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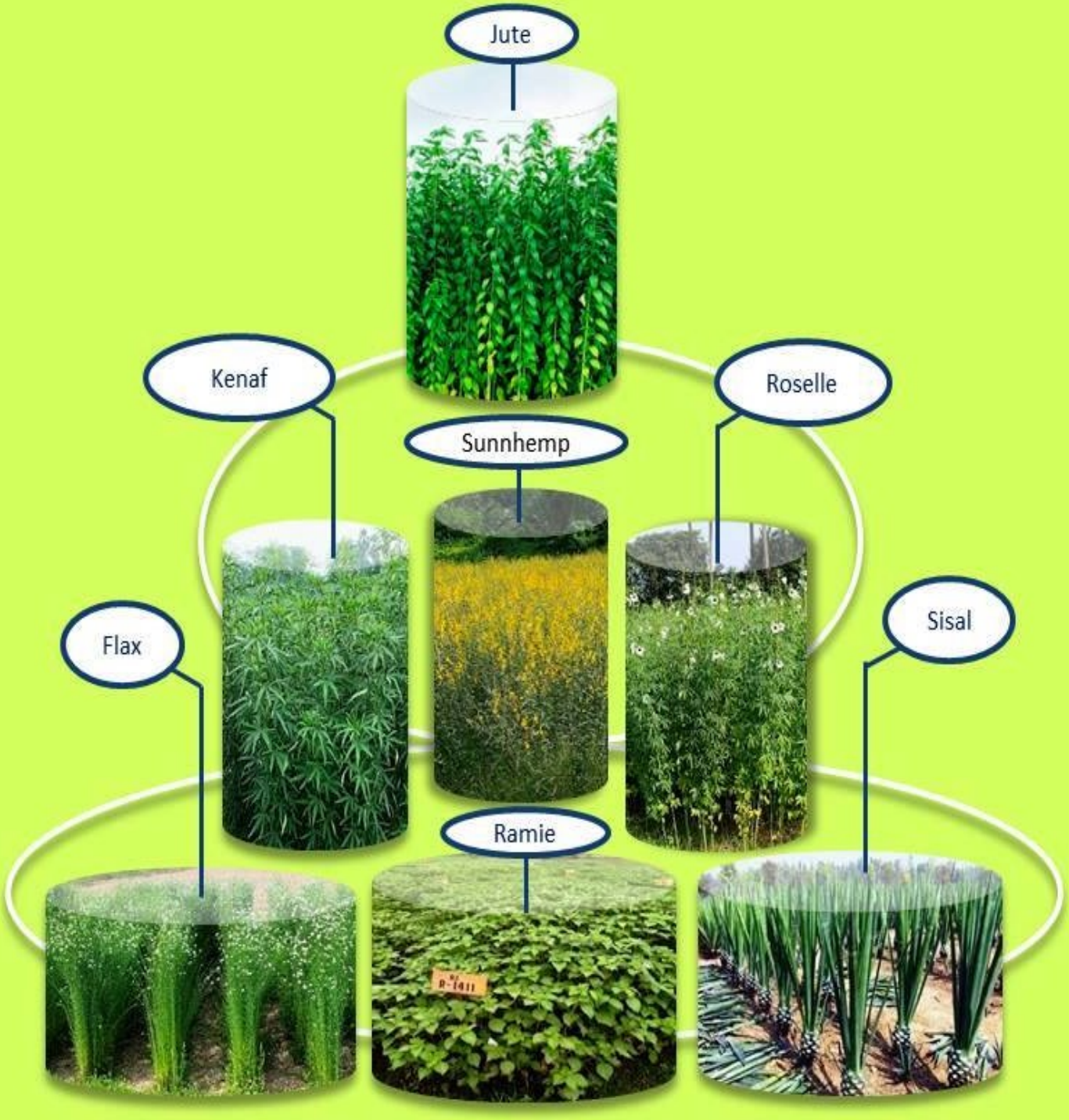
ANNUAL REPORT I 2022



भाकृअनुप - केन्द्रीय पटसन एवं समवर्गीय रेशा अनुसंधान संस्थान

ICAR-Central Research Institute for Jute and Allied Fibres

Barrackpore, Kolkata-700121

Cover First back page

Eco-friendly Natural Fibre

for supporting livelihood, soil fertility, Industrial use and Making Clean & Green environment

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वार्षिक प्रतिवेदन

ANNUAL REPORT

2022

भा.कृ.अ.नु.प. - केन्द्रीय पटसन एवं समवर्गीय रेशा अनुसंधान संस्थान
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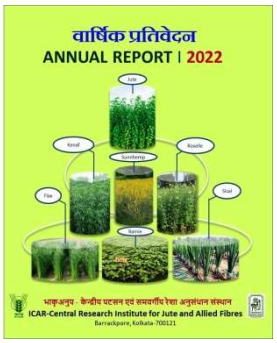

Front Cover Legend:

Fibre crop of Jute, Kenaf, Sunnhemp, Rossel, Flax, Ramie and Sisal

Back Cover Legend:

Value added products of jute and allied fibres with trends of jute and mest export (2017-2022) from India

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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 have tremendous potential not only as economical commercial crops but also to generate sizable employment, contributing significantly to the national exchequer through export of fibre-based goods. These plant-based biodegradable natural fibres have huge ecosystem service value too and are the only alternatives that can substitute plastics and synthetic-made products and save the environment. 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.

Our institute is now dedicatedly working to develop technologies to produce high quality, high grade finer fibre with better strength, which will be suitable to produce diversified products and can lead to replace the plastics and synthetics for a clean and green environment. In 2022, the institute has streamlined research projects with major goals of bridging the yield gap between potential and actual yield, and harnessing the pharmaceutical, nutraceutical, and ecosystem service values that will generate technology to improve the overall benefit of jute and allied fibre crops. In current year, the institute has made some

significant achievements in research and development like development of tossa jute genotype, JROP-4, for high yield and biomass, release of JROB-3, JRCP-5 of olitorius jute and HSLC-1 of HS mesta; JROB 2 for higher biomass and bioethanol production; crop diversification, conservation agriculture, and jute-based integrated farming systems to reduce non-renewable energy inputs, lowering GHG emissions and maintaining a positive nutrient balance; improved tractor-drawn multi-crop planter for precision sowing; nano-sulphur and nano-silica for controlling jute yellow mite for semilooper; identification of germplasms of jute (OIN 119, OIJ 77, OIJ 113, OIN 159, OIN 140, and OIN 118) against the stem rot pathogen (*Macrophomina phaseolina*); and implementation of ICAR-CRIJAF technology in 1,55,000 ha area of West Bengal, Assam and Bihar. These technologies will help India to achieve 100 per cent self-reliance in high-quality raw jute production, and there will be big savings from import substitution.

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. To showcase ICAR-CRIJAF technologies on fibre and fibre based products, we have developed an exhibition-cum-fibre museum. During this period, 20 scientists participated in international, global, national webinars, seminars, conferences, and other HRD programs. Also, our institute was recognised in national and international scientific forums and received 6 Awards during the reporting year 2022. ICAR-CRIJAF also published research papers in high-ranking peer-reviewed journals.

I am happy to present the CRIJAF annual report that highlights the research achievements of 2022, and I invite readers to go through the detailed report. We sincerely hope that the readers of this report will find it useful and offer valuable suggestions on our research and development work. Such inputs are valuable for the continuous refinement and improvement of our work.

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 Dr. R. K. Singh, Assistant Director General (Commercial Crops), ICAR, New Delhi, 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.

(Gouranga Kar)
Director, ICAR-CRIJAF

Place: Barrackpore
Date: 25.12.2022

Vision & Mission

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has been assessed and found to comply with the requirements of:

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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

S. Dutta
Managing Director

July 2022
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July 2023
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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 2022 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 2021 में भाकृअनुप-क्रिजफ के पास 42 इन-हाउस प्रोजेक्ट और 18 बाहरी संस्था से वित्त पोषित परियोजनाएं चल रही थीं। वार्षिक प्रतिवेदन का कार्यकारी सारांश नीचे प्रस्तुत किया गया है।

फसल सुधार

- भा.कृ.अनु.प.-क्रिजैफ में पटसन एवं समवर्गीय रेशा की 719 एकत्रित जननद्रव्य (जर्मप्लाज्म) पंक्तियों को पुनर्जीवित किया गया। ओलिटोरियस पटसन के सात जननद्रव्य ने समय से पहले पुष्पण प्रतिरोध प्रदर्शित किया जबकि दो पंक्तियों ने जल-जमाव की स्थिति में अच्छा प्रदर्शन किया। मध्यम अवधि वाली भंडारण इकाई में कुल 5,745 जर्मप्लाज्म को संरक्षित किया गया और फील्ड जीन बैंक में 100 रेमी जर्मप्लाज्म पंक्तियों का रख-रखाव किया गया। जर्मप्लाज्म की पच्चीस नई पंक्तियाँ पश्चिम बंगाल और आंध्र प्रदेश से एकत्र की गईं।
- पटसन की पैंतीस उन्नत प्रजनन पंक्तियों ने समय से पहले पुष्पण के प्रति सहनशीलता दिखाई। क्रॉस NFR-48 x RS-6 की F4 आबादी में कुल 51 पंक्तियों में समय से पहले पुष्पण नहीं पाया गया, जो चार प्रमुख जीनों की संचयी क्रिया द्वारा नियंत्रित होती है । क्रॉस OIN 1216 x RS-6 के 45 पौधों में 100% पुष्पण प्रदर्शित हुआ जिसमें समय से पूर्व पुष्पण एक प्रमुख जीन द्वारा नियंत्रित होती है ।
- किस्म परीक्षण के दौरान AVT-II की प्रविष्टियों में तोषा पटसन की एक जीनोटाइप JROP-4 ने अन्य जीनोटाइपों की तुलना में 38.4 क्वि/ हेक्टेयर उत्पादन क्षमता और 67.8 टन/ हेक्टेयर की बायोमास उपज द्वारा बेहतर प्रदर्शन किया । इस जीनोटाइप के तना में रंग द्रव्य तथा JRO 524 की तुलना में कम लिग्निन होता है।
- पटसन पौधा के विभिन्न हिस्सों में फेनोलिक्स और फ्लेवोनोइड्स के इन-सीटू पहचान हेतु अंधेरे में एक प्रोटोकॉल डाइफेनिलबोरिक एसिड 2-एमिनोइथाइल एस्टर (DBPA) के साथ हिस्टोकेमिकल प्रतिक्रिया के आधार पर विकसित किया गया । क्वेरसेटिन और केम्पफेरोल की उपस्थिति में पत्ती व परिपक्व तना में तीव्र नारंगी लिए एक चमकीला सुनहरा रंग चिह्नित किया।
- उल्लेखनीय रूप से पटसन की चार जीनोटाइप अर्थात CMU-13, OIJ-173, OIN-199 और SS-02 में सड़न अवधि 6-7 दिनों की थी जो JRO 204 और JROB-03 में 12-14 दिनों की तुलना में कम थी। इन जर्मप्लाज़्म वंशक्रमों का उपयोग न्यूनतम सड़न अवधि वाली पटसन किस्मों को विकसित करने में किया जा सकता है।
- DUS परीक्षण के दौरान रेशा मजबूती के आधार पर कैंडिडेट कैप्सुलारिस किस्म संदर्भ किस्मों से एकदम अलग था। एक अन्य कैंडिडेट ओलिटोरियस किस्म बीज रंग के आधार पर एकदम अलग थी। मेस्ता के लिए DUS दिशा निर्देशों के विकास के हेतु कुल 21 गुणों की पहचान की गई।
- पटसन में जैविक दबाव सहिष्णुता उत्पन्न करने हेतु प्रजनन पूर्व सामग्री के रूप में JRO-524 x OIJ-161, JROG-1 x OIJ-161, JRO-204 x OIJ-161, और JRO-2407 x OIJ-161 के क्रॉस विकसित किए गए । पांच जननद्रव्यों में पीली मकड़ी की सघनता कम पायी गई। तना सड़न रोग के प्रति दो परिग्रहणों OMU-42 और OIJ-143 ने उल्लेखनीय सहनशीलता प्रदर्शित किया गया ।

- तोषा पटसन के 71 संकरों में से सर्वश्रेष्ठ चार संकरों का अर्ध-डाईएलील में संकरण किया गया। हेटरोसिस ओवर चेक (JRO 204) के प्रति रेशा उपज में भिन्नता -11% ((JROBA3 x JRO 524) x (JROBA3 x JROBA4)) से 58% ((JROBA3 x JRO 2407) x (JROBA3 x JROBA4)) के बीच पाई गई । इसी तरह सफेद पटसन के 66 संकरों में से सर्वश्रेष्ठ चार संकरों का अर्ध-डाईएलील में संकरण किया गया। हेटरोसिस ओवर चेक (JRC 517) के प्रति रेशा उपज में भिन्नता -19% ((JRCJ11x JRCP7) x (JRCP7 x JRCJ11)) से 43% ((Padma x JRCP7) x (JRCP6 x JRC532) तक पाई गई ।
- हाल ही में विमोचित पटसन की किस्मों की गुणवत्ता प्रोफ़ाइल से पता चला है कि कैप्सुलरिस किस्मों की रेशा महीनता 1.12 टेक्स (JRCM 2) से 2.1 टेक्स (KJC 7) तक होती है जबकि ओलिटोरियस किस्मों की रेशा महीनता 2.71 टेक्स (JBO 1) से 3.42 टेक्स (तरुण) तक होती है । इसी तरह कैप्सुलरिस किस्मों की रेशा शक्ति 14.08 ग्रा./टेक्स (BCCC 1) से 22 ग्रा./टेक्स (JRC 698) तक होती है और ओलिटोरियस किस्मों की रेशा शक्ति 18.79 ग्रा./टेक्स (JROG 1) से 25.76 ग्रा./टेक्स (इरा) तक होती है। उपज पर रेशा गुणवत्ता लक्षणों का नकारात्मक प्रभाव होता है ।
- सफेद पटसन में इन-विट्रो शूट और रूट पुनर्जनन प्रणाली का मानकीकरण एडवेंटिटियस शूट रिजनरेशन मीडियम (ASRM) का BAP, NAA और एस्कॉर्बिक एसिड के पूरक प्रयोग से किया गया । हाइपोकोटाईल व्युत्पन्न बहिःरोप अनेक शूट और रूट प्रवर्तन के लिए सहज रूप से अधिक उत्तरदायी थे।
- सी. ओलिटोरियस की पत्ती, जड़, बीज और तना से उत्पन्न ट्रांस्क्रिप्टोंस द्वारा 24,785 जीन से जुड़े SNPs की पहचान की गई, जिससे 384 जेनिक SNPs का चयन गोल्डनगेट जीनोटाइपिंग परख के लिए किया गया। 92 प्रतिलेखों में से कुल 113 जीनिक SNPs का मैपिंग सात लिंकेज समूहों को कवर करने वाले 346.3 सेंमी से किया गया । पटसन जीनोम के साथ एकीकरण के बाद 382 मार्करों वाले एक संयुक्त मानचित्र को 301 कंटिग्स के साथ एकीकृत किया गया।
- फ्लैक्स किस्म JRF-2 के पुनर्जनन प्रोटोकॉल का मानकीकरण किया गया। शूट बढ़ाव की प्राप्ति MS मीडिया में 0-2.0 मि.ग्रा./ली. 6-BAP, 0-2.0 मि.ग्रा./ली. काईनेटिन और 0-2.0 मि.ग्रा./ली. सिल्वर नाइट्रेट ($AgNO_3$) से हुआ । सभी गैर-रूपांतरित बहिःरोप को नष्ट करने में हाइग्रोमाइसिन 40 मि.ग्रा./ली. को सबसे अधिक कुशल पाया गया।
- स्रोत सामग्री के रूप में पटसन की 28 किस्मों, मेस्ता की 13 किस्मों, सनई की चार किस्मों और फ्लैक्स की एक किस्म के न्यूक्लियस बीज से ब्रीडर बीजों का उत्पादन किया गया। DAC के प्रजनक बीज मांगपत्र 4.12 क्वि पटसन, 0.09 क्वि मेस्ता और 2.0 क्वि सनई के मुकाबले कुल 5.05 क्वि पटसन, 0.22 क्वि मेस्ता और 2.2 क्वि सनई बीज का उत्पादन किया गया । विभिन्न कार्यक्रमों के तहत विभिन्न फसलों के कुल 1433.6 क्वि बीज का उत्पादन किया गया।

फसल उत्पादन

- एकीकृत मृदा-फसल प्रबंधन के तहत मृदा जैविक कार्बन (SOC) गतिकी के पूनरुत्पादन और पूर्वानुमान के लिए पटसन-धान-सरसों फसल में मृदा जैविक कार्बन (SOC) अनुक्रम के रोथसी (ROTH C) मॉडल का उपयोग किया गया । SOC गतिकी सिमुलेशन के परिणाम ने जैविक C स्टॉक को प्रति वर्ष 0.4% तक बढ़ाने के लिए ~ 2,400 कि.ग्रा./है. की वार्षिक C इनपुट आवश्यकता का संकेत दिया । सदी के प्रथम अर्ध (2050-2060) में RCP4.5 और RCP8.5 के परिदृश्यों में सबसे अच्छी मिट्टी व फसल संयोजन से क्रॉपलैंड SOC स्टॉक 9.32% था इसके बाद संचित SOC में नुकसान हुआ। इस जानकारी का उपयोग एकीकृत मृदा-फसल कार्यप्रणाली के तहत मृदा कार्बन पृथक्कीकरण हेतु C इनपुट प्रबंधन के मार्गदर्शन हेतु किया जा सकता है।
- PSB के दो उपभेदों (JRPS 16 और JRPS 13) ने क्रमशः 45% और 40% की उच्चतम गुणात्मक घुलनशीलता गतिविधियों के प्रदर्शन सहित फॉस्फेट और पोटेशियम घुलनशीलता दक्षता को स्पष्ट रूप से प्रदर्शित किया, जबकि KSB के तीन उपभेदों (JPK S66, JPKS 71 और JPKS 11) ने क्रमशः 66%, 55% और 50% उच्चतम गुणात्मक घुलनशीलता गतिविधियों का प्रदर्शन किया ।
- पटसन आधारित फसल प्रणाली में पारिस्थितिकी तंत्र सेवाओं का उच्चतम आर्थिक मूल्य बिना जुताई+अवशेष (NT+R) के बाद बिना जुताई (NT) से प्राप्त हुआ । सबसे कम मूल्य संरक्षित जुताई (CT) में प्राप्त हुई । बेहतर पारिस्थितिकी तंत्र सेवाओं के साथ कृषि पद्धति के अधिकतम संरक्षण के कारण NT और NT+R के तहत हरित आय का उच्चतर मूल्य दर्ज किया गया जो कृषि प्रणालियों की दीर्घकालिक स्थिरता सुनिश्चित कर सकती है।

- दीर्घकालिक उर्वरक प्रयोग (LTFE) में संतुलित उर्वरक प्रयोग (100%NPK+FYM) से अधिकतम रेशा उपज (38 क्वि./ हेक्टेयर) हुई । उच्चतम मृदा जैविक कार्बन सामग्री और N क्रमशः 100% NPK+FYM और 150% NPK से प्राप्त हुआ । 100% N और कंट्रोल भूखंडों में मृदा-उपलब्ध P का ह्रास दर्ज किया गया ।
- किसान के खेत पर पटसन (CO-58) के लिए विकसित मृदा परीक्षण आधारित लक्ष्य उपज समीकरण का सत्यापन किया गया । उच्चतम पटसन रेशा उपज (39.88 क्वि./ हेक्टेयर) ST-TY+IPNS से -0.3% लक्षित उपज विचलन के साथ दर्ज की गई।
- शून्य–कर्षण के तरीकों को अपनाने से मृदा जैविक C-पूल, कुल गठन और स्थिरता सूचकांकों पर सकारात्मक प्रभाव पड़ा, जिससे मृदा भौतिक-रासायनिक गतिविधि में वृद्धि हुई । परिणामस्वरूप, फ्लैक्स आधारित फसल प्रणालियों में मिट्टी की गुणवत्ता बनाए रखने में शून्य–कर्षण तकनीक और संतुलित खनिज उर्वरक का प्रयोग बेहद ही फायदेमंद है ।
- स्प्रिंकलर सिंचाई के प्रारंभिक परिणाम से पटसन में पानी की बचत, एकसमान जल उपलब्धता, उच्च जल उपयोग दक्षता, परिवहन हानि में कमी, गहरा रिसाव में कमी, श्रम बचत, माइक्रोक्लाइमेट मॉडरेशन, मिट्टी की सघनता में कमी और अधिक रेशा उपज जैसे कई फायदे देखे गये।
- तोषा पटसन (JRO 204) के सिंचाई शैड्यूल में 75% DASM (उपलब्ध मिट्टी की नमी की कमी) के साथ 100% ETC से अधिकतम पौध ऊंचाई (290 से.मी.), आधारी परिधि (13.7 मि. मी.) एवं रेशा उपज (3.6 टन/ हेक्टेयर) की प्राप्ति हुई ।
- पटसन फसल जीवन चक्र विश्लेषण अध्ययन से यह स्पष्ट हुआ है कि 120-125 दिन की अवधि में 1 किलो पटसन बैग के लिए ग्लोबल वार्मिंग क्षमता (GWP) लगभग -0.253 कि.ग्रा. कार्बन डाइऑक्साइड (CO_2) है । जो शुद्ध पृथक्करण द्वारा मिट्टी में कार्बन डाइऑक्साइड (CO_2) को संचित करता है । पटसन जीवन चक्र में कृषि स्तर पर लगभग 1.26 कि.ग्रा.CO_2eq को आत्मसात किया जाता है, जब कि फार्म स्तर पर 1 कि.ग्रा. कच्चा रेशा उत्पादन के लिए 1.00 कि.ग्रा.CO_2eq अवमुक्त किया जाता है।
- सूखा की अवस्था में AsA का बहिर्जात प्रयोग पटसन पौधा की रेडॉक्स स्थिति को विनियमित करके सूखा के प्रतिकूल प्रभाव को कम करता है। शुष्कावस्था में पटसन के पौधे की ऊंचाई को भी कायम रखता है । ओलिटोरियस पटसन कि किस्म JRO 204 (सुरेन) सूखा के प्रति अधिक सहिष्णु प्रतीत होती है।
- सुंदरवन (भारत और बांग्लादेश) के मैंग्रोव पारिस्थितिकी तंत्र के पारिस्थितिक विक्षोभ का अध्ययन MODIS ग्लोबल डिस्टर्बेंस इंडेक्स (MGDI) से करने पर यह ज्ञात हुआ है कि इस क्षेत्र को 2020 में सुपर चक्रवात "अम्फान" और 2021 में "यास" के कारण अशांत क्षेत्र के रूप में वर्गीकृत किया गया है।
- संपूर्ण फसल बढ़वार अवधि के लिए पत्ती के स्तर पर निरंतर शुद्ध CO_2 अवशोषण का अनुमान लगाने के लिए टॉवर-व्युत्पन्न PPFD डाटा पर प्रतिगमन समीकरण का प्रयोग किया गया । पारिस्थितिक तंत्र-स्तर पर CO_2 प्रवाह में लौकिक भिन्नताएँ पत्ती-स्तर CO_2 की तुलना में अधिक है। वर्तमान अध्ययन से पत्ती स्तर पर CO_2 प्रवाह डाटा से पारिस्थितिकी तंत्र स्तर पर CO_2 प्रवाह का प्रतिनिधित्व करने के लिए फसल विकास मापदंडों के साथ-साथ फेनोलॉजी संशोधक के भूमिका के महत्व को बताया।
- JuteMet® एक वेब-आधारित कृषि मौसम विज्ञान डाटाबेस प्रबंधन प्रणाली (ADBMS) और कृषि-सलाह प्रणाली की अवधारणा कृषि, बागवानी, वानिकी सेवाओं व संबंधित कृषि-मौसम विज्ञान और कृषि-सलाह सेवा के लिए विकसित की गई। पटसन उत्पादकों को जलवायु परिवर्तन परिदृश्यों से निपटने के लिए जलवायु-लचीली कृषि-सलाह सेवाएं और पटसन किस्मों की जानकारी दी गई।
- पटसन में खरपतवार प्रबंधन के लिए इपफेनकार्बाजोन @90 ग्रा./है. (PE)+ नेल वीडर 14DAS में तथा इपफेनकार्बाजोन@90 ग्रा./है. (PE) + नेल वीडर 21DAS के प्रयोग को आशाजनक (36.8 क्वि./है.)पाया गया । प्रतिस्पर्धा के कारण बचे हुए खरपतवारों से रेशा उपज में कमी क्रमशः 4.77% और 5.62% पाई गई ।
- ओलिटोरियस पटसन में पौधे की आबादी का प्रभाव रेशा उपज में एक कारक के रूप में महत्वपूर्ण नहीं था, हालांकि इससे परिचालन हेतु मानव श्रम की आवश्यकता बढ़ी। पटसन के सघन रोपण @10, 20 और 40 लाख/है. से क्रमश: 0.005%, 3.44% और 35.16% पौधे तना सड़न रोग से प्रभावित पाए गए।

- कम्पोस्ट (BSC / BGSC) और रासायनिक NPK का 50:50 प्रयोग पटसन, फ्लैक्स और रेमी रेशा उत्पादन के लिए NPK उर्वरकों की अनुशंसित खुराक के 100% उपयोग का एक विकल्प हो सकता है।
- देश में फ्लैक्स क्षेत्र विस्तार हेतु एक मॉडल "कार्य योजना" विकसित की गई है। इस 5-वर्षीय कार्य योजना के अनुसार, 2,000 हेक्टेयर वाली फ्लैक्स क्षेत्र से लगभग 3,000 मीट्रिक टन कच्चा फ्लैक्स रेशा (स्कॉच्ड) का उत्पादन संभव है।
- देश में रेमी क्षेत्र विस्तार के उद्देश्य से कृषि-जलवायु और सामाजिक परिस्थितियों के आधार पर रेमी उत्पादन के लिए संभावित क्षेत्रों की पहचान की गई। प्रारंभिक तौर पर रेमी रेशा के विपणन से संबद्ध स्थानीय संभावित खरीदारों/उद्योगों की भी पहचान की गई ।
- सीसल क्षेत्र विस्तार के लिए उड़ीसा के झारसुगड़ा, संबलपुर, क्योंझर, जाजपुर, ढेंकनाल, खोरदा और नयागढ़ जिलों के किसानों को विभिन्न सरकारी योजनाओं और कार्यक्रमों के माध्यम से लगभग 1.27 लाख अधिक उपज वाले सकर और कन्द वितरित किए गए।
- एकीकृत कृषि प्रणाली (IFS) के अंतर्गत सीसल-आधारित कृषि प्रणाली में 'सीसल+बकरी+डेयरी+वर्मीकम्पोस्टिंग' वाली घटक सबसे अधिक लाभकारी थी । फसलों के विभिन्न उद्यमों की तुलना में पशु घटकों की शुद्ध आय अधिक थी । पटसन आधारित IFS में रोजगार के अवसरों को बढ़ाते हुये आय सृजन में 47% वृद्धि करने की क्षमता है। इसी तरह सीसल-आधारित IFS में फसल विफलता के जोखिम एवं रोग व कीट के संक्रमण को कम करते हुए मृदा उर्वरता में सुधार द्वारा 105% आय वृद्धि की संभावना है ।
- उच्च भूमि में पटसन और अन्य छोटे बीज वाली फसलों की सटीक बुवाई के लिए ट्रैक्टर संचालित बहु-फ़सलीय बुवाई यंत्र विकसित (बीज दर @3.5-4.5 कि.ग्रा./ हेक्टेयर) किया गया । यंत्र द्वारा पंक्ति में समान दूरी (30-50 मि.मी.) के साथ –साथ एक ही गहराई पर बीज (80-85%) की बुवाई होती है ।
- उन्नत फ्लैक्स रेशा एक्सट्रैक्टर के भौतिक क्षमता, थ्रुपुट क्षमता और निष्कर्षण दक्षता के आधार पर कार्यात्मक उपलब्धि फ्लैक्स तना से रेशा निकालने के लिए बहुत ही उपयोगी साबित हुआ है ।
- प्रतिक्रिया सतह पद्धति (बॉक्स बेहेनकेन डिजाइन) द्वारा पटसन जैवमास को क्षार पूर्व-उपचार द्वारा डिलिग्निफिकेशन की इष्टतम परिस्थिति को तापमान, सान्द्रता और समय द्वारा अनुकूलित करना संभव हो गया है।
- एक उच्च-बायोमास पटसन किस्म (JROB 2) की कोशिका दीवार संरचना का तुलनात्मक अध्ययन अन्य किस्म (cv. JRO 524) से करने पर JROB 2 में 120 DAS पर उच्च बायोमास, सेलूलोज़ और लिग्निन की सान्द्रता पाई गई।
- पटसन सड़न के लिए धीमी गति से बहने वाले जल जैसी अवस्था के लिए एक तकनीक विकसित की गई है, जिससे 8-12 दिनों के भीतर माइक्रोबियल फॉर्मूलेशन 'क्रिजैफ सोना' द्वारा सड़न प्रक्रिया पूरी होती है। एक समान और तेजी से सड़न होने से अधिक रेशा प्राप्ति व गुणवत्ता में सुधार होता है। इस रेशा की महीनता 2.5 - 2.64 टेक्स और रेशा शक्ति 25 - 25.4 ग्राम/टेक्स दर्ज की गई ।
- Jute-ICARE परियोजना पश्चिम बंगाल, बिहार, असम, ओडिशा, मेघालय और आंध्र प्रदेश राज्यों के 170 विकास खंडों में लागू की गई, जिसमें 1,55,000 हेक्टेयर क्षेत्रफल और 3.60 लाख किसान शामिल हैं। परियोजना क्षेत्र में ICAR-CRIJAF के वैज्ञानिकों के तकनीकी मार्गदर्शन और पर्यवेक्षण में पश्चिम बंगाल, असम और बिहार में 314 क्रॉप कटिंग एक्सपेरिमेंट (CCE) क्रियान्वित किए गए। इस एक्सपेरिमेंट से यह पता चला है कि पटसन रेशा उपज 30.0 - 36.75 क्वि./है. बीच थी । पारंपरिक सड़न की तुलना में औसतन पटसन कृषक समुदाय को उनके गुणवत्ता वाले पटसन रेशा के लिए ₹450 - 500/क्वि. तक अधिक बाजार मूल्य की प्राप्ति हुई।

फसल सुरक्षा

- नैनो-सिलिका (30NM) और नैनो-सल्फर (25NM) क्रमशः पटसन सेमीलूपर्स और पीली मकड़ी के लिए अत्यधिक विषाक्त थे। नैनो-सिलिका का LC_{50} न्यूनतम 0.0013 ppm था, जबकि प्रोफेनोफॉस का LC_{50} 990.84 ppm था। नैनो-सल्फर @ 0.01 ppm के प्रयोग से पटसन की पीली मकड़ी में 93.43% मृत्युदर देखी गई और नैनो-सल्फर का LC_{50} 0.000033 ppm था।
- जैव-नियंत्रण कंसोर्टियम विकसित करने हेतु ट्राइकोडर्मा स्पीसीज़ के तीन संगत आइसोलेट्स CJMR180, CJMR180, और CJMR193 अलग-अलग ऊष्मायन तापमान में बेहतर वृद्धि प्रकृति और तीन रोगजनकों (एम.

फेजोलिना, राइजोक्टोनिया स्पीसीज़ और स्क्लेरोटियम स्पीसीज़) के प्रति विरोधात्मक प्रभाव और वृद्धि को बढ़ावा देने वाली गुणों के कारण उपयोग में लाये जा सकते हैं।

- पटसन की पीली मकड़ी के प्रति पटसन की किस्मों, मृदा सल्फर पोषण, एकेरिसाइड्स और एंटोमोपैथोजेनिक कवक के संयुक्त प्रभाव के जैव-प्रभावकारिता मूल्यांकन से पता चला है कि फेनपाइरोक्सीमेट @ 5EC @1.5 मि.ली./ली. के पर्णीय उपचार के साथ-साथ सल्फर-युक्त मिट्टी में उगाए गए JRO 204 में मकड़ी संक्रमण की घटना JRO 2407 किस्म की तुलना में काफी कम थी जहाँ पर गंधक एवं एकेरिसाइड्स प्रयोग नहीं किया गया था । हालांकि मकड़ी के प्रति बी. बेसियाना और आई. फ्यूमोसोरोसिया फॉर्मूलेशन के संयुक्त प्रयोग ने औसत उपलब्धि प्रदर्शित किया तथा मकड़ी के संक्रमण को सार्थक रूप से कंट्रोल की तुलना में काफी कम कर दिया । पौधे के बढ़वार लक्षण और क्लोरोफिल सामग्री (SPAD) पर मकड़ी-सहिष्णु किस्मों, मिट्टी में प्रयुक्त सल्फर और मकड़ी नियंत्रण के पर्णीय छिड़काव का सार्थक असर हुआ ।
- किसान की खेत पर पीली मकड़ी के प्रबंधन में मकड़ी के प्रति मध्यम-सहिष्णु पटसन किस्म (JRO 204), निवारक मिट्टी सल्फर पोषण और एकेरिसाइड के पर्णीय स्प्रे का एकीकृत प्रभाव ने मिट्टी में सल्फर @ 45 कि. ग्रा. /है. और फेनपायरोक्सिमेट 5EC @ 1.5 मि.ली./ली. (45 और 55 DAS) का पर्णीय छिड़काव ने अलग-अलग और संयुक्त रूप में एक अर्थपूर्ण भूमिका निभाई ।
- पटसन में तना सड़न, पीला मकड़ी एवं अन्य रोगों के प्रबंधन हेतु बुवाई से 7 दिन पहले ब्लीचिंग पाउडर (30 कि.ग्रा./है.) से मिट्टी का निवारक उपचार और कार्बेन्डाजिम + इमिडाक्लोप्रिड से बीजोपचार को बेहतर पाया गया।
- फील्ड परिस्थितियों में, SpobNPV ($3.54x10^8$ POB's/मि.ली. @2मि.ली./ली.) को एडिटिव्स शीरा (5%), ग्लिसरॉल (10%) और स्टिकर प्लस (0.1%) के संयोजन को स्प्रे द्वारा लार्वा को 2, 4, और 7 दिनों के बाद संक्रमित करने से लार्वा की संख्या में क्रमश: 50.52%, 63.25% और 82.91% की कमी आई और जो बीटी कुर्स्ताकी के समतुल्य था ।
- असम के हॉट स्पॉट स्थिति में कृत्रिम इनोक्यूलेशन एवं मूल्यांकन के आधार पर 60 जर्मप्लाज्म द्वारा तना सड़न रोगज़नक़ एवं मैक्रोफ़ोमिना फ़ेज़ोलिना रोग के प्रति प्रतिरोध प्रदर्शन में 6 जर्मप्लाज्म, अर्थात् OIN119, OIJ77, OIJ113, OIN159, OIN140, और OIN118 ने सार्थकतापूर्ण प्रतिरोध प्रदर्शन किया ।
- विभिन्न जलवायु परिवर्तन परिदृश्यों जैसे RCP2.6, RCP4.8, RCP6.0 और RCP8.5 के तहत इंडिगो कैटरपिलर के उत्पादन सूचकांक (GI) और स्थापना जोखिम सूचकांक (ERI) का GIS मानचित्र विकसित किया गया । इससे यह पता चलता है कि वर्तमान में जहां पर इंडिगो कैटरपिलर कीट नगण्य है, वहाँ पर आगामी 2021-40 और 2061-80 की अवधि के दौरान व्यापक क्षेत्रों में इसकी मौजूदगी संभावित है ।
- पटसन में रोग प्रबंधन के उद्देश्य से एक निर्णय समर्थन प्रणाली (DSS) को फसल फेनोलॉजी के सापेक्ष पहचानने और मौसम के मापदंडों को एकीकृत करते हुए SQL सॉफ्टवेयर (2008 या 12.0) में एक डाटाबेस विकसित किया गया है । इस वेब-आधारित निर्णय समर्थन प्रणाली को दो भाषा में कीट व रोग प्रबंधन के सबसे बेहतर तरीकों को जानने के लिए बनाया गया है ।

कृषि प्रसार

- कोविड के बाद की अवधि में पटसन के इन उन्नत तकनीकों – पंक्तिबद्ध बुवाई, उन्नत किस्मों (JROBA 3) का उपयोग, सिंगल-व्हील पटसन वीडर और क्रिजैफ सोना द्वारा पटसन की उपज और रेशे की गुणवत्ता में सुधार किया, जिससे किसानों की प्रति है॰ आय में ₹38925/- की वृद्धि हुई । इसके अतिरिक्त आय बढ़ाने के लिए, स्वयं सहायता समूहों (एस.एच.जी.) को पटसन रेशे के मूल्यवर्धन पर भी प्रशिक्षित किया गया साथ-ही बाजार तक आसान पहुँच के लिए स्वयं सहायता समूहों को कृषक उत्पादन संगठन (एफ.पी.ओ.) से भी जोड़ा गया ।
- गूगल आधारित फ़ॉर्म का उपयोग करके (JAF Kisan) पश्चिम बंगाल, असम, बिहार, ओडिशा और मेघालय जैसे विभिन्न पटसन उत्पादक राज्यों में रेशे उपज में गैप का आँकलन किया गया जिसमें ये पाया गया कि ऐसा एक्सटैन्शन गैप (5.6-6.2 क्वि/हेक्टेयर) और तकनीकी गैप (7.2-8.2 क्वि/हेक्टेयर) के कारण हुआ है।
- प्लास्टिक को प्रतिस्थापित करने और कृषि कार्यों के अलावा आय में वृद्धि करने के उद्देश्य से, मूल्यवर्धित विविध पटसन निर्मित वस्तुओं, विशेष रूप से पटसन रेशे और फ़ैब्रिक आधारित हस्तकला वस्तुओं पर विभिन्न कौशल-

विकास कार्यक्रम आयोजित किए गए। उत्तर 24 परगना में स्थित विभिन्न स्वयं सहायता समूहों (एस.एच.जी.) की साठ महिला कृषकों को उनके उत्पादों को बेचने के प्रावधान के साथ प्रशिक्षित किया गया ।

- पश्चिम बंगाल के उत्तरी 24 परगना, हुगली और नदिया जिलों में कुल 603 प्रक्षेत्र प्रदर्शनों (एफ.एल.डी.) का आयोजन किया गया । उच्च उपज देने वाली नई किस्मों (JRO 204, JRO 2407, JBO 1, JROM 1, और CO 58) ने स्थानीय किस्म की तुलना में 7.86–11.76 क्वि/हेक्टेयर की औसत उपज वृद्धि दर्ज की जो कि उल्लेखनीय है। सर्वोत्तम उपज सी.ओ. 58 (41.65 क्विंटल/हेक्टेयर) ने दर्ज की, जबकि किसानों द्वारा इस्तेमाल की जाने वाली स्थानीय किस्म की औसत उपज मात्र 29.89 क्विंटल/हेक्टेयर पायी गई।
- पश्चिम बंगाल के उत्तर 24 परगना, हुगली और नदिया जिलों के 125.40 हेक्टेयर में क्रिजैफ सिंगल व्हील पटसन वीडर द्वारा यांत्रिक खरपतवार प्रबंधन के परिणामस्वरूप रेशे उपज में 6.15 - 9.78 क्वि/हेक्टेयर की वृद्धि एवं रु 11767– 15810 प्रति हेक्टेयर श्रम लागत खर्च में बचत हुई ।
- पश्चिम बंगाल के उपर्युक्त तीन जिलों में, 145.01 हेक्टेयर क्षेत्रफल में पटसन सीडर द्वारा पंक्तिबद्ध बुवाई के प्रक्षेत्र प्रदर्शनों ने रेशे की उपज में 4.31-8.37 क्वि/हेक्टेयर की वृद्धि दर्ज की और प्रति हेक्टेयर श्रम लागत खर्च में 8831-13286 रूपये की बचत की।
- क्रिजैफ सोना (@30 किग्रा/हेक्टेयर) के प्रयोग से सभी स्थानों पर सड़न की अवधि 4-6 दिनों तक कम हो गई और रेशे की गुणवत्ता में भी 1- 2 श्रेणी का सुधार हुआ जिससे कारण प्रति क्विंटल 400 - 450 रुपया अतिरिक्त आमदनी हुई । इस विधि में रेशे के लिए कम पानी की आवश्यकता होती है ।
- असम के चिरांग जिले में, रैमी रेशे उत्पादन और निष्कर्षण तकनीकी पर 2 हेक्टेयर में प्रक्षेत्र प्रदर्शनों (एफ.एल.डी.) के तहत, हजारिका किस्म (आर 1411) लगाया गया और रैमी अनुसंधान केन्द्र (आर.आर.एस.), सोरभोग, असम में 10 हेक्टेयर क्षेत्रफल के रैमी बागान में रख-रखाव गतिविधियां भी की गईं।
- राष्ट्रीय खाद्य सुरक्षा मिशन (NFSM) के तहत, भा.कृ.अनु.प.-क्रिजैफ ने एम.पी.के.वी.(MPKV), राहुरी, महाराष्ट्र और ए.आर.एस. (ARS), अमादलावलसा और ए.एन.जी.आर.ए.यू. (ANGRAU), आंध्र प्रदेश के सहयोग से गुंटूर, आंध्र प्रदेश में JRO 204, JBO-1, JROM-1, और JRO-2407 नामक पटसन किस्मों के बीज उत्पादन का कार्य किया । हाल ही में विमोचित मेस्ता (रोजेल) किस्मों जैसे AMV-7 (0.8 क्वि), AMV-8 (0.7 क्वि), AMV-8 (0.7 क्वि), AMV-9 (0.5 क्वि) के आधारी बीज (Foundation seed) और सनई के किस्म SUIN 03 (1.5 क्वि) का भी उत्पादन किया गया ।
- पटसन, मेस्ता और सनई के चालीस क्विंटल के लक्ष्य में से कुल 30.32 क्विंटल आधारीय बीज का उत्पादन किया गया (75.8% उपलब्धि) । वर्ष 2021-22 के दौरान पटसन (किस्म सीओ 58) के 95 क्विंटल, 2 क्विंटल मेस्ता (किस्म ए.एम.वी. 7), और 3 क्विंटल सनई (किस्म एस.यू.आई.एन. 037) के प्रमाणित बीज का लक्ष्य के मुक़ाबले कुल 76.24 क्विंटल प्रमाणित बीज का उत्पादन किया गया ।
- असम और मेघालय के कुल 400 किसानों को रेमी की खेती और रेशे निष्कर्षण तकनीकों पर प्रशिक्षित किया गया । भा.कृ.अनु.प.-क्रिजैफ में पटसन आधारित फसल प्रणाली में प्राकृतिक और जैविक खेती पर एक मेगा अभियान में कुल 100 किसानों ने भाग लिया और पश्चिम बंगाल के मालदा जिले के बामनगोला ब्लॉक में 50 किसानों को नई पटसन किस्मों का प्रदर्शन किया गया ।
- भा.कृ.अनु.प.-क्रिजैफ विकसित मल्टी-रो सीड ड्रिल (MRSD) को विशेष रूप से संशोधित किया गया ताकि इसे हल्का और महिलाओं के अधिक अनुकूल बनाया जा सके ताकि कठिन श्रम को कम किया जा सके। पश्चिम बंगाल के उत्तर 24 परगना और नदिया जिलों में खेतिहर महिलाओं के लिए नेल वीडर और सिंगल-व्हील पटसन वीडर के उपयोग पर प्रदर्शन-सह-प्रशिक्षण आयोजित किए गए।
- खेतिहर महिलाओं को पटसन के बैग और अन्य हस्तशिल्प तैयार करने में प्रशिक्षित किया गया था, और उन्हें उद्यमशीलता गतिविधियों को विकसित करने के लिए स्वयं सहायता समूह बनाने के लिए प्रोत्साहित किया गया था। इसके अलावा, पटसन आधारित एकीकृत कृषि प्रणाली में कुक्कुट और बत्तख पालन की शुरूआत ने खेतिहर महिलाओं की भागीदारी में वृद्धि की।
- स्वच्छता गतिविधियों ने पटसन और संबंधित रेशे फसलों पर ध्यान देने के साथ अपशिष्ट पुनर्चक्रण, वर्मी कम्पोस्टिंग, जैविक कृषि और उप-उत्पाद के उपयोग पर जोर दिया। परिसर के अंदर उत्पन्न बायोडिग्रेडेबल कचरे को पुनः

प्रयोग करने का सबसे अच्छा तरीका - एक कुशल कंपोस्टिंग विधि के माध्यम से जैव उर्वरकों का उत्पादन करने के लिए विकसित किया गया जो कि अपशिष्ट से धन उपार्जन के लिए था।

- मेरा गाँव मेरा गौरव (एम.जी.एम.जी.) कार्यक्रम 43 गाँव में लागू किया गया । चार से पाँच वैज्ञानिकों वाली कुल 10 टीमों ने बीज, उर्वरक, रसायन, कृषि मशीनरी जैसे कृषि आदानों के वितरण में भाग लिया और स्वच्छ भारत अभियान, जलवायु परिवर्तन, जल संरक्षण, मिट्टी उर्वरता जैसे राष्ट्रीय महत्व के मुद्दों पर किसानों को जागरूक किया।
- पटसन आधारित कृषि प्रणाली को बढ़ावा देने के लिए, पश्चिम बंगाल और ओडिशा के 5668 अनुसूचित जाति के किसानों को सब्जी की खेती, मत्स्य पालन, वर्मीकम्पोस्ट जैसे विभिन्न उद्यमों के लिए पर्याप्त संसाधन और तकनीकी सहायता प्रदान की गई ।
- पश्चिम बंगाल में अनुसूचित जनजाति के लाभार्थियों के क्षमता निर्माण कार्यक्रम के तहत, 233 लाभार्थियों के लिए विभिन्न प्रशिक्षण और प्रदर्शन आयोजित किए गए, जैसे – घरेलु स्तर पर मुर्गी पालन, तालाब आधारित एकीकृत खेती प्रणाली, पटसन आधारित हस्तशिल्प की डिजाइनिंग और निर्माण और फसल कटाई उपरांत प्रबंधन ।
- अनुसूचित जाति के किसानों की आय बढ़ाने के लिए महत्वपूर्ण कृषि आदान जैसे सब्जी बीज किट, नेल वीडर, साइकिल वीडर, बैटरी से चलने वाले स्प्रेयर, कुदाल (फावड़ा), दरांती, खुरपी, बीज (पटसन, सनई, धान), क्रिजैफ सोना, उन्नत खेती के लिए क्रिजैफ मल्टी-रो सीड ड्रिल, वर्मीबिड, रसायनिक खाद, मतस्य खाद्य सामग्री, फलदार पौधों के पौध, नीम केक, वर्मीकम्पोस्ट, बतखों के चूजे, मुर्गी के चूजे, सीसल सकर, सीसल बल्ब, मशरूम स्पॉन, मछली का जीरा (फिश फिंगरलिंग) आदि प्रदान किये गये ।
- वर्ष 2022 के दौरान, एस.सी.एस.पी. कार्यक्रम के तहत, पंद्रह प्रशिक्षण कार्यक्रम आयोजित किये गये जिसके माध्यम से 1150 किसान लाभान्वित हुए। इसी दौरान पश्चिम बंगाल के मुर्शिदाबाद, उत्तर दिनाजपुर और दक्षिण दिनाजपुर जिलों में सत्रह इन-सीटू पटसन सड़न के लिए तालाबों की खुदाई की गई ।
- उत्तर-पूर्व के हिल क्षेत्रों (NEH) कार्यक्रम के तहत, भा.कृ.अनु.प.-क्रिजैफ ने वेस्ट गारो हिल्स और वेस्ट त्रिपुरा में कृषि विज्ञान केंद्र के सहयोग से "अपशिष्ट से धन - जैव-खाद और खेतों में इसका उपयोग" लागू किया एवं मेघालय और त्रिपुरा के किसानों को 200 वर्मीबिड्स भी वितरित किए गये ।
- दो कृषि विज्ञान केन्द्रों (के.वी.के.) - वर्दवान और उत्तर 24 परगना (अतिरिक्त), ने बोरो धान और तिलहन (तिल) में पोषक तत्व प्रबंधन, कटे हुए फूलों की गुणवत्ता में सुधार, भिंडी और बैंगन में कीट और रोग प्रबंधन और दुग्धपान कराने वाली संकर गायों की पोषक तत्व प्रबंधन जैसे महत्वपूर्ण कृषि मुद्दों पर सात ओ.एफ.टी. का आयोजन किया।
- वर्ष 2022 के दौरान पटसन, धान, मसूर, चना, खरीफ प्याज, बैंगन में एकीकृत पोषक तत्व प्रबंधन (आई.पी.एम.), केला में टिश्यू कल्चर, ओयस्टर मशरूम की खेती और कुक्कुट पालन के विभिन्न पहलुओं पर बर्दवान और उत्तर 24 परगना में कृषि विज्ञान केन्द्रों (के.वी.के.) द्वारा कुल 253 प्रक्षेत्र प्रदर्शनों (एफ.एल.डी.) का आयोजन किया गया ।

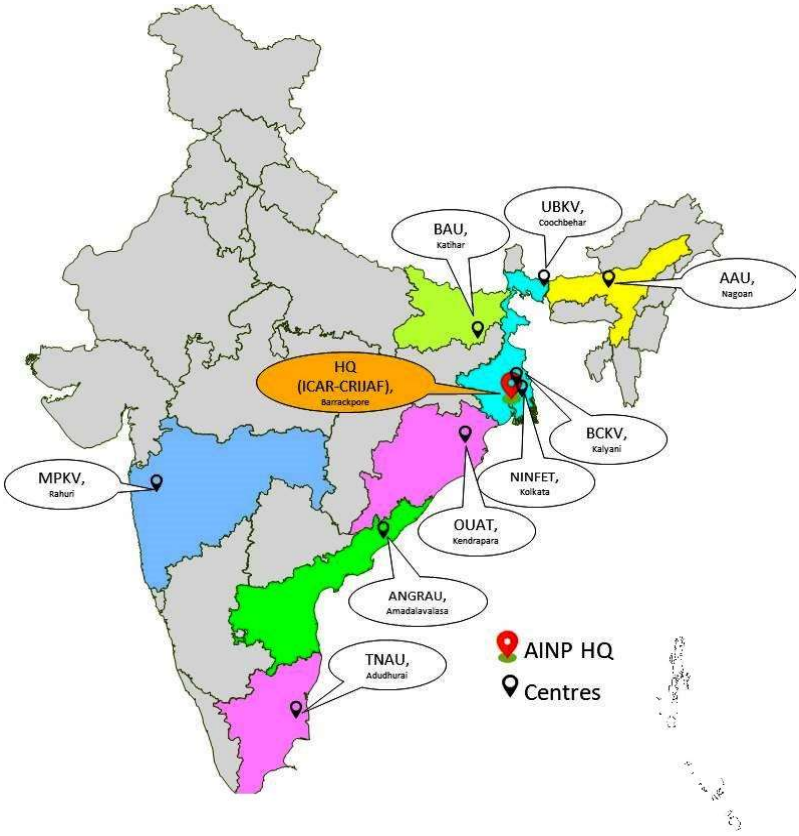
Organogram of ICAR-CRIJAF

Director General
ICAR

Deputy Director General
Crop Sciences, ICAR

Research Advisory Committee (RAC)	Director (ICAR-CRIJAF)	Institute Management Committee (IMC)

Research Division	AINP-JAF	Research Station	Service Section	KVK
- Crop Improvement - Crop Production - Crop Protection - Extension & Outreach	7 States 9 Centres	- 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.	- Administration - Finance & Accounts - AKMU Cell - HRD Cell - Library - Farm & Building	1. Purba Bardhaman 2. North 24 Parganas (Additional)



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 2022, the institute made significant achievements in research and demonstrated the technologies to jute and allied fibre growing farmers through various programmes. ICAR-CRIJAF had 42 in-house projects and 18 externally funded projects in operation in the year 2022. The executive summary of the report is presented below.

Crop Improvement

- At ICAR-CRIJAF, 719 collected lines of jute and allied fibre germplasm were regenerated. Seven olitorius jute germplasm exhibited premature flowering resistance while two lines performed well under water-logged condition. A total of 5745 germplasm were conserved in the medium-term storage unit and 100 ramie germplasm lines are maintained in the field gene bank. Twenty-five new germplasm lines were collected from West Bengal and Andhra Pradesh.
- Thirty-five advanced breeding lines of jute showed premature flowering tolerance. In the cross NFR-48 x RS-6, a total of 51 lines in the F_4 population did not show premature flowering, where the cumulative action of four dominant genes governed complete tolerance to premature flowering. In the cross OIN 1216 x RS-6, in which 45 plants exhibited 100% flowering in which the premature flowering was controlled by a single dominant gene.
- JROP-4, a promising tossa jute genotype that outperformed other AVT-II entries in varietal testing exhibited production potential of 38.4 q/ha and biomass yield of 67.8 t/ha. The genotype has pigmented stem and less lignin than JRO 524.
- A protocol for in-situ detection of phenolics and flavonoids in jute plant parts was developed based on the histochemical reaction in the dark with diphenylboric acid 2-aminoethyl ester (DPBA). An intense orange to brilliant gold colour marked the presence of quercetin and kaempferol in the leaf and mature stem.
- Four jute genotypes i.e., CMU-13, OIJ-173, OIN-199, and SS-02 had significantly low retting durations of 6–7 days compared to 12-14 days in JRO 204 and JROBA-03. These germplasm lines may be

utilized for developing jute varieties with shortest retting duration.

- DUS testing of candidate *capsularis* variety was distinct from reference varieties on the basis of fibre strength. Another candidate *olitorius* variety was distinct on the basis of seed colour. A total of 21 characters were identified for the development of DUS guidelines for mesta.
- Crosses of JRO-524 x OIJ-161, JROG-1 x OIJ-161, JRO-204 x OIJ-161, and JRO-2407 x OIJ-161 were developed for pre-breeding material development for biotic stress tolerance in jute. Five germplasm exhibited low mite density. Two accessions, OMU-42 and OIJ-143, exhibited significant tolerance against stem rot disease.
- Best four hybrids from 71 hybrids of tossa jute were crossed in half-diallel. Heterosis over check (JRO 204) for fibre yield varied from -11% ((JROBA3 x JRO 524) x (JROBA3 x JROBA4)) to 58% ((JROBA3 x JRO 2407) x (JROBA3 x JROBA4)). Best four hybrids from 66 hybrids of white jute were crossed in half-diallel. Heterosis over check (JRC 517) for fibre yield varied from -19% ((JRCJ11x JRCP7) x (JRCP7 x JRCJ11)) to 43% ((Padma x JRCP7) x (JRCP6 x JRC532).
- The quality profile of recently released jute varieties indicated that the fibre fineness of the capsularis varieties varied from 1.12 tex (JRCM 2) to 2.1 tex (KJC 7), and the fibre fineness of the olitorius varieties varied from 2.71 tex (JBO 1) to 3.42 tex (Tarun). Likewise, the fibre strength of the capsularis varieties varied from 14.08 g/tex (BCCC 1) to 22 g/tex (JRC 698) and the strength of the olitorius varieties varied from 18.79 g/tex (JRO G 1) to 25.76 g/tex (Ira). The fibre quality traits have negative impact on yield.
- An *in-vitro* shoot and root regeneration system was standardized in white jute using Adventitious Shoot Regeneration medium (ASRM) supplemented with BAP, NAA, and ascorbic acid. Hypocotyl derived explants were more amenable to multiple shoots and root induction.
- By generating Transcriptomes from leaf, root, seed, and stem of *C. olitorius*, 24,785 gene-associated SNPs were identified and 384 genic SNPs were selected for the development of a GoldenGate genotyping assay. A total of 113 genic SNPs from 92 transcripts were mapped over seven linkage groups covering 346.3 cM. After integration with the jute genome a combined map comprising 382 markers was integrated with 301 contigs.
- The regeneration protocol for flax variety JRF-2 was standardized. Shoot elongation was achieved in MS media with 0-2.0 mg/L 6-BAP, 0-2.0 mg/L Kinetin, and 0-2.0 mg/L silver nitrate ($AgNO_3$). Hygromycin at 40 mg/L was found to be most efficient at killing all the non-transformed explants.
- Nucleus seeds of 28 varieties of jute, 13 varieties of mesta, four varieties of sunnhemp, and one variety of flax were produced as the source material for breeder seeds. A total of 5.05 q of breeder seeds of jute, 0.22 q of mesta, and 2.2 q of sunnhemp were produced against the DAC indent of 4.12 q, 0.09 q, and 2.0 q of jute, mesta, and sunnhemp, respectively. A total of 1433.6 quintals of seed for different crops was produced under different programmes.

Crop Production

- The RothC model of soil organic carbon (SOC) sequestration was used for reproducing and forecasting SOC dynamics under integrated soil-crop management of a jute-rice-mustard cropping system. The results of the SOC dynamics simulation indicated an annual C input requirement of ~2400 kg/ha to increase organic C stocks by 0.4% per year. Cropland SOC stocks with the best soil and crop combination were 9.32% in the first half of the century (2050–2060) in the RCP4.5 and RCP8.5 scenarios, followed by a loss in accumulated SOC. This information can be used to guide carbon input management under integrated soil-crop practices for soil carbon sequestration.
- Phosphate and potassium solubilization efficiency clearly showed that two strains of PSB (JRPS16 and JRPS13) exhibited the highest qualitative solubilization activities of 45% and 40%, respectively, and three strains of KSB (JPKS66, JPKS71, and JPKS11) exhibited the highest qualitative solubilization activities of 66%, 55%, and 50%, respectively.
- The highest economic value of ecosystem services was realized in the no tillage+residue (NT+R), followed by the NT and the lowest in the conservation tillage (CT) in jute based cropping system. Under NT and NT+R higher value of green income was recorded because of higher conservation of agricultural practices with better ecosystem services that can ensure long-term sustainability of agricultural systems.
- In long term fertilizer experiment (LTFE), balanced fertilizer application (100% NPK+FYM) resulted in highest jute fibre yield (38 q/ha). The highest soil organic carbon content and N was recorded in 100% NPK+FYM and 150% NPK respectively. Soil-available P was depleted in the 100% N and control plots.
- Soil Test based target yield equation developed for jute (cv. CO-58) was verified in the farmers' fields. The highest jute fibre yield (39.88 q/ha) was recorded under ST-TY+IPNS with -0.3% of targeted yield deviation.
- Adoption of zero-till crop establishment practices had positive impacts on soil organic C-pools, aggregate formation, and stability indices, promoting better soil physico-chemical behaviour. As a result, zero-till crop establishment practices and balanced mineral fertiliser application are extremely beneficial in flax-based cropping systems for maintaining soil quality.
- Preliminary result of sprinkler irrigation in jute exhibited several advantages, like water savings, uniform water application, higher water use efficiency, lower conveyance losses, reduced deep percolation, labour savings, microclimate moderation, reduced soil compactness, and improved fibre yield.
- Irrigation scheduled at 75% DASM (depletion of available soil moisture) with 100% ETC recorded significantly higher plant height (290 cm), basal diameter (13.7 mm), and fibre yield (3.6 t/ha) in tossa jute (cv. JRO 204).
- Life cycle analysis study indicated that the global warming potential (GWP) for the production of 1 kg of jute bag is approximately -0.253 kg CO_2 that indicates a net sequestration of the CO_2 in the soil by the cultivation of jute crops in 120–125 days. In the jute life cycle, approximately 1.26 kg CO_2eq is assimilated at the agricultural stage, with the release of 1.00

kg CO_2eq for the production of 1 kg of raw fibre at the farm stage.

- Exogenous application of AsA ameliorates the adverse effect of drought stress by regulating the redox status of the jute plant under drought. It also maintained the plant height of jute under drought. The Olitorius jute variety JRO 204 (Suren) appeared to be more drought-tolerant.
- The ecological disturbance study of the mangrove ecosystem of Sundarbans (India and Bangladesh) using the MODIS Global Disturbance Index (MGDI) indicates that the area is categorised as a disturbed area due to super cyclones *Amphan* in 2020 and Yaas in 2021.
- The regression equation was deployed on the tower-derived PPFD data to generate continuous net CO_2 assimilation estimates (simulated) at leaf level for the entire crop growth period. The temporal variations in ecosystem-level CO_2 flux are greater than those in leaf-level CO_2. The present study proposed the role of phenology modifiers along with crop growth parameters to represent ecosystem level CO_2 flux using leaf level CO_2 flux data.
- JuteMet®, a web-based agrometeorological database management system (ADBMS) and agro-advisory system, was conceptualised and developed for agriculture, horticulture, and forestry services and related agrometeorological and agro-advisory services. Climate-resilient agro-advisory services and information on jute varieties were disseminated to jute farmers to cope with climate change scenarios.
- Application of ipfencarbazone @ 90 g/ha (PE) + nail weeder at 14 DAS and ipfencarbazone @ 90 g/ha (PE) + single wheel jute weeder at 21 DAS were found promising for weed management in jute (36.8 q/ha). The fibre yield reduction due to competition from surviving weeds was only 4.77 and 5.62%, respectively.
- In Olitorius jute, the effect of plant population as a factor was not significant in fibre yield, though it increased operational manpower requirements. For dense plantings of jute at 10, 20, and 40 lakh/ha, 0.005%, 3.44%, and 35.16% of plants were observed to be affected by stem rot disease.
- Application of compost (BSC/BGSC) and chemical NPK in a 50:50 ratio may be an alternative to using 100% of the recommended dose of NPK fertilizers for jute, flax, and ramie fibre production.
- A model "Action Plan" for the country's flax area expansion has been developed. As per this 5-year action plan, a potential flax area of 2,000 ha may produce about 3000 metric tonnes of raw flax fibre (scotched).
- With an aim to expand the ramie area in India, potential areas for ramie cultivation expansion programmes were identified based on agro-climatic and social conditions. Initially, for the marketing linkages of ramie fibres, possible buyers or industries were also identified in the country.
- About 1.27 lakh high-yielding suckers and bulbils were provided through different government schemes and programmes to the farmers for the promotion of sisal in Jharsugda, Sambalpur, Keonjhar, Jajpur, Dhenkanal, Khorda, and Nayagarh districts of Odisha for the sisal area expansion.
- Sisal-based farming system comprising 'sisal+goatery+dairy+vermicomposting' was most remunerative IFS (integrated farming system) components. Animal components had greater net income among the different enterprises under study than crops. The IFS system has the potential to increase income generation by

increasing employment opportunities by 47% in jute-based IFS and 105% in sisal-based IFS, while lowering the risk of crop failure, increasing soil fertility, and reducing disease and pest infestation.

- A tractor-drawn multi-crop planter for precision sowing of jute and other small-seeded upland crops was developed with seed rate of 3.5–4.5 kg/ha. The uniformity of seed dropping and spacing along the row were found to be 80–85% and 30–50 mm, respectively.
- The functional performance of the improved flax fibre extractor in terms of its material capacity, throughput capacity, and extraction efficiency proved to be very useful in the fibre industry for extracting fibre from flax stems.
- By using response surface methodology (Box Behnken design), it has been possible to optimize the alkali pre-treatment condition for jute biomass by observing how temperature, concentration, and time influence percent delignification.
- In a study comparing the composition of cell wall of a high-biomass jute variety (cv. JROB 2) with another variety (cv. JRO 524), JROB 2 was found to have the higher biomass, cellulose and lignin concentrations at 120DAS.
- The technology for free-flowing water conditions for jute retting has been developed which completes retting within 8–12 days with the addition of the microbial formulation 'CRIJAF SONA'. The uniform and faster retting improves the fibre recovery and quality of jute fibre. The fibre fineness was 2.5–2.64 tex, and the fibre strength was 25–25.4 g/tex.
- Jute-ICARE project was implemented in 170 blocks in West Bengal, Bihar, Assam, Odisha, Meghalaya, and Andhra Pradesh states, covering 1,55,000 ha of area and involving 3.60 lakh farmers. Crop cutting experiments (CCE) were conducted in West Bengal, Assam, and Bihar under the technical guidance and supervision of scientists from ICAR-CRIJAF in Jute-ICARE areas. The CC data of 314 experiments revealed that the jute fibre yield varied between 30 and 36.75 q/ha. On average, the jute farming community got a higher market price for their quality jute fibre by ₹450 to 500 /q as compared to conventional retting.

Crop Protection

- Nano-silica (30 nm) and nano-sulphur (25 nm) were highly toxic to jute semiloopers and yellow mites, respectively. The LC_{50} of nano-silica was as low as 0.0013 ppm, whereas the LC_{50} of profenophos was 990.84 ppm. Application of nano-sulphur @ 0.01 ppm caused 93.43% mortality of the jute yellow mite, and the LC_{50} of nano-sulphur was 0.000033 ppm.
- Three compatible isolates of *Trichoderma spp., e.g.*, CJMR180, CJMR180, and CJMR193, may be used for bio-control consortium development because of their superior growth behaviour under varying incubation temperatures and antagonistic effect against the three pathogens, i.e., *M. phaseolina, Rhizoctonia* sp. and *Sclerotium* sp. and growth-promoting characteristics
- The bioefficacy evaluation of the combined effect of jute varieties, soil sulphur nutrition, acaricides, and entomopathogenic fungus against the jute yellow mite revealed that the incidence of mite infestation was significantly lower in JRO 204 grown in sulphur-applied soil with foliar treatment of fenpyroximate

5EC @1.5 ml/lit compared to JRO 2407 variety with no sulphur and foliar application of acaricides. Although the combined use of *B. bassiana* and *I. fumosorosea* formulation against mites showed moderate promise; it reduced the mite infestation significantly less than the control. Mite-tolerant varieties, soil-applied sulphur, and foliar sprays for mite control manifested a significant effect on plant growth character and chlorophyll content (SPAD).

- Under farmers' field conditions, the integrated effect of a moderately mite-tolerant jute variety (JRO 204), preventive soil sulphur nutrition, and foliar spray of acaricide demonstrated a significant role for soil-applied sulphur @ 45 kg/ha and foliar application of fenpyroximate 5EC @ 1.5 ml/lit (45 and 55 DAS) individually and in combination in the control of yellow mite.
- Preventive treatment of soil with bleaching powder (@30 kg/ha) 7 days before sowing and seed treatment with carbendazim+imidacloprid simultaneously was superior in the management of stem rot, yellow mite, and other pests of jute.
- Under field conditions, *Spob*NPV ($3.54x10^8$ POB's/ml @2ml/L) in combination with the additives molasses (5%), glycerol (10%), and Sticker Plus (0.1%) caused a 50.52%, 63.25%, and 82.91% reduction of larvae at 2, 4, and 7 days after spray by infecting the larvae, and was found to be at par with *Bt kurstaki.*
- Based on the performance of 60 germplasms under artificial inoculation and evaluation for disease resistance under the hot spot condition of Assam, 6 germplasms, namely OIN 119, OIJ 77, OIJ 113, OIN 159, OIN 140, and OIN 118, exhibited significant resistance against the stem rot pathogen, *Macrophomina phaseolina,* under field conditions.
- The GIS map of the generation index (GI) and establishment risk index (ERI) of the indigo caterpillar under different climate change scenarios, viz., RCP 2.6, RCP 4.8, RCP 6.0, and RCP 8.5, were developed, which indicate the occurrence of indigo caterpillars in broader areas during the periods 2021–40 and 2061–80, where at present the pest is not that significant.
- A Decision Support System (DSS) for disease management in jute with the aim of identifying and integrating weather parameters vis-à-vis crop phenology has been attempted, and a database in SQL Software (2008 or 12.0) was developed for the DSS. This web-based decision support system was made in bilingual mode to provide the best pest and disease management practices.

Extension and Outreach

- Intervention with agricultural practices like line sowing, use of improved varieties like JRO BA3 and the single-wheel jute weeder, and CRIJAF Sona improved the yield and fibre quality of jute, which increased income by ₹38925/ha in the post-COVID period. To increase off-farm income, SGHs were also trained on jute value addition, and the SGHs were linked with FPO for easy market access.
- The fibre yield gap due to extension gaps (5.6–6.2 q/ha) and technology gaps (7.2–8.2 q/ha) in various jute growing states like West Bengal, Assam, Bihar, Odisha, and Meghalaya was assessed based on on-field

information using a Google-based form called JAF Kisan.

- With the objective to substitute plastics and improve off-farm income, various skill-development programmes on value-added diversified jute items, particularly jute fibre and fabric-based handicraft items, were organized. Sixty farm women from different self-help groups (SHGs) in the North 24 Parganas were trained with a provision to sell their products.
- A total of 603 FLDs were conducted in the North 24 Parganas, Hooghly, and Nadia districts of West Bengal. New high-yielding varieties (JRO 204, JRO 2407, JBO 1, JROM 1, and CO 58) significantly enhanced the average yield by 7.86–11.76 q/ha over local checks. CO 58 was the highest yielder (41.65 q/ha), while the average yield of the farmers' used variety was found to be 29.89 q/ha.
- Demonstrations on mechanical weed management by the CRIJAF single wheel jute weeder in 125.40 ha of the North 24 Parganas, Hooghly, and Nadia districts of West Bengal resulted in 6.15–9.78 q/ha fibre yield gain over farmers' practice with labour savings of ₹11767–₹15810 per ha.
- Demonstrations on line sowing by a jute seeder in a 145.01 ha area in three districts of West Bengal increased the fibre yield by 4.31–8.37 q/ha and reduce labour costs by ₹8831– ₹13286 per ha.
- Application of CRIJAF SONA (@30 kg/ha) reduced the retting period by 4–6 days at all places and improved the fibre quality fetching additional ₹400-450 per quintal. It also required a lower fiber-to-water ratio (v/v).
- Under FLD on ramie fibre production and extraction technology, the ramie variety Hazarika (R1411) was planted in 2 ha at Chirang district of Assam, and maintenance activities were also carried out in a 10 ha ramie plantation at RRS, Sorbhog, Assam.
- Under NFSM, ICAR-CRIJAF conducted participatory seed production of jute varieties, namely JRO 204, JBO-1, JROM-1, and JRO-2407, in Guntur, Andhra Pradesh, in collaboration with MPKV, Rahuri, and ARS, Amadalavalasa, ANGRAU, Andhra Pradesh. Foundation seed of recently released mesta (roselle) varieties such as AMV-7 (0.8 q), AMV-8 (0.7 q), AMV-8 (0.7 q), AMV-9 (0.5 q), and sunnhemp variety SUIN 03 (1.5 q) was produced.
- A total of 30.32 q of foundation seed jute, mesta, and sunnhemp was produced out of a target of 40 q (75.8% achievement). A total of 95 q of the jute variety CO 58, 2 q of the mesta variety AMV 7, and 3 q of the sunnhemp variety SUIN 037 were targeted during 2021–22, and a total of 76.24 q of certified seed were produced.
- A total of 400 farmers of Assam and Meghalaya were trained on ramie cultivation and fibre extraction technologies. A total of 100 farmers participated in a mega campaign on natural and organic farming in the jute-based cropping system at ICAR-CRIJAF, and new varieties were demonstrated to 50 farmers at the Bamangola block of Malda district, West Bengal.
- The CRIJAF Multi-row Seed Drill (MRSD) was specifically modified to make it lighter and more woman-friendly to reduce drudgery. Demonstration-cum-trainings on the use of a nail weeder and single-wheel jute weeder for farm women were organised in North 24 Parganas and Nadia districts of West Bengal.
- Farm women were trained in the preparation of jute bags and other handicrafts, and they were encouraged to form Self-Help groups in order to develop entrepreneurial activities. Also, the introduction of poultry and duckary in a

jute-based integrated farming system increased the participation of farm women.

- 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.
- MGMG programme was implemented in 43 villages. A total of 10 teams, each with 4-5 scientists, participated in the distribution of agricultural inputs like seed, fertilizer, chemicals, agricultural machinery and sensitize farmers on issues of national importance such as Swachh Bharat Abhiyaan, climate change, water conservation, soil fertility etc.
- To promote the jute-based farming system, 5668 ST farmers from West Bengal and Odisha were provided with adequate resource and technology support for various enterprises such as vegetable cultivation, fishery, vermicompost preparation etc. Farm inputs like paddy seed, jute seed, fertilizers, CRIJAF Sona, fish fingerlings, fish feed, etc., and farm implements (sprayer, jute seeder, jute weeder, etc.) were also distributed among the farmers.
- Under the capacity-building program, various trainings and demonstrations, like backyard poultry production, farm pond-based integrated farming systems, the designing and making of jute-based handicrafts, and post-harvest management in sisal, were conducted with 233 ST beneficiaries in West Bengal.
- To increase the income of SC farmers, critical farm inputs such as vegetable seed kits, nail weeders, cycle weeders, battery operated sprayers, spades (*phowrah*), sickles, khurpi, seeds (jute, sunnhemp, paddy), CRIJAF Sona, CRIJAF multi-row seed drills, vermibed, fertilizer, fish feed, fruit plant seedlings, neem cake, vermicompost, ducklings, chicks, sisal suckers, sisal bulbils, mushroom spawn, fingerlings, etc. were provided for improved farming.
- Under SCSP program, fifteen training programmes were conducted, through which 1150 farmers benefited during the year 2022. Seventeen *in-situ* retting ponds were excavated in the Murshidabad, North Dinajpur, and South Dinajpur districts of West Bengal.
- Under the NEH programme, ICAR-CRIJAF in collaboration with Krishi Vigyan Kendra in West Garo Hills and West Tripura implemented "Wealth from Waste: Bio-Compost and its Utilization in Crop Fields" and the distributed 200 vermibeds to NEH farmers of Meghalaya and Tripura.
- Two KVKs at Burdwan and North 24 Parganas (additional) conducted seven OFTs on important agricultural issues like nutrient management in boro rice and oilseed (sesame), improving the quality of cut flowers, pest and disease management in okra and brinjal, and nutrient management of lactating cross-bred cows.
- A total of 253 FLDs on various aspects of jute, paddy, lentil, chickpea, kharif onion, IPM in brinjal, tissue culture banana, oyster mushroom cultivation, and poultry farming were conducted by the KVKs at Burdwan and North 24 Parganas during the year 2022.

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

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.

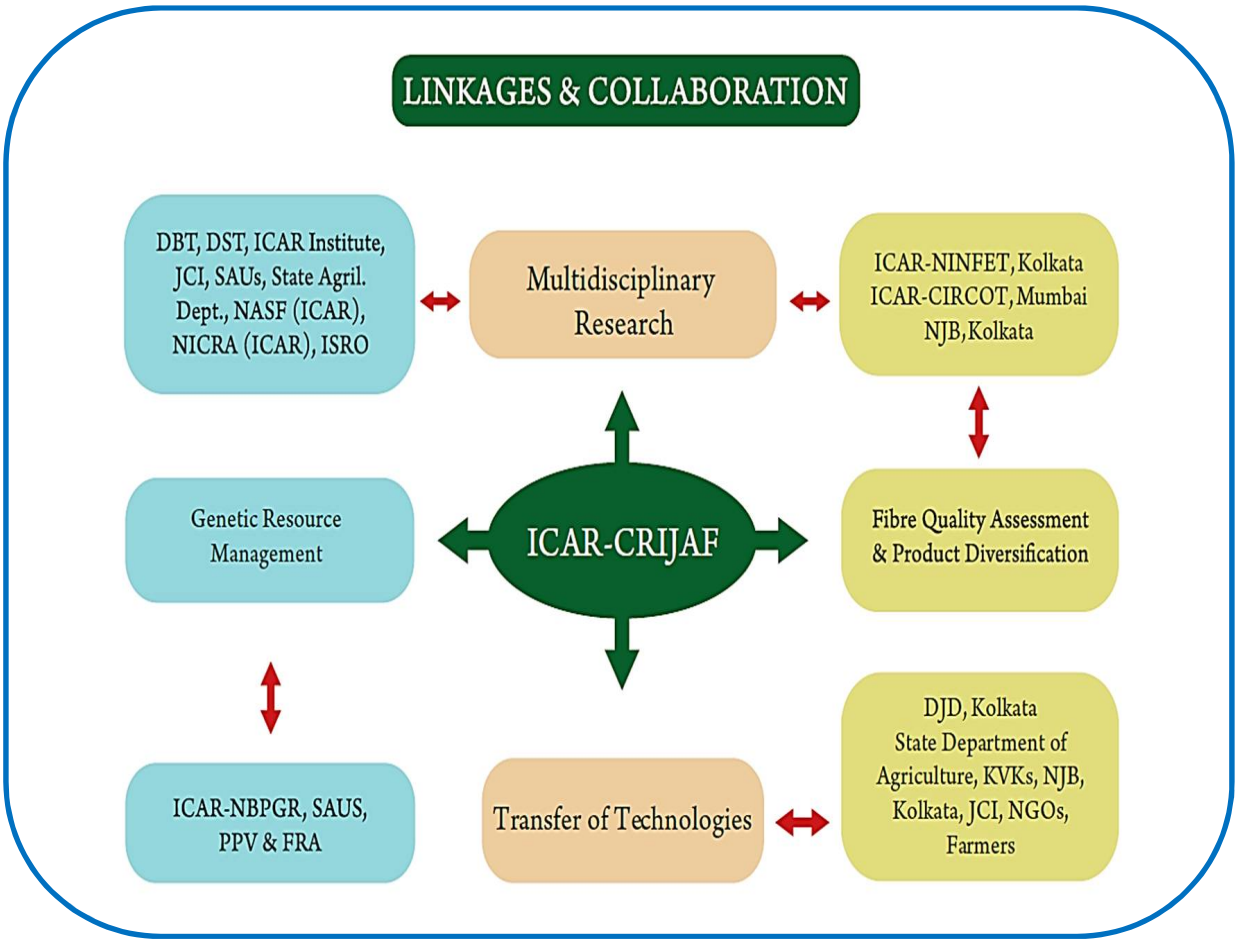
Management Cell

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 2022

(in Lakh)

S. No.	Sub-Head	BE 2022	RE 2022	Actual Expenditure (Apr-Dec 2022)
A)	**GRANT FOR CREATION OF CAPITAL ASSETS (CAPITAL)**			
1	Works - Office Building	10.00	10.00	11.82
2	Equipment	50.00	50.00	22.86
3	Information Technology	25.00	25.00	27.52
4	Furniture & Fixtures	10.00	10.00	2.75
5	Others	5.00	5.00	-
	Sub-Total (A)	100.00	100.00	64.96
B)	**GRANTS IN AIDS - SALARIES (REVENUE)**			
1	Establishment Expenses - Salaries	2407.20	2416.15	1656.89
	Sub-Total (B)	2407.20	2416.15	1656.89
C)	**GRANTS IN AIDS - GENERAL (REVENUE)**			
1	Pension & Other Retirement Benefits	350.00	355.00	129.24
2	Travelling Allowances	15.00	15.00	15.84
3	Research & Operational Expenses	240.00	240.00	204.55
4	Administrative Expenses	381.30	381.30	235.48
5	Miscellaneous Expenses (HRD & Others)	63.70	63.70	54.89
	Sub-Total (C)	1050.00	1055.00	640.00
D)	**TSP**			
1	Capital	0.00	0.00	0.00
2	Revenue	36.00	36.00	21.51
	Sub-Total (D)	36.00	36.00	21.51
E)	**NEH**			
1	Capital	0.00	0.00	0.00
2	Revenue	00.00	00.00	0.00
	Sub-Total (E)	00.00	00.00	0.00
F)	**SCSP**			
1	Capital	25.00	25.00	12.67
2	Revenue	100.00	100.00	52.76
	Sub-Total (F)	125.00	125.00	65.43
GRAND TOTAL (A+B+C+D+E+F)		3718.20	3732.15	2448.79

Financial Statement of AINPJAF and KVKs

Head	Target (B.E.)	Achievement (Apr-Dec 2022)
AINPJAF	547.50	385.65
KVK, Purba Bardhaman	177.90	127.09
KVK, North 24 Parganas (Addl.)	148.00	107.90

REVENUE Generated

ICAR-CRIJAF Head Quarter, Barrackpore	CSRSJAF, Budbud	Ramie Research Station, Sorbhog	Sisal Research Station, Bamra	Sunnhemp Research Station, Pratapgarh	Total	Target
40.57	11.50	0.80	5.86	0.75	59.48	59.65

Staff Position

Position	Sanctioned	Filled	Vacant
Director (R.M.P.)	01	01	00
Head of Divisions	03	00	03
Principal Scientist	02	04	00
Senior Scientists	10	09	01
Scientists	40	30	10
Technical Officers / Technical Assistants	108	45	63
Sr. Administrative Officer	01	00	01
Administrative Officer	02	01	01
Sr. Finance and Accounts Officer	01	00	01
Assistant & Administrative Officer	07	05	02
Private Secretary	01	01	00
Personal Assistants	02	02	00
Assistants	18	14	04
Upper Divisional Clerks (UDC)	04	03	01
Lower Divisional Clerks (LDC)	05	01	04
Skilled Support Staff	46	29	17
Grand Total	**251**	**145**	**108**

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.

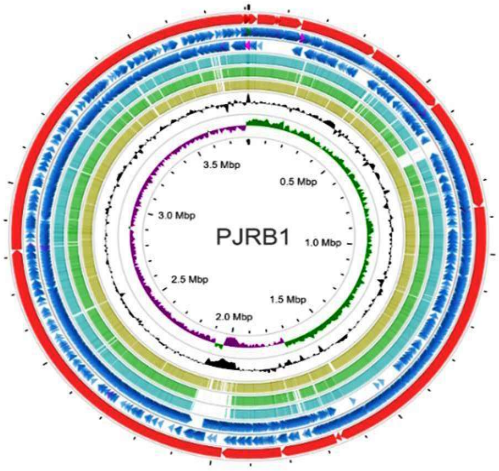
Priorities & Thrust Areas

- 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 2022

- JROP-4, a promising tossa jute genotype that ranked first in AVT-II under national testing, was found to have a fibre production potential of 38.4 q/ha and a biomass production potential of 67.8 t/ha with significantly less lignin in the biomass (18.5%) than JRO-524.
- Tolerance to premature flowering was found to be controlled by the cumulative action of four genes, while complete susceptibility was controlled by a single dominant gene.
- An *in-vitro* shoot and root regeneration system was developed in white jute using adventitious shoot regeneration medium.
- Transcriptome shotgun assemblies from leaf, root, seed, and stem tissues of *Corchorus olitorius* Sudan Green and JRO-632 were constructed.
- A combined genetic map of tossa jute comprising 382 markers on 365.7 cM was integrated with a physical map of 301 contigs of 9,831,073 bp.
- The regeneration protocol for the flax variety JRF-2 was standardized. The dose of Hygromycin (40 mg/L) was standardized for the selection of genome edited/tramsformed calli of flax.

TJ-40
(Mahadev)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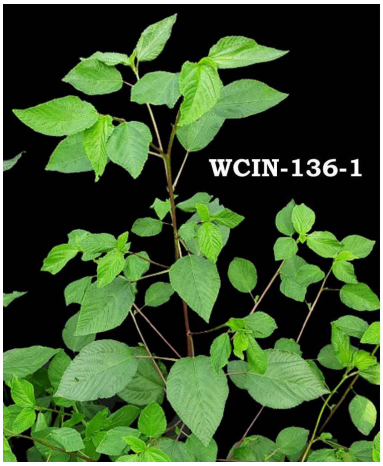
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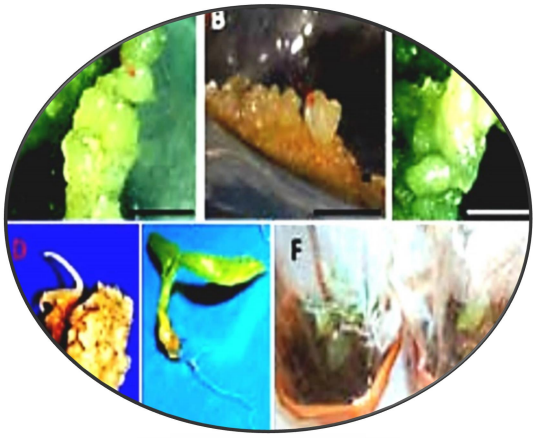

B
D
F

1 Genetic Resources and Crop Improvement

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

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

Project code: In-house Project-JB 1.1

Regeneration and evaluation: A total of 719 jute and allied fibre germplasm lines were regenerated, which include roselle (141), capsularis jute (440), and exploration material (138). 139 olitorius jute germplasm lines were evaluated (DOS:05-03-2022) for premature flowering tolerance, and about 7 lines showed premature flowering tolerance with less than 5% flowering and 2 lines showed no premature flowering. 339 olitorius jute germplasm lines were screened for waterlogging tolerance; two germplasm lines (Fig. 1) were identified as highly tolerant to waterlogging conditions after a two-week stress.

Table 1. Species-wise list of germplasm lines conserved at ICAR-CRIJAF

Fibre crop species	No. of accessions
Cultivated species	
***Corchorus olitorius* L.**	1770
***Corchorus capsularis* L.**	965
***Hibiscus cannabinus* L.**	770
***Hibiscus subdariffa* L.**	988
***Crotalaria juncia* L.**	197
***Linum utitassimum* L.**	260
Crop wild relatives	
Wild corchorus species	557
Wild hibiscus species	124
Wild crotalaria species	114
Grand total	5745

Maintenance: A total of 5745 (Table 1) jute and allied fibres germplasm lines were conserved at medium term storage unit. At RRS, Sorbhog (Assam), around 100 ramie germplasm lines are maintained in field gene bank.

Distribution: A total of 1512 jute and allied fibre germplasm lines were distributed to ICAR-CRIJAF scientists and other indenters: olitorius (1229), capsularis (162), wild jute (15), roselle (54) and mesta (52) (Table 2).

Table 2. Species wise distribution status of JAF germplasm to indenters

Crop/species	ICAR-CRIJAF
C. olitorius	1229
C. capsularis	162
Wild *Corchorus* spp.	15
Roselle	54
Mesta	52
Grand total	1512

Collection: 25 germplasm lines were collected (West Bengal and Andhra Pradesh) during the current year: roselle (23), *Hibiscus surratensis* (Fig. 2) and wild jute (01).

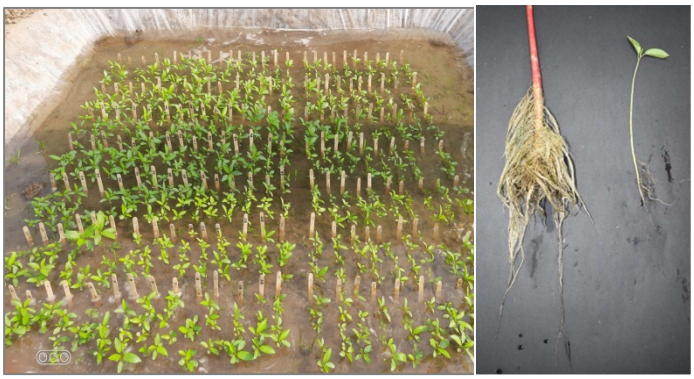


Fig. 1: Evaluation of oiltorius germplasm under water logging stress

Fig 2: Wild hibiscus germplasm collections from West Bengal

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

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

Project code: In-house Project-JB 10.3

Evaluation of segregating generation in flax: Evaluation of 150 single plant progenies of F_4 from seven crosses was done during Rabi 2021–22, and the mean, range, and CV for important fibre related traits are given in Table 3. The F_4 progenies displayed promising traits such as tall height, bold stems, fewer axillary branches, late flowering, and a stay green phenotype with variation in different fibre yield related traits among progenies, and 60 superior individual plants were selected based on these traits. Consequently, a total of 60 selected F_5 single plant progenies from seven crosses are being evaluated in the current 2022–23 Rabi season for further generation advancement with selection (Fig. 3). In addition, four F_4 lines and four F_3 lines each have also been sown for evaluation and selection. A total of 357 germplasm lines, including 90 exotic accessions, are under maintenance breeding.

Table 3. Range, mean and CV of F_4 progeny in flax

Characters	Range	Mean	CV (%)
Pl ht (cm)	93.5 - 168.8	108.60 ± *9.45*	19.50
BD(mm)	1.00 - 6.74	2.84 ± *0.34*	22.01
Green wt/pl (g)	11.05-186.84	52.54 ± *7.34*	35.66
Fibre yield/pl (g)	0.4-6.2	1.65 ± *0.23*	47.89

Screening germplasm lines for Fusarium wilt: A total of 60 selected germplasm lines were evaluated for the second time for screening for Fusarium wilt under epiphytic (sick pot) conditions at Pratapgarh (U.P.), and seven lines were confirmed to be resistant, with one line susceptible.

Fig. 3: Evaluation of F_4 generation in flax during Rabi 2021-22

1.3 Genetic improvement of jute for diversified end use

P. Satya, S. K. Pandey and Suman Roy

Project code: In-house Project-JB 10.4

Screening for premature flowering tolerance in advanced breeding lines: Developing premature flowering tolerance (tolerance to early flowering under long day photoperiod) is an important breeding objective for tossa jute. A total of 148 selected advanced breeding lines from seven different populations were tested for tolerance to premature flowering by sowing on 26-28 February 2022. Of these, a total of 35 lines did not flower at 90 days after

sowing, suggesting these lines have considerable tolerance to premature flowering (Table 4). The highest frequency of tolerance was noted in the cross NFR 48 x RS-6 and lowest frequency was observed in the random intermated F_2 derived F_4 population of *C. olitorius* and *C. capsularis*.

Table 4: Screening for premature flowering tolerance in advanced breeding lines

Cross combination	Number of lines tested	Number of lines exhibiting tolerance to flowering
***C. olitorius* x *C. capsularis* (OC lines) F_6 progeny**	25	6
***C. olitorius* x *C. capsularis* F_2 random intercross (RIM) derived F_4 progeny**	63	7
JROB-2 X RS-6	12	6
NFR 32 X RS-6	7	2
NFR 48 X RS-6	18	12
OIN 1206 X JRO 524	18	1
OIN 1219 X JRO 204	5	1
Total	**148**	**35**

Genetics of premature flowering (long-day early flowering) tolerance in *C. olitorius:* A genotype RS-6 (JRORS-6), derived from progenies of cultivated *C. olitorius* and wild *C. aestuans* was previously identified for having considerable premature flowering tolerance when sown in 1st week of March (< 10% flowering). To understand the nature of the tolerance, it was crossed to another similar premature flowering tolerant line NFR-48 and also to a highly susceptible *C. olitorius* accession OIN 1216 (100 % flowering in 1st week of March). As all the jute plants may not flower even under extreme early sowing condition, both the time of sowing and genetic make-up influence expression of premature flowering tolerance. Percent flowering plants (number of plants that flowered/total number of plants in the population, expressed in percentage) was thus considered as a measure of tolerance to premature flowering under long-day condition. As the trait flowering percentage could not be determined from a single F_2 plant, progenies from both the crosses were advanced to F_4 generation by developing corresponding F_4 family from each F_2 plant. A total of 156 F_4 lines of the cross NFR-48 x RS-6 and 197 lines of OIN-1216 x RS-6 were evaluated by sowing on 28 February 2022 with parental lines. Percent flowering at 50 and 90 days after sowing and the number of branches after 120 days of sowing were determined to study the flowering pattern (Fig. 4). In the cross NFR-48 x RS-6, a total of 51 lines in the F_4 population did not show flowering at 90 days, while the rest 105 lines exhibited a range of 5.9–66.7 % flowering. The population was highly skewed towards low percentage of flowering classes (mean = 13.03 %, skewness = 1.36) The ratio of flowering : non-flowering lines (107 : 49) fitted significantly to 175 : 81 ratio, with a chi-square value of 0.002 (p = 0.97) indicating that cumulative action of four dominant genes (A_B_C_D_) may be responsible for long day flowering tolerance, and also indicated that the source of premature flowering tolerance in RS-6 and NFR-48 are controlled by different genes with duplicate gene action. In each of these parents, two such dominant genes may be present which are sufficient to induce premature flowering tolerance up to > 90% (< 10% flowering) but could not provide 100% tolerance. As both the parents exhibited flowering in the range of 6.4–8.1 % when sown on 28 February 2022, the appearance of 31 non-flowering plants (0 % flowering) could be explained by combined expression of four genes, two from each parent.

In the cross OIN 1216 x RS-6, 195 out of 196 plants flowered when sown on 28 February 2022, of which 45 plants exhibited 100% flowering similar to the parent OIN 1216. The mean flowering percentage of the population was 73.81%, with a skewness of −0.84. When percent flowering was converted to categorical data, the ratio of the traits partial flowering under long-day (<100 % flowering) and

complete susceptibility to flowering under long-day (100% flowering) were distributed in the population in the ratio 147: 49, which fitted close to 3: 1 expected ratio of monogenic segregation (chi-square value 0.43, $p < 0.51$), indicating a single recessive gene is responsible for inducing complete susceptibility to flowering in OIN 1216.

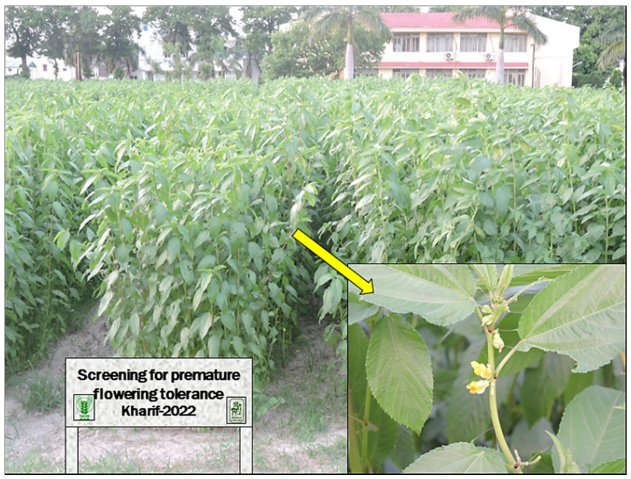


Fig. 4: Screening for premature flowering tolerance in F_4 populations

Fig. 5: Field view of JROP-4

JROP-4, a promising tossa jute genotype for high yield, high biomass and low lignin content in biomass: JROP-4 was developed by crossing *C. olitorius* cv. S-19 with *C. trilocularis* and backcrossing the F_1 to S-19, followed by single plant selection at BC_1F_2 stage (Fig. 5). The entry was submitted to AINPJAF for varietal evaluation trial in 2015 and was selected for adaptive trial as the top entry on the basis of pooled performance in AVT-I and AVT-II, where it outperformed check varieties JRO 524 and JRO 204 by 9.4% and 7.8%, respectively. JROP-4 has a pigmented stem; intensity of pigmentation depends on exposure to sunlight. It has a high fibre yield production potential (38.7 q/ha) under good management condition. At ICAR-CRIJAF, biomass yield and composition of JROP-4 was compared to cultivated variety JRO 524 and high biomass variety JROB-2. The experiment was conducted for two years (2021 and 2022) for biomass yield and lignin content was estimated from the biomass obtained in 2022. The biomass yield of the three genotypes differed significantly over years (Table 5) but the year x genotype interaction was non-significant indicating stable expression of the traits over years. JROB-2 produced the highest biomass (77.3 t/ha) over years followed by JROP-4 (67.8 t/ha) and JRO-524 (55.7 t/ha). JROB-2 produced 38.7% higher biomass than JRO-524, while JROP-4 produced 21.7% higher biomass than JRO-524.

Table 5. ANOVA for fresh biomass yield of three jute genotypes (JROP-4, JROB-2 and JRO-524) for two years (2021 and 2022)

Source	df	Mean Square	F	Sig.
Year	1	3686.54	125.15	0.000
Genotype	2	701.54	23.82	0.000
Replication	2	46.14	1.57	0.256
Year x Genotype	2	105.12	3.57	0.068

Acid soluble lignin content was measured from whole biomass as well as from fibre. Significant differences were observed for lignin content in biomass as well as in fibre (Table 6). Variety JROB-2 contained the lowest lignin in biomass (17.73 %) and in fibre (13.04 %) which was significantly lower than that of JRO-524 (biomass lignin 22.61 %, fibre lignin 15.25%). JROP-4 contained significantly lower lignin in biomass (18.49%) than JRO 524 and was at par with JROB-2 for biomass

lignin content. The fibre lignin content of JROP-4 (15.02 %) was at par with JRO 524 (Table 7).

Table 6. ANOVA for lignin content in biomass and fibre of three jute genotypes

Trait	Source	df	Mean Square	F	Sig.
Lignin content in whole biomass	Genotype	2	4831.02	47.16	0.000
	Replication	6	117.7	1.15	0.393
Lignin content in fibre	Genotype	2	1042.02	22.22	0.000
	Replication	6	31.09	0.663	0.681

A protocol for histochemical localization of phenolics and flavonoids in jute: A protocol for *in-situ* detection of phenolics and flavonoids in jute plant parts was developed. For localization of flavonoids in different tissues, semithin cross sections of leaf and stem segments of plants at various ages were treated with saturated (0.25%) diphenylboric acid 2-aminoethyl ester (DPBA) in dark. It was observed that addition of a non-ionic detergent such as Triton X-100 (0.005%) improves the detection of flavonoids. The timing of treatment was standardized to be 5 min. for soft tissues like leaf and meristem, 10-12 min. for harder stem sections and 15 min for root tissues. The treated sections were visualized under a fluorescent microscope fitted with FITC filter (excitation 450–490 nm, suppression LP 515 nm) and photographed immediately. Phenolics and flavonoids were found to be evenly distributed in hypocotyl as emitting green fluorescence. With the increase in age, developing trichomes in the hypocotyl exhibited accumulation of yellow-green and bright yellow spots suggesting presence of kaempferol and naringenin chalcone (Fig. 6). An intense orange to brilliant gold colour marked presence of quercetin and kaempferol in leaf and mature stem. The flavonoids were found to be unevenly distributed, concentrating mostly in the epidermal layers of leaf and outermost layers of stem in patchy areas.

Table 7. Duncan's multiple range test (DMRT) and Tuckey's honestly significant difference test for lignin content of three jute genotypes

	Genotype	Replication	Lignin content (%) in biomass		Lignin content (%) in fibre	
			A	B	A	B
Tukey 's HSD	JROB-2	7	17.73		13.04	
	JROP-4	7	18.49			15.02
	JRO-524	7		22.61		15.25
	Significance		0.37	-	-	0.80
DMRT	JROB-2	7	17.73		13.04	
	JROP-4	7	18.49			15.02
	JRO-524	7		22.61		15.25
	Significance		0.19	-		0.53

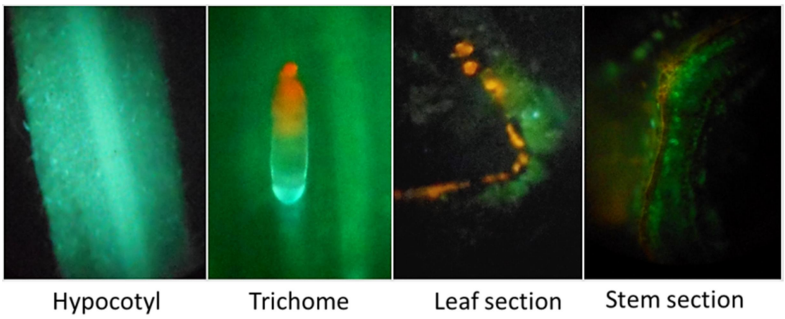


Fig. 6: Histochemical localization of phenolics and flavonoids in different plant parts of jute

1.4 Introgression of low pectin content into high yielding jute varieties

J.K. Meena, A. Anil Kumar and B. Majumdar

Project code: In-house Project-JB 10.6

Screening of olitorius and capsularis germplasm lines for retting duration: 18 genotypes (2 capsularis and 16 olitorius germplasm lines) were evaluated for retting duration and fibre yield. In jute germplasm, retting duration varied from 6 to 14 days, with significant differences among the germplasm lines (Fig. 7). Among the germplasm lines, CMU-13, OIJ-173, OIN-199, and SS-02 exhibited significantly low retting durations of 6–7 days, whereas for JRO 204 and JROBA-03 the duration was 12 and 14 days, respectively. Among the low retting duration jute germplasm lines, OIJ-173 (17.1 g/pl) and OIJ-199 (16.2 g/pl) produced high fibre yield (Fig. 8). These lines can be used to introgress low retting duration and high fibre yield into cultivated background. A crossing programme was attempted, and F_1 hybrids of SS-02 × JRO-204 and JRC-212 × CMU-43 were developed for further backcrossing programme.

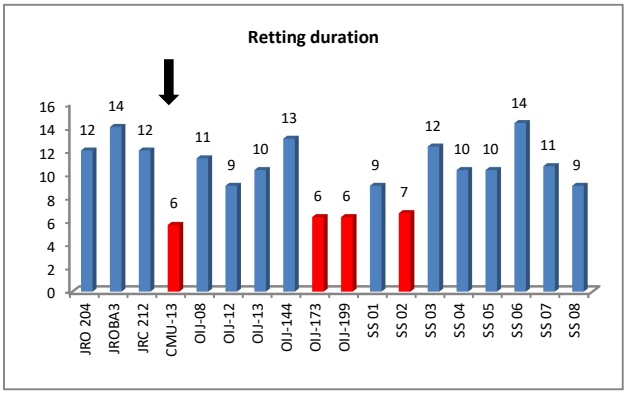


Fig.7: Variation in retting duration in jute germplasm

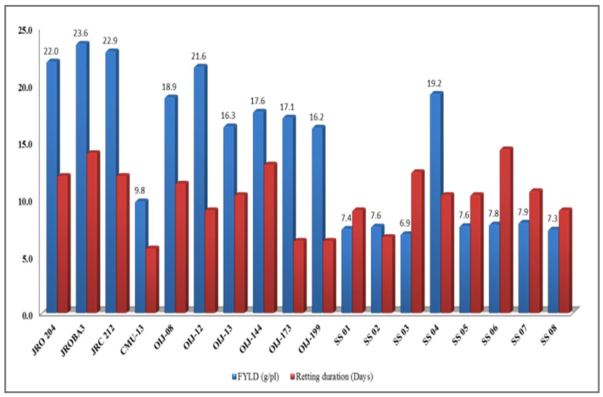


Fig. 8: Variation in fibre yield and retting duration in jute germplasm

1.5 Development of DUS test guidelines for mesta

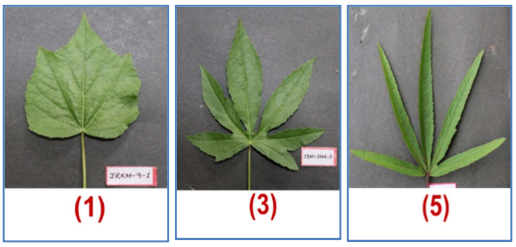
A. Bera and C.S. Kar

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

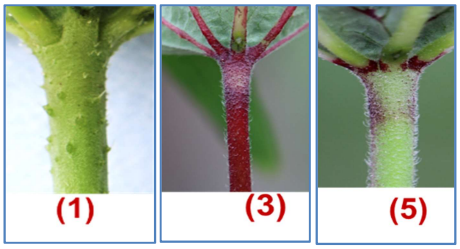
A total of 31 characters (hypocotyl pigmentation, cotyledonary leaf pigmentation, leaf blade lobbing pattern, incision of leaf margin, leaf vein colour, leaf petiole pigmentation, leaf collar colour, leaf blade angle, leaf pubescence, stipule colour, stem colour, stem pubescence, presence of spine on stem, density of spine on stem, plant height, stem branching habit, days to 50% flowering, flower bud colour, flower petal colour, flower eye zone colour, flower eye zone extension, stigma colour, late stem colour, fruit pigmentation, fruit pubescence, capsule dehiscence, seed shape, seed coat colour, thousand seed weight, fiber fineness and fibre strength) were recorded. Among these characters, 21 characters (hypocotyl pigmentation, leaf blade lobing pattern, leaf vein colour, leaf petiole pigmentation, leaf collar colour, leaf pubescence, stipule colour, stem colour, stem pubescence, presence of spine on stem, stem branching habit, plant height, flower petal colour, flower eye zone colour, stigma colour, fruit colour, fruit pubescence, seed coat colour, thousand seed weight, fiber fineness and fibre strength) were found useful for establishing

distinctness of varieties (Fig. 9). Among these characters, 6 characters were dimorphic and 15 characters were polymorphic. Based on these 21 characters, DUS test guideline for mesta fibre crop have been prepared.

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

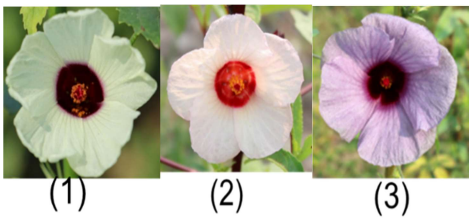


Leaf blade Lobing pattern: Unlobed (1), Partially lobed (3), Deeply lobed (5)

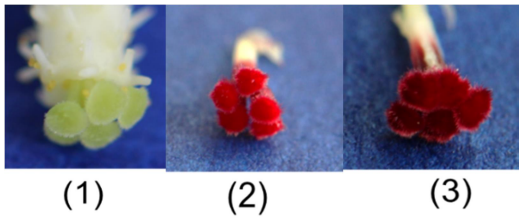


Leaf collar colour: Green (1), Red (3) , Variegated (5)

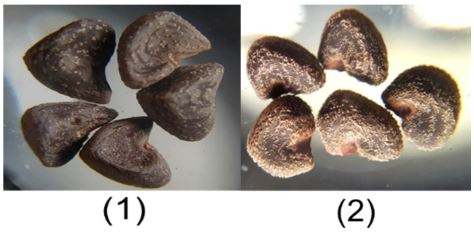
Stem colour: Green (1) Coppery red (3), Dark red (5), Variegated (7), Other (9)



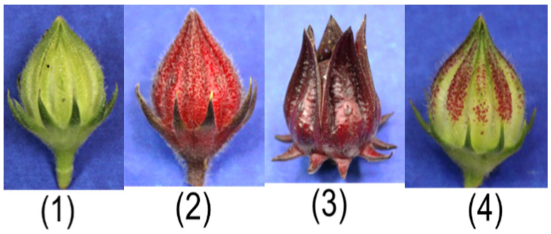
Flower Petal colour: Creamy yellow (1), Pale yellow (2), Violet (3)



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. 9. Descriptors, descriptor states of mesta

1.6 Protection of jute varieties and DUS testing

A. Bera and H.R. Bhandari

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

DUS testing of two candidate varieties received from PPV&FR was conducted during 2021–22 at ICAR-CRIJAF, Barrackpore (nodal centre) and ICAR-CSRSJAF, Bud Bud (co-nodal center). Based on 17 essential characteristics, one candidate variety (*C. capsularis*) was distinct from reference varieties on the basis of fibre strength, and another candidate variety (*C. olitorius*) was distinct from reference varieties on the basis of seed colour. Second year DUS testing of these two candidate varieties was initiated in March

2022. Among the 17 essential characteristics, observations of 13 essential characteristics have been recorded. However, observations on the remaining 4 characteristics will be taken in due course, after which the distinctness of these candidate varieties could be ascertained. To maintain a reference collection of jute, 30 varieties of tossa jute, viz., JRO 204, IRA, JRO 632, JRO 3690, JRO 66, JRO 524, JRO 7835, JRO 878, JRO 8432, S19, 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, NJ 7010, NJ 7050, NJ 7055, Bidhan Rupali, JROM 1 and NJ 7005; and 21 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 centres during July 2022. After recording observations of 17 essential characters, a reference collection database shall be created.

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

Development of F_1 and backcross hybridization in tossa jute (*C. olitorius*): Hybridization was attempted between agronomically superior, high yielding, but biotic stress susceptible varieties JRO 524, JROG 1, JRO 204 and JRO 2407 and biotic stress resistance genotypes WCIN136-1, WCIN-179 and OIJ-161. Only the crosses JRO-524 x OIJ-161, JROG 1 x OIJ-161, JRO 204 x OIJ-161 and JRO 2407 x OIJ-161 produced viable seeds in the Rabi season of 2021.These F_1s were backcrossed with their respective recurrent parents during the Rabi season of 2022 to develop BC_1 progenies.

Field screening of tossa jute germplasm for yellow mite and stem rot resistance: A total of 100 germplasm of tossa jute were evaluated for yellow mite in the field. Among these, only 5 germplasm exhibited low mite density, namely, OEX-032 (11.10/cm^2), OIN-082 (10.83/cm^2), OEX-007 (11.33/cm^2), OIJ-295 (10.33/cm^2) and OIJ-98 (11.00/cm^2). These lines were considered tolerant to yellow mite, while OIN-092 (52.17/cm^2), OIN-66 (64.67/cm^2) and OIN-057 (53.33/cm^2) exhibited high susceptibility for yellow mite. Similarly in the case of stem rot resistance screening, 100 germplasm of tossa jute evaluated for stem rot in the field. Only 2 germplasm, OMU-42 (1.73 cm) and OIJ-143 (1.65 cm) exhibited significant tolerance against stem rot disease with least disease development. While, OMU-19 (3.92 cm), OIJ-249 (3.27 cm), OIN-301 (3.83 cm), OIN-212 (3.48 cm), OIN-120 (3.30 cm), OIN-456 (3.23 cm), OIN-503 (3.48 cm), OIN-570 (3.28 cm), OIN-577 (3.75 cm), OIM-25 (3.40 cm) and OIM-54 (3.42 cm) exhibited high susceptibility for stem rot.

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, A.R. Saha and R.K. De

Project code: In-house Project- JB 10.5

Based on performance of 71 F_1 hybrids of tossa jute from 10 x 10 full diallel mating design (JRO 204, JRO 2407, S 19, JBO 1, JROM 1, JROMU 1, JROBA 3, JRO 524, JRO 8432, JROBA 4) best four hybrids were chosen for crossing in half diallel fashion. JROBA3 x JRO 2407, JROBA3 x JRO 524, JRO 8432 x JROBA4 and JROBA3 x JROBA4 were the most promising hybrids among the 71 F_1 hybrids. Plant height of the hybrids varied from 324 cm to 496 cm whereas basal diameter range was from 13.5 mm to 22.0 mm. Heterosis over check (JRO 204) for fibre yield varied from -11 % ((JROBA3 x JRO 524) x (JROBA3 x JROBA4)) to 58 % ((JROBA3 x JRO 2407) x (JROBA3 x JROBA4)) (Fig. 10). Similarly, based on the performance of 66 F_1 hybrids of white jute (JRC 517, Padma, JRC 532, JRC 698, JRCJ 11, JRCP-6, JRCP-7, JRCA-3, JRCA- 55 and JRCA-2) from 10 x 10 full diallel mating design, best four hybrids were chosen for inter-crossing in half diallel fashion. Padma x JRCP7, JRCJ11x JRCP7, JRCP6 x JRC532 and JRCP7 x JRCJ11 were the most outyielding hybrids among 66 F_1 hybrids. Plant height of the hybrids varied from 235 to 435 cm. Heterosis over check (JRC 517) for fibre yield varied from -19 % ((JRCJ11x JRCP7) x (JRCP7 x JRCJ11)) to 43 % ((Padma x JRCP7) x (JRCP6 x JRC532)). Among the 71 F_1 hybrids of tossa jute and 66 F_1 hybrids of white jute 25 F_1s each were planted in this season. From these, a total of 150 F_2 progenies in tossa jute and 134 F_2 progenies in white jute were selected based on tall height (> 400 cm), non-branching, disease tolerance, non-flowering (Fig. 11) and advanced for next generation.

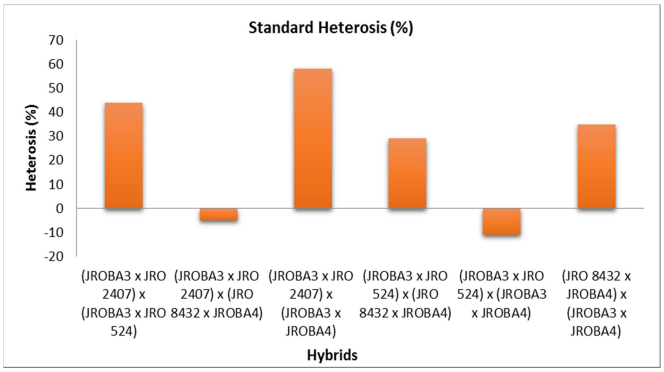


Fig. 10: Better parent heterosis (%) of double cross hybrids of *C. olitorius*

Fig. 11: F_2 generation of *C. olitorius*

2.3 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

Creating a fibre quality profile of the released jute cultivars under ideal and uniform conditions was one of the project's objectives. For which, olitorius (23) and capsularis (22) varieties were screened for fibre strength and fineness. Since the fibre quality is detrimentally influenced by the post-harvest biological retting process used to extract fibre from the jute stem, retting under free flowing water along with CRIJAF-SONA was used to minimize variation from retting condition. Fibre bundle strength (g/tex) and fibre

fineness (tex) was determined on an individual plant basis following standard methods. Fibre fineness of the capsularis varieties varied from 1.12 tex (JRCM 2) to 2.1 tex (KJC 7) and fineness of olitorius varieties varied from 2.71 tex (JBO 1) to 3.42 tex (Tarun) (Fig. 12). Likewise, fibre strength of the capsularis varieties varied from 14.08 g/tex (BCCC 1) to 22 g/tex (JRC 698) and strength of olitorius varieties varied from 18.79 g/tex (JRO G 1) to 25.76 g/tex (Ira) (Fig. 13). These results were achieved on the basis of one year experiment. These materials will be further evaluated in the year 2023 for checking repeatability of the result, since there are many external factors influencing the fibre quality traits.

Correlation study showed that greater values for plant height, stick weight and green weight have accounted for high fibre yield, whereas fibre quality traits including fibre fineness and strength have negative impact on fibre yield (Table 8).

Table 8. Correlation between fibre quality and yield related traits for tossa jute varieties released in India

	Plant Height	Basal Diameter	Biomass	Fibre weight	Stick weight	Strength
Basal Diameter	0.52	1.00				
Biomass	0.42	0.50	1.00			
Fibre weight	0.30	0.64	0.80	1.00		
Stick weight	0.49	0.59	0.96	0.85	1.00	
Strength	-0.40	-0.39	-0.32	-0.20	-0.29	1.00
Coarseness	-0.19	-0.03	-0.26	-0.04	-0.18	0.62

It can also be noted that fibre strength and fibre coarseness are directly related i.e., with increase in fibre fineness there is decrease in fibre strength.

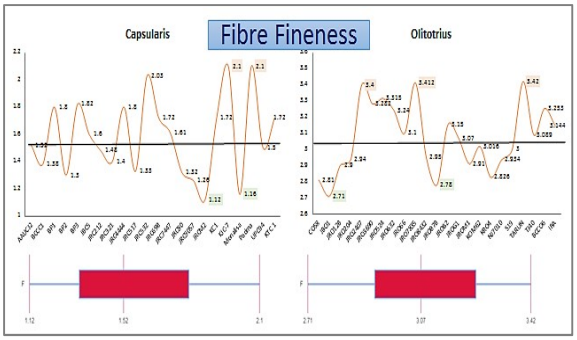


Fig. 12: Fibre fineness profile of capsularis and olitorius varieties

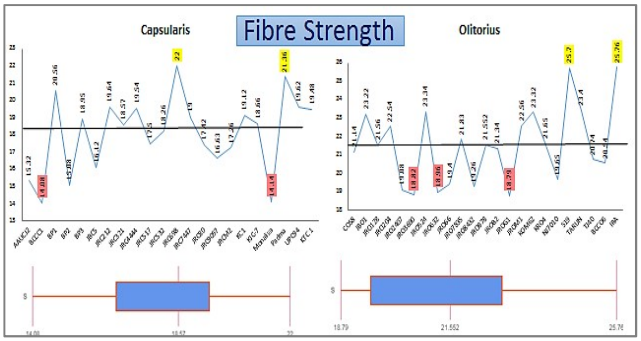


Fig. 13: Fibre strength profile of capsularis and olitorius varieties

2.4 Standardizing the dose of ethyl methane sulphonate (chemical mutagen) for creating viable mutants in tossa jute

N. Mohan and Thribhuvan R.

Project code: In- house project-JB 10.9

A set of tossa jute seeds (50 per plate) were taken for the dose standardisation experiment with four replications. Petriplates containing 50 seeds each of tossa jute seeds were treated with 1% ethyl methane sulfonate for three different durations (1 hour, 4 hours, and 8 hours) along with a control. The results showed that the control had a germination rate of between 97 and 100 percent, while treatments with 1% ethyl methane sulfonate for 1 hour, 4 hours, and 8 hours resulted in germination rates of 80, 44.5, and 41 percent, respectively (Table 9).

Table 9. Treatment of tossa jute seeds with 1% ethyl methane sulfonate

Treatments	Germinated seeds (out of 50)				Mean Germination (%)
	R1	R2	R3	R4	
Control	50	50	50	44	97.0
1% EMS for 1 hour	35	40	43	43	80.5
1% EMS for 4 hour	22	22	16	29	44.5
1% EMS for 8 hour	19	16	19	28	41.0

3 Biotechnological Intervention

3.1 In vitro regeneration and haploidy induction in jute

S. Datta, K. Meena, K.N. Chaurasia

Project code: In-house project-JBT 4.9

In vitro regeneration system in *C. capsularis*: An *in-vitro* shoot and root regeneration system was developed in white jute (*C. capsularis*) which may be used for transformation of jute with suitable genes. For *in vitro* regeneration of shoots, both hypocotyl and cotyledonary node explants showed promising results, however hypocotyl derived explants were more amenable to multiple shoots and root induction. Hypocotyl and adaxial surface of the cotyledonary leaves of 5 days-old seedlings were plated on adventitious shoot regeneration medium (ASRM) supplemented with BAP, NAA and Ascorbic acid (Fig. 14a). After around 10 days, callus starts forming from the both cotyledonary leaves and hypocotyls which are then sub-cultured to fresh ASRM plates. Mother callus with multiple shoot primordia was cultured on elongation medium containing MS supplemented with 1mg/l GA_3 and 2 mg/l BAP (Fig. 14b, c). Elongated shootlets were separated from each calli and cultured on rooting medium containing ½ strength MS with reduced sucrose concentration supplemented with 1mg/l NAA (Fig. 14d).

Standardization of microspore culture: Unopened flower buds of different pre-anthesis stages (Fig. 15a, b) were collected from field-grown jute plants and anthers were seperated and squashed on a glass slide with few drops of acetocarmine. Mature bi-nucleated pollen grains with a vegetative nucleus and a generative nucleus were not suitable for culture and were rejected (Fig. 15c). Microscopic observation reveled that flower buds of approxmitely 1.5 mm size showed large number of uni-nucleated micropspores that are unseperated in the form of tetrad and a few was seperated as uni-nucleated pollen grain with size of approxmitely 10-15 µm (Fig. 15d, e). Based upon this observation buds of about 1-1.5 mm were sterilized and dried and anthers were dusted on liquid MS medium rich in sucrose and supplemented with 2 mg/l 2,4-D and 1 mg/l kinetin. The culture flaks were incubated for 48-72 hours for bursting of anthers and release of pollen forming a turbid culture (Fig. 15f, g).

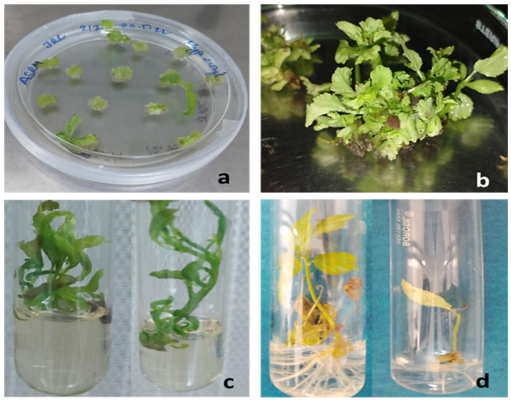


Fig. 14. Adventitious shoot regeneration in jute. a) *C. capsularis* shoot bud initiation from explants in adventitious shoot regeneration medium; b) multiple shoot regeneration; c) elongated shoots from hypocotyl and cotyledonary leave derived explants; d) robust root induction in rooting medium.

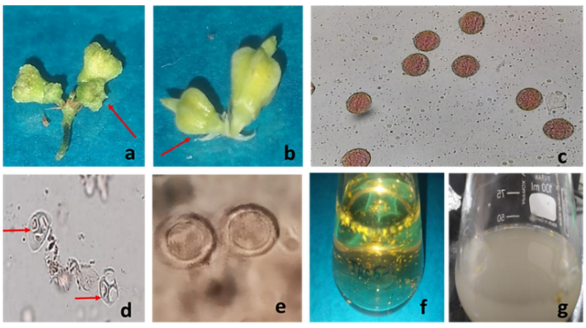


Fig 15: Standardization of microspore culture in *Corchorus spp.* a) Unopened buds of *C. capsularis* for isolation of pollen; b) Unopened buds of *C. olitorius;* c) mature pollens –not suitable for culturing anthers in suspension culture; d-e) tetrad and uninucleate stage pollens selected for culturing; f-g) release of pollens in suspension culture.

3.2 Jute functional genomics

D. Sarkar, P. Satya, N.A. Mandal and N.K. Singh

Project code: Externally Funded Project ICAR-NPTC

A functional SNP-based linkage map of tossa jute using GoldenGate® genotyping assay: Transcriptome shotgun assemblies (TSAs) from leaf, root, seed and stem tissues of *Corchorus olitorius* cv. Sudan Green (GenBank: GFDJ00000000.1; 19,978 unigenes) and *C. olitorius* cv. JRO-632 (GenBank: GFDO00000000.1; 18,576 unigenes) were constructed *de novo* based on Roche 454 GS FLX platform. High-quality reads of these two TSAs were re-assembled and mapped to discover a total of 24,785 gene-associated SNPs, of which 1,068 were validated by Sanger sequencing. Finally, a set of 384 genic SNPs were selected for the development of a GoldenGate® genotyping assay; custom OPA (GS0014193-OPA) design by Illumina (test version: 09464019). An F_2 population of *C. olitorius* cv. Sudan Green × *C. olitorius* mt. *bfs* (176 lines) were genotyped together with the two founder parents (Fig. 16).

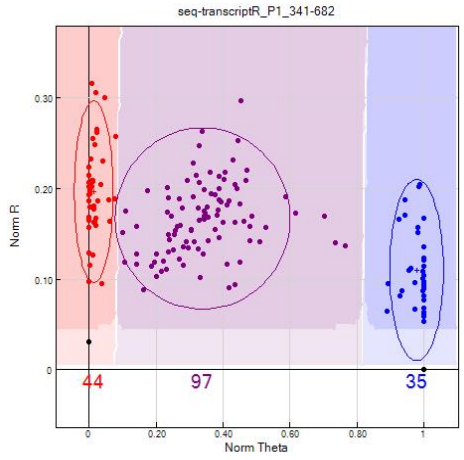


Fig. 16: A representative cluster snapshot of the GoldenGate® genotyping of the *C. olitorius* cv. Sudan Green × *C. olitorius* mt. *bfs* biparental F_2 intercross population

A functional SNP-based linkage map was constructed using R/qtl, with an error probability of 0.01. It comprised a total of 113 genic SNPs—derived from 92 transcripts—over seven linkage groups covering a total genetic distance of 346.3 cM, with an average marker interval of 3.34 cM (Fig. 17). The total length of this linkage map was in close agreement with the RAD-SNP linkage map (358.5 cM) reported earlier.

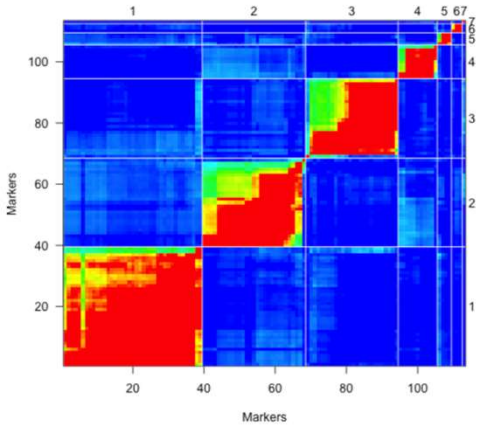


Fig. 17: A functional SNP-based linkage map of tossa jute for the Sudan Green × *bfs* intercross (F_2) comprising 92 transcript-derived 113 SNP markers that cover a total genetic distance of 346.3 cM over seven linkage groups. Plotted as pairwise recombination fractions versus LOD scores

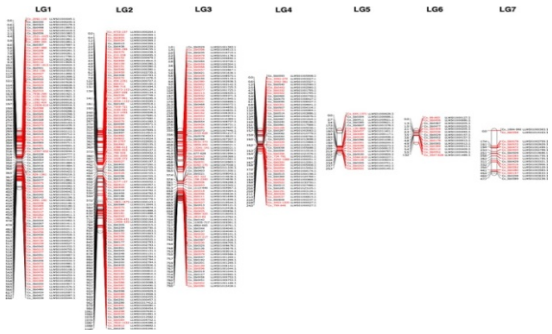


Fig. 18: A genome-integrated SNP-based linkage map of tossa jute for the Sudan Green × *bfs* intercross (F_2) population. The scale is based on Kosambi centiMorgan (cM), with *horizontal lines* representing the position of mapped loci on each linkage group. Markers suffixed with alphanumeric and numeric characters represent RAD and genic-SNP markers, respectively. Gene-associated loci are highlighted in red. *LG* linkage group; *RAD*, restriction site-associated DNA

A genome-integrated genetic map of tossa jute: The functional Sudan Green × *bfs* linkage map (vide 3.1) was combined with its corresponding RAD-SNP linkage map

followed by its integration with the WGS shotgun genome assembly of JRO-524 (GenBank: LLWS00000000.1) using Chromonomer v1.07. The resulting linkage map that comprises 382 markers (317 genomic RAD markers and 65 genic SNPs) was integrated with 301 contigs across seven linkage groups, with 365.7 cM genetic and 9,831,073 bp physical length (Fig. 18). It was characterized by an average length and marker interval of 52.2 cM (1,404,439 bp) and 1.2 cM (25,736 bp), respectively.

3.3 Standardization of plant regeneration for genome editing in fibre flax

D. Saha and S. Datta

Project code: Externally Funded Project- SERB-CRG/2021/001317

Callus and direct multiple shoot induction from flax hypocotyl: Seeds of *Linum usitatissimum* var. JRF-2 was surface sterilized and germinated on half strength Murashige and Skoog's (MS) media. Hypocotyls from 7-day old germinated seeds were excised into small pieces (1-2 cm) and cultured on MS medium supplemented with different concentrations and combinations of plant growth regulators such as 0-2 mg/L 2,4-Dicholorophenoxy acetic acid (2,4-D), 0-0.5 mg/L 6-Benzyl amino purine (6-BAP), and 0-2 mg/L Thidiazuron (TDZ). Explants inoculated on 2,4-D plates were incubated in the dark for whiter callus production, whereas the plates containing TDZ were incubated under the photoperiodic conditions. The hypocotyl explants cultured on 1.0 mg/L of 2,4-D produced satisfactory quality callus with a whitish colour, whereas explants cultured on 2.0 mg/L of TDZ with 0.25 mg/L of 6-BAP induced maximum multiple shoots from the entire hypocotyl surface (Fig. 19). When the callus cultures from the 2, 4-D plates were subcultured on shoot induction and elongation media, they turned green and regenerated with shoots.

Shoot elongation and root inductions: The in vitro generated green and healthy multiple shoots from the hypocotyl tissues and calli were further subcultured individually in test tubes or in magenta boxes in shoot elongation media comprised of MS media with 0-2.0 mg/L 6-BAP, 0-2.0 mg/L Kinetin and 0-2.0 mg/L silver nitrate ($AgNO_3$). The shoots were observed to be elongated and multiplied most efficiently on MS media with 1.0 mg/L Kinetin and 0.5 mg/L $AgNO_3$ after 21 days of sub-culture (Fig. 20A-B). For rooting, the regenerated shoots were excised and sub-cultured on root induction media, consisting of half strength MS supplemented with 0-2 mg/L indole butyric acid (IBA), naphthalene acetic acid (NAA) and indole acetic acid (IAA). The best media with PGR producing 90-100% root from the explants was MS media supplemented with 1.0 mg/L IBA (Fig. 20C).

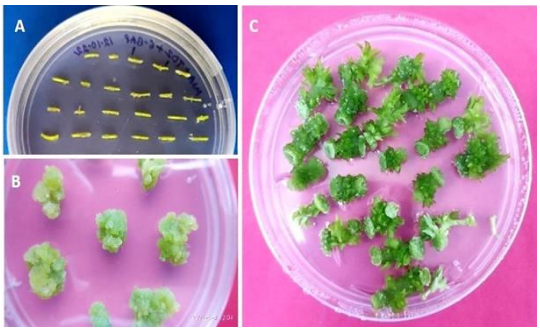


Fig. 19: A) Hypocotyl tissues of JRF-2 cultured on MS medium with different combinations of plant growth regulators for callus and shoot induction; B) Organogenic calli from JRF-2 hypocotyls induced by 1.0 mg/L 2,4-D & 0.25 mg/L 6-BAP; C) Multiple shoot induction on MS with 2.0 mg/L TDZ & 0.25 mg/L 6-BAP.

Hygromycin dose determination for selection of transformed explants: In order to confirm transformed plants for overexpression of genes and gene editing CRISPR/Cas9 plasmids, 7–10-day old JRF-2 shoot apical meristems and hypocotyl-derived callus tissues

were used as explants to select the hygromycin dose. The shoot apical meristems of 5-day-old seedlings were excised (approximately 1 cm from the top) and used as explants. In the case of callus, 14-day-old calli were used. The explants were cultured on the regeneration medium (RM) consisting of MS with 2 mg/L 6-BAP and hygromycin at different concentrations of 0, 2.5, 5, 7.5, 10, 12.5, 15, 20, and 40 mg/L. Hygromycin at 40 mg/L was found to be most efficient at killing all the non-transformed explants (Fig. 21).

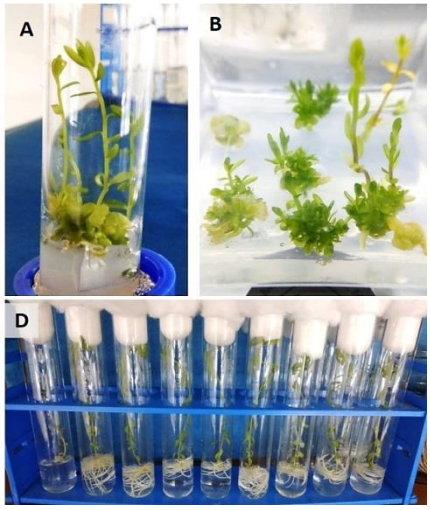


Fig. 20: A-B) Shoot elongation and multiplication on MS medium with 1.0 mg/L kinetin, 0.25 mg/L NAA & 0.5 mg/L $AgNO_3$; C) Root initiation and elongation on half-MS with 2.0 mg/L IBA.

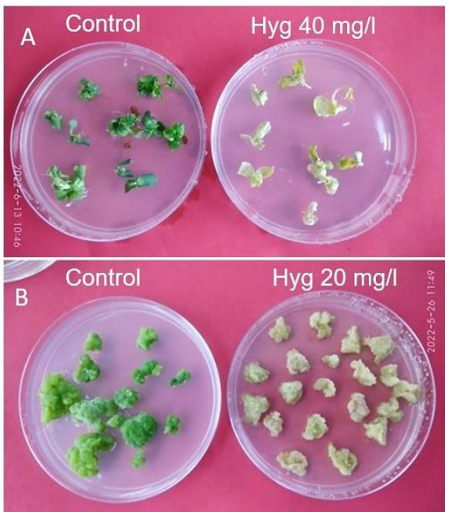


Fig. 21: A) Hygromycin dose selection showing death of shoot apices at 40 mg/L; B) Organogenic calli turned yellowish brown on more than 20 mg/L hygromycin.

4 Seed Production

4.1 Quality seed production under ICAR seed project

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

Project code: Externally Funded Project-ICAR Seed project

Total of 143.8 kg of nucleus seeds of jute and allied fibres were produced (Table 10 to Table 12). Nucleus seeds of 28 varieties of jute (59.5 kg), 13 varieties of mesta (25.5 kg), 4 varieties of sunnhemp (49.8 kg) and 1 variety of flax, JRF 2 (9.0 kg) were produced as the source material for breeder seeds for next season (Kharif 2022).

Table 10. Quantity of nucleus seed production in jute

S. No	Variety	Quantity (Kg)	S. No	Variety	Quantity (kg)	S. No	Variety	Quantity (kg)
1	JRO 524	3.5	**10**	JROG 1	1.5	**19**	JRC 532	3.5
2	JRO 204	6.0	**11**	JROM 1	1.5	**20**	JRC 9057	2.0
3	JRO 8432	3.5	**12**	JRO 66	1.5	**21**	JRC 212	1.5
4	JBO 2003H	2.5	**13**	Padma	1.5	**22**	JRC 698	2.0
5	CO 58	1.0	**14**	JBC 5	2.0	**23**	Monalisa	1.0
6	JRO 128	1.5	**15**	JRCM 2	3.0	**24**	JRC 4444	1.0
7	S 19	3.0	**16**	JRC 517	4.0	**25**	Bidhan Pat-3	1.0
8	JRO 2407	1.0	**17**	JRC 321	2.0	**26**	Bidhan Rupali	0.5
9	JRO 878	2.0	**18**	JRC 80	4.5	**27**	JBO 1	1.5
							Total	**59.5**

Table 11. Nucleus seed production of mesta

S. No	Variety	Quantity (kg)
1	MT 150	2.5
2	HC 583	3.0
3	Central kenaf JBMP 2	1.5
4	AMC 108	2.5
5	JRKM-9-1	3.5
6	HS 7910	2.0
7	HS 4288	0.5
8	CRIJAF R 2	3.5
9	CRIJAF R 8	2.0
10	AMV 1	0.5
11	AMV 2	1.0
12	JBM 81	2.0
13	JRR 17	1.0
	Total	25.5

Table 12. Nucleus seed production of sunnhemp and flax

S. No.	Variety	Quantity (kg)
Sunnhemp		
1	SUIN 053	15.0
2	SUIN 03	11.8
3	SUIN 037	11.5
4	JRJ 610	11.5
Flax		
1	JRF 2	9.0

Breeder seed of 11 varieties of jute, 3 varieties of mesta and 2 varieties of sunnhemp were produced as per indent. A total of 5.05 q of breeder seeds of jute, 0.22 q of mesta and 2.20 q of sunnhemp were produced against the DAC indent of 4.12 q, 0.09 q and 2.00 q of jute, mesta and sunnhemp, respectively. The seeds were distributed to various external agencies as per the allocation of Department of Agriculture & Cooperation, Ministry of Agriculture and Farmers' Welfare. The details of the indent and production are given in the Table 13.

Table 13. Jute breeder seed indent and production

S. No	Variety	Indent (q)	Production (q)
Jute			
1	JRO 2407	0.60	0.70
2	CO 58	0.05	0.20
3	JROG 1	0.50	0.60
4	JROM 1	0.05	0.10
5	JRC 9057	0.20	0.30
6	JBO 2003H	0.10	0.60
7	JRO 204	0.70	1.00
8	S 19	0.05	0.10
9	JRO 524	1.17	0.70
10	JROB 2	0.35	0.50
11	JROMU 1	0.35	0.25
	Total	4.12	5.05
Mesta			
1	HS 4288	0.05	0.10
2	JRM 5	0.02	0.05
3	HS 7910	0.02	0.07
	Total	0.09	0.22
Sunnhemp			
1	JRJ 610	1.00	1.10
2	SUIN 053	1.00	1.10
	Total	2.00	2.20

In addition, quality seeds of different crops and different classes were produced as detailed in Table 14:

Table 14. Seed production of different crops at ICAR-CRIJAF, Barrackpore

Crop/Variety	Class of seed	Quantity produced (q)
Jute /JRO 204	FS	0.10
Jute/JROB 2	TL	0.10
Sunnhemp/JRJ 610	TL	0.50
Sunnhemp/SUIN 037	TL	0.14
Flax/JRF 2	BS	0.50
Flax/JRF 2	TL	4.40
Sunnhemp/SUIN 037	BS	0.30
Wheat/DBW187	TL	19.00
Paddy/ MTU 7029	CS	328.50
Paddy/ IET 4786	CS	342.00
Paddy/ CR 1009 Sub-1	FS	1.20
Paddy/ MTU 7029	FS	5.10
Dhaincha/ Local	TL	730.00
Mustard/NRCYS 05-02	TL	0.06
Mustard/ B 9	TL	1.70

BS: Breeder seed, FS: Foundation seed, CS: Certified seed

Bast Fibres of Jute, Ramie, Flax, Mesta (Kenaf, Roselle), Sisal and Ramie

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 2022

- SOC dynamics simulation study indicated an annual C input requirement of ~2400 kg/ha to increase organic C stocks by 0.4% per year under integrated soil-crop management system.
- The highest economic value of ecosystem services was found in the NT+R (71,224/ha), followed by the NT (68,533/ha), and the lowest in the CT (59,086/ha).
- Adoption of zero-till crop establishment practices in flax-based cropping systems had positive impacts on soil organic C-pools and better soil physico-chemical behaviour for maintaining soil quality.
- Irrigation scheduled at 75% DASM with 100% ET_C recorded significantly higher fibre yield (3.6 t/ha) in Olitorius jute.
- In the jute life cycle, approx. 1.26 kg CO_2eq is assimilated at the agricultural stage, with the release of 1.00 kg CO_2eq for the production of 1 kg of raw fibre at the farm stage.
- Exogenous application of AsA plays an important role in ameliorating the adverse effect of drought stress by regulating the redox status of the jute plant under drought.
- Application of ipfencarbazone @ 90 g/ha (PE)+nail weeder at 14 DAS or single wheel jute weeder at 21 DAS produced a higher fibre yield (~37 q/ha).
- Leaf litter compost and chemical NPK in 50:50 ratio may be an alternative to 100% NPK fertilizers for fibre production.
- The large suckers and higher fertilizer dose yielded the highest fibre yield in sisal (1146.7 kg/ha).
- A tractor-drawn multi-crop planter for precision sowing of jute and other small-seeded upland crops was developed.
- Under free-flowing water conditions, retting of jute completes within 8–12 days with the addition of "CRIJAF SONA."
- The Jute-ICARE project was carried out in 170 blocks in West Bengal, Bihar, Assam, Odisha, Meghalaya, and Andhra Pradesh states, covering 1.55 lakh hectares and involving 3.60 lakh farmers.

1 Soil and Water Productivity

1.1 Improvement of soil carbon stocks and farm productivity through integrated cropland management practices in jute cultivation areas: A farmer's participatory research

A.K. Singh, M.L. Roy and G. Kar

Project code: In-house Project-JA 7.6

In this study, integrated soil-crop management (ILM_{soil}), improved management (IM_{soil}) and conventional management (CM_{soil}) were studied to quantify the dynamics of organic carbon stock in soils and to justify technologies that allow an annual increase in the arable soil layer of 0.4% per annum. The RothC (ver. 26.3) was used for reproducing and forecasting SOC dynamics under integrated soil-crop management of a jute-rice-mustard cropping system with RCP4.5 and RCP8.5 climate change scenarios. We then estimated the required increase in SOC input to preserve or increase SOC stocks. The results of the SOC dynamics simulation indicated an annual C input requirement of ~2400 kg/ha to increase organic C stocks by 0.4% per year. Cropland SOC stocks with the best soil and crop combination were 9.32% in the first half of the century (2050–2060) in the RCP4.5 and RCP8.5 scenarios, followed by a loss in accumulated SOC (Fig. 22). The results of the study can be used to guide carbon input management under integrated soil-crop practices for soil carbon sequestration in India's IGP region and neighbouring countries, thus mitigating climate change.

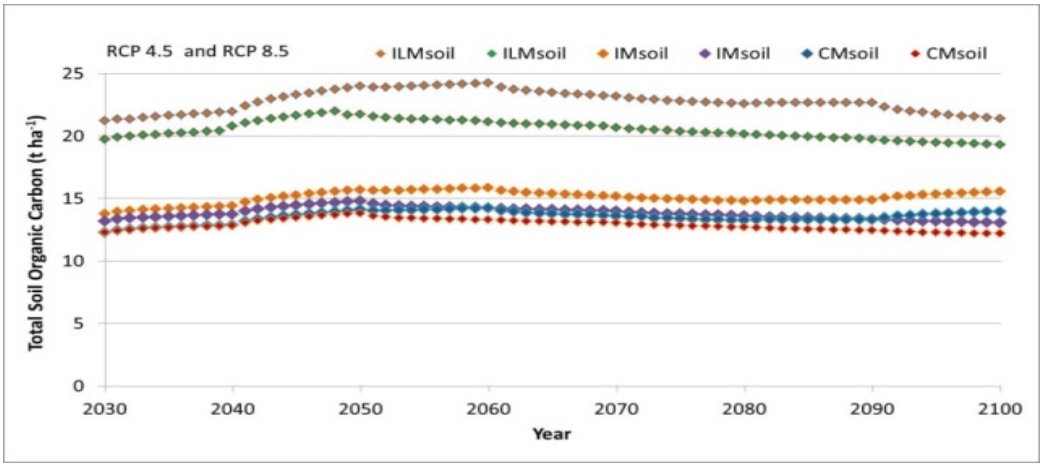


Fig. 22: The dynamics of total SOC stocks for IM_{soil}, ILM_{soil} and CM_{soil} calculated using RothC model for the year 2020-2100 under RCP4.5 and RCP8.5 climate scenario

1.2 Qualitative screening of rhizobacteria isolated from the jute rhizosphere for phosphate and potassium solubilization activity

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

Project code: In-house Project-JA 8.7

A total of 74 soil samples were collected for rhizobacteria isolation from the jute growing fields of the Nadia and North 24 Paraganas districts, and morphologically distinct bacterial isolates were further purified by successive subculturing. The viable cell count was calculated as colony forming units (CFU) per gram of soil. Dot culturing of single bacterial colonies on Pikovskaya's medium with tricalcium phosphate (TCP) as the sole P-

source and Aleksandrov medium with potassium alumino silicate as the sole K-source was used to study the qualitative estimation of phosphate and potassium solubilization by the bacterial isolates. The plates were incubated at 30 °C for 7-10 days. After incubation, the Phosphate Solubilizing Bacteria (PSB) and Potassium Solubilizing Bacteria (KSB) showing a clear zone were selected, and the capacity of the bacterial isolates to solubilize insoluble phosphorus and potassium was studied by the determination of solubilization efficiency.

Table 15. Isolation of plant growth promoting rhizobacteria and soil properties in the study area

Location of jute rhizosphere soil	No. of isolates	Culturable Bacterial population (CFU/g soil)	Soil properties		
			pH	EC (dS/m)	Org C (g/kg)
Panchkahania	16	16.5×10^5	7.50	0.210	6.8
Bhawanipur	15	28.3×10^5	6.88	0.740	6.3
Kumra	21	11.3×10^5	7.21	0.291	6.6
Makaltala	10	15.7×10^6	6.89	0.239	7.2
Bharati Nagar	12	24.2×10^6	6.80	0.154	7.7

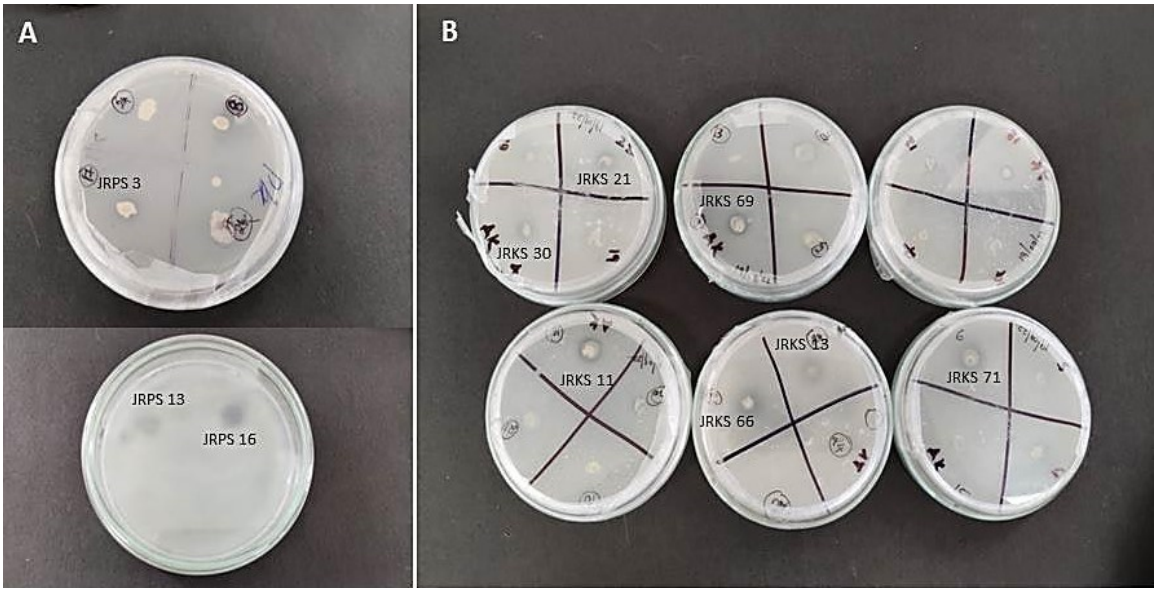


Fig. 23: (A-B): (A) Growth of PSB on the Pikovskaya's medium containing insoluble phosphate, and (B) Growth of KSB on the Aleksandrov medium containing insoluble potassium characterized by the clear zone around the colony

The results indicated that the culturable bacterial population in these soils ranged from 11.3×10^5 to 24.2×10^6 CFU/g soil, of which the population was highest in Bharati Nagar (24.2×10^6 CFU/g) of North 24 Parganas; this may be due to the optimum pH and organic carbon content of the soil (Table 15). The further findings showed that out of 74 isolates, 5 isolates (JRPS3, JRPS13, JRPS16, JRPS37 and JRPS60) were able to form a clear transparent halo zone around the colony on Pikovskaya's medium (Fig. 23A) and 11 isolates (JRKS2, JRKS3, JRKS11, JRKS21, JRKS29, JRKS30, JRKS46, JRKS52, JRKS66, JRKS69 and JRKS71) were able to form a clear transparent halo zone around the colony on Aleksandrov medium (Fig. 23B). Phosphate and potassium solubilization efficiency on both media clearly showed that two strains of PSB (JRPS16 and JRPS13) exhibited the highest qualitative solubilization activities of 45% and 40%, respectively, and three strains of KSB (JPKS66, JPKS71, and JPKS11) exhibited the highest qualitative solubilization activities of 66%, 55%, and 50%, respectively. Based on these results, the isolated rhizobacteria in this study were further studied for other plant growth-promoting activities.

1.3 Quantification of ecosystem services of jute based cropping systems under tillage and residue management practices

R. Saha, S.P. Mazumdar, G. Kar, R.K. Naik, M.S. Behera, D. Barman, B. Majumdar, A.R. Saha and L. Sharma

Project code: In-house Project-JA 5.7

Quantification of ecosystem services in jute-based cropping systems under conventional (CT) and no-tillage with and without additional (NT and NT+R) residue management treatments revealed that green income was calculated for these treatments based on the data for quantification of ecosystem services under field experimentation with the same set of treatments for 6 consecutive years. The NT+R had the highest economic value of ecosystem services (₹ 71,224/ha), followed by NT (₹ 68,533/ha), and CT had the lowest (59,086/ha). Green income from conventionally tilled jute based cropping systems was ₹ 28,545/ha, which increased to ₹ 41,528/ha in NT and to ₹ 45,407/ha in NT+R (Fig. 24). Higher green income in the NT and NT+R treatments was due to the higher value of ecosystem services along with lower pollution costs and lower input costs. The study highlighted the significance of conservation agricultural practices with better ecosystem services for the long-term sustainability of agricultural systems.

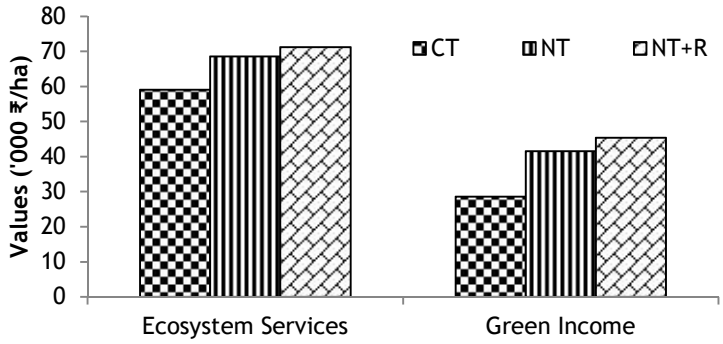


Fig. 24. Ecosystem services and green income of jute based cropping systems under tillage and residue management practices

1.4 Balanced application of fertilizer for attaining maximum jute fibre and wheat yield in long-term fertilizer experiment

A.R. Saha, B. Majumdar, S.P. Mazumdar and M.S. Behera

Project code: External Funded Project-LTFE

Long term fertilizer experiment was conducted in permanently laid out experimental plots for Wheat (cv. HD 2967) and Jute (cv. JRO 204). It was observed that all the treatments recorded a higher wheat grain yield than the control. The super-optimal dose (150% NPK) recorded the highest wheat grain yield (37.7 q/ha) (Fig. 25). Wheat grain yield recorded at 150% NPK was 19% higher than that the yield obtained at 100% NPK. The yield from an integrated nutrient management treatment (100% NPK+ FYM) was comparable to the yield from 150% NPK. A balanced treatment recorded a higher wheat grain yield than imbalanced treatments (100% NP and 100% N). Similarly, jute fibre yield increased with increasing doses of

fertilizers. Balanced fertiliser application (100% NPK+FYM) resulted in the highest jute fibre yield (38 q/ha). Imbalanced doses of fertilizers recorded lower jute fibre yields. Application of S-free fertilizer (100% NPK-S) reduced jute fibre yield as compared to 100% NPK. The highest soil organic carbon content (8.8 g/kg) was recorded in 100% NPK+FYM. The highest soil N available was recorded at 150% NPK, followed by 100% NPK+FYM. Soil-available P was depleted in the 100% N and control plots.

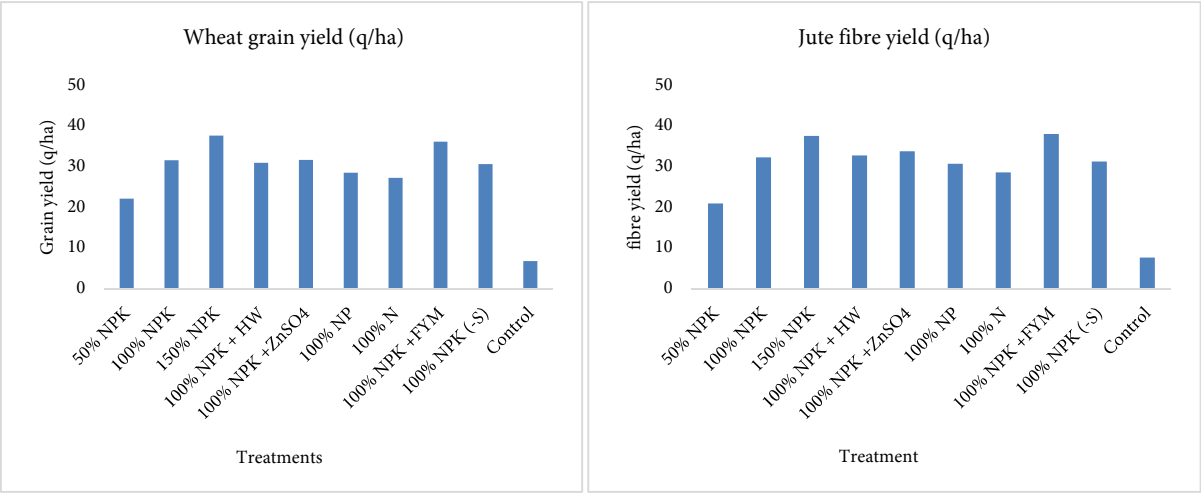


Fig. 25: Wheat grain yield influenced by different fertilizer treatments

1.5 Soil test based integrated plant nutrient supply system for sustainable jute fibre production

A.R. Saha, B. Majumdar, S.P. Mazumdar, M.S. Behera and S. Ghosh

Project code: External Funded Project-STCR

Soil Test based target yield equation developed for jute (cv. Co-58) was verified in the farmers' fields at Ghetugachi, Chakdah, Nadia. The total area covered during the verification trial was 1.54 ha. In the presence or absence of FYM, ST-TY based fertilizer application recorded higher jute fibre yield as compared to farmers' practice and the recommended dose of fertilizer (RDF). The application of ST-TY-based fertiliser and manure (yield target: 35 q/ha) recorded the desired yield with a (+) 2.1% yield deviation. The highest jute fibre yield (39.88 q/ha) was recorded under ST-TY+IPNS (target 40 q/ha). The targeted yield was achieved with a -0.3% yield deviation (Table 16).

Table 16. Soil test target yield based fertilizer application on jute fibre yield

Treatment	Fibre yield (q/ha)	Yield Deviation (%)
T1-FP	33.48	5.21
T2-RDF	34.95	4.85
T3-ST-TY target 35 q/ha	35.72	(+) 2.05
T4-ST-TY target 35 q/ha+ IPNS-1	37.60	(+) 7.43
T5- ST-TY target 40 q/ha	37.66	(-) 5.85
T6- ST-TY target 40 q/ha + IPNS-2	39.88	(-) 0.3

1.6 Studies on nitrogen dynamics under rice-flax cropping system

S.P. Mazumdar, D. Barman, R. Saha, S. Mitra and M.S. Behera

Project code: In-house Project-JA 7.8

A field experiment was conducted for four years (2018 to 2022) to study the impact of flax-based cropping systems {Fallow-Flax, Rice-Flax (conventional tillage), Rice-Flax (zero tillage), and nitrogen application {W1 (N0), W2 (N40), W3 (N80) and W4 (N120)} on total soil organic carbon, soil carbon pools, and soil aggregation. After 4 years of crop rotation, in the top 0–20 cm of soil depth, rice–flax (zero tillage) had higher total organic carbon (TOC) than Rice-Flax (Conventional Tillage) (Fig. 26). Rice-flax (ZT) increased labile, less labile, and non-labile carbon pools. The treatment with W4 fertilization had the highest very labile carbon content, while W1 had the lowest. Very labile carbon was the dominant carbon fraction, followed by non-labile carbon and labile carbon. Soil aggregation was significantly influenced by fertilizer level and cropping system, and among the cropping systems, rice-flax (ZT) recorded the highest water-stable macro-aggregates. Adoption of zero-till crop establishment practices had positive impacts on soil organic C-pools, aggregate formation, and stability indices, promoting better soil physico-chemical behaviour (Fig. 27 and Fig. 28). As a result, zero-till crop establishment practices and balanced mineral fertilizer application are extremely beneficial in maintaining soil quality in flax-based cropping systems.

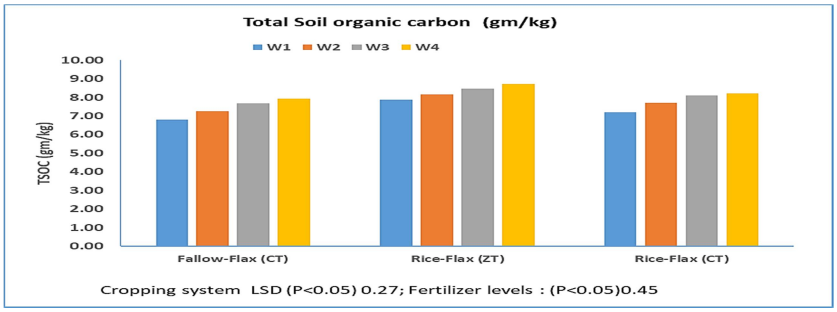


Fig. 26: Effect of cropping systems and fertilizer application and on total organic carbon

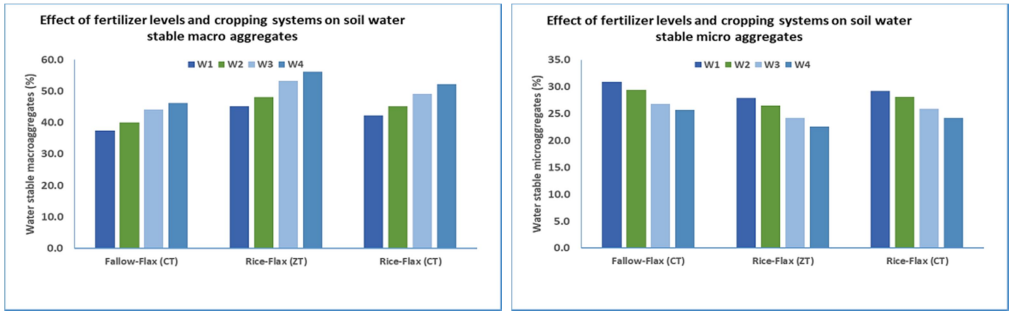


Fig. 27: Effect of cropping systems and fertilizer application and on soil aggregation

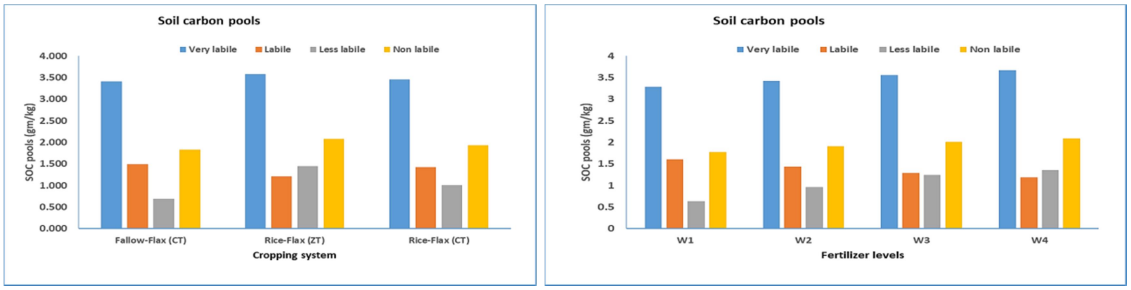


Fig. 28: Effect of cropping systems fertilizer application and on soil carbon pools

1.7 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 8.7

Under the impending climate change scenario and the scarcity of freshwater resources for irrigation, developing water-efficient irrigation systems is the need of the hour. The traditionally used surface irrigation methods face significant water losses through runoff, percolation, and channel seepage, which leads to non-uniform water application across fields. A preliminary trial on sprinkler irrigation scheduling in jute was conducted from April to August, 2022 to assess the feasibility of sprinkler irrigation and its comparative effects on crop growth and yield in jute. A questionnaire survey on farmers' irrigation practice in jute revealed that most farmers provide either 2 irrigations (post sowing and at 40 DAS) or 3 irrigations (post sowing, at 20–25, and 40–45 DAS) in jute, depending on rainfall occurrence, with a total irrigation amount of 150–250 mm. Treatments of the preliminary trial in jute comprised sprinkler irrigation (15 mm per application) at 30–50% available soil moisture (ASM) deficit (T1), which was compared against surface irrigation at 75% ASM deficit (T_2), farmers' practice (T_3) and control with 1 post-sowing irrigation (T_4). Total irrigations applied in jute were lowest under control (50 mm), followed by sprinkler (75 mm), farmers' practise (120 mm), and surface irrigation (130 mm) based on rainfall occurrence. Field capacity (FC) and permanent wilting point (PWP) were estimated based on soil texture analysis and found to be 23% and 11% on a weight basis (w/w), respectively. Sprinkler irrigation (T_1) showed significantly higher plant height (Fig. 29a) and basal diameter (Fig. 29b) throughout the jute growing period compared with other treatments. There was also better root growth under sprinkler irrigation as compared with other treatments. Sprinkler irrigation produced the highest fibre yield, which was 12%, 19%, and 51% higher than flood irrigation at 75% ASM depletion (T2), farmers' practise (T3), and control (T4), respectively (Fig. 30). Therefore, sprinkler irrigation can be feasible in jute with several advantages like water savings, uniform water application, higher water use efficiency, lower conveyance losses, reduced deep percolation, labour savings, microclimate moderation, reduced soil compactness, and improved fibre yield. At subsequent stages (beyond 50 DAS), the height of sprinkler risers needs to be increased to facilitate irrigation.

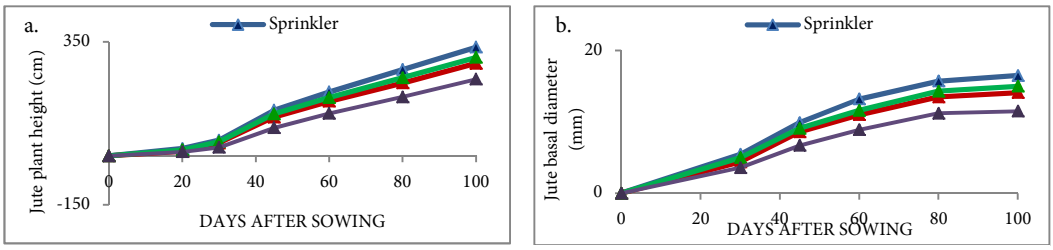


Fig. 29: Plant height (a) and basal diameter (b) of jute under different irrigation methods

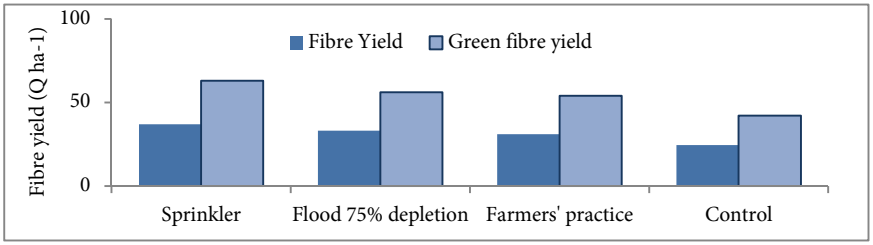


Fig. 30: Fibre of jute under different irrigation methods

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

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

Project code: In-house Project-JA 8.5

Jute, traditionally being a rainfed crop, is vulnerable to monsoon breaks throughout the crop's growth due to water stress. Maps were prepared on the block wise distribution of irrigation and net groundwater availability in the jute growing belts of West Bengal (Fig. 31). Net groundwater availability in most of the jute growing blocks was less than 12500 ha m. The experiment was conducted at the Research Farm of ICAR-CRIJAF, Barrackpore, to standardize irrigation scheduling in jute based on available soil moisture depletion (DASM) and crop evapotranspiration (ETc). Superior plant height, basal diameter, and fibre yield were recorded with moisture maintained at field capacity. The experimental results revealed that among the treatments, irrigation scheduled at 75% DASM with 100% ET_C recorded significantly higher plant height (290 cm), basal diameter (13.7 mm) and fibre yield (3.6 t/ha) over control. This was closely followed by 75% DASM with 75% ET_C which had comparable fibre yields (Fig. 32). At 30 DAS, the canopy cover was greatest under 75% DASM with 100% ET_C and lowest in the control treatment. A significantly higher value of leaf area index (LAI) was recorded in 75% DASM with 100%ET_C which was 35% higher than control at 45 DAS. The fibre yield reduction under control was almost 15–27% lower than the irrigation scheduling treatments.

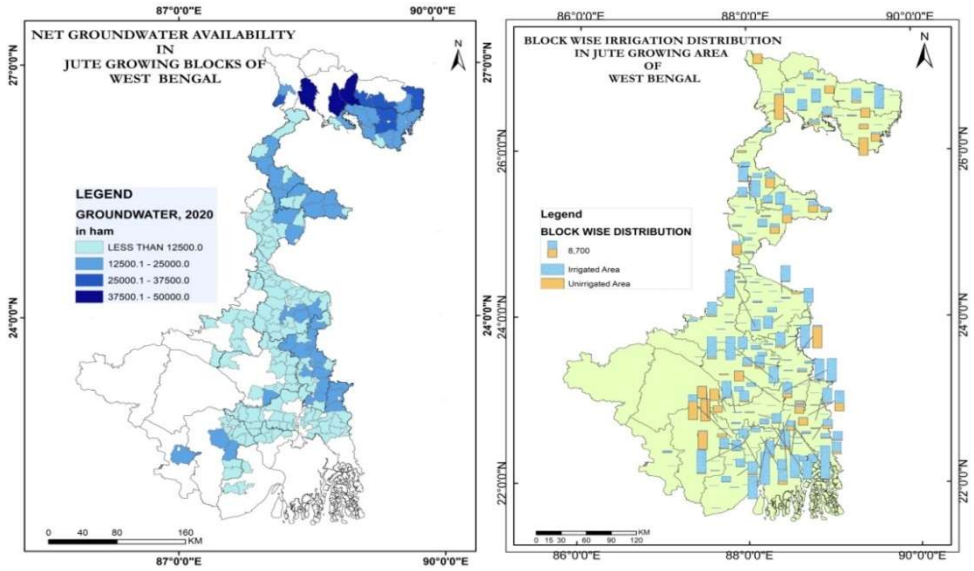


Fig. 31: Maps showing net groundwater availability and irrigation distribution in jute growing areas of West Bengal

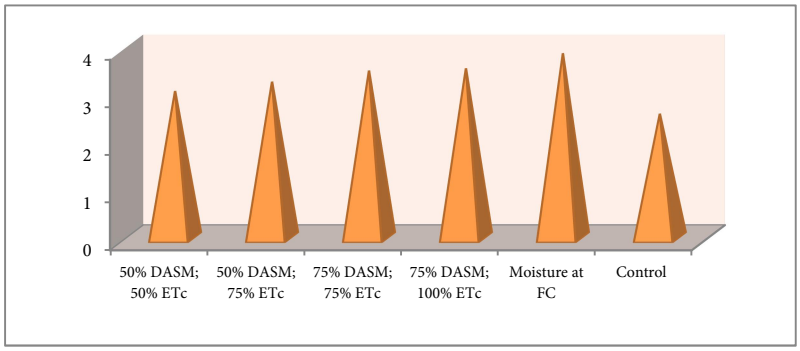


Fig. 32: Effect of irrigation scheduling treatments on fibre yield (t/ha) of jute

2 Climate Change and Resilient Agriculture

2.1 Assessment of carbon footprint of jute product for an eco-friendly substitute for plastic

A.K. Singh, Shamna A. and G. Kar

Project code: In-house Project-JEXA 6.2

Increasing demand for jute made shopping carry bag materials has given rise to various issues relating to their disposal as well as to the overall environmental footprint and sustainability of the packaging materials. Life Cycle Assessment (LCA) study was conducted of all inputs and outputs, aggregated in the form of resources used and environmental emissions, extending from the production of raw materials to the final disposal of the product. The system boundary chosen in this LCA study was cradle-to-grave, i.e., from jute cultivation to the disposal of jute bags. The global warming potential (GWP) for the production of one kg of jute bag is approximately -0.253 kg CO_{2eq}. The negative sign indicates a net sequestration of the CO_2 in the soil by the cultivation of jute crops in 120-125 days. Approximately 1.26 kg CO_{2eq} is assimilated at the agricultural stage, with the release of 1.00 kg/CO_{2eq} for the production of 1 kg of raw fibre at the farm stage (Fig. 33). A jute bag can be reused more than 30 times as its primary use for shopping and packaging. The jute bag degrades within 150 - 160 days if mixed with soil under normal environmental conditions. The overall climate change impact of jute bags from agriculture farm to the usage and disposal phase is net carbon sequestration, i.e., sequestering more CO_2, than is emitted in the entire life cycle stages. The excess sequestered carbon is left in the form of fixed carbon in organic matter, and this increases the soil fertility. Thus, the jute bag is an environmentally friendly material from a climate change perspective.

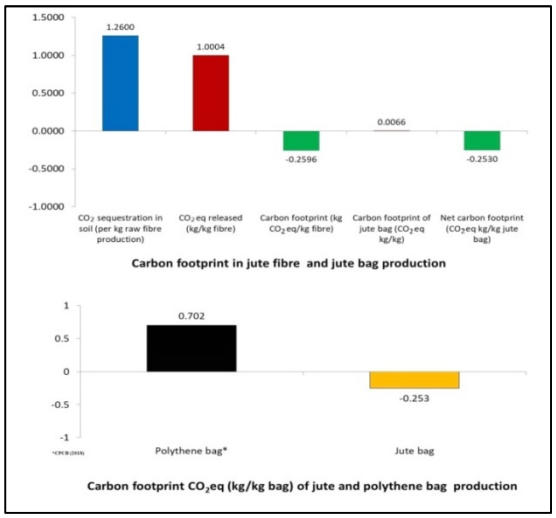


Fig. 33: Carbon footprint of jute and plastic product

2.2 Role of antioxidant machinery of jute under drought stress

L. Sharma, J. Mitra, S. Mitra, P. Satya, D. Barman and S. Roy

Project code: In-house Project-JA 7.4

A comparative study was taken up among the tolerant (OIN 631 and OIN 632), susceptible (OIN 694 and OIN 873), and JRO 204 genotypes of jute to understand the antioxidant response of jute under drought. 30-day-old plants grown in pot culture were subjected to drought by withholding irrigation. Another set of plants was sprayed with 10 mM ascorbic acid (AsA) for two consecutive days and subjected to stress. Soil moisture content and relative water content was maintained at 4.9 – 7.31 % and 42.4 – 53.2 %. Various morpho-physiological and biochemical parameters were observed. Plant height was found to be reduced more under drought than the plants treated with exogenous AsA under

drought. However, after 15 days of rewatering, there was 6–10 % recovery in plant height with exogenous AsA treated plants than the plants under drought. Total Chlorophyll, total carotenoids and membrane stability were reduced while TBARs content increased under drought as compared to control. The reduction was more prominent under drought as compared to plants sprayed with exogenous AsA under stress (Fig. 34 a-d). The reactive oxygen species (ROS) (hydrogen peroxide and superoxide radicals) which accumulated under drought was found to accumulate less with exogenous AsA (Fig. 35). Moreover, the accumulation of ROS was higher in the susceptible genotypes compared to tolerant ones. The antioxidant enzyme (peroxidase and ascorbate peroxidase) activity that increased under drought increased further on exogenous AsA application. The activity of catalase was found to reduce under drought which further increased with exogenous application of AsA. It may be thus inferred that exogenous application of AsA plays an important role in ameliorating the adverse effect of drought stress by regulating the redox status of the plant under drought. It also maintained the plant height of jute under drought. Moreover, JRO-204 appeared to be more tolerant of drought compared to the OIN series.

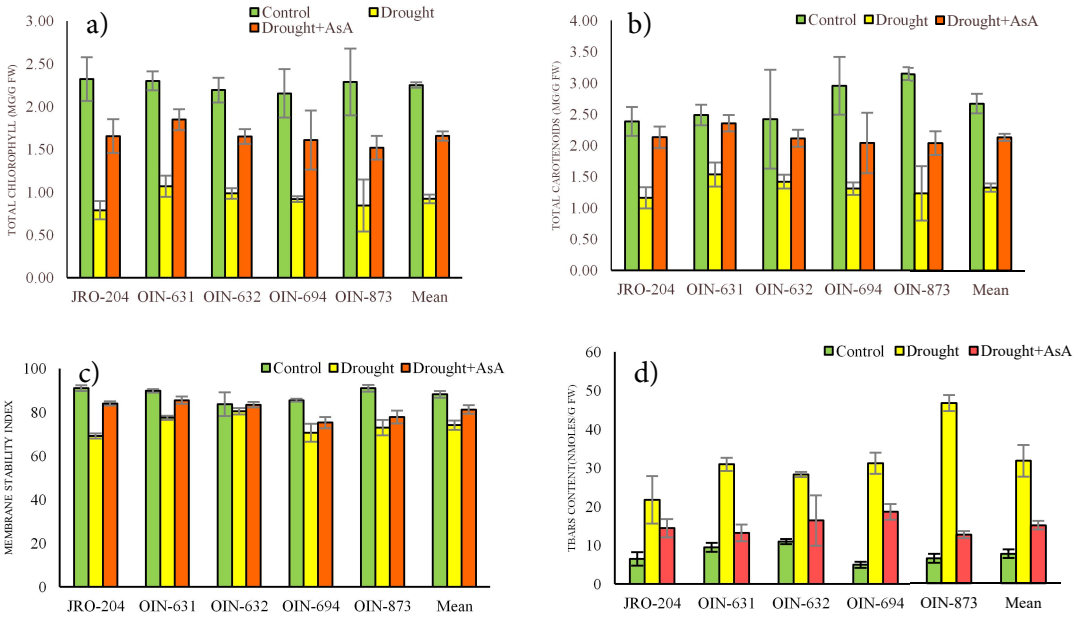


Fig. 34: (a) Total chlorophyll, (b) total carotenoids, (c) membrane stability and (d) TBARs content of five jute genotype under drought and with exogenous AsA

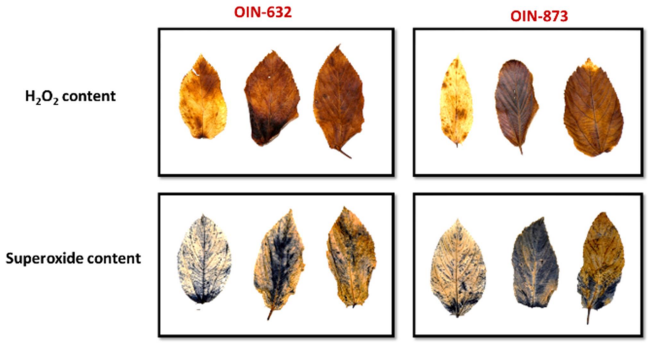


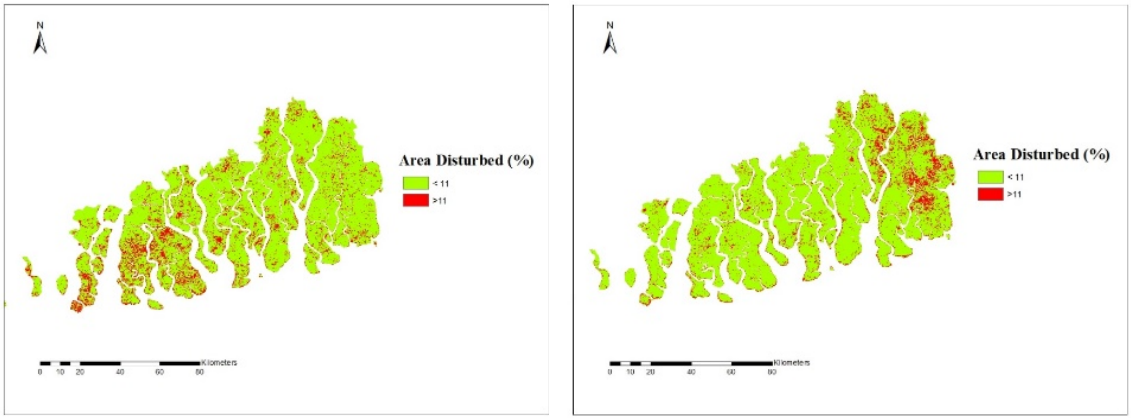
Fig. 35: ROS accumulation in jute genotypes under drought and with exogenous AsA

2.3 Assessing climate induced natural hazards in mangrove forest ecosystem of Sundarbans

D. Barman and G. Kar

Project code: Externally Funded Project-APN multinational

The Sundarbans, a UNESCO World Heritage Site, is the world's largest mangrove forest composed of a network of low lying conglomeration islands created from sediment loads deposited from Himalayan rivers. 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 scenarios of climate change. Therefore, the ecological disturbance was computed in the Sundarbans of the mangrove ecosystem of India and Bangladesh using the MODIS Global Disturbance Index (MGDI). The threshold value of MGDI was fixed at 11. This means that where the MGDI value is less than 11, the area is categorized as a non-disturbed area, and where it is more than 11, the area is disturbed due to the cyclone. The ecological disturbance area due to super cyclones *Amphan* in 2020 and Yaas in 2021 was computed in the mangrove ecosystem of the Sundarbans of India and Bangladesh (Fig. 36).



(a) **(b)**

Fig.36: Ecological disturbance map of Sundarbans regions of India and Bangladesh due to cyclone (a) amphan (2020), and (b) Yaas (2021)

2.4 Cytokinin promotes vegetative growth in jute better than auxin

S. Roy, P. Satya, L. Sharma and H. Bhandari

Project code: In-house Project-JA 7.5

Flowering in jute plants is a problem when sown in early March or at the end of February. The plants may experience short days or cooler temperatures during this period. Therefore, maintaining the vegetative phase of the life cycle is very important to minimize yield losses. Hormones play an important role in phase change in plants. Cytokinin is known for increasing the vegetative growth period by suppressing florigen expression in rice and maize. Other plant hormones, like auxin, also have several roles in phase change. An experiment has been conducted with two genotypes of jute, JRC 517 and NBR 21, where

both cytokinin and auxin were applied as foliar sprays in single doses and in combination. Under field conditions, Tween 20 was used as a surfactant along with double-distilled water as a control under field condition. Cytokinin alone (20 mg/lit) is much more effective than auxin (10 M) in maintaining the vegetative phase of both JRC 517 and NBR 21. Application of both hormones in combination is least effective for increasing the plant height from 40 DAS to 60 DAS as well as from 60 DAS to 80 DAS (Fig. 37a, Fig. 37b).

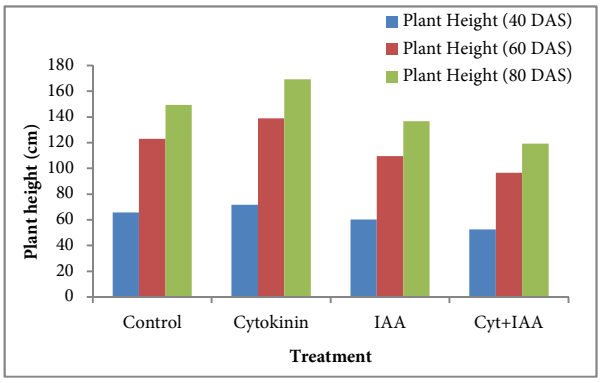


Fig 37a: Plant height of NBR 21at 40 DAS, 60 DAS and 80 DAS

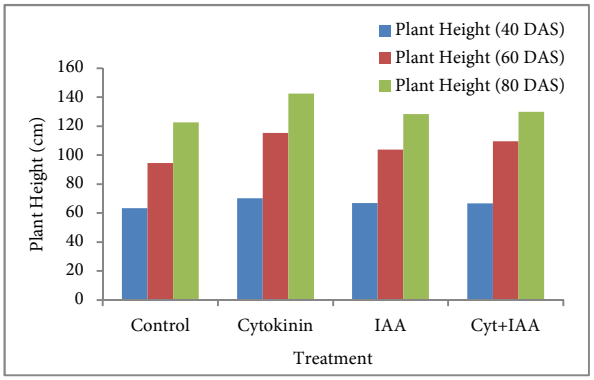


Fig 37b: Plant height of JRC 517 at 40 DAS, 60 DAS and 80 DAS

2.5 Upscaling of ecosystem level CO_2 fluxes using eddy covariance technique

D. Barman, P.K. Das, A. Chakraborty and G. Kar

Project code: Externally Funded Project-ISRO (NCP)

The study was conducted to develop a relationship between leaf and eco-system level CO_2 fluxes in a jute agroecosystem toward its upscaling using the eddy covariance technique. The estimated CO_2 flux represents a fetch area of around 100 m surrounding the flux tower. Simultaneously, the leaf-level CO_2 gas exchange values were also measured during various phenological stages of the jute crop using the LI-6800 portable gas exchange system. For selected days, leaf level estimations (shade and sunlit leaves) were carried out from 06:00 hrs to 17:00 hrs at around a half-hourly interval for a representative jute crop with sufficient replications. The univariate regression analysis was carried out to identify the best suitable parameter to represent leaf-level net CO_2 assimilation. It was observed that the photosynthetically active photon flux density (PPFD) was showing the maximum coefficient of regression while representing leaf-level net CO_2 assimilation. The leaf level PPFD data was estimated on selected days; however, the flux tower has the capability to provide continuous PPFD data at ecosystem level. Hence, before deploying the equation on flux tower-derived PPFD, a regression analysis between leaf and ecosystem-level PPFD was carried out. It was found that the tower data could address more than 85% of the variability of leaf-level PPFD data. Thereafter, the regression equation was deployed on the tower derived PPFD data to generate continuous net CO_2 assimilation estimates (simulated) at leaf level for the entire crop growth period. While comparing, it was discovered that the temporal variations in ecosystem-level CO2 flux (mol m-2. sec-1) are greater than those in leaf-level CO2 flux (Fig. 38).

It was hypothesized that the leaf level CO_2 flux represents the net CO_2 assimilation potential of the crop (a physiological trait), whereas ecosystem level CO_2 flux addresses crop growth factors such as biomass, leaf area index (LAI), etc. along with the net CO_2 assimilation potential of the crop. In the present study, the

crop growth factor was represented in terms of LAI. To bridge the gap between leaf and ecosystem level CO_2 flux, the LAI was integrated with the simulated leaf level CO_2 flux. It was observed that in the initial crop growth stages, it was underestimating the CO_2 flux values, whereas in later stages, it was overestimating them. Hence, the present study proposed the role of phenology modifiers along with crop growth parameters to represent ecosystem level CO_2 flux using leaf level CO_2 flux data (Fig. 39).

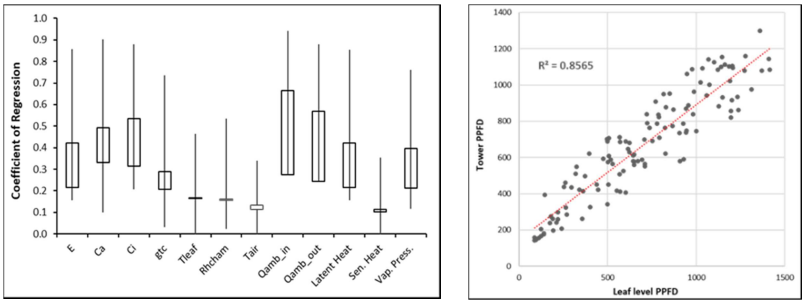


Fig. 38: Relationship between leaf level and ecosystem level photosynthetically active photon flux density

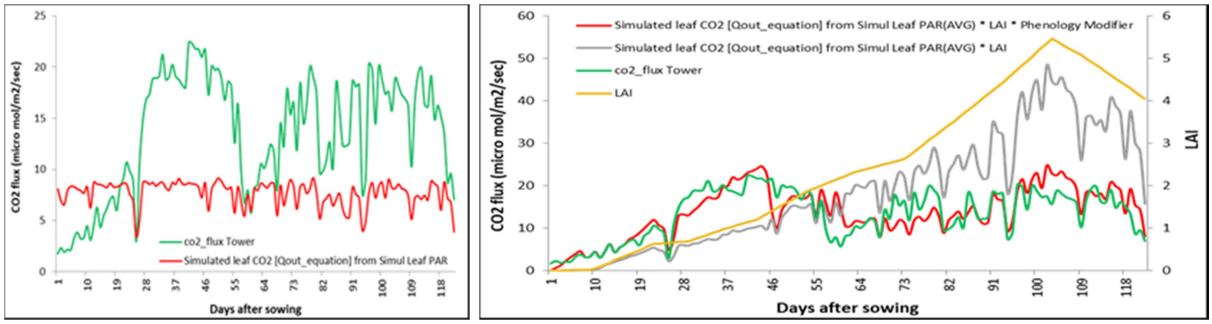


Fig. 39: Simulation of ecosystem level CO_2 fluxes

2.6 JuteClimet and Climate Expert on jute: ICT based decision support system

D. Barman, G. Kar and R. Saha

Project code: Externally Funded Project-DSTBT

Jute farming is primarily climate dependent, and its success is thus determined by the availability of accurate real-time climate information in the hands of the farming community. This can be addressed by information and communication technology (ICT), and therefore a web-based dashboard, Climate Expert on Jute (Fig. 40) and an Android mobile app, JuteClimet, have been designed for farmers and other stakeholders. The dashboard contains different modules that deal with information related to jute cultivation, such as a brief history about the origin of jute and its suitable climatic requirements, agro-climatic zones and agronomy, jute production vulnerability zones, and climate solutions. The climate solution module deals with the management aspects of jute production, such as the choice of a suitable jute variety, appropriate management practices for irrigation, weeding, disease, and pests, mechanization, retting, and a suitable jute-based cropping system. The Android mobile app, JuteClimet, is designed as a farmer-friendly ICT tool for addressing their site-specific needs. It is based on a set of rules and logic. For example, if a farmer wants to choose a suitable variety for a specific land,

first the farmer needs to select the land condition, whether it is upland or lowland, then the drainage condition of the land, whether the drainage is good or bad, then the type of jute, whether it is olitorius (tossa or mitha pat) or capsularis (desi/tita pat), and finally the promising variety of the location. Likewise, logical frameworks have been developed for applying irrigation, weedicides, and pesticides (diseases and insect pests) for jute cultivation, which will serve as an expert system.

Fig. 40: Design of the web-based dashboard of climate expert on jute

2.7 Climate change risk assessment in jute production and related advisory services through decision support system

D. Barman, A.K. Singh, R. Saha, S.P. Mazumdar, L. Sharma and S. Mitra

Project code: In-house project- JA 7.1

The study was carried out during the period of 2016 to 2021. In this study, district-level climate data for West Bengal were analysed on a spatio-temporal scale. Using monthly data on maximum and minimum air temperature and rainfall, climate variability and trends in West Bengal were identified. A Markov chain model was used to identify the dry and wet spells during the jute growing period in Barrackpore, Cooch Behar, Nagaon, and Bhubaneswar, sites of jute growing locations. Climate change vulnerability factors for jute were identified, such as rate of change of maximum and minimum temperatures, availability of retting water, etc. Some climate solutions or climate change adaptive measures were identified, and the strategies were developed to save the jute crop from adverse climate change conditions. JuteMet®, a web-based agrometeorological database management system (ADBMS)-cum-agroadvisory system, was conceptualized and developed for agriculture, horticulture, and agro-advisory services. Climate-resilient agro-advisory services and jute variety information were disseminated to jute farmers to cope with climate change scenarios (Fig. 41).

Fig. 41: JuteMet-web-based agrometeorological database management system

3 Crop Management

3.1 Upgraded mechanical weeder and novel herbicides for efficient weed management in jute

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

Project code: In-house project- JA 8.2

Performance of mechanical weeder and herbicides on weed management was evaluated in *tossa* jute (cv. JRO 204). Maximum plant height (368.3 cm) at harvest (120 DAS) was recorded with two manual weeding treatments. 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 plants (347.0 cm), closely followed by ipfencarbazone @ 90 g/ha (PE) + single wheel jute weeder at 21 DAS (342.8 cm). Like PH, similar trends were observed in the case of jute basal diameter (BD) at harvest. The highest jute fibre yield (38.98 q/ha) was obtained with two manual weedings. Among the herbicidal and mechanical weed management methods considered, application of ipfencarbazone @ 90 g/ha (PE) + nail weeder at 14 DAS produced higher fibre yield (37.12 q/ha), closely followed by and at par with the fibre yield recorded with ipfencarbazone @ 90 g/ha (PE) + single wheel jute weeder at 21 DAS (36.79 q/ha). The fibre yield reduction due to competition from surviving weeds was only 4.77 and 5.62%, respectively, in both of the effective combination treatments, when compared to the fibre yield obtained in the manual weeding treatment. The stick yield of jute also followed the same pattern of fibre yield with the different weed management treatments (Table 17). The jute fibre quality did not differ significantly with the different weed management treatments considered. The obtained fibre was very good in terms of colour, strength, and fineness.

Table 17. Effect of different weed management methods on PH, BD and fibre yield in *tossa* jute

Tr. No.	Treatment details	PH (cm)	BD (cm)	Fibre Yield (q/ha)	Stick Yield (q/ha)
T_1	Manual weeding (*Nirani*) two times (7 DAS and 21 DAS)	368.3	1.98	38.98	93.82
T_2	Nail weeder two times (7 DAS and 14 DAS)	335.5	1.80	32.24	77.58
T_3	Single wheel weeder two times (10 DAS and 21 DAS)	325.2	1.67	31.88	76.72
T_4	Nail weeder (7 DAS) + Single wheel jute weeder (21 DAS)	322.3	1.70	31.99	77.00
T_5	Ipfencarbazone @ 90 g ai/ha	320.0	1.80	29.87	71.88
T_6	Ipfencarbazone @ 120 g ai/ha	312.7	1.61	30.80	74.12
T_7	Ipfencarbazone @ 90 g ai/ha + Nail weeder at 14 DAS	347.0	1.88	37.12	89.33
T_8	Ipfencarbazone @ 120 g ai/ha + Nail weeder 14 DAS	341.6	1.73	34.66	83.41
T_9	Ipfencarbazone @ 90 g ai/ha + Single wheel jute weeder at 21 DAS	342.8	1.93	36.79	88.55
T_{10}	Ipfencarbazone @ 120 g ai/ha + Single wheel jute weeder at 21 DAS	338.1	1.79	34.41	82.81
CD (P=0.05)		16.01	0.136	2.568	6.188

DAS: Days after sowing; PH: Plant height of jute at harvest; BD: Basal diameter of jute at harvest.

3.2 Effect of plant density and weed management practices on plant size composition and productivity of jute

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

Project code: In-house project-JST 6.3

To study the dynamics of jute plant size composition, the 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, 30 cm × 6.6 cm). Jute (line JROBA 3) and mung bean (*cv.* Virat) sown on 8 March 2022. Mung pods were harvested between 53 and 68 days after sowing. Jute was harvested at 120 DAS. The sole mung yield was 15.2 q/ha. Intercropping system produced 2.5–3.4 t/ha of dry mung bean waste. By 30 DAS, mung plants had smothered weeds (Fig. 42). In control (no weeding and thinning), mixed cropping with high density sowing 60 jute plants per m^2 and 45 mung plant per m^2 produced 8.2 q/ha of jute fibre and 7.2 q/ha of mung seed, while jute plant densities of 10-15 produced 3.5 q/ha of fibre and 11.8 q/ha of mung seed. Whereas jute fibre yield was 27.3 q/ha for dense sowing of jute with the application of straw mulch @ 7.5 t/ha and no weeding and thinning. Regardless of plant density variation, the population of large-sized (>300 cm) plants per hectare settled around 55,000 for bare and mixed intercrop systems. With the increase in plant density, the medium (250–300 cm) plant count increased from 135000 to 252000 for the bare field and from 117000 to 149000 for the mung bean intercrop system. Because of improved soil hydrothermal regimes and oxygen diffusion rate, effective plant composition increased in the straw mulch system, with large plant count increasing from 107,000 to 137,000 and medium plant count increasing from 118,000 to 168,000 for plant populations of 3.5 and 5.0 lakh/ha, respectively. In an exploratory trial with 16 cm×16 cm grid planting (Fig. 43), the shares of large and medium plants were 90.12% and 9.88%, respectively, for line JROBA 3, and for line JRO NS-1, these were 90.37% and 9.63%, and yields of 50.7 and 47.2 q/ha of jute fibre were recorded at 110 DAS for the genotypes.

These differences in plant size composition influenced jute fibre yield, mung seed yield, jute equivalent yield (JEY; i.e., the economic contribution from jute fiber, jute stick, mung

seed, and mung waste), and the systems' gross and net income. The weeding method significantly ($p<0.05$) influenced jute fibre yield and gross and net income (Table 18). The effect of plant population as a factor was not significant in fibre yield, though it increased operational mandays requirements. The incidence of stem rot was recorded at 0.5% in RSM, 0.9% in mung intercrop, and 2% in bare cultivation. For dense planting of jute @ 10, 20 and 40 lakh/h, 0.005 %, 3.44% and 35.16% plants were observed dead being affected with stem rot.

Table 18. Fibre yield, mung seed yield, jute equivalent yield (q/ha) and cost-benefit ratio with different weeding methods and plant densities

Weeding Method	Plant Population (lakh/ha)								Mean		
	3.5				5.0						
	Fibre Yield (q/ha)	Mung Seed Yield (q/ha)	Jute Equivalent yield (q/ha)	Cost Benefit Ratio	Fibre Yield (q/ha)	Mung Seed Yield (q/ha)	Jute Equivalent yield (q/ha)	Cost Benefit Ratio	Fibre Yield (q/ha)	Mung Seed Yield (q/ha)	Jute Equivalent yield (q/ha)
Bare	36.31	0	38.05	1:2.20	34.05	0	35.69	1:2.06	35.18	0	36.87
Mung	24.31	8.44	40.39	1:2.66	26.68	6.72	39.97	1:2.59	25.49	7.58	40.18
RSM	37.54	0	39.34	1:2.34	37.86	0	39.51	1:2.36	37.7	0	39.51
Mean	32.72	-	39.26	-	32.86	-	38.45	-	32.79	-	38.85

LSD ($p<0.05$) for jute fibre yield was 1.47 whereas for JEY the treatment effects were not significant.

Fig. 42: Jute-mungbean intercropping at 30 DAS

Fig. 43: Uniform jute crop growth in grid planting (16 cm × 16 cm) at 55 DAS

3.3 Growth and yield of sisal and hybrid sisal as affected by planting materials and fertilizer levels.

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

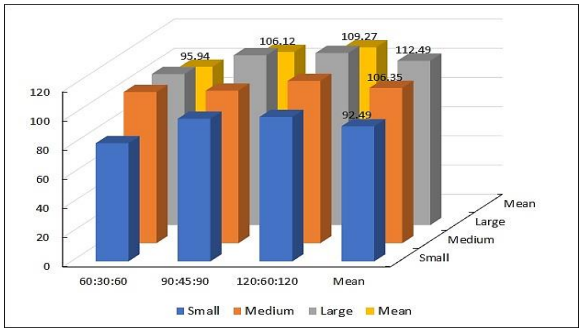
Project code: In-house project-SLA 1.7

Effect of sucker size and fertilizer level on Sisalana sisal: From the recorded leaf parameters, it was noted that the mean leaf length and mean leaf breadth of sisalana sisal significantly varied with sucker size at planting and fertilizer dose (Table 19). Irrespective of fertilizer dose, the longest leaf (106.19 cm) was produced by large sized sucker at planting; similarly, irrespective of sucker size, the longest leaf (94.98 cm) was produced by the highest fertilizer dose. Similar pattern of variation like leaf length were recorded in case

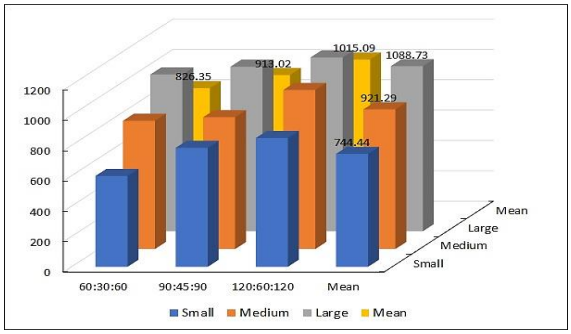
of leaf breadth of sisalana sisal (Table 19). The broadest leaf (9.59 cm) was produced by large sized sucker and higher fertilizer dose. It was observed that the number of leaf production varied significantly due to different size of planting materials at planting and fertilizer doses in Sisalana sisal (Fig. 44). Irrespective of nutrients levels, the maximum number (112.5 x 10^3/ha) of harvestable leaves was produced by the large sized sucker at planting which was statistically at par with the harvestable leaf produced by the medium sucker size (106.3 x 10^3/ha). Similarly, irrespective of sucker size, the maximum number of harvestable leaves (109.3 x 10^3/ha) was produced by the highest dose of fertilizer i.e., N, P, K @ 120, 60, 120 kg/ha which was closely followed by and at par with the harvestable leaf (106.1 x 10^3/ha) produced by medium fertilizer dose. In the interaction effect of the size of sucker at planting and fertilizer dose, it was recorded that the maximum number of harvestable leaves (117.8 x 10^3/ha) or produced (111.1 x 10^3/ha) either by the large sized sucker x higher fertilizer dose with medium sized sucker x higher fertilizer dose. In case of fibre yield from the 1st cutting year, the large sized sucker x high fertilizer dose yielded the highest (1146.7 kg/ha) which was closely followed by and statistically at par with the fibre yield (1049.1 kg/ha) obtained with medium sucker size x high fertiliser dose.

Table 19. Effect of size of planting materials (sucker size) and fertilizer levels on leaf length and breadth in sisalana sisal

Sucker size at planting	Mean leaf length (cm)				Mean leaf breadth (cm)			
	Nutrient levels (kg/ha)							
	60:30:60	90:45:90	120:60:120	Mean	60:30:60	90:45:90	120:60:120	Mean
Small	79.40	81.84	84.47	81.91	7.55	7.89	7.93	7.79
Medium	88.13	91.55	93.22	90.97	8.29	8.39	8.61	8.42
Large	104.89	106.42	107.27	106.19	9.22	9.29	9.59	9.37
Mean	90.80	93.27	94.98		8.35	8.52	8.71	
CD (p=0.05) within a factor		1.494				0.184		
CD (p=0.05) interaction		2.590				0.315		



Number of leaves harvested ('000) in sisalana sisal



Fibre yield (kg/ha) of sisalana sisal

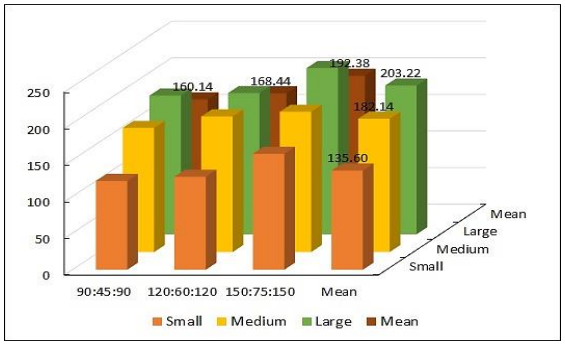
Fig 44: Effect of size of planting materials and fertilizer levels on number of leaves harvested and fibre yield in sisalana sisal

Effect of sucker size and fertilizer level on Hybrid sisal: In case of hybrid sisal, irrespective of fertilizer dose, the longest leaf (87.40 cm) was produced by the large size sucker at planting; similarly, irrespective of sucker size, the higher nutrient levels produced the longest leaf (79.69 cm). In case of leaf breadth also, similar variations were recorded like leaf length (Table 20). The maximum leaf breadth (7.54 cm) was recorded with large size sucker at planting with higher fertilizer dose. In case of hybrid sisal, it was noted that irrespective of fertilizer dose, large sized sucker at planting produced the highest number of harvestable leaves (203.2 x 10^3/ha). Whereas, irrespective of sucker size, the maximum number of harvestable leaves (192.4 x 10^3/ha) were produced with the highest fertilizer dose i.e., N, P, K @ 150, 75, 150 kg/ha. In the interaction effect, it was recorded that large

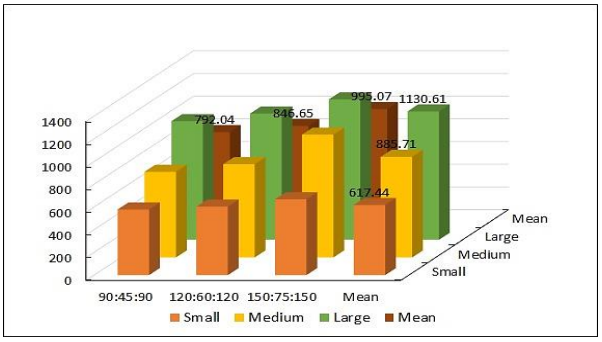
sized sucker at planting x highest fertilizer dose produced the maximum number of harvestable leaves (227.1 x 10^3/ha). Regarding fibre yield from the 1st year of cutting, unlike the case of sisalana sisal, only the large sized sucker x high fertilizer dose (150:75:150 kg/ha of N:P:K) produced the highest fibre yield (1236.2 kg/ha) in hybrid sisal (Fig. 45).

Table 20. Effect of size of planting materials (sucker size) and fertilizer levels on leaf length and breadth in hybrid sisal

Sucker size at planting	Mean leaf length (cm)				Mean leaf breadth (cm)			
	Nutrient levels (kg/ha)							
	90:45:90	120:60:120	150:75:150	Mean	90:45:90	120:60:120	150:75:150	Mean
Small	65.71	68.69	70.82	68.40	5.28	5.48	5.58	5.44
Medium	71.42	72.00	76.60	73.35	5.72	6.13	6.17	6.00
Large	85.93	87.60	88.67	87.40	7.39	7.51	7.54	7.48
Mean	74.35	76.09	79.69		6.12	6.37	6.43	
CD (p=0.05) within a factor		1.294				0.171		
CD (p=0.05) interaction		2.231				0.296		



Number of leaves harvested ('000) in hybrid sisal



Fibre yield (kg/ha) of hybrid sisal

Fig. 45: Effect of size of planting materials (sucker size) and fertilizer levels on number of leaves harvested and fibre yield in hybrid sisal

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

A.K. Singh, S. Mitra, B. Majumdar, M.L. Roy, S. Satpathy, S.K. Sarkar, M.S. Behera 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. The goal of the study was 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. The experiment was carried out at ICAR-CRIJAF (Barrackpore), to investigate the effect 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. 46). Results indicate that application of compost (BSC/BGSC) and chemical NPK in a 50:50 ratio may be an alternative to using 100% of the recommended dose of NPK fertilizers for jute and flax fibre production.

During the period of study of ramie fibre crop, a total of seven cuttings of ramie, were taken on 15/11/21, 27/01/22, 29/3/21, 01/06/22, 21/07/22 and 12/09/22, respectively. All the

fertilizer treatments (sole organic, sole inorganic and combinations) recorded significantly higher fibre yield of ramie over control. Maximum fibre yield (2.22 to 8.63 q/ha) of the crop was recorded with 100% NPK treatment at all the cuttings. During the 2nd, 3rd and 4th cuttings, the fibre yield recorded with T_5 (100% NPK) treatment was statistically at par with that of T_3 (50% BSC + 50% NPK) and T_4 (50% BGSC + 50% NPK). During the 5th, 6th and 7th cuttings, T_5 treatment recorded significantly higher fibre yield (4.54 to 8.63 q/ha) over other treatments and was followed by T_3 (3.86 to 7.67 q/ha) and T_4 (2.70 to 5.99 q/ha) treatments, respectively (Fig. 47a). A similar trend was observed in ramie total fibre yield, with maximum fibre recorded with T5 treatment (27.33 q/ha), which was statistically equal to the fibre yield recorded with T3 treatment (24.34 q/ha) (Fig. 47b).

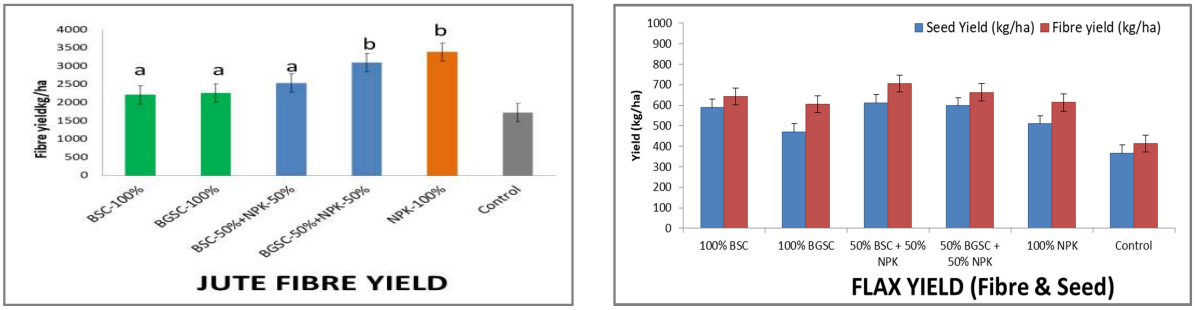


Fig. 46: Jute and flax yield in different treatments of compost and fertilizer

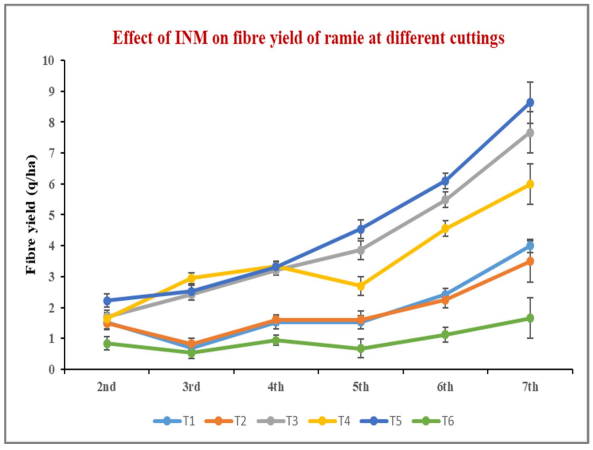


Fig. 47a: Effect of INM on fibre yield of ramie at different cuts

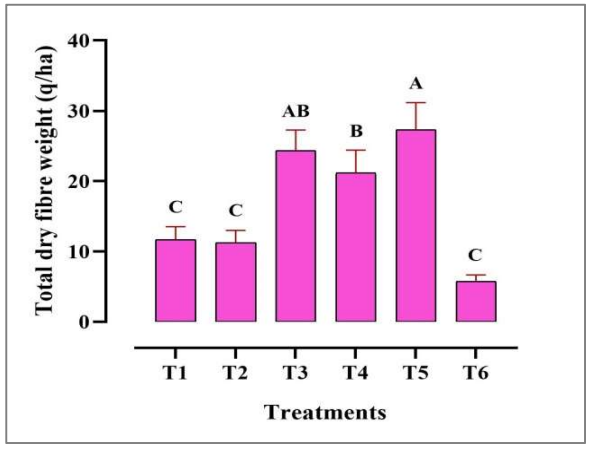


Fig. 47b: Effect of INM on total fibre yield of ramie

3.5 Efficacy of different weed management strategies in ramie fibre crop

K. Das, C.S. Kar, M.S. Behera, S. Sarkar, S. Mitra, R.K. De and R.K. Naik

Project code: In-house project-RA 1.1

A field experiment was conducted at Ramie Research Station (Sorbhog, Assam) with 10 weed management strategies (i.e. T1-Pendimethalin 30% EC as pre-emergence (PE) @ 1.0 lt/ha + 1 hand weeding (HW); T2-Oxyfluorfen 23.5% EC as PE @ 1.0 lt/ha + 1HW; T3-Quizalofop-ethyl 10% EC as post-emergence (PoE) @ 38 g/ha + 1HW ; T4-Propaquizafop 10% EC as PoE @ 1.0 lt/ha + 1HW; T5-Pendimethalin 30% EC as PE @ 1.0 lt /ha + Quizalofop-ethyl 10% EC as PoE @ 38 g/ha at 20 days after pre-emergence herbicide spray (DASp) + 1HW; T6-Pendimethalin 30% EC as PE @ 1.0 lt/ha + Propaquizafop 10% EC

as PoE @ 1.0 lt/ha at 20 DASp + 1HW; T7-Oxyfluorfen 23.5% EC as PE @ 1.0 lt/ha + Quizalofop-ethyl 10% EC as PoE @ 38 g/ha at 20 DASp + 1HW; and T8-Oxyfluorfen 23.5% EC as PE @ 1.0 lt/ha + Propaquizafop 10% EC as PoE @ 1.0 lt/ha at 20 DASp + 1 HW; replicated thrice to study the efficacy of different weed management strategies. The efficacy of weed management practices in terms of total fibre weight was calculated. The highest efficacy (90.8%) was found with T_7 followed by T_5 (86.7%) and T_8 (80.5%), respectively, in R-1411 (Hazarika). A similar trend was observed in R-67-34 (Kanai). The highest efficacy (95.2%) was also found with T_7 followed by T_5 (89.2%) and T_8 (86.4%), respectively (Fig. 48).

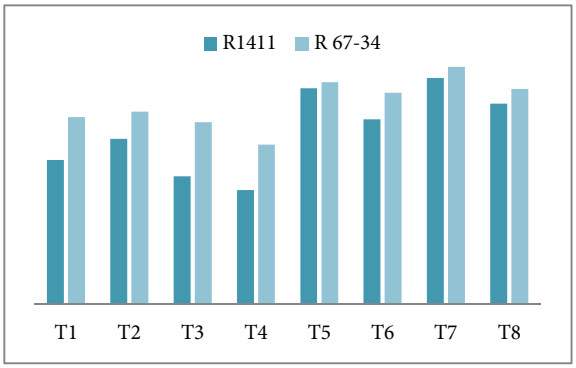


Fig. 48: Efficacy of different weed management methods in ramie crop cultivation

3.6 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, K. Das, M.S. Behera, K.V. Shivakumar and S.P. Mazumdar

Project code: In-house project-JA 8.4

Under this project, emphasis was given on: creating awareness about the scope of commercial fibre flax cultivation at both the farmer and industry levels; preparing an action plan for area expansion of fibre flax in the country; identifying locations and farmers and providing them training on improved production technologies for fibre flax; and developing linkages between the farmers and industry for efficient disposal of raw flax fibre. The potential areas for fibre flax cultivation in the country based on climatic suitability had been identified, and it was observed that fibre flax can be successfully cultivated in the uplands of North Bengal, Assam, Nagaland, Meghalaya, Manipur, Uttar Pradesh, Bihar, Jammu & Kashmir, Uttarakhand, and also in the Nilgiri Hills area with proper irrigation facilities (Fig. 49). A model "Action Plan" for area expansion of fibre flax in the country had been developed, as had the potential through which, in 5 years, fibre flax area of 2000 ha, producing about 3000 tonnes of raw flax fibre (scotched), could be produced indigenously (Fig. 50). To increase the availability of quality seed of flax (cv. JRF 2) to the farmers, about 9.0 q of TL seed of JRF 2 had been produced at ICAR-CRIJAF, Barrackpore; Sh. R. S., Pratapgarh; R.R.S., Sorbhog and AINPJAF Centre, RARS, Nagaon, Assam.

Improved cultivation practices for flax fibre production was demonstrated in 0.7 ha area covering two farmer's fields in 'Hanuman Pandey Ka Purwa' in Pratapgarh district, Uttar Pradesh. Similarly, demonstrations of improved seed production technologies had been conducted on a 0.5 ha area on farmers' fields at Majgaon Jajori village, Nagaon, Assam (Fig. 51, Fig. 52). Three training programmes for interested farmers had been conducted at Mazgaon Jajori village, Nagaon district, Assam, and 60 farmers (20/training) participated in the programme. The farmers were exposed to the commercial scope of flax cultivation and were also given training on improved production technologies.

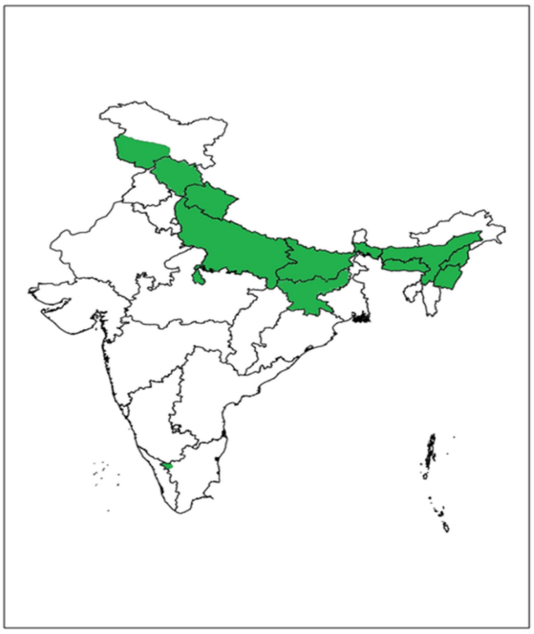


Fig. 49: Suitable areas for flax cultivation in India

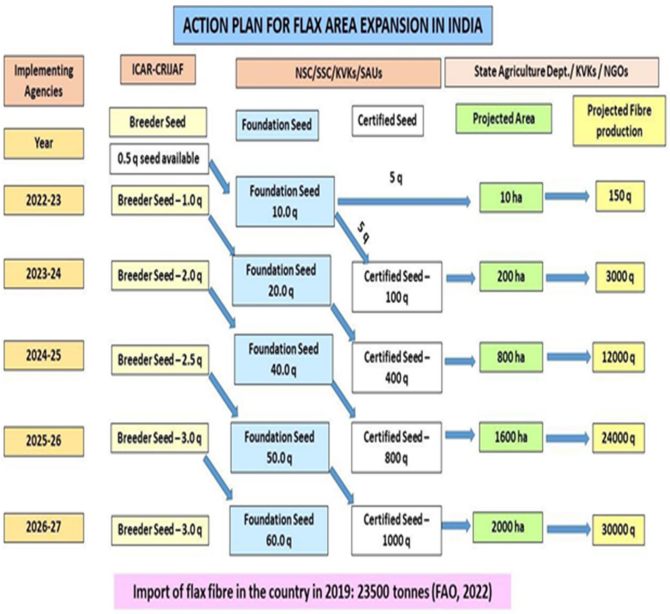


Fig. 50: Action plan for area expansion of flax in the country

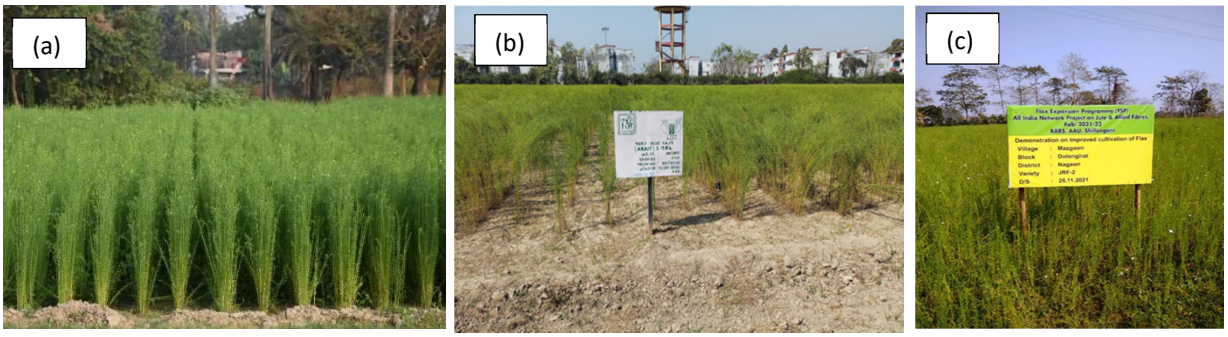


Fig. 51: Seed production at (a) Barrackpore (W.B.), (b) Pratapgarh (UP) and (c) Nagaon (Assam)

Fig. 52: Demonstration on flax fibre production (a) at Pratapgarh (UP) and flax seed production (b) at Nagaon (Assam)

3.7 Identification of suitable areas for expansion of ramie farming in North-Eastern India with improved genotypes, technologies & marketing linkages

K. Das, C.S. Kar, M.S. Behera, S. Sarkar, S. Mitra, R.K. De and R.K. Naik

Project code: In-house project-RA 1.2

The project involves the expansion of ramie plantations to various geographical areas across north-eastern India and the creation of a standardized social database for the same. Initially, potential areas for ramie cultivation expansion programmes were identified based on agro-climatic and social conditions. Awareness and training programmes were conducted on the ramie-based farming system, as well as demonstrations of the best available packages and technological and physical inputs for the initial establishment of the plantation. Ramie rhizomes were provided for plantation at selected locations, i.e., at Sorbhog, Barpeta, and Chirang districts of Assam, and Simkalangre, West Garo Hills district of Meghalaya. For the marketing linkages of ramie fibres, possible buyers or industries were also identified (Fig. 53).

Fig. 53: List of ramie fibre marketing linkages identified

3.8 Area expansion strategy under sisal farming in India with improved production technologies

M.S. Behera, A.R. Saha, S. Sarkar and D. Datta

Project code: In-house project-SLA 1.9

Sisal is a hardy, eco-friendly, profitable crop that can even be grown on marginal land. Considering its potential, steps are being taken for the promotion of sisal as a commercial crop in intercropping or farming system mode or as a sole crop, including raising the crop for watershed development, soil conservation measures, and live fencing (Fig. 54). Action has been initiated for area expansion of sisal in Rajasthan after a joint meeting of ICAR-CRIJAF and ICAR-CAZRI, Jodhpur, and planting of sisal for an on-station trial at ICAR-CAZRI before further upscaling. An initiative has been made to include sisal as a commercial crop by the Department of Agriculture and Farmers Welfare, Govt. of Odisha. The Department of Soil Conservation, Government of Odisha, has been contacted about renovating existing sisal plantations grown for soil conservation purposes and

expanding the area with new plantations. The forest department in Tamil Nādu has begun an investigation into the commercial cultivation of sisal on an area of 30,000 ha. Initiative has been taken for the growing of sisal as life fencing and commercial cultivation in the states of Andhra Pradesh, Karnataka, and Maharashtra. Liaison was made with KVK, Bargarh, and KVK, Sambalpur, Odisha, for the promotion of sisal, and work has been initiated with on-station planting in the respective KVKs. In Odisha, five training programmes on sisal cultivation were organized. SC and ST Farmers from ITDA Kuchinda and ITDA Garposh in the district of Jharsugda, Odisha, were trained at SRS Bamra for the promotion of IFS on sisal. Jharkhand sponsored a 3-day capacity-building-cum-exposure visit programme for the promotion of sisal in collaboration with NABARD in the Palamau district. Steps have been taken for conducting a 3-day training programme for the forest officers and researchers of the Conservator of Forests and State Silviculturist for the promotion of sisal in terrestrial forests of Jharkhand. A training manual in Hindi and English on sisal cultivation has been prepared, and a manual in Oriya is under process for technology transfer to different stakeholder groups.

A total of 1,00,000 bulbils and 30,000 suckers were produced at Sisal Research Station, Bamra, providing quality planting material for the farmers. Initiatives were taken for the renovation of a 50 ha existing plantation raised under TSP. Steps were taken for the extraction of fibre from the existing plantations, and farmers were impressed to take plantations in Sambalpur, Boudh, Keonjhar, and Dhenkanal districts of Odisha. Through different government schemes and programs, 1,27,524 high-yielding suckers and bulbils were provided to farmers for the promotion of sisal in Jharsugda, Sambalpur, Keonjhar, Jajpur, Dhenkanal, Khorda, and Nayagarh districts of Odisha.

Fig. 54a: Area expansion of sisal in Odisha

Fig. 54b: Intercropping of cashew plant after renovation of sisal plantation in farmer's field

3.9 Integrated Farming System in jute and sisal under organic management package

M. S. Behera, R. Saha and S. Sarkar

Project code: In-house project-SLA 1.8

Integrated Farming Systems in jute and sisal were taken up at ICAR-CRIJAF, Barrackpore, and Sisal Research Station, Bamra, respectively. The experiment involved growing field crops in one hectare for sisal and 0.4 ha for jute using conventional methods and an integrated farming system (IFS). The IFS model, consisting of crop components viz., main crop, intercrops, and crops in cropping sequence, and animal components such as dairy, goatery, poultry, duckery, apiary, pisciculture, mushroom unit, compost unit,

vermicomposting, and dike-height horticulture, recorded net returns of ₹ 116344, which is 84% higher compared to the conventional cropping sequence (Table 21). Similarly, the Integrated Farming System in Sisal recorded net returns of ₹ 102645, which is a 125 % increase in net return compared to conventional practice. An increase in the milk production of the cattle as well as goat production, efficient resource recycling on the farm through the use of vermicompost and sisal waste led to higher net revenue. "Sisal+goatery+diary+vermicomposting" were the most lucrative IFS components under study (Fig. 55). It was also observed that animal products exhibited greater net income among the different enterprises under study than crops. The IFS System has the potential to increase income generation by increasing employment opportunities by 47% in jute-based IFS and 105% in sisal-based IFS, while lowering the risk of crop failure, increasing soil fertility, and reducing disease and pest infestation.

Table 21. Economics and employment opportunity under integrated farming system

Particulars	Jute (1 Acre)				Sisal (1 Hectare)			
	Conventional system	IFS System	Net	% Change	Conventional System	IFS System	Net	% Change
Gross Return (₹)	157750	248794	91044	57	108250	192290	84040	77
Cost (₹)	94725	132450	37725	39	62750	89645	26895	42
Net Profit (₹)	63025	116344	53319	84	45500	102645	57145	125
Employment Generation (man-days)	161	238	77	47	103	212	109	105

Fig. 55a: Jute based integrated farming system

Fig. 55b: Sisal based integrated farming system

4 Mechanization and Energy Management

4.1 Development of tractor drawn multi-crop planter for small seeded crops

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

Project code: In-house project-JAE 3.6

A tractor-drawn multi-crop planter for precision sowing of jute and other small-seeded upland crops was developed (Fig. 56). It is operated through a 3-point linkage tractor drawbar (35 hp and above). The machine consists of a seed and fertilizer box, metering mechanism, ground wheel, furrow openers, seed covering device, seed tube, balancing wheel, standing platform, and hitching point. The planter has a separate fertilizer box and metering mechanism for applying granular fertilizer along with the seed. The planter uses an inclined plate metering mechanism to meter the seeds for precision seed sowing. The planter has seven rows with a row-to-row distance of 25 cm. Power transmission from the ground wheel to the metering mechanism is through a chain and sprocket and a bevel gear drive. The inclined plate metres the seed from the seed box and drop it on the furrow and close to the ground via seed tubes during the operation. A seed-covering device made of M.S. flat attached behind the furrow opener covers the seed. The field evaluation of the machine for jute seed sowing shows a seed rate of 3.5–4.5 kg/ha. The uniformity of seed dropping and spacing along the row were found to be 80–85% and 30–50 mm, respectively.

Fig. 56: Tractor drawn multi-crop planter for small seeded crops

4.2 Functional performance evaluation of improved flax fibre extractor

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

Project code: In-house project-JAE 3.6

The functional performance of the improved flax fibre extractor in terms of its material capacity, throughput capacity, and extraction efficiency were evaluated at ICAR-CRIJAF, Barrackpore (Fig. 57). Retted and dried flax straw from different AINP on JAF centres and other projects was processed in the machine for extraction of fibre. During the evaluation, the material capacity and throughput capacity found to be 75-80 kg flax straw/h and 40-45 kg flax fibre/h, respectively. The extraction efficiency found to be 90-95% with fibre recovery ranges from 42-52 % on dry weight basis. The fibre extraction using the machine found to be satisfactory in terms of quantity and quality of fibre. The operational process of the machine is very simple and very easy to use. No specific skill is required to operate or

adjust the machine. The machine is very helpful in fibre industries to extract the fibre from flax straw/ plant.

Fig. 57: Improved flax fibre extractor

4.3 Response surface methodology for optimization of alkali pretreatment in jute biomass

L. Sharma, N.M. Alam, S. Roy, P. Satya, G. Kar and B. Majumdar

Project code: Externally Funded Project-NICRA

Lignocellulosic biomass like jute poses inherent recalcitrance which results in a lower fermentable sugar yield. In order to enhance the reducing sugar yield, the reduction of lignin content in the biomass should be addressed through pre-treatment. A study was undertaken to optimize the alkali pre-treatment condition in jute through response surface methodology employing the Box Behnken design. Three independent variables (NaOH concentration, incubation time, and temperature) at three levels (-1: low, 0: medium, and 1: high) were used to study the optimization. Percent delignification was used as a response variable. Table 22 shows the box-Behnken design matrix with three independent variables and one response variable.

Table 22. Box Benkhen design for alkali pretreatment with reaction temperature, incubation time and NaOH concentration as independent variables and delignification percentage as response variable

Run	Temperature (°C)	Incubation time (hr)	NaOH Concentration (%)	Percent delignification	
				Actual	Predicted
1	50	8	1	66.05	72.99
2	70	4	2	69.93	70.35
3	30	8	2	63.92	62.43
4	50	6	2	79.69	79.66
5	70	6	1	67.34	65.32
6	70	6	3	76.14	72.62
7	50	4	3	71.37	72.29
8	30	4	2	72.37	65.08
9	50	6	2	79.98	70.05
10	30	6	3	71.89	66.94
11	70	8	2	70.59	75.92
12	50	8	3	71.85	79.66
13	50	4	1	60.62	68.53
14	50	6	2	79.32	64.43
15	30	6	1	64.86	79.66

The adequacy of the developed model was evaluated through analysis of variance (ANOVA). F-value of 2.01 indicated that 'Lack of Fit' is not significant relative to pure error, and there is only a 5.36% chance that a Lack of Fit F-value could occur due to noise. Further, the coefficient of determinant (R^2) of 0.92 for the actual and predicted percent delignification is also confirmed by the straight line obtained in the normal probability plot. Moreover, all the residual values fall within the control limits, and hence the developed model can be used to predict the percent delignification for NaOH pre-treatment of jute biomass. For alkali pre-treatment, the second-order polynomial model representing the percent delignification (Y) is expressed as a function of temperature (˚C, T), time (hour, t) and concentration (%, C). The model obtained for delignification percentage is as follows:

$$Y = 79.66 + 1.37T - 0.23t + 4.05C + 2.28T2 + 0.44t2 - 1.24C2 - 3.94Tt - 6.52TC - 5.67tC$$

The positive values in this model indicate a synergistic effect, while the negative ones indicate an antagonistic effect between the variables. Moreover, we observed from the ANOVA that at the quadratic level, only concentration (C at $p < 0.01$) showed a significant effect, whereas at the interaction level, only the interaction between time and temperature (AB at $p < 0.10$) showed a relatively significant effect. An elliptical response surface is observed for the interactions between all three variables, with maximum response at the centre point (Fig. 58). A paired t-test between actual and predicted response data showed non-significance ($p=0.08$, $t=1.84$) suggesting that there was no significant difference between both values. Hence, the model developed is accurate. Moreover, the maximum percent delignification (80.42 %) in the study was obtained at the optimal conditions of 55.8 °C temperature, 5.9 hr time duration and 2.47% NaOH concentration.

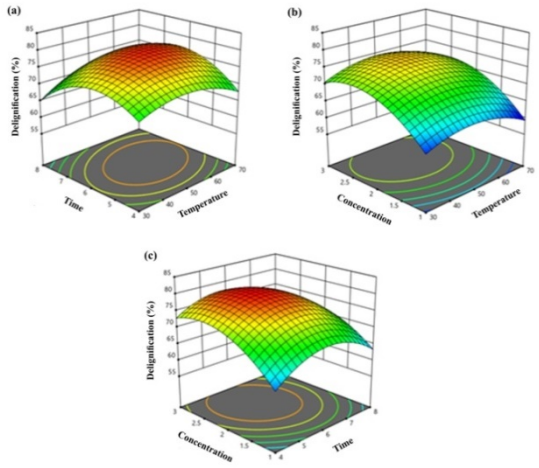


Fig. 58: 3D surface plot of percent delignification showing interaction of various variable pairs on alkali pretreatment of jute biomass. (a) Interaction effect of reaction temperature and incubation time, (b) Interaction effect of reaction temperature and NaOH concentration, and (c) Interaction effect of incubation time and NaOH concentration

4.4 Cell wall composition of whole jute biomass for bioethanol production

L. Sharma, P. Satya, S. Roy and B. Majumdar

Project code: Externally Funded Project-ST&B-WB

A study was taken up to compare the cell wall composition of high biomass jute variety (JROB 2) and other variety (JRO 524). The jute biomass was analyzed for different physico-chemical parameters like moisture content and nitrogen, phosphorus and potassium content as well as cell wall compositional analysis (Cellulose, hemicellulose, lignin and pectin). The comparative study showed that JROB 2 has superior biomass quality compared to JRO 524 (Table 23). JROB 2 biomass has higher cellulose (66.5±0.7%) and lower hemicellulose (13.11±0.29 %), lignin (19.43±0.15%) and pectin (3.03±0.07%) compared to that of JRO 524. The proximate analysis of jute biomass showed 0.21±0.006 % nitrogen, 0.12±0.001%

phosphorus and 0.75±.006% potassium content on dry weight basis. The moisture content and ash content was found to be 5.145±0.005 and 0.358±0.03, respectively. This shows the suitability of JROB 2 for bioethanol production.

Table 23. Biomass quality of JROB 2 and JRO 524

Chemical component	JROB 2	JRO 524
Total Nitrogen (%)	0.21	0.33
Total Phosphorus (%)	0.12	0.15
Total Potassium (%)	0.75	0.73
Cellulose (%)	66.5	55.7
Hemicellulose (%)	13.1	17.5
Lignin (%)	19.6	22.4
Pectin (%)	3.5	5.3
Ash content (%)	0.04	0.06
Moisture content (%)	5.15	6.28

Optimization of time of harvest with better biomass quality: Superior quality biomass with higher production is a prerequisite for a potential feedstock for bioethanol production. In this context, JROB-2 and JRO-524 sown with recommended package of practices were harvested at seven intervals i.e., 30 days after sowing (DAS), 45 DAS, 60 DAS, 90 DAS, 105 DAS, 120 DAS and 135 DAS. Biomass was recorded at each stage of harvest. To find out the superior biomass quality, cellulose and lignin was estimated at all the stages. It was found that that with the increase in the growth duration, there is increase in biomass, cellulose content and lignin content (Fig. 59). Further, cellulose: lignin ratio was derived to find out the stage of harvest with highest cellulose and low lignin content. At 120 DAS, the cellulose: lignin showed 4.1:1 ratio high indicates that biomass quality is superior at 120 days of growth for whole jute biomass (Fig. 60). It can be thus inferred that the biomass along with its superior quality (cellulose and lignin content) is attainable at 120 DAS.

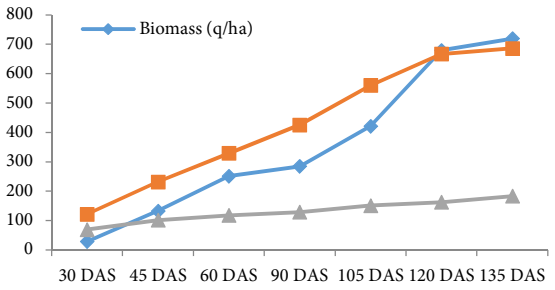


Fig. 59: Biomass, cellulose content and lignin content of jute biomass across the growth intervals

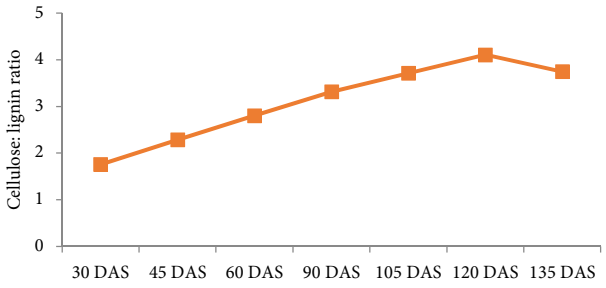


Fig 60: Cellulose: lignin ratio at different growth intervals

5 Post-harvest Management and Value-addition

5.1 Development of technology on jute retting under free-flowing water for quality fibre production

R.K. Naik, B. Majumdar, G. Kar, S.K. Jha, M.S. Behera and Shamna A.

Project code: Externally Funded Project-NFSM-CC

The conceptualization of the technology for free-flowing water conditions for jute retting has been developed by constructing one unit of a retting tank at the Dr. T. Ghosh Farm of ICAR-CRIJAF, Barrackpore (Fig. 61). The retting tank consists of six (6) retting chambers, one reservoir, and one buffer chamber. The flow, or re-circulation of water in the retting tank was achieved through a 2 hp submersible hybrid solar pump. The pump is either operated by solar energy or electrical energy. The pumping system consists of a solar panel, solar-hybrid submersible motor with pump (2 hp), battery, inverter, changeover

switch, etc. The system simulates a natural, slow-moving water body. Due to the better efficiency of microbes, there is more uniform and faster retting. It was found that the retting of jute completes within 8–12 days with the addition of the microbial formulation 'CRIJAF SONA'. The uniform and faster retting improves the fibre recovery and quality of jute fibre. The fibre fineness was 2.5-2.64 tex and the fibre strength was 25-25.4 g/tex. This process of jute retting reduces foul smell generated during retting by removing decomposing products from the retting site. The same retting water can be re-used without affecting the fibre quality.

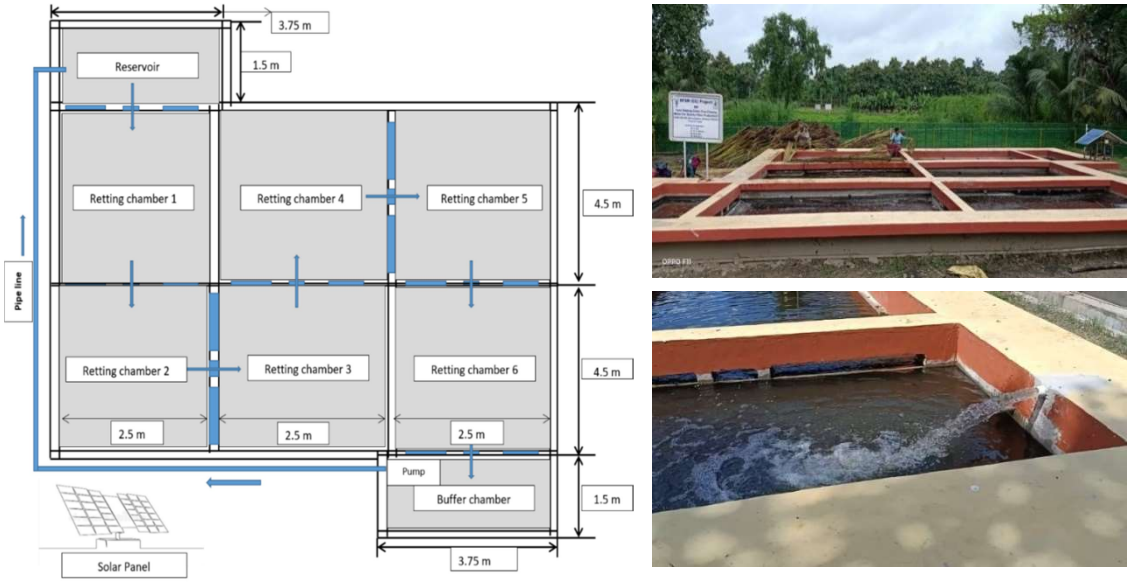


Fig. 61: Layout drawing and jute retting tank with free flowing water condition

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

B. Majumdar, S. Satpahty, A.R. Saha, 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

The Jute-ICARE project was carried out in 170 blocks of West Bengal, Bihar, Assam, Odisha, Meghalaya, and Andhra Pradesh states, covering 1,55,000 ha of area and involving 3.60 lakh farmers during 2022–23 in collaboration with the National Jute Board (NJB) and Jute Corporation of India (JCI). About 750 MT of certified seeds of jute (cv. JRO 204, JBO 2003H, and CO-58), 800 each of a CRIJAF multi-row seed drill and a CRIJAF single wheel jute weeder, were distributed among the farming community. During the retting season, 600 MT of CRIJAF Sona were distributed among the farming communities for improved retting of jute and mesta. For the first time, 314 crop cutting experiments (CCE) were conducted in West Bengal, Assam, and Bihar under the technical guidance and supervision of scientists from ICAR-CRIJAF in Jute-ICARE areas (Fig. 62). The construction of 149 in-situ retting tanks using MGNREGA funds under Jute-ICARE was completed in West Bengal, Assam, and Bihar (Fig. 63). The CCE data revealed that the jute fibre yield varied between 30 and 36.75 q/ha. Four in-house trainings on "Improved Jute Production Technology of Jute" of 2 days each were conducted for 110 supervisors and master trainers working under Jute-ICARE by ICAR-CRIJAF at ICAR-CRIJAF, Barrackpore,

from 2nd June to 14th June, 2022. 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. Scientists of ICAR-CRIJAF have conducted about 60 FLDs on "Improved Retting with CRIJAF SONA" in all the jute growing states under Jute-ICARE, benefiting about 4500 jute farmers.

The regular agro-advisories issued by ICAR-CRIJAF were disseminated directly to the farming community under Jute-ICARE in different local languages. The quality check of samples of CRIJAF SONA received from two licenced farms—Bengal Biotech and Research (Panskura) and Next to Nature (Guwahati) was carried out at ICAR-CRIJAF before the distribution of 600 MT of CRIJAF SONA to the farming community. Scientists from ICAR-CRIJAF assessed the impact of regular agro-advisories in Jute-ICARE areas. An impact study of the application of CRIJAF SONA on fibre quality, productivity, and net income was conducted for four consecutive years in five important jute growing districts (East Burdwan, Nadia, Hooghly, Murshidabad, and North 24 Parganas) of West Bengal under Jute-ICARE. In five intensive jute growing districts of West Bengal, the improvement in fibre quality and increase in jute fibre recovery with applied microbial consortium for jute retting has significantly increased the net return of the farming community by ₹15,624 to ₹18,017 per hectare over that without microbial consortium. The use of a microbial consortium for jute retting was the only factor contributing to faster retting, quality fibre production, and an increase in the net income of jute farmers across different jute-growing districts in West Bengal. Under JUTE-ICARE, the digitization of jute growing areas, soil types, productivity, etc., in the states of West Bengal has been completed. The fibre yield of jute in the Jute-ICARE area increased by more than 10% compared to the non-Jute-ICARE area, and the fibre quality ranged between TD-2 and TD-3. On average, the farming community got a higher market price for their quality jute fibre by ₹450 to 500 /q than the conventional retting.

Fig. 62: Crop cutting experiment in farmers' field under Jute-ICARE

Fig. 63: Construction of *In-situ* retting tank, retting of jute plant and the resultant fibre with CRIJAF SONA under Jute-ICARE

CROP PROTECTION

Overview

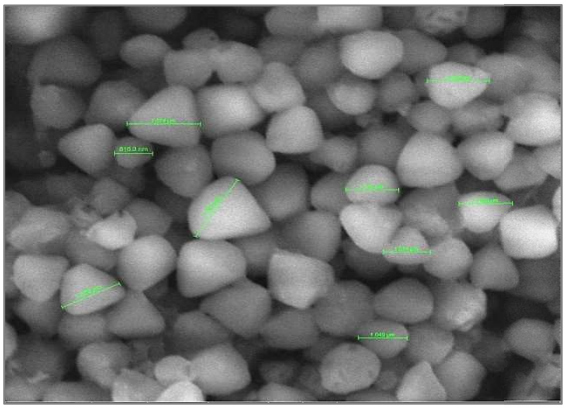
Productive agriculture systems are always vulnerable to hazards of climate, pests and diseases causing threat to crop production. In the changing climatic scenario, the crops are facing a wider range of pests and disease outbreaks and making the JAF crop production unstable. The Crop Protection Division 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.

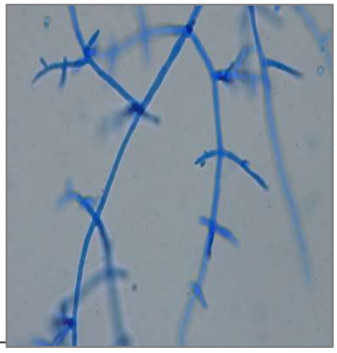
Priorities & Thrust Areas

- 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 2022

- Efficacy of nano-sulphur and nano-silica on jute yellow mite and semilooper was established.
- *Trichoderma* isolates CJMR180, CJMR191, and CJMR193 consistently performed better against two or more pathogens and were adjudged to be the best antagonists.
- Mite-tolerant jute varieties, soil-applied sulphur, and foliar sprays of fenpyroximate (5EC) for mite control manifested a significant effect on mite control and plant growth character and chlorophyll content.
- Pre-sowing soil treatment with bleaching powder and seed treatment with carbendazim + imidacloprid simultaneously are effective for stem rot, yellow mite, and other pest control in jute.
- *Spob*NPV in combination with the additives molasses, glycerol, and Sticker Plus caused a 50–83% reduction of larvae and was found to be at par with *Bt Kurstaki.*
- Six germplasms of jute (OIN 119, OIJ 77, OIJ 113, OIN 159, OIN 140, and OIN 118) exhibited significant resistance against the stem rot pathogen (*Macrophomina phaseolina*) under field conditions.
- The GIS map of the generation index (GI) and establishment risk index (ERI) of the indigo caterpillar under different climate change scenarios indicates its occurrence in broader areas.
- A web-based decision support system was made in bilingual mode to provide the best pest and disease management practices.





1 Insect-Pest and Disease Management

1.1 Use of nanoparticles against jute pests and carbon nanotubes for salinity tolerance

C. Biswas and V. Ramesh Babu

Project code: In-house Project- JM 9.3

Efficacy of nanosilica against the jute semilooper: Nano-silica (30 nm) was sprayed on semilooper 2nd instar larvae in different concentrations from 0.0032 ppm to 5 ppm in petri plates to assess its efficacy in controlling this pest. Nano-silica @ 0.2 ppm caused 90% mortality, and 100% mortality was achieved at 1 ppm concentration (Fig. 64). The LC_{50} of nano-silica was also calculated and was as low as 0.0013 ppm, whereas the LC_{50} of the popular insecticide profenophos was 990.84 ppm. Therefore, the toxicity of nano-silica is comparable to profenophos and may be used as an alternative to it for management of jute semilooper.

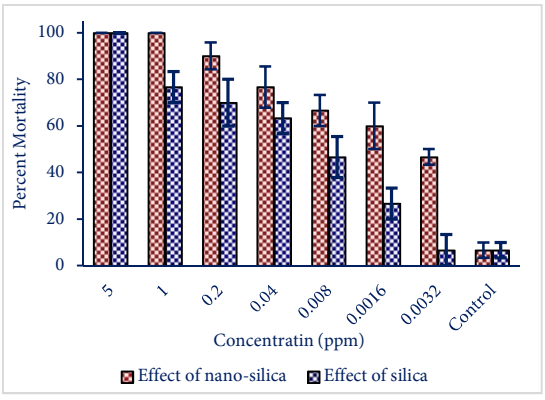


Fig.64: Larval mortality of jute semilooper at different nanosilica concentrations

Toxicity of nano-sulphur against yellow mite of jute: The efficacy of nano-sulphur (25 nm) was tested against the yellow mite under laboratory conditions. Mite-infested leaves were collected from the field. The yellow mite population on those leaves was counted prior to nano-sulphur application at test concentrations, from 0.00001 ppm to 0.1 ppm. After 48 hours, treated and untreated leaves were again examined for the presence of a live mite population. The leaf petioles were covered with wet cotton to keep the plucked leaves fresh. Application of nano-sulphur @ 0.01 ppm caused 93.43% mortality, and 100 percent mortality was achieved at 0.05 ppm concentration (Fig. 65). The LC_{50} of nano-sulphur was calculated at 0.000033 ppm.

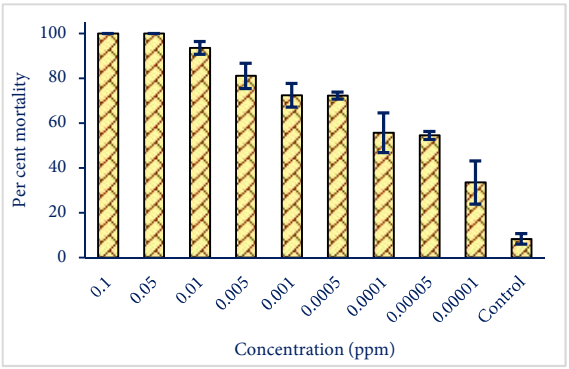


Fig.65: Effect of nano-sulphur on yellow mite in jute

Effect of carbon nanotube (CNT) treatment on salinity tolerance in jute: Jute seedlings cv. JRO 204 (30-day old) were treated with CNT (length of 500 nm and a diameter of 30 nm) to induce salinity tolerance in jute. The seedlings were treated through root dip into CNT solution @ 3 ppm for 15 min. Six grades of saline solution, viz., 300 mM, 350 mM, 400 mM, 450 mM, 500 mM, and 600 mM, were prepared by adding required quantities of NaCl in conical flasks. Another set of six conical flasks was taken to serve as untreated checks, wherein untreated jute seedlings were placed in the same manner. Observations were taken after 6 days. Plants survived only in 300 mM NaCl in the untreated control, and all

other treatments of higher salinity plants died with scorching of the leaves (Fig. 66). But in the case of CNT treatment, the jute plants survived up to 500 mM of NaCl. The jute plants dried in 600 mM of NaCl (Fig. 67).

Fig. 66: Effect of different levels of salinity on jute plants

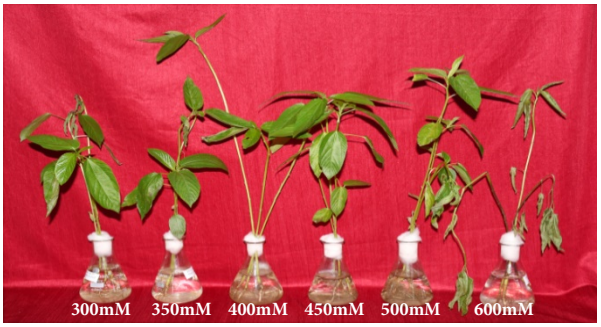


Fig. 67: Effect of CNT under different levels of salinity on jute plants

1.2 Possibility of preparing a *Trichoderma* based consortium against soil borne pathogens

K. Mandal, S.K. Sarkar and R. Saha

Project code: In-house Project- JM 9.2

Effect of temperature on growth inhibition of Trichoderma isolates: Thirty-three *Trichoderma* isolates were screened in vitro against *M. phaseolina, Rhizoctonia* sp and *Sclerotium* sp causing diseases in flax and jute. On the basis of antagonistic effect three isolates, CJMR180, CJMR191 and CJMR193 were found promising against these pathogens. Since, these screenings were conducted at a fixed temperature (25°C) the interactions at other temperatures were also studied (Fig. 68). At an incubation temperature of 25°C all three *Trichoderma* isolates produced similar growth suppressions of *M. phaseolina*. It varied between 71.1% and 73.7% in CJMR180 and CJMR191, respectively. Similar results were observed against *Sclerotium* sp. The bioagents resulted in 69.3%–71.5% growth suppression of the pathogen by CJMR193 and CJMR191, respectively. Against *Rhizoctonia,* CJMR180 and CJMR193 were less effective, causing 58.3% and 55.7% growth suppression, respectively. CJMR191 resulted in 71.8% growth inhibition. However, pathogen growth suppression efficiency of CJMR180 and CJMR193 reduced significantly at higher temperatures (30°C and 35°C). At higher temperatures, CJMR180 was more sensitive than the other. Against *M. phaseolina*, growth suppression was gradually reduced to 42.5% and 28.5% at 30°C and 35°C, respectively. Whereas, the isolate CJMR193 resulted in a 54.8% and 43.0% growth reduction of the pathogen at these temperatures, respectively. At 30°C and 35°C, CJMR180 could cause 28.9% and 26.8% growth inhibitions of *Rhizoctonia* sp., respectively. Against *Sclerotium* sp., growth suppression by this isolate was 28.1% and 27.2%, respectively, at these two elevated temperatures. Interestingly, CJMR191 maintained its pathogen inhibition efficiency under all these conditions. It resulted in 70.6% to 75.4% growth inhibition of different pathogens at 25°C to 35°C. Moderately effective isolates, viz., CJMR180 and CJMR193 possess some special characteristics, such as plant growth promotion. Hence, a formulation comprising more than one isolate could be a better option. With this idea, the compatibility of the selected isolates was tested at varying temperatures. At lower temperatures of 25°C and 30°C, all three

isolates grew similarly, and no inhibition zone was formed. However, at 35°C, colony growth of CJMR180 and CJMR193 was reduced significantly.

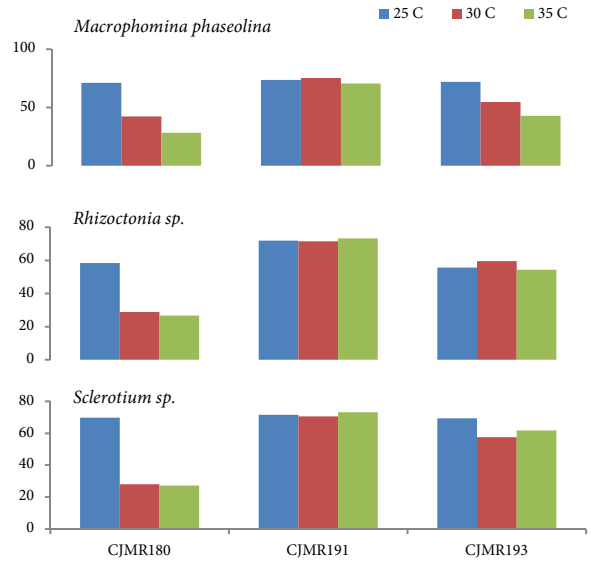


Fig. 68: Growth inhibition of *M. phaseolina*, *Rhizoctonia* sp. and *Sclerotium* sp. by *Trchoderma* isolates *in vitro* at varying temperatures

Antagonistic effect of Trichoderma on *M. phaseolina*: The effect of *Trichoderma* on *M. phaseolina* mycelia was also determined. For this, the morphology of *M. phaseolina* mycelia at the interaction zone with the bioagents was studied under the microscope (Fig. 69). It was observed that the bioagents caused de-melanisation, breakage at the cross wall, and disintegration of the pathogen's mycelia.

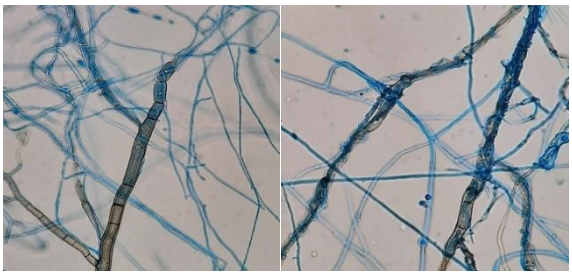


Fig. 69: Broken and disintegrating mycelia of *M. phaseolina* due to interaction with *Trchoderma* isolates

1.3 Integrated management of yellow mite of jute

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Project Code: In-house Project-JE 1.9

To study the combined effect of jute varieties, soil sulphur nutrition, acaricides, and entomopathogenic fungus various treatment combinations were evaluated under field conditions for bioefficacy evaluation against the jute yellow mite. The foliar application of Fenpyroximate 5EC @1.5 ml/lit and entomopathogenic formulations sprayed on two moderate mite tolerant and susceptible jute varieties (JRO-204 and JRO- 2407) sown in plots with soil applied sulphur and normal soil were evaluated for control of jute mite (Fig. 70). During the pre-treatment observation prior to foliar application of acaricides and entomopathogenic fungus, significantly fewer mites were recorded in the JRO 204 variety in sulphur applied treatments (20.10 and 20.11 mites/cm^2). At this stage, the significantly highest mite population prevailed in JRO 2407 sown in normal soil. The range of mite counts prior to the foliar application of acaricides varied from 22.31 to 29.89 mite/cm^2 in normal soil compared to 20.10 to 22.55/cm^2 in the crop grown in sulphur applied plots. The treatment effects of all three components had a significant impact on mite infestation. During both post-treatment periods, JRO 204 in S applied soil with foliar treatment of fenpyroximate 5EC @1.5 ml/lit had significantly lower mite infestation (12.85 and 7.10/cm^2) compared to 43.44 and 36.15/cm^2 in JRO 2407 variety with no sulphur and foliar spray of acaricides (Table 24). Although the combined use of *B. bassiana* and *I. fumosorosea* formulation against mites showed moderate promise, it reduced the mite infestation significantly less than the control. The impact of treatments was also reflected on

the yield. The JRO 204 variety produced the highest yield of 38.16 q/ha with preventive soil application of sulphur as well as foliar spray of fenpyroximate 5EC, which was comparable to the treatments containing sulphur and entomopathogenic fungus (36.64 q/ha). The yield of JRO 2407 with preventive soil applied sulphur and foliar sprays of chemical acaricides yielded 35.83q/ha being at par with the yield of the best treatment combination.

Table 24. Effect of treatment combinations on mite infestation and agronomic parameter of jute

Treatments	Mite /cm^2 (Pre-treatment)	Mite /cm^2 (post-treatment)	Mite /cm^2 (post-treatment)	Yield (q/ha)	Pt ht (cm)	Basal dia (mm)	Chlorophyll (SPAD)
T1- S0A1V1	25.11^{b}	27.20^{e}	23.19^{de}	38.16^{a}	353.10^{ab}	11.56^{ab}	31.02^{ab}
T2 - S0A1V2	21.77^{bc}	26.97^{e}	17.20^{fg}	34.63^{bcd}	341.06^{abcd}	10.03^{b}	33.17^{ab}
T3 -S0A2V1	20.97^{bc}	35.16^{c}	28.60^{bcd}	30.97^{efg}	331.20^{cd}	10.55^{ab}	31.68^{ab}
T4- S0A2V2	29.89^{a}	26.91^{e}	23.88^{de}	31.94^{def}	337.93^{abcd}	11.33^{ab}	28.26^{b}
T5- S0A3V1	23.88^{bc}	43.44^{a}	36.15^{a}	28.41^{g}	327.06^{d}	9.97^{b}	28.73^{b}
T6- S0A3V2	25.44^{b}	38.94^{b}	31.91^{ab}	29.04^{fg}	332.74^{bcd}	11.11^{ab}	27.69^{b}
T7- S1A1V1	22.22^{bc}	20.36^{f}	14.80^{g}	35.83^{abc}	355.16^{a}	11.79^{ab}	36.02^{a}
T8 -S1A1V2	20.10^{c}	12.85^{g}	7.01^{h}	38.16^{a}	358.86^{a}	12.17^{a}	36.37^{a}
T9 –S1A2V1	22.55^{bc}	26.98^{e}	25.61^{cde}	33.33^{cde}	354.80^{a}	11.48^{ab}	35.56^{a}
T10- S1A2V2	20.11^{c}	17.77^{f}	21.76^{ef}	36.64^{ab}	356.26^{a}	11.67^{ab}	36.11^{a}
T11- S1A3V1	24.95^{bc}	32.64^{cd}	29.54^{bc}	31.66^{efg}	347.46^{abcd}	11.65^{ab}	29.81^{ab}
T12- S1A3V2	22.31^{bc}	29.66^{de}	24.56^{cde}	32.87^{cde}	349.00^{abc}	11.21^{ab}	32.78^{ab}
CD (P=0.05)	3.98	3.17	5.12	3.01	18.52	1.75	5.72

V1-JRO-2407, V2-JRO-204: S1-S @ 45kg/ha, S0- No S; A1- Fenpyroximate 5EC @1.5 ml/lit A2- B. bassiana + I. fumosorosea @3g/l each); A3- control

Fig. 70: Experimental field at ICAR-CRIJAF farm

Tolerant varieties, soil-applied sulphur, and foliar sprays for mite control manifested a significant effect on plant growth character and chlorophyll content (SPAD). The plant height of the JRO 204 variety grown with preventive sulphur and fenpyroximate application was the highest (358.86 cm) at harvest, which was at par with other treatments except those without sulphur and acaricides. The basal diameter of the plants in different treatments also showed similar trends as in the case of plant height and varied from 9.9 mm in JRO 2407 without soil applied sulphur and foliar spray to 12.17 mm in JRO 204 with all the treatments. Similarly, chlorophyll content ranged from 29.81 to 36.37 SPAD in S treatments compared to 27.69 to 33.17 SPAD in non-S treatments. JRO 204 variety and acaricide application also had higher chlorophyll levels, which could be attributed to less mite infestation.

Evaluation of yellow mite management in farmers' fields: Integrated effect of moderate mite-tolerant jute variety (JRO 204) along with preventive soil sulphur nutrition and foliar spray of acaricide was evaluated under farmers' field condition at Beraberia (2 locations) and Mallikapur, North 24 Parganas. The role of soil-applied sulphur @ 45 kg/ha at the time of sowing and foliar application of fenpyroximate 5EC @ 1.5 ml/lit (45 and 55 DAS) individually and in combination could significantly suppress the population of yellow mite under farmers' field conditions, indicating a significant role for these components in regulating the mite population (Fig. 71, Fig. 72).

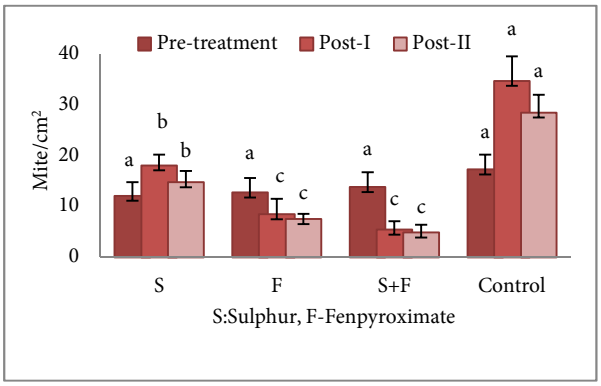

Fig. 71: Mean yellow mite infestation trend in farmers' field of three locations

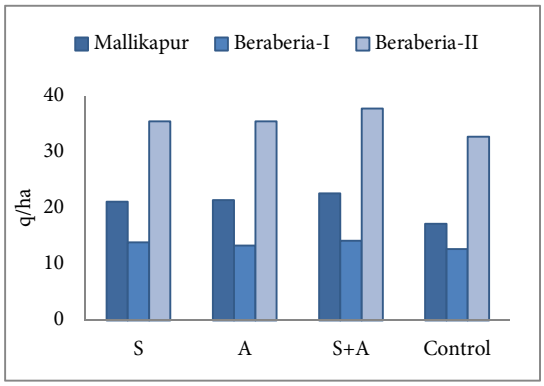

Fig. 72: Village-wise fibre yield (q/ha) of jute

During the first post treatment observation on mite density at 3 days after the first spray on 45 DAS, the mite population among the treatments varied from 5.47 to 18.13 mites/cm^2 leaf area, being significantly less than the control (34.80/cm^2). Foliar application of fenpyroximate 5EC as well as soil sulphur application resulted in significantly fewer mites (5.47/cm^2) compared to only foliar spray of acaricide (8.50/cm^2). Suprox alone was also effective, reducing mite infestation by 50% compared to the untreated control. A similar trend in the treatments' efficacy against the jute mite was observed in subsequent observations. The pest management components, comprising soil sulphur and acaricide application, exhibited superior performance on yield. Among the three villages, the highest yield of 37.70 q/ha were obtained with this treatment at Beraberia II village. In this village, the yields in the control plot was 32.80 q/ha (Fig. 73).

Fig. 73: Experiment site at Mallikapur and Beraberia-II

Evaluation of botanicals and entomopathogenic formulations against the yellow mite of jute (Glass house experiment): The effect of botanicals and entomopathogenic fungal formulations was evaluated under glass house conditions against the jute yellow mite with the objective to find out alternative to chemical acaricides. The potted plants of jute (Cv. JRO-8432) were uniformly sprayed twice at 30 and 65 DAS by an automizer before counting the mite population level. The pre-treatment mite population varied from 34.89 to 44.41 mite/cm^2 which reduced significantly after the spray. During the first observation after treatment, at 2 days after the spray, significantly lower and higher mite populations were observed in the fenpyroximate and control plots, with 9.33 and 27.67 mite/cm^2 respectively (Fig. 74). Among the botanicals, insecticidal neem soap showed better performance (13.67 mite/cm^2) followed by neem oil (17.66/cm^2). In subsequent observation, also fenpyroximate suppressed the mite population to significant level (7.22/cm^2) followed by neem soap (11.77/cm^2) and neem oil (12.00/cm^2).

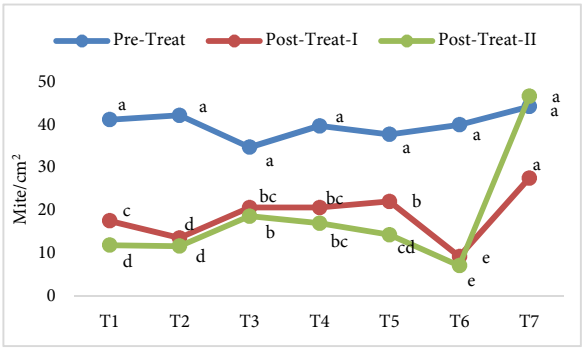

Fig. 74: Level of mite population in jute sprayed with botanical, entomopathogenic formulation and acaricide

Field experiment: The same treatments were evaluated under field conditions. In terms of mite infestation under field conditions, fenpyroximate recorded the significantly lowest values (19.77 and 10.66/cm^2), followed by insecticidal neem soap application (29.55 and 15.55/cm^2). The damage grade in the treatments was significantly less (0.58 to 1.5) than the control (Table 25). The damage reduction and population suppression due to the application of acaricides and botanicals enhanced the yield. Acaricide treatment recorded the significantly highest yield (34.66 q/ha), being at par with insecticidal neem soap application (32.50 q/ha).

Table 25. Yellow mite infestation, damage and yield under different botanical and entomopathogenic formulations in the field

Treatments	Mite density/cm^2 leaf		Damage grade	Yield (q/ha)
	Post treat-I	Post treat-II		
Neem oil-10000 ppm(2.5ml/l)	30.33^{bc}	21.88^{c}	1.5^{b}	30.18^{bc}
Insecticidal Neem Soap (5g/l)	29.55^{bc}	15.55^{d}	1.08^{bcd}	32.5^{ab}
NSKE (4%)	33.11^{ab}	16.22^{d}	0.83^{cd}	31.58^{b}
Neem+ Pongamia (3ml/lit)	38.33^{a}	25.88^{b}	1.5^{b}	31.50^{b}
Bb+Pf (2gm+2gm/l)	28.44^{bc}	25.22^{bc}	1.33^{bc}	30.33^{bc}
Fenpyroximate (1.5ml/lit)	19.77^{c}	10.66^{e}	0.58^{d}	34.66^{a}
Control	40.52^{a}	36.84^{a}	2.5^{a}	27.83^{c}
CD (P=0.05)	7.47	3.73	0.50	2.61

1.4 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

Standardization of seed treatment component for the IPM module of jute: 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 evaluated under field condition. The incidence of stem

rot and damages caused by different insect pests were lower in combined treatments than using single pesticide. Among the two fungicides and insecticide combinations, carbendazim + imidacloprid was superior over tebuconazole + chloropyriphos with dry fibre yields of 33.9 and 27.9 q/ha, respectively. Seed treatment with *Trichoderma* reduced stem rot to 7.6%, and it improved its performance against stem rot disease and different sucking and leaf eating insect pests when combined with different insecticides. The application of bleaching powder to the soil at a rate of 30 kg/ha 7 days before sowing was also very promising, as it reduced stem rot to 4.8%. Simultaneous treatment of soil with bleaching powder and seed with carbendazim + imidacloprid was the best of all treatments tested, reducing stem rot to 2.3 from 24.3% in control, yellow mite to 15.2 from 23.9% in control, and increasing highest dry fibre yield by 58.7% to 36.1 q/ha (Table 26, Fig. 75).

Table 26. Effect of combined seed treatment on stem rot disease and different sucking and leaf eating insect pests of jute

Treatments	Stem rot (%)	Yellow mite (%)	Semilooper (%)	Fibre Yield (q/ha)
T1- Carbendazim 50% WP @ 2 g/kg	3.90 (11.40)*	8.30 (16.70)	6.90 (15.30)	31.60
T2- Imidacloprid @4 g/kg seed	15.70 (23.30)	6.30 (14.50)	3.80 (11.20)	27.90
T3- T1 + T2	4.0 0(11.50)	5.90 (13.90)	4.10 (11.40)	33.90
T4- Chloropyriphos @4 ml/kg seed	16.30 (23.80)	6.30 (14.60)	3.90 (11.40)	26.50
T5- Tebuconazole @2 ml/kg seed	4.90 (12.80)	14.60 (22.40)	4.40 (12.10)	25.80
T6- T4 + T5	4.50 (12.20)	6.40 (14.70)	3.70 (11.10)	27.90
T7-*Trichoderma viride* @10 g/kg	7.6 0(16.00)	24.20 (29.50)	7.40 (15.80)	25.70
T8- T7+T2	8.30 (16.70)	6.30 (14.50)	4.10 (11.70)	26.50
T9- T7+T4	7.30 (15.70)	5.00 (12.80)	4.20 (11.90)	26.10
T10- Bleaching powder @30 kg/ha 7 DBS	4.80 (12.60)	10.90 (19.30)	7.90 (16.30)	28.60
T11- T10+T3	2.30	5.20 (13.10)	3.90 (11.40)	36.10
T12- Chlorothalonil	6.40 (14.60)	22.10 (28.00)	7.60 (16.00)	25.60
T13- Control	24.30 (29.50)	23.90 (29.20)	8.30 (16.7)	22.70
CD (P=0.05%)	1.4	2.90	2.10	2.10

**Figures in the parenthesis are arc sine transformed values*

Development of IPM module of jute and mesta : In order to find an IPM module for jute and mesta, field experiments were carried out with factorial RBD with three factors: two varieties, namely, JRO 204 (V1) and JRO 2407(V2) of jute and HS 4288 (V1) and HC 583 (V2) of mesta, two IPM modules (M1 and M2), and two sowing dates (S1: 6 April, S_2 : 6 May- for jute ; S1: 6 May , S_2 : 6 June- for mesta). M1 consisted of bio-IPM (soil application of *Pseudomonas fluorescens* + ST with *Trichoderma* + 1 spray of neem formulation @ 10000 ppm @ 3ml/lit against mites + 1 spray of Bt formulation 2 ml/lit against lepidopteran pests); and M2 consisted of chemical-IPM (soil application of bleaching powder @ 30 kg/ha + ST with carbendazim 50 WP @ 2 g/kg and imidacloprid @ 4 g/kg seed + spraying of spiromesifen 240 SC @ 0.7 ml/lit at 35 DAS + spraying of tebucanazole @ 0.15% at 45 DAS for stem rot.

Jute: Early sowing in the March with chemical IPM module recorded a lowest stem rot incidence in both the varieties (JRO 204 with 6.8, JRO 2407 with 4.2%). However, late sowing with similar condition showed stem rot to 8.4% in JRO 204 and 7.3 in JRO 2407. Performance of bio-IPM module was lower than chemical IPM module in both the varieties and sowing conditions. In case early sowing, 9.7% stem rot was noted in JRO 204 and 8.9% in JRO 2407. In late sowing, stem rot of 8.7% was observed in JRO 204 and 9.8% in JRO 2407. Early sowing with variety JRO 2407

with chemical IPM module significantly decreased the stem rot incidence compared to late sowing of JRO 204 using bio-IPM module (Table 27).

Mesta: Incidence of foot and stem rot was more in HS 4288 (20.6% and 32.1%) than HC 583 (9.9% and 14%) in both the sowing dates. On the contrary, collar rot was more prevalent in HC 583 (13.4% and 20.2%) than HS 4288 (10.7% and16%) in two sowing conditions. HS varieties were more susceptible to foot and stem rot than collar rot, whereas, HC varieties were more prone to collar rot than foot and stem rot. Sowing late makes both mesta varieties more susceptible to collar rot and foot and stem rot. When two modules were compared, it was observed that chemical IPM performed better with low collar rot (7.3% and 9.7%) and foot and stem rot (7.6% and 4%) compared with bio-IPM module with more collar rot (8.9% and10.1%) and foot and stem rot (11.9% and 6.8%) respectively in two varieties. In early sown mesta crop, chemo-IPM module was better with low diseases compared to higher incidences in case of bio-IPM module irrespective of two varieties (Table 27).

Table 27. Performance of chemical and bio-based IPM modules on diseases of jute and mesta

Treatments	Jute crop	Mesta crop	
	Stem rot % *	Foot and stem rot % *	Collar rot % *
S1V1M1	9.7 (11.8)	7.6 (16.0)	7.3 (15.6)
S1V1M2	6.8 (18.3)	11.9 (20.1)	8.9 (17.3)
S1V2M1	8.9 (18.1)	4.0 (11.5)	9.7 (18.1)
S1V2M2	4.2 (16.9)	6.8 (15.1)	10.1 (18.3)
S2V1M1	8.7 (21.5)	16.2 (23.7)	10.1 (18.5)
S2V1M2	8.4 (23.4)	12.2 (20.5)	12.4 (20.6)
S2V2M1	9.8 (20.0)	9.0 (17.5)	15.7 (23.4)
S2V2M2	7.3 (26.1)	11.9 (20.1)	17.8 (24.9)
S1 V1M0	13.4 (15.7)	20.6 (27.0)	10.7 (19.1)
S1 V2M0	11.7 (15.1)	9.9 (18.3)	13.4 (21.5)
S2 V1M0	19.4 (17.4)	32.1 (34.5)	16.0 (23.6)
S2 V2M0	15.8 (17.1)	14.0 (22.0)	20.2) (26.7)
CD (5%)			
Sowing	0.43	0.92	0.34
Variety	0.43	0.92	0.34
Module	0.53	1.14	0.42
Sowing * Variety	0.61	NS	0.48
Sowing * Module	0.75	1.60	0.59
Variety* Module	0.75	1.60	0.59
Sowing * Variety *Module	1.06	2.26	0.84

Fig. 75: Trials of IPM module for jute in Research Farm of ICAR-CRIJAF

1.5 Identification of microbial entomopathogens for management of major lepidopteran pests of jute

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Project code: In-house Project- JE 2.0

Larval bioassays of *spobNPV*: Leaf dip bioassay of *spobNPV* with 2nd, 3rd, and 4th instar larvae of *Spilosoma obliqua* revealed that the LC_{50} value against second instar *S. obliqua* was $2.42x10^4$, $3.09x10^6$ and $5.05x10^7$ POB's/ml, respectively after 72 hours of treatment.

Table 28. Larval bioassay with *Spob*NPV against 2nd, 3rd and 4th instar larvae of *S.obliqua*

Larval Instar	LC_{50} (POB's/ml)	Fiducial Limits		Slope
		Lower Limit	Upper Limit	
2nd Instar	$2.42x10^4$	$1.24x10^4$	$4.99x10^4$	0.87
3rd Instar	$3.09x10^6$	$9.75x10^5$	$1.03x10^7$	0.56
4th Instar	$5.05x10^7$	$4.11x10^6$	$9.23x10^7$	0.31

Field efficacy of *Spob*NPV: Field efficacy of *Spob*NPV ($3.54x10^8$ POB's/ml @2ml/L) was compared to *Bacillus thuringiensis* var. *kurstaki* (*Btk*) NCIM2514 formulation @ 2 ml/L and conventional insecticide chlorpyriphos (20% EC @2 ml/L) in a field experiment. One day before spraying, the number of larvae from 50 randomly selected plants was counted as a pre-treatment observation. *SpobNPV* at 3.54 X 10^8 OBs/ml was sprayed at 2 ml/l in combination with the additives molasses (5%), glycerol (10%), Sticker Plus (0.1%), and Btk NCIM2514. Post treatment observations on the number of *S. obliqua* larvae were recorded at 2, 4 and 7 days after spray applications from 50 randomly selected plants.

The field efficacy of chlorpyriphos (20 EC) and spobNPV were comparable in terms of larvae per plant at 2 DAS and significantly different from Bt var. *Kurstaki* and control treatments. Likewise, at 4 and 7 DAS, treatment with chlorpyriphos 20 EC was significantly different from other treatments, whereas treatments *for spobNPV* and *Bt* var. *kurstaki* were at par with each other but significantly different from the control treatment (Table 28). With regards to percent larval reduction, chlorpyriphos 20 EC was effective in causing larval mortality with 61.03%, 78.70%, and 94.68% reduction at 2, 4, and 7 days after spray. It was on par with *Spob*NPV at 2 and 7 DAS and significantly different from *Bt* var. *Kurstaki* and control treatments which was envisaged with least number of larvae/plant. Though *Spob*NPV caused larval reductions of 50.52%, 63.25% and 82.91% at 2, 4, and 7 days after spray, it was found to be at par with *Bt* var. *Kurstaki*. Despite having a larval reduction of 27.51%, 57.56%, and 75.66% at 2, 4, and 7 days after spray, Bt var. *kurstaki* was at par with the control treatment at 2 days after spray but significantly different at 4 and 7 days after spray (Table 29).

Table 29. Field evaluation of *Spob*NPV against *Spilosoma obliqua* infesting jute crop

Concentration	Pre-count	Larvae/plant Days After Spray			Per cent larval reduction		
		2DAS	4DAS	7DAS	2DAS	4DAS	7DAS
SpobNPV ($3.54x10^8$ POB's/ml) @ 2ml/L	46.67^A ±5.24	23.00^C ±3.46	18.67^B ±0.88	9.67^B ±1.20	50.52^{AB} ±11.54	63.25^B ±3.94	82.91^{AB} ±5.29
***Bacillus thuringiensis kurstaki* NCIM2514@2ml/L**	45.33^A ±4.10	33.67^B ±3.71	20.67^B ±0.88	13.33^B ±2.60	27.51^{BC} ±12.02	57.56^B ±6.96	75.66^B ±8.95
Chlorpyriphos 20EC @2ml/L	47.67^A ±2.40	19.33^C ±0.88	11.33^C ±0.88	3.33^C ±0.33	61.03^A ±4.07	78.70^A ±0.35	94.68 ^{A}±0.66
Control	45.00^A ±3.51	47.33^A ±3.53	50.00^A ±3.21	59.33^A ±1.20	-	-	-
C.D. (P=0.05)		6.79	4.17	4.81	23.68	11.95	15.16

Means followed by different letters within a row indicate significant differences (P < 0.05; LSD)

2 Screening of Host Plant Resistance

2.2 Screening of *tossa* jute germplasms against stem rot

S.K. Sarkar

Project code: In-house Project- JB1.1

Based on the performance of 60 germplasms under artificial inoculation with *Macrophomina phaseolina* causing stem rot at Barrackpore, during the last three years twelve germplasms, namely OIN-118, OIN-119, OIN-156, OIN-113, OIJ-62, OIN-114, OIN 140, OIJ-60, OIN-161, OIJ 77, OIN 159, and OIN 158, were shortlisted for field evaluation at the natural epiphytotic condition (hot spot) at Ramie Research Station, Sorbhog (Fig. 76-77).

Fig. 76: Field view of the experiment at RRS Sorbhog

The disease incidence up to 50 days after sowing, varies from 31–52%. Such high incidence at this stage may be due to high rainfall after sowing. Thereafter, the disease progress was slow, with no increase in disease incidence in OIJ 77, OIN 140, and OIN 118. Considering the overall performance of six germplasms, namely OIN 119, OIJ 77, OIJ 113, OIN 159, OIN 140, and OIN 118 exhibited significant resistance against the pathogen under field condition (Table 30).

Table 30. Progress of stem rot of jute under natural epiphytotic condition (hot spot) at RRS, Sorbhog, Assam

Germplasm	Incidence of stem rot (%)				
	50 DAS	60 DAS	70 DAS	80 DAS	90 DAS
OIN 119	31.25	31.25	37.50	37.50	37.50
OIJ 77	38.98	38.98	38.98	38.98	38.98
OIJ 113	31.76	32.94	32.94	35.29	40.00
OIN 159	32.84	32.84	32.84	32.84	40.30
OIN 140	41.67	41.67	41.67	41.67	41.67
OIN 118	50.00	50.00	50.00	50.00	50.00
OIJ 62	48.10	49.37	50.63	50.63	50.63
OIN 158	49.33	49.33	50.67	50.67	50.67
OIN 156	52.24	52.24	52.24	52.24	53.73
OIN 161	50.00	50.00	51.16	53.49	54.65
OIN 114	50.56	50.56	53.93	55.06	59.55
OIJ 60	48.05	49.35	50.65	61.04	72.73

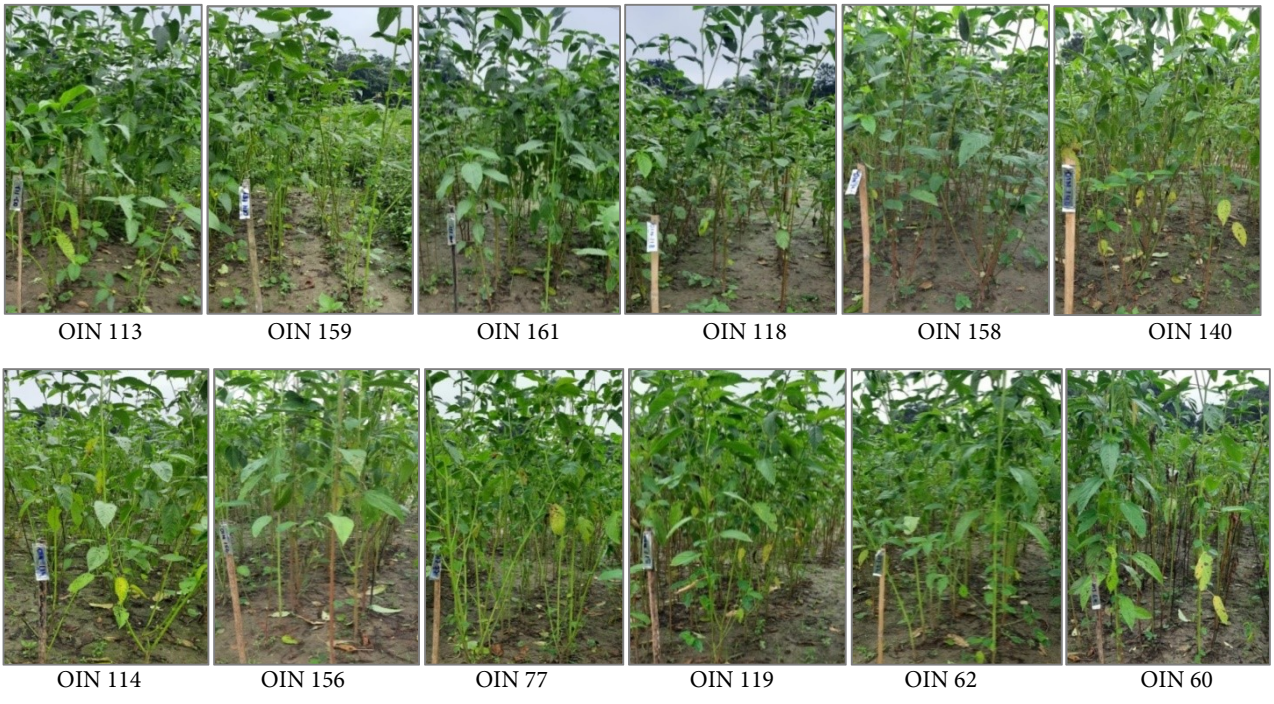

Fig. 77: Incidence of stem rot of jute in different germplasm of jute

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

S.K. Sarkar, K. Mandal, Anil Kumar and Kajal Das

Project code: In-house Project- JM 9.5

Ninety-six germplasms, including twelve shortlisted germplasms, earlier tested at Barrackpore under sick plot conditions during the year 2021 were evaluated at Ramie Research Station Sorbhog (Fig. 78) for field testing under natural epiphytotic conditions (hot spot). The results showed that the disease incidence varies from 35.4 to 54 percent up to 50 days after sowing. The final disease incidence at 90 days after sowing varies from 26.04% (OIN 148) to 91.14% (OIN 237). The least affected germplasm (incidence 26.04–39.66%) are OIN 148 (26.04%), OIN 209 (38.3%), OIN 176 (38.7%), OIN 167(39.19%), OIN 154 (36.8%), and OIN 197 (39.66%).

Fig. 78: Severe incidence of stem rots of jute under natural epiphytotic condition at RRS, Sorbhog (Assam)

3 Informatics for Pest and Disease Infestation Prediction

3.1 Risk assessment through modelling of major pests and diseases of jute under climate change scenario

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

Project code: In-house Project- JE 5.2

Different models were fitted to obtain the development rate r(T) of different immature stages (egg, larva, and pupa) of the indigo caterpillar (*S. litura*), a polyphagous pest of jute. Sharpe and DeMichele model was used for estimating the nonlinearity of egg development. The Logan model was used to estimate the nonlinearity in larvae development rate, and a modified version of the Janish-1 model was used to describe the effect of temperature on pupae development rate. The expressions of the models are presented in Table 31. A GIS map of the generation index (GI) and establishment risk index (ERI) of the indigo caterpillar under different climate change scenarios, viz., RCP 2.6, RCP 4.8, RCP 6.0, and RCP 8.5, were developed for the periods 2021–40 and 2061–80. ERI for the period 2021–40 under different climate change scenarios has been shown in Fig. 79. From the figure, it can be observed that due to the increase in temperature,

infestations of indigo caterpillars will be more common in the future under all the climate change scenarios, and the occurrence of indigo caterpillars can be observed in different areas where at present the pest is not that significant.

Table 31. Models and their parameters fitted to development rate for immature life stages of indigo caterpillar

Life stage	Model	Parameters	F value	df	P	R-sq	R-sq (adj)
Egg	Sharpe and DeMichele model $r(T) = \frac{P \times \frac{T}{T_0} \times e^{\left[\frac{\Delta H_A}{R}\left(\frac{1}{T_0} - \frac{1}{T}\right)\right]}}{1 + e^{\left[\frac{\Delta H_L}{R}\left(\frac{1}{T_L} - \frac{1}{T}\right)\right]}}$	P: 49.15 (±0.42) H_A: -5641.12 (±0.24) H_L: -25981.32(±0.21) T_L: 241.16(±29.45)	56.21	3,5	<0.01	0.47	0.45
Larvae	Logan model $r(T) = P \times e^{\left(b(T-T_b) - e^{\left(\frac{b(T-T_b)}{DT_b}\right)}\right)}$	P: 0.87 (±0.13) B: 0.24 (±0.59) T_b: 7.94 (±0.67) DT_b: 4.32 (±1.60)	17.03	3,4	0.01	0.31	0.29
Pupa	Janish-1 model $r(T) = \frac{2}{D_{\min}\left(e^{K(T-T_{opt})} + e^{-K(T-T_{opt})}\right)}$	D_{min}: 5.98 (±0.28) T_{opt}: 30.54 (±1.83) K: 0.65 (±0.11)	49.01	2,2	0.02	0.43	4.42

R is the universal gas constant (1.987 cal degree^{-1} mol^{-1}), P, ΔH_A, ΔH_L, T_L, B, T_b, and DTb, D_{min}, K, and T_{opt} are the parameters. In all cases e is the natural exponential

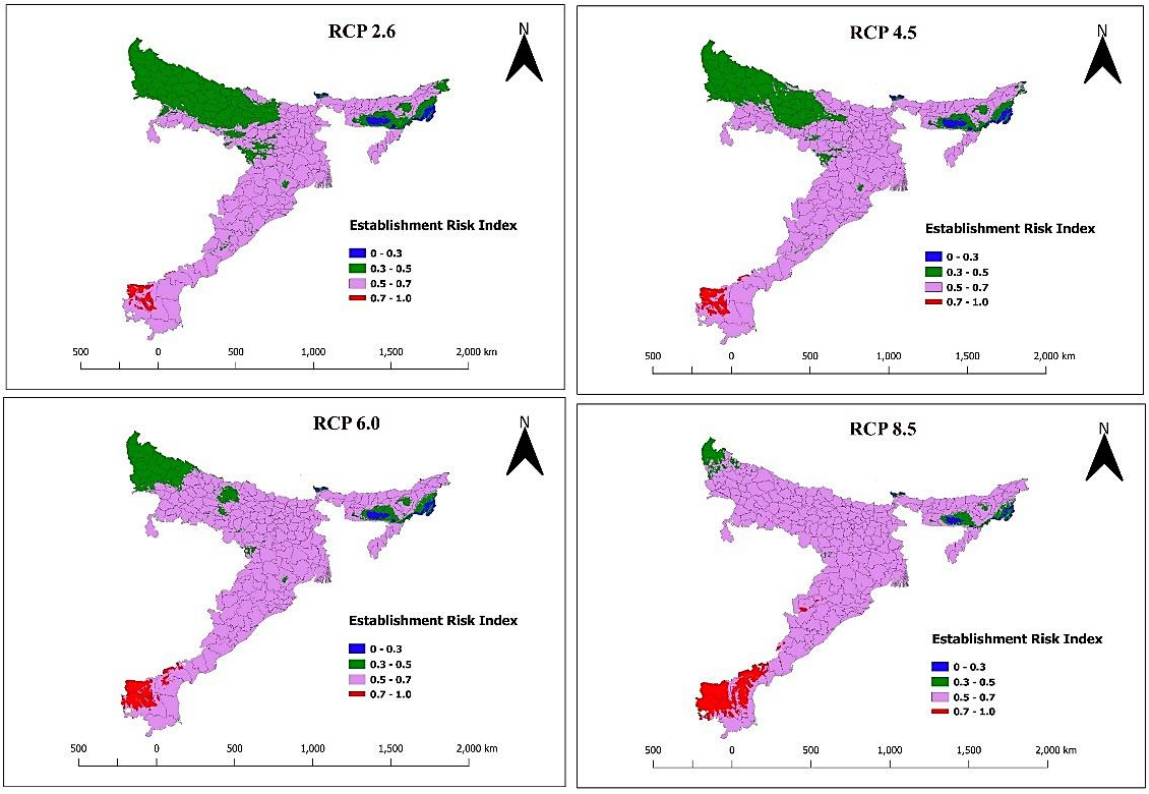

Fig. 79: Establishment risk index of indigo caterpillar under different climate change scenarios during 2021-40

3.2 Decision support system for pest management in jute

V. Ramesh Babu, N.M. Alam, S.K. Sarkar and S.K. Pandey

Project code: In-house Project-JE 2.3

A Decision Support System (DSS) for disease management in jute with the aim of identifying and integrating weather parameters vis-à-vis crop phenology and developing disease forewarning models in the 24 North Parganas district of West Bengal was initiated. Data encompassing weather-related issues (rainfall, humidity, temperature, daylight hours), abiotic stress factors (critical stages of irrigation, drought periods), biotic stress factors (critical stages of disease incidence, management issues), and crop-related factors (varieties, crop phenology) in conjunction with management practices has been collected to develop a database in SQL Software (2008 or 12.0). This web-based decision support system was made in bilingual mode to provide the best pest and disease management practices.

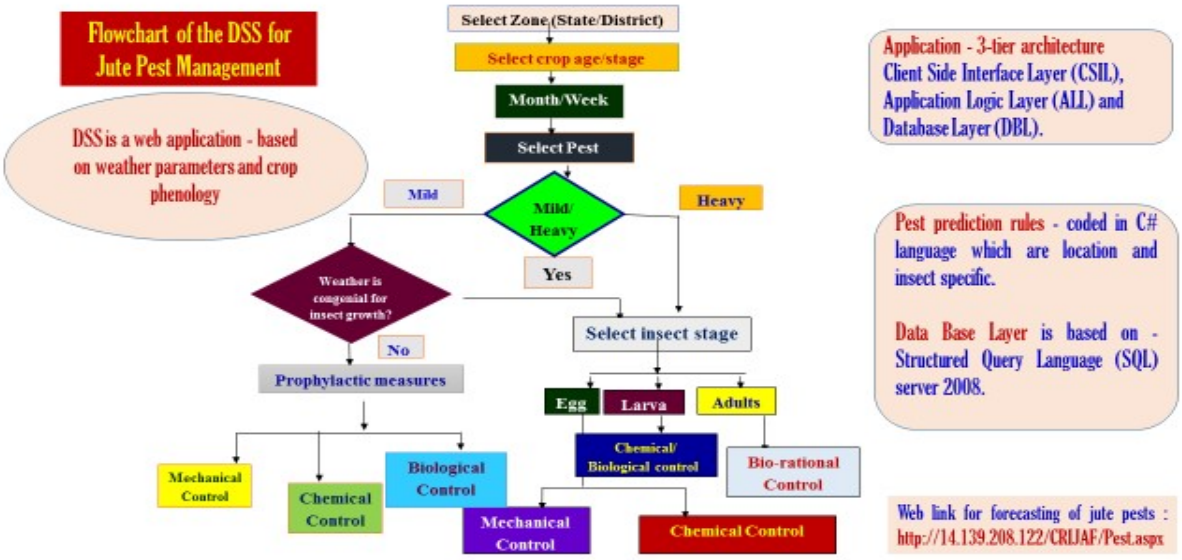

Fig. 80: Flowchart of DSS for jute pest management

Agro-advisory services on jute and allied fibre crops for farmers and extension personnel

Eco-farming model of ICAR-CRIJAF for in-situ retting of jute and mesta fibre and growing fruits, vegetables, fishes, poultry, etc.

AGRICULTURAL EXTENSION

Overview

Jute and allied fiber crops are primarily grown as a rainfed crop. The majority of growers are small and marginal with limited resources. The traditional method of growing such fibre crops resulted in low-quality fibre production. Farmers are confronted with growing agricultural costs, which result in economic losses. Farmers working in jute and allied fibre farming receive knowledge, skills, and desired direction from the institute's Agricultural Extension Section, which helps them to become more efficient and capable of taking on improved production technologies.

Priorities & Thrust Areas

- Development of research methodological tools including scales and indices for estimation of socio-personal, socio-economic and psychological variables.
- Development of convergence led, ICT mediated Extension Models for multi-stakeholder participation, effective communication and faster diffusion of improved farming technologies.
- Research for promotion of agri-business and rural entrepreneurship and impact assessment.
- Development of innovative educational and training methodologies and entrepreneurship to enhance off-farm income.
- Climate change research in social and livelihood perspectives.

Research Highlights of 2022

- Doubling Farmers Income by deployment of CRIJAF technologies through central schemes like NFSM, Jute-ICARE, SCSP and TSP.
- Skill-development programmes on value-added diversified jute products, particularly jute fibre and fabric-based handicraft items as a substitute of plastics and synthetics.
- Linkage with the Farmers Producers Organisation (FPO) by forming the Self Help Groups (SGHs) and Farmers Interest Groups (FIGs) for easy market access.
- Agro-advisories to mitigate the yield gap in jute and allied fibre crops in West Bengal, Assam, Bihar, Odisha, and Meghalaya
- Constraint analysis of farmers and industry on fibre production, processing and marketing.

Extension Research

Technological and economic empowerment of SC farm families to mitigate the impact of Covid-19 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 socio-economic status of farmers during the post COVID period by promoting the best package of practices of jute-based farming, the value chain in jute and entrepreneurship development among farm women. For assessing the suitable jute production technologies, six different jute varieties, like JRO 204, JRO BA3, JROMU 1, JRO 524, JRO 2407, and CO 58, were demonstrated in the project area. For jute line sowing, CRIJAF-multi-row seed drill demonstration was performed. Around 65 percent of farmers had followed line sowing in jute. CRIJAF-Single wheel jute weeder was used in the package which helped the farmers in reducing drudgery and the number of labourers involved in weeding operation. The use of CRIJAF Sona was demonstrated in jute retting for fibre quality improvement. The jute variety JRO BA3 yielded the highest (55.18 q/ha) among the different varieties demonstrated, followed by JRO 2407 (48.24 q/ha), CO 58 (47.15 q/ha), JRO 204 (45.64 q/ha), JROMU1 (44.46 q/ha), and JRO 524 (41.99 q/ha). The cost savings and profit in terms of all the jute production technologies introduced in the villages were analysed (Table 33). It was found that the additional income (₹ 46425/ha) could obtain by saving costs and improving yield.

A value chain model for jute and diversified products was finalised (Fig. 81), based on which the project activities related to value chain establishment were initiated. The farmers in the project area were grouped into seven Farmers Interest Groups (FIGs) based on their location which were brought under the existing FPO in the locality, Sabka Apna Farmer Producer Company Limited. In the year 2022, one SHG of farm women was formed, bringing the total to four SHGs. The group was also trained on jute value addition and linked with FPO for easy access to marketing.

Table 33. Economic benefit to farmers by adoption of different jute production technologies

Sl. No.	Topic/operations	Traditional method	Improved method	Savings	Savings (in ₹)
1.	Seed requirement (kg/ha)	5.625	3.375	2.625	300
2.	Labour requirement during sowing (per ha)	7.5	7.5	0	0
3.	Weeding (man-days/ha)	67.5	22.5	45	11250
4.	Harvesting (man-days/ha)	75	67.5	7.5	3000
5.	Fibre extraction (man-days/ha)	75	67.5	7.5	1875
6.	Fibre production (q/ha)	37.5	43.5	6.0	30000
				Total	46425

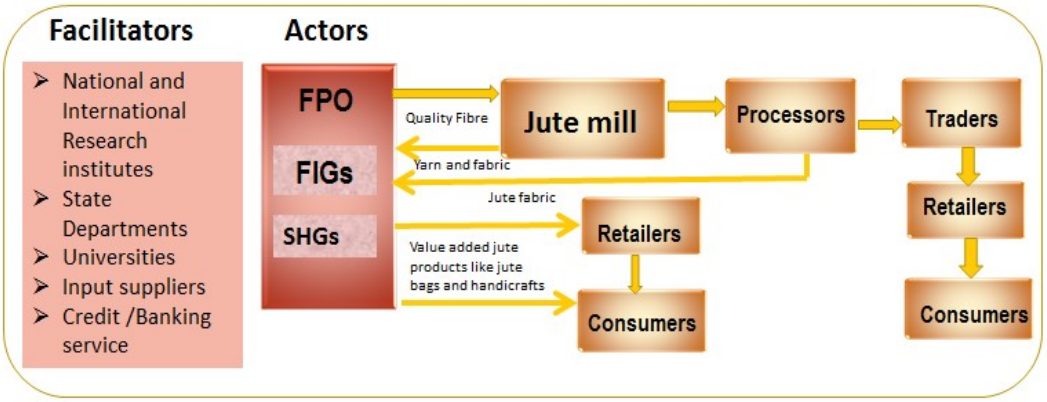

Fig. 81: Value chain model in jute and jute diversified products involving FIGs and SHGs

SHG formed in Beraberia village, North 24 Parganas

Farmer Scientist Interaction with SHG leaders

Visit of multidisciplinary team at demonstration site, Beraberia, North 24 Parganas, W.B.

Crop cutting experiment at Ratanpur village , North 24 Parganas, W.B.

Director, ICAR-CRIJAF interacting with the FIG members of Ratanpur and Beraberia villages, W.B.

Distribution of farm implements to SC farmers under DST SEED Project by Director, ICAR-CRIJAF

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

On-field information from the project locations under Jute-ICARE programme was collected through Google-based form called JAF Kisan. The link to this Google form was provided to all the master trainers (MTs) under Jute-ICARE. The overall technology gap as well as extension gap in West Bengal, Assam, Bihar, Odisha and Meghalaya were assessed (Table 34 and Fig. 82-85). In West Bengal, the maximum extension gap was found in Murshidabad (6.52 q/ha) and Uttar Dinajpur (6.25 q/ha), while the maximum technology gap was found in Malda (7.45 q/ha) and Dakhin Dinajpur (7.25 q/ha). Similarly, in Assam, the technology gap was maximum at South Salmara (7.65 q/ha) and West Karbi Anglong (7.24 q/ha), while the extension gap was maximum at Bongaigaon (6.31 q/ha), followed by South Salmara (6.28 q/ha). In Bihar, the technology gap was maximum at Araria (8.20 q/ha) and Katihar (7.84 q/ha), while the extension gap was more at Supaul (6.08 q/ha) and Kishanganj (5.61 q/ha). In the case of Odisha, the maximum technology gap was in Cuttack (8.17 q/ha), while the extension gap was more in Jajpur (6.03 q/ha).

Table 34. Jute yield gap at different jute growing states of India

District	Yield (q/ha) in Farmers' practice	Yield (q/ha) in field Demonstration	Potential yield (q/ha)	Technology gap (q/ha)	Extension gap (q/ha)
ASSAM					
Nagaon	30.17	34.90	40.00	5.10	4.73
Morigaon	29.40	33.87	40.00	6.13	4.47
Barpeta	28.92	34.55	40.00	5.45	5.63
West Karbi Anglong	27.31	32.76	40.00	7.24	5.45
Goalpara	27.45	32.92	40.00	7.08	5.47
South Salmara	26.07	32.35	40.00	7.65	6.28
Dhubri	28.90	34.78	40.00	5.22	5.88
Bongaigaon	26.88	33.19	40.00	6.81	6.31
BIHAR					
Supaul	26.36	33.04	40.00	7.56	6.08
Kishanganj	27.15	32.76	40.00	7.24	5.61
Araria	26.48	33.10	40.00	8.20	5.32
Madhepura	28.35	32.06	40.00	7.14	4.51
Katihar	27.85	31.96	40.00	7.84	4.31
MEGHALAYA					
Tura	25.76	31.78	40.00	8.22	6.02
ODISHA					
Cuttack	26.72	31.83	40.00	8.17	5.11
Jajpur	26.39	32.42	40.00	7.58	6.03
WEST BENGAL					
Murshidabad	27.05	33.57	40.00	06.43	06.52
Hooghly	29.08	34.72	40.00	05.28	05.64
Dakhin Dinajpur	26.54	32.65	40.00	07.35	05.11
Nadia	30.25	35.87	40.00	04.13	05.62
Uttar Dinajpur	27.58	33.83	40.00	06.17	06.25
Malda	27.18	32.55	40.00	07.45	05.37
North 24 Pgs.	29.85	35.75	40.00	04.25	05. 90

The technology gap observed may be attributed to 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 the trend. Hence, to narrow down the yield gap, location-specific recommendations on improved agro-technologies are required. Increased use of improved production technologies can narrow down the extension gap between demonstration yield and farmer yield. As a part of the strategies to mitigate the yield gap, farmers were advised through regular agro-advisory issued by ICAR-CRIJAF to adopt the stage specific operations including proper drainage of water in the field and reduce the negative effects of water stagnation on crop growth.

Technology gap (q / ha), i.e. (yield gap I) = Potential yield – Demonstration yield

Extension gap (q / ha), i.e. (yield gap II) = Demonstration yield – Farmer's practice yield

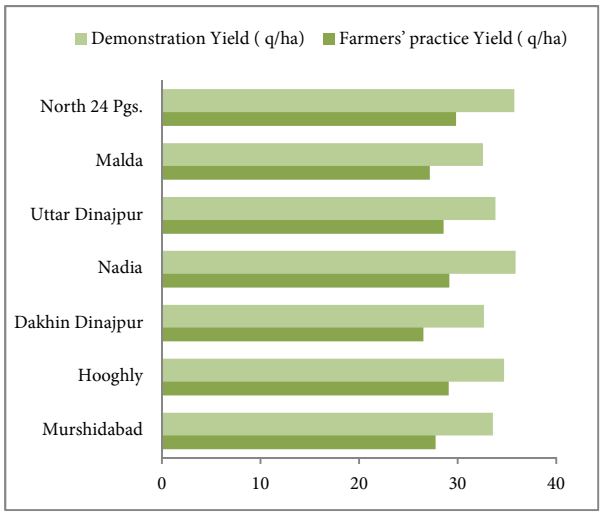

Fig. 82: Yield gap in West Bengal

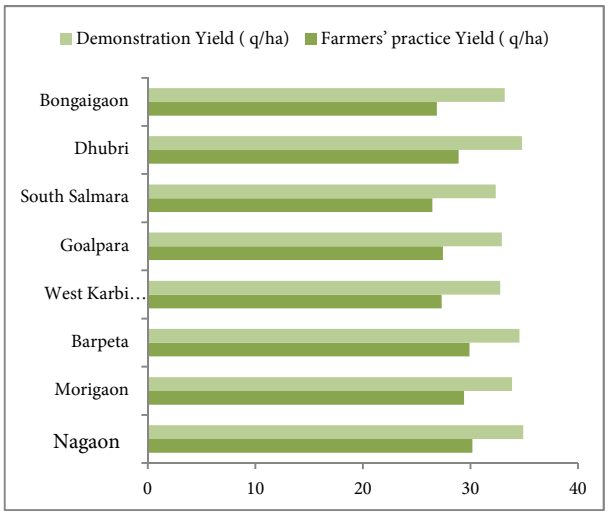

Fig. 83: Yield gap in Assam

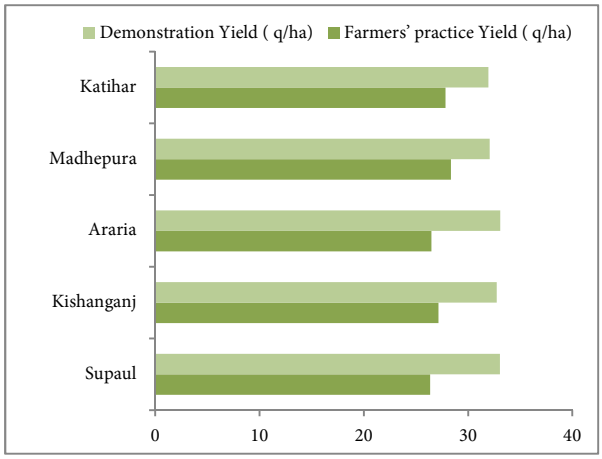

Fig. 84: Yield gap in Bihar

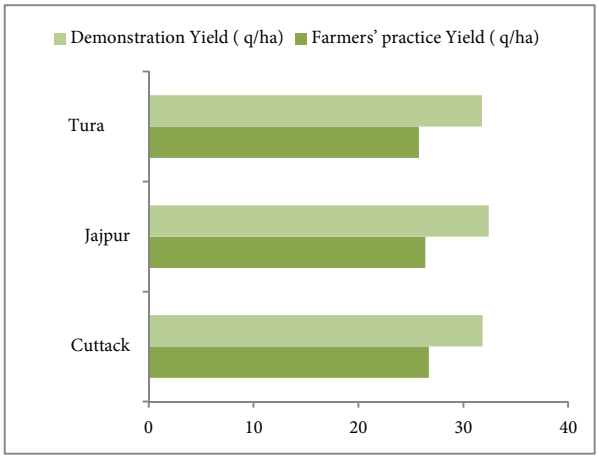

Fig. 85: Yield gap in Meghalaya and Odisha

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

The objective of the project was to identify possible jute-based diversified products as a substitute for plastics and synthetics and impart skills among SHGs for developing jute-based products, entrepreneurship development, and socio-economic empowerment. In the year 2022, focus was given to jute fibre and fabric-based handicraft decorative items (Fig. 86). The fibre requirement for each item was also calculated. These jute diversified products if promoted can replace plastics and synthetics. Based on a foreseeable calculation, the requirement of each diversified item identified was projected based on the total households in our country and the income-earning population (domestic market), which was found to be to the tune of 30 lakh bales. The socio-economic status of the farm women groups was studied using the revised Udai Pareek socio-economic status scale (2021), and it was found that the majority of the participants belonged to the lower middle scale, with scale values ranging from 13 to 23 out of 62. Sixty farm women from North 24 Parganas of West Bengal were trained on different identified jute diversified products. A skill-development programme on the bleaching and dyeing of jute fibre and yarn was also done for members of different self-help groups. A sale counter of jute-based diversified items was launched at ICAR-CRIJAF in February 2022 to promote jute-based diversified items as a substitute for plastics and synthetics and to encourage farm women involved in value addition in jute. Resource generation amounting ₹ 28010 was earned from the sale of different value-added jute products made by farm women from the sale counter of ICAR-CRIJAF.

Fig. 86: Skill development in diversified jute products

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 of ICAR-CRIJAF and ICAR-ATARI 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) Zinc (Zn) and boron (B) application combined with recommended NPK (100:50:50) significantly increase the productivity of boro rice. As such, farmers are advised to apply $ZnSO_4$ at 25 kg per ha and Borax at 10 kg per ha, or a foliar spray of 20% chelated Zn at 45 and 70 DAT.

ii) The evaluation of different sulphur (S) doses in sesame productivity under medium upland condition of Paschim Bardhaman revealed that application of S @30 kg or 40 kg/ha along with recommended NPK (80:40:40 kg/ha) recorded significantly higher production (9.23 q/ha and 10.45 q/ha) as compared to application of 20 kg S/ha coupled with recommended NPK (8.05 q/ha kg/ha) and FP.

- The most effective method for improving the quality of cut flowers (for the correction of reddishness in the tips of flower petals) was foliar sprays of chlorated Zn.

Under the administrative control of ICAR-CRIJAF, two KVKs at Burdwan and the North 24 Parganas conducted seven OFTs on important agricultural practices like nutrient management in boro rice and oilseed (sesame), improving the quality of cut flowers, pest and disease management in okra and brinjal, and nutrient management of lactating cross-bred cows.

KVK, North 24 Parganas (additional) conducted following 4 OFTs:

- Disease-tolerance in Okra varieties (cv. Arka Anamika, Kashi Kranti, Bindu, Check: Garima).
- Performance evaluation of jute varieties (cv. JRO 204, JRO CO58, JRO B2, JRO G).
- Organic management of fruit and shoot borer in brinjal.
- Nutrient management in lactating cross-bred cows.

2. Frontline Demonstrations (FLDs)

A total of 253 FLDs were conducted by both the KVKs during the year 2022 on jute, paddy, lentil, chickpea, onion, vegetables, banana and poultry. There were significant increases in productivity of all the field crops 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 35.

A total of 253 FLDs on various aspects of jute, paddy, lentil, chickpea, kharif onion, IPM in brinjal, tissue culture banana, oyster mushroom cultivation, and poultry farming were conducted by the KVKs in Burdwan and in North 24 Parganas. To promote the IFS system, KVK Burdwan developed demonstration units like vermicomposting, azolla farming, mushroom farming, poultry and duckery rearing, a goatary, and an apiary.

OFT on okra (bhindi)

OFT on performance of jute varieties

OFT on nutrient management in lactating cross bred cow

OFT on nutrient management in lactating cross bred cow

Fig. 87a: Various activities of KVK, Burdwan

Table 35. Details of FLDs conducted by KVK Burdwan and North 24 Parganas (Additional) during the year 2022

Crop/livestock (No. of FLDs)	Technology demonstrated	Results
	KVK, Burdwan	
Jute (445)	Improved production technology with CO 58	3.62% increase in productivity of jute with improved practice (34.3 q/ha) over local check (33.1 q/ha).
Banana(15)	Cultivation of tissue culture banana in jute based IFS	29.5% increase in productivity of tissue culture banana cv. Grand Naine with a yield of 610 q/ha. BCR of Grand Naine was 2.70 over local check of 2.10
Onion (20)	Kharif onion in jute based cropping system	Kharif onion (cv. Agrifound Dark Red) resulted in better alternative than the existing crops and ensured better utilization of medium or upland in kharif and late kharif season in terms of profitability. Average yield of kharif onion was 190 q/ha with B:C ratio of 2.20.
Brinjal (20)	Integrated Pest Management in brinjal on *Leucinodes orbonalis*	19.1% improvement in yield than farmer's field was recorded.
Oyster mushroom	Improved production technology of Oyster mushroom.	250% increase in productivity of fresh mushroom with improved practice (Avg. 1000 g/bed) over local check (Avg. 800 g/bed).
	KVK, North 24 Parganas (Addl)	
Jute (22)	Improved retting of jute by 'CRIJAF Sona' (powder and liquid formulation)	CRIJAF Sona (powder formulation) : Retting duration (days)=13.80; Fibre strength (g/tex)= 23.00; Root content=7.26% CRIJAF Sona (liquid formulation): Retting duration (days)=11.50; Fibre strength (g/tex) =25.20; Root content=2.8% Control (check) Retting duration (days)=18.50; Fibre strength (g/tex) =19.90; Root content=11.75%
Jute (24)	Variety JRO MU1	Variety JRO MU 1: Fibre yield=37.37 q/ha; BC ratio=1.40 Check: Fibre yield=27.56q/ha; BC ratio=1.14
Kharif Onion (10)	Variety Agrifound Dark Red	Avg. Plant height=40.97cm; Avg. Neck diameter=1.65 cm; Avg. Bulb diameter= 5.36 cm; Avg. Bulb weight=49.01g; Avg. yield= 19.50 t/ha; B:C ratio=3.72
Mustard (30)	Variety: PM 30	Demonstration yield (q/ha) = 13.92 (38.9 % more yield than the check variety); B:C ratio: 2.96
Cattle (20)	Teat dip method	Pre-demonstration incidence of clinical mastitis (6 months) = 9.09% Post-demonstration incidence of clinical mastitis (6 months) = 2.59%, B:C Ratio =1.32

Fig. 87b: Various activities of KVK, Burdwan

FLD on mustard cv. PM 30

FLD on improved jute retting using CRIJAF Sona powder

FLD on prevention of mastitis using Teat Dip Method

FLD on Kharif Onion cv. AFDR

3. Demonstrations 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*	15,000 worms, vermicompost: 15 q	**Earthworm**	5100 pc
Mushroom	Oyster	40 beds	**Vermicompost**	9846 kg
Poultry	Kadaknath	20 nos.	**Fruit sapling**	1610 nos.
Duckery	Khaki Campbell	30 nos.	**Paddy (foundation seed of MTU 7029, GB3 and Hasant)**	21.4 ton
Goatary	Black Bengal	4 nos.	**Livestock (Karaknath, RIR, Duck and Egg)**	249 nos.
Apiary	*Apis mellifera*	6 beehives	**Horticulture Crops**	5350 nos.
Azolla	-	4 kgs		

AINP on Jute and Allied Fibres

All India Network Project on Jute and Allied Fibres (AINPJAF) functions through eight SAUs and four ICAR institute-based centres with its Head Quarter's at ICAR-CRIJAF, Barrackpore. During the year 2022-23, a total of 69 (crop improvement 40, crop production 13 and crop protection 16) projects were evaluated on jute (*C. capsularis* and *C. olitorius*), mesta (*Hibiscus sabdariffa* and *H. cannabinus*), sunnhemp (*Crotalaria juncea*), ramie (*Boehmeria nivea*), sisal (*Agave sp.*) and flax (*Linum usitatissimum*) pertaining to crop improvement, crop production and crop protection aspects.

Crop Improvement

A total of 40 projects comprising of 185 trials were evaluated at different centres under crop improvement programme. 22 projects were evaluated for jute, 14 for mesta, 2 for flax and 1 each for sunnhemp and ramie, including germplasm evaluation, national hybridization programme, initial evaluation trials, advance varietal trial-I, advance varietal trials-II and adaptive trials on jute and allied fibre crops.

Recommendation for Release and notification of JAF varieties

One variety each of *olitorius* jute (JROBA-3), *capsularis* jute (JRCP-5), HC mesta (JBMP-5) and HS mesta (HSLC-1) were recommended for release by the Central Sub-Committee on Crop Standard, Notification and Release of Varieties for their central release during the 89th meeting held on 26th October, 2022. The brief salient features of these varieties are given below:

JROBA-3: A high yielding (31.84 q/ha) green stem tossa jute variety suitable for early sowing owing to its pre-mature flowering resistance. It is highly resistant to stem rot and root rot diseases and also exhibits high tolerance to stem weevil, semilooper, Bihar hairy caterpillar and yellow mite than check varieties JRO 204 and JRO 524. It is at par with JRO 524 and JRO 204 in terms of fibre quality especially in fibre fineness and fibre tenacity. It has 07.61% less root content than check JRO 204 and 10.10% less defects than JRO 524, which offers additional benefits. Its potential fibre yield is 40.95 q/ha.

Fig. 88a: Trials of JROBA-3 in research field

JRCP-5: A high yielding white jute variety with red stem colour produces 28.81 q/ha average fibre yield and secured 1st rank in 14 out of 26 multi-location trials. This variety is more resistance to stem rot and yellow mosaic diseases. It exhibited 26.87% less incidence of yellow mite and 11.46% less incidence of jute semilooper than checks. It has better fibre quality in terms of 7-9% defects, 25 - 27% less root content.

Fig. 88b: Trials of JRCP-5 in research field

JBMP-5: It is a high yielding coppery red stem colour and lobed leaf HC mesta variety recorded 28.91 q/ha average fibre yield in coordinated trials with potential yield of 38 - 41 q/ha. It is more tolerant to foot and stem rot disease, semilooper and mesta mealybug. It is also superior in terms of fibre quality owing to 14-18% less root content, 14-18% less defects, 5-12% stronger and >5% finner fibre to the check varieties.

HSLC-1: This is an HS mesta variety exclusively identified for release as calyx type variety with an average fresh calyx yield of 41.09 q/ha which is suitable for all mesta growing belt of the country. Its potential calyx yield is 61.3 q/ha which was found at Rahuri in Maharashtra. Calyces of this variety are rich in minerals like K, Ca, Mg, Na, Fe and vitamins like C, B1, B3, B5 which may add a high-value nutritive vegetable and can supply significant amount of recommended daily allowance (RDA) of mineral and vitamins to an adult.

Fig. 88c: Trials of HCLC-1 in research field

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

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

Cultivar		Location of Trials
NP (JB) 1.10	:	Evaluation of *capsularis* jute germplasm at Kalyani, Coochbehar, Kendrapara, Nagaon and Katihar centres.
NP (JB) 1.11	:	Evaluation of *olitorius* jute germplasm at Kalyani, Coochbehar, Kendrapara, Nagaon, Katihar and Rahuri centres.
NP (MB) 1.10	:	Evaluation of roselle germplasm at Amadalavalasa, Katihar, Aduthurai and Barrackpore centres.
NP (MB) 1.11	:	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

Cultivar		Location of Trials
NP (JB) 2.5	:	NHP with *olitorius* jute- Station Trial of F_7 population at Kalyani, Rahuri, Katihar, Nagaon and Kendrapara centres.
NP (JB) 2.6	:	NHP with *capsularis* jute- Station Trial of F_7 population at Nagaon centre.
NP (JB) 2.7	:	NHP with *capsularis* jute-Evaluation of F_6 progenies at Nagaon and Katihar centre.
NP (JB) 2.8	:	NHP with *olitorius* jute-Evaluation of F_6 progenies at Kalyani, Rahuri and Katihar centres.
NP (JB) 2.9	:	NHP with *olitorius* jute-Evaluation of F_5 progenies at Rahuri centre.
NP (JB)2.10	:	NHP with *olitorius* jute-Evaluation of F_3 progenies at Rahuri, Kalyani and Coochbehar centres.
NP(JB) 2.11	:	NHP with *capsularis* jute-Evaluation of F_3 progenies at Kalyani and Coochbehar centres.
NP (JB)2.12	:	NHP with *olitorius* jute-Evaluation of F_2 progenies at Kalyani, Coochbehar and Rahuri centres.
NP (JB)2.13	:	NHP with *olitorius* jute-Pre-breeding for pest and disease resistance-Evaluation of F_1 cross 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_1 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_1 crosses at Coochbehar, Katihar#, Kendrapara#, Nagaon and Kalyani centres.
NP(MB)2.3	:	NHP with mesta-Evaluation of F_6 progenies of kenaf at Barrackpore and Aduthurai centres.
NP (MB)2.4	:	NHP with mesta-Evaluation of F_2 progenies of roselle at Barrackpore centre.
NP(MB)2.5	:	NHP with mesta-Breeding for YVMV resistance in kenaf-Evaluation of F_1 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_1 crosses at Amadalavalasa, Rahuri and Aduthurai centres.
NP(MB)3.1	:	Mutation breeding in mesta for creation of new variability-Evaluation of M_2 population at Barrackpore, Amadalavalasa, Aduthurai, Katihar and Rahuri

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

NP (JB) 5.60	:	IVT with tossa jute (*C. olitorius*) at Kendrapara, Katihar, Kalyani, Coochbehar, Rahuri and Nagaon centres.
NP (JB) 5.61	:	AVT-I with tossa jute (*C. olitorius*) at Kendrapara, Coochbehar, Barrackpore, Rahuri, Katihar, Kalyani and Nagaon centres.
NP (JB) 5.62	:	AVT-II with tossa jute (*C. olitorius*) at Kendrapara, Coochbehar, Barrackpore, Rahuri, Katihar, Kalyani and Nagaon centres.
NP (JB) 5.63	:	IVT with white jute (*C. capsularis*) at Kendrapara, Katihar, Kalyani, Coochbehar and Nagaon centres.
		NP (JB) 5.64: AVT-I with white jute (*C. capsularis*) at Kendrapara, Katihar, Kalyani, Coochbehar, Nagaon and Barrackpore centres.
NP (JB) 5.65	:	AVT-II with white jute (*C. capsularis*) at Kendrapara, Katihar, Kalyani, Coochbehar, Nagaon and Barrackpore centres..
NP (SB) 12.84	:	IVT with roselle (*H. sabdariffa)* Amadalavalasa, Rahuri, Aduthuai, Kendrapara, Coochbehar and Katihar centres.
NP (SB) 12.85	:	AVT-I with roselle (*H. sabdariffa*) at Amadalavalasa, Rahuri, Kendrapara, Aduthurai, Coochbehar and Katihar centres.
NP(SB) 12.79 (Repeat)	:	AVT-I with roselle (*H. sabdariffa*) Amadalavalasa, Rahuri, Kendrapara, Aduthurai, Coochbehar and Katihar centres.
NP (SB) 12. 86	:	AVT-II with roselle (*H. sabdariffa*) at Amadalavalasa, Rahuri, Kendrapara, Aduthurai, Coochbehar and Katihar centres.
NP (CB) 1.55	:	IVT with kenaf (*H. cannabinus*) at Amadalavalasa, Rahuri, Kendrapara, Aduthuai and Coochbehar.
NP (CB) 1.56	:	AVT-I with kenaf (*H. cannabinus*) at Amadalavalasa, Rahuri, Kendrapara, Aduthurai, Coochbehar and Barrackpore centres.
NP (CB) 1.57	:	AVT-II with kenaf (*H. cannabinus*) at Amadalavalasa, Rahuri, Kendrapara, Aduthurai, Coochbehar and Barrackpore centres.

NP (SUN-B) 1.33	:	IVT with sunnhemp (*C. juncea*) at Barrackpore, Pratapgarh, Kalyani, Aduthurai and Budbud centres.
NP (FB) 1.23	:	IVT with flax (*L. usitassimum*) at Pratapgarh, Coochbehar, Kalimpong, Nagaon, Sorbhog and Budbud centres.
NP (FB) 1.24	:	AVT-II with fibre flax (*L. usitassimum*) at Pratapgarh, Coochbehar, Nagaon, Sorbhog and Budbud centres.
NP (RB) 1.13	:	IVT with ramie (*B. nivea*) at Sorbhog, Coochbehar and Nagaon.

Multi-location evaluation of elite JAF lines for specific traits

NP (JB) 3.6	:	Premature flowering resistance in tossa jute at Barrackpore, Kalyani, Coochbehar, Katihar, Kendrapara and Nagaon centres.
NP (JB) 3.7	:	IVT with white jute for late sown conditions at Kalyani, Katihar, Kendrapara, Coochbehar, Nagaoan and Rahuri centres.
NP (JB) 3. 8	:	Adaptive trial on tossa jute suitable for leafy vegetables at Barrackpore, Budbud, Kalyani, Coochbehar and Nagaon centres.

Crop Production

In crop production programme, 13 projects comprising of 56 trials were conducted at different centres. Out of 13 projects, 6 projects were evaluated for jute, 4 for mesta, and 1project each for flax sisal and ramie comprising of 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:

1) NP(JA) 2.10: Site specific nutrient management for higher productivity of jute and allied fibre based cropping systems

i) NP (JA) 6.10: Performance of new jute genotypes under Adaptive trials at different fertilizer schedules (*C. olitorius:* Kalyani, Coochbehar, Nagaon, Katihar, Kendrapara centres; *C. capsularis:* Kalyani, Coochbehar, Nagaon, Katihar and Kendrapara).

ii) NP (JA) 6.11: Performance of new mesta genotypes under Adaptive trials at different fertilizer schedules (*H. cannabinus* : Aduthurai, Amadalavalasa and Rahuri)

iii) NP (JA) 6.19 (title modified in 2021): Soil test based fertilizer application in jute / mesta based cropping system for improved nutrient management (*Neutral Soil condition*: Jute- Katihar (rainfed); Mesta-Aduthurai (irrigated) centre; *Acid soil condition*: Jute-Nagaon, Coochbehar; Mesta-Amadalavalasa)

iv) NP (RA) 2.4: Yield maximization in ramie through improved management practices (CRIJAF, Coochbehar and Sorbhog).

v) NP (RA) 2.5: Effect of nitrogen and potassium on fibre yield and fibre quality of ramie (Sorbhog centre)

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

vii) NP (JA) 7.15: Carbon dynamics and fertility status of the soils in jute and mesta growing areas (Jute- Kalyani, Coochbehar, Katihar, Kendrapara, Nagaon; Mesta-Aduthurai, Amadalavalasa, Rahuri)

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

ix) NP (JA) 2.11: Integrated weed management in jute and allied fibres

x) NP (JA) 7.10: Integrated weed management in jute and allied fibres (Jute: Kalyani, Coochbehar, Kendrapara, Katihar, Nagaon centres; Mesta: Amadalavalasa, Aduthurai, Rahuri)

3) NP(JA) 2.12: Conservation agriculture and cropping system research in jute and allied fibres for higher productivity and profitability

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

ii) NP(SIA) 5.3 : Development of sisal based intercropping system for higher productivity and profitability along with improved resource use, a) Performance evaluation of short duration pulses and oilseed crops grown in inter rows of sisal (Amadalavalasa); b)Inter-cropping of aromatic grasses in sisal plantation for checking soil erosion and enhancing farm income (Bamra and Amadalavalasa); c) Inter-cropping of spices and medicinal plants in sisal plantation for higher farm income (Bamra and Amadalavalasa)

iii) NP(JA) 7.20: Development of flax based intercropping system for higher productivity and profitability (Barrackpore, Kalyani, CoochBehar, Nagaon and Katihar)

Crop Protection

A total of 16 projects comprising of 45 trials were conducted at different centres. Out of 16 projects, eight projects were evaluated for jute, five for mesta, two for sunnhemp and one project for flax comprising of survey and surveillance of pests and diseases, screening of germplasm for pests and diseases, integrated pests and disease managament and evaluation of pesticides against pests and diseases of jute and allied fibre crops. The trials conducted under various projects are summarized below:

1. NP (JP) 3.10. Survey & Surveillance of insect pests and diseases in JAF crops

i) NP (JMPE) 1.1: Barrackpore, Coochbehar, Kendrapara, Katihar, Nagaon, Amadalavalasa centres

2. NP(JP)3.11. Screening of JAF germplasms varietal entries against insect pests and diseases

i) NP (JB) 1.0 a: Screening of jute germplasm against pests (Coochbehar, Kendrapara, Katihar and Nagaon)

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

iii) NP (JPE) 2.20: Integrated management of pest and diseases in jute (Kendrapara, Katihar Coochbehar and Nagaon)

iv) NP (FP) 2.5: Management of flax wilt caused by *F. oxysporum* f. sp. *lini* Schlecht (Pratapgarh)

v) NP (ME) 4.6 Eco-friendly management of sucking pests in mesta (Katihar and Kendrapara)

vi) NP (JP) 2.6: Intensive screening of *olitorius* jute germplasms against stem rot disease (Barrackpore, Kendrapara, Coochbehar, Katihar and Nagaon)

vii) NP (JE) 6.6: Intensive screening of *olitorius* jute germplasms against yellow mite (Katihar, Kendrapara, Coochbehar and Nagaon

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

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

3. NP (JP) 3.12. Evaluation of fungicides/ insecticides and integrated pest and disease management in JAF crops

i) NP(SHE)1.1: Management of lepidopteran pests in seed crop of sunnhemp (Amadalavalasa and Pratapgarh).

ii) NP (JP) 2.7: Field evaluation of fungicides against foot and stem rot of mesta (Amadalavalasa and Katihar)

ii) NP(SHP)1.2: Standardization of disease free sunnhemp seed production technology in important sunnhemp growing states (Barrackpore, Amadavalasa and Pratapgarh)

iii) NP (ME): 4.7: Insecticidal Management of insect pests in mesta (Amadalavalasa and Coochbehar)

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

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

Research Achievements

Concluded Projects: 2021 & 2022

1. In-house Projects

Project Code: JA 5.7 (2015-2021)

Conservation agricultural practices of jute-based cropping systems under climate change scenario

Field experiments were conducted at the ICAR-Central Research Institute for Jute & Allied Fibres (CRIJAF) with no tillage (NT), no tillage + residue (NT+R), and conventional tillage (CT) under the most predominant cropping systems, i.e., Jute-Rice-Wheat/lentil/mustard systems, and standardized the agro-technology for conservation agriculture practice in jute based cropping systems. The addition of crop residue in the form of *Sesbania* spp. @ 2 t/ha under no tillage (NT+R), which has induced a better root-zone hydro-physical regime in the most promising jute-based cropping system (Jute-Rice-Lentil) with the highest system productivity, energy productivity, net return, and economic efficiency. The salient achievements under this project are as follows:

- The nutrient balance sheet after the 6th year of continuous experimentation showed that there was the highest positive balance in NT+R (N: 195.89; P: 28.02; and K: 134.17 kg/ha, respectively).
- The addition of crop residue under no-tillage (NT+R) improved bulk soil organic carbon (SOC), particulate SOC content (PSOC) and aggregate stability, promoting a better root-zone hydro-physical regime in all crop-rotations. NT+R contributed the highest SOC stock (3.30 Mg C/ha) followed by NT (2.94 Mg C/ha), and CT (2.42 Mg C/ha). The significant increase in SOC stock under NT+R and NT may be ascribed to the mean annual absolute rate of change in SOC stock, which is much higher (0.15-0.24 Mg C/ha/year) as compared to CT (0.2 Mg C/ha/year).
- Soil microbial biomass (SMBC) was significantly higher in NT +R (range: 641.84 to 745.97 µg/g) followed by NT (631.42 to 678.46 µg/g) and conventional tillage (490.68 to 634.83 µg/g).
- Tillage practices and residue incorporation have a significant impact on profile moisture storage, which remains above 50% of the available water holding capacity up to 75 DAS under NT+R treatment.
- Quantification of ecosystem services in jute-based cropping systems under conventional (CT) and no tillage with or without additional (NT and NT+R) residue management treatments revealed that the economic value of the ecosystem services was highest in NT+R (₹ 71,224/ha), followed by NT (₹ 68,533/ha), and the lowest in CT (₹ 59,086/ha). Green income from conventionally tilled jute-based cropping systems was ₹ 28,545 per hectare, rising to ₹ 41,528 in NT and ₹ 45,407 in NT+R.

Publications

- Saha, R., Paswan, Alka, Mazumdar, S.P. Barman, D., Majumdar, B., Behera, M.S. and Saha, A.R. (2022). Improvement in soil quality through tillage and residue management in Jute (*Corchorus spp.*) based cropping systems of Indo-Gangetic plains. *Carbon Management*. 13(1): 205-215.

- Saha, R., Paswan, Alka, Majumdar, B., Barman, D., Behera, M.S., Mazumdar, S.P. and Sarkar, S. (2018). Soil Quality under Tillage and Residue Management in Jute (*Corchorus* spp.) based Cropping Systems of Indo-Gangetic Plains. *International Journal of Current Microbiology and Applied Sciences*. 7(11): 133-140.
- Datta, Debarati, Saha, R. and Ghorai, A.K. (2020) Conservation agriculture and resource management under Jute (*Corchorus* spp.) based cropping systems in eastern India. *Current Science*. 119(6): 926-933. doi: 10.18520/cs/v119/i6/926-933.
- Saha, R., Sarkar, S., Barman, D., Behera, M.S. (Eds.). 2019. Compendium of ICAR Short Course on 'Recent Advances in Resource Conservation Technologies (RCTs) under Aberrant Climate Change Scenario. ICAR-Central Research Institute for Jute and Allied Fibres, Barrackpore, Kolkata. P.235.

Presentation in Symposium

- Saha, R., Majumdar, B., Paswan, Alka, Behera, M.S., Barman, D., Sharma, Laxmi and Sarkar, S. (2019) Resource conservation technology for jute based cropping systems: Issues and prospects in Indo-Gangetic plains. *In*: International Conference on 'Soil and Water Resource Management for Climate Smart Agriculture, Global Food and Livelihood Security'. 5-9 November, 2019, at New Delhi. pp. 209.
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- Saha, R., Behera, M.S., Sharma, Laxmi, Paswan, Alka, Sarkar, S. and Majumdar, B. (2019) System productivity, Resource and Radiation use efficiency under Conservation Agriculture in jute based cropping systems. *In:* COBACAS 4th National Conference on "Diversified Farming System: Sustainable Livelihood and Doubling Farmer's income" on 17-18 January, 2019 at Majhian Campus, UBKV, Dakshin Dinajpur. pp. 23-24.
- Saha, R., Paswan, Alka, Saha, A.R., Majumdar, B., Mazumdar, S.P. and Sarkar, S. (2018) Impact of tillage and residue management on soil quality in jute based cropping systems. *In:* National Seminar on "Agri-chemicals for benign environment" on 29 March, 2018 at BCKV, Kalyani, pp. 09.
- Saha, R., Behera, M.S., Paswan, Alka, Mazumdar, S.P. and Barman, D. (2017) Soil organic carbon, aggregate stability and microbial attributes under conservation tillage with crop residues in jute based cropping systems. *In:* National Seminar on Developments in Soil Science: 2017 during 11-14 December, 2017 at Amity University, Kolkata.

Training organized

- ICAR Short Course training on "Recent Advances in Resource Conservation Technologies (RCTs) under Aberrant Climate Change Scenario" conducted at ICAR-CRIJAF, Barrackpore during 14-23 November, 2019.
- Farmers Training on "Resource Conservation and Crop Diversification in Jute based Cropping System" organized under SCSP programme on 1 March 2021 at ICAR-CRIJAF, Barrackpore.

Project Code: JA 7.1(2016-21)

Climate change risk assessment in jute production and related advisory services through decision support system

Development of a decision support system (DSS) for disseminating agro-advisory services: The study was carried out from 2016 to 2021. In this study, district-level climate data for West Bengal were analysed on a spatio-temporal scale. Climate variability and climate trend in West Bengal were identified using monthly data of maximum and minimum air temperature, and rainfall. A Markov chain model was used to identify the dry and wet spells during the jute growing period in Barrackpore, Cooch Behar, Nagaon, and

Bhubaneswar. Climate change vulnerability factors of jute were identified, such as rate of change of maximum and minimum temperatures, availability of retting water, etc. Some climate solutions or climate change adaptive measures were identified, and strategies were developed to save the jute crop from adverse climate change conditions. JuteMet®, a web-based Agrometeorological Database Management System (ADBMS) and Agro-advisory System, was conceptualized and developed for Agriculture, Horticulture, and Forestry Services and related Agrometeorological and Agro-advisory Services, and trademark registration was obtained for that. Climate-resilient agro-advisory services and jute variety information were disseminated to jute farmers to cope with climate change scenarios.

Publication/technology/product

- **Developed 'JuteMet®'** - a web-based Agrometeorological Database Management System (ADBMS)-cum-Agro-advisory System was conceptualized and developed for Agriculture, Horticulture, and Forestry Services and related Agrometeorological and Agro-advisory Services.
- Trademark registration was obtained for 'JuteMet'.
- Barman D., Kundu D.K., Pal S., Pal Susanto, Chakraborty A.K., Jha A.K., Mazumdar S.P., Saha R., and Bhattacharyya P., (2017) Soil temperature prediction from air temperature for alluvial soils in lower Indo-Gangetic plain. Int. Agrophysics, 31, 9-22.

Presentation in Symposium

- Barman D., Chakraborty Sukla, Chakraborty A.K., Saha R., and Singh, A.K. (2018) JuteMet – A web-based agro-advisory system for mitigating climate uncertainty in jute cultivation. In: International Conference on "Livelihood Promotion, Bio-diversity Conservation and Social Security in Indian Sundarbans" 7-9 December, 2018, Eco-Tourism Hub, Jharkhali, S 24-Parganas, West Bengal. (ORAL).
- Barman D., Bhowmick T., Saha R., Das S. (2019) Spatial and temporal variability analysis of rainfall in jute growing areas of West Bengal using remote sensing data. In: Book of abstract (Eds.), Ghosh R.K., Sahu P.K., Roy K., International Seminar on "Agri-skills for convergence in research, industry & livelihood (ACRIL-2019)" Nov 28 to Dec 1, 2019, Kalyani, Nadia, West Bengal.

Project Code: JEXA 5.8 (2017-2021)

Climate variability *vis-a-vis* jute-based cropping system in West Bengal- an appraisal based on farmers' perspective

The study was conducted in three predominantly jute-growing districts of West Bengal, *viz.,* North 24 Parganas, Nadia, and Hooghly. The jute farmers who had more than 10 years of farming experience were selected as respondents (N=218). Focused group discussions as well as personal interviews were conducted with the farmers to explicit their perceptions.

- It was found that respondent farmers had a strong perception that jute-based cropping systems are affected by climate variability. The findings revealed that the majority of respondents had a favourable perception of the general effect of climate variability, including the following: change in duration of traditional crop seasons (87.16%), pre-maturing flowering in jute due to unexpectedly low temperatures (81.65%), increased incidences of crop damage and yield losses (87.61%), unavailability of desirable soil moisture levels during sowing time (76.15%), and increased reliance on ground water for irrigation.
- The knowledge level of the farmers about adaptive measures for climate variability was assessed through a knowledge test developed for this purpose, and it was found that most of the farmers (82.11%) had a medium level of

knowledge. The attitude of the farmers towards adaptive measures of climate variability was also measured by developing an attitude scale, and the results showed that the majority of the respondents (62.39%) possessed a medium level of attitude towards adaptive measures of climate variability.

- The majority of farmer adopters (n = 60) believed that technology such as the CRIJAF Nail Weeder for mechanical weed control in jute, the CRIJAF Multi-row Seed Drill for jute line sowing, the CRIJAF Sona for improved retting of jute, and jute-moong intercropping for efficient resource utilisation had the potential to combat the effect of climate variability by promoting soil and water conservation, minimising farmers' time, capital,
- It was found that the perception of the scientists and experts (N = 35) about the effect of climate variability was in line with the perception of the farmers (as per Spearmen's rank difference correlation test). It indicates that the perceptions of the farmers were not vague, but rather were tested by their rich experience. It was also realised that the farmers' perception score on most of the effects was higher than that of the scientists and experts, indicating that the farmers had first-hand experience with these effects and realised their negative impact.
- In terms of the impact of weather variability (temperature, rainfall, and humidity) on a jute-based cropping system, farmers perceived that a rise in temperature caused insect infestation in jute, drying of soils and plants (76.61 percent, 70.18 percent, and 95.87 percent, respectively), while a fall in temperature caused disease infestation in crops and premature flowering in jute (63.76 percent and 81.65 percent, respectively).A lack of rainfall has resulted in seedling drying and a lack of water for jute retting (86.24% and 97.55%, respectively).
- Farmers also perceived that an increase in atmospheric humidity has been causing increased disease pest infestation in crops (95.87%), an increase in soil humidity has been resulting in an increased population of weeds and soil-borne pathogens (84.86%), and 79.35%, respectively), and a decrease in soil humidity has been causing a decrease in seed germination rate (86.24 %).
- A conceptual model for building the climate resilience of farmers in jute-based cropping systems was developed. It depicts the broad effects of climate change in this system, adaptive and mitigation measures highlighting ICAR-CRIJAF technologies, and cognitive and consequential behavioural changes in farmers as a result of training and demonstration to increase their climate resilience.

In this study, the perceptions of the farmers as well as the perceptions of the scientists and experts were studied to determine the effect of climate variability in a jute-based cropping system. Both the perceptions were compared, and it was found that they were in conformity. Hence, the findings of this study could pave the way for participatory development of climate-smart technologies and farming practices. Farmers' knowledge and attitude regarding adaptive measures for climate variability could be utilized for planning effective capacity-building programmes. For devising appropriate weather-based agro-advisory for the farmers, the identified effect of variability in weather components (temperature, rainfall, and humidity) on a jute-based cropping system could be taken into account.

Presentation in Symposium

- Roy, M. L., Jha, S. K., Singh, A. K., Shamna, A. and Kumar, S. (2021) "Effect of Climate Variability on Jute-based Cropping System as Perceived by the Agricultural Scientists", International Symposium of Coastal Agriculture during March 16-19, 2021.
- Oral presentation in ISEE National Seminar on "Integrated Farming systems for Enhancing Farmer's income and Nutritional Security" held at WBUAFS, Belgachia, Kolkata during 5-7 December, 2018.

Project Code: JEXA 6.0 (2019-21)

Impact evaluation of proven ICAR-CRIJAF technologies under jute-ICARE

The study was carried out in the major jute-growing districts of West Bengal, namely, Murshidabad, Nadia, North 24 Parganas and Hooghly. The beneficiaries (n = 132) of the Jute-ICARE Project were selected as the respondents. The impact of CRIJAF technologies has been measured in terms of increase in fibre yield, reduction in cost of cultivation, change in area, improvement in fibre quality, change in knowledge score about CRIJAF technologies, and adoption quotient of the respondent.

- The socio-psychological profile of the respondents showed that the majority (50%) of them belonged to the age group of 25–55 years, had farming experience of more than 20 years (79.54%), and education up to middle school (57.66%). Most of them had land holdings <1 ha (68.93%) and annual incomes < Rs. 1 lakh (82.57%). With regard to psychological characteristics, most of them (more than 70%) had a medium level of innovativeness, scientific orientation, and risk taking ability. The attributes, namely, education, innovativeness, scientific orientation, and risk-taking ability, were positively and significantly (0.05% level) related to the impact of ICAR-CRIJAF technologies.
- Prior to the application of CRIJAF technologies, average jute acreage was 0.48 ha, which increased to 0.56 ha (an area increase of 16.66%). Approximately half (47.61%) of the respondents had increased the area under jute cultivation. North 24 Parganas saw the greatest increase in jute acreage (22.91%), followed by Hooghly (14.63%), Murshidabad (10.63%), and Nadia (8.77%).
- Respondents using the CRIJAF technologies could harvest 9.49–24.46% more fibre than the yield achieved by conventional practice (24.98–27.27 q/ha). Simultaneously, the cost of cultivation was reduced by Rs. 5,690—15,079 per hectare compared to conventional farmer practices.
- With regard to quality improvement, respondents were asked to give scores on lustre and root content, retting duration, and fibre recovery. Murshidabad respondents received the highest score (2.87), while North 24 Parganas respondents received the lowest (2.37). It also indicates that respondents in Murshidabad had less awareness and knowledge of quality aspects than their counterparts in the North 24 Parganas.
- A more than threefold increase in the knowledge score (2.23 to 11.27) of the respondents with regard to CRIJAF technologies has been observed. The respondents of North 24 Parganas (2.10 to 12.07) had the highest gain in knowledge score, followed by Nadia (2.20 to 11.17), Hooghly (2.55 to 11.37) and Murshidabad (1.97 to 10.5).
- With regard to adoption level, the North 24 Parganas scored highest (61.34), followed by Hooghly (60.05), Nadia (57.95), and Murshidabad (56.59). The majority of the farmers (71.42%) had a medium level of adoption of improved jute production technologies. The remaining farmers (28.58%) were found to be in the high adoption category.
- The order of preferences for CRIJAF technologies (on a five-point continuum) was CRIJAF seed (28.49), followed by CRIJAF Sona (26.65), nail weeder/single-wheel jute weeder (25.67), and MRSD (24.54).
- The improved jute variety of CRIJAF contributed around 9–13% more fibre yields over local seeds used by farmers (24.98–27.27 q/ha). Application of MRSD reduced the seed amount (by 50%) as well

as the requirement of manual labour by 12–18 ha. The CRIJAF Nail Weeder and Single Wheel Jute Weeder saved 40-50 mandays per hectare. The user of CRIJAF Sona earned additional remuneration of at least Rs. 200–300/q due to grade improvement (TD5 to TD3). The respondents of North 24 Parganas were the major beneficiaries in comparison to the respondents of Hooghly, Nadia, and Murshidabad.

Replacement of other varieties by CRIJAF seed (JRO 204, JBO 2003 H, etc.) alone gave a higher fibre yield (9.49–13.94%) due to purity, better germination, and plant vigour. CRIJAF seed and CRIJAF Sona produced 14.69-14.966 percent more fibre than farmers' usual practices. The additional fibre yield for Seed + MRSD + CRIJAF Sona was 17.30-18.29%. The maximum fibre gain (23.51-24.46%) has been found in Seed +MRSD+CRIJAF Sona+ CRIJAF Nail weeder.

It can be concluded from this study that the knowledge level and adoption level of the respondents with regard to CRIJAF agro-technologies were higher. As a result, there was a significant reduction in the cost of the cultivation of jute. That motivated the respondents to increase the area under jute cultivation. Socio-economic and psychological attributes, namely, education, innovativeness, scientific orientation, and risk-taking ability, positively and significantly played a major role in the impact of CRIJAF technologies. This study can be scaled up in other similar jute-growing areas and districts to get a larger data base on the impact of technological interventions.

Project Code: JBT 4.7 (2017-2022)

Mining novel alleles for stress tolerance in jute and allied fibres

Genome-wide analysis of the aquaporin gene family in jute: In the case of *Corchorus olitorius*, total of 39 aquaporin (AQP) genes were identified, including nine NOD26-like intrinsic proteins (NIPs), eight tonoplast intrinsic proteins (TIPs), 12 plasma membrane intrinsic proteins (PIPs), and eight small basic intrinsic proteins (SIPs). In *C. capsularis,* a total of 35 AQP genes were identified, including 11 PIPs, 10 NIPs, eight TIPS, and three SIPS. Gene features and promoter profiling indicated one to three introns and the most common cis-acting elements were INRE, PTBP, TF2B, YTBP, ABRE, AHBP, AP2L, AREF, DREB, MADS, MYBL, etc. The AQP 3D protein structure contains the conserved hour-glass model with a pore-forming integral membrane protein. The loops HE and HB, each containing the conserved NPA motifs, get close together in the centre of the membrane. The expression profile of Corchorus AQP genes by qRT PCR indicated that distinct tissue specific differential expression differs widely between the WT and the mutant.

Genome-wide analysis of the Heat Shock Factor (HSF) genes in jute: A total of 13 heat shock factors were identified in jute, and the positions of DNA binding domains were identified. In *C. capsularis*, ten (58.8%) of the HSFs were categorized as class A. The corresponding molecular weight of the proteins varied from 23.5 to 58.7 kD, with a mean of 40.2 kD. The number of introns per gene varied from one to three. A total of 34 heat shock factor genes were identified from the flax genome, physically mapped onto 14 of the 15 flax chromosomes, and phylogenetically clustered into three broad groups and 15 sub-groups. The number of residues in jute HSFs ranged from 213 to 535, with a mean of 357 residues per protein. The theoretical isoelectric

point (pI) of ColHsfs ranged from 4.79 to 9.03, with an average of 6.21. The corresponding molecular weight of the proteins varied from 23.5 to 58.7 kD, with a mean of 40.2 kD.

Allelic variations in flowering-related genes in jute:

Genes regulating flowering in jute were identified in the sequenced genomes of jute (3 *C. olitorius* and 2 *C. capsularis*). Selected genes were aligned, and single nucleotide polymorphisms (SNPs) were identified. Allele specific PCR primers designed for marker development. Many genes encode enzymes involved in the Gibberellin (GA) biosynthetic pathway or GA receptor and play crucial roles in regulation of flowering. Other major genes, identified by targeted homology search found to be involved in regulating flowering behaviour, were- Gibberellin receptor GID1C (GID1C), Gibberellin receptor GID1B (GID1B), Zinc finger protein CONSTANS, Calcium-dependent protein kinase 6 (CDPK6), Cyclin-dependent kinase C-2 (CDKC2) and Protein TOPLESS (TPL).

Phylogeny and Allelic Variation in Pectate Lyases Genes: Protein sequences of the pectate lyase genes from higher plants were downloaded from the UniProt protein database. A BLASTP search was performed using the protein sequences from the Pec_Lyase_C domain of the AtPLL proteins as the query to identify their homologs in jute. Sequences of CRIJAF SONA retting bacterial strains, fungi, and nematodes were also included. The jute pectate lyase genes were strongly grouped with those of other higher plants, and different isoforms of the jute PL gene were identified. Allelic variation sites were identified as potential targets for base editing.

Presentation in Symposium

- Datta S and Saha D (2018). "Genome-Wide Analysis of the Heat Shock Factor (HSF) Genes in Jute (*Corchorus olitorius L. and Corchorus capsularis* L.) Presented in 1st National Genetics Congress held from December 14-16, 2018 at IARI, New Delhi.
- Datta S, Saha D, Satya P, Anil Kumar A, Mitra J, and Kar, G. (2021). "Genomic and Transcriptomic Approaches to Accelerate Salinity Stress Tolerance in Jute (*Corchorus* spp.)". Presented in the International Symposium on Coastal Agriculture: Transforming Coastal Zone for Sustainable Food and Income Security during March 16 - 19, 2021.

Project Code: JA 7.7 (2018-2022)

Environment friendly low-cost retting technology for jute and metagenomics of retting microbiome

Development and validation of liquid formulations of CRIJAF SONA: The spore-based liquid formulation of the CRIJAF microbial formulation (CRIJAF SONA) has been developed with a shelf life of 18 months. Forty large-scale retting trials were conducted for three consecutive years in different districts, viz., the North 24 Parganas, Nadia, Murshidabad, and North Dinajpur of West Bengal. The retting with liquid "CRIJAF SONA" was completed in 10 to 15 days, compared to 17 to 23 days without liquid formulation. The resultant jute fibre with liquid CRIJAF SONA from all the districts recorded mean fibre strength ranging from 23.7 to 25.07 g/tex, fibre fineness of 2.65 to 2.69 tex and root content of 4.51 to 6.97% compared to lower fibre strength of 19.25 g/tex, 3.18 tex and root content of 11.25% under without liquid formulation.

Whole genome sequencing of the present microbial formulation: Comprehensive genomic analyses of three bacterial strains (PJRB 1, 2 and 3) of the consortium and resolve their taxonomic status, genomic features, variations, and pan-genome dynamics. The genome sizes of the strains are ~3.8 Mb with 3729 to 4002 protein-coding genes. Detailed annotations of the protein-coding genes revealed different carbohydrate-degrading CAZy classes, *viz.,* PL1, PL9, GH28, CE8, and CE12. The phylogeny and structural features of PJRB pectate lyase proteins reveal their functional uniqueness as well as evolutionary convergence with closely related Bacillus strains. Genome-wide prediction of genomic variations revealed 12461 to 67381 SNPs, and notably, many unique SNPs were localized within the important pectin metabolism genes.

Metagenomics of the jute retting microbiome: The BIOLOG ECO microplate was used to analyze the metabolic functions of jute retting water samples collected from the five most jute growing areas in West Bengal (North 24 Parganas, Murshidabad, Hooghly, Nadia, and South Dinajpur). In most of the places, utilization of D-galacturonic acid and D-xylose was maximum at 48 hrs of incubation. The maximum activities of cellulose degraders were recorded in between 48 and 72 hrs of incubation. Utilization of tween 40 and tween 80 (lipid and wax components) increased stridently after the lag phase and continued up to 96 h of incubation. The AWCD of six types of carbon sources in retting water samples under Community-level physiological profiling study. The miscellaneous group (pyruvic acid methyl ester, glucose-1-phosphate, and D-L--glycerol phosphate) had the highest degree of carbon source utilization. The retting water samples collected from different places were processed, but the metagenomics study could not be done as the rate contract for sequencing services was not done by the institute during the years 2021–22. The metagenomics part will be done in due course without extension of the project under the Jute-ICARE project.

Publication/technology/products

- Datta**,** S., Saha, D., Chattopadhyay, L. and Majumdar, B. (2020) Genome comparison identifies different *Bacillus* species in a bast fibre-retting bacterial consortium and provides insights into pectin degrading genes. *Scientific Reports* 10:8169
- Majumdar, B., Mazumdar, S. P., Sarkar, S. and Kar, G. (2022) Liquid formulation of CRIJAF SONA: A new beginning in jute retting. *Indian Farming*, 72 (3): 28-29.
- Majumdar, B., Sarkar, S., Saha, A. R., Mazumdar, S. P., Saha, R., Sarkar, S. K. and Jha S. K. (2019) Enhancing water use efficiency through improved microbial jute retting technique. International Conference on "Soil and water resource management for climate smart agriculture, global food and livelihood security" NAAS Complex, New Delhi, 5-9 November, 2019, pp. 54.

NCBI submission:

- The whole genome sequence of three constituent pectinolytic bacteria of "CRIJAF SONA" was submitted to NCBI. *(Source: JA 7.7, Contributors: B. Majumdar, S. P. Mazumdar, D. Saha, S. Datta, S. Sarkar and S. K. Jha).*

Project Code: SNHM 1.1 (2019-2022)

Collection and isolation of Fusarium isolates and native antagonist from major sunnhemp growing areas of Uttar Pradesh

Collection of fungal isolates: A survey was conducted from June to July 2019 in sunnhemp growing areas of UP. Five isolates each of *Fusarium udum* f.sp. *crotalariae* and *Trichoderma* were successfully isolated. The morphological characteristics of all the isolates were recorded. One native *Trichoderma* isolate was found to be effective in inhibiting the pathogen.

Screening germplasms for wilt resistance: Fifty germplasms were screened for resistance to wilt. Only one genotype, SUIN 41, with a disease incidence of 9.88 % was identified as resistant, while most of the other genotypes were moderately resistant. The identified resistant source can be utilized for further breeding of varieties against Fusarium wilt. Genotypes SUIN-18, SUIN-23, SUIN-39, SUIN-42, SUIN-48, SUIN-49 and SUIN-51 were susceptible to wilt, with more than 30% disease incidence.

Testing the efficacy of fungicides and antagonists against Fusarium isolates and the compatibility of antagonists with effective fungicides: The efficacy of six fungicides, namely Carbendazim 50% WP, Propiconazole 13.9% + Difenoconazole 13.9% EC, Carboxin 37.5% + Thiram 37.5% WS , Tebuconazole 25.9% EC, Propineb 54.2%+Tricyclazole 15% WP and Hexaconazole 5% SC, were tested on *Fusarium udum* f.sp. *crotalariae* isolates. No isolate was found compatible with the fungicides. Carbendazim 50% WP, Propiconazole 13.9% + Difenoconazole 13.9% EC, Carboxin 37.5% + Thiram 37.5% WS, Tebuconazole 25.9% EC caused 100% inhibition of the fungus.

Integrated disease management under field conditions: Seed treatment with Carboxin + Thiram @ 2g/kg Seed + Soil application of neem cake @ 2.5kg/ha + Intercropping with fodder Sorghum (10:1) was effective to control sunnhemp wilt. The IDM module can be utilized to effectively manage losses caused by a wilt pathogen. The multiple linear regression models could be utilized to recommend timely preventive measures to avoid yield losses due to disease. The use of resistant sources and adaptation of sustainable IDM practices will help in minimizing pesticide hazardous, cost of cultivation, and the sustainable management of the disease, thereby helping to double the farmer's income.

Publication/technology/product from the project:

- Shivakumar KV, Sarkar SK. 2020. Efficacy of fungicides against *Fusarium udum* f.sp. *crotalariae*. JAF News 18 (1); 9-10.
- Shivakumar KV, Behera MS, Pandey SK, Gotyal BS, Mangal V and Bhandari H. 2020. Integrated insect-pest and disease management in sunnhemp. Sunnhemp Research Station, ICAR-CRIJAF, Pratapgarh.

Product

- Five isolates each of *Fusarium udum* f.sp. *crotalariae* and *Trichoderma*

Technology

- Integrated disease Management for sunnhemp wilt

Project code: JE 2.1 (2019-2022)

Identification of resistant source against jute hairy caterpillar in wild and cultivated jute species

Insect resistance pattern among the wild jute accessions belonging to *C. aestuans* , *C. pseudo-olitorius* and cultivated species *C. olitorius* and *C. capsularis* based on biological parameters of jute hairy caterpillar, *Spilosoma obliqua* revealed that larvae survival period did not exceed beyond 10 days of feeding in case of *C. aestuans*. Larval weight gain ranged from 0.00 mg (WCIJ034) to 32.84 mg (WCIN-114) in wild accessions belonging to *C. pseudoolitorius*. Larval duration was recorded to be least in *C. aestuans* species (WCIJ-123 and WCIN-179, 11 days) in comparison to *C. pseudo-olitorius* and cultivated species studied. Growth index was recorded to be maximum in *C. capsularis* (2.87) in contrast to other species cultivated and wild accessions studied implying the susceptibility nature of *C. capsularis* to hairy caterpillar.

2. External Funded Projects

Project Code: ICAR-NICRA (2018-2021)

Impact of tropospheric ozone on crop production under jute-rice cropping system

A research project on "*Impact of tropospheric ozone on crop production under the jute-rice cropping system,"* supported by the National Innovations on Climate Resilient Agriculture (NICRA), Indian Council of Agriculture Research (ICAR), was undertaken during the years 2018–21 to investigate ozone-induced risk using ethylene diurea (EDU) treatment in two important crops of eastern India, i.e., boro rice and jute, under two field conditions, i.e., semi-urban and rural area. In addition to the assessment of jute and rice production losses from the risk of ozone-induced damage, the screening of the best varieties of such crops for their ozone sensitivity/tolerance was also performed, which may reduce the detrimental environmental effects associated with increased levels of ozone concentration in the atmosphere.

- According to the study's findings, there was a strong seasonal variation in ground level O3 concentrations with weather variables, with maximum concentrations occurring during the summer crop season (February to May) and minimum concentrations occurring during the monsoon crop season (June and July). During the boro rice season, daytime ozone levels often exceeded 40 ppb (critical level) and increased further throughout the experiment, attaining maximum levels at the peak of the vegetative phase (>50 ppb). IR 36, GB 3, IET 4786, and Ganga Kaveri cultivars of rice screened under this study were found sensitive to ambient ozone concentrations. There was no significant yield difference in MTU 1010 and Khitish cultivars for EDU and Control treatments, as evidenced by increased yield and antioxidative defense. **As a result, MTU 1010 and Khitish may be considered ozone-tolerant cultivars.**
- During the jute crop experiment, O_3 concentrations were low during the maturity phase (June–July). However, the hourly O_3 concentrations increased above "the critical level" in the main vegetative stage. There was no significant yield difference between the **JRO 204 and NJ 7010 cultivars, which may be considered well adapted to ozone exposure**.

Other cultivars of jute (JRO 524, JRO 632, IRA, and S 19) screened under the experiment were sensitive to ambient ozone concentrations. Prevailing O_3 concentrations in the Indo-Gangetic Plains of West Bengal (India) may have a negative impact on the growth and yield of rice and jute crops.

Publications

- **Singh, Arvind Kumar**, Mitra, Sabyasachi and Kar, Gouranga (**2022**) Assessing the impact of current tropospheric ozone on yield loss and antioxidant defense of six cultivars of rice using ethylenediurea in lower Gangetic Plains of India. *Environmental Science and Pollution Research* 29: 40146-40156.
- **Singh, Arvind Kumar**, Majumdar, Bijan and Kar, Gouranga (**2022**) Tropospheric ozone effect on yield, quality and antioxidant defence of six cultivars of jute with ethylene diurea in the lower Gangetic Plains of India. *Arabian Journal of Geosciences* 15:962. DOI: 10.1007/s12517-022-10266-4
- ए. के. सिंह एवं गौरंगा कर (2021) क्षोभ मंडलीय ओजोन गैस सांद्रता का पटसन एवं धान कृषि जलवायु पर प्रभाव। रेशा किरण, 4(1): 11 -15.

Presentation in Conferences

- NICRA Annual Workshop for project presentation, at NASC, New Delhi during 17-18 Dec 2019
- Review meeting of NICRA project (CGC) by NICRA Expert Committee at ICAR-CRIDA, Hyderabad on 11 March 2021

Trainings organized

- Farmer's training on "Climate Resilient Jute based Cropping System for Scheduled Caste Farmers of W.B" during 12 March 2020 at ICAR-CRIJAF, Barrackpore.
- Farmers' Training-cum-Scientist Interaction on Climate resilient jute based cropping system for SC farmers of West Bengal during 9-10 March 2021at ICAR-CRIJAF, Barrackpore.

Project Code: Ministry of MSME, GoI (2017-2022)

Intellectual Property Facilitation Centre (IPFC) for MSME

An IP Facilitation Centre (IPFC) was established in January 2017 under the NMCP scheme of the Office of Development Commissioner, Micro, Small, and Medium Enterprises (DC-MSME) at the ICAR-Central Research Institute for Jute and Allied Fibres, Barrackpore, North 24 Parganas, West Bengal. The major role of this IPFC was to identify the beneficiaries of the target sector by providing IP-related consultation services, extensive training and awareness programmes, patent and trademark search services, and IP registrations that include filing patent, trademark, GI, industrial design, and copyright applications.

Awareness Programs: About ten IP awareness programmes were conducted in different districts, viz., Nadia, Burdwan, North 24 Parganas, South 24 Parganas, and Kolkata.

Filed Trademarks: At least 116 enterprises have been assisted in filing their trademarks during 2017–18 and 2018–19. Filed trademark applications covered different sectors of industries, under trademark classes 14, 16, 19, 8, 24, 31, 34, 37, and 41. In the year 2019–20, about 82 trademarks were filed.

Patent Filing: Sixteen (16) patents have been filed in different fields during the year 2018–19. In the year 2019–20, 25 patents were filed.

GI filing: Work has been done for filing GI on the guava of Baruipur and the *mitha pan* (beetle vine leaf) of West Bengal. Work was also initiated on the possibility of GI registration of Sitashal rice in Burdwan and Begampur saree in Hooghly district. Potential Geographical Indications (GI) of West Bengal has been identified.

OUTREACH PROGRAM

Scientists & Farmers Linkages

Field Day and Kisan Sammelan for Farmers

The Hon'ble Minister of State for Agriculture and Farmers Welfare, Govt. of India, Shri Kailash Choudhary Ji graced a programme on "Field Day-cum-Kishan Sammelan," organized at ICAR-CRIJAF, Barrackpore, on July 4, 2022. During his interaction with farmers at Kisan Sammelan, Shri Kailash Choudhary, Hon'ble Minister and Chief Guest of this program, informed them about the vast potential of natural fibres such as jute, mesta, sisal, flax, ramie, hemp, and others in creating self-employment opportunities and creating a clean and green India. The Hon'ble Minister and other dignitaries also visited the exhibition hall, the fibre museum, the farm pond-based integrated farming system, the improved jute retting complex, farm machinery, laboratories, the experimental farm, and KVK, North 24 Parganas (addl). This programme was attended by approximately 250 farmers, farm women, SHG members, and dignitaries from other institutes, members of the press and media, and institute staff.

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

A skill development programme for making jute bags and other household materials from jute fabrics was organised for farm women during June 13–20 and Sept 20-30, 2022 (TSP). During the valedictory session, different types of jute bags made by the trainees were exhibited. Smt. P. L. Verma, IAS, Joint Secretary, Ministry of Textiles, Govt. of India, graced the valedictory programme as the chief guest. Sri Kishan Singh, Joint Director, Ministry of Textiles, Govt. of India, and Sri Mahadev Dutta, Deputy Director, NJB were present. A similar type of programme was also conducted for women of the Sundarbans region during April11–16, 2022 under the project "Protecting ecosystems and livelihoods of the Sundarbans" funded by Asia Pacific Network for Global Change Research.

Sri Kailash Choudhary, Hon'ble Minister of State for Agriculture and Farmers Welfare, Govt. of India, interacting with farm women and scientists of ICAR-CRIJAF

Field Day and Seed Exhibition for Jute Farmers

A Field Day-cum Seed Exhibition was organised on May 23, 2022 to create awareness among jute farmers about the improved high-yielding varieties and other new technologies developed by the institute. Dr. N. S. Rathore, Vice Chancellor, MPUAT, Udaipur, graced the occasion as chief guest and addressed the farmers. Farmers-Scientists interaction and field visits for the farmers were also arranged. More than 150 farmers, SHG members, and scientists participated in this program.

Trainers' Training on Improved Production Technology

A series of training programmes were organised on "Improved Production Technology for Quality Jute Fibre Production" during June 2–14, 2022 for the Block Supervisors and Master Trainers of the Jute-Improved Cultivation and Retting Exercise (Jute-ICARE) project jointly implemented by ICAR-CRIJAF, Jute Corporation of India and the National Jute Board. This project will benefit approximately 3 lakh farmers in West Bengal, Assam, Bihar, Odisha, Meghalaya, and Andhra Pradesh.About 91 Master Trainers and Block Supervisors from West Bengal, Bihar, Assam, Odisha, and Andhra Pradesh have been trained.

Mega Campaign on Natural and Organic Farming in Jute

Mega campaign on natural and organic farming in a jute-based cropping system was organised for farmers during April 23–24, 2022. Sri Dhrubajyoti De, IPS, Joint Commissioner (HQ.), Barrackpore, graced the occasion as the Chief Guest and interacted with the farmers. Diuring the campaign, Dr. Gouranga Kar, Director, ICAR-CRIJAF said that profitable farming and women's empowerment should to be taken into account while implementing natural and organic farming. The programme was attended by 100 farmers of West Bengal.

Farmers' Awareness Campaign on Balanced use of Fertilizers

Awareness campaign on efficient and balanced use of fertilizers in agricultural crops was organized on 21st June 2022 to make aware the farmer on importance of judicious nutrient management for improving yield of crops, INM through inclusion of organic manures, composting, green manures, etc., and also enlightened the participants on modern innovative techniques like use of leaf colour charts, drip fertigation, and nano-fertilizer applications through drones. The programme was attended by 35 farmers, scientists, and students.

Dr. N. S. Rathod, Vice Chancellor of MPUAT, Udaipur interacting with Director and Scientists on occasion of Seed Exhibition of CRIJAF

Participants receiving certificate from Smt. P.L. Verma, Joint Secy, MoT, GoI in presence of Director of ICAR-CRIJAF and JD, MoT, GoI

Kisan Bhagidari Prathmikta Hamari Campaign

A farmer's fair-cum-awareness programme as a part of the "Kisan Bhagidari Prathmikta Hamari" Campaign was organised by ICAR-CRIJAF along with KVK of North 24 Parganas (Additional) and Burdwan during April 26-28, 2022. The inaugural program of Krishi Bhawan Chaired by Hon'ble Minister of Agriculture and Farmers' Welfare was webcasted for the farmers. A total of 772 farmers participated in these programs. Farmers visited the exhibition hall-cum-fibre museum, the jute retting pond based integrated farming system model, and different demonstration plots of ICAR-CRIJAF and KVK.

Wealth from Waste: Bio-Compost and Its Utilization in the Field Crops

A farmer's training was organised from September 13–15, 2022, at ICAR-CRIJAF, Barrackpore, West Bengal, to disseminate bio-compost production in farmers' fields. This technology of bio-composting may provide an alternative approach to waste management for a clean environment. In the valedictory session, Dr. Gauranga Kar, Director, ICAR-CRIJAF, stressed the use of biocompost to improve soil quality and emphasised the production of biocompost and green manuring crop like sunnhemp to curtail the use of chemical fertilisers. Vermi-bed for vermicompost and sunnhemp seeds was distributed to all farmers.

Farm Pond Based Integrated Farming System for Higher Income Opportunities

A training programme on "Farm pond based integrated farming systems for higher income opportunities" was organised during September 22–24, 2022, under the TSP scheme at ICAR-CRIJAF, Barrackpore. 25 farmers from Minakha, North 24 Parganas, W.B. participated in the programme. In the concluding session, Dr. Gouranga Kar, Director, ICAR-CRIJAF, interacted with the farmers and highlighted the significance of an in-situ retting tank based farming system for fetching higher income and profits to meet living expenses. The tribal farmers were given vegetable seeds, vermi-beds, and small farm implements.

Awareness Programme on Conservation of Crop Varieties

An awareness programme was organised for "Conservation of Crop Varieties under PPV & FR Act" at Babpur village, North 24 Parganas, West Bengal on May 24, 2022. The objective of the programme was to sensitise the farmers about the protection of their rights in the areas of farm innovations, breeding and protection of varieties, including the PPV & FR Act and conservation of varieties. A total of 45 community resource persons and farmers participated in the programme.

Sri Dhrubajyoti De, IPS, Joint Commissioner, Barrackpore with Director, and scientists of ICAR-CRIJAF

Participants with Managing Director, JCI and Director of ICAR-CRIJAF

Farmer-Scientist-Expert Interface Meeting

A one-day Farmer-SHG-Scientist-Expert Interface Meeting was organised on June 23, 2022, in which farmers and SHG members from four districts, viz., Hooghly, North 24 Parganas, Nadia, and Murshidabad, participated. The Chairman of RAC, Prof. S. K. Datta, Vice Chancellor, Biswa Bangla University, along with other esteemed members including Dr. R.K. Singh, ADG (CC), ICAR-New Delhi, graced the Interface Meeting. They interacted with farmers and SHG members. About 150 farmers, SHG members, and FPO representatives participated in the programme.

Kisan Diwas Organised for the Use of Natural Fibre to Replace Plastic

Kisan Diwas 2022 was organised on December 23, 2022, to create awareness about the use of natural fibre products to replace plastic. Shri Saurav Barik, SDO, Barrackpore, inaugurated the programme and distributed farm implements and inputs among participating farmers in the presence of the director and scientists of ICAR-CRIJAF. The inaugural programme of Krishi Bhawan Chaired by Hon'ble Minister of Agriculture and Farmers' Welfare was also webcasted for the farmers. Around 125 farmers participated in the programme.

Post-Harvest Management Practices of Jute for Quality Fibre Production and Higher Profit

A farmers' training programme on "Post-harvest management practices of jute for quality fibre production and higher profit" was organised from September 21–23, 2022, at ICAR-CRIJAF, Barrackpore. A total of 17 farmers from Taraberia village, North 24 Parganas (W.B.), participated. In the valedictory programme, critical agricultural inputs and farm implements were distributed among farmers. In the concluding session, Dr. Gouranga Kar, Director, ICAR-CRIJAF, encouraged the farmers to implement the CRIJAF technologies in their fields for better yield and increased profitability.

Use of CRIJAF SONA in Jute Retting for Quality Fibre Production

A farmers' training on "Use of CRIJAF SONA in jute retting for quality fibre production" was conducted September 27–29, 2022, for the SC farmers of Barrackpore block of West Bengal. In the valedictory programme, Dr. Gouranga Kar, Director, ICAR-CRIJAF, stressed the importance of in-situ jute retting tanks and the CRIJAF SONA for quality fibre production and diversified jute products.

Chairman and Members of RAC during Farmer-Scientist-Expert Interface Meet at ICAR-CRIJAF, Barrackpore

Training Organised

	Topic of the training	Place	Duration	No. of Participants
1.	Designing and making of jute fabric based files and folders	ICAR-CRIJAF, Barrackpore	27 Jan – 9 Feb 2022	12
2.	Wealth from waste: Bio-compost & its utilization in crop fields (under NEH Scheme)	Haripur, Rajabala & ICAR-KVK Tura, West Garo Hills and Kodaldhowa, Zikzak, South-West Garo Hills	24, 25 & 26 Feb 2022	200
3.	Improved production technology of jute (under DST- SEED Project)	ICAR-CRIJAF, Barrackpore	9 - 11 Mar 2022	42
4.	Jute diversified products making for women empowerment and livelihood improvement in Sundarbans Delta (under APN Multinational Project)	ICAR-CRIJAF, Barrackpore	11-16 Apr 2022	12
5.	Improved jute production technology of jute (under Jute-ICARE)	ICAR-CRIJAF, Barrackpore	2-14 Jun 2022	110
6.	Mid season management of onion crop in jute based cropping sequence (under DST- SEED Project)	Hansia, North 24 Parganas Ratanpur, North 24 Parganas Beraberia, North 24 Parganas	14 Jun 2022 15 Jun 2022 17 Jun 2022	50 50 50
7.	CRIJAF technologies for jute based cropping system	Krishak Bazar, Nakashipara, Nadia	15 Jul 2022	50
8.	Improved production technology on jute retting by CRIJAF SONA (under Jute- ICARE)	Charghat, Maslandapur, North 24 Parganas	2 Aug 2022	60
9.	Training-cum- demonstration on Improved retting of jute through CRIJAF SONA (under Jute- ICARE)	Chandpara, Bongaon, North 24 Parganas	3 Aug 2022	60
10.	Improved retting of jute through CRIJAF SONA (under Jute- ICARE)	Champadang & Jirat, Hooghly Barpeta & Darrang, Assam Madhepura & Katihar, Bihar	4-5 Aug 2022 4-6 Aug 2022 7-8 Sep 2022	94 118 160
11.	Improved retting of jute through CRIJAF SONA and crop cutting (under Jute- ICARE)	Krishnanagar, Nadia	4-6 Aug 2022	108
12.	Designing and making of jute bags for the farm women (under AINPJAF)	ICAR-CRIJAF, Barrackpore	16-23 Aug 2022	12
13.	Improved retting and fibre extraction technology for high quality fibre (under DST-SEED Project)	ICAR-CRIJAF, Barrackpore	1 Sept 2022	30
14.	Popularization of STCR technology for efficient and balanced use of fertilizer (under STCR Project)	Ghetugachi, Nadia	30 Sep 2022	30
15.	Post-harvest management in sisal for improving fibre quality & higher profit	SRS, Bamra	27 Oct 2022	33
16.	पटसन रेशा निर्मित विभिन्न उत्पाद संबंधित प्रशिक्षण (under ATMA, Supaul, Bihar)	ICAR-CRIJAF, Barrackpore	14-19 Nov 2022	32
17.	Improved seed production technology of major field crops cultivated in West Bengal	ICAR-CRIJAF, Barrackpore	22-24 Nov 2022	20

Training programmes conducted by Krishi Vigyan Kendra (KVK)

Training Category	Number of Trainings	No. of Participants						
		General			SC/ST			Grand Total
		Male	Female	Total	Male	Female	Total	
KVK, North 24 Parganas (Addl)								
Practicing Farmers	24	130	158	288	81	116	197	485
Rural Youth	4	1	19	20	21	28	49	69
Extension Functionaries	3	53	0	53	11	5	16	69
Total	**31**	**184**	**177**	**361**	**113**	**149**	**262**	**623**
KVK, Burdwan								
Practicing Farmers	12	--	--	--	195	166	361	361
Rural Youth	4	--	--	--	12	68	80	80
Extension Functionaries	4	42	5	47	44	16	60	107
Total	**20**	**42**	**5**	**47**	**251**	**250**	**501**	**548**

Field & method demonstration programmes in Farmer's Field

	Programme	Place	Duration	No. of Participants
1.	Jute retting demonstration, Jute- ICARE	Paschim Sualoni, Nagaon, Assam	3 Aug 2022	25
2.	Retting demonstration and farmers interaction, Jute- ICARE	Mukali Nasastra, Nagaon, Assam Beltali village, Nagaon, Assam Lalpur, Forbishganj, Bihar Fulbari, Kishanganj, Bihar DhupaguriKachargaon, Assam	4 Aug 2022 5 Aug 2022 18 Aug 2022 19 Aug 2022 4 Aug 2022	15 15 100 70 40
3.	Method demonstration on "Multi Row Seed Drill and Single Wheel Jute Weeder"	Hansia, North 24 Parganas Beraberia, North 24 Parganas	21 Mar 2022 21 Mar 2022	40 60
4.	Demonstration on use of "Paddy Drum Seeder"	ICAR-CRIJAF, Barrackpore	3 Aug 2022	13
5.	Demonstration programme on "Weeding in Rice using Mandwa Weeder"	ICAR-CRIJAF, Barackpore	2 Sep 2022	15
6.	Farmers Field School on "Jute crop cutting and improved retting using CRIJAF-SONA"	Ratanpur	4 Aug 2022 22 Sep 2022	60

Farmer's Training and Method Demonstration on retting under Jute-ICARE Project in Hooghly district, West Bengal

National Food Security Mission (NFSM)

1. Frontline demonstrations (FLD)

Improved Production Technologies of Jute under NFSM (CC) Jute: Frontline demonstrations on the latest high yielding varieties (JRO 204, JRO 2407, JBO 1, JROM 1, and CO 58) and other improved production technologies (weed management through the CRIJAF Nail Weeder and 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 three major jute growing districts (viz. North 24 Parganas, Hooghly, and Nadia) of West Bengal.

Table 36. FLDs on improved production technologies of jute in West Bengal

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 & other nearby villages (Chakdah, Nadia)	105	70.50	38.00	32.50
Panji & other nearby villages (Baduria, North 24 Parganas)	233	125.25	55.00	70.25
Charkrishnabati & other nearby villages (Balagarh, Hooghly)	265	74.66	32.40	42.26
Total	603	270.41	125.40	145.01

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, JRO 2407, JBO 1, JROM 1, and CO 58) significantly enhanced the average yield by 7.86–11.76 q/ha over the varieties used by the farmers. Out of all the demonstrated five varieties, CO 58 was the highest yielder (41.65 q/ha), followed by JRO 204, JROM 1, JBO 1, and JRO 2407, while the average yield of the farmers' used variety was found to be 29.89 q/ha.

Table 37. FLDs on improved varieties of jute in West Bengal

Particulars	FLD on high yielding jute varieties					Farmer's Practice
	JRO 204	CO 58	JBO 1	JROM 1	JRO 2407	
Cost of cultivation (₹/ha)	99727	99727	99727	99727	99727	115488
Gross return (₹/ha)	240421	250025	234297	236218	225460	179336
Net return (₹/ha)	140694	150298	134570	136491	125733	63848
Fibre yield (q/ha)	40.05	41.65	39.03	39.35	37.75	29.89
BCR	2.41	2.51	2.35	2.37	2.26	1.55

Weed management through the mechanical method: In order to reduce the cost of weeding and increase the profitability of jute cultivation, the demonstrations on mechanical weeding by the CRIJAF single wheel jute weeder (SWJW) were conducted in the farmer's field (125.40 ha) in three districts of West Bengal (Table 38). Demonstrations on mechanical weed management resulted in 6.15–9.78 q/ha fibre yield gain over farmers' practice (29.54–30.21 q/ha). Labour savings ranged from ₹11767 to ₹15810 per ha.

Table 38. Economics of jute cultivation in North 24 Parganas district of West Bengal

Locations/ Particulars	IC (₹/ha)	LC (₹/ha)	CC (Kg/ha)	Yield (₹/ha)	GR (₹/ha)	NR (₹/ha)	BCR
Mechanical weed management							
Nadia							
SWJW	12058	86778	98836	36.06	216365	117529	2.19
FP	14879	101616	116495	30.21	181266	64771	1.56
North 24 Parganas							
SWJW	11578	82610	94189	39.71	238278	144089	2.53
FP	15450	98420	113871	29.93	179570	65699	1.58
Hooghly							
SWJW	12377	89017	101395	38.53	231162	129767	2.28
FP	15312	100784	116097	29.54	177217	61120	1.53
Line sowing by jute seeder							
Nadia							
Multi-row seed drill	11325	85134	96459	34.52	207090	110631	2.15
FP	15450	98420	113871	30.21	181266	67395	1.60
North 24 Parganas							
Multi-row seed drill	11644	92118	103762	38.30	233782	130020	2.25
FP	14879	101616	116495	29.93	179570	63075	1.58
Hooghly							
Multi-row seed drill	11767	91954	103720	37.35	224082	120362	2.16
FP	15312	100784	116097	29.54	177217	61120	1.53

IC- Input Cost, LC- Labour Cost, CC- Cost of Cultivation, GR-Gross Return, NR-Net Return, BCR-Benefit Cost Ratio, FP - Farmers' Practice, NW- Nail Weeder, SWJW-Single Wheel Jute Weeder, Prices of jute fibre and jute stick were Rs.5400/q and Rs.400/q, respectively.

Fig. 89. Frontline demonstration of improved production technologies of jute

Line sowing by jute seeder: Demonstrations on line sowing by jute seeder were conducted in 145.01 ha area of three districts of West Bengal (Table 39). It helped increase the fibre yield by 4.31–8.37 q/ha. It also reduced the cost of human labour in jute cultivation by ₹8831– ₹13286 per ha over farmers' practice.

Table 39. Qualitative evaluation of improved jute retting with CRIJAF SONA

Location	Fibre quality		Retting duration (days)		Additional income (₹/ha)
	Improved	Conventional	Improved	Conventional	
Nadia	TD 2-3	TD 5-6	16-18	20-22	400-450
North 24 Parganas	TD 2-3	TD 5-6	20-22	24-26	450-500
Hooghly	TD 2-3	TD 5-6	18- 20	22-24	400-450

Improved retting through CRIJAF SONA: Improved retting demonstrations were also conducted. In comparison to the previous years, there was scarce of rainfall in most of the places at the time of sowing as well as harvesting, 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 an improvement in fibre quality. Growers could earn an additional ₹ 400-450 per quintal as jute fibre quality improves. As the process of improved retting through CRIJAF SONA involves a lower fiber-to-water ratio (v/v) for retting, in such conditions this method has proven its utility.

Fig. 90: Demonstations of improved retting for production of high quality fibre

FLD on ramie fibre production and extraction technology: As per the approved plan of NFSM (commercial crops) 2022–23 by DAC&FW, Govt. of India, "FLD on ramie fibre production and extraction technology," plantations in a 2 ha area were done in the farmers' field of Chirang district of Assam, and the quality planting materials (of variety R-1411 or Hazarika) for expansion were supplied by Ramie Research Station, Sorbhog, Assam. Maintenance activities in a 10 ha area of ramie plantation at RRS, Sorbhog, Assam, was also carried out.

2. Quality Seed Production

Foundation seed: Emphasis has been given to the increasing availability of new varieties of jute, mesta, and sunnhemp. For the first time, ICAR-CRIJAF has ventured into foundation seed production of new jute varieties (JRO204, JBO-1; JROM-1 and JRO 2407, target 28 q) in Guntur, Andhra Pradesh, in a farmer's participatory mode, along with MPKV, Rahuri. Similarly, foundation seed production of the latest released sunnhemp variety, SUIN 03, was targeted for 5 q. But due to an unknown disease, no seed was obtained instead of pod formation in sunnhemp. A total of 25 q of foundation seed of jute was produced by ICAR CRIJAF out of a target of 30 q (83.3% achievement). Similarly, ARS, Amadalavalasa, under ANGRAU, Guntur (Andhra Pradesh), has produced 5.32 q of foundation seed of jute, mesta and sunnhemp against a target of 10 q. This centre has produced the foundation seed for recently released mesta (roselle) varieties like AMV-7 (0.80 q), AMV-8 (0.70 q), and AMV-9 (0.50 q). Foundation seeds of the popular jute variety JRO-204 of 1.82 q and the sunnhemp variety SUIN 03 of 1.50 q were also produced against targets of 3 q and 2 q, respectively.

Table 40. Foundation seed production during 2021-22

Component	Variety	Target (q)	Achievement (q)
ICAR-CRIJAF, Barrackpore			
Jute	JBO-1	5.00	3.10
	JROM-1	5.00	6.00
	JRO-2407	10.00	10.00
Sunnhemp	SUN03	5.00	0.00
MPKV, Rahuri, Maharashtra			
Jute	JRO-204*	5.00	5.90
ARS, Amadalavalsa, AP			
Jute	JRO-204	3.00	1.82
Mesta	AMV-7, AMV-8, AMV-9	5.00	2.00
Sunnhemp	Suin03	2.00	1.50
TOTAL		40.00	30.32

Fig. 91: Production of foundation seed of jute at Budbud, West Bengal

Fig. 92: Production of foundation seed of jute and mesta at Amadalavalasa, Andhra Pradesh and Budbud, West

Certified Seed: To popularise the new jute, mesta, and sunnhemp varieties, initiatives were taken under the NFSM Commercial Crops Program for certified jute seed production. ICAR-CRIJAF has undertaken certified seed production of Tossa jute (*C. olitorius*) variety CO-58 (Sourav) due to the availability of foundation seed produced under the NFSM Commercial Crops Programme during 2020–21. A total of 95 q of the jute variety CO-58, 2 q of the mesta variety AMV-7, and 3 q of the sunnhemp variety SUIN 037 were targeted during 2021–22, and a total of 74.26 q of certified seed were produced as per **Table 41**.

Table 41. Certified seed production during 2021-22

Location	Seed production (q)		
	Jute	Mesta	Sunnhemp
	CO-58	AMV 7	SUIN 037
ICAR-CRIJAF, Barrackpore	60.00	0.00	0.00
Target	45.00	0.00	0.00
Achievement			
MPKV, Rahuri, Maharastra	30.00	0.00	0.00
Target	24.26	0.00	0.00
Achievement			
ARS, Amadalvalsa, AP			
Target	5.00	2.00	3.00
Achievement	2.00	1.00	2.00

Fig. 93: Production of certified seed of jute and mesta at Amadalavalasa

Fig. 94a: Monitoring of Mesta variety AMV7

Fig. 94b: Monitoring of Mesta variety AMV10 at Amadalavalasa

3. Farmers trainings conducted

Name of the training	Date	Location	Participants
Improved production and extraction technology of ramie	21st Jan, 2022	RRS, Sorbhog, Assam	50
	28th Jan, 2022	RRS, Sorbhog, Assam	50
	9thMarch 2022	Tura, West Garo Hills , Meghalaya	50
	10thMarch 2022	Chokpot,South Garo Hill, Meghalaya	50
	11thMarch 2022	Warimagre, South Garo Hills, Meghalaya	50
Ramie production and fibre extraction technology'	28th Sept. 2022	RRS, Sorbhog, Assam	50
	26th Oct. 2022	RRS, Sorbhog, Assam	50
	30th Nov. 2022	RRS, Sorbhog, Assam	50

Fig. 95: Farmers' trainings at Ramie Research Station, Sorbhog, Assam under NFSM-CC 2022-23

4. Field Day/Workshop Organized

	Title	Location	Participants
1.	**Demonstration of improved jute varieties**	1 June 2022 Banagola, Malda	50
2.	**Mega campaign on natural and organic farming in jute-based cropping system**	23-24 April 2022 ICAR-CRIJAF, Barrackpore	100

Fig. 96: Farmers' trainings at Ramie Research Station, Sorbhog, Assam under NFSM-CC 2022-23

TSP, SCSP & NEH Programs

Tribal Sub-Plan (TSP), Scheduled Caste Sub-Plan (SCSP), and NEH programs was 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.

1. Tribal Sub-Plan (TSP)

1.1 Agricultural input distribution for enhancing crop productivity and farm income

A series of activities were undertaken under TSP during the year 2022 through integrated approaches in jute and allied fibres based cropping systems with various components like fruit plants, vegetables, fishery, vermicompost, etc. in West Bengal and Odisha. With adequate resource support, successful technology models, farm equipment, improved seed, animal components, and other appliances for improving farm income in jute and allied fibre based cropping programme were promoted among ST farmers. Various agricultural inputs like improved varieties of seeds, fruit planting materials, fertilizers, vermicompost beds, CRIJAF Sona, and farm implements/tools etc. were distributed to more than 5688 farmers.

To promote a jute-based farming system, various enterprises, such as vegetable cultivation, fishery, vermicomposting, etc., along with technological support, were provided to approximately 5700 ST farmers in West Bengal and Odisha. Farm inputs (seeds, fertilizers, CRIJAF Sona, fish fingerlings, fish feed) and farm tools (sprayer, jute seeder, jute weeder, etc.) were given to all participating farmers.

Inputs distributed	Quantity
Seeds	
Jute seed (cv. JRO 204)	300 kg
Paddy seed (cv. MTU 7029, Swarna)	10000 kg
Paddy seed (cv. IET 4786, Shatabdi)	13600 kg
Mustard/ Toria seed	100 kg
CRIJAF Sona	3000 kg
Farm implements	
a. Knapsack sprayer & Single wheel jute weeder	50 nos. each
b. Jute seeder	25 nos.
c. Small farm implements (Spade, Sickle, Khurpi)	165 nos. each
Fertilizer	
a. Urea : SSP : MOP	2610:3750:1000 kg
b. Liquid NPK consortium	50 litres
c. Plant growth promoter	50 litres
Vermicompost Beds	210 nos.
Vegetable seed kit	1730 packets
Fruit saplings (cv. Amrapali Mango, L49 Guava)	500 nos. each
Fish Fingerling	50000 nos.
Fish Feed	15000 kg
Fish dragnet	8 nos.

1.2. Farm skill development of ST farmers

To develop knowledge and skill of ST farmers by identifying and addressing the issues related to low farm income in the field of agriculture and allied sectors, scientists of ICAR-CRIAF has conducted various capacity building programmes like trainings and demonstration in several districts of West Bengal. During 2022, six training programmes were conducted under TSP which benefitted about 233 ST farmers (Table 42).

Under the capacity-building programmes among the ST farmers, various trainings and demonstrations, like backyard poultry production, farm pond-based integrated farming systems, the designing and making of jute-based handicrafts, and post-harvest management in sisal, were conducted for 233 ST beneficiaries.

Table 42. Capacity building programmes under TSP

Capacity building programme	Date/Place	No. of Participants
Post-harvest management in sisal for improving fibre quality for higher profit	27 October, 2022 SRS, ICAR-CRIJAF Bamra, Odisha	30
Backyard poultry production for additional income of the jute growing tribal farmers	21- 23 September, 2022 ICAR-CRIJAF, Barrackpore	15
Farm pond based integrated farming system for higher income opportunities	22- 24 September, 2022 ICAR-CRIJAF, Barrackpore	26
Designing and making of jute based handicrafts for the farm women	20- 30 September, 2022 ICAR-CRIJAF, Barrackpore	12
Farmers' fair cum input distribution program	14 July, 2022 Herobhanga bazar, Canning, South 24 Parganas	100
Awareness camp cum input distribution program	12 April, 2022 Naliakhali, Canning, South 24 Parganas	50

Fig. 97: Farmers attending programmes of TSP in West Bengal

2. Scheduled Caste Sub-Plan (SCSP)

The SCSP (Scheduled Caste Sub Plan) has been started by the Government of India to benefit the farmers of scheduled caste (SC) communities of the country. The institute implemented the SCSP plan in jute and allied fibre crop based farming system to benefit the farmers of the SC community. Fifteen trainings programmes on various aspects were conducted and 1150 farmers were benefited during the year 2022. Agricultural inputs were also distributed for demonstrations in the adopted villages.

- Scheduled caste sub-plan activities were implemented in five villages of North 24 Parganas district of West Bengal, covering around ~220 beneficiaries.
- Demonstrations on jute, paddy and vegetables were conducted in SC farmers' fields covering 50 ha area.
- To increase the income of SC beneficiaries, critical agricultural inputs such as vegetable seed kits, CRIJAF-Nail Weeder, CRIJAF-Single Wheel Jute Weeder, battery operated sprayers, spade (*phowrah*), sickle, khurpi, jute seed, sunnhemp seed, CRIJAF Sona, CRIJAF multi-row seed drills, vermibed, NPK fertilizer (10:26:26), urea, MOP, fish feed, paddy seed, fruit plant seedlings, sisal suckers, sisal bulbils, neem cake, vermicompost, ducklings, chicks, mushroom spawn, and fingerlings, etc. were given to all participating farmers.
- Excavation of 17 *in-situ* retting ponds was done at Murshidabad, Uttar Dinajpur, and Dakshin Dinajpur districts of West Bengal.
- About 5496 SC farmers were covered under the SCSP programme in 2022.

Critical agricultural inputs such as seeds, farm implements, CRIJAF Sona, vermibed, fertilizer, fish feed, fruit plant seedlings, neem cake, ducklings, bird chicks, sisal suckers and bulbils, mushroom spawn, fish fingerlings, etc. were distributed among SC farmers. Seventeen *in-situ* retting ponds were excavated in the Murshidabad, Uttar Dinajpur, and Dakshin Dinajpur districts of West Bengal. 15 trainings on various aspects were conducted to benefit 1150 farmers.

Distribution of CRIJAF-SONA and seeds of various crops to farmers under SCSP

Demonstration of improved jute variety in SC farmer's field

Table 43. Trainings conducted under SCSP during 2022

Capacity building programme	Date/Place	No. of participants
Farmers-experts interaction programme and distribution of input	22 - 23 February, 2022 Kakdwip, Sundarban, W.B.	100
Skill development on bleaching and dyeing of jute fibre and yarn	7-9 March, 2022 ICAR-CRIJAF, Barrackpore, W.B.	24
Skill development on bleaching and dyeing of jute fibre and yarn	10 - 14 March, 2022 ICAR-CRIJAF, Barrackpore	24
Awareness programme and input distribution	11 - 3 April 2022 Odisha	150
One day farmers – expert interaction and distribution of inputs to SC farmers.	1 June 2022 Canning, W.B.	160
Field trainings and supply of inputs for development of in-situ retting pond-based sustainable self-reliant eco-farming models	4 - 6 August, 2022 Beldanga and Raghunathganj, Murshidabad, W.B.	86
Enhancing yield and income of jute growing farmers through retting pond based farming system and CRIJAF-Sona	7 - 9 September, 2022 Jajpur, Keonjhar and Dhenkanal district of Odisha	150
Wealth from waste: Bio-compost and it's utilization in the field crops	13 -15 September, 2022 ICAR-CRIJAF, Barrackpore, W.B.	15
Effect of integrated weed management on growth and yield of jute and allied fibres for augmenting farm income	20 - 22 September, 2022 ICAR-CRIJAF, Barrackpore, W.B.	23
Impact of integrated pest management for enhancing production and productivity of rice in jute based cropping system	20 - 22 September, 2022 ICAR-CRIJAF, Barrackpore, W.B.	46
Post-harvest management practices of jute for quality fibre production and higher profit	21-23 September, 2022 ICAR-CRIJAF, Barrackpore, W.B.	17
Use of CRIJAF-Sona in jute retting for quality fibre production	27 - 29 September, 2022 ICAR-CRIJAF, Barrackpore, W.B.	20
One day farmers-expert interaction programme and distribution of input	29 September, 2022 Kulpi, Diamond harbour, W.B.	150
Scope of duck farming in enhancing rural livelihood in jute growing area	17 -19 October, 2022 ICAR-CRIJAF, Barrackpore, W.B.	15
Filed-day cum farmers-scientists interaction meeting and input distribution programme.	10 November, 2022 Gobardanga, Gaighata, W.B.	170

Fig. 98: Farmers attending programmes of SCSP in West Bengal

Fig. 99: Farmers attending programmes of SCSP in West Bengal and Odisha

3. North Eastern Hill (NEH) Programme

ICAR-CRIJAF in collaboration with Krishi Vigyan Kendra of West Garo Hills and West Tripura implemented a major component of NEH programme. A collaborative programme on "Wealth from Waste: Bio-Compost & its Utilization in Crop Fields" and distribution of Vermi-beds to the NEH farmers were initiated in Meghalaya and Tripura. Altogether 200 Vermi-beds were distributed to all participating farmers of West Garo Hills of Meghalaya and West Tripura district of Tripura. Participatory demonstrations were conducted with all 200 beneficiaries. Under NEH component, training programmes in collaboration with respective ICAR-KVKs were also conducted.

A programme on "Wealth from Waste: Bio-Compost & its Utilization in Crop Fields' for NEH farmers was initiated in Meghalaya and Tripura in collaboration with Krishi Vigyan Kendra of West Garo Hills and West Tripura. Vermi-beds were distributed to all the participating farmers.

Fig. 100: Vermi-bed for production of vermicompost distributed to NEH farmers

Mera Gaon Mera Gaurav

An initiative has been taken by ICAR-CRIJAF to promote direct interface of scientists with the farmers under ***Mera Gaon Mera Gaurav*** (MGMG) programme to increase the process of lab to land technology dissemination. During 2022, the MGMG villages of the institute have been reshuffled to cater the benefit of institute technologies, agro-advisories, outreach extension programmes (SCSP, TSP, NFSM) and CSS to some new villages. A total of 43 villages could be covered under MGMG programme. The scientists were grouped into 10 teams each with 4-5 scientists. The major work undertaken under MGMG programme were distribution of agricultural inputs like seed, fertilizer, chemical, agricultural machinery, etc. Awareness programmes were conducted to make them aware about the programmes of the sensitive issues of national importance such as Swachh Bharat Abhiyaan, climate change, water conservation, soil fertility etc. Technical problems were also addressed at village level and make use of those in prospective research programmes and generate technical, social and economic data related to institute technical programmes. The farmers were involved in programmes like Swachhta Abhiyan, Kisan Diwas, World Soil Day, World Environment Day, World Food Day, International Women Day etc. These activities helped the farming community to increase their awareness in different farming issues and related aspects.

Table 44. 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. Suman Roy Dr. J. K. Meena	Ghidah, Selampur, Gustia, Telenipara, Chapuria (North 24 Parganas)	6.	Dr. C.S. Kar Dr. M.S. Behera 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, Keuti, Tetulia, Bhabagachi,Rautara (North 24 Parganas)	7.	Dr. S. Mitra Dr. Kunal Mondal Dr. D. Saha Dr. Tribhuvan R.	Paschim Simla, Dighirpar, Chandanpur, Durgapur, (North 24 Parganas)
3.	Dr. A.R. Saha 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 Dr. A. Anil Kumar Dr. Laxmi Sharma	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)

Broad Areas of Activities

- **Awareness program on IFS, IPM, INM, organic farming**
- **Demonstration of improved production technologies of jute and distribution of agricultural inputs**

Interface meetings were organized at villages on CRIJAF technologies. Farmers of MGMG villages were invited to attend on-campus training programmes organized at ICAR-CRIJAF, Barrackpore. Demonstrations were conducted on improved production technologies of jute and allied fibres and other enterprises. Extension literatures and inputs like CRIJAF SONA, improved seeds of vegetables for nutrition garden, farm implements, etc. were provided to the farmers. The farmers were trained on major areas like improved production practices of jute, improved retting technology of jute, mushroom cultivation, soil fertility and water management, bio-compost production, farm mechanization and integrated farming system, pest and disease management, etc.

Farmer's training and farm inputs distribution in MGMG villages

Farm inputs distribution visit of scientists in MGMG villages

Farmer's training and demonstration of retting using CRIJAF technology in MGMG villages

Swachh Bharat Mission

For the implementation of Swachh Bharat activities at ICAR-CRIJAF, the institute has adopted a few best practices not only with respect to cleaning and generating awareness about waste recycling but also by taking initiatives to reduce the use of stationery in daily office activities.

Waste recycling, vermicomposting, organic agriculture, and by-product utilisation with special reference to jute and allied fibre crops were given special emphasis through Swachhta activities. Being a natural fibre institute, ICAR-CRIJAF has taken many initiatives on Swachhata, particularly in disseminating the knowledge to make wealth from waste, which will fulfil the dream of a clean environment vis-à-vis higher income for farmers. The institute has developed best practices to recycle the biodegradable waste generated inside the premises to produce biofertilizers through an efficient composting method. It is an initiative to create wealth from waste.

Hon'ble MoS, Agriculture and Farmers Welfare, Shri Kailash Choudhury Jee visiting the composting unit of the institute

Dignitaries are briefed about the waste recycling through composting

All the administrative staff of the institute actively participated in stocktaking on the digitization of office records (e-office implementation). The institute has converted to a "green office" by fully adopting "e-office," which is completely paperless. Besides many important official records, like books, journals, and land records, these have been digitized. Environment-friendly practices like the use of plastic stationery are reduced in day-to-day office work, particularly in official meetings and trainings.

An awareness-raising programme on sanitation, vermicomposting, and biodegradable waste management was organised in the institute's neighbouring villages. Furthermore, during the training programs, the farmers were taken to the institute's composting unit to gain practical experience with the composition of agro-waste. Awareness is created among the farmers for natural or organic farming with the least use of chemical inputs for a clean and sustainable environment. Awareness is spreading among farm women to prepare the use and marketing of jute-based diversified products to replace plastic for a clean environment.

The institute staff participated in the cleaning and beautification of different divisions and sections and the surrounding areas. Awareness programmes for school children were organized in Giddah and Kumra villages of the

North 24 Parganas regarding the importance of sanitation and the vermicomposting and composting of biodegradable waste to generate wealth from waste.

Swachhta awareness programmes were organized at the local level by visiting households and conveying the message of swachhta to the farm women.

Director and staff of ICAR-CRIJAF taking Swachhta Pledge on 16 Dec 2022

Awareness program on sanitation in village of West Bengal

Collection of leaf litter for composting in ICAR-CRIJAF

ICAR-CRIJAF sends the message for cleaner environment by adopting natural fibres

Institute staff participating in campus cleaning activities

Women Empowerment

Empowering and mainstreaming rural women's workforce in agriculture can bring a paradigm shift towards economic growth. In this vein, ICAR-CRIJAF, has implemented many empowerment programs, particularly for women farmers, to improve livelihood security, drudgery reduction, skill and entrepreneurship development. The institute has taken initiatives to improve farm women's participation in agriculture and to empower them through entrepreneurship development. Small farm implements like a jute seed drill, a nail weeder, a single row jute weeder, and a knapsack sprayer were distributed among several farm women in TSP and SCSP adopted villages. A skill development programme was organised on the making of jute-based handicrafts, jute bags, etc. for the economic empowerment of farm women.

Demonstration of women-friendly farm implements for drudgery reduction

Improved Jute Seeder: The introduction of the manual CRIJAF Multi-row Seed Drill (MRSD) encouraged the women farmers to adopt the line sowing method in jute cultivation. The implement was specifically modified to make it lighter and more woman-friendly. The modified machine is lighter in weight and has a transparent and weather-resistant. Due to the reduced weight, the drudgery in sowing operations is reduced, which is appreciated by the women farmers.

Tools for weed management: Single wheel jute weeder was introduced to reduce the drudgery of weeding among farm women. Manual weeding in jute involves lots of drudgery, as the critical period for weeding coincides with extremely hot and humid weather. A demonstration-cum-training on the use of a nail weeder and a single-wheel jute weeder was organised in various villages in the North 24 Parganas and Nadia districts of West Bengal. These low-cost, simple farm implements are very easy to handle, and the mechanical weeding can be done in a standing posture. The introduction of such implements had a positive impact on the working conditions of farm women.

Skill development for economic empowerment of farm women

For empowering farm women, various initiatives were taken by ICAR-CRIJAF, like skill development on the making of jute bags and jute ornaments, the introduction of poultry and duckary in a jute-based integrated farming system, etc. Farm women were trained in the preparation of jute bags and other handicrafts, and they were encouraged to form Self-Help Groups in order to develop entrepreneurial activities among them. The groups so formed are actively involved in jute value addition through jute bag making and jute handicrafts.

Women farmer sowing jute seeds with CRIJAF MRSD

Training of farm women in value addition of jute fibre and fabrics

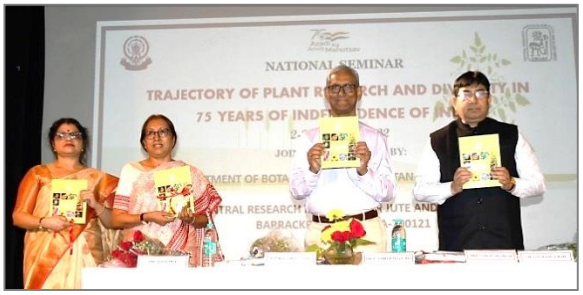
HUMAN RESOURCES DEVELOPMENT

Training & Capacity Building of Staff Members

The Annual Training Plan (ATP) of the ICAR-CRIJAF for the year 2022-23 was developed using the TMIS software. The ATP (2022-23) contains a plan for training of 21 employees. Care was taken to give priority to the manpower who did not receive any training during the previous years. The plan included training proposals for scientific (6), technical (10), administrative (1) and skilled supporting staff (4). Till December 2022, a total of five scientific staff have received six trainings on different aspects, including 'MDP on Intellectual Property Valuation and Technology Management', 'Artificial Intelligence', 'QTL Analysis and Genome Wide Association Studies' and 'MDP on Design Thinking in Agricultural Research and Education'. Five technical personnel were trained on 'Quality Management System as per ISO 9001:2015', 'Objective Quality Evaluation of Jute and Other Lignocellulosic Fibres', 'Microbial bio-inoculants in Organic Agriculture', 'Advance Level Training in Soil Testing, Plant Analysis, and Water Quality Assessment' and 'Competency Enhancement Training Programme on Motivation, Positive Thinking, and Communication Skills for Technical Officers'. Three administrative staff members received training on 'Establishment Matters for LDC and UDC of ICAR', 'MDP on Public Procurement (Advance)' and 'Capacity Building Programme for ICAR-CJSC'.

National Seminar

A National Seminar on Trajectory of plant research and diversity in 75 years of independence of India was jointly organized by ICAR-CRIJAF, Barrackpore and Department of Botany, Shri Shikshayatan College, Kolkata during 2-3 December 2022 at Shri Shikshayatan College, Kolkata. Dr. Gouranga Kar, Director, ICAR-CRIJAF, Barrackpore, and Dr. Aditi Dey, Principal, Shri Shikshayatan College, Kolkata, acted as conveners of the national seminar. Dr. Illora Sen, Head, Dept. of Botany, from Shri Shikshayatan College, along with Dr. Pratik Satya and Dr. Dhananjay Barman from ICAR-CRIJAF, served as organising secretaries, while Dr. C. S. Kar from ICAR-CRIJAF was one of the co-organizing secretaries. The keynote address was given by Dr. Gouranga Kar during the inaugural session, which was chaired by Dr. Timir Baron Jha, Former Head, Department of Botany, Presidency College. More than 150 delegates participated in this national seminar and submitted research in the form of posters. A total of 25 participants from ICAR-CRIJAF, including 16 technical personnel and 7 scientists, attended the seminar. Dr. Jiban Mitra and Dr. S. Satpathy delivered lectures in the presentation, and Dr. Subhojit Datta served as the evaluator for the poster sessions.



Director, ICAR-CRIJAF and other dignitaries during National Seminar at Shri Shikshayatan College, Kolkata

Technical personnel of ICAR-CRIJAF attending National Seminar at Shri Shikshayatan College, Kolkata

Table 45. Training attended by ICAR-CRIJAF employee during Jan-Dec 2022

Sl. No.	Name of the Staff & Designation	Events attended with Details
A. Scientific staff		
1	Dr. C. Biswas Principal Scientist	Online training on 'MDP on intellectual property valuation and technology management' from 18th to 22nd January 2022 at NAARM, Hyderabad
2	Dr. Dipnarayan Saha Principal Scientist	Online training on 'MDP on design thinking in agricultural research and education' from 23rd to 28th May 2022 organised by NAARM, Hyderabad
3	Dr. Thribhuvan R. Scientist	Online training on 'Winter school training programme on artificial intelligence in agriculture' from 03rd to 23rd February 2022 Online training on 'QTL analysis and genome wide association studies' Organized by IASRI, from 15th to 24th February, 2022
4	Dr. J.K. Meena Scientist	Online training on 'Winter school training programme on artificial intelligence in agriculture' from 03rd to 23rd February 2022 Online training on 'QTL analysis and genome wide association studies' Organized by IASRI, from 15th to 24th February, 2022.
B. Technical staff		
1.	Ashish Madan Pitre Technical Assistant	Online training on 'quality management system as per ISO 9001:2015' from 16th to 18th February, 2022 at ICAR-NINFET, Kolkata.
2.	Deshraj Meena Technical Officer	Training on 'Objective quality evaluation of jute & other lignocellulosic fibres' from 06th to 08th June, 2022 at ICAR-NINFET, Kolkata
3.	Vinay Kumar Singh Sr. Technician	Training on 'Objective quality evaluation of jute & other lignocellulosic fibres' from 06th to 08th June, 2022 at ICAR-NINFET, Kolkata
4.	Dr. S. K. Bhattacharyya Technical Officer	Training on 'Microbial bio-inoculants in organic agriculture' from 23rd to 26th May, 2022 at ICAR-NBAIM, Mau, UP Training on 'Competency enhancement training programme on motivation positive thinking and communication skills for technical officers' from 13th to 16th September, 2022 at ICAR-NAARM, Hyderabad
5.	Biswajit Biswas Technician	'19th Advance level training in soil testing, plant analysis and water quality assessment' from 01st to 21st September, 2022 at ICAR-IARI, New Delhi.
C. Administrative staff		
1.	Mr. Ranjan Kr. Das LDC	Training on 'Establishment Matters for LDC and UDC of ICAR' from 17th to 22nd January, 2022 at ICAR-IISR Lucknow
2.	Mr. Avirup Das Assistant	Training on 'MDP on Public Procurement (Advance)' from 4th to 6th July, 2022 at AJNIFM, Faridabad
3.	Mr. Chandan Kr. Verma Assistant	Training on 'Capacity Building Programe for ICAR-CJSC' from 15th to 19th November, 2022 at ICAR-NAARM, Hydrabad

Internship at ICAR-CRIJAF

Five M.Sc. (Biotechnology) students of ADAMAS University completed a one-month summer internship at ICAR-CRIJAF from August 12 to October 12, 2022, under the guidance of Dr. S. Datta (2 students), Dr. K. Meena (2 students), and Dr. P. Satya (1 student). 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 on bioinformatics analysis of molecular data, including the handling of sequence data, marker diversity studies, and phylogenetic analyses. A sum of ₹50000 was generated as revenue from the internship programme.

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 2022. The trainees and students were 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.

Execution of the MOU for Research

For better collaboration in higher education and research, ICAR-CRIJAF executed the 'Umbrella Memorandum of Understanding between ICAR Institutes and Universities/DUs for Facilitating Students' Training and Postgraduate Research Work" with ADAMAS University, Barasat, for a period of three years with effect from August 10, 2022. The director of ICAR-CRIJAF and the registrar of ADAMAS University were the signing authorities in the MOU.

Hands-on training during summer internship of M. sc. students from ADAMAS University

Table 46. Exposure visit of college students and scientsts in ICAR-CRIJAF during Jan-Dec 2022

Exposure Visit	Date	No. of participants
Sri Shikshayatan College, Kolkata	11 April, 2022	32
Sreerampore College, Hooghly	18 April, 2022	78
College of Forestry, OUAT, Bhubaneswar	17 May, 2022	47
Barasat Government College, West Bengal	15 June, 2022	33
St. Claret School, Barrackpore, West Bengal	30 August, 2022	28
College of Agriculture, Birsa Agriculture University, Ranchi, Jharkhand	23 September, 2022	45
JIS University, Kalyani, West Bengal	22 November 2022	23
ICAR-NINFET, Kolkata, , West Bengal	9 December, 2022	24

College and school students with Director of ICAR-CRIJAF during Exposure visit (Jan-Dec 2022)

WEBINAR, SEMINAR, WORKSHOPS & MEETINGS

National Workshop on Jute Production, Marketing and Utilization Strategies On 4th March, 2022

ICAR-CRIJAF, in association with the Directorate of Jute Development (DJD), organised a National Level Workshop on March 4, 2022 to discuss jute production, marketing, and utilisation strategies for export promotion and import substitution. Mr. M.C. Chakrabortty, Jute Commissioner, chaired the session in which Dr. B. S. Mahapatra, VC, BCKV was the Chief Guest and Dr. Gouranga Kar, Director, ICAR-CRIJAF, Mr. A. K. Jolly, MD, JCI, and Dr. D. B. Shakyawar, Director, ICAR-NINFET were the Guests of Honours. Mr. Narendar Kumar, Director, DJD, briefed them about the workshop. More than 100 delegates from ICAR-CRIJAF, ICAR-NINFET, DJD, JCI, NJB, State Agril. Dept., State Agril. Universities, and NSC participated in this workshop.

Role of nano-fertilizer in global farming on 24th September 2022

A seminar was organized jointly by ICAR-CRIJAF and the Indian Society of Soil Science, Kolkata chapter in hybrid mode on 24 September 2022 at Barrackpore. The lecture on the topic entitled "Role of nano-fertilizer in global warming" was delivered by Dr. J.C. Tarafdar, Emeritus Scientist & Former National Fellow, ICAR-CAZRI, Jodhpur. Total 60 participants participated in the programme both on online and offline mode.

Guests and experts are interacting during workshop held at ICAR-CRIJAF

Pran Kumar De Memorial Lecture of ISSS organized at ICAR-CRIJAF, Barrackpore on 6th August 2022

Prof. Pran Kumar De Memorial Lecture was organized by Indian Society of Soil Science Kolkata Chapter along with ICAR-CRIJAF on 6th August, 2022 at Barrackpore. Dr. T.J. Purakayastha given this prestigious lecture on the topic entitled "Carbon carrying capacity of soil: Role of clay, substrate quality, and microbes at the interface of climate change". Dr. Biswajit Ghosh, Vice Chancellor, Neotia University, Kolkata was the Chief guest of the programme. Dr. J.C. Tarafdar, Emeritus Scientist ICAR-CAZRI, Jodhpur, Speaker, Dr. Tapan Jyoti Purakayastha, Principal Scientist, ICAR-IARI, New Delhi, Dr. S.K. Sanyal, Former Vice chancellor, BCKV, Mohanpur, Dr. D.C. Nayek, President, ISSS Kolkata Chapter, Dr. Krishnendu Das, Secretary, ISSS Kolkata Chapter were present. Soil Scientists from various ICAR institutes and Agril. Universities, KVKs located in and around Kolkata attended the programme.

भाकृअनुप (मुख्यालय) एवं भाकृअनुप- क्रिजैफ द्वारा दो दिवसीय भाषा उत्सव एवं हिन्दी संगोष्ठी (24-25 अगस्त, 2022)

भाकृअनुप (मुख्यालय) एवं भाकृअनुप- क्रिजैफ द्वारा भाकृअनुप- क्रिजैफ, बैरकपुर, कोलकाता में "स्वतंत्रता के 75 वर्ष और राजभाषा हिन्दी का विकास" विषय पर भारतीय कृषि अनुसंधान परिषद के राजभाषा अधिकारियों के लिए 24-25 अगस्त, 2022 को दो दिवसीय भाषा उत्सव एवं हिन्दी संगोष्ठी का उद्घाटन किया गया । इस उद्घाटन समारोह में पुलिस आयुक्त, बैरकपुर, श्री अजय ठाकुर, मुख्य अतिथि के रूप में तथा श्री अजय कुमार जॉली, अध्यक्ष एवं प्रबंध निदेशक, भारतीय पटसन निगम, कोलकाता सम्मानित अतिथि के रूप में उपस्थित थे । इस संगोष्ठी में परिषद के विभिन्न संस्थानों से 110 प्रतिभागियों ने भाग लिया ।

Dr. Gouranga Kar, Director of ICAR-CRIJAF addressing the participants of Hindi Seminar

The 33rd Annual Workshop of All India Network Project on Jute and Allied Fibres (AINPJAF) was organized virtually during 22-24 Feb 2022

The 33rd Annual Workshop of AINPJAF was organised in hybrid mode at ICAR-CRIJAF, Barrackpore, during 22-24th February, 2022. The inaugural session was chaired by Dr. T. R. Sharma, Deputy Director General (Crop Science), as chief guest and co-chaired by Dr. R. K. Singh, ADG (CC), ICAR, New Delhi as guest of honour. Dr. D. B. Shakyawar, Director, ICAR-NINFET, Kolkata; Dr. Gouranga Kar, Director, ICAR-CRIJAF, Barrackpore; and Dr. S. Mitra, Principal Scientist & in-charge, AINPJAF, also graced the occasion. All scientists of ICAR-CRIJAF and scientists-in-charge of SAUs and four ICAR based AINPJAF centres participated in the workshop. The salient research achievements of AINPJAF for the years 2021-22 were presented and a detailed technical programme for the years 2022-23 was formulated. Four varieties of jute and allied fibre crops were also identified for central release during the workshop.

Dr. T.R. Sharma, DDG (Crop Science) interacting with team of AINPJAF during Annual Workshop 2021-22 at ICAR-CRIJAF, Barrackpore

Seminar on Nutrient Mining In Indian Agricultural Scenario on 28 October 2022

A seminar on "Nutrient Mining in the Indian Agricultural Scenario" was organized jointly by ICAR-CRIJAF and the Indian Society of Soil Science, Kolkata chapter, on 28 October 2022 at ICAR-CRIJAF, Barrackpore. The lecture on the topic was delivered by Dr. S. K. Sanyal, Former Vice-Chancellor, BCKV, Mohanpur. Altoether 102 participants were present in the seminar in both online and offline mode.

Brainstorming Session on Agricultural Water Management in West Bengal: Issues and strategies on 26th August 2022

Brainstorming Session on "Agricultural Water Management in West Bengal: Issues and strategies" was organized by ICAR-Central Research Institute for Jute and Allied Fibres, Barrackpore in collaboration with National Academy of Agricultural Sciences, Kolkata Chapter t on 26th August 2022. Dr. Trilochan Mahapatra, President, NAAS, New Delhi delivered the inaugural address and highlighting the present-day concern about agricultural water management considering the climate change scenario. He emphasized that the regional chapters must flag the regional problems and has scientific deliberation involving senior fellows, young scientists and students to frame specific guidelines for policy intervention by state Govts. The technical session was chaired by NAAS Fellow, Dr. B.B. Jana, Former Professor, University of Kalyani. There were six lectures on different aspects of agricultural water management delivered by Dr. Gouranga Kar, Director of ICAR-CRIJAF; Sri Sujit Choudhury, Executive Director of PAN Network Pvt. Ltd.; Dr. Dibyendu Sarkar, Former Secretary of Department of Panchayati Raj and Self-Help Group (Govt. of West Bengal); Dr. Dhiman Barman, Principal Scientist of CSSRI RRS (Canning, West Bengal); Dr. B.K. Das, Director of ICAR-CIFRI, and Dr. A.N. Chowdhury, Chemist of CGWB, Kolkata. Altogether 52 distinguished NASS Fellows, scientists from various ICAR institutes and universities attended the session in hybrid mode.

Seminar on Energy – Agricultural Integration on 25 November 2022

A seminar on "Energy-Agricultural Integration" was organized jointly by ICAR-CRIJAF, Barrackpore, and the Indian Society of Soil Science, Kolkata chapter, on November 25, 2022, at ICAR-CRIJAF, Barrackpore. The lecture was delivered by Dr. Biswajit Ghosh, Vice-Chancellor, Neotia University, Kolkata. The session was chaired by Dr. S. K. Sanyal, Former Vice-Chancellor, B.C.K.V., Mohanpur, in the presence of Dr. R.K. Singh, ADG (CC), ICAR, New Delhi, and Dr. Gouranga Kar, Director, ICAR-CRIJAF, Barrackpore. A total of 71 participants participated in the seminar both online and offline.

Brainstorming session on agricultural water management in West Bengal hed at ICAR-CRIJAF, Barrackpore

National Seminar on Trajectory of plant research and diversity in 75 years of independence of India

A National Seminar on the Trajectory of Plant Research and Diversity in India's 75th Year of Independence was jointly organised by ICAR-CRIJAF, Barrackpore, and Shri Shikshayatan College, Kolkata, during December 2–3, 2022. Dr. Gouranga Kar, Director, ICAR-CRIJAF, and Convener of the National Seminar, delivered the keynote address, which was chaired by Dr. Timir Baron Jha, Former Head, Department of Botany, Presidency College, in the presence of Ms. Aditi Dey, Principal, Shri Shikshayatan College. More than 150 delegates, including heads and scientists from ICAR-CRIJAF, participated in this national seminar.

Eco-restoration – Soil, People and Climate

A seminar on "Eco-restoration – Soil, People and Climate" was organized jointly by ICAR-CRIJAF, Barrackpore, and the Indian Society of Soil Science, Kolkata chapter, on December 14, 2022, at ICAR-CRIJAF, Barrackpore. The lecture was delivered by Dr. D.D. Patra, Former Vice-Chancellor, BCKV, Mohnpur, West Bengal. The session was chaired by Dr. S. K. Sanyal, Former Vice-Chancellor, B.C.K.V., Mohanpur. A total of 65 participants participated in the seminar both online and offline.

Webinars/ Seminars under Aazadi ka Amrit Mahatsov

The Agricultural Extension along with its two KVKs of ICAR-CRIJAF organised a weekly webinar to commemorate 'Aajadi ka Amrit Mahatsav'. In 75 weeks, 75 webinars on different themes was organized. Webinars/seminars were conducted as per the following topics:

Topic of Webinar/ Seminar	Location (West Bengal)	Date	No. of participants
1. Vermicomposting technology	Mathurapur, Barrackpore	4 January 2022	20
2. Motivational force for ensuring fruitful results of science and technology and establishing welfare society (Dr. P.S. Brahmanand, ICAR-IIWM)	ICAR-CRIJAF, Barrackpore	5 January 2022	50
3. High-tech horticulture for higher productivity	Purba Bardhaman	6 January 2022	30
4. Vertical gardening	Purba Bardhaman	21 January 2022	30
5. Good management practices in dairying	Purba Bardhaman	25 March 2022	30
6. Mechanization for sustainable environment	Purba Bardhaman	7 April 2022	31
7. Motivating farm women for jute based product	No North 24 Parganas	28 April 2022	212
8. Natural farming (Annadata Devo Bhaba)	North 24 Parganas	23-24 April 2022	175
9. Livestock based farm yard manure	Panjapara	28 April 2022	30
10. Ecosystem management for sustainable production	Purba Bardhaman	7 May 2022	31
11. Garib Kalyan Sammelan	North 24 Parganas	31 May 2022	2556
12. Improving Soil Health	Purba Bardhaman	31 May 2022	31
13. Biotic stresses and their management	Purba Bardhaman	2 June 2022	39
14. Sequencing the genome of plants economically important for India (Dr. N.K. Singh, ICAR-NIPB)	ICAR-CRIJAF, Barrackpore	11 July 2022	67
15. Jute community development and environmental justice (Dr. Abhijit Paul, W. B. State University)	ICAR-CRIJAF, Barrackpore	17 August 2022	71

Research Advisory Committee Meeting

(23-24 June 2022)

The Research Advisory Committee (RAC) meeting of ICAR-CRIJAF, Barrackpore was held during 23-24 June 2022 under the Chairmanship of Dr. Swapan Kr. Datta, Vice-Chancellor, Biswa Bangla University, Former Vice-Chancellor, Visva Bharati, and Former Deputy Director General (Crop Sciences), ICAR, New Delhi. The committee discussed in detail the research activities of ICAR-CRIJAF for the period of April 2021 to March 2022, and the Chairman advised the scientists to orient the research activities to generate new knowledge, technologies, and products for the farmers. On this occasion, ICAR-CRIJAF organised a one-day Farmer-SHG-Scientist-Expert Interface Meeting on June 23, 2022 with adopted farmers and self-help group (SHG) members from four districts viz. Hooghly, North 24 Parganas, Nadia, and Murshidabad. The Chairman of RAC and other esteemed members, including Dr. R.K. Singh, ADG (CC), ICAR-New Delhi, advised the farmers and SHG members to adopt the varieties and technologies developed by ICAR-CRIJAF.

Chairman and Members of RAC during review of research activities of ICAR-CRIJAF

Institute Research Council Meeting was conducted during 28-29 June & 18-19 Oct, 2022 to review research projects

The Institute Research Council (IRC) meeting was held in hybrid mode on 28-29 June & 18-19 Oct, 2022, to review the institute's research projects including external funded projects. Altogether, 58 ongoing and 4 new research projects were discussed. Dr. Gouranga Kar, Chairman, IRC, congratulated the scientists for the achievements made and suggested the scientists strengthen the need-based and demand-driven technology-oriented research for the stakeholders of the jute and allied fibre sector, so that derived technology will reach the stakeholders after the completion of the project.

Institute Management Committee (IMC) Meeting on 28th May 2022

The 35th IMC meeting of ICAR-CRIJAF was held on May 28, 2022, under the chairmanship of Dr. Gouranga Kar, Director, in the presence of Dr. A. R. Rao, ADG (PIM), ICAR, New Delhi. The representative of the Director of Agriculture, Govt. of Odisha, and other dignitaries from different ICAR Institutes and State Agricultural Universities attended the meeting. Besides discussing the general agenda, the committee laid emphasis on global marketing of jute, social transformation from lab to land, and public-partner relationships for upliftment of small and marginal farmers.

Scientific Advisory Committee Meeting of KVK, North 24 Parganas (Addl) on 18th January 2022

The 3rd Scientific Advisory Committee meeting of KVK, North 24 Prgs (Addl.) was organised on 18th January 2022. The Annual Report for the year 2021 was reviewed by the committee and various suggestions were given by the members for enrichment of the Action Plan for the year 2022. Dr. Gouranga Kar, Director of ICAR-CRIJAF, advised to focus on the efficient use of natural and human resources, particularly water resources, and to emphasise problem-solving, need-based and demand-driven technology transfer.

Director and Scientists during presentation and discussion of IRC Meeting

Stakeholders Meet on Advanced Agronomic Practices for Jute Cultivation on 5th March 2022

ICAR-CRIJAF, in association with the National Jute Board (NJB) and Jute Corporation of India (JCI), organised a one-day Stakeholders' Meet on "Modern Agronomic practices for Jute cultivation" under the Jute-ICARE Project on March 5, 2022. More than 100 delegates from ICAR-CRIJAF, ICAR-NINFET, Directorate of Jute Development, Jute Corporation of India, National Jute Board, Ministry of Textiles, GoI, representatives from different state governments, Indian Space Research Organization, National Seed Corporation, Indian Jute Mill Association, Bailer's Association, NABARD, etc. participated in the meet. In the inaugural session Jute Commissioner, Mr. M.C. Chakrabortty was the Chief Guest and Dr. Gouranga Kar, Director, ICAR-CRIJAF; Mr. A. K. Jolly, MD, JCI; Mr. Kamlesh Kumar, GM, NABARD; Mrs. Esther Kathar, Additional Secretary, P& RD, Govt. of Assam; and Dr. D. B. Shakyawar, Director, ICAR-NINFET were the Guests of Honour.

Interface meeting between ICAR-CRIJAF and NABARD on 24th March 2022

An interface meeting between ICAR-CRIJAF and NABARD was organized on 24 March 2022 at ICAR-CRIJAF to discuss about the possible areas of collaboration on the jute based cropping system for the benefit of jute growers and other stakeholders. Dr. A. R. Khan in his address emphasized the new technologies must focus the small and marginal farmers who are vulnerable to the adverse effect of climate change. He also emphasized that West Bengal should become *Atma Nirbhar* in jute seed production for which the required policy and infrastructure support shall be given. Dr. S. Satpathy, Principal Scientist highlighted the technologies and ICT initiatives taken up by the institute which have been commercialized and positively impacted the scientific cultivation, mechanization, post-harvest operation in jute and allied fibre crops.

Director and guests holding Stakeholders Meet on 'Advanced Agronomic Practices for Jute Cultivation'

Participations in webinar, seminar, workshop & meetings

DIRECTOR

Dr. Gouranga Kar

9th Annual Convention and Webinar on Managing Agro-chemicals for Crop and Environmental Health, 25-26 February 2022, organized by Society for Fertilizers and Environment (online)

Seminar on 1st Indian Fisheries Outlook 2022: Priming Indian Fisheries in Attaining Sustainable Development Goals, 22-24 March 2022, ICAR-CIFRI, Barrackpore

National Conference on Managing Weather and Climate Risks in Agriculture, 24-26 March 2022, SKUAST, Srinagar, Kashmir

National Symposium on Food, Nutrition and Environmental Security: Towards Achieving SDGs, 29-30 Aug 2022, New Delhi

Eastern Region Seminar on Abiotic Stress Management for Resilient Agriculture, 26 August 2022 at Kolkata

Virtual meeting on Pathways to Strengthen S&T Delivery and Access Facilities for Societal Development, 11 January 2022, organised by SEED-DST, New Delhi

Agricultural Research Management System (ARMS), 2 Feb 2022, organised by ICAR, New Delhi

2nd EC meeting under SUNIL programme, 7-8 February 2022, organised by SEED-DST, New Delhi

254th , 255th , 256th and 257th Meeting of the Executive Council of Bidhan Chandra Krishi Viswavidyalaya, 31 May, 12 August, 23 November and 16 December 2022, Directorate of Extension Education, BCKV, Mohanpur, W.B.

Regional Meeting of Price Policy for Raw Jute 2023-24 Season, 19 September 2022, Kolkata, West Bengal

25th, 26th and 27th Board meeting of the National Jute Board, 7 February, 25 April and 25 October 2022, Udyog Bhavan, New Delhi

Meeting of the Expert Committee on Jute (ECJ), 26 April 2022, JC Office, Kolkata

88th meeting of Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops, 17 June 2022

XXVI RCM-II meeting, 29 June 2022, ICAR-National Rice Research Institute for Zone-II, Cuttack, Odisha (online)

Online Consultation Meeting of the Principal Secretary, DSTBT, GOWB on the Draft West Bengal State Science, Technology and Innovation Policy, 12 July 2022

9th Meeting of the SAC of Sasya Shyamala KVK, 30 August 2022, Ramakrishna Mission Vivekananda Educational and Research Institute,

72nd Meeting of the Executive Council, 20 September 2022, UVKV, West Bengal (online)

XXVI Meeting of ICAR Regional Committee No. II, 14 Oct 2022, ICAR-NRRI, Cuttack

Meeting of ICAR Regional Committee-IV, 7th November, 2022 (online)

Meeting on Yield Estimation of Jute crop through Remote Sensing Technology & CCE, 9 November 2022, NJB, Kolkata

SCIENTISTS

International Symposium on Cereals for Food Security and Climate Resilience, 18-20 January 2022, organized by Society for Advancement of Wheat & Barley Research, Karnal, ICAR-Indian Institute of Wheat & Barley Research (IIWBR), Karnal- Dr. D. Datta, Dr. S. Ghosh

Global Symposium on Soils for Nutrition (Virtual mode), 26-29 July 2022, organized by FAO, Rome- Dr. A.K. Singh, Dr. S.P. Majumdar

56th Annual Convention of ISAE and International Symposium on India@2047:

Agricultural Engineering Perspective, 9-11 November 2022, organized by AEC&RI, TNAU, Coimbatore, Tamil Nadu- Dr. R.K. Naik

International Conference on Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2022), 12-14 June 2022, organised by Society for Scientific Development in Agriculture and Technology, Meerut- Kanti Meena

National Seminar on Agrophysics for Smart Agriculture (online mode), 22-23 February 2022, organized by Indian Society of Agrophysics, New Delhi, New Delhi- Dr. R. Saha, Dr. S.P. Majumdar, Dr. S. Ghosh

National Webinar on Managing Agro-chemicals for Crop and Environmental Health, 25-26 February 2022, organized by Society of Fertilizers and Environment, Kolkata-Dr. Ritesh Saha, Dr. S.P. Majumdar, Dr. D. Datta, Dr. S. Ghosh

National Conference on Modern Agronomic Practices for Jute Cultivation and Stakeholders' Meet, 5 March 2022, organized by ICAR-CRIJAF, Barrackpore-All Scientists

National Conference on Promotion of Kisan Drones: Issues, Challenges and Way forward, 2 May 2022, at NASC, New Delhi-Dr. S. Ghosh

National Seminar on Climate Change Concerns: Challenges for Agriculture Sector and Food and Nutrition Security, 14-15 May 2022, organized by ICAR-Indian Institute for Millet Research, Hyderabad and Karnataka Agri-Professional Association (KAPA) - N. Mohan

Biennial National Conference of KVKs, 1-2 June 2022, at Y.S. Parmer University of Horticulture and Forestry, Solan, H.P.- Dr. T. Samajdar

11th National Seed Congress, 21 -23 August 2022, organized by Rajmata Vijayraje Scindia Krishi Viswavidyalaya, Gwalior and National Seed Research & Training Centre, Varanasi - Dr. A. Bera

राष्ट्रीय स्तर की हिंदी संगोष्ठी- स्वतंत्रता के *75* वर्ष और राजभाषा हिंदी का विकास, 24-25 August 2022, organized by ICAR-CRIJAF, Barrackpore-All Scientists

86th Annual Convention of Indian Society of Soil Science (ISSS) and National Seminar on Developments in Soil Science – 2022, 15-18 November 2022, at MPKV, Rahuri-Dr. R. Saha, Dr. S.P. Majumdar

National Symposium on Entomology 2022: Innovation and Entrepreneurship, 8-10 December 2022, at PJTSAU, Rajendranagar, Hyderabad-Dr. V. Ramesh Babu

33rd Annual Workshop of AINP on Jute and Allied Fibres, 22-24 February 2022, organized by ICAR-CRIJAF, Barrackpore- All Scientists

National Workshop on Jute Production, Marketing and Utilization Strategies, 4 March 2022, organized by ICAR-CRIJAF, Barrackpore-All Scientists

Annual Zonal Workshop, 27-29 May 2022, at KVK, Jalpaiguri -Dr. T. Samajdar

National Workshop on Pathways for Effective Implementation of SC Sub-lan Scheme in ICAR, 18-19 August 2022, organized by ICAR-NAARM, Hyderabad- M.S. Behera

State Level Officers Meeting under NFSM-CC Jute based Cropping System, 21-22 March 2022, organized by Office of the DDA, Krishi Bhawan, North 24 Parganas- Dr. A.R. Saha, Dr. S. Sarkar, Dr. B. Majumdar, Dr. C.S. Kar, Dr. K. Mandal, Dr. M. L. Roy

The 3rd Meeting of Monitoring Committee under Jute-ICARE scheme, 23 March 2022, at Office of the Jute Commissioner, Salt Lake, Kolkata-Dr. S. Sarkar, Dr. R.K. Naik

Joint Annual Group meeting of ICAR Seed Project and National Seed Project, 12-13 May 2022, organized by Indian Institute of Seed Science, Mau, UP- Dr. A. Bera

Inter-institute Scientists Interaction on Feasibility of Sisal Plantation in Rajasthan, 14-15 July 2022, at ICAR-CAZRI, Jodhpur-Dr. S. Sarkar, Dr. M.S. Behera

Annual DUS review meeting, 10 -11 November 2022, organized by PPVFR Authority, New Delhi- Dr. A. Bera

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- Annual Report 2021
- Resha Kiran 4(2) 2021; 5(1) 2022
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MAJOR EVENTS & CELEBRATIONS

ICAR-CRIJAF celebrated 69th Foundation Day on 9th February, 2022

ICAR-CRIJAF celebrated its glorious 69th Foundation Day on February 9, 2022. The foundation day programme was organised in hybrid mode (online and offline). Dr. T. R. Sharma, Deputy Director General (Crop Science), ICAR, New Delhi, was the chief guest of this program. Prof. Swapan Kumar Datta, Vice Chancellor of Biswa Bangla University and former Deputy Director General (Crop Science), ICAR, New Delhi, delivered the Foundation Day lecture on the latest application of cutting edge science in crop improvement programmes. Mr. M. C. Chakraborty, Jute Commissioner, GoI; Mr. A. K. Jolly, Managing Director, Jute Corporation of India; Dr. B. K. Das, Director, ICAR-CIFRI, Barrackpore; and Dr. D. B. Shakywar, Director, ICAR-NINFET, Kolkata, were the Guests of Honor.

Prof. Swapan Kumar Datta, Vice Chancellor of Biswa Bangla University and former DDG, ICAR, New Delhi delivering Foundation Day lecture

Observance of National Girl Child Day on 24th January 2022

National Girl Child Day was observed on January 24, 2022. The Chief Guest, Mrs. Jayeeta Dasgupta, State Coordinator, Jan Sahas, gave a presentation on a number of topics like the rights of a girl child, the importance of education, proper nutrition, and health. Dr. Gouranga Kar, Director, ICAR-CRIJAF, highlighted that the birth of a girl child should be greeted with joy and she should receive all the care and love needed to grow to her full potential. Altogether 63 participants were present in the programme.

World Pulse Day-2022 was celebrated on 10th February, 2022

ICAR-CRIJAF celebrated "World Pulses Day" on 10th February 2022. The Chief Guest, Dr. Kalyan Jana, Assistant Professor of BCKV emphasised up on inclusion of pulse in the cropping system to improve the soil quality and also reduce the nitrogen requirement for the next crop. He said that pulse crops are important source of protein and minerals. In the farmer-scientists interaction session, Dr. Gouranga Kar, Director, ICAR-CRIJAF, highlighted the need for increased access to pulse crops among underprivileged sections of the population. All ICAR-CRIJAF staffs and farmers participated in the program through virtual mode.

73rd Republic Day & 76th Independence Day of India Celebration

ICAR-CRIJAF celebrated its 73nd Republic Day on 26th January and 76th Independence Day on 15th August 2022 with pride and remembered the great scarifies made by freedom fighter of the country. Dr Gouranga Kar, Director, ICAR-CRIJAF hoisted the tri-colour national flag and delivered the speech. In his address, he inspired the scientists and staff of the Institute to work hard to make India "*Atma Nirbhar*" through research and development. Progressive farmers, farm women and the agricultural workers were felicitated on this occasion.

Samvidhan Diwas on 26 November, 2022

ICAR-CRIJAF celebrated Constitution Day on November 26, 2022, on the theme "India, the Mother of Democracy," to commemorate the adoption of the Constitution of India as Jan Bhagidari and honour and acknowledge the contributions of the Founding Fathers of the Constitution.

COVID vaccination camp for staffs of ICAR-CRIJAF

In compliance of the ICAR Endorsement No.:21-40/2022-DN dated 04.08.2022, ICAR-CRIJAF, Barrackpore has organized the Covid Vaccination Amrit Mahotsav Camp as a part of the Azadi ka Amrit Mahotsav for free Precaution Dose to all the employees of this Institute including their family members and contractual staff as a preventive measure to contain the spread of Novel Coronavrius on 15 September 2022 in collaboration with B. N. Bose Govt. Hospital, Barrackpore. Total 86 persons were given Precaution Dose among which 80 were Covishield and 6 were Covaxin.

17th Parthenium Awareness Week during 16-22 August, 2022

Parthenium, popularly known as *gajar ghas* is an economically important invasive weed not only infests the crop field and reduces the crop productivity but also infest human habitat and fallow land. To create awareness regarding the harmful effects of parthenium, its management, and preventing its further spread, the ICAR-CRIJAF observed the 17th Parthenium Awareness Week during August 16–22, 2022. All employees took part in the awareness and cleaning drive.

World Soil Day 2022 on 5th December, 2022

World Soil Day was celebrated on December 5, 2022, with the aim of creating awareness about the importance of healthy soil and its effects on crop production. Shri Dhrubajyoti Dey, Joint Commissioner, Kolkata Police, and chief guest of the programme interacted with the audience and emphasized the importance of maintaining good soil health. Dr. Gouranga Kar, Director of ICAR-CRIJAF, emphasized that healthy soils can significantly contribute to end hunger and creating a healthy planet. He expressed concern on irrational use of fertilizers which can have negative effects on ecosystems, biodiversity loss, and greenhouse gas emissions. 157 soil health cards were distributed among the farmers.

World Environment Day was celebrated

World Environmental Day 2022 was observed on June 4, 2022, with the theme "Self-employment opportunities and making a clean and green environment through natural fibres". On this occasion, lectures and presentations on the importance of Environment Day were made by the scientists and eminent scholars. Prof. Mohua Das, Vice Chancellor, West Bengal State University graced the occasion as the Chief Guest and Prof. Abhijit Paul, Nehru Fulbright Fellow, University of Berkeley, California was the Guest of Honour. Dr. Gouranga Kar, Director of ICAR-CRIJAF in his address highlighted the replacement of single-use plastics with jute-based products. About 200 participants were present in the program.

Vigilance Awareness Week-2022 on Corruption-free India for a Developed Nation

ICAR-CRIJAF and its Research Stations and KVK observed Vigilance Awareness Week-2022 during during 31 October to 6 November, 2022. Dr. Gouranga Kar, Director of ICAR-CRIJAF 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.

Observance of Vigilance Awareness Week-2022 at ICAR-CRIJAF, Barrackpore

AWARDS, FELLOWSHIPS & RECOGNITIONS

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

   गृह मंत्रालय, भारत सरकार का सबसे प्रतिष्ठित "राजभाषा कीर्ति पुरस्कार" दिनांक 14 Sept 2022 को गुजरात के सूरत में आयोजित दो दिवसीय हिंदी दिवस समारोह एवं द्वितीय अखिल भारतीय राजभाषा सम्मेलन के अवसर पर भाकृअनुप-केन्द्रीय पटसन एवं समवर्गीय रेशा अनुसंधान संस्थान, बैरकपुर, कोलकाता के द्वारा प्रकाशित अर्ध-वार्षिक राजभाषा गृह पत्रिका "रेशा किरण" को वर्ष 2022 का द्वितीय पुरस्कार प्रदान किया गया। इस हिंदी दिवस एवं द्वितीय अखिल भारतीय राजभाषा सम्मेलन के उद्घाटन सत्र की अध्यक्षता भारत सरकार के माननीय गृह एवं सहकारिता मंत्री, श्री अमित शाह जी ने की। इस अवसर पर गुजरात सरकार के माननीय मुख्यमंत्री श्री भूपेंद्र भाई पटेल, भारत सरकार के गृह राज्य मंत्री माननीय श्री अजय कुमार मिश्रा एवं माननीय श्री निशीथ प्रमाणिक के अलावा अन्य गणमान्य व्यक्ति भी उपस्थित थे। भाकृअनुप-क्रिजैफ के निदेशक डॉ. गौरंग कर ने अन्य गणमान्य व्यक्तियों की गरिमामयी उपस्थिति में गृह राज्य मंत्री, भारत सरकार माननीय श्री अजय कुमार मिश्रा के द्वारा इस प्रतिष्ठित पुरस्कार को प्राप्त किया।

2. **भा.कृ.अनु.प.-क्रिजैफ को "गणेश शंकर विद्यार्थी हिंदी पत्रिका पुरस्कार" तथा "राजर्षि टंडन राजभाषा पुरस्कार" प्रदान किया गया**

   भारतीय कृषि अनुसंधान परिषद, नई दिल्ली के 94वें स्थापना दिवस एवं पुरस्कार समारोह के उपलक्ष्य पर भा.कृ.अनु.प.-क्रिजैफ को कार्यालयीन कार्यों तथा अन्य कार्यालय प्रकाशनों में हिंदी भाषा के उपयोग में उत्कृष्ट योगदान के लिए भा.कृ.अनु.प., नई दिल्ली द्वारा प्रतिष्ठित पुरस्कार "गणेश शंकर विद्यार्थी हिंदी पत्रिका पुरस्कार" तथा "राजर्षि टंडन राजभाषा पुरस्कार" से सम्मानित किया गया। उक्त पुरस्कारें राष्ट्रीय कृषि विज्ञान केंद्र (एनएएससी/NASC), नई दिल्ली में प्रदान किया गया।

3. **Best Article Award** for the article entitled "Pre-Breeding Approaches for Genetic Enhancement in Jute (*Corchorus* sp.)" published in Agriculture & Food: e-Newsletter, 4(3) - J. K. Meena, Scientist
4. **Best Oral Presentation Award,** 1st International Symposium on Cereals for Food Security and Climate Resilience, 18-20 January 2022- D. Datta, Scientist
5. **Best Oral Presentation Award,** National Webinar on Managing Agro-Chemicals for Crop and Environmental Health, 25-26 February 2022- D. Datta, Scientist
6. **Best Scientist Award 2021,** ICAR-CRIJAF, Barrackpore-R.K. Naik, S.P. Mazumdar, Senior Scientists
7. **Lead paper presented** on "Management of storage insects of pulses and oil seed research outcomes of AICRP on seed crops' at 11th National Seed Congress held at Rajmata Vijayraje Scindia Krishi Viswavidyalaya, Gwalior during 21 -23 August 2022- A. Bera, Senior Scientist
8. Editorial Board Member, Krishi Jagran (Bengali Edition)- S. Sarkar, Principal Scientist
9. Editorial Board Member, International Journal of Bioresource Science- S. P. Mazumdar, Senior Scientist
10. Member Secretary of Peer Review Team, NAEAB (ICAR), New Delhi - S.K. Sarkar, Principal Scientist

माननीय श्री नरेन्द्र सिंह तोमर, केंद्रीय कृषि एवं किसान कल्याण मंत्री, भारत सरकार के द्वारा "गणेश शंकर विद्यार्थी हिंदी पत्रिका पुरस्कार" को प्राप्त करते हुए भाकृअनुप-क्रिजैफ के निदेशक डॉ. गौरंग कर

माननीय श्री अजय कुमार मिश्रा, केंद्रीय गृह राज्य मंत्री, भारत सरकार, के द्वारा "राजभाषा कीर्ति पुरस्कार" को प्राप्त करते हुए भाकृअनुप-क्रिजैफ के निदेशक डॉ. गौरंग

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OFFICIAL LANGUAGE IMPLEMENTATION

संसदीय राजभाषा समिति द्वारा भाकृअनुप-क्रिजैफ, बैरकपुर में राजभाषा हिन्दी के कार्यान्वयन का निरीक्षण

कोलकाता में दिनांक 16 नवम्बर, 2022 को संसदीय राजभाषा समिति की दूसरी उप समिति के संयोजक माननीय प्रो. रीता बहुगुणा जोशी जी तथा समिति के अन्य सम्मानित सदस्यों द्वारा भाकृअनुप-केन्द्रीय पटसन एवं समवर्गीय रेशा अनुसंधान संस्थान(क्रिजैफ), बैरकपुर, कोलकाता का राजभाषा हिन्दी के कार्यान्वयन एवं अनुप्रयोग में हुई प्रगति का निरीक्षण तथा पुनर्विलोक किया गया । विगत वर्षों के दौरान संस्थान में हुई राजभाषा संबंधित कार्यों का ब्यौरा संस्थान के निदेशक डॉ. गौरांग कर ने समिति के समक्ष प्रस्तुत किया, जिसपर समिति के संयोजक सहित अन्य सभी सदस्यों ने संतोष व्यक्त किया । इस निरीक्षण बैठक में माननीय सन्योजक एवं सांसद प्रो. रीता बहुगुणा जोशी के अतिरिक्त माननीय सांसद श्रीमती माला राज्य लक्ष्मी शाह तथा समिति सचिव श्री धर्मराज खटीक एवं समिति सचिवालय के अन्य अधिकारीगण उपस्थित रहे । निरीक्षण के दौरान समिति ने कुछ बिंदुओं पर और बेहतर करने का सुझाव दिया, जिसपर संस्थान के निदेशक डॉ. गौरांग कर ने आवश्यक कदम उठाने का आश्वासन दिया । इस बैठक में परिषद, मुख्यालय के वरिष्ठ पदाधिकारियों तथा संस्थान की ओर से निदेशक डॉ. गौरांग कर सहित संस्थान के राजभाषा कार्यान्वयन से संबंधित वैज्ञानिकों तथा अधिकारियों ने प्रतिभागिता दर्ज कराई ।

संसदीय राजभाषा समिति की दूसरी उप समिति के संयोजक माननीय प्रो. रीता बहुगुणा जोशी जी तथा समिति के अन्य सम्मानित सदस्यों द्वारा भाकृअनुप-केन्द्रीय पटसन एवं समवर्गीय रेशा अनुसंधान संस्थान, बैरकपुर का राजभाषा हिन्दी के कार्यान्वयन एवं अनुप्रयोग में हुई प्रगति का निरीक्षण तथा पुनर्विलोक करते हुए

राष्ट्रीय स्तर के हिंदी भाषा महोत्सव और संगोष्ठी का आयोजन

भाकृअनुप-केंद्रीय पटसन एवं समवर्गीय रेशा अनुसंधान संस्थान (ICAR-CRIJAF), बैरकपुर में दिनांक 24-25 अगस्त, 2022 को "स्वतंत्रता के 75 वर्ष और राजभाषा हिंदी का विकास" विषय पर दो दिवसीय राष्ट्रीय स्तर के भाषा महोत्सव और हिंदी संगोष्ठी का आयोजन किया गया । इस संगोष्ठी में भारतीय कृषि अनुसंधान परिषद (आईसीएआर) के विभिन्न संस्थानों / निदेशालयों / ब्यूरो आदि में कार्यरत राजभाषा से जुड़े 150 अधिकारियों / कर्मचारियों ने भाग लिया । उद्घाटन कार्यक्रम में श्री अजय ठाकुर, आईपीएस, पुलिस आयुक्त, बैरकपुर मुख्य अतिथि, श्री ए के जॉली, अध्यक्ष और प्रबंध निदेशक, भारतीय पटसन निगम सम्मानित अतिथि तथा श्रीमती सीमा चोपड़ा, निदेशक (राजभाषा), भारतीय कृषि अनुसंधान परिषद, नई दिल्ली उद्घाटन सत्र में विशिष्ट अतिथि के रूप में उपस्थित थी । कार्यक्रम की अध्यक्षता निदेशक, भाकृअनुप-क्रिजैफ, बैरकपुर डॉ. गौरांग कर द्वारा किया गया । इस दो दिवसीय कार्यक्रम के दौरान विभिन्न सत्रों में इन महत्वपूर्ण विषयों पर चर्चा की गई :- (1) राजभाषा कार्यान्वयन : आधुनिकीकरण और प्रभाव : क) तकनीकी क्षेत्रों में हिंदी की प्रगति और ख) राजभाषा के कार्यान्वयन में तकनीकी साधनों का योगदान, (2) अद्यतित प्रशासनिक नियम : क) परिचय और अनुपालन संबंधी व्यवस्थाएं, ख) भाकृअनुप में वित्तीय नियम, (3) बदलते पर्यावरणीय परिवेश में पटसन एवं समवर्गीय रेशा की भूमिका, (4) राजभाषा कार्यान्वयन : विकास की सुदीर्घ यात्रा और प्रगति के प्रयत्न एवं विकल्पों की आलोचना, (5) राजभाषा कार्यान्वयन : वर्तमान एवं भावी योजनाएं – एक क्रियात्मक दृष्टिकोण तथा राजभाषा कार्यान्वयन की वर्तमान और भावी योजनाएं : बदलते परिदृश्य में तथा (6) तकनीकी अनुवाद : वैज्ञानिक और तकनीकी अनुवाद की समस्याएं और उनका समाधान । इन सत्रों में दिए गए प्रासंगिक विषय के विशिष्ट वक्ता थे - श्री अनूप कुमार, सहायक निदेशक, राजभाषा विभाग, गृह मंत्रालय, हिन्दी शिक्षण योजना, कोलकाता; श्री राजीव लाल, संयुक्त सचिव, भाकृअनुप.-केन्द्रीय मात्स्यिकी शिक्षा संस्थान, मुम्बई; श्री राजेश सहाय, निदेशक (वित्त), भारतीय कृषि अनुसंधान परिषद, नई दिल्ली; डॉ सुनीति कुमार झा, प्रधान वैज्ञानिक, भाकृअनुप-क्रिजैफ, बैरकपुर, कोलकाता; डॉ. नवीन कुमार प्रजापति, प्रभारी, केन्द्रीय अनुवाद ब्यूरो, राजभाषा विभाग, कोलकाता; श्रीमती सीमा चोपड़ा, निदेशक (राजभाषा), भारतीय कृषि अनुसंधान परिषद, नई दिल्ली तथा डॉ पूरन चंद टंडन, प्रोफेसर, दिल्ली विश्वविद्यालय । दिनांक 25 अगस्त, 2022 को समापन कार्यक्रम में; श्रीमती नंदिनी घोष बनर्जी, सहायक महाप्रबंधक, भारतीय स्टेट बैंक द्वारा प्रतिभागियों को सम्बोधित किया ।

भाकृअनुप-केंद्रीय पटसन एवं समवर्गीय रेशा अनुसंधान संस्थान (ICAR-CRIJAF), बैरकपुर में दिनांक 24-25 अगस्त, 2022 को "स्वतंत्रता के 75 वर्ष और राजभाषा हिंदी का विकास" विषय पर दो दिवसीय राष्ट्रीय स्तर के भाषा महोत्सव और हिंदी संगोष्ठी का आयोजन

हिन्दी कार्यशाला का आयोजन

केन्द्रीय पटसन एवं समवर्गीय रेशा अनुसंधान संस्थान, बैरकपुर, कोलकाता में दिनांक 17 मार्च, 25 जून, 29 सितम्बर एवं 20 दिसंबर 2022 को राजभाषा हिंदी के प्रगामी प्रयोग को बढ़ावा देने तथा राजभाषा संबंधी अधिनियमों, नियमों एवं आदेशों के अनुपालन हेतु हिंदी कार्यशाला का आयोजन किया गया। हिन्दी कार्यशाला संस्थान के निदेशक, डॉ. गौरांग कर जी की अध्यक्षता में आयोजित किया गया। इस अवसर पर निदेशक महोदय ने अपने अध्यक्षीय संबोधन में विचार व्यक्त करते हुए कहा कि हिन्दी में कार्य करने के प्रति स्वयं को समर्पित करते हुए कार्य को सम्पन्न करना चाहिए, तथा प्रत्येक क्षेत्र में अपना शत-प्रतिशत प्रयास देना चाहिए, जिससे हमारा संस्थान राजभाषा के क्षेत्र में अपना श्रेष्ठ स्थान बना सके । उन्होंने अपने सम्बोधन में यह भी कहा कि एक वैज्ञानिक अनुसंधान संस्थान होने के नाते ये हमारा कर्तव्य बनता है कि हमें शोध से संबंधित जानकरियाँ हिन्दी में किसान भाइयों तक पहुंचाने का यथासंभव प्रयास करना चाहिए । कार्यालय के कार्यों में सरल, सुबोध एवं आसान शब्दों का प्रयोग करने पर भी जोर देते हुए यह उद्घाटित किया कि राजभाषा संबंधी आदेशों का

अनुपालन सुनिश्चित किया जाना अति आवश्यक है। इस अवसर पर संस्थान के, प्रभारी-प्रभागाध्यक्ष ने अपने सम्बोधन में कहा कि हमें हिन्दी में कार्यालीन कार्य यथासंभव करने का प्रयास करना चाहिए तथा संस्थान में आयोजित होने वाले हिन्दी कार्यशाला से सर्वाधिक लाभ उठाना चाहिए। संस्थान के समस्त प्रभागाध्यक्ष एवं अनुभाग प्रभारी सहित संस्थान के अन्य अधिकारी तथा कर्मचारी इस कार्यशाला में सम्मिलित होकर हिन्दी के प्रति अपना समर्पण दर्शाए। निर्मल कुमार दुबे, सहायक निदेशक राजभाषा विभाग, गृह मंत्रालय, कोलकाता; श्री फतेह बहादुर सिंह, हिन्दी प्राध्यापक, हिन्दी शिक्षण योजना, भारत सरकार, गृह मंत्रालय, राजभाषा विभाग, कोलकाता; एवं श्री लखन कुमार सिंह, हिन्दी प्राध्यापक, हिंदी शिक्षण योजना, राजभाषा विभाग, गृह मंत्रालय, भारत सरकार, निजाम पैलेस, कोलकाता को मुख्य वक्ता के तौर पर आमंत्रित किया गया था। हिन्दी कार्यशाला के अतिथि वक्ता द्वारा निदेशक महोदय तथा समस्त प्रभागाध्यक्षों का धन्यवाद ज्ञापित करते हुए राजभाषा अधिनियम, नीति, नियम व प्रमुख बिन्दुओं पर विस्तारपूर्वक व उदाहरण सहित चर्चा की। इस अवसर पर उन्होने संस्थान के अधिकारियों तथा कर्मचारियों को हिन्दी में कार्य करने की प्रतिशत दर में वृद्धि करने पर भी जोर दिया । यह कार्यशाला बहुत ही उपयोगी एवं उदेश्यपूर्ण रही।

हिन्दी कार्यशाला के दौरान प्रशिक्षण प्रदान करते हुए अतिथि वक्ता श्री निर्मल कुमार दुबे, सहायक निदेशक राजभाषा विभाग, गृह मंत्रालय, कोलकाता

हिन्दी पख़वाड़ा का आयोजन

राजभाषा हिन्दी के प्रति जागरूकता पैदा करने तथा इसके प्रभावों में गति लाने के उद्देश्य से दिनांक 14 से 29 सितम्बर, 2022 तक हिन्दी पखवाड़ा का आयोजन किया गया । हिन्दी पखवाड़ा के दौरान आठ प्रकार के प्रतियोगितायों का आयोजन किया गया। विजेता प्रतियोगियों को क्रमशः प्रथम, द्वितीय एवं तृतीय पुरस्कार प्रदान किया गया। साथ ही हिन्दी प्रोत्साहन योजना के अन्तर्गत वित्तीय वर्ष)2020-21) के दौरान कार्यालयीन कार्य करने पर 05 अधिकारियोंकर्मचारियों को भी / समापन समारोह 2022 पुरस्कृत किया गया। हिन्दी पखवाड़ा की अध्यक्षता संस्थान के निदेशक, डॉगौरांग कर . ने किया। उन्होंने कहा कि राजभाषा भारतवर्ष के कण नेकण में विराजमान है जिसे और व्यापक बनाने की जरूरत है । उन्हों-संस्थान के समस्त अधिकारियों एवं कर्मचा से अपील किया कि हिन्दी को प्रतिबद्धता के कारण न अपनाएं बल्कि उसे हृदय की भाषा बनाएं तथा अपनेअपने कार्यालयीन कार्यों में इसका व्यापक रूप में प्रयोग करें। आगे उन्होंने कहा कि संविधान की - संकल्पनाओं, राजभाषा विभाग के निदेशों, मुख्यालयों की अपेक्षाओं और कार्यालयों की अवश्यकताओं लक्ष्यों के अनुरूप / में कार्य हो रहा है तथा राजभाषा हिन्दी के क्रियान्वयन में इस कार्यालय ने जो मुकाम हासिल किया है हिन्दी, जो कृतिमान स्थापित किया है उसे बरकरार रखने में ही नहीं अपितु उसमें और भी अभिवृद्धि करने के लिए आह्वान किया । साथ ही हिन्दी कक्ष एवं हिन्दी प्रकाशन समिति के सदस्यों को भाकृअनुप.केपसरेअसं-, बैरकपुर को कार्यालयीन कार्यों में उत्कृष्ठ योगदान तथा अन्य कार्यालय प्रकाशनों में हिन्दी भाषा के प्रयोग में उत्कृष्ठ योगदान के लिए भारतीय कृषि अनुसंधान परिषद, नई दिल्ली द्वारा प्रतिष्ठित पुरस्कारें "न्दी पत्रिका पुरस्कारगणेश शंकर विद्यार्थी हि", तथा "राजर्षि टंडन राजभाषा पुरस्कार" गृह मंत्रालय, भारत सरकार का प्रतिष्ठित "राजभाषा कीर्ति पुरस्कार" दिनांक 14 सितम्बर 2022 को सूरत, गुजरात में आयोजित हिन्दी दिवस एवं द्वितीय अखिल भारतीय राजभाषा सम्मेलन के अवसर पर भाकृअनुप.केपसरेअसं-, बैरकपुर

द्वारा प्रकाशित राजभाषा गृह पत्रिका "रेशा किरण" को वर्ष 2021-22 का द्वितीय पुरस्कार से सम्मानित करने पर भूरी भूरी-प्रशंसा एवं बधाई दिया।

हिन्दी **पख़वाड़ा** के दौरान संस्थान के निदेशक, डॉ. गौरांग कर विजेता प्रतियोगियों को पुरस्कार प्रदान करते हुए

राजभाषा कार्यान्वयन समिति की बैठक

संस्थान में राजभाषा कार्यान्वयन समिति की चार बैठकें क्रमशः दिनांक 11 मार्च, 22 जून, 28 सितंबर और 26 दिसंबर 2022 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 चर्चायेँ की गई। इसके अलावा इन बैठकों में संस्थान के अधिकारियो /कर्मचारियों को राजभाषा विभाग द्वारा जारी वार्षिक कार्यक्रम (2022-23) 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।

डॉ. गौरांग कर जी की अध्यक्षता में राजभाषा कार्यान्वयन समिति की बैठक

संस्थान में हिन्दी प्रशिक्षण तथा परीक्षाओं का आयोजन

संस्थान के 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 जनवरी से नवंबर 2022, के दौरान संस्थान में ही हिन्दी प्रवीण/प्राज्ञ/ पारंगत की कक्षायें एवं परीक्षाएँ का आयोजन किया गया।

PRINT & MEDIA COVERAGE

भाकृअनुप-क्रिजैफ बैरकपुर ने 9 फरवरी को अपना 69वां स्थापना दिवस मनाया

स्थापना दिवस के उपलक्ष्य पर मैं चिंतराम, भाकृअनुप-क्रिजैफ एवं अन्य वरमान्य अतिथि

20 JUNE 2022

गुणवत्ता पूर्ण पटसन रेशा उत्पादन के लिए प्रशिक्षण श्रृंखला का आयोजन

भाकृअनुप - केंद्रीय पटसन एवं संबर्गीय रेशा अनुसंधान संस्थान ने राष्ट्रीय बालिका दिवस का उत्सव मनाया

बालिकाओं को शिक्षा एवं सुरक्षा में आत्मनिर्भर बनाना जरूरी : डॉ. गौरांग कर

दैनिक दुनिया

प्रादेशिक

पटसन एवं समवर्गीय रेशा पर आधारित अभा नेटवर्क परियोजना की 33वीं वार्षिक कार्यशाला का उद्घाटन

26 APRIL 2022

भाकृअनुप-क्रिजैफ ने पटसन में प्राकृतिक और जैविक खेती पर मेगा अभियान और जागरूकता कार्यक्रम, किसानों को दिया प्रशिक्षण

18 JANUARY 2022

पटसन एवं समवर्गीय रेशा फसलों के उत्पादकों के लिए क्रिजैफ परामर्श एड्वाइज़री ऐप्प

वर्तमान

पाटेर जिनिस व्यवहारे जोर 'क्राईजफ'-एर

परिवेश रक्षाय प्लास्टिक वर्जनेर आह्वान

KJ KRISHI JAGRAN

11 JANUARY 2022

ICAR-CRIJAF Developed "CRIJAF Advice" Android App for Growers of Jute & Allied Fibres

TIMES NATION

8 JULY 2022

Union minister at ICAR-CRIJAF, Barrackpore field day, 'kishan' meet

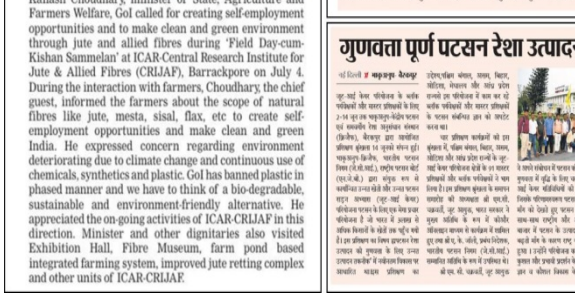
जलवायु परिवर्तन, रसायनिक, सिंथेटिक्स के उपयोग से पर्यावरण हो रहा खराब : मंत्री चौधरी

THE TIMES OF INDIA

Powered by Indiatimes

22 JULY 2022

ICAR-CRIJAF wins Ganesh Shankar Vidyarthi, Rajarshi Tandon awards



गुणवत्ता पूर्ण पटसन रेशा उत्पादन के लिए प्रशिक्षण श्रृंखला का आयोजन

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 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 Bangla 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 (AGRIS).

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 and 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, anexhibition-cum-fibre museum has been established.

IPR Protection

Trademark of 'CRIJAF SONA': Trademark application of 'CRIJAF SONA', a microbial consortium for improved jute retting, 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. 5269569 dated 01.01.2022) valid for ten years.

Copyright of 'CRIJAF Advice': Copyright application for 'CRIJAF Advice', an android mobile application on Agro-advisory for growers of jute and allied fibers issued by ICAR-CRIJAF, Barrackpore has been registered by the Copyright Office, Govt. of India under Application No. 1347/2022-CO/SW on 21.01.2022.

Government of India
Trade Marks Registry
Trade Marks Act, 1999
CRIJAF SONA
Trade Marks Registry MUMBAI

Trademark registration certificate of 'CRIJAF SONA'

Copyright Office
Government of India
Extracts from the Register of Copyrights

Copyright registration certificate of 'CRIJAF Advice'

Technology Commercialization and Registration

Technology License Agreement between ICAR-CRIJAF and M/s Next 2 Nature and M/s Bengal Biotech and Research for Commercialization of CRIJAF SONA: ICAR-CRIJAF, Barrackpore, Kolkata (Licensor) had Technology License Agreement (TLA) with M/s Next 2 Nature, Guwahati, Assam and M/s Bengal Biotech and Research, Purba Midnapore, WB (Licensees) through Agrinnovate India Ltd., New Delhi (Facilitator) for the purpose of manufacturing, sale and supply of 'CRIJAF SONA' for a period of five (5) years. The MoU has been signed on 15th February, 2022 with only a non-exclusive and non-assignable right to use the technology.

Royalty earned

A total amount of ₹49,46,950 has been received as royalty payment of various commercialized technologies (CRIJAF SONA, Nail Weeder, Multi Row Seed Drill and CRIJAF Single Wheel Jute Weeder) from authorized manufacturer and sellers during 2022.

Technology License Agreement signed with M/s Next 2 Nature

Technology License Agreement signed with M/s Bengal Biotech and Research

DISTINGUISHED VISITORS

1.	Shri Kailash Choudhary, Minister of State, Agriculture & Farmers Welfare, GOI	04.07.2022
2.	Dr. T. R. Sharma, DDG (CS), ICAR, New Delhi	24.02.2022
3.	Prof. Swapan Kumar Datta, Vice Chancellor of Biswa Bangla University	09.02.2022
4.	Dr. Narendra Singh Rathore, Vice Chancellor, MPUAT, Udaipur & Former DDG	23.05.2022
5.	Dr. R. K. Singh, ADG (CC), ICAR, New Delhi	24.02.2022
6.	Shri Ajay K. Thakur, IPS, Police Commissioner, Barrackpore	24.08.2022
7.	Prof. B.S. Mahapatra, Vice-Chancellor, BCV, Mohanpur, West Bengal	05.03.2022
8.	Dr. J.C. Tarafdar, Emeritus Scientist & Former National Fellow, ICAR-CAZRI, Jodhpur	06.08.2022
9.	Prof. S. K. Sanyal, Former Vice Chancellor, BCKV, Mohanpur, West Bengal	17.03.2022
10.	Prof. D. D. Patra, Former Vice Chancellor, BCKV, Mohanpur, West Bengal	22.11.2022
11.	Prof. Biswajit Ghosh, Vice-Chancellor, Neotia University, Kolkata	25.11.2022
12.	Prof. Mohua Das, Vice Chancellor, West Bengal State University	04.06.2022
13.	Dr. K. K. Satpathy, Ex Director, ICAR-NINFET	31.01.2022
14.	Dr. A. Pattanayak, Director, ICAR- IIAE, Ranchi	11.02.2022
15.	Dr. B. K. Das, Director, ICAR-CIFRI, Barrackpore	09.02.2022
16.	Dr. D. B. Shakywar, Director, ICAR-NINFET, Kolkata	09.02.2022
17.	Dr. Debashis Nag, Ex- Director, ICAR-NINFET, Kolkata	23.06.2022
18.	Dr. S.S. Singh, Director (Extension), RLBCAU, Jhansi	23.06.2022
19.	Dr. P.S. Brahmanand, Director (Research), DRPC Agricultural University, Pusa, Bihar	05.04.2022
20.	Dr. Debashis Nag, Ex- Director, ICAR-NINFET, Kolkata	23.06.2022
21.	Smt. Seema Chopra, Director (Rajbhasha), ICAR, New Delhi	24.08.2022
22.	Dr. Nagendra Kr. Singh, National Professor, B. P. Pal Chair, ICAR-NBPB	11.07.2022
23.	Dr. A.R. Khan, CGM, NABARD, Kolkata	24.03.2022
24.	Dr. Dibyendu Sarkar, Former Secretary of Deptt. of Panchayati Raj and SHG, GoWB	26.08.2022
25.	Mr. Sudipta Porel, Joint Secretary DST & Biotechnology, Govt. of WB, Kolkata	26.08.2022
26.	Shri Jay Prakash, RGM, National Seed Corporation, Kolkata	21.12.2022
27.	Prof. Abhijit Paul, Nehru Fulbright Fellow, University of Berkeley, California	04.06.2022
28.	Dr. S. Roy Chowdhury, Dean, College of Basic Science & Humanities, DRCAU, Pusa	07.04.2022
29.	Dr. Prafulla Kumar Mahapatra, Dean, OUAT, Bhubneswar	23.06.2022
30.	Shri Narender Kumar, Director, Directorate of Jute Development, DA & FW, Kolkata	04.03.2022
31.	Smt. Prajakta L. Verma, Joint Secretary, Ministry of Textile, GOI	21.06.2022
32.	Shri Kamalesh Kumar, G.M., NABARD, Kolkata	05.03.2022
33.	Shri Dhrabajyoti De, Joint CP (Security), Kolkata Police	23.04.2022
34.	Smt. Esther Kathar, Additional Secretary, P& RD, Govt. of Assam	05.03.2022
35.	Prof. B. B. Jana, International Centre for Ecological Engineering, Kalyani University	27.08.2022
36.	Shri G. P. Sharma, Joint Secretary (Finance), Krishi Bhawan, New Delhi	08.12.2022
37.	Shri Rajesh Sahay, Director (Finance), Krishi Bhawan, New Delhi	05.07.2022
38.	Shri M. C. Chakraborty, Jute Commissioner, GoI	09.02.2022
39.	Commdr. A. K. Jolly, Managing Director, Jute Corporation of India	09.02.2022

Distinguished visitors of ICAR-CRIJAF during 2022

ON-GOING RESEARCH PROJECTS

Institute Funded Projects

Crop Improvement Division

	Project Title	Project Code with Duration	PI/CO-PIs
1.	**Genetic improvement of jute genotypes against biotic stresses**	JB 10.1 (2015-24)	**A. Anil Kumar**, K. Mandal, and B.S. Gotyal
2.	**Genetic improvement of flax (*Linum usitatissimum*) for higher fibre productivity and fibre quality**	JB 10.3 (2016-25)	**J. Mitra**, D. Saha, K. Mandal, and Shiva Kumar K.V.
3.	**Genetic improvement of jute and mesta for diversified end use.**	JB 10.4 (2016-24)	**P. Satya**, S. K. Pandey, and S. Roy
4.	**Introduction, maintenance, characterization and conservation of jute, mesta and flax germplasm**	JB 1.1 (1977-longterm)	**J. Mitra**, A. Bera, A. Anil Kumar, S. K. Sarkar, K. Das, and Tribhuvan R.
5.	**Mining novel alleles for genome engineering applications for herbicide and stress tolerance in jute and allied fibres**	JBT- 4.7 (2017-22)	**S. Datta**, J. Mitra, D. Saha, P. Satya, and A. Anil Kumar
6.	**Maximising fibre productivity in jute through genetic and agronomical approaches**	JB 10.5 (2020-25)	**K. N. Chourasia**, J. K. Meena, P. Satya, J. Mitra, S. Mitra, S. Sarakar, A. R. Saha, and R. K. De
7.	**Introgression of low pectin content into high yielding jute varieties**	J.B- 10.6 (2020-25)	**A. Anil Kumar**, and B. Majumdar.
8.	**Pre-breeding and breeding approaches for developing major biotic stress resistance in jute**	J.B 10.7 (2021-26)	**J. K. Meena**, K. N. Chourasia, S. Satpathy, and K. Mandal
9.	**Effects of plant density and weed management practices on plant size composition and productivity of jute modeling crop growth**	JST 6.3 (2021-24)	**A. K. Chakraborty**, D. Datta, S. P. Mazumdar, N. M. Alam, and R. K. De
10.	***In vitro* regeneration and haploidy induction in jute**	JBT 4.9 (2022-2027)	**S. Datta**, and K. N. Chourasia
11.	**Chemical mutagenesis for creating variability in tossa jute and roselle**	JB. 10.9 (2021-2024)	**Neetu Mohan, S. K. Pandey** Thribhuvan R.
12.	**Genetic enhancement of fibre quality traits in tossa jute (*Corchorus olitorius*)**	JB. 10.8 (2021-2026)	**Thribhuvan R.,** J K Meena, and R K Naik
13.	**Molecular mapping for stem rot resistance in jute *(Corchorus)***	JBT 5.0 (2022-27)	**K. Meena,** K. Mondal, Tribhuvan R., and S. Datta

Crop Production Division

	Project Title	Project Code with Duration	PI/CO-PIs
1.	**Physiological basis of drought tolerance at early growth stage in jute (*C. olitorius*)**	JA 7.4 (2017-23)	**L. Sharma**, J. Mitra, S. Mitra, P. Satya, D. Barman and S. Roy
2.	**Physiology of flowering behaviour of jute under different photoperiod regimes**	JA 7.5 (2017-22)	**S. Roy,** P. Satya, D. Sarkar, L. Sharma, and H. R. Bhandari
3.	**Improvement of soil carbon stocks and farm productivity through integrated cropland management practices in jute cultivation areas (farmer's participatory research)**	JA 7.6 (2018-23)	**A. K. Singh**, R. Saha and M. L. Roy.
4.	**Environment friendly low-cost retting technology for jute and metagenomics of retting micro biome**	JA 7.7 (2018-22)	**B. Majumdar**, S. P. Mazumdar, D. saha, S. Datta, S. Sarkar and S. K. Jha
5.	**Assessing the role of microbes in jute from seed to fibre**	JA 8.7 (2021-2024)	**Lavanya**, **A. K.,** A. R. Saha, S. Datta, S. Sarkar and D. Datta
6.	**Leaf litter management: Decomposition and nutrient dynamics of leaf litter composts and its effects on JAF crops**	JA 8.1 (2020-25)	**A. K. Singh**, B. Majumdar, S. Mitra, M. S. Behera, S. K. Sarkar, S. Satpathy, M. L. Roy, and G. Kar
7.	**Upgraded mechanical weeder and novel herbicides for efficient weed management in jute**	JA 8.2 (2020-23)	**S. Sarkar**, R. K. Naik, B. Majumdar and D. Datta
8.	**Quantification and emission of greenhouse gases in conventional and improved jute retting.**	JA 8.3 (2020-25)	**B. Majumdar**, S. P. Mazumdar, P. Bhattacharya, Rachna Dubey, other Scientists
9.	**Water management strategies for profitable and sustainable jute cultivation under rainfed and irrigated ecosystems**	JA 8.5 (2020-23)	**D. Datta**, G. Kar, A. K. Singh, D. Barman, N. M Alam, and R. K. Naik
10.	**Expansion of flax area in pilot scale with improved technologies**	JA 8.4 (2020-25)	**S. Mitra**, J. Mitra, C. S. Kar, S. Sarkar, S. K. Jha, S. K. Pandey, R. K. Naik, K. Das, M. S. Behera, K. V. Shivakumar, and S.P. Mazundar
11.	**Farm mechanization for efficient sowing and fibre extraction for jute and allied fibre**	JAE 3.6 (2021-24)	**R. K. Naik**, C. S. Kar, G. Kar, and S.K. Jha
12.	**Risk Assessment through modeling of major pests and diseases of jute under climate change scenario in India**	JE 2.2 (2019-23)	**N. M. Alam**, B. S. Gotyal, D. Barman, S. Satpathy, S. Mitra and S. K. Sarkar
13.	**Effect of planting materials and fertilizer levels on growth and yield of sisal (*Agave sisalana*) and hybrid sisal**	SLA 1.7 (2018-24)	**S. Sarkar**, M. S. Behera, B. Majumdar and R. K. Naik
14.	**Integrated farming system in sisal plantation under organic management package**	SLA 1.8 (2018-23)	**M. S. Behera,** R. Saha, and S. Sarkar
15.	**Precision irrigation scheduling for augmenting yield, resource-use efficiency and water productivity in Jute based cropping systems**	JA8.8 (2022-25)	**S. Ghosh**, G. Kar, S. Mitra, A.K. Singh, T. Samajdar, R.K. Naik, D. Barman.

Crop Protection Division

	Project Title	Project Code with Duration	PI/CO-PIs
1.	**Bio-ecology and management of sucking pests in jute**	JE 1.9 (2016-23)	**S. Satpathy,** B. S. Gotyal, V. Ramesh Babu, S.P. Mazumdar, and Suman Roy
2.	**Isolation, characterization and application of *Trichoderma* for disease management**	JM 9.2 (2018-23)	**K. Mandal**, S. K. Sarkar and R. Saha
3.	**Use of nanoparticles for managing pests and diseases in jute and carbon nanotube for salinity tolerance**	JM 9.3 (2018-23)	**C. Biswas** and V. Ramesh Babu
4.	**Identification of donor lines for resistance against stem rot and anthracnose diseases in jute**	JM 9.5 (2021-24)	**S. K. Sarkar**, K. Mandal, K. Das, and A. Anil Kumar
5.	**Identification of microbial entomo-pathogens for management of major lepidopteron pests of jute**	JE 2.0 (2018-23)	**V. Ramesh Babu,** Shivakumar K. V. and S. Satpathy
6.	**Identification of sources and mechanism of resistance among wild and cultivated accessions of jute against lepidopteron pest complex**	JE 2.1 (2019-23)	**V. Ramesh Babu,** S. Satpathy, and S. Roy
7.	**Decision support system for pest management in jute**	JE 2.3 (2020-23	**V. Ramesh Babu**, S.K. Sarkar, S.K. Pandey and N.M. Alam
8.	**Development of IPM module in mesta**	JM 9.4 (2020-25)	**R. K. De**, S. Satpathy, V. Ramesh Babu, and Shamna A.

Extension Section

	Project Title	Project Code with Duration	PI/CO-PIs
1.	**Scope of value chain development in jute and role of farmer-producers' organizations**	JEXA 5.9 (2019-22)	**Shamna A**, S. K. Jha, T. Samajdar, R. K. Naik, A. Bera, S. P. Mazumdar, B. S. Gotyal and N. M. Alam.
2.	**Analysis of yield gap and Contribution of production factors in cultivation of jute**	JEXA- 6.1 (2020-25)	**S. K. Jha**, M. L. Roy, S. Mitra, R. Saha, S. P. Mazumdar, R. K. Naik, and A.K. Chakraborty
3.	**Enhancing farm income through up-scaling of jute based bio-diversified products as an alternative to plastics**	JEXA- 6.2 (2020-24)	**Shamna A**, S. K. Jha, S. Kumar and M. L. Roy
4.	**Innovative Extension Methods for Augmentation of Income of Jute-based Farm Families in West Bengal – A Cluster Approach**	JEXA 6.3 (2022-24)	**M. L. Roy,** S K Jha, S Kumar, and Shamna A

Regional Research Station

	Project Title	Project Code with Duration	PI/CO-PIs
1.	**Expansion of ramie-based farming system with improved genotypes and technology**	RA 1.2 (2020-23)	**K. Das**, C. S. Kar, M. S. Behera, S. Mitra, S. Sarkar, R. K. De and R. K. Naik
2.	**Management of sunnhemp wilt**	SNHM 1.1 (2019-2022)	**Shivakumar K.V.** and S. K. Sarkar
3.	**Development of high fibre yielding jute genotypes through hybridization**	**CSRSJAF 1.1** (2019-24)	**H. R. Bhandari**, C. S. Kar, K. N. Chourasia and J. K. Meena

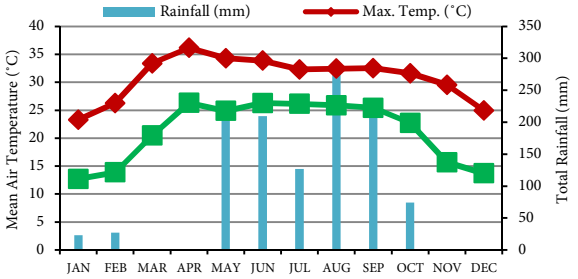
External Funded Projects

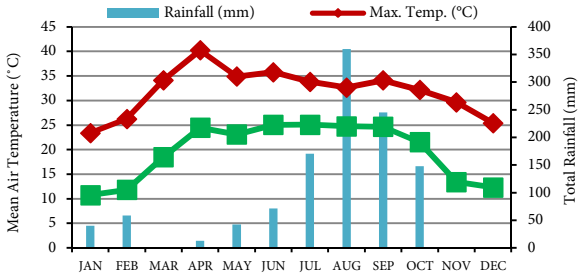
	Project Title	Principal Investigator	Funding Agency	Duration
1.	**NFSM (Commercial Crops) Jute based cropping system**	C. S. Kar	MoAFW, New Delhi	Long Term
2.	**AICRP- National Seed Project**	C. S. Kar	ICAR-New Delhi	Long Term
3.	**Protection of jute varieties and DUS testing**	A. Bera	PPVFRA	Long Term
4.	**Development of descriptors for DUS testing of mesta (Kenaf-Hibiscus cannabinus L. and Roselle- H. sabdariffa L.)**	A. Bera	PPVFRA	2020-23
5.	**Quantitative assessment of carbon and moisture fluxes over jute based agro-ecosystems: integrating ground observations, satellite data and modeling**	D. Barman	ISRO-NRSC	2018-25
6.	**Changes in soil quality, crop productivity and sustainability under jute-rice-wheat cropping system**	A. R. Saha	JC 5.2 (AICRP-LTFE)	Long Term
7.	**Soil test and resource based integrated plant nutrient supply system for sustainable agriculture**	A. R. Saha	JC 5.6 (AICRP-STCR)	Long Term
8.	**Assessment of vulnerability of jute production to climate change and its mitigation strategies development using remote sensing GIS in W.B.**	D. Barman	DST-WB	2018-23
9.	**The impact of heat shock factors in regulating heat stress induced epigenomic changes: A case study in flax**	D. Saha	SERB-DST	2019-22
10.	**Frontline demonstration on jute under NFSM(CC)**	S. K. Jha	NFSM Sub Project	2014- Long Term
11.	**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	Asia Pacific Network for Global Change Research	2021-23

12.	**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	DST (SEED), GOI	2021-24
13.	**Prospecting heat stress tolerance through genome-edited heat shock factors and NAC-domain transcription factors in flax (*Linum usitatissimum*)**	D. Saha	SERB-DST	2021-24
14.	**Development of technology on jute retting under free-flowing water for quality and fibre production**	R. K. Naik	NFSM- CC	2020-23
15.	**Bioethanol from lignocellulose biomass(jute and kenaf-mesta): a green fuel for climate change mitigation"**	L. Sharma	NICRA	2022-24
16.	**Upscaling flax farming technology for import substitution**	S. K. Jha	Vegan Textile	2021-23
17.	**Genome sequencing and functional genomics of bast fibre quality.**	D. Sarkar	ICAR-NPFGGM	2021-2026
18.	**Jute- Improved cultivation and advanced retting exercise (JUTE-ICARE)**	B. Majumdar	National Jute Development Programme	2015-long term)

Weather Report 2022

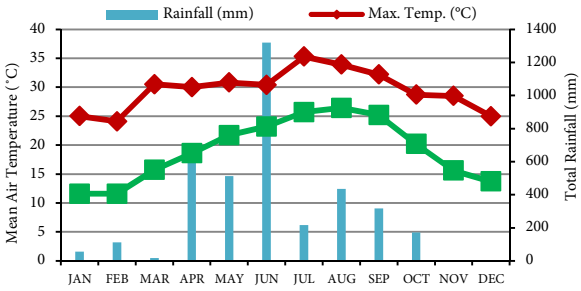
ICAR-CRIJAF, Barrackpore (West Bengal)
Total annual rainfall: 1198 mm
Annual mean maximum air temperatures: 30.9°C
Annual mean minimum air temperatures: 21.2°C
Hottest Month: April (36.2°C)
Coldest Month: January (12.7°C)
The highest monthly total rainfall: August (287.3 mm)
The lowest monthly total rainfall: February (23.2 mm)
No rainfall in months: March, April, Nov., Dec.

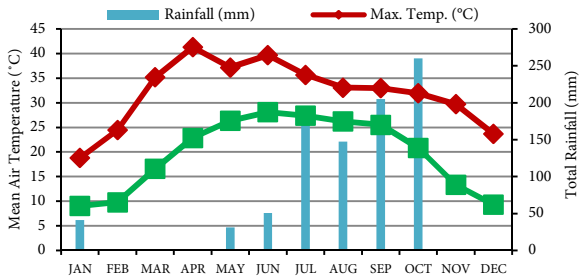




CSRSJAF, Budbud (West Bengal)
Total annual rainfall: 1149 mm
Annual mean maximum air temperatures: 31.9°C
Annual mean minimum air temperatures: 19.6°C
Hottest Month: Apri (40.2°C)
Coldest Month: January (10.8°C)
The highest monthly total rainfall: August (359.9 mm)
The lowest monthly total rainfall: April (12.8 mm)
No rainfall in months: March, Nov., Dec.

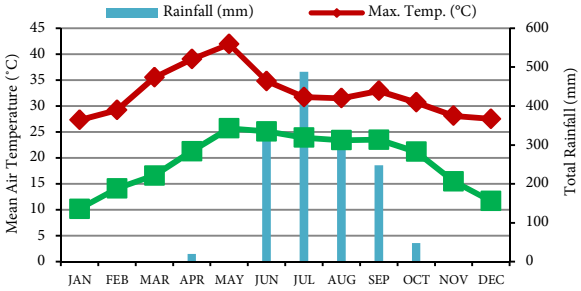
RRS, Sorbhog (Assam)
Total annual rainfall: 3776 mm
Annual mean maximum air temperatures: 29.5°C
Annual mean minimum air temperatures: 19.1°C
Hottest Month: July (35.3°C)
Coldest Month: January (11.6°C)
The highest monthly total rainfall: June (1319 mm)
The lowest monthly total rainfall: March (17 mm)
No rainfall in months: November, December





ShRS, Pratapgarh (Uttar Pradesh)
Total annual rainfall: 918.7 mm
Annual mean maximum air temperatures: 32°C
Annual mean minimum air temperatures: 19.6°C
Hottest Month: June (39°C)
Coldest Month: January (9°C)
The highest monthly total rainfall: October (260 mm)
The lowest monthly total rainfall: May (31.0 mm)
No rainfall in months: Feb, Mar, Apr, Nov, Dec

SRS, Bamra (Odisha)
Total annual rainfall: 1470.6 mm
Annual mean maximum air temperatures: 32.5°C
Annual mean minimum air temperatures: 19.4°C
Hottest Month: May (41.9°C)
Coldest Month: January (10.2°C)
The highest monthly total rainfall: July (488.2 mm)
The lowest monthly total rainfall: April (20 mm)
No rainfall in months: Jan, Feb, March, May, Nov, Dec



Source: Agrometeorology Units, ICAR-CRIJAF H.Q. and Regional Stations; D. Barman, C. Chattopadhay, H. Bhandari, and K. Das

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Sri Uddhab Gayari	Sri Chandra Mondal	Sri Jawahar	Sri Bhuwal Pal
Sri Ram Asre Yadav	Sri Lochindra	Sri Ram Raj Pal	Sri Ram Bhajan Saroj
Sri Sugriva	Kum. Koushalya	Sri Jokhu	Sri Radhey Shyam Yadav
Sri Naba Kumar Dutta	Sri Narendra	Sri Narottam	Sri Ram Baran Yadav
			Sri Pabitra Das

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 2022

Name of the Person	Designation	Date (w.e.f.)
Dr. B. S. Gotyal	Sr. Scientist	Transferred to ICAR-NBAIR, Bengaluru (31.03.2022)
Sri Shiva Kumar K.V.	Scientist	Transferred to ICAR-DFR, Pune (31.08.2022)
Dr. A. Anil Kumar	Sr. Scientist	Transferred to ICAR-IIOR, Hyderabad (03.09.2022)

2. Transfer to ICAR-CRIJAF, Barrackpore during Jan-Dec 2022

Name of the Person	Designation	Date (w.e.f.)
Dr. Chirantan Chattopadhyay	Pr. Scientist	16.08.2022(F/N) from ICAR-IIAB, Ranchi
Sri Vikash Kumar Keshri	T-4	03.06.2022(F/N) from ICAR-IISR, Indore
Sri Abhra Ghosh	T-3	02.07.2022(F/N) from ICAR-IIHR, Bengaluru
Mrs. Anindita Pal	T-3	02.07.2022(F/N) from ICAR-NRRI, Cuttack

3. Superannuation / Termination / VRS of ICAR-CRIJAF, Barrackpore during Jan-Dec 2022

Name of the Person	Designation	Date (w.e.f.)
Sri Trinath Shaw	SSS	31.01.2022 (A/N)
Dr. A.K.Ghorai	Pr. Scientist	28.02.2022 (A/N)
Sri Dilip Kr. Patra	Tech. Officer	30.09.2022 (A/N)
Sri Gopal Chandra Dey	AAO	01.12.2022 (F/N) VRS
Dr. A.R. Saha	Pr. Scientist	31.12.2022 (A/N)
Sri Munindra Kr. Das	Tech. Officer	31.12.2022 (A/N)
Sri R.B. Thapa	SSS	31.12.2022 (A/N)
Sri Isra Bansfore	SSS	31.12.2022 (A/N)
Sri Kartich Ch. Mitra	SSS	31.12.2022 (A/N)
Sri Ashok Ghosh	SSS	31.12.2022 (A/N)

Promotions during the Year 2022

Name of the Person	Designation	Promoted to (Date)
4. Dr. S.P. Mazumdar	Sr. Scientist	Sr. Scientist RGP Rs. 9000/- (15.12.2021)
5. Dr. N. M. Alam	Sr. Scientist	Sr. Scientist RGP Rs. 9000/- (23.06.2021)
6. Dr. Shamna A.	Sr. Scientist	Sr. Scientist RGP Rs. 9000/- (23.06.2021)
7. Dr. Manik Lal Roy	Sr. Scientist	Sr. Scientist RGP Rs. 9000/- (04.11.2021)
8. Mrs. Kanti Meena	Scientist	Scientist RGP Rs. 9000/- (07.01.2022)
9. Dr. Maruthi R. T.	Scientist	Sr. Scientist RGP Rs. 8000/- (01.01.2022)
10. Sri Sribash Dey	Assistant	AAO (01.01.2022)
11. Sri Ravi Mishra	AAO	AO (20.05.2022)
12. Sri Amit Kr. Mandal	UDC	Assistant (03.06.2022)
13. Sri H. K. Das	STA	Technical Officer (15.03.2021)

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