

वार्षिक प्रतिवेदन

ANNUAL REPORT

2021



**ICAR-Central Research Institute
for Jute and Allied Fibres**
Barrackpore, Kolkata-700121





**Eco-friendly natural fibre
for supporting livelihood, soil fertility, industrial use
and making clean & green environment**

<https://crijaf.icar.gov.in>

वार्षिक प्रतिवेदन ANNUAL REPORT 2021



भा.कृ.अ.नु.प. - केन्द्रीय पटसन एवं समवर्गीय रेशा अनुसंधान संस्थान
बैरकपुर, कोलकाता -700121
ISO 9001 : 2015

ICAR - Central Research Institute for Jute and Allied Fibres
Barrackpore, Kolkata-700121

Citation:

Annual Report, ICAR-CRIJAF (2021). ICAR- Central Research Institute for Jute and Allied Fibres, Barrackpore, Kolkata. P. 192



Front Cover Legend:

Left to Right: Field crop of Sisal, Sunnhemp, Kenaf, Flax, Jute, Roselle and Ramie
Bottom: Recyclable bast fibre of JAF crop

Back Cover Legend:

Value added products of Jute and Allied fibres

Editorial Team:

A.K. SINGH
S. SATPATHY
SITANGSHU SARKAR
P. SATYA
S.K. SARKAR
M.L. ROY

Published By:

GOURANGA KAR
Director
ICAR-Central Research Institute for Jute and Allied Fibres
Nilganj, Barrackpore, Kolkata-700121
Email: director.crijaf@icar.gov.in
Website: <http://crijaf.icar.gov.in>

Disclaimer: Scientific inputs in this annual report are entirely based on research work of the concerned scientist(s) mentioned in each section and not necessarily represent the views of the Institute. Editors accepts no responsibility in relation to the accuracy, completeness, usefulness or otherwise, of the contents; the same should not be construed as a statement of law or used for any legal purposes.

Photography: Scientists and Library Unit of ICAR-CRIJAF (K.K. Banik)

Printed at: Semaphore Technologies Pvt. Ltd Kolkata -700012

Contents

	PREFACE
1	विशिष्ट सारांश
7	EXECUTIVE SUMMARY
14	ICAR-CRIJAF AT A GLANCE
20	ON-GOING RESEARCH PROJECTS
	RESEARCH HIGHLIGHTS
25	Crop Improvement
47	Crop Production
73	Crop Protection
91	Agricultural Extension
99	Krishi Vigyan Kendra
103	AINP on Jute and Allied Fibre
	OUTREACH PROGRAM
112	Scientists & Farmers Linkages
118	National Food Security Mission
124	SCSP, TSP & NEH Program
131	Mera Gaon Mera Gaurav
133	Swachh Bharat Mission
136	Women Empowerment
137	HUMAN RESOURCE DEVELOPMENT
139	WEBINAR, SEMINAR, WORKSHOP & MEETING
148	RESEARCH PUBLICATIONS
157	MAJOR EVENTS & CELEBRATIONS
165	AWARDS, FELLOWSHIPS & RECOGNITIONS
167	PRESS & MEDIA COVERAGE
189	OFFICIAL LANGUAGE IMPLEMENTATION
171	KNOWLEDGE MANAGEMENT & TECHNOLOGY COMMERCIALIZATION
173	INFRASTRUCTURE DEVELOPMENT
176	DISTINGUISHED VISITORS
177	PEOPLE @ICAR-CRIJAF
181	APPENDICES

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



I CAR-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 2021, the institute has streamlined research projects with major goals of breaking the yield barrier, 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 white jute genotype, JRCP-5, for high yield, anthocyanin and flavonoid content; JROB 2 for higher biomass and bioethanol production; HSLC 1 of roselle for high mineral and vitamin contents; 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 flax fibre extractor and multi-crop seed drill for effective extracting of fibres and seed sowing; liquid formulation of CRIJAF Sona for better fibre quality; nano-carbendazim for suppressing *M. phaseolina*; SpobNPV for mass production of entomopathogens; and Trichoderma isolates for manifesting antagonistic properties against multiple diseases of jute and flax. 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.

Continuously for the second year, the jute sowing season coincided with the peak incidence of COVID cases and a nationwide lockdown. In this difficult situation, researchers, extension specialists, and farmers are linked through various online platforms for information exchange and input management. This coordinated effort 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, 22 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 15 Awards and fellowships during the reporting year 2021. 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 2021, 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. Trilochan Mohapatra, 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.

Place: Barrackpore
Date: 11 January 2022



(Gouranga Kar)
Director, ICAR-CRIJAF

Vision & Mission



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 जिम्मेदारी 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-जेएफ) द्वारा अनुशंसित करने के पश्चात विस्तार और संवर्धन कार्यक्रमों के माध्यम से किसानों और हितधारकों के बीच बढ़ाया जाता है। वर्ष 2021 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-क्रिजैफ के पास 43 इन-हाउस प्रोजेक्ट और 17 बाहरी संस्था से वित्त पोषित परियोजनाएं चल रही थीं। वार्षिक प्रतिवेदन का कार्यकारी सारांश नीचे प्रस्तुत किया गया है।

फसल सुधार

- ❑ पटसन जीनोम से पुष्पण को विनियमित करने वाली जीनों की पहचान की गई, जिनसे जिबरेलिन (जीए) जैवसंश्लेषण मार्ग और जिबरेलिन रिसेप्टर्स की भूमिका का पता चला तथा मार्कर विकसित करने के लिए इन जीनों के लिए एसएनपी और एलील वेरिएंट की पहचान की गई। जबकि, बेस एडिटिंग के लिए पटसन और सड़न (रेटिंग) बैक्टीरिया से पेक्टेट लाइसेज जीन के एलीलिक वेरिएंट की भी पहचान की गई।
- ❑ फ्लैक्स के पौधे में गर्मी के झटके के कारण ऑक्सीडेटिव क्षति को 5-एजेसीटिडाइन उपचार से 15-20% तक कम किया गया। एक डीएनए मेथिलट्रांसफेरेज एन्कोडिंग जीन (LuMET1) ने फ्लैक्स के पौधों में गर्मी तनाव प्रतिक्रिया में डीएनए मेथिलिकरण की भागीदारी को दिखाया। मिथाइलोम अनुक्रमण से पता चला कि मिथाइलेटेड लोको की सीजी संदर्भ में सबसे अधिक (50.4-52.3%), इसके बाद सीएचजी में (21.9-22.8%) और सीएचएच में (24.9-27.7%) वितरित किया गया था। 5-एजेसीटिडाइन उपचारित फ्लैक्स में सीएचएच अधिक हाइपोमेथिलेटेड था।
- ❑ एक एच.एस.-मेस्ता (रोजेल) जीनोटाइप (एच.एस.एल.सी.-1) को 59.99 किंवटल/हेक्टेयर ताजा कैलीक्स उपज के साथ अखिल भारतीय नेटवर्क परियोजना के तहत अनुकूली परीक्षण के लिए बढ़ावा दिया गया है। जबकि, 95 रोजेल जर्मप्लाज्म के एक पैनेल के मूल्यांकन से पौधे की ऊंचाई (31 - 183 सेमी), प्रति पौधे शाखाओं की संख्या (0 - 13) और प्रति पौधे फलों की संख्या (7.00 - 69.33), फलों की लंबाई (2.05-4.34 सेमी), और फलों का व्यास (1.69 - 2.63 सेमी) में उच्च भिन्नता का पता चला। इसके अलावा रोजेल जर्मप्लाज्म में कैलीक्स उपज प्रति पौधे के लिए उच्चतम मात्रा में भिन्नता देखी गई।
- ❑ सफेद पटसन (5.1 मिलीग्राम/ग्राम सूखी पत्ती) की तुलना में टोसा पटसन (5.9 मिलीग्राम/जी सूखी पत्ती) की पत्तियों में कुल फ्लेवोनोइड की मात्रा काफी अधिक पायी गयी। टोसा पटसन फसल की जे.आर.ओ.-204 किस्म (7.0 मिलीग्राम/ग्राम सूखी पत्ती) अधिक फ्लेवोनोइड की मात्रा के लिए अन्य जीनोटाइप से बेहतर प्रदर्शन किया, इसके बाद जे.आर.ओ.वी.-5 (5.5 मिलीग्राम/ग्राम सूखी पत्ती) का स्थान रहा।
- ❑ सफेद पटसन की प्रविष्टि, जे.आर.सी.पी.-5 (प्रजाति पंकज) 34.5 किंवटल/हेक्टेयर रेशे की उपज क्षमता के साथ एवीटी-2 में अन्य सभी जीनोटाइप से बेहतर प्रदर्शन रहा और अखिल भारतीय नेटवर्क परियोजना के तहत अनुकूली परीक्षण के लिए उन्नत पायी गयी। समन्वित परीक्षणों से पता चला कि जे.आर.सी.-517 की तुलना में जे.आर.सी.पी.-5 में तना सड़न की घटना (13.3 प्रतिशत) कम पायी गयी। इसके तने में अन्य टोसा पटसन की तुलना में बहुत अधिक सापेक्ष एंथोसायनिन की मात्रा (1.376/ग्राम ताजा छाल वजन) पायी गयी। इसके अलावा जे.आर.सी.पी.-5 की पत्तियों में उच्च फ्लेवोनोइड (5.4 मिलीग्राम/ग्राम सूखी पत्ती) की मात्रा पायी गयी, जो जे.आर.सी.-517 के बराबर था और जे.आर.सी.-532 से काफी अधिक था। ये दोनों लक्षण जे.आर.सी.पी.-5 के उच्च रोग प्रतिरोध में योगदान कर सकते हैं।
- ❑ फ्लैक्स में सात क्रॉस की एफ-3 की 209 एकल पौधों की संतानों के मूल्यांकन से रेशे की उपज संबंधी लक्षणों के लिए व्यापक भिन्नता का पता चला, जिसके परिणामस्वरूप 150 श्रेष्ठ व्यक्तिगत पौधों का चयन किया गया। रखरखाव प्रजनन के लिए 90 विदेशी जर्मप्लाज्म सहित कुल 357 जर्मप्लाज्म लाइनों को बोया गया। इसके अलावा, 60 चयनित फ्लैक्स जर्मप्लाज्म का मूल्यांकन फ्यूजेरियम विल्ट प्रतिरोधी लक्षण की स्क्रीनिंग के लिए किया गया और सात लाइनों में प्रतिरोधी लक्षण पाया गया।
- ❑ फ्लैक्स में, एफ-24 लाइन में रेशा की गुणवत्ता संबंधी लक्षणों में शामिल 11 जीनों की अभिव्यक्ति मानक रेशा-प्रकार किस्म जे.आर.एफ.-2 की तुलना में अधिक थी। इन जीनों का उपयोग रेशा गुणवत्ता या उपज के लक्षण वर्णन में उपयुक्त रूप से किया जा सकता है।
- ❑ टोसा पटसन के 71 एफ-1 संकरों के 10 × 10 पूर्ण डाई-एलिल मेटिंग डिजाइन के मूल्यांकन से पौधे की ऊंचाई (416 से 485 सेमी) और बेसल व्यास (15.6 से 23.1 मिमी) में उच्च भिन्नता का पता चला। जबकि, सफेद पटसन के 66 एफ-1 संकरों के मूल्यांकन से पौधे की ऊंचाई (226 से 422 सेमी) में उच्च भिन्नता का पता चला। इसके बाद टोसा पटसन और सफेद पटसन दोनों के सर्वश्रेष्ठ 5 एफ-1 संकर को डाई-एलिल फैशन में फिर से संकरित किया गया।
- ❑ पूर्व-प्रजनन की सुविधा के लिए टोसा पटसन की किस्मों और जंगली प्रजातियों को शामिल करते हुए 12 क्रॉस किए गए, जिसके परिणामस्वरूप 50-95 प्रतिशत तक बीज सेट हुआ। जबकि, पूर्व-प्रजनन में उपयोग ली गई जंगली प्रजातियों में तना सड़न और बिहार हैरी कैटरपिलर के लिए उच्च प्रतिरोध एवं उच्च रेशा गुणवत्ता का लक्षण पाया गया।

- ❑ चार रोजेल जीनोटाइप में कृषि-रूपात्मक और पोषण संबंधी लक्षणों के मूल्यांकन से पता चला कि जीनोटाइप एच.एस.सी.एल.-1 में सबसे अधिक कैलीक्स उपज (157.4 ± 11.1 ग्राम/पौधा) है, जो अधिकांश खनिजों और विटामिनों से संवर्धित है। वही दूसरी तरफ़ आर.आई.जे.-73-1 में आयरन की मात्रा अधिकतम पाया गया।
- ❑ अखिल भारतीय नेटवर्क परियोजना परीक्षणों के तहत विभिन्न भौगोलिक स्थानों पर पटसन जीनोटाइप जे.आर.ओ.वी.-5 ने 30 दिनों (111.0 - 262.3 किंटल/हेक्टेयर) में उच्च विटामिन-सी की मात्रा (1.08-1.37 मिलीग्राम/ग्राम ताजा वजन) और फ्लेवोनोइड की मात्रा (5.5 मिलीग्राम/ग्राम सूखी पत्ती) को हासिल किया। जे.आर.ओ.वी.-5 एक सब्जी पटसन फसल के रूप में इसकी उच्च क्षमता को दर्शाता है।
- ❑ कापोली पटसन की एफ-2:3 और आरआई-8 आबादी का मूल्यांकन (सफेद पटसन प्रजाति जे.आर.सी.-212 × कोरकोरस ओलिटोरियस प्रजाति जे.आर.ओ.-524) ने रेशे की उपज के लिए महत्वपूर्ण जीनोटाइपिक प्रभाव का खुलासा 0.68 से 0.79 की चयन सटीकता के साथ किया। आरआई-8 और आरआई-9 कापोली के संयुक्त मूल्यांकन से पता चला है कि पौधे की ऊंचाई, तनों का बेस व्यास और रेशे की उपज में महत्वपूर्ण जीनोटाइपिक प्रभाव थे, लेकिन जीनोटाइप × वर्ष परस्पर प्रभाव गैर-महत्वपूर्ण थे। जे.आर.ओ.-524 की तुलना में, तीन पंक्तियों, जी-266, जी-329 और जी-365 ने 40% अधिक उपज दिया। कापोली लाइनों में रेशे की उपज वृद्धि पौधे की ऊंचाई और तनों का बेस व्यास में इसी वृद्धि के साथ संगत नहीं थी। वही दूसरी तरफ़ रेशा की उपज (0.645) के लिए आनुवंशिकता अनुमान उच्चतम पाया गया, जबकि पौधे की ऊंचाई (0.371) के लिए सबसे कम पाया गया।
- ❑ रोजेल जीनोटाइप के मूल्यांकन से हरे पौधे का वजन (146 - 479.5 ग्राम/पौधे), पौधे का तना वजन (17.7 - 75 ग्राम/पौधे) और रेशा उपज (7.2 - 26.3 ग्राम/पौधे) में उच्च भिन्नता का पता चला। एक अन्य परीक्षण में, 100 में से 38 टोसा पटसन लाइनों ने जे.आर.ओ.-524 (2.7 टेक्स) और जे.आर.ओ.-204 (2.5 टेक्स) किस्मों की तुलना में काफी उच्च रेशा गुणवत्ता दर्ज की।
- ❑ पटसन में 3.88 किंटल बीज-मांगपत्र की तुलना में कुल 5.81 किंटल प्रजनक (ब्रीडर) बीज का उत्पादन किया गया। केन्द्रीय पटसन एवं समवर्गीय रेशा बीज अनुसंधान केंद्र, बुधुद, में पटसन की 28 किस्में, मेस्ता की 11 किस्में, सनई की 4 किस्में और फ्लैक्स की 1 किस्म का रखरखाव किया गया, जिससे कुल 123.9 किलोग्राम न्यूक्लियस बीज का उत्पादन हुआ। जबकि, भाकृअनुप (ICAR) बीज परियोजना के तहत कुल 509.3 किंटल बीज का उत्पादन किया गया।
- ❑ पटसन की तीन किस्में (जे.आर.ओ.एम.यू.-1, जे.आर.सी.जे.-11 और जे.आर.ओ. बी.-2) पंजीकरण के लिए पी.पी.वी.एफ.आर. प्राधिकरण को प्रस्तुत की गई हैं, एवं मेस्ता के लिए कुल 26 डिस्क्रिप्टर विकसित किए गए, जिनमें से 11 डाई-मॉर्फिक और 15 पॉली-मॉर्फिक थे।

फसल उत्पादन

- ❑ एकीकृत फसल-भूमि प्रबंधन (ICLM) प्रणाली में प्रयुक्त फसल विविधीकरण और कृषि संबंधी उत्पादकता सुधार से गैर-पुनर्निर्विकरण ऊर्जा के इनपुट में कमी के परिणामस्वरूप कृषि पारिस्थितिक तंत्र से ग्रीन हाउस गैस (GHG) उत्सर्जन में कमी हो सकती है। मृदा स्वास्थ्य के अनुकूल कृषि प्रणालियों के प्रबंधन, मृदा और जल हास में न्यूनतम कमी और जैविक उर्वरकों की मात्रा में वृद्धि से कार्बन फुटप्रिंट को कम करने में भी मदद मिली।
- ❑ कृषि जनित ग्रीन हाउस गैस (GHG) उत्सर्जन तथा जलवायु परिवर्तन के नकारात्मक प्रभाव को कम करने में सनई की हरी खाद और सूक्ष्मजीव (ईएम) के मदद से वृक्षों के सड़े-गले पत्तियों से कम्पोस्ट बनाना एक उपयोगी तकनीक हो सकती है।
- ❑ पूर्वी भारत के सभी चार पटसन उत्पादक क्षेत्रों (नौगांव, पुंडीबारी, बैरकपुर और भुवनेश्वर) में पटसन-आधारित फसल प्रणालियों के नियोजन में शुष्क और नमी की संभाव्यता विश्लेषण से यह मालूम हुआ है कि 22 अक्टूबर से 25 मार्च के बीच किसी भी फसल को उगाने के लिए पूरक सिंचाई की आवश्यकता होती है।
- ❑ पटसन में पूरे दिन के विश्लेषण से यह देखा गया है कि, सुबह 7:00 बजे से शाम 5:30 बजे के बीच 85% ईटीसी (ETc) हुआ और सुबह 10:00 बजे से दोपहर 1:30 बजे के बीच 42% ईटीसी (ETc) हुआ। पटसन की 117 दिनों की फसल अवस्था में ईटीसी कुल 364 मि.मी. था।
- ❑ पटसन के सिंचाई प्रबंधन के तहत, उच्चतम पटसन (cv. JRO 204) रेशा की उपज 75% DASM के तहत 100% ETc (3.49 टन/हेक्टेयर) के साथ प्राप्त की गई, इसके बाद 75% DASM 75% ETc (3.37 टन/हेक्टेयर) के साथ प्राप्त हुई। फ्लैक्स फसल में, वाष्पीकरण कुल वर्षा से अधिक होती है, इसलिए इसके उत्पादन में पूरक सिंचाई की आवश्यकता होती है।
- ❑ पटसन आधारित फसल प्रणालियों के अंतर्गत मिट्टी के पोषक तत्व संतुलन पर जुताई और अवशेष प्रबंधन के दीर्घकालिक प्रभाव में बिना जुताई तथा अतिरिक्त फसल अवशेष (एनटी + आर) द्वारा उच्चतम सकारात्मक संतुलन (एन: 195.9; पी: 28.0 और के: 134.2 किग्रा/हेक्टेयर) को दर्शाया है।
- ❑ पटसन आधारित फसल प्रणालियों के तहत जुताई और अवशेष प्रबंधन के प्रभावों का मृदा जल की गतिशीलता पर अध्ययन से पता चला है कि मृदा प्रोफाइल में नमी भंडारण (50 प्रतिशत से अधिक उपलब्ध जल धारण क्षमता) जुताई और अवशेष प्रबंधन उपचार के तहत (NT और NT+R) बुआई 60-75 दिन तक बना रहता है। इस प्रकार, पूरे मृदा प्रोफाइल में नमी की उपलब्धता में वृद्धि होती है।
- ❑ दीर्घकालिक पटसन उत्पादन हेतु मृदा परीक्षण आधारित एकीकृत पौध पोषक तत्व आपूर्ति प्रणाली में, जब अजैविक उर्वरक (ST-TY के तहत 3.5 टन/है.) को गोबर की खाद (FYM) और जैव उर्वरक (एज़ोटोबैक्टर और पीएसबी) के संयोजन में लागू किया गया तो उच्चतम पटसन रेशा उपज (36.4 किंव./है.) दर्ज की गई।

- ❑ दीर्घकालिक उर्वरक प्रयोग (LTFE) में अधिकतम पटसन रेशा उपज (34.3 किं./ हेक्टेयर) की प्राप्ति 150% NPK उपचार के बाद 100% NPK + FYM से हुई। शत प्रतिशत NPK उपचार की तुलना में, केवल 100% N उपचार और सल्फर विहीन उपचार (100% NPK -S) से कम रेशा उपज दर्ज की गयी।
- ❑ दक्षिण बंगाल में बिना उर्वरक प्रयोग (532.5 कि.ग्रा./ हेक्टेयर) की तुलना में $N:P_2O_5 : K_2O :: 80:40:80$ कि.ग्रा./ हेक्टेयर के प्रयोग से 124.1% अधिक पटसन बीज उपज (1192 कि.ग्रा./ हेक्टेयर) तथा सुपुष्ट बीज, विगार सूचकांक आदि के मामले में बेहतर गुणवत्ता की प्राप्ति हुई। अधिकतम बीज उपज के लिए ओलिटोरियस पटसन में नत्रजन को दो बार में देने के बजाय इस को तीन बार में देना (50% बुवाई के 21-28 दिन बाद, 25% बुवाई के 42 दिन बाद और 25% बुवाई के दिन 56 बाद) बेहतर पाया गया।
- ❑ पटसन की शुष्कावस्था में म्यूसिलेज जल धारण कर एक महत्वपूर्ण भूमिका निभाता है। पटसन अपने उच्च म्यूसिलेज (लगभग 12 %) के कारण कम मृदा नमी की स्थिति में भी जल धारण करने में सक्षम होता है।
- ❑ पटसन के दोनों प्रजातियों-ऑलिटोरियस और कैप्सुलरिस में शीघ्र पुष्पण को कम करने के उद्देश्य से छह अलग-अलग रसायनों के प्रयोग में GA3 @ 0.02% को सबसे बेहतर पाया गया।
- ❑ पटसन की अनेक परीक्षण की गई क्रिस्मों में से जेआरओबी-2 ने बेहतर गुणवत्ता और अधिकतम जैव भार द्वारा बायोएथेनॉल उत्पादन को प्रदर्शित किया।
- ❑ औसतन पटसन रेशा उत्पादकता में बड़े, मध्यम, छोटे पौधे और अपरिपक्व पौध समूहों का योगदान क्रमशः 73%, 21%, 6% और 0% संख्या में 1.52 (37%), 1.09 (26%), 0.71 (17%) 0.85 (20%) लाख/हेक्टेयर और प्रति पौध 18.05, 7.55 और 3.09 और 0.0 ग्रा. रेशा की प्राप्ति होती है। पुआल पलवार के बाद मिट्टी में उपलब्ध P, K और जैविक कार्बन (33-39 कि.ग्रा./ हेक्टेयर, 140-184 कि.ग्रा./हेक्टेयर और 0.55%), बायोमास (75-88 टन/ हेक्टेयर) और रेशा उपज (53.2-55.2 किं./ हेक्टेयर) उच्चतम दर्ज की गई। इस तरह के पलवार में 5 और 6.67 लाख/ हेक्टेयर, पटसन पौधे के साथ 53.2 – 55.2 किं./हेक्टेयर रेशा उपज की प्राप्ति हुई, जबकि 5 लाख/हेक्टेयर पटसन पौधे के साथ 49.6 किं./ हेक्टेयर रेशा उपज की प्राप्ति हुई और 3.5 लाख/हेक्टेयर पटसन पौधे के साथ 47.2 किं./हेक्टेयर रेशा उपज की प्राप्ति हुई।
- ❑ किसानों के खेत में कम घनत्व वाली बुवाई विधि से 33-36 किं./ हेक्टेयर पटसन रेशा (प्रजाति NJ 7010) की प्राप्ति हुई, जिसमें 60-70 मानव दिवस की बचत भी हुई। बुवाई के 45 दिन बाद पटसन और हरा चना की इंटरक्रॉपिंग से बने छाया में भूमि पर प्रकाश पहुँच में लगभग 90% की कमी होती है। इस तरह प्रति हेक्टेयर 36.5 किं. पटसन रेशा (प्रजाति JRO BA3) और मूंग 6 किं. की प्राप्ति हुई, जिसमें प्रमुख कार्यों के लिए हाथ से निराई की तुलना में 79 मानव दिवस/हेक्टेयर की बचत हुई।
- ❑ पटसन (प्रजाति JRO 204) के लिए शाकनाशी और यांत्रिक खरपतवार प्रबंधन विधियों में से, ईपफेकार्बजोन @120 ग्रा./हेक्टेयर (PE) + बुवाई के 15 दिन बाद पर नेल वीडर के प्रयोग से अधिकतम रेशा उपज (34.3 किं./हेक्टेयर) का उत्पादन हुआ।
- ❑ खरपतवार प्रबंधन हेतु हाथ से निराई की तुलना में क्रिजैफ नेल वीडर के प्रयोग से 5 सेंमी. मिट्टी की गहराई पर 3.1-4.2% और 10 सेंमी. मिट्टी की गहराई पर 3.3-3.5% मृदा नमी की बचत होती है। प्रारंभ में ईपफेकार्बजोन (90-120 ग्रा./हेक्टेयर) का प्रयोग PE के रूप में करने के 10 दिन बाद, FDAH (32.3-38.2%), डिहाइड्रोजीनेज (14.3-27.8%), β -ग्लूकोसाइडेज (29.9-47.5%), और यूरेज (28.2-42.4%) की गतिविधि कम हो जाती है। हालांकि, कटाई के समय (बुवाई के 120 दिन बाद), महत्वपूर्ण मृदा एंजाइम लगभग सामान्य स्तर (FDAH का 95.6% और डिहाइड्रोजीनेज का 93.4%) तक पहुंच गए।
- ❑ रेमी में खरपतवार प्रबंधन के मामले में, ऑक्सीफ्लोरफेन (23.5% ईसी (पीई) @ 1.0 लीटर/हेक्टेयर + क्विजालोफॉप-एथिल 10% ईसी (पीओई) @ 38 ग्राम/हेक्टेयर 20 डीएस + 1 एचडब्ल्यू) के उपचार से प्राप्त रेमी रेशा उपज (19.3 किं.टल / हेक्टेयर) की तुलना में उच्चतम रेशा उपज (21.2 किं.टल / हेक्टेयर) खरपतवार मुक्त स्थिति में उत्पादित की गई।
- ❑ एकीकृत कृषि प्रणाली (पटसन के साथ) में, कई कृषि कार्यों के एकीकरण, फसल अवशेषों और उप-उत्पादों के पुनर्चक्रण से 114% लाभ में वृद्धि के साथ 226 मानव दिवस/ हेक्टेयर रोजगार सृजन दर्ज किया गया।
- ❑ सीसल में क्षेत्र विस्तार के प्रयास में ओडिशा सरकार की विभिन्न एजेंसियों को 2.17 लाख रोपण सामग्री (बुलबुल) दिये गए, जबकि 0.40 लाख बुलबुल की आपूर्ति मेघालय को गई। संबंधित राज्यों में इसका उपयोग सीसल के नए रोपण के लिए किया गया।
- ❑ पूर्वोत्तर भारत में रेमी क्षेत्र के विस्तार हेतु, असम और मेघालय के पश्चिमी गारो पहाड़ियों में 70 किं.टल रेमी प्रकंद का रोपण किया गया है।
- ❑ फ्लैक्स क्षेत्र के विस्तार कार्यक्रम की शुरुआत प्रतापगढ़ (यूपी), नौगांव (असम) और कूचबिहार (पश्चिम बंगाल) के 11 गाँव के 35 चयनित किसानों से की गई।
- ❑ बहु-फसल बीज ड्रिल (एमसीएसडी) के कार्यात्मक मूल्यांकन में 90-95% क्षेत्र दक्षता के साथ प्रभावी क्षेत्र क्षमता (ईएफसी) 0.25- 0.28 हेक्टेयर/ घंटा एवं औसत ड्राफ्ट ऑपरेशन 85.02 N दर्ज किया गया।
- ❑ फ्लैक्स का उन्नत रेशा निकालने की मशीन एक दिन में 450-480 कि.ग्रा. सड़े और सूखे पुआल का खपत कर 40-45 कि.ग्रा. रेशा का उत्पादन करता है। शुष्क भार के आधार मशीन से रेशा रिकवरी 52% थी। इस रेशा निकालने की मशीन से एक हेक्टेयर क्षेत्र के फ्लैक्स पुआल से 7-8 दिनों के भीतर रेशा को निकाला जा सकता है।

- ❑ क्रिजैफ सोना का प्रयोग धीमी गति से बहते जल की स्थिति में करने से पटसन सड़न 10-12 दिनों में पूरी हो गई और तीव्र सड़न के कारण ज्यादा रेशा रिकवरी, रेशा शक्ति (25.4 ग्रा./टेक्स) और रेशा महीनता (2.65 -2.74 टेक्स) की भी प्राप्ति हुई। इस उन्नत सड़न प्रणाली से कठिन परिश्रम में कमी आई और पटसन किसानों के लिए अधिक स्वच्छ और स्वस्थ स्थिति पायी गयी।
- ❑ पश्चिम बंगाल के विभिन्न पटसन उत्पादक जिलों में 'क्रिजैफ सोना' के 12 महीने पुराने तरल (बीजाणु आधारित) फॉर्मूलेशन को बड़े पैमाने पर परीक्षण करने से ये देखा गया कि 12.5 - 13.6 दिनों के भीतर ही बेहतर रेशा शक्ति (23.7-25.07 ग्रा.), उच्च रेशा महीनता (2.65 से 2.69 टेक्स) और कम वांछनीय जड़ सामग्री (4.51 - 6.97%) वाली रेशा की प्राप्ति हुई।
- ❑ क्रिजैफ सोना के तरल फॉर्मूलेशन द्वारा पटसन सड़न (i) धीमी गति से बहने वाले जल (ii) कंक्रीट टैंक के रुके हुये जल और (iii) इन-सीटू सड़न तालाब में रुके हुए जल में pH की कमी दर्ज की गई। सड़न पश्चात कंक्रीट और इन-सीटू सड़न टैंक में रुके हुए जल में धीमी गति से बहने वाले जल की तुलना में अधिक EC थी। ऑक्सीजन की अधिक उपलब्धता के कारण धीमी गति से बहने वाले जल में उच्च एंजाइमेटिक गतिविधियां (पॉलीगैलेक्टुरोनेज, पेक्टिन लाइसेज और ज़ाइलैनेज) हो सकती हैं।

फसल संरक्षण

- ❑ बड़े पैमाने पर स्पेब (रोमिल सुडी) एनपीवी (SpobNPV) के इन विवो उत्पादन हेतु उच्चतम उत्पादकता अनुपात के साथ सुडी की मापदंडों और संक्रामण खुराक का मानिकीकरण किया गया। पटसन रोमिल सुडी के लगभग 130-140 मिलीग्राम वजन वाले तीसरे लार्वा इंस्टार को 280C तापमान पर पांच दिनों तक 3x104 POB/मि. ली. का वायरल इनोकुलम का संक्रमण खुराक देने से स्पेब एनपीवी का अधिकतम उत्पादकता सूचकांक प्राप्त हुआ।
- ❑ विभिन्न मृदा स्थितियों से एकत्रित 29 ट्राइकोडर्मा आइसोलेट्स का परीक्षण तीन मिट्टी जनित रोगजनकों जैसे राइजोक्टोनिया स्पीसीज, मैक्रोफोमिना फेजोलिना और स्कलेरोटियम स्पीसीज के प्रति किया गया। रोगजनक कॉलोनी विकास अवरोध क्षमता के आधार पर इन आइसोलेट्स के CJMR180, CJMR191 और CJMR193 ने लगातार दो या दो से अधिक रोगजनकों के प्रति बेहतर प्रदर्शन के साथ सबसे अच्छे आइसोलेट साबित हुये।
- ❑ पटसन रोमिल सुडी के लार्वा विकास के तरीका से जंगली पटसन प्रजातियों में प्रतिजीविता का पता चलता है। जंगली प्रजाति सी. एस्टुअन्स और सी. स्यूडो-ऑलिटोरियस से प्राप्त जर्म प्लाज्म लाइनों में रोमिल सुडी का प्रारंभिक लार्वा वजन, संचयी लार्वा वजन और लार्वा अस्तित्व में काफी कम था। पटसन के प्लाज्म लाइनों WCIN 123 और WCIN 179 (सी. एस्टुअन्स) WCIJ 34 (सी. स्यूडो-ऑलिटोरियस) में प्रतिजीविता प्रभाव अधिकतम था। खेती की प्रजातियों में, टोसा पटसन के OIN 154 लाइनों ने अधिकतम प्रतिजीविता प्रदर्शित की।
- ❑ रुण प्लाट में तना सड़न की घटना के आधार पर, 12 जर्मप्लाज्म अर्थात्, OIN-62, OIN-26, OIJ-193, OIM-23, OIN-236, OIN-142, OIN-391, OIN-904, OIN-1040, OIN-908, OIN-891 और OIN-858 को पूर्णतः रोगविहीन पाया गया। पटसन के 70-दिन पुराने पौधों में कृत्रिम संक्रामण से पटसन के जर्मप्लाज्म जैसे OIN-118, OIN-119, OIN-156, OIN-154, OIN-113, OIJ-62, OIN-114, OIN-140, OIJ-60 और OIN-161 को कम से कम जख्म के साथ तना सड़न के प्रति न्यूनतम संवेदनशील पाया गया।
- ❑ पीली मकड़ी प्रबंधन हेतु प्रभावी अकेरिसाईड और पटसन के अपेक्षाकृत सहिष्णु प्रजाति का सफलतापूर्वक एकीकृत किया गया। पटसन की प्रजातियों JRO 204 और JROG 1 में फेनपायरोक्सिमेट 5 EC @1.5 मि.ली./ली. का पर्ण छिड़काव करने से पीली मकड़ी के संक्रमण और क्षति स्तर में कमी के साथ-साथ रेशा की उपज में वृद्धि होती है।
- ❑ मिट्टी में सल्फर प्रयोग का प्रभाव पीली मकड़ी की संख्या, क्षति और उपज को नियमित करने वाले पौधे बढ़वार के मापदंडों पर स्पष्ट दिखाई दिया। मिट्टी में सल्फर का प्रयोग 30 और 60 कि.ग्रा./हेक्टेयर करने से पीली मकड़ी से होने वाला नुकसान और उसकी संख्या में कमी आई। इसके अलावा इसका सकारात्मक प्रभाव उपज बढ़ाने वाले मापदंड जैसे पौधे की ऊंचाई, आधार व्यास और पौधे के शुष्क भार पर भी दिखाई दिया।
- ❑ सनई विल्ट घटना का वर्षा और न्यूनतम तापमान के साथ अहम सकारात्मक संबंध है। अधिकतम तापमान होने से रोग बढ़ोतरी में नकारात्मक वृद्धि देखी गई। न्यूनतम तापमान के साथ-साथ वर्षा और मृदा नमी में वृद्धि होने से रोग की घटना में बढ़ोतरी देखी गयी।
- ❑ पिछले तीन वर्षों में अधिकतम और न्यूनतम वायुमंडलीय तापमान के संबंध में फ्लैक्स बुवाई की विभिन्न तिथियों (30 अक्टूबर, 15 नवंबर और 30 नवंबर) से यह पता चलता है कि औसत वायुमंडलीय तापमान में कमी होने से विल्ट संक्रमण में कमी होती है। न्यूनतम तापमान में कमी की तुलना में अधिकतम तापमान में कमी के साथ रोग की कमी अधिक स्पष्ट है। रोग हास की घटना न्यूनतम तापमान में कमी की तुलना में अधिकतम तापमान में कमी होने पर ज्यादा स्पष्ट दिखाई देती है।
- ❑ सभी उपचारों में से बुवाई से 7 दिन पहले एक ही समय में मिट्टी को ब्लीचिंग पाउडर @ 25 कि.ग्रा./हेक्टेयर और कार्बेन्डाजिम @ 2 ग्रा./ कि.ग्रा. + इमिडाक्लोप्रिड @ 4 ग्रा./कि.ग्रा. से बीजोपचार करने से तना सड़न में 24% और पीली मकड़ी के संक्रमण होने वाले क्षति में 50% तक कमी के साथ-साथ सबसे अधिक रेशा उपज की प्राप्ति हुयी।

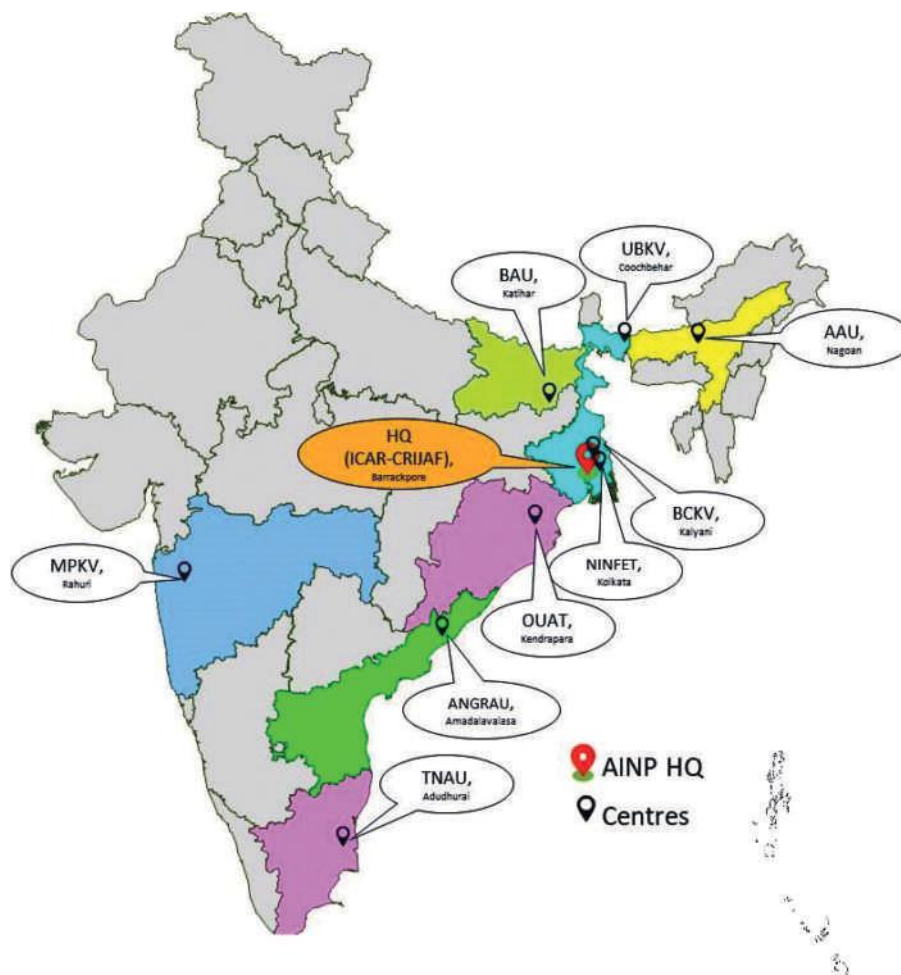
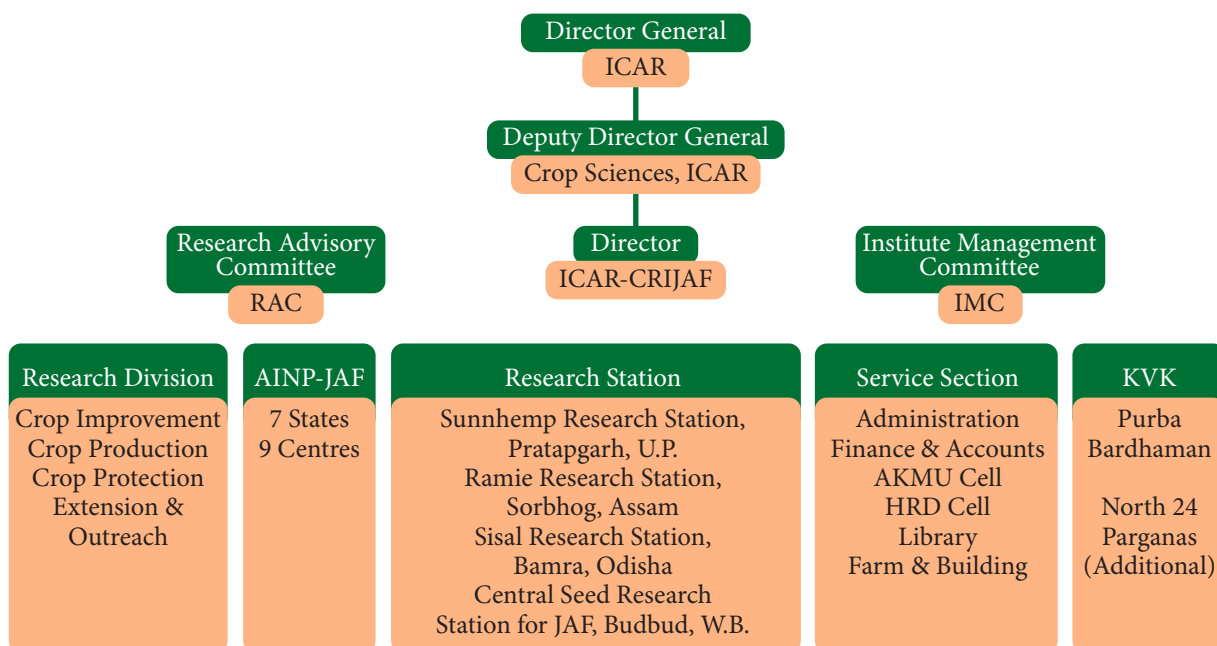


- ❑ बीजोपचार के माध्यम से एकीकृत रोग प्रबंधन (आईडीएम) द्वारा कार्बोक्सिन+ थीरम @ 2 ग्रा./कि.ग्रा. बीज+नीम केक @ 250 कि.ग्रा./हेक्टेयर और ट्राइकोडर्मा स्पीसीज @ 2.5 कि.ग्रा./हेक्टेयर+चारा ज्वार (10:1) के साथ अंतःफसल में प्रयोग से सनई विल्ट का प्रभावी ढंग से प्रबंधन होता है।
- ❑ नैनो-कार्बेन्डाजिम @ 10-6 एम. फेजोलिना संक्रमण को कम करने में प्रभावी होती है। इससे रोगजनक की वृद्धि पूर्ण रूप से रुक गई। जबकि 100% सफलता प्राप्त के लिए विष खाद्य तकनीक के तहत पारंपरिक कार्बेन्डाजिम @ 1ppm की आवश्यकता थी।

कृषि प्रौद्योगिकी का प्रसार

- ❑ अगर पटसन आधारित विविध उत्पादों को बढ़ावा मिले तो काफी हद तक इसे प्लास्टिक और सिंथेटिक्स के बदले प्रयोग में लाया जा सकता है। इसलिए प्लास्टिक और सिंथेटिक्स के विकल्प के रूप में पटसन आधारित विविध उत्पादों की पहचान की गई, संभावित मात्रा और रेशा की आवश्यकता (24.5 लाख गांठ) का भी अनुमान लगाया गया।
- ❑ पटसन किसानों की सामाजिक-आर्थिक स्थिति में सुधार के लिए, किसान हित समूहों (एफ.आई.जी.) का गठन करके किसान उत्पादक संगठन (एफ.पी.ओ.) और किसान उत्पादक कंपनी (एस.ए.एफ.पी.सी.एल.) के साथ संपर्क स्थापित किया गया है। प्रारंभ में दो स्वयं सहायता समूह भी बनाए गए और उन्हें उचित रूप से प्रशिक्षित किया गया ताकि पटसन मूल्य श्रृंखला निर्माण के माध्यम से उनकी सहायता की जा सके।
- ❑ किसान ने महसूस किया कि (i) तापमान और आर्द्रता में भिन्नता ने शीघ्र पुष्पण और कीटों के प्रकोप में महत्वपूर्ण भूमिका निभाई, (ii) वर्षा में भिन्नता ने बुवाई के समय, अंकुरण और पौधों की वृद्धि और रेशा गुणवत्ता को सार्थक रूप से प्रभावित किया। पटसन आधारित फसल प्रणाली में किसानों के लिए जलवायु अनुकूलता के निर्माण के लिए एक वैचारिक मॉडल विकसित किया गया है।
- ❑ पटसन-आई.सी.ए.आर.ई. (Jute-ICARE) क्षेत्र में गैर पटसन-आई.सी.ए.आर.ई. क्षेत्र की तुलना में रेशे की उपज में कम-से-कम 10% की वृद्धि हुई और रेशा गुणवत्ता (टीडी-2 और टीडी-3) में भी सुधार हुआ। पटसन-आई.सी.ए.आर.ई. (Jute-ICARE) कार्यक्रम के अंतर्गत सूचीबद्ध किसानों को उनके गुणवत्ता वाले पटसन रेशे के लिए पारंपरिक रूप से अपगलन किये गये रेशे की तुलना में प्रति क्विंटल रुपये 450 से 500 अधिक बाजार मूल्य मिला।
- ❑ प्रचार प्रसार में हुए कमी की वजह से पटसन रेशा उपज में प्रति हेक्टेयर छह क्विंटल से अधिक का अंतर, किसानों को उन्नत उत्पादन तकनीकों का उपयोग करने के लिए शिक्षित करने की आवश्यकता पर बल देता है। उपज अंतर को कम करने की रणनीति के एक भाग के रूप में, किसानों को भा.कृ. अनु.प.- क्रिजैफ द्वारा नियमित रूप से जारी कृषि-सलाह का उपयोग करने की भी सलाह दी गई थी।
- ❑ किसानों के अनुसार पटसन की खेती में ये बाधाएं प्रमुख थीं- (i) सड़न के समय पर्याप्त पानी की अनुपलब्धता, (ii) पटसन की कटाई के दौरान श्रम संकट और श्रम मजदूरी की उच्च दर, (iii) अपेक्षित रूप से पटसन का कम बाजार भाव और (iv) आसपास के क्षेत्र में सुनिश्चित बाजार का अभाव।
- ❑ किसानों की आय दुगुनी करने की दिशा में भा.कृ.अनु.प.- क्रिजैफ के इन तकनीकों जैसे (i) उन्नत बीज, (ii) अंतरफसल, (iii) एकीकृत पोषक तत्व और कीट प्रबंधन विधियाँ (iv) यांत्रिक बुवाई और निराई के लिये उपलब्ध यंत्र (बहु-पंक्ति सीड ड्रिल, नेल वीडर, सिंगल व्हील पटसन वीडर), (v) उन्नत सड़न तकनीक (क्रिजैफ सोना द्वारा) को केंद्रीय योजनाओं (एन. एफ. एस. एम. (NFSM), पटसन - आई.सी.ए.आर.ई. (Jute- ICARE), एस.सी.एस.पी. (SCSP), टी.एस.पी. (TSP)) के माध्यम से वृद्धि की।
- ❑ कृषि विज्ञान केंद्र (KVK), बर्दवान ने शाकनाशी का उपयोग करके खरपतवार नियंत्रण, पटसन में मिश्रित फसल, सब्जियों की रोपाई की विभिन्न तकनीकों और टमाटर की उन्नत किस्म के मूल्यांकन के लिए चार फार्म परीक्षण (On Farm Trials) आयोजित किए। पटसन, मसूर, चना, केला और सब्जियों पर कुल 120 फ्रंटलाइन कृषि प्रदर्शन (Frontline demonstration) आयोजित किए गए। एकीकृत कृषि प्रणाली (IFS) प्रौद्योगिकी का प्रसार करने के लिए वर्मीकम्पोस्टिंग, एजोला खेती, मशरूम खेती, मुर्गी पालन और बतख पालन, बकरी पालन, मधुमक्खी पालन की कुछ प्रदर्शन इकाइयां स्थापित की गई हैं। कृषि विज्ञान केंद्र (KVK), उत्तर 24 परगना ने सरसों, मसूर, पटसन और मुर्गी तथा बतख पालन पर 133 फ्रंटलाइन कृषि प्रदर्शन (Frontline demonstration) आयोजित किए।
- ❑ आदिवासी उपयोजना (TSP) के तहत संस्थान ने 229 अनुसूचित जाति समुदाय के किसानों के लिए 9 प्रशिक्षण और प्रदर्शन कार्यक्रम आयोजित किए। इसके अलावा, पश्चिम बंगाल और ओडिशा के अनुसूचित जाति बहुल जिलों के 3900 किसानों को कृषि उत्पादक सामग्री का वितरण किया गया।
- ❑ अनुसूचित जाति समुदाय के किसानों को लाभ पहुंचाने के लिए संस्थान ने पटसन और समवर्गीय रेशा फसल आधारित कृषि प्रणाली में एससीएसपी (SCSP) योजना लागू की। वर्ष 2021 के दौरान 45 प्रशिक्षण आयोजित किए गए और ऐसे प्रशिक्षणों के माध्यम से 1055 किसान लाभान्वित हुए। पांच गोद लिए गए गांवों में 50 हेक्टेयर प्रदर्शनों के लिए कृषि उत्पादक सामग्री (इनपुट) और उपकरण का वितरण किया गया।
- ❑ भाकृअनुप-क्रिजैफ ने पश्चिम गारो पहाड़ी और पश्चिमी त्रिपुरा के कृषि विज्ञान केंद्र के सहयोग से एनईएच (NEH) कार्यक्रमों का एक प्रमुख घटक लागू किया। पश्चिम त्रिपुरा और मेघालय के गारो हिल्स के किसानों को 480 क्राईजाफ सिंगल व्हील जूट वीडर और 200 वर्मी बेड वितरित किए गए तथा 680 किसानों के समक्ष विभिन्न कृषि संबंधी तकनीकों का प्रदर्शन भी किया गया।

ORGANOGRAM OF ICAR-CRIJAF





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 2021, the institute made significant achievements in research and demonstrated the technologies to jute and allied fibre growing farmers through various programmes. ICAR-CRIJAF had 43 in-house projects and 17 externally funded projects in operation in the year 2021. The executive summary of the report is presented below.

Crop Improvement

- Mining the jute genomes, genes regulating flowering were identified which revealed role of Gibberellin (GA) biosynthetic pathway and GA receptors. SNPs and allelic variants were identified for these genes to develop markers. Allelic variants for pectate lyase genes from jute and retting bacteria were also identified for base editing.
- Oxidative damage due to heat shock was observed to be reduced by 15-24% in 5-Azacytidine treated flax. A DNA methyltransferase encoding gene, LuMET1, showed involvement of DNA methylation in heat stress response in flax seedlings. Methylome sequencing revealed that the methylated loci were distributed most (50.4-52.3%) in CG context followed by 21.9-22.8% in CHG and 24.9-27.7% in CHH contexts. The CHH context regions were more hypomethylated in 5-Azacytidine treated flax.
- A HS-Mesta (roselle) genotype, HSLC 1 with 59.99 q/ha fresh calyx yield has been promoted to adaptive trial for varietal testing under AINPJAF. Evaluation of a panel of 95 roselle germplasm revealed high variation in plant height (31 - 183 cm), number of branches per plant (0 - 13) and number of fruits per plant (7.00 - 69.33), fruit length (2.05-4.34 cm) and fruit diameter (1.69 - 2.63 cm). The Highest amount of variability was observed for calyx yield per plant.
- Total flavonoid content was significantly higher in *C. olitorius* (5.9 mg/g dry leaf) than in *C. capsularis* (5.1 mg/g dry leaf), suggesting tossa jute has higher medicinally and nutritionally important flavonoids than white jute. JRO 204 (7.0 mg/g dry leaf) outperformed other genotypes for flavonoid content, followed by JROV-5 (5.5 mg/g dry leaf).
- A white jute entry, JRCP-5 (Pankaj) with fibre yield potential of 34.5 q/ha outperformed all the other genotypes in AVT-II and was advanced to adaptive trial under AINPJAF. JRCP-5 was found to show 13.3% less incidence of stem rot than JRC 517 in coordinated trials. It has much higher relative anthocyanin content (1.376 /g fresh bark weight) in its stem than other capsularis varieties. JRCP-5 also contains high flavonoid in leaf (5.4 mg/g dry leaf) being at par with JRC 517 and significantly higher than JRC 532. Both the traits may contribute to higher disease resistance of JRCP-5.
- Evaluation of 209 single plant progenies of F3 of seven crosses in flax revealed wide variation among progenies for different fibre yield related traits resulted in selection of 150 superior individual plants. Seven selected flax germplasm were resistant to Fusarium wilt.

- In flax, expression of 11 genes involved in fibre quality traits in F 24 line was comparable or higher than the standard fibre-type variety JRF 2. These genes could be suitably used in characterization of fibre quality or yield.
- Evaluation of 71 F1 hybrids of tossa jute from 10 x 10 full diallel mating design revealed high variation in plant height (416 to 485 cm) and basal diameter (15.6 to 23.1 mm). Evaluation of 66 F1 hybrids of white jute revealed high variation in plant height (226 to 422 cm). Best 5 F1 hybrids of both tossa jute and white jute were hybridized again in diallel fashion.
- To facilitate pre-breeding, 12 crosses performed in jute involving cultivated varieties and wild *Corchorus sp.* resulted in 50-95% seed set. The wild species have high resistance to stem rot and Bihar hairy caterpillar and exhibited high fibre fineness.
- Evaluation of agro-morphological and nutritional traits in four roselle genotypes revealed that the genotype HSCL-1 has the highest calyx yield (157.4 ± 11.1 g/plant), highest values for majority of minerals and vitamins. RIJ-73-1 recorded highest value for Fe content.
- A jute genotype JROV-5 that exhibited high foliage yield at 30 days (111.0 – 262.3 q/ha) in different geographical locations under AINPJAF trials also has high vitamin C content (1.08-1.37 mg/g fresh wt) and flavonoid content (5.5 mg/g dry leaf), indicating its high potential as a vegetable jute crop.
- Evaluation of F2:3 and RI8 populations of CAPOLI jute (*Corchorus capsularis* cv. JRC-212 X *C. olitorius* cv. JRO 524) revealed significant ($P < 0.001$) genotypic effect for fibre yield, with a selection accuracy of 0.68 to 0.79. Combined evaluation of RI8 and RI9 CAPOLI in lines showed that plant height, stem-base diameter and fibre yield had significant genotypic effects but the genotype X year interaction effect were non-significant. Three lines, G266, G329 and G365 were characterized by >40% bast fibre yield over the better parent JRO 524 in pooled analysis. Fibre yield increments in the CAPOLI lines were not concomitant with corresponding increases in plant height and stem-base diameter.
- Evaluation of roselle genotypes revealed high variation in green weight (146 - 479.5g/plant), stick weight (17.7 - 75 g/plant) and fibre yield (7.2 - 26.3g/plant). In another trial, 38 out of 100 *C. olitorius* lines recorded significantly high fibre fineness than check varieties JRO 524 (2.7 tex) and JRO 204 (2.5 tex).
- A total of 5.81 quintal (q) of breeder seed of jute was produced against the indent of 3.88 q. At Budbud, 28 varieties of jute, 11 varieties of mesta, 04 varieties of sunnhemp and 01 variety of flax were maintained, producing a total of 123.9 kg nucleus seed. A total of 509.3 q of seed were produced under ICAR seed project.
- Three jute varieties (JROMU 1, JRCJ 11 and JROB 2) have been submitted to PPV&FR Authority for registration. A total of 26 descriptors for mesta were developed of which 11 were dimorphic and 15 were polymorphic.

Crop Production

- Improving crop diversification and agronomic productivity as used in integrated land and crop management practices may decrease the inputs of non-renewable energy and consequently reduce the emission of GHGs from agroecosystems. Management of soil health-friendly farming systems, minimization of soil and water loss, and increase in amount of organic fertilizers curb the carbon footprint.
- Composting tree leaf litters with effective microorganism (EM) and green sunnhemp plants could be a useful technique for recycling of agriculture waste and lowering agriculture GHG emissions while also helping to mitigate climate change.
- Dry and wet spell probability analysis for planning jute-based cropping systems in eastern India, revealed that the supplemental irrigations are essential for growing any crop in all the four studied jute growing regions (Nagaon, Pundibari, Barrackpore, and Bhubaneswar) during 22nd October - 25th March.
- In jute during entire day, 85% of ET_c occurred between 7:00 AM and 5:30 PM, and 42% occurred between 10:00 AM to 1:30 PM. The total ET_c of jute crop was 364 mm in 117 days growth period.
- Under irrigation management of jute, the highest jute (cv. JRO 204) fibre yield was obtained under 75% DASM with 100% ET_c (3.49 t/ha) followed by 75% DASM with 75% ET_c (3.37 t/ha).
- In flax crop, evaporation was higher than the total rainfall, and therefore, there is a need for supplemental irrigation for flax production.
- Long term effects of tillage and residue management on soil nutrient balance under jute based cropping systems depicted positive nutrient balance in no tillage with additional crop residue (NT+R) with highest positive balance (N: 195.9; P: 28.0 and K: 134.2 kg/ha, respectively).
- Study on the effects of tillage and residue management on soil water dynamics under jute based cropping systems showed that the profile moisture storage remains above 50% available water holding capacity up to 60-75 DAS under tillage and residue management treatments (NT and NT+R), thus, increased moisture availability throughout the soil profile.
- In soil test based integrated plant nutrient supply system for sustainable jute production, the highest jute fibre yield (36.4 q/ha) was recorded, when inorganic fertilizer (ST-TY for 3.5 t/ha) was applied in combination with FYM and biofertilizer (Azotobacter and PSB).
- In LTFE, highest jute fibre yield (34.3 q/ha) was recorded in 150% NPK treatment followed by 100% NPK + FYM treatment. Imbalanced treatment (100% N) and sulphur free treatment (100% NPK -S) recorded lower jute fibre yield as compared to 100% NPK treatment.
- Application of N 80, P₂O₅ 40, K₂O 80 kg/ha produced 124.1% more jute seed yield and better quality in terms of boldness of seed, vigour index etc. as compared to no fertilizer application (532.5 kg/ha) in southern Bengal condition. Instead of two split applications, three split applications of N (50% at 21-28 DAS, 25% at 42 DAS and 25% at 56 DAS) was superior for higher seed yield in olitorius jute.
- Mucilage plays a critical role in withholding water under drought stress in jute. Jute, by virtue of its higher mucilage (approx. 12%) is able to retain water even at lower soil moisture conditions.

- In early sown jute, application of GA3 @ 0.02% reduced flowering in both olitorius and capsularis genotypes.
- Jute cultivar JROB-2 exhibited superior quality and higher biomass for bioethanol production among the tested varieties.
- A study on plant composition dynamics as influenced by plant density and weed management practices, recorded increased share of effective plants due to sustained plant growth under improved soil hydrothermal regimes and aeration, fibre yield with the application of straw mulch.
- In farmers' field using the technique of low density sowing (3 kg live seed + 5 kg inert seed) produced 33-36 q jute fibre/ha (cv. NJ 7010) and saved 60-70 mandays in major field operations. Jute and green gram intercropping reduced light interception by about 90% below its canopy at 45 DAS, produced 36.5 q jute fibre (cv. JRO BA3) and 6 q mung grain and reduced 79 man-days/ha for its major operations over manual weeding.
- Among the herbicidal and mechanical weed management methods considered for jute (cv. JRO 204), application of ipfencarbazone @120 g/ha (PE) + nail weeder at 15 DAS produced higher fibre yield (34.3 q/ha).
- Use of CRIJAF nail weeder for weed management also saved 3.1 to 4.2% soil moisture at 5 cm soil depth and +3.3 to 3.5% at 10 cm soil depth as compared to manual weeding treatment. Application of Ipfencarbazone (90-120 g/ha) as PE, reduced the activity of FDAH by 32.3-38.2%, dehydrogenase by 14.3-27.8%, β -Glucosidase by 29.9-47.5%, and urease by 28.2-42.4%. Initially (10 days after application). However, at harvest (120 DAS), the important soil enzymes reached to the near normal level (95.6% of FDAH and 93.4% of dehydrogenase).
- In case of weed management in ramie, the highest total fibre yield (21.2 q/ha) was produced in weed free condition, closely followed by the ramie fibre yield (19.3 q/ha) obtained from application of Oxyfluorfen 23.5% EC (PE) @ 1.0 litre/ha + Quizalofop-ethyl 10% EC (PoE) @ 38 g/ha at 20 DAS + 1 HW.
- In jute-based Integrated Farming System, due to the integration of multiple farm operations and recycling of crop residue and by-products inside the system itself, 114% increase in profit was recorded along with increase in employment generation by 226-man days/ha.
- In an attempt for area expansion in sisal, 2.17 lakh bulbils were provided to different agencies of Govt. of Odisha and 0.40 lakh bulbils were supplied to Meghalaya for new sisal plantations. In ramie, 70 q of rhizome has been provided and planted in Assam and West Garo hills of Meghalaya.
- In functional performance evaluation of multi-crop seed drill (MCSD) it was recorded that effective field capacity (EFC) varied from 0.25 to 0.28 ha/hr, obtaining 90-95% field efficiency with mean draft of operation 85.02 N.
- Improved fibre extractor for flax can utilize 450-480 kg of retted and dried straw and produce 40-45 kg fibre in a day. The fibre recovery by the machine was 52% on dry weight basis. The improved extractor can extract flax straw of one ha area within 7-8 days.
- Initiative in jute retting under free-flowing water condition using CRIJAF Sona, showed that the retting is completed in 10-12 days and due to faster retting there is increase in fibre recovery, fibre strength (25.4 g/tex) and fibre fineness (2.65-2.74 tex). This improved retting system reduced drudgery, and created more hygienic and healthy condition for the jute farmers.
- In large scale retting trials of jute in different jute growing districts of West Bengal deploying 12 months old liquid (spore based)



formulation of 'CRIJAF Sona' completed the retting within 12.5 to 13.6 days only producing better fibre strength (23.7-25.07 g/tex), higher fibre fineness (2.65 to 2.69 tex) and desirable low root content (4.51 to 6.97%).

- The jute retting by liquid formulation of CRIJAF Sona in (i) slow moving water, (ii) stagnant water retting in concrete tank, and (iii) stagnant water retting in in-situ retting pond recorded decreased pH of

retting water. The EC in post retting water of stagnant water retting in concrete and in-situ retting tank was higher as compared to retting with slow moving water. The enzymatic activities (polygalacturonase, pectin lyase and xylanase) were higher in slow moving water retting, might be due to higher oxygen availability causing higher enzymatic activities.

Crop Protection

- The host parameters and inoculation dose for in vivo mass production of SpobNPV with highest productivity ratio was standardized. The productivity index of SpobNPV was maximized by infecting the third larval instar of jute hairy caterpillar weighing approximately 130-140 mg with a viral inoculum dose of 3x10⁴ POB/ml and incubation at 28 °C for five days.
- Among the 29 Trichoderma isolates collected from diverse edaphic condition tested against three soil borne pathogens viz, *Rhizoctonia sp.*, *Macrophomina phaseolina* and *Sclerotium sp.* based on pathogen colony growth inhibition ability of these isolates; CJMR180, CJMR191 and CJMR193 consistently performed superior against two or more pathogens and adjudged to be the best antagonist.
- The larval growth pattern of jute hairy caterpillar indicated antibiosis in wild jute species. The initial larval weight gain, cumulative larval weight and larval survival was significantly least in the accessions belonging to wild species, *C. aestuans* and *C. pseudo-olitorius*. The antibiosis effect was highest in jute accessions WCIN 123 and WCIN 179 (*C. aestuans*); WCIJ 34 (*C. pseudo-olitorius*). Among the accessions of cultivated species, OIN 154 of *C. olitorius* manifested maximum antibiosis.
- Based on the incidence of stem rot in sick plot, 12 germplasms viz., OIN-62, OIN-26, OIJ-193, OIM-23, OIN-236, OIN-142, OIN-391, OIN-904, OIN-1040, OIN-908, OIN-891 and OIN-858 were identified to be absolutely free from the disease. The artificial inoculation of 70-day old jute plants indicated the jute germplasms namely OIN-118, OIN-119, OIN-156, OIN-154, OIN-113, OIJ-62, OIN-114, OIN-140, OIJ-60 and OIN-161 to be least susceptible to stem rot with minimum lesion development.
- Effective acaricides and jute varieties relatively tolerant to yellow mite were successfully integrated for yellow mite management. Foliar spray of fenpyroximate 5EC@1.5 ml/lit in jute varieties JRO 204 and JROG 1 reduced the mite infestation and damage grade as well as enhanced the fibre yield significantly.
- The effect of soil-applied sulphur on mite population, damage and plant growth parameters which regulate the yield was very prominent. The sulphur applied @ 30 and 60 kg/ha in soil suppressed the mite population and damage besides yield attributing parameters like plant height, basal diameter and plant dry weight also showed positive effect.
- The relationship of sunnhemp wilt incidence with rainfall and minimum temperature showed significant positive correlation.

Maximum temperature showed negative correlation with the disease development. Disease incidence increases with increase in minimum temperature coupled with increase in rainfall and soil moisture.

- The progress of flax wilt on different dates (30 October, 15 November and 30 November) of sowing in respect of maximum and minimum atmospheric temperature over last three years revealed that with lowering of mean atmospheric temperature wilt incidence decreases. The decrease of disease with lowering of maximum temperature is more pronounced than decrease in minimum temperature.
- Simultaneous treatment of both soil with bleaching powder @ 25 kg/ha, 7 days prior to sowing and seed with both carbendazim @ 2g/

kg + imidacloprid @ 4g/kg proved to be the best of all treatments to reduce the stem rot by 24% and mite damage by 50% and significantly enhanced the fibre yield.

- Integrated Disease Management (IDM) through seed treatment (ST) with carboxin + thiram @ 2g/ kg seed + soil application of neem cake @ 250 kg/ha and *Trichoderma sp.* @ 2.5 kg/ha + intercropping with fodder sorghum (10:1) effectively controlled the sunnhemp wilt.
- Nano-carbendazim @10⁻⁶ is effective in suppressing *M. phaseolina* which inhibited the growth of the pathogen completely, whereas to achieve 100% inhibition conventional carbendazim @1ppm was required under poison food technique.

Extension and Outreach

- The jute based diversified products as a substitute of plastics and synthetics were identified and the probable quantity and additional fibre requirement (24.5 lakh bales) was also estimated. These jute diversified products if promoted can replace plastics and synthetics to a great extent.
- For improving socio-economic conditions of jute farmers through value chain creation, linkage has been established with the Farmers Producers Organisation (FPO) and Farmers Producers Company (SAFPCL) by forming the Farmers Interest Groups (FIGs). Two self-help groups were also formed and capacity building programme for imparting training to the members has been initiated.
- Farmer perceived that (i) variations in temperature and humidity played an important role in early flowering and pest infestation, (ii) variation in rainfall significantly influenced the sowing time, germination and plant growth and fibre quality of jute. A conceptual model

for building climate resiliency in jute-based cropping system has been developed.

- In Jute-ICARE the jute fibre yield increased by ≥10% and also the fibre quality has been improved (TD-2 and TD-3) as compared to non-Jute-ICARE area. The enlisted farmers of Jute-ICARE programme got higher market price (₹ 450 to 500 /q) than the conventionally retted fibre.
- A wide extension gap in jute yield (≥ 6 q/ha) emphasizes the need to educate farmers for using improved production technologies. As a part of the strategy to mitigate the yield gap, farmers were also advised to use agro-advisories issued by ICAR-CRIJAF regularly.
- Major constraints in jute cultivation as perceived by the farmers were (i) non-availability of sufficient retting water in time, (ii) labour crisis during harvesting of jute and higher rate of labour wage, (iii) comparatively lower price of jute fibre than expected, and (iv) absence of assured market in the vicinity.



- Jute farmers income increased greatly on the way of achieving 'Doubling Farmer's Income' by deployment of CRIJAF technologies like (i) improved seeds, (ii) intercropping, (iii) integrated nutrient and pest management practices, (iv) mechanical sowing and weeding (multi-row seed drill, nail weeder, single wheel jute weeder), (v) improved retting (by CRIJAF Sona), provided through central schemes like NFSM, Jute-ICARE, SCSP and TSP.
- KVK, Burdwan conducted four OFTs to evaluate recommended technologies like weed control by using post emergence herbicides in rice, intercropping and mixed cropping in jute, different techniques of vegetable seedling transplanting, and assessment of improved variety of tomato. A total of 120 FLDs were conducted on jute, lentil, chickpea, banana and vegetables. To disseminate the integrated farming system (IFS) technology, some demonstration units of vermicomposting, azolla farming, mushroom farming, poultry and duckery rearing, goatary, apiary have been established for the benefit of farmers. KVK, North 24 Parganas (additional) conducted 133 FLDs on rapeseed and mustard, lentil, jute and poultry.
- Under TSP, the institute conducted 9 capacity building programmes for 229 ST farmers. Besides, agricultural inputs were distributed to 3900 farmers of ST dominated districts of West Bengal and Odisha.
- The institute implemented the SCSP plan in jute and allied fibre crop based farming system to benefit the farmers of the SC community. 45 trainings were conducted and 1055 farmers were benefited through such trainings during the year 2021. Agricultural inputs were distributed for ~50 hectare demonstrations in five adopted villages.
- ICAR-CRIJAF in collaboration with Krishi Vigyan Kendra of West Garo Hills and West Tripura implemented a major component of NEH programmes. 480 single wheel jute weeders and 200 Vermi-beds were distributed to farmers of West Garo Hills of Meghalaya and West Tripura, district of Tripura. Participatory demonstration was conducted with 680 farmer beneficiaries.



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 (Sunn hemp 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.

Sub-stations of ICAR-CRIJAF



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)

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, etc.

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 crop 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

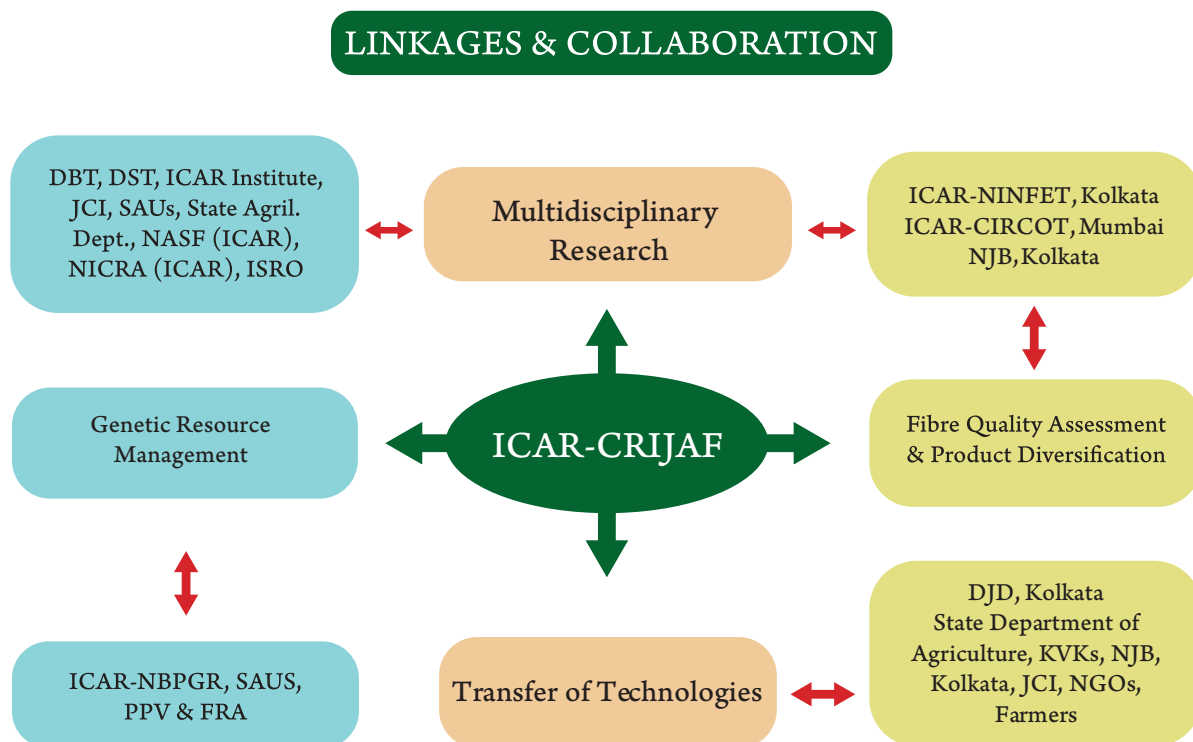
Prioritization, Monitoring and Evaluation (PME) Cell: PME of the Institute is working as “Single window” system for priority setting, research monitoring and evaluation, maintenance of databases related to projects, achievements, technologies developed, publication etc. PME cell coordinates in maintaining 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, NASE, 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 2021

(in Lakh)

S. No.	Sub-Head	BE 2021-22	RE 2021 -22 (Proposed)	Actual Expenditure (Apr-Dec 2021)
A) GRANT FOR CREATION OF CAPITAL ASSETS (CAPITAL)				
1	Works - Office Building	00.00	85.00	24.55
2	Equipment	10.00	15.50	00.00
3	Information Technology	05.00	17.45	00.00
4	Furniture & Fixtures	03.00	05.00	00.00
5	Others	07.00	11.60	00.00
	Sub-Total (A)	25.00	134.55	24.55
B) GRANTS IN AIDS - SALARIES (REVENUE)				
1	Establishment Expenses - Salaries	2248.89	2206.20	1826.67
	Sub-Total (B)	2248.89	2206.20	1826.67
C) GRANTS IN AIDS - GENERAL (REVENUE)				
1	Pension & Other Retirement Benefits	350.00	370.00	183.63
2	Travelling Allowances	20.00	15.00	8.11
3	Research & Operational Expenses	235.00	260.18	159.30
4	Administrative Expenses	342.00	403.00	262.37
5	Miscellaneous Expenses (HRD & Others)	71.00	69.45	41.79
	Sub-Total (C)	1018.00	1117.63	655.20
D) TSP				
1	Capital	00.00	00.00	00.00
2	Revenue	31.00	35.78	19.78
	Sub-Total (D)	31.00	35.78	19.78
E) NEH				
1	Capital	00.00	20.00	9.74
2	Revenue	12.00	09.00	2.42
	Sub-Total (E)	12.00	29.00	12.16
F) SCSP				
1	Capital	10.00	08.00	04.74
2	Revenue	100.00	61.05	29.41
	Sub-Total (F)	110.00	69.05	34.15
GRAND TOTAL (A+B+C+D+E+F)		3444.89	3592.21	2572.51

Financial Statement of AINPJAF and KVKs

Head	Target (B.E.)	Achievement (Apr-Dec 2021)
AINPJAF	431.66	361.06
KVK, Purba Bardhaman	205.40	126.93
KVK, North 24 Parganas (Addl)	110.71	113.54

REVENUE Generated upto November 2021

ICAR-CRIJAF Head Quarter, Barrackpore	CSRSJAF, Budbud	Ramie Research Station, Sorbhog	Sisal Research Station, Bamra	Sunnhemp Research Station, Pratapgarh	Total	Target
21.19	0.41	0.95	03.91	00.85	27.41	44.00

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	34	06
Technical Officers / Technical Assistants	108	43	65
Sr. Administrative Officer	01	00	01
Administrative Officer	02	00	02
Sr. Finance and Accounts Officer	01	00	01
Assistant & Administrative Officer	07	06	01
Junior Account Officer	00	00	00
Private Secretary	01	01	00
Personal Assistants	02	02	00
Stenographers Gr. III	00	00	00
Assistants	18	14	04
Upper Divisional Clerks (UDC)	04	05	00
Lower Divisional Clerks (LDC)	05	01	04
Skilled Support Staff	46	35	11
Grand Total	251	155	96

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 (2015-22)	A. Anil Kumar, Maruthi R.T, K. Mandal and B.S. Gotyal
2. Genetic improvement of flax (<i>Linum usitatissimum</i>) for higher fibre productivity and fibre quality	JB 10.3 (2016-22)	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 (2016-21)	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, Maruthi R.T, 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, D. Sarkar, A. R. Saha, R. K. De, S. Mitra and Sitangshu Sarakar
7. Introgression of Low pectin content into high yielding jute varieties	J.B- 10.6 (2020-25)	A. Anil Kumar, Maruthi, R.T and B. Majumdar.
8. Pre-breeding approaches in jute for major biotic stresses resistance	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, A. K. Ghorai, N. M. Alam and R. K. De.

Crop Production Division

Project Title	Project Code with Duration	PI/CO-PIs
1. Conservation agricultural practices of jute based cropping systems under climate change scenario	JA 5.7 (2015-21)	R. Saha, M. S. Behera, A. R. Saha, B. Majumdar, S. P. Mazumdar, D. Barman, R. K. Naik and L. Sharma
2. Climate change risk assessment in jute production and related advisory services through decision support system (DSS)	JA 7.1 (2016-21)	D. Barman, P. Satya, B. S. Gotyal, A. K. Singh, A. K. Chakraborty, R. Saha, S. P. Mazumdar, S. Mitra, Shamna A. and L. Sharma
3. Physiological basis of drought tolerance at early growth stage in jute (<i>C. olitorius</i>)	JA 7.4 (2017-22)	L. Sharma, J. Mitra, S. Mitra, P. Satya, D. Barman and S. Ray

Project Title	Project Code with Duration	PI/CO-PIs
4. Physiology of flowering behaviour of jute under different photoperiod regimes	JA 7.5 (2017-22)	S. Ray , P. Satya, D. Sarkar, L. Sharma, A. K. Jha and H. R. Bhandari
5. Improvement of soil carbon stocks and farm productivity through integrated cropland management practices in jute cultivation areas (a farmer's participatory research)	JA 7.6 (2018-23)	A. K. Singh , A. K. Ghorai, R. Saha and M. L. Roy.
6. 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
7. Studies on nitrogen dynamics under rice-flax cropping system	JA 7.8 (2018-21)	S. P. Mazumdar , D. Barman and M. S. Behera
8. Leaf litter management: Decomposition and nutrient dynamics of leaf litter composts and its effects on JAF crops	JA 8.1 (2020-23)	A. K. Singh , A. K. Ghorai, B. Majumdar, S. Mitra, M. S. Behera, S. K. Sarkar, S. Satpathy, K. N. Chourasia and M. L. Roy.
9. Upgraded mechanical weeder and novel herbicides for efficient weed management in jute	JA 8.2 (2020-23)	S. Sarkar , A. K. Ghorai, R. K. Naik, B. Majumdar and D. Datta
10. 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, Scientists from AINP-Katihar and AINP-Kendrapara
11. 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
12. Expansion of flax area in pilot scale with improved technologies	JA 8.4 (2020-23)	S. Mitra , J. Mitra, C. S. Kar, S. Sarkar, S. K. Jha, S. K. Pandey, M. S. Behera, R. K. Naik, K. Das and K. Shivakumar
13. Technology development for efficient sowing and fibre extraction through mechanization for jute and allied fibre crops	JA 3.6 (2021-24)	R. K. Naik , S. Mitra, C. S. Kar and G. Kar
14. Risk assessment through modeling of major pests and diseases of jute under climate change scenario in India	JE 2.2 (2019-22)	N. M. Alam , B. S. Gotyal, D. Barman, S. Satpathy, S. Mitra and S. K. Sarkar
15. Effect of planting materials and fertilizer levels on growth and yield of sisal (<i>Agave sisalana</i>) and hybrid sisal	SLA 1.7 (2018-23)	S. Sarkar , M. S. Behera, A. K. Jha, B. Majumdar and R. K. Naik
16. Integrated farming system in jute and sisal plantation under organic management package and its promotion	SLA 1.8 (2018-23)	M. S. Behera , R. Saha, S. Sarkar and A. K. Jha
17. Area expansion strategy under sisal farming in India with modern production technologies	SLA 1.9 (2020-21)	M. S. Behera , S. Sarkar, A. K. Jha, A. R. Saha and D. Datta

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 S. Roy
2. Isolation, characterization and application of <i>Trichoderma</i> for disease management	JM 9.2 (2018-22)	K. Mandal , S. K. Sarkar and R. Saha
3. Use of nanoparticles for managing pests and diseases in jute	JM 9.3 (2018-23)	C. Biswas and V. Ramesh Babu
4. Identification of pre-breeding materials to develop stem rot and anthracnose resistant tossa jute	JM 9.5 (2021-26)	S. K. Sarkar , K. Mandal, A. Anil Kumar and K. Das
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)	B. S. Gotyal , S. Satpathy and V. Ramesh Babu
7. Decision support system for pest management in jute	JE 2.3 (2020-23)	V. Ramesh Babu , G. Shivakumar K. V. and S. Satpathy
8. Development of IPM module for jute and mesta	JM 9.4 (2020-25)	R. K. De , S. Satpathy, V. Ramesh Babu and Shamna A.

Extension Section

1. Climate variability <i>vis-à-vis</i> jute-based cropping system in West Bengal- An appraisal based on farmers' perspective	JEXA 5.8 (2017-21)	M. L. Roy , S. K. Jha, S. Sarkar, A. K. Ghorai, A. K. Singh, S. Satpathy and A. K. Chakraborty
2. 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
3. Impact assessment of CRIJAF technologies in Jute-ICARE areas of West Bengal	JEXA 6.0 (2019-21)	S. Kumar , S. K. Jha, Shamna A., M. L. Roy and N. M. Alam
4. Analysis of yield gap and contribution of production factors in cultivation of jute	JEXA- 6.1 (2020-25)	S. K. Jha , M. L. Roy, A. K. Ghorai, S. Mitra, R. Saha, S. P. Mazumdar, R. K. Naik, A. Chakraborty & AINP-Incharges
5. Enhancing farm income through up-scaling of jute based bio-diversified products as an alternative to plastics	JEXA- 6.2 (2020-25)	Shamna A , S. K. Jha, S. Kumar and M. L. Roy

Regional Research Station

1. Development of improved weed management strategies to enhance fibre and rhizome productivity of ramie in north-eastern India	RA 1.1 (2019-23)	K. Das , S. Sarkar, B. Majumdar and R. K. De
2. Expansion of ramie-based farming system with improved genotypes and technology	RA 1.2 (2020-23)	K. Das , S. Sarkar, C. S. Kar, M. S. Behera, S. Mitra, R. K. De and R. K. Naik
3. Management of sunnhemp wilt	SNHM 1.1 (2019-22)	Shivakumar K.V. and S. K. Sarkar
4. Development of high fibre yielding jute genotypes through hybridization	CSRSJAF 1.1 (2019-21)	H. R. Bhandari , C. S. Kar, K. N. Chourasia and J. K. Meena

External Funded Projects

Project Title	Principal Investigator	Funding Agency	Duration
1. ICAR Seed Project	C. S. Kar	ICAR-New Delhi	Long Term
2. NFSM- Commercial Crops Jute	C. S. Kar	MoAFW, New Delhi	Long Term
3. AICRP- National Seed Project	C. S. Kar	ICAR-New Delhi	Long Term
4. Protection of jute varieties and DUS testing	A. Bera	DAC	Long Term
5. Quantitative assessment of carbon and moisture fluxes over jute based agro-ecosystems: integrating ground observations, satellite data and modeling	D. Barman	ISRO-NRSC	2018-21
6. To study changes in soil quality, crop productivity and sustainability under jute-rice-wheat cropping system (LTFE)	A. R. Saha	JC 5.2 (AICRP-LTFE)	Long Term
7. Soil test and resource based integrated plant nutrient system for sustainable agriculture	A. R. Saha	JC 5.6 (AICRP-STCR)	Long Term
8. Long term effect of ST-TY equation based INM on yield, value addition, nutrient budgeting and quality of soil under jute-rice-lentil sequence	A. R. Saha	JC 5.6a (AICRP-STCR)	Long Term
9. Assessment of vulnerability of jute production to climate change and its mitigation strategies development using remote sensing GIS in West Bengal	D. Barman	DST-WB	2018-21
10. The impact of heat shock factors in regulating heat stress induced epigenomic changes: A case study in flax	D. Saha	SERB-DST	2019-22
11. Frontline demonstration on jute under NFSM(CC)	S. K. Jha	NFSM Sub Project	2014- Long Term
12. IP facilitation centre for jute products and other regional handicrafts of West Bengal	C. Biswas	DC-MSME	2016-21
13. Utilizing the potential of jute biomass for bio-ethanol production	L. Sharma	ST&B-WB	2018-21
14. 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	2021-22
15. 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-GOI (Seed Science)	2021-24
16. Prospecting heat stress tolerance through genome-edited heat shock factors and NAC-domain transcription factors in flax (<i>Linum usitatissimum</i>)	D. Saha	SERB-DST	2021-24
17. Development of technology on jute retting under free-flowing water for quality and fibre production	R. K. Naik	NFSM- CC	2020-23

SIGNIFICANT ACHIEVEMENTS

(JANUARY - DECEMBER 2021)





CROP IMPROVEMENT

Overview

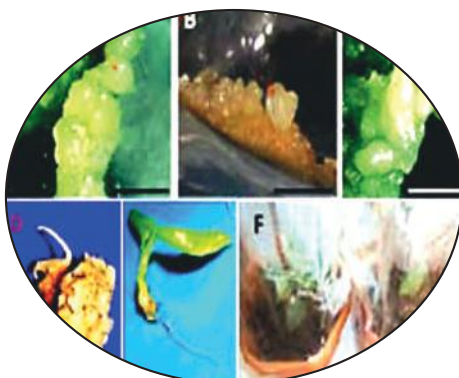
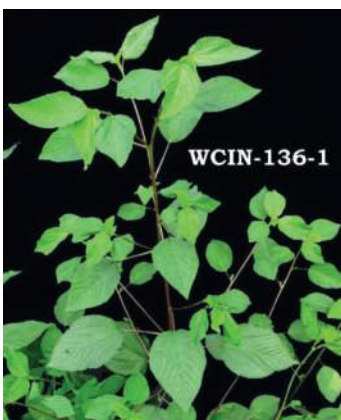
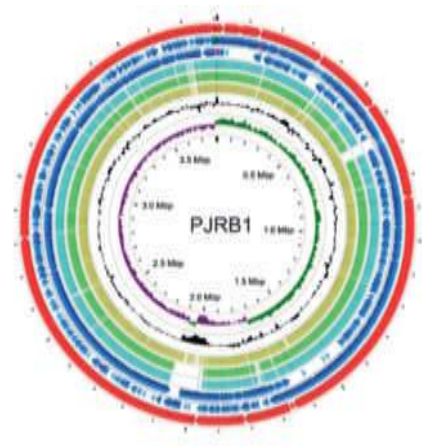
Jute and allied fibres (JAF) are important commercial crops all over the world, particularly in India. Maintaining low lignin and fibre fineness is becoming increasingly crucial for crop improvement in the face of changing climate, abiotic stress, new pathogens, drought, and water logging conditions. 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 2021

- ❑ Methylome sequencing in flax revealed role of a methyltransferase (LuMET1) in heat stress response and identified differentially methylated regions.
- ❑ Analysis of recombinant inbred lines developed from *C. capsularis* and *C. olitorius* identified three superior lines, G266, G329 and G365, exhibiting over 40% fibre yield than JRO 524.
- ❑ A white jute genotype, JRCP-5 has been advanced to the adaptive trial under All India Network Project on Jute and Allied Fibres. JRCP-5 combines high yield, disease resistance along with high anthocyanin and flavonoid content.
- ❑ A calyx-purpose roselle genotype HSLC-1 has been advanced to the adaptive trial under All India Network Project on Jute and Allied Fibres. HSLC-1 exhibits high calyx yield with better mineral and vitamin content.



RESEARCH

1. Novel Biotechnological Approaches in Improvement of JAF Crops

1.1 Mining novel alleles for stress tolerance in jute

S. Datta, J. Mitra, D. Saha, P. Satya and A. Anil Kumar

Project Code: In-house Project JBT 4.7

Allelic variations in flowering related genes in *Corchorus olitorius* and *C. corchorus capsularis*: Genes regulating flowering in jute were identified in five sequenced genomes of jute (3 *C. olitorius* and 2 *C. capsularis*). Genes were individually studied and proteins sequences were checked for presence of motifs and protein domains. Selected genes were aligned and single nucleotide polymorphism (SNPs) were identified (Fig. 1). Allele specific PCR primers were designed for marker development. Many of the 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: Bast fibres are strongly bound to middle lamella by pectin and other cementing substances. Pectin consists of polysaccharides rich in galacturonic acid viz. homogalacturonan, rhamnogalacturonan and xylogalacturonan. Plant pectate lyases (PELs, EC 4.2.2.2) belong to polysaccharide lyase family 1 (PL1) and is of immense significance for pectin degradation, disease resistance and vascular functions. However, PL genes in *Corchorus* are not studied well. 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 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 other higher plants (Fig. 2). Allelic variation sites were identified as potential targets for base editing (Fig. 3).

DNA Sequences	Translated Protein Sequences
Species/Abbrv	* * * * *
1. JRO_GAOX2	C T T C T T T G A G T T G C C A C T T A A C G A A A A G C A A A G G C T C A G A G G A A A C T C G G C G A G
2. O4_GAOX2	C T T C T T T G A G T T G C C A C T T A A C G A A A A G C A A A G G C T C A G A G G A A A C T C G G C G A G
3. Kuan_GAOX2	C T T C T T T G A G T T G C C A C T T A A C G A A A A G C A A A G G C T C A G A G G A A A C T C G G C G A G
4. Huan_GAOX2	C T T C T T T G A G T T G C C A C T T A A C G A A A A G C A A A G G C T C A G A G G A A A C T C G G C G A G
5. CVL_GAOX2	C T T C T T T G A G T T G C C A C T T A A C G A A A A G C A A A G G C T C A G A G G A A A C T C G G C G A G
1. JRO_GAOX2	A A A C G C T T T C G T T T C G A T T C T C A G C T G A G G A A A A A T C A T C C A A G A T G G T
2. O4_GAOX2	A A A C G C T T T C G T T T C G A T T C T C A G C T G A G G A A A A A T C A T C C A A G A T G G T
3. Kuan_GAOX2	A A A C G C T T T C G T T T C G A T T C T C A G C T G A G G A A A A A T C A T C C A A G A T G G T
4. Huan_GAOX2	A A A C G C T T T C G T T T C G A T T C T C A G C T G A G G A A A A A T C A T C C A A G A T G G T
5. CVL_GAOX2	A A A C G C T T T C G T T T C G A T T C T C A G C T G A G G A A A A A T C A T C C A A G A T G G T

Fig. 1: Allelic variation in the Gibberellin 20 oxidase 2 (GAOX2) gene in *C. olitorius* and *C. capsularis*

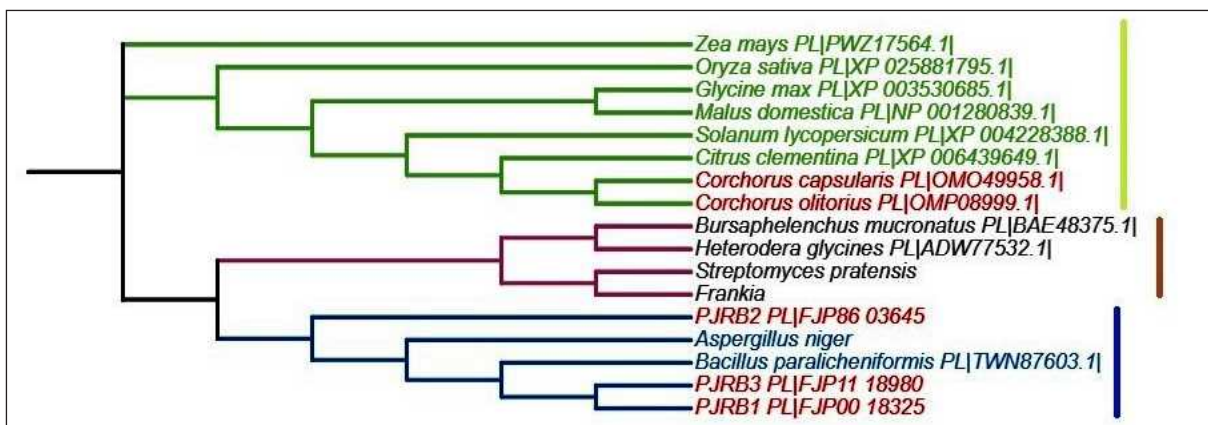


Fig. 2: Phylogeentic relationship of pectate lyase genes in *C. olitorius*, *C. capsularis* vis-a vis other higher plants and microbes

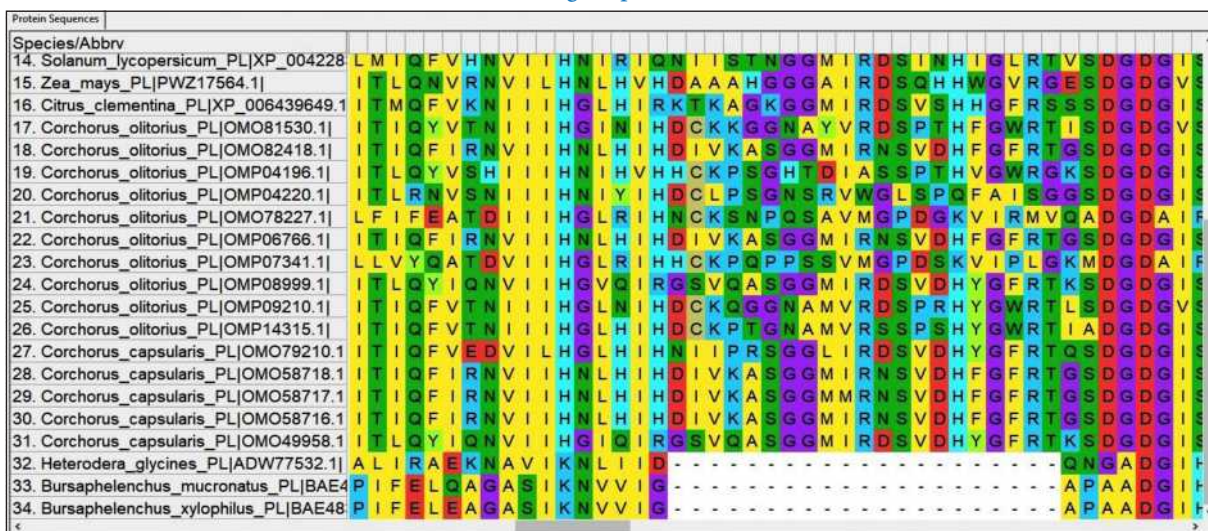


Fig 3: Allelic variation in pectate lyase genes in *C. olitorius* and *C. capsularis*

1.2 Impact of heat shock factors in regulating heat stress-induced epigenomic changes in flax

D. Saha

Project Code: SERB project- EEQ/2018/00274

Fibre flax usually prefers extended cooler climate. Poor climatic adaptability is thus one of the major limitations of the cultivation area expansion of superior quality fibre flax in India. Epigenetic factors, especially the DNA methylation mechanism, are reportedly involved in response to environmental changes. Epigenomic phenomenon, like the chromatin modulations, activities of transposable elements and long non-coding RNAs, and DNA methylation patterns are paving the way for a genome-wide understanding of

the extra genetic responses of plants under challenging environments. Identification of critical epigenetic phenomenon and loci are gradually envisaged as an important strategy towards addressing stable transgenerational climatic adaptability of plants through stress priming, epimutations, epiRILs and epigenomic editing. Epigenomic investigations in flax are scarce till date. For the first time, a genome-wide DNA methylation analysis was performed in flax seedlings in response to heat stress and hypomethylating agent, 5-Azacytidine.

Heat stress (40°C) in a fibre flax cultivar JRF-2 produced evidences of oxidative damage compared to the control plants. The oxidative damage was observed to be reduced by 15-24% in 5-AzaC-treated plants. Changes in gene expression of a DNA methyltransferase encoding gene, LuMET1, showed involvement of DNA methylation in heat stress response in flax seedlings. Single-base resolution DNA methylation profiles (85.1-98.7 million 5mC loci) through whole genome bisulfite sequencing (WGBS) were developed in flax seedlings for heat stress and 5-AzaC treatments. The 5mC loci were distributed most (50.4-52.3%) in CG context followed by 21.9-22.8% in CHG and

24.9-27.7% in CHH contexts throughout the 15 flax chromosomes randomly (Fig. 4). A high number of differentially methylated regions (DMRs), especially the hypomethylated DMRs, in the CHH context, were identified in 5-AzaC treated plants compared to the control and heat stressed plants. A majority of the DMRs were located in the intergenic regions, but a substantial proportion of the DMRs were also detected in the promoter regions of genes relevant to heat stress response and epigenetic mechanisms. The DMRs identified in the flax seedlings in response to heat stress will facilitate further research on improving its climatic adaptability and development of a climate-smart flax variety.

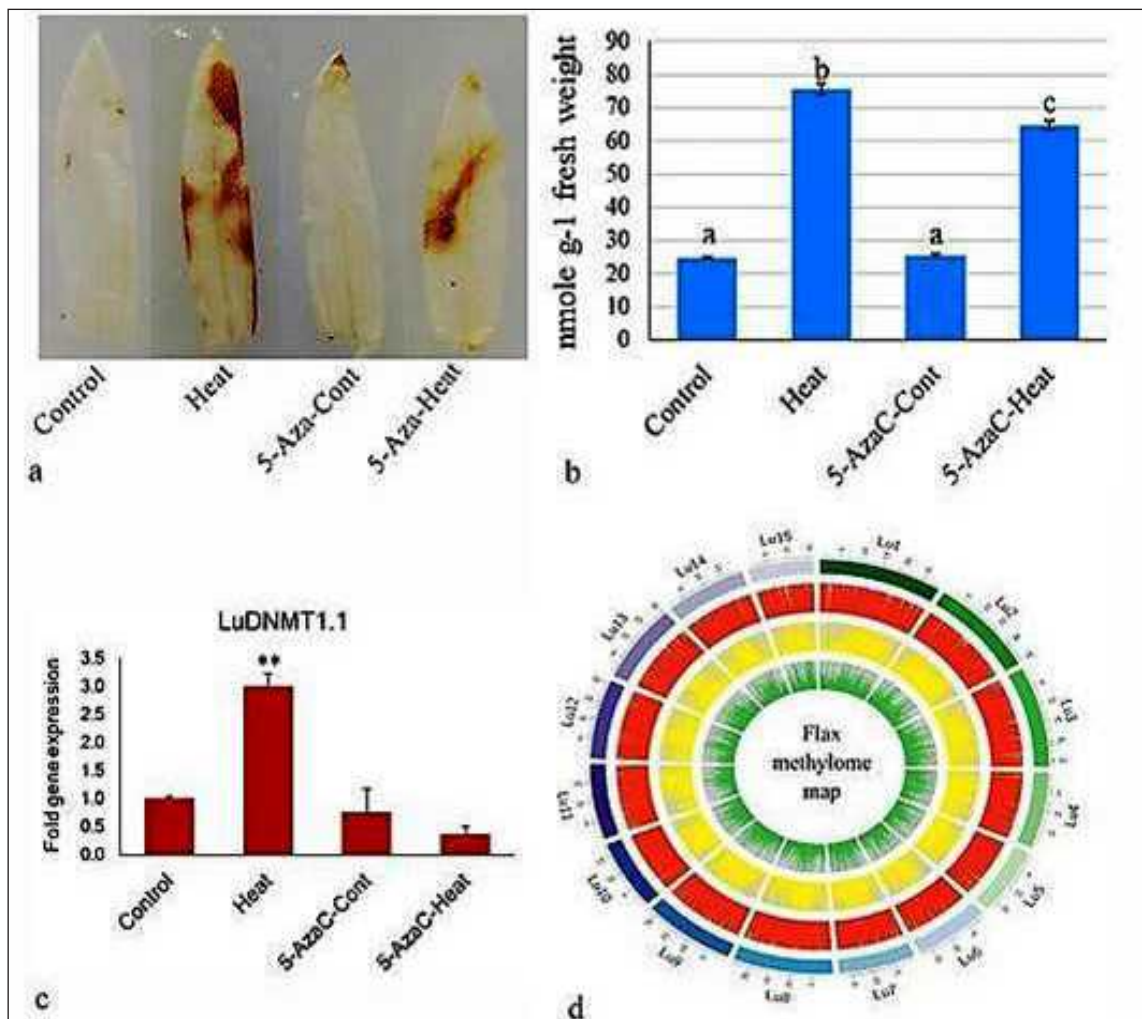


Fig. 4: a) Diaminobenzidine (DAB) staining showing hydrogen peroxide accumulation (oxidative damage) in flax leaves due to heat stress. b) Graph showing malonaldehyde (MDA) content (nmol g⁻¹ fresh weight) in flax seedlings. Higher MDA indicates higher oxidative stress due to heat. c) Gene expression changes in DNA methyltransferase-encoding gene due to heat stress in flax. d) Genome-wide distribution pattern of 5-methyl cytosines on 15 flax chromosomes. The ring from the outer denotes, Chr, 5-mCs in CG context, CHG, and CHH contexts.

2. Varietal Development

2.1 Varietal development of calyx type roselle

R.T. Maruthi, A. Anil Kumar and A.R. Saha

Project Code: In-house Project-JB 9.6

A HS-Mesta (roselle) genotype, HSLC 1 with 59.99 q/ha fresh calyx yield significantly out yielded best check HS 4288 (31.82 q/ha) in AINPJAF 2020-21 trials and has been promoted to adoptive trial in 32nd Annual workshop of AINPJAF. Further, in an attempt to identify superior calyx type roselle genotypes, a panel of 95 roselle germplasm accessions were screened for 21 (7 quantitative; 14 qualitative) agro-morphological traits. Variety of roselle morpho-types were observed differing with respect to leaf and stem characteristics, fruit length, diameter and calyx colour. Plant height of the accessions ranged from 31 - 183 cm with mean 83.65 ± 32.34 cm (Table 1). Number of branches per plant and number of fruits per plant varied from 0 - 13

and 7.00 - 69.33, respectively. Significant plant architectural difference was observed among the genotypes viz., tall plant with few branches, and short plant with profuse branches. Same has been depicted by high Coefficient of variation (~ 30) for number of branches and number of fruits per plant. Similarly, for fruit length and diameter the ranges were 2.05-4.34 cm and 1.69 - 2.63 cm, respectively. There were fruits of different size and shape. The calyx weight per fruit was varied from 0.69 - 2.15 g. The highest amount of variability was observed for calyx yield per plant with CV 32.63, the trait ranged from 6.41-130.20 g. Superior genotypes from different morph-types identified in the study will be included in future breeding programmes.

Table 1: Performance of calyx type roselle accessions

Traits	Range	Mean $\pm$ SD	CD	CV
Calyx length (mm)	20.05 - 43.38	34.85 $\pm$ 5.42	2.58	4.59
Calyx diameter (mm)	16.89 - 26.26	21.33 $\pm$ 1.88	1.82	5.3
Calyx weight (g)	0.69 - 2.15	1.51 $\pm$ 0.38	0.198	8.15
Plant height (cm)	31 - 183	83.65 $\pm$ 32.34	10.33	7.66
No of fruits	7.00 - 69.33	25.80 $\pm$ 15.43	12.68	30.49
No of branches	0 - 13	5.60 $\pm$ 2.93	2.59	28.69
Calyx yield/plant (g)	6.41 - 130.20	39.93 $\pm$ 28.39	21.01	32.63

2.2 Development of high yielding jute genotypes through hybridization

H. R. Bhandari, C.S. Kar and J.K. Meena

Project Code: In-house Project-CSRSJAF 1.1

Germplasm accessions of *C. olitorius* (47) and *C. capsularis* (49) were evaluated for fibre yield and related traits (plant height, basal diameter, biomass, fibre yield). Among olitorius germplasm, the entries OEX 20, OIM 12, OIJ

204, 10, OEX 13, OIN 686, OEX 19 were the best with respect to fibre yield (Table 2). Among the capsularis accessions, the entries CIM 32, CIJ 59, CIJ 125, CEX 48, CEX 04 were the best with respect to fibre yield (Table 3). Based on fibre



yield and related traits, genetically diverse lines were identified using D² cluster analysis. Cluster analysis in *C. olitorius* indicated limited diversity among the accessions studied. A total of 6 clusters were formed with majority of genotypes clustered together. Cluster analysis in *Corchorus capsularis* indicated moderate diversity among

the accessions studied. A total of 11 clusters were formed with relatively even distribution of genotypes. 12 fresh crosses (5 in *capsularis* and 9 in *olitorius*) were attempted using diverse lines indicated from the study. 20 F₁s and 13 F₅s were advanced to F₂ and F₆ generation, respectively. Advanced generation lines were multiplied.

Table 2: *Olitorius* germplasm lines identified for fibre yield related traits

Trait	Range	Best Entries
Plant height (cm)	271.5-356.5	OEX 13, OIJ 093, OEX 20, OIJ 050, OIN 686, OIJ 184, OIJ 161, OIJ 204, OEX 12, OEX 19
Basal diameter (mm)	10.1-15.3	OEX 13, OIJ 093, OIN 225, OIJ 050, 47, OEX 19, OIJ 138, OIN 686, OIJ 229
Biomass(kg/ plant)	0.22-0.44	OIJ 093, OIN 686, OIN 225, OEX 13, 6, OIJ 050, OEX 19, 27, OIJ 184, 47,
Fibre yield (kg/ plant)	0.01-0.03	OEX 20, 27, OIJ 204, 10, OEX 13, 37, OIN 686, 26, 28, 47, OEX 19

Table 3: *Capsularis* germplasm lines identified for fibre yield related traits

Trait	Range	Best Entries
Plant height (cm)	233.5-338.5	CEX 19, CIM 32, CIN 003, CIN 202, CIM 57, 49, 30, 47, 32, CEX 48
Basal diameter (mm)	12.5-18.7	40, CIM 32, CIM 57, CEX 19, 37, CIJ 59
Biomass(kg/ plant)	0.19-0.46	CIM 32, CEX 19, CIM 57, CIM 56, CIN 202, CIN 003, CIJ 59
Fibre yield (kg/ plant)	0.01-0.01	CIM 32, CIJ 59, CIJ 125, CEX 48, CEX 04

2.3 Screening of jute genotypes for flavonoid content

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

Project Code: In-house Project-JB 10.4

Flavonoids are important phytochemicals of medicinal and nutritional value. Jute leaf is considered to be highly nutritious and medically important. Despite the medicinal importance of jute flavonoids, difficulty in metabolite identification due to mucilaginous nature of the leaf extract has been a major concern for characterization of flavonoids from jute. A study was undertaken to estimate the flavonoid content in different jute genotypes and to identify the key flavonoids to aid the breeding

programme for jute leafy vegetable. Eight cultivated varieties and advanced breeding lines of *C. capsularis* and *C. olitorius* were selected for the study. Flavonoid content was estimated from leaf by aluminium complex reaction. Significant difference was observed among the genotypes ($P < 0.001$) for flavonoid content (Table 4). JRO 204 (7.0 mg/g dry leaf) outperformed other genotypes for flavonoid content, followed by JROV-5 (5.5 mg/g dry leaf) while JRC 532 exhibited lowest leaf flavonoid content (4.5 mg/g

dry leaf) (Fig. 5). Total flavonoid content was significantly higher in *C. olitorius* (5.9 mg/g dry leaf) than in *C. capsularis* (5.1 mg/g dry leaf), suggesting tossa jute has higher medicinally and nutritionally important flavonoids than white jute. However, some white jute cultivars like JRC 517 (5.4 mg/g dry leaf) and advanced breeding line JRCP-5 (5.4 mg/g dry leaf) have

higher flavonoid content than other capsularis cultivars like JRC 532 and JRC 212.

Table 4: ANOVA for flavonoid content of promising jute genotypes

Source	df	Mean Square	F	Sig.
Genotype	7	4.02	25.28	0.00
Replication	6	0.10	0.65	0.69

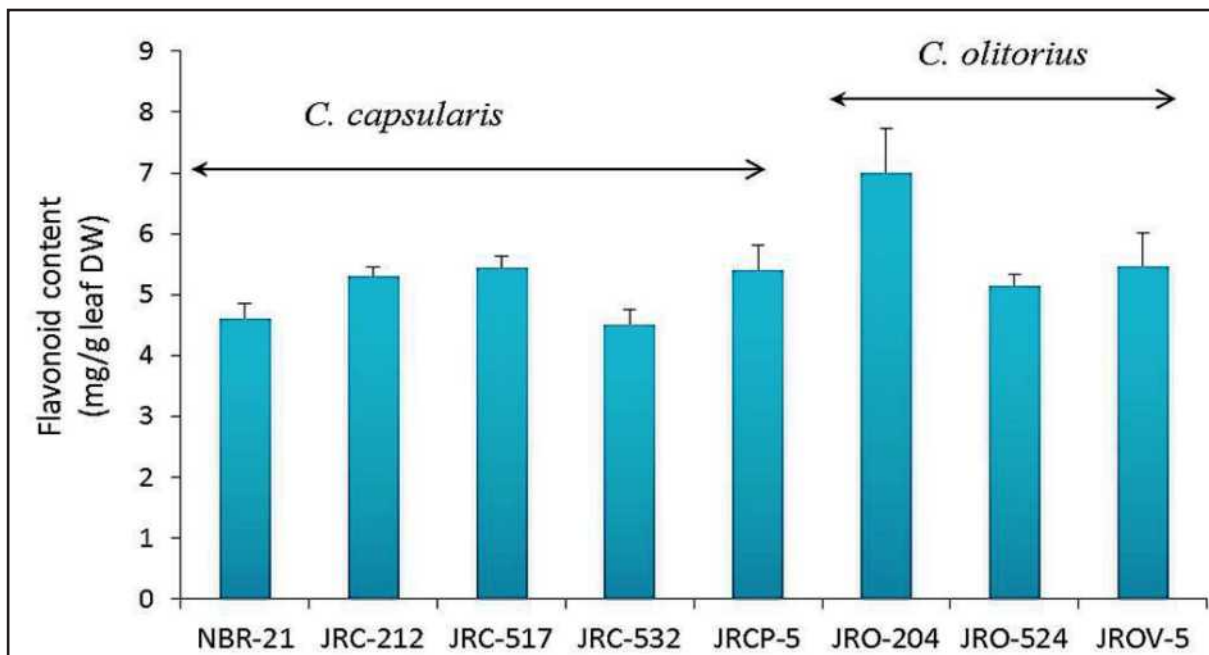


Fig. 5: Comparative flavonoid content of seven jute genotypes

2.4 JRCP-5 (PANKAJ): A promising white jute genotype with high fibre yield and stem anthocyanin

P. Satya, S.K. Pandey and S. Roy
Project Code: In-house Project-JB 10.4

To obtain high yielding capsularis jute genotype with stem pigmentation and disease resistance, JRCP-5 (Pankaj) was developed (Fig. 6) by pedigree breeding of the progenies derived from crossing CIM-036, a germplasm tolerant to *Macrophomina phaseolina* and another popular cultivar JRC-517. The entry was tested under National coordinated trials for three years and was advanced to adaptive trial in 2021. To estimate the extent of pigmentation, relative anthocyanin content was measured by difference in absorbance of methanolic extract at 530 nm and 657 nm (as per Neff and Chory,

1998). The genotype JRCP-5 has cylindrical, glossy, coppery red with increased intensity of pigmentation from top to base. The leaf of JRCP-5 is deep green with pigmentation at leaf base, ovate-lanceolate, serration at leaf margin with deep red petiole and stipule. Under AVT-II of All India Network Project on Jute and Allied Fibres the cultivar has topped outperforming check varieties JRC 517 and JRC 698. The genotype has a fibre yield potential of 34.5 q/ha and average yield of 30 q/ha. JRCP-5 has 4.8% and 7% higher fibre strength than the check varieties JRC 517 and JRC 698, respectively.

JRCP-5 was found to show 13.3% less incidence of stem rot than JRC-517 in coordinated trials. It is also finer than JRC-698 and is at par with JRC-517 for fibre fineness. It also has higher resistance than JRC 517 to yellow mite and stem weevil. JRCP-5 has much higher relative anthocyanin content (1.376/g fresh bark weight) in its stem than other capsularis varieties such as JRC 512, JRC 321, JRC 698 and Monalisa (Table 5) and also has high flavonoid content in leaf (5.4 mg/g dry leaf) which was at par with JRC 517 (5.4 mg/g dry leaf) and significantly higher than JRC 532 (4.5 mg/g dry leaf).

Table 5: Relative anthocyanin content of JRCP-5 in comparison with other capsularis varieties

Cultivars	Relative anthocyanin content (/g FW)	Absorbance at 530 nm
JRCP-5	1.376	0.359
JRC 517	0.005	0.149
JRC 321	0	0.192
JRC 698	0	0.173
Monalisa	0	0.176

The high anthocyanin might be responsible for its higher resistance towards *Macrophomina*

phaseolina and may also contribute to other abiotic stresses, particularly heat and UV-rays. Moreover, its high leaf flavonoid content makes it desirable as flavonoid-rich leafy vegetable.

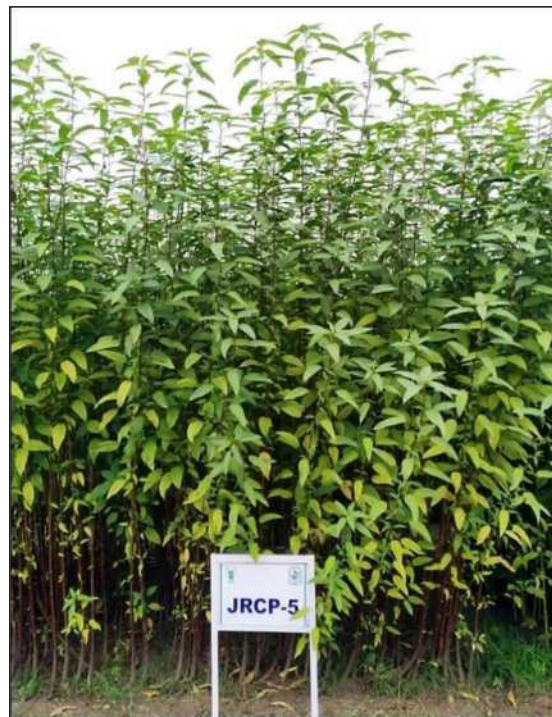


Fig. 6: Field view of JRCP-5

3. Breeding for Fibre Yield and Quality Improvement

3.1 Genetic improvement of flax 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 209 single plant progenies of F_3 of seven crosses during Rabi 2020-21 where progenies exhibited promising traits like tall height (>150 cm), bold stems, less axillary branches, late flowering and stay green phenotype with wide variation among progenies for different fibre yield related traits resulted in selection of 150 superior individual plants. Consequently, a total of 150 selected F_4 single plant progenies from seven crosses are being evaluated in the current 2021-22 Rabi season for further generation advancement with selection. In addition, four F_3 line and F_2

line each have also been sown for evaluation and selection. A total of 357 germplasm lines including 90 exotic accessions have been sown for maintenance breeding.



Fig. 7: Evaluation of F_3 generation in flax during Rabi 20-21

Screening germplasm lines for Fusarium wilt: A total of 60 selected germplasm lines were evaluated for screening for resistance to fusarium wilt under epiphytotic (sick pot)

condition at Pratapgarh, UP (Fig. 8) and seven lines were found to be resistant where one line highly susceptible (Table 6).

Table 6: Disease reaction of 60 germplasm lines of flax for fusarium wilt

Scale	Wilt %	Reaction	No.	Germplasm
0	0%	I	0	Nil
1	0-5%	R	7	Ayogi-1, Faiking, FT-835 Purple, FT-845 Purple FT-866, GIZA-8, IC-96580
2	5-15%	MR	25	EC-41623, , FT-868, FT-882, FT-991, FT-994 Blue, FT-999, FT-1006, H-31, H-49, IC-58417A, IC-96464, IC-96682, Jeevan, JRF-1, <i>L. africanum</i> , <i>L. angustifolium</i> , <i>L. tenuis</i> , Nagarkot, Parvati, Polf-23, Polf-26, Reshmi, T-65 Blue, T-66, JRF-2
3	15-30 %	MS	24	Assam-2, , EC-41650, FT-844, FT-854, FT-881, FT-887, FT-889, FT-1001, FT-1002, FT-1005, FT-1017, H-23, H-45, IC-56364, IC-64964, IC-96560, IC-96565, IC-96581, <i>L. galicum</i> , Natasha, NFT-1, T-63, T-65, T-74
4	30-50%	S	3	Belinko-60, FT-998, H-8
5	> 50 %	HS	1	B-509

Expression analysis of fibre quality genes in flax: *Fasciclin-like arabinogalactan (FLA)*, *cellulose synthase (CeSA)*, *xyloglucan endotransglucosylase /hydrolase (XTH)*, a transcription factor *MYB46* and *Rho GTPase-activating protein (ROPGAP3)* are known to have role in the secondary cell wall formation and regulation in plants. These genes thus could be crucial candidates for fibre quality analysis in flax. Eleven sets of RT-qPCR primers from these genes were used for gene expression in bark tissues of fibre flax genotype JRF2 and seven other lines morphologically selected for tall plant height and fibre yield. In majority of the cases gene expression of F24 line was comparable or higher than the standard fibre-type variety JRF 2 (Fig. 9). Thus, these genes could be suitably used in characterization of fibre quality or yield alongside the other approaches of fibre quality and yield determination in flax.



Fig. 8: Screening flax germplasm against Fusarium wilt during Rabi 2020-21

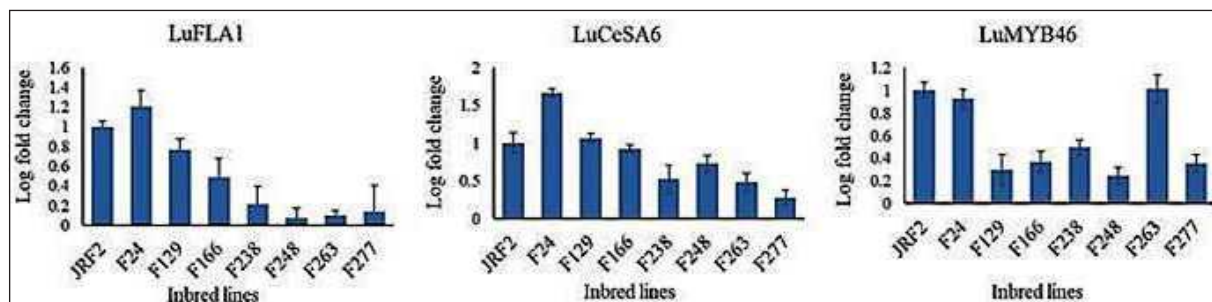


Fig. 9: Representative RT-qPCR graphs of putative fibre quality determining genes screened in JRF2 and seven selected inbred lines. Gene expression variations by these genes can be utilized in fibre quality characterization in flax varieties coupled with other fibre quality determining parameters.

3.2 Evaluation of F_1 progenies and hybridization among F_1 hybrids of jute

K.N. Chourasia, J.K. Meena, J. Mitra, P. Satya. S. Mitra, A.R. Saha and R.K. De

Project Code: In-house Project-JB 10.5

Altogether 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) were evaluated along with their parents (Fig. 11). Plant height of the hybrids varied from 416 to 485 cm whereas basal diameter range was from 15.6 to 23.1 mm. Similarly, 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 were evaluated along with their parents. Plant height of the hybrids varied from 226 to 422 cm. Best 5 F_1 hybrids of both tossa jute and white jute were hybridized again in diallel fashion. JRO 204 and JRC 517 were evaluated at under different fertilizers doses namely Control, 80:40:40 (N:P: K), 80:40:40 (N:P: K), 25% N replaced by FYM, 120:60:60 (N:P:K) and 120:60:60 (N:P:K), 25% N replaced by FYM for determining the yield potential (Fig. 10).

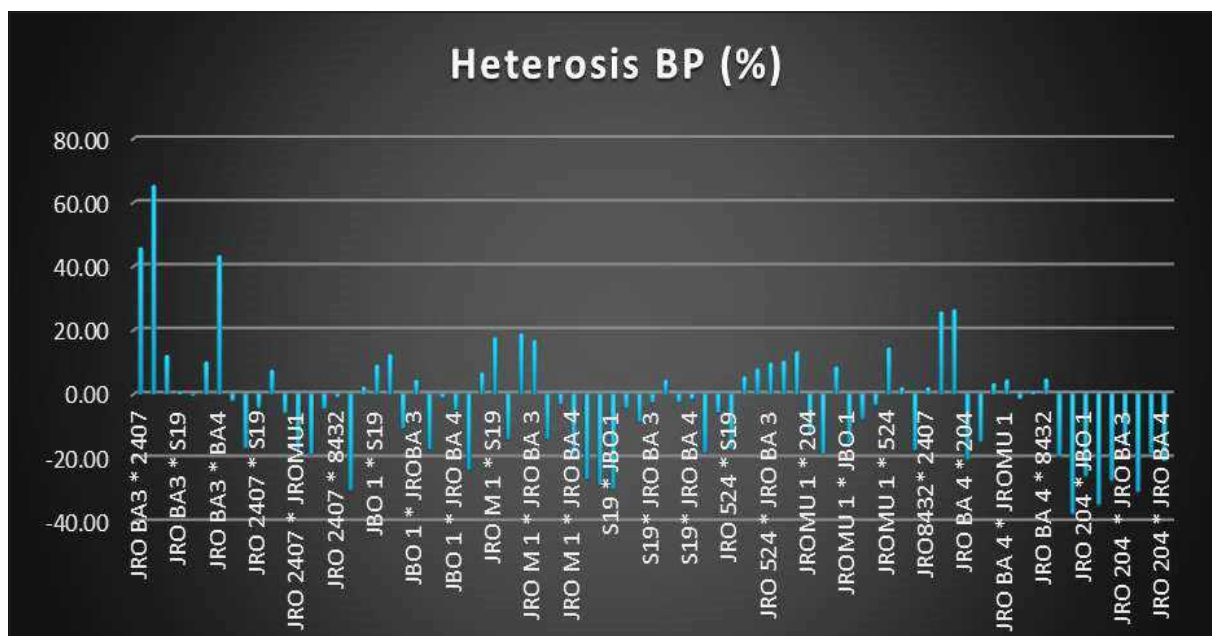


Fig. 10: Better parent heterosis (%) of 79 F_1 Hybrids of *C. olitorious*



Fig. 11: Potential yield trial of *C. olitorius*

4. Breeding for Special Traits

4.1 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

Under this research project pre-breeding approaches was carried out between major biotic susceptible and resistance lines. For cross hybridization agronomically superior, high yielding but biotic stresses susceptible varieties JRO 524 and JROG1 along with JRO 204 and JRO 2407 included as recurrent parent in the study (Table 7). While, WCN-136-1 (Stem rot resistance, BHC resistance and Fibre fineness), WCIN-179 of *C. aestuans* (BHC resistance) and OIJ-161 (Stem rot resistance) was used as resistance sources.

Table 7: Total number of crosses and seed set percentage in Jute (*C. olitorius*)

Cross combinations	Number of crosses	Seed set (%)
JRO 524 × OIJ-161	20	18 (90%)
JRO 524 × WCIN-179	10	06 (60%)
JRO 524 × WCIN-136-1	10	05 (50%)
JRO 204 × OIJ-161	20	17 (85%)
JRO 204 × WCIN-179	20	14 (70%)
JRO 204 × WCIN-136-1	20	12 (60%)
JRO 2407 × OIJ-161	20	19 (95%)
JRO 2407 × WCIN-179	20	16 (80%)
JRO 2407 × WCIN-136-1	20	17 (85%)
JROG1 × OIJ-161	20	19 (95%)
JROG1 × WCIN-179	20	14 (70%)
JROG1 × WCIN-136-1	20	12 (60%)

4.2 Nutritional profiling of different roselle morpho-types

R.T. Maruthi, A. Anil Kumar and A.R. Saha

Project Code: In-house Project-JB 9.6

Four different roselle (*H. sabdariffa* var. *sabdariffa*) morpho-types, namely HSLC-1, HSLC-2, RIJ-73-1 and RIN-257-1 were evaluated for agro-morphological and nutritional (mineral and vitamin) characteristics. Significant differences were observed among the morpho-types for both morphological traits and nutritional composition of calyces. The genotype RIJ-73-1 was found to be a tall plant type with few branches, long intermodal

length, bearing less number of fruits per branch, where as other three genotypes had short bushy type plant architecture with more number of branches, short inter-nodal length enabling more number of fruits per branch. But with respect to calyx yield, the genotype HSLC-1 (157.4 ± 11.1 g/plant) ranked first followed by HSLC-2 (140.0 ± 14.0 g/plant) and both were significantly different from RIN-257-1 (87.8 ± 7.2 g/plant) and RIJ-73-1 (84.6 ± 7.5 g/plant).

The potassium (K) content in the genotypes ranged from 164.75 ± 5.80 to 329.68 ± 8.63 mg (Fig.12). Roselle calyx contains highest K concentration than any other element. The relative mineral contents of roselle calyx in descending order of abundance are found to be as follows: $K > Ca > Mg > P > Na > Fe > Zn > Mn > Cu$. The genotypes HSLC-1 and

HSLC-2 with red calyx recorded highest values for majority of minerals; while RIN-257-1 with green calyx had lower values. In contrast, the genotype RIJ-73-1 recorded highest value for Fe content, almost four times the value of HSLC-1 and RIN-257-1, and also recorded highest values for vitamins like A, B2, B3, B5 and C (Fig. 13).

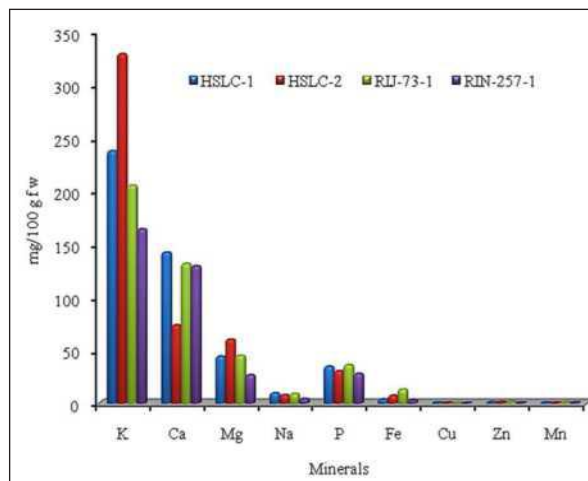


Fig. 12: Elemental profile of roselle calyx

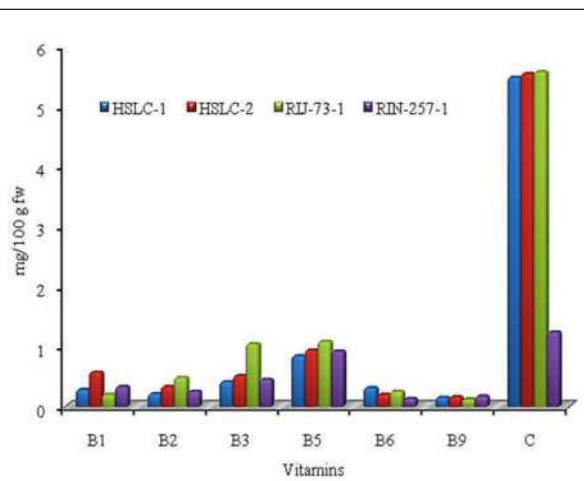


Fig. 13: Vitamin profile of roselle calyx

4.3 JROV-5: A high vitamin C containing *C. olitorius* genotype suitable for consumption as leafy vegetable

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

Project Code: In-house Project-JB 10.4

Although *C. olitorius* is consumed in many countries including India as leafy vegetable, presently there is no specific cultivar for jute as leafy vegetable. The objective of the present research was to develop nutritionally enriched jute for vegetable purpose. JROV-5 was developed by introgressing wild *Corchorus* gene pool by crossing *C. trilobularis* with S-19, a *C. olitorius* cultivar, followed by crossing their progenies with JRO 204. The entry was tested under National coordinated trials for three years. Leaf nutritional profiles like vitamin C and flavonoid content of the JROV-5 were compared with JRO 204 and JRO 524, two widely cultivated jute varieties. The genotype JROV-5 has lush green foliage at crop cutting stage (30-45 days) with high foliage yield.

Table 8: Duncan's multiple range test (DMRT) and Tuckey's honestly significant difference test for vitamin C content of selected *C. olitorius* genotypes.

Test	Genotype	Vitamin C content (mg/g fresh weight of leaf)			
		1	2	3	4
Tukey's HSD	JRO-524-Rabi	0.615			
	JRO-204-Kharif		0.804		
	JROB-2-Rabi			0.810	
	JRO-204-Rabi				0.837
	JROV-5-Rabi				1.083
DMRT	JROV-5-Kharif				1.367
	JRO-524-Rabi	0.615			
	JRO-204-Kharif		0.804		
	JROB-2-Rabi			0.810	
	JRO-204-Rabi				0.837
	JROV-5-Rabi				1.083
	JROV-5-Kharif				1.367

Under national coordinated trials it recorded 111.0 – 262.3 q/ha foliage yield in different geographical locations outperforming all the other entries and was at par with the best check JRO 204 for foliage yield. Under both the kharif and rabi season, the vitamin C content of JROV-

5 was significantly higher than the best check JRO 204 (Table 8). On the other hand, flavonoid content of JROV-5 (5.5 mg/g dry leaf) was significantly lower than JRO 204 (7.0 mg/g dry leaf) but significantly higher than JRO 524 (5.1 mg/g dry leaf).

5. Advanced Breeding in Jute

5.1 The inter-specific CAPOLI jute breaking bast fibre yield barrier

D. Sarkar

Project Code: ICAR-NPTC-3070

The recovery of the first fertile sexual hybrid (*Corchorus capsularis* cv. JRC-212 × *C. olitorius* cv. JRO-524) between the two cultivated jute species resulted in the development of the advanced CAPOLI recombinant-inbred (RI) population (Fig. 14). Phenotyping of these populations—fixed at different filial stages identified genotypes (lines) with significantly ($P \leq 0.01$) higher bast fibre yield.



Fig 14: The RI₈ CAPOLI population growing in the field at ICAR-CRIJAF (Barrackpore) under long-day summer conditions

Both F_{2:3} and RI₈ populations were phenotyped in field experiments laid out in RCBD (with three replications) and α -lattice, respectively under long-day summer conditions at a single location (ICAR-CRIJAF, Barrackpore), and data were analyzed using mixed-effects models (REML/BLUP) assuming the genotype as random. Population-level summary statistics for bast fibre yield and two major yield components (plant height and stem-base diameter) are shown in Table 9. For both the populations, bast fibre yield had significant ($P \leq 0.001$) genotypic effect, with a selection accuracy (square root of

heritability on the entry-mean basis) of 0.68 to 0.79. A total of 26 lines fixed at RI₈ had $\geq 50\%$ bast fibre yield—with as high as 34.2 g/plant over the founder parent *C. olitorius* cv. JRO-524 (17.4 g/plant).

Table 9: Summary statistics for bast fibre yield and yield components of the CAPOLI (*C. capsularis* × *C. olitorius*) jute populations at two different stages of fixation

Item ^a	PH ^b		SBD		FY	
	F _{2:3}	RI ₈	F _{2:3}	RI ₈	F _{2:3}	RI ₈
Genotypes	177	196	177	196	177	196
Min	127.7	247	11.2	7.4	9.3	7.4
Max	346	406	35.1	27.7	35.0	36.3
MinGEN	134.1	282	11.6	11.9	11.7	12.9
MaxGEN	333.7	391	32.2	24.1	33.0	34.2
Mean	228	340	21.9	16.6	21.1	21.3

^aMin, the minimum value observed; Max, the maximum value observed; MinGEN, the genotypic lowest mean; MaxGEN, the genotypic highest mean; ^bPH, plant height (cm); SBD, stem-base diameter (mm); FY, fibre yield (g plant⁻¹)

Many of these improved lines were characterized by branching habit and poor seed germination that requires physical scarification of seeds prior to sowing. However, a total of 16 CAPOLI lines were identified with ideal non-branching habit and normal seed germination, of which three lines, viz., G266 (mean: 26.5 g/plant/BLUP: 23.7 g/plant), G329 (mean: 27.1 g/plant /BLUP: 24.0

g/plant) and G365 (mean 28.4 g/plant/BLUP: 24.6 g/plant) were characterized by >50% bast fibre yield over the founder parent *C. olitorius* cv. JRO-524.

Interestingly, bast fibre yield increments in the CAPOLI lines were not concomitant with corresponding increases in plant height and stem-base diameter, suggesting that more efficient photo-assimilate partitioning (to bast tissues) may be accounted for bast fibre yield improvement.

Table 10: Bast fibre quality traits for the three CAPOLI (*C. capsularis* × *C. olitorius*) lines (non-branching habit and normal seed germination) showing >50% bast fibre yield increment as compared to their founder parent *C. olitorius* cv. JRO-524

Genotype	Fibre fineness (tex) ^a	Tensile strength (g tex ⁻¹)	Lignin content (%)
G266	2.44±0.06 ^{ns}	16.23±0.36 ^{ns}	10.97±0.42 ^{ns}
G329	2.18±0.02 ^{ns}	15.68±0.37 ^{ns}	11.20±0.62 ^{ns}
G365	2.24±0.04 ^{ns}	14.81±0.64*	12.44±0.40 ^{ns}
JRO-524	2.21±0.04	17.15±0.50	12.17±0.47

* and ns = significantly different and non-significant from JRO-524 at $P \leq 0.05$, according to Welch's two-sample *t*-test with unequal variances, respectively.

When characterized for fibre quality traits, these three CAPOLI lines with >50% bast fibre yield increment did not show any significant ($P \leq 0.05$) differences in fibre fineness, tensile strength and lignin content as compared to their founder parent *C. olitorius* cv. JRO-524 (Table 10). In order to validate the results over the years and to estimate the genotype × year interaction effects on bast fibre yield and two major yield components (PH and SBD), the RI₉ CAPOLI population was phenotyped in a field experiment (in 2021) laid out in α -lattice as described above.

Prior to statistical analyses, all data were tested for normality and homogeneity of error variance. The combined data were analyzed using mixed-effects model (REML/BLUP) assuming genotype, genotype × year interaction

and incomplete blocks nested within complete replicates as random to make use of inter-block information according to Mohring et al. (2015) [Theor Appl Genet 128: 1541-1554], and complete replicates nested within year and years as fixed.

Table 11: Likelihood Ratio Test (LRT) for bast fibre yield and yield components pooled over the two years (2020-2021)

Trait ^a	Model ^b	AIC ^a	LRT	Pr(>Chisq)
PH	Genotype	7360.00	12.60	0.000387
PH	Block (Year:Rep)	7361.35	13.95	0.000188
PH	Genotype:Year	7347.41	0.00	1.000000
SBD	Genotype	3556.96	12.53	0.000400
SBD	Block (Year:Rep)	3552.55	8.12	0.004383
SBD	Genotype:Year	3544.43	0.00	1.000000
FY	Genotype	4625.35	65.78	0.000000
FY	Block (Year:Rep)	4560.42	0.85	0.357582
FY	Genotype:Year	4559.57	0.00	1.000000

^aSame as in Table 1; AIC, Akaike information criterion

^bGenotype, genotype × year and incomplete blocks nested within complete replicates as random, while complete replicates nested within year and years as fixed

Results showed that plant height, stem-base diameter and fibre yield had significant ($P \leq 0.001$) genotypic effects (Table 11). However, none of the traits had significant ($P \leq 0.05$) genotype × year interaction effect, suggesting that the genotypic effects on bast fibre yield and yield components are consistent over the years. In order to validate the results, the combined data were also analyzed (REML/BLUP) assuming all effects, except the intercept, as random. No significant ($P \leq 0.05$) genotype × year interaction effect was observed for either of the traits including bast fibre yield (data not shown).

Summary statistics for the CAPOLI population pooled over the two years are shown in Table 12. Pooled over the two years, a total of 23 CAPOLI lines showed $\geq 40\%$ bast fibre yield increment over the founder parent *C. olitorius* cv. JRO-524, with nine (G227, G262, G278, G314, G323,

G363, G403, G430 and G443) and two lines (G278 and G403) characterized by even >50% and >60% fibre yield increments, respectively.

Table 12: Summary statistics for bast fibre yield and yield components of the CAPOLI (*C. capsularis* × *C. olitorius*) population pooled over the two years (2020-2021)

Item ^a	PH ^b	SBD	FY
Min	203.33	7.44	4.17
Max	406.80	27.69	36.30
MinGEN	281.22	14.73	12.84
MaxGEN	366.35	22.66	29.42
MinYR	2 (315.03)	1 (16.62)	2 (17.47)
MaxYR	1 (340.57)	2 (18.81)	1 (21.30)
Mean	327.80	17.72	19.38
SE	1.07	0.09	0.18
SD	29.92	2.65	5.03

^a, ^bSame as in Table 1; MinYR, the year with lowest mean; MaxYR, the year with the highest mean

Pooled over both the years (2020-2021), the three CAPOLI lines, with non-branching habit and normal seed germination, recorded 43.77% to 46.96% fibre yield increments over the founder parent *C. olitorius* cv. JRO-524 (Table 13). This fibre yield increment was, however, associated with only 1.38% to 3.18% increment in plant height. Interestingly, in two of the lines (G266 and G329), stem-base diameter was even found to have decreased by nearly 20.0%. Further, the estimated BLUPs for these genotypes are indicative of significant improvement in bast fibre yield (Table 13).

Table 13. Bast fibre yield and yield components for the three CAPOLI (*C. capsularis* × *C. olitorius*) lines (with non-branching habit and normal seed germination) pooled over the two years (2020-2021)

Gen ^a	Mean			BLUP ^b		
	PH ^a	SBD	FY	PH ^a	SBD	FY
G266	349.68	17.29	24.83	335.51	17.52	22.95
G329	349.34	17.08	24.80	334.56	17.45	22.80
G365	343.24	22.11	25.35	333.33	19.40	23.22
JRO-524	338.59	21.46	17.25	325.12	18.47	17.62

^aSame as in Table 1; Gen, genotype

^bBLUP, best linear unbiased prediction

Phenotypic variance was the highest for plant height and the lowest for stem-base diameter, with bast fibre yield showing the highest genotypic coefficient of variation (Table 6). Whereas heritability estimates were the highest for bast fibre yield (0.645) and the lowest for plant height (0.371). Obviously, bast fibre yield had the highest selective accuracy (0.803). Bast fibre yield had the highest phenotypic correlation with plant height (0.697) followed by stem-base diameter (0.488), while both the yield components were estimated to have a phenotypic correlation of 0.490. No genotype-year correlation was observed for either of the traits phenotyped pooled over the two years (Table 14).

Overall, the current results confirm that the inter-specific CAPOLI jute is characterized by significantly higher bast fibre yield. Moreover, the absence of significant ($P \leq 0.05$) genotype × year interaction underscores the stability of bast fibre yield in CAPOLI jute over the years. The CAPOLI population has been fixed in RI₁₀, with 194 lines.

Table 14: Genetic parameters for bast fibre yield and yield components as estimated in the CAPOLI population pooled over the two years (2020-2021)

Parameter ^a	PH	SBD	FY
Phenotypic variance	719.40	5.45	21.70
GEr2	0.00	0.00	0.00
h2mg	0.371	0.380	0.645
Selective accuracy	0.609	0.617	0.803
rge	0.00	0.00	0.00
CVg	2.84	4.70	13.34
CVr	7.39	11.99	19.81
CV ratio	0.38	0.39	0.67

^aGEr2, the coefficient of determination of the interaction effects; h2mg, heritability on the entry mean basis; rge, the genotype-year correlation, Cvg, the genotypic coefficient of variation; CVr, the residual coefficient of variation.

6. Germplasm Resource Management

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

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

Project Code: In-house Project-JB 1.1

Regeneration and evaluation: A total of 440 capsularis germplasm lines were sown for regeneration which includes exotic (41) indigenous (338) and mutant germplasm lines (61). A total of 82 Roselle germplasm lines were evaluated for yield attributing traits. Among the yield traits green weight ranged from 146 to 479.5 g/plant, stick weight from 17.7 to 75 g/plant and fibre yield from 7.2 to 26.3 g/plant. A total of 100 indigenous olitorius germplasm lines were evaluated for fibre finess and significant variation for fibre fineness was observed. Among the evaluated germplasm lines 38 lines were recorded significantly high fibre fineness (Fig.16) than check varieties JRO 524 (2.7 tex) and JRO 204 (2.5 tex). Distribution: A total of 1130 jute and allied fibres germplasm lines distributed to ICAR-CRIJAF scientists and other indenters, olitorius (941 nos), capsularis (60 nos), wild jute (07 nos), Roselle (70 nos) and mesta (52nos).

Collection: Six germplasm lines were collected (Fig.15) (West Bengal, Rajasthan and Telangana) during the current year wild sunnhemp (01), tossa jute (02) and wild jute (03).



Fig. 15: Fibre finess of indigenous olitorius germplasm

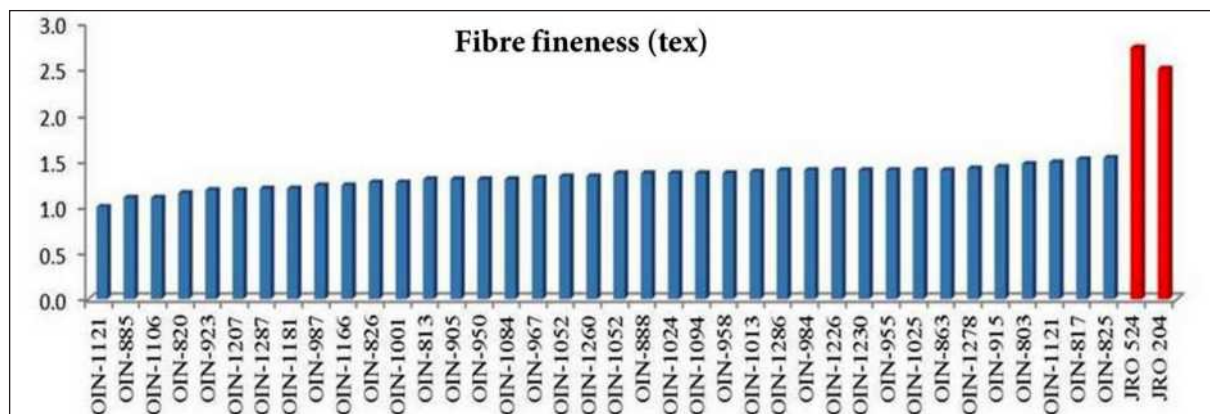


Fig 16: Germplasm collections from West Bengal and Rajasthan

7. Seed Production of JAF Crops

7.1 Breeder and nucleus seed production

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

Project Code: Externally Funded Project-BSP 1.0

During 2020-21, breeder seed of nine varieties of jute and two varieties of sunnhemp were produced. A total of 5.81 quintal (q) of breeder seed of jute were produced against the indent of 3.88 q. A total of 3.10 q of breeder seed of sunnhemp were produced against the indent of 2.00 q. Crop-wise details of the breeder seed production are presented in Table 15.

Table 15: Indent and production of breeder seed of jute and sunnhemp varieties (2020-21)

Crop/Variety	Indent (q)	Production (q)
Jute		
JRO 2407 (Samapti)	0.80	0.80
CO 58 (Sourav)	0.42	0.45
JBO 1 (Sudhangshu)	0.05	0.44
JRC 532 (Sashi)	0.20	0.37
IRA (JBO 2003H)	0.55	1.00
JRO 204 (Suren)	1.20	1.90
Subala (S 19)	0.20	0.30
JRO 524 (Navin)	0.45	0.50
JROB 2 (Purnendu)	0.01	0.05
Total	3.88	5.81
Sunnhemp		
JRJ 610	1.00	1.50
SUIN 053	1.00	1.60
Total	2.00	3.10

During 2021, 28 varieties of jute, 11 varieties of mesta, 04 varieties of sunnhemp and 01 variety of flax were maintained following the principles of maintenance breeding. A total of 123.9 kg of nucleus seed of jute and allied fibre crops (jute-61.9 kg, mesta-30.2 kg, sunnhemp-29.3 kg and Flax-2.5 kg) were produced. The variety wise details are given in Table 16.



Fig 17: Breeder seed plot of jute crop



Fig 18: Monitoring of Breeder seed plot at CSRSJAF, Budbud



Fig 19: Nucleus seed plot at CSRSJAF, Budbud

Table 16: Nucleus seeds of jute produced during 2020-2021

Variety	Jute		Mesta		Sunnhemp		
	Quantity (kg)	Variety	Quantity (kg)	Variety	Quantity (kg)	Variety	Quantity (kg)
JRO 524	4.0	KOM 62	2.5	MT 150	3.2	SUIN 053	10.5
JRO 204	3.0	JRCM 2	3.2	HC 583	3.4	K 12 Yellow	1.3
JRO 8432	3.2	JRC 517	1.5	Central kenaf JBMP 2	2.5	SUIN 037	9.0
JBO 2003H	4.0	JRC 321	2.5	AMC 108	2.0	JRJ 610	8.5
CO 58	2.0	JRC 80	3.5	JRKM-9-1	2.0	Flax	
JRO 128	3.5	JRC 532	2.5	HS 7910	2.5		
S 19	3.0	JRC 9057	3.5	HS 4288	2.6	JRF 2	2.5
JRO 2407	2.5	JRC 212	2.0	CRIJAF R 2	4.0		
JRO 7835	2.5	JRC 698	1.0	CRIJAF R 8	2.0		
JRO 878	2.0	Bidhan Pat-2	0.4	AMV 3	2.6		
JROG 1	2.5	Monalisa	0.4	AMV 4	3.4		
JROM 1	1.0	JRC 7447	0.6				
JRO 632	1.5	UPC 94	0.6				
JRO 3690	1.5	Bidhan Pat-1	1.5				

7.2 Quality Seed Production under ICAR Seed Project

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

Project Code: Externally Funded Project-ICAR Seed Project

Under ICAR Seed Project, quality seeds of different crops viz., jute, mesta, sunnhemp, paddy, wheat, mustard, jute, dhaincha etc.

were produced. A total of 509.3 q of seeds were produced as detailed below in Table 17.



Fig. 20: Seed crop of jute at CSRSJAF, Budbud, West Bengal



Fig. 21: Seed crop of mesta at CSRSJAF, Budbud, West Bengal

Table 17: Quality seed produced under ICAR-seed project in 2020-21

Crop	Category of seed	Variety	Production (q)
Jute	Truthfully labelled	JROM 1, JBO 2003H, JRO 2407, JRC 698, JRC 517, JRO 524, JRO 204)	1.59
	Certified	JRO 2407	0.30
Mesta	Truthfully labelled	HC 583, AMC 108, HS 4288	0.65
Sunnhemp	Breeder	SUIN 053	0.5
	Truthfully labelled	SUIN 053, SUIN 03, JRJ 610	3.31
Paddy	Certified	Var. MTU 7029)	478.5
	Truthfully labelled	MTU 7029	15.0
Wheat	Truthfully labelled	DBW 187	26.50
Mustard	Truthfully labelled	B9, NRCYS 05-02. NRCHB 101, B 54	5.00
Dhaincha	Truthfully labelled	Non-descript	4.4

7.3 Protection of jute varieties and DUS testing

A. Bera and H.R. Bhandari

Project Code: DAC Project

DUS testing of two candidate varieties received from PPV&FR Authority was initiated during 2021. Among 17 essential characteristic, observations of 13 essential characteristics have been recorded. Based on these characteristics candidate varieties were not distinct from reference varieties. However, observations on rest 4 characteristics will be taken in due course of time after which distinctness of these candidate varieties could be determined. Application for registration of three jute varieties (JROMU 1, JRCJ 11 and JROB 2) have been sent to PPV&FR Authority. For maintenance of reference collection of jute, thirty varieties of tossa jute, viz., JRO 204, IRA,

JRO 632, JRO 3690, JRO 66, JRO 524, JRO 7835, JRO 878, JRO 8432, S-19, JRO 128, JRO 620, JRO 36 E, Chinsurah Green, Sudan Green, Tanganyika-1, JRO 2345, KOM 62, TJ 40, CO-58, JRO 2407, Tarun, JBO 1, JROG 1, NJ7010, NJ 7050, NJ 7055, Bidhan Rupali, JROM 1 and NJ 7005 and twenty one varieties of white jute, viz., JRC 212, JRC 80, JRC 698, JRC 7447, JRC 4444, Padma, JRC 321, Monalisa, UPC 94, Bidhan Pat 1, Bidhan Pat 2, Bidhan Pat 3, KC 1, KTC 1, D 154, JRC 517, JRC 532, JBC 5, JRCM 2, KJC 7 and JRC 9057 were sown through plant to progeny row method at both ICAR-CRIJAF, Barrackpore and ICAR-CSRSJAF, Budbud centres during July, 2021.



Fig. 22: DUS testing plots of jute varieties at ICAR-CRIJAF

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

A. Bera and H.R. Bhandari

Project Code: DAC Project

A total of 26 descriptors were recorded and out of 26 descriptors, 11 descriptors are dimorphic (hypocotyl pigmentation, pigmentation of cotyledonary leaf collar, pigmentation of cotyledonary leaf margin, pigmentation of cotyledonary leaf lamina, leaf shape, stem pubescence, presence of spine on stem, flower eye zone extension, capsule dehiscence, seed shape, seed coat colour) and 15 descriptors are

polymorphic (leaf blade lobe number, incision of leaf margin, leaf vein colour, leaf petiole colour, leaf collar colour, stipule colour, stem colour, density of spine on stem, pigmentation of flower buds, flower petal colour, flower eye zone colour, late stem colour, fruit pigmentation, fruit pubescence and thousand seed weight). All these descriptors were successfully utilized for DUS testing purpose.

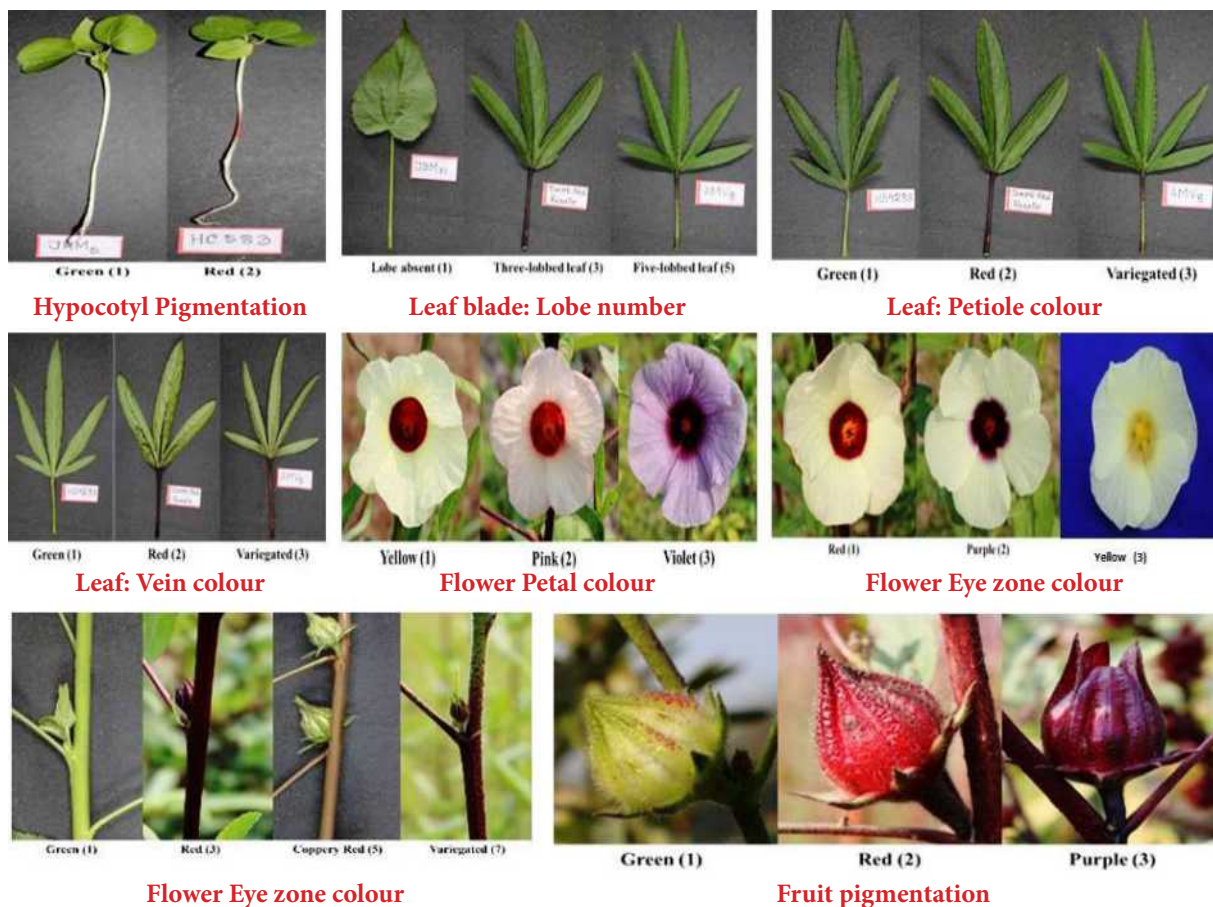


Fig. 23: Descriptors of mesta (kenaf and roselle)



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



CROP PRODUCTION

Overview

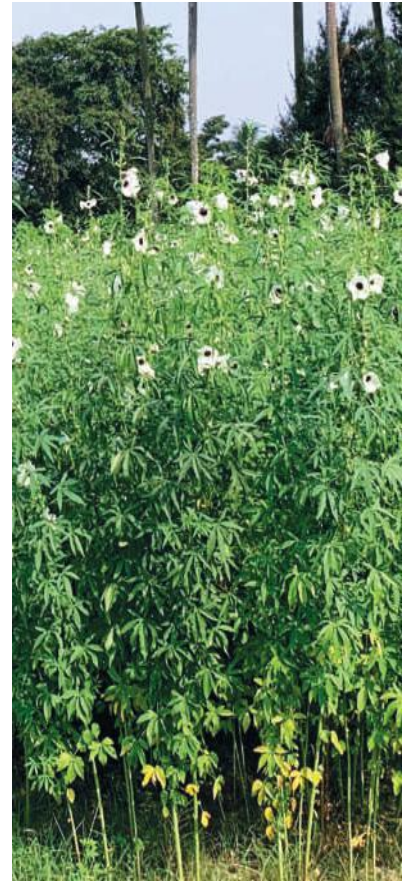
JAF growing tracts of India are classified into nine agro-climatic zones comprising of the alluvial and red & lateritic soils and sandy loam to clay loam in texture. Alluvial soils are derived mainly from the deposition of the Ganges and the Brahmaputra river systems and carry ample potash and phosphoric 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 2021

- Crop diversification in jute based cropping system decreased the inputs of non-renewable energy and consequently reduces the emission of GHGs from agroecosystems.
- Long term effects of no tillage and additional residue management under jute based cropping systems provided positive nutrient balance.
- Application of GA3 @ 0.02% reduced flowering in both olitorius and capsularis genotypes.
- Composting tree leaf litters with effective microorganism (EM) and green sunnhemp plants was found effective in crop wastes management.
- The highest jute fibre yield was recorded, when inorganic fertilizer in combination with FYM and biofertilizer. Application of N 80, P₂O₅ 40, K₂O 80 kg/ha produced 124.1% more jute seed yield.
- Jute cultivar JROB 2 exhibited superior quality and higher biomass for bioethanol production.
- In tossa jute, application of ipfencarbazone + nail weeder at 15 DAS was the better method of weed management and produced higher jute fibre yield.
- Jute based integrated farming system, 114% increase in profit was recorded along with increase in employment generation by 226-man days/ha.
- Liquid formulation of CRIJAF Sona completed the retting process within 13 days and produced better fibre strength and fineness. Enzymatic activities were maximum in slow moving water retting system.



RESEARCH

1. Climate Resilient in JAF Crops

1.1 Diversifying rice based crop rotations with jute fibre crop for mitigating life cycle GHGs under integrated soil-crop management system

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

Project Code: In-house Project-JA 7.6

Modern soil and crop management practices are resulting in loss of soil organic carbon (SOC). Main agronomic practices for SOC loss are minimum crop rotations and residues management, imbalanced soil fertilization, and less use of organic compost. In this study, a suitable crop and land management practices along with inter or mixed crops through two management systems: integrated soil-crop management (ILM_{soil}), and improved management (IM_{soil}) along with farmers' practice (CM_{soil}) was practiced to increase the amount of organic matter in the soil and thereby improve soil carbon sequestration, and mitigate GHG emissions to the atmosphere. The life cycle assessment (LCA) approach was used to estimate carbon footprint with the inclusion of GHG emissions of different soil-crop management systems in the Eastern Gangetic Plains (West Bengal, India) from successive

crops of rice, mustard and jute with or without intercrops while accounting for changes in SOC. The adoption of ILM_{soil} reduced the CF (78%) and increased overall economic yield by 25% over those obtained under recommended improved method of cultivation (IM_{soil}). Net CO₂-eq emission was 68% less under ILM_{soil} as compared to other systems. The reduction in net LCA-GHG emission was mainly due to high SOC sequestration by jute crop and leguminous intercrops. Thus, the improving crop diversification and agronomic productivity as used in ILM_{soil} system may decrease the inputs of non-renewable energy and consequently reduce the emission of GHGs from agroecosystems. Management of soil health friendly farming systems, minimization of soil and water loss, and increase in amount of organic fertilizers are also found helpful in reducing the carbon footprint.

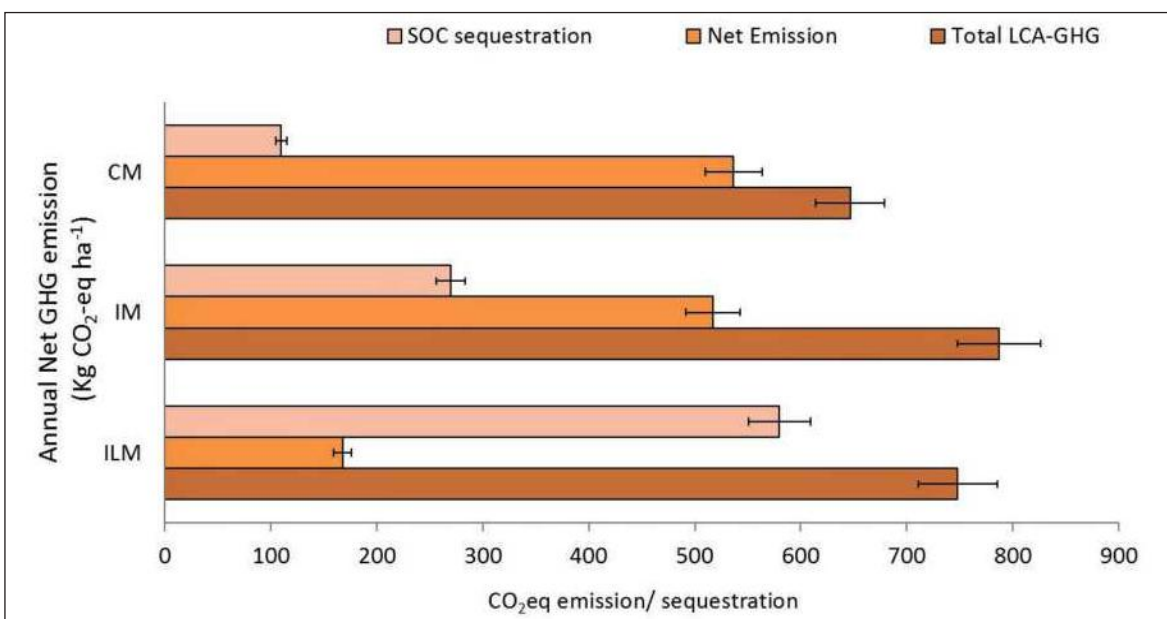


Fig. 24: Average total (LCA-GHG) and net life cycle greenhouse gas emitted for the production of per hectare area in the rice-mustard-jute crop rotations (p=0.05)

1.2 Mucilage content in *tossa* jute cultivars to retain more water under drought condition

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

Project code: In-house project -JA 7.4

A study was taken up in order to find out the role of mucilage in drought tolerance in jute. Mucilage was mainly found to be localized in the xylem vessel. The mucilage content of leaf and stem was 47 mg/g fresh weight and 85 mg/g fresh weight, respectively. Further, the mucilage was isolated and physico-chemical studies were done. Mucilage was ash to ash brown in color, has characteristic smell, soluble in water and has a pH of 6.1. The swelling volume was 85% which is much higher and therefore provides the capacity to withhold water. To understand its role in drought, mucilage content of three varieties, JRO-524, JRO-204 and S-19 were studied under stress. 30 days old plants were

subjected to drought by withholding irrigation (soil moisture content: 8.4% and relative water content: 53.4%). An increase in mucilage content was recorded in all the varieties under drought (Fig. 25). The percent increase (29.95 %) in JRO-204 was higher than the other two varieties. The increase in mucilage content might have provided the plants to retain more water under drought and maintain the metabolic activity. It may be inferred that mucilage plays a critical role in withholding water under drought stress. Jute, by virtue of its higher mucilage (approximately 12%) is able to retain water even at lower soil moisture conditions.

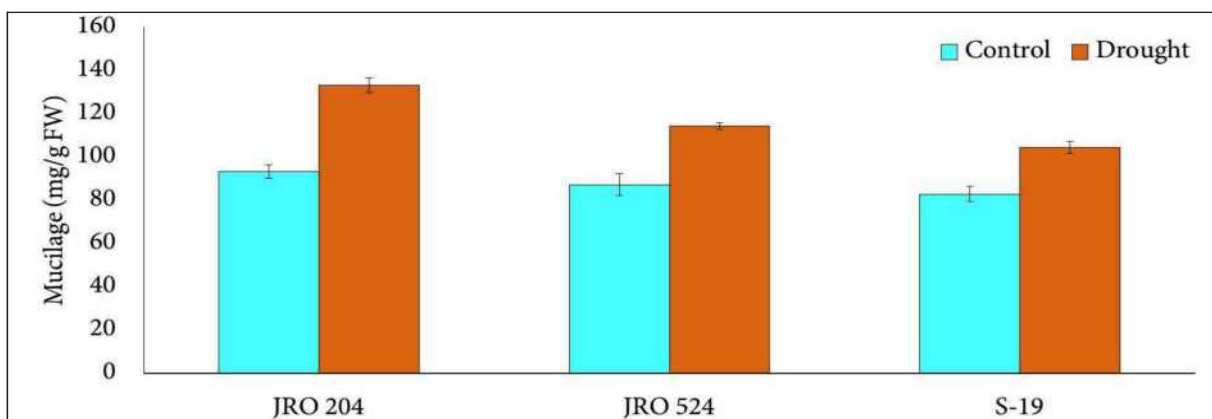


Fig. 25: Mucilage content of three cultivated *tossa* jute varieties under drought

1.3 Markov chain model for dry and wet spell probability analysis for planning jute-based cropping systems in eastern India

D. Barman, P. Satya, B.S. Gotyal, A.K. Singh, A.K. Chakraborty,

R. Saha, S.P. Mazumdar, Shamna A., S. Mitra and L. Sharma

Project Code: In-house project- JA 7.1

The marginal, conditional, and consecutive dry and wet week probabilities were analysed using Markov chain model, and the forward and backward accumulation method was used for computing probabilities of onset and withdrawal of monsoon season for planning jute-based cropping systems by taking weekly

rainfall data of the four stations situated in jute growing areas of eastern India namely, Nagaon (Assam) (period: 2011-2020), Pundibari (West Bengal) (period: 1998-2016), Barrackpore (West Bengal) (period: 1983-2020) and Bhubaneswar (Odisha) (period: 2008-2020). Markov chain analysis revealed that in a year there are two

distinct transitional phases of dry and wet weeks' sequences for all the four locations, viz. Nagaon, Pundibari, Barrackpore, and Bhubaneswar. The ideal sowing time of jute crop is between 26th March and 1st April in all the four regions for effective use of the pre-monsoon nor'wester shower. However, the probabilities of dry week and two consecutive dry weeks from 26th March to 3rd June varied from 10-60% and 0-40%, respectively, in Nagaon and Pundibari, and 37-82% and 16-68% in Barrackpore, and 50-100% and 38-92% in Bhubaneswar. Therefore, lifesaving and supplemental irrigations are needed up to 3rd June (22 SMW) and thereafter no irrigation is required for jute and subsequent rice or any other kharif crops grown in the system because monsoon starts and remains

active for 16 weeks in Nagaon (11th June - 7th October) and Barrackpore (18th June to 14th October), 15 weeks in Pundibari (4th June 23rd September) and 12 weeks in Bhubaneswar (11th June - 9th September). From 1st January to 25th March (1-12 SMW), the probability of a dry week varied from 70-100% in Nagaon and Pundibari, and from 85-100% in Barrackpore and Bhubaneswar. From 15th October to 31st December (42-52 SMW), and 1st January to 25th March (1-12 SMW), the probabilities of two consecutive dry weeks varied from 40-90% in Nagaon, 45-95% in Pundibari, 50-97% in Barrackpore, and 50-92% in Bhubaneswar. The supplemental irrigations are therefore needed for growing any crop in all the four studied regions from 22nd October to 25th March.

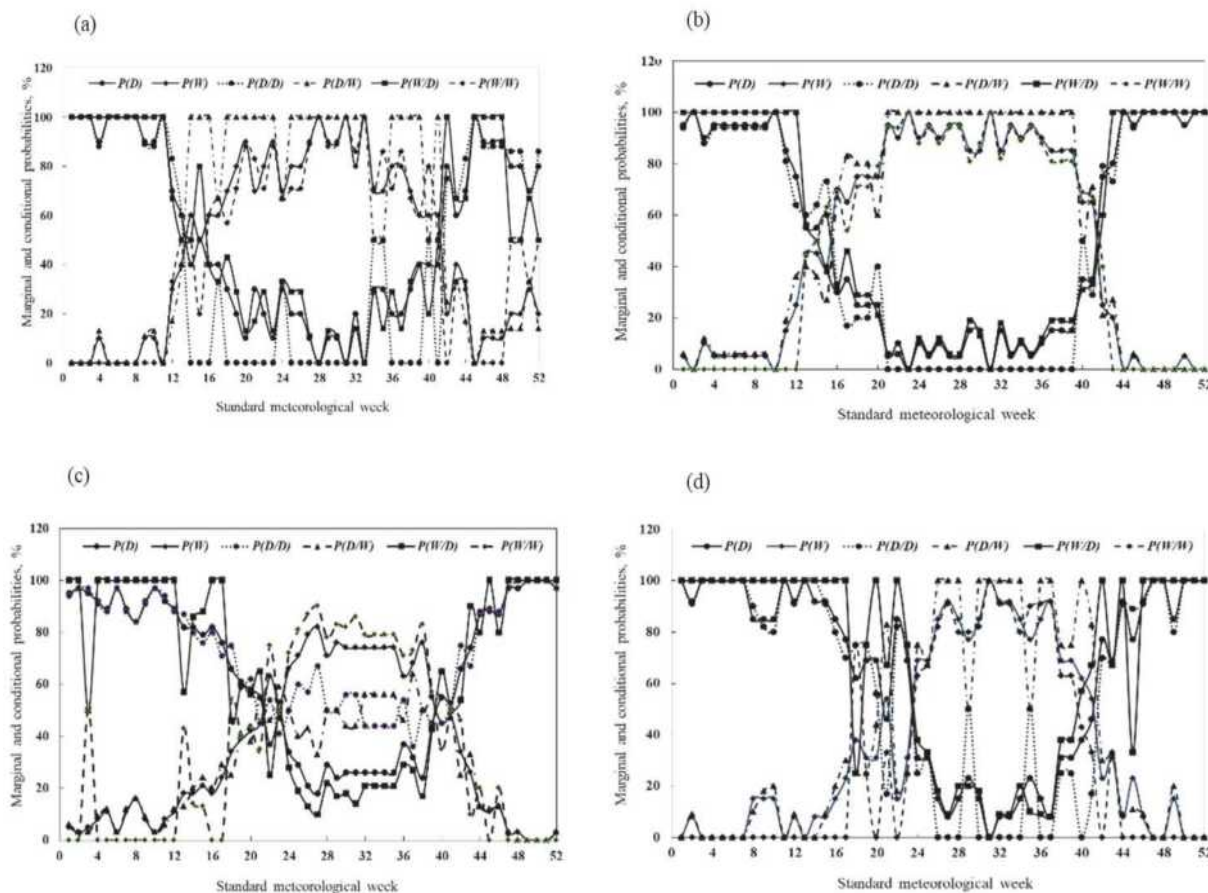


Fig. 26: Initial and conditional probability of dry and wet weeks at (a) Nagaon, (b) Pundibari, (c) Barrackpore, and (d) Bhubaneswar

1.4 Reduction in early flowering of jute fiber crop by application of Gibberellic acid (GA₃) under long day condition

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

Project Code: In-house project- JA 7.5

Jute (*Corchorus sp*) is a short-day plant and photoperiod play an extremely important role for its vegetative and reproductive growth. Sowing early (end of February or early March) leads to reproductive development of the plant. As a result, fibre production is severely hampered in jute due to early flowering. Chemicals, especially plant hormones are known to modulate the time of flowering in plants. Hence, six chemicals were exogenously applied at 15 days interval on the canopy of

the standing crops. Among all six chemicals applied, GA₃ @ 0.02% reduced flowering in both *olitorius* and *capsularis* genotypes. In both the jute varieties there is 25% less flowering as compared to the control at 90 DAS (Fig. 27). Application of ABA before onset of flowering does not affect the percentage of flowering but severe growth retardation was recorded. ABA restricts further flowering when applied after initial floral bud emergence.

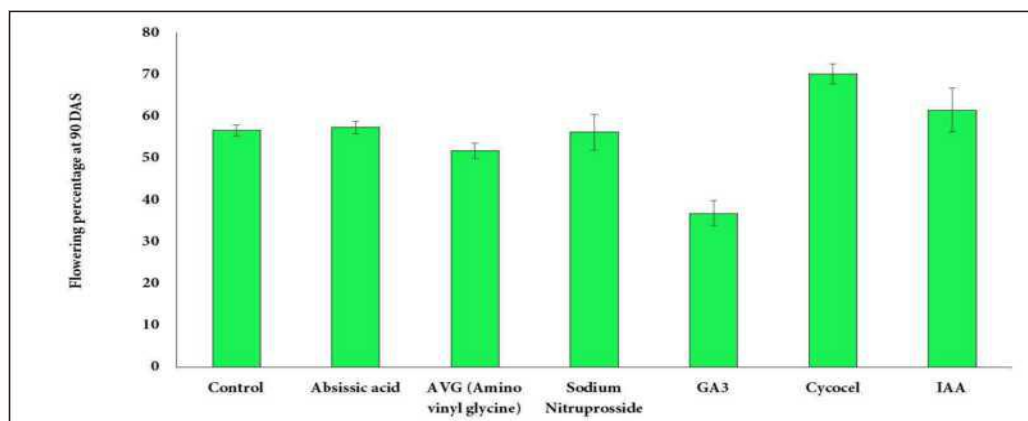


Fig. 27: Effect of application of chemicals on flowering percentage

1.5 Leaf litter composting with effective microorganisms and green sunnhemp plants for mitigation of CO₂ emission

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

Project Code: In-house Project-JA 8.1

Tree leaf litters can be a potential source of plant nutrient supply, if correctly and biologically turned into compost by several ways of decomposition to produce well decomposed humus. A study was conducted on the decomposition of admixture of tree leaf litters using effective microorganism (EM) and green sunnhemp plants treatment under aerobic conditions. The patterns and cumulative amounts of CO₂-C emissions and CO₂ mitigation potentials of mixed leaf litter decomposition were assessed using laboratory incubation procedures. To analyse the vigour

index in the compost with soil, a pot culture experiment was done for phytotoxicity testing of compost on flax and jute seed germination. Plant nutrient content was higher in both composting treatments than the critical value. The green sunnhemp manure treated compost had a greater total plant nutrient concentration than the EM treated compost. In EM treated compost, the germination index and vigour index were both higher. CO₂ emission patterns were similar in both litter treatments, however, the quantity of CO₂ released during the incubation differed significantly. Carbon

mineralization was highest in the compost that had EM added to it. The addition of sunnhemp green plants helps to reduce CO₂ emissions. Composting techniques used in this study can save approximately 310 kg CO₂-eq in GHG

emissions. Composting tree leaf litters with EM and green sunnhemp manure could be a useful technique for lowering agriculture GHG emissions while also helping to mitigate climate change.

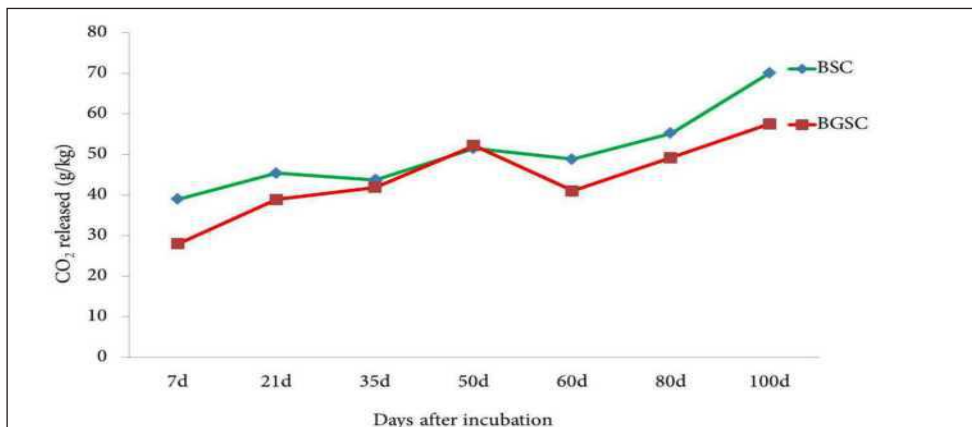


Fig. 28: CO₂-C emission by leaf litter during decomposition of BSC and BGSC composts

1.6 Eddy covariance measurement of crop evapotranspiration of jute

*D. Barman, A. Chakraborty, P.K. Das, R. Saha, S.P. Mazumdar, S. Roy,
S. Mitra, A.K. Singh and A.R. Saha*

Project Code: ISRO-NRSC National carbon project

The eddy covariance tower was established in jute field of ICAR-CRIJAF research farm and jute crop was sown on 20th April 2021 surrounding the eddy tower maintaining fetch area and the jute crop was harvested on 14th Aug, 2021. During the jute growing season (117 days), diurnal variation, daily average and growth phase wise ET_c of jute crop were measured using open path eddy covariance technique. Plotting of the eddy measured ET_c values averaged over entire growing season, against local time in a day (mid night to mid night) forms a bell-shaped

curve (Fig. 29). ET_c was minimum at 4:30 am (IST) (0.02 mm/h) and maximum at 12:00 noon which may be attributed to increasing solar radiation with local time. It was observed that during entire day, 85% of ET_c occurred between 7:00 am and 5:30 pm, and 42% occurred between 10:00 am to 1:30 pm. During the initial (15 days), development (45 days), mid (45 days) and late (15 days) stages of jute crop, the average ET_c were 3.1, 4.3, 3.8, and 3.5 mm/d, respectively, and the total ET_c was 364 mm in 117 days growth period.

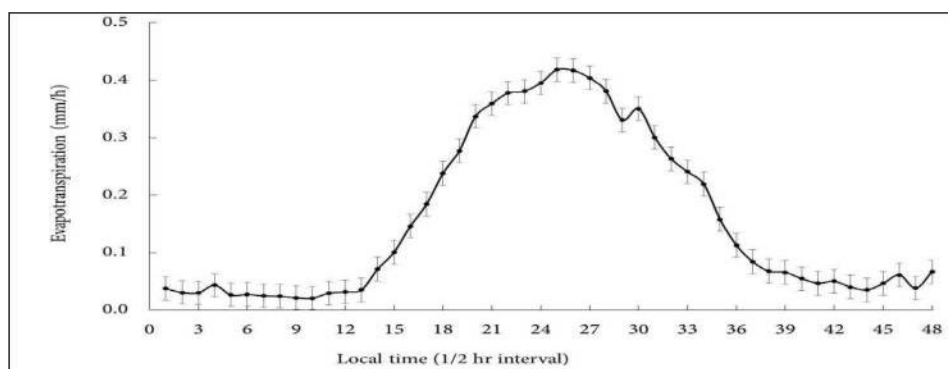


Fig. 29: Eddy measured ET_c values, averaged over entire growing season of jute crop

2. Soil Health for Sustainable Productivity

2.1 Nutrient balance as affected by tillage and residue management in jute based cropping systems

*R. Saha, A.R. Saha, S.P. Mazumdar, B. Majumdar, M.S. Behera,
D. Barman, R. K. Naik and L. Sharma
Project Code: In-house project- JA 5.7*

Study conducted to assess the effects of tillage and residue management on soil nutrient balance after 6 years continuous jute based cropping systems in alluvial soils of Indo-Gangetic plains. The tillage and residue management treatments were (i) conventional tillage (CT), (ii) no tillage (NT), and (iii) no tillage with additional crop residue (NT+R). Available nutrient (N, P and K) contents in soil (0-60 cm soil depth) and crop uptakes were measured at the end of 6 year crop cycle following the standard methodology and nutrient balance were calculated. Higher amount of nutrients was added through no tillage with additional crop residue (NT+R).

The highest amount of nutrient availability was found in NT+R (N: 338.01; P: 44.21 and K: 179.24 kg/ha, respectively) as compared to NT and CT. Similarly, the crop uptake was also highest in NT+R (N: 84.72; P: 28.90 and K: 77.28 kg/ha, respectively). The nutrient balance sheet (Table 18) showed that there was a positive nutrient balance in all the tillage treatments with highest positive balance in NT+R (N: 195.89; P: 28.02 and K: 134.17 kg/ha, respectively). Significant positive nutrient balance under NT+R may be attributed with the application of additional crop residues of *Sesbania* sp. having high N, P, K contents.

Table 18: Nutrient balance sheet as influenced by tillage treatments in jute based cropping systems

Tillage treatments	Initial availability	Final availability	Crop uptake	Total	Apparent balance
Available N (kg/ha)					
CT	226.84	273.61	33.58	307.19	+80.35
NT	226.84	314.93	51.86	366.79	+139.95
NT+R	226.84	338.01	84.72	422.73	+195.89
Available P (kg/ha)					
CT	45.09	37.80	11.59	49.39	+4.30
NT	45.09	41.73	19.40	61.13	+16.04
NT+R	45.09	44.21	28.90	73.11	+28.02
Available K (kg/ha)					
CT	122.35	152.01	46.62	198.63	+76.28
NT	122.35	171.22	60.56	231.78	+109.43
NT+R	122.35	179.24	77.28	256.52	+134.17

conventional tillage (CT), no tillage (NT), and no tillage with additional crop residue (NT+R)

2.2 Studies on nitrogen dynamics under rice-flax cropping system

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

Project Code: In-house project- JA 7.8

Rice-fallows are gaining attention for cropping intensification in northeastern India and thus there is a scope to include flax in rice-fallow condition with effective conservation practices. The study was conducted aimed to evaluate different cropping systems on yield, weed dynamics, soil physical and chemical properties. Among the different cropping systems, rice-flax (zero-tillage) increased the fibre yield of flax over rice-flax (conventional tillage) and fallow-flax; and fibre yield varied from 10.2 to 14.5 q/ha. On average, rice-flax (conventional tillage) showed relatively lower weed dry biomass as compared to rice-flax (zero-tillage) and fallow-flax. Predominant weed flora in flax consisted of *Cyperus rotundus*, wild wheat, *Chenopodium album* and *Cynodon dactylon*. Highest soil

microbial biomass (198 mg/kg) and soil organic carbon (6.4 g/kg) was recorded in rice-flax (zero-tillage). Differences in soil bulk density were not significant. However, higher soil aggregation was observed under rice-flax (zero-tillage). Macro aggregates (0.25 to >2 mm) comprised of 40-57% of the total WSA compared to 20-29% as micro aggregates. Irrespective of treatments, there was a concomitant decrease in micro aggregates with increase in macro aggregates. Analysis of weekly weather data revealed that weekly total rainfall was higher than total evaporation throughout rice growing period except 45th, 46th and 48th week. In flax crop, evaporation was higher than the total rainfall, and therefore, there is a need for supplemental irrigation for flax production.

2.3 Effects of compost and chemical fertilizer on growth and fibre yield of ramie crop

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

Project Code: In-house Project-JA 8.1

The experiment was initiated at the Research Farm of ICAR-CRIJAF, Barrackpore to study the effect of two sources of composts, viz. Bench scale compost (BSC) (leaf litter + effective micro-organism) and Brown-green compost (BGSC) (leaf litter + fresh sunnhemp plants) alone or in combination with 50% recommended dose of NPK on growth and fibre yield of ramie. The experimental results revealed that application of 100% NPK recorded significantly more plant

height (1.04 m), number of canes/m² (21.9) and fibre yield (2.07 q/ha) over other fertilizer treatments during the 1st cut. Application of compost alone (100%) or with NPK (50:50) could not increase fibre yield of ramie significantly over unfertilized control in the 1st cut. Highest value of LAI was recorded in 100% NPK treatment (3.24) though the variation in LAI of ramie was non-significant across the treatments.

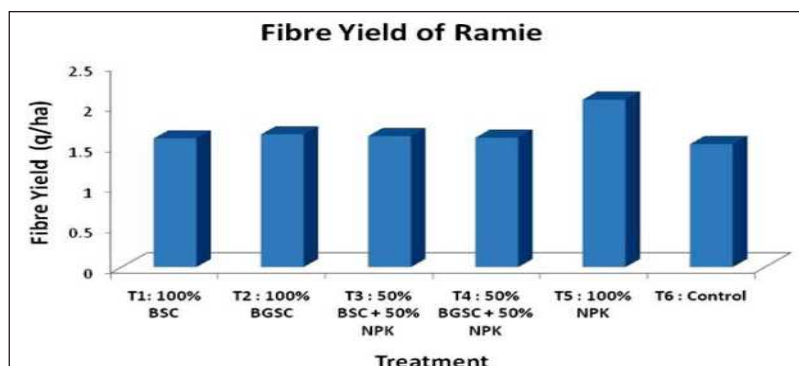


Fig. 30: Effect of fertilizer and compost on fibre yield of ramie from 1st cutting

2.4 Yield and quality of jute seed as influenced by method of application and dose of fertilizer nutrients in southern Bengal condition

S. Sarkar, M.S. Behera, A. Bera and S.K. Sarkar

Project Code: In-house Project-JA 7.9

Field experiment was conducted during 2020-21 at ICAR-CRIJAF farm with 4 levels of fertilizers (i) no fertilizer, (ii) N 80 kg/ha, (iii) N 80, P₂O₅ 40 kg/ha, (iv) N 80, P₂O₅ 40, K₂O 80 kg/ha) and 2 levels of N application methods i.e., (i) 50% N at 21-28 DAS coinciding with weeding and thinning and 50% N at 42 DAS coinciding with topping of apical bud; (ii) 50% N at 21-28 DAS coinciding with weeding and thinning; 25% N at 42 DAS coinciding with topping of apical bud; and 25% N at 56 DAS coinciding with active branching, to study the effect of method of application and quantity of fertilizer nutrients on yield parameters and seed yield of *olitorius* jute seed (cv. JRO 204). It was observed (Table 19) that the maximum number of pods/plant (38.2) was produced with T7, where 50% N at 21-28 DAS coinciding with weeding and thinning; 25% N at 42 DAS coinciding with topping of apical bud; and 25% N at 56 DAS coinciding with active branching) and the minimum number of pods/plants was recorded with no fertilizer application (15.7). Similarly, the maximum number of seeds/pod (236) was recorded with T7 and no fertilizer application produced the lowest number of seeds/pod (144).

The jute seed yield followed the same pattern of seed yield parameters with different doses and method of fertilizer application. The highest

seed yield of 1231.8 kg/ha was recorded with T7, (where 50% N at 21-28 DAS coinciding with weeding and thinning; 25% N at 42 DAS coinciding with topping of apical bud; and 25% N at 56 DAS coinciding with active branching). Application of N alone @ 80 kg/ha produced 83.9% more jute seed yield as compared to the seed yield obtained with no fertilizer application (532.5 kg/ha). It was also noted that application of 80 kg N along with 40 kg P₂O₅ enhanced the jute seed yield by 95.6% and N 80, P₂O₅ 40, K₂O 80 kg produced 124.1% more jute seed yield as compared to no fertilizer application in southern Bengal condition. Instead of two split applications (50% at 21-28 DAS and 50% at 42 DAS), three split applications of N (50% at 21-28 DAS, 25% at 42 DAS and 25% at 56 DAS) produced about $\pm 7\%$ more seed yield in *olitorius* jute. The highest 1000 seed weight (2.291 g) was obtained with T7 and the lowest 1000 seed weight was with no fertilizer application (1.786 g). The maximum seedling weight was recorded with N 80, P₂O₅ 40, K₂O 80 (22.16 mg/20 seedlings) and the minimum seedling weight was observed with no fertilizer treatment (16.98 mg/20 seedlings). Similarly, the highest seedling vigour index was obtained in case of N 80, P₂O₅ 40, K₂O 80 (2212) and the lowest value was recorded in no fertilizer treatment (1664).

Table 19: Yield and quality parameters of *olitorius* jute seed as influenced by method of application and dose of fertilizer nutrients

Treatments	No. of branch/ plant	No. of pods/ plant	No. of seeds/ pod	Seed yield (kg/ha)	1000 seed weight (g)	Germin- ation (%)	Speed of germin- ation (%)	Seedling weight (mg/20 seedlings)	Vigour index
					(A)	(B)	(C)	(D)	(E)= (B)x(D)
T ₁ : No fertilizer	8.44	15.67	144.27	532.50	1.786	98	94.67	16.98	1664
T ₂ : N ₈₀ (2 splits)	11.78	29.78	208.10	970.06	1.853	98	93.33	18.83	1845
T ₃ : N ₈₀ (3 splits)	12.22	30.11	208.47	988.65	2.128	99	94.33	18.84	1865
T ₄ : N ₈₀ (2 splits) P ₄₀	12.89	31.22	212.43	1020.90	2.146	100	95.67	20.13	2013
T ₅ : N ₈₀ (3 splits) P ₄₀	13.00	31.44	213.27	1062.04	2.156	99	94.83	20.14	1994
T ₆ : N ₈₀ (2 splits) P ₄₀ K ₈₀	15.11	35.89	235.77	1155.34	2.220	100	95.83	22.12	2212
T ₇ : N ₈₀ (3 splits) P ₄₀ K ₈₀	15.22	38.22	236.43	1231.86	2.291	99	94.83	22.16	2194
CD (P=0.05)	1.216	1.558	13.219	90.292	0.062	NS	NS	1.141	149

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

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

Project Code: JC 5.6- STCR Project

Trials on soil test target yield (ST-TY) based fertilizer application for jute crop (cv. JRO 204 & CO 58) were undertaken in the farmers' field of Briddhapalla village of Bongaon, West Bengal. From the results, it was found that in presence or absence of FYM, there was an increase in jute fibre yield of both JRO 204 and CO 58 cultivars as compared to recommended dose of fertilizer (RDF) and Farmers' practice. Targeted yield for jute was achieved within ($\pm$) 10% yield deviations. Highest jute fibre yield (38.9 q/ha) was recorded with CO 58 when IPNS and ST-TY based fertilizer and manure were applied. In another trial with ST-TY based fertilizer application, in presence or absence of FYM and biofertilizer (Azotobacter and PSB) with Jute (cv. JRO 8432), application of ST-TY (4.0 t/ha and 3.5 t/ha) based inorganic fertilizer recorded

higher jute fibre yield over recommended dose of fertilizer and Farmers' practice. Application of inorganic fertilizer based on ST-TY (3.5 t/ha) in combination with FYM and/or biofertilizer improved the jute fibre yield as compared to inorganic fertilizer alone. Highest jute fibre yield (36.4 q/ha) was recorded when inorganic fertilizer (ST-TY for 3.5 t/ha) was applied in combination with FYM and biofertilizer.



Fig. 31: STCR trial of jute crop (cv. CO 58) in farmer's field of West Bengal

2.6 Balanced application of fertilizer yielded maximum jute fibre in long-term multiple cropping fertilizer experiment

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

Project Code: JC 5.2-LTFE Project

Long term fertilizer experiment with jute-rice-wheat cropping system is being conducted for 50th year. The treatments undertaken were: T1-50% NPK, T2-100% NPK, T3- 150% NPK, T4-100% NPK+ hand weeding, T5- 100% NPK + Zn (in wheat), T6- 100% NP, T7-100% N, T8- 100% NPK + FYM (in jute @ 5 t/ha), T9-100% NPK(-S), T10-Control. Wheat (cv. HD 2967) and jute crop (cv. JRO 204) have been harvested. Highest wheat grain yield (27.0 q/ha) was recorded in 150% NPK treatment (Fig. 32). Nutrient omission treatments such as 100% NP

and 100% N and sub optimal treatment (50% NPK) recorded lower grain yield as compared to 100% NPK treatment. From the results it was found that highest jute fibre yield (34.3 q/ha) was recorded in 150% NPK treatment followed by 100% NPK + FYM treatment (Fig.32). Imbalanced treatment (100% N) and Sulphur free treatment (100% NPK-S) recorded lower jute fibre yield as compared to 100% NPK treatment. This emphasizes the importance of balanced fertilizer application to get optimum crop yield.

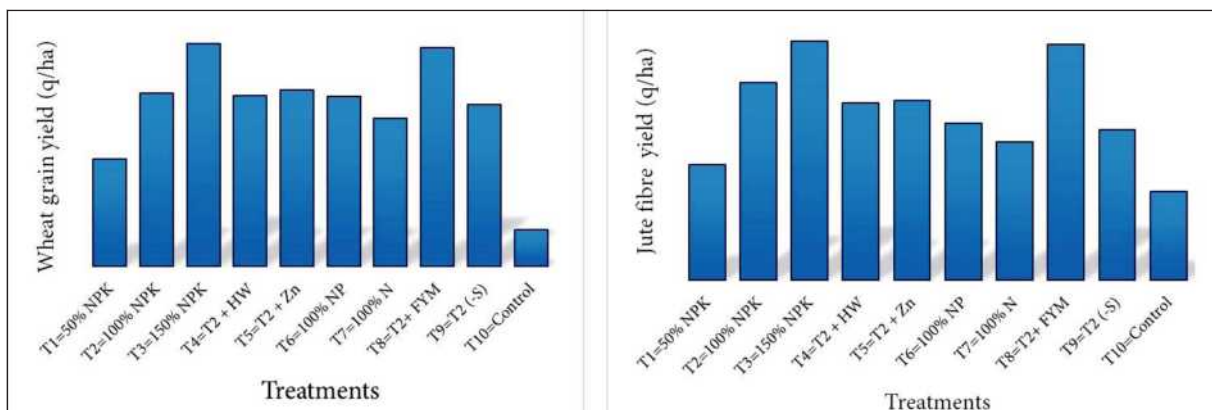


Fig. 32: Effect of treatments on wheat grain yield and jute fibre yield

2.7 Long term effect of tillage and residue management on soil water dynamics and compaction in jute based cropping systems

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

Project Code: In-house Project-JA 5.7

Long term effects of tillage and residue management i.e., conventional tillage (CT), no tillage (NT), and no tillage with additional crop residue retention (NT+R) on soil water dynamics and soil compaction were evaluated in jute based cropping systems. The profile moisture storage (Fig. 33) was above 50% available water holding capacity up to 45 DAS during crop growth in *Rabi* season irrespective of the tillage treatments. Thereafter the effect of tillage practices and residue incorporation was prominent as the profile moisture storage remained above 50% available water holding capacity up to 60 and 75 DAS under NT and NT+R treatments, respectively. The application of additional crop residue under NT+R

increased the moisture availability throughout the soil profile by reducing evaporation loss, increased infiltration and soil moisture retention. Soil penetration resistance (Fig. 34) was significantly less in CT as compared to NT and NT+R throughout the soil depth. Loosening of the soil due to ploughing in CT had reduced the mechanical resistance of the soil compared to NT and NT+R. The differences among NT and NT+R were less pronounced at deeper layer (80 cm onwards) which might be due to impervious layer of soil layer without the effect of crop residue. Thus, soil moisture availability and compaction were significantly influenced by tillage and residue incorporation.

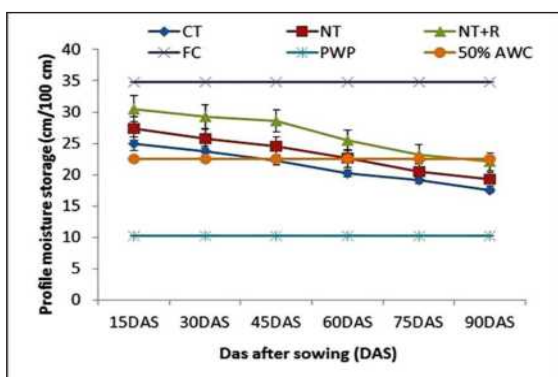


Fig. 33: Profile moisture storage during *rabi* season as influenced by tillage practices

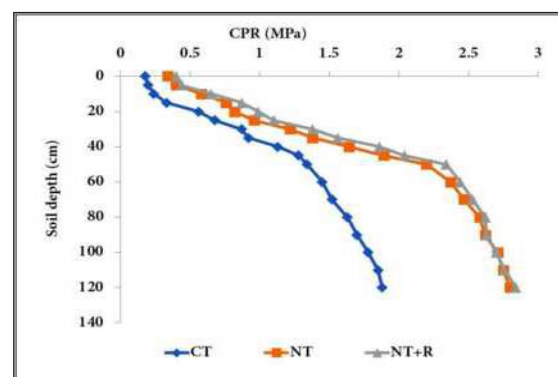


Fig. 34: Soil compaction at the end of *rabi* season as influenced by tillage practices

2.8 Effect of different weed management methods on soil moisture and soil enzymes in *tossa* jute

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

Project Code: In-house project- JA 8.2

Under different weed management practices, soil moisture and soil enzymes in *tossa* jute were analysed at 5 cm and 10 cm soil depth after 7, 10 and 15 DAS. It was recorded that 5 days after the use of nail weeder (10 DAS), the soil moisture content at 5 cm depth was higher (2.93 to 3.07%) in nail weeded plots as compared to the manual weeding treatment and herbicide alone treatment (Fig. 35). Similarly, in such cases the soil moisture content at a soil depth of 10 cm was 1.09 to 1.26% more in nail weeder used plots as compared to manual weeded plots. At 10 days after nail weeder running (15 DAS), the soil moisture content increased by 3.10 to 4.21% at 5 cm soil depth in the nail weeded plots. In this condition, the soil

moisture content at 10 cm soil depth was more by +3.32 to 3.50% where at least once nail weeder was used for weed management. In case of soil enzyme study, it was observed that 10 days after application of Ipfcencarbazon (@ 90 and 120 g a.i./ha) reduced the activity of soil enzymes like FDHA by 32.34-38.19%, dehydrogenase by 14.34-27.82%, β -Glucosidase by 29.96-47.46%, and urease by 28.18-42.45%. However, at harvest (120 DAS), the important soil enzymes increased to near normal level (90.12-95.57% of FDHA and 85.88-93.43% of dehydrogenase). In case β -glucosidase the level increase to 55.87-72.86% and in case of urease, the levels increased to 62.37-75.98% as compared to the manual weeding treatments (Table 20).

Table 20: Effect of different weed management methods on soil enzyme activities in *tossa* jute

Tr.	Treatments	Enzyme activity in soil							
		FDHA (μ g fluorescein g/h)		Dehydrogenase (μ g TPF g/d)		β -Glucosidase (μ g pNP g/h)		Urease (μ g/ml)	
		10 DAS	120 DAS	10 DAS	120 DAS	10 DAS	120 DAS	10 DAS	120 DAS
T1	Manual weeding twice	12.43	24.62	88.60	153.17	12.24	21.47	19.83	56.12
T2	Nail weeder twice	12.42	24.63	88.66	152.89	12.24	21.50	19.81	56.41
T3	Single wheel weeder twice	12.42	24.62	88.02	152.90	12.19	21.44	19.58	55.89
T4	Nail weeder + Single wheel weeder	12.44	24.66	87.89	153.15	12.08	20.98	19.81	56.33
T5	Ipfcencarbazon 90 g	8.35	22.96	75.84	142.46	8.56	15.63	13.95	42.15
T6	Ipfcencarbazon 120 g	7.68	22.19	64.31	131.57	6.43	11.99	11.61	35.00
T7	Ipfcencarbazon 90 g + Nail weeder	8.38	23.53	75.89	143.11	8.57	15.64	14.11	42.64
T8	Ipfcencarbazon 120 g + Nail weeder	7.69	22.39	64.38	131.58	6.55	12.01	11.41	35.08
T9	Ipfcencarbazon 90 g + Single wheel weeder	8.41	23.37	75.53	142.42	8.52	15.62	14.24	42.37
T10	Ipfcencarbazon 120 g + Single wheel weeder	7.68	22.70	63.95	131.55	6.54	12.00	11.39	34.71

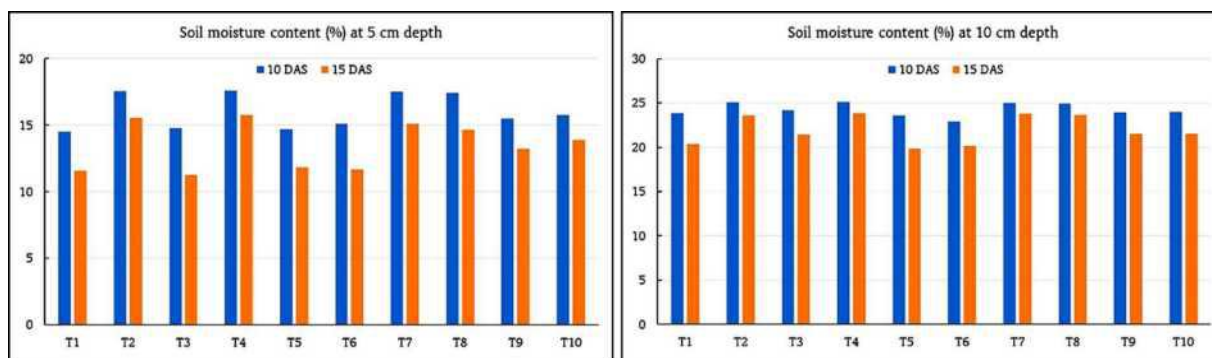


Fig. 35: Effect of different weed management treatments on soil moisture content (%) at 5 and 10 cm depth

3. Integrated Crop and Water Management for Smart Farming

3.1 Integrated weed management and low density jute sowing to increase its net return minimizing manpower requirements in different major operations

A.K. Ghorai, A.K. Chakraborty, S. Roy and S.P. Mazumdar

Project Code: In-house project- JA 8.0

A field experiment was conducted with low density (LDS) jute seeds (cv. NJ 7010, germination > 90%) @ 1.20, 1.5, 1.9, 2.25 and, 2.6 kg/ha were thoroughly mixed with river sand @ 2.6 kg to 3.4 kg/ha and broadcast sown on levelled land by double criss-cross pattern. These treatments were tested against normal sowing methods. For weed smothering, jute and green gram were intercropped in 1:1 ratio. CRIJAF nail weeder was operated at 5 DAE for mechanical weed control, thinning, line arrangement and moisture conservation in broadcast jute. At 48 hours after sowing with irrigation, Pretilachlor 50 EC @ 0.9 kg/ha was applied for pre-emergence weed control. This low density sowing (LDS) significantly reduced ultimate plant population (Eq. 1), increased individual plant and fibre weight (Eq. 3 & 4), plant height without affecting fibre yield and biomass production (Eq. 2 & 5). Low density sowing methods curtailed 125-147 mandays/ha in major operations and reduced cost of cultivation (₹31250-Rs. 36750/ha @ ₹250/mandays, (Table 21) over conventional high-density sowing (Eq. 6 & 7). At farmers' field (2 ha area in North 24 PGS), applying LDS (2.25 to 2.6 kg live jute seed (cv. NJ-7010) + 4-6 kg inert seeds or river sand @ 7.5 kg /ha, the jute fibre yield varied from 30-38 q/ha and reduced 60-90 mandays/ha (₹15000 to ₹22500/ha). In

Nowda, Murshidabad (2.4 ha area) using LDS (3 kg live seed + 5 kg inert seed or river sand) produced 33-36 q jute fibre/ha (cv. NJ 7010) and saved 60-70 man days in major operations even after phasic waterlogging due to untimely heavy rain in May. In Paschim Midnapur (2 ha) the jute fibre yield was comparatively low (18-24 q/ha) due to waterlogging since 60 DAS (zero till jute and conventional tillage jute) and saved 75-80 man days/ha in major operations. Jute and green gram intercropping reduced light interception by about 90% below its canopy at 45 DAS, produced 36.48 q jute fibre (JRO BA3) and 6.0 q green gram grain and reduced 79 mandays/ha for its major operations over manual weeding process. For large scale intercropping, jute (jute seed: river sand : 1:10) and green gram (green gram seed: river sand :: 1:3) may be sown using zero till seed drill. In post-harvest soil of jute-mung intercropping system, the available, nitrogen, phosphorus, potassium and organic carbon content (214, 30.76, 141 kg/ha and 0.60%) were higher over sole jute (204, 26.36, 109 kg/ha and 0.57%). CRIJAF nail weeder produced 38.17 q jute fibre and reduced 81 man days/ha in its major operations. The relationships with seed rates, crop biometry, mandays requirements and savings in expenditures in major operations are shown below:

$Y P_{\text{open/ha}}$	$= 2.86 + 0.34 X$	$R^2 = 0.78 \dots \dots \dots$ (Eqn. 1)
$Y \text{ Fib}_{\text{yield/ha}}$	$= 35.57 + 0.31 X,$	$R^2 = 0.17 \dots \dots \dots$ (Eqn. 2)
$Y \text{ Plnt.wt}$	$= 123.6 - 4.57X,$	$R^2 = 0.17 \dots \dots \dots$ (Eqn. 3)
$Y \text{ Fib.wt}$	$= 11.50 - 0.64X$	$R^2 = 0.78 \dots \dots \dots$ (Eqn. 4)
$Y \text{ Biomass/ha}$	$= 51.7 + 0.32 X$	$R^2 = 0.03 \dots \dots \dots$ (Eqn. 5)
$Y \text{ MDMajorpr/ha}$	$= 200.21 + 20.4X$	$R^2 = 0.80 \dots \dots \dots$ (Eqn. 6)
$Y S_{\text{avexpdt/ha}}$	$= 43883 - 4082X$	$R^2 = 0.69 \dots \dots \dots$ (Eqn. 7)

Where, $Y P_{\text{open/ha}}$, $Y \text{ Fib}_{\text{yield/ha}}$, $Y \text{ Plnt.wt}$, $Y \text{ Fib.wt}$, $Y \text{ Biomass/ha}$, $Y \text{ MDMajorpr/ha}$, $Y S_{\text{avexpdt/ha}}$ are effective plant population(lakh/ha), fibre yield (q/ha), individual fresh plant weight (g), individual fibre weight (g), fresh biomass/ha, man days reduction in major operations and savings in major operations (₹/ha). X is the different doses of seed rates applied (kg/ha).

Table 21: Plant population at harvest, individual fibre yield, total fibre yield and labour savings in major farm operations (weeding, thinning, sorting and fibre extraction) under low density jute sowing

Sl. No.	Treatments	Plant population (lakh/ha)	Individual fibre yield (g/plant)	Total fibre/ green gram yield (q/ha)	Labour requirement (mandays/ ha)	Labour savings/ha over conventional seed rate @6 kg/ha
1	Live seed 1.2 kg /ha (cv. NJ 7010) + inert seed (4.8 kg/ha) + Pretilachlor 50 EC 0.9kg/ha +1 HW	3.04	12.00	36.25	257	130
2	Live seed 1.50 Kg/ha (cv.NJ 7010) + inert seed (4.5 kg/ha) + Pretilachlor 50 EC 0.9kg/ha +1 HW	3.89	9.17	35.47	240	147
3	Live seed 1.9 kg/ha(cv. NJ 7010) + inert seed (4.1 Kg/ha) +1 HW	3.84	9.93	38.35	253	134
4	Live seed 2.25kg /ha (cv.NJ 7010) + inert seed (3.75Kg/ha) + 1 HW	4.16	8.23	34.15	256	131
5	Live seed 2.6 kg/ha (cv NJ 7010) + inert seed (3.4 kg/ha) + 1 HW	3.77	8.77	38.00	262	125
6	Live seed 3.0 kg/ha (cv NJ 7010) + inert seed (3.0 kg/ha) + 1 HW	5.61	6.73	38.40	323	64
7	Live seed 3.75kg/ha (cv NJ 7010) + inert seed (2.25 kg/ha) + 1 HW	5.35	6.80	35.71	357	30
8.	Live seed 6.0 kg/ha (cv NJ 7010) + inert seed (0 kg/ha) + 1 HW	5.32	7.30	39.13	387	00
9	Jute (JRO BA 3, 2.2 kg/ha) + Green gram (Cv. Virat 15 kg/ha) + 1 HW	2.92	12.53	36.48 * (6.0)	308	79
10	Control 6.0 kg/ha (cv. NJ 7010)	5.75	3.17	16.87	222	165
11	Live seed 6.0Kg/ha (cv NJ 7010)+ CRIJAF nail weeder (5-6 DAS)+1 HW	3.77	10.33	38.17	254	133
	S.Em±	0.53	0.74	3.06	19.65	19.65
	CD (p= 0.05)	1.55	2.17	9.01	57.63	57.63

*Figure in parenthesis denotes green gram grain yield

3.2 Upgraded mechanical weeder and novel herbicides for efficient weed management in *tossa* jute

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

Project Code: In-house project- JA 8.2

In a field experiment with upgraded mechanical weeder and novel herbicides for efficient weed management in jute, it was recorded that two times manual weeding (7 and 21 DAS) produced the lowest weed dry matter at 42 DAS (32.2 g/m²) and 60 DAS (18.1 g/m²) in *tossa* jute (Table 22). However, at 42 DAS, among the herbicidal and mechanical weed management methods, the lowest weed dry matter was noted either with ipfencarbazone @120 g/ha (PE) + nail weeder

at 15 DAS (44.2 g/m²) or with ipfencarbazone @120 g/ha (PE) + single wheel jute weeder at 21 DAS (48.6 g/m²). The highest *tossa* jute (cv. JRO 204) plant height (PH) at harvest (120 DAS) was recorded with two manual weeding treatments (352.4 cm). In the mechanical methods of weed management, the highest PH was recorded with nail weeder twice at 7 and 15 DAS (330.5 cm). Among the herbicidal and mechanical weed management treatments, it was observed that,

ipfencarbazone @120 g/ha (PE) + nail weeder at 15 DAS produced the tallest jute plant (327.8 cm) closely followed by the plant height (PH) obtained with ipfencarbazone @120 g/ha (PE) + single wheel jute weeder at 21 DAS (325.4 cm). Like PH, similar trends were observed in case of jute basal diameter (BD) at harvest. The highest

jute fibre yield was obtained with two manual weeding (36.04 q/ha). Among the herbicidal and mechanical weed management methods considered, application of ipfencarbazone @120 g/ha (PE) + nail weeder at 15 DAS produced higher fibre yield (34.25 q/ha).

Table 22: Effect of different weed management methods on weeds and fibre yield in *tossa* jute

Tr. No.	Treatment details	Dry weight of weeds (g/m ²)		PH (cm)	BD (cm)	Fibre Yield (q/ha)
		42 DAS	60 DAS			
T ₁	Manual weeding (<i>Nirani</i>) two times (7 DAS and 21 DAS)	32.18	18.14	352.4	1.76	36.04
T ₂	Nail weeder two times (7 DAS and 21 DAS)	41.56	21.23	330.5	1.68	34.25
T ₃	Single wheel weeder two times (10 DAS and 21 DAS)	58.45	24.47	320.4	1.64	30.20
T ₄	Nail weeder (7 DAS) + Single wheel jute weeder (21 DAS)	49.15	23.55	314.8	1.62	30.65
T ₅	Ipfencarbazone @ 90 g ai/ha	64.35	38.33	312.0	1.62	27.27
T ₆	Ipfencarbazone @ 120 g ai/ha	58.64	29.19	316.1	1.64	28.69
T ₇	Ipfencarbazone @ 90 g ai/ha + Nail weeder at 21 DAS	54.37	27.16	322.1	1.64	31.81
T ₈	Ipfencarbazone @ 120 g ai/ha + Nail weeder 21 DAS	44.25	25.46	327.8	1.68	34.22
T ₉	Ipfencarbazone @ 90 g ai/ha + Single wheel jute weeder at 21 DAS	61.17	31.55	324.9	1.66	30.48
T ₁₀	Ipfencarbazone @ 120 g ai/ha + Single wheel jute weeder at 21 DAS	48.65	29.87	325.4	1.67	31.65
CD (P=0.05)		4.35	2.98	11.86	0.043	2.70

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

3.3 Effect of different weed management strategies on the fibre yield of ramie

Kajal Das, S. Sarkar, B. Majumdar and R.K. De

Project Code: In-house project- RA 1.1

A field experiment was conducted at Ramie Research Station (Sorbhog, Assam) with 10 treatments of weed management (i.e. T₁-Pendimethalin 30% EC as pre-emergence (PE) @ 1.0 lt/ha + 1hand weeding (HW); T₂-Oxyfluorfen 23.5% EC (PE) @ 1.0 lt/ha + 1HW; T₃-Quizalofop-ethyl 10% EC as post-emergence (PoE) @ 38 g/ha + 1HW; T₄-Propaquizafop 10% EC (PoE) @ 1.0 lt/ha + 1HW; T₅-Pendimethalin 30% EC (PE) @ 1.0 lt /ha + Quizalofop-ethyl 10% EC (PoE) @ 38 g/ha (PoE; at 20 days after pre-emergence herbicide spray (DASp) + 1HW; T₆-Pendimethalin 30% EC (PE) @ 1.0 lt/ha + Propaquizafop 10% EC (PoE) @ 1.0 lt/ha at 20 DASp + 1HW; T₇-Oxyfluorfen 23.5% EC (PE) @ 1.0 lt/ha + Quizalofop-ethyl 10% EC (PoE) @ 38 g/ha at 20 DASp + 1HW; T₈-Oxyfluorfen 23.5% EC (PE) @ 1.0 lt/ha +

Propaquizafop 10% EC (PoE) @ 1.0 lt/ha at 20 DASp + 1 HW; T₉-Weedy check and T₁₀-Weed free (by HW) replicated thrice to study the effect of weed management strategies on the fibre productivity of ramie. It was observed that the maximum number of canes/m² (48) was recorded with T₇ and the lowest number of canes/m² was recorded with T₉. Similarly, the highest plant height was recorded with T₇ (169 cm). The highest basal diameter (1.52 cm) was also recorded with T₇ and that is at par with T₅ (1.51 cm) and T₈ (1.49 cm), respectively. The ramie fibre (un-degummed) yield followed the same pattern of yield parameters with different weed management methods. The highest total fibre yield (2124.6 kg/ha) was produced with T₁₀ (weed free) followed by T₇ (Oxyfluorfen 23.5% EC (PE) @ 1.0 litre/ha + Quizalofop-ethyl

10% EC (PoE) @ 38 g/ha at 20 DASp + 1HW) (1929.8 kg/ha) and the lowest fibre yield (481.5 kg/ha) was recorded with T₉ (weedy check or

unweeded). Similar trend was observed in both the varieties (cv. R-1411 or Hazarika and R 67-34 or Kanai) (Table 23).

Table 23: Effect of different weed management methods on the fibre yield of ramie

Treatments	Fibre Yield (kg/ha) Hazarika (cv. R-1411)				Fibre Yield (kg/ha) Kanai (cv. R-67-34)			
	1 st Cutting	2 nd Cutting	3 rd Cutting	Total (kg/ha)	1 st Cutting	2 nd Cutting	3 rd Cutting	Total (kg/ha)
T ₁	262.0	271.7	696.7	1230.4	108.9	219.1	765.6	1093.5
T ₂	304.1	405.4	698.9	1408.3	114.8	243.5	766.7	1125.0
T ₃	213.9	250.7	624.4	1089.1	104.8	209.3	748.9	1063.0
T ₄	179.1	183.1	608.9	971.1	92.8	193.5	645.6	931.9
T ₅	483.7	561.3	796.7	1841.7	198.3	292.0	807.8	1298.2
T ₆	349.6	445.7	782.2	1577.6	171.3	267.0	796.7	1235.0
T ₇	525.2	600.2	804.4	1929.8	213.5	348.9	824.4	1386.9
T ₈	405.0	520.2	785.6	1710.8	184.1	274.5	798.9	1257.4
T ₉	44.1	107.4	330.0	481.5	27.6	113.2	300.0	440.7
T ₁₀	581.3	645.5	897.8	2124.6	246.3	382.0	827.8	1456.1
CD (p=0.05)	81.37	113.52	181.82	-	66.13	60.84	135.74	-

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

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

Project Code: In-house project- JST 6.3

Plant composition dynamics studied in a 3×3 factorial treatment setup of weed control measures (rice straw mulch @ 5.0 t/ha+2HW (RSM), mungbean+1NW+1HW and 2NW+2HW) and jute plant populations (3.5, 5.0 and 6.7 l/ha with respective spacing of 30 cm × 9.5 cm, 30 cm × 6.6 cm, 30 cm × 5 cm) laid in an RBD with 3 replications. Jute (genotype JRO BA3) sown on plots of size 5m×4m and irrigated once on March 24, 2021. At 4 and 22 days after emergence (DAE), CRIJAF Nail Weeder (NW) operated in between the rows to build soil mulch. At 25 and 49 DAE, the plots manually weeded. Grown other set of sole mungbean, sole jute with one weeding at 32 DAE for comparison and sole jute with 10, 20 and 40 l/ha plant populations to examine self-thinning phenomenon in jute. Soil moisture, temperature during 5-17 DAE, oxygen diffusion rate (ODR) at 12 DAE, weed counts, manual weeding time, weekly plant height of jute, mung seed yield, basal diameter of plants at harvest (123 DAE), plot wise composition of

jute plants based on plant height (Large >300 cm, Medium 250-300 cm, Small 150-250 cm and Chad <150 cm), green weight of whole plants, fibre weight after retting and N, P, K and organic carbon status of soil samples were recorded and analysed. Soil moisture reduced at a faster rate in un-mulched plots. Mulches effectively improved soil hydrothermal regimes in the order RSM > NW > un-mulched (control) (Fig. 36). Seedlings were active and fresh until 17 DAE in mulch system. Oxygen diffusion rates (ODR) measured at 13 DAE recorded 303, 262 and 140.25 µg O₂ /m² /sec for NW, RSM and Control treatment, respectively (Fig. 36). NW is more promising than RSM to control weeds. RSM recorded significantly high grass dry weight (22.2 q/ha) and weeding required significantly higher mandays/ha (194.3). Bare soil and mungbean-intercropping had 12.4 and 9 q/ha grass dry weight and required 127.3 and 85.2 mandays/ha for manual weeding, respectively. Composition of large plants were static around 1.5 l/ha across

the treatments. On an average, large, medium, small and chad plant categories accounted for 73%, 21%, 6% and 0% of fibre productivity, 1.52 (37%), 1.09 (26%), 0.71 (17%) and 0.85 (20%) l/ha of the total plant population and 18.05, 7.55 and 3.09 and 0.0 g/plant fibre Fig. 36, respectively. Weekly plant heights improved in the order RSM > NW > Mung-intercrop (Fig. 36). With RSM, average plant height (372 cm), basal diameter (18.83 mm), fibre content (19.42 g/plant) of large plants were significantly higher. Stem growth rates (cm/day) were steadily higher for RSM (Fig. 36).

Average intercrop mung seed yield was 2.50 q/ha and sole mungbean seed yield was 13.75 q/ha. Growth rate of jute plants for the first 33 DAE with straw-mulched plants was significantly higher (0.95 cm/day). Most active period of growth was during 41-96 DAE (SMW 19-26) and sharply decreased (<3 cm/day) beyond 103 DAE. RSM recorded more biomass (60.7±14.9 t/ha) over others. However, differences in total green biomass and fibre yields were not significant. Plots with high soil available P, K and organic C (33-39, 140-184 kg/ha and 0.55%) recorded relatively higher biomass (75-88 t/ha) and fibre yield (53.2 -55.2 q/ha for straw mulch with 5 and 6.67 l/ha jute, 49.6 q/ha for mung-

intercropping with 5 l/ha jute and 47.2 q/ha for bare soil (2NW+ 2HW) with 3.5 l/ha jute population). There was no self-thinning in jute, even with high plant population of 10, 20 and 40 l/ha and weeding. No variation in the incidence pattern of diseases or insects and pests in jute observed owing to mung-intercropping or other weeding methods or plant density variations.

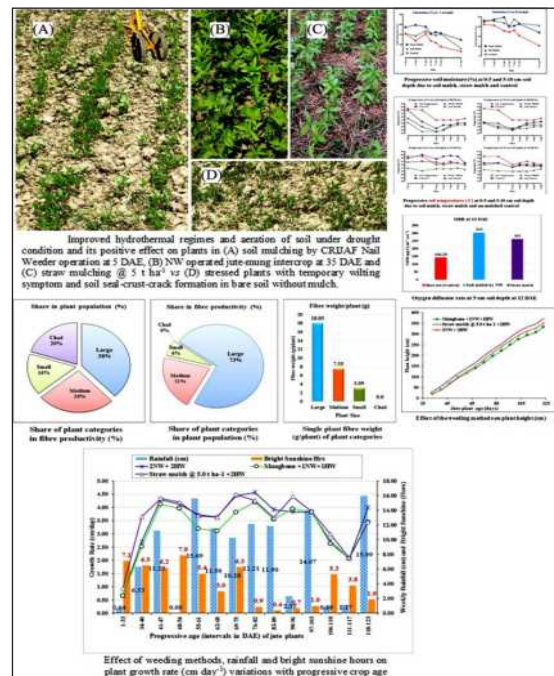


Fig. 36: Plant size composition and productivity of jute under weed management

3.5 Deficit irrigation scheduling in jute crop during dry periods of West Bengal

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

Project Code: In-house Project-JA 8.5

Drought events and sparse rainfall due to climate change in recent years are resulting in demand for agricultural water resources, requiring sustainable management addressing water use efficiency, timing, and irrigation water requirement (IWR). This study illustrates both water requirements and water use efficiency (WUE) and their effect on yield in jute (*Corchorus olitorius* L.) during the year 2021 for quantification of deficit irrigation. Procedures in this study was based on available soil moisture depletion (DASM) and crop evapotranspiration (ET_c), which maximize crop

production for deficit irrigation scheduling during early and peak vegetative crop growth period of two months, i.e. April and May. The water treatments applied were 50% DASM with 50% ET_c, 50% DASM with 75% ET_c, 75% DASM with 75% ET_c, 75% DASM with 100% ET_c, and Control (rainfed) under surface irrigation. The results showed that the highest fibre yield was obtained under 75% DASM with 100% ET_c (3.49 t/ha) followed by 75% DASM with 75% ET_c (3.37 t/ha) while lowest was observed in control (2.59 t/ha). Irrigation scheduling led to yield increments by 16-34% in comparison

to control treatment (rainfed). Water savings in irrigation at 75% DASM with 100% ET_c was 51.5% (IWR-121 mm) as compared to fully irrigated condition (IWR-250 mm). A small proportionate increase of optimum soil-water increased the same proportion of jute fibre yield. The highest WUE of irrigation treatments (75%

DASM with 75% ET_c) was equivalent to 1070 m^3/ha , which may be recommended as water application level in irrigation scheduling during dry periods (April-May). This relationship between yield and applied water will allow in improving the management of water resources under irrigation water scarcity.

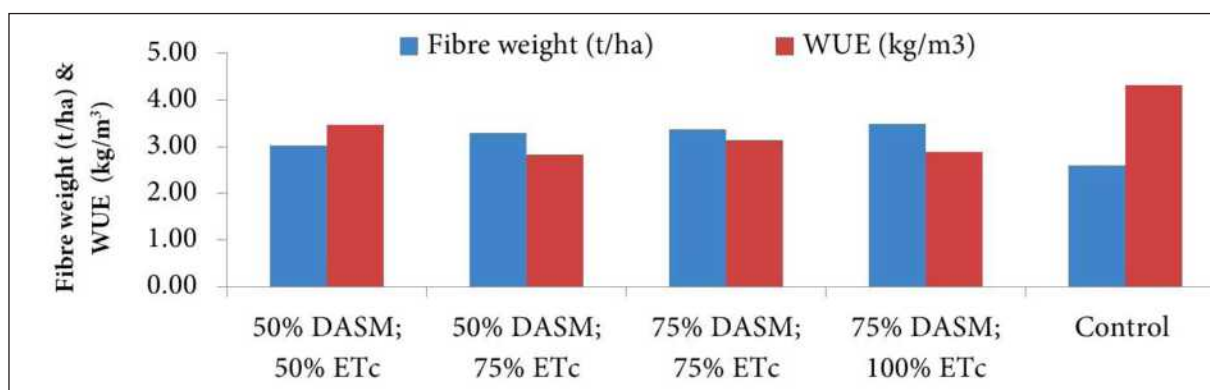


Fig. 37: Fibre yield and water use efficiency in different irrigation treatments of jute crop

3.6 Integrated farming system in jute and sisal under organic management package

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

Project Code: In House New Project- SLA 1.8

Integrated Farming System in jute and sisal was taken up at ICAR-CRIJAF, Barrackpore and Sisal Research Station, Bamra respectively, to enhance crop productivity and evaluate the performance of different components taken up in IFS Model. In the Sisal-based IFS, around 52% of total input costs were met through by-products from other enterprises, as calculated in the model. In the field, animal waste such as vermicompost, sisal waste, and oil cakes were used as manure. Poultry litter and cow dung was also utilized as fish feed. Weed and pest infestations were reduced as a result of the integration of several IFS components. Due to the integration of multiple farm operations and

recycling of crop residue and by product inside the system itself, 114% increase in profit was recorded along with 226-man days/ha increase in employment generation. The Jute Based IFS experiment was initiated by cultivating jute followed by paddy, legumes, oilseeds, vegetables, spices, medicinal and aromatic plants and maize crops. Papaya and banana were planted on embankment of the pond. Pisciculture, apiary, vermicompost, and mushroom farming were also integrated into the farming system. When compared to the traditional jute-based cropping sequence, there was 38% rise in net income and 51% increase in job creation.

Table 24: Economics of sisal and jute based farming system

Economical parameters	Sisal based IFS				Jute based IFS			
	Farmers' Practice	IFS	Net Income	% Change	Farmers' Practice	IFS	Net Income	% Change
Gross Return (₹)	113400	187302	73902	65	165398	236578	71180	43
Cost (₹)	69282	92847	23565	34	92654	135981	43327	46
Net Profit (₹)	44118	94455	50337	114	72744	100597	27853	38
Employment Generation (Man days)	108	226	118	109	173	262	89	51



Fig. 38: JAF crop based integrated farming system at Barrackpore (West Bengal) and Bamra (Odisha)

4. Area Expansion under JAF Crops

4.1 Expansion of flax area in pilot scale with improved technologies

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

Kajal Das and K. Shiva Kumar

Project Code: In House Project-JA8.4

The project entitled “Project expansion of flax area in pilot scale with improved technologies” was initiated with the aim to identify suitable areas for pilot scale demonstration of improved technologies of fibre flax and to create awareness among the farmers to develop an action plan for flax area expansion in the country. A total of 11 villages covering 9.0 ha area involving 35 farmers were identified in Pratapgarh, Uttar Pradesh; Nagaon, Assam and Coochbehar district of West Bengal for demonstration of improved fibre flax variety ‘JRF 2’ and improved production technologies of flax. The detail study of the socio-economic conditions of the selected villages revealed that in two villages of Coochbehar (Jay Gopalganj & Durganagar), the average land holding of 60% farmers were in the range of 0.2 – 0.5 ha and the average annual income of 40% people ranged between ₹ 20,000 and 35,000 and 35% farmers had annual income higher than ₹ 30,000/-. The prevalent cropping system was jute-rice-potato. At Barpeta and Nagaon districts of Assam, the average land holding of the farmers

varied between 0.2 – 0.8 ha and average annual income ranged between ₹ 30000 – 40000. The prevalent cropping systems were jute-rice-mustard/vegetables in Nagaon and jute-rice-potato / vegetables / fallow at Sorbhog, Assam.

The rainfall probability analysis of the target areas, i.e., Nagaon and Sorbhog districts of Assam, Coochbehar district of West Bengal and Pratapgarh district of Uttar Pradesh during the flax growing season were done. The results revealed that the weekly rainfall distribution was congenial at Nagaon, Assam for flax cultivation during 42nd to 1st standard meteorological week (SMW) (corresponding to mid-October to 1st week of January) at both 50% and 70% probability levels, which would facilitate the germination and support crop growth of fibre flax up to 60 days after which 1-2 irrigation may be needed. However, at Coochbehar, the rainfall probability analysis revealed that irrigation has to be provided to ensure crop establishment and crop growth in flax throughout the growth period. The

analysis of monthly rainfall distribution both at Pratapgarh (Uttar Pradesh) and Sorbhog (Assam) revealed the need of irrigation for sustaining crop growth during November to early February. The temperature data also

revealed that the optimum sowing time for fibre flax was end-October to mid-November at all the selected locations. The soil of the targeted areas varied in their physico-chemical properties.

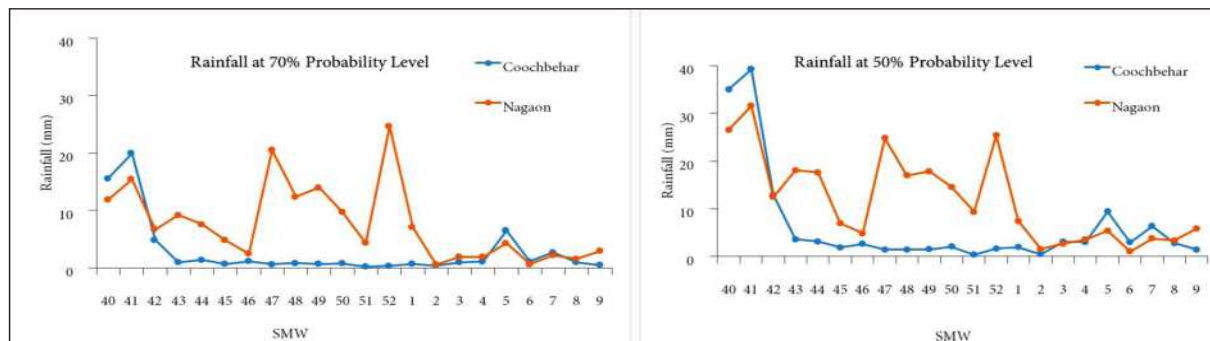


Fig. 39: Rainfall probability analysis during flax growing season at Nagaon and Coochbehar

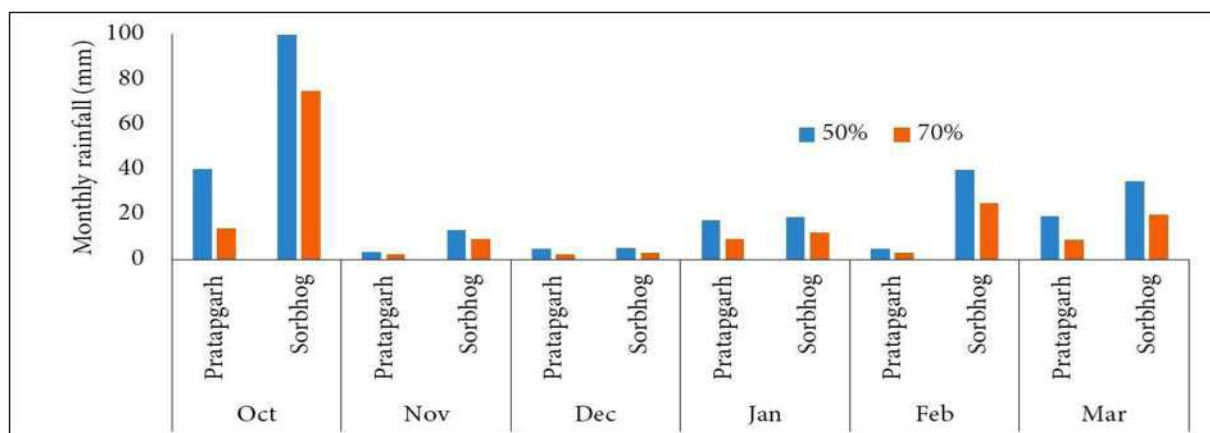


Fig. 40: Rainfall probability analysis during flax growing season at Sorbhog and Pratapgarh

4.2 Area expansion strategy under sisal farming in India with modern production technologies

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

Project Code: In House New Project- SLA 1.9

Farmers training programs were organized in Odisha and Meghalaya, where 302 nos farmers were trained regarding production technologies and profitability of sisal plantation. Liaison was made with different KVK, NGO and Line department officials for area expansion and renovation of existing sisal plantations. Planting materials like 1,75,000 bulbils and 60,800 suckers were produced at SRS, Bamra out of which 40,000 bulbils

were supplied to Meghalaya State. Project Directorate Watershed under MGNREGA, Sambalpur and DFO, Rehrakhol, Odisha have taken initiatives for planting of 1,52,000 suckers and 65,000 suckers respectively. Efforts are being taken to popularize sisal for soil conservation purpose, watershed development, live fencing and as a profitable crop in marginal land, adopting the intercropping system.

4.3 Area expansion strategy under ramie farming in northeastern India with improved genotypes and technologies

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

Project Code: In House New Project- RA 1.2

Initiatives were taken for expansion of area under ramie plantation to various geographical areas across northeastern India and efforts have been made for creating standardized social database for the same. In this programme, awareness and training of farmers on ramie-based farming system, demonstration of the best available packages and technological and physical inputs to the beneficiary farmers has been provided. Meetings and discussion were

held with different stakeholders for ramie area expansion in the respective states. For new plantation, 70 quintals of ramie rhizomes have been provided and planted at Sorbhog (Assam) and Simkalangre (West Garo hills, Meghalaya). Availability of 40 q planting materials has also been ensured. Plantation in 5 ha area at Ramie Research Station, has been planned to meet the demand of quality planting materials during 2021-22.



Fig. 41: Awareness programme on expansion of ramie cultivation in Meghalaya

5. Farm Mechanization

5.1 Functional performance evaluation of multi-crop seed drill

R.K. Naik, A.K. Ghorai, S. Sarkar and S.K. Jha

Project Code: In-house Project-JAE 3.4

The manually operated multi-crop seed drill (jute seeder) has been improved based on the on-farm trial at ICAR-CRIJAF Research Farm, Barrackpore. For easy movement of machine in the field and to reduce drudgery in operation, two sealed ball bearings are fitted on the drive/ground shaft. The furrow openers of the machine have been modified to prevent deep furrow in the field. The length and shape of the pegs on the ground wheels are modified for smooth movement of the machine. The handle has been modified for easy pulling of machine by the operator. The seed covering chains are modified

for thorough covering of drilled seed in the furrow. The functional performance evaluation of the seeder was carried out in the farmers' field in all jute growing states under Jute-ICARE programme. For functional performance evaluation in all the locations, the seed rate was found to be 3.5-4.0 kg/ha. The depth of seed placement was varied from 10 mm to 15 mm. The operational speed of implement in the field was varied from 2.0-2.5 km/h. Effective field capacity (EFC) of the machine was varied from 0.25 to 0.28 ha/h with field efficiency of 90-95% with mean draft of operation 85.02 N.

After operation of the machine, the farmers' feedback was as follows:

- It was easy in filling of seed in the seed box.
- There is visibility of seed quantity inside the box during operation and which helps in addition of seed as per the requirement.
- It was easy in operating the machine and there is reduction in drudgery while operating the seeder.
- The machine is women farmer friendly.



Fig. 42: Manual driven multi-crop seed drill

5.2 Performance evaluation of improved fibre extractor for flax

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

Project Code: In-house Project-JAE 3.5

An improved fibre extractor for flax has been evaluated at ICAR-CRIJAF, Barrackpore (Fig. 43). The conveyor belt at the inlet side of the machine facilitates continuous feeding of flax straw. For machine operation, two operators are required; one for feeding the straw and other for collection of scutched fibre. Retted and dried flax straw was used for extraction of fibre. During performance evaluation test, it was found that the machine can deal 450-480 kg of retted and dried straw in a day and produce 40-45 kg fibre. The fibre recovery from the straw was found to be 14% on green weight basis and 52% on dry weight basis. The machine can extract flax straw of 1 ha area in 7-8 days. The fibre extraction with the machine reduces drudgery and as well labour requirement to 12-14 man-days/ha. The machine gives higher fibre recovery with



Fig. 43: Improved fibre extractor for flax

extraction efficiency of more than 90%. This flax fibre extractor is very easy to use and no specific skill is required to operate or adjust the machine. The machine is very ideal for small as well as large flax growers. The machine can provide entrepreneurship development in natural fibre production and sale.

6. Post-harvest Processing and Retting

6.1 Development of technology for jute retting under free-flowing water condition for quality fibre production

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

Project code: NFSM-CC Project

Free flowing jute retting technology system has been conceptualized by the institute to achieve slow moving water condition for quality fibre retting. The technology consists of six numbers of retting chambers with one reservoir and one

buffer chamber. In this system a 1 hp submersible solar Hybrid pump creates circulation of water in the corresponding chambers. The pump is operated by solar energy during the day time and in the night it is operated either

by battery power or electricity. The pumping system consists of solar panel, solar-hybrid submersible motor with pump (1 hp), battery, inverter, changeover switch etc. It was found that the retting of jute completes in 10-12 days with addition of microbial formulation 'CRIJAF SONA'. Due to faster retting there is increase in fibre recovery with fibre strength of 24.80-25.4 g/tex and fibre fineness of 2.65-2.74 tex. The technology is being promoted through

various training and awareness programme for farmers, entrepreneurs and other stakeholders. This retting technology reduces drudgery, more hygienic and healthy because farmers need not to stand long time inside muddy polluted water body. Loading, unloading of jute bundles, stripping of fibre can be done from the wall of the retting structure itself. Therefore, chances of water borne diseases and problems of snakes, snails, etc can be avoided.



Fig. 44: Jute retting tank with free flowing water condition

6.2 JROB-2 cultivar of jute for bioethanol production

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

Project code: DST-WB Project

A study was undertaken to screen 16 jute genotypes for superior biomass quality and quantity. Jute plants were harvested at 120 days after sowing. Plant height, basal diameter, fresh and dry biomass were taken after harvest. JROB-2 showed a higher plant height (434 cm), fresh (5.4 kg/m²) and dry biomass (1.71 kg/

m²). The dry biomass was then used to assess the cellulose content. Out of the 16 genotypes, JROB-2 recorded the highest cellulose content (68.9 mg/g dry weight). This suggests that JROB-2 has superior quality and higher biomass for bioethanol production and is most suitable among the cultivated varieties.

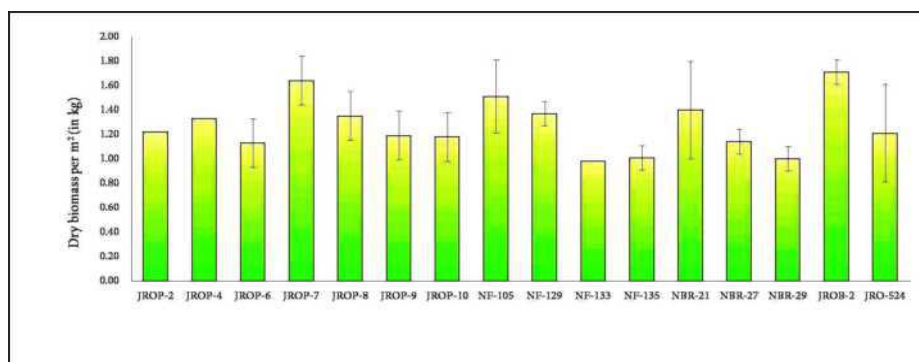


Fig. 45: Dry biomass content of jute genotypes

6.3 Retting of jute using liquid formulation of CRIJAF SONA

B. Majumdar, S.P. Mazumdar, S. Sarkar and S.K. Jha

Project Code: In-house Project-JA 7.7

Twenty-three large scale retting trials of jute were carried out in different parts of North 24 Parganas, Nadia, Murshidabad and Uttar Dinajpur districts utilizing 12 months old liquid (spore based) formulation of “CRIJAF SONA” during July to September, 2021 (Fig. 46). The details of the results are given in Table 25. The retting of jute completed in 11 to 15 days in all the four districts, with a mean value of 12.5, 13.1, 13.25 and 13.6 days respectively in Murshidabad, North 24 Parganas, Uttar Dinajpur and Nadia districts. The resultant jute fibre 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%. Retting without liquid CRIJAF SONA recorded retting duration of 16 to 23 days in all the districts with a mean value of 19.2 days, lower fibre strength of 19.25 g/tex, lower fineness of 3.18 tex and higher root content of 11.25%.

Comparative performance of liquid formulation of CRIJAF SONA under different retting methods: The jute retting efficacy of liquid formulation of CRIJAF SONA was evaluated under three different retting methods developed by ICAR-CRIJAF viz., slow moving water, stagnant water retting in concrete tank,

and stagnant water retting in in-situ retting pond during the retting period of 2021 at ICAR-CRIJAF, Barrackpore. The day to day retting water samples were collected from each system and analysed for microbial population and different enzymes related to retting and for physico-chemical properties. The details of the results are given in Table 26. The jute retting with liquid CRIJAF SONA completed in 12 to 14 days in all the three retting methods compared to retting without CRIJAF SONA which took 17 to 21 days. In all the three systems, pH of retting water decreased in post retting water as compared to pre retting water. The electrical conductivity in post retting water of stagnant water retting in concrete and in-situ retting tank was higher as compared to retting with slow moving water. The enzymatic activities (polygalacturonase, pectin lyase and xylanase) were higher in slow moving water retting compared to stagnant water retting might be due to higher oxygen availability to the associated microbes resulting in higher enzymatic activities. There was minor variation in N, P, Ca+Mg, bicarbonate content in different jute retting methods except K content which was higher in post retting water of stagnant water retting compared to slow moving water retting.

Table 25: Performance of liquid formulation of CRIJAF SONA on retting of jute

Locations (West Bengal)	Nos. of retting trial	Retting duration (days)	Fibre strength (g/ tex)	Fibre fineness (tex)	Root content (%)
North 24 Parganas	10	11 - 15 (13.1)	23.8 - 26.3 (24.45)	2.55 - 2.75 (2.66)	2.00 - 6.54 (4.51)
Nadia	05	13 - 15 (13.6)	23.2 - 24.2 (23.7)	2.66 - 2.72 (2.69)	5.65 - 6.5 (6.01)
Murshidabad	04	12 - 14 (12.5)	23.8 - 26.2 (25.07)	2.62 - 2.71 (2.65)	6.5 - 7.5 (6.97)
Uttar Dinajpur	04	12 - 14 (13.25)	22.8 - 25.2 (23.90)	2.62 - 2.70 (2.66)	5.60 - 6.20 (5.84)

Note: Mean values of each parameter are given in parenthesis



Fig. 46: Application of liquid CRIJAF SONA for jute retting and golden fibre production

Table 26: Changes in physico-chemical properties of retting water under different retting methods

Parameters	Retting in slow moving water		Stagnant water retting in concrete tank		Stagnant water retting in In-situ retting tank	
	Pre-retting	Post-retting	Pre-retting	Post-retting	Pre-retting	Post-retting
pH	7.05	6.35	7.07	6.85	7.61	6.83
EC ($\mu\text{S}/\text{cm}$)	305	1074.5	589	1262	372	1201
N (mg/l)	3.8	33.75	6.2	43.5	15.3	32.7
P (mg/l)	2.04	5.53	2.01	6.82	1.79	7.67
K (mg/l)	15.66	44.53	16.97	89.37	12.51	79.81
Ca+ Mg (ppm)	24.05	105.85	23.71	105.1	31.20	104.69
Bicarbonate (me/l)	1.61	7.57	1.37	7.58	2.57	8.09



CROP PROTECTION

Overview

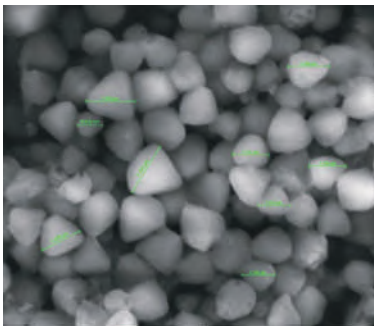
Productive agriculture systems are always vulnerable to hazards of climate and pests & diseases causing threat to crop production. In the changing climatic scenario, the crops are facing a wider range of pests and disease outbreaks and making the JAF crop production unstable. The Crop Protection Division 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, 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 2021

- The productivity index of SpobNPV was maximized through appropriate host, inoculation and incubation parameters.
- The antibiosis effect was highest in jute accessions WCIN 123 and WCIN 179 (*C. aestuans*); WCIJ 34 (*C. pseudo-olitorius*).
- Trichoderma isolates CJMR180, CJMR191 and CJMR193 consistently performed superior against two or more pathogens and adjudged to be the best antagonist.
- Foliar spray of fenpyroximate 5EC@1.5 ml/lit in jute varieties JRO 204 and JROG was most effective for mite control.
- Sunnhemp wilt incidence increases with increase in minimum temperature coupled with increase in rainfall and soil moisture.
- Integrated Disease Management (IDM) through seed treatment, intercropping and antagonist was standardised for sunnhemp wilt disease.
- Nano-carbendazim @ 10^{-6} is effective in suppressing *M. phaseolina* which inhibited the growth of the pathogen completely.



RESEARCH

1. Biological Control of Insect Pests and Diseases

1.1 Productivity Index of *Spilosoma obliqua* NPV

V. Ramesh Babu, G. Sivakumar and S. Satpathy

Project Code: In-house Project-JE 2.0

One of the major pre-requisites in the usage of baculoviruses as biocontrol agent is the need for *in vivo* production, since baculoviruses are obligate pathogens. The availability of mass reared host insects necessitates the optimization of virus production, which therefore requires selection of the appropriate larval stage and weight for infection with baculovirus and also standardization of inoculum dose to permit maximal larval growth resulting in higher occlusion bodies (OB) yield/larva. Therefore, to determine the productivity index of *SpobNPV*, two larval stages of hairy caterpillar, *Spilosoma obliqua* were evaluated with three infective doses of viral inoculum which were calibrated based on the median lethal concentration (LC_{50}) assessed earlier.

Leaf dip bioassay was conducted with eight concentrations of NPV against third instar larvae and the median lethal concentration (LC_{50}), obtained was 3.09×10^6 OBs/ml. Three doses of viral inoculum, viz. 3×10^4 , 6×10^4 and 6×10^5 OB/larva, were tested on 2nd - and 3rd -instar larvae weighing 47 mg and 140 mg,

incubated at 28°C temperature (Table 27). Maximum POB yield, 3.97×10^8 /larvae was obtained from the 2nd instar larva post 5 days after treatment with the viral inoculum of 3×10^4 POB/ml (Fig. 47). The occlusion bodies (OBs) per milligram (mg) weight (1.72×10^6 OBs/mg) of the insect body was also maximum for this inoculum dose. Similarly, the ratio of yield to inoculum dose was maximum for this inoculum dose, 1.32×10^4 (Table 27). Against the third instar larvae, the highest virus yield of 6.36×10^8 POB/larvae was obtained upon incubation with the lowest viral dose 3×10^4 OB/larva (Fig. 42). The occlusion bodies (OB's) per milligram (mg) weight of the insect body was also maximum for this inoculum dose. The productivity ratio was maximum for this inoculum dose, 2.12×10^4 . The *SpobNPV* yield decreased gradually with increase in the viral inoculum dose. The study revealed that for maximum productivity index of *SpobNPV* the best combination of infecting third larva instar, with larval weight of 140mg and with a viral inoculum dose of 3×10^4 POB/ml.

Table 27: NPV yield from larva of *S.obliqua* post infection with *SpobNPV*

Infection dose	DAT (duration $\pm$ S.E)	Avg Wt (mg $\pm$ S.E)	Yield (POB/ larvae)	POB/mg	Ratio (Yield:Dose)
Second instar larva					
3×10^4 POB/ml	5.04 ± 0.62	231 ± 11.2	3.97×10^8	1.72×10^6	1.32×10^4
6×10^4 POB/ml	4.16 ± 0.51	163 ± 14.6	1.73×10^8	1.06×10^6	2.88×10^3
6×10^5 POB/ml	3.73 ± 0.39	97 ± 10.3	7.71×10^7	7.95×10^5	1.28×10^2
Third instar larvae					
3×10^4 POB/ml	5.29 ± 0.81	345 ± 21.3	6.36×10^8	1.84×10^6	2.12×10^4
6×10^4 POB/ml	4.41 ± 0.77	219 ± 11.2	2.12×10^8	9.68×10^5	3.53×10^3
6×10^5 POB/ml	3.13 ± 0.29	166 ± 13.7	5.49×10^7	4.73×10^5	9.15×10^1



Fig. 47: Second instar larvae at optimum stage for POB extraction



Fig. 48: Third instar larvae at optimum stage for POB extraction

1.2 Isolation of native *Bacillus thuringiensis*

V. Ramesh Babu, G. Sivakumar and S. Satpathy

Project Code: In-house Project-JE 2.0

A total of 15 soil samples from jute growing villages (Panchkania, Kumro, Habra) adjoining ICAR-CRIJAF were collected for isolation of native microbial bio agent viz. *Bacillus thuringiensis*. Isolation of entomocidal bacterial isolates was carried out using standard protocols for ensuring bacterial growth on the respective media i.e. initial incubation of 4 hrs at 37°C in nutrient broth containing 0.25M sodium

acetate and heat shock treatment at 80°C for 10 min and finally incubating at 30°C for 3-5 days. The colony characters and Gram's staining results indicated the bacterial colonies to be rod shaped bacteria of genus *Bacillus*. Purification and isolation of the spore crystal mixture of cry toxin from the *Bt* cultures was carried out. The toxicity of the isolated toxin will be determined against lepidopteran pests of jute.

1.3 *In vitro* assessment of *Trichoderma* isolates against soil borne pathogens

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

Project Code: In-house Project-JM 9.2

A total 33 *Trichoderma* isolates collected from diverse edaphic condition, including four from commercial formulations (AGRI-TV, AGRI-TH, Ecoderma, Ecoderma-H), were tested *in vitro* against two soil borne pathogens viz, *Rhizoctonia* sp. and *Macrophomina phaseolina*. Growth inhibition ability of *Trichoderma* isolates CJMR191 and CJMR193 was best in

suppressing the vegetative growth of *Rhizoctonia* sp (Fig. 50). These caused 68% and 68.6% growth inhibition, respectively. Efficacy of these isolates was comparable with those originated from the commercial formulations (AGRI-TV and AGRI-TH). *Trichoderma* isolate CJMR191 was best in growth suppression of *M. phaseolina* (Fig. 51). It outperformed those isolated from

the commercial formulations. CJMR191 caused 72.2% growth suppression of the test pathogen. The third soil borne pathogen, *Sclerotium* sp. was effectively suppressed by different *Trichoderma* isolates (Fig. 52). Vegetative growth of the pathogen was inhibited to maximum extent by *Trichoderma* isolate CJMR180 resulting in 76.9% suppression. Isolates CJMR184, CJMR190 and CJMR191 caused 74.9–74.3% growth suppression. CJMR180, CJMR191 and CJMR193 consistently performed superior against two or more pathogens.

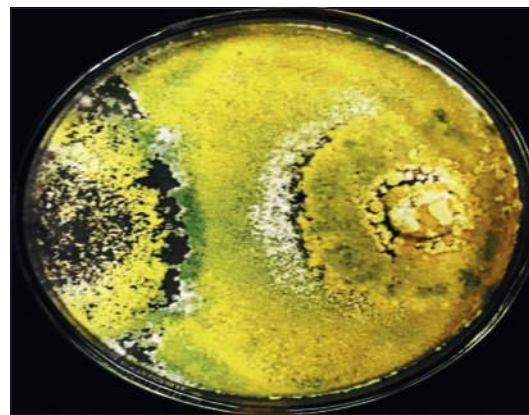


Fig. 49: Inhibition zone created by *Trichoderma* isolates

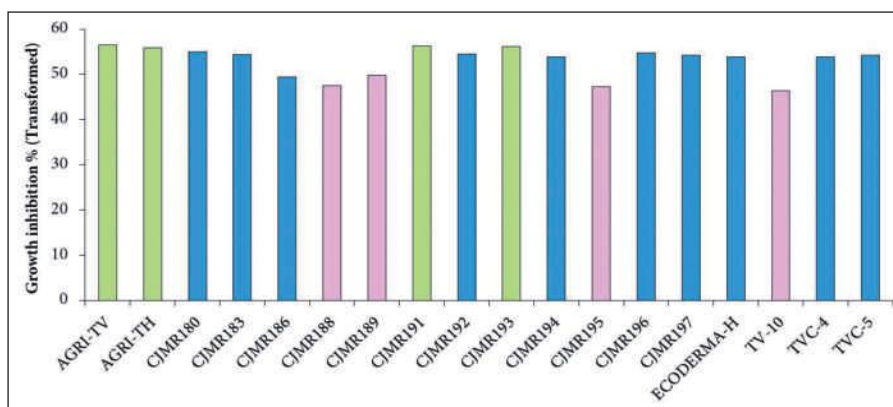


Fig. 50: Growth inhibition of *Rhizoctonia* sp. by *Trichoderma* isolates in dual culture assay

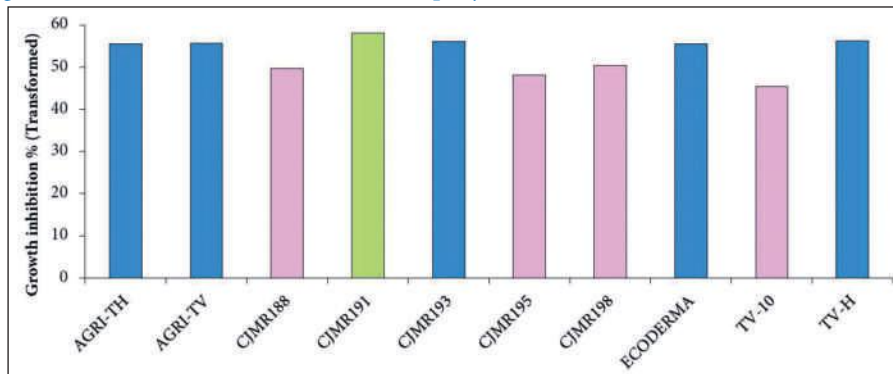


Fig. 51: In vitro growth inhibition of *M. phaseolina* by *Trichoderma* isolates

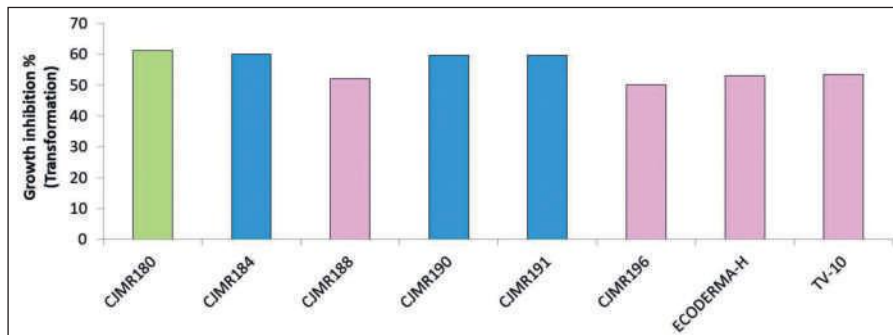


Fig. 52: In vitro growth inhibition of *Sclerotium* sp by *Trichoderma* isolates

2. Host Plant Resistance

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

B.S. Gotyal, S. Satpathy and V. Ramesh Babu

Project code: In house Project-JE 2.1

The wild jute germplasms are useful sources of genes for insect resistance to biotic stress, when the resistance within the crop species is absent. Mechanism of insect resistance among the wild jute species based on comparative biological parameters of jute hairy caterpillar was studied. The larval growth pattern indicated maximum antibiosis effect in wild jute species. The initial larval weight gain, cumulative larval weight and larval survival was significantly least in the accessions belonging to wild species, *C. aestuans* and *C. pseudo-olitorius* (Table 28). The larvae couldn't survive for 10 days of feeding in *C. aestuans*. In case of *C. pseudo-olitorius* the larval weight gain ranged from 0.00mg (WCIJ034) to 32.84 mg (WCIN-114). The weight gains in capsularis and olitorius

germplasm was significantly higher than the wild species. Similarly, larval weight and survival was also significantly less in wild compared to the cultivated species. Least larval duration was recorded in *C. aestuans* i.e. 13 days (WCIN-09), 11 days in WCIJ-123 and WCIN-179 as compared to *C. pseudo-olitorius* i.e. 14.33 days (WCIJ-034) and 21.46 days (WCIN-114). Whereas, it was maximum in cultivated species and it ranged from 18.86 (OIN-154) to 21.53 (JRO-204).

The growth index was highest in *C. capsularis* (2.87) indicating the more susceptible species than *C. olitorius* species (2.49). In wild species the growth index was zero that indicates the high degree of antibiosis which impaired the life cycle of jute hairy caterpillar (Fig. 53).

Table 28: Comparative larval growth parameters of jute hairy caterpillar on wild and cultivated jute species

Jute species (Accessions)	Larval Weight gain (15 Days)	Larval weight (mg)	Larval survival (%)	Larval duration (Days)
<i>C.aestuans</i>				
WCIN-09	00.00 (0.71) ^d	00.00 (0.71) ^d	00.00 (0.71) ^e	13.00 ^{de}
WCIJ-123	00.00 (0.71) ^d	00.00 (0.71) ^d	00.00 (0.71) ^e	11.00 ^e
WCIN-179	00.00 (0.71) ^d	00.00 (0.71) ^d	00.00 (0.71) ^e	11.00 ^e
<i>C.pseudo olitorius</i>				
WCIJ-34	00.00 (0.71) ^d	00.00 (0.71) ^d	33.33 (5.75) ^d	14.33 ^{cd}
WCIN-114	32.84 (5.74) ^c	50.62 (7.13) ^c	86.66 (9.33) ^a	21.46 ^a
WCIN-184	27.93 (5.33) ^c	46.39 (6.84) ^c	53.33 (2.40) ^c	16.30 ^c
<i>C. capsularis</i>				
CIJ-12	395.77 (19.82) ^a	413.89 (20.28) ^a	93.33 (9.68) ^a	20.60 ^{ab}
CIJ-42	420.61 (20.50) ^a	436.10 (20.88) ^a	96.60 (9.85) ^a	20.26 ^{ab}
JRC-412	376.00 (19.41) ^a	391.07 (19.78) ^a	93.30 (9.67) ^a	21.43 ^a
<i>C. olitorius</i>				
OIN-125	255.53 (15.98) ^b	274.91 (16.58) ^b	80.00 (8.96) ^{ab}	20.53 ^{ab}
OIN-154	211.02 (14.49) ^b	227.71 (15.06) ^b	63.30 (7.95) ^{bc}	18.86 ^b
JRO-204	227.72 (15.09) ^b	243.39 (15.60) ^b	80.00 (8.96) ^{ab}	21.53 ^a
CD (P=0.05)	1.53	1.47	0.30	2.10

Figures in the parenthesis are square root transformed values

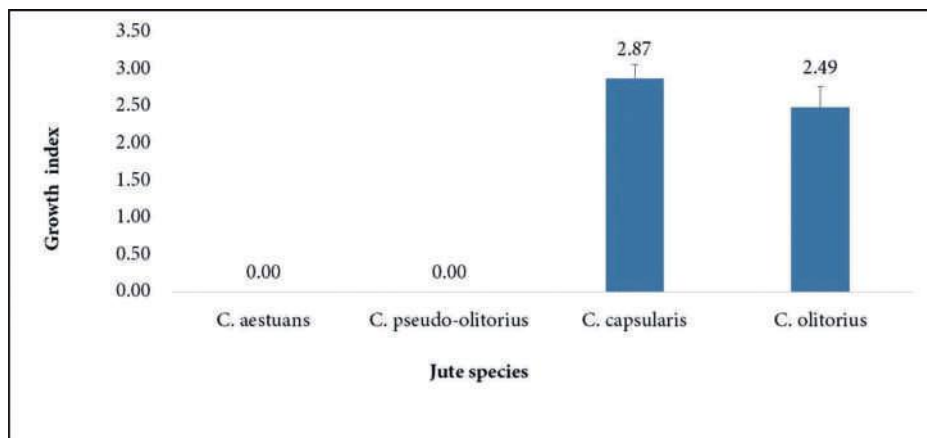


Fig. 53: Growth index of jute hairy caterpillar on wild and cultivated jute species

2.2 Identification of donor of stem-rot resistance in jute under sick plot conditions

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

Project Code: In-house Project-JM9.5

Based on the previous records, 95 olitorius jute germplasm were raised in sick plot during the period April to July, 2021 (Fig. 54). On the basis of relative incidence of stem rot, 12 germplasms viz., OIN-62, OIN-26, OIJ-193, OIM-23, OIN-236, OIN-142, OIN-391, OIN-904, OIN-

1040, OIN-908, OIN-891 and OIN-858 were identified to be absolutely free from the disease. These germplasms will be screened again both at hotspot, RRS Sorbhog, Assam as well as in sick plot at ICAR-CRIJAF, Barrackpore during the next season.



Fig. 54: Reaction of olitorius jute germplasms to stem rot infection in sick plot



Fig. 55: Field view of the experiment

2.3 Screening of *tossa* jute germplasms against stem rot under artificial inoculation

S.K. Sarkar

Project Code: In-house Project-JB 1.1

The stem of 70-day old jute plants were artificially inoculated with freshly isolated mycelial bits of *Macrophomina phaseolina* culture during jute growing season (April to August) (Fig. 56). Based on average length of the lesion developed (at 7, 15, 23 and 30 days after inoculation), the germplasms were grouped in to five groups viz. Gr. 1 (2.5 cm), Gr. 2 (2.5 - 3.0 cm), Gr. 3 (>3.0-4.0 cm), Gr. 4 (> 4.0-5.0 cm) and Gr 5 (>5.0 cm). The least susceptible germplasms were OIN 118 (2.03 cm), OIN 119 (2.12 cm), OIN 156 (2.13 cm) and OIN 146 (2.46 cm). Six germplasm i.e., OIN 154, OIN 158, OIN 113, OIJ 62, OIJ 71 and OIN 153 were adjudged in Gr.2. Based on the result of last three years ten germplasms namely OIN-118, OIN-119, OIN-156, OIN-154, OIN-

113, OIJ-62, OIN-114, OIN-140, OIJ-60 and OIN-161 germplasm were selected for further testing (Fig. 56).



Fig. 56: Stem inoculation technique for screening stem rot



OIN 118



OIN 119



OIN 156

Fig. 57: Few promising jute germplasm showing resistance against stem rot

3. Bio-ecology and Management of Insect Pests and Diseases

3.1 Integrated management of yellow mite of jute

S. Satpathy, B.S. Gotyal, V. Ramesh Babu, S.P. Mazumdar and S. Roy

Project Code: In-house Project-JE 1.9

Integration of acaricides and tolerant varieties for yellow mite management in jute: Effective acaricides and jute varieties relatively tolerant to yellow mite were evaluated for integrated management of this sucking pest under field condition. Both the factors i.e., acaricides and tolerant varieties manifested significant effect on mite infestation. During the peak infestation

period, the tolerant variety JRO 204 was significantly least infested and recorded 27.04 and 24.91 mites/cm², respectively. Another elite variety, JROG 1 also had significantly less mite density than JRO 2407 which is relatively more susceptible to mite. Foliar spray of fenpyroximate 5EC@1.5 ml/lit manifested significantly superior performance in reduction of mite population.

During the post treatment period, fenpyroximate 5EC@1.5 ml/lit recorded 26.53 and 22.59 mite/cm² mite density followed by spiromesifen 240 SC@0.8ml/l (30.63 and 25.39/cm² respectively). In tolerant varieties, the damage caused by the yellow mite was significantly less (Table 29). Fenpyroximate treatment significantly restricted the leaf damage to maximum extent. The main effect varieties and acaricides were significant on the fibre production due to effective control of yellow mite (Fig. 58). Maximum yield was obtained in JRO 204 (31.13 q/ha) being at par with JROG 1 (30.01 q/ha) and significantly higher than JRO 2407 (28.33 q/ha). Among the acaricides, fenpyroximate recorded

significantly higher yield (32.01q/ha) followed by spiromesifen (30.26 q/ha).

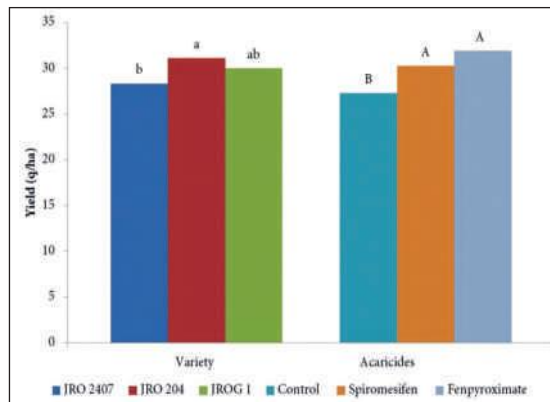


Fig. 58: Effect of varieties and acaricides on fibre yield of jute

Table 29: Effect of varieties and acaricides on damage grade due to mite infestation in jute

Acaricide	Damage grade			
	JRO 2407	JRO 204	JROG 1	Mean
Control	3.06	2.46	2.46	2.66 ^a
Spiromesifen 240 SC@0.8ml/l	3.13	1.66	1.73	2.17 ^b
Fenpyroximate 5 EC @1.5ml/l	1.73	2.53	2.00	2.08 ^b
Mean	2.64 ^a	2.22 ^b	2.06 ^b	
CD (P=0.05)	Variety- 0.38	Acaricide-0.38	Variety x Acaricide- NS	

Integration of soil-applied sulphur and tolerant varieties for yellow mite management in jute:

The role of soil applied sulphur (@ 30 and 60 kg/ha) and tolerant jute varieties for management of yellow mite was explored in a field experiment. Sulphur was applied @ 30 and 60 kg/ha in the soil just before sowing. The main effect of sulphur treatment and tolerant varieties was prominent in regulating the mite population in jute. During the first observation at 40 DAS, the mite infestation in the relatively tolerant varieties, JRO 204 (30.26/cm²) and JROG 1 (33.41/cm²) was significantly less than the most susceptible variety, JRO 2407 (41.96/cm²) (Table 30). Soil treated sulphur reduced the mite population to 30.07 and 35.14 mite/cm² compared to 40.51/cm² in control. At 55 DAS also significantly less mite density was

observed in JRO 204 (34.33/cm²) and sulphur applied @60kg/ha (37.21/cm²). The mite-tolerant varieties suffered less damage which was significantly less (1.71 to 2.11grade) than the susceptible variety, JRO 2407 (2.97 grade) (Fig. 61). The extent of damage due to mite infestation was significantly reduced due to sulphur application. In sulphur treated crop the damage grade varied from 1.73 to 2.22 being significantly less than the untreated control (2.84). Both the tolerant varieties had least mite infestation and recorded higher yield (37.39 and 36.41 q/ha) (Fig. 61), whereas application of sulphur showed positive impact by recording 37.94 q/ha fibre yield being significantly higher than control. The interaction effect of tolerant varieties and sulphur application had non-significant effect on mite damage and yield.



Fig. 59: Field view of the experiments



Fig. 60: Mite susceptible (S) and tolerant (T) varieties of jute

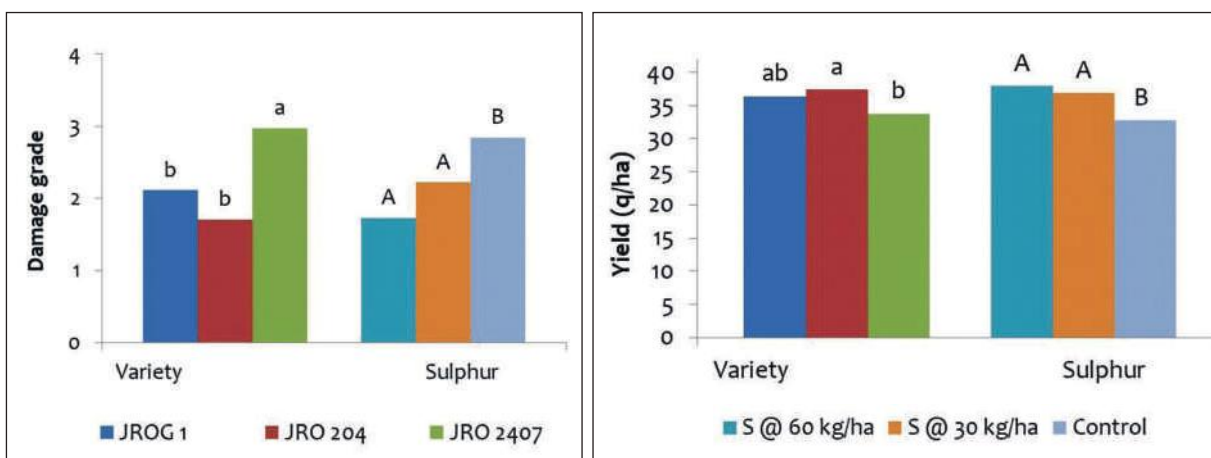


Fig. 61: Damage grade and yield in jute varieties at different level of sulphur treated soil

Table 30: Mite population density in jute varieties at different level of sulphur treated soil

Mite/cm ² (40 DAS)				
S-dose	JROG 1	JRO 204	JRO 2407	Mean
S @ 60 kg/ha	30.33	26.80	32.99	30.07 ^c
S @ 30 kg/ha	32.33	27.99	45.11	35.14 ^b
Control	37.55	36.21	47.77	40.51 ^a
Mean	33.40 ^b	30.36 ^c	41.96 ^a	
CD (P=0.05)	Variety- 2.58	Sulphur- 2.58	Variety x Sulphur-NS	
Mite/cm ² (55 DAS)				
S @ 60 kg/ha	36.88	32.22	42.56	37.21 ^c
S @ 30 kg/ha	42.22	31.53	48.18	40.65 ^b
Control	39.33	39.20	56.88	45.14 ^a
Mean	39.47 ^b	34.33 ^c	49.20 ^a	
CD (P=0.05)	Variety- 2.78	Sulphur- 2.78	Variety x Sulphur- NS	

3.2 Effect of sulphur on yellow mite infestation, damage and other growth parameters of jute

S. Satpathy, B.S. Gotyal, V. Ramesh Babu, S.P. Mazumdar and S. Roy

Project Code: In-house Project-JE 1.9

The effect of soil-applied sulphur on mite population, damage and plant growth parameters which regulate the yield was studied in a pot experiment (Fig. 62). The sulphur applied @ 30 and 60 kg/ha was incorporated in the pot soil before sowing of jute seeds (cv. JRO 8432). Plants grown in pots with soil-applied sulphur manifested significant variation in mite population density on jute leaves. The egg (26.27 and 22.94/cm²) and adult (20.38 and 24.44/cm²) population in plants raised on sulphur-applied soil were significantly less compared to the plants grown in soil without sulphur (32.00 and 32.05/cm²) (Table 31). Similarly, the damage grade was also significantly reduced (1.80 and 1.60) due to the enhanced nutritional effect because of sulphur application. Other yield attributing parameters like plant height, basal diameter and plant dry weight significantly proved the positive effect of sulphur application on soil (Table 31). Hence soil-applied sulphur has definite role to subside

the mite infestation as well as compensating the mite damage caused by desaping of the plants.



Fig. 62: View of the pot experiments

Table 31: Effect of sulphur on mite population, damage and fibre yield attributing parameters at different levels of sulphur application on jute

S-Dose	Mite population and damage			Fibre yield attributing parameters			
	Mite population/cm ²		Damage grade	Plant height (cm)		Basal Diameter (mm)	Dry weight (g)
	Adult	Adult		40 DAS	115 DAS		
S @ 60 kg/ha	20.83 ^c	22.94 ^c	1.60 ^b	73.66 ^a	204.16 ^a	24.86 ^a	24.11 ^a
S @ 30 kg/ha	24.44 ^b	26.27 ^b	1.80 ^{ab}	69.81 ^a	186.25 ^a	22.66 ^a	20.44 ^a
Control	32.05 ^a	32.00 ^a	2.46 ^a	56.05 ^b	143.58 ^b	18.11 ^a	13.77 ^b
CD (P=0.05)	2.79	2.63	0.26	8.72	39.65	NS	5.96

3.3 Epidemiology of sunnhemp wilt

K.V. Shiva Kumar and S.K. Sarkar

Project Code: In-house Project-SNHM 1.1

The role of various weather parameters on development of sunnhemp wilt was assessed at ShRS, Pratapgarh, U.P. It was observed that the

wilt symptoms initiated during 18th Standard Week i.e., (1st week of May). The relationship of sunnhemp wilt incidence with rainfall and

minimum temperature showed significant positive correlation, but it was non-significant positive correlation for soil moisture. Maximum temperature showed negative correlation with the disease development. Disease incidence increases with increase in minimum temperature coupled with increase in rainfall and soil moisture (Table 32).

Table 32: Correlation coefficient (r) between Sunnhemp wilt and weather

Weather parameters	Correlation coefficient (r)
Minimum Soil temp. (°C)	0.820*
Maximum Soil temp. (°C)	-0.123
Soil Moisture (%)	0.563
Cumulative rainfall (mm)	0.964*

*Correlation significant at 5 %; $R^2 = 0.96$

3.4 Management and epidemiology of flax wilt

S.K. Sarkar, K. Mandal, N. M. Alam and K. V. Shivakumar

Project Code: In-house Project-JM 9.1

Progress of vascular wilt of flax in different dates of sowing: Flax crops were sown in three different dates i.e. 30th Oct. (D₁), 15th Nov. (D₂) and 30th Nov. (D₃) at ICAR-CRIJAF Research Farm, Barrackpore. The progress of vascular wilt was recorded at 10 days interval starting from 30 days after sowing (DAS) and continued up to 70 DAS. The progress of the disease gradually increased with crop age in all dates of sowing (Table 33). However, the disease incidence gradually decreases in late sown crops and least incidence (up to 3.07%) was recorded in 30th November sown crop.

Table 33: Progress of vascular wilt of flax in different dates of sowing

Date of sowing	Incidence of vascular wilt of flax (%)				
	30 DAS	40 DAS	50 DAS	60 DAS	70 DAS
30 Oct. (D ₁)	2.10	3.20	4.33	5.20	6.47
15 Nov.(D ₂)	1.50	2.60	3.47	4.13	5.07
30 Nov. (D ₃)	0.00	0.73	1.53	2.27	3.07
CD (P= 0.05)	0.61	0.71	0.81	0.83	0.97

DAS= Days after sowing

Effect of sowing date, fertilizer and seed treatment on vascular wilt and seed yield: The date of sowing has significant effect on flax wilt with least incidence of vascular wilt (up to 3.07%) in third date of sowing i.e. 30th November (Table 34). Similarly, significant

reduction in disease incidence (3.5%) was recorded in seed treatment with carbendazim 50 WP @ 0.2% than the control plot (7.10%). Application of fertilizer registered no significant effect on vascular wilt. The interaction effect indicated least incidence of vascular wilt (2.2%) in carbendazim closely followed by seed treatment with *Trichoderma* formulation in 30th November sown crop. Third date of sowing on 30th November showed higher seed yield of 5.6 q/ha than D₁ (3.2 q/ha) and D₂ (3.6 q/ha). Fertilizer application and seed treatment had no effect on seed yield. Therefore, it can be concluded that the sowing of flax crop during mid-November, seed treatment with carbendazim 50WP @2g/kg seed or *Trichoderma* formulation @10g/kg seed not only significantly reduce the incidence of vascular wilt but also increase the seed yield.

Effect of atmospheric temperature on incidence of flax wilt under field condition:

The disease progress in different dates (30 October, 15 November and 30 November) of sowing in respect of maximum and minimum atmospheric temperature over last three years revealed that with lowering of mean atmospheric temperature wilt incidence decreases (Fig. 63). The decrease of disease with lowering of maximum temperature is more pronounced than decrease in minimum temperature.

Table 34: Effect of date of sowing, fertilizer and seed treatment on vascular wilt and seed yield of flax

Seed treatment	Sowing on 30 October (D ₁)				Sowing on 15 November (D ₂)				Sowing on 30 November (D ₃)			
	NPK-F1	NPK-F2	NPK-F3	Mean	NPK-F1	NPK-F2	NPK-F3	Mean	NPK-F1	NPK-F2	NPK-F3	Mean
Carbendazim	4.30 (3.67)	4.44 (3.14)	4.51 (3.42)	4.42 (3.41)	3.67 (3.51)	3.78 (3.48)	3.81 (3.67)	3.75 (3.55)	2.20 (6.07)	2.49 (5.44)	2.43 (5.37)	2.37 (5.63)
Trichoderma	5.12 (3.31)	5.20 (3.49)	5.07 (3.32)	5.13 (3.37)	3.97 (3.74)	4.19 (3.61)	4.28 (3.67)	4.14 (3.67)	2.58 (5.15)	2.56 (5.22)	2.82 (6.39)	2.65 (5.59)
Control	9.72 (2.80)	10.13 (2.82)	9.81 (2.86)	9.89 (2.83)	7.32 (3.74)	7.23 (3.59)	7.20 (3.41)	7.25 (3.58)	3.93 (5.63)	4.13 (5.85)	4.37 (5.56)	4.15 (5.68)
Mean	6.38 (3.26)	6.59 (3.15)	6.46 (3.20)	6.48 (3.20)	4.99 (3.66)	5.07 (3.56)	5.10 (3.58)	5.05 (3.60)	2.90 (5.62)	3.06 (5.51)	3.21 (5.77)	3.06 (5.63)
Mean	D1	D2	D3	F1	F2	F3	S1	S2	S3			
	6.47 (3.2)	5.07 (3.6)	3.07 (5.6)	4.73 (4.2)	4.87 (4.1)	4.90 (4.2)	3.50 (4.2)	3.97 (4.2)	7.10 (4.0)			
CD (P= 0.05)	Main plot effect			Sub plot effect= NS			Sub-sub plot effect			Other Interactions =NS		
	Wilt= 1.6; Yield= 0.53						Wilt= 0.3; Yield= NS					

Figure in parenthesis indicate seed yield (q/ha); F1=NPK:: 40: 40:40; F2= NPK:: 60:40: 60; F3= NPK:: 60:40: 80; S1=Carbendazim; S2= Trichoderma; S3= Control

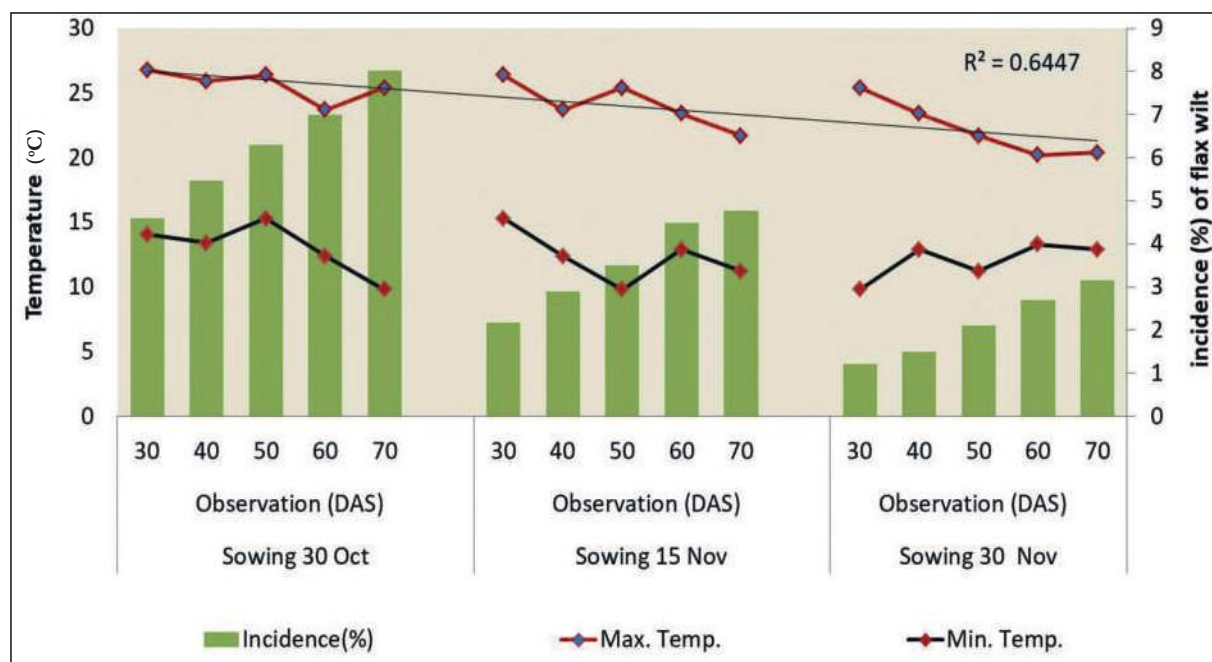


Fig. 63: Effect of temperature on incidence of flax wilt

3.5 Development of IPM module for jute and mesta

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

Project Code: In-house Project-JM 9.4

Development of robust seed treatment strategy for IPM module of jute: In a field experiment with pre-sowing seed treatment using fungicide, insecticide or biocontrol

agent either alone or in combination against stem rot disease and different sucking and leaf eating insect pests of jute, it was observed that incidence of stem rot and damages caused by

different sucking and leaf eating insect pests was minimum (9.4%) in carbendazim @ 2g/kg + imidacloprid @ 4g/kg treatment with highest dry fibre yield of 32.2 q/ha. It was better than any other treatment using either of the two components or *Trichoderma* with fungicide or insecticide. Soil application of bleaching powder @ 25 kg/ha, 7 days prior to sowing was

also very promising as it reduced the stem rot (15.1%). Simultaneous treatment of both soil with bleaching powder and seed with both carbendazim + imidacloprid was the best of all treatments tested to reduce the stem rot to 8.45% from 29.7% in check and yellow mite to 10.4 from 20.2 % in check and achieved the highest dry fibre yield of 34.2 q/ha (Fig. 64).



Fig. 64: Field view of the experiments

Alternative novel fungicide for seed treatment in jute: Kresoxim-methyl and azoxystrobin 23%SC are novel fungicides in the strobilurins group with very unique mode of action. Radial growth of the pathogen was reduced to 21 mm at highest dose of 2000 $\mu\text{g/ml}$, and 28 mm in 1000 $\mu\text{g/ml}$ Kresoxim-methyl compared to 90 mm in check. Growth inhibition was 77% at highest dose of 2000 $\mu\text{g/ml}$ and 69% at 1000 $\mu\text{g/ml}$. Azoxystrobin was also found effective against *M. phaseolina* in vitro. Radial growth was reduced to 16.3 mm at highest dose of 2000 $\mu\text{g/ml}$ and 18 mm in 1000 $\mu\text{g/ml}$ compared to 90 mm in check. Growth inhibition was 82% at

highest dose of 2000 $\mu\text{g/ml}$ and 80 % in 1000 $\mu\text{g/ml}$ (Fig. 65).



Fig. 65: Effect of Kresoxim-methyl and azoxystrobin on *M. phaseolina* in vitro

3.6 Integrated management of sunnhemp wilt

K.V. Shivakumar and S.K. Sarkar

Project Code: In-house Project-SNHM 1.1

Integrated Disease Management (IDM) approach was investigated at ShRS, Pratapgarh to combat sunnhemp wilt with a combination of fungicides, bio-agents, organic amendments (Organic liquid formulation- OLF) and different cropping systems. The results of two years pooled data (2020-21) indicated that two treatments viz., seed treatment (ST) with carboxin + thiram @ 2g/ kg seed + soil application (SA) of neem cake @ 250 kg/ha and *Trichoderma* sp. @ 2.5 kg/ha + intercropping (IC) with fodder sorghum (10:1) recorded lowest mean wilt incidence of 11.35% with highest mean fibre yield of 8.56 q/ha and ST with carboxin + thiram @ 2g/ kg seed + soil

application of neem cake @ 250 kg/ha and *Trichoderma* sp. @ 2.5 kg/ha + intercropping with fodder maize (10:1) recorded wilt incidence of 12.03% with mean fibre yield of 8.53 q/ha which are statistically superior over other treatments. However ST with *Trichoderma* sp @ 5g/ Kg seed + SA of Neem cake @ 250 Kg/ha and *Trichoderma* sp. @ 2.5 kg/ha + IC with Sorghum (10:1) + S.A. of OLF @ 500 lit/ ha @ 40 DAS recorded wilt incidence of 15.44 per cent with 7.76 q/ha fibre yield was also found effective in controlling wilt incidence and increasing fibre yield compared to untreated control (44.71 per cent wilt incidence and 4.34 q/ha fibre yield) (Table 35).

Table 35: Integrated management of sunnhemp wilt with bio-agent, fungicide, intercropping and organic liquid formulation

Treatments	Plant Height (cm)	Basal Diameter (mm)	Wilt incidence (%)	Disease Control (%)	Fibre yield (q/ha)
SA of OLF @ 500 lit/ha + <i>Trichoderma</i> sp ST @ 5g/ Kg seed + IC with Maize (10:1)	224.50	9.33	18.08	59.56	7.48
SA of OLF @ 500 lit/ha + <i>Trichoderma</i> sp seed treatment @ 5g/ Kg seed + IC with Sorghum (10:1)	208.49	8.85	19.40	56.60	7.15
ST with Carboxin + Thiram @ 2g/ Kg seed + SA of Neem cake @ 250 Kg/ha and <i>Trichoderma</i> sp. @ 2.5 kg/ha + IC with Maize (10:1)	222.37	9.35	12.03	73.09	8.53
ST with Carboxin + Thiram @ 2g/ Kg seed + SA of Neem cake @ 250 Kg/ha and <i>Trichoderma</i> sp. @ 2.5 kg/ha + IC with Sorghum (10:1)	238.67	9.41	11.35	74.61	8.56
ST with Tebuconazole @1ml/ Kg seed + SA of Neem cake @ 250 Kg/ha and <i>Trichoderma</i> sp. @ 2.5 kg/ha + IC with Maize (10:1)	202.13	7.85	21.09	52.82	6.55
ST with Tebuconazole @1ml/ Kg seed + SA of Neem cake @ 250 Kg/ha and <i>Trichoderma</i> sp. @ 2.5 kg/ha + IC with Sorghum (10:1)	199.00	7.79	24.25	45.76	5.88
ST with Carbendazim @ 2g/ Kg seed + SA of Neem cake @ 250 Kg/ha and <i>Trichoderma</i> sp. @ 2.5 kg/ha (Positive check)	208.77	8.36	18.28	59.11	6.92
ST with <i>Trichoderma</i> sp @ 5g/ Kg seed + SA of Neem cake @ 250 Kg/ha and <i>Trichoderma</i> sp. @ 2.5 kg/ha + IC with Sorghum (10:1) + SA of OLF @ 500 lit/ ha @ 40 DAS	221.00	8.91	15.44	65.46	7.76
Control	194.60	7.36	44.71	-	4.34
CD (P=0.05)	19.53	0.94	4.03	-	0.72

4. Nano Pesticides for Disease Management in Jute

4.1 Effect of nano carbendazim on jute stem rot pathogen

C. Biswas and V. Ramesh Babu

Project Code: In-house Project-JM 9.3

Efficacy of nanocarbendazim against jute stem rot pathogen: Nano-carbendazim was found more effective against *M. phaseolina* than conventional carbendazim. Nano-carbendazim @10⁻⁶ ppm inhibited the growth of the pathogen completely, whereas to achieve 100% inhibition conventional carbendazim @1ppm was required under poison food technique. Nano-carbendazim @10⁻⁷ ppm caused 89.33% growth inhibition whereas conventional carbendazim @10⁻⁷ ppm caused only 46% inhibition.

Transcriptome analysis of nano-carbendazim treated samples: Total mRNA was isolated from nano carbendazim treated, carbendazim treated and untreated plant tissue using Oligotex Direct mRNA kit (Qiagen) and respective cDNA libraries were constructed. The 454 sequence reads were assembled into contigs using 454 Newbler (Roche Diagnostics)

or SeqMan™ NGen™ v1.2 software (DNASTar, Inc). In total more than 3.7 million (37, 20, 410) reads were generated corresponding to 1.2 million nucleotides of cDNA sequences from treated plant. A total of 29,212 contigs were generated from both treated and untreated cDNA libraries. BLASTX alignments to model system proteomes showed that ~ 70% of the transcript contig sequences from cDNA libraries studied have strong similarity to predicted proteins in *Arabidopsis sp.* Several annotation categories including “superoxide dismutase (SOD)”, “ascorbate peroxidase (APX)”, “NAD(P)H quinone dehydrogenase”, “catalase (CAT), glutathione peroxidase (GPX) and peroxiredoxin (PrxR)” were significantly over-represented in nano carbendazim treated sample, but not expressed in untreated and carbendazim treated samples.

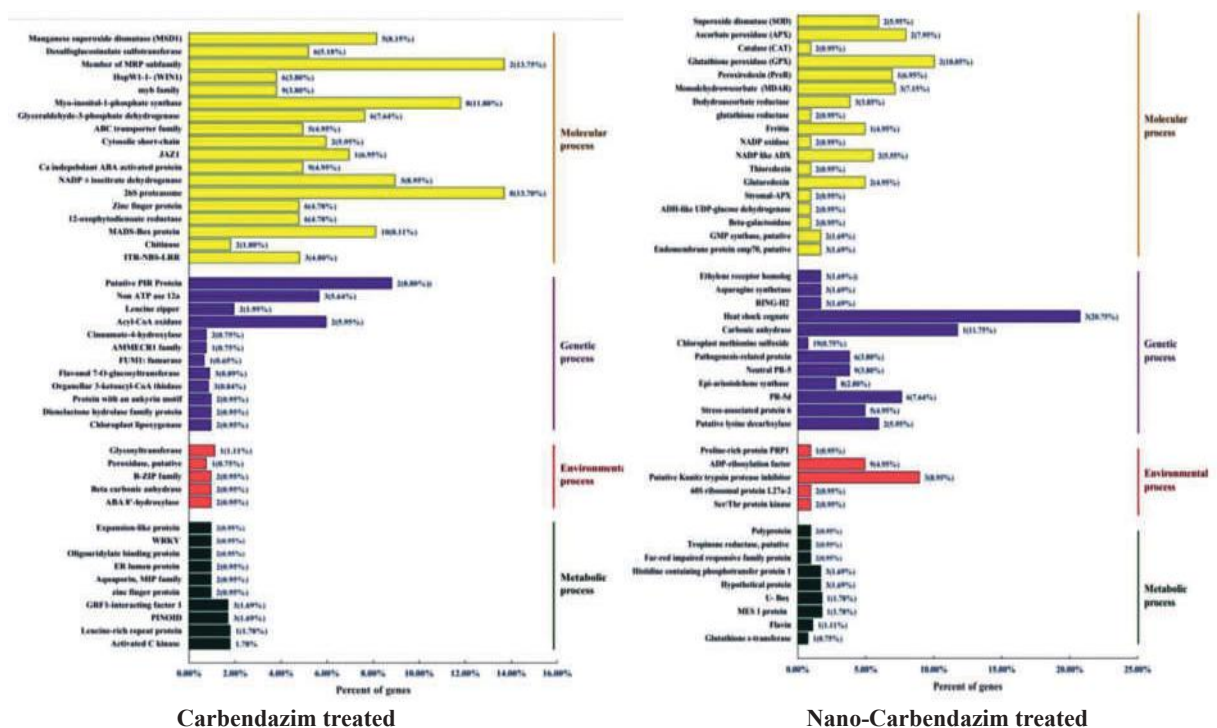


Fig. 66: KEGG analysis of Carbendazim and nano- Carbendazim treated samples

GO annotation and KEGG pathway analysis: GO annotation and KEGG pathway analysis were done. In nano carbendazim treated plants, the genes clustered in environmental information group were mainly associated with superoxide dismutase (SOD), ROS, ascorbate peroxidase (APX), catalase (CAT). Molecular function terms were involved in ion exchange, glutathione peroxidase (GPX), peroxiredoxin (PrxR),

monodehydroxyascorbate (MDAR). Cellular component terms were mainly associated with photosynthesis, Mg complex, water transport, regulation of water depreciation and thylakoid lumen. In case of carbendazim treated plants, the genes clustered in molecular process were Manganese superoxide dismutase (MSD1), HopW1-1- (WIN1), myb family, Myo-inositol-1-phosphate synthase and JAZ1 etc. (Fig. 66)

5. Informatics for Pest Prediction and Management

5.1 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 203

Decision Support System (DSS) for management of insect pests and diseases in jute and mesta crops enunciates the farmers in providing decision making process, related to insect pests and diseases based on crop phenology, weather

parameters, insect life stage, occurrence of diseases, pictorial guide and management practices thereof. Web based version of the DSS is under process in bilingual mode and mobile based app will also be developed in future.

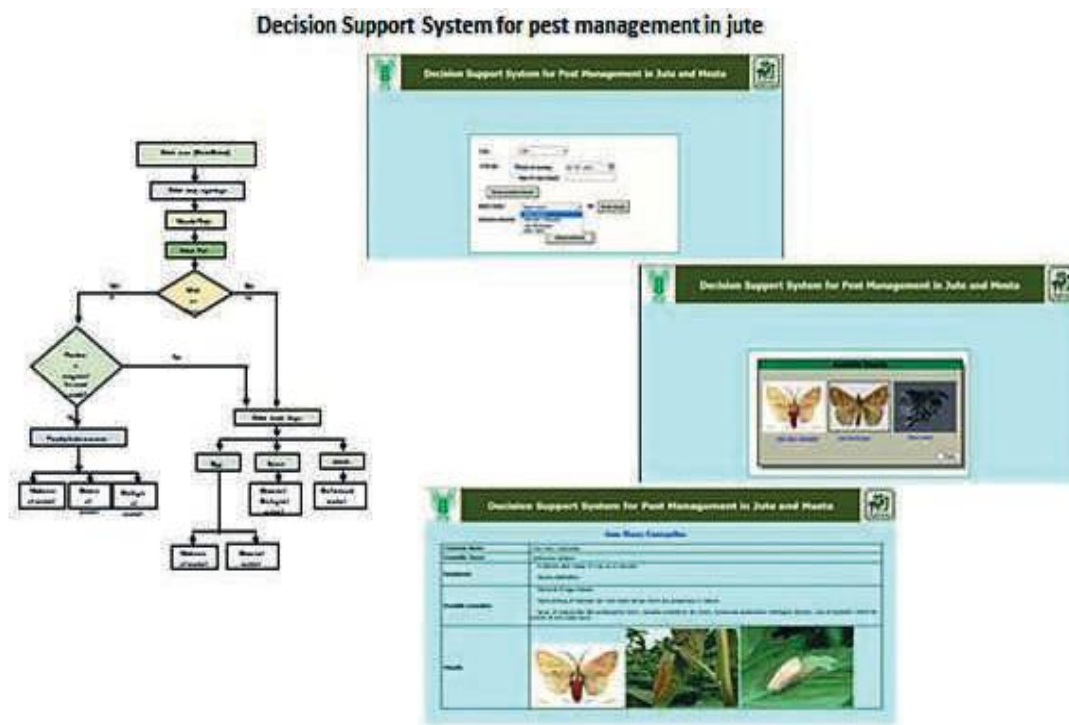


Fig. 67: Flow chart of DSS of pest management

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

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

Project Code: In-house Project- JE 2.2

Indigo caterpillar is a polyphagous pest attacking wide range of crops including bast fibre crops like jute. The possibility to become this insect an increasingly severe pest in major jute grown region of West Bengal due to increased habitat suitability with the changing climate was examined through the development of temperature-based phenology for *S. litura*, by constructing thermal reaction norms for cohorts of single life stages using ILCYM model.

The data were fitted with non-linear functions to estimate the life table parameters of the species. The results show that the development rate as a function of temperature increased linearly for all

the immature stages of *S. litura* until 32°C. Highest fecundities, intrinsic rate of natural increase and net reproductive rate was recorded between 27-30 °C. The risk maps of GI reveal that under RCP 2.6 scenario indicated that there will be around 30% increase of area in 2050 where mean number of generations produced within a given year will be more than 10 due to increase in temperature as compared to 2020 (Fig 68). The finding of the study will provide important information to enhance monitoring and surveillance, and designing of integrated pest management to control this pest in jute and other hosts.

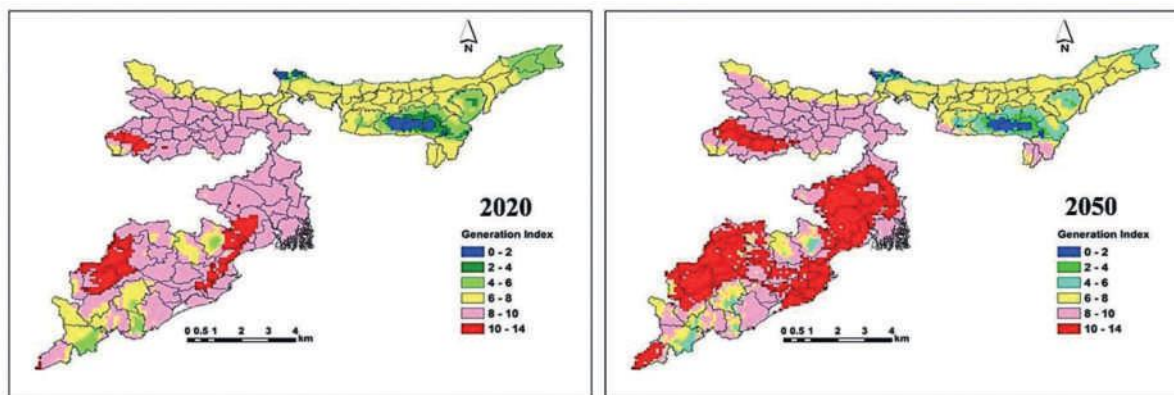


Fig. 68: Generation Index of *S. litura* according to ILCYM model



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 2021

- Identification of jute based diversified products as a substitute of plastics and synthetics.
- Linkage with the Farmers Producers Organisation (FPO) and Farmers Producers Company (SAFPCL) by forming the Farmers Interest Groups (FIGs).
- Development of conceptual model for building climate resiliency in jute-based cropping system.
- Agro-advisories to mitigate the yield gap in jute and allied fibre crops.
- Doubling farmer's income by deployment of CRIJAF technologies through central schemes like NFSM, Jute-ICARE, SCSP and TSP.
- Constraint analysis of farmers and industry on fibre production, processing and marketing.

RESEARCH

1. Up-Scaling of Jute based Diversified Products to Substitute Plastics

1.1 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 is to identify possible jute based diversified products as a substitute of plastics and synthetics and impart skill among SHGs for developing jute-based products, entrepreneurship development and socio-economic empowerment. A series of products were identified and preliminary training on making of those identified products was given for the farm women groups. Under this project, during the period under report six skill development programmes for entrepreneurship development through making of jute fibre and fabric-based products were conducted for farm

women. The estimated jute fibre requirement per unit for the jute based diversified products identified were also calculated based on the primary data obtained from research and secondary data collected from the jute industry (Table 36). These jute diversified products if promoted can replace plastics and synthetics. Based on a foreseeable calculation, requirement of each diversified items identified were projected based on the total households in our country and income earning population. Total fibre requirement of each product calculated was about 24.45 lakh bales.

Table 36: The diversified jute products identified and its fibre requirement

Sl. No.	Particular	Unit required (in lakh)	Fibre per unit (in g)	Total weight of the jute fibre required (in tonne)
1.	Shopping bag (big size)	3,500	400	1,40,000
2.	Jute bag (medium size)	3,500	200	70,000
3.	Jute bag (small size)	3,500	150	52,500
4.	Handmade jute bag (big size)	1,000	750	75,000
5.	Handicraft jute bag (small size)	1,000	200	20,000
6.	Handmade jute sling bag	1,000	200	20,000
7.	Bottle bag	10	70	70
8.	Jute office folder	300	200	6,000
9.	Jute office bag	300	400	12,000
10.	Jute flower bouquet	50	50	250
11.	Jute pen stand	100	100	1,000
12.	Coaster	3,000	70	21,000
13.	Table mat	3,000	60	18,000
14.	Jute ornaments	50	10	50
15.	Jute handmade carpet	50	2000	10,000
16.	Door hanger	60	400	2,400
Total				4,40,270



Fig. 69: Skill enhancement of women group in making of jute diversified products

1.2 Technological and economic empowerment of jute growing farm families

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

Project Code: DST SEED Project

With an aim to improve socio-economic conditions of jute farmers through value chain establishment, project work was started during April 2021 in North 24 Parganas district of West Bengal. As per baseline survey on the social and economic status of the farm households of the study area, the average landholding was small (0.39 ha) and hardly generate sufficient income for an average size family. For increasing the farm income, a cafeteria of technologies like, improved jute variety, multi-row seed drill for line sowing, single wheel jute weeder, improved retting using CRIJAF Sona, value addition of jute fibre and fabrics

etc. were introduced. Knowledge on various improved practices on vegetable crops that fits in jute based cropping sequence were also imparted to the farmers through different extension programmes. The introduction of new interventions in jute crop resulted in an additional income of ₹6400/ha. A linkage has been established with the Farmers' Producers Organisation (FPO) and Farmers' Producers Company (SAFPCL) by forming the Farmers' Interest Groups (FIGs). Two self-help groups were also formed and they were trained on value addition for making diversified products of jute fibre.



Fig. 70: Different activities for technological and economic empowerment of farmers

2. Climate Variability Assessment in Jute Farming

2.1 Climate resiliency of farmers in jute-based cropping system

M.L. Roy, S.K. Jha, S. Sarkar, A.K. Ghorai, A.K. Singh,

S. Satpathy and A.K. Chakraborty

Project Code: In house-Project -JEXA 5.8

A knowledge test and attitude scale was developed following Likert's summated rating method to measure the farmers' knowledge and attitude towards adaptive measures of climate variability. Most of the respondents were in high level of attitude category towards the effect of climate variability on jute-based cropping system like, change in duration of traditional crop seasons, unavailability of desirable soil moisture level during jute sowing time, increased dependency on ground water for irrigation, depletion of ground water table, high infestation of weeds, insects and diseases, water stagnation due to untimely heavy rainfall, pre-maturing flowering due to low night temperature, drying of existing water bodies of retting, increased incidences of crop damage and yield losses, crop lodging due to high wind and/or hail storm and reduction of fibre yield due to erratic behaviour of rainfall, drought and

storm/norwester during early growth stages. The perception of the respondent farmers was also found in significant level of conformity with the scientists' perception about the effect of climate variability on jute-based cropping system. Farmer respondents perceived that variations in temperature and humidity played an important role in early flowering and pest infestation. They also perceived that variation in rainfall significantly influenced the sowing time, germination and plant growth and fibre quality of jute. A conceptual model for building climate resiliency of farmers in jute-based cropping system was developed (Fig. 71). It depicts the broad effect of climate change in this system, adaptive and mitigation measures highlighting ICAR-CRIJAF technologies and cognitive and conative behavioural changes of farmers through training and demonstration for building their climate resiliency.

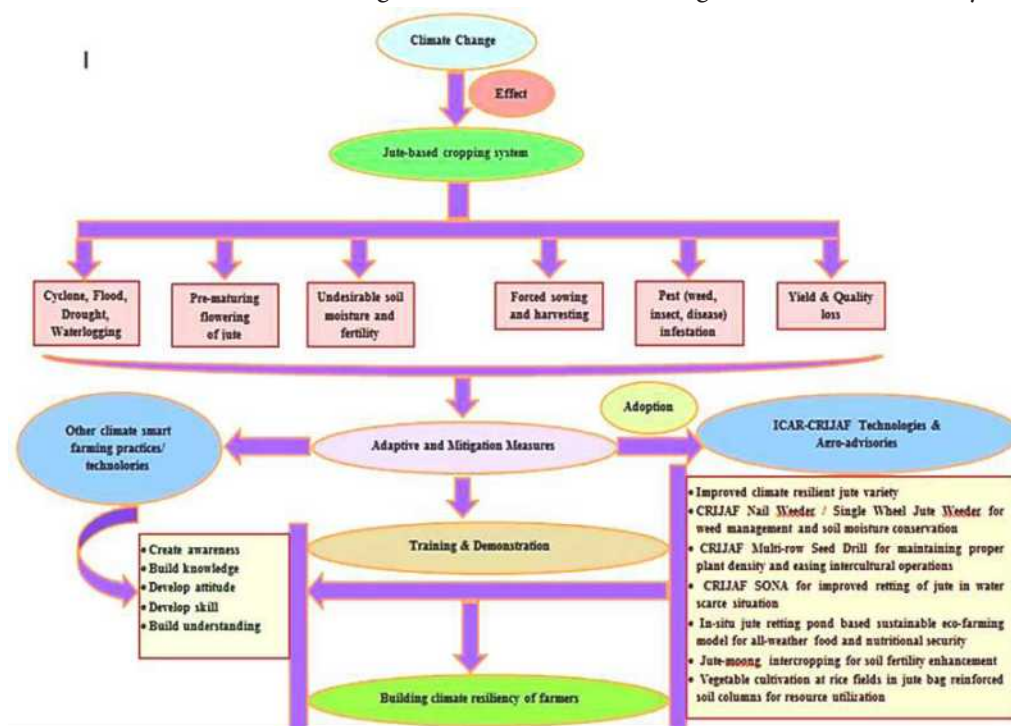


Fig 71: Model for building climate resiliency of farmers in jute based cropping system

3. Jute-Improved Cultivation and Advanced Retting Exercise (Jute-ICARE)

3.1 Technology backstopping to jute farmers under improved cultivation and advanced retting exercise (Jute-ICARE) programme

B. Majumdar, S. Sarkar, S.K. Jha, R.K. Naik, S. Satpathy and G. Kar

Project code: Jute-ICARE

Amid COVID-19 pandemic, the Jute-ICARE project was carried out in 140 blocks of West Bengal, Bihar, Assam, Odisha, Meghalaya and Andhra Pradesh states covering 1,25,000 ha area involving 3.0 lakh farmers during 2021- 22 in collaboration with National Jute Board (NJB) and Jute Corporation of India (JCI). About 835 tonne of certified seeds of jute (cv. JRO 204 and JBO 2003H), 1000 nos. of CRIJAF multi row seed drill and 1200 nos. of CRIJAF single wheel jute weeder were distributed among the farming community. During retting season, 605 tonne of CRIJAF Sona were distributed among the jute farmers for improved retting of jute and mesta. 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 of ICAR-CRIJAF. The regular agro-advisory issued by ICAR-CRIJAF were disseminated directly to the farming community under Jute-ICARE in appropriate local languages. A two days trainers'

training programme on "Improved Production Technologies of Jute for Enhancing Productivity and quality" was conducted under Jute-ICARE for block supervisors and master trainers working in the project. Besides this, the Director and scientists of ICAR-CRIJAF attended several video conferences for benefit of the jute farming community. Improved retting demonstrations (8 nos.) were carried out with newly developed liquid formulation of CRIJAF Sona in North 24 Parganas, Murshidabad and Uttar Dinajpur districts of west Bengal. The quality check of samples of CRIJAF Sona received from Bengal Biotech and Research, Panskura and Next to Nature, Guwahati were conducted in the laboratory. The fibre yield of jute in Jute-ICARE area increased by more than 10% compared to non-Jute-ICARE area and the fibre quality of Jute-ICARE area ranged between TD-2 and TD-3. On an average the jute farming community got higher market price for their quality jute fibre by ₹450 to 500 /q more than the jute fibre price of conventionally retted fibre.



Fig. 72: Different activities of Jute-ICARE in farmer's field

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

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

Project Code: In house-Project -JEXA 6.1

Analysis of technological and extension gap and impact of technical intervention of ICAR-CRIJAF in cultivation of jute was done under Jute-ICARE program in jute growing states of West Bengal, Assam, Bihar, Odisha and Meghalaya. The on-field information from the cultivated field of the project was collected through a google based JAF Kisan Form. The link of this google form was provided to all the Master Trainers (MTs) under Jute-ICARE. The overall technological and extension gap was observed in West Bengal, Assam and Bihar as presented in Fig. 73. In West Bengal, technology gap was found maximum in Uttar Dinajpur (9.19 q/ha) and Malda (8.07 q/ ha) districts, while the extension gap was found maximum in North 24 Parganas (8.63 q/ ha) followed by Nadia (8.25 q/ha) district. In case of Assam, technological gap was found maximum in South Salmara (9.94 q/ ha) and Bongaigaon (9.19 q/ha) district, while the extension gap was found maximum in Bongaigaon (5.63 q/ ha) followed by South Salmara (5.25 q/ha) districts. In Bihar, both technological and extension gap was found maximum at Supaul (11.02 q/ ha, 6.05 q/ ha) followed by Araria district (10.07 q/ha, 6.00 q/ha). To address the problem of water stagnation due to heavy rain and cyclone, an advance agro-advisory was issued to all participating farmers, to make drainage channels in the field and reduce the impact of water stagnation on crop growth.

A wide extension gap emphasizes the need to educate farmers for using improved production technologies. As a part of the strategy to mitigate the yield gap, farmers were also advised to use agro-advisories issued by ICAR-CRIJAF regularly.

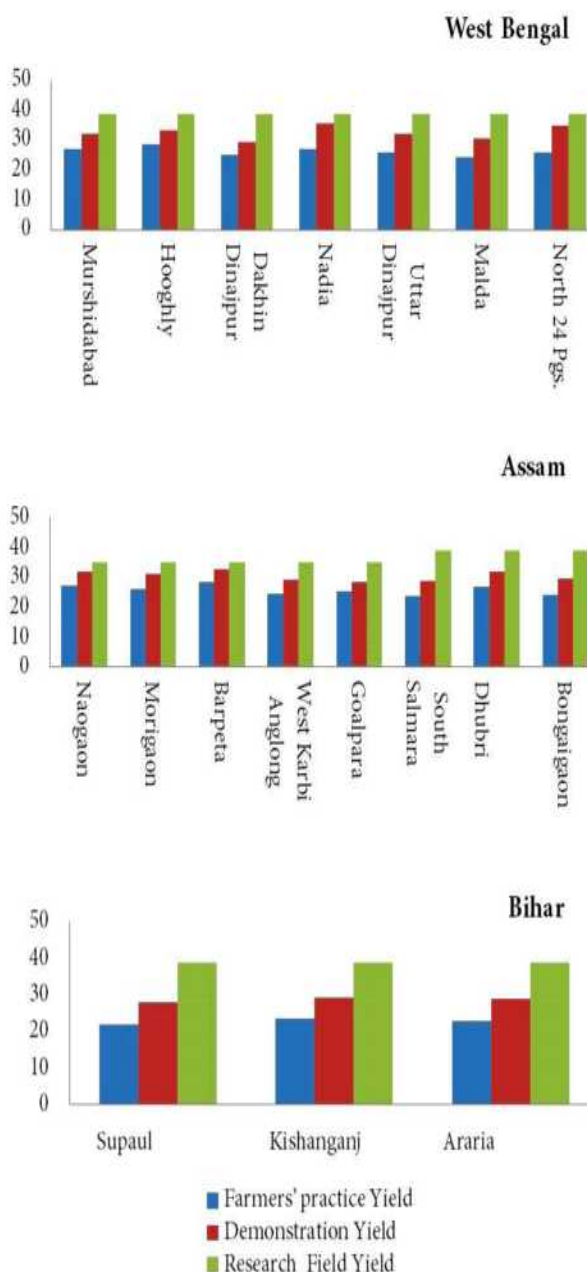


Fig. 73: Technological and extension gap in West Bengal, Assam and Bihar

3.2 Impact assessment of CRIJAF technologies in Jute-ICARE areas of West Bengal

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

Project Code: In house-Project-JEXA 6.0

A study was carried out in Hooghly district of West Bengal to know the benefits of Jute-ICARE technologies. Data from the respondents (n=42) were collected with the help of a structured interview-schedule. Information were collected with regard to four technological interventions, namely, high yielding varieties of jute, multi row seed drill, CRIJAF nail weeder/ single wheel jute weeder and CRIJAF Sona used by the respondents. The level of adoption with respect to improved production of jute showed that majority of them (71.42%) had medium level of adoption of jute production technologies. Remaining farmers (28.7%) were in the high adoption category. There was gain in jute fibre yield by 9.49-24.26% as well as knowledge score regarding application of ICAR-CRIJAF technologies at field level. These interventions resulted in reduction in cost of cultivation and

improvement of fibre grade. Approximately half (47.61%) of the respondent jute farmers increased the acreage under jute. The socio-psychological profile of the respondents showed that majority of them (57%) belonged to middle age group (35-55 years) with education up to matriculation (64%). Most of them were in medium category of sources of information utilization, innovative proneness, scientific orientation and risk bearing ability. These factors had significant influence upon adoption of ICAR-CRIJAF technologies. In general, major constraints in jute cultivation as perceived by the respondents were non-availability of sufficient retting water in time, labour crisis during harvesting of jute and higher rate of labour wage, comparatively lower price of jute fibre than expected, and absence of assured market in the vicinity.

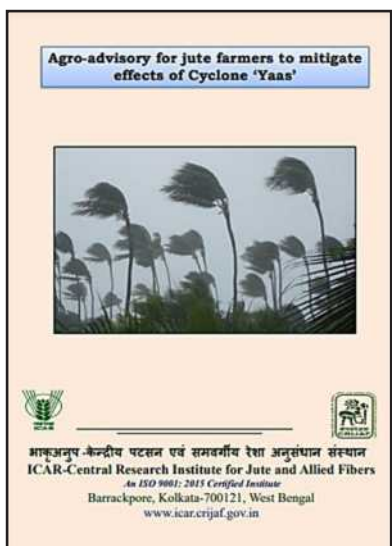
4. Extension Activities

Particulars	Place	Date
Farmers-Scientists Interaction (3 nos.)	Paschim Simla, North 24 Parganas; ICAR-CRIJAF, Barrackpore; Kumra, North 24 Parganas	3 February, 2021 24 March, 2021 21 June, 2021
Farmers' Exhibition (2 nos.)	ICAR-NINFET, Kolkata; ICAR-CRIJAF, Barrackpore	24 February, 2021 7 August, 2021
Field Day Programme (one)	ICAR-CRIJAF, Barrackpore	20 July, 2021
Farmers Field School on Improved Rice Cultivation Practices	ICAR-CRIJAF, Barrackpore	12-27 October, 2021

4.1 Doubling of farmer's income through Central Sector Schemes

In major jute growing states, the various central sector schemes like NFSM, Jute-ICARE, SCSP, TSP, etc. were launched to improve the productivity through CRIJAF technologies like use of (i) improved seeds, (ii) intercropping, (iii) integrated nutrient and pest management practices, (iv) mechanical sowing and weeding (multi-row seed drill, nail weeder, single

wheel jute weeder), (v) improved retting (by CRIJAF Sona), etc. Participating farmers have been provided support of extension literature, agricultural inputs and skill upgradation trainings. During 2021, more than 1000 farmers benefited by such technological interventions and trend of doubling of farmer's income are being observed.



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.



KRISHI VIGYAN KENDRA

Two KVKs, Burdwan and North 24 Parganas (Additional) working under ICAR-CRIJAF implemented various On Farm Trials (OFTs), Front Line Demonstrations (FLDs), and trainings/vocational trainings for disseminating new agricultural technologies and improving the skills of farmers, farm women, rural youths and extension workers. Other extension activities like exposure visits, field day, method demonstration, technology week and many other important activities 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 accomplishments of these KVKs are depicted below in brief.

1. On Farm Trials (OFTs)

Four OFTs were conducted by the KVK, Burdwan for evaluation of different recommended technologies like weed control by using post emergence herbicides in rice, intercropping and mixed cropping in jute, different techniques of vegetable seedling transplanting, and assessment of improved variety of tomato.

- i.) Application of post emergence herbicides bispyribak sodium and penoxulum were most effective in controlling weeds in paddy while penoxulum was most effective in controlling grasses and broad leaf weeds. Yield increment in application of bispyribak sodium (54.1 q/ha) and penoxulum (56.9 q/ha) over farmers practice (FP) of application of butachlor (49.4 q/ha) were 9.5% and 15.2%, respectively.
- ii.) In jute under medium upland situation intercropping or mixed cropping was profitable than sole crop. System yield was significantly higher in case of jute mixed cropping with green amaranthus (50.2 q/ha) with highest profitability. (B:C ratio of 1.93). In case of jute + greengram intercropping (1:1) system, productivity was lowest. But profitability of this option

was better as compared to FP or single cultivation by line sowing.

- iii.) Raising of seedlings in pluck trays and transplanting with the help of manual transplanter was most labour saving method with less seedling mortality and higher economic viability in cauliflower. Use of pluck trays to raise seedlings reduced the chance of seedlings mortality considerably.
- iv.) Arka Rakshak and Arka Samrat varieties of tomato showed better results in terms of yield and resistance to leaf curl virus in comparison to existing variety Abhilash. Round shape of Arka Samrat fruits fetched better market price.

2. Frontline Demonstrations (FLDs)

A total of 253 FLDs were conducted by both the KVKs during the year 2021 on jute, paddy, lentil, chickpea, onion, vegetables, banana and poultry. There was significant increase in productivity of all field crops and fruit crops in 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 increased the fibre strength and fibre fineness. The salient findings of the FLDs are given in [Table 37](#).

Table 37: Details of FLDs conducted by KVK Burdwan and North 24 Parganas (Addl) during the year 2021

Crop/livestock (No. of FLDs)	Technology demonstrated	Results
KVK, Burdwan		
Jute (25)	Improved production technology (cv. JRO 204)	There was 16.67% increase in productivity of jute in improved practice (36.4 q/ha) over local check (31.2 q/ha; cv. JRO 524). BCR in improved practice was 1.92 over local check of 1.60.
Lentil (37)	Improved variety (cv. HUL 57) + application of sulfur+ NPK + aqualcal	There was 19.3% increase in productivity of lentil in improved practice (10.86 q/ha) over local check (9.10 q/ha; cv. Ranjan).
Chickpea (35)	Improved variety (cv. NBEG 45) + application of sulfur+ NPK + aqualcal	There was 28% increase in productivity of lentil in improved practice (10.61 q/ha) over local check (8.30 q/ha; cv. Mahamaya).
Tissue cultured banana (13)	Tissue cultured planting material of cv. Grand Naine	31.9% increase in productivity of tissue cultured banana with yield of 620 q/ha. BCR in Grand Naine was 2.56 over local check of 1.95.
Cauliflower (10)	Use of pluck tray and transplanter	There was a significant reduction of seedling mortality (8%) by the use of pluck tray and transplanter. BCR in improved practice was 2.56 as against local check of 2.14.
KVK, North 24 Parganas (Additional)		
Poultry (10)	Backyard poultry farming with Kadaknath	Test: Avg. Initial body wt. at 1st month (g)-137; Avg. body wt. at 6th month(g)-1074; Avg. Age at 1st lay(weeks)-26; Avg. egg wt.(g)-46.75; Net return (₹ /unit): 3401; BCR:1.60 Check: Avg. body wt. at 1st month(g):139.38; Body wt. at 6th month(g): 912.67; Avg. Age at 1st lay (weeks): 26; Avg egg wt.(g): 45.57; Net return (₹./unit): 2040; BCR:1.36
Rapeseed & Mustard (55)	Improved variety (cv. PM 30)	Demonstration yield was 14.68 q/ha; 33% more than the check with BCR: 3.07
Lentil (60)	Improved variety (WBL 77); Rhizobium inoculation	Average yield of 11.61 q/ha was recorded: 63.52 % more than the local check with BCR: 2.04
Jute (3)	Improved variety (JRO 204 & JROMU 1)	JRO 204 : Fibre yield: 33.02 q/ha; BCR: 1.44 JROMU 1: Fibre yield:34.46 q/ha; BCR:1.51 Check: Fibre yield: 24.12q/ha; BCR:1.20
Jute (5)	Improved retting of jute by 'CRIJAF Sona'	CRIJAF Sona (powder) Retting time:14 days; fibre strength-21.85 g/tex; Fibre fineness: 2.75 (tex); Root content: 6.93 % CRIJAF Sona (Liquid) Retting time -11 days; fibre strength-24.71 g/tex; Fibre fineness -2.65 (tex); Root content-3.93 % Conventional retting Retting time -18 days; fibre strength-19.90 g/tex; Fibre fineness -3.18 (tex); Root content-11.75 %



Various activities of KVK, Burdwan, West Bengal

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 farming, mushroom farming, poultry and duckery rearing, goatary, apiary, etc.

Demonstration unit			Farm input production	
Unit	Variety/Species	Quantity produced	Product	Quantity
Vermicompost	Eisenia fetida	4,000 worms, vermicompost: 8 q	Vermiworm	20278 pc
Mushroom	Oyster	40 beds	Vermicompost	4390 kg
Poultry	RIR	50 nos.	Fruit sapling	1990pc
Poultry	Kadaknath	95nos.	Paddy (foundation seed of MTU 7029)	14 ton
Duckery	Khaki Campbell	60 nos.		
Goatary	Black Bengal	5 nos.		
Apiary	<i>Apis mellifera</i>	6 beehives		
Azolla	-	5 kgs		

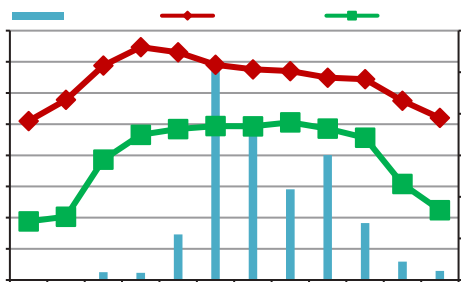
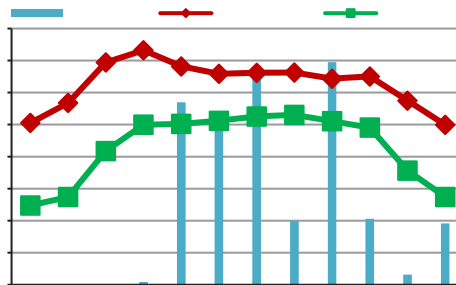


Demonstration of pluck tray and transplanter

Weather Report 2021

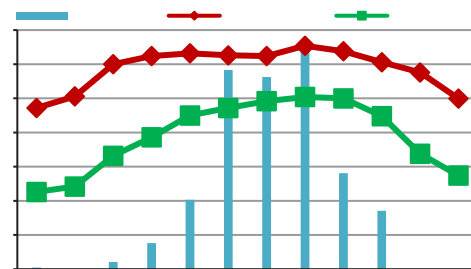
CRIJAF, Barrackpore (West Bengal)

Total annual rainfall: 2289 mm
Annual mean maximum air temperatures: 31.4°C
Annual mean minimum air temperatures: 21.4°C
Hottest Month: April (36.6°C)
Coldest Month: January (12.4°C)
The highest monthly total rainfall: September (521.3 mm)
The lowest monthly total rainfall: February (0.5 mm)
No rainfall in months: January, March



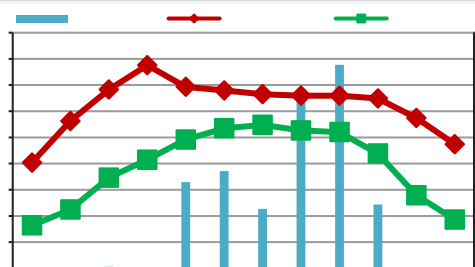
CSRSJAF, Budbud (West Bengal)

Total annual rainfall: 1789 mm
Annual mean maximum air temperatures: 32.0°C
Annual mean minimum air temperatures: 19.6°C
Hottest Month April: 37.4°C
Coldest Month: January 9.4°C
The highest monthly total rainfall: June (532.2 mm)
The lowest monthly total rainfall: February (0.3 mm)
No rainfall in months: January



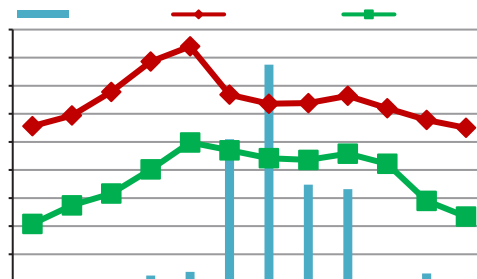
RRS, Sorbhog (Assam)

Total annual rainfall: 3280 mm
Annual mean maximum air temperatures: 29.4°C
Annual mean minimum air temperatures: 19.4°C
Hottest Month: August (32.7°C)
Coldest Month: January ()
The highest monthly total rainfall: June (834 mm)
The lowest monthly total rainfall: February (6 mm)
No rainfall in months: February, November, December



ShRS, Pratapgarh (Uttar Pradesh)

Total annual rainfall: 1316 mm
Annual mean maximum air temperatures: 31.2°C
Annual mean minimum air temperatures: 19.5°C
Hottest Month: April (38.8°C)
Coldest Month: January (8.2°C)
The highest monthly total rainfall: September (388.7 mm)
The lowest monthly total rainfall: March (3.0 mm)
rainfall in months: Jan Feb, Apr, Nov, Dec



SRS, Bamra (Odisha)

Total annual rainfall: 1372 mm
Annual mean maximum air temperatures: 32.5°C
Annual mean minimum air temperatures: 18.5°C
Hottest Month: May (42.0°C)
Coldest Month: January (10.4°C)
The highest monthly total rainfall: July (516.6 mm)
The lowest monthly total rainfall: October (1.2 mm)
No rainfall in months: January to March, December

AINP on Jute and Allied Fibres

The All India Network Project on Jute and Allied Fibres (AINPJAF), headquartered at ICAR-CRIJAF in Barrackpore, Kolkata, operates through eight SAUs and four ICAR Institute-based centres spread across seven JAF-growing states. During 2021, a total of 64 sub-projects on jute, mesta, sunnhemp, ramie, flax, and sisal were carried out, including 36 under crop improvement, 12 under crop production, and 16 under crop protection. The summary of research achievements, training and demonstrations conducted under the AINPJAF scheme during 2021 is presented below.

1. Jute

1.1 Evaluation of jute germplasm

A new set comprising of 50 germplasm of *C. olitorius* jute were screened along with 2 check varieties namely, JRO 524 and JRO 204 for fibre yield and diseases and pests infestation in six locations (Kalyani, Coochbehar, Kendrapara, Nagaon, Katihar and Rahuri). Data across five locations has been received and analysis of data is under process.

A new set of 50 accessions of *C. capsularis* jute have also been evaluated along with 2

check varieties namely, JRC 517 and JRC 698 in five locations (Kendrapara, Kalyani, Coochbehar, Nagaon and Katihar) for fibre yield and other yield contributing traits and reaction to biotic stresses. Data across five locations has been received and analysis of data is under process.

1.2 National hybridization programme

In *olitorius* jute, segregating lines in F_7 , F_6 , F_5 , F_4 , F_3 , and F_2 progenies of different cross combinations were evaluated at Rahuri, Coochbehar, Kalyani, Kendrapara, Katihar and Nagaon centre and promising lines have been identified and selected for further evaluation. Besides, fresh crosses have also been attempted at these locations under the breeding and pre-breeding programme of AINPJAF. In *capsularis* jute, F_6 , F_5 and F_2 progenies of different cross combinations were also evaluated at Coochbehar, Katihar, Kalyani, Nagaon and Kendrapara centres. Promising cross combinations at different centres have been identified for further evaluation. Fresh crosses under the breeding and pre-breeding programme of AINPJAF have also been attempted at these locations and seed have been collected for further evaluation.



Fig. 74: Evaluation of jute germplasm



Fig. 75: National hybridization programme of jute

1.3 Yield evaluation trials

1.3.1 Tossa jute

IET: Test entry JRONS-1 (33.57 q/ha) recorded highest fibre yield followed by JROP-9 (31.76 q/ha), NJ-7080 (31.64 q/ha) and BROJ-3 (31.38 q/ha) over the best check JRO 204 (31.36 q/ha) and JRO 524 (29.85 q/ha).

AVT-I: Test entry NJ-7068 recorded higher fibre yield (32.67 q/ha) than the best check JRO 204 (31.69 q/ha) followed by UBOJ-1 (31.06 q/ha), JROBA-6 (30.07 q/ha), NOJ-17-2 (29.31 q/ha), JROP-6 (28.96 q/ha) and JRO 524 (28.6 q/ha).

AVT-II: Based on pooled analysis of data over locations and years (grand mean), test entry JROP-4 (30.24 q/ha) recorded highest fibre yield followed by JROBA-5 (29.66 q/ha) over the best check JRO 204 (28.05 q/ha) and JRO 524 (27.64 q/ha).

1.3.2 White jute

IET: Test entry UBCJ-3 recorded highest fibre yield (36.78 q/ha) followed by NCJ-17-5-5 (36.48 q/ha), BRCJ-6 (35.94 q/ha) and BCCC-20 (34.4 q/ha) which were better than best check JRC 698 (33.46 q/ha) and JRC 517 (32.46 q/ha).

AVT-I: Test entry JRCP-9 recorded high fibre yield (32.40 q/ha) than the best check JRC 517 (30.73 q/ha) followed by JRC 698 (29.23 q/ha), BCCC-17 (28.97 q/ha), JRCP-8 (28.5 q/ha) and NCJ-16-53-1 (25.98 q/ha).

AVT-II: Based on analysis of mean over locations and years, test entry JRCP-7 recorded highest fibre yield (31.55 q/ha) followed by check variety JRC 517 (30.20 q/ha) and test entries BRCJ-5 (29.63 q/ha) and JRCP-6 (29.59 q/ha).

The *tossa* jute entry JROBA-3 recorded significantly higher fibre yield (23.82 to 30.61 q/ha) over check variety JRO 524 only at Kalyani and at Coochbehar and over both the check varieties JRO 204 and JRO 524 at Katihar and also recorded maximum values of gross return, net return and B:C ratio.

The *capsularis* entry JRCP-5 recorded significantly higher value of fibre yield (21.33 to 26.58 q/ha) over both the check varieties (JRC 517 & JRC 698) at Kalyani, Coochbehar, Kendrapara, Katihar and Nagaon, also, recorded maximum values of gross return, net return and B:C ratio.

In jute, the targeted yield of jute (4.0 t/ha) was also achieved when inorganic fertilizer based on ST-TY approach was applied at 150% levels alone with (-)8% yield deviation or in combination with FYM or lime at (+)3.68% and (+)5.68% yield deviation, respectively under acid soil condition at Coochbehar, West Bengal, while under neutral soil condition, the targeted yield could not be achieved at Katihar, Bihar.



Fig. 76: Yield evaluation trials of jute



In jute, maximum fibre yield of jute, minimum weed dry matter and maximum weed control efficiency were recorded with two hand weeding treatment at Kalyani and Coochbehar. At Kendrapara, maximum fibre yield of jute was recorded with application of Ipfen carbazone 22.8% SC (@ 115 g/ha + 1 HW) (31.11 q/ha) though the weed control treatments. Results were at par in yield of jute and weed dry matter. Similarly, at Nagaon, maximum fibre yield was recorded with application of Ipfen carbazone 22.8% SC (@ 90 g/ha + 1 HW) (25.44 q/ha), while minimum weed dry matter and maximum weed control efficiency was recorded with quizalofop ethyl 10% EC @ 38 g/ha + 1 HW or ipfen carbazone @ 90 g/ha + 1 HW treatments at Nagaon, Assam.

Conventional tillage recorded higher fibre yield of jute along with better economics and minimum weed dry matter compared to zero tillage at all the locations. At Coochbehar, highest fibre yield (27.00 q/ha), net return (₹65974/ha) and B:C ratio (2.62) were recorded with conventional tillage. The corresponding values at Kalyani centre were 29.44 q/ha, ₹42250/ha and 1.48, respectively. Minimum weed biomass at 35 DAE in jute was also recorded with conventional tillage at Coochbehar centre. At Kendrapara, conventional tillage

recorded significantly higher fibre yield of jute (28.37 q/ha) and significantly lower weed biomass at 15 DAE than zero tillage and the net return (₹ 73350/ha) and B:C ratio (2.07) were higher with conventional tillage system. Crop residue retention also increased fibre yield and economics of jute significantly and also decreased weed dry matter in jute over control at almost all locations.

At Coochbehar, the increase in fibre yield of jute due to residue retention was in the order of rice straw @ 2 t/ha (28.95 q/ha) > dhaincha @ 2 t/ha (26.41 q/ha) > sunnhemp @ 2 t/ha (24.78 q/ha), while at Kendrapara, maximum fibre yield was recorded with rice straw residue (28.25 q/ha) followed by dhaincha (25.93 q/ha) and sunnhemp (25.20 q/ha) residue treatments. Minimum weed dry matter was recorded with rice straw residue at Coochbehar and Kendrapara. Maximum net return and B:C ratio were recorded with rice straw residue at Coochbehar (₹72897/ha, 2.76) and at Kendrapara (₹74750/ha, 2.12) centres.

Maximum seed yield of *olitorius* jute variety JRO 204 was recorded with INM treatment of 75% RDN + 25% N from FYM + 5 kg MgSO₄/ha (17.27 q/ha) and it also recorded higher values of net return (₹67558/ha) and B:C ratio (2.51) at Rahuri, Maharashtra.

2. Mesta

2.1 Evaluation of mesta germplasm

New set of 50 accessions of roselle mesta along with two check varieties namely, HS 4288 and AMV 5 were evaluated for fibre yield and yield related traits at four locations (Amadalavalasa, Katihar, Aduthurai and Barrackpore). Data across four locations has been received and analysis is under process.

A new set of 50 accessions of kenaf with two check varieties, namely, HC 583 and AMC 108 were also evaluated for fibre yield and yield attributing characters at four locations (Rahuri, Amadalavalasa, Aduthurai and Barrackpore). Data across four locations have been received and analysis is under process.

2.2 National Hybridization Programme

In mesta, mutation breeding using chemical mutagen (EMS) has been attempted in both the species (roselle and kenaf) to create new variability. An LD₅₀ dose of roselle and kenaf has been determined using different concentrations of EMS. Besides, fresh crossing has also been attempted at Rahuri, Aduthurai and Amadalavalasa centre using selected parents under breeding and pre-breeding programme of AINPJAF and seed of crosses have been collected for further evaluation.

2.3 Yield evaluation trials

2.3.1 Kenaf

IET: Five test entries with 2 checks were evaluated at 5 locations (Aduthurai, Amadalavalasa, Rahuri, Kendrapara, and Coochbehar). Data analysis is in progress.

AVT-I: Four test entries with 2 checks were evaluated at 6 locations (Aduthurai, Barrackpore, Amadalavalasa, Rahuri, Kendrapara and Coochbehar). Data analysis is in progress.

AVT-II: Four test entries with 2 checks were evaluated at 6 locations (Aduthurai, Amadalavalasa, Rahuri, Kendrapara, Barrackpore and Coochbehar). Data analysis is in progress.



Fig. 77: Yield evaluation trials of mesta

2.3.1 Roselle

IET: Seven test entries with 2 check varieties were evaluated at 6 locations (Aduthurai,

Kendrapara, Amadalavalasa, Rahuri, Coochbehar and Katihar). Data analysis is in progress.

AVT-I: Four test entries with 2 checks were evaluated at 6 locations (Amadalavalasa, Aduthurai, Kendrapara, Rahuri, Coochbehar and Katihar). Data analysis is in progress.

AVT-II: Three test entries with 2 checks were evaluated at 6 locations (Aduthurai, Amadalavalasa, Rahuri, Kendrapara, Coochbehar and Katihar). Data analysis is in progress.

At Amadalavalasa, the kenaf entry, JRK-2016-5 recorded significantly higher fibre yield (16.41 q/ha) over the check variety HC 583 only, while at Aduthurai, kenaf entry JRK-2016-5 recorded significantly higher plant height (246.6 cm), basal diameter (2.94 cm) and fibre yield (26.14 q/ha) over check varieties (AMC 508 & HC 583). At Rahuri, the test kenaf entry JRK-2016-5 recorded significantly higher fibre yield (20.83 q/ha) over check varieties.

In mesta, the targeted fibre yield of mesta (3.5 t/ha) was achieved with application of 100% NPK on ST-TY + FYM @ 5 t/ha under neutral soil conditions at Aduthurai, Tamil Nadu. Under acid soil condition, the targeted yield of mesta could not be achieved at Amadalavalasa, Andhra Pradesh.

At Amadalavalasa, mesta + greengram (1:1) intercropping treatment recorded mesta equivalent yield (20.92 q/ha) which was statistically at par with weed free check (20.93 q/ha) while application of quizalofop ethyl 10% EC @ 38 g/ha + 1 hand weeding or nail weeder twice + scrapper recorded lower weed dry matter (8.73 – 9.16 q/ha) in mesta at 45 DAS. At Aduthurai, pre-emergence spraying of Ipifencarbazone (22.8%) @ 115 g/ha + one HW at 15 DAS recorded significantly higher fibre yield (25.20 q/ha) of mesta with lowest weed dry matter (0.30 q/ha) and highest weed control efficiency (85.8%).

Highest mesta equivalent yield (105.71 q/ha), net return (₹226369/ha) and B:C ratio (3.86) was recorded with mesta- maize crop sequence followed by mesta + groundnut and mesta - cluster bean crop sequences at Amadalavalasa. Similarly, at Aduthurai, mesta - sunnhemp sequence recorded significantly higher mesta equivalent yield (71.96 q/ha) along with higher net return (₹166880/ha) and B:C ratio (5.19) followed by mesta - maize and mesta - groundnut sequences.

At Kendrapara, maximum mesta fibre equivalent yield (48.20 q/ha) was recorded



with mesta + groundnut (2:2) which was statistically at par with mesta + mungbean (2:2) (45.25 q/ha) and mesta + urdbean (2:2) (44.08 q/ha) while net return was in the order mesta + mungbean (2:2) (₹ 84788/ha) > mesta + urdbean (2:2) (₹81533/ha) > mesta + groundnut (2:2) (₹80875/ha). At Aduthurai, maximum mesta fibre equivalent yield (35.55 q/ha), net return (₹85045/ha) and B:C ratio (3.82) among the intercropping systems was recorded with mesta + maize (2:2) followed by mesta + groundnut (2:2) (32.77 q/ha, ₹73643/ha & 3.25).



Fig. 78: Evaluation trials of intercropping with mesta

3. Sunnhemp

IET: Six test entries with 2 checks were evaluated at 5 locations (Barrackpore, Pratapgarh, Kalyani, Aduthurai and Budbud). Data analysis is in progress.

At Amadalavalasa, higher seed yield of sunnhemp (10.23 q/ha) was recorded with sowing on 15th September and varieties SUIN 053 or JRJ 610 gave better seed yield (5.34 – 5.42 q/ha) and were found suitable for seed production in Andhra Pradesh. Similarly at Kalyani, sowing of sunnhemp between 15th

to 30th September recorded higher seed yield (18.38 – 18.60 q/ha) and the suitable sunnhemp varieties identified for seed production were SUIN 053 and SUIN 037. At Rahuri, sowing of sunnhemp seed crop between 15th June to 1st July recorded higher seed yield (15.73 – 16.14 q/ha), net return (₹46090 – 49207/ha) and B:C ratio (2.52 – 2.56). Sunnhemp variety JRJ 610 recorded higher seed yield (15.10 q/ha), net return (₹39828/ha) and B:C ratio (2.31) and is recommended for the region.

4. Ramie

IET: Trial on three test entries with 2 checks has been laid at three locations (Sorbhog, Coochbehar and Nagaon). Yield data will be recorded during ensuing season.

At Barrackpore, higher fibre yield (total) of ramie was recorded in ridge and furrow (14.80 q/ha) and raised bed method (14.28 q/ha) of planting which were statistically at par. The total fibre yield of ramie recorded with the INM treatment [125% N from RDN (inorganic) + 25% N from ramie compost]

was significantly higher (15.77 q/ha) than fibre yield recorded with 150% RDN (14.63 q/ha). Similarly, at Coochbehar, ridge and furrow planting (8.99 q/ha) and INM treatment comprising 25% N from ramie compost (9.60 q/ha) recorded maximum fibre yield of the crop. Total fibre yield (two cuttings) of ramie increased significantly with N application up to 50 kg N/ha (4.10 q/ha) and 25 kg K/ha (3.68 q/ha) at Sorbhog, Assam.



5. Flax

AVT-I: Three test entries with 1 check were evaluated at 4 locations (Pratapgarh, Coochbehar, Nagaon and Sorbhog). Data has been received and analysis is in progress.

AVT-II: Three test entries along with check variety JRF 2 were evaluated at 4 locations (Pratapgarh, Coochbehar, Nagaon and Sorbhog). Data has been received and analysis is in progress.

Higher fibre yield of flax in Coochbehar was recorded when the crop was sown between 1st November to 11th November (14.11 – 14.99 q/ha) after which fibre yield reduced significantly. The pooled data on fibre yield also revealed that increase in yield was significant up to 80 kg N/ha only (14.18 q/ha) in Coochbehar.

Intercropping of flax with lentil, grass pea, pea, red amaranth, chenopodium or coriander increased system productivity in flax cultivation. At Barrackpore, maximum flax fibre equivalent yield was recorded with intercropping of flax + garden pea (2:1) (17.71 q/ha) followed by flax + red amaranth (2:1) (16.42 q/ha) whereas at Coochbehar, maximum flax fibre equivalent yield was recorded with flax + coriander (2:1) (40.25 q/ha) followed by flax + chenopodium (2:1) (39.58 q/ha). At Nagaon, maximum flax seed equivalent yield was recorded with flax + spinach (2:1) (42.30 q/ha) followed by flax + coriander (2:1) (29.66 q/ha).



Fig. 79: Evaluation trials of intercropping with flax

6. Sisal

Application of NPK @ 90:30:60 kg/ha + sisal waste @ 20 t/ha recorded maximum number of leaves (89167/ha), leaf weight (41500 kg/ha) and fibre yield (19.33 q/ha) of sisal at Bamra, Odisha, while at Amadalavalasa, Andhra Pradesh, maximum sisal fibre yield was recorded with application of NPK @ 60:13:50 kg/ha + poultry manure @ 4 t/ha (19.30 q/ha) closely followed by application of NPK @ 90:13:50 kg/ha + vermi-compost @ 2.5 t/ha (19.13 q/ha).

Intercropping of sisal with pulses and oilseed crops or with aromatic grasses, spices or medicinal plants increased the system productivity in sisal. In sisal + pulse / oilseed intercropping system, maximum sisal fibre equivalent yield was recorded with sisal + groundnut (24.94 q/ha) which was at par with sisal + kulthi (24.21 q/ha). At Amadalavalasa, highest sisal fibre equivalent yield was recorded with sisal + greengram intercropping system (23.23 q/ha) followed by sisal + blackgram (20.99 q/ha) system.

In sisal + aromatic grass intercropping system, maximum sisal fibre equivalent yield was observed in sisal + vetiver intercropping system (31.04 q/ha) followed by sisal + lemon grass system (22.08 q/ha). In sisal + spices / medicinal plant intercropping, maximum sisal fibre equivalent yield was observed in sisal + fennel intercropping system (32.35 q/ha) followed by sisal + aloe vera (31.35 q/ha) and sisal + safed musli (29.83 q/ha) intercropping systems.



Fig. 80: Evaluation trials of intercropping with sisal

Training and Demonstration

All India Network Project on Jute and Allied Fibers (AINPJAF) had conducted 40 training programmes in the year 2021 with a participation of 1520 farmers of the JAF growing states. Eight (8) technologies were demonstrated in 134.42 ha area of 38 villages in seven jute growing states across India and 380 farmers benefited from this programme. Under general FLD programme, technologies were demonstrated in 74.45 ha area in 19 villages involving 122 farmers in the states of

West Bengal (3.45 ha), Tamil Nadu (10.0 ha), Andhra Pradesh (30.0 ha), Bihar (30.0 ha) and Odisha (1.0 ha). Under TSP component, demonstrations were conducted in 38.62 ha area in 11 villages of West Bengal (6), Assam (4) and Odisha (1) involving 152 farmer's field. Similarly, under SCSP programme, eleven (11) technologies were demonstrated in seven (7) villages of West Bengal in 20.95 ha area with participation of 104 farmers.



Fig. 81: Training program of farmers at different JAF growing states



OUTREACH PROGRAM



Scientists & Farmers Linkages

Capacity Building of Farmers on 'Climate Resilient Jute based Farming System'

A farmer's training-cum-Scientist interaction was organised during 10-11 March 2021 to disseminate the problem solving knowledge and reducing vulnerability of weather aberrations and climate change shocks through adoption of the available technology of ICAR-CRIJAF for jute. Climate resilient agriculture technology topics like- climate smart soil-water smart soil-water, weeds and pests-disease management, recycling of farm wastes for compost production and eco-farming system were discussed. The programme was conducted under SCSP component of NICRA project. Seeds and other farm inputs were given to all farmers.

Agro-advisory Services for Improving Jute and Allied Fibres Cultivation

Agro-advisory services for improved farming of jute and allied fibres were provided regularly for farmers and extension personnel. Training was also organised for timely use of weather forecast and agro-advisories in jute and allied fibres based agriculture. During May-June 2021, the peak jute growing season again coincided with second wave of COVID-19 pandemic and YAAS cyclone across the jute growing states. The Institute issued special agro-advisory at appropriate time to take measures to reduce the impact of cyclone and to revive the crop through several agro-techniques using information technology and institute's website.

Improved Jute Production Technology and In-Situ Retting Tank based Farming System

A 3-days training program was organized during 5-7 January, 2021. During technical session, Director, ICAR-CRIJAF interacted with the farmers and highlighted the significance of in-situ retting tank based farming system for fetching higher income and profits to enhance their livelihood. A field visit was also organized to demonstrate the 'In-situ jute retting pond based farming system model' at ICAR-CRIJAF Farm. During the valedictory session, jute bag and farm implement were provided to all participating farmers.



Skill Development Program on Operation and Maintenance of Farm Equipment

Skill development program for the SC farmers was organised during 10-12 February and 4-6 March 2021 to provide first-hand information on operation, maintenance of oil engines and other farm equipment. In practical session, the identification of engine parts, dismantling and re-assembling of parts of diesel engine were demonstrated. Role of custom hiring centre (CHC), use of tractor/power tiller in agriculture, safe use of plant protection equipment etc. were discussed. Farm tools and inputs like multi-row seed drill, single wheel jute weeder and hand compression sprayer were given to farmers.

Resource Conservation in Jute based Agriculture

A training program on “Resource Conservation and Crop Diversification in Jute based Agriculture” was organised for SC farmers of West Bengal. Importance of integrated farming system (IFS) for resource conservation and improving farm income in today’s agriculture situation was discussed. Dr. Gouranga Kar, Director in his address emphasized benefits of IFS and its role in eco-farming system.

Farmers’ Awareness Campaign on Balanced Use of Fertilizers

Awareness campaign on balanced use of fertilizers in agricultural crops was organized on 18th June 2021 to make aware the farmer on importance of soil testing and balanced used of fertilizers; use of organic manures and biofertilizer for sustainable crop production. Farmers and extension personnel participated in this program. Director of the Institute shared his view on green and clean farming by reducing the uses of chemical fertilizer in agriculture.



Agro-Technique in Sunnhemp and Flax for Yield and Fibre Quality Enhancement

Training was organized for farmers of Pratapgarh (U.P.) to make them aware about different seed treatment procedures and management of pests and diseases at early stages of crop growth. In field visit, various sunnhemp and flax trials were shown to the farmers to understand the impact of technology. Seeds, fertilizers, bioagents, pesticides, and insect traps were given to all the farmers for its use in sunnhemp cultivation.

IPM in Jute Based Cropping System

Integrated insect pest management in vegetable crops and jute based cropping system; and IPM of major diseases of jute and allied fibre crops were discussed during the training session of SC farmers. A field visit was also organized to show the model of integrated farming system (IFS). Farm inputs for jute cultivation were provided to all the participating farmers.

Farmers-Scientist Interaction during Inauguration of ICAR-NIBSM, Raipur

A farmers-scientist interaction session was organised during Inaugural programme of ICAR-NIBSM, Raipur and launching of 35 new crop varieties by Hon'ble Prime Minister of India on 28th September 2021. Altogether 181 farmers and scientists attended this programme. On this occasion, seeds of new varieties of jute with improved traits were provided to farmers.



Farmers' Workshop on Improved Retting Technology

Jute farmers from Nadia and North 24 Parganas district participated in this workshop-cum-training programme on 11th August, 2021 organised under NFSM-CC (jute) Project. Technical sessions on jute retting using CRIJAF Sona was demonstrated at newly developed solar-powered free flow water retting tank.

Farmers' Training and Farm Input Distribution under TSP

A Farmers' Training-cum-Input Distribution Program under TSP was organized at Dakshin Dinajpur in collaboration with KVK during 14-15 July 2021. Altogether 100 ST farmers of Pransagar, Ashokgram, Sahartali, Barshapara Patiram, Balapur and Mahadevpur Tapan participated. Paddy seed (Var. Swarna), rabi season vegetable seed kits, vermicompost beds and small farm implements were provided to all participating farmers.



Distribution of seeds of new varieties of jute with improved traits by the Director

Training Organised

Topic of the training	Place	Duration	No. of Participants
1. Skill development training on jute fibre based handicrafts	ICAR-CRIJAF, Barrackpore	29 Dec 2020-8 Jan 2021	12
2. Improved jute production technology and in-situ retting tank based farming system	ICAR-CRIJAF, Barrackpore	5-7 Jan 2021	12
3. Advanced skill training on jute fabric based value added products	ICAR-CRIJAF, Barrackpore	22-30 Jan 2021	12
4. In-situ jute retting pond based farming: An approach for sustainable eco farming	ICAR-CRIJAF, Barrackpore	28-30 Jan 2021	12
5. Farm mechanization in jute based cropping system for enhancing productivity and profit	ICAR-CRIJAF, Barrackpore	10-12 Feb 2021	12
6. Seed production technology of jute and allied fibre crops for enhancing farm income	CSRSJAF, Budbud	18-19 Feb 2021	80
7. Vermicomposting for improving soil health	ICAR-CRIJAF, Barrackpore	24-26 Feb 2021	10
8. Resource conservation and crop diversification in jute based agriculture	ICAR-CRIJAF, Barrackpore	1 Mar 2021	15
9. Maximization of farm income through jute based integrated pest management	ICAR-CRIJAF, Barrackpore	2 Mar 2021 6 Mar 2021	15 15
10. Farm mechanization role of CHC in jute based cropping system	ICAR-CRIJAF, Barrackpore	4-6 Mar 2021	15
11. Ramie production and extraction technology (under NFSM-CC)	RRS, Sorbhog, Assam	5 -15 Mar 2021	50
12. Upgraded agronomic practices for achieving higher fibre yield and quality of jute	ICAR-CRIJAF, Barrackpore	5 Mar 2021	15
13. Agro-technique in sunnhemp and flax for yield enhancement and quality fibre production	Sh. R. S. Pratapgarh	5 Mar 2021	40
14. Flax cultivation (JRF-2)	Sh. R. S. Pratapgarh	6 Mar 2021	35
15. Eco-friendly weed management technology for cost reduction and higher fibre yield in jute	ICAR-CRIJAF, Barrackpore	6 Mar 2021	15
16. Women-friendly farm implements for drudgery reduction in agriculture	ICAR-CRIJAF, Barrackpore	8 Mar 2021	15
17. Climate smart soil, nutrient and water management in jute farming (under NICRA Project)	ICAR-CRIJAF, Barrackpore	9-10 Mar 2021	40
18. Improved production technologies of jute for enhancing productivity & quality (under Jute-ICARE)	ICAR-CRIJAF, Barrackpore	11-12 Mar 2021	79
19. Improved production technologies of jute and allied fibres (under NFSM- CC-Jute)	ICAR-CRIJAF, Barrackpore	17-19 Mar 2021	21
20. Integrated farming systems for enhancing farm productivity and income in NEH region (under NEH scheme)	COA, Kyrdekulai, Meghalaya	18-20 Mar 2021	50
21. Improved jute retting and farmer-scientist interaction meeting (under DST Seed Project)	Beraberia, North 24 Parganas	29 Jul 2021	18
22. Improved retting of jute (NFSM-CC Project)	ICAR-CRIJAF, Barrackpore	11 Aug 2021	20

Topic of the training	Place	Duration	No. of Participants
23. Improved retting of jute (under DST Seed Project)	South Hansia, Barrackpore	12 Aug 2021	32
24. Improved retting and fibre extraction technology for high quality fibre (under DST Seed Project)	ICAR-CRIJAF, Barrackpore	1 Sept 2021	30
25. Improved retting of jute in slow moving water	ICAR-CRIJAF, Barrackpore	9 Sept 2021	20
26. Improved vegetable cultivation in jute based cropping sequence (under DST Seed Project)	ICAR-CRIJAF, Barrackpore	28-30 Sept 2021	33
27. Importance of farmers producers organisation for small holder farmers	ICAR-CRIJAF, Barrackpore	17 Nov 2021	30
28. Weed management in ramie using mechanical Weeder (under NEH scheme)	West Garo Hills, South Garo Hills Meghalaya	25 Oct 2021	30
29. Designing and making of customized jute bags	ICAR-CRIJAF, Barrackpore	24 Nov - 1 Dec 2021	12
30. Skill Development programme on making of jute fibre based decorative items	ICAR-CRIJAF, Barrackpore	7-24 Dec 2021	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	29	160	194	354	211	158	369	723
Rural Youth	5	17	64	81	14	18	32	113
Extension Functionaries	6	17	27	44	45	34	79	123
Total	40	194	285	479	270	210	480	959
KVK, Burdwan								
Practicing Farmers	41	--	--	--	446	440	886	1772
Rural Youth	6	--	--	--	40	30	70	140
Total	47	--	--	--	486	470	956	1912



National Food Security Mission

1. Skill Development Programs

1.1 Quality seed production of jute, mesta and sunnhemp

A skill development training program was organized under National Food Security Mission (NFSM) of Commercial Crops program on “Quality seed production technologies in mesta and sunnhemp” at Agricultural Research Station (Amadalavalasa, Andhra Pradesh) and at AINP Centre of Jute and Allied Fibres of ICAR-CRIJAF. Altogether 9 Associate

Director of Agriculture, 12 Mandal Agricultural officers, 14 Village Agricultural Assistants, and 4 progressive farmers from Srikakulam and Vizianagaram districts participated in the program. On this occasion, a technical bulletin titled “Integrated crop management for quality seed production in mesta and sunnhemp” in Telugu language was released.



Fig. 82: Participating farmers during training at Amadalavalasa (Andhra Pradesh)

1.2 Improved retting technology on mesta

Agricultural Research Station, Amadalavalasa in collaboration with ICAR-CRIJAF conducted a skill development programme on “Improved retting technology on mesta” to the officials of the Department of Agriculture and progressive farmers (60 nos.) of Srikakulam

district. The program was attended by the Dr. S.S.R.K. Netaji, Hon’ble Member, Board of Management, ANGRAU, Associate Director of Research, RARS, Anakapalle, Joint Director of Agriculture and Project Director, ATMA, Srikakulam District.



Fig. 83: Demonstration of mesta retting technology to farmers at Amadalavalasa, Andhra Pradesh

2. Frontline demonstrations (FLD)

Ramie: FLD on Ramie fiber production and extraction technology has been included in “Local Initiatives” under NFSM (Commercial Crops) during 2019-20 by DAC& FW, Govt. of India. During 2021, ramie plantations in 3 ha area at RRS, Sorbhog was done to supply quality planting materials for ramie area expansion. Four training programs were also organised on ‘Improved production and extraction technology of ramie’ during March 2021. Altogether 200 farmers from Rampur, Duramari, Noontola, Puthimari, Ahom pathar, Bairapur, Dakhin Buri Khamar, Mathurapur, Belsar, Sorbhog and Kamargaon village participated in the training.

Jute: Frontline demonstrations on the latest high yielding varieties and other improved production

technologies of jute were conducted in various blocks of North 24 Parganas, Hooghly, and Purba Bardhaman.



Fig. 84: Demonstration of ramie fiber extraction technology

Table 38: FLDs on improved production technologies of jute in West Bengal

Location of FLD	Area coverage under different technology (ha)			
	No. of FLD	Improved variety	Mechanical weed control	Line sowing with Multi-row seed drill
Habra-I (North 24 Parganas)	70	37.50	12.52	24.98
Barrackpore-I (North 24 Parganas)	40	15.00	4.55	10.45
Madhusudanpur (Hooghly)	72	26.50	4.28	22.22
Dhobapara, Bolagarh (Purba Bardhaman)	20	20.00	-	5.00
Total	202	99.00	21.35	62.65

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 CRIJAF single wheel jute weeder (SWJW) was conducted in the farmer's field (21.35 ha) in two districts of West Bengal (Table 39). Demonstrations on mechanical weed management resulted in 4.11-5.75 q/ha fibre yield gain over farmers' practice

(26.45-29.60 q/ha). Saving on the cost of labour was ₹9,806 to 13,175/ha.

Line sowing: Demonstrations on manual four-rows seed drill was conducted in 62.65 ha area in two districts of West Bengal (Table 39). It helped in increasing the fibre yield by 2.80-4.55 q/ha. It also saved the cost of human labour in jute cultivation by ₹7,359-11072/ha over farmers' practice.

Table 39: Economics of jute cultivation in North 24 Pargana district of West Bengal

Locations/ Particulars	IC (₹/ha)	LC (₹/ha)	CC (₹/ha)	Yield (q/ha)	GR (₹/ha)	NR (₹/ha)	BCR
Mechanical weed management							
Belley Sankarpur							
NW/SWJW	10485	72315	82800	32.65	223326	140526	2.69
FP	12938	84680	97618	28.42	194393	96775	1.99
Kumra							
NW/SWJW	10068	68842	82800	35.35	221194	138394	2.67
FP	13435	82017	95452	29.60	202464	107012	2.12
Madhusudanpur							
NW/SWJW	10763	74181	84244	30.56	209030	124086	2.48
FP	13315	83987	97302	26.45	180576	83274	1.85
Line sowing with multi-row seed drill							
Belley Sankarpur							
Multi-row seed drill	9848	70945	82793	34.15	213586	130793	2.57
FP	13435	82017	95452	29.60	202464	107012	2.12
Kumra							
Multi-row seed drill	10125	76765	86890	31.65	216486	129596	2.49
FP	12938	84680	97618	28.42	194393	96775	1.99
Madhusudanpur							
Multi-row seed drill	10232	76628	86860	29.25	200070	113210	2.30
FP	13315	83987	97302	26.45	180918	83616	1.85

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 ₹ 6,000/q and ₹400/q, respectively.

Improved retting through CRIJAF SONA:

Improved retting demonstrations were also conducted. In comparison to the conventional method of jute retting, the application of CRIJAF SONA (@30 kg/ha) reduced the retting period by 6-9 days at all places. There was an improvement (1-2 grade) in fibre quality and

colour i.e. yellowish to bright golden. Due to improvement in the quality of jute fibre, growers could earn additional income of ₹300 - 450/q (Table 40). This method also reduced the fibre : water ratio (v/v) to only 1:5 which is four times less than the conventional method of retting (1:20).

Table 40: Qualitative evaluation of improved jute retting with CRIJAF SONA

Extension centre	Fibre quality		Retting Duration (days)		Additional Income (₹/q)
	Improved	Conventional	Improved	Conventional	
Belley Sankarpur	TD 2-3	TD 5 - 6	11 - 14	19 - 23	500
Kumra	TD 2-3	TD 5 - 6	13 - 16	20 - 26	500
Madhusudanpur	TD 2-3	TD 5 - 6	14 - 17	22 - 26	450

Mesta: FLD on improved production and protection technologies were done in Srikakulam (13 villages, 14 farmers) and Vizianagaram district (12 villages, 15 farmers) of Andhra Pradesh in 10 ha. The fibre yield

was recorded in the range of 21-26 q per ha in Srikakulam and 21-30 q in the Vizianagaram district. Recently released mesta (roselle) varieties AMV 7, AMV 8, AMV 9 and AMV 10 were demonstrated.



Fig. 85: Frontline demonstration on improved varieties of mesta at G. Devipeta, Srikakulam



Fig. 86: Frontline demonstration on integrated nutrient management of mesta at Peddasalikam, Srikakulam

In another FLD, ten frontline demonstrations of improved retting technologies of mesta were carried out in Srikakulam (5) and Vizianagaram (5) covering an area of 2.5 ha. Fibre recovery

recorded was 21-27 q/ha in Srikakulam and 21-28 q/ha in Vizianagaram. Altogether 405 farmers participated in these FLDs.



Fig. 87: Demonstration of mesta retting technology to farmers at Srikakulam & Vizianagaram, A. P.

3. Quality Seed Production

During 2021, emphasis was given to increase availability of jute seeds of newly developed varieties. For the first time, foundation seed (cv. JBO-1, 5q; JROM-1, 10q; JRO 2407, 10q) and certified seed (CO-58, 100q) was produced at Guntur (Andhra Pradesh). Seed certification was done with Andhra Pradesh State Seed

Certification Agency (APSSCA). In addition, foundation seed (JRO-204) and certified seed (CO-58) production of jute was done at MPKV, Rahuri (Maharashtra) with a target production of about 10 q and 40 q, respectively from 5 ha area.



Fig. 88: Certified seed (var CO-58) production at MPKV, Rahuri (Maharashtra)



Fig. 89: Monitoring of foundation seed production of JRO 204 at MPKV, Rahuri



Fig. 90: Foundation seed production (var AMV 7 and AMV 10) at ARS, Amadalavalasa



ICAR-CRIJAF component of targeted foundation seed of jute was 35 q, and the certified seed was 140 q. About 11.22 q foundation seed of olitorius jute variety CO 58 was produced at MPKV Rahuri (Maharashtra). A total of 7.20 q certified seed of jute (JRO 2407), mesta (AMV 7) and sunnhemp (JRJ 610) was produced by ICAR-CRIJAF and ARS-Amadalavalasa (Andhra Pradesh) jointly. In addition to jute, a total of 9 q foundation seed of mesta (AMV 7, AMV 8, AMV 9) and sunnhemp (SUIN 037) were also produced at ARS-Amadalavalasa.

Foundation seed production program was undertaken for four varieties of mesta (roselle) namely, AMV 7, AMV 8, AMV 9, and AMV 10 in 1 ha area with a target of 5 q seed. The crop is presently in the flowering stage. For jute (JRO 204) and sunnhemp (SUIN 03), 0.6 ha and 0.4 ha area were sown with a target of 3.0 q and 2.0 q, respectively. Three varieties one each of jute (CO 58), mesta (AMV 7) and sunnhemp (SUIN 037) has been sown in 1.8 ha area with a target of 2 q, 5 q and 3 q of certified seed.



Fig. 91: Performance of improved variety of jute (JRO 204) under FLD



Fig. 92: Golden fibre of jute produced in ICAR-CRIJAF technology demonstration

SCSP, TSP & NEH Programs

The Scheduled Caste Sub-Plan (SCSP), Tribal Sub-Plan (TSP) and NEH programmes were taken up by the institute to address the issues and problems related to farming faced by scheduled caste and tribal communities in an integrated way. These programmes primarily focused on the promotion of R&D-based proven technologies for skill and livelihood improvement in order to assist the SC and ST farmer communities in their developmental aspirations programs, which were supported by the provision of adequate resources and technological know-how.

1. Tribal Sub-Plan (TSP)

1.1 Agricultural input distribution for enhancing crop productivity and farm income

Successful technology models, farm equipment, improved seed, animal components and other appliances for improving the farm income in jute and allied fibre based cropping system were promoted among the ST farmers with adequate resource support. Various agricultural inputs like

improved variety of jute, paddy and vegetable seeds, fruit planting materials, fertilizers, vermi beds, CRIJAF Sona for retting and farm implements/tools (CRIJAF Nail and Cycle Weeder, Sprayer, etc.) were distributed to more than 3900 farmers of various districts of West Bengal and Odisha.



Fig. 93: Agricultural input distribution for field demonstration

1.2. Farm skill development of ST farmers

In order 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 field, scientists of ICAR-CRIAF has conducted capacity building activities like trainings and demonstration in several districts of West Bengal. During 2021, altogether 9 programmes were conducted under TSP and about 229 ST farmers were trained.

Capacity building programme	Date/Place	No. of Participants
1. Jute fabric based value added products	6-12 March, 2021 ICAR-CRIJAF, Barrackpore	12
2. Nutrient management of crops in jute based farming system	5 March, 2021 KVK, Budbud, Bardhaman	30
3. Crop diversification in jute based cropping systems	14 July, 2021 Dakshin Dinajpur, Balurghat	27
4. Integrated farming system approach in jute based crop sequence	15 July, 2021 Dakshin Dinajpur, Balurghat	25
5. Jute seed production based crop diversification	19 July, 2021 Kulabahal, Saltora, Bankura	26
6. Mesta seed production based crop diversification	20 July, 2021 Kulabahal, Saltora, Bankura	25
7. Disease and insect free jute seed production	29 July, 2021 Jadugora Adibashi Gram Vikas Kendra, Purulia	28
8. Disease and insect free jute seed production	30 July, 2021 Jadugora Adibashi Gram Vikas Kendra, Purulia	25
9. Organic manure production under integrated farming system approach	06 August, 2021 Ashokenagar, 24 PGS (N)	31



Fig. 94: Farmers attending programmes of TSP in West Bengal

1.3 Awareness programme and other events under TSP

Keeping in view of the importance of trees and forests in maintaining an ecological balance, a programme on *Van Mahotsav* and *Poshan Vatika Maha Abhiyan* was organised in a ST village (Makaltala, North 24 Parganas) of West

Bengal. Altogether 82 ST farmers including 33 girls participated in this programme, where nutrient rich food containing millets were served. About 200 fruit plants (mango, guava, etc.) were planted in the ST villages.



Fig. 95: Plantation of mango plant as a part of Van Mahotsav at Makaltala village of West Bengal

2. Scheduled Caste Sub-Plan (SCSP)

The SCSP (Scheduled Caste Sub Plan) was initiated 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. Altogether 45 trainings were conducted and 1055 farmers were benefited through such trainings during the year 2021. Agricultural inputs were distributed for field demonstrations in the adopted villages.

- Scheduled caste sub plan activities were implemented in five villages of North 24 Parganas district of West Bengal State covering around ~220 beneficiaries.

- Field demonstrations on jute, paddy and vegetables were conducted in 50 hectare SC farmers' fields. Seed of improved cultivars of jute (JRO 204); paddy (MTU 7029, Swarna); 2300 fruit plants like Mango (Himsagar), Lemon (Pati, Gandharaj), Guava (Baruipur), Jackfruit, Banana (G9); fertilizer (NPK, 6000 kg), CRIJAF Sona (1700 kg), IIHR vegetable kits (1220 nos.) etc. were provided to the SC communities.
- In order to increase the income of SC beneficiaries and encourage back-yard poultry, ducklings (Khaki Campbell, ~ 2360 nos.) were distributed in all five adopted villages of North 24 Parganas districts of West Bengal state.



**CRIJAF-Sona
distribution to SC
farmers for improved
retting of jute fibre**

**Farm input
distribution to SC
farm women**



**Demonstration on
improved variety of
rice in SC farmer's
field**

Table 41: Trainings conducted for SC farmers during 2021

Capacity building programme	Date/Place	No. of participants
1. Advantages of intercropping in jute and allied fibre crops	25 February, 2021 ICAR-CRIJAF, Barrackpore	15
2. Agro-advisory services for jute and allied farming	3 March, 2021 ICAR-CRIJAF, Barrackpore	15
3. Agro-technique in sunnhemp and flax for yield enhancement and quality fibre production	5 March, 2021 ICAR-CRIJAF, Barrackpore	40
4. Alternative income generation through mushroom cultivation	25-27 February, 2021 ICAR-CRIJAF, Barrackpore	15
5. Awareness on advanced research tools in agriculture	26 February, 2021 ICAR-CRIJAF, Barrackpore	15
6. Climate smart jute cultivation	1-3 March, 2021 ICAR-CRIJAF, Barrackpore	15
7. Eco-friendly weed management technology for cost reduction and higher fibre yield in jute	6 March, 2021 ICAR-CRIJAF, Barrackpore	15
8. Farm mechanization in jute based farming system for enhancing productivity and profit	10-12 February, 2021 ICAR-CRIJAF, Barrackpore	20
9. Farmer-SHG members-scientist-expert interaction meeting	24 March, 2021 ICAR-CRIJAF, Barrackpore	45
10. Farmers training on balanced fertilization and fertilizer dose calculation and distribution of agri inputs	11 March, 2021 RRS, Sorbhog, Assam	50
11. Improved jute retting technology for quality fibre production	26 February, 2021 3 March, 2021 ICAR-CRIJAF, Barrackpore	15 15
12. Improved production technology of jute and allied fibre for enhancing farm income	18 February, 2021 19 February, 2021 CSRSJAF, Budbud	40 40
13. Improved seed production technology of different field crops	30 March, 2021 CSRSJAF, Budbud	40
14. Improving the farmers income through jute based integrated pest management	6 March, 2021 ICAR-CRIJAF, Barrackpore	15
15. Insight into jute varietal development from farmers perspective	2 March, 2021 ICAR-CRIJAF, Barrackpore	15
16. In-situ jute retting tank based farming: an approach for sustainable eco-farming	28-30 January, 2021 ICAR-CRIJAF, Barrackpore	15
17. Integrated insect-pest management in jute based cropping system	23 February, 2021 ICAR-CRIJAF, Barrackpore	15
18. Integrated jute based farming system	24 March, 2021 KVK, Burdwan	30
19. Integrated pest management in jute based cropping system	3-5 March, 2021 ICAR-CRIJAF, Barrackpore	45
20. Jute based farming system	6-8 January, 2021 KVK, Burdwan	30
21. Management of disease in jute and allied fibre crops	19 February, 2021 ICAR-CRIJAF, Barrackpore	20

Capacity building programme	Date/Place	No. of participants
22. Maximization of farm income through jute based integrated pest management	2 March, 2021 ICAR-CRIJAF, Barrackpore	15
23. Natural biodiversity conservation, plant breeder rights and farmer rights	3 March, 2021 ICAR-CRIJAF, Barrackpore	15
24. New varieties for jute and allied fibre crops for diversified use	25 February, 2021 ICAR-CRIJAF, Barrackpore	15
25. Nutrient management in jute and allied fibres	25 February, 2021 ICAR-CRIJAF, Barrackpore	15
26. Nutrient management in jute based cropping system	27 February, 2021 ICAR-CRIJAF, Barrackpore	15
27. Opportunity of jute and allied fibre based cropping system for enhancing farm income and sustainable agriculture	25 March, 2021 Mahanga, Jajpur, Odisha	50
	27 March, 2021 Bhuban, Dhenkanal, Odisha	50
	28 March, 2021 Bhaganayi, Keonjhar, Odisha	50
28. Precision pest management for enhancing farm income	6 March, 2021 ICAR-CRIJAF, Barrackpore	15
29. Principles of quality seed production	4 March, 2021 ICAR-CRIJAF, Barrackpore	15
30. Resource conservation and crop diversification in jute based cropping system	1 March, 2021 ICAR-CRIJAF, Barrackpore	15
31. Role of biological control in integrated pest management for enhancing farm income	1 March, 2021 ICAR-CRIJAF, Barrackpore	15
32. Role of custom hiring centres in mechanization of jute based cropping system	4-6 March, 2021 ICAR-CRIJAF, Barrackpore	15
33. Role of farmers in jute germplasm conservation and management	1 March, 2021 ICAR-CRIJAF, Barrackpore	15
34. Scientific livestock production for augmenting the income of SC farmers	5 March, 2021 ICAR-CRIJAF, Barrackpore	15
35. Scientific seed production technology of mesta and sunnhemp	27 February, 2021 ICAR-CRIJAF, Barrackpore	15
36. Scope of jute based cropping system for enhancing farmer income and sustainable agriculture	10 February, 2021 ICAR-CRIJAF, Barrackpore	43
	10-12 March, 2021 SRS, Jharsuguda, Odisha	25
37. Scope of sisal based integrated farming system for doubling farm income and rural livelihood	10-12 March, 2021 SRS, Sambalpur, Odisha	20
38. Upgraded agronomic practices for achieving high fibre yield and quality of jute	5 March, 2021 ICAR-CRIJAF, Barrackpore	15
39. Vermi-composting for improving soil health	24-26 February, 2021 ICAR-CRIJAF, Barrackpore	12
40. Weed management in jute	4 March, 2021 ICAR-CRIJAF, Barrackpore	15
41. Women-friendly farm implements for drudgery reduction in agriculture	8 March, 2021 ICAR-CRIJAF, Barrackpore	15

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 “Weed management in ramie and field crops using mechanical weeder (CRIJAF Cycle Weeder)” and “Vermicomposting using Vermi Bed” were initiated in Meghalaya and Tripura. 480 cycle weeders and 200 Vermi-beds are being distributed to all participating farmers of West Garo Hills of Meghalaya and West Tripura

district of Tripura. Participatory demonstrations were conducted with 680 farmer beneficiaries. Under NEH component, training programmes in collaboration with respective ICAR-KVKs were organized. The theme of the training programmes were focused on the scientific ramie cultivation technologies for increasing profitability and resource use efficiency, integrated weed and nutrient management and adaptation of CRIJAF planting materials of ramie under upland condition.



Fig. 96: CRIJAF-Cycle Weeder for weed management in jute and other field crops 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. A total of 52 villages could be covered under MGMG programme. The scientists were grouped into 11 teams each with 3-4 scientists. During the COVID-19 pandemic situation also scientist had contacted the farmers of adapted villages to periodically update the farmers about agricultural activities through phone and mobile messages. 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.

Table 42: Groups of scientists and the allotted villages under MGMG program of ICAR-CRIJAF

Group	Members	Villages/(District)	Group	Members	Villages/(District)
1.	Dr. A. K. Ghorai Dr. S. Roy Dr. J. K. Meena	Bagnabar, Barisha (Paschim Medinipur)	7.	Dr. M. S. Behera Dr. A. K. Chakraborty Dr. Shamna. A Dr. B. S. Gotyal	Makaltala, Farmania, Sonakenia, Abad, Kharo-rudrapur, Beliakhali, (North 24 Parganas)
2.	Dr. J. Mitra Dr. R. K. De Dr. M. L. Roy	Madhusudanpur, Beraberi Khagragachi, Bajemelia Kinkarkati, Jampukur (Hooghly)	8.	Dr. A.K. Singh Dr. A. Bera Dr. D. Barman	Ghidah, Selampur, Gustia, Telenipara, Chapuria (North 24 Parganas)
3.	Dr. C. Biswas Dr. S. Datta Dr. S. Kumar	Kumra, Kashipur Rudrapur, Bijoyanagar, Nikerati, Panchpota (North 24 Parganas)	9.	Dr. K. Mandal Dr. R. Saha Dr. P. Satya Dr. N. M. Alam	Teghoria, Kadambagachi, Raigram, Bonkanda, Baidyapur, Bharpara (North 24 Parganas)
4.	Dr. B. Majumdar Dr. A. Anil Kumar Dr. L. Sharma	Athghara, Kirtipur, Rajapur, Kanupur, Bena (North 24 Parganas)	10.	Dr. S. Mitra Dr. D. Sarkar Dr. C.S. Kar Dr. S.K. Pandey	Bargachia, Baichhigachi, Ratanpur, Kushdanga, Tapanpur, Shrirampur (North 24 Parganas)
5.	Dr. S. Satpathy Dr. S. K. Sarkar Dr. S. Sarkar Dr. V. R. Babu	Goaldaha, Gokulpur, Bhaduria, Bankra, Koijhury (North 24 Parganas)	11.	Dr. A.R. Saha Dr. S.P. Mazumdar Dr. R.T Maruthi	Brahmapur, Panchkahania, Satyapole, Bhabanipur, Bansbona, Dhopagachi, Bamanpara(Nadia)
6.	Dr. S. K. Jha Dr. D. Saha Dr. R. K. Naik	Paschim Simla, Dighirpar, Chandanpur, Durgapur, Saiadpur, Dakshin Simla (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 in villages on soil health management, IPM and other 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 as well as paddy and other enterprises. Extension literatures and inputs like CRIJAF SONA, improved seeds of vegetable for nutrition garden 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 management, farm mechanization and integrated pest management.



Fig 97: Jute fibre production using CRIJAF Sona in MGMG adopted village of West Bengal



Fig 98: Waste to wealth programme in MGMG adopted village of West Bengal

Swachh Bharat Mission

To contribute towards the vision of Mahatma Gandhi of keeping the surroundings neat and clean, the Government of India initiated the Swachh Bharat Abhiyan. Observing the vision of the Mission, the ICAR-CRIJAF organized the *Special National Swachhta Campaigns* on the Theme - “Waste-to-Wealth” during 2nd October to 31st Oct 2021. Scientists and staffs of the Institute visited all the Divisions, Sections and

Administrative units of the Institute to create awareness about importance of cleanliness and sanitation in day to day life and maintaining Swachhta in their respective workplaces. Cleanliness drives were also carried out in office premises and in the adopted villages. Director, Heads of the Divisions/Sections, Scientists, Staff of the Institute, farmers, students were actively involved in the cleaning campaign.

Waste-to-Wealth :

Leaf litter management for composting and its utilization as essential plant nutrients in crops

ICAR-CRIJAF has started a programme on leaf litter management for its rapid composting and making cost-effective composts. Decomposition of admixture of tree leaf litters is being done using effective microorganism (EM) and green sunnhemp plants treatment under aerobic conditions. Compost prepared from leaf litter can be used as source of plant nutrient in JAF crops like jute, ramie and flax. This technology is being promoted through various training and awareness programme for farmers and extension functionaries in the villages under Swachh Bharat Mission. Utilization and management of leaf litter as source of organic plant nutrients in agricultural crops may provide an alternative approach to waste management for clean environment. This compost can also reduce the use of chemical fertilizer in crop cultivation and help in lowering agriculture GHG emissions to mitigate climate change.



Fig 99: Awareness programme on waste-to-wealth management



Fig. 100: Awareness program for waste management under Swachh Bharat Mission at ICAR-CRIJAF



Fig. 101: The ICAR-CRIJAF employees being briefed about the Swachhta campaign activities by the committee.



Fig. 102: Director, ICAR-CRIJAF leading the cleaning operation at the Institute Campus

A series of awareness programs and trainings were conducted on “General cleanliness” and “Crop residue management and creating wealth from the farm and home wastes by

vermicomposting technology” for farmers and school students of West Bengal, Assam, Uttar Pradesh and Odisha by Regional Research Stations and Krishi Vigyan Kendras.



Fig. 103: Special Swachhta Campaign in villages by ShRS, Pratapgarh

As part of observance of Special Swachhta Campaign from 2nd October to 31st October, ICAR-CRIJAF organized webinar on “Swachh Bharat”. In this webinar the genesis, flagship programmes, impact on cleanliness and hygiene and way forward for greater output of Swachhta

Abhiyan in future were discussed. Besides the role of natural plant fibre, particularly jute in replacing plastics for making the environment clean and green was also highlighted. Altogether 70 participants from institute and regional stations took part in this webinar.



Fig. 104: Webinar on Swachh Bharat at ICAR-CRIJAF

Women Empowerment

Celebration of International Women's Day on 8th March 2021

International Women Day was observed on the theme “Women in leadership: achieving an equal future in a COVID-19 world”. An interaction programme on ‘Women friendly farm implements for drudgery reduction in agriculture’ was organised for farm women of West Bengal. A Drawing Competition on the theme “Choose to Challenge” was also organized.



Fig. 105: Farm women visiting eco-farming model of ICAR-CRIJAF

Mahila Kisan Diwas for equity and empowerment of farm women organised on 15th October 2021

Farm women from Nadia and North 24 Parganas district of West Bengal attended the programme through virtual mode to mark the occasion. Dr. Gouranga Kar, Director, urged the farm women to work as entrepreneurs for making agriculture more profitable and making India *Atmanirbhar*. Ms. Khadiza Khatun, Extension Officer of West Bengal interacted with the farm women for improving their income by adoption of new technologies and also outlined the various schemes of Government to empower the women.

Human Resource Development

The Human Resource developed by ICAR has played a pivotal role in transforming Agricultural Scenario in the country and achieving self-sufficiency in food grain production. In this endeavor, ICAR has contributed significantly through strengthening and development of higher Agricultural Education. During the year 2021, ICAR-CRIJAF could realize 88.9% of the annual training plan with 99.5% budget utilisation. Accordingly, the Annual training Plan of ICAR-CRIJAF for the year 2021-22 was developed after receiving inputs from respective applicants and reviewing officers using the 'Training Management Information System (TMIS)'. The ATP (2021-22) contains plan for training of 31 employees. Care was taken to give priority to those who did not receive any training during previous years. The plan included training proposals for scientific (8), technical (9), administrative (13) and skilled supporting

(4) staff members. Due to pandemic situation, most of the trainees attended training online. Till December, 2021, a total of 8 scientific staffs have received training on different aspects including 'Enhancing Research Skills and Refinement of Technology', 'Bio-security and Bio-safety: Policies, Diagnostics, Phytosanitary treatments and issues', 'Internet of Things', 'MDP on PME in Agricultural Research Projects' and 'Agri-Business, IP management and Entrepreneurship Development'. The Administrative staff members received training on 'Establishment Rules', 'Accrual Accounting', 'Technical Services Rules', 'Capacity Building Programme for Administrative Staff', 'Public Procurement for Government Officers', 'RTI', 'Reservation in Service including Reservation Rosters' and 'Accrual Accounting'. Two technical staff members were trained on Skill Developments in Maintaining Soil Health, Plant Health for better Crop Ecosystems.

Training (Online) Attended During Jan-Dec 2021

1. Scientific Staff

1	Dr. Debarati Datta, Scientist	Enhancing Research Skills and Refinement of Technology by a Scientist, during 18th -20th January 2021 at ICAR-IIHR, Bengaluru
2.	Dr. S.K. Sarkar, Principal Scientist	Reservation in Service including Reservation Rosters, during 28-30 June 2021, at ICAR-NAARM, Hyderabad
3	Dr. M. S. Behera, Principal Scientist	Enhancing Agricultural Resilience through Index-based Flood Insurance and Post-flood Management Interventions in India, during 29-30 June 2021, at IIWM Bhubneswar
4	Dr. Sitangshu Sarkar, Principal Scientist	Training Workshop for Vigilance Officers of ICAR Institutes, during 16-18 August 2021 at ICAR-NAARM, Hyderabad
5	Dr. Subhojit Datta, Principal Scientist	Bio-security and Bio-safety: Policies, Diagnostics, Phytosanitary Treatments and Issues, during 15 – 24 September 2021 at ICAR-NBPGR, New Delhi
6	Dr. C. S. Kar, Principal Scientist	MDP on PME in Agricultural Research Projects, during 25 – 30 October, 2021 at ICAR-NAARM, Hyderabad
7.	Ms. Neethu Mohan, Scientist	Internet of Things (TOT) for Women Scientists Under Women Component, DISHA Scheme (Mo S&T, GOI) during 25 – 29 October 2021
8.	Dr. Ritesh Saha, Principal Scientist	Agri-Business, IP Management and Entrepreneurship Development in Natural Sector, during 23 – 27 November 2021 at ICAR-NINFET, Kolkata

2. Technical Staff

1	Mr. Sahid Mukhtar, T.O	Skill Developments in Maintaining Soil Health, Plant Health for Better Crop Ecosystems, during 21st – 23rd Jan. 2021 at ICAR-IIHR, Bengaluru
2.	Dr. S. K. Bhattacharyya, T.O	Skill Developments in Maintaining Soil Health, Plant Health for better Crop Ecosystems, during 21st – 23rd Jan. 2021 at ICAR-IIHR, Bengaluru

3. Administrative Staffs

1.	Sri Kamal Dasgupta, Assistant	Establishment Rules, organised by ISTM, New Delhi	01.03.2021 to 05.03.2021
2.	Sri Ravi Patra, LDC	Noting & Drafting, organised by ISTM, New Delhi	15.03.2021 to 17.03.2021
3.	Sri Paras Nath Pal, UDC	Noting & Drafting, organised by ISTM, New Delhi	15.03.2021 to 17.03.2021
		Establishment Matters for LDC and UDC of ICAR, organised by ICAR-IISR, Lucknow	15.11.2021 to 20.11.2021
4.	Sri Radha Raman Debnath, JAO	Accrual Accounting, organised by ICAR-NRRI, Cuttack	19.01.2021 to 21.02.2021
5.	Sri Prasanta Kumar Das, Assistant	Technical Services Rules, organised by ICAR-NAARM, Hyderabad	06.01.2021 to 08.01.2021
6.	Sri Sushanta Dey, Personal Assistant	Capacity Building Programme for Administrative Staff, organised by ICAR-NINFET, Kolkata	26.07.2021 to 30.07.2021
7.	Sri Sandeep Prakash, Assistant	Capacity Building Programme for Administrative Staff, organised by ICAR-NINFET, Kolkata	26.07.2021 to 30.07.2021
8.	Sri Soumya Roy, Assistant	Public Procurement for Government Officers, organised by ICAR-AJNIFM, Faridabad	06.09.2021 to 11.09.2021
9.	Sri Raj Kumar Ghosh, AAO	Right to Information Act (RTI), organised by ICAR-NAARM, Hyderabad	15.07.2021 to 16.07.2021
10.	Sri Chandan Kr. Verma, Assistant	Right to Information Act (RTI), organised by ICAR-NAARM, Hyderabad	15.07.2021 to 16.07.2021
11.	Sri Ravi Mishra, AAO	Reservation in Service including Reservation Rosters, organised by ICAR-NAARM, Hyderabad	28.06.2021 to 30.06.2021
12.	Sri Ritesh Kumar, Assistant	Accrual Accounting, organised by ICAR-NRRI, Cuttack	26.07.2021 to 30.07.2021

Webinar, Seminar, Workshop & Meeting

Webinar series on “Making Clean and Green India” on occasion of *Bharat Ka Amrut Mahotsav & World Environment Day* during 4-7 June, 2021

Webinars on “Natural fibre as an alternative to plastic, Wealth from waste and sustainable eco-farming” and “Genome editing in bast fibres” were presented by Key Speakers Dr S.K. Jha, Dr A.K. Singh and Dr Subhojit Datta, Principal Scientists of ICAR-CRIJAF. The webinar were chaired by Dr D.B. Shakyawar (Director, ICAR-NINFET), Dr. B.K. Das (Director, ICAR-CIFRI), and Dr. Gouranga Kar (Director, ICAR-CRIJAF). Chairman of Webinar emphasised on the need of preparation of road map in framing research programme considering the expertise available and through possible collaborations so that the target can be achieved within a specific time frame. All the Scientist and staff of ICAR-CRIJAF, its regional stations, KVKs and also from ICAR-NINFET, Kolkata participated in this webinar.



Speaker and Chairman of Webinar during Bharat Ka Amrut Mahotsav 2021

Jute Farmers Awareness Workshop and launching of Phase VII of JUTE-ICARE project was organised at ICAR-CRIJAF on 15 February 2021 jointly by ICAR-CRIJAF, NJB & JCI

Smt. Smriti Zubin Irani, Union Minister for Textiles and Women & Child Development, Govt. of India inaugurated the Jute Farmers Awareness Workshop and Certified Jute Seeds Distribution Plan organised at ICAR-CRIJAF, Barrackpore, West Bengal. Hon'ble Union Minister has called upon the farmers to use certified seeds to increase their income and productivity and contribute to the country in jute diversified and technical textile products. Government of India had taken a resolution to exponentially spread the distribution of certified jute seeds through commercial seed programme for the benefit of about 5 lakh jute farmers. On this occasion, certified high yielding varieties of jute seed (variety JRO-204) developed by ICAR-CRIJAF was distributed to the farmers.



Hon'ble Minister of Textiles and Women & Child Development, Smt. Smriti Zubin Irani addressing jute farmers



Director, ICAR-CRIJAF, Chairman, NJB, and MD, JCI during Jute Seed Distribution Plan

The 32nd Annual Workshop of All India Network Project on Jute and Allied Fibres (AINPJAF) was organized virtually during 8-9 March 2021

In 32nd Annual Workshop of AINPJAF, the presentation of action taken report on recommendations was made by Dr. S. Mitra, Principal Scientist and In-charge, AINPJAF. The salient research achievements and other activities of individual centre were presented by the respective In-charges of AINPJAF centres. During two days deliberations, the detailed technical program for the year 2021-22 pertaining to Crop Improvement, Crop Production and Crop Protection discipline were formulated. A total of 74 scientists from 8 SAUs and 4 ICAR based centres of AINPJAF participated in the workshop.



Monthly seminar organised to create awareness on jute and allied fibre based natural resource management, value addition and livelihood support to farmers

IPR issues in agriculture research by Dr. Ritesh Saha,
Principal Scientist, Crop Production Division (2 Jan 2021)



Virtual water and water footprints in agriculture
by Dr. Gouranga Kar, Director, ICAR-CRIJAF (30 Jan 2021)



Exploring possible collaboration with different stakeholders and organizations for R&D in jute and allied fibres
by Dr. Jiban Mitra, Principal Scientist, Crop Improvement Division (22 Mar 2021)



Parthenium - Problem and Management by Dr. Sitangshu Sarakar, Principal Scientist, Crop Production Division (21 Aug 2021)



Food, Fibre and Nutritional Security by J.K. Meena, Scientist, Crop Improvement Division (16 Oct 2021)



Interaction meeting with Members of Public Accounts Committee (PAC) on jute farming and technological backup of ICAR-CRIJAF on 11th January 2021

Hon'ble Chairperson of Public Accounts Committee (PAC) and leader of Opposition in Lok Sabha, Shri Adhir Ranjan Chowdhury along with other Senior Members of Parliament and Members of PAC, Shri Jagadambika Pal, Dr. Satya Pal Singh, Shri Ram Kripal Yadav, and Smt. Darshana Vikram Jardosh interacted with Director and scientists on January 11, 2021 at Behrampur, West Bengal. Director ICAR-CRIJAF, Dr. Gouranga Kar briefed about the jute and allied fibre sector and milestone over the period to the committee. Members of PAC also visited ICAR-CRIJAF exhibition stall to see the CRIJAF technologies.



Scientific Advisory Committee Meeting of KVK, North 24 Parganas (Addl) on 3rd March 2021

The Annual progress of the KVK for the year 2020 was reviewed by the committee for preparation of the Action Plan-2021. Director, ICAR-CRIJAF emphasized on the need based demand driven transfer of technologies with a focus on efficient use of natural as well as human resources. The Director of Extension Education (BCKV), In-charge (NDRI, ERS), Assistant Director (Research, WBIAFS), officers from the State Line Departments, In-charges of the Divisions/Sections of ICAR-CRIJAF attended the meeting.

Research Advisory Committee Meeting (23-24 March 2021)

Research Advisory Committee (RAC) of ICAR-CRIJAF reviewed research achievements of the scientists and made nine specific recommendations for further strengthening of the research activities of the Institute. The RAC team also visited recently developed exhibition hall-cum-museum and research farms. A Farmer-Scientist interaction meet was organized on 24th March 2021, to comprehend the views regarding CRIJAF technology used in farmer's field.



Research Advisory Committee

Chairman:

Prof. Swapan K Datta, VC, Biswa Bangla University, Shibpur

Members:

Dr. P.K. Mahapatra, Ex- Dean OUAT
Dr. Debashis Nag, Ex- Director, ICAR-NINFET, Kolkata
Dr. P.G. Karmakar, Ex-Director, ICAR-CRIJAF, Barrackpore
Dr. L.K. Hazarika, Professor & Head, AAU, Jorhat
Dr. S.S. Singh, Director (Extension), RLBCAU, Jhansi
Dr. R.K. Singh, ADG (Commercial Crops), ICAR, New Delhi
Dr. Gouranga Kar, Director, ICAR-CRIJAF, Barrackpore



Institute Research Council (IRC) Meeting was conducted during 13 April and 20-22 July, 2021 to review research projects

In Institute Research Council (IRC) Meeting-2021, 10 new and 53 ongoing research projects of ICAR-CRIJAF and 9 sponsored projects were discussed. Dr. Gouranga Kar, Chairman, IRC congratulated the scientists about the important achievement made during 2020-21 and suggested the Scientists to strengthen the need-based and demand-driven technology-oriented research for the stakeholders of jute and allied fibre sector, so that derived technology will reach to the stakeholders after completion of the project.



Director and Principal Scientists of ICAR-CRIJAF during presentation of new projects in IRC meeting-2021

Seed Industry Meet on 9th August 2021 to sensitize the jute seed industry about the new varieties its commercial productions

The representatives of eight Seed Industries having expertise in jute seed sector participated in this meet. Director, ICAR-CRIJAF emphasized that the seed industries must cooperate in systematic production and marketing of the seeds of new jute varieties in consultation with CRIJAF scientists so that the benefit of research can percolate to the farmers for higher productivity and profitability.



Director (ICAR-CRIJAF) and representatives of seed industries during Seed Meet

Jute Industry-Stakeholders Meet on 28th August 2021 to showcase the Institute's developed technologies

Recently developed technologies of ICAR-CRIJAF were highlighted in Jute Industry-Stakeholders Meet to boost the jute sector by augmenting quality, productivity and profitability. Shri U. P. Singh, Secretary, Ministry of Textiles, GoI graced the occasion as Chief Guest. Shri M. C. Chakraborty, Jute Commissioner and Shri A. K. Jolly, Managing Director, Jute Corporation of India, Ministry of Textile, GoI were the Guest of Honour.



Secretary (MoT), Jute Commissioner and Managing Director (JCI), Ministry of Textile, GoI during Jute Industry-Stakeholder Meet with Director, ICAR-CRIJAF

Participations in webinar, seminar, workshop & meetings

DIRECTOR

Dr. Gouranga Kar

Meeting with Public Accounts Committee, 11 January 2021, Behrampur, West Bengal

State Level review meeting cum Strategic Planning on Jute Development Activities, 6 February 2021, organised by BCKV, Kalyani, W. B.

Stakeholders Meet of National Jute Development Program Umbrella Scheme for 2021-26, 15 July 2021, Kolkata

International Symposium for Coastal Agriculture on Transforming Coastal Zone for Sustainable Food & Income Security, 16-19 March 2021, organised by ISCAR, Canning Town, W. B.

Meeting with Secretary, DARE and DG, ICAR on Commercialization of Public Sector Varieties to Different Seed Producing Agencies, 19 April 2021, New Delhi

Institute-Industry Interface, 30 September 2021, ICAR-NINFET, Kolkata

Meeting with vendors for Wider Use of Machineries & Faster Retting Materials, 29 November 2021, JCI, Salt Lake, Kolkata

National Consultation on Plant-based Local Food Systems for Health and Nutrition, October 22, 2021

SCIENTISTS

International Symposium for Coastal Agriculture on Transforming Coastal Zone for Sustainable Food & Income Security, 16-19 March 2021, organised by ISCAR, Canning Town, W. B.- Dr. A.R. Saha, Dr. S.K. Jha, Dr. M.S. Behera, Dr. S. Sarkar, Dr. R.K. Naik, Dr. D. Barman, Dr. N.M. Alam, Dr. Shamna. A, Dr. M.L. Roy, Dr. J.K. Meena

International Webinar on Desert locust Schistocerca gregaria International scenario and a potential threat to India, 2 July 2021, organised by NIPHM, Hyderabad - Dr. V. Ramesh Babu

International Webinar on Seed Testing for Quality Assurance- Eastern Zone, 13-16 July 2021, organised by ICAR-Indian Institute of Seed Science, Mau-K. Das, H.R. Bhandari

International Conference on Reorienting Agronomic Research & Education to Combat Current and Future Challenges in Agriculture, 20-22 September 2021, organised by RPCAU, Pusa, Bihar - Dr. A.R. Saha, Dr. D. Barman, Dr. S.P. Mazumdar, Dr. D. Datta

International Potato Conference, 23-26 November 2021, at Shimla - Dr. K.N. Chourasia

Global Symposium on Salt-Affected Soils-GSAS21, 20-22 October 2021, organised by Food and Agriculture Organisation of the United Nation - Dr. A.K. Singh

International Webinar on Alternate Cropping Systems for Climate Change and Resource Conservation, 29 September-1 October 2021, organised by ICAR-Indian Institute of Farming System Research, Modipuram - K. Das

International Symposium on Emerging Trends in Agricultural Engineering Education, Research and Extension, 23-25 November 2021, RPAU, Pusa- Dr. R.K. Naik



Webinar on Herbicide Resistance in India: Problems and Management, 29 January 2021, at ISWS, Jabalpur, M.P. - Dr. S. Sarkar

Webinar on Agriculture Research through Knowledge Discovery on 23 February 2021 – K. Das

National Web-Symposium on Recent Advances in Beneficial Insects during 25-27 February 2021, organised by ICAR-IINRG, Ranchi - Dr. B. S. Gotyal

6th National Conference on Biological Control, 3-5 March 2021, organised by ICAR-NBAIR - Dr. V. Ramesh Babu

National Webinar on Entrepreneurial Skills to Manage Dryland Areas through Integrated Farming Systems, 24 June 2021, organised by Karan Narendra Agril. University, Rajasthan - K. Das

National Webinar on Integrated Pest Management- A Paradigm Shift, 27-28 August 2021, organised by ICAR-National Centre for Integrated Pest Management, Hyderabad - Dr. V. Ramesh Babu

Webinar on 'Ecosystem for Sustainable FPO', 30 July 2021 organised by ICAR Research Complex for Eastern Region, Patna- Kajal Das

National Conference on Materials, Devices and Circuits in Commercialization Technology (MDCCT-2020), 27-29 October 2021- Dr. M. L. Roy

XV Agricultural Science Congress, 13-16 November 2021, organised by B.H.U, Varanasi - Dr. R.K. De

85th Annual Convention of the Indian Society of Soil Science (ISSS), 16-19 November 2021, organised by Institute of Agriculture, Visva-Bharati, Santiniketan - Dr. A.R. Saha, Dr. A.K. Singh, Dr. S.P. Mazumdar

30th National Conference of SCSi on Soil and Water Management Technologies for Climate Resilience, Agricultural and Environmental Sustainability, 14-16 Dec 2021, Organised by IIWM, Bhubneswar- Dr. G.Kar, Dr. A.K. Singh, Dr. R. Saha, Dr. M.S. Behera, Dr. D. Barman, Dr. R. Naik, Dr. D. Datta

Review meeting of NICRA project (CGC), 11 March 2021, organised by ICAR-CRIDA, Hyderabad- Dr. A. K. Singh

Review and Sensitization Workshops of ZTMUs/ITMUs/ PMEs under NAIF scheme of ICAR, 11 October 2021- Dr. R. Saha

Workshop on Right to Information Act, 15-16 July 2021, organised by ICAR-NAARM, Hyderabad - Dr. M. S. Behera

Annual Zonal Workshop, 6-8 July 2021 organised by ATARI, Kolkata- Dr. T. Samajdar

IASWC Award Ceremony -2020 & Dr K.G. Tejwani Memorial Lecture, 23 September 2021, organised by IASWC, Deheradun- Dr. R. Saha

SAC Meeting of KVK Jaipur and Bargarh, Odisha, 11-12 February, 2021- Dr. M.S. Behera

Internation conference on Integrated Agriculture, Natural Farming, Bio-diversity Conservation and Rural Bio-Entrepreneurship under Changing Climate Scenerio, 7-9 December 2021, organised by College of Agriculture, Meghalaya- Dr. G. Kar, Dr. M.S. Behera

TECHNICAL STAFFS

6th Asian PGPR National Conference on "APTBAE-2021", 3-4 September 2021, organised by B.U, Bhopal, M.P - Dr. S.K. Bhattacharyya

RESEARCH PUBLICATIONS

PEER REVIEWED JOURNALS

Alam, N.M., Mazumdar, S.P., Mitra, S., Saha, R., Pandey, S.K., Panwar, S., Kar, G. 2021. Predictive model for fibre yield estimation of tossa jute (*Corchorus olitorius*) in India. The Indian Journal of Agricultural Sciences, 91 (6): 837-841.

Asha, A., Nivetha, N., Krishna, G., Lavanya, A.K., Vikram, K., Paul, S. 2021. Interactive effect of rhizobacteria and drought stress on physiological attributes of mustard. The Indian Journal of Agricultural Sciences, 91(5): 734-738.

Bera, Amit, Mukhopadhyay, E., Kar, C.S., Kumar, M., Bhandari, H.R. 2020. Efficacy of scarification treatments on release of seed coat imposed dormancy in five wild species of genus *Corchorus*. South African Journal of Botany 135: 144-147 <http://krishi.icar.gov.in/jspui/handle/123456789/59106>

Bhandari, H.R., Srivastava, K., Tripathi, M.K., Chaudhary, B., Biswas, S. 2021. Genotype-environment interaction for quality traits in tomato hybrids. Agricultural Research <https://doi.org/10.1007/s40003-021-00579-3>

Bhandari, H.R., Srivastava, K., Tripathi, M.K., Chaudhary, B., Biswas, S., Shreya 2021. Environment×Combining ability interaction for quality traits in tomato (*Solanum lycopersicum* L.). International Journal of Bio-resource and Stress Management. <https://doi.org/10.23910/1.2021.2276>

Biswakarma, N., Pooniya, V., Zhiipao, R.R., Kumar, D., Verma, A.K., Shivay, Y.S., Lama, A., Choudhary, A.K., Meena, M.C., Bana, R.S., Pal, M., Das, K., Sudhishri, S., Jat, R.D., Swarnalakshmi, K. 2021. Five years integrated crop management in direct seeded rice-zero till wheat rotation of north-western India:

Effects on soil carbon dynamics, crop yields, water productivity and economic profitability. Agriculture, Ecosystems & Environment, 318: 107492. <https://doi.org/10.1016/j.agee.2021.107492>

Biswas, C., Dey, P., Ramesh Babu, V., Alam, N.M., Kar, G. 2021. First report of papaya ring spot virus (PRSV) infecting jute (*Corchorus olitorius*) in India. Plant Disease. <https://doi.org/10.1094/PDIS-03-21-0652-PDN>

Chourasia, Kumar N., Lal, M.K., Tiwari, R.K., Dev, D., Kardile, H.B., Patil, V.U., Kumar, A., Vanishree, G., Kumar, D., Bhardwaj, V., Meena, J.K., Mangal, V., Shelake, R.M., Kim, J.Y., Pramanik, D. 2021. Salinity stress in potato: understanding physiological, biochemical and molecular responses. Life, 11(6):545 <https://doi.org/10.3390/life11060545>

Das, A., Basu, P.S., Kumar, M., Ansari, J., Shukla, A., Thakur, S., Singh, P., Datta, S., Chaturvedi, S.K., Sheshshayee, M.S., Bansal, K.C., Singh, N.P. 2021. Transgenic chickpea (*Cicer arietinum* L.) harbouring AtDREB1a are physiologically better adapted to water deficit. BMC Plant Biology, (21) 3.

Das, T.K., Ghosh, S., Das, A., Sen, S., Datta, D., Ghosh, S., Raj, R., Behera, B., Roy, A., Vyas A.K. 2021. Conservation agriculture impacts on productivity, resource-use efficiency and environmental sustainability: A holistic review. Indian Journal of Agronomy, 66 (SI)

Datta, D., Ghorai, A.K., Ghosh, S. 2021. Cultivation in gunny sack. Current Science, 120(10): 1549.

De, R. Kumar, Ramesh Babu, V., Shamna, A. 2021. New IPM module against stem rot and insect pests of jute (*Corchorus olitorius* L.). Indian Journal of Plant Protection, 49 (1):18-25.



Ghorai, A.K., Mazumdar, S.P., Datta, D. 2021. Jute and mesta stick charcoal production using smokeless fire in Kon Tiki-Kiln, an open earth pyrolysis process. *International Journal Current Microbiology and Applied Science*, 10(02): 1304-1310. <https://krishi.icar.gov.in/jspui/handle/123456789/60957>

Kar, G., Patra, P.K., Raychoudhury, M., Anand, P.S.B., Alam, N.M., Panigrahi, S., Sahoo H., Chaudhury, S.K. 2021. Land resources evaluation and drainage network analysis of watershed for site specific crop planning using GIS. *Current Science*, 121(11)1470-79.

Kumar, M., Mitra, S., Mazumdar, S.P., Majumdar, B., Saha, A.R., Singh, S.R., Pramanick, B., Gaber, A., Alsanie, W.F., Hossain, A. 2021. Improvement of soil health and system productivity through crop diversification and residue incorporation under jute-based different cropping systems. *Agronomy*, 11: 1622. <https://krishi.icar.gov.in/jspui/handle/123456789/60296>

Lal, M.K., Tiwari, R.K., Kumar, R., Naga, K.C., Kumar, A., Singh, B., Raigond, P., Dutt, S., Chourasia, K.N., Kumar, D., Parmar, V., Changan, S.S. 2021. Effect of potato apical leaf curl disease on glycemic index and resistant starch of potato (*Solanum tuberosum* L.) tubers. *Food Chemistry* 359:129939. <https://doi.org/10.1016/j.foodchem.2021.129939>

Majumdar, B., Saha, A.R., Sarkar, S., Sarkar, S.K., Mazumdar, S.P., Chattopadhyay, L., Barai, S. 2021. An insight into the sequential changes in enzymatic activities during retting of jute (*Corchorus spp.* L.). *Journal of Environmental Biology*, 42: 636-643.

Mandal, K., Anil Kumar, A., Ghosh, D. 2021. Development of screening techniques to evaluate response of jute (*Corchorus olitorius*) to *Macrophomina phaseolina*. *Australasian Plant Pathology*, 50:621-630.

Maruthi, R.T., Anil Kumar, A., Choudhary, S.B., Sharma, H.K., Mitra, J. 2021. Diversity assessment of Indian sunnhemp (*Crotalaria juncea* L.) accessions for enhanced biomass and fibre yield using Geographic Information System approach. *Legume Research*. <https://doi.org/10.18805/LR-4510>

Mazumdar, S.P., Bhattacharya, R., Saha, A.R., Majumdar, B., Kundu, D.K., Behera, M.S., Ghorai, A.K., Barman, D., Saha, R., Padhy, S.R., Kar, G., Bhattacharya, P. 2021. Trade-off between soil aggregate stability and carbon decomposition under 44 years long-term integrated nutrient management in rice-wheat-jute system. *Archives of Agronomy and Soil Science*. <https://doi.org/10.1080/03650340.2021.2002304>

Meena, J.K., Bhandari, H.R., Mangal, V., Chourasia, K.N., Thiribhuvan, R., Kar, C.S., Mitra, J. 2021. Genetic diversity analysis by D2 clustering of yield and yield attributing traits in Jute (*Corchorus olitorius*) germplasm lines. *Vegetos*. <https://doi.org/10.1007/s42535-021-00271-5>

Meena, J.K., Dikshit, H.K., Aski, M., Singh, S., Singh, A., Tripathi, A., Thiribhuvan, R., Chourasia, K.N. 2021. Molecular mapping of a gene conferring fusarium wilt resistance in lentil (*Lens culinaris* Medikus sub sp. *culinaris*) using bulked-segregant analysis. *Legume Research*. <https://doi.org/10.18805/LR-4700>

Mitra, S., Das, K., Sarkar, S., Satpathy, S., Kar, G., Singh, R. K. 2021. Status of ramie cultivation in India. *RASSA Journal of Science for Society*, 3(2): 102-113.

Pooniya, V., Zhiipao, R.R., Biswakarma, N., Jat, S.L., Kumar, D., Parihar, C.M., Swarnalakshmi, K., Lama, A., Verma, A.K., Roy, D., Das, K., Majumdar, K., Satyanarayana, T., Jat, R.D., Ghasal, P.C., Ram, H., Jat, R., Nath, A. 2021. Long-term conservation agriculture and best nutrient management improves productivity

and profitability coupled with soil properties of a maize–chickpea rotation. *Scientific Reports*, 11(1):10386. <https://doi.org/10.1038/s41598-021-89737-9>

Ramesh Babu, V., Satpathy S., Reddy, B. V. .S. 2021. Identification of female released sex pheromone components of jute semilooper, *Anomis sabulifera* Guenee. *Journal Environmental Biology*. 42: 254-264.

Saha, D., Shaw, A.K., Datta, S., Mitra, J. 2021. Evolution and functional diversity of abiotic stress-responsive NAC transcription factor genes in *Linum usitatissimum* L. *Environmental and Experimental Botany*, 188:104512. <https://krishi.icar.gov.in/jspui/handle/123456789/60958>

Satpathy, S., Gotyal, B.S., Alam, N.M., Ramesh Babu, V. 2021. Host suitability and differential performance parameters of cotton mealybug, *Phenacoccus solenopsis* Tinsley for resistance in kenaf genotypes. *Journal of Environmental Biology*, 42: 609-614.

Satpathy, S., Gotyal, B. S., Ramesh Babu 2021. Bio-efficacy of certain insecticides applied as soil and seed treatments for management of spiral borer, *Agilus aculatus* in kenaf, *Hibiscus cannabinus*. *Journal of Applied Zoological Research*, 32(2):150-155.

Satpathy, S., Gotyal, B.S. and Ramesh Babu, V. (2021). Preventive seed treatment for the management of mealybug and flea beetle in kenaf, *Hibiscus cannabinus* L. *Journal of Entomological Research*, 45 (4) : 669-674

Satya, P., Sarkar, D., Vijayan, J., Ray, D. P., Mandal, N.A., Roy, S., Sharma, L., Bera, A., Kar, C.S., Mitra, J., Singh, N.K. 2021. Pectin biosynthesis pathways are adapted to higher rhamnogalacturonan formation in lignocellulosic jute (*Corchorus spp.*). *Plant Growth Regulation*, 92:131-147. <https://krishi.icar.gov.in/jspui/handle/123456789/60803>.

Selvaraj, K., Gotyal, B.S., Bhattacharya, N., Satpathy, S., Ramesh Babu, V. 2021. Effect of bast fibre crops and their biochemicals on nutritional indices of *Spilosoma oblique* Walker. *Indian Journal of Entomology*, 83(3): 350-354.

Singh, A.K., Ghorai, A.K., Kar G. 2021. Diversification of rice growing areas in eastern India with integrated soil–crop system management for GHGs mitigation and higher productivity. *Carbon Management*. <https://doi.org/10.1080/17583004.2021.2023049>.

Thakur, M., Shamima Praveen, S., Divte, P.R., Mitra, R., Kumar, M., Gupta, C.K., Kalidindi, U., Bansal, R., Roy, S., Anand, A., Singh, B. 2021. Metal tolerance in plants: Molecular and physicochemical interface determines the “not so heavy effect” of heavy metals. *Chemosphere*, 287: 131957.

Zaman, A.S.N., Saha, R., Mitra, S., Paswan, Alka, Mazumdar, S.P., Alam, N.M., Islam, S., Adhikary, B. 2020. Water retention and transmission characteristics of jute growing soils of Nagaon district of Assam. *Indian Journal of Soil Conservation*, 48 (3): 246- 250

POPULAR ARTICLES

Das, T.K., Ghosh, S., Datta, D., Sen, S., Roy, A., Raj, R., Behera, B., Sharma, A.R., 2021. Conservation agriculture for efficient resource use, sustainable crop production and better environment. *Indian Farming*, 71(11): 7-11.

Datta, D., Ghosh, S., Nath, C.P. 2021. Cyclone proofing of Indian agriculture: contingency planning and mitigation strategies. *Agriculture & Environment e-Newsletter*, 2(6): 74-81.

Garai, S., Rahman Sk. Md., A., Behera, M.S., Kar, G. 2021. Kadaknath murgir pratipalan. *Bardhaman Jyoti, Burdwan*. 52(30): 4

Ghosh, S., Datta, D., Soumia, P.S., Kumar, A., Ghodke, P., Singh, M. 2021. Purple nutsedge (*Cyperus rotundus* L.) menace in agricultural



systems: etiology and management strategies. Agriculture & Environment e-Newsletter, 2(7): 1-5.

Gotyal, B.S., Satpathy, S. 2021. Host plant resistance to insect pests in jute: Antenna- Bulletin of Royal Entomological Society, 45 (3): 122-127.

Majumdar, B., Jha, S. K., Mazumdar, S. P., Datta, D. 2021. Patson ki uchit sadan tay karti hain reshe ki gunwatta (In Hindi). Resha Kiran 4(1): 32-34.

Majumdar, B., Sarkar, S., Kar, G. 2020. Jute retting water: A potential source of essential plant nutrients. Indian Farming, 70(9): 21-23.

Mazumdar, S.P., Datta D. 2021. Biochar from jute and mesta: A promising tool for sustainability. Agriculture and Environment E-Newsletter. 2 (9): 12-14.

Naik, R.K. 2021. Improved sowing machinery for jute. Agrobios Newsletter, 20(02):67-69.

Naik, R.K., Jha, S.K., Shamna, A. 2020. Mahila anukul krishi yantra aur upakarno dwara kathin prishram main kami (in Hindi). Resha kiran, 3(2): 57-60.

Naik, R.K., Kumar, S., Jha, S.K., Shamna, A. 2020. Yantrikaran dwara patsan ka lavaprada utpadan (in Hindi). Resha kiran, 3(2): 54-56.

Roy, M.L. 2021. Krishi prayuktir bikash evam prasare krishakder anghshograhaner gurutwo (in Bengali). Bardhaman Jyoti, 53 (12):5.

Roy, M.L. 2021. Krishite krishi paramorsho sewa evam er tatporjo (in Bengali). Bardhaman Jyoti, 53 (11): 5.

Roy, M.L. 2021. Nari o yubo sampradayer kshamatayaner gurutwo evam pat-vittik kshudro udyoger bhumika (in Bengali). Sabuj Sona, 44 (21): 4.

Saha, D., Shaw, A.K., Datta, S., Mitra, J. 2021. Functional genomics of abiotic stresses tolerance in flax, *Linum usitatissimum*. Agriculture Letters, 11(1) 46-50.

Shamna, A., Kumar, S. 2021. Mahela krishokon ke sashaktikaran ebong aajibika suraksha ke liye krishok utpadan sangathan ek bardan. <https://www.krishisewa.com/miscellaneous/1333-fpo-a-boon-for-farm-women-empowerment-and-livelihood-security.html>

Shamna, A., Naik, R.K. 2021. FPO: A Boon for farm women empowerment and livelihood security, Agrobios News letter, 19(9):44

दत्ता, डी., कर, जी., सिंह, ए. के., नायक, आर. के., बर्मन, डी., झा, एस. के., सरकार, एस., एन. एम. आलम. 2021. पटसन में सूखे की स्थिति से निपटने की कारगर रणनीति। रेशा किरण, 4(1): 16-18.

मजूमदार, बी., झा, एस. के., मजूमदार, एस. पि., दत्ता, डी. 2021. पटसन की उचित सरन तय करती है रेशे की गुणवत्ता। रेशा किरण, 4(1): 32-34.

मीना, जितेंद्र कुमार, मंगल, विकास, चौरसिया, कुमार निशांत, भण्डारी, एच. आर., त्रिभवन, आर. 2021. पोषण और स्वास्थ्य लाभ में पटसन का महत्व। रेशा किरण, 4(1):41.

साहा, आर., सरकार, एस. के., कर, जी. 2021. हरि खाद के रूप में सनाई (क्रोटेलेरिया जूनसिया) - व्यावहारिक दृष्टिकोण। रेशा किरण, 4(1): 41-42.

सिंह, ए. के., कर, गौरंगा 2021. पटसन एवं धान खेती मौसम के दौरान जलवायु परिवर्तन का क्षोभ मंडलीय ओजोन गैस के सांद्रता पर प्रभाव। रेशा किरण, अंक 4 (1): 10-14.

सिंह, जी., चंद्रा, एस., भटनागर, ए., दत्ता, डी. 2021. बसंतकालीन मक्के में जल सदुपयोग कैसे करें। किसान भारती, 52(5): 4-7.

सरकार, एस. के. 2020. रोग मुक्त पटसन बीज उत्पादन। रेशा किरण, अंक 3 (1): 35-37.

सरकार, एस. के., सरकार, एस., सतपथी, एस., झा, एस. के., आलम, एन., कुमारा, शिव, बेहरा, एम. एस., घोरई, ए. के., मंगल, विकास, दास, काजल एवं मीणा, जे. के. 2020. भा.कृ.अ.प.- केन्द्रीय पटसन एवं समवर्गीय रेशा अनुसंधान संस्थान द्वारा जारी की गई पटसन एवं समवर्गीय रेशा उगाने वाले किसानों को कृषि-सलाह सेवाएं। रेशा किरण, अंक 3 (1): 64-73.

BOOKS & BOOK CHAPTER

- Banerjee, M., Saha, R.** 2021. Biodynamic farming and organic farming: traditional approach for resource conservation. In: Saha, R., Barman, D., Behera, M.S., Kar, G. (Eds.), Conservation Agriculture and Climate Change: Impacts and Adaptations. NIPA Genx Electronic Resources & Solutions P. Ltd., New Delhi, pp. 189-210.
- Barman, D., Saha, R., Bhowmick, T., Bagui, A., Dutta, G., Das, S.** 2021. Role of GIS, remote sensing and agro-advisory in conservation agriculture. In: Saha, R., Barman, D., Behera, M.S., Kar, G. (Eds.), Conservation Agriculture and Climate Change: Impacts and Adaptations. NIPA Genx Electronic Resources & Solutions P. Ltd., New Delhi, pp. 233-248.
- Behera, M.S., Sharma, L., Samanta, P.** 2021. Resource conservation through crop residue management for sustainable agriculture. In: Saha, R., Barman, D., Behera, M.S., Kar, G. (Eds.), Conservation Agriculture and Climate Change: Impacts and Adaptations. NIPA Genx Electronic Resources & Solutions P. Ltd., New Delhi, pp. 135-142.
- Chakrabarti, B., Pramanik, P., Mazumdar, S.P., Dubey, R.** 2021. Nano bioremediation technologies for clean environment. In: Rakshit, A., Parihar, M., Sarkar, B., Singh, H.B., Fraceto, L.F. (Eds.). Bioremediation Science from Theory to Practice. CRC Press. <https://doi.org/10.1201/9780429327643>
- Choudhury, S.R., Agarwala, B.K., Sett, S.K., Choudhuri, P., Paul, P., Bhattacharjee, G., Deb, S., Chowdhury, S., Devi, P., Barman, S., Gogoi, M., Biswas, T., Bidya, P., Bora, A., Chakraborty, A., Chanda, C., Saha, S., Modak, A., Das, G., Sarkar, P., Jamatia, R., Mukherjee, A., Kumar, A., Thakur, A.R., Sudarshan, M., Nath, R., Mishra, L., Mukherjee, I., Bose, G., Singh, A. and Naik, R.K.** 2021. Self-sustained ramie cultivation in Tripura: A source of multiple commercial uses for adoption as an alternative livelihood. Bioresources Utilization and Management, Apple Academia Press, pp. 365-382.
- Datta, D.,** 2021. Rhizospheric microflora management for resource conservation. In: Mohapatra, U., Pradhan S.K. (Eds.), Modern Agriculture: Approaches and Applications, Brillion publisher, New Delhi. ISBN 978-93-89350-30-2, pp.165-191.
- Datta, D., Ghosh, S., Singh, S.V.,** 2021. Biofortification strategies for achieving food and nutritional security. In: Maurya N.K. (Ed.). Pharmacognosy and Nutrition, Vol. 2, Virgin Sahityapeeth publisher, pp. 65-89.
- Datta, D., Ghosh, S., Saha, R., Nath, C.P.,** 2021. Cover Crops: Potential and prospects in conservation agriculture. In: Saha, R., Barman, D., Behera, M.S., Kar, G. (Eds.), Conservation Agriculture and Climate Change: Impacts and Adaptations. NIPA Genx Electronic Resources & Solutions P. Ltd., New Delhi, pp. 496.
- De, R. Kumar** 2020. Disease spectrum of jute and their management. In: Srivastava J.N., Singh, A.K. (Eds), Diseases of field crops: Diagnosis and Management. Volume 1: Cereals, Small Millets and Fibre Crops, Apple Academic Press, CRC Press, pp 325-373.
- Ghorai, A.K., Datta, D.** 2021. Crop diversification in CA /RCTs under climate change perspective: special reference to jute and allied fibres. In: Saha, R., Barman, D., Behera, M.S., Kar, G. (Eds.), Conservation Agriculture and Climate Change: Impacts and Adaptations. NIPA Genx Electronic Resources & Solutions P. Ltd., New Delhi, pp. 119.
- Ghosh, P.K., Nath, C.P., Datta, D., Hazra, K.K.** 2021. Relevance of conservation agriculture in climate change perspective: An Issue for Climate Resilient Agriculture. In: Saha, R., Barman, D., Behera, M.S., Kar, G. (Eds.), Conservation



Agriculture and Climate Change: Impacts and Adaptations. NIPA Genx Electronic Resources & Solutions P. Ltd., New Delhi, pp. 33.

Gotyal, B.S., Satpathy, S., Ramesh Babu, V. 2021. Environmental friendly insect pest management and resource conservation technologies. In: Saha, R., Barman, D., Behera, M.S., Kar, G. (Eds.), Conservation Agriculture and Climate Change: Impacts and Adaptations. NIPA Genx Electronic Resources & Solutions P. Ltd., New Delhi, pp. 211-222.

Jha, S.K., Kumar, S., Shamna, A., Roy, M. L., Samajdar, T. 2021. Retrospect and prospects of resource technologies in Indo-Gangetic plains. In: Saha, R., Barman, D., Behera, M.S., Kar, G. (Eds.), Conservation Agriculture and Climate Change: Impacts and Adaptations. NIPA Genx Electronic Resources & Solutions P. Ltd., New Delhi, pp.457-467.

Lavanya, A.K., Grover, M., Manjunath, M. 2021. Recent advances in agricultural microbiology for sustainable agricultural production. In: Ch. Shrinivasa Rao et al., (Eds.), Agricultural Research, Technology and Policy: Innovations and Advances, ICAR-National Academy of Agricultural Research Management (NAARM) Hyderabad, Telangana, India, pp. 1-40.

Majumdar, B. Sarkar, S., Chattopadhyay, L., Barai, S. 2021. Impact of conservation agriculture practices on soil microbial diversity. In: Saha, R., Barman, D., Behera, M.S., Kar, G. (Eds.), Conservation Agriculture and Climate Change: Impacts and Adaptations. NIPA Genx Electronic Resources & Solutions P. Ltd., New Delhi, pp.335-350.

Mitra, S., Saha, R., Alam, N.M. 2021. Impact of conservation agriculture practices on soil water dynamics. In: Saha, R., Barman, D., Behera, M.S., Kar, G. (Eds.), Conservation Agriculture and Climate Change: Impacts and Adaptations. NIPA Genx Electronic Resources & Solutions P. Ltd., New Delhi, pp. 351-360.

Naik, R.K., Paswan, A. 2021. Energy budgeting and farm mechanization in relation to RCTs/CA. In: Saha, R., Barman, D., Behera, M.S., Kar, G. (Eds.), Conservation Agriculture and Climate Change: Impacts and Adaptations. NIPA Genx Electronic Resources & Solutions P. Ltd., New Delhi, pp.373-384.

Nath, C.P., Kumar, N., Datta, D., Das, T.K., Dutta, A., Hazra, K.K. and Praharaj, C.S. 2021. Sustainable intensification of cereal based cropping systems with summer mungbean in Indo-Gangetic Plains. In: Kumar Narendra, Nath C.P., Sah Uma, Praharaj C.S., Singh, N.P. (Eds.), Sustainable Production of Pulses in Diverse Agro-ecosystems, Vol.-1, Strategies for enhancing production, Scientific Publishers, Jodhpur, pp. 67-80.

Nath, C.P., Kumar, N., Datta, D., Das, T.K., Dutta, A., Hazra, K.K. and Praharaj, C.S. 2021. Weed management in pulse-based conservation agriculture system. In: Saha, R., Barman, D., Behera, M.S., Kar, G. (Eds.), Conservation Agriculture and Climate Change: Impacts and Adaptations. NIPA Genx Electronic Resources & Solutions P. Ltd., New Delhi, pp. 209-228

Nivetha, N., Lavanya, A.K., Vikram, K.V., Asha, A.D., Sruthi, K.S., Bandedappa, S., Annapurna, K., Paul, S. 2021. PGPR-mediated regulation of antioxidants: Prospects for abiotic stress management in plants. In: Antioxidants in Plant-Microbe Interaction, Springer, Singapore, pp. 471-497.

Saha, A.R., Mazumdar S.P., Paswan, A. 2021. Nutrient dynamics through conservation agriculture under climate change scenario. In: Saha, R., Barman, D., Behera, M.S., Kar, G. (Eds.), Conservation Agriculture and Climate Change: Impacts and Adaptations. NIPA Genx Electronic Resources & Solutions P. Ltd., New Delhi, pp.309-318.

Saha, R., Barman, D., Roy, S., Samanta, P. 2021. Scope of agroforestry systems for climate change adaptation. In: Saha, R., Barman, D., Behera, M.S., Kar, G. (Eds.), Conservation Agriculture and Climate Change: Impacts and Adaptations. NIPA Genx Electronic Resources & Solutions P. Ltd., New Delhi, pp. 405-416.

Saha, R., Datta, D., Sarkar, S., Majumdar B., 2021. Agricultural intensification through crop diversity and land configuration for maximizing productivity, profitability: Needs and approaches. In: K.C. Swain, D, Bhattacharya, B.K. Saren and S. Mandal (Eds.), Modern Agricultural Technology: A step Towards Rural Self-Reliance, AGROBIOS Research, Jodhpur, pp. 63-75.

Saha, R., Mitra, J., Paswan, A. 2021. Conservation agriculture and resource conservation technologies (RCTs): why and how? In: Saha, R., Barman, D., Behera, M.S., Kar, G. (Eds.), Conservation Agriculture and Climate Change: Impacts and Adaptations. NIPA Genx Electronic Resources & Solutions P. Ltd., New Delhi, pp. 75-92.

Saha, Ritesh, Barman, Dhananjay, Behera, Madhusudan and Kar, Gouranga 2021. Conservation Agriculture and Climate Change: Impacts and Adaptations. NIPA Genx Electronic Resources & Solutions Pvt. Ltd., New Delhi-110 034 (ISBN: 978-93-90591-08-4), pp 496.

Sarkar, S., Majumdar, B. 2021). Agro-ecological dynamics and strategic cultural management of weeds in conservation agriculture. In: Saha, R., Barman, D., Behera, M.S., Kar, G. (Eds.), Conservation Agriculture and Climate Change: Impacts and Adaptations. NIPA Genx Electronic Resources & Solutions P. Ltd., New Delhi, pp.143-156.

Mazumdar, S.P., Sasmal, S., Bhattacharya, R. 2021. Conservation agriculture and its impact on soil quality in climate change scenario. In: Saha, R., Barman, D., Behera, M.S., Kar, G. (Eds.),

Conservation Agriculture and Climate Change: Impacts and Adaptations. NIPA Genx Electronic Resources & Solutions P. Ltd., New Delhi, pp. 319-334

Satya, P., Roy, S., Sharma, L., Ray, S., Bera, A., Ghosh, S., 2021. Mining genetic resources for plant traits suited to changing climatic conditions. In: Saha, R., Barman, D., Behera, M.S., Kar, G. (Eds.), Conservation Agriculture and Climate Change: Impacts and Adaptations. NIPA Genx Electronic Resources & Solutions P. Ltd., New Delhi, pp.385-404.

Shamna, A., Jha, S.K., Kumar, S, Roy, M. L. 2021. Prospects and constraints in adoption of conservation agriculture practices. In: Saha, R., Barman, D., Behera, M.S., Kar, G. (Eds.), Conservation Agriculture and Climate Change: Impacts and Adaptations. NIPA Genx Electronic Resources & Solutions P. Ltd., New Delhi, pp.449 – 456.

Singh, A.K. 2021. Conservation agriculture approaches for reducing carbon footprints. In: Saha, R., Barman, D., Behera, M.S., Kar, G. (Eds.), Conservation Agriculture and Climate Change: Impacts and Adaptations. NIPA Genx Electronic Resources & Solutions Pvt. Ltd., New Delhi, pp.417-432.

CRIJAF EXTENSION SERIES

Improved technology for production mesta. CRIJAF (CSRSJAF) Training Leaflets, 04/2021. (Bhandari, H.R., Kar, C.S., Bera, Amit, Behera, M.S., Anil Kumar, A., Prasad, B.L., Barik, S. 2021)

Improved production and fibre extraction technology of ramie. CRIJAF (RRS) Training Leaflets. (Das, Kajal, Kar, C.S., Sarkar, S., Mitra, S., Naik, R.K., Behera, M.S.)

Fertilizer dose calculation and balanced fertilization. Training Leaflets. CRIJAF (RRS) Training Leaflets. (Das, Kajal, Behera, M.S., Sarkar, S.)



Tisi chaser Paddhati (in Bengali). CRIJAF Training Leaflets-3/2021 (Kar, C.S., Bhandari, H.R., Bera, A., Behera, M., Anil Kumar, A., Kumbhakar, M.K., Sethi, S.K.)

Paat Beejer unnat utpadan paddhati, CRIJAF Training Leaflets-1/2021. (Kar, C.S., Bhandari, H.R., Bera, A., Behera, M., Meena, J.K., Roy, A.S., Singh, B.N.)

Sanpaat beej utpadaner unnat paddhati, CRIJAF Training Leaflets-2/2021. (Kar, C.S., Bhandari, H.R., Bera, A., Behera, M., Shivakumar, K.V., Banerjee, P.P.)

Jhinuk mushroomer unnoto chash paddhati. CRIJAF Training Leaflets. (Mandal, K., Roy, M.L., Shamna, A., Samajdar, T.)

Mechanical weed management of ramie using CRIJAF single wheel weeder. CRIJAF Training Leaflets. (Naik, R.K., Das, K., Kar G.)

Susanghoto paddhatite pate rogpoka niyantran bidhi Agro-techniques in flax for quality fibre production. CRIJAF Training Leaflets. (Sarkar, S.K., Satpathy, S., Roy, M.L.)

Gunavatta resha utpaadan ke liye alasee ki krushi takaneek (in Hindi). CRIJAF (SRS) Training Leaflets. (Shivakumar, K.V., Behera, M.S., Mitra, S., Bhandari, H.R., Deshraj Meena, Vinay Kumar Singh, Sandip Roy)

Agro-techniques in sunnhemp for quality fibre production (in English). CRIJAF (SRS) Training Leaflets. (Shivakumar, K.V., Behera, M.S., Mitra, S., Bhandari, H.R., Meena, Deshraj, Singh, Vinay Kumar and Roy, Sandip)

Quality seed production technology of sunnhemp in (English and Hindi). CRIJAF (SRS) Training Leaflets. (Shivakumar, K.V., Kar, C.S., Mitra, S., Meena, Deshraj, Singh, Vinay Kumar, Roy, Sandip)

Flax cultivation (JRF-2) (in English and Hindi). CRIJAF (SRS) Training Leaflets. (Shivakumar, K.V., Mitra, S., Bhandari, H.R., Deshraj Meena, Vinay Kumar Singh, Sandip Roy)

CRIJAF TRAINING MANUALS

Kar, C.S., Kumar S., Roy M.L. 2021. Improved Production Technology of jute and Allied Fibres. CRIJAF Training Manual, P.85

Naik, R.K., Shamna, A., Roy, M.L., Jha, S.K. 2021. Krushi jantrikaran dwara patvitik phasalchakrer utpadanshilata ebom lav brudhi (in Bengali). CRIJAF Training Manual, P.41.

Naik, R.K., Shamna, A., Roy, M.L., Jha, S.K. (2021). Pat bhitik krushi pranalar jatrikarane custom hiring centres Kendra gulir bhumika (in Bengali). CRIJAF Training Manual, P.45.

Kumar, S., Jha, S.K., Roy, M.L., Shamna, A. 2021. Vermicomposting for improving soil health. CRIJAF Training Manual, P. 29

Shamna, A., Mazumdar, S.P., Alam, N.M., Naik, R.K., Kar, G. 2021. Ucca gunomaner aash pawar jonno paater unnata pochon paddhoti. CRIJAF Training Manual (No-01/DST SEED/2021), P.27

Shamna, A., Mazumdar, S.P., Alam, N.M., Naik, R.K., Roy M.L., Kar, G. 2021. Dhan chaser unnata paddhoti. CRIJAF Training Manual (No-02/DST SEED/ 2021), P.25

Shamna, A., Mazumdar, S.P., Alam, N.M., Naik, R.K., Roy M.L. and Kar, G. 2021. Paat bhittik sorsho porjaye unnoto poddhotite sobji chaser proshikkhon. CRIJAF Training Manual (No-03/DST SEED/ 2021), P.64

e-PUBLICATIONS

Thribhuvan, R., Ravikiran, K.T., Meena, J.K., Kumar N. Chourasia. 2021. Jute quality breeding. Agriculture & Food: e-Newsletter, 3(11).

Mazumdar, S.P., Datta, D., Majumdar, B., Saha, A.R. 2021. Long term impact of fertilization and manuring on soil health. E-Training Manual on Management of soil health for sustainable production, IARI, New Delhi, pp.152-162

Roy, M.L. 2021. Popularizing jute production technology and enterprises through non-government organization: scope & prospect. Krishi Jagran. <https://www.krishijagran.com/featured/popularizing-jute-production-technology-enterprises-through-non-government-organization-scope-prospect/>

Roy, M. L. 2021. Unnata prayuktite pat utpadan evam patjato bibidho ponyo tairir bishaye prashikshaner gurutwo (In Bengali). Krishi Jagran. <https://bengali.krishijagran.com/news/importance-of-training-on-jute-production-in-advanced-technology-and-manufacturing-of-various-jute-products/>

Roy, M.L. 2021. Jute smart village-an innovative concept for rural development. Krishi Science, 2 (10): 46-48. <https://krishiscience.in/viewfullartical/1880>

Roy, M.L. 2021. Farmer producer organization and its probable role for promotion of jute production technology & jute-based micro-enterprises. Krishi Jagran. <https://krishijagran.com/featured/farmer-producer-organization-and-its-probable-role-for-promotion-of-jute-production-technology-jute-based-micro-enterprises/>

[com/featured/farmer-producer-organization-and-its-probable-role-for-promotion-of-jute-production-technology-jute-based-micro-enterprises/](https://www.krishijagran.com/featured/farmer-producer-organization-and-its-probable-role-for-promotion-of-jute-production-technology-jute-based-micro-enterprises/)

CRIJAF TECHNOLOGY SERIES

Impact of Tropospheric Ozone on Crop Production under Jute-Rice Cropping System.

Research Bulletin- 01/2021. ICAR-Central Research Institute for Jute and Allied Fibres (ICAR), Barrackpore, Kolkata, 48 p. (Singh, A.K., Ghorai, A.K., Majumdar, B., Behera, M.S., Mitra, S., Roy, S., Saha, R., Kar, G.)

INSTITUTE PUBLICATION

Annual Report 2020

Resha Kiran 4(1) 2021

JAF News 19(1) 2021

ICAR-CRIJAF- A Profile, ICAR-Central Research Institute for Jute and Allied Fibres, Barrackpore, Kolkata, 36 p. (Sarkar, S.K., Jha, S.K., Kar, G., Satpathy, S., Mitra, J., Saha, A.R., Mitra, S.)



Release of ICAR-CRIJAF publications by invited guests

Major Events & Celebrations

Inauguration of Exhibition Hall, Fibre Museum and Retting Complex by Hon'ble Secretary (DARE) & DG, ICAR on 6th October 2021

Dr. Trilochan Mohapatra, Secretary, Department of Agricultural Research and Education (DARE), GoI and Director General, ICAR, New Delhi inaugurated the Exhibition Hall, Fibre Museum and the Retting Complex facility of the ICAR-CRIJAF. He appreciated the recent developments and facilities created in the institute. He also emphasized that various handicrafts and jute diversified products manufactured by Self Help Groups must reach better market facility for higher income and urged for up-scaling of jute based diversified products for export promotion. Other dignitaries present in this occasion were Dr. J.K. Jena, Deputy Director General (Fishery Sci., ICAR), Prof. B.S. Mahapatra, Vice Chancellor (BCKV, Mohanpur), Dr. Anil Rai, Assistant Director General (ICT, ICAR), Dr. B.K. Das, Director (ICAR-CIFRI), Dr D.B. Shakyawar, Director (ICAR-NINFET); scientists from different ICAR Institutes and Senior Officials from State Govt. Good number of farmers and members of women SHG were also present.



Inauguration of Fibre Retting Complex and Exhibition Hall-cum-Museum by the Director General, ICAR



Dr. Trilochan Mohapatra, Secretary (DARE) & DG (ICAR) interacting with farmers and scientists of ICAR-CRIJAF

ICAR-CRIJAF celebrated 68th Foundation Day on 9th February, 2021

On the occasion of 68th Foundation Day of ICAR-CRIJAF, Dr. Gouranga Kar, Director, ICAR-CRIJAF presented major achievements of the institute like development of crop varieties and technologies to resolve the bottlenecks and problems faced by the farmers in the cultivation of jute and allied fibre crops. Prof. Swapan Kr. Datta, VC of Biswa Bangla University graced the occasion in presence of Dr. B.K. Das (Director, ICAR-CIFRI), A.K. Jolly (MD, JCI), Dr. D.B. Shakywar (Director, ICAR-NINFET), farmers and all the scientists and staff of ICAR-CRIJAF.



Director addressing Scientists, staffs and farmers



Guests lighting the lamp on occasion of Foundation Day

World Water Day-2021 was celebrated on 22nd March, 2021

World Water Day-2021 was celebrated by organising a seminar on the theme 'Valuing Water'. Dr. Gouranga Kar, Director, ICAR-CRIJAF spoken about the importance of water in human life, agriculture, fisheries and livestock. Dr. Srikanta Samanta, Principal Scientist of ICAR-CIFRI delivered a lecture on the thematic topic. A drawing competition was also organized in which staff of ICAR-CRIJAF participated.



Dr. S. Samanta presenting seminar on 'Valuing water'

72nd Republic Day & 75th Independence Day of India Celebration

ICAR-CRIJAF celebrated its 72nd Republic Day on 26th January and 75th Independence Day on 15th August 2021 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.



Director hoisted National Flag on the occasion of 72nd Republic Day of India



Scientist and staffs of ICAR-CRIJAF celebrating 75th Independence Day

Observance of National Science Day, Anti-terrorism day and No Tobacco Day

National Science Day 2021 was observed on 28th February 2021 to remember historic invention by C.V. Raman. The theme for National Science Day was “Future of STI: Impacts on Education, Skills, and Work”. ICAR-CRIJAF also observed “Anti-terrorism day” on 21st May, 2021 and “No Tobacco Day” on 31st May, 2021.



Director addressing scientists of the Institute during National Science Day 2021

ICAR-CRIJAF observed International Day of Yoga

On 21st June 2021, International Day of Yoga was performed by the staff members of ICAR-CRIJAF. On this occasion, Dr. Gouranga Kar, Director spoken about important role of Yoga in promoting our health in a holistic manner by improving physical, mental and spiritual health which ultimately helps in fighting stresses and also alleviate other ailments including depression, anxiety and also increase individual as well as organisational productivity.



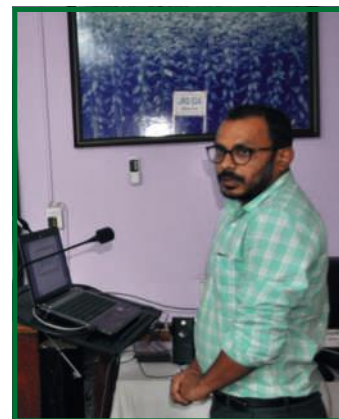
Director addressing staffs of the Institute in virtual mode during International Day of Yoga 2021

COVID vaccination camp for staffs of ICAR-CRIJAF

Staff members of ICAR-CRIJAF were vaccinated in a free COVID-19 vaccination camp organised by the institute in association with Dr. B.N Bose Sub Divisional Hospital Barrackpore, North 24 Parganas on 12th August 2021.

**World Food
Day-2021 was
celebrated on 16th
October 2021
by organizing
webinar**

On this occasion, a seminar on “Food, Fibre & Nutritional Security: Challenges” was presented by Dr. J.K. Meena, Scientist, ICAR-CRIJAF. A detailed discussion was held on challenges on food security of the country and ways to achieve food and nutritional security through incorporation of protein and nutrition rich food through bio-fortified varieties of different food crops. Dr. Gouranga Kar, Director, ICAR-CRIJAF briefed about the role of ICAR in providing food and nutritional security of the country. He also emphasized that by-products like roselle calyx and jute leaf vegetables have potential to provide nutritional security for the marginal, resource poor people as well as for the general public.



Dr. J.K. Meena, Scientist of ICAR-CRIJAF presenting seminar on “Food, Fibre & Nutritional Security: Challenges”

**Fit India
Freedom Run was
organised on 29th
September 2021**

To commemorate the 75th Independence Day - “Azadi Ka Amrit Mahotsav”, all the staffs of the institute participated in the Fit India Freedom Run 2.0 event enthusiastically. The event was inaugurated by Shri Sudipta Porel, Joint Secretary, DST and Biotechnology, Government of West Bengal. On the occasion, Dr. Gouranga Kar, Director of the institute discussed about usefulness of such event to keep fit and healthy lifestyle, which can create positivity in working atmosphere too.



Scientists and staffs of the institute participating in the Fit India Freedom Run 2.0 event

**Bharat Ka
Amrut Mahotsav
& World
Environment Day
was celebrated**

On the occasion of *Bharat Ka Amrut Mahotsav* in commemoration of completion of 75 years of India's Independence, ICAR-CRIJAF celebrated by conducting a series of webinar, painting and poetry competition during 4-7th June, 2021. Three webinars in the theme “*Making of Clean and Green India*” were organised to highlight the importance of natural fibre for the environment. A drawing and poetry competition on “earth and environment” was also organised.

Poshan Vatika Maha Abhiyan and Tree Plantation programme was organised on 17th September 2021

Webcasting of inaugural programme of mega event 'Nutri-cereals, Multi-Stakeholders, Mega Convention 3.0', as inaugurated by Shri Narendra Singh Tomar, Hon'ble Union Minister of Agriculture and Farmers Welfare, GoI was done in the villages. A large numbers of farmers and members of NGOs attended the programmes. Awareness programmes of "Poshan Vatika Maha Abhiyan and Tree Plantation programme" was also organised in West Bengal and Assam. Altogether 124 farmers and 177 girl student participated where nutrient rich food was served. Fruit saplings and vegetable seeds were distributed among all participants.



Dr. G. Kar, Director and scientists of ICAR-CRIJAF during organisation of awareness programme on "Poshan Vatika Maha Abhiyan and Tree Plantation programme"

16th Parthenium Awareness Week during 16-22 August, 2021 to protect environment and biodiversity

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 among the people and farmers about the harmful effect of parthenium and its management, institute organised Parthenium Awareness Week in the villages of North 24 Parganas (W.B.). A webinar on 'Parthenium – Problems and Management' was also organised.



Scientists of ICAR-CRIJAF organising various activities during 16th Parthenium Awareness Week- 2021

Vigilance Awareness Week-2021 on Independent India @ 75: Self Reliance with Integrity

ICAR-CRIJAF and its Research Stations and KVK observed Vigilance Awareness Week-2021 during 26 October to 1 November, 2021. Dr. Gouranga Kar, Director of ICAR-CRIJAF administered the Integrity Pledge to all the Officers and staffs of the institute and appealed to the employees to be honest, corruption free, disciplined, punctual, dedicated and efficient 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.



Dr. G. Kar, Director administered the Integrity Pledge to all the Officers and staffs of ICAR-CRIJAF during Vigilance Awareness Week-2021

Communal Harmony Campaign Week and National Flag Day

During the week-long drive (19-25 Nov 2021), the message of communal harmony was spread among the staff of the institute put the communal harmony stickers individually. In the concluding day, Director, Dr. Gouranga Kar, sensitized the staff of the institute regarding the importance of communal harmony for the development of a nation.

Samvidhan Diwas on 26th Nov, 2021 to create awareness about Indian Constitution

All the staff of ICAR-CRIJAF attended the online live streaming of the programme from the central hall of Parliament addressed by Hon'ble President, Hon'ble Vice President, Hon'ble Prime Minister, Hon'ble Speaker, Ministers, MPs and other dignitaries. The programme was followed by reading of the Preamble by the Director and all the employees of ICAR-CRIJAF.



Director addressing staffs of the institute during Communal harmony campaign and Samvidhan Diwas 2021

World Soil Day 2021 on 5th December, 2021 to create improve soil productivity

A farmers-scientists interaction was organised and issues such as soil salinization and its management was discussed. Soil health cards were distributed to more than 400 farmers of West Bengal. Dr Gouranga Kar, Director emphasized the causes of soil degradation and promising reclamation technologies and strategies for soil salinity amelioration viz. alternate land use system, cultivation of salt tolerant crop varieties, phytoremediation, bioremediation etc.



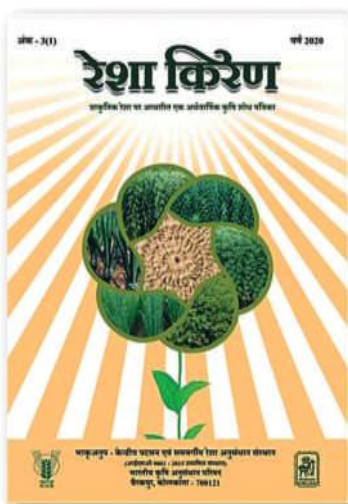
Director and Scientists of with farmers on occasion of World Soil Day 2021

Awards, Fellowships & Recognitions

1. **ICAR-CRIJAF की हिंदी पत्रिका “रेशा किरण”, भाकृअनुप के गणेश शंकर विद्यार्थी पुरस्कार से सम्मानित - वर्ष २०२०, द्वितीय, ‘ग’ क्षेत्र**
2. **Leadership Award 2020, Soil Conservation Society of India (SCSI) - G. Kar, Director**
3. **National Societal Innovation Award 2020, National Research Development Corporation, Department of Science & Technology, GoI - B. Majumdar, A.R. Saha, S. Das, S. Datta, D. Saha, L. Chattopadhyay, S.K. Jha, G. Kar**
4. **Early Career Entomologist Award, Royal Entomological Society, London - B.S. Gotyal, Senior Scientist**
5. **Best Young Scientist Award 2020, ICAR-CRIJAF - D. Barman, Senior Scientist**
6. **Young Scientist Award, Society for Applied and Zoological Research Association - B.S. Gotyal, Senior Scientist**
7. **Commendation Medal Award 2020, Indian Society of Agricultural Engineers - R.K. Naik, Senior Scientist**
8. **Dr. S. Venkataraman Young Scientist Award 2020, Association of Agro-meteorologists - D. Barman, Senior Scientist**
9. **Best Poster Presentation Award, International Symposium on Coastal Agriculture: Transforming Coastal Zone for Sustainable Food and Income Security, 16-19 March 2021- S. Datta et al., Principal Scientist**
10. **Best Oral Presentation Award, National Conference on Soil and Water Management Technologies for Climate Resilience, Agricultural and Environmental Sustainability, 14-16 December 2021- R. Saha et al., Principal Scientist, D. Barman et al., Senior Scientist**
11. **Fellow of Indian Society of Coastal Agricultural Research - G. Kar, Director**
12. **Indian Association of Soil & Water Conservationists (IASWC) Fellowship 2020 - R. Saha, Principal Scientist**
13. **Fellow of Indian Phytopathological Society, New Delhi - C. Biswas, Principal Scientist**
14. **Member, Expert Committee on Jute - G. Kar, Director**
15. **Member, DST Expert Group - G. Kar, Director**
16. **Editor, Journal of Crop Science, Bioinfo Publication- S. Sarkar, Principal Scientist**
17. **Member Secretary of Peer Review Team, NAEAB (ICAR) - S.K. Sarkar, Principal Scientist**
18. **Editorial Board Member, Journal of Natural Resource and Development - R.K. Naik, Senior Scientist**
19. **Member, State Level Executive Committee (SLEC), Farm Mechanization Schemes, Directorate of Agriculture, Govt. of West Bengal - R.K. Naik, Senior Scientist**
20. **Executive Member, Organic Agriculture Society of India, CSKHPKV, Palampur - A.K. Singh, Principal Scientist**



National Societal Innovation Award 2020 by National Research Development Corporation, Department of Science and Technology, Government of India, New Delhi



ICAR-CRIJAF की हिंदी पत्रिका 'रेशा किरण',
भाकृअनुप के गणेश शंकर विद्यार्थी पुरस्कार से सम्मानित

Young Scientist Award 2020 of ICAR-CRIJAF

Print & Media Coverage

The Statesman
KOLKATA 10 February, 2021

Foundation Day: ICAR-Central Research Institute for Jute and Allied Fibers on Tuesday observed 68th foundation day at Barrackpore. Senior Scientist and director of ICAR-CRIJAF Dr Gouranga Kar said women from several rural areas' self-help groups made several eco-friendly products from fibre

the pioneer
NEW DELHI 10 JUNE 2021

Towards clean and green India
In accordance with Bharat Ka Amrit Mahotsav, ICAR-Central Research Institute for Jute and Allied Fibres (ICAR-CRIJAF), Barrackpore, organised lectures during the week coinciding with World Environment Day

"To commemorate the completion of 75 years of India's independence, our nation will address a year-long mega-event, Bharat Ka Amrit Mahotsav, which will culminate on August 15, 2022. The Central Government has scheduled programmes to focus on the high priority of social, cultural, scientific and technological aspects in the country's post-independence journey. Along these lines, ICAR-Central Research Institute for Jute and Allied Fibres alternatives to plastic and why natural fibres, especially jute fibre, can be a good alternative was explained.

In his special remarks, Dr Kar expressed ICAR-CRIJAF's commitment and emphasis on the technology and food safety has been focused to achieve the future demand of jute fibre in case of phasing out of single-use plastics. There will be an additional segment of more than eight lakh bales per day due to the new in agriculture. There are numerous technologies available for waste-to-energy conversion using various natural materials generated during agricultural activities for sustainable eco-friendly and to create employment opportunities to the rural areas.

Dr R. S. Das, Director, CRIJAF, Barrackpore, said that it's high time to use jute and possibly to transfer the technologies to create wealth from agricultural waste for the benefit of the farmers and the

আজকাল
10 JUNE 2021

পাটজাত পণ্য ব্যবহারে জোর

আজকালের প্রতিবেদন

কৃষিকের একমাত্র বিকল্প পাট। 'ভারত কা অমৃত মহোৎসব' এবং বিশ্ব পরিবেশ দিবস উপলক্ষ্যে কৃষিক্ষেত্রে পাটের একটি সমাবেশে বিভিন্ন উৎসাহিতার প্রদর্শন করা হয়।

dailyhunt
KOLKATA 2 January 2021

क्राउजैफ ने सिखाए किसानों की आय बढ़ाने के सुर

दैनिक हन्ट क्रोउजैफ के आय बढ़ाने के सुर के बारे में किसानों को शिक्षित करने के लिए एक कार्यक्रम आयोजित किया गया। इस कार्यक्रम में, विशेषज्ञों ने किसानों को बताया कि कैसे वे अपने आय को बढ़ा सकते हैं।

सबुज सोना
RANAGHAT, 1st March, 2021 १०१ मकसु, १०११

संशित पाट बीज वितरण शिविर

विशाल पट्टा १०१ मकसु के आय बढ़ाने के लिए एक कार्यक्रम आयोजित किया गया। इस कार्यक्रम में, विशेषज्ञों ने किसानों को बताया कि कैसे वे अपने आय को बढ़ा सकते हैं।

KJ KRISHI JAGRAN
24 May 2021

ICAR-CRIJAF - 'सुखेरा हट' कार्यक्रम

ICAR-CRIJAF - 'सुखेरा हट' कार्यक्रम का आयोजन किया गया। इस कार्यक्रम में, विशेषज्ञों ने किसानों को बताया कि कैसे वे अपने आय को बढ़ा सकते हैं।

the pioneer
KOLKATA 11 February 2021

ICAR-CRIJAF celebrates 68th foundation day

आनन्दबाजार पत्रिका
24 May 2021

खेतों के पाट बाँटते परामर्श गवेषणा संस्थान

ICAR-CRIJAF - 'सुखेरा हट' कार्यक्रम का आयोजन किया गया। इस कार्यक्रम में, विशेषज्ञों ने किसानों को बताया कि कैसे वे अपने आय को बढ़ा सकते हैं।

कालांतर
KOLKATA 5 March 2021

क्राइजाफे के उच्च फलनशील पाट बीज वितरण कार्यक्रम

ICAR-CRIJAF - 'सुखेरा हट' कार्यक्रम का आयोजन किया गया। इस कार्यक्रम में, विशेषज्ञों ने किसानों को बताया कि कैसे वे अपने आय को बढ़ा सकते हैं।

सबुज सोना
1 June 2021

अमरसिंह रोड के समेत पाट जलाने के सुर परामर्श

ICAR-CRIJAF - 'सुखेरा हट' कार्यक्रम का आयोजन किया गया। इस कार्यक्रम में, विशेषज्ञों ने किसानों को बताया कि कैसे वे अपने आय को बढ़ा सकते हैं।

the pioneer
NEW DELHI 7 January 2021

Clean and green India

The ICAR-Central Research Institute for Jute and Allied Fibres to support the government

सबुज सोना
RANAGHAT 16 February 2021

क्राइजाफ-एर ६८तम प्रतिष्ठा दिवस

68th Foundation Day Celebration

KJ KRISHI JAGRAN
8 June 2021

ICAR-CRIJAF विश्व परियोजना दिवस

ICAR-CRIJAF - 'सुखेरा हट' कार्यक्रम का आयोजन किया गया। इस कार्यक्रम में, विशेषज्ञों ने किसानों को बताया कि कैसे वे अपने आय को बढ़ा सकते हैं।

सुखेरा हट
BARASAT 16 February 2021

ICAR-CRIJAF विश्व परियोजना दिवस

ICAR-CRIJAF - 'सुखेरा हट' कार्यक्रम का आयोजन किया गया। इस कार्यक्रम में, विशेषज्ञों ने किसानों को बताया कि कैसे वे अपने आय को बढ़ा सकते हैं।



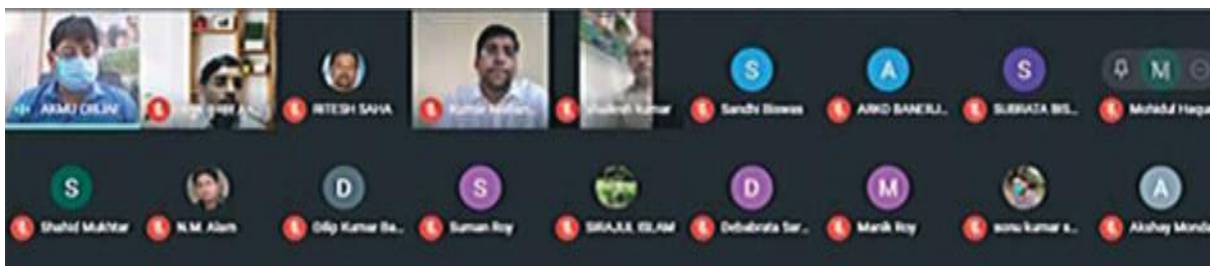
Official Language Implementation

हिन्दी कार्यशाला का आयोजन

भाकृअनुप-केन्द्रीय पटसन एवं समवर्गीय रेशा अनुसंधान संस्थान, बैरकपुर, कोलकाता में दिनांक 26 मार्च, 17 जून एवं 8 सितम्बर, 2021 को राजभाषा हिन्दी के प्रगामी प्रयोग को बढ़ावा देने तथा राजभाषा संबंधी अधिनियमों, नियमों एवं आदेशों के अनुपालन हेतु हिन्दी कार्यशाला का आयोजन ऑनलाइन माध्यम से किया गया। हिन्दी कार्यशाला की अध्यक्षता संस्थान के निदेशक, डॉ. गौरांग कर जी ने की। इस कार्यशाला में व्याख्यान (ऑनलाइन माध्यम) हेतु श्री राजेश चतुर्वेदी, मुख्य प्रबंधक (राजभाषा), स्थानीय प्रधान कार्यालय, भारतीय स्टेट बैंक (कोलकाता), श्री अनुप कुमार, सहायक निदेशक (टंकण एवं आशुलिपि), हिन्दी शिक्षण योजना, राजभाषा विभाग, भारत सरकार, कोलकाता एवं श्री अजय माँझी, पद संचालक, ग्लोबल सोल्यूशन, कोलकाता को आमंत्रित किया गया था। मुख्य वक्ता हिन्दी कार्यशाला में ऑनलाइन माध्यम से जुड़ते हुए राजभाषा अधिनियम, नीति, नियम व प्रमुख बिन्दुओं पर विस्तारपूर्वक उदाहरण के साथ तथा मशीनी अनुवाद व टंकण को पावर प्वाइंट के माध्यम से प्रस्तुत किया तथा इस पर खुली चर्चा भी की तथा उनका कुशल पूर्वक समाधान भी किया। इस अवसर पर श्री अजय माँझी ने साइबर सुरक्षा से संबंधित ढेर सारी विस्तृत जानकारियाँ दी जैसे- डिवाइस के जरूरी डाटा, डिवाइस के हार्डवेयर और साफ्टवेयर के डाटा को साइबर अपराध से कैसे बचाया जाए। कार्यशाला बहुत ही उपयोगी एवं उद्देश्यपूर्ण रही। इस हिन्दी कार्यशाला में लगभग 70 अधिकारियों/कर्मचारियों ने ऑनलाइन/ऑफलाइन माध्यम से भाग लिया। संस्थान में राजभाषा कार्यान्वयन समिति की बैठक का आयोजन 15 मार्च एवं 18 जून, 2021 को माननीय निदेशक की अध्यक्षता में आयोजित की गई।



हिन्दी कार्यशाला के अवसर पर श्री अजय माँझी, ग्लोबल सोल्यूशन, कोलकाता साइबर सुरक्षा से संबंधित जानकारियाँ देते हुए



हिन्दी पखवाड़ा का आयोजन

राजभाषा हिन्दी के प्रति जागरूकता पैदा करने तथा इसके प्रभावों में गति लाने के उद्देश्य से दिनांक 14 से 28 सितम्बर, 2021 तक हिन्दी पखवाड़ा का आयोजन किया गया। इस कार्यक्रम की अध्यक्षता संस्थान के निदेशक, डॉ. गौरांग कर, अध्यक्ष, राजभाषा कार्यान्वयन समिति ने किया। इस समारोह में मुख्य अतिथि के रूप में श्री फतेह बहादुर सिंह, हिन्दी प्राध्यापक, शिक्षण योजना, राजभाषा विभाग, गृह मंत्रालय, भारत सरकार, कोलकाता तथा श्री ओम शंकर ओझा, प्रभारी शिक्षक, हाजीनगर हिन्दी विद्यालय (एच. एस.) को विशेष अतिथि के रूप में आमंत्रित किया गया था। इस अवसर पर उन्होंने संस्थान में राजभाषा नीतियों के अनुपालन की जानकारी दी और संस्थान की प्रतिबद्धता पर अपने विचार

व्यक्त किए। हिन्दी पखवाड़ा के दौरान विभिन्न प्रतियोगितायें जैसे - तत्कालिक भाषण, हिन्दी टाइपिंग, वाद-विवाद, हिन्दी निबंध लेखन आदि का आयोजन किया गया तथा सभी विजेता प्रतियोगियों को पुरस्कार और प्रशस्ति पत्र निदेशक महोदय के कर कमलों द्वारा प्रदान किए गए। पखवाड़ा का आयोजन ऑफलाइन एवं ऑनलाइन माध्यम से किया गया जिसमें संस्थान के सभी कार्मिकों ने उत्साह पूर्वक अपनी सहभागिता दर्ज कराई। “पखवाड़ा” में सरकार की कोविड 19 दिशा-निर्देशों का अनुपालन पूर्णरूपेण किया गया।



भाकृअनुप-क्रिजैफ, बैरकपुर में प्रदर्शनी हॉल, रेशा संग्रहालय तथा रेटिंग कॉम्प्लेक्स का उद्घाटन

रुपिय (टैक्स) एवं ग्राहमिनेटाल
मल्लिक गुणित अनुलेखन परिचय
नई दिल्ली में किया गया है

ती, क्रियेन मयाधत्, लीङ्, पूर्वे मातृगणम्
 यो निष्ठा निष्ठा, पात मयार एवं
 मयिपठेत्, अस्तेति मातृगणम् पीठ, अ
 मयिपठेत् ॥ ६ अथवा ओ प्रकृत्यन्त- क्रियेन,
 मैतृगणम् कः कृष्ण और प्रकृत्यन्त- इति, रेभ
 मयिपठेत् लोपेति अस्तेति कः उदात्त
 निष्ठा प्रकृत्यन्त- क्रियेन वे क्रियेन ओ
 निष्ठाति के लोप अस्तेति ओ प्रकृत्यन्त ओ
 प्रकृत्यन्त लोप के क्रिये एवं प्रकृत्यन्त इति ओ
 मयिपठेत् ॥ ७ प्रकृत्यन्त इति मयिपठेत् लोपेति,
 मयिपठेत् ओ लोप के सप्त प्रकृत्यन्तके,
 निष्ठा ओ मयिपठेत् ओ मयिपठेत् ओ प्रकृत्यन्त
 ओ प्रकृत्यन्त निष्ठा ॥

[illegible]

विशेष के लिए सुविधा हो। इन-सीट, रेखा बरतने, टैक और फोटो-वर्धित को विशेष रूप से प्रदर्शित होना में प्रतीति किया है।

प्रदर्शनी डॉल और रेखा संरक्षण के उद्घाटन के बाद, डॉ. शिवेनका साहू ने बताया कि सुविधाएं बहुत आवश्यक हैं जो प्रशिक्षक रेखा प्रणाली को विदेशी, सुविधा प्रौद्योगिकी में से लेकर उपर उन्नत विचार तक को जगहवादी होते हैं। वेदोपेक्षा संस्था अकादमिक, शिवेनका सुविधा और उपस्थिति को प्रदर्शित है और अकादमिक सामग्री रेखा सेट में प्रतीति किया है, तब, विचारकों के लिए बहुत

राजभाषा होने के साथ ही हिंदी सबसे सरलतम भाषा भी है : डॉ. गौरांग

केन्द्रीय घटसन एवं रेशा अनुसंधान में हिन्दी पखवाड़ा मनाया

[illegible]

अच्छे स्वास्थ्य के लिए फिट इंडिया फ्रीडम रन 2.0 का किया आयोजन

Key words:

(from music) in very relaxed
 mood; it was one of the first
 before we started with the pro-
 ceedings, music, and we
 decided not to give them a
 wall to lean on. And I was
 on time, well, I was on
 schedule, we expected others to
 be there, but they didn't
 come, so I had to wait, and
 then we started.

And the day after it was
 the anniversary of the
 anniversary, so we
 decided to have the day
 after it, so we were on
 time, in very relaxed mood.

[illegible]

भाऊअनुक्रिजोफ, वैरकपुर ने सतर्कता जागरूकता सप्ताह-2021 मनाया, दिलाई शपथ

Il virus, almeno a suo inizio
negativo degli studi di controllo dei
paesani cinesi. Il virus, almeno
nell'attuale situazione, è figlio
della nostra vita che si vive in modo più
spesso collettivo, di quel che l'Occidente
potrebbe pensare. Non solo. La
nostra vita è un po' più diversa da
quella di 10 anni fa, perché in questi
anni si è venuto a più volte toccare
con la mano il virus della crisi
economica e della crisi ecologica. Ma
il virus della crisi economica è
più legato al nostro sistema di
regole sociali e politiche che al
nostro sistema di vita. E il virus
della crisi ecologica è legato al nostro
sistema di vita.

le parole di milioni e di milioni di persone che hanno in mano milioni e di milioni di copie degli atti di un processo che si svolge in un'aula di un tribunale, dove i giudici sono in trenta, dove i giurati sono ottanta e dove il presidente è uno di quei grandi nomi della magistratura italiana, come il professor Cossiga, che ha fatto da presidente della Corte Costituzionale. E' tutto questo che si svolge in un'aula di un tribunale, dove i giudici sono in trenta, dove i giurati sono ottanta e dove il presidente è uno di quei grandi nomi della magistratura italiana, come il professor Cossiga, che ha fatto da presidente della Corte Costituzionale.

भाकअनप-किजैफ को मिला प्रतिष्ठित राष्ट्रीय सामाजिक नवाचार परस्कार

[illegible]

...e per fare pace di
...e per fare pace di
...e per fare pace di
...e per fare pace di
...e per fare pace di



...e per fare pace di
...e per fare pace di
...e per fare pace di
...e per fare pace di
...e per fare pace di

[illegible]

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.

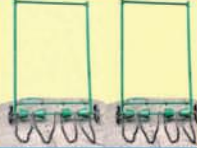
Digitization of documents: Library started digitization of all kinds of scientific and technical information of the institute.

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

Technology Commercialization & Registration

Jute Seeder: Technology License Agreement with M/s Creative Displayers (Licensee) through Agrinnovate India Ltd. (Facilitator) was done for manufacturing, sale and supply of 'Jute Seeder' for a period of five (5) years. The MoU has been signed on 6th July, 2021 on non-exclusive and non-assignable right to use the technology.



MAJOR COMMERCIALISED TECHNOLOGIES OF ICAR - CRIJAF & ROYALTY EARNED DURING 2019 - OCTOBER, 2021					
Technology	Authorized manufacturer	Qty. sold during last 3 years	Total value (₹) of the product	Royalty earned (₹)	Photographs
CRIJAF Multi Row Seed Drill	M/s. Joy Ma Tera Enterprise, Sodepur, Muragacha, North 24 PGS, W.B., Pin-700110 M/s. Krishi Udyog Samabaya Pally, Bally, Howrah, W.B., Pin-711205	2672 unit	1,15,04,000/-	8,01,400/-	
CRIJAF Nail Weeder	M/s. Creative Displays, 55(26) S.N. Banerjee Road, Barrackpore, W.B., Pin-700120 M/s. Krishi Udyog Samabaya Pally, Bally, Howrah, W.B., Pin-711205	16180 unit	2,99,32,315/-	21,84,250/-	
CRIJAF SONA	M/s. Next to Nature 1st Floor, 33 S.N. Kakoti Road, Ulubari, Guwahati, Assam, Pin-781007 M/s. Bengal Biotech and Research, Pandit, Hapur, Pankhura, East Medinipur, W.B., Pin-721131	18408.70 quintal	9,71,47,350/-	75,64,235/-	
CRIJAF Single Wheel Jute Weeder	M/s. Creative Displays, 55(26) S.N. Banerjee Road, Barrackpore, W.B., Pin-700120	3035 unit	60,70,000/-	4,09,725/-	
			14.476 Crore	1.10 Crore	



CRIJAF SONA: Manufacturing and selling agreement of CRIJAF SONA (MoU signed dated 12.04.2019 signed between ICAR-CRIJAF and M/s Bengal Biotech and Research) extended for next 6 months (w.e.f. 13th April, 2021 to 12th October 2021).

Jute Ribboner: Design application for Jute Ribboner, has been registered under Design No. 320657-00 in class 15-03 for ten years w.e.f. 13.08.2019. Certificate was received for authorized IPR firm on 16.01.2021.



Infrastructure Development

Infrastructure development/renovation in the year 2021

Sl. No.	Name
1.	Renovation of laboratory of Crop Production and Crop Improvement Division, JARI Cooperative Society, and KVK Storage Room at main campus of ICAR-CRIJAF
2.	Repairing of residential quarters, Amphan-wrecked glass house in the Biotechnology Unit & Crop Protection Division, boundary wall, farm road at main campus of ICAR-CRIJAF
3.	GI Barbed wire fencing with RCC post at CSRSJAF, Budbud, Burdwan
4.	Installation of new street light pole at main campus and north farm road of KVK damaged in Amphan Cyclone
5.	Repairing and painting of training hall, museum, store room of Agricultural Extension Section, office room of Crop Improvement Division, Administrative building & training hostel building of KVK at main campus of ICAR-CRIJAF; residential quarter, bituminous road, boundary wall and drainage channel, extraction shed, bailing shed and garage of sisal research, Bamra (Odisha); and brick boundary wall of ramie research station, Sorbhog (Assam)
6.	Facility for slow water moving retting tank at main campus of ICAR-CRIJAF
7.	New facilities created at ICAR-CRIJAF to showcase proven technologies

Institute's research farm is dedicated to the names of its Founder Directors

The institute has three research farms viz., Main farm, North farm and South farm. The main farm has been renamed as J.S. Patel farm who was the founder Director of Jute Agricultural Research Laboratory (JARL) at Dhaka during 1939-46. The North farm has been renamed as B.C. Kundu farm who was the founder director of Jute Agricultural Research Institute (JARI) at Chinsurah/Barrackpore, India (1946-1961). The South farm of the institute is dedicated to the name of Dr T. Ghosh who was the director of the Institute during 1964-1979.



New Exhibition - Cum - Fibre Museum



Dr. Trilochan Mohapatra, DG (ICAR) visiting Exhibition-cum-Museum Hall of ICAR-CRIJAF with DDG (Fishery Sci.), VC (BCKV), ADG (ICT), Director (ICAR-CIFRI) and Director (ICAR-NINFET)



Prof. S.K. Datta, Chairman (RAC) & VC, Biswa Bangla University and Swami Vishwamayananda (Secretary, Rama Krishna Mission) visiting Exhibition-cum-Museum Hall of ICAR-CRIJAF



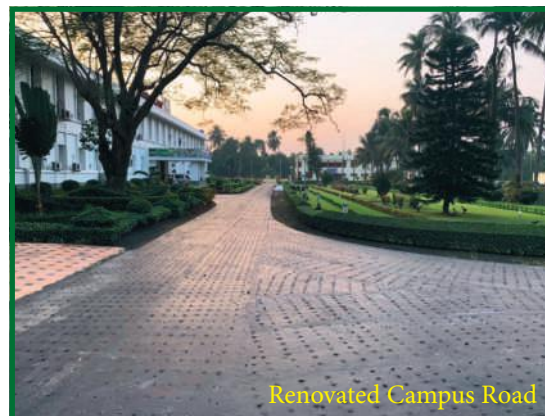
Extended Fibre Museum Hall of ICAR-CRIJAF



Slow Moving
Water Retting Model



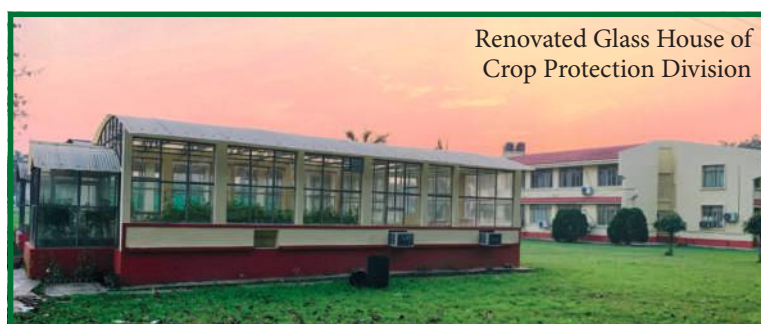
Renovated Farm Implements Shed



Renovated Campus Road



Renovated Glass House of Biotechnology Unit



Renovated Glass House of
Crop Protection Division



Renovated Research
Laboratory

Distinguished Visitors

1.	Dr. T. Mahapatra, Secretary, DARE & Director General, ICAR, New Delhi	6.10.2021
2.	Mr. U.P. Singh, Secretary, Ministry of Textiles, Govt. of India, New Delhi	28.8.2021
3.	Sri M. C. Chakraborty, Jute Commissioner, Govt. of India, Kolkata	15.2.2021
4.	Dr. J. K. Jena, Dy. Director General (Fisheries Science), ICAR, New Delhi	6.10.2021
5.	Prof. Swapan Kumar Datta, Ex. DDG (Crop Sci.) & VC, Biswa Bangla University, W.B.	9.2.2021
6.	Dr. R.C. Maheshwari, Former V.C., SDAU, Gujarat; Former ADG LSL/FC/PIM	16.10.2021
7.	Dr. B.S. Mahapatra, Ex. Director, ICAR-CRIJAF & VC, BCKV, Kalyani	6.10.2021
8.	Dr. Anil Rai, ADG (ICT), ICAR, New Delhi	6.10.2021
9.	Mr. Sudipta Porel, Joint Secretary DST & Biotechnology, Govt. of WB, Kolkata	29.9.2021
10.	Sri Ajay Kumar Jolly, MD, JCI, Kolkata	9.2.2021
11.	Dr. R.K. Singh, ADG (CC), ICAR, New Delhi	1.10.2021
12.	Dr. K.K. Satpathy, Ex. Director, ICAR-NINFET, Kolkata	20.4.2021
13.	Dr. P.K. Ghosh, Director, ICAR- NIBSM, Raipur	14.9.2021
14.	Dr. Arunava Pattanayak, ICAR-IIAB, Ranchi	26.7.2021
15.	Dr. B.K. Das, Director, ICAR-CIFRI, Barrackpore	9.2.2021
16.	Dr. D.B. Shakyawar, Director, ICAR-NINFET, Kolkata	9.2.2021
17.	Dr. K.K. Rout, Dean, College of Agriculture, OUAT, Bhubaneswar	6.10.2021
18.	Dr. Somnath Roy Choudhury, Dean College of Basic Science & Humanities, Samastipur	14.4.2021
19.	Swami Vishwamayana, Secretary, Rama Krishna Mission Ashrama, Sargachi, W.B.	18.3.2021
20.	Dr. A.P. Singh, Joint Commissioner, Crop, DAC, Govt. of India, New Delhi	27.9.2021
21.	Smt. Seema Chopra, Director (Rajbhasha), ICAR, New Delhi	24.11.2021
22.	Sri Dibyendu Sarkar, IAS, Adviser to Govt. of West Bengal, Environment Sector	7.12.2021



Distinguished visitors of ICAR-CRIJAF during 2021

People @ICAR-CRIJAF

<u>Name</u>	<u>Designation</u>	<u>E-mail id</u>
Dr. Gouranga Kar	Director	director.crijaf@icar.gov.in
Scientific Staff		
Dr. S. Satpathy	Pr. Scientist (Agril. Entomology) & HoD	Subrata.Satpathy@icar.gov.in
Dr. J. Mitra	Pr. Scientist (Plant Breeding) & I/c HoD	Jiban.Mitra@icar.gov.in
Dr. A.R. Saha	Pr. Scientist (Soil Science) & I/c, HoD	Amit.Saha@icar.gov.in
Dr. S. Mitra	Pr. Scientist (Agronomy) & I/c AINPNF	Sabyasachi.Mitra@icar.gov.in
Dr. A.K. Ghorai	Pr. Scientist (Agronomy)	Ashesh.Ghorai@icar.gov.in
Dr. D. Sarkar	Pr. Scientist (Biotechnology)	Debabrata.Sarkar@icar.gov.in
Dr. R.K. De	Pr. Scientist (Plant Pathology)	Rajib.De@icar.gov.in
Dr. K. Mandal	Pr. Scientist (Plant Pathology)	Kunal.Mandal@icar.gov.in
Dr. S.K. Sarkar	Pr. Scientist (Plant Pathology)	Surja.Sarkar@icar.gov.in
Dr. B. Majumdar	Pr. Scientist (Soil Science)	Bijan.Majumdar@icar.gov.in
Dr. C.S. Kar	Pr. Scientist (Plant Breeding)	Chandan.Kar@icar.gov.in
Dr. S. Sarkar	Pr. Scientist (Agronomy)	Sitangshu.Sarkar@icar.gov.in
Dr. S.K. Jha	Pr. Scientist (Agril. Extension) & I/c	Suniti.Jha@icar.gov.in
Dr. C. Biswas	Pr. Scientist (Plant Pathology)	Chinmay.Biswas@icar.gov.in
Dr. S. Datta	Pr. Scientist (Biotechnology)	Subhojit.Datta@icar.gov.in
Dr. D. Saha	Pr. Scientist (Biotechnology)	Dipnarayan.Saha@icar.gov.in
Dr. R. Saha	Pr. Scientist (Soil Physics)	Ritesh.Saha@icar.gov.in
Dr. S.K. Pandey	Pr. Scientist (Plant Breeding)	Surendra.Pandey@icar.gov.in
Dr. P. Satya	Pr. Scientist (Plant Breeding)	Pratik.Satya@icar.gov.in
Dr. M.S. Behera	Pr. Scientist (Agronomy)	Madhusudan.Behera@icar.gov.in
Dr. A.K. Singh	Pr. Scientist (Soil Science)	Arvind.Singh3@icar.gov.in
Dr. S. Kumar	Pr. Scientist (Agril. Extension)	Shailesh.Kumar@icar.gov.in
Dr. R.K. Naik	Sr. Scientist (Farm Machinery & Power)	Ranjan.Naik@icar.gov.in
Dr. D. Barman	Sr. Scientist (Soil Physics)	Dhananjay.Barman@icar.gov.in
Dr. A. Bera	Sr. Scientist (Seed Technology)	Amit.Bera@icar.gov.in
Dr. B.S. Gotyal	Sr. Scientist (Agril. Entomology)	Bheemanna.Gotyal@icar.gov.in
Dr. Shamna A.	Sr. Scientist (Agril. Extension)	Shamna.A@icar.gov.in
Dr. N.M. Alam	Sr. Scientist (Agril. Statistics)	Nurnabi.Alam@icar.gov.in
Dr. M.L. Roy	Sr. Scientist (Agril. Extension)	Manik.Roy@icar.gov.in
Dr. S.P. Mazumdar	Sr. Scientist (Soil Science)	Sonali.Majumdar@icar.gov.in
Mr. H.R. Bhandari	Sr. Scientist (Plant Breeding) & I/c CSRSJAF, Budbud	Hem.Bhandari@icar.gov.in
Dr. V. Ramesh Babu	Sr. Scientist (Agril. Entomology)	Veegala.Babu@icar.gov.in
Dr. A.K. Chakraborty	Scientist (Agril. Statistics)	Asim.Chakraborty@icar.gov.in
Mrs. K. Meena	Scientist (Biotechnology) on study leave	Kanti.Meena@icar.gov.in
Dr. A. Anil Kumar	Sr. Scientist (Plant Breeding)	anil.kumar8@icar.gov.in
Dr. Maruthi R.T.	Scientist (Genetics) (till 23.11.21)	Maruthi.RT@icar.gov.in
Dr. Laxmi Sharma	Scientist (Plant Physiology)	Laxmi.Sharma@icar.gov.in
Dr. Suman Roy	Scientist (Plant Physiology)	Suman.Roy@icar.gov.in
Mr. Kajal Das	Scientist (Agronomy)	kajal.das@icar.gov.in
Mr. Shivakumar K.V.	Scientist (Plant Pathology) & I/C ShRS, Pratapgarh	shivakumar.kv@icar.gov.in
Mr. Vikash Mangal	Scientist (Plant Breeding) (till 3.2.21)	vikas.mangal@icar.gov.in

<u>Name</u>	<u>Designation</u>	<u>E-mail id</u>
Dr. J. K. Meena	Scientist (Plant Breeding)	jitendra.meena@icar.gov.in
Dr. Debarati Datta	Scientist (Agronomy)	Debarati.Datta@icar.gov.in
Dr. Thribhuvan, R.	Scientist (Genetics & Plant Breeding)	thribhuvan.r@icar.gov.in
Ms. Lavanya, A.K.	Scientist (Agril. Microbiology)	neethu.mohan@icar.gov.in
Ms. Neethu Mohan	Scientist (Genetics & Plant Breeding)	lavanya.ak@icar.gov.in
Dr. Kumar N. Chourasia	Scientist (Genetics & Plant Breeding)	kumar.chourasia@icar.gov.in
Dr. Saurav Ghosh	Scientist (Agronomy)	Saurav.ghosh@icar.gov.in
Dr. T. Samajdar	Sr. Scientist-cum-Head, KVK, North 24 Prgs (additional)	tanmay.samajdar@icar.gov.in
Dr. Sk. Md. Azizur Rahman	Sr. Scientist-cum-Head KVK, Burdwan	Azizur.Rahman1@icar.gov.in

Technical Staff (Category I)

Sri K. P. Debnath	Technical Officer	Kalipada.Debnath@icar.gov.in
Sri L. N. Ghosh	Technical Officer	Lakshmi.Ghosh@icar.gov.in
Sri Dilip Kr. Patra	Technical Officer	Dilip.Patra@icar.gov.in
Sri Ashim Mukhopadhyay	Technical Officer	Ashim.Mukhopadhyay@icar.gov.in
Sri S.K. Bhattacharyya	Technical Officer	Saurindra.Bhattacharyya@icar.gov.in
Sri Hare Krishna Das	Sr. Technical Assistant	Hare.Das@icar.gov.in
Sri Sanjib Ghosh	Technical Assistant	Sanjib.Ghosh@icar.gov.in
Sri Avtar Singh	Technical Assistant	Avtar.Singh@icar.gov.in
Sri Laxman Pradhan	Technical Assistant	Laxman.Pradhan@icar.gov.in
Sri B.L. Prasad	Technical Assistant	Bharat.prasad@icar.gov.in
Sri Uma Sankar Das	Senior Technician	Uma.Das@icar.gov.in
Sri M.K.Kumbhakar	Senior Technician	Mrinal.Kumbhakar@icar.gov.in
Sri Baskit Nath Singh	Senior Technician	Baskit.Singh@icar.gov.in
Sri Vinay Kr Singh	Senior Technician	Vinay.Singh@icar.gov.in
Sri Satya Brata Barik	Senior Technician	Satya.Barik@icar.gov.in
Sri Kamal Kr. Banik	Senior Technician	Kamal.Banik@icar.gov.in
Sri Sanjay Kr. Sethi	Senior Technician	Sanjay.Sethi@icar.gov.in
Sri Biswajit Biswas	Technician	Biswajit.Biswas@icar.gov.in
Ms. Sharmila Sarkar	Technician	sharmila.sarkar@icar.gov.in
Sri Sanjay Kumar	Technician	Sanjay.Kumar12@icar.gov.in
Sri Paritosh Roy	Technician	Paritosh.Roy@icar.gov.in
Sri Ram Nivas Kumar	Technician	Ram.Nivash@icar.gov.in
Sri Arko Banerjee	Technician	Arko.Banerjee@icar.gov.in
Sri Ankan Singha Roy	Technician	Ankon.Roy@icar.gov.in

Technical Staff (Category II)

Sri Nilanjan Paul	Chief Technical Officer	Nilanjan.Paul@icar.gov.in
Sri Munindra Kr. Das	Technical Officer	Munindra.Das@icar.gov.in
Sri Saurav Biswas	Technical Officer	Saurav.Biswas@icar.gov.in
Sri Kalyan Broto Roy	Technical Officer	Kalyan.Roy@icar.gov.in
Sri Rakesh Kr Roshan	Technical Officer	Rakesh.Roshan@icar.gov.in
Sri Akshaya Mondal	Technical Officer	Akshaya.Mondal@icar.gov.in
Sri Manoja Kr Pradhan	Technical Officer	Manoja.Pradhan@icar.gov.in
Sri Deshraj Meena	Technical Officer	Deshraj.Meena@icar.gov.in
Md. Shahid Mukhtar	Technical Officer	Shahid.Mukhtar@icar.gov.in
Sk. Sirajul Islam	Technical Officer	Sirajul.Islam@icar.gov.in
Sk. Mohidul Haque	Technical Officer	Mohidul.Haque@icar.gov.in

<u>Name</u>	<u>Designation</u>	<u>E-mail id</u>
Sri Bitan Das	Sr. Technical Assistant	Bitan.Das@icar.gov.in
Sri Avijit Dutta	Sr. Technical Assistant	Avijit.Dutta@icar.gov.in
Sri Sandip Roy	Technical Assistant	Sandip.Roy@icar.gov.in
Ms. Pallavi Mandal	Technical Assistant	Pallavi.Mandal@icar.gov.in
Sri Raktim Mitra	Technical Assistant	raktim.mitra@icar.gov.in
Sri Kallol Sarkar	Technical Assistant	Kallol.Sarkar@icar.gov.in
Sri Ashish Madan Pitre	Technical Assistant	Ashish.Pitre@icar.gov.in
Sri Sudip Nandy	Technical Assistant	Sudip.Nandy@icar.gov.in
Administrative Staff		
Sri P. K Jain	Chief Administrative Officer (till 28.8.21)	Pradyumna.Jain@icar.gov.in
Sri R.R. Debnath	Junior Account Officer (till 31.1.21)	Radha.Debnath@icar.gov.in
Sri Ravi Mishra	Assistant Administrative Officer	Ravi.Mishra@icar.gov.in
Sri S. K. Bala	Assistant Administrative Officer (till 31.8.21)	Swapan.Bala@icar.gov.in
Sri B.N. Mukhopadhyay	Assistant Administrative Officer (till 6.4.21)	Baidyanath.Mukhopadhyay@icar.gov.in
Sri S. K. Pal	Assistant Administrative Officer	Subrata.Pal@icar.gov.in
Sri Gopal Ch. Dey	Assistant Administrative Officer	gopal.dey@icar.gov.in
Sri Pankaj Kr. Das	Assistant Administrative Officer	Pankaj.Das@icar.gov.in
Sri D. K. Barua	Assistant Administrative Officer	Dilip.Barua@icar.gov.in
Sri Raj Kumar Ghosh	Assistant Administrative Officer	Raj.Ghosh@icar.gov.in
Ms. Sohini Bhattacharya	Assistant Administrative Officer	Sohini.Bhattacharya@icar.gov.in
Sri Sribash Dey	Assistant	Sribash.Dey@icar.gov.in
Sri Sandip Prakash	Assistant	Sandeep.Prakash@icar.gov.in
Sri Manoj Kumar Roy	Assistant	Manoj.Roy@icar.gov.in
Sri Kamal Das Gupta	Assistant	Kamal.Dasgupta@icar.gov.in
Sri Chandan Kr. Verma	Assistant	Chandan.Verma@icar.gov.in
Sri Prashanta Kr. Das	Assistant	Prasanta.Das@icar.gov.in
Sri Bhola Nath Dey	Assistant	Bhola.Dey@icar.gov.in
Sri Tridib Ghosh	Assistant	Tridib.Ghosh@icar.gov.in
Sri Soumya Roy	Assistant	Soumya.Roy@icar.gov.in
Sri Surajit Barman	Assistant	Surajit.Barman@icar.gov.in
Mrs. Swati Kumari	Assistant (till 8.11.21)	swati.kumari@icar.gov.in
Sri Avirup Das	Assistant	avirup.das@icar.gov.in
Sri Ritesh Kumar	Assistant	ritesh.kumar1@icar.gov.in
Ms. Satarupa Roychowdhury	Assistant	Satarupa.Chowdhury@icar.gov.in
Sri Nilesch Ray	Assistant	
Sri Sonu Kr. Suman	Assistant	sonu.suman@icar.gov.in
Sri Paras Nath Pal	UDC	Paras.Pal@icar.gov.in
Sri Amit Kr. Mandal	UDC	Amit.Mandal@icar.gov.in
Sri Sandhi Biswas	UDC	Sandhi.Biswas@icar.gov.in
Sri Avishek Barua	UDC	Avishek.Barua@icar.gov.in
Sri Ranjan Das	UDC	Ranjan.Das@icar.gov.in
Ms. Farheen Banu	LDC (till 19.8.21)	Farheen.Banu@icar.gov.in
Sri Ravi Patra	UDC	ravi.patra@icar.gov.in
Sri Subrata Biswas	P.S.	Subrata.Biswas2@icar.gov.in
Sri. Sushanta Dey	P.A.	Sushanta.Dey@icar.gov.in
Smt. Neena Mandal	P.A.	Neena.Mandal@icar.gov.in

Supporting Staff

Sri Isra Bansfore	Sri Sunil Patra	Smt. Fulmani	Sri Jagdish Singh
Sri S.B. Rajbansi	Sri Jhulan Gupta	Sri Nelson	Sri Mahesh Singh Verma
Smt. Laxmi Bansfore	Sri Chandra Mondal	Sri Jawahar	Sri Bhuwal Pal
Sri R.B. Thapa	Shri Trinath Shaw	Sri Ram Raj Pal	Sri Ram Bhajan Saroj
Sri Anup Das	Smt Parbati Bauri	Sri Jokhu	Sri Radhey Shyam Yadav
Sri Shyamal Bhanja	Sri Prabin Boro	Sri Narottam	Sri Ram Baran Yadav
Sri Lochindra	Smt. Khira	Sri Narendra	Sri Pabitra Das
Sri Ram Asre Yadav	Kum. Koushalya	Sri Sugriva	Sri Puren Choudhury
Sri Kartich Ch. Mitra	Sri Ashok Ghosh	Sri Minaketan	Sri Uddhab Gayari
Sri Naba Kumar Dutta			

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





APPENDICES

PERSONNEL, TRANSFERS, NEW JOINING, SUPERANNUATION, PROMOTIONS

1. Transfer from ICAR-CRIJAF, Barrackpore during Jan-Dec 2021

Name of the Person	Designation	Date (w.e.f.)
1. Mr. R.R. Debnath	Jr. A.O.	31.01.2021 (A/N) transferred to ICAR-NEH, Barapani on promotion basis.
2. Mr. Vikas Mangal	Scientist	03.02.2021 (A/N) transferred to ICAR-CPRI, Shimla.
3. Mr. P. K. Jain	Chief Administrative Officer	28.08.2021 (A/N) transferred to ICAR-NBPGR, New Delhi on promotion basis.
4. Dr. Maruthi R.T.	Scientist	23.10.2021 (A/N) transferred to ICAR-SBI, Coimbatore.
5. Mrs. Swati Kumari	Assistant	08.11.2021 (A/N) transferred to ICAR-IIAB, Ranchi.

2. Transfer to ICAR-CRIJAF, Barrackpore during Jan-Dec 2021

Name of the Person	Designation	Date (w.e.f.)
1. Dr. Kumar Nishant Chourasia	Scientist	27.01.2021 (F/N) transferred from ICAR-CPRI, Shimla
2. Dr. Sourav Ghosh	Scientist	11.10.2021 (F/N) transferred from ICAR-DOGR, Pune

3. New joining at ICAR-CRIJAF, Barrackpore during Jan-Dec 2021

Name of the Person	Designation	Date (w.e.f.)
1. Dr. Thribhuvan, R	Scientist	07.01.2021 (F/N)
2. Ms. Lavanya A.K.	Scientist	12.01.2021 (F/N)
3. Ms. Neethu Mohan	Scientist	13.01.2021 (F/N)

4. Superannuation / Termination / VRS of ICAR-CRIJAF, Barrackpore during Jan-Dec 2021

Name of the Person	Designation	Date (w.e.f.)
1. Mr. B.N. Mukhopadhyay	AAO	06.4.2021 (F/N) VRS
2. Ms. Farheen Banu	LDC	19.8.2021 (A/N) resignation on her own request
3. Mr. Swapan Kumar Bala	AAO	31.8.2021
4. Mr. Subrata Kumar Pal	AAO	31.12.2021
5. Smt. Parbati Bauri	SSS	31.12.2021
6. Smt. Khira	SSS	31.12.2021
7. Sri Jhulan Gupta	SSS	31.12.2021
8. Sri Minaketan	SSS	31.12.2021



MS CERT

Certificate Of Registration **QUALITY MANAGEMENT SYSTEM**

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

Address:

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

ISO 9001:2015
(Quality Management System)

Scope of Certification:

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

Sector Code: (M-74.90)

Certificate Number: IN/QMS/01396/8654

Issue no.: 01

Date of approval : 14.09.2021

Valid until : 13.09.2024

Revision no: nil

Revision date : nil

Original Certification Date: 14.09.2021



Surveillance Audit 1st Year



S. Dutta
Managing Director



Surveillance Audit 2nd year



MSCB- 240

MS CERTIFICATION SERVICES PVT. LTD.

Address: 3/23, R.K. Chatterjee Road, Kolkata-700042, West Bengal, India.

www.msccertification.net

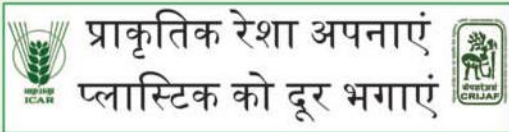
*The validity of this certificate can be verified at register or www.msccertification.net
The Certificate is Valid Only if the Annual Surveillance Mark is Signed by Auditor on Original.*
F60.rev.05



नोट्स

[illegible]





हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

Agrisearch with a human touch

Published By:

ICAR-Central Research Institute for Jute and Allied Fibres

Nilganj, Barrackpore, Kolkata- 700121

Email: director.crijaf@icar.gov.in

Website: <http://crijaf.icar.gov.in>