17.33
0.001	77.00	21.33
0.0005	70.00	32.67
0.0001	68.33	34.00
0.00005	68.00	37.33
0.00001	59.33	45.33
Control	71.00	63.33
CD	NS	13.95
SEm		4.55
SEd		6.44

Effect of carbon nanotubes (CNT) treatment on proline and flavonoid content in jute leaf under salinity stress: Jute seeds cv. JRO 204 were treated with CNT (length 500 nm and a diameter 30 nm) solution @ 3 ppm for 15 min and sown in plastic pots. Seven grades of saline solution, viz., 50 mM, 100 mM, 150 mM, 200 mM, 250 mM, 300 mM, and 350 mM, were prepared by adding the required quantities of NaCl. The 15-day-old seedlings were treated through soil drenching with NaCl solutions. Then leaf samples were taken from CNT- treated as

well as untreated seedlings of different salinity levels. Proline content was measured by ninhydrin-based and flavonoid-based colorimetric methods. Proline content was estimated as µ moles per gram of tissue. It was negligible (less than.001) in treatments devoid of CNT. In the case of 350 mM NaCl and CNT, it was 3.29 µ moles, whereas in the case of 150 mM NaCl and CNT, it was 1.17 µ moles. In the case of 50 mM NaCl and CNT, the proline content was 0.464 µ moles (Fig. 63). The highest flavonoid content (15.69 mg/g) was recorded under 250 mM NaCl and CNT. It was 13.93 mg/g under 300 mM NaCl and CNT and 12.72 mg/g under 350 mM NaCl and CNT treatment (Fig. 64).

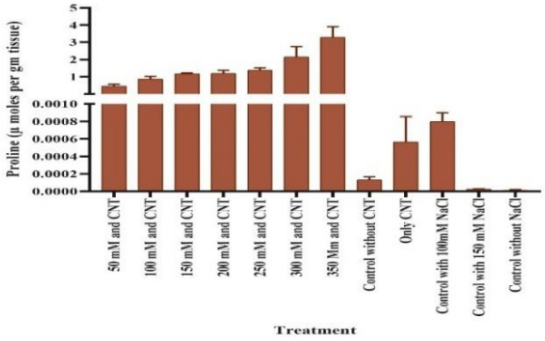


Fig.63. CNT treatment increased proline content under salinity stress in jute

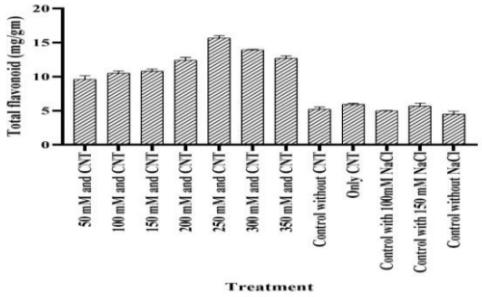


Fig.64. CNT treatment increased flavonoid content under salinity stress in jute

1.2 Development of IPM module for jute and mesta

R.K. De, S. Satpathy, V. Ramesh Babu and Shamna. A

Project Code: In-house Project- JM 9.4

Development of a low-cost pre-sowing seed treatment strategy: To develop a low-cost seed treatment strategy, a field experiment with pre-sowing seed treatment using fungicide, insecticide, or biocontrol agent either alone or in combination against stem rot disease and different sucking and leaf-eating insect pests of jute, variety JRO 204 (Suren) was conducted with 13 treatments. It was observed that the incidence of stem rot and damages caused by different insect pests was lower with combined treatments than with a singular approach. Among the two fungicide and insecticide combinations, carbendazim + imidacloprid was better than tebuconazole + chloropyriphos, with fibre yields of 32.8 and 30.7 q/ha, respectively. Both were better than using either of the two components. Seed treatment with *Trichoderma* reduced stem rot to 8.3%, and it also reduced the stem rot disease and different sucking and leaf-eating insect pests when combined with different insecticides, indicating that two pesticides (chloropyriphos and imidacloprid) might have inhibited the performance of *Trichoderma*.

Soil application of bleaching powder @30 kg/ha 7 days ahead of sowing reduced the stem rot to merely 5.7%. The damage caused by stem rot (19%), yellow mite (10.2%) and semilooper (6.4%) was highest. Simultaneous treatment of soil with bleaching powder and seed with carbendazim+ imidacloprid was the best among all treatments to reduce stem rot disease and different sucking and leaf-eating insect pests of jute. Stem rot decreased to the lowest of 5.1% (control 19%) and the yellow mite to 5.1% (control 10.2%) and recorded the highest dry fibre yield of 34 q/ha with a 41.3% increase over check (Fig. 65).

Evaluation of different IPM modules on major diseases and insect pests of mesta: A field experiment was carried out in randomised block design with six different IPM modules on four major diseases, namely, foot and stem rot caused by *Phytophthora parasitica* var. *sabdariffae;* collar rot caused by *Sclerotium rolfsii;* phoma blight caused by *Phoma* sp.; yellow vein mosaic (YVM) caused by a genus of *Begomovirus* (family Geminiviridae), and four major insect pests, namely, spiral borer (*Agrilus acutus*); mesta flea beetle (*Nisotra orbiculata*); mealy bug (*Maconellicoccus hirsutus*); and jassids (*Amrasca biguttula biguttula*) with yellow vein mosaic resistant variety of mesta (JBMP 2).

In IPM module 4, the damage of all four diseases was the lowest, with 2.7% foot and stem rot (6.6% in check), 2.6% collar rot (4.9% in check), and 2% phoma blight (17% in check). The incidence of YVM disease was nil, as the variety was resistant to it. Similarly, minimum damage by spiral borer (0.4%), mesta flea beetle (0.1%), mealy bug (0.4%), and jassids (0.3%) was recorded. This treatment was most effective in managing all eight major diseases and insect pests of mesta, with the highest fibre yield of 25.6 q/ha (35% higher over check). In terms of fibre yield, IPM module 4 was best followed by IPM module 3 (23.1q/ha), IPM module 1 (22.1q/ha), IPM module 2 (21.1q/ha), IPM module 5 (21.1q/ha), and IPM module 6 (20.3q/ha), with 21.9, 16.6, 11.4, 11.4, and 7.1% higher fibre yield over check (Table 17).

Evaluation of different IPM modules on major diseases and insect pests of jute: Six IPM modules to control stem rot caused by *Macrophomina phaseolina* and five major sucking and leaf-eating insect pests, namely, indigo caterpillar (*Spodoptera litura*), yellow mite (*Polyphagotarsonemus latus*), semi-looper (*Anomis sabulifera),* hairy caterpillar (*Spilosoma obliqua),* and apion (*Apion corchori)* of jute were evaluated. In IPM module 4, stem rot disease was the lowest (5.7%), compared to 12.1% in check. Similarly, minimum damage by indigo caterpillars (1.3%), yellow mites (1.4%), semi-loopers (0.6%), hairy caterpillars (0.8%), and apions (0.6%) was observed. This module was the most effective in reducing all the major diseases with the highest fibre yield of 33 q/ha (63.6% higher than check). In terms of fibre yield, the IPM module 4 was followed by IPM module 3 (24.3q/ha), IPM module 1 (23.2q/ha), IPM module 5 (22.5q/ha), IPM module 2 (22.3q/ha), and IPM module 6 (22.3q/ha), with a 20.7, 14.9, 11.6, 10.7 higher fibre yield over check (Table 18).

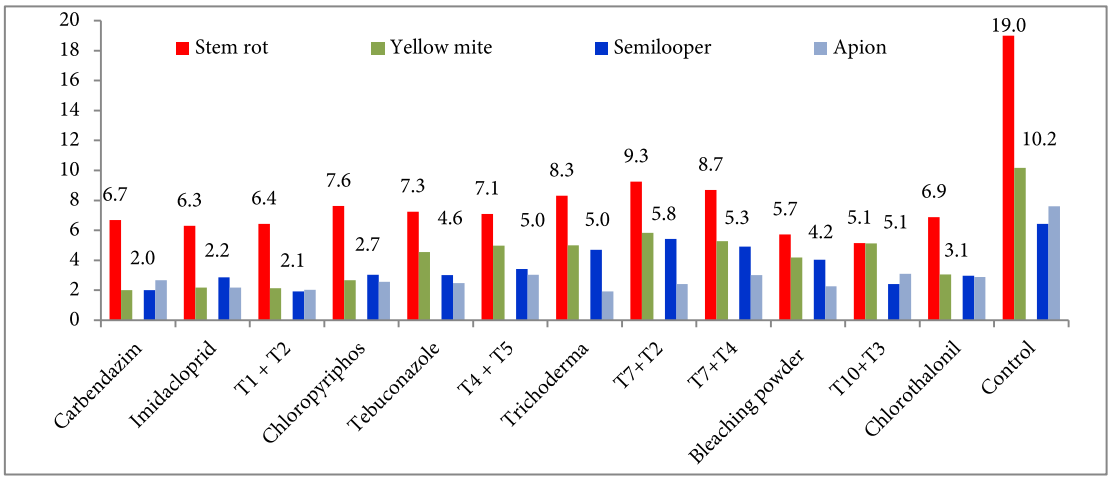


Fig. 65. Effect of seed treatment on stem rot disease and different sucking and leaf-eating insect pests of jute

Table 17. Field performance of different IPM modules on insect pests and disease of HC mesta

Treatment		Foot and stem rot (%)	Collar rot (%)	Phoma blight (%)	Spiral borer (%)	Mesta flea beetle (%)	Mealy bug (%)	Jassids (%)	Fibre Yield q/ha	% Increase over T7
T1	IPM module 1	3.3	3.4	3.8	0.6	0.3	0.6	0.3	22.1	16.6
		(10.5)	(9.5)	(11.2)	(4.3)	(2.5)	(4.5)	(3.1)		
T2	IPM module 2	3.4	3.1	3.9	0.6	0.3	0.6	0.3	21.1	11.4
		(10.6)	(7.3)	(11.4)	(4.2)	(2.4)	(4.3)	(3.0)		
T3	IPM module 3	5.2	2.9	4.2	0.9	0.3	0.6	0.3	23.1	21.9
		(13.2)	(8.4)	(11.7)	(5.4)	(2.7)	(4.5)	(3.3)		
T4	IPM module 4	2.7	2.6	2.0	0.4	0.1	0.4	0.3	25.6	35.0
		(9.5)	(9.3)	(8.1)	(3.5)	(1.2)	(3.5)	(2.9)		
T5	IPM module 5	4.4	3.1	2.7	0.8	0.3	0.5	0.4	21.1	11.4
		(11.9)	(10.0)	(9.3)	(4.1)	(2.4)	(4.0)	(3.5)		
T6	IPM module 6	5.7	3.5	4.9	0.7	0.8	0.5	0.3	20.3	7.1
		(13.6)	(10.7)	(12.8)	(4.9)	(4.1)	(3.8)	(3.0)		
T7	**Farmers'**	6.6	4.9	17.0	2.3	1.4	2.3	1.7	19.0	-
	practice	(14.8)	(12.8)	(24.3)	(8.7)	(6.8)	(8.7)	(7.4)		
CD (5%)		(3.8)	(3.2)	(4.2)	(1.9)	(1.5)	(1.8)	(1.5)	0.7	-
SEm±		(2.2)	(1.5)	(2.6)	(0.6)	(0.3)	(0.5)	(0.3)	0.3	-

*Figures in the parenthesis represent the Arc Sine transformed values

Table 18. Field performance of IPM modules on stem rot disease and different sucking and leaf-eating insect pests of jute

Treatment		Stem rot (%)	Indigo caterpillar (%)	Yellow mite (%)	Semi-loopers (%)	Hairy caterpillars (%)	Apion (%)	Fibre yield q/ha	% increase over T7
T1	IPM module 1	6.7	2.7	2.9	0.7	0.7	0.7	23.2	14.9
		(15.0)	(6.8)	9.6	(4.7)	(4.8)	(4.7)		
T2	IPM module 2	8.4	3.0	4.1	0.8	1.0	0.8	22.3	10.7
		(16.9)	(7.7)	11.6	(5.1)	(5.7)	(5.1)		
T3	IPM module 3	6.3	2.7	2.0	1.2	1.0	0.8	24.3	20.7
		(14.4)	(7.0)	8.1	(6.0)	(5.4)	(4.9)		
T4	IPM module 4	5.7	1.3	1.4	0.6	0.8	0.6	33.0	63.6
		(13.8)	(5.0)	6.7	(4.4)	(5.0)	(4.4)		
T5	IPM module 5	7.4	4.3	2.3	1.1	0.9	0.8	22.5	11.6
		(15.7)	(9.0)	8.6	(4.9)	(5.5)	(4.9)		
T6	IPM module 6	7.7	4.0	4.3	0.9	1.5	0.9	22.3	10.7
		(16.0)	(8.6)	12.0	(5.5)	(7.0)	(5.5)		
T7	**Farmers' practice**	12.1	6.3	7.9	3.1	3.9	2.1	20.2	-
		(20.3)	(11.3)	16.3	(10.1)	(11.4)	(8.3)		
CD (5%)		(2.1)	(1.6)	2.3	(3.1)	(2.1)	(1.6)	1.5	
SEm±		(0.6)	(0.4)	0.6	(0.9)	(0.6)	(0.4)	0.4	

Figures in the parenthesis represent the Arc Sine transformed values

1.3 Monitoring and assessment of insecticide resistance in major insect pests of jute and jute based cropping systems

V. Ramesh Babu, S. Satpathy and C. Biswas

Project Code: In-house Project- JM 2.4

Toxicity of profenophos to 3rd instar larvae of major lepidopteran pests infesting jute 24 HAT F_2 generation: Leaf dip bioassays were carried out with the third instar larvae of the second filial generation (F_2) for the major lepidopteran pests, viz., the hairy caterpillar (*Spilosoma oblique*), indigo caterpillar, (*Spodoptera litura*), and the jute semilooper (*Anomis sabulifera*) infesting jute against the conventional

organophosphorus insecticide profenophos 50EC used for pest management. The LC_{50} deduced for the three pest populations 24HAT were 279.3 ppm, 1218.7 ppm, and 114.6 ppm for the hairy caterpillar, indigo caterpillar, and jute semilooper, respectively. The bioassay results clearly indicated that the indigo caterpillar and hairy caterpillar populations had 10.63- and 2.43-fold higher resistance ratios than the jute semilooper population (Table 19).

Table 19. Toxicity of profenophos to 3rd instar larvae of major lepidopteran pests infesting jute

Insect	LC_{50} (ppm)	R R	Slope± SE	F Limits (ppm)		χ^2 (Degrees of Freedom)
				Lower	Upper	
Spilosoma obliqua	279.3	2.43	1.29±0.16	57.3	751.6	4.0(7)
Anomis sabulifera	114.6	1.00	1.14 ±0.21	21.4	433.1	2.31(7)
Spodoptera litura	1218.7	10.63	2.84±0.33	339.7	2579.1	6.86(7)

R R: Resistance Ratio over one generation

Qualitative and quantitative changes of carboxylesterase (CarE), glutathione-S-transferase (GST's), and acetylcholinesterase (AchE): Qualitative and quantitative changes of carboxylesterase, GST's, and AchE were worked out with midgut extracts of the major lepidopteran pests, viz., the hairy caterpillar, indigo caterpillar, and the jute semilooper, infesting jute. The protein content in the midgut homogenates was 0.92 µg/µl, 0.98 µg/µl, and 0.39 µg/µl, respectively, for the three pest populations based on the alpha-naphthol standard curve. The midgut extracts from the three pest populations showed a difference in the carboxylestease titre calculated in the presence of α-napthyl acetate as substrate. The carboxylesterase titres in S. *oblique, S. litura,* and *A. sabulifera* were 355.21 µmols/min/mg protein, 879.14 µmols/min/mg protein, and 114.39 µmols/min/mg protein, respectively. The results revealed that *S. oblique* and *S. litura* had 3.11-fold and 7.68-fold greater carboxylesterase in their midgut homogenates than the *A. sabulifera* population.

The glutathione-S-transferase titre also followed the same trend as that of carboxylesterase in the presence of substrate 3, 4-dichloronitrobenzene. The GSTs titres in *S. oblique, S. litura,* and *A. sabulifera* were 12.59 µmols/min/mg protein, 91.27 µmols min/mg/protein, and 3.65 µmols/min/mg protein, respectively. The results revealed that *S. oblique* and *S. litura* had 3.44-fold and 25.01-fold greater GSTs in midgut homogenates than the *A. sabulifera* population. The AchE titre also followed the same trend as carboxylesterase and GSTs in the presence of substrates, acetylthiocholine iodide and 5, 5-thiobis-2-nitrobenzoic acid. The AchE titres in *S. oblique, S. litura,* and *A. sabulifera* were 266.45 µmols/min/mg protein, 779.23 µmols/min/mg protein, and 56.19 µmols/min/mg protein, respectively. The results revealed that *S. oblique* and *S. litura* had 4.74-fold and 13.86-fold greater acetylcholine esterase in midgut homogenates than the *A. sabulifera* population (Table 20).

Table 20. Qualitative and quantitative changes of CarE, GST and AchE activity from midgut homogenates of 3rd instar larvae of major lepidopteran pests infesting jute

Insect	CarE (µmoles/min /mg protein)	CarE folds -	GST (µmoles/min /mg protein)	GST folds -	AchE (µmoles/min /ml of protein)	AchE Folds -
Spilosoma obliqua	355.21	3.11	12.59	3.44	266.45	4.74
Anomis sabulifera	114.39	1.00	3.65	1.00	56.19	1.00
Spodoptera litura	879.14	7.68	91.27	25.01	779.23	13.86

CarE: Carboxyl Esterase (using alpha –nahpthyl acetate as substrate and alpha –nahpthol standard curve); GST: Glutathione S Transferase (using 3,4-dichloronitro benzene as substrate); AchE: acetylcholine Esterase (using Acetylthiocholine Iodide and 5,5-thiobis-2-nitrobenzoic acid as substrate).

2 Screening for Host Plant Resistance

2.1 High throughput in vitro screening technique for jute stem rot

K. Mandal, K. Meena, Thribhuvan R. and S.Dutta

Project Code: In-house Project- JBT 5.0

Screening for resistance against stem rot is usually done under sick plot conditions. However, the method is resource-intensive and dependent on other factors, such as environmental conditions. Moreover, generation advancement becomes a major challenge for the susceptible lines; those die before seed setting. A high-throughput screening technique has been developed to overcome these bottlenecks. Plants are grown under field conditions following recommended agronomic practices. At 60–70 DAS (>1.5 m plant height), three 7-cm stem-bits are removed from the mid-length of a plant. These are inoculated by puncturing the bark with a needle and placing a PDA plug containing the growing mycelial edge of *Macrophomina phaseolina* (Fig. 66). The inoculated stems are placed inside a moist chamber and incubated at 28–30 °C for 48 h when the lesion length is measured. Lesion lengths developed under *in vitro* conditions are highly correlated with those under field conditions. The decapitated plants branch at the cut end and bear flowers and seeds. The method is especially suitable for segregating material to develop mapping populations.

Fig. 66. Variation in lesion length upon artificial inoculation with *M. phaseolina*

2.2 Screening of Linum accessions for resistant against Rhizoctonia wilt

K. Mandal, J. Mitra and D. Saha

Project Code: In-house Project- JB 10.3

Flax (*Linum usitatissimum*) is a rabi season crop that yields highly priced apparel-grade fibres. However, it is affected by a fungal disease, Rhizoctonia wilt (Fig. 67). To identify genetic resistance against this pathogen, 56 flax lines and four related species were screened under sick plot conditions. From the preliminary screening, twelve accessions were selected and tested for resistance in bigger plots. Among these, FT-999 and FT-1006 (both *L. usitatissimum*) and one line of *L. tenus* were the least affected. On the other hand, flax accessions IC-96565 and IC-96560, with 25.9% and 43.5% mortality, respectively, were susceptible to this disease.

Fig. 67. Rhizoctonia wilt-affected flax seedlings, extreme right is disease free

2.3 Identification of donor of stem-rot resistance in jute under natural epiphytotic condition of Assam

S.K. Sarkar and K. Mandal

Project Code: In-house Project- JM 9.5

One hundred seventy selected germplasms were tested both at Barrackpore (sick plot) and Sorbhog (hotspot) against stem rot of jute (*Macrophomina phaseolina*) during 2021 and 2022. Out of these gemplasm, fourteen, namely OIN-852, OIN-148, OIN-201, OIN-118, OIN-159, OIN-119, OIJ-77, OIN-113, OIN-197, OIN-154, OIN-140, OIN-167, OIN-176, and OIN-209, were selected based on least incidence of stem rot and sown in sick plots as well as screened under artificial conditions using the stem inoculation method at Barrackpore (Fig. 68).

Fig. 68. Artificial inoculation techniques in stem rot of jute (Macrophomina phaseolina)

Under field conditions, sowing was done on April 5, 2023, and disease records were taken at 10-day intervals starting 50 days after sowing (DAS). The results showed that the disease incidence of these 14 selected germplasms varies from 0 to 16.5%. The least affected germplasm were OIN-852, OIN-148, OIN-201, OIN-159, and OIN-113. The same sets of germplasm were screened under artificial conditions using the stem inoculation method during the same season. Least reaction in terms of lesion length was recorded in OIN-852, OIN-148, OIN-201, OIN-118, and OIN-159. Considering both field and artificial screening, it can be concluded that OIN-852, OIN-148, OIN-201, OIN-159, OIN-113, and OIN-118 are the least susceptible to stem rot (Fig. 69).

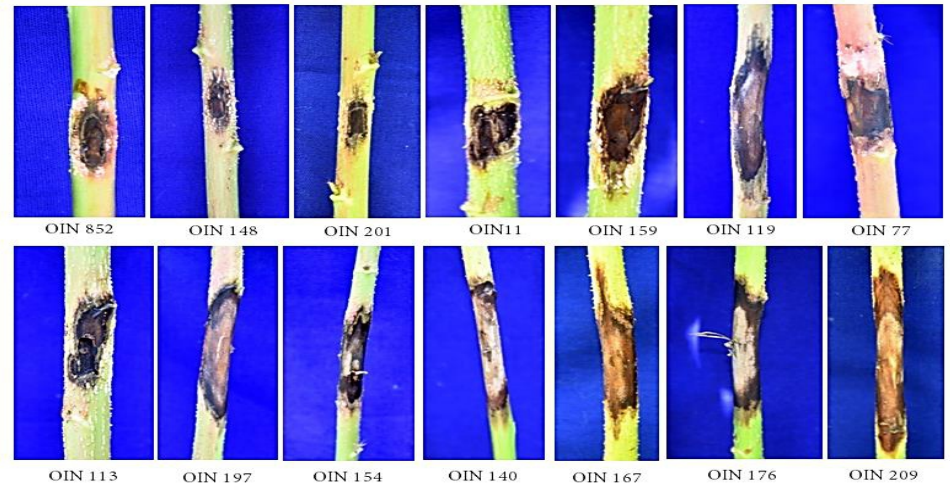


Fig. 69. Disease reaction in different germplasm against stem rot of jute in stem inoculation method

3 Informatics for Pest and Disease Infestation Prediction

3.1 Risk Assessment through Modeling of Major Pests and Diseases of Jute under Climate Change Scenario in India

N.M. Alam, D. Barman, S. Satpathy, S. Mitra and S.K. Sarkar

Project Code: In-house Project- JE2.2

The studies on the temperature-dependent development of mealybug were carried out at five constant temperatures (14, 19, 25, 31, and 36 °C) maintained inside the incubator. Both linear and non-linear models were fitted to describe the relationship between the development rate and temperature. The linear relationship between temperature and the development rate was determined by using a simple linear regression analysis. Whereas, nonlinear developmental rates were well explained by the modified four-parameter version of the Sharpe and DeMichele model:

$$r(T) = \left\{ \frac{D_{min}}{2} \times (\exp(k[T - T_{opt}] + \exp(-k \times [T - T_{opt}] \right\}^{-1}$$

The development rate of the immature stages of mealybug increased linearly with an increase in temperature between 16 and 33 °C (Fig. 70). The lower thermal threshold (Tmin) for the egg-to-crawler stage was estimated at 10.59 °C, while that for the II instar and III instar was 9.03 and 10.92◦C, respectively. Above 33 ◦C, the development rate was well described by the Sharpe and DeMichele models for crawler (R2 = 0.91 and AIC = 31.25; $p < 0.001$), II-instar ($R^2 = 0.89$ and AIC = 40.12; $p < 0.001$), and III-instar ($R^2 = 0.93$ and AIC = 28.63; $p < 0.001$) (Fig. 70). The fastest mean development times for crawler and II-instar were observed at 31 °C (crawler 4.1±0.5 days and II-instar 6.0±0.09 days), whereas for III-instar, the fastest development was observed at 36 °C (5.2±0.09 days).

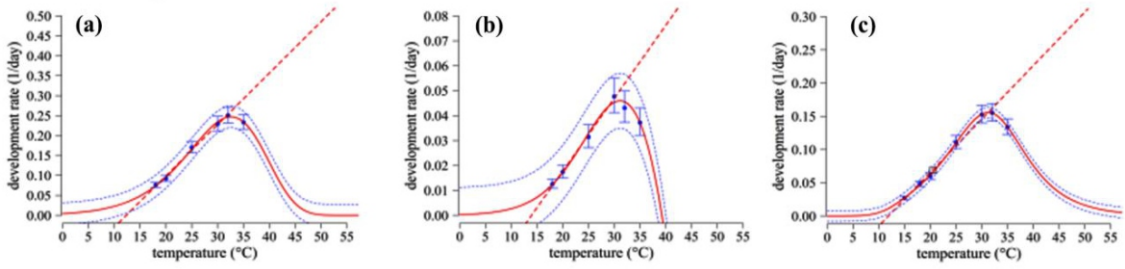


Fig 70. Temperature-dependent development rates of mealybug immature stages (a) crawler, (b) II-instar and (c) III-instar. The solid curve is nonlinear Janish-1 model and the straight line is the linear regression model. Dashed lines in blue represent the upper and lower 95% confidence bands.

KRISHI VIGYAN KENDRA

Krishi Vigyan Kendra

Two KVKs namely KVK Burdwan and KVK North 24 Parganas (Additional) implemented various On Farm Trials (OFTs), Front Line Demonstrations (FLDs) and training programs for disseminating new agricultural technologies as well as improving skills of farmers, farm women, rural youths and extension workers. Other extension activities like exposure visits, field day, method demonstration, technology week, etc. were also conducted. KVK, Burdwan is presently serving two districts of Purba and Paschim Bardhaman after bifurcation of the erstwhile district of Burdwan.

The salient accomplishments of these KVKs are presented below.

1. On Farm Trials (OFTs)

The following OFTs were conducted by the KVK, Burdwan:

i) **Weed management of onion in jute based cropping system**: Results indicated that application of pre-emergence herbicides (Pendimethalin) + weeding by ICAR- CRIJAF Cycle weeder (2 times) was the most effective measure for weed management of onion. Not only highest yield (230 q/ha) was obtained, it was most cost effective (B: C ratio 2.22) as it reduced labour requirement for weeding. At present when timely availability of labour is a big concern, use of the above technology is a sustainable solution for weed control in onion.

ii) **Assessment of sulphur and boron application on curd quality and yield in cauliflower in jute based cropping system**: Results indicated that application of sulphur @20 kg/ha as basal+ foliar spray of boron (3 times) was most effective in controlling of browning and hollow stem in cauliflower. Better yield (215 q/ha in comparison to 180 q/ha at farmers practice) and B: C ratios (2.45) also indicate the benefit of boron application on cauliflower.

OFT on Weed management in jute crop by KVK, Burdwan

iii) **Assessment of different improved weed management of jute under medium upland situation**: Results indicated that application of Propaquizafop (10% EC) @ 1.5 – 2.0 ml/l after 15 days + One hand weeding (Technology option 3) was most effective in controlling weeds in jute (weed density:14.3 no/m^2) while application of Fenoxaprop-p-ethyl (9% EC) @ 1.5 – 2.0 ml/l after 15 days + One hand weeding (Technology option 2) was the second best option (weed density:18.7 no/m^2) and was at par with two hand weedings at 25 and 45 DAS (Farmers' practice) (weed density:17.2 no/m^2). Fibre productivity in TO3 was 34.3 q/ha while in TO2 and farmers practice yield was recorded as 31.5 q/ha and 32.1 q/ha, respectively. However, cost benefit ratio in farmers' practice (B:C= 1.68) was lower than technology options (TO2=1.85 and TO3=2.01)

The details of OFT conducted by the KVK, North 24 Parganas (Additional):

i) **Assessment of Yellow Vein Mosaic Virus (YVMV) disease tolerant okra** : The YVMV resistant varieties recorded 5.5% YVMV incidence in Arka Anamika, 4.1% in Bindu, 3.8% in Kashi Kranti, 10.3% in local check (cv. Garima). Yield (t/ha)obtained was 10.54 in Arka Anamka, 11.88 in Bindu, 12.78 in Kashi Kranti, 9 in local check. B:C ratio was 1.52 in Arka Anamka, 1.62 in Bindu, 1.75 in Kashi Kranti and 1.28 in local check.

OFT on YVMV in okra crop by KVK, N24Prg (Addl)

2. Frontline Demonstrations (FLDs)

A total of 218 FLDs were conducted by both the KVKs during the year 2023 on jute, paddy, lentil, chickpea, onion, vegetables, banana and poultry. There were significant increase in productivity of all the field and fruit crops under improved practices over conventional methods. Demonstration on backyard poultry farming with kadaknath increased the income by more than 60% per unit. Improved retting of jute by using CRIJAF Sona formulation increased the fibre strength and fineness. The salient findings of the FLDs are given in Table 21.

FLD on cauliflower and lentil by KVK, Burdwan

FLD on onion and mushroom by KVK, N24Prg (Addl)

Table 21. Details of FLDs conducted by KVK Burdwan and North 24 Parganas (Additional) during the year 2023

Crop/livestock (No. of FLDs)	Technology demonstrated	Results
	KVK Burdwan	
Jute (29)	Seed treatment+ use of seed drill/cycle weeder+ 80:40:40 NPK+retting with CRIJAF SONA	There was 17.2% increase in productivity of jute in improved practice (36.2 q/ha) over local check (30.9 q/ha; JRO 524 with conventional practice). Cost return ratio in improved practice was 2.13 as against local check of 1.74.
Lentil (50)	INM (Seed treatment with rhizobium+10:40:20 NPK/ha+ soil application of rhizobium)	There was 7.6% increase in productivity of lentil in improved practice of INM (11.2 q/ha) over local check (10.4 q/ha). Cost return ratio in improved practice was 2.44 as against local check of 2.27.
Tomato (12)	Improved production technology with Arka Samrat	There was 18.5% increase in productivity of tomato in improved practice (320 q/ha) over local check (270 q/ha).
Banana(12)	Cultivation of tissue culture banana in jute based IFS	There was 25% increase in productivity of tissue culture banana Var Grand Naine with a yield of 625 q/ha. BCR of Grand Naine was 2.65 over local check of 2.08
Brinjal (20)	Integrated Pest Management in brinjal on *Leucinodes orbonalis* (Brinjal shoot and fruit borer) in Integrated Farming System.	Total 20 numbers of demonstrations were conducted covering an area of 1 ha. Result showed 20.8 percent improvement in yield than other farmer's field. Farmers showed interest about the technology.
Fodder crops (40)	Promotion of fodder crops to improve animal health	Distributed of 200 kgs of maize seeds (Var. J-1006), to the farmers and farm women to create awareness for green fodder production towards better animal health and milk production.
	North 24 Parganas (Additional)	
Jute (10)	Improved retting of jute by 'CRIJAF Sona' powder & liquid	CRIJAF Sona (Powder) : Retting Time (Days)=12.7, Fibre strength (g/tex) =22.00, Root content=6.25 % CRIJAF Sona (Liquid): Retting Time (Days)=11.10, Fibre strength (g/tex) =25.10, Root content=2.6 % Control: Retting Time (Days)=17.50, Fibre strength (g/tex) =19.75, Root content=10.65 %
Jute (25)	Variety-JRO 204	Variety JRO 204: Fibre yield=34.20 q/ha, BC ratio=1.42 Check: Fibre yield=26.43 q/ha, BC ratio=1.16
Kharif Onion (10)	Variety-Agrifound Dark Red	Mean Plant height=41.82 cm, Mean Neck diameter=1.62 cm, Mean Bulb diameter= 5.28 cm, Avg. Bulb weight=48.12 g, Mean yield= 18.40 t/ha, B:C ratio=3.65
Mushroom production (10)	Oyster mushroom	Days to pin head formation: 13.5 days, Days to first harvest: 21 days, Yield/bag: 1.65 kg, B:C ratio: 3.57

3. Demonstration Units and Farm Input Production

To disseminate the integrated farming system (IFS) technology, KVK-Burdwan has developed some demonstration units of vermicomposting, azolla production, mushroom cultivation, poultry and duckery rearing, goatary, apiary, etc.

Demonstration unit			Farm input production	
Unit	Variety/Species	Quantity produced	Product	Quantity
Vermicompost	*Eisenia fetida*	7,000 worms, vermicompost: 8 q	Earth worm	6500 pc
Mushroom	Oyster	40 beds	Vermicompost	943 kg
Poultry	Kadaknath, Haringhata Black, Sonali	44 nos	Fruit sapling	135 nos
Duckery	Chara Chameli,	11 nos	Paddy (foundation & certified seed of MTU 7029, GB3 and Hasant)	13.9 ton
Goatary	Black Bengal	5 nos	Livestock (Karaknath, RIR, Duck and Egg)	249 nos
Apiary	*Apis mellifera*	3 beehives	Horticulture Crops	327 nos
			Misc. product	225 kgs

Method demonstration and seed distribution KVK, Burdwan

Method demonstration by KVK, N 24 Prg (Addl)

AINP on Jute and Allied Fibres

The All India Network Project on Jute and Allied Fibers, at its headquarter at ICAR-CRIJAF, Barrackpore, Kolkata, functions through 8 SAUs and 4 ICAR Institute-based centres across 7 JAF-growing states. A total of 67 projects, comprising 34 projects under crop improvement, 13 under crop production, and 20 under crop protection programs on jute (*C. capsularis and C. olitorius*), mesta (*Hibiscus sabdariffa* and *Hibiscus cannabinus*), sunnhemp (*Crotalaria juncea*), ramie (*Boehmeria nivea*), sisal (*Agave sp.),* and flax (*Linnum usitatissimum*) were executed during 2023–24.

Crop Improvement

Under the crop improvement program, thirty-four projects comprising 152 trials were conducted on jute and allied fibre crops in different centres.

Recommendation for Release and Notification of JAF Varieties

One variety each of *capsularis* jute (JRCP-7) and HC mesta (JBMP-6) and two varieties of *olitorius* jute (JROP-4 for fibre purpose and JROV-5 for leafy vegetable purpose) were recommended for central release by the Central Sub-Committee on Crop Standard, Notification, and Release of Varieties during the 91st meeting held on November 21, 2023. The salient features of these varieties are summarized below:

JRCP-7 (Arijit): A green stem white jute variety with an average fibre yield of 31.50 q/ha and specifically adapted to the *capsularis* growing belt of the country under the rainfed and irrigated ecosystems of West Bengal, Assam, Bihar, Odisha, Tripura, and Uttar Pradesh. It is more tolerant to stem rot and root rot diseases and insect pests like the Bihar hairy caterpillar and stem weevil than check varieties JRC 698 and JRC 517. Its fibre quality is also better in terms of strength and root content. Its potential fibre yield is 39 q/ha.

Capsularis jute (JRCP-7)

JROP-4 (Renuka): A red stem tossa jute variety with an average fibre yield of 31.24 q/ha and a potential fibre yield of 38–39 q/ha. It is adapted to the entire tossa jute-growing belt of the country (West Bengal, Assam, Bihar, Odisha, and Tripura). JROP-4 is highly tolerant to stem rot and foot rot diseases, and less incidence of insects pests like the Bihar hairy caterpillar, stem weevil, and jute semilooper is observed. This variety also has less biomass lignin content than check varieties.

Red stem tossa jute variety (JROP-4)

JROV-5 (Vitapat-1): The first tossa jute variety exclusively released as a vegetable crop, which produces 151.31 q/ha average foliage yield in 30 days of crop duration. It is also rich in leaf vitamin C content (1.05 mg/g fresh leaf wt) and at par in iron content with other cultivated jute varieties. Specifically adapted to the olitorius-growing belt of the country in a rainfed or irrigated ecosystem during March to September. It can also be cultivated as a fibre crop (120 DAS), fetching 35–38 q/ha yield.

First tossa jute variety as vegetable crop (JROV-5)

JBMP-6 (Titli): A red stem HC mesta (kenaf) variety suitable for cultivation in mid- to high-land rainfed agro-ecological regions of West Bengal, Odisha, Maharashtra, Andhra Pradesh, Bihar, and the NEH regions. The average fibre yield is 28.06 q/ha, with a potential fibre yield of 36–37 q/ha. This variety is tolerant to foot and stem rot disease of mesta, and the incidence of insects and pests like aphids, semiloopers, and mesta mealy bugs is very low as compared to cultivated varieties. It also has high cellulose and hemicellulose contents, making it suitable for the pulp and paper industries.

Red stem HC mesta (kenaf) variety JBMP-6

Screening of JAF germplasm for yield, quality, biotic stresses, and special traits

Under this project, trials were conducted in the following sub-projects at various locations, as per the details given below:

NP (JB) 1.12: Evaluation of *capsularis* jute germplasm at Kalyani, Coochbehar, Kendrapara, Nagaon, and Katihar centres.

NP (JB) 1.13: Evaluation of *olitorius* jute germplasm at Kalyani, Coochbehar, Kendrapara, Nagaon, Katihar, and Rahuri centres.

NP (MB) 1.12: Evaluation of roselle germplasm at Amadalavalasa, Katihar, Aduthurai, and Barrackpore centres.

NP (MB) 1.13: Evaluation of kenaf germplasm at Aduthurai, Amadalavalasa, Rahuri, and Barrackpore centres.

Multi-location evaluation of elite lines with improved fibre yield, quality, and resistance to diseases and pests

NP (JB) 2.7: NHP with *capsularis* jute-evaluation of F_7 progenies at Nagaon and Katihar centre.

NP (JB) 2.8: NHP with *olitorius* jute-evaluation of F_7 progenies at Kalyani, Rahuri, and Katihar centres.

NP (JB) 2.9: NHP with *olitorius* jute-evaluation of F_6 progenies at Rahuri centre.

NP (JB) 2.10: NHP with *olitorius* jute-evaluation of F_4 progenies at Rahuri, Kalyani, and Coochbehar centres.

NP (JB) 2.11: NHP with *capsularis* jute-evaluation of F_4 progenies at Kalyani, Coochbehar, and Nagaon centres.

NP (JB) 2.12: NHP with *olitorius* jute-evaluation of F_3 progenies at Kalyani, Coochbehar, Nagaon, and Rahuri centres.

NP (JB) 2.13: NHP with *olitorius* jute-pre-breeding for pest and disease resistance-evaluation of F_2 crosses at Kalyani, Coochbehar, Katihar, Kendrapara, Rahuri, and Nagaon centres.

NP (JB) 2.14: NHP with *olitorius* jute-pre-breeding for fibre fineness-evaluation of F_2 crosses at Kalyani, Coochbehar, Katihar, Kendrapara, Rahuri, and Nagaon centres.

NP (JB) 2.15: NHP with *capsularis* jute-pre-breeding for fibre strength-evaluation of F_2 crosses at Coochbehar, Katihar, Kendrapara, Nagaon, and Kalyani centres.

NP(MB) 2.3: NHP with mesta-Station trial of F_7 progenies of kenaf at Barrackpore and Aduthurai centres.

NP (MB) 2.4: NHP with mesta-evaluation of F_3 progenies of roselle at Barrackpore centre.

NP(MB) 2.5: NHP with mesta-breeding for YVMV resistance in kenaf-evaluation of F_2 crosses at Aduthurai, Rahuri, and Amadalavalasa centres.

NP(MB) 2.6: NHP with mesta-pre-breeding for foot and stem rot resistance-evaluation of F_2 crosses at Amadalavalasa, Rahuri, and Aduthurai centres.

NP(MB) 3.1: Mutation breeding in mesta for creation of new variability-evaluation of M_3 population at Barrackpore, Amadalavalasa, Aduthurai, Katihar, and Rahuri centres.

Multi-location evaluation of elite lines with improved fibre yield, quality, and resistance to diseases and pests

NP (JB) 5.66: IVT with tossa jute (*C. olitorius*) at Kendrapara, Katihar, Kalyani, Coochbehar, Rahuri, and Nagaon centres.

NP (JB) 5.67: AVT-I with tossa jute (*C. olitorius*) at Kendrapara, Coochbehar, Barrackpore, Rahuri, Katihar, Kalyani, and Nagaon centres.

NP (JB) 5.68: AVT-II with tossa jute (*C. olitorius*) at Kendrapara, Coochbehar, Barrackpore, Rahuri, Katihar, Kalyani, and Nagaon centres.

NP (JB) 5.69: IVT with white jute (*C. capsularis*) at Kendrapara, Katihar, Kalyani, Coochbehar, and Nagaon centres.

NP (SB) 12.87: IVT with roselle (*H. sabdariffa)* Amadalavalasa, Rahuri, Aduthuai, Kendrapara, Coochbehar, and Katihar centres.

NP (SB) 12.88: AVT-I with roselle (*H. sabdariffa*) at Amadalavalasa, Rahuri, Kendrapara, Aduthurai, Coochbehar, and Katihar centres.

NP (SB) 12. 89: AVT-II with roselle (*H. sabdariffa*) at Amadalavalasa, Rahuri, Kendrapara, Aduthurai, Coochbehar, and Katihar centres.

NP (CB) 1.58: IVT with kenaf (*H. cannabinus*) at Amadalavalasa, Rahuri, Kendrapara, Aduthuai, and Coochbehar centres.

NP (CB) 1.59: AVT-I with kenaf (*H. cannabinus*) at Amadalavalasa, Rahuri, Kendrapara, Aduthurai, Coochbehar, and Barrackpore centres.

NP (CB) 1.60: AVT-II with kenaf (*H. cannabinus*) at Amadalavalasa, Rahuri, Kendrapara, Aduthurai, Coochbehar, and Barrackpore centres.

NP (SUN-B) 1.34: IVT with sunnhemp (*C. juncea*) at Amadalavalasa, Barrackpore, Pratapgarh, Kalyani, Aduthurai, and Budbud centres.

NP (RB) 1.13: IVT with ramie (*B. nivea*) at Sorbhog, Coochbehar, and Nagaon centre.

Multi-location evaluation of elite JAF lines for specific traits

NP (JB) 3.9: AVT-I with white jute for late sown conditions at Kalyani, Katihar, Kendrapara, Coochbehar, Nagaon, and Rahuri centres.

NP (JB) 3.10: IVT with tossa jute suitable for leafy vegetables at Barrackpore, Budbud, Kalyani, Coochbehar and Nagaon centres.

NP (JB) 3.11: Evaluation of elite MAGIC lines of tossa jute for economic traits at Barrackpore, Kalyani, Coochbehar, Kendrapara, Katihar, and Rahuri centres.

Crop Production

Under the crop production program, 13 projects, comprising 64 trials, were conducted at different centres. Out of 13 projects, six were evaluated for jute, four for mesta, and one each for flax sisal and ramie, comprising fertilizer scheduling, nutrient management, intercropping, cropping systems, and yield maximization in jute and allied fibre crops. The trials conducted under various projects are summarized below:

NP (JA) 6.10: Performance of new jute genotypes under adaptive trials at different fertilizer schedules

- *Olitorius:* at Kalyani, Coochbehar, Nagaon Katihar, and Kendrapara centres.
- *capsularis:* at Kalyani, Coochbehar, Nagaon Katihar, and Kendrapara centres.

NP (JA) 6.11: Performance of new mesta genotypes under adaptive trials at different fertilizer schedules

- Kenaf (cannabinus) at Aduthurai, Amadalavalasa, Kendrapara, and Rahuri centres
- Roselle (sabdariffa) at Aduthurai, Amadalavalasa, Rahuri, and Kendrapara

NP (JA) 6.19 (title modified in 2021): Soil test-based fertilizer application in jute and mesta-based cropping systems for improved nutrient management

- Jute: at Katihar (rainfed), and Mesta: at Aduthurai (irrigated).

NP (RA) 2.4: Yield maximization in ramie through improved management practices at Barrackpore, Coochbehar, and Sorbhog centres.

NP (RA) 2.5 (title modified 2020): Effect of nitrogen and potassium on fibre yield and fibre quality of ramie at Sorbhog centre.

NP (SIA) 5.2: Nutrient management in sisal at Amadalavalasa and Bamra centres.

NP(JA) 7.15 (title modified 2018): Carbon dynamics and fertility status of the soils in jute and mesta growing areas at Kalyani, Coochbehar, Katihar, Kendrapara, Nagaon, Aduthurai, Amadalavalasa, and Rahuri centres.

NP (JA) 7.10 (title modified 2021): Integrated weed management in jute and allied fibres

Jute: Kalyani, Coochbehar, Kendrapara, Katihar, and Nagaon.

Mesta: Amadalavalasa, Aduthurai, and Rahuri centres.

NP (MA) 3.5: Comparative evaluation of mesta-based cropping systems for higher productivity and profitability at Amadalavalasa, Aduthurai, Kendrapara, and Rahuri centres.

NP (SIA) 5.3 (title modified in 2021): Development of sisal-based intercropping systems for higher productivity and profitability along with improved resource use

- Performance evaluation of short-duration pulses and oilseed crops grown in interrows of sisal at the Amadalavalasa and Rahuri centre.
- Inter-cropping of aromatic grasses in sisal plantations for checking soil erosion and enhancing farm income at Bamra and Amadalavalasa centres.
- Inter-cropping of spices and medicinal plants in sisal plantations for higher farm income at Bamra and Amadalavalasa centres.

NP (JA) 7.18: Integrated nutrient management in seed production of *tossa* jute (*C. olitorius*) at Rahuri.

NP (JA) 7.19: Conservation agricultural practice under Jute-Rice-Lentil cropping system at Barrackpore, Kalyani, Coochbehar, Katihar, and Kendrapara centres.

NP (FLA) 1.5: Development of flax-based intercropping systems for higher productivity and profitability at Barrackpore, Kalyani, CoochBehar, Nagaon, and Katihar centres.

Crop Protection

A total of 20 projects, comprising 83 trials, were conducted at different centres. Out of 21 projects, ten projects were evaluated for jute, eight for mesta, two for sunnhemp, and one project for flax, comprising survey and surveillance of pests and diseases, screening of germplasm for pests and diseases, integrated pests and disease management, and evaluation of pesticides against pests and diseases of jute and allied fibre crops. The trials conducted under various projects are summarized below:

NP (JMPE) 1.1: Survey and surveillance of pests and diseases of jute, mesta, and sunnhemp at Barrackpore, Coochbehar, Kendrapara, Katihar, Nagaon, and Amadalavalasa centres.

NP (JPE) 1.0a: Screening of jute germplasm against pests at Coochbehar, Kendrapara, Katihar, and Nagaon centres.

NP (ME) 4.5: Evaluation of mesta germplasms against pests and diseases at Amadalavalasa, Katihar, and Coochbehar centres.

NP (JPE) 2.20: Integrated management of pests and diseases in jute at Kendrapara, Katihar, Coochbehar, and Nagaon centres.

NP (JP) 2.6: Intensive screening of *olitorius* germplasms against stem rot disease (new set of germplasm-2021) at Barrackpore, Kendrapara, Coochbehar, Katihar, and Nagaon centres.

NP (JP) 2.8: Intensive screening of *capsularis* germplasms against stem rot disease (new set of germplasm-2021) at Barrackpore, Kendrapara, Coochbehar, Katihar, and Nagaon centres.

NP (JE) 6.6: Intensive screening of *olitorius* germplasm against yellow mite (new set of germplasm-2021) at Katihar, Kendrapara, Coochbehar, and Nagaon centres.

NP (JP) 6.7: Evaluation of elite *C. olitorius* jute genotypes against nematode infestation under pot condition at Coochbehar centre.

NP (SHP) 1.2: Standardization of disease-free sunnhemp seed production technology in important sunnhemp-growing states at Barrackpore and Amadavalasa centres.

NP (ME): 4.7. Insecticidal management of insect pests in mesta at Amadalavalasa and Coochbehar centres.

NP (MP): 2.9: Intensive screening of kenaf germplasms against foot and stem rot disease at Amadalavalasa and Katihar.

NP (JP): 6.8: Evaluation of fungicides for management of jute diseases at Kendrapara, Katihar, Nagaon, and Coochbehar centres.

NP (JP) 6.9: Management of root-knot nematode (*Meloidogyne* spp.) in jute at Coochbehar centre.

NP (ME): 4.8. Management of spiral borer in mesta at Amadalavalasa centre.

NP (JB) 5.67: AVT-I with tossa jute (*C. olitorius*) at Kendrapara, Coochbehar, Barrackpore, Katihar, and Nagaon centres.

NP (JB) 5.68: AVT-II with tossa jute (*C. olitorius*) at Kendrapara, Coochbehar, Barrackpore, Katihar, and Nagaon centres.

NP (SB) 12.88: AVT-I with roselle (*H. sabdariffa*) at Amadalavalasa, Kendrapara, Coochbehar, and Katihar centres.

NP (SB) 12. 8**9**: AVT-II with roselle (*H. sabdariffa*) at Amadalavalasa, Kendrapara, Coochbehar, and Katihar centres.

NP (CB) 1.59: AVT-I with kenaf (*H. cannabinus*) at Amadalavalasa, Kendrapara, Coochbehar, and Barrackpore centres.

NP (CB) 1.60: AVT-II with kenaf (*H. cannabinus*) at Amadalavalasa, Kendrapara, Coochbehar, and Barrackpore centres.

Research Achievements

Concluded Projects: 2022-23

1. In-house Projects

Project Code: JA 7.6 (2018-2023)

Improvement of Soil Carbon Stocks and Farm Productivity through Integrated Cropland Management Practices in Jute Cultivation Areas: A Farmer's Participatory Research

Sustainably feeding the growing population by increasing production and profitability in the presence of biotic and abiotic stress is challenging. Rice, mustard, and jute are the major crops of the Bengal Delta region of India, and the annual income from their cultivation is relatively low. The goal of this study was to integrate soil and crop management practises by linking agro-ecosystem services at temporal (crop rotation) and spatial scales (intercropping) in the prevailing climatic, agronomic, and economic conditions of a farmer's field. The study was started in the year 2018 at three locations, viz. Barrackpore, Swarupnagar and Haringhata situated in West Bengal (India) after village survey and farmers' interaction. The soil texture of the plough layer (0-30 cm) was clay loam to silty clay loam. The soil was moderately alkaline (pH 7.52 - 7.72), having high available phosphorus (43 – 52 kg ha^{-1}) with low available nitrogen (178 - 194 kg ha^{-1}), available potassium (75 - 83 kg ha^{-1}) and organic carbon (4.40 – 5.10 g kg^{-1}). The long-term (1973–2020) mean annual temperature varied between 9.8 °C (January) and 36 °C (May) and mean annual precipitation was between 1242 mm and 1485 mm. Jute-rice-mustard is the dominant cropping system followed in most of the jute growing areas of eastern India. The study included three crop-soil management systems, (i) integrated soil-crop management (ILM_{soil}) with intercropping or mixed cropping, (ii) improved management with the optimized crop and nutrient procedures (IM_{soil}), and conventional management (CM_{soil}) practices as followed by farmers. At each location, the field experiment was laid out in field plots of 300 m^2 with three replications under a randomised block design. Rice was grown during the rainy season (August-November); followed by mustard in winter (December-March), and jute as a fibre crop in summer (April-July).

Inclusion of green gram and pumpkin as intercrops in jute and wet rice and lentil as a mixed crop in mustard helped to meet 85% of the cost of cultivation of all crops. The economic yield increased by about 63–78% for the main crops over conventional practices. Leguminous crops as intercrops and mixed crops also helped in reducing weeds by about 50% and provided nitrogen for subsequent crops. Nitrogen use efficiency and water use efficiency were significantly increased. Integrated soil-crop management (ILM) helped optimise chemical fertilizer and manure, water, and labour costs. Improvements in resource use efficiency through ILM may contribute to efficient economic conversion by way of higher productivity, a lower cost per unit of output, and sustainability, and can be potential adaptation strategies in the face of climate change. Ecosystem services in agroecosystems depend on maintaining soil health through integrated soil-crop management. This challenge is especially more pressing under climate change, which, as our study shows, seems to intensify the loss of SOC. We are able to assess the long-term consequences of weather variability on resolving the issue of increasing organic C by 0.4% per year, as well as the influence of changes in technology in intensive agriculture on the capacity to control the SOC stocks

of arable land. The best window for developing adaption strategies for the increased accumulation of SOC would be between the year 2050 and 2060. The shortage of manures is a significant impediment to apply the necessary amounts of organic fertilizers. The management strategy as adopted under the ILM_{soil} system may be highly recommended for the jute growing region. One of the options for maintaining and boosting SOC pools in soils is the use of leguminous crops as intercrops or mixed crops. It is necessary to conduct more research to see whether faster-growing green manures, such as sunnhemp, biochar made from jute sticks, and other carbon sources (composting leaf litter), could replace conventional manure-based soil additions.

Publications:

1. Singh, A. K., Ghorai A. K. and Kar, G. (2022) Diversification of rice growing areas in eastern India with integrated soil–crop system management for GHGs mitigation and higher productivity. *Carbon Management* 13(1): 105-116. (*NAAS:9.52*)
2. Singh, A. K., Roy, M.L. and Ghorai A. K. (2020) Optimize NPK fertilizer use through soil health assessment in West Bengal: Saves money and the environment. *International Journal of Current Microbiology and Applied Science* 9(6):322-330 (*NAAS:5.90*)

Project Code: JE 1.9

Bio-ecology and management of sucking pests in jute

- The infestation of yellow mite had positive correlation with maximum temperature (0.64) and minimum temperature (0.53) while negative correlation of mite population was observed with RH (- 0.78) and rainfall (-0.49).
- Total life cycle of mealy bug was reduced by 29 days with an increase of 18^{0}C temperature. The survival of mealy bug was highest at 28^{0}C and lowest at 16^{0}C. Effect of temp. was more prominent on fecundity/female (96.36-152.10)
- On the basis of mite population density in the critical stage of infestation, JR0 204, JRO 524 and JROG 1 were identified to be the mite tolerant varieties with least population, mite days, susceptibility index and higher tolerant index.
- JROM 1 was least susceptible to mealy bug with lowest female establishment rate and instantaneous growth rate.
- The persistent and translaminar toxicity of fenpyroximate 5EC(0.005%) spiromesifen 22.9EC(0.016%) and diafenthiuron 50WP(0.05%) was very high against jute mite. Two acaricides, fenpyroximate and spiromesifen were most effective against both egg and adult stages.
- Soil-applied S had significant effect in reduction of mite density, infestation, damage grade due to uptake and higher S content in leaf and elevated level of chlorophyll. These parameters could compensate the adverse effect of mite damage.
- Talc based formulation of *Isaria fumosorosea* (=*Paecilomyces fumosoroseus*) (Pf) and *Beauveria bassiana* (Bb) at 6x10^8 cfu/ml concentrations caused maximum cumulative mortality which indicates higher infectivity of talc based formulation of Pf and Bb and ideal for yellow mite control in jute.
- The mite tolerant variety JRO 204 with soil applied S and foliar treatment of fenpyroximate 5EC reduced the mite infestation significantly. Besides least mite damage, this treatment also manifested significant positive effect on yield, plant growth character and chlorophyll content (SPAD). Combined use of *B. bassiana* and *I. fumosorosea* formulation as foliar spray against showed moderate promise.

Publications

1. Satpathy, S., Gotyal, B.S. and Selvaraj, K. (2016). First report of cotton mealybug, *Phenacoccus solenopsis* Tinsley on cultivated jute (*Corchorus olitorius* L.) in India. *Entomologia Generalis*. 36(1): 55-61
2. Satpathy, S., Gotyal, B. S., and Ramesh Babu, V. (2019). Infectivity of entomopathogenic fungal bio-agents on yellow mite, *Polyphagotarsonemus latus* Bank of jute. *Journal of Biological Control.* 33(4): 389-392 DOI: 10.18311/jbc/2019/22708.
3. Satpathy, S., Gotyal, B. S., and Ramesh Babu, V. (2020). Record of parasitoid, *Aenasius bambawalei* Hayat on mealybug, *Phenacoccus solenopsis* Tinsley in jute ecosystem, *Journal of Applied Zoological Researches*, 31(2): 196-199.
4. Satpathy, S., Gotyal, B. S., and Ramesh Babu, V. (2020). Role of novel insecticides in crop protection and their selectivity to natural enemies: A review. *Journal of Environmental Biology*, 41:149-160

Extension Folders

1. Satpathy and B. S. Gotyal (2022). *Patasn mein pili makdi : prabandhan ki sambhabanye* (in Hindi), ICAR- CRIJAF, Kolkata.
2. S. Satpathy and B. S. Gotyal (2022). *JAF-Safe*- Ek Ablokan (in Hindi), ICAR- CRIJAF, Kolkata

Presentations in conference/Symposia

- Satpathy, S., Gotyal, B. S., and Ramesh Babu, V. (2018). Infectivity of entomopathogenic fungal bio-agents on yellow mite, *Polyphagotarsonemus latus* Bank of jute. In: Ist International Conference on Biological Control: Approaches and Applications" 27-29th September, 2018, Bengaluru, India. P. 103.
- Satpathy, S., Biswas, C. Gotyal, B.S. and Ramesh Babu, V. (2018). Advances in the use of entomopathogenic fungi for sustainable biocontrol under changing climatic condition. In International Conference on Climate Change and Adaptive Crop Protection for Sustainable Agri-horticulture Landscape ICAR-NRCSS, Ajmer 20-22 Dec, 2018. Pp. 5-6

Trainings/demonstrations organized:

- Demonstrated the IPM and acaricidal management of mite in jute at Mallikapur village, North 24 Parganas, West Bengal

Project code: JM 9.2

Isolation, characterisation and application of *Trichoderma* for disease management

The soil samples were collected from West Bengal, Assam, Meghalaya and Himachal Pradesh to isolate the target bio-agents. In total 56 soil samples were collected that yielded 12 Trichoderma isolates. Seven more were successfully isolated directly from varied substrates such as wild mushrooms and wooden logs. Apart from these 19 new isolates, four from previous studies, six from Culture Collection Centres and four from commercial formulations were also included in the study; making the total isolates 33.

- The efficiency of these isolates was tested using the dual culture method against three soil-borne fungal pathogens infecting fibre crops. These were *Macrophomina phaseolina* causing stem rot of jute, *Rhizoctonia solani* causing wilt of flax and *Sclerotium rolfsii* causing white rot of kenaf. From this study, CJMR191 was found effective against all three pathogens, while CJMR193 and CJMR180 showed specific inhibitory activity against *R. solani* and *S. rolfsii*, respectively.
- The effect of incubation temperature on the interaction between *Trichoderma* and the fungal pathogens were also tested. CJMR191 performed well at higher temperatures (30 and

35°C) however, CJMR180 and CJMR193 showed better efficiency at 25 °C.

- The compatibility of these three isolates was tested between 20 and 35 °C. It was observed that between 20 and 30°C all three selected *Trichoderma* isolates produced similar growth rates on PDA plates. At 35°C, CJMR191 produced significantly higher growth than the other two isolates. However, all three isolates were compatible with each other.
- A high throughput screening technique was developed to test the efficiency of the *Trichoderma* isolates as seed treatment against *M. phaseolina*. Seed germination and seedling mortality were counted till ~80% of seedlings from untreated seeds were dead (3-4 DAS). Ten isolates, eight from present study (CJMR189, CJMR193, CJMR180, CJMR187, CJMR197, CJMR192, CJMR196 and CJMR191), one each from previous study (TVC-1) and Culture Collection Centre (TV-10) performed well under this condition.
- A consortium-based formulation was made containing equal concentrations of CJMR180, CJMR191 and CJMR193. The formulation is being tested under the AINPJAF platform against stem rot disease of jute. The first year's results suggested that the formulation significantly reduced stem rot severity at multiple locations.

Academics & Human Resource Development

IARI-Mega University Hub, Kolkata

ICAR-IARI, New Delhi, has recognized 16 different institutes of ICAR as IARI-Mega University Hubs. ICAR-CRIJAF is one of these hubs entrusted by IARI to initiate UG/PG/PhD teaching in agriculture. In this session, ICAR-CRIJAF has offered 20 seats for UG, 6 seats for PG (Plant Breeding-2, and Soil Science-4), and 4 seats for PhD (Plant Breeding-1 and Soil Science-3). ICAR-CRIJAF, Kolkata hub has introduced these programs in association with 8 sister ICAR institutes, namely, ICAR-CIFRI, Barrackpore; ICAR-NINFET, Kolkata; ICAR-NBSSLUP, Kolkata Centre; ICAR-CSSRI, Canning Town Centre; ICAR-NDRI, Kalyani Centre; ICAR-IVRI, Kolkata; ICAR-CIFA, Rahara Centre; and ICAR-CIFE, Kolkata Centre, as hub partners.

Table 22. Course and discipline wise seats of IARI-Mega University Hub, Kolkata at ICAR-CRIJAF 2023-24

Courses	Disciplines	No. of seats
Undergraduate	Agriculture	20
Postgraduate	Soil Science, Plant Breeding	6
Ph.D.	Soil Science, Plant Breeding	4
Total		30

ICAR-CRIJAF organized an orientation meeting for the faculties of the IARI-Mega University Hub, Kolkata, on September 5, 2023, under the chairmanship of the Director, ICAR-CRIJAF, to discuss the plan and preparedness for the smooth conduct of these academic programs with all sorts of cooperation and help from the hub partners. The new academic program has been introduced for a noble cause to produce the best quality students for the service of the agriculture sector of the country by imparting quality education in the field of agriculture through this extended IARI's off-campus education facility at ICAR-CRIJAF.

Faculty Meet of IARI-Mega University Hub, Kolkata on September 5, 2023

The institute has created the best facilities for teaching and other co-curricular activities on campus. This hub has the strength of more than 70 faculties of diverse disciplines from across the hub partner institutes. Smart class room with the best audio-visual facilities has been created for all the students of UG, PG, and PhD. Besides, an examination hall, digital library, gymnasium, and other sports facilities are in place to provide the best academic and co-curricular environment that can be held to shape the overall personality of the students. The practical classes are being arranged in the laboratories of different divisions that has been customized for student purposes, which include the Soil Science Lab., Biotechnology Lab., Soil Microbiology Lab., Genetics Lab., Agronomy Lab., Seed Science Lab., PGR Lab., Plant Physiology Lab., Plant Protection Lab. and Farm Engineering Workshop. The classes for the current academic session started on 4th December 2023, for which the orientation program started on November 28, 2023. A Fresher's welcome program for UG, PG and Ph.D. students was organised on 20th December 2023.

Faculty Orientation Program of IARI-Mega University Hub, Kolkata held on 5th September, 2023

Fresher's Welcome Program of IARI-Mega University Hub, Kolkata held on 20 December, 2023

Participation of UG, PG and Ph.D. students during Fresher's Welcome Program of IARI-Mega University Hub, Kolkata

HRD Program for ICAR-CRIJAF

Training and Capacity Building of Staff Members

The Annual Training Plan (ATP) of the ICAR-CRIJAF for the year 2023–24 was developed using the TMIS software. The ATP (2023–24) contains a plan for training 21 employees. Care was taken to give priority to the manpower who did not receive any training during previous years. The plan included training proposals for scientific (8), technical (8), and administrative (5) staff. Till December 2023, a total of 11 scientific staff members have received training on different aspects, including 'plant genome editing and regulatory guidelines', 'Enhancing pedagogical competencies for Agricultural Education', 'Massive open online course on digital techniques', and 'Prevention, Prohibition and Redressal Sexual Harassment of Women at Workplace'. Three technical personnel were trained on 'Training Program on Seed Certification' and 'Agriculture in the Future and Future in Agriculture'. A total of six administrative staff received training on 'Vigilance Perspectives for ICAR Personnel' and 'Virtual Pre-Examination Training for Limited Departmental Audit and Accounts Examinations'.

Name of the Staff		Training attended
A. Scientific staff		
1	Dr. P. Satya, Principal Scientist	NABL Assessors' Training Course on ISO/IEC 17025:2017 scheduled at ICAR-CIFRI, Barrackpore during 17-21 January, 2023
		Enhancing Pedagogical Competencies for Agricultural Education at NASF, New Delhi, from 31 July to 5 August 2023
2.	Dr. S. K. Sarkar, Principal Scientist	Enhancing Pedagogical Competencies for Agricultural Education at NASF, New Delhi, during 25 - 30 September 2023
3.	Dr. S. Datta, Principal Scientist	Enhancing Pedagogical Competencies for Agricultural Education at NASF, New Delhi, from during 25 - 30 September 2023
4.	Dr. Thribhuvan R. Scientist	Enhancing Pedagogical Competencies for Agricultural Education at NASF, New Delhi, during 20 - 24 November 2023
5.	Dr. M.L. Roy, Senior Scientist	Massive Open Online Course on digital techniques organised by NAARM, Hyderabad during 1 - 31 October, 2023
6.	Dr. K.N. Chourasia, Scientist	Massive Open Online Course on digital techniques organised by NAARM, Hyderabad during 1 - 31 October, 2023
7.	Dr. R. Bhowmick, Scientist	Massive Open Online Course on digital techniques organised by NAARM, Hyderabad during 1 - 31 October, 2023
8.	Dr. S. Ghosh, Scientist	Massive Open Online Course on digital techniques organised by NAARM, Hyderabad during 1 - 31 October, 2023
9.	Ms. Lavanya AK, Scientist	Prevention, Prohibition and Redressal Sexual Harassment of Women at Work Place, Conducted by ISTM, New Delhi from 13 - 14 February, 2023.
10.	Ms. N. Mohan, Scientist	Prevention, Prohibition and Redressal Sexual Harassment of Women at Work Place, Conducted by ISTM, New Delhi from 13 - 14th February, 2023.
		Brain storming session cum workshop on sensitization on recent advances in plant genome editing and regulatory guidelines on 8-9 February, 2023
11.	D.P. Raghunath, Scientist	Professional Attachment Training 21 September to 20 December 2023

B. Technical staff		
1.	M.K. Kumbhakar, T-2	Training programme on seed certification on 19 May 2023, Burdwan Kisan Mandi, Purba Bardhaman.
2.	A. Singha Roy, T-1	Training programme on seed certification on 19 May 2023, Burdwan Kisan Mandi, Purba Bardhaman.
3.	B. Biswas, T-1	International training programme on "Agriculture in Future and Future in Agriculture" from 20th Nov to 10th Dec, 2023, online mode, Gwalior.
C. Administrative staff		
1.	S. Bhattacharya, AAO	Vigilance perspectives for ICAR personnel from 18-20, Ocober 2023, conducted by NAARM Hyderabad.
2.	Ritesh Kumar, AAO	Vigilance perspectives for ICAR personnel from 1-3, November 2023, conducted by NAARM Hyderabad.
3.	C. K. Verma, Assistant	Virtual pre-examination training for limited departmental Audit & Accounts examination conducted by ICAR-NIASM, Baramati from 20 July to 6 Oct, 2023
4.	S. Barman, Assistant	Virtual pre-examination training for limited departmental Audit & Accounts examination conducted by ICAR-NIASM, Baramati from 20 July to 6 Oct, 2023
5.	S.K. Suman, Assistant	Virtual pre-examination training for limited departmental Audit & Accounts examination conducted by ICAR-NIASM, Baramati from 20 July to 6 Oct, 2023
6.	A. Barua, UDC	Virtual pre-examination training for limited departmental Audit & Accounts examination conducted by ICAR-NIASM, Baramati from 20 July to 6 Oct, 2023

Internship at ICAR-CRIJAF: Four M.Sc. (Biochemistry) students of West Bengal State University completed a two-month summer internship at ICAR-CRIJAF under the guidance of Dr. K. Meena. Four M.Sc. (Microbiology) students of West Bengal State University completed a two-month (March 2023–April 2023) summer internship at ICAR-CRIJAF under the guidance of Mrs. Lavanya A.K. Five M.Sc. (Biotechnology) students of ADAMAS University completed a one-month summer internship at ICAR-CRIJAF from July 17, 2023, to August 17, 2023, under the guidance of Dr. S. Datta, Dr. K. Meena, Dr. P. Satya, Dr. R. Bhowmik, and Dr. D. Saha. They were trained on various molecular biology and biotechnology tools and techniques, including good laboratory practice, DNA and RNA isolation from plant tissues and quantification, performing polymerase chain reactions, detecting molecular marker variations, cDNA synthesis, plant tissue culture techniques, plant breeding techniques, etc. They were also trained in bioinformatics analysis of molecular data, including the handling of sequence data, marker diversity studies, and phylogenetic analyses. A sum of ₹ 90,000 was generated as revenue from the internship program.

Exposure visit of Trainees and Students from other Institutes/Universities

The HRD cell, ICAR-CRIJAF, also coordinated the exposure visits of various trainees and students to ICAR-CRIJAF during 2023. A total of 372 students visited the institute. The trainees and students became acquainted with the CRIJAF technologies through live demonstrations in the field and

laboratories. They visited the ICAR-CRIJAF museum, Agricultural Engineering section, compost management units, free-flowing retting system, integrated farming system, gene bank, biotechnology laboratories, etc. The students interacted with the scientists of the institute and received information on various scientific advancements of the institute.

Exposure Visit	Date	No. of participants
Exposure visit of college students from Serampore college, Hoogly	16 May 2023	20
Educational tour of school students from Nona Chandan Pukur, Manmathanath School, Kolkata	2 June 2023	30
Exposure visit of college students from Central Agricultural University, Meghalaya	19 July 2023	16
Exposure visit of school students from Jawahar Navodaya Vidyalaya, Banipur, Ashok Nagar, N-24 Parganas, W.B.	20 Sept 2023	36
Exposure visit of school students from Jawahar Navodaya Vidyalaya, South 24-Parganas, WB	20 Sept 2023	13
One day exposure visit of B.Sc (Hons.) Agriculture students of Swami Vivekananda University	12 Oct 2023	40
One day exposure visit of school students of Kendriya Vidyalaya, Cossipur, Dum Dum	28 Nov 2023	80
One day exposure visit of school students of Kendriya Vidyalaya, IIT Kharagpur	6 Dec 2023	110
One day exposure visit IRDM, Ramakrishna Mission Narendrapur, W.B.	14 Dec 2023	27
Total		372

Visit of college and school students during their Exposure visit to ICAR-CRIJAF in 2023

OUTREACH PROGRAMME

Scientists & Farmers Linkages

Awareness-cum-Training on Plant Genetic Resources Conservation

ICAR-NBPGR, New Delhi, in collaboration with ICAR-CRIJAF, organized an awareness-cum-training program on "Plant Genetic Resources Conservation for Improving Nutritional and Livelihood Security of Farmers and Promotion of Natural Fibres" during 2-4 February 2023, at ICAR-CRIJAF, Barrackpore. The main objective of the training was to create awareness among the SC farmers regarding the conservation and proper utilization of traditional crop varieties and promote natural fibres to improve their nutritional and livelihood security. Sri Dhrubajyoti De, I.P.S., Joint Commissioner, Kolkata Police, and Sri Sourav Barik, SDO, Barrackpore, graced the occasion as Chief Guest and Guest of Honour. Dr. Gouranga Kar, Director, ICAR-CRIJAF, highlighted the major objectives of the program and said that the visibility of ICAR will increase if the institutes work in such collaborations for proper utilization of resources for the upliftment of agriculture and farm families. More than 200 farmers and SHG members attended the training and interacted with the scientists. All the participants received their certificates of participation and the farm inputs during the valedictory session.

Skill Development for Making Jute-based Diversified Handicraft Products for Women Empowerment

A 15-day-long skill development training on jute fibre-based handicrafts was organized under SCSP from February 14 to 6 March 2023, for the benefit of jute-growing farm families. The major objective of the program was to augment the income of jute farmers through off-farm income from jute fibre-based value-added products. Twelve farm women had participated in the training program. A range of jute-based decorative items like flowers with vases, scenery, Idols of Lord Ganesha, Goddess Durga, etc. were made by the trainees during the program. Dr. Gouranga Kar, Director, ICAR CRIJAF, applauded all the trainees for their successful participation in the program. He also gave an insight on the importance of jute-based diversified products in national and international markets.

Participating farmers with farm inputs received in the training program on Plant Genetic Resources Conservation

Director of ICAR-CRIJAF with participating farmwomen of the training program

Kisan Sammelan and Farmers-Scientist Interaction

ICAR-CRIJAF, in association with Farmers of Gobardanga Seba Samity, North 24-Parganas, organized a Kisan Sammelan and farmers-scientist interaction program on June 15, 2023, to promote and get feedback on the technologies and skill training promoted by the Institute for farmers, farm women, SHGs, and FPCs. Prof. S. K. Datta, VC, Biswa Bangla University, and former DDG (CS), ICAR, and Chairman (QRT, ICAR-CRIJAF) was the Chief guest on the occasion. While interacting with the farm women trainees, he expressed satisfaction with the activities undertaken by ICAR-CRIJAF to enhance their skills and income of farm women. More than 1000 farmers, farm women, FPC members, and scientists attended this program.

Trainers' Training on Improved Production Technology

A series of eight training programs on 'Improved Production Technology for Quality Jute Fibre Production' under Jute-ICARE were organized at ICAR-CRIJAF, Barrackpore, during 14–15 February 2023, 27–28 February 2023, 1-2 March 2023, 6-7 March 2023, 17–18 April 2023, 19–20 April 2023, 24–25 April 2023, 31 May–1 June 2023, involving 192 Block supervisors, master trainers, and agriculture officials from the states of West Bengal, Assam, Bihar, Meghalaya, Jharkhand, Nagaland, and Uttar Pradesh. In these trainings, topics like the prospect of the Jute-ICARE program, improved production technology of jute, crop cutting experiments on jute, improved retting with CRIJAF Sona, pest and disease management of jute, etc. were covered. In the valedictory session, Dr. Gouranga Kar, Director, ICAR-CRIJAF, encouraged and suggested that the trainees implement their acquired knowledge for better crop yield and increased profitability from farming without causing any damage to the environment in their states.

Soil Testing for Jute-based Cropping Systems

A three-day farmers' training on 'Soil Testing and Nutritional Recommendation for Jute-based Cropping System' was conducted during 13–15 March 2023, at the ICAR-Central Research Institute for Jute and Allied Fibres, Barrackpore, for the tribal farmers under TSPSTCR. In this training, 20 tribal farmers from Makaltala and Farmania villages in the Habra-I block of the North 24 Parganas districts participated.

Director of ICAR-CRIJAF addressing farmers during Kisan Sammelan and farmers-scientist interaction program

Participating officials of Jute-ICARE training on 'Improved Production Technology for Quality Jute Fibre Production'

Enhancing Production in Jute-based Cropping Systems through Efficient Nutrient Management

An awareness-cum-training program on "Enhancing Production in Jute-based Cropping Systems through Efficient Nutrient Management" was organized in collaboration with ICAR-NBSS & LUP, Regional Centre, Kolkata, during 22–23 March 2023. The main objective of the program was to create awareness among the farmers about the judicial and smart use of plant nutrients for enhancing productivity in jute-based cropping systems. Director, ICAR-CRIJAF, and scientists of ICAR-NBSS & LUP, Kolkata, distributed CRIJAF Multi-Row Seed Drill, Nail and Single Wheel Jute Weeder to the farmers for line sowing and mechanical weed management in the jute crop. About 100 farmers and SHG members attended the training.

Farm Mechanization in Jute-based Cropping Systems for Enhancing Productivity and Profit

A five-day farmers' training program on "Farm Mechanization in Jute-based Cropping Systems for Enhancing Productivity and Profit" under the TSP Program was organized during 19–23 June 2023, at ICAR-CRIJAF, Barrackpore. A total of 15 ST farmers from Nadia district (W.B.) participated in the program. The topics covered were the importance of farm mechanization, use of tractors and power tillers in agriculture, the safe use of plant protection equipment, the maintenance of health and safety in the workplace, etc. In the concluding session, Director, ICAR-CRIJAF, emphasized the importance of farm mechanisation for timely field operation and reducing the cost of cultivation.

Farm Pond based Integrated Farming System for Higher Income Opportunities

Three days training programme was organized for ST farmers on “Pond-based Integrated Farming Systems for Augmenting Farm Income” under TSP scheme from 16-18 August 2023 at ICAR-CRIJAF, Barrackpore. Farmers of Rupamari, Bailani villages of Hingalganj, North 24 Parganas participated in the programme. Trainees were felicitated with certificates and agriculture implements (sprayer, CRIJAF single wheel jute weeder, CRIJAF jute seeder) by the Director, ICAR-CRIJAF.

Improved Cultivation Practices and Management of Rice

A three-day farmers' training program on "Improved cultivation practices and management of rice crops" under the TSP Program was organized during 26–28 June 2023, at ICAR-CRIJAF, Barrackpore. A total of 23 ST farmers from Chakdah Block, Nadia district of West Bengal participated in the program. Dr. Gouranga Kar, Director, ICAR-CRIJAF, advised the trainees to apply knowledge obtained through training in field situations.

Input distribution to farmers under training of NBSS & LUP

Participating farmers of TSP training on 'Farm Pond based IFS'

Integrated Pest Management for Enhancing Productivity of Rice in Jute Based Cropping System

A three-day training program on "Integrated Pest Management for Enhancing Productivity of Rice in Jute-Based Cropping Systems" was organized at ICAR-CRIJAF during 21–23 March 2023, for the tribal community of Makaltala village, North 24 Parganas (W.B.) under the Tribal Sub Plan. A total of 20 tribal farmers participated in the program. During the program, the farmers learned about the recent approaches to Integrated Pest Management in jute based cropping systems, weed management, disease and pest management biocontrol, and the safe use of pesticides. The farmers actively interacted with the resource persons regarding the problems they faced in pest and disease management and were satisfied with the solutions advised by the experts.

Custom Hiring Centres in the Mechanization of Jute-based Cropping Systems

A farmers' training on 'Role of custom hiring centres in mechanization of jute-based cropping systems' was organized during 15–17 February 2023, at ICAR-CRIJAF, Barrackpore. A total of 20 SC farmers from Goaldah (Swarupnagar Block), and Taraberia and Bhabagachhi, (Amdanga Block) villages of North 24 Parganas district (W.B.) participated in the program. In the valedictory session, Dr. Gouranga Kar, Director, ICAR-CRIJAF, interacted with the farmers and emphasized the importance of advanced training on Agriculture Machine Operation for skill development and employment generation. The critical inputs and farm Implements were distributed among the farmers.

Agri-Drone Demonstration

ICAR-CRIJAF has been selected as one of the ICAR Institutes for "Drone technology demonstration" under the Sub Mission on Agricultural Mechanization during 2022–23. In this aspect, a drone-based spraying demonstration was carried out at the ICAR-CRIJAF campus on March 22, 2023, to create farmers' awareness and promote drone technology. Director, ICAR-CRIJAF, explained to the farmers that Drone technology is going to be very popular among farmers in the near future. It's a boon to the jute farmers, as it will become very handy to apply the pesticides and monitor the crop with better accuracy and in the shortest amount of time. Various benefits of drone-based spraying were explained by ICAR-CRIJAF scientists to farmers, which created great interest and motivation among the stakeholders. The program was attended by 150 farmers and other stakeholders.

Director and scientists of ICAR-CRIJAF with participating farmers during demonstration of Agri-Drone

Participating farmers discussing pest disease problems with scientists of ICAR-CRIJAF

Plant Protection Measure for Jute Crop

A training program on "Plant Protection Measure for Jute Crop" was organized at ICAR-CRIJAF on 30 May 2023, for the tribal community of Chakdah village, North 24 Parganas (W.B.) under the Tribal Sub Plan. A total of 20 tribal farmers participated in the program. During the program, the farmers learned about the recent approaches to pest and disease protection in the jute crop. The farmers actively interacted with the resource persons regarding the problems they faced in pest and disease management and some solutions were advised by the scientist.

Stakeholder's Meeting at Sundarbans

ICAR-CRIJAF organized a stakeholders meeting on February 22, 2023, at Gosaba, Sundarbans, under the multinational (Australia, Bangladesh, India, and Indonesia) Project sponsored by APN-GCR and UNiSC, Australia. A total of 25 farmers, NGO representative, and a local administrative representative participated in the interaction meeting. The jute bags were distributed for awareness campaign of biodegradable products against plastics to maintain the good health of the agricultural and mangrove ecosystems. Dr. D. Barman, PI of the project (ICAR-CRIJAF), described climate-induced natural hazards such as tropical cyclone and its impact on the Sundarbans. Dr. Sanjeev Srivastava, UniSC, Australia, briefed about the sustainable development goals, the vulnerability of the mangrove ecosystem, and mechanisms for uplifting of livelihood of the local people.

Mushroom Production Technology for Enhancing the Rural Livelihood of Tribal Farmers

A three-day training program entitled "Mushroom Production Technology for Enhancing Rural Livelihood of Tribal Farmers" was organized at ICAR-CRIJAF, Barrackpore, during 23–25 January 2023, under the TSP Program. A total of 20 tribal women farmers and rural youth from various villages of Barrackpore, North 24 Parganas were trained in the training program. The objective of the training program was to provide first-hand training on the production technology of oyster mushrooms and mushroom spawn production to the trainees. The training was conducted in a two-way interactive mode, i.e., theory and practice. Scientists from ICAR-CRIJAF distributed mushroom cultivation starter kits (spawn, agricultural lime, fungicides), agricultural inputs (Irrigation kits, small farm implements), and participation certificates to the tribal farmer trainees.

Participating ST farm women preparing mushroom casing mixture during the training

Certificate distribution by the resource person during valedictory function of the training

Training Organised

Sl. No.	Topic of the Training	Place	Duration	No. of Participants
1.	Health management of goats	Bijoypur Village, N24 Prg	2 January 2023	21
2.	Oyster mushroom production	Koyra village, N24 Prg	28 January 2023	26
3.	Post- harvest management of fruits through value addition	Beraberia village, N24 Prg	31 January 2023	14
4.	Diversified poultry production for income generation	Kharermath Village, N24 Prg	14 February 2023	19
5.	Improved production technology for quality jute fibre production for master trainers and block supervisors from West Bengal (Jute-ICARE)	ICAR- CRIJAF, Barrackpore	14-15 February 2023	27
6.	Profitable jute farming through intensive cropping and efficient water use	ICAR-CRIJAF, Barrackpore	15-17 February 2023	20
7.	Improved production technology for quality jute fibre production for master trainers and block supervisors from West Bengal (Jute-ICARE)	ICAR- CRIJAF, Barrackpore	27-28 February 2023	33
8.	SERB-CRG scheme for the flax genome editing project	ICAR- CRIJAF, Barrackpore	1 Feb - 31 Mar 2023	1
9.	Improved production technology for quality jute fibre production for master trainers and block supervisors from Assam region (Jute-ICARE)	ICAR- CRIJAF, Barrackpore	6-7 March, 2023	20
10.	Opportunities of natural farming in horticultural crops	ICAR-CRIJAF Barrackpore	16 March 2023	40
11.	Natural Farming : Scope & Opportunities	ICAR-CRIJAF, Barrackpore	16-17 March 2023	40
12.	International year of Millets 2023 & Webcasting of Hon'ble PM address	ICAR-CRIJAF, Barrackpore	18 March 2023	42
13.	Scientific housing & healthmanagement of goat	Ratanpur, N24 Prg	27 April 2023	16
14.	Improved production technology for quality jute fibre production for JSLPS Officer from Jharkhand region (Jute-ICARE)	ICAR- CRIJAF, Barrackpore	17-18 April 2023	20
15.	Improved production technology for quality jute fibre production for Officials of Jharkhand (Jute-ICARE)	ICAR- CRIJAF, Barrackpore	19-20 April 2023	20
16.	Important medicinal plants of North 24 Parganas and its uses	Babpur, N24 Prg	29 April 2023	20
17.	Improved production technology of okra	Beraberia, N24 Prg	1 May 2023	31
18.	Improved production technology for quality jute fibre production for agril. officials of Nagaland, U.P., W.B., Assam & Bihar (Jute-ICARE)	ICAR- CRIJAF, Barrackpore	31 May-1June 2023	20
19.	Feeding management of goats	Beraberia, N24 Prg	9 May 2023	14
20.	Improved production technologies of major cucurbits	ICAR-CRIJAF, Barrackpore	29-31 May 2023	15
21.	Livestock integration for organic vegetable production	Jalsukha Village, N24 Prg	31 May 2023	15
22.	Converting waste to wealth through vermicomposting	Huda village	5 June 2023	50

23.	Backyard duck farming	Beraberia village, N24 Prg	8 June 2023	17
24.	Improved cultivation practices and management of rice crop	ICAR-CRIJAF, Barrackpore	26-28 June 2023	23
25.	Vegetative propagation techniques of important fruitcrops	ICAR-CRIJAF, Barrackpore	18 July 2023	13
26.	Livestock farming under pond based integrated farming system	ICAR-CRIJAF, Barrackpore	26 July 2023	27
27.	Improved fruits and vegetable production under pond based IFS	ICAR-CRIJAF, Barrackpore	27 July 2023	24
28.	Improved green fodder production & preservation	Selarhat Village, N24 Prg	28 July 2023	22
29.	Jute fabric based value added products	ICAR-CRIJAF, Barrackore	1-7 August 2023	13
30.	Livestock management under pond based integrated farming system	ICAR-CRIJAF, Barrackpore	2 August 2023	22
31.	Vegetative propagation techniques in horticultural crops	KVK North 24 Parganas (Addl)	9-11 August 2023	15
32.	Scientific duck farming	ICAR-CRIJAF, Barrackpore	16 August 2023	20
33.	Vermicompost production	Babpur village, N24 Prg	29 September 2023	20
34.	Livestock management under different climatic conditions	Charuhat Village, N24 Prg	26 September 2023	17
35.	Scientific nursery raising techniques in winter vegetables	ICAR-CRIJAF, Barrackpore	3-5 October 2023	15
36.	Oyster mushroom production	Beraberia village, N24 Prg	16 October 2023	15
37.	Farmers' awareness programme on 'Proper use of agricultural tools for achieving higher yield'	CRIJAF-RRS, Sorbhog, Assam.	9-13 October 2023	300

Training and demonstration conducted under DST SEED Project

Sl. No.	Topic of the Training	Place	Duration	No. of Participants
1.	Skill development in making of customized jute bags	ICAR-CRIJAF	9–20 March 2023	12
2.	Field day on onion harvesting and safe storage	Basudebpur Barracpore-1 block	10 March 2023	32
3.	Jute based handicrafts	ICAR-CRIJAF	11–21 March 2023	13
4.	Improved production technology on jute	ICAR-CRIJAF	20–22 March 2023	40
5.	Demonstration programme on Multi-row seed drill and Single wheel jute weeder	Basudebpur Barracpore-1 block	31 March 2023	29
6.	Demonstration on improved jute retting & farmer-scientist interaction meeting	Basudebpur Barracpore-1 block	9 August 2023	41
7.	Demonstration on improved jute retting & farmer-scientist interaction meeting	Beraberia Amdanga block	15 August 2023	53
8.	Making of jute bags	ICAR-CRIJAF	11–18 October 2023	12
9.	Demonstration programme on Onion Seeder	Beraberia Amdanga block	1 November 2023	24

Training programmes conducted by Krishi Vigyan Kendra (KVK)

Training Category	Number of Trainings	No. of Participants						Grand Total
		General			SC/ST			
		Male	Female	Total	Male	Female	Total	
KVK, North 24 Parganas (Addl.)								
Practicing Farmers	20	30	48	78	182	215	397	475
Rural Youth	5	6	10	16	27	44	71	87
Extension Functionaries	2	11	13	24	7	10	17	41
Total	27	47	71	118	216	269	485	603
KVK, Burdwan								
Practicing Farmers	51		13	13	805	695	1500	1513
Rural Youth	5	0	0	0	64	76	140	140
Extension Functionaries	1	0	0	0	30	0	30	30
Total	57	0	13	0	899	771	1670	1683

Chairman and Member of RAC with the Director, ICAR-CRIJAF during Farmers Meet

Awareness program on International Year of Millets 9 June, 2023

Seed Day 2023 on 18 March 2023 at ICAR- CRIJAF

Hands on training of ramie fibre extraction

Director and Scientist interacting with trainees

National Food Security Mission

Frontline demonstrations (FLD)

Improved Production Technologies of Jute under NFSM (CC) Jute: Frontline demonstrations on the latest high-yielding varieties (JRO 204, JROB 2, JROMU 1, JROBA 3, and JROG 1) and other improved production technologies (weed management through the CRIJAF Nail Weeder, CRIJAF Single Wheel Jute Weeder, line sowing by the CRIJAF Multi-Row Seed Drill, and CRIJAF Jute Seeder) of jute were conducted in various blocks of major jute growing districts, viz. North 24 Parganas, Hooghly, and Nadia of West Bengal (Table 23).

Table 23. Area coverage under different technology (ha)

Location of FLD	No. of farmers	Area coverage under different technology (ha)		
		Improved variety	Mechanical weed control	Line sowing with Multi-row seed drill
Bishnupur (Chakdah, Nadia)	248	64.60	18.00	22.56
Panji (Baduria, North 24 Parganas)	393	79.00	37.00	42.00
Charkrishnabati (Balagarh, Hooghly)	108	13.20	07.39	06.65
Total	749	156.80	62.39	71.21

Enhancing yield through high-yielding jute varieties: Farmers were made aware of the importance of certified seeds and improved jute varieties. Accordingly, frontline demonstrations on improved varieties were conducted in various village clusters of different blocks in the North 24 Parganas, Hooghly, and Nadia districts of West Bengal. Frontline demonstrations on the latest high-yielding varieties (JRO 204, JROB 2, JROMU 1, JROBA 3, and JROG 1) significantly enhanced the average yield by 6.04–11.40 q/ha over the varieties used by the farmers. Out of all the five demonstrated varieties, JROBA 3 was the highest yielder (39.10 q/ha), followed by JROB 2, JRO 204, JROMU 1, and JROG 1, while the average yield of the farmers' used variety was found to be 27.70 q/ha (Table 24).

Table 24. Performance of high yielding jute varieties across three extension centres and nearby locations

Particulars	High yielding jute varieties					
	JRO 204	JROB 2	JROBA 3	JROG 1	JROMU 1	**Farmers' Practices**
Cost of cultivation (₹/ha)	100463	100463	100463	100463	100463	118254
Gross return (₹/ha)	166369	170361	181502	156621	161449	128600
Net return (₹/ha)	65906	69898	81039	56158	60986	10346
Fibre yield (q/ha)	35.84	36.70	39.10	33.74	34.78	27.70
B : C	1.66	1.70	1.81	1.56	1.61	1.09

Weed management through the mechanical method: In order to reduce the cost of weeding and increase the profitability of jute cultivation, demonstrations on mechanical weeding by the CRIJAF single-wheel jute weeder (SWJW) were conducted in the farmer's field (62.39 ha) in three districts of West Bengal (Table 25). Demonstrations on mechanical weed management resulted in a 3.71–5.44 q/ha fibre yield gain over farmers' practices (27.12–28.13 q/ha). Saving on the cost of labour was ₹12002 to ₹16127/ha.

Line sowing by jute seeder: Demonstrations on line sowing by jute seeder were conducted in 71.21 ha area in three districts of West Bengal (Table 25). It helped in increasing the fibre yield by 2.97–4.43.q/ha. It also saved the cost of human labour in jute cultivation by ₹6429–13811/ha over farmers' practices.

Table 25. Economics of jute cultivation across three extension centres and nearby locations

Locations/ Particulars	Economics of jute cultivation (₹/ha)						
	IC	LC	CC	Yield	GR	NR	BCR
Mechanical weed management							
NADIA							
SWJW	12661	88514	101175	32.26	149751	48576	1.48
FP	15623	103648	119271	27.86	129326	10055	1.08
NORTH 24 PARGANAS							
SWJW	12157	84262	96419	32.56	151126	54707	1.57
FP	16223	100389	116612	28.13	130580	13968	1.12
HOOGHLY							
SWJW	12996	90798	103794	30.83	143113	39319	1.38
FP	16078	102800	118878	27.12	125891	7013	1.06
Line sowing by jute seeder							
NADIA							
MRSD	11891	89837	101728	31.28	145202	43474	1.43
FP	15623	103648	119271	27.86	129326	10055	1.08
NORTH 24 PARGANAS							
MRSD	12227	93960	106187	31.55	146455	40268	1.37
FP	16223	100389	116612	28.13	130580	13968	1.12
HOOGHLY							
MRSD	12355	93793	106148	30.09	139678	33530	1.31
FP	16078	102800	118878	27.12	125891	7013	1.06

IC- Input Cost, LC- Labour Cost, CC- Cost of Cultivation, GR-Gross Return, NR-Net Return, BCR-Benefit Cost
FP - Farmers' Practice, NW- Nail Weeder, SWJW-Single Wheel Jute Weeder, MRSD –Multi-seed row drill; price of jute fibre and jute stick were Rs.4200/q and Rs.200/q, respectively.

Improved retting through CRIJAF SONA: In comparison to the previous years, there was a shortage of rainfall in most of the places at the sowing as well as at the time of harvesting and retting, as a result of which the crop duration increased by 3–4 weeks. In the improved method of jute retting, the application of CRIJAF SONA (@30 kg/ha) reduced the retting period by 4–6 days at all places. There was a slight improvement in fibre quality, because of which growers could earn an additional income of only ₹100–200/q. As the process of improved retting through CRIJAF SONA involves a lower fibre-to-water ratio (v/v) for retting, in such conditions, this method has proven its utility.

Table 26. Qualitative evaluation of improved jute retting with CRIJAF SONA

Location	Fibre quality		Retting duration (days)	
	Improved	Conventional	Improved	Conventional
Nadia	TD 4-5	TD 5-6	17-20	22 - 25
North 24 Parganas	TD 4-5	TD 5-6	18-22	23 - 28
Hooghly	TD 4-5	TD 5-6	20 - 22	25 - 27

FLD on Mesta: Mesta production technologies were demonstrated in an area of 7.0 ha, involving 20 farmers in the Srikakulam and Vizianagaram districts of Andhra Pradesh, with an improved variety of mesta AMV 7, line sowing, and integrated weed and pest management. Fibre yield was in the range of 20.00 to 27.00 q/ha. Three retting demonstrations were conducted to demonstrate the use of the CRIJAF SONA microbial consortium, and 95 farmers participated in these demostrations.

Local Area Initiatives: FLD on ramie fibre production and extraction was done in 2 ha farmers' field in Chirang district of Assam, and quality planting materials (cv. R-1411 and Hazarika) were supplied. Maintenance activities of the ramie plantation were carried out in a 10 ha area at RRS, Sorbhog, Assam.

Quality Seed Production

In jute, 6.81 q foundation seed of 12 jute varieties (JROB 2, JROMU 1, JRO 2407, JROG 1, JRC 9057, CO 58, JBO2003-H, JRO 204, JRO 524, JRC 212, JRCM 2, JBO 1) and 2.26 q certified seed of JRO-2407 and JROM-1 were produced against a target of 11.0 q and 50 q, respectively, in ICAR-CRIJAF. Foundation seed of JRO204 (7.0 q) and 30.40 q certified seed of CO-58 were produced against a target of 6 q and 25 q, respectively, at MPKV Rahuri. Foundation seed (10 q) of four improved mesta varieties, namely AMV 7, AMV 8, AMV 9, and AMV 10, has been produced in ARS, Amadalavalsa, AP against a target of 2.00 q, along with 5.00 quintals of certified mesta seed of AMV 7 and AMV 9 to meet the target of 5 q in ARS Amadalavalasa.

SCSP & TSP Programs

Scheduled Caste Sub-Plan (SCSP) and Tribal Sub-Plan (TSP) programs were taken up by ICAR CRIJAF to address the issues and problems related to farming faced by scheduled caste and tribal communities in an integrated way. These programmes focused primarily on promotion of R&D based proven technologies for skill and livelihood improvement to facilitate SC and ST farmers in their developmental aspiration backed up by the supply of adequate resource and technological knowhow.

Scheduled Caste Sub-Plan (SCSP)

The institute implemented the SCSP plan in jute and allied fibre crop-based farming systems to minimize the gap between the livelihoods of SC and general communities. Scheduled caste sub-plan activities were implemented in various villages in the North 24 Parganas, South 24 Parganas, Nadia, Bankura, Purulia, and Purba Bardhaman districts. In order to develop the knowledge and skills of SC farmers by identifying and addressing the issues related to low farm income in the fields of agriculture and allied fields, ICAR-CRIAF has conducted various capacity-building activities like trainings and demonstrations in several districts of West Bengal.

- During 2023, altogether, 6 training programs, 2 field demonstration programs on improved methods of jute retting, and 2 Kisan Sammelan (mega events) were conducted, and about 4338 SC farmers benefited from the programs.
- Successful technology models, farm equipment, improved seed, animal components, and other agricultural inputs for improving farm income in the jute and allied fibre-based cropping program were promoted among the SC farmers with adequate resource support.

Various agricultural inputs, like improved varieties of jute seed, paddy seed, vegetable seed kits, fertilizers, vermicompost beds, CRIJAF Sona, crop protection kits, and farm implements and tools (CRIJAF single-wheel jute weeders, jute seeders, battery-operated sprayers, etc.), were distributed to more than 11547 farmers in various districts of West Bengal.

Table 27. Capacity building programmes under SCSP

Capacity building programme	Date/Place	No. of Participants
Mushroom Production Technology	18-20 January, 2023 ICAR-CRIJAF, Barrackpore	20
Role of Custom Hiring Centres in Mechanization of Jute based Cropping System	15-17 February, 2023 ICAR-CRIJAF, Barrackpore	20
Improved Retting Technology for Better Quality Jute Fibre	07-09 June, 2023 ICAR-CRIJAF, Barrackpore	30
Improved Retting Technology for Quality Jute Fibre Production	18-20 July, 2023 ICAR-CRIJAF, Barrackpore	30
Farm Pond based Integrated Farming System for Higher Income Opportunities	25-27 July, 2023 ICAR-CRIJAF, Barrackpore	25
Jute Fabric based Value Added Products	26 July-03 August, 2023	13
Field Demonstration on "Improved Retting Technology for Quality Jute Fibre Production"	28 July, 2023 Gaighata, 24 Parganas(N)	100
	04 August, 2023 Chakdah, Nadia	100

Tribal Sub Plan (TSP)A series of activities were undertaken under Institute TSP Program for overall development of schedule tribe (ST) farming communities in identified villages of Nadia and North 24 paraganas districts of West Bengal during the year 2023 through integrated approaches in jute and allied fibres based cropping/ farming systems with various components like nutritional garden, field crop cultivations, vegetables and fruit plantations, fisheries, backyard poultry, vermicomposting, etc. with adequate resource support, successful technology models, farm implements, improved seeds, animal components, fish and poultry feed along with other appliances for improving household food security, farm income and additional employment opportunities family labour of ST farming community under jute and allied fibre based cropping/ farming system program.

To promote a jute-based farming system, various enterprises, such as vegetable cultivation, fishery, vermicomposting, organic farming etc., along with technological support, were provided to approximately 4000 ST farmers in West Bengal. Farm inputs (seeds, fertilizers, CRIJAF Sona, fish feed) and farm tools (sprayer, jute seeder, jute weeder, etc.) were given to all participating farmers.

Table 28. Inputs distribution under TSP program

Inputs	Quantity
Seeds (Field Crops viz., jute, rice, mustard, lentil etc.)	15.9 tonnes
Seeds (High Value Crops and vegetable seeds etc.)	5.5 kg
Cutting , slips, suckers, etc	200 no.
Small equipment's (upto Rs 2000)	215 no.
Fish Feed	3.5 tonnes
CRIJAF SONA -Microbial formulation for retting	4.5 tonnes
Animal Health Camps	2 no.
Artificial Insemination / Vaccination	200 no. animals
Veterinary Services (on-site treatment)	150 no. animals
Distribution of Literature	350 no.

Scientists of ICAR-CRIAF has conducted various capacity building program like awareness camp, animal health camp, world soil day, trainings and demonstration in several districts of West Bengal. During 2023, sixteen training program were conducted which benefitted about 540 ST farmers.

Table 29. Capacity building program under TSP Program

SI. No.	Capacity building program	Date/ Place	No of Participants
1	Training on Mushroom Production Technology for Enhancing the Rural Livelihood of Tribal Farmers.	23-25 January 2023 at ICAR-CRIJAF	20
2	Soil Testing and Nutritional Recommendation for Jute-based Cropping System	13-15 March 2023 at ICAR-CRIJAF	20
3	Field Day on "Pond-based Integrated Self-Reliant Eco-farming Systems in Jute" and the Farm Input Distribution Program	15 March 2023 at ICAR-CRIJAF	100
4	Training on Integrated Pest Management for Enhancing Productivity of Rice in Jute Based Cropping System.	21-23 March 2023 at ICAR-CRIJAF	20
5	Improved Production Technologies of Major Cucurbits	29-31 May 2023 at ICAR-CRIJAF	20
6	World Environment Day, 2023 with the theme: Beat Plastic Pollution	5th June 2023 at Hudu Village, Chakda Block, Nadia	50
7	Farm mechanization in jute-based cropping systems for enhancing productivity and profit	19-23 June 2023 at ICAR-CRIJAF	20
8	Improved cultivation practices & management of rice crop	26-28 June 2023 at ICAR-CRIJAF	20
9	Awareness Camp & Farmers-scientists interaction meeting	08 August, 2023 at Chakdhah Block, Nadia	150
10	Pond-based integrated farming Systems for augmenting farm Income	16 - 18 August, 2023 at ICAR-CRIJAF	20
11	Organic farming and zero budget natural farming in jute based cropping system	23 -25 August, 2023 at ICAR-CRIJAF	20
12	Agro-advisory Services for Improved Farming of Jute and Allied Fibres	25-27 September, 2023 at ICAR-CRIJAF	20
13	Scientific nursery raising techniques in winter vegetables	03 -05 October 2023 at ICAR-CRIJAF	20
14	Skill development on bleaching, dying, and Jute based handicrafts	20 November – 06 December, 2023 at ICAR-CRIJAF	20

Mera Gaon Mera Gaurav

An initiative has been taken by ICAR-CRIJAF to promote the direct interface of scientists with farmers under the *Mera Gaon Mera Gaurav* (MGMG) program to increase the process of lab-to-land technology dissemination. During 2023, a total of 43 villages could be covered under the MGMG program for providing the benefit of institutes' technologies, agro-advisories, outreach extension programs (SCSP, TSP, NFSM), and CSS to these villages. The major work undertaken under the MGMG program was the distribution of agricultural inputs like seed, fertilizer, chemicals, agricultural machinery, etc. Awareness programs were conducted to make them aware of the programs on sensitive issues of national importance, such as Swachh Bharat Abhiyaan, climate change, water conservation, soil fertility, etc. Technical problems were also addressed at the village level and made use of prospective research programs to generate technical, social, and economic data related to institute technical programs. The farmers were involved in programs like Swachhta Abhiyan, Kisan Diwas, World Soil Day, World Environment Day, World Food Day, International Women's Day, etc. These activities helped the farming community increase their awareness of different farming issues and related aspects.

Table 30. Groups of scientists and the allotted villages under MGMG program of ICAR-CRIJAF

Group	Group Members	Villages (District)	Group	Group Members	Villages (District)
1.	Dr. S.K. Sarkar Dr. A.K.Singh Dr. J. K. Meena	Ghidah, Selampur, Gustia, Telenipara, Chapuria (North 24 Parganas)	6.	Dr. C.S. Kar Dr. D. Barman Dr. V. Ramesh Babu	Kumra, Kashipur Rudrapur, Bijoynagar, (North 24 Parganas)
2.	Dr. Jiban Mitra Dr. M.L. Roy Dr. D. Dutta Ms. Kanti Meena	Belle Sankarpur, Keutia, Tetulia, Bhabagachhi, Rautara (North 24 Parganas)	7.	Dr. S. Mitra Dr. Kunal Mondal Dr. D. Saha Dr. Tribhuvan R.	Paschim Sim ghirpar, Chandanpur, Durgapur, (North 24 Parganas)
3.	Dr. S. Kumar Dr. C. Biswas Dr. S. Datta	Athghara, Kirtipur, Rajapur, Kanupur, Panji (North 24 Parganas)	8.	Dr. S.K. Jha Dr. S.K. Pandey Dr. N.M. Alam Dr. Sourav Ghosh Ms. Lavanya A.K	Jagannathpur,Neulia,Purba Bishnupur,Goalbari,Chinili (Nadia)
4.	Dr. B. Majumdar Dr.A.K. Chakraborty	Hansia,Basudebpur Kairapur,Mathurapur (North 24 Parganas)	9.	Dr. D. Sarkar Dr. S. Sarkar Dr. P. Satya Dr. Ritesh Saha	Makaltala, Farmania, Sonakenia, Beliakhali, (North 24 Parganas)
5.	Dr. S. Satpathy Dr. R.K. De Dr. Amit Bera Dr. S.P Mazumder	Panji, Baduria, Bankra, Pingaleswar, Koijhury (North 24 Parganas)	10.	Dr. R.K. Naik Dr. Shamna.A Dr. K.N. Chourasia Ms. Neethu Mohan	Beraberia,Chharuhat, Bijoypur, Ratanpur, Dakhin Hansia (North 24 Parganas)

Swachh Bharat Mission

ICAR-CRIJAF, Barrackpore organized community cleaning drive, awareness programme, Kisan Diwas, quiz competition to sensitize different section of citizens including institute staff, college students, farm women, residents, farmers, general public and other stakeholders. Waste recycling, composting, replacing SUP, organic farming, personal sanitation, sewage disposal, market place cleaning, waste segregation, *shramdan* for sewage cleaning etc related to clean environment and swachhta were highlighted during community cleaning drive, and awareness programme. During the pakhwada period various activities were planned and executed on day to day basis. All the administrative staff of the Institute actively participated in stock taking on digitization of office records /e-office implementation, cleanliness activities including cleaning of offices, corridors and premises, review of progress on weeding out old records, disposing of old and obsolete furniture, junk materials and white washing / painting. The scientists, technical, RA, SRFs of different divisions and students of IARI Kolkata Hub actively participated in the swachhata initiatives of institute. More than 564 participants from different categories were took part in Swachhta activities organized during the pakhwada.

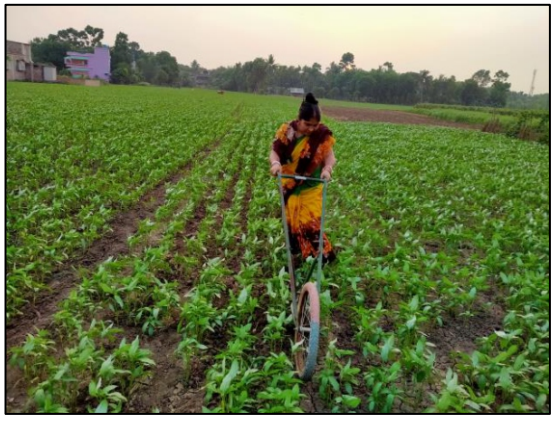
Participation of staff and students in various activities of Swachhta Pakhwada held during 6 Dec. to 31 Dec., 2023

Women Empowerment

Women play an important role in agriculture, and empowering them technologically and economically would have a huge impact on overall economic development. The ICAR Central Research Institute for Jute and Allied Fibres had initiated research and an extension convergence approach with the farm women to come up with women-friendly technologies and off-farm income-generating activities suitable to enhance their income and, in turn, empower them. Women's empowerment in agriculture includes empowerment in terms of agricultural production decisions, access to and decision-making power over productive resources, control over the use of income, leadership roles within the community, and time allocation.

Under TSP, SCSP, and various other institute activities and projects, emphasis was placed on enhancing the livelihood security of jute-growing farm families through training on jute production technologies, value addition in jute, and value chain development. The introduction of the manual CRIJAF multi-row seed drill (MRSD) encouraged the women farmers to adopt the line sowing method in jute cultivation. A single-wheel jute weeder was introduced to reduce the drudgery of weeding among the farm women. Manual weeding in jute involves lots of drudgery, as the critical period for weeding coincides with extreme hot and humid weather. Demonstration-cum-training on the use of nail weeder and single-wheel jute weeder was organized in various villages in the North 24 Parganas and Nadia districts. Farm women had reported a reduction in labour required as well as drudgery. In addition to the income from jute, off-farm income from jute-diversified products was targeted for the farm families so that a regular income flow for the jute-growing farm families could be ensured.

In the year 2023, ICAR CRIJAF organized skill development training for around 150 farm women and also encouraged these farm women to form Women Self-Help Groups (SHGs). ICAR CRIJAF had established a museum for jute fibre and value-added products in order to create awareness among farmwomen, youth, and other entrepreneurs about various jute products. Skill development was done in the making of different types of jute bags, right from small shopping bags to school bags, jute handicrafts, and other value-added products. The existing women's SHGs were also supported by ICAR CRIJAF by facilitating their participation in various forums, especially Asia's biggest book fair, the Kolkata Book Fair 2023.



Weeding by Single-Wheel Jute Weeder to reduce the drudgery

Skill development for making value-added products by Women Self-Help Groups

Diversified jute products are emerging as catalysts for rural economic transformation, poverty reduction, and women's empowerment in rural areas of India. Proper skill development, group formation, and linkage with the market are the necessary milestones for successful women's SHGs in Jute Diversified Products' microbusiness. The efforts of ICAR CRIJAF became a great success as the farm women started earning through jute-diversified products. These models can also be replicated in other jute-growing areas. There are incredible prospects for the growth of jute-based diversified products and the economic status of jute growers through value addition and marketing of jute-diversified products.

Director of ICAR-CRIJAF taking feedback from Women Self-Help Groups

Participation of Women SHGS in Asia's biggest book fair, the Kolkata Book Fair 2023

WORKSHOP, SEMINAR & MEETINGS

Workshop and Brainstorming session on Recent Advances in Plant Genome Editing (8-9 Feb 2023)

A two-day workshop with a brainstorming session on "Recent Advances in Plant Genome Editing and Regulatory Guidelines" was organized during 8–9 February 2023, for faculty members from colleges and universities. On this occasion, Prof. Swapan Kumar Datta, former Deputy Director General (Crop Science), ICAR, New Delhi, Chaired the session on February 9, 2023. Dr. R. K. Singh, ADG (CC), ICAR, New Delhi; Prof. Timir Baran Jha, Former Head of Botany, Presidency University; and Dr. Viswanathan Chinnusamy, JD (Res.), ICAR-IARI, New Delhi, were among the expert panelists. Prof. Swapan Kumar Datta appreciated the institute for organizing this important event in cutting-edge genome editing technologies for the benefit of participating faculty members and scientists. Dr. Gouranga Kar, Director, ICAR-CRIJAF, emphasized the need for preparedness for the application of genome editing tools in jute and allied fibre crops. Faculty members from colleges and universities who are involved in teaching and research, the scientists, technical staff, and students and scholars of ICAR-CRIJAF participated in the program. The program was organized under the Scientific Social Responsibility (SSR) program of SERB, DST.

Workshop on IPR Issues in Agricultural Sciences (18 Jan 2023)

A workshop entitled "Intellectual Property Right (IPR) Issues in Agricultural Sciences" was organized in hybrid mode on 18 January 2023, with the objective of sensitizing the younger scientists about the importance of intellectual property rights (IPR) in the development of agricultural technologies and products. Dr. Vikram Singh, Sr. Scientist, IPTM, ICAR HQ, New Delhi; Dr. Yashawant Dev Panwar, Scientist, TIFAC, Faridabad; and Dr. Sakshi Gupta, Registered Patent Agent at IARI, New Delhi, were present in the workshop. They explained the scope and potential of products and technologies related to jute and allied fibers for IPR. The program was organized by the ITMU section of the institute. Altogether, 46 scientists attended the workshop conducted in hybrid mode.

Director and scientists of ICAR-CRIJAF with participants of workshop on plant genome editing

Director and scientists attending workshop on "IPR issue in Agriculture Sciences" on 18th January 2023

Seminar on Managing Soil with Sensors and AIML (24 Jan 2023)

A seminar was organized jointly by ICAR-CRIJAF and the Indian Society of Soil Science, Kolkata chapter, in hybrid mode on 24 January 2023, at ICAR-CRIJAF, Barrackpore. The lecture on "Agriculture 5.0: Managing Soil with Sensors and AIML" was delivered by Dr. S. Chakraborty, Associate Professor, IIT Kharagpur. The session was chaired by Dr. S. K. Sanyal, Former Vice-Chancellor (BCKV), in the presence of President, ISSS, Kolkata Chapter.

Developments of Scientific Research in Soil, Water and Environment

A National Seminar was organized jointly by ICAR-CRIJAF and the Department of Agricultural Chemistry and Soil Science, University of Calcutta, from April 30 to May 1, 2023. Scientists from ICAR-CRIJAF presented research papers on recent developments of scientific research in soil, water and environment related to jute and allied fibres.

Clean water supply in changing climates and increasing global demands (7 Nov, 2023)

A seminar on "Can we secure clean water supply in changing climates and increasing global demands?" was organised on 7 November 2023 at ICAR-CRIJAF, Barrackpore. Prof. Tapas K. Biswas, Commonwealth Scientific and Industrial Research Organization and Australian National University delivered the lecture on the topic. Prof S. K. Datta, Former DDG (CS), ICAR and Former VC (Visva Bharati, & Biswa Bangla Univ.) chaired the Seminar. Total 66 participants attended the seminar.

The 34th Annual Workshop of All India Network Project on Jute and Allied Fibres (23-24 Feb 2023)

Annual Workshop of the All India Network Project on Jute and Allied Fibres (AINPJAF), ICAR-CRIJAF was organized during 23–24 February 2023, at MPKV, Rahuri (Maharashtra). The Workshop was attended by 44 scientists from nine AINPJAF centers and ICAR-CRIJAF. Three jute varieties (JROV-5, JROP-4, JRCP-7) and one mesta variety (JBMP-6) were identified by Variety Identification Committee chaired by Dr. R.K. Singh, ADG (CC), ICAR, New Delhi, for submission to the Central Sub-Committee on Crop Standards, Notification, and Release of varieties for agricultural crops.

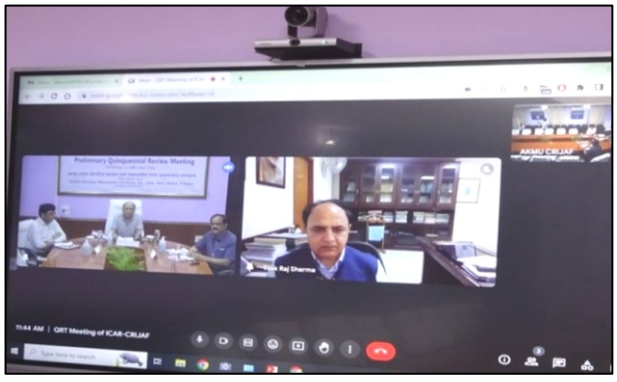
Prof. T.K. Biswas delivering the seminar on clean water supply in changing climates & increasing global demands

ADG (CC) conducting workshop of AINP with Director (ICAR-CRIJAF), Incharge (AINP) and Experts

Meeting of Quinquennial Review Team (*QRT*)

Meeting of the Quinquennial Review Team (*QRT*) was held on 14 June 2023, in which the progress and achievements of ICAR-CRIJAF during the last 5 years were reviewed by the Committee under the Chairmanship of Prof. S. K. Datta, VC, Biswa Bangla University, and former DDG (CS), ICAR. DDG (CS) and ADG (CC) virtually attended the meeting. Other members, Dr. N. K. Singh, National Professor, ICAR-NIPB, New Delhi; Dr. Sain Dass, Former Director, ICAR-DMR, New Delhi; Prof. R. K. Ghosh, Ex Professor, BCKV, Kalyani; Dr. Virendra Kumar Baranwal, National Professor, ICAR-IARI, New Delhi; and Prof. V. K. Dhanpuri, Former Prof. and Head, CSK HPKV, Palampur, were also present.

In order to get acquainted with the research achievements and other facilities at CRIJAF HQ and the sub-stations and Centres of AINP on Jute and Allied Fibres, the QRT visited selected stations and centres (Budbud, W.B., and OUAT, Bhubaneswar). The QRT conducted five review meetings and assessed the progress of research, staff positions, technologies developed and commercialized publications, infrastructure facilities available, ToT activities, resource generation, and other relevant aspects specific to the mandate of the institute. During the review process, the QRT also interacted with the farmers, SHGs, FPOs, and FPCs, officials of Jute Industries, and related departments.



Quinquennial Review Team (QRT)

QRT members interacting with the scientists, farmers and CRIJAF trained SHG members

Research Advisory Committee Meeting

(16-17 November 2023)

The Research Advisory Committee (RAC) meeting of ICAR-CRIJAF, Barrackpore, was held during November 16–17, 2023, under the chairmanship of Dr. Swapan Kr. Datta, Vice-Chancellor, Biswa Bangla University, Former Vice-Chancellor of Visva Bharati, and Deputy Director General (Crop Sciences), ICAR, New Delhi. The committee discussed in detail the research activities of the scientists of ICAR-CRIJAF for the period of July, 2022 to November, 2023. The committee was satisfied with the Action Taken Report (ATR) presented in the meeting. Under the broad mandate of the Institute presented by the Director, the Chairman advised the scientists to orient the research activities according to the mandate of the Institute as decided by the ICAR. The RAC made seven specific recommendations for further strengthening of the research activities of the Institute.

On this occasion, ICAR-CRIJAF, Barrackpore organized a Kisan Sangosthi under SCSP on 17 November 2023. Prof. S.K. Datta, Former DDG (Crop Science), ICAR & RAC Chairman, ICAR-CRIJAF was the chief guest of this programme. Dr. Gouranga Kar, Hon'ble Director, ICAR-CRIJAF motivated the farmers to produce as per market demand and consumer preference to get more profit. He also put emphasis on off-farm income generation through value addition in jute. Total 150 farmers from Belle Shankarpur, Taraberia and Beraberia villages of North 24 Parganas participated in this programme. Dr. P.K. Mahapatra, Dr. Debashish Nag, Dr. Manabendra Ray, Dr. S.S. Singh (online), and Sri Stayanarayan Singh (online) attended the meeting in the presence of Dr. Gouranga Kar, Director & Member, Dr. S. Datta, Principal Scientist and Member Secretary, and all scientists of ICAR-CRIJAF.

Chairman and Members of RAC with scientists and farmers during Farmer-Scientist-Expert Interface Meeting

Institute Research Council Meeting was conducted during 14-16 March & 27 September 2023 to review research projects

The Institute Research Council (IRC) meeting of the year 2022-23 was conducted during 14- 16 March and 20 March at the Conference Hall, ICAR-CRIJAF under the chairmanship of Dr. Gouranga Kar, Director. All the Heads/In-charges of the Divisions/Sections and the scientists participated in the meeting. The chairman apprised about new modes of project selection and monitoring, one-scientist one-product, revenue generation, and efficient use of inputs are being emphasized by the Council. He requested the investigators to make the projects output-oriented and improve publications to reach the goal of 1.7 publications per year. All the in-house projects were presented theme-wise and reviewed critically by the Institute Research Council. HoDs, In-charges and other scientists provided valuable suggestions for improving each project.

Institute Management Committee (IMC) Meeting on 26th May 2023

The 36th IMC meeting of ICAR-CRIJAF was held on 26 May 2023, under the chairmanship of Dr. Gouranga Kar, Director, ICAR-CRIJAF. Proceedings of 35th IMC Meeting was confirmed and fresh agenda for 36th IMC Meeting like Capital expenditure, budget allocation, revenue generation, staff position, IJSC, Women's cell, Grievance Committee, recognition of Private Hospitals, Skill Development Centres for SC Farmers, etc. were discussed. The representative of the Director of Agriculture, Govt. of Odisha, and other dignitaries from different ICAR Institutes and State Agricultural Universities attended the meeting.

Scientific Advisory Committee Meeting of KVK, North 24 Parganas (Addl) on 28th February 2023

The 4th Scientific Advisory Committee meeting of ICAR-KVK, North 24 Prgs (Additional) was held on 28 February 2023. Dr. Gouranga Kar, Director, ICAR-CRIJAF, chaired the meeting. Dr. P. P. Pal, Principal Scientist, ICAR-ATARI, Zone V, Kolkata; Dr. Champak Bhagat, NDRI-Eastern Regional Station, Kalyani; Dr. S. Naskar, IVRI-Eastern Region Station, Kolkata; officers from KVK, Ashokenagar; State Line departments; the Heads/In-charges of the Divisions/Sections and Nodal Officers, KVKs of ICAR-CRIJAF, along with the farmer members, attended the meeting. Director, ICAR-CRIJAF, suggested to focus on the need-based, demand-driven, and problem-solving transfer of technologies.

Director and Scientists during presentation and discussion of IRC Meeting

Scientific Advisory Committee (SAC) meeting of ICAR-KVK (North 24 Prg-Additional)

Interactive Meeting between ICAR-CRIJAF and ICAR-CIRCOT on 26 April 2023

An interactive meeting on "Prospect and potential of allied fibres (flax, sisal, and ramie) in India" was organized on 26 April 2023, between ICAR-CRIJAF and ICAR-CIRCOT for possible research collaboration and a future roadmap of the expansion program of the allied fibre crops. Dr. Gouranga Kar, Director, ICAR-CRIJAF, and Dr. S.K. Shukla, Director, ICAR-CIRCOT, along with Heads of Division and Scientists of both institutes, were present.

Meeting with Ghana Delegation Team on 23 April 2023

A delegation of research scientists, CEOs, and senior officials of jute sector of Ghana visited ICAR-CRIJAF on 23 April 2012. The team interacted with the Director and scientists and visited exhibition hall, fibre museum, gene bank, jute retting complex, and research field of the institute. The delegates were impressed to know about the scientific and technological developments in the Indian jute sector led by ICAR-CRIJAF and also desired to have mutual collaboration for the popularization of jute cultivation in Ghana.

Interaction Meeting between ICAR-CRIJAF and ISRO-SAC on 3 May 2023

An online interaction meeting was organised to discuss the scope of collaboration between ICAR-CRIJAF, Barrackpore and ISRO-SAC, Ahmedabad, on 3 May 2023, to explore the application of the geospatial technique in jute farming and research. An action plan was prepared on stress assessment in jute cultivation using high resolution remote sensing data for developing resilient management strategies for providing decision support system.

Interactive meeting on One Health Program, 18 August 2023

An interactive meeting on “One Health Program” was organized on 18 August 2023 in ICAR-CRIJAF. The lecture on "Sunnhemp: a green manure, fibre & fodder crop for soil, animal and environment health" was delivered by Dr. A.K. Singh, Principal Scientist. Sri Dhrubajyoti De, Joint Commissioner, Kolkata Police, Dr. G. Kar, Director, along with all scientists and project fellows of the Crop production division were present in the meeting.

Monthly Seminars of ICAR-CRIJAF

Speaker	Topic	Date	Participants
Dr. P.K. Chakraborty, Former member, ASRB & Former ADG, ICAR, New Delhi	Interaction meeting	11 January 2023	33
Dr. Somsubhra Chakraborty, Associate Professor, IIT-Kharagpur	Agriculture 5.0: Managing soils with sensors and AIML	24 January 2023	61
Dr. Rajib Kumar De, Principal Scientist, Crop Protection Division, ICAR-CRIJAF	JM 9.4: Development of IPM module in Mesta	21 April 2023	33
Dr. B. N. Singh, Ex-Director, NRRI, Cuttack	Interaction meeting	2 May 2023	30
Dr. Tanmoy Karak, Professor, Soil Science, Nagaland University	Biochar: Application for a crop of majestic motivations	18 August 2023	36
Mr. Suvajit Mukherjee, PhD Scholar, University of Lille, France	Deciphering bast fibre retting by a multimodal approach	1 November 2023	33
Prof. Tapas K. Biswas, Sr. Scientist, CSIRO, Australia	Can we secure clean water supply in changing climates and increasing global demands?	11 November 2023	66

Participations in webinar, seminar, workshop & meetings

DIRECTOR

Dr. Gouranga Kar

Workshop on Advances in Earth Observation : Hyperspectral Data Analysis and Processing, 10-14 July, 2023, organised by University of the Sunshine Coast (UniSC), Australia

International Workshop on Nonconventional water for irrigated agriculture– benefits of advanced technologies, 2-3 November, 2023

Study Visit Programme of SUST (Shahjalal University of Science and Technology), Sylhet, Bangladesh, 17-19 February, 2023

Krishi Samridhhi Mela-cum-National Seminar on Integrated Farming System towords Food security and Sustainable Agriculture, 14 January, 2023, organised by Dhaanyaganga KVK, Murshidabad

National Workshop on Jute – Production, Marketing & Utilization Strategies, 24 March, 2023, organised by ICAR-NINFET, Kolkata

National Conference on Natural Fibre for sustainable societal development at ICAR-NINFET, Kolkata, 3-4 January, 2023

National Seminar on Recent Developments of Scientific Research in Soil, Water and Environment, 30 April, 2023, Organised by Dept. of Jute & Fibre Technology, Calcutta University

Seminar on Environmental Law: Issues and Challenges, 5th June, 2023 organised by Kolkata Police, Bodyguard Lines

Stakeholders meeting of dissemination on jute mark India logo scheme, 25 January, 2023, organised by NJB, Kolkata

Intersessional virtual meeting of the Intergovernmental Group (IGG) on Hard Fibres and the IGG on Jute, Kenaf and Allied Fibres, 26 January, 2023

XXII Convocation of Bidhan Chandra Krishi Viswavidyalaya (BCKV), Mohanpur, Nadia, 19 May, 2023

52nd Foundation Day at Bengal Chamber of Commerce, 3 April, 2023

259th meeting of the Executive Council of Bidhan Chandra Krishi Viswavidyalaya, 10 May, 2023.

Special lecture on Mission Lifestyle for Awareness (LiFE), 2 June, 2023, organised by ICAR-NBSS& LUP, Regional Centre, Kolkata

3rd EC meeting of SUNIL programme, 5-7 June, 2023, organised by Manav Rachna University, Faridabad, Haryana,

FAI-ER Seminar on Smart Farming– A Key to Sustainable Agriculture Development, 15 May, 2023, organised at Pride Plaza Hotel, Kolkata

91st meeting of Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops, 21 November, 2023

Study Visit Programme of the Committee on Estimates to Kalimpong, Gangtok and Kurseong, 6-9 October, 2023.

9th Meeting of the Monitoring Committee of Jute-ICARE Scheme, 13 October, 2023, organised by Jute Commissioner Office, Kolkata

Scientific Advisory Committee (SAC) of the Sasya Shyamala Krishi Vigyan Kendra, 1 December, 2023, organised by Ramakrishna Mission Vivekananda Educational and Research Institute

Saurabh Ghosh Memorial Lecture Series on Climate change, public health and equity, 9 December, 2023, organised by Indian Statistical Institute, Kolkata

SCIENTISTS

International Conference on Agricultural Innovations for Sustainable Development Goals with Special Focus on Natural Farming, 30 September - 2 October, 2023, organized by Crop and Weed Science Society, Kalyani, W.B. - Dr. S. Saha, Dr. S. Sarkar

International conference on Millets: Breeding, Physiology, Genomics, Biotechnology and Nutraceutical-2023, 5-7 July, 2023 at Kerala, organised by Deptt. of Biosciences & RRDC, Kerala, India - Dr. Kanti Meena

International Conference on Plant Health Management- Innovation & Sustainability, 15-18 November, 2023 at PJSTAU, Hyderabad - Dr. V. Ramesh Babu

International Conference on Pulses: Smart Crops for Agricultural Sustainability and Nutritional Security, 10-12 February 2023 at NASC, New Delhi - A.K. Chakraborty

International Conference on Innovative applications in agricultural extension for sustainable food & Environmental Security, 27-30 January, 2023, at BHU, Varanasi – Dr. S.K. Jha

International Conference on Entrepreneurship Development: Opportunities & Challenges, 24-25 March, 2023 at Visva Bharati, W.B. - Dr. M. L. Roy

Global Symposium on Soils and Water, 2-5th October, 2023, organized by Food and Agriculture Organization of the United Nation - Dr. S.P. Mazumdar

National Seminar on Development of Soil Science, 3-6 October, 2023, organised by ICAR-Indian Institute of Soil Science, Bhopal - Dr. B. Majumdar, Dr. R. Saha.

National Conference on Natural and Organic farming for ecological, economical and Nutritional Security, 7-9 June 2023, at CSK Himachal Pradesh Krishi Viswavidyalaya, Palampur - Dr. A.K. Singh

National Conference on Natural Fibre for Sustainable Societal Development, 3-4th January, 2023, organized by The Indian Natural Fibre Society, Kolkata - Dr. R.K. Dey, Dr. S. Sarkar, Dr. R.K. Naik, Dr. D. Barman, Dr. A. Bera, Dr. Shamna, A, Dr. M.L. Roy, Dr. H.R. Bhandari, Dr. Ritesh Saha, Dr. Debarati Datta

National Seminar on Recent Developments of Scientific Research in Soil, Water and Environment, 30 April to 1 May, 2023, organized by Deptt. of Agricultural Chemistry & Soil Science, University of Calcutta, and ICAR-CRIJAF, Barrackpore - Dr. A.K. Singh, Dr. S. Mitra, Dr. S. Sarkar, Dr. R. Saha, Dr. D. Barman, Dr. S.P. Mazumdar, Dr. D. Datta, Dr. S. Ghosh

38th Annual Group meeting of AICRP on Seed (Crops), 9-10 May, 2023 at TNAU, Coimbatore- Dr. A. Bera

Workshop on Prevention, Prohibition and Redressal of Sexual Harassment of Women at Work Place on 13-14 February, 2023, organized by Institute of Secretariat Training and Management, New Delhi- N. Mohan.

Review-cum-Workshop of ITMUs/ZTMCs/ABIs under IPTM, ICAR, New Delhi on 23rd June, 2023 (Online mode) - Dr. R. Saha.

Krishi Samriddhi Mela cum National Seminar, 12-16 January, 2023, organised by Krishi Vigyan Kendra, Murshidabad - Dr. R.K. Naik

Remote Pilot Certificate (RPC) training at Amtron Drone School, Guwahati, Assam during 12-14 July, 2023- Dr. Sourav Ghosh, Dr. N.M. Alam

Massive Online Open Course (MOOC) on Digital teaching techniques, 1-31 October, organized by NAARM, Hyderabad- Dr. S. Ghosh, Dr. M.L. Roy, Dr. K.N. Chaurasia, Dr. R. Bhowmick

26th National Agriculture Exhibition, 24-27 August, 2023, organized by Central Calcutta Science & Culture Organization- Dr. R.K. Naik, Dr. M.L. Roy, Dr. S. Satpathy

34th Annual workshop of All India Network Project on Jute and Allied Fibres, ICAR-CRIJAF during 23-24 February, 2023 at MPKV, Rahuri- Drs. S. Mitra, S.K. Pandey, N.M. Alam, J. Mitra, P. Satya, D. Barman, S.P. Mazumdar, S. Satpathy, C.S. Kar, K. Mandal, R.K. De, V. Ramesh Babu, C. Chattopadhyay, Thribhuvan R.

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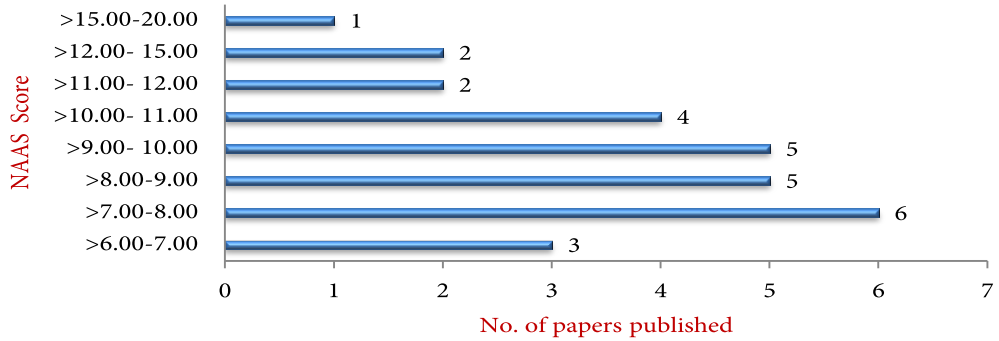

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- Annual Report 2022
- Resha Kiran 5(2) 2021; 6(1) 2023
- JAF News 20(2) 2022
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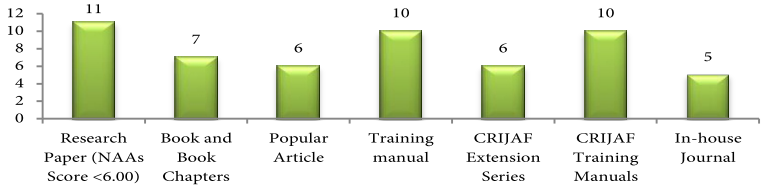


MAJOR EVENTS & CELEBRATIONS

Visit of Hon'ble Secretary, DARE and Director General, ICAR, New Delhi on 15 January 2023

Hon'ble Secretary of DARE, and Director General of ICAR, Dr. Himanshu Pathak, visited the ICAR-CRIJAF, Barrackpore, on 15 January 2023, and interacted with farmers, scientists, and staff of the ICAR-CRIJAF, as well as with the Directors and Heads of Regional Stations of Kolkata-based ICAR institutes. Dr. Pathak expressed satisfaction with the promotion and outreach of institutes' technologies and the farmers' feedback on their effectiveness in improving yield, quality, and reducing the cost of cultivation. He also inaugurated some newly created facilities like institute's main gate-cum-sale counter and the farmers' hostel of ICAR-KVK (North 24 Parganas, Additional). Dr. Gouranga Kar, Director highlighted that the institute has transformed the research projects into need-based, demand-driven, problem solving programs for the improvement of jute and allied fibers. About 250 farmers, farm women, SHG members, scientists, and ICAR personnel participated in this program.

Visit of Dr. H. Pathak, Director General of ICAR to ICAR-CRIJAF and inauguration of Institutes' main Gate and KVK Training Hostel

ICAR-CRIJAF celebrated 71st Foundation Day on 9th February, 2023

ICAR-CRIJAF celebrated its 71st Foundation Day on 9 February 2023. On this auspicious occasion, Prof. Swapan Kumar Datta, Vice Chancellor of Biswa Bangla University and former Deputy Director General (Crop Science), ICAR, New Delhi, graced the occasion as the Chief Guest. Prof. Timir Baran Jha, Former Head of Botany, Presidency University, Dr. B. K. Das, Director, ICAR-CIFRI, Barrackpore; Dr. Pradip Dey, Director, ICAR-ATARI, Kolkata; and Mr. Debdut Mukherjee, Asst. Director, NJB, Kolkata, were the Guests of Honor. The guests and dignitaries released balloons, and pigeons cut the cake in commemoration of the 71st Foundation Day of the institute. The guests inaugurated the exhibition stalls displaying proven technologies developed by ICAR-CRIJAF, KVKs, and SHGs. Dr. S.K. Datta, the Chief Guest, appreciated the institute for putting excellent effort into increasing its visibility among related stakeholders.

74th Republic Day & 77th Independence Day of India Celebration

ICAR-CRIJAF celebrated its 74th Republic Day on 26th January and 77th Independence Day on 15th August 2023 with pride and remembered the great sacrifices made by freedom fighters of the country. Dr. Gouranga Kar, Director, hoisted the national flag, followed by the recitation of the national anthem. Director, Head of the Divisions, Scientists, Officers of Administration and Finance, etc. conveyed the message of Republic Day on this occasion.

World Intellectual Property Day

An awareness program was organized on 26 April 2023, as a part of the celebration of "World Intellectual Property Day" under the theme 'Women and IP: Accelerating Innovation and Creativity' to sensitize the women staff of the institute about the necessity of protecting farm innovation and creativity in day-to-day life. The program was chaired by Dr. Gouranga Kar, Director, ICAR-CRIJAF, in the presence of the heads of the Divisions and In-charges of various sections. Dr. Gouranga Kar has highlighted the role of women in the development of innovation and creativity and appreciated the scientists of the institute for developing the institute's technologies. Other HoDs and In-charges shared their knowledge and experiences as per the theme of World IP Day 2023.

Director and delegates during the Foundation Day of ICAR-CRIJAF on 9th February 2023

Director ICAR-CRIJAF hoisting the National Flag

World Soil Day 2023 Celebrated on 5th December

World Soil Day was celebrated on 5 December 2023, with the theme "Soil and Water: A source of Life." Prof. Tapas K. Biswas, Australian National University, Canberra, Australia, lent his expertise on online mode. Shri Dhrubajyoti Dey, Joint Commissioner, Kolkata Police, graced the occasion as the chief guest. Dr. Gouranga Kar, Director, ICAR-CRIJAF, emphasized in his key note speech that healthy soils and the availability of pure water can significantly contribute to ending hunger and creating a healthy planet. On this occasion, 100 soil health cards were prepared and distributed to farmers in different villages of the North 24-Parganas district in West Bengal. The event witnessed the participation of over 200 participants, including 100 farmers, students of the IARI Kolkata hub, students of the KP Law Institute, and research scholars and scientists from ICAR-CRIJAF.

World Environment Day 2023 celebrated on 5th June

An awareness program on 'World Environment Day' was organized by ICAR-CRIJAF, Barrackpore, in association with KVK, North 24 Parganas (Additional) on 5 June 2023, in Huda village, Nadia district (W.B.). The topics on which deliberation was made by the scientists were: i) jute-based products: an alternative to single-use plastic; and ii) the use of plastics and its role in air and water pollution. During the program, a plantation program of neem tree saplings was done in the village, and saplings were also distributed to the participants for plantation in their backyards. Altogether, 50 farmers participated in the World Environment Day program.

Vigilance Awareness Week-2023: Say No to Corruption-Commit to the Nation

ICAR-CRIJAF and its Research Stations and KVK observed Vigilance Awareness Week-2023 during during 30 October to 5 November, 2023. Dr. J. Mitra, HoD (Crop Improvement) administered the Integrity Pledge to all the staffs and appealed to the employees to be honest and disciplined in the organization as well as in public life. Several programmes related to vigilance like speech competition, sensitization lecture, drawing competition and quiz competition were organised.

Participation in ICAR Zonal Sports Competition

ICAR-CRIJAF participated in the ICAR Zonal Sports Competition (East Zone) 2022 and won two Gold medals (high jump and long jump); six Silver medals (4 x 100 m relay race, volleyball, discuss, 100 m race, 400 m race, 800 m race); and five Bronze medals (200 m race, 1500 m race, javelin, men's high jump, and women's high jump). The sports events were organized at ICAR-IVRI, Izzatnagar, Bareilly (U.P.) during April 24-27, 2023. ICAR-CRIJAF also participated in ICAR Zonal Sports Tournament for Eastern Zone-2023 held at ICAR-NRRI (Cuttack) and bagged 13 medals in individual events (Athletics, Chess, Carrom) and 1 medal in team event (Volleyball smashing). Sri Ritesh Kumar, AAO became the Best Athlete (men) after winning 3 Gold and 2 Silver medals.

Visit of District Magistrate, North 24 Parganas, W.B.

Sri Sarad Kumar Dwivedi, IAS, District Magistrate, North 24 Parganas district, along with senior officials of district administration, visited ICAR-CRIJAF, Barrackpore, on July 20, 2023, to learn about the current activities of ICAR-CRIJAF, particularly new technologies for jute cultivation and promotional activities that can be further intensified through different government schemes at the district level. The DM and other senior officials visited the exhibition hall, museum, and field of ICAR-CRIJAF. Dr. Gouranga Kar, Director, ICAR-CRIJAF, presented a brief overview of the activities and achievements of the institute.

Survey of Agricultural and Mangrove Ecosystems of Sunderban regions

ICAR- CRIJAF organized a survey program of the Indian Sundarbans region during 20–23 February, 2023 at different islands of the Sundarbans delta under the multinational (Australia, Bangladesh, India, and Indonesia) Project on "Protecting ecosystems and livelihoods of the Sundarbans, a World Heritage Site: Assessing the impact of natural hazards on forest and jute-based ecosystems" funded by the Asia Pacific Network for Global Change Research (APN-GCR). The survey team consists of Scientists from ICAR-CRIJAF, India, and faculty from the University of the Sunshine Coast, Australia, and BCKV, India.

Staff of ICAR-CRIJAF with trophies won in ICAR Zonal Sports Competition (East Zone)

Director interacting with District Magistrate, North 24 Parganas during his visit to ICAR-CRIJAF

AWARDS, FELLOWSHIPS & RECOGNITIONS

- **भाकृअनुप - क्रिजैफ, कोलकाता को गृह मंत्रालय, भारत सरकार के प्रतिष्ठित" क्षेत्रीय राजभाषा पुरस्कार " से सम्मानित किया गया**

  गृह मंत्रालय, राजभाषा विभाग द्वारा वर्ष 2022-23 के क्षेत्रीय राजभाषा पुरस्कार के अंतर्गत पूर्व क्षेत्र के "ग" क्षेत्र में स्थित कार्यालयों, जिसमें कार्यरत अधिकारियों तथा कर्मचारियों की संख्या 50 से अधिक है, की श्रेणी में भाकृअनुप – केन्द्रीय पटसन एवं समवर्गीय रेशा अनुसंधान संस्थान, बैरकपुर, कोलकाता को प्रथम पुरस्कार प्रदान करने के लिए चयन किया गया है।
- **Co-Organiser of International Workshop** on Nonconventional Water for Irrigated Agriculture-benefits of advanced technologies, 25th ICID International Congress/74th IEC Meeting, 2-3 November 2023, Vishakhapatnam, India organised by International Commission for Irrigation and Drainage (ICID) in conjunction with the Irrigation Australia (IA)- Gouranga Kar, Director
- **Foreign Visit** (Bangladesh, 17-18 Feb 2023; and Australia, 10-14 July 2023) under the Multinational Project funded by APN-GCR & UniSC, Australia- Gouranga Kar, Director and D. Barman, Senior Scientist.
- **Dr. J.S. Kanwar XII International Congress Commemoration Award** by Indian Society of Soil Science, New Delhi, 3 October, 2023- Dr. R. Saha, Principal Scientist
- **Young Scientist Award** by Directorate of Research, Uttar Banga Krishi Viswa vidyalaya on the occasion of National Seminar on 'Climate resilient and input efficient agriculture for food and nutritional security', 19-20 January 2023-N.M. Alam, Sr. Scientist
- **Best Paper Award** in National conference on Natural fibre for sustainable societal development for presentation of paper on 'Development of DUS test guideline in Mesta' held at ICAR-NINFET, Kolkata, 3-4 January, 2023, organized by The Indian Natural Fibre Society, ICAR-NINFET and ICAR-CRIJAF- A. Bera, Senior Scientist
- **National Academy of Biological Sciences Fellowship** for the year 2022 by National Academy of Biological Sciences, Chennai, Tamil Nadu- R. Saha, Principal Scientist
- **Member of the Institute Management Committee** (IMC) of ICAR-ATARI, Zone VI, Guwahati - B. Majumdar, Principal Scientist
- **Lead paper presentation** on 'Jute and Allied fibres for Environmental sustainability', National Conference on Natural Fibre for sustainable societal development, The Indian Natural Fibre Society, 3-4 January, 2023- Gouranga Kar, Director
- **Lead paper presentation** on 'Jute and allied fibre crops for sustainable organic farming through their ecosystem services' at National Conference on Natural and Organic farming for ecological, economical and Nutritional Security, 7-9 June 2023, CSK Himachal Pradesh Krishi Viswavidyalaya, Palampur, Himachal Pradesh- A.K. Singh, Principal Scientist

OFFICIAL LANGUAGE IMPLEMENTATION

हिन्दी कार्यशाला का आयोजन

भाकृअनुप-केंद्रीय पटसन एवं समवर्गीय रेशा अनुसंधान संस्थान, बैरकपुर, कोलकाता में दिनांक 2 मार्च, 27 जून, 29 सितम्बर एवं 29 दिसम्बर 2023 को कार्यशाला का आयोजन किया गया। इस कार्यशाला की अध्यक्षता संस्थान के माननीय निदेशक, डॉ गौरांग कर जी के द्वारा किया गया। 2 मार्च 2023 के कार्यशाला के तकनीकी सत्र में श्रीमती पूनम दीक्षित, पूर्व उपनिदेशक, हिन्दी शिक्षण योजना, राजभाषा विभाग, गृह मंत्रालय, भारत सरकार, गुवाहाटी ने निदेशक महोदय एवं सभी प्रतिभागियों का अभिनंदन करते हुए प्रयोजनमूलक हिन्दी के अंतर्गत टिप्पण एवं मसौदा लेखन विषय पर विस्तृत जानकारी प्रदान की तथा विभिन्न बिन्दुओं पर चर्चा की। कार्यशाला में ऑफलाइन के माध्यम से 41 अधिकारियों एवं कर्मचारियों ने तथा ऑनलाइन के माध्यम से 23 अधिकारियों एवं कर्मचारियों ने भाग लिया।

27 जून, 2023 के कार्यशाला में श्री निर्मल कुमार दुबे, प्रभारी-उप निदेशक (कार्यान्वयन), राजभाषा विभाग, गृह मंत्रालय, भारत सरकार, निजाम पैलेस, कोलकाता ने संघ की राजभाषा नीति, नियम, राजभाषा का महत्व एवं राजभाषा नियम / अधिनियम विषयों पर व्याख्यान दिया। उन्होंने प्रतिभागियों से कार्यालयीन कार्यों में प्रयुक्त होने वाले प्रशासनिक शब्दों / प्रशासनिक वाक्यांशों इत्यादि पर हिन्दी पर्याय पूछे। साथ ही उन्होंने हिन्दी के मानकीकरण पर भी चर्चा की। कार्यशाला में उपस्थित सभी प्रतिभागियों ने पूरे सत्र में शांतिपूर्वक, उत्साहपूर्वक एवं तल्लीन होकर ज्ञानार्जन किया तथा अधिकारियों/कर्मचारियों के शंकाओं का भी समाधान किया। हिन्दी कार्यशाला में कुल 60 कार्मिकों (34 अधिकारी एवं 26 कर्मचारी) ने भाग लिया।

29 सितम्बर 2023 के हिन्दी कार्यशाला में श्रीमती पूनम दीक्षित, पूर्व उपनिदेशक, हिन्दी शिक्षण योजना, राजभाषा विभाग, गृह मंत्रालय, भारत सरकार, गुवाहाटी ने निदेशक महोदय एवं सभी प्रतिभागियों का अभिनंदन करते हुए राजभाषा अधिनियम, नीति, नियम व प्रमुख बिन्दुओं पर विस्तारपूर्वक जानकारी प्रदान की तथा विभिन्न बिन्दुओं पर चर्चा की। माननीय निदेशक, डॉ. गौरांग कर ने सरल, सुबोध एवं आसान शब्दों का प्रयोग करने पर जोर देते हुए यह उद्घोष किया कि राजभाषा संबंधी आदेशों का शत प्रतिशत अनुपालन किया जाए। उन्होंने आगे कहा कि हिन्दी के प्रयोग को बढ़ाने के लिए सरकार ने भी बहुत सी प्रोत्साहन योजनाएं शुरू की हैं तथा इन प्रयासों से हिन्दी के प्रयोग को बढ़ावा मिल रहा है। हमारा संकल्प है कि राजभाषा हिन्दी के साथ-साथ सभी प्रांतीय भाषाएं विकसित हों और हम इस दिशा में प्रयासरत हैं। उन्होंने यह भी कहा कि हिन्दी में कार्य करने में कोई कठिनाई महसूस हो तो उसे नि:संकोच हिन्दी कक्ष के माध्यम से दूर किया जा सकता है। उन्होंने राजभाषा विभाग द्वारा विनिर्दिष्ट नीति का पालन करते हुए कार्यशालाओं के माध्यम से हिन्दी के प्रचार-प्रसार पर बल देते हुए प्रशिक्षणार्थियों से कार्यालीन कार्य हिन्दी में करने तथा अन्य समस्त कर्मचारियों से भी कार्यालीन कार्य हिन्दी में करने का आग्रह किया। निदेशक महोदय ने इस बात पर खुशी व्यक्त किया कि प्रशासनिक अनुभागों तथा लेखा परीक्षा व लेखा अनुभाग में ई ऑफिस के माध्यम से टिप्पण एवं मसौदा, कार्यालय आदेश इत्यादि हिन्दी में किए जा रहे हैं तथा परिपत्र आदि भी द्विभाषी रूप (हिन्दी-अंग्रेजी) में जारी किए जा रहे हैं। साथ ही साथ उन्होंने यह भी कहा कि वैज्ञानिकगण कार्यालयीन कार्य हिन्दी में करते हैं। कार्यशाला बहुत ही उपयोगी एवं उद्देश्यपूर्ण रही। हिंदी कार्यशाला का संचालन डॉ. कुमार निशान्त चौरसिया, वैज्ञानिक एवं प्रभारी, हिन्दी कक्ष द्वारा किया गया।

हिन्दी पखवाड़ा का आयोजन

भाकृअनुप-केन्द्रीय पटसन एवं समवर्गीय रेशा अनुसंधान संस्थान, बैरकपुर, कोलकाता में दिनांक 14-29 सितम्बर, 2023 तक हिन्दी पखवाड़ा का आयोजन किया गया। उद्घाटन समारोह के अध्यक्ष एवं संस्थान के निदेशक, डॉ. गौरांग कर ने अपने संबोधन में कहा कि संविधान सभा द्वारा राज-काज चलाने के लिए तथा केन्द्र व राज्यों के बीच सम्पर्क भाषा की भूमिका निभाने का उत्तरदायित्व हिन्दी को ही सौंपा है, क्योंकि यह देश के अधिकांश भाग में बोली व समझी जाती है। किसी भी देश या वर्ग विशेष की पहचान उसकी भाषा और संस्कृति से होती है, इसलिए हमें अपनी पहचान बनाए रखने के लिए हिन्दी को अपनाना आवश्यक है। हिन्दी भाषा को हम राष्ट्र भाषा के रूप में पहचानते हैं। उन्होंने आगे कहा कि हमें केवल हिन्दी पखवाड़ा मनाने मात्र तक सीमित नहीं रहना चाहिए, बल्कि यह संकल्प भी लेना चाहिए कि हम अपना अधिकाधिक कार्यालयीन कार्य हिन्दी में करने का प्रयत्न करें। डॉ. सुब्रत सतपथी, प्रभागाध्यक्ष, फसल संरक्षण ने संस्थान में समय-समय पर आयोजित होने वाली राजभाषा हिन्दी से संबंधित आयोजनों पर संतोष व्यक्त करते हुए कहा कि इससे संस्थान के अधिकारियों एवं कर्मचारियों में हिन्दी कार्य के प्रति जागरूकता बढ़ेगी और वे अपना कार्यालयीन कार्यों में इसका अधिकाधिक प्रयोग करेंगे। डॉ. जीवन मित्र, प्रभागाध्यक्ष, फसल सुधार ने सभी से अपना अधिकाधिक कार्य हिन्दी में करने का आह्वान किया। डॉ. सुनीति कुमार झा, प्रधान वैज्ञानिक एवं प्रभारी, कृषि प्रसार अनुभाग, डॉ. सव्यसाची मित्र, प्रधान वैज्ञानिक एवं प्रभारी, ए.आई.एन.पी., डॉ. बिजन मजुमदार, प्रधान वैज्ञानिक एवं श्री रवि मिश्र, प्रशासनिक अधिकारी ने भी अपने-अपने संबोधन में कहा कि हिन्दी बहुत ही सरल, सहज और आसान भाषा है; जिसे हमें अपने-अपने कार्यालयीन कार्यों में सर्वाधिक प्रयोग करना चाहिए।

इस पखवाड़ा के अन्तर्गत कई कार्यक्रम आयोजित किए गए। दिनांक 18 सितम्बर, 2023 को तात्कालिक भाषण, दिनांक 19 सितम्बर, 2023 को हिन्दी टंकण प्रतियोगिता, दिनांक 21 सितम्बर, 2023 को वाद-विवाद प्रतियोगिता, दिनांक 22 सितम्बर, 2023 को हिन्दी श्रुतलेखन एवं पठन प्रतियोगिता, दिनांक 25 सितम्बर, 2023 को अनुवाद प्रतियोगिता, दिनांक 26 सितम्बर, 2023 को हिन्दी निबंध लेखन प्रतियोगिता तथा दिनांक 27 सितम्बर, 2023 को हिन्दी टिप्पण एवं मसौदा लेखन प्रतियोगिताओं का आयोजन किया गया। इन कार्यक्रमों में संस्थान के सभी वर्गों के अधिकारियों व कर्मचारियों ने उत्साहपूर्वक भाग लिया।

दिनांक 29 सितम्बर, 2023 को हिन्दी पखवाड़ा का समापन एवं पुरस्कार वितरण समारोह का आयोजन किया गया। समापन समारोह कार्यक्रम का संचालन करते हुए डॉ. सुरेन्द्र कुमार पाण्डेय, प्रधान वैज्ञानिक ने उपस्थित अधिकारियों एवं कर्मचारियों का संस्थान की राजभाषा कार्यान्वयन समिति एवं हिन्दी कक्ष की ओर से हार्दिक स्वागत करते हुए उन्हें हिन्दी पखवाड़ा के अन्तर्गत आयोजित किए गये विभिन्न हिन्दी प्रतियोगिताओं में सफल होने वाले अधिकारियों एवं कर्मचारियों के नामों की जानकारी दी। साथ ही हिन्दी प्रोत्साहन योजना 2022-23 में शामिल पाँच अधिकारियों तथा कर्मचारियों को भी पुरस्कृत किया गया। विभिन्न प्रतियोगिताओं में प्रथम, द्वितीय व तृतीय स्थान प्राप्त करने वाले अधिकारियों/कर्मचारियों को निदेशक, डॉ. गौरांग कर तथा श्रीमती पूनम दीक्षित, पूर्व उप-निदेशक, हिन्दी शिक्षण योजना, राजभाषा विभाग, गृह मंत्रालय, भारत सरकार के कर कमलों द्वारा पुरस्कार प्रदान किए गए। संस्थान के निदेशक, डॉ. गौरांग कर जी ने संस्थान में राजभाषा हिन्दी पखवाड़ा तथा इस दौरान आयोजित विभिन्न हिन्दी प्रतियोगिताओं के सफल आयोजन पर अपनी खुशी जाहिर की तथा पखवाड़ा के सफल आयोजन के लिए हिन्दी कक्ष से जुड़े अधिकारियों तथा कर्मचारियों को बधाई देते हुए आशा व्यक्त किया कि इससे संस्थान में हिन्दी के प्रयोग में उत्तरोत्तर प्रगति होगी। कार्यक्रम का समापन डॉ. कुमार निशान्त चौरसिया, वैज्ञानिक एवं प्रभारी हिन्दी कक्ष के धन्यवाद ज्ञापन के साथ सम्पन्न हुआ।

राजभाषा कार्यान्वयन समिति की बैठक

संस्थान में राजभाषा कार्यान्वयन समिति की चार बैठकें क्रमशः दिनांक 28.02.2023, 27.06.2023, 27.09.2023 एवं 28.12.2023 को माननीय निदेशक, डॉ. गौरांग कर जी की अध्यक्षता में आयोजित की गई। राजभाषा कार्यान्वयन समिति की वर्ष में चार बैठकों का आयोजन किया गया। इन बैठकों में संस्थान में हो रही विभिन्न गतिविधियों में हिंदी के प्रगतिशील प्रयोग के तरीकों और साधनों पर चर्चायें की गई। इसके अलावा इन बैठकों में संस्थान के अधिकारियो/ कर्मचारियों को राजभाषा विभाग द्वारा जारी वार्षिक कार्यक्रम (2023-24) के अनुसार "ग" क्षेत्र के लिए निर्धारित 55 प्रतिशत लक्ष्यों पर भी चर्चा की गई। सभी बैठकें ऑफलाइन मोड के माध्यम से आयोजित की गई थी। सभी बैठकों के अंत में अध्यक्ष महोदय के प्रति धन्यवाद ज्ञापन के साथ बैठक समाप्त हुई।

महत्पूर्ण उपलब्धियाँ

1. भारत सरकार की राजभाषा नीति के प्रावधानों, राजभाषा अधिनियम, 1963 और अधिनियम के तहत बनाए गए राजभाषा नियम, 1976 का कार्यान्वयन किया जाता है।
2. हिंदी का कार्यसाधक ज्ञान रखने वाले कर्मचारियों के लिए वर्ष में चार हिंदी कार्यशालाओं का आयोजन।
3. राजभाषा विभाग, गृह मंत्रालय द्वारा समय-समय पर जारी आदेशों एवं वार्षिक कार्यक्रम का क्रियान्वयन।
4. विभाग की राजभाषा कार्यान्वयन समिति से संबंधित सभी मामले - एजेंडा नोट्स और बैठकों के कार्यवृत तैयार करना और उन पर अनुवर्ती कार्रवाई की जाती है।
5. संस्थान के कार्यालयीन कार्यों में राजभाषा हिन्दी के प्रयोग को प्रोत्साहित करने के लिए प्रति वर्ष हिन्दी पखवाड़ा का आयोजन किया जाता है।
6. अधिकांश विहित फार्मों, सभी मानक मसौदे, रजिस्टरों के शीर्षक, सभी रबर की मोहरें, नाम पट्ट, शीर्षक-पत्र इत्यादि द्विभाषी हैं। समय-समय पर आवश्कतानुसार मोहरों एवं नाम पट्ट का अद्यतन किया जाता है।
7. संस्थान की राजभाषा कार्यान्वयन समिति की बैठकों में होने वाली चर्चायें सिर्फ और सिर्फ हिन्दी में होती हैं।
8. संस्थान की विभिन्न बैठकों में होने वाली चर्चायें हिन्दी में भी होती हैं।
9. शब्द ज्ञान में वृद्धि तथा अद्यतन करने हेतु प्रतिदिन 'आज का शब्द' हिन्दी एवं अंग्रेजी में लिखा जाता है।
10. हिन्दी अनुभाग में प्रविष्टियाँ, टिप्पणी एवं मसौदा लेखन व अन्य कार्य हिन्दी में ही होते हैं तथा अन्य अनुभागों में भी अधिकांश प्रविष्टियाँ, टिप्पणी एवं मसौदा लेखन ई ऑफिस में हिन्दी में किए जा रहे हैं।
11. संस्थान के सभी कम्प्यूटरों में द्विभाषी रूप में काम करने के लिए यूनीकोड की सुविधा उपलब्ध है।
12. संस्थान के अन्य भाषा-भाषी अधिकारियों/कर्मचारियों को हिन्दी में प्रशिक्षण देने के लिए हिन्दी शिक्षण योजना के अन्तर्गत राजभाषा कक्ष द्वारा संस्थान में ही हिन्दी कक्षायें चलायी जाती है।
13. नगर राजभाषा कार्यान्वयन समिति' कोलकाता (कार्यालय-2), सीएसआईआर-केंद्रीय काँच एवं सिरामिक अनुसंधान संस्थान, 196 राजा एस.सी. मल्लिक रोड़, कोलकाता – 700032) की छमाही बैठकों में संस्थान की ओर से संस्थान के निदेशक सहित अन्य अधिकारी सम्मिलित होते हैं।
14. हिन्दी में प्राप्त पत्रों के शत्-प्रतिशत उत्तर हिन्दी में ही दिए जाते हैं।
15. संस्थान में धारा 3(3) के अन्तर्गत आने वाले संस्थान के सभी दर आमंत्रण, निविदा-प्रपत्र, निविदा सूचनाएं एवं बिक्री सूचनायें आदि द्विभाषी रूप में जारी किए जाते हैं।
16. संस्थान के अन्य भाषा-भाषी अधिकारियों/कर्मचारियों को हिन्दी में प्रशिक्षण प्रदान करने के लिए हिन्दी शिक्षण योजना, राजभाषा विभाग, गृह मंत्रालय, भारत सरकार के अन्तर्गत संस्थान के राजभाषा कक्ष के द्वारा जुलाई से नवम्बर 2023 के दौरान संस्थान में ही हिन्दी प्रवीण / प्राज्ञ / पारंगत की कक्षाओं का आयोजन किया गया। साथ ही संस्थान के द्वारा दिनांक 18, 19 नवम्बर 2023 एवं दिनांक 25.11.2023 को बैरकपुर के विभिन्न कार्यालयों के अधिकारियों एवं कर्मचारियों हेतु परीक्षा केंद्र खोला गया, जिसमें हिन्दी प्रवीण / प्राज्ञ / पारंगत पाठ्यक्रम की परीक्षाएँ का आयोजन भी किया गया।
17. हिन्दी प्रोत्साहन योजना (वित्तीय वर्ष 2022-2023 के दौरान) के अंतर्गत विभिन्न अधिकारियों एवं कर्मचारियों को पुरस्कृत किया गया।

KNOWLEDGE MANAGEMENT & TECHNOLOGY COMMERCIALIZATION

CRIJAF Library: Information and Documentation Unit

Library continued its support for research activities of the institute by subscribing to electronic resources and providing various information services of all kinds of scientific and technical information on jute and allied fibres like mesta, ramie, sisal, sunnhemp and flax.

Virtual library through CeRA platform: Library continued to provide this service to enable users to access subscribed journals from a single portal, irrespective of place and time. It helps a lot to users especially during Covid-19 pandemic lockdown period.

Scientific books: Presently, it holds about 9895 books under various themes of agriculture and allied sectors like agronomy, soil science, genetics & plant breeding, plant pathology, agricultural entomology, agricultural extension, plant physiology, bio-technology, agricultural engineering, etc. from national and international publishers. Besides, library also procured general books like stories, economics and politics in Hindi, English and Bengali languages.

Scientific journals: The library is enriched with 39 International and 106 Indian journals and digital version of international bibliographic information system for the agricultural sciences and technology

The library has about 9230 bound volumes of journals and scientific literatures since 1947.

Annual reports: To keep abreast of the activities of the Institute, the library sends the Annual Reports, Newsletters (JAF news) and Technical bulletins of ICAR-CRIJAF to various research organizations including Universities and Developmental Departments of the States. Library also holds the annual reports/newsletters/technical bulletins of various ICAR Institutes and SAU's, Commission/ Committee reports.

Software support for library information: An open source library management software (KOHA) installed for database management of library books.

Digitization of documents: Library started digitization of all kinds of scientific and technical information of the institute.

Reprographic and photographic facility: This facility met photography, photocopying and printing requirements of the institute for the research and administrative purposes of the institute.

Exhibition-cum-Fibre Museum: To showcase ICAR-CRIJAF technologies on fibre and fibre based products, an exhibition-cum-fibre museum has been established.

Trademark of 'ICAR-CRIJAF Tech': Trademark application of 'ICAR-CRIJAF Tech', a logo to be attached with all the ICAR- CRIJAF products or technologies to enhance Institute credentials, has been registered under Trade Mark Act, 1999 of Section 23 (2), Rule 56(1) by Trade Marks Registry Office, Govt. of India (Application No. 5454490 in Class 42 dated 19.05.2022) with validity up to ten years (19.05.2032).

COPYRIGHT REGISTRATION

Copyright registration of A Decision Support System (DSS) for Pest Management of Jute and Mesta' has been accomplished with registration no. SW-17998/2023 on 28 December 2023.

Workshop on "IPR Issues in Agricultural Sciences" organised by ICAR-CRIJAF on 18th January, 2023

Technology Commercialization and Registration

Design Registration of 'Improved Fibre Extractor for Flax' : Design Registration for 'Improved Fibre Extractor for Flax', an electrically operated high capacity fibre extractor for retted and dried straws of flax, has been issued by the Patent Office, Govt. of India under Design Application No. 337776-001 in Class 15-03 on 21.01.2021 for ten years (upto 21.01.2031).

Royalty Earned

A total amount of ₹68.15 lakh has been received as royalty payment of various commercialized technologies (CRIJAF SONA, CRIJAF Multi Row Seed Drill, CRIJAF Nail Weeder, CRIJAF Single Wheel Jute Weeder, and CRIJAF Jute Seeder) from authorized manufacturer and sellers during 2023.

DISTINGUISHED VISITORS

1.	Dr. Himanshu Pathak	15.1.2023
	Secretary, DARE and Director General, ICAR	18.5.2023
2.	Prof. Swapan Kumar Datta	14.6.2023
	Vice Chancellor, Biswa Bangla Univ. and former DDG (Crop Sci.), ICAR, New Delhi	16.11.2023
3.	Dr. S. K. Sanyal	24.1.2023
	Former Vice-Chancellor, B.C.K.V., Mohanpur	
4.	Dr. Sain Dass	14.6.2023
	Former Director, ICAR-DMR, New Delhi	
5.	Dr. B. K. Das	9.2.2023
	Director, ICAR-CIFRI, Barrackpore	
6.	Dr. Pradip Dey	9.2.2023
	Director, ICAR-ATARI, Kolkata	
7.	Dr. N. K. Singh	14.6.2023
	National Professor, ICAR-NIPB, New Delhi	
8.	Dr. V. K. Baranwal	14.6.2023
	National Professor, ICAR-IARI, New Delhi	
9.	Dr. Tapas Biswas,	7.11.2023
	Sr. Research Scientist (Environment), CSIRO, Australia	
10.	Sri Rajinder Kumar	1.12.2023
	Director, ASRB, New Delhi	
11.	Sri Dhrubajyoti De, I.P.S.	2.2.2023
	Joint Commissioner, Kolkata Police	
12.	Sri Avanindra Singh, I.A.S	17.3.2023
	Secretary, Fisheries Department, Govt. of W. B.	
13.	Sri Sharad Kr. Dwivedi, I.A.S.	20.7.2023
	District Magistrate, North 24 Parganas, W.B.	
14.	Sri Sourav Barik	2.2.2023
	SDO, Barrackpore	
15.	Prof. Timir Baran Jha	9.2.2023
	Former Head of Botany, Presidency University	
16.	Dr. Somsubhra Chakraborty,	24.1.2023
	Associate Professor, Agril. and Food Engg. Department, IIT Kharagpur	
17.	Prof. V. K. Dhanpuri	14.6.2023
	Former Prof. and Head, CSK HPKV, Palampur	
18.	Prof. R. K. Ghosh	14.6.2023
	Ex Professor, BCKV, Kalyani	
19.	Mr. Debdut Mukherjee	9.2.2023
	Asst. Director, NJB, Kolkata	
20.	Sri Partha Sengupta	26.5.2023
	Director, Agriculture, West Bengal	
21.	Dr. H.K. Singh	14.6.2023
	Professor, NDUAT, U.P.	
22.	Sri Sourav Sengupta	20.7.2023
	Project Director, DRDC, North 24 Parganas	
23.	Sri Ratanlal Daga	6.9.2023
	Expert (Organic Farming), Jodhpur & Member (CACP)	
24.	Vivek Shukla	6.9.2023
	Co-founder, Rice Hydroponics	

RESEARCH PROJECTS

Externally Funded Projects

Sl. No.	Project Title	Investigators	Funding Agency	Duration
1.	Prospecting heat stress tolerance through genome -edited heat shock factors and NAC-domain transcription ax (*Linum usitatissimum*)	D. Saha (PI), S. Datta	DST-SERB	(2021-2024)
2.	Technologic and economic empowerment of SC farm families to mitigate the impact of COVID-19 through jute fiber based farming, value addition and value chain establishment	Shamna A (PI), R. K. Naik, S. P. Mazumdar, N. M. Alam	DST-SEED, GoI	(2021-2024)
3.	Quantitative assessment of carbon and moisture fluxes over jute based agro - ecosystems: integrating ground observations, satellite data & modeling	D. Barman (PI), G. Kar, A.K. Singh, N.M. Alam	ISRO-NRSC	(2018-2025)
4.	Genome sequencing and functional genomics of bast fibre quality	D. Sarkar (CCPI)	ICAR-NPFGGM	(2021-2026)
5.	In-season smart sensor enabled advanced technological interventions for real time water managements of jute crops for adaption in SC farmers' fields under changing climate scenario	A K Singh (PI) G. Kar, D. Datta Collaborating Institute: CSIR-CMERI	DST- SEED, GoI	(2023-2026)
6.	Development of descriptors for DUS testing of mesta	A. Bera (PI), C. S. Kar	PPVFRA	(2020-2023)
7.	Protection of jute varieties and DUS testing Project	A. Bera (PI), H. R. Bhandari	PPVFRA	Long Term
8.	Protecting eco-systems and livelihoods of the sunder bans, a world heritage site: assessing the impact of natural hazards on forest and jute -based ecosystem services	D. Barman (PI), G. Kar	Multi-national Project APN-GCR	(2021-2023)
9.	biomass fuel for	P. Satya (PI), L. Sharma, G. Kar, B. Majumdar, S. Roy, Lavanya A.K, A.K. Singh, S. Ghosh	NICRA	(2022-2024)
10.	Assessment of vulnerability of jute production to climate change and its mitigation strategies development using remote sensing GIS in West Bengal	D. Barman (PI), R. Saha, Suman Roy	DST-WB	(2018-23)

11.	Jute - Improved cultivation and advanced retting exercise (JUTE - ICARE)	G. Kar (PC), B. Majumdar (PI), S. Satpathy, S. Mitra, S. Sarkar, S.K. Sarkar, S.K. Jha, S. Datta, K. Mandal, A. K. Singh, R. K. Naik, Shamna A and M. L. Roy	National Jute Development Program	(2015-long term)
12.	NFSM- Commercial crops (jute-based cropping system)	C. S. Kar (PI), M.L. Roy, A. Bera, S. Kumar, S K Jha	MoAFW, New Delhi	Long Term
13.	AICRP on seeds (crops)	C. S. Kar (PI), H. R. Bhandari, A. Bera	ICAR-New Delhi	Long Term
14.	To study changes in soil quality, crop productivity and sustainability under jute-rice-wheat cropping system (LTFE)	B. Majumdar (PI), S.P. Mazumdar, , M.S. Bahera, N. M. Alam	AICRP - LTFE	Long Term
15.	Soil test and resource based integrated plant nutrient supply system for sustainable agriculture	B. Majumdar (PI), S.P. Mazumdar	AICRP - STCR	Long Term

Institute Funded Projects

Crop Improvement Division

Project code	Project title	Investigators	Duration
JB 1.1	Introduction, maintenance, characterization and conservation of jute, mesta and flax germplasm	Jiban Mitra (PI), A. Bera, S.K. Sarkar, K. Das, Thribhuvan R	(1977-Long Term)
JB 10.3	Genetic improvement of flax (Linum usitatissimum) for higher fibre productivity and fibre quality	J. Mitra (PI), D. Saha, K. Mandal	(2016-2025)
JB 10.5	Maximizing fibre productivity in jute through genetic and agronomical approaches	K. N. Chaurasia (PI), J. K. Meena, P. Satya, J. Mitra, S. Mitra, S. Sarkar, A. R. Saha, R. K. De	(2020-2025)
JBT 4.9	In vitro regeneration and haploidy induction in jute	S. Datta. (PI), K. N. Chourasia	(2022-2027)
JB 10.7	Pre-breeding and breeding approaches for developing major biotic stress resistance in jute	J. K. Meena (PI), K. N. Chaurasia, S. Satpathy, K. Mandal	(2021-2026)

JB. 10.9	Chemical mutagenesis for creating variability in tossa jute and roselle Sub-project 1: Mutagenesis in tossa jute Sub-project 2: Mutagenesis in roselle	Neetu Mohan, (PI), Thribhuvan R. S. K. Pandey (PI), Neetu Mohan	(2021-2024)
JB 10.6	Introgression of low pectin content into high -yielding jute varieties	J. K. Meena (PI), B. Majumdar	(2020-2025)
JB. 10.8	Genetic enhancement of fibre quality traits in tossa jute	Thribhuvan R (PI), J. K. Meena, R. K. Naik	(2021-2026)
JB 10.4	Genetic improvement of jute for diversified end use.	Dr. P. Satya (PI), S. K. Pandey, S. Roy	(2017-2024)
JST 6.3	Effects of plant density and weed management practices on plant size composition and productivity of jute and modelling crop growth	A. K. Chakraborty (PI) D. Datta, S. P. Mazumdar, N. M., Alam, R. K. De, S. Saha	(2021-2024)
JB 10.1	Genetic improvement of jute genotypes against biotic stresses	Thribhuvan R (PI), Kunal Mandal	(2015-2024)
JBT 5.0	Molecular mapping for stem rot resistance in jute	K. Meena (PI) K.Mondal, Thribhuvan R, S.Dutta	(2022-2027)

Crop Production Division

Project code	Project title	Investigators	Duration
JA 8.4	Expansion of flax area in pilot scale with improved technologies	S Mitra (PI), J. Mitra, C. S. Kar, S. Sarkar, S. K. Jha, S. K. Pandey, R. K. Naik, K. Das, S. P. Majumdar	(2020-2025)
JA 8.2	Upgraded mechanical weeder and novel herbicides for efficient weed management in jute	S. Sarkar (PI), R.K. Naik, B. Majumdar, D. Datta	(2020-2023)
JA 7.5	Physiology of flowering behaviour of jute under different photoperiod regimes	S. Roy (PI), P. Satya, D. Sarkar L. Sharma, A.K. Jha, H.R. Bhandari	(2017-2023)
JA 8.5	Water management strategies for profitable and sustainable jute cultivation under rainfed and irrigated ecosystems	D. Datta (PI), A. K. Singh, D. Barman, N. M. Alam, R. K. Naik, G. Kar	(2021-2024)
JA 7.4	Physiological basis of drought tolerance at early growth stage in jute *(C. olitorius)*	S. Mitra (PI), J. Mitra, S. Mitra, P. Satya, D. Barman, S. Roy	(2017-2024)
JA 8.7	Assessing the role of microbes in jute from seed to fibre.	Ms. Lavanya (PI), S. Datta, S. K. Sarkar, D. Datta, S. Saha	(2021 -2024)

JA 7.7	Environment friendly low -cost retting technology for jute and metagenomics of retting microbiome	B. Majumdar (PI), S. P. Mazumdar, D. Saha, S. Datta, S. Sarkar, S. K. Jha	(2018-2024)
JA 7.6	Improvement of soil carbon stocks and farm productivity through integrated crop and management practices in jute cultivation areas (A Farmer's Participatory Research)	A.K. Singh (PI), R. Saha, M. L. Roy	(2018-2023)
JA 8.1	Leaf Litter Management: Decomposition and nutrient dynamics of leaf litter composts and its effects on JAF crops	A. K. Singh (PI), B. Majumdar, S. Mitra, M. S. Behera, S. Satpathy, S.K. Sarkar, M. L. Roy	(2020-2025)
JA 8.8	Precision irrigation scheduling for augmenting yield, resource use efficiency and water productivity in jute-based cropping systems	S. Ghosh (PI), G. Kar, S. Mitra, A.K. Singh, T. Samajdar, R.K. Naik, D. Barman	(2022-2025)
SLA 1.7	Effect of planting materials and fertilizer levels on growth and yield of sisal (Agave sisalana) and hybrid sisal	S. Sarkar (PI), M.S. Behera, B. Majumdar, R.K. Naik	(2018-2024)
SLA 1.8	Integrated Farming System in sisal plantation under organic management package	S. Sarkar (PI), B. Majumdar, K. Mandal, R. Saha, R. K. Naik, R. Bhowmick	(2018-2023)
JE 2.2	Risk assessment through modeling of major pests and diseases of jute under climate change scenario in India	N. M. Alam (PI), D. Barman, S. Satpathy, S. Mitra, S. K. Sarkar	(2019-2024)
JE 3.6	Farm mechanization for efficient sowing and fibre extraction for jute and allied fibre.	R. K. Naik (PI), C. S. Kar, G. Kar, S. K. Jha	(2021-2024)
JEXA 6.1	Analysis of yield gap and contribution of production factors in cultivation of jute	S. K. Jha (PI), M.L. Roy, S. Mitra, R. Saha, S. P. Mazumdar, R. K. Naik, A. K. Chakraborty	(2020-2025)
JEXA 6.2	Enhancing farm income through up -scaling of jute based diversified products as an alternative to plastics	Shamna A. (PI), S. K. Jha, S. Kumar, M. L. Roy	(2020-2024)
JEXA 6.3	Innovative extension methods for augmentation of income of jute -based farm families in West Bengal – A Cluster Approach	M. L. Roy (PI), S.K.Jha, S.Kumar, Shamna A.	(2022-2024)

Crop Protection Division

Project code	Project title	Investigators	Duration
JE 1.9	Bio-ecology and management of sucking pests in jute	S. Satpathy (PI), V. Ramesh Babu, S. P. Mazumdar, S. Roy	(2016-2023)
JM 9.2	Isolation, characterisation and application of Trichoderma for Disease Management	K. Mandal (PI), S. K. Sarkar, R. Saha	(2018-2023)
JM 9.3	Use of nanoparticles for managing pests and diseases in jute and carbon nanotube for salinity tolerance	C. Biswas (PI), V. Ramesh Babu	(2018-2024)
JM 9.4	Developm ent of IPM module in mesta	R. K. De (PI), S. Satpathy, V. Ramesh Babu, Shamna A.	(2021-2025)
JM 9.5	Identification of donor lines for resistance against stem rot and anthracnose diseases in jute	S.K. Sarkar (PI), K. Mandal, K. Das	(2021-2024)
JE 2.0	Identification of microbial entomopathogens for management of major lepidopteran pests of jute	V. Ramesh Babu (PI), S. Satpathy	(2018-2023)
JE 2.1	Identification of sources and mechanism of resistance among wild and cultivated accessions of jute against lepidopteran pest complex	V. Ramesh Babu (PI), S. Satpathy, S. Roy	(2019-2023)
JE 2.3	Decision Support System for pest management in jute	V. Ramesh Babu (PI), N. M. Alam	(2020-2023)

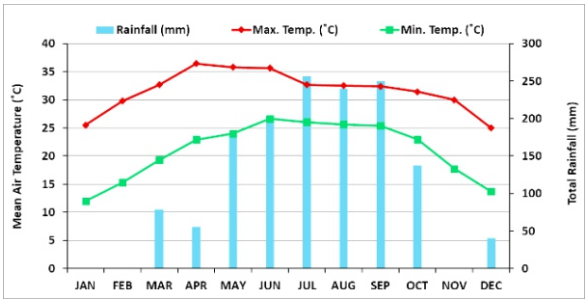
Regional Research Station

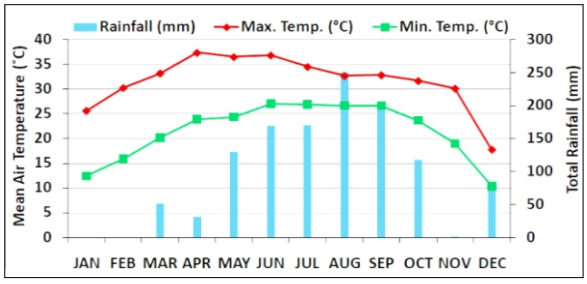
Project code	Project title	Investigators	Duration
RA 1.2	Expansion of ramie -based farming system with improved genotypes and technology.	S. Sarkar (PI), B. Majumdar, K. Mandal, R. Saha, R. K. Naik, N. M. Alam	(2020-2023)
CSRSJAF 1.1	Development of high -yielding jute genotypes through hybridization	C.S. Kar (PI), K. N. Chaurasia, J.K. Meena	(2019-2024)

Weather Report 2023

ICAR-CRIJAF, Barrackpore (West Bengal)

Total annual rainfall: 1429.7 mm
Annual mean maximum air temperatures: 31.6 °C
Annual mean minimum air temperatures: 21.0 °C
Hottest Month: April (36.4°C)
Coldest Month: January (12.0°C)
The highest monthly total rainfall: August (255.7 mm)
The lowest monthly total rainfall: February (55.5 mm)
No rainfall in months: January, February, November



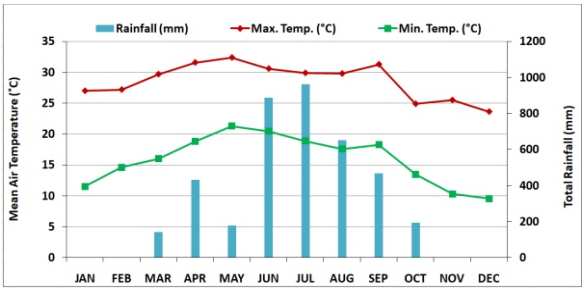


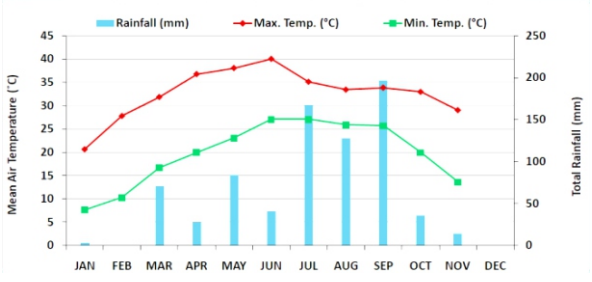
CSRSJAF, Budbud (West Bengal)

Total annual rainfall: 1199.9 mm
Annual mean maximum air temperatures: 31.6 °C
Annual mean minimum air temperatures: 21.4 °C
Hottest Month: Apri (37.4 °C)
Coldest Month: January (10.3 °C)
The highest monthly total rainfall: August (250.3 mm)
The lowest monthly total rainfall: April (1.4 mm)
No rainfall in months: January, February, November

RRS, Sorbhog (Assam)

Total annual rainfall: 3915 mm
Annual mean maximum air temperatures: 28.6°C
Annual mean minimum air temperatures: 15.95°C
Hottest Month: July (32.4 °C)
Coldest Month: January (9.6 °C)
The highest monthly total rainfall: June (962 mm)
The lowest monthly total rainfall: March (143 mm)
No rainfall in months: January, February, Nov., Dec.



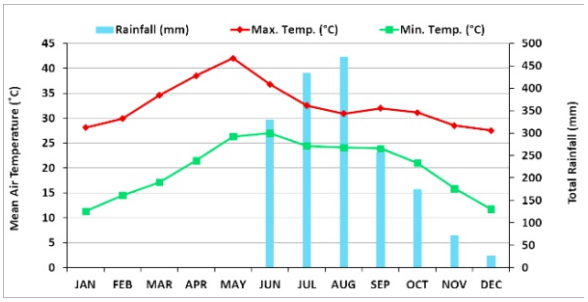


ShRS, Pratapgarh (Uttar Pradesh)

Total annual rainfall: 767.9 mm
Annual mean maximum air temperatures: 32.7 °C
Annual mean minimum air temperatures: 19.7 °C
Hottest Month: June (40 °C)
Coldest Month: January (7.7 °C)
The highest monthly total rainfall: October (196.4 mm)
The lowest monthly total rainfall: May (3.0 mm)
No rainfall in months: February, December

SRS, Bamra (Odisha)

Total annual rainfall: 1767.2 mm
Annual mean maximum air temperatures: 32.7°C
Annual mean minimum air temperatures: 19.9°C
Hottest Month: May (42 °C)
Coldest Month: January (11.3 °C)
The highest monthly total rainfall: July (470.6 mm)
The lowest monthly total rainfall: April (27 mm)
No rainfall in months: Jan, Feb, March, Apr, May



Source: Agrometeorology Units, ICAR-CRIJAF H.Q. and Regional Stations

PEOPLE @ICAR-CRIJAF

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Sri Ram Asre Yadav	Sri Nelson	Sri Bhuwal Pal	
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Sri Sunil Patra	Sri Ram Raj Pal	Sri Ram Baran Yadav	

Note: This is not purported to be a seniority list.

PERSONNEL, TRANSFERS, NEW JOINING, SUPERANNUATION, PROMOTIONS

1. Transfer from ICAR -CRIJAF, Barrackpore during Jan-Dec 2023

Name of the Person	Designation	Date (w.e.f.)
Dr. H.R. Bhandari	Sr. Scientist	Transferred to ICAR-DOGR, Pune on 31.03.2023
Dr. Laxmi Sharma	Scientist	Transferred to ICAR-NBPGR, New Delhi on 31.03.2023
Dr. Suman Roy	Scientist	Transferred to ICAR-NBPGR, New Delhi on 31.03.2023
Mr. Kajal Das	Scientist	Transferred to ICAR-NBPGR, New Delhi on 31.03.2023
Mrs. Neethu Mohan	Scientist	Transferred to ICAR-IARI, New Delhi on 08.12.2023
Mr. Pankaj Kr. Das	AAO	Transferred to ICAR-ATARI, Guwahati on 13.10.2023
Mr. Surajit Barman	Assistant	Transferred to ICAR-NEHR, Umium on 25.09.2023
Sri Satyabrata Barik	Technical Asstt.	Transferred to ICAR-NRRI, Cuttack on 24.11.2023

2. Transfer to ICAR -CRIJAF, Barrackpore during Jan-Dec 2023

Name of the Person	Designation	Date (w.e.f.)
Dr. Sanjay Saha	Pr. Scientist	20.03.2023 from ICAR-NRRI, Cuttack
Dr. Rakesh Bhowmick	Scientist	01.03.2023 from ICAR-VPKAS, Almorah
Mr. Chanchal Kundu	Sr. Technical Officer	11.12.2023 from ICAR-NINFET, Kolkata

3. Superannuation / Termination / VRS of ICAR-CRIJAF, Barrackpore during Jan -Dec 2023

Name of the Person	Designation	Date (w.e.f.)
Dr. M. S. Behera	Pr. Scientist	30.04.2023
Shri Narendra	S.S.S.	30.04.2023
Shri Uddhab Gayari	S.S.S.	30.04.2023
Shri Chandra Mondal	S.S.S.	31.05.2023
Shri Narottam	S.S.S.	31.10.2023
Shri Kamal Dasgupta	Assistant	Died on 19.12.2023
Sri Sunil Patra	S.S.S.	31.12.2023
Sri Naba Kumar Dutta	S.S.S.	31.12.2023

4. NEW JOINING AT ICAR-CRIJAF, BARRACKPORE DURING JAN - DEC 2023

Name of the Person	Designation	Date (w.e.f.)
Mr. Divte Pandurang Raghunath	Scientist	21.07.2023 (F/N) joined ICAR-CRIJAF

5. Promotions during the Year 2023

Name of the Person	Designation	Promoted to (Date)
Dr. Ranjan Kumar Naik	Sr. Scientist	Pr. Scientist w.e.f. 27.06.2021
Dr. Debojyoti Borkotoy	ACTO (KVK)	CTO w.e.f. 01.11.2022
Sri. Sandipan Garai	STO (KVK)	ACTO w.e.f. 18.04.2021
Sri Soumya Sarathi Kundu	STO (KVK)	ACTO w.e.f. 06.01.2022
Sri Kalipada Debnath	TO	STO w.e.f. 06.12.2021
Sk. Golam Rasul	TO(KVK)	STO w.e.f. 10.04.2021
Sri R. K. Roshan	TO	STO w.e.f. 29.10.2022
Sri Akshaya Mondal	TO	STO w.e.f. 17.10.2022
Sri Shahid Mukhtar	TO	STO w.e.f. 28.04.2023
Sri Sirajul Islam	TO	STO w.e.f. 25.04.2023
Dr. S. K. Bhattacharyya	TO	STO w.e.f. 17.07.2023
Sri Bharat Lal Prasad	TA	STA w.e.f. 17.01.2023
Sri Abhra Ghosh	TA	STA w.e.f. 09.07.2023
Sri Santinath Pal	Driver/TA	STA w.e.f. 10.07.2021
Sri Joydeep Pal	Driver/TA	STA w.e.f. 06.07.2021
Sri Avtar Singh	Driver/TA	STA w.e.f. 11.12.2021
Sri Sanjib Ghosh	Driver/TA	STA w.e.f. 11.12.2021
Sri Satyabrata Barik,	ST	TA w.e.f. 17.09.2022
Sri Baskit Nath Singh	ST	TA w.e.f. 17.01.2023
Sri M. K.Kumbhakar	ST	TA w.e.f. 07.01.2023
Sri Manoj Kumar Roy	Assistant	AAO on 01.02.2023
Sri Ritesh Kumar	Assistant	AAO on 29.03.2023
Sri Chandan Kumar Verma	Assistant	AAO on 29.11.2023
Sri Radhey Shyam Yadav	SSS	LDC on 20.06.2023

वसुधैव कुटुम्बकम्

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प्लास्टिक को दूर भगाएं

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