2023
ANNUAL REPORT
वार्षिक प्रतिवेदन 2023

भाकृअनुप
ICAR

ICAR-NATIONAL RESEARCH CENTRE ON PIG
RANI, GUWAHATI - 781 131, ASSAM

भा.कृ.अनु.प.–राष्ट्रीय शूकर अनुसंधान केन्द्र
राणी, गुवाहाटी–७८११३१, असम

RANI GUWAHATI ASSAM
nrcp

ANNUAL REPORT

वार्षिक प्रतिवेदन

2023

भा.कृ.अनु.प.-राष्ट्रीय शूकर अनुसंधान केन्द्र
राणी, गुवाहाटी-७८११३१, असम

ICAR-NATIONAL RESEARCH CENTRE ON PIG
Rani, Guwahati - 781 131, Assam

Citation

ICAR-NRC on Pig, Annual Report, 2023

Compiled and edited by

Chief Editor	:	Dr. Vivek Kumar Gupta, Director
Editor	:	Dr. R. Thomas, Principal Scientist
Co- Editors	:	Dr. Salam Jayachitra Devi, Scientist
		Dr. Satish Kumar, Scientist
		Dr. Sunil Kumar, Scientist

Editorial Board :

Dr. Vivek Kumar Gupta, Director and Chairman
Dr. S. Rajkhowa, Principal Scientist and Member
Dr. N.H. Mohan, Principal Scientist and Member
Dr. Rajib Deb, Senior Scientist and Member
Dr. Priyajoy Kar, Scientist and Member
Dr. Satish Kumar, Scientist and Member
Dr. R. Thomas, Principal Scientist and Member Secretary

Cover Page Photo Description

Mrs. Mina Pegu, progressive pig farmer, Tadang, Lakhimpur (Front cover); Mrs. Jadumoni Narah, progressive pig farmer, Gomirijan, Lakhimpur (Back cover) and a pig farmer guiding his indigenous pig herd to its shelter (Front cover).

Published by

The Director
ICAR-NRC on Pig, Rani
Guwahati, Assam

ICAR-National Research Centre on Pig
Rani, Guwahati- 781131, Assam, India
Tel.No. : 0361-2847195
Fax : 0361-2847195
Email : nrconpig@rediffmail.com
Website: http://www.nrcp.icar.gov.in

Printed at : Maa Manasha Printers
Zoo Road Tiniali, Guwahati

TABLE OF CONTENTS

Message from Director

Dear Stakeholders,

As we reflect on the accomplishments and strides made by the ICAR-National Research Centre on Pig (ICAR-NRCP) over the past year, it is with great pleasure that I present our annual report. This document encapsulates our collective efforts, achievements, and commitments towards advancing research, innovation, and sustainable practices in the domain of pig farming and husbandry.

Throughout the year, our dedicated team of researchers, scientists, technicians, and support staff have worked tirelessly to address the evolving challenges and opportunities within the pig husbandry/industry. From genetic improvement and disease management to nutrition and welfare, our multidisciplinary approach continues to yield significant breakthroughs and advancements.

Innovation remains at the heart of our endeavours, as we strive to develop novel technologies, methodologies, and best practices to enhance productivity, profitability, and resilience in pig farming systems. Our collaborative partnerships with national and international institutions, academia, industry, and stakeholders have been instrumental in fostering knowledge exchange, capacity building, and technology transfer.

Amidst the global uncertainties and disruptions, our resilience and adaptability have been tested, yet we have emerged stronger and more determined than ever. The various transboundary diseases like African Swine Fever (ASF) pandemic underscored the critical role of the pig sector, and we remain steadfast in our commitment to supporting pig farmers and ensuring food security and livelihoods.

During the last 21 years, ICAR-National research Centre on Pig is relentlessly working with the vision to bring in excellence in pig production, health and product processing through innovative research in order to provide technology backstopping for quality germplasm, enhanced pork production, employment generation and poverty reduction among socially and economically weaker sections through medium of pig husbandry. The

Institute is coordinating 20 All India Coordinated Research Project on Pig, located in different parts of the country. Krishi Vigyan Kendra (KVK) of the institute is actively been engaged in conducting several programmes for extension personnel of line departments, entrepreneurs and farmers in different aspect of animal science, crop science, farm mechanization, fishery, home science, horticulture, plant protection, and soil and water conservation through training, OFTs and FLDs.

On human resource development front, the scientists and administrative staffs of the Institute were awarded/ honoured in various platforms.

Looking ahead, we are poised to embrace emerging opportunities and tackle new challenges with vigor and enthusiasm. Our strategic priorities encompass sustainable intensification, digitalization, value addition, and market integration, as we work towards achieving the vision of a vibrant, inclusive, and environmentally responsible pig sector.

I extend my sincere gratitude to our esteemed stakeholders, including farmers, policymakers, industry partners, funding agencies, and the community at large, for their unwavering support and collaboration. Together, we will continue to push the boundaries of knowledge and innovation, driving positive transformation and prosperity across the pig value chain.

I wish to express my sincere thanks and gratitude for the constant support and encouragement received from Dr. Himanshu Pathak, Secretary, DARE & Director General, ICAR and Dr. Raghavendra Bhatta, Deputy Director General (Animal Sciences). I am thankful to Dr. A.K. Tyagi, ADG (ANP), Dr. Ashok Kumar, ADG (Animal Health), Dr. G. K. Gaur, ADG (AP&B) and other staff of Animal Science Division, ICAR, Krishi Bhawan, New Delhi for their continuous support.

It will be unfair not to put on record the untiring effort of the Scientists and other staffs of the Institute. Their hard work and dedication have been duly reflected in this report. I congratulate the entire team of the editorial board for bringing out this report as per the schedule.

In closing, I invite you to explore this annual report, which serves as a testament to our collective achievements and aspirations. As we embark on the journey ahead, let us remain united in our pursuit of excellence and impact, guided by our shared commitment to the advancement of the pig sector and the well-being of society.

(Vivek Kumar Gupta)
Director

कार्यकारी सारांश

भाकृअनुप-राष्ट्रीय शूकर अनुसंधान केंद्र ने अपनी स्थापना के 21 शानदार वर्ष सफलतापूर्वक पूरे करने के साथ-साथ किसानों, विस्तार प्रतिनिधियो, विधि-विधायकों और शूकर पालन व पोर्क प्रसंस्करण में शामिल व्यवसायों को शीर्ष स्तर की सेवाएं प्रदान करता है। यह संस्थान अपनी संबद्ध इकाइयों जैसे कृषि विज्ञान केंद्र (केवीके) और पूरे देश में फैले हुए अखिल भारतीय शूकर समन्वित अनुसंधान परियोजना के 20 केंद्रों के साथ वैज्ञानिक शूकर उत्पादन और उपज उपरान्त के प्रबंधन को लोकप्रिय बनाने के लिए गंभीर प्रयास कर रहा है। संस्थान ने वर्ष 2023 के दौरान, 21 वैज्ञानिकों, 06 तकनीकी कर्मचारियों, 06 प्रशासनिक और लेखा कर्मियों के साथ कार्य किया। वित्तीय वर्ष के दौरान कुल योजना और गैर-योजना बजट आवंटन 2461.17 लाख रुपये था। संस्थान ने इस अवधि के दौरान 34.19 लाख रुपये का राजस्व अर्जित किया । संस्थान के वैज्ञानिकों ने छह प्रमुख कार्यक्रमों के तहत परिभाषित अनुसंधान और विस्तार से संबंधित विभिन्न लक्ष्यों को प्राप्त करने के लिए लगातार काम किया। वर्तमान में भाकृअनुप-राष्ट्रीय शूकर अनुसंधान केंद्र को "भारतीय कृषि अनुसंधान परिषद" की छत्रछाया में सबसे जीवंत संगठनों में से एक माना जाता है और यह एक ISO/IEC 17025:2017 मान्यता प्राप्त और ISO9001:2015 प्रमाणित संस्थान है।

शूकरों का संरक्षण और आनुवंशिक सुधार

भारतीय शूकर नस्लों (घुंघरू, डूम, नियांग मेघा, अगोंडा गोवा और मणिपुरी ब्लैक) के भीतर आनुवंशिक भिन्नता का पता एफ.ए.ओ. आईएसएजी माइक्रोसेटेलाइट मार्करों का उपयोग करके देशी प्रजनन पथ से 50 आनुवंशिक रूप से असंबंधित शूकरों के साथ किया गया । लिट्टर संख्या के लक्षणों के साथ विभिन्न उम्मीदवार जीन में एकल न्यूक्लियोटाइड बहुरूपता के रूप में आनुवंशिक परिवर्तनशीलता का संबंध तीन भारतीय शूकर नस्लों (घुंघरू, डूम और नियांग मेघा) में खोज किया गया। शूकरों की स्वास्थ्य स्थिति की जांच के लिए आईआरटी छवि-आधारित प्रणालियों पर किए गए अध्ययनों से यह स्थापित हुआ है कि इन्फ्रारेड थर्मोग्राफी से योनि की त्वचा के तापमान के विकास की निगरानी करके शूकरों का मद में मूल्यांकन करने की क्षमता है। शूकरों में लिट्टर संख्या और अन्य प्रजनन लक्षणों के संदर्भ में अलग-अलग आनुवंशिक क्षमता होती है। इन विशिष्ट नस्लों में चयन हस्ताक्षर विकसित करने के लिए भारत के घुंघरू और डूम शूकरों में जीनोम-वाइड चयन हस्ताक्षर की खोज शुरू की गई है। माइटोकॉन्ड्रियल डीएनए डी-लूप क्षेत्र का उपयोग करके वाकचैम्बिल शूकरों का आनुवंशिक लक्षण वर्णन किया गया।

शूकर फार्म प्रबंधन प्रक्रियाओं में सुधार

देसी और संकर नस्ल के शूकरों का कल्याण मूल्यांकन और ईथोग्राम विकास संस्थान के फार्म और किसान के क्षेत्र दोनों में किया गया । संस्थान के फार्म में कुल 40 उत्पादक शूकरों का और किसान के क्षेत्र से 42 उत्पादक शूकरों का मूल्यांकन किया गया। व्यवहार के अवलोकन के दौरान, अन्य पशु-आधारित उपायों से संबंधित पैरामीटर जैसे अच्छा भोजन, आवास और स्वास्थ्य सिद्धांत भी दर्ज किए गए। शूकरों का उनके शरीर की स्थिति, बर्साइटिस, शरीर पर मल, लंगड़ापन, शरीर पर घाव, हुडलिन और हांफने के लिए व्यक्तिगत रूप से विश्लेषण किया गया। स्कोरिंग का विश्लेषण पेन स्तर

पर किया गया । कल्याण के मुद्दों के साथ तनाव के स्तर का आकलन करने के लिए, कोर्टिसोल स्तर पर कल्याण संकेतकों के प्रभाव का अध्ययन किया गया । इस उद्देश्य के लिए, शूकरों से लार के नमूने एकत्र किए गए, जिसमें कल्याण का आकलन किया गया। जिन शूकरों की शारीरिक स्थिति खराब थी, उनमें कोर्टिसोल का स्तर (पी<0.05) अधिक था। अच्छी शारीरिक स्थिति वाले शूकरों में कोर्टिसोल का स्तर 2.99±0.249 एनजी/एमएल था, जबकि खराब शारीरिक स्थिति वाले शूकरों में यह मूल्य 3.93±0.44 एनजी/एमएल दर्ज किया गया था। बर्साइटिस (3.57±0.45 एनजी/एमएल) वाले शूकरों की तुलना में अच्छी स्थिति वाले शूकर (3.10±0.25 एनजी/एमएल) में संख्यात्मक रूप से उच्च कोर्टिसोल स्तर पाया गया। इसके अलावा, संगठित शूकर उत्पादन में जल पदचिह्न का आकलन किया गया जिसमें गहन शूकर उत्पादन प्रणालियों की तुलना घरेलू अर्ध-गहन उत्पादन प्रणाली से की गई ।

लाभदायक शूकर उत्पादन के लिए पोषण संबंधी हस्तक्षेप

प्रयोगशाला पशु मॉडल में अकार्बनिक ट्रेस तत्वों की तुलना में Zn, Cu, Mn और Cr जैसे कार्बनिक ट्रेस तत्वों के ऊतक वितरण और जैव उपलब्धता को निर्धारित करने के लिए अकार्बनिक और कार्बनिक स्रोतों के पूरक पर ट्रेस खनिजों की जैव उपलब्धता और ऊतक उपयोग का अध्ययन किया गया । साप्ताहिक विभिन्न समूहों के बीच शरीर के वजन में परिवर्तन की तुलना से पूरे प्रयोग के दौरान खनिज स्रोत के प्रकार के साथ-साथ खनिजों और भोजन के प्रकार के बीच बातचीत का कोई महत्वपूर्ण प्रभाव नहीं दिखा। प्रतिबंधित आहार समूहों में एडीजी 6.0 ग्राम पाया गया और यह सामान्य आहार समूहों एडीजी 7.5 ग्राम से काफी कम (पी<0.01) पाया गया। सामान्य आहार की स्थिति में Zn चेलेटेड खनिज पूरक समूह में सामान्य आहार के तहत अकार्बनिक Zn पोषित नियंत्रण समूह की तुलना में अधिक अवशोषण (मिलीग्राम/दिन) दिखा। नियंत्रित समूह की तुलना में प्रतिबंधित आहार समूह में तुलनात्मक रूप से उच्च सापेक्ष जैवउपलब्धता पाई गई।

शूकरों की प्रजनन क्षमता में सुधार

शूकर के शुक्राणु की गुणवत्ता पर विभिन्न योजकों के प्रभाव अर्थात ब्यूटाइलेटेड हाइड्रॉक्सी टोल्यूनि (बीएचटी), रिड्यूस्ड ग्लूटाथियोन (जीएसएच), टॉरिन (टीएयू) और ट्रेहलोज (टीआरई) का 72 घंटे तक प्रशीतित तापमान (5 डिग्री सेल्सियस) पर संग्रहीत क्षमता अध्ययन किया गया। शुक्राणु की गतिशीलता में 24, 48 और 72 घंटे पर 5 डिग्री सेल्सियस पर संरक्षण के दौरान काफी अंतर (पी<0.05) पाया गया, जबकि जीवित शुक्राणु का प्रतिशत 24 घंटे, 48 घंटे और 72 घंटे पर एलईवाई एक्सटेंडर में एडिटिव्स की अलग-अलग सांद्रता के साथ काफी भिन्न (पी<0.05) था। भंडारण (5°C) पर यह देखा गया कि बीएचटी 1mM के बाद जीएसएच 3mM और ट्रेहलोज 100mM ने 5°C पर भंडारण के दौरान शुक्राणु की गुणवत्ता में उल्लेखनीय रूप से (P<0.05) सुधार किया। इसके अतिरिक्त, बीएचटी 1एमएम ने 72 घंटे की संरक्षण अवधि में अन्य उपचार समूहों की तुलना में महत्वपूर्ण रूप से (पी <0.05) उच्च शुक्राणु व्यवहार्यता, झिल्ली अखंडता और एक्रोसोमल अखंडता दिखाई। प्रशीतित संरक्षण के दौरान वीर्य की गुणवत्ता पर एंटीऑक्सिडेंट के संयोजन ने आशाजनक प्रभाव पाया गया, जिससे कम तापमान पर शूकर वीर्य संरक्षण तकनीकों में संभावित अनुप्रयोगों के लिए मूल्यवान अंतर्दृष्टि प्रदान की गई। किसानों के क्षेत्र में शूकर मल्टीप्लायर इकाइयां (6+1 इकाई)

स्थापित की गईं। डॉपलर और थर्मल इमेजिंग का उपयोग शूकरों की प्रजनन क्षमता का अनुमान लगाकर प्रजनन की सुदृढ़ता के मूल्यांकन के लिए शूकर स्कोर का अनुमान लगाया गया। जैवसंसाधन अनुपूरण से मादा शूकरों में यौवन के समय उम्र कम और उत्पादन प्रदर्शन में सुधार होता है जबकि नर शूकरों में इन विट्रो शुक्राणु प्रजनन क्षमता में वृद्धि पाई गईं। चार जैवसंसाधनों का मेटाबोलॉमिक्स किया गया।

शूकरों में शारीरिक क्रिया में सुधार

स्वदेशी माली और घुंघरू और क्रॉसब्रीड रानी शूकरों में विभिन्न मौसमी परिस्थितियों के तहत जांघ की मांसपेशियों और बृहदान्त्र के ऊतकों में विभिन्न गर्मी तनाव उत्तरदायी एचएसपी और एमसीटी जीनों की सापेक्ष अभिव्यक्ति प्रवृत्तियों का मूल्यांकन किया गया। स्वदेशी (घुंघरू और माली) और विदेशी (हैम्पशायर और बड़े व्हाइट यॉर्कशायर) के पूरे जीनोम को अगली पीढ़ी के अनुक्रमण का उपयोग करके शुरू किया गया और गुणसूत्र स्तर तक इकट्ठा किया गया । संसाधित कच्चे डेटा को वेरिएंट की पहचान करने के लिए सस स्क्रोफा 11.1 संदर्भ जीनोम से जोड़ा गया । संदर्भ असेंबली Sscrofa11.1 के साथ घुंघरू, हैम्पशायर, माली और LWY की जीनोम-स्तरीय तुलना के माध्यम से वेरिएंट के विभिन्न वर्गों की पहचान की गई। विश्लेषण से चार नस्लों के जीनोम में कुल 100864 संरचनात्मक वेरिएंट का पता चला, जिसमें 46687 विलोपन, 352 दोहराव और 53825 सम्मिलन शामिल थे। डिम्बग्रंथि कूपिक सेल ट्रांसक्रिपटॉमिक्स पर शोध से शूकरों में सेलुलर अनुकूलन को नियंत्रित करने वाले प्रजनन विशिष्ट उपन्यास उम्मीदवार जीन और सिग्नलिंग मार्ग प्राप्त हुए। साइकलिंग शूकरों में ल्यूटोलाइटिक संवेदनशीलता के अधिग्रहण के साथ कॉर्पस ल्यूटियम और गर्भाशय ट्यूब की प्रोटीन प्रोफाइलिंग से ल्यूटियल रिग्रेशन के स्थानिक-अस्थायी विनियमन का पता चला।

शूकर रोग की जांच और निगरानी

मानक एल्गोरिदम का उपयोग करके संदर्भ जीन के रूप में पांच व्यापक रूप से उपयोग किए जाने वाले हाउसकीपिंग जीन (एचपीआरटी 1, बी 2 एम, 18 एस आरआरएनए, पीजीके 1 और एच 3 एफ 3 ए) की अभिव्यक्ति स्थिरता के लिए स्वस्थ और अफ्रीकी स्वाइन फीवर वायरस (एएसएफवी) संक्रमित पोर्सिन ऊतकों का मूल्यांकन किया गया । प्रत्येक ऊतक नमूने से कुल आरएनए (स्वस्थ और एएसएफवी-संक्रमित शूकरों से लिम्फ नोड, प्लीहा, गुर्दे, हृदय और यकृत) को निकाला गया और बाद में सीडीएनए को संश्लेषित किया गया, और क्यूआरटी-पीसीआर के अधीन किया गया। अध्ययन से स्वस्थ और साथ ही एएसएफ-संक्रमित शूकरों में पाए जाने वाले स्थिर संदर्भ जीन का पता चला और इस अध्ययन के माध्यम से पहचाने गए ये संदर्भ जीन आधारभूत डेटा बनाएंगे जो एएसएफवी-संक्रमित सूअरों में जीन अभिव्यक्ति पर भविष्य की जांच में बहुत उपयोगी होंगे। क्लासिकल स्वाइन बुखार, अफ्रीकी स्वाइन बुखार और पोर्सिन प्रजनन और श्वसन सिंड्रोम वायरस का पता लगाने के लिए अनुकूलित क्यूपीसीआर परख किया गया। कोकिडिया एसपी की गतिशीलता को समझने के लिए बेकयार्ड शूकर पालन (80) और अर्ध-गहन शूकर पालन इकाइयों (104) से कुल 184 सकारात्मक नमूने एकत्र किए गए। शूकरों में संक्रमण.-3डी संस्कृति के विकास के लिए पोर्सिन मांसपेशी स्टेम कोशिकाओं के अलगाव और लक्षण वर्णन के लिए एक नई परियोजना शुरू की गई है। मत्स्य पालन और पशु रोगाणुरोधी प्रतिरोध योजना के लिए भारतीय नेटवर्क के तहत अनुसंधान

गतिविधियों से मल्टीड्रग-प्रतिरोधी एंटरोबैक्टीरिया वाले कई प्लास्मिड की उपस्थिति का पता चला है जो कोलिस्टिन और कार्बापेनेम्स जैसी अंतिम उपाय वाली दवाओं के प्रति प्रतिरोधी हैं। अध्ययन में भारत के शूकर पालन फार्म के कचरे में छह ट्रांसपोज़ेबल तत्वों टीएन 6763, टीएन 6764, टीएन 6765, टीएन 2003, टीएन 6072 और टीएन 6020 की व्यापकता की भी पहचान की गई, जो एंटरोबैक्टीरियासी परिवार से संबंधित हैं।

उपजउपरान्त पोर्क प्रसंस्करण और मूल्यवर्धन

थर्मल तनाव और अनुकूलन के खिलाफ रोगजनक ई. कोलाई की प्रतिक्रिया, जो खाद्य प्रसंस्करण और भंडारण वातावरण में प्रासंगिक है, का मूल्यांकन किया गया और विषाणु से संबंधित जीनों की अभिव्यक्ति के स्तर को निर्धारित किया गया, जैसे कि ई. कोली संलग्न करना और मिटाना (ईईई), विष जैसे शिगा (एसटीएक्स1 और एसटीएक्स2) और शूकर के मांस से पृथक रोगजनक ई. कोली के उपभेदों में हेमोलिसिन (एचएलआईए)। कॉलोनी आकृति विज्ञान और जैव रासायनिक विशेषताओं के आधार पर, शूकर के मांस के नमूनों से कुल 176 ई. कोली आइसोलेट्स बरामद किए गए, हालांकि पीसीआर आधारित विषाणुजन्य जीन का पता लगाने के आधार पर केवल 4 आइसोलेट्स (2.27%) को रोगजनक ई. कोली होने की पुष्टि की गई। डी-मान सभी अलग-अलग उपभेदों में उल्लेखनीय वृद्धि हुई (पी <0.05) क्योंकि अनुकूलित तापमान 4°C से बढ़कर 42°C हो गया, सीरोटाइप की परवाह किए बिना और 4°C, 25°C, 37°C और 42°C पर फ़ील्ड आइसोलेट्स के अनुकूलन के परिणामस्वरूप विषाणु जीन के अभिव्यक्ति स्तर में महत्वपूर्ण परिवर्तन हुए हैं। एक ही समूह और समूहों के बीच। यह देखा गया कि रोगजनक ई. कोलाई में प्रेरित थर्मल तनाव सहिष्णुता इन उपभेदों के लंबे समय तक उच्च तापमान के संपर्क से शुरू हो सकती है, जिसने थर्मल प्रसंस्करण के दौरान उनके अस्तित्व में योगदान दिया। डीएसटी-एसटीआई हब परियोजना के तहत, आवश्यक मशीनरी और क्षमता निर्माण के साथ, मूल्य वर्धित पोर्क उत्पादों के प्रसंस्करण के लिए नई तकनीकों को विकसित और लाभार्थियों को हस्तांतरित किया गया है।

शूकर उत्पादन बढ़ाने के लिए विस्तार हस्तक्षेप

नई पशुधन प्रौद्योगिकियों और बाधाओं को अपनाने को बढ़ावा देने वाले प्रौद्योगिकी हस्तांतरण मॉडल की पहचान करने के लिए अनुसंधान कार्य किया गया है, जिसमें अंतराल एक प्रमुख विवाद है। असम के तीन जिलों से प्रारंभिक डेटा संग्रह ने उनके लक्षण वर्णन के साथ विभिन्न उत्पादन प्रकारों की पहचान की है, हितधारकों के आकलन के साथ विभिन्न जिलों में प्रमुख प्रौद्योगिकियों की पहचान की गई है। एक ई-लर्निंग मॉड्यूल विकसित किया गया है, जो ज्ञान का प्रसार करने और टिकाऊ प्रथाओं को बढ़ावा देने के लिए डिजिटल तकनीक का लाभ उठाता है। इस मॉड्यूल की सामग्री में जैव सुरक्षा, भोजन, कृषि संचालन, खेती, नस्ल पहचान और प्रशिक्षण कार्यक्रमों की जानकारी शामिल है। शूकर पालन क्षेत्र में ड्रोन डिलीवरी का उपयोग करने की संभावना का पता लगाया गया है।

शूकर उत्पादन में आईटी और कंप्यूटर अनुप्रयोग

सेल छवि विश्लेषण में हाल की प्रगति ने माइक्रोस्कोपी सेल छवियों को खंडित और विश्लेषण करने के लिए डिज़ाइन किए गए स्वचालित डीप लर्निंग एल्गोरिदम को विकास दिया। विभिन्न अनुसंधान

डोमेन में व्यापक और विश्वसनीय सेल विश्लेषण प्राप्त करने में चल रही चुनौतियों का समाधान करने के लिए, रूपात्मक गुणों, फेनोटाइप और उप-सेलुलर गतिशीलता की सटीक मात्रा निर्धारित करने के लिए यह कृत्रिम बुद्धि-आधारित विधि आवश्यक है। यह अध्ययन एक कोशिका विभाजन तकनीक पेश करता है जिसका उद्देश्य वैज्ञानिकों और शोधकर्ताओं को विभिन्न कोशिका प्रकारों और व्यवहार्यता की तेजी से और सटीक पहचान करने में सहायता करना है। ड्रोन दूरदराज के स्थानों में संक्रमित जानवरों के इलाज के लिए चिकित्सीय दवाओं की सटीक निश्चित-बिंदु डिलीवरी करते सक्षम पाए गए ।

सामाजिक रूप से पिछड़े लोगों की आजीविका बढ़ाने के लिए तकनीकी हस्तक्षेप

टीएसपी और एससीएसपी के तहत 2023 के दौरान कुल 36 शूकर स्वास्थ्य और जागरूकता शिविर सह इनपुट वितरण आयोजित किए गए, जिसमें कुल 4380 आदिवासी शूकर पालकों को इन कार्यक्रमों से सीधे लाभ हुआ। इन किसानों के बीच, शूकर फ़ीड और विभिन्न छोटे इनपुट जैसे स्टील की बाल्टी, गमबूट, प्रजनन शूकर, खनिज मिश्रण और स्थानीय भाषाओं में शूकर पालन प्रबंधन पर विभिन्न वैज्ञानिक पत्रक वितरित किए गए।

प्रशिक्षण और क्षमता निर्माण

भाकृअनुप-राष्ट्रीय शूकर अनुसंधान केंद्र ने शूकर उत्पादन, कृत्रिम गर्भाधान, पोर्क प्रसंस्करण और मूल्य संवर्धन के विभिन्न पहलुओं में 30 प्रशिक्षण कार्यक्रम आयोजित किए, ताकि प्रतिभागियों को लाभदायक शूकर पालन के लिए नस्ल/किस्मों/प्रभेदों के चयन और प्रजनन रणनीतियों की मूल बातें, विभिन्न प्रकार के शूकर फ़ीड में जानकारी प्रदान की जा सके। शूकरों की श्रेणियाँ और शूकरों को खिलाने के लिए गैर-पारंपरिक खाद्य पदार्थों का उपयोग, शूकरों की विभिन्न श्रेणियों की देखभाल और प्रबंधन, वीर्य प्रयोगशाला संपर्क, वीर्य संग्रह, कृत्रिम गर्भाधान के लिए शूकर के वीर्य का प्रसंस्करण और मूल्यांकन, वैज्ञानिक शूकर पालन के लिए आवास की आवश्यकता, शूकरों की सामान्य बीमारियाँ और उनका प्रबंधन जिसमें टीकाकरण कार्यक्रम, फार्म की सफाई, कीटाणुशोधन, नियमित फार्म संचालन प्रक्रियाएं, शूकरों का बधियाकरण और सुई के दांत काटना और शूकरों में दवाओं के प्रशासन के विभिन्न तरीके, और शूकरों की विभिन्न श्रेणियों के लिए फ़ीड के निर्माण का प्रदर्शन शामिल था।

प्रौद्योगिकी हस्तांतरण और बिजनेस इनक्यूबेशन समर्थन

भाकृअनुप-राष्ट्रीय शूकर अनुसंधान केंद्र ने 03 प्रौद्योगिकियां विकसित की हैं और इन प्रौद्योगिकियों के व्यावसायीकरण और हस्तांतरण के साथ-साथ परामर्श, अनुबंध अनुसंधान और अनुबंध सेवाओं जैसी विभिन्न सेवाओं के लिए विभिन्न उद्यमियों, हितधारकों(Stakeholders) और संगठनों के साथ 02 एमओयू पर हस्ताक्षर किए हैं। वर्ष के दौरान, 03 पेटेंट प्रदान हुए जबकि संस्थान ने 03 पेटेंट के लिए आवेदन किया । इसके अलावा, 2023 के दौरान 04 ट्रेडमार्क, 11 कॉपीराइट और 01 डिज़ाइन प्रदान हुए । भाकृअनुप-राष्ट्रीय शूकर अनुसंधान केंद्र ने 2023 के दौरान एबीआई के तहत 02 उद्यमियों/स्टार्टअप को शामिल किया । प्रौद्योगिकी हस्तांतरण समझौता उद्यमिता कौशल विकास सहित ऊष्मायन और व्यवसाय विकास कार्यक्रम वाणिज्यिक शूकर पालन, संबद्ध सेवा क्षेत्रों और शूकर के मांस में मूल्यवर्धन के क्षेत्रों में गतिविधियाँ पर केंद्रित है। संस्थान ने उद्यमियों को उनकी शुरुआत को बढ़ाने के लिए व्यावसायिक डोमेन में आधुनिक प्रौद्योगिकी-आधारित व्यावसायिक

विचारों और मॉडलों को विकसित करने के लिए तकनीकी परामर्श और सलाहकार कनेक्शन, मार्गदर्शन और प्रशिक्षण के संदर्भ में सक्रिय और मूल्य वर्धित व्यावसायिक सहायता प्रदान करके भी मदद की है।

कृषि विज्ञान केन्द्र

वर्ष के दौरान 1393 प्रतिभागियों के लिए कुल 60 प्रशिक्षण कार्यक्रम आयोजित किए गए। कृषि विज्ञान केंद्र गोलपारा ने नव निर्मित कृषि प्रौद्योगिकियों पर 07 ऑन फार्म परीक्षण आयोजित किए हैं। रिपोर्ट की गई अवधि के दौरान सात संख्या में एफएलडी भी आयोजित किए गए। इसके अलावा, केवीके ने विभिन्न योजनाएं/परियोजनाएं आयोजित की हैं जैसे प्राकृतिक खेती, स्वच्छता अभियान, अंतर्राष्ट्रीय बाजरा वर्ष और विकसित भारत संकल्प यात्रा।

स्वच्छ भारत

भाकृअनुप-राष्ट्रीय शूकर अनुसंधान केंद्र, रानी ने पूरे वर्ष समय-समय पर सक्रिय रूप से भाग लिया और "स्वच्छता अभियान" का आयोजन किया। नियमित गतिविधियों, विशेष अभियान के अलावा संस्थान ने 15 सितंबर से 2 अक्टूबर, 2023 तक "स्वच्छता ही सेवा" अभियान चलाया, जिसका उद्देश्य 'कचरा मुक्त भारत' को बढ़ावा देना था, जिसमें दृश्य स्वच्छता और सफाई मित्रों की भलाई पर जोर दिया गया। इस पहल में 'धन्यवाद सफ़ाईमित्र' अभियान भी शामिल था जिसका उद्देश्य स्वच्छता कार्यकर्ताओं के योगदान का सम्मान और सराहना करना था। संस्थान ने 2 अक्टूबर से 31 अक्टूबर 2023 तक स्वच्छता को संस्थागत बनाने और सरकारी कार्यालयों में लंबित मामलों को कम करने के लिए विशेष अभियान 3.0 का आयोजन किया है और 16 दिसंबर 2021 से 31 दिसंबर 2021 तक स्वच्छता पखवाड़ा मनाया है।

अखिल भारतीय शूकर समन्वित अनुसंधान परियोजना

संस्थान ने परिषद के परामर्श से तकनीकी और वित्तीय निगरानी और समीक्षा बैठक के आयोजन के माध्यम से शूकर परियोजना (20 केंद्रों) पर एआईसीआरपी की प्रगति की नियमित निगरानी जारी रखी। विभिन्न कृषि जलवायु स्थितियों में शूकरों के प्रदर्शन का अध्ययन करने, गुणवत्ता वाले जर्मप्लाज्म सहित प्रथाओं के क्षेत्र-विशिष्ट पैकेज विकसित करने और स्वदेशी जर्मप्लाज्म को संरक्षित करने के लिए एआईसीआरपी परियोजना देश भर के विभिन्न केंद्रों में जारी है।

अन्य

संस्थान ने नियमित रूप से अनुसंधान सलाहकार, संस्थान अनुसंधान समिति और संस्थान प्रबंधन समिति की बैठकें आयोजित की हैं। संस्थान ने गणतंत्र दिवस, स्वतंत्रता दिवस, अंतर्राष्ट्रीय योग दिवस, हिंदी पखवाड़ा, संस्थान स्थापना दिवस और विश्व पर्यावरण दिवस जैसे विभिन्न आधिकारिक समारोह भी मनाए। मनोरंजन क्लब द्वारा कर्मचारियों के लिए विभिन्न सामाजिक कार्यक्रम भी आयोजित किए गए। कार्यालय और परिसर को स्वच्छ और पर्यावरण अनुकूल बनाए रखने के लिए विभिन्न पहल की गईं।

EXECUTIVE SUMMARY

After successfully completing 21 illustrious years since its founding, the ICAR-National Research Centre on Pig has continued to provide top-notch services to farmers, extension agents, legislators, and businesses involved in pig farming and pork processing. Together with its affiliated units, Krishi Vigyan Kendra (KVK) and the 20 centers of the All India Coordinated Research Project on Pig, which are spread throughout the nation, the institute has been making sincere efforts to popularize scientific pig production and postharvest management in the nation since its inception. During the year 2023, the Institute functioned with 21 scientists, 06 technical staff and 06 administrative and accounts personnel. The total plan and non-plan budget allocations were 2461.17 lakh during the financial year. The institute has generated Rs 34.19 lakh as revenue during the period. The scientists of the Institute relentlessly worked for achieving various targets related to research and extension, defined under the six major programmes as per the mandate. Currently, ICAR-NRCP is considered as one of the most vibrant organizations under the umbrella of "Indian Council of Agricultural Research" and it is an ISO/IEC 17025:2017 Accredited and ISO 9001:2015 certified Institution.

Conservation and genetic improvement of pigs

Genetic variation within Indian Pig breeds viz. Ghungroo, Doom, Niang Megha, Agonda Goan and Manipuri black was explored using FAO ISAG microsatellite markers with 50 genetically unrelated pigs from the native breeding tract. The association of genetic variability in the form of single nucleotide polymorphism in different candidate gene with litter size traits was explored in three Indian pig breeds viz. Ghungroo, Doom and Niang Megha breeds of pigs. Studies on IRT image-based systems for examining the health status of pigs has established that infrared thermography has the potential to evaluate physiological changes by monitoring the evolution of the vulvar skin temperature of pigs in oestrus and not in oestrus. These pigs have different genetic potential in terms of litter size and other reproduction traits. Exploration of genome-wide selection signature in Ghungroo and Doom pigs of India has been initiated to develop a selection signature in these specific breeds. Genetic characterization of Wak Chambil pigs using mitochondrial DNA D-loop region was carried out.

Improvement in pig farm management practices

Welfare assessment and ehogram development of growing Desi and crossbred pig has been carried out both at institute farm and farmer's field. A total of 40 grower piglets were assessed in institute farm and 42 grower pigs were assessed from the farmer's filed. During the observation of behaviour, other animal-based measures related parameters viz. good feeding, housing, and health principles were also recorded. Pigs were individually analyzed for their body condition, bursitis, manure on the body, lameness, wounds on the body, huddling, and panting. The scoring was analyzed at the pen level. To assess the stress level with welfare issues, the effect of welfare indicators on cortisol level was studied. For this purpose, saliva samples were collected from the pigs in which welfare has been assessed. The grower pigs having poor body conditions have higher ($P<0.05$) cortisol levels. The pigs with good body condition score had cortisol levels of 2.99±0.249 ng/mL, whereas, the value was recorded 3.93±0.44 ng/mL in poor body condition pigs. The numerically higher cortisol level was found in good condition (3.10±0.25 ng/mL) pig as compared with pigs with bursitis (3.57±0.45 ng/mL). In addition, water footprint in organized pig production was assessed wherein intensive pig production systems were compared with household semi-intensive production system.

Nutritional interventions for profitable pig production

Bioavailability and tissue utilization of trace minerals on supplementing inorganic and organic sources in laboratory animal model was studied to determine the tissue distribution and bioavailability of organic trace elements such as Zn, Cu, Mn and Cr in rats in comparison to inorganic trace elements. The weekly body weight change comparison between the different groups showed no significant effect of type of mineral source as well as interaction between the minerals and type of feeding throughout the experiment. The ADG in restricted feeding groups was 6.0 g and it was significantly ($P<0.01$) lowers than the normal feeding groups ADG 7.5 g. The Zn chelated mineral supplemented group under normal feeding condition had more absorption (mg/d) than the inorganic Zn fed control group under normal feeding. Restricted feeding group relatively had higher relative bioavailability values than the control group.

Improvement of reproductive efficiency in pigs

The effects of different additives viz. Butylated Hydroxy Toluene (BHT), Reduced Glutathione (GSH), Taurine (TAU) and Trehalose (TRE) on the quality of boar spermatozoa was studied, when stored at refrigerated temperature (5°C) up to 72h. Sperm motility did differ significantly ($p<0.05$) between different concentrations of additives at 24, 48 and 72h of preservation at 5°C, while percentage of live spermatozoa differed significantly ($p\leq0.05$) with different concentrations of additives in LEY extender at 24h, 48h and 72 h of storage at 5°C. It was observed that BHT 1mM followed by GSH 3mM and Trehalose 100mM significantly ($P<0.05$) improved sperm quality during storage at 5°C. Additionally, BHT 1mM showed significantly ($P<0.05$) higher sperm viability, membrane integrity, and acrosomal integrity compared to other treatment groups over the 72-h preservation period. Addition of antioxidants exhibited promising effects on semen quality during refrigerated preservation, providing valuable insights for potential applications in boar semen preservation techniques at low temperatures. Pig multiplier units were established as 6+1 sow units. Doppler and thermal imaging can be used to predict the fertility of boars and boar scores for breeding soundness evaluation. Bioresources supplementation reduces age at puberty and improved the production performance in female while in male, augment the in vitro sperm fertility. Metabolomics of the four bioresources was done.

Improvement of physiological efficiency in pigs

Relative expression trends of various heat stress responsive HSP and MCT genes in the thigh muscle and colon tissue under various seasonal conditions in indigenous Mali and Ghoongroo and crossbreed Rani pigs were evaluated. Whole genome of indigenous (Ghungroo and Mali) and exotic (Hampshire and Large White Yorkshire) was undertaken using Next Generation Sequencing and assembled upto chromosome level. The processed raw data were aligned to Sus Scrofa 11.1 reference genome to identify variants. Various classes of variants were identified through a genome-level comparison of Ghungroo, Hampshire, Mali and LWY with the reference assembly Sscrofa11.1. Analysis revealed a total of 100864 Structural Variants in the genomes of four breeds, with 46687 deletions, 352 duplication, and 53825 insertions. Researches on ovarian follicular cell transcriptomics yielded reproduction specific novel candidate genes and signalling pathways governing cellular acclimation in pigs. The proteome profiling of corpus luteum and uterine tube with acquisition of luteolytic sensitivity in cycling pigs revealed spatio-temporal regulation of luteal regression.

Pig disease monitoring and surveillance

Healthy and African swine fever virus (ASFV) infected porcine tissues were assessed for the expression

stability of five widely used housekeeping genes (HPRT1, B2M, 18S rRNA, PGK1 and H3F3A) as reference genes using standard algorithm. Total RNA from each tissue sample (lymph node, spleen, kidney, heart and liver) from healthy and ASFV-infected pigs was extracted and subsequently cDNA was synthesized, and subjected to qRT-PCR. The study revealed the stable reference genes found in healthy as well as ASF-infected pigs and these reference genes identified through this study will form the baseline data which will be very useful in future investigations on gene expression in ASFV-infected pigs. Optimized qPCR assay for detection of Classical Swine Fever, African Swine Fever and Porcine Reproductive and Respiratory Syndrome viruses. A total of 184 positive samples were collected from backyard piggery (80) and semi-intensive piggery units (104) for understanding the dynamics of Coccidia sp. infection among the pigs. A new project has initiated for isolation and characterization of porcine muscle stem cells for development of 3D culture. Research activities under Indian network for fisheries and animal antimicrobial resistance scheme has revealed presence of several plasmids carrying multidrug-resistant Enterobacteriaceae which are resistant to last-resort medications like colistin and carbapenems. The study also identified prevalence of six transposable elements namely Tn6763, Tn6764,, Tn6765, Tn2003, Tn6072 and Tn6020 in piggery farm waste from India which are belongs to Enterobacteriaceae family.

Post harvest processing and value addition of pork

Response of pathogenic E. coli against thermal stress and adaptation which are relevant in food processing and storage environments was evaluated and determined the expression levels of virulence related genes namely E. coli attaching and effacing (eae), shiga like toxin (stx1 &stx2) and hemolysin (hlyA) in strains of pathogenic E. coli isolated from pork. Based on the colony morphology and biochemical characteristics, a total of 176 E. coli isolates were recovered from the pork samples, however only 4 isolates (2.27%) were confirmed to be pathogenic E. coli based on the PCR based detection of virulent genes. D-values of all isolated strains were increased significantly ($p<0.05$) as adapted temperature increased from 4oC to 42oC, regardless of the serotypes and adaptation of field isolates to 4oC, 25oC, 37oC and 42oC has resulted in significant changes in expression levels of virulent genes within the same group and between the groups. It was observed that induced thermal stress tolerance in pathogenic E. coli might be triggered by prolonged high temperature exposure of these strains, which further contributed to their survival during thermal processing. Under the DST-STI Hub project, new technologies for processing value added pork products have been developed and transferred to the beneficiaries, along with necessary machineries and capacity building.

Extension interventions to augment pig production

Research work has been carried out to identify the technology transfer model promoting the adoption of new livestock technologies and constraints, with gaps being a key contention. Preliminary data collection from three districts of Assam have identified different production typologies with their characterization, with stakeholder assessments identifying prominent technologies across different districts. An e-learning module has been developed, leveraging digital technology to disseminate knowledge and promote sustainable practices. The content of this module includes information on biosecurity, feeding, farm operations, farrowing, breed identification, and training programs. Possibility of using drone delivery in piggery sector has explored.

IT and Computer applications in pig production

Recent advancements in cell image analysis, have led to the development of automated deep learning

algorithms designed to segment and analyze microscopy cell images. This artificial intelligence-based method is essential for accurately quantifying morphological properties, phenotypes, and sub-cellular dynamics, addressing the ongoing challenges in achieving comprehensive and reliable cell analysis across diverse research domains. This study introduces a cell segmentation technique aimed at assisting scientists and researchers in rapidly and accurately identify different cell types and viability. Drones are found to perform accurate fixed-point delivery of therapeutic drugs to treat infected animal in remote places.

Technological interventions for livelihood enhancement of socially backward people

A total 36 numbers of pig health and awareness camp cum input distribution was conducted during 2023 under TSP and SCSP, in which a total of 4380 tribal Pig farmers directly benefited through these programmes. Among these farmers, pig feed and different small inputs like steel buckets, gumboots, pigs for breeding, mineral mixture and different scientific leaflets on piggery management in local languages were distributed.

Trainings and capacity building

ICAR-NRC on Pig has conducted 30 training programmes in different aspects of pig production, artificial insemination, pork processing and value addition to provide exposure to participants on the basics of selection of breed/ varieties/strain and breeding strategies for profitable pig farming, feeding of different categories of pigs and use of non-conventional feed stuffs for swine feeding, care and management of different categories of pigs, exposure to semen lab, semen collection, processing and evaluation of boar semen for Artificial Insemination, housing requirement for scientific pig farming, common diseases of pigs and their management including vaccination schedule, farm cleaning, disinfection, routine farm operation practices, castration and needle teeth clipping of piglets and different methods of administration of medicines in pig, and demonstration of formulation of feeds for different categories of pigs.

Technology transfer and Business Incubation Support

ICAR-NRC on Pig has developed 03 technologies and signed 02 MoUs with different entrepreneurs, stakeholders and organization to commercialize and transfer these technologies as well as for various services like consultancy, contract research and contract services. During the year, 03 patents were granted while institute has applied for 03 Patents. Also, 04 trademarks, 11 copyrights and 01 design were granted during 2023. ICAR-National Research Centre on Pig has inducted 02 numbers of Entrepreneurs/Startups under ABI during 2023. The technology transfer agreement focuses on incubation and business development programme including entrepreneurship skill development activities in the areas of commercial piggery, allied service sectors and value addition in pork. Institute has also helped the entrepreneurs by providing them pro-active and value-added business support in terms of technical consultancy and mentor connections, guidance and trainings to develop modern technology-based business ideas and models in business domains in order to scale their start-ups effectively.

Krishi Vigyan Kendra

A total of 60 training programmes were conducted covering 1393 number of participants during the year. The Krishi Vigyan Kendra Goalpara has conducted 07 On farm Trial on newly generated agricultural technologies. Seven numbers of FLDs were also conducted during the reported period. In addition, KVK has organized different schemes/ projects viz. Natural Farming, Swachata Abhiyan, International year of Millets and Viksit Bharat Sankalp Yatra.

Swachh Bharat

ICAR-National Research Centre on Pig, Rani actively participated and organized “Swachhta Abhiyan” from time to time throughout the year. Apart from regular activities, special campaign the institute orchestrated the "Swachhta hi Sewa" campaign from September 15th to October 2nd, 2023 which was aimed at promoting a 'Garbage Free India,' emphasizing visual cleanliness and the well-being of SafaiMitras. The initiative also featured a 'Thank you SafaiMitra' campaign aimed at honoring and appreciating the contributions of sanitation workers. Institute has organized Special Campaign 3.0 for institutionalizing Swachhata and minimizing pendency in Government offices from 2nd October -31st October 2023 and celebrated Swachhta Pakhwada from December 16, 2021, to December 31, 2021.

AICRP on Pig

The Institute continued regular monitoring of the progress of AICRP on Pig project (20 centers) through technical and financial monitoring in consultation with the council and conduction of review meet. The AICRP project is continuing in different centers across the country to study the performance of pigs in different agroclimatic condition, to develop region-specific package of practices including quality germplasm and to conserve the indigenous germplasm.

Others

The Institute has conducted meetings of Research Advisory, Institute Research committee and Institute Management Committee regularly. The Institute also observed various official functions such as Republic Day, Independence Day, International Yoga Day, Hindi Pakhwada, Institute Foundation Day and World Environment Day. Various social events were also organized by the Recreation Club for the staff. Various initiatives were taken to maintain the office and campus premises clean and environment friendly.

INTRODUCTION

INTRODUCTION

The ICAR-National Research Centre on Pig (ICAR-NRCP) was established in 2002 under the aegis of the Indian Council of Agricultural Research (ICAR) to bring in excellence in pig production, health and product processing through innovative research in order to provide technology backstopping for enhanced pork production, employment generation and poverty reduction among socially and economically weaker sections through the medium of pig husbandry. The institute has been trying its level best for popularizing the scientific pig production and post harvest management in the country since its inception as well as all round development of the piggery sector along with its affiliation units, namely Krishi Vigyan Kendra (KVK), and twenty centres of All India Coordinated Research Project (AICRP) on Pig spread over different parts of the country. All India Coordinated Research Project on Pig is the flagship programmes for which the Institute acts as a nodal agency. Development of region-specific pig production technologies and filling the critical gap of demand for superior pig genetics are the focus of AICRP on Pig programme.

Location

The institute is located at Rani, Guwahati in the state of Assam. The institute is approximately 35 kms away from the Guwahati City Railway Station and 12 kms from the Lokpriya Gopinath Bordoloi International Airport.

Faculty and Staff

The Institute is headed by the Director and currently 19 scientists, 06 administrative/finance/supporting and 06 technical staffs are in position.

Staff Position

RMP Cadre and Scientist Cadre

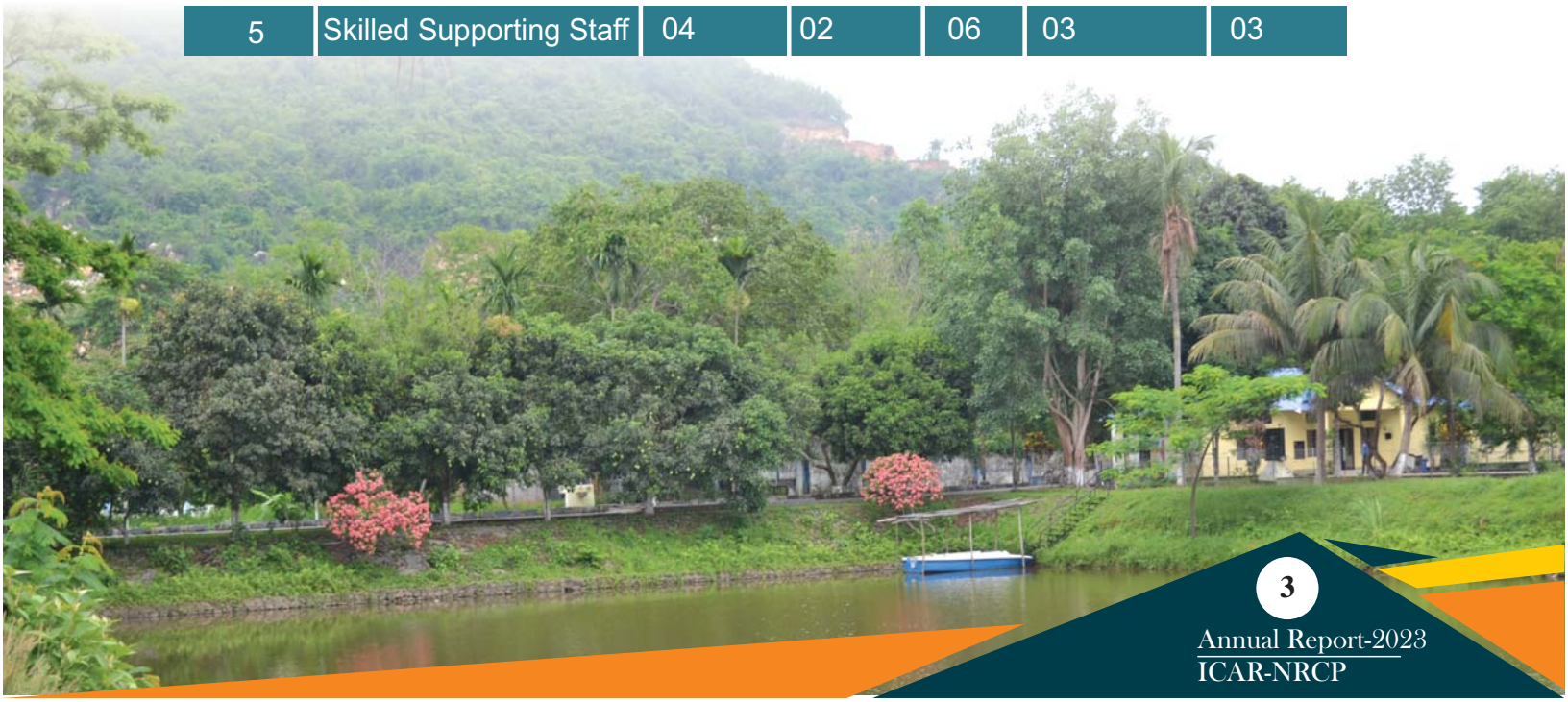
Sl. No.	Name of the post	Sanctioned post	In-position	Vacant
1	RMP Cadre - Director	01	01	00
2	Principal Scientist	02	00	02
3	Senior Scientist	04	03	01
4	Scientist	18	17	01
	Total	25	21	04

Administrative Cadre

Sl. No.	Name of the post	Sanctioned post		Total	In-position	Vacant
		ICAR-NRC on Pig	KVK-Goalpara			
1	LDC	01	00	01	01	00
2	UDC	01	00	01	01	00
3	Stenographer Grade III	00	01	01	00	01
4	PA	02	00	02	02	00
5	Assistant	05	01	06	00	06
6	AAO	01	00	01	01	00
7	AO	01	00	01	00	01
8	FAO	01	00	01	01	00

Technical Cadre and Skilled Supporting Staff Cadre

Sl. No.	Name of the post	Sanctioned post		Total	In-position	Vacant
		ICAR-NRC on Pig	KVK-Goalpara			
1	T-1	05	02	07	04	03
2	T-3	04	00	04	03	01
3	T-4	00	03	03	03	00
4	SMS/STO/T-6	00	06	06	03	03
5	Skilled Supporting Staff	04	02	06	03	03



PRIORITY SETTING AND MANAGEMENT

The Institute has a high-powered Research Advisory Committee (RAC) comprising of eminent scientists and professors, who guide the research agenda of the institute and set research priorities. Dr. A.K. Srivastava, Vice-Chancellor, Pandit Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwavidyalaya Evam Go-Anusandhan Sansthan, Mathura, UP is the chairman of the committee. The other members include scientists and professors from the field of Animal Genetics and Breeding, Animal Health, Animal Nutrition, Animal Physiology, Extension and Livestock Products Technology. The Quinquennial Review Team (QRT) of the institute for the period from 01.04.2017 to 31.03.2022 is headed by Dr. V.K. Taneja, Former Vice Chancellor, GADVASU, Ludhiana. The functioning of the institute is supervised by Institute Managemental Committee (IMC) headed by the Director of the institute as Chairman and members drawn from state government, university and public personnel. A number of internal committees such as Purchase, Library, Works, Official Language Implementation, ISO 9001- 2015 Implementation, Grievance, Publication, Priority Setting Monitoring and Evaluation Cell, Staff Welfare Club, IPR Cell, Institute Technology Management Unit, Agri-Business Incubation and ICC (women committee) have been constituted to decentralize the management with developed responsibilities for smooth functioning of the institute. The Institute Joint Staff Council has been constituted for promoting healthy and congenial work environment. The Institute Research Council (IRC) provides a platform for effective professional interactions in respect of review and implementation of various research projects.

VISION

To bring in excellence in pig production, health and product processing through innovative research in order to provide technology backstopping for enhanced pork production, employment generation and poverty reduction among socially and economically weaker sections through the medium of pig husbandry.

MISSION

Performance appraisal and genetic cataloguing of indigenous pigs, development of improved pig variety together with production, health, product processing and pig based integrated farming system technologies to facilitate the pig rearers of the country for achieving household food, nutritional and economic security.

MANDATE

The mandate of the institute is:

- To undertake basic and applied research for enhancing pig production
- To act as a repository of information on pig production
- Capacity building

RESEARCH PROGRAMMES

Programme-1: Conservation and genetic improvement of indigenous pigs

Programme-2: Optimization of physiological and reproductive efficiency including identifying markers for early detection of fertility

Programme-3: Characterization of production system, feeding practices and their optimization for enhancing pig production, especially under field conditions.

Programme-4: Continuous monitoring, recording of pig diseases and development of disease management protocol

Programme-5: Technology development for improved post-harvest handling, processing and value addition of pig products

Programme-6: Institute-stakeholder linkages and skill development

EXPENDITURE STATEMENT

BUDGET *VIS-A-VIS* EXPENDITURE 2023-24 **(Rs. in lakhs)**

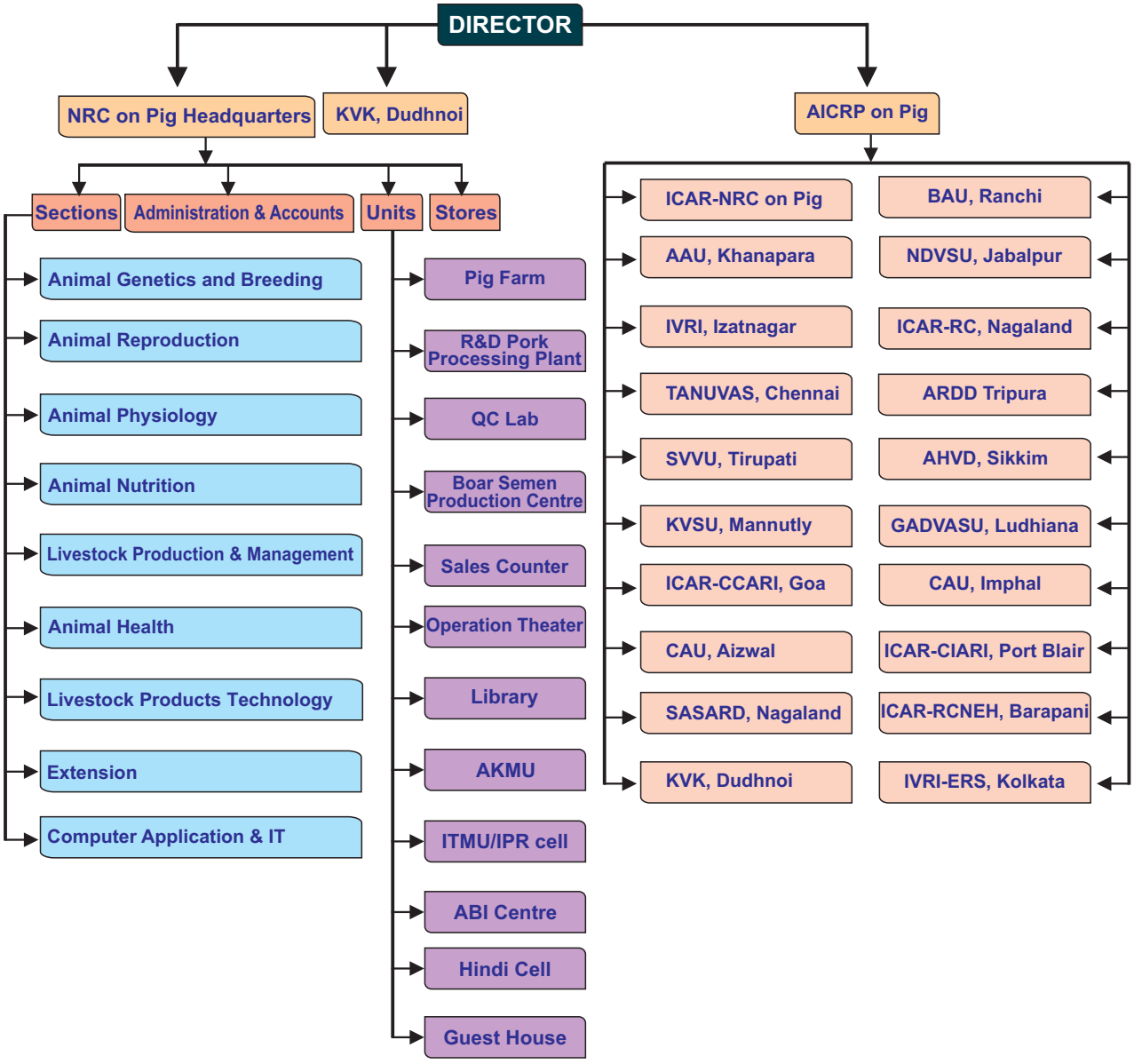
NAME OF THE SCHEME /PROJECT	DETAILED	PAY & ALLOWANCES	GENERAL	CAPITAL	TOTAL
ICAR-NRC ON PIG, MAIN SCHEME	R.E.	773.26	613.00	165.00	1551.26
	EXP.	773.26	613.00	165.00	1551.26
AICRP ON PIG PROJECT	R.E.	70.01	717.00	122.90	909.91
	EXP.	70.01	717.00	122.90	909.91

REVENUE GENERATION

(Rs. in lakhs)

REVENUE TARGET DURING 2023-24	25.00
REVENUE GENERATION DURING 2023-24	34.19

ORGANIZATIONAL SETUP



The matrix mode of management is adopted in the research activities which provide devolved responsibilities for effective implementation of multidisciplinary/ interdisciplinary programmes. Director is the Head of the Institute, supported by administrative and financial wings. To strengthen the local decision-making and research monitoring, Research Advisory Committee, Institute Management Committee, Institute Research Council and PME Cell play a vital role through periodical meetings.

PHYSICAL PROGRESS

PHYSICAL PROGRESS

Construction of Annexure Building

The main building of the institute has been expanded to improve facilities for both scientific and non-scientific staff. With the expansion, the building now includes wide areas of working spaces, offering an environment that is beneficial for all official staff members of the Institute.

Annual Report-2023
ICAR-NRCP

RESEARCH PROJECTS

RESEARCH PROJECTS

Animal Genetics and Breeding

Institute Project: Molecular characterization of indigenous pig breeds

Satish Kumar, S. Banik, P. J. Das, Sunil Kumar, A.R Sahu (ICAR-CCARI)

For analysis of genetic variation within Indian Pig breeds Viz. Ghungroo, Doom, Niang Megha, Agonda Goan and Manipuri black was explored using 30 FAO ISAG microsatellite markers with 50 genetically unrelated pigs from the native breeding tract. Genomic DNA was isolated and amplified with microsatellite primers labelled with fluorescent dyes and genotyped using genetic analyzer. The estimates of various genetic diversity parameters revealed mean number of observed alleles (Na), effective number of alleles (Ne), observed (Ho) and expected (He) heterozygosity values, polymorphic information content (PIC) and F-values was determined for all the breeds.

Genotyping and molecular sizing and recording of microsatellite alleles: The genotyping of the microsatellite primers was done by the automated genotyping in ABI3730 sequencer. The multiplex PCR product was used for automated genotyping using the fluorescent dye. The multiplex-PCR products were genotyped using capillary electrophoresis with fluorescent detection (ABI 3730 DNA Analyzer, Applied Biosystems, USA). The fragment size was calibrated with GeneMapper Software. The .fsa file generated by the ABI3730 was analysed in the gene mapper software for determining the allele size of the markers in each individual.

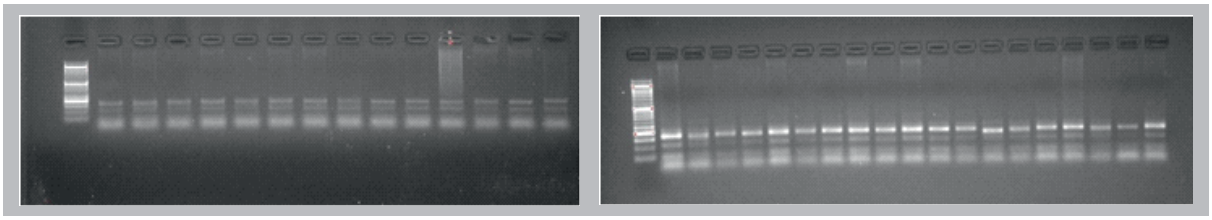
Statistical analysis for population parameter: The alleles present in each individual of for all the breeds and their size was recorded from the chromatogram images of the automated genotyping and noted down in a notepad file which could be loaded into Popgene32 software for the analysis of population parameters like observed homozygosity, expected homozygosity, observed heterozygosity, expected heterozygosity, Observed number of alleles, Effective number of alleles, Shannon's Information index (I), expected heterozygosity Nei's and Wright's fixation index (Fis) of all the microsatellite loci for all the breeds studied.

The polymorphism information content (PIC) was calculated in the EXCEL Toolkit by the formula given by Botstein et al. (1980).

$$PIC\ (Pj) = 1-\sum pi^2$$

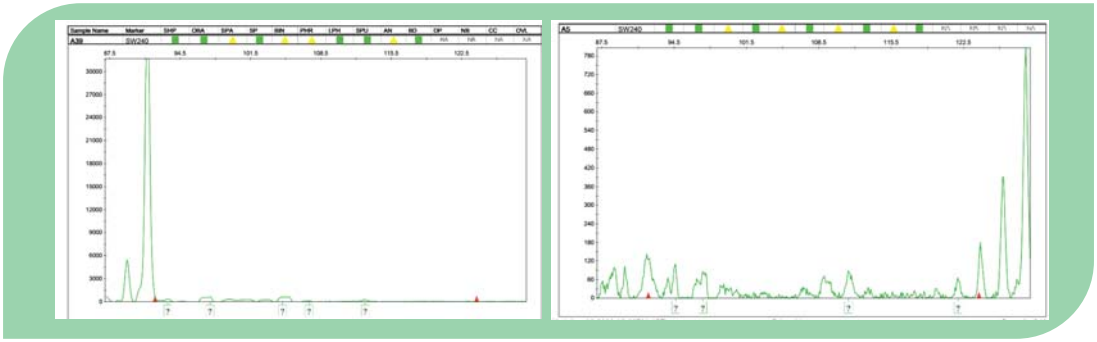
where i is i-th allele of the j-th marker, P is allele frequency. $\sum$ is the summation of all the alleles of the jth marker.

Standardization of annealing temperature and Multiplex PCR reaction for microsatellite markers: All the microsatellite markers were standardized by gradient PCR for suitable annealing temperature by seeing the most contrast and single band of specific amplicaon length. The some of the representative samples for gradient PCR are shown below-



Multiplex PCR of Microsatellite markers for M2 and M4

Genotyping of Microsatellite primers: The genotype and allelic profiling of each animal was determined by the peak of the chromatogram using gene mapper software. Some of the representative images of the allele size and genotypes are given below.



Representative images of Allele size for SW240 microsatellite markers in Ghungroo Pigs

Ghungroo: A total of 290 alleles were observed in the 30 microsatellite markers explored in Ghungroo breed of Pig and all the loci were observed as polymorphic in the examined population. The allele size range, observed and effective number of alleles observed and expected heterozygosity and PIC at all 30 Microsatellite loci in Ghungroo pigs were determined. The allele size range varied from 89–102 bp at locus S0026 to 245-253 bp at locus S0335. The total number of alleles ranged between 6 (Sw2008) and 16 (Sw1828). It showed the genetic diversity within the population as assessed by effective number of alleles and heterozygosity. The effective number of alleles ranged from 3.77 (S0143) to 10.4918 (S0005) with a mean of 6.10667±0.284.The mean observed heterozygosity are almost similar to the expected values based on these 30 studied loci. The observed and expected heterozygosity ranged from 0.7 to 1 and 0.74 to 0.91 in Ghungroo breed of pig, respectively. A total of 60 private alleles were observed which was exclusive to a particular breed which can be used for breed panelling by molecular methods.

Doom pig: A total of 179 alleles were observed in the 30 microsatellite markers explored in Doom breed of Pig and all the loci were observed as polymorphic in the examined population. The allele size range, observed and effective number of alleles observed and expected heterozygosity and PIC at all 30 Microsatellite loci in Doom pigs were determined. The allele size range varied from 85–107 bp at locus Sw1828 to 248-270 bp at locus S0335. The total number of alleles ranged between 4 and 12. It showed the genetic diversity within the population as assessed by effective number of alleles and heterozygosity. The effective number of alleles ranged from 1.38 (S0218) to 8.39 (Sw1828) with a mean of 3.83±0.284.

0.89 in Doom breed of pig, respectively. A total of 44 private alleles were observed which was exclusive to a particular breed which can be used for breed panelling by molecular methods.

Niang Megha: A total of 212 alleles were observed in the 30 microsatellite markers explored in Niang Megha breed of Pig and all the loci were observed as polymorphic in the examined population. The allele size range, observed and effective number of alleles observed and expected heterozygosity and PIC at all 30 Microsatellite loci in Niang Megha pigs were determined. The allele size range varied from 85–107 bp at locus S0026 to 248-270 bp at locus S0335. The total number of alleles ranged between 4 and 12. It showed the genetic diversity within the population as assessed by effective number of alleles and heterozygosity. The effective number of alleles ranged from 0.7 (Sw1067) to 8.4 (Sw1828) with a mean of 3.8±0.32. The mean observed heterozygosity 0.64 was less than the expected heterozygosity 0.685 based on these 30 studied loci. The observed and expected heterozygosity ranged from 0.08 to 1 and 0.41 to 0.89 in Niang Megha breed of pig, respectively. A total of 52 private alleles were observed which was exclusive to a particular breed which can be used for breed panelling by molecular methods.

Agonda Goan: A total of 211 alleles were observed in the 30 microsatellite markers explored in Agonda Goan breed of Pig and all the loci were observed as polymorphic in the examined population. The allele size range, observed and effective number of alleles observed and expected heterozygosity and PIC at all 30 Microsatellite loci in Agonda Goan pigs were deterimined. The allele size range varied from 85–97 bp at locus S0026 to 244-270 bp at locus S0335. The total number of alleles ranged between 4 and 12. It showed the genetic diversity within the population as assessed by effective number of alleles and heterozygosity. The effective number of alleles ranged from 1.8738 (S010) to 8.39 (Sw1828) with a mean of 3.95±0.36.The mean observed heterozygosity 0.678276 was less than the expected heterozygosity 0.686997 based on these 30 studied loci. The observed and expected heterozygosity ranged from 0.13 to 1 and 0.46 to 0.89 in Agonda Goan breed of pig, respectively. A total of 42 private alleles were observed which was exclusive to a particular breed which can be used for breed panelling by molecular methods.

Manipuri Black: A total of 181 alleles were observed in the 30 microsatellite markers explored in Manipuri Black breed of Pig and all the loci were observed as polymorphic in the examined population. The allele size range, observed and effective number of alleles observed and expected heterozygosity and PIC at all 30 Microsatellite loci in Manipuri Black pigs were determined. The allele size range varied from 85–95 bp at locus S0026 to 244-260 bp at locus S0335. The total number of alleles ranged between 3 (Sw2008) and 11 (Sw2008). It showed the genetic diversity within the population as assessed by effective number of alleles and heterozygosity. The effective number of alleles ranged from 1.7 (S010) to 7.99 (Sw1828) with a mean of 3.90±0.32. The mean observed heterozygosity 0.65 was less than the expected heterozygosity 0.69 based on these 30 studied loci. The observed and expected heterozygosity ranged from 0.13 to 0.94 and 0.36 to 0.88 in Manipuri Black breed of pig, respectively. A total of 32 private alleles were observed which was exclusive to a particular breed which can be used for breed panelling by molecular methods. The smaller number of allele and heterozygosity was observed which may be due to the small number of samples (30) used for the study.

The microsatellite markers were used for the characterization of pig breed of India. For the first time we have successfully genotyped the animals on the basis of all 30 microsatellite markers in 50 animals as recommended by the ISAG and FAO. There was presence of substantial amount of genetic diversity in the Indian pig breeds. However, Ghungroo breed was found to have greatest diversity than other pig breeds which may be evident from the no. of observed and effective alleles in all the microsatellite markers studied.

The PIC is a parameter indicative of the informative degree of a marker. The PIC value can range from 0 to 1, however, range of PIC estimates in this study were ranging from 0.41(Sw2008) to 0.86 (S0218) for Niang Megha whereas from 0.45 (S0026) to 0.88 (S0005) in Agonda Goan with mean of 0.65 ±0.03 and 0.68± 0.0.03, respectively. Similar results were also reported in other pigs. Most of the markers had PIC values higher than 0.5, which is a useful indicator of genetic variability and forms the basis for developing breeding or genetic improvement strategy for a population. The present study resulted in identification of five highly polymorphic SSR loci viz., S0005, Sw936, S 0218, S0226 and S0178 for Niang Megha and S0005, Sw24, Sw936, Sw122 and S0178 for Agonda Goan respectively. These polymorphic primers can effectively be used in further molecular breeding programs since they exhibited very high polymorphism over other loci. SSR analysis resulted in a more definitive separation of clustering of genotypes indicating a higher level of efficiency of SSR markers for the accurate determination of relationships.The inbreeding coefficient measures the reduction of heterozygosity because of non-random mating within the population. Hence F value greater or lesser than zero reveals inbreeding or out breeding. Inbreeding coefficients for all markers used in this study are given in Table. Six loci in case of Niang Megha and 11 loci in Ghungroo revealed negative F value (F<0) indicating absence of inbreeding at these loci. Average F value for markers ranged from 0.002 (Sw122) to 0.81 (Sw2008) in Niang Megha whereas from 0.08 (S0355) to 0.78 (Sw2008) in Agonda Goan with mean of 0.15 ±0.05 and 0.05± 0.06, respectively. Among the negative values it ranged from –0.29 (Swr1941) to –0.01 (S0178) in Niang Megha whereas from- 0.06 (S0026) to -0.29 (S0097) in Ghungroo, respectively. The mean lower F value indicated the nominal amount of inbreeding in these populations. The higher negative F indicated presence of heterozygosity suggesting that these populations might have been managed under controlled mating system by avoiding mating between the close relatives.

External Project: Traceable value chain for safe pork in the north eastern region of India (Funded by NASF)

P.J. Das (from September, 2023), S. Banik (till August 2023), S.R. Pegu, Satish Kumar, B.C. Das, R. Thomas, and V.K. Gupta

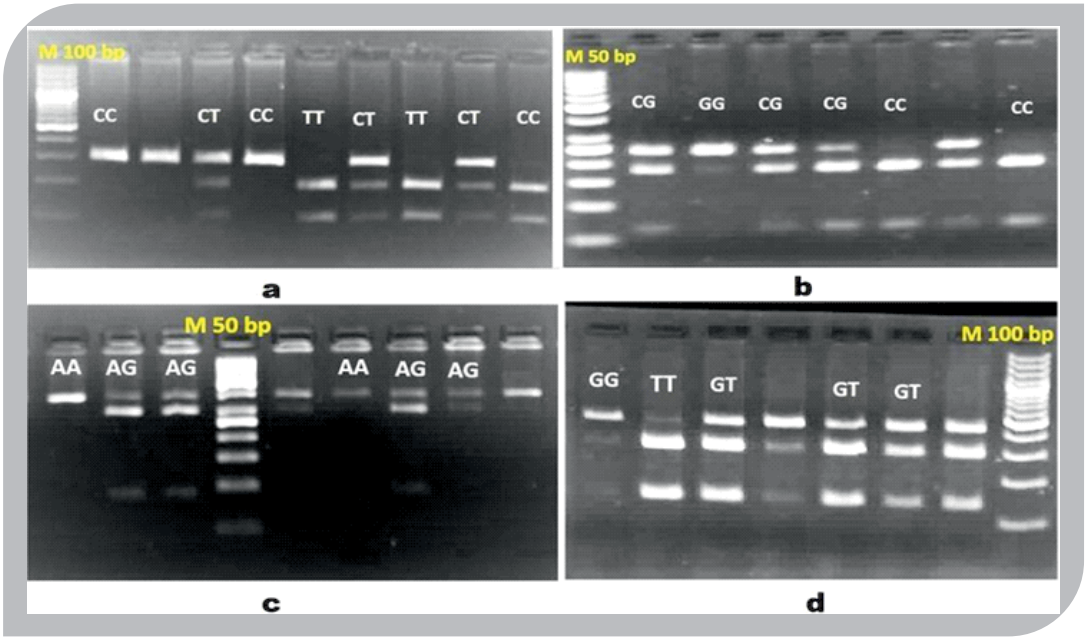
Depending on the age group of the animals the facial images were captured in a non-exhausting environment using the mobile phone as well as with a DSLR camera (Fig.1). In order to identify the unique characters in facial images for individual identity the programming was based on Local Binary Patterns Histograms (LBPH), Histogram of Oriented Gradients (HOG) and PCA. A protocol was made after standardizing all the features related to capturing the facial image of the animals such as distance, light source, camera, angle etc. for understanding the unique features for individual considerations a large number of facial images were captured from the same pigs. The image-capturing protocol was standardized in normal stress-free environment conditions to facilitate capturing of facial images of pigs in the normal field environment. During the last four months, facial images of pigs captured from different pig breeds of different age groups after weaning have been captured from ICAR-NRCP, Rani (National Research Centre on Pig). Algorithms have been developed to amplify certain hidden features in the face. The features-based image recognition algorithms like Local Binary Patterns Histograms (LBPH), Histogram of Oriented Gradients (HOG), Principal Component Analysis (PCA) and Support Vector Machine (SVM) have been applied for individual pig recognition.

Facial image for development of algorithms to identify unique features.

Institute Project: Exploring Genetic Variability in Different Candidate Genes and their Association with Re (Production) Traits in Pigs.

Satish Kumar, S. Banik (till 17/07/2023), P. J. Das, Jaya, Sunil Kumar

The association of genetic variability in the form of single nucleotide polymorphism in different candidate gene with litter size traits was explored in three Indian pig breeds viz. Ghungroo, Doom and Niang Megha breeds of pigs. These pigs have different genetic potential in terms of litter size and other reproduction traits. For the purpose, 40 SNPs in FSHB, LEP, ESR1, ESR2, LEPR and RBP4 genes were targeted for genotyping using PCR-RFLP methods using suitable restriction enzymes (RE). After genotyping of all SNPs it was found that 30 SNPs out of 40 SNPs were polymorphic in our population.



The associations between SNPs polymorphisms and litter size in pigs were estimated with the general linear model (GLM procedure) in the SAS 9.1 software, the significance was calculated by Duncan's new multiple range test (SAS 8.2.software), using model

$$Yijk = \mu + Gi + eijk$$

Where Yijk: trait examined; μ: mean; Gi: fixed effect of i-th genotype (i = 1, 2, 3); eijk: random error.

All the SNPs except rs322393640 in ESR1 gene, rs81213577 in FSHb, rs793436160 & rs695579307 in LEP gene, rs702631546, rs691411429 & rs703419496 in ESR2 gene, rs80815247 in RBP4 genes were polymorphic in the studied pig population. The polymorphic SNPs were further used for the association with litter trait in pigs on the basis of the genotypic profiles of each SNPs. The genotypes frequencies in SNPs viz. rs80878671 in RBP4 gene; rs707640403 in ESR1 gene, rs694660564 in LEPR gene; rs322495865 in ESR2 gene; rs45431507 and rs1110706811 in LEP gene and rs789053059 in FSHB gene were significantly different among Ghungroo, Doom and Niang Megha breeds.

The association study revealed that SNP rs789053059 in FSHB was associated with reproduction traits in Ghungroo but not in other two breeds. The heterozygote AB was found to be associated with high litter size in Ghungroo breed but had no significant effect on Doom and Niang Megha breed. In LEP gene two SNPs, rs45431507 and rs1110706811 were associated with reproduction traits in all three breeds of pigs. The 1st homozygote AA was found to be higher litter size. Similarly, SNP rs707640403 in ESR1, rs80995712 in RBP4 while rs790299157, rs708345040, rs336266062, CAMB0000347 in ESR2 gene was associated with the litter traits in pigs. The study also shows that some of the SNPs associated with litter size in one breed was not found to be significantly associated with litter size in other breeds. These markers were found to be breed specific and can't be used for the selection of litter size traits across the breed. While, the SNPs which were significantly associated with litter size traits across the three breeds can be considered as a marker for litter size in pigs and could be included as a marker for litter size in the marker Panel after validation in the larger population.

Gene	SNPs	Genotype	GH(100)	NM(30)	Doom(65)	P value
FSHB	rs789053059	AA	0.64	0.12	0.75	0.012*
		AB	0.32	0.44	0.22	
		BB	0.04	0.44	0.03	
	rs338948692	AA	0.01	0	0	0.23
		AB	0.12	0.08	0	
		BB	0.87	0.92	1	
LEP	rs45431507	AA	0.95	0.53	0.78	0.03*
		AB	0.05	0.38	0.19	
		BB	0	0.09	0.03	
	rs45431505	AA	0.65	0.58	0.6	0.65
		AB	0.14	0.2	0.18	
		BB	0.21	0.22	0.22	
	rs701423985	AA	0.95	0.53	0.78	0.34
		AB	0.05	0.38	0.19	
		BB	0	0.09	0.03	
	rs45431504	AA	0.51	o.38	0.45	0.16
		AB	0.15	0.09	0.13	
		BB	0.34	0.53	0.42	

	rs1110706811	AB	0	0.02	0.45	0.04*
		BB	1	0.98	0.55	
ESR2	rs708729773	AA	0.1	0.12	0.04	0.24
		AB	0.38	0.31	0.43	
		BB	0.52	0.57	0.53	
	rs790299157	AA	0.45	0.47	0.3922	0.17
		AB	0.43	0.33	0.6078	
		BB	0.12	0.20	0	
	rs343283407	AA	0.3529	0.41	0.45	0.57
		AB	0.2157	0.14	0.25	
		BB	0.4314	0.45	0.3	
	rs322495865	AA	0.4118	0.25	0.43	0.048*
		AB	0.2745	0.51	0.22	
		BB	0.3137	0.24	0.35	
	rs708345040	AA	0.7059	0.82	0.74	0.16
		AB	0.2941	0.18	0.26	
	rs342775108	AA	0.62	0.10	0.75	0.022
		AB	0.22	0.41	0.22	
		BB	0.16	0.49	0.03	
	rs336266062	AA	0.65	0.58	0.6	0.54
		AB	0.14	0.2	0.18	
		BB	0.21	0.22	0.22	
LEPR	rs694660564	AA	0.92	0.40	0.82	0.017*
		AB	0.02	0.41	0.15	
		BB	0.06	0.19	0.03	
ESR1	rs707640403	AA	0.68	0.14	0.72	0.007**
		AB	0.38	0.40	0.22	
		BB	0.04	0.46	0.06	
	rs699440955	AA	0.02	0	0	0.32
		AB	0.14	0.09	0.06	
		BB	0.84	0.91	0.94	
RBP4	rs80947737	AA	0.65	0.58	0.6	0.43
		AB	0.14	0.2	0.18	
		BB	0.21	0.22	0.22	
	rs80878671	AB	0.10	0.04	0.58	0.022*
		BB	0.90	0.96	0.42	
	rs80995712	AA	0.55	0.48	0.45	0.38
		AB	0.12	0.09	0.13	
		BB	0.33	0.43	0.42	
	rs1109638302	AA	0.95	0.77	0.78	0.23
		AB	0.05	0.14	0.19	
		BB	0	0.09	0.03	

Institute Project: Exploring Genome Wide selection signatures in Ghungroo and Doom pigs

Satish Kumar, S. Banik (till August, 2023), P. J. Das, and Jaya

Selection Signature in pigs: Pigs were domesticated about 9000 years ago from Eurasian wild boar Sus Scrofa. Due to continuous selection in pigs after domestication, a wide diversity is being found in todays' pig population and selection strategies impose pressure on specific genomic regions that may control the particular breed characteristics. These unique genetic patterns or footprints left behind in the genome of pigs under selection are called selection signatures. The selection signature may be unique for a particular breed or a signature of divergent selection may exist among different pig breeds. The identification of selection signature in the pig breeds could give insights into the regions in the genome which are under selection pressure and changes that occurred by artificial selection. Ghungroo and doom pig breeds have developed after long-term artificial and natural selection and show greater variation with respect to reproduction and production traits. Hence, exploration of genome-wide selection signature in these pigs may provide the selection signature in specific breeds as well as divergent selection signature between Ghungroo and Doom pigs of India.

Genotyping of pigs by SNP 80K array: To explore the genome wide signature selection in different pig breeds, the blood samples were collected and DNA was isolated. All extracted DNA Samples were run & checked on 0.8 % Agarose Gel made in 1X TAE Buffer. The good quality 96 DNA samples (28 Ghungroo, 14 Agonda Goan, 28 Doom, 14 Mali, 12 Manipuri Black were used for the genotyping of SNPs using Illumina Infinium SNP Chip PorcineSNP80v1_HTS_20033000_A2 having 75753 SNPs spread evenly over all the chromosomes of pig. The genotyped data of all the individual samples were obtained. The genotyping summery of the DNA samples shows that total 75753 SNPs were genotyped in 96 pigs thus a total of 7272300 SNPs were genotyped with 99.105 % no missingness percentage. The average minor allele frequency of the SNPs was 0.23. If genotypes were filtered on the MAF 0.05, thus after removal of SNPs with minor allele frequency less than 0.05, the total 67212 SNPs were genotyped in 96 pigs thus a total of 6452400 SNPs were genotyped with 99.283 % not missing. The average minor allele frequency was 0.2625.

Table: The allelic summary of all the genotyped pigs

Alleles	Number	Proportion	Frequency	Alleles	Number	Proportion
G	2534408	0.3485	0.35165	C:A	6930	0.09148
A	2178900	0.29962	0.30232	A:C	5889	0.07774
R	1528747	0.21022	0.21211	A:A	1234	0.01629
C	602863	0.0829	0.08365	G:G	1234	0.01629
M	333198	0.04582	0.04623	C:C	1188	0.01568
N	65120	0.00895	0.00904	C:G	165	0.00218
T	13545	0.00186	0.00188	G:C	164	0.00216
S	7827	0.00108	0.00109	A:T	159	0.0021
W	7680	0.00106	0.00107	T:A	151	0.00199
G:A	35402	0.46733		T:T	29	0.00038
A:G	23108	0.30504				

Principal component analysis: PCA of the genotyped samples using genotype data at 0.05 MAF. Which clearly shows the five cluster. The clustering of samples in five groups shows that the presence of five genetic group in the samples used for genotyping.

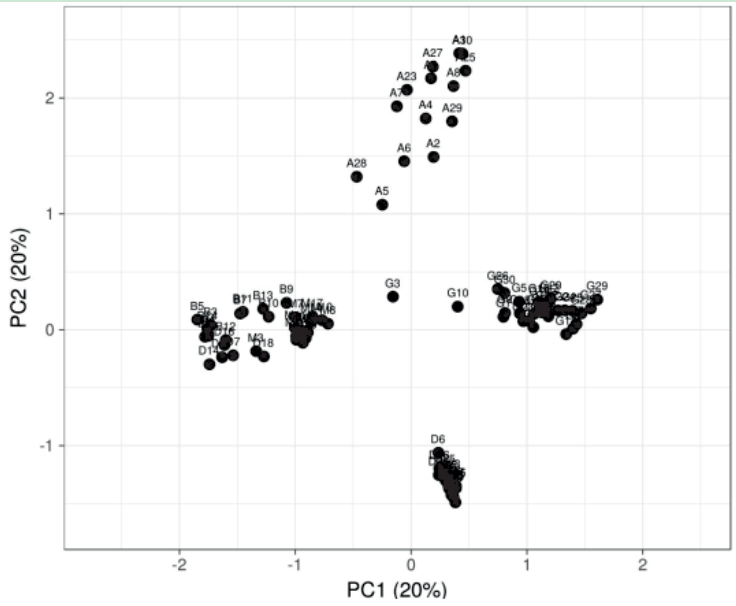


Figure 1: PCA plot at 0.05 MAF

The dendrogram of the genotyped data with 0.05 MAF also shows the clear five cluster of the animals. The clusters of Ghungroo, Doom, Agonda Goan are clearly seen. However, there is some of the intermixing between Mali and Manipuri black pigs.

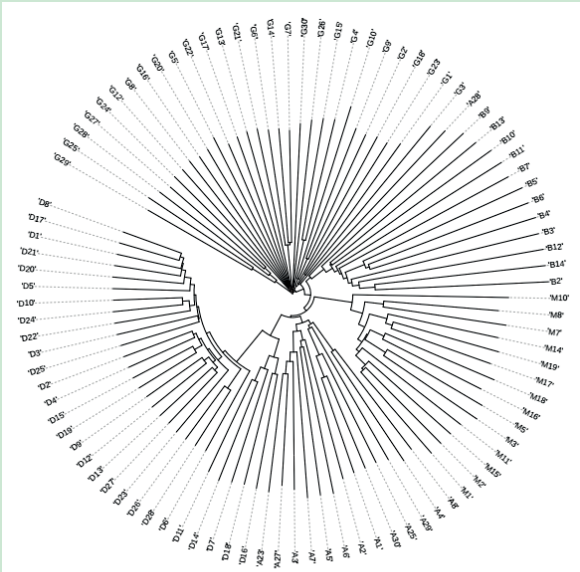


Figure 2: Polar Tree at 0.05 MAF

Genetic characterization of Wak Chambil pigs using mitochondrial DNA D-loop region (research work carried out during Professional Attachment Training as a part of FOCARS at ICAR-NRCP)

Meera K

Wak Chambil pigs are newly registered breeds of pigs found in Meghalaya and exhibit unique phenotypic characteristics, such as small size, round pendulous bellies, small heads, erect ears, short snouts, and a thick coat of long hair on their foreheads and necks, with short bristles covering their bodies and are renowned for their flavourful pork. Genetic characterization is crucial for understanding their diversity, population structure, and evolutionary history, aiding in conservation efforts and breeding strategies. Mitochondrial DNA (mtDNA) serves as a valuable source of genetic markers due to its maternal inheritance and lack of recombination. Mitochondrial DNA (mtDNA) sequencing, focusing on the D-loop region, offers insights into genetic diversity, evolutionary relationships, and conservation priorities. Blood samples from 16 Wak Chambil pigs were collected and DNA was extracted using phenol-chloroform extraction method. Quality assessment was done using NanoDrop™ Lite spectrophotometer and agarose gel electrophoresis.

Mitochondrial genome sequences available in the NCBI database were utilized for primer design, employing online tools such as Primer-BLAST and Primer 3. Subsequently, 30 primer pairs were designed each targeting specific regions of the mitochondrial genome. These primer pairs were used to amplify the complete mitochondrial DNA (mtDNA) genome (Fig.1-Gel Photo). Furthermore, the D-loop sequences of 16 Wak Chambil pigs were specifically targeted for amplification and were sequenced using Sanger sequencing (Fig.2-Gel Photo). Sequences were edited using the DNASTAR software. D-loop sequences from other indigenous pig breeds, crossbred varieties and common exotic pig breeds were obtained from the NCBI GenBank database for comparison purposes. The nucleotide sequences were aligned and the phylogenetic tree was constructed using the MegAlign package of DNASTAR. Phylogenetic analysis provided valuable information on Wak Chambil pigs' genetic makeup and relationships with other breeds. The analysis revealed notable mitochondrial DNA (mtDNA) D-loop variation both within individual pigs of the Wak Chambil breed and between different breed sequences. This variation highlights the genetic diversity present within each breed as well as the distinct differences observed between breeds. Such findings underscore the importance of studying and understanding mtDNA D-loop variation for elucidating the evolutionary history and genetic makeup of pig populations.

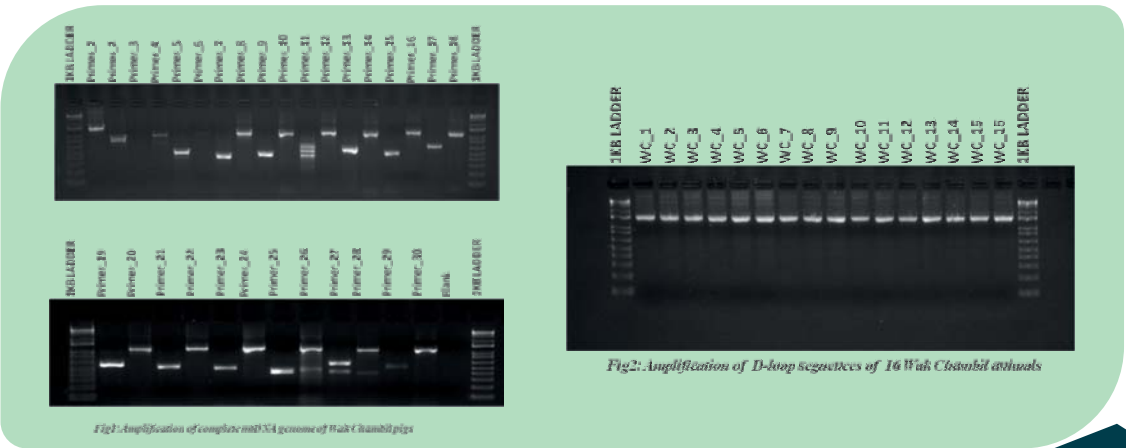
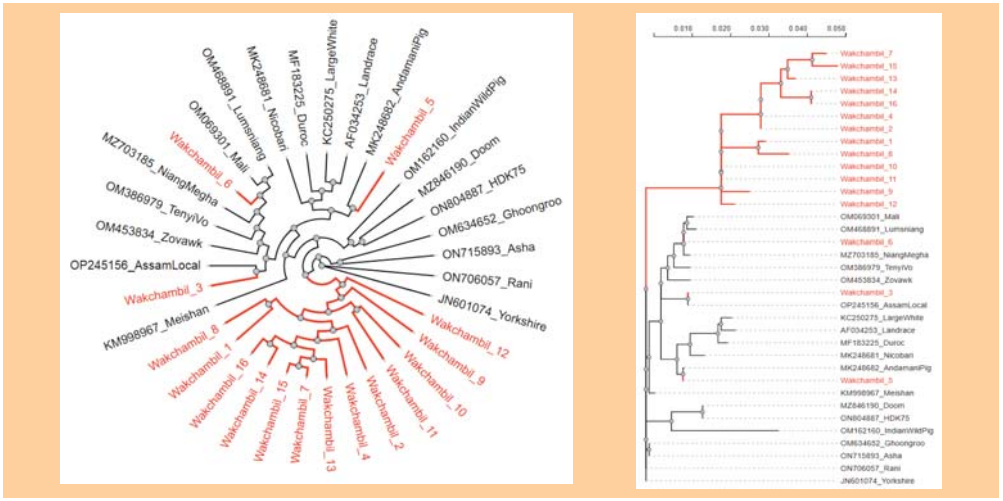


Fig2: Amplification of D-loop sequences of 16 Wak Chambil animals

Fig1: Amplification of complete mtDNA genome of Wak Chambil pigs



Phylogenetic tree of Wak Chambil pigs and other pig breeds based on D-loop sequences

Table: Percent identity and divergence of Wak Chambil pigs and other pig breeds based on D-loop sequences

Percent Identity

Divergence

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
1		98.5	98.5	98.8	96.9	97.9	98.5	99.0	96.9	95.0	98.5	99.0	98.1	98.8	98.5	98.3	99.8	98.5	98.1	98.3	98.5	79.8	80.0	80.0	79.8	99.0	97.5	98.3	98.5	98.5	98.1	98.5	98.1
2	0.4		98.7	98.8	96.7	99.3	100.0	99.0	96.7	95.1	97.1	97.5	98.7	98.9	99.8	98.7	98.3	99.8	98.7	98.7	99.5	79.8	80.0	80.0	79.8	98.7	98.2	99.1	99.8	99.8	99.5	98.7	98.6
3	0.4	0.2		98.8	96.9	98.5	98.7	99.0	96.9	94.4	97.1	97.5	97.8	98.0	98.9	97.8	98.3	98.9	97.8	97.9	98.2	79.8	80.0	80.0	79.8	97.5	97.0	98.2	98.9	98.9	98.6	97.5	97.3
4	0.0	0.0	0.0		96.9	98.1	98.8	97.5	96.9	94.8	97.2	97.6	98.8	98.8	98.8	98.8	98.6	98.8	98.6	98.6	98.8	79.5	78.7	78.7	79.3	98.8	98.6	98.8	98.8	98.8	98.4	98.4	98.1
5	1.1	0.7	0.6	0.7		98.4	98.7	98.0	100.0	97.6	99.2	98.7	95.7	95.8	96.9	95.7	96.7	96.9	95.8	95.2	95.2	77.9	78.2	78.2	78.0	95.7	95.5	96.2	96.9	96.9	96.6	95.8	95.3
6	1.1	0.7	0.6	0.7	0.4		99.3	99.7	96.4	96.9	97.7	98.1	98.2	98.4	99.5	98.2	97.7	99.5	98.4	98.7	98.7	79.0	79.2	79.2	79.0	98.2	98.0	98.7	99.5	99.5	99.1	98.4	97.8
7	0.4	0.0	0.2	0.0	0.7	0.7		99.0	96.7	95.1	97.1	97.5	98.7	98.9	99.8	98.7	98.3	99.8	98.7	98.7	99.5	79.8	80.0	80.0	79.8	98.7	98.2	99.1	99.8	99.8	99.5	98.7	98.6
8	1.0	1.0	1.0	1.0	0.8	0.3	1.0		98.0	95.7	98.7	99.7	99.0	99.0	99.0	99.0	98.7	99.0	99.0	99.2	99.0	79.0	79.2	79.2	79.0	99.0	99.2	99.0	99.0	99.0	98.5	99.0	98.5
9	1.1	0.7	0.6	0.7	0.0	0.4	0.7	0.8		97.6	96.2	96.7	95.7	95.8	96.9	95.7	96.7	96.9	95.8	96.2	96.2	77.9	78.2	78.2	78.0	95.7	95.5	96.2	96.9	96.9	96.6	95.8	95.3
10	2.8	2.3	2.1	2.7	2.2	1.9	2.3	2.8	2.2		94.4	94.8	94.0	94.2	95.3	94.0	94.8	95.3	94.2	94.2	94.6	75.3	75.5	75.5	75.3	94.0	93.5	94.6	95.3	95.3	94.9	93.9	93.7
11	1.5	1.9	1.9	1.7	1.7	1.3	1.9	1.3	1.7	3.4		98.8	96.7	97.3	97.1	96.9	98.3	97.1	96.7	97.3	97.1	77.9	78.2	78.2	78.0	97.5	96.5	96.9	97.1	97.1	96.7	97.5	96.7
12	1.1	1.5	1.5	1.2	1.3	0.8	1.5	0.3	1.3	3.0	1.3		97.1	97.7	97.5	97.3	98.8	97.5	97.1	97.7	97.5	78.7	78.9	78.9	78.8	97.9	96.9	97.3	97.5	97.5	97.1	97.9	97.1
13	0.8	1.3	1.5	0.0	1.9	1.9	1.3	1.0	1.9	3.4	2.4	1.9		99.5	98.6	98.9	97.9	98.6	98.2	95.8	99.3	79.8	80.0	80.0	79.8	98.9	98.2	98.6	98.6	98.6	98.2	98.9	98.7
14	0.4	1.1	1.3	0.0	1.7	1.7	1.1	1.0	1.7	3.2	1.9	1.5	0.5		98.7	99.5	98.5	98.7	98.4	96.9	99.1	79.8	80.0	80.0	79.8	99.5	97.5	98.7	98.7	98.7	98.4	99.1	98.6
15	0.8	0.2	0.2	0.0	0.6	0.6	0.2	1.0	0.6	2.1	2.3	1.9	1.5	1.3		98.6	98.3	100.0	98.9	99.0	99.3	79.8	80.0	80.0	79.8	98.6	98.1	99.3	100.0	100.0	99.7	98.6	97.7
16	0.8	1.3	1.5	0.0	1.9	1.9	1.3	1.0	1.9	3.4	2.4	1.9	1.1	0.5	1.5		98.1	98.6	98.6	95.8	98.9	79.8	80.0	80.0	79.8	98.9	97.3	98.9	98.6	98.6	98.2	98.6	98.6
17	0.2	0.6	0.6	0.2	1.3	1.3	0.6	1.3	1.3	3.0	1.7	1.3	1.1	0.6	1.1	1.1		98.3	97.9	98.1	98.3	79.5	79.7	79.7	79.6	98.8	97.3	98.1	98.3	98.3	97.9	98.3	97.9
18	0.4	0.2	0.0	0.0	0.6	0.6	0.2	1.0	0.6	2.1	1.9	1.5	1.5	1.3	0.0	1.5	0.6		98.9	98.9	99.3	79.8	80.0	80.0	79.8	98.6	98.0	99.3	100.0	100.0	99.6	98.6	98.4
19	1.1	1.3	1.1	0.2	1.7	1.7	1.3	1.0	1.7	3.2	2.6	2.1	1.8	1.7	1.1	1.5	1.3	1.1		97.3	98.2	79.8	80.0	80.0	79.8	97.8	97.8	99.3	98.9	98.9	98.6	97.8	98.0
20	1.3	1.3	1.3	0.2	1.3	1.3	1.3	0.8	1.3	3.2	2.4	1.9	2.6	2.4	1.1	2.6	1.5	1.1	2.2		98.0	99.7	99.5	99.5	99.7	97.4	99.2	98.0	99.1	99.1	98.8	97.7	97.1
21	0.6	0.5	0.9	0.0	1.3	1.3	0.5	1.0	1.3	2.8	2.1	1.7	0.7	0.9	0.7	1.1	0.9	0.7	1.8	1.7		99.7	100.0	100.0	99.7	98.9	98.0	98.6	99.2	99.2	98.9	99.2	99.1
22	0.0	0.0	0.0	0.0	0.7	1.0	0.0	1.0	0.7	3.8	2.4	1.4	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.3		99.7	99.7	100.0	100.0	99.7	100.0	100.0	100.0	100.0	99.7	99.7
23	0.0	0.0	0.0	0.0	0.7	1.0	0.0	1.0	0.7	3.7	2.4	1.4	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.5	0.0	0.3		100.0	99.7	99.7	99.5	99.7	99.7	99.7	99.7	99.5	99.5
24	0.0	0.0	0.0	0.0	0.7	1.0	0.0	1.0	0.7	3.7	2.4	1.4	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.5	0.0	0.3	0.0		99.7	99.7	99.5	99.7	99.7	99.7	99.7	99.5	99.5
25	0.0	0.0	0.0	0.0	0.7	1.0	0.0	1.0	0.7	3.8	2.4	1.4	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3	0.3	0.0	0.3	0.3		100.0	99.7	100.0	100.0	100.0	99.7	100.0	99.7
26	0.4	1.3	1.6	0.0	1.9	1.9	1.3	1.0	1.9	3.4	1.9	1.5	1.1	0.5	1.4	1.1	0.6	1.5	2.2	2.2	1.1	0.0	0.3	0.3	0.0		97.1	98.5	98.8	98.8	98.5	99.1	98.6
27	1.7	1.5	1.8	0.2	1.9	1.9	1.5	0.8	1.9	3.8	2.8	2.4	1.7	2.2	1.6	2.4	1.9	1.7	2.0	0.8	1.6	0.3	0.5	0.5	0.3	2.4		98.5	98.3	98.3	98.0	97.7	97.7
28	1.3	0.9	0.9	0.0	1.3	1.3	0.9	1.0	1.3	2.8	2.8	2.3	1.5	1.3	0.7	1.1	1.5	0.7	0.7	1.6	1.4	0.0	0.3	0.3	0.0	1.6	1.4		99.4	99.4	99.1	98.5	98.6
29	0.8	0.2	0.2	0.0	0.6	0.6	0.2	1.0	0.6	2.1	2.3	1.9	1.5	1.3	0.0	1.5	1.1	0.0	1.1	0.9	0.8	0.0	0.3	0.3	0.0	1.3	1.4	0.6		100.0	99.7	98.8	98.6
30	0.8	0.2	0.2	0.0	0.6	0.6	0.2	1.0	0.6	2.1	2.3	1.9	1.5	1.3	0.0	1.5	1.1	0.0	1.1	0.9	0.8	0.0	0.3	0.3	0.0	1.3	1.4	0.6	0.0		99.7	98.8	98.6
31	1.3	0.5	0.5	0.5	0.9	0.9	0.5	1.5	0.9	2.4	2.8	2.3	1.8	1.7	0.3	1.8	1.5	0.4	1.5	1.3	1.1	0.0	0.3	0.3	0.0	1.6	1.7	0.9	0.3	0.3		98.8	98.9
32	0.9	1.3	1.6	0.5	1.7	1.7	1.3	1.0	1.7	3.6	1.9	1.5	1.1	0.9	1.4	1.5	1.1	1.5	2.2	1.9	0.8	0.3	0.5	0.5	0.3	0.9	1.7	1.6	1.3	1.3	1.3		99.2
33	1.3	1.5	1.8	0.7	2.3	2.3	1.5	1.5	2.3	3.8	2.8	2.4	1.3	1.5	1.6	1.7	1.5	1.7	2.0	2.4	0.9	0.0	0.3	0.3	0.0	1.4	1.9	1.4	1.4	1.4	1.1	0.8	

Livestock Production and Management

Institute Project: Ethogram development and welfare assessment of desi and crossbred growing pig

Kalyan De, Nitin M. Attupuram, Souvik Paul, Rafiqul Islam, N.H. Mohan, and B.C. Das

Welfare assessment of grower pigs in the intensive system of management: Animal welfare involves the freedom from hunger and thirst, from discomfort, from pain, injury, and disease, from fear and distress and the freedom to express normal behavior. The Five Domains are subdivided into “nutrition,” “environment,” “health,” “behavior,” and “mental state”. The animal welfare is reflected in four main principles assessing feeding, housing, health, and behavior. Independent but complementary criteria were chosen for each of these principles. A detailed description of the measures were given in Table

In the present study, welfare of pigs housed in 10 pens were assessed which included 4 pens from the institute farm and 6 pens from the farmer's field. A total of 40 grower piglets were assessed in institute farm and 42 grower pigs were assessed from the farmer's filed. At the beginning of the observation, general information related to the farm was collected. The information includes general management, prevention of diseases, feeding, hygiene management, temperature regulation, castration routine, and production and mortality records. After the collection of general information behavioural observations were taken. During the observation of behaviour, other animal-based measures related parameters viz. good feeding, housing, and health principles were also recorded. Pigs were individually analyzed for their body condition, bursitis, manure on the body, lameness, wounds on the body, huddling, and panting. The scoring was analyzed at the pen level. However; huddling, shivering, panting, coughing, and sneezing were observed outside the pens. All other measures were assessed inside the pen in order to better observe the pig's body. Manure on the body, skin condition, bursitis, and wounds on the body were assessed only on one side of each pig. The Appropriate behaviour was assessed by evaluating active behaviour and a human–animal relationship (HAR) test or panic response. Pigs were scored as either active or inactive.

The behaviours recorded from active pigs were as follows: positive social behaviour, negative social behaviour, exploratory behaviour, and others (eating, drinking, etc.). Before beginning the scan, the evaluator entered the room to ensure that all animals were standing up. The observation of all the animals was recorded 5 minutes later from outside the pen. Each pen was observed 2 times consecutively with an interval of 2.5 minutes between 2 scans. The good human-animal relationship was measured by observing the fear of humans. Fear of humans was assessed by entering the pens, walking around the group slowly until returning to the starting point, and then waiting for 30 s. Then surveyor walked around slowly again in the opposite direction. The response was scored as good or poor. Good means that up to 60% of pigs panicked, whereas poor means more than 60% of pigs showed panic responses.

The result of the welfare assessment is presented in Table In the current study, in the institute farm 7.5±2.7% of grower pig and in the field 17.1±3.1% of grower pigs were in poor body condition. The presence of bursitis was observed in 5.9±3.4% and 7.6±3.1% grower pigs in institute farm and field conditions, respectively. The manure on the body was observed in 2.1% and 7.2% of pigs, respectively in institute farms and fields. Panting, huddling, lameness, coughing/sneezing was not observed in the grower of pig of the institute farm and field during the visit. However, lesions on the skin were observed in 7.5±2.8% of grower pig in the institute farm and 9.5±4.5% of grower pig in the field. During the visit, scoring was found in 1 pen in the field. The active animal percentage was 71.5±6.8 and 60.9±4.4, respectively in institute farm and field conditions.

Effect of welfare indicators on salivary cortisol level: To assess the stress level with welfare issues, the effect of welfare indicators on cortisol level was studied. For this purpose, saliva samples were collected from the pigs in which welfare has been assessed. The saliva samples were collected by allowing the grower pigs to chew a capric cotton roll to for 1-2 minutes. Afterward, the cotton roll was centrifuged in the 15 ml centrifuge tubes at 4000 RPM for 2 minutes and the saliva samples were collected. The plasma cortisol was estimated through ELISA using a commercial ELISA kit (Intra- and inter-assay coefficients of variations were <5.1% and <11.80%). A total of 60 saliva samples were collected. The saliva cortisol level of the grower pig was 3.19±0.35 ng/mL in our institute farm and 3.27±0.34 ng/mL in field conditions . The grower pigs

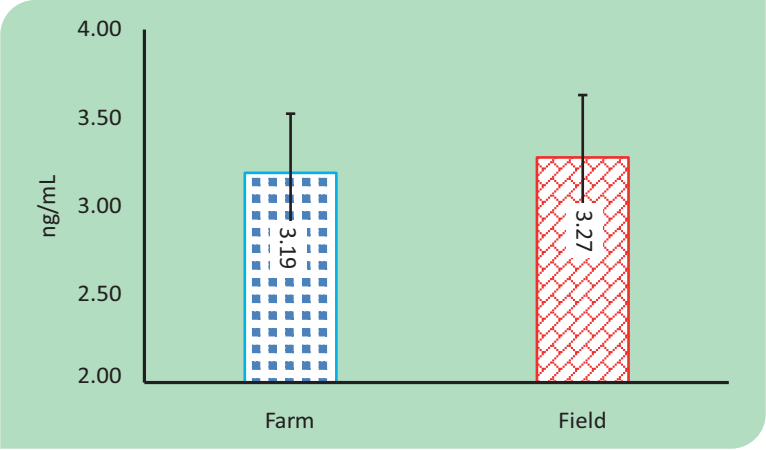
having poor body conditions have higher (P<0.05) cortisol levels. The pigs with good body condition score had cortisol levels of 2.99±0.249 ng/mL, whereas, the value was recorded 3.93±0.44 ng/mL in poor body condition pigs . The numerically higher cortisol level was found in good condition (3.10±0.25 ng/mL) pig as compared with pigs with bursitis (3.57±0.45 ng/mL) . The pigs in panting (3.13±0.25 ng/mL) had higher cortisol level as compared to normal respirating (3.61±0.52 ng/mL) pigs. The plasma cortisol level was significantly (P<0.5) higher in pigs having lesions or wounds in the body parts as compared to the pigs having intact body without evidence of any lesions .

Table: Description of welfare measures in pigs

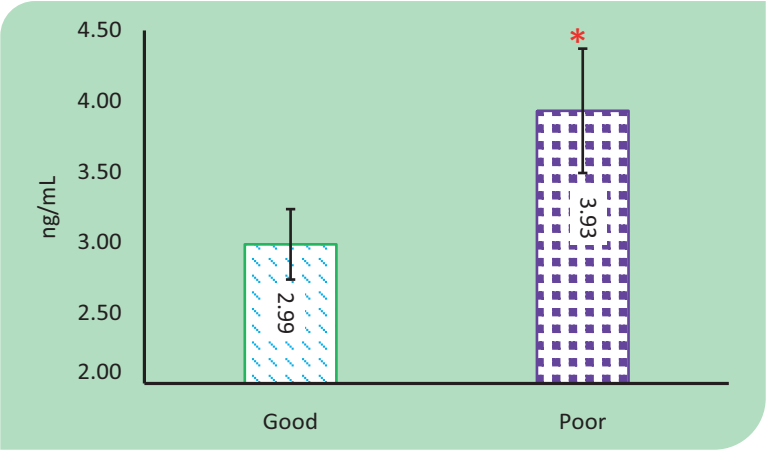
Criteria	Measures	Description
Good Feeding	Body condition	Good: Pig with a good body condition
		Poor: Pig with visible spine, hip, and pin bones
Good Housing	Bursitis	Good: No evidence or small of bursae/swelling
		Poor: Several large bursae on the same leg or one extremely large bursa
	Manure on the Body	Good: Less than 50% body surface is soiled with faeces
		Poor: More than 50% body surface is soiled with faeces
	Huddling	Good: Pig lying with less than half of its body on top of another pig
		Poor: Pig lying with more than half of its body on top of another pig
	Panting	Good: Normal breathing
		Poor: Rapid short breathing
Good Health	Lesions	Good: No evidence of tail/ear biting; superficial biting and no evidence of fresh blood or of any swelling
		Poor: Evidence of biting on body parts and superficial injuries, inflammation and appearance of blood
	Scoring	Good: No liquid manure visible in the pen
		Poor: Areas in the pen with some liquid manure visible
	Coughing/Sneezing	Good: No evidence of coughing/sneezing
		Poor: Evidence of coughing and sneezing
	Lameness	Good: No difficulty in walking
		Poor: Visible difficulty in walking
Appropriate Behaviour	Expression of social behaviour	Good: Pig expressing social behaviour and active
		Poor: Not active
	Pens with panic response	Good: Animal (Less than 60% animals of a pen) does not fear from handlers/human
		Poor: Animal (More than 60% animals of a pen) does not fear from handlers/human

Table: Welfare assessment of grower pig in farm and field

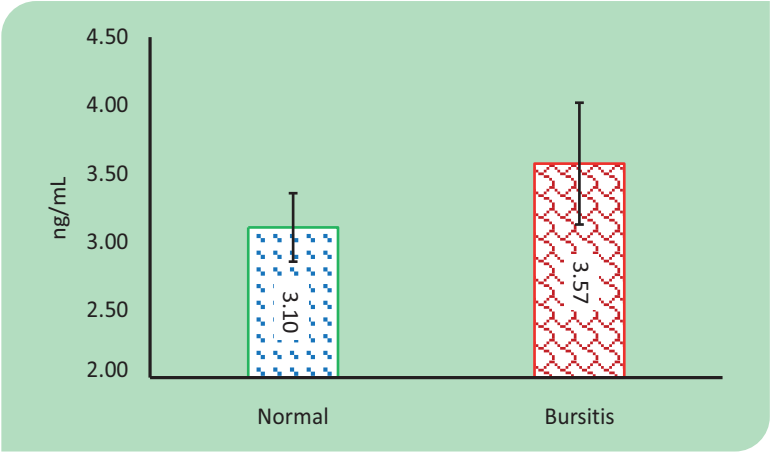
	Farm (%)		Field (%)		
Welfare measures	**Mean**	**SE**	**Mean**	**SE**	**P value**
Poor Body condition	7.5	2.7	17.1	3.1	0.205
Presence of Bursitis	5.9	3.4	7.6	3.1	0.685
Manure on the body	2.1	2.1	7.2	4.9	0.329
Panting	0	0	6.7	4.9	0.085
Huddling	0	0	0	0	-
Lesions	7.5	2.8	9.5	4.5	0.743
Lameness	0	0	0	0	-
Coughing/ Sneezing	0	0	0	0	-
Scouring in Pens	0	0	16.6	0	-
Active Animals	71.5	6.8	60.9	4.4	0.492
Pens with panic response	1 pen	-	4 pens	-	-



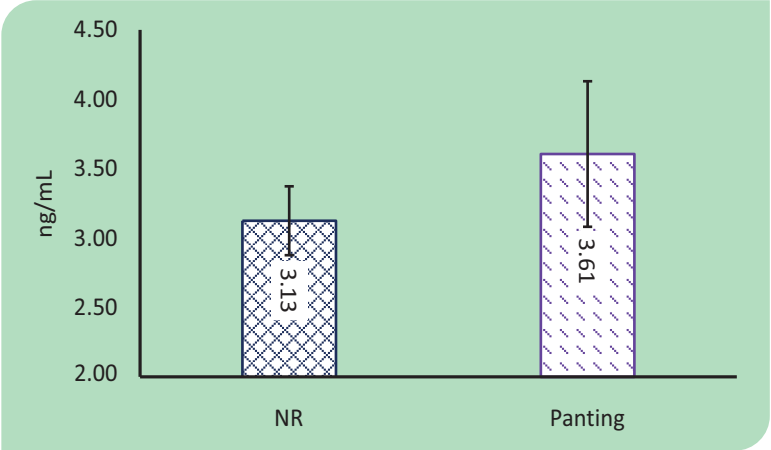
Comparison of saliva cortisol level of grower pigs in the institute farm and farmers field



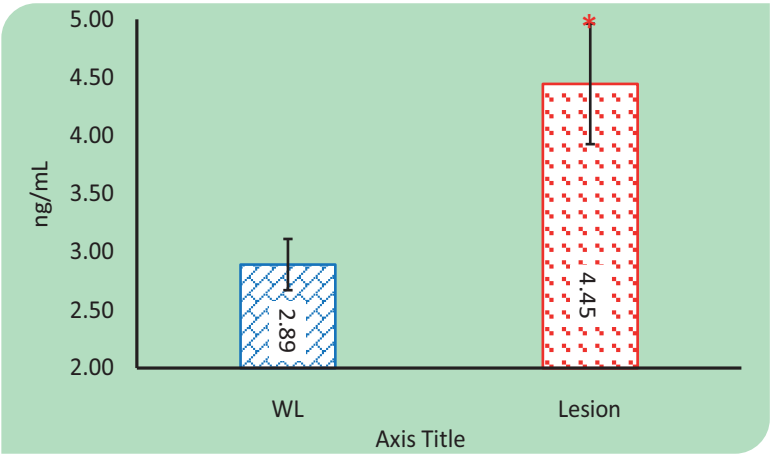
Comparison of saliva cortisol level of good and poor body condition grower pigs



Comparison of saliva cortisol level of grower pigs with bursitis and without bursitis



Comparison of saliva cortisol level of normal respirating and panting grower pigs



Comparison of saliva cortisol level of grower pigs without skin lesions and with skin lesions

Institute Project: Assessment and optimization of the water footprint in organized pig production

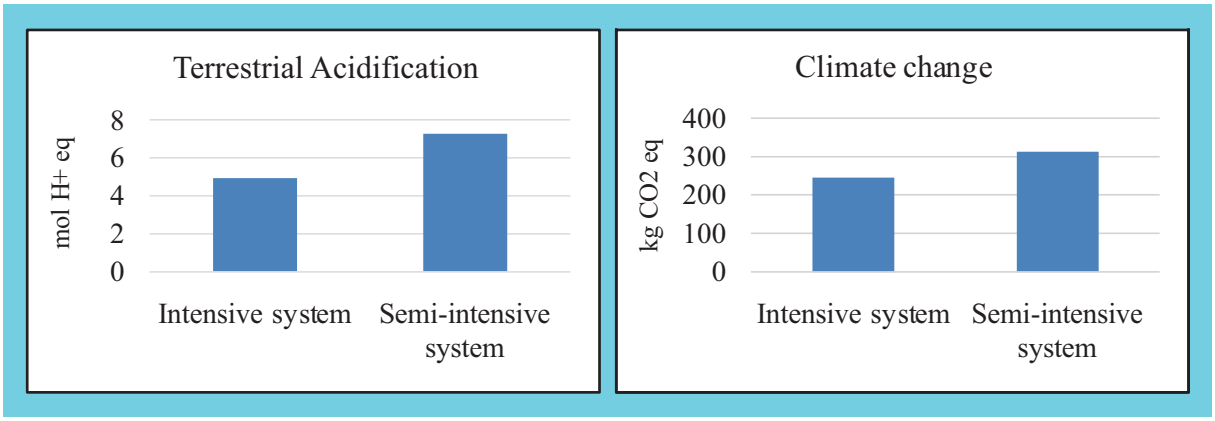
Nitin M. Attupuram, Kalyan De, R. Thomas, K. Barman (till September, 2023), NH Mohan

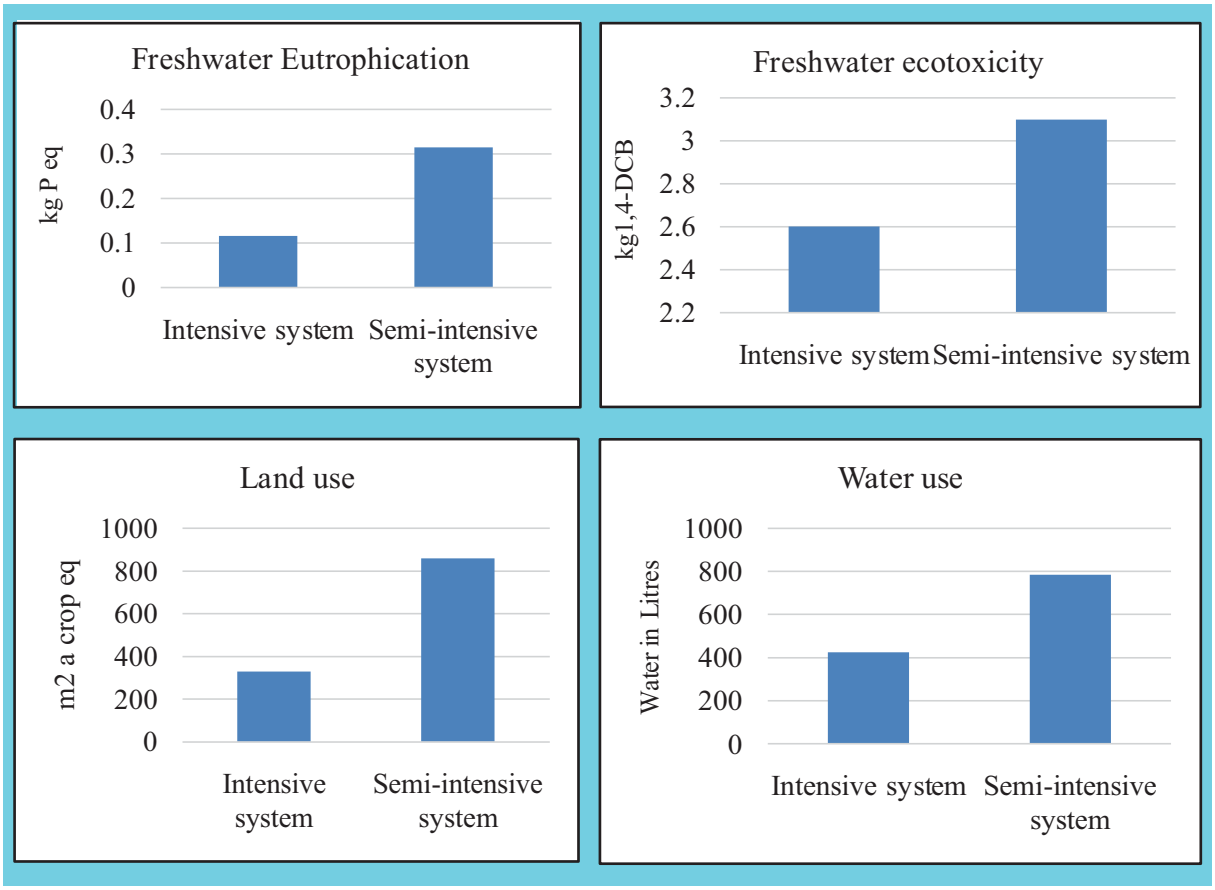
Ecological impact of pig production systems through lifecycle assessment: The growth trajectory of swine husbandry demands data-driven research on the carbon, water, and ecological footprints for assessing sustainability, which necessitated this research. Life Cycle Assessment (LCA) has emerged as the state-of-the-art system analysis approach in this concern. Our objective was to map hotspots along the value chain, assess the environmental impact of pig farming, and realize the sectoral contribution to carbon neutrality and climate change adaptation. Lifecycle assessment methodology was adopted to estimate the impact of pig production systems. The methodology was based on the LCA framework for assessing the environmental impact of products and processes (ISO 14040:2006). A cradle-to-gate lifecycle analysis was performed.

Intensive pig production systems were compared with household semi-intensive production system by using ReCiPe midpoint 2016 (H) and Environmental Impact3 as implemented in OpenLCA 2.0.1 using Agribalyse®v301 and EcoInvent 3.3 databases. The environmental impact per functional unit (110 Kg Live weight) was calculated using the EF 3.0 method and the results are given below.

Table: Environmental impact assessment for production of pig feed

Sl No	Impact category (EF 3.0)	Environmental impact		Unit
		Intensive system	Semi-intensive system	
1	Terrestrial Acidification	4.924766	7.2851	mol H+ eq
2	Climate change	246.0866	314.0306	kg CO2 eq
3	Eutrophication, freshwater	0.116861	0.3156	kg P eq
4	Water use	426.5359	786.6552	m^3
5	Freshwater ecotoxicity	2.6	3.1	kg1,4-DCB
6	Land use	330.2	860.9	m^2 a crop eq





A cradle-to-gate lifecycle analysis revealed pig feed as the major hotspot of environmental impact in pig husbandry. Environmental impact assessment for the production of one kilogram of pig feed was calculated using ReCiPe midpoint 2016 (Hierarchical) method. The results are presented in the table below.

Table: Environmental impact assessment for the production of pig feed

Sl No	Impact category	Environmental Impact	Unit
1	Fine particulate matter formation	0.00158	kg PM2.5 eq
2	Freshwater ecotoxicity	0.01291	kg 1,4-DCB
3	Freshwater eutrophication	0.00032	kg P eq
4	Global warming	0.60201	kg CO2 eq
5	Mineral resource scarcity	0.01011	kg Cu eq
6	Ozone formation, Human health	0.00231	kg NOx eq
7	Ozone formation, Terrestrial ecosystems	0.00233	kg NOx eq
8	Terrestrial acidification	0.00914	kg SO2 eq
9	Terrestrial ecotoxicity	1.17887	kg 1,4-DCB
10	Water consumption	0.23309	m^3

Bioavailability and tissue utilization of trace minerals on upplementing inorganic and organic sources in laboratory animal model (work done during Professional Attachment Training at ICAR-NIANP as a part of FOCARS)

Lokesha E

The present study was carried out to determine the tissue distribution and bioavailability of organic trace elements such as Zn, Cu, Mn and Cr in rats in comparison to inorganic trace elements. Organic trace elements were prepared in laboratory by chelating Zn, Cu, Mn and Cr with carnitine. Chelating agent carnitine used is known to involve in energy metabolism by transportation of long chain fatty acids across the mitochondrial membrane for β-oxidation and further ATP production. Hence in order to assess the function of carnitine energy restriction was fallowed at the end of the trial. The hypothesis of the present study was carnitine metal chelates improve the tissue storage and bioavailability of the minerals in comparison to inorganic trace elements. Four-week-old forty weaned male Wistar rats (Rattus norvegicus) of BW 105.3 ± 6.01 g were divided into four equal groups each consisting of 5 replicates of 2 animals. Total experimental duration was 35 days. Semi purified basal diet was prepared to meet NRC, (1995) requirements for rats.

CON: Inorganic minerals + Normal Feeding

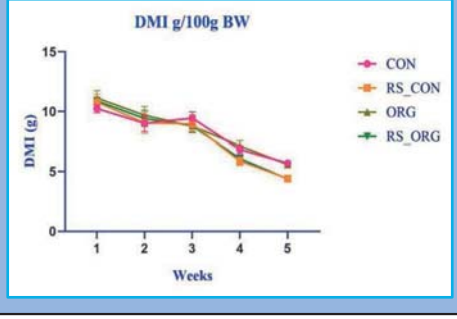
RS_CON: Inorganic minerals + Restricted feeding (35% less than the control)

ORG: Organic minerals + Normal Feeding

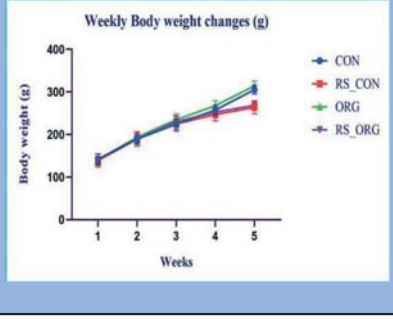
RS_ORG: Organic minerals + Restricted Feeding (35% less than the control)

Weekly dry matter intake and Body weight changes

All groups were fed with adlibitum feed from the start of the experiment to 21 days. After that RS_CON and RS_ORG groups were fed with restricted feed (35% less than the control) up to completion of the trial. Results indicated no significant difference between the groups in weekly DMI during the adlibitum feeding of animals . After introducing restricted feeding in RS_CON and RS_ORG groups in 4th and 5th week of experiment showed significant difference (P<0.05; P<0.01) between the normal feeding and restricted feeding groups. However, effect of source of minerals and interaction of minerals and type of feeding throughout the experiment was non-significant.



Effect of source of minerals and different feeding conditions on weekly DMI intake



Effect of source of minerals and different feeding conditions on weekly body weight changes

The weekly body weight change comparison between the different groups showed no significant effect of type of mineral source as well as interaction between the minerals and type of feeding throughout the experiment However, restricted feeding decreased the body weight significantly (P<0.01) in the fifth week of experiment in RS_CON and RS_ORG groups. The ADG in restricted feeding groups was 6.0 g and it was significantly (P<0.01) lowers than the normal feeding groups ADG 7.5 g.

Intake, absorption and relative bioavailability values (RBV) of minerals

The Zn chelated mineral supplemented group under normal feeding condition had more absorption (mg/d) than the inorganic Zn fed control group under normal feeding. The Zn absorption in ORG group (46.09%) was 27 times higher than the CON group (36.36%). Whereas Cu intake, absorption (mg/d) and RBV were almost comparable between the different sources of minerals. Restricted feeding group relatively had higher relative bioavailability values than the CON group. The Mn intake and absorption (mg/d) were higher in ORG group compared to CON group. Absorption percentage of Mn fed with Mn-carnitine group was (20.09%) higher than the inorganic Mn (9.98%) fed group. The RBV of Mn-carnitine was 100 times higher than the inorganic Mn fed group. The RBV of Mn in RS_CON and RS_ORG were comparable. The Cr intake and absorption (mg/d) as well as absorption percentage of organic and inorganic sources was almost similar (Table 2). Whereas RBV of Cr-carnitine was 14% higher than the inorganic Cr fed group. The RBV values of Mn and Cr were comparable between the RS_CON and RS_ORG groups.

Table: Zinc and Copper Intake, Absorption and Relative Bioavailability Value

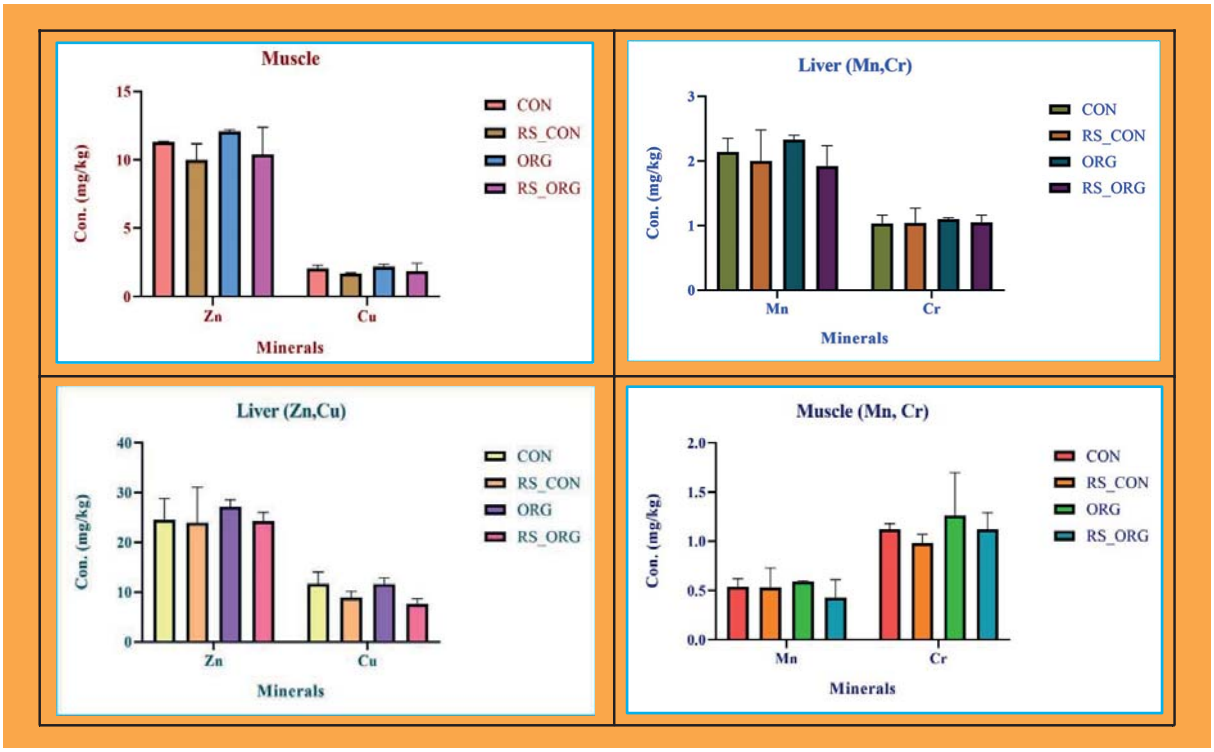
Groups	CON	ORG	RS_CON	RS_ORG
Zinc				
Intake (mg/d)	0.355 ± 0.053	0.345 ± 0.039	0.249 ± 0.009	0.264 ± 0.008
Absorbed (mg/d)	0.129 ± 0.033	0.159 ± 0.033	0. 114 ± 0. 011	0.127 ± 0.015
Absorption (%)	36.36 ± 5.882	46.09 ± 0.580	45.86 ± 3.235	48.13 ± 5.661
RBV (%)	100.00	127.00	126.12	132.36
Copper				
Intake (mg/d)	0.224 ± 0.020	0.205 ± 0.039	0.135 ± 0.005	0.146 ± 0.004
Absorbed (mg/d)	0.119 ± 0.009	0.114 ± 0.020	0.073 ± 0.005	0.079 ± 0.010
Absorption (%)	53. 125 ± 1.433	55.61 ± 3.255	54.07 ± 1.979	54.11 ± 6.661
RBV (%)	100.00	105.00	102.00	102.00

Table: Manganese and Chromium Intake, Absorption and Relative Bioavailability Value

Groups	CON	ORG	RS_CON	RS_ORG
Manganese				
Mn Intake (mg/d)	0.337 ± 0.047	0.340 ± 0.068	0.229 ± 0.008	0.247 ± 0.008
Mn Absorbed (mg/d)	0. 035 ± 0.014	0. 066 ± 0.009	0. 030 ± 0. 015	0.034 ± 0.015
Mn Abs (%)	9.984 ± 2.567	20.089 ± 4.428	13.085 ± 6.268	13.598 ± 5. 935
RBV of Mn (%)	100.00	201.21	131.06	136.20
Chromium				
Cr Intake (mg/d)	0.048 ± 0.009	0.081 ± 0.012	0.037 ± 0.001	0.033 ± 0.002
Cr Absorbed (mg/d)	0. 024 ± 0.004	0. 046 ± 0.010	0. 014 ± 0. 001	0.018 ± 0.003
Cr Abs (%)	50.005 ± 1.105	56.970 ± 1.869	51.293 ± 3.566	54.545 ± 5. 176
RBV of Cr (%)	100.00	114.00	102.43	109.08

Tissue mineral concentrations

Tissue mineral concentrations in different groups were comparable statistically . On fresh basis liver Zn, Mn and Cr concentrations in ORG group were 27.16 ± 1.44, 2.33 ± 0.07 and 1.10 ± 0.02 mg/kg respectively were only numerically higher than the CON group Zn (24.57 ± 4.24 mg/kg) Mn (2.14 ± 0.21 mg/kg) and Cr (1.03 ± 0. 13 mg/kg) concentrations respectively. The Cu concentration of CON (11.64 ± 2.39 mg/kg) was similar to ORG group (11.59 ± 1.27 mg/kg). Whereas among the RS_CON and RS_ORG groups, Zn concentration in RS_ORG group 24.21 ± 1.85mg/kg was relatively higher than the RS_CON group 23.98 ± 7.06 mg/kg. The liver concentrations of Cu, Mn and Cr in RS_CON was comparable with the RS_ORG group. Concentrations of Zn, Cu, Mn and Cr in muscle of ORG group were 12.08 ± 0.11, 2.21 ± 0.17, 0.59 ± 0.01 and 1.26 ± 0.44mg/kg respectively and they were marginally higher than the CON group Zn (11.31 ± 0. 06mg/kg), Cu (2.06 ± 2.39mg/kg), Mn (0.54 ± 0.08 mg/kg) and Cr (1.12 ± 0. 0.06mg/kg) concentrations. Similarly, concentrations of Zn, Cu, Mn and Cr in muscle of RS_ORG group were 10.40 ± 1.98, 1.86 ± 0.60, 0.43 ± 0.18 and 1. 12 ± 0.17 mg/kg respectively were marginally higher than the RS_CON group Zn (10.01 ± 1.16), Cu (1.70 ± 0.04), Mn (0.53± 0.20), and Cr (0.98 ± 0.09) concentrations.



Tissue retention of minerals in rats fed with organic and inorganic minerals under different feeding conditions.

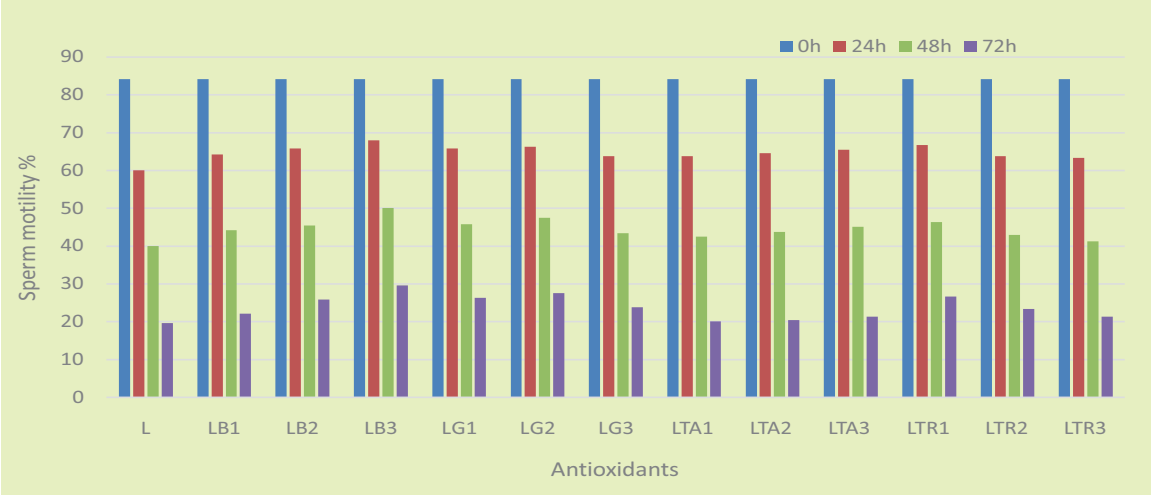
Institute Project: Preservation of boar semen using different additives in liquid and frozen state.

Rafiqul Islam, Sunil Kumar, Keshab Barman (till September, 2023) and Santanu Banik (till August, 2023)

Boar spermatozoa are generally preserved at 17°C for several days for using in artificial insemination programme. Lowering the Storage temperature would be beneficial to reduce the risk of bacterial growth but it causes deterioration of the sperm quality owing to the high cold shock susceptibility of boar spermatozoa. Currently, new hypothermic preservation concepts are evolving to store boar spermatozoa at 5°C. Oxidative stress caused by the generation of reactive oxygen species (ROS) during semen preservation is considered a significant factor in the deterioration of sperm quality. The antioxidant levels present in the semen is not sufficient to control the reactive oxygen species (ROS) formed due to sperm aerobic metabolism during refrigerated boar semen preservation. This imbalance between antioxidants and pro-oxidants leads to lipid peroxidation of the polyunsaturated fatty acids in the sperm membrane and thereby boar spermatozoa suffer from irreversible damage. The study was planned to find a suitable egg yolk-based extender - antioxidant combination for maintaining higher quality of boar spermatozoa during storage at refrigerated temperature by protecting them from the adverse affect of low temperature and reactive oxygen species (ROS).

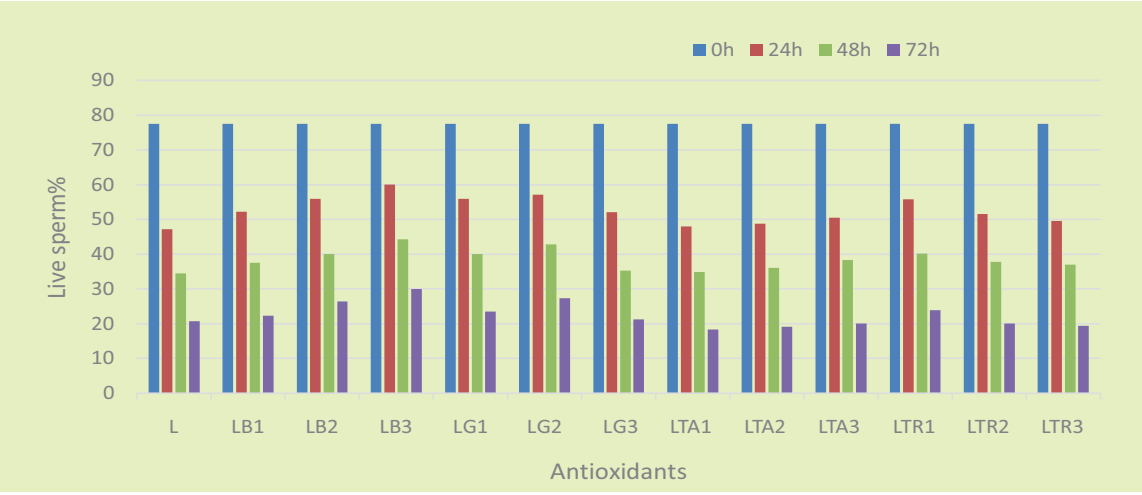
The effects of different additives viz. Butylated Hydroxy Toluene (BHT), Reduced Glutathione (GSH), Taurine (TAU) and Trehalose (TRE) on the quality of boar spermatozoa was studied, when stored at refrigerated temperature (5°C) up to 72h. Samples from 24 ejaculates of four adult healthy boars were split and extended in Lactose Egg Yolk (LEY) extender with and without the additives. The 13 treatment groups using different concentrations of additives in LEY extender were L (no additive - control), LB1 (BHT 0.2mM), LB2 (BHT 0.6mM), LB3 (BHT 1mM), LG1 (GSH 1mM), LG2 (GSH 3mM), LG3 (GSH 5mM), LTA1 (TAU 5mM), LTA2 (TAU 10mM), LTA3 (TAU 25mM), LTR1 (TRE 100mM), LTR2 (TRE 125mM) and LTR3 (TRE 150mM). The quality of the stored semen sample was evaluated for sperm, motility, viability, intact acrosome and membrane integrity at 0 (immediately after dilution), 24, 48 and 72h of preservation.

Sperm motility: Sperm motility did differ significantly ($p<0.05$) between different concentrations of additives at 24, 48 and 72h of preservation at 5°C . The acceptable motility of ≤50% was found up to 48 h of preservation at 5°C in semen sample extended in LEY extender with BHT1 mM (LB3). The sperm motility was the highest in LB3 at 24h (67.91±0.74), 48h (50.00±0.87) and 72h (29.58±0.96) of preservation amongst all other combination of antioxidants including the control. Next to LB3, the higher sperm motility per cent was recorded for LG2 (GSH 3mM) and LTR1 (Trehalose 100mM) from 24 h through 72h of preservation. However, the difference was non-significant between LG2 and LTR1 for all the storage hours from 24h to 72h. It is also observed that increasing the concentration of trehalose from 100 to 150 mM decreased the sperm motility and the deterioration was pronounced at 72h of storage.



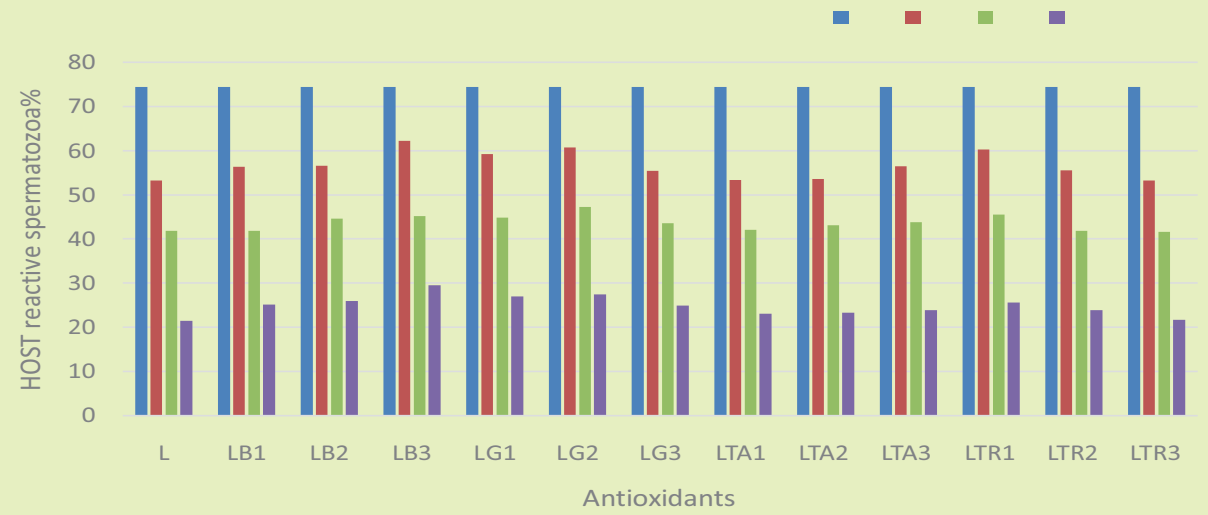
Effect of different concentration of additives on motility of boar spermatozoa at different hours of preservation in LEY extender at 5°C

Sperm viability: Percentage of live spermatozoa differed significantly ($p \leq 0.05$) different concentrations of additives in LEY extender at 24h, 48h and 72 h of storage at 5°C (Fig. 2). The live sperm count of boar spermatozoa was significantly ($p \leq 0.05$) higher in LB3 (BHT1mM) group at 24h (60.08±0.55) and 72 h (30.00±0.47) of storage at 5°C of storage than all other concentration of antioxidants in LEY extender. Next to LB3, the sperm viability was also significantly higher for LG2 (GSH 3mM) at 48h (42.75±0.72) and 72h (27.33±0.85) of preservation than the other concentrations of antioxidants. It is also observed that increasing the concentration in taurine groups (LTA) and butylated hydroxytoluene (LB) sperm viability was seen to be increased, whereas in glutathione (LG) and trehalose (LTR) groups sperm viability was seen to be decreased with the increase in concentrations.



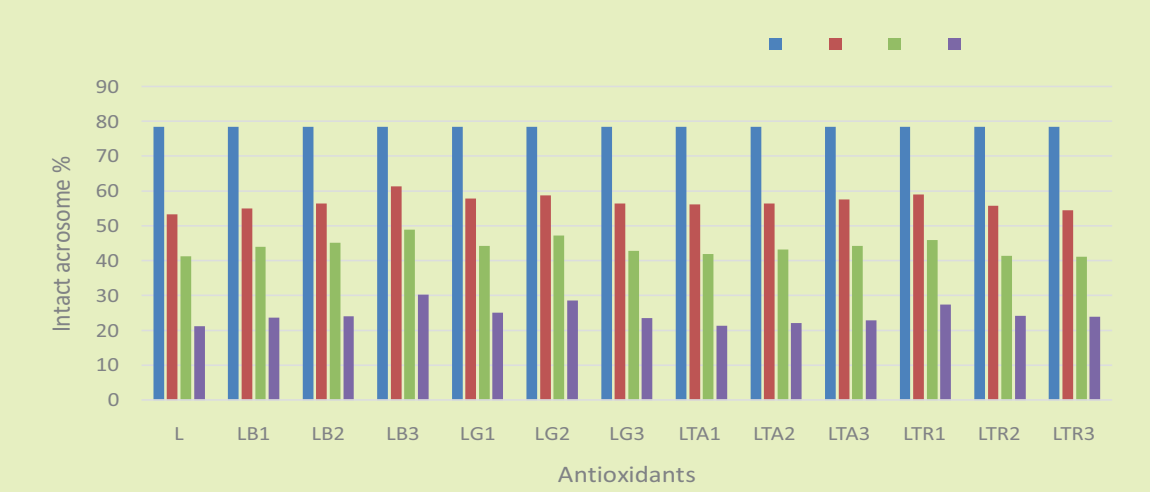
Effect of different concentration of additives on viability of boar spermatozoa at different hours of preservation in LEY extender at 5°C

HOST reactive spermatozoa: Percentage of HOST reacted spermatozoa differed significantly (p≤0.05) between different concentrations of additives in LEY extender at 24h, 48h and 72 h of storage at 5°C . The HOST reacted spermatozoa was higher than 60% in LB3, LG2 and LTR1 in LEY extender at 24h of storage at 5°C. The corresponding value in respect of membrane integrity of boar spermatozoa was higher than 45% at 48h storage. The HOST reactive spermatozoa were significantly (p≤0.05) higher for LB3 (29.50±0.65) than the other concentrations of additives in LEY extender during storage up to 72h. Similarly, next to LB3, LG1(27.00±0.61) and LG2 (27.41±0.55) maintained higher membrane integrity of boar spermatozoa stored up to 72 h than the other concentrations of additives in LEY extender.



Effect of different concentration of additives on membrane integrity of boar spermatozoa at different hours of preservation in LEY extender at 5°C

Intact Acrosome: Percentage of intact acrosome in boar spermatozoa differed significantly (p≤0.05) between different concentrations of additives in AND extender during preservation at 5℃ from 24h to 72h of storage. The LB3 (61.33±0.56) followed by LG2 (58.75±0.56) maintained significantly (p≤0.05) higher acrosomal integrity than other concentrations of additives in LEY extender at 24h of preservation. Similarly, LB3 (49.00±0.46) followed by LG2 (47.33±0.68) also maintained significantly higher intact acrosome percent than other concentrations of additives in LEY extender at 48h of preservation. The corresponding figures for LB3 (30.33±0.49) followed by LG2 (28.58±0.62) were also higher than the other concentrations of additives in LEY extender at 72h of preservation. Amongst the Trehalose concentrations Trehalose 100Mm concentration (LTR1) in LEY extender maintained higher intact acrosomes than 125 mM (LTR2) and 150mM (LTR3) during preservation from 24h through 72h.



Effect of different concentration of additives on acrosomal integrity of boar spermatozoa at different hours of preservation in LEY extender at 5°C

It is revealed that BHT 1mM followed by GSH 3mM and Trehalose 100mM significantly ($P<0.05$) improved sperm quality during storage at 5°C. Additionally, BHT 1mM showed significantly ($P<0.05$) higher sperm viability, membrane integrity, and acrosomal integrity compared to other treatment groups over the 72-h preservation period. Addition of antioxidants exhibited promising effects on semen quality during refrigerated preservation, providing valuable insights for potential applications in boar semen preservation techniques at low temperatures.

Institute Project: Propagation of Artificial Insemination for establishment of multiplier units and optimizing reproductive efficiency in pigs at farmers' field

Sunil Kumar, Rafiqul Islam, Santanu Banik (till August, 2023), P.J. Das and Keshab Barman (till September, 2023)

Establishment of pig multiplier units at farmers' field: Under the objective for pig multiplier units' establishments following services were provided to the farmers such as knowledge scaling up of farmers, technical guidance, hormones for estrus synchronization, needful veterinary aids, inputs such as dewormer, feed (as per availability), supplements and mineral mixture, ultrasonographic services and artificial insemination services. Efforts were made to establish self-sustaining multiplier units with 42 farmers; however some farmers (18) were not able to maintain the required number of 6 sows units due to several constraints and discontinued. Farmers discontinued the units because several constrains including the lack of sufficient financial availability and emergency requirement of money for their daily needs and fear of death of animals because of disease outbreak/diseases. Currently eleven units are under self-sustainable establishment, out of which three have become self-sustaining (6 sows units). The thirteen self-sustaining units, now have more than 3+1 sow unit pigs in their farms and eleven 6+1 sow units. The performance of the multiplier units is described below along with the constraints followed by the farmer. In four units at Kathalguri, Sajjanpara, Nampara, Puijula village, the units reached 6 sow unit pig but due to

African swine fever outbreak in the region, all the pigs of the unit got mortality due to the viral disease. Second constraint felt by the farmers was the high cost of feed. Third most common constraint was the lack of timely veterinary aids and medicine and the cost of treatment also. Further multiplication of pigs at their units is in progress.

Performa prepared for feedback from farmers maintaining multiplier units. Feedback and impact assessment by as per criteria suggested by Likert (1932) and Edward (1957). Farmers from 15 units are highly satisfied with score 5 and 9 units farmers are satisfied (score 4) with the services

Multiplier unit at Farmers' field

Institute QRT visited and evaluated the performance of four pig multiplier units established under the project at Nahira, Betkuchi and Chayagoan of Kamrup rural district, and appreciated the development of pig multiplier units.

Visit of Institute QRT at Pig Multiplier units

Doppler and Thermal imaging for fertility prediction and breeding soundness evaluation in boars: To generate the basic data, B-mode and doppler imaging used to measure parenchyma, resistance index (RI) and vascular characteristics (PI) of the testicles and pampiniform plexus. Thermal imaging was started to carry out scrotal surface mean temperature (SST). Boar scores were generated and correlation with respect to seminal attributes was estimated. In results, scrotal surface temperature and testicular vascular characteristics showed positive correlation with sperm in vitro function parameters.

Table: Hemodynamics, thermal imaging and seminal attributes in boars

Boar	PI (PP)	RI (TP)	SST (°C)	Motility %	Live%	Defect %
A	1.94±0.1	0.73±0.6	35.65±014	78.33±2.8	79.16±2.1	15.83±1.4
B	2.28±0.1	0.8±0.6	35.62±.12	80±2.3	80±2.04	14.28±1.83
Poor	2.12±0.09[a]	0.76±0.04[a]	35.63±0.09	79.23±1.84	79.61±1.49	15±1.17[a]
D	1.56±0.06	0.45±0.03	34.35±0.15	90.83±1.4	80.83±2.4	11.66±1.92
E	1.52±0.08	0.48±0.04	34.71±0.21	92.14±1.09	83.57±2.27	8.57±0.99
Good	1.54±0.05[b]	0.46±0.02[b]	34.54±0.14	91.53±0.9[a]	82.30±1.72	10±1.17[b]

In conclusion, Doppler and thermal imaging can be used to predict the fertility of boars and boar scores can be used for breeding soundness evaluation.

External Funded Project: Augmenting pig production by accretion of reproductive efficiency and artificial insemination for generating livelihood security and Entrepreneurship in NER

Sunil Kumar, Rafiqul Islam and Vivek Kumar Gupta

The project was sanctioned on 06.02.2023 by DBT, Govt. of India. Reproductive efficiency is one of the most important facets in swine production. Limited hormones, poor ovarian dating and unavailability of fertile boar/semen cause economic percussions to piggery stakeholders particularly under backyard production systems.

Effect of Moringa oleifera in delayed pubertal gilts: For the purpose of augmenting the reproductive efficiency in gilts, one plant identified as Moringa oleifera. Firstly, Moringa oleifera therapeutics at the standardized therapeutic regimen was used in delayed pubertal gilts. Proximate composition of control feed, dried leaves powder of Moringa oleifera and dried leaves powder of Moringa oleifera mixed with feed was estimated.

Table: Proximate composition of control feed, dried leaves powder of Moringa oleifera and dried leaves powder of Moringa oleifera mixed with feed

Parameter	Control Feed	Treatment Feed (control feed+ Dried leaves powder of *Moringa oleifera)*	Dried leaves powder of *Moringa oleifera*
CF (%)	11.70±0.20[b]	12.20±0.53[b]	13.25±0.09[a]
CP (%)	16.15±0.03[b]	16.55±0.03[b]	21.71±0.56[a]
OM (%)	88.56±0.22	87.26±0.06	91.19±0.14
Ash (%)	11.44±0.22[a]	12.74±0.06[a]	8.81±0.14[b]
EE (%)	5.06±0.09[b]	5.61±0.10[b]	7.67±0.05[a]
NFE (%)	55.64±0.47	52.90±0.51	48.56±0.74

In results, Moringa oleifera treatment significantly ($p<0.05$) improved the reproductive and productive performances in gilts.

Table: Effect of *Moringa oliefera* feeding on reproductive and productive characteristics of gilts

Parameter	Control	Treatment
Gilt (n)	6	8
Age (months)	6.33±0.10	6.52±0.07
B.Wt (kg)	50.17±0.74	51.13±1.35
Estrus induced (%)	(33.33) 2/6	75.00 (6/8)
EEI (Estrus expression intensity; 1/2/3/4)	$1.50±0.28^{a}$	$3.66±0.16^{b}$
ITEE Days (Interval from treatment to first estrus expression)	$20.75±5.09^{a}$	$9.12±0.77^{b}$
IFTSH (Interval from first to second estrus expression)	$24.5±1.50^{a}$	$21.33±0.61^{b}$
Pregnancy Rate % (First Service)	50%	83.33%
Repeat Breeding % (First Service)	50%	16.67 %
LSB (Litter size at Birth)	7.00±0	8.6±0.4

In conclusion, Moringa oliefera supplementation reduces age at puberty and production performance was also improved

Effect of local bioresources on in vitro sperm functions: Extracts of Moringa oleifera, Terminalia chebula, Dypsis lutescens and Camellia sinensis were tested in extended semen and subsequent post insemination production performance was evaluated. In results, no significant ($p>0.05$) effect of added extracts of bioresources except Terminalia chebula ($p<0.05$) was found in extended semen as well as post artificial insemination.

Table: *In vitro* effects of extracts of bioresources on sperm functional characteristics

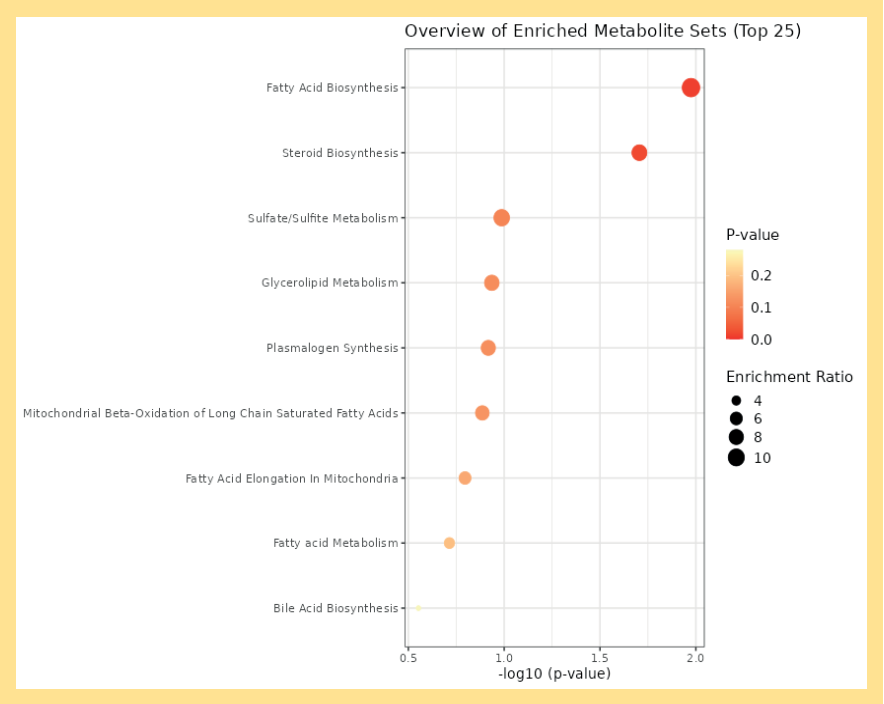
Bioresource	Time	Motility (%)	Live (%)	Clumping (%)	HOST (%)
Control	0h	91.66±1.05	85±2.23	4.33±0.33	76.66±1.66
	48h	71.66±1.05	64.16±2.00	7.5±1.11	65.83±2.00
	96h	$55±2.23^{b}$	43.33±2.10	15.83±2.00	$49.16±2.00^{b}$
Moringa oleifera	0h	89.16±0.83	87.5±1.11	6±0.81	75±2.58
	48h	74.16±2.00	67.5±1.70	11.66±1.05	63.33±3.33
	96h	55±2.23	50.83±2.38	17.5±1.70	55±2.88
Terminalia chebula	0h	90±1.29	88.33±2.47	7.5±1.11	72.5±2.5
	48h	76.66±2.10	70±2.23	13.33±1.66	60±2.58

	96h	59.33±1.66[a]	49.16±2.71	17.5±1.11	55.83±2.71[a]
Dypsis lutescens	0h	93.33±1.66	86.66±1.66	5.83±0.83	78.33±4.01
	48h	70±2.88	66.66±2.10	10.83±0.83	52.5±3.59
	96h	45.83±2.71	50±2.23	16.66±1.05	43.33±1.66
Camellia sinensis	0h	91.66±1.66	85.83±2.38	7.5±1.11	78.33±3.07
	48h	73.33±4.01	76.66±2.10	15±1.82	53.33±3.33
	96h	43.33±2.47	47.5±1.70	19.16±1.53	38.33±6.66

In conclusion, semen extended with extracts of bioresources at liquid state may be further tested for sperm fertility.

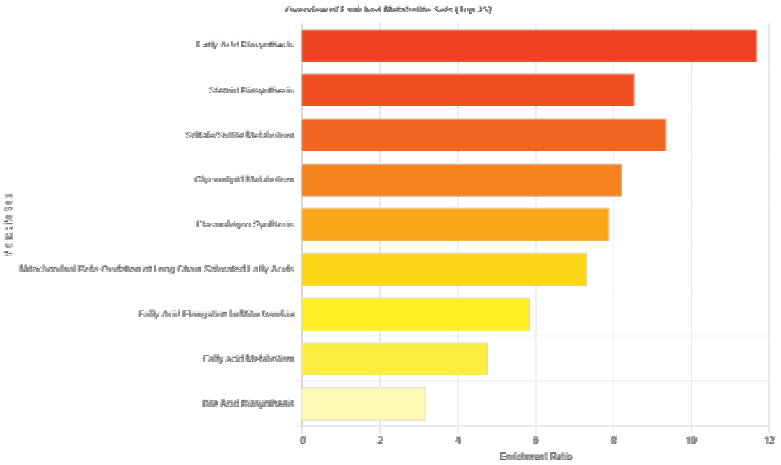
Metabolomics analysis of local bioresources: Extracts of *Moringa oleifera, Terminalia chebula* and *Dypsis lutescens* were subjected to metabolomics analysis where more than 444 compounds were identified and some of the compounds were noted to have potential roles in as antioxidants, hormonal precursor, antimicrobials antifungal. These compounds are involved in several metabolic pathways, bio stimulation, plasma membrane stabilization and capacitation.

Metabolomics analysis of Moringa oleifera: Total 34 compounds were identified in extracts of *Moringa oleifera* having role as/in antioxidant, hormonal precursor, metabolic pathways, biostimulation, plasma membrane stabilization and antimicrobials.



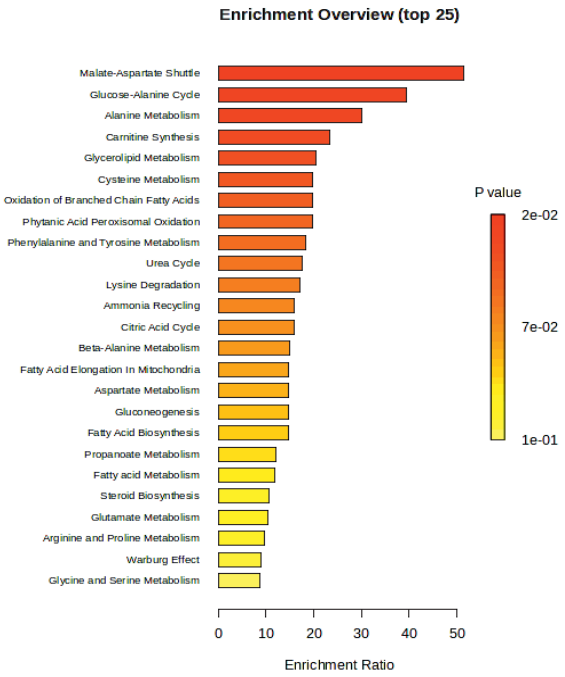
Enrichment analysis of metabolites found in extracts of *Moringa oliefera*

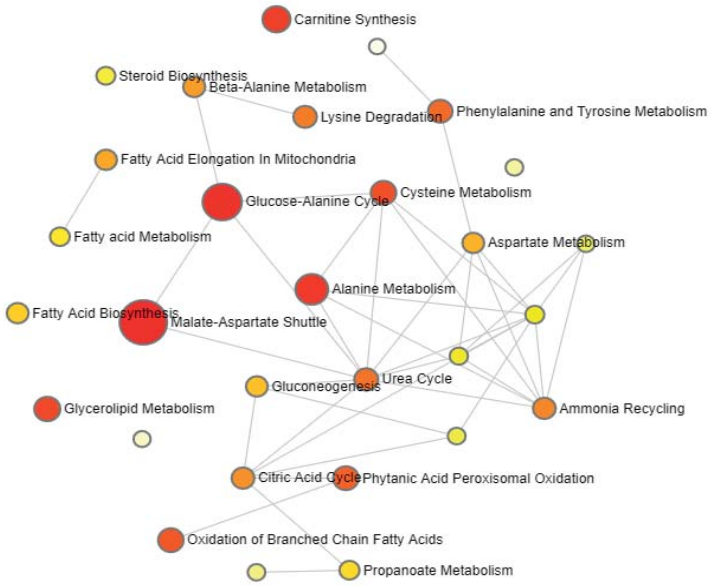
Metabolomics analysis of *Terminalia chebula*: Total 27compounds were identified in extracts of *Terminalia chebula* having role as/in capacitation, antioxidant, hormonal precursor, metabolic pathways, biostimulation, plasma membrane stabilization and antimicrobials.



Gas chromatogram and enrichment analysis of metabolites found in extracts of *Terminalia chebula*

Metabolomics analysis of *Dypsis lutescens*: Total 21 compounds were identified in extracts of *Dypsis lutescens* having role as/in capacitation, antioxidant, hormonal precursor, metabolic pathways, biostimulation, plasma membrane stabilization and antimicrobials.





Enrichment and network analysis of metabolites found in extracts of Dypsis lutescens

In conclusion, compounds identified in the bioresources may be explored further for semen preservation for fertility and antimicrobial activity.

Service Project: Artificial Insemination in Pigs

Rafiqul Islam and Sunil Kumar

A total of 313 ejaculates were collected from healthy boars during the year and a total of 785 liquid boar semen doses were produced and supplied by the Institute for artificial insemination in pigs at the farmers' field and organized farms. Out of this, 139 doses were given to tribal farmers under TSP, 14 under SCSP, 100 to organized farm and rest 532 boar semen doses were sold to other category of farmers. Seven training programmes of 3-7 days durations on artificial insemination in pig were conducted for various stakeholders. Out of the seven programmes, two programmes were conducted for Veterinary Officers deputed by Animal Husbandry & Veterinary Department of Govt of Assam and Govt of Meghalaya. Two Technology Demonstration programmes on Artificial Insemination techniques in pigs were conducted for the progressive farmers and entrepreneurs. Demonstrations and lectures on artificial insemination in pigs were delivered in different other trainings and awareness programmes conducted under SCSP, TSP, EDP, externally funded projects etc. organized by ICAR-NRC on Pig, Rani. Regular advisory services on reproductive management, therapeutic management of infertility conditions, proper method and timing of artificial insemination in pigs, post insemination measures were provided to the farmers at their doorstep, during the visit of the farmers to the Institute and also through telephonic conversations.

New inseminators trained: During the year, 341 new entrepreneurs/ farmers were trained on artificial insemination in pigs with liquid boar semen to carry out inseminations at their farms and also to the neighboring farms of their locality for self-employment.

New farmers registered: During the reported period, 26 new farmers were registered, who learnt the technique of AI and received liquid semen supplied by ICAR- NRC on Pig, Rani for artificial insemination of their pigs.

Manoj Rabha of Village - Chakardo with the 11 piglets born from AI

Manoj Rabha of Village - Chakardo with his 7 piglets born from AI

Irish Sangma of village Panbari inseminating his sow

Gopikanta Rabha of Umsur village with 8 piglets born from AI

Ganga Daimary of village Rani with the 11 piglets born from AI

Darshana Boro of village Boko with 9 piglets born from AI

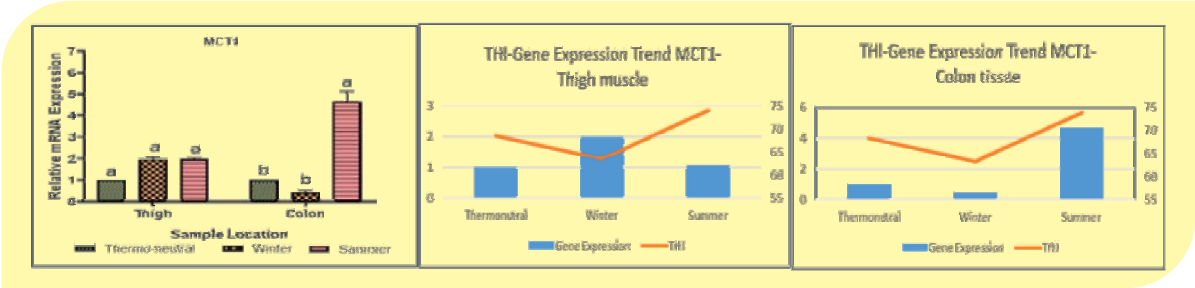
Animal Physiology

Institute Project: Physio-Genomic responses and MCT profiling of exotic and indigenous pig breeds in heat stress during different seasons

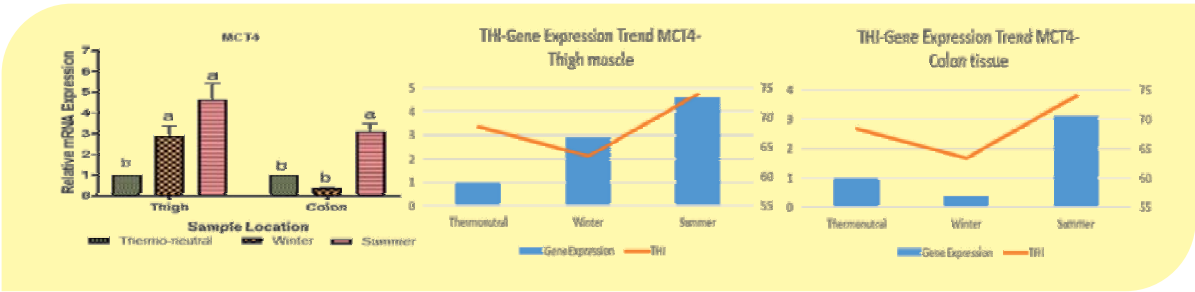
B.C. Das, N.H. Mohan, Jaya, Kalyan De, J. Doley, A. Paul

In order to evaluate the expression trend of various heat stress responsive HSP and MCT genes in the thigh muscle and colon tissue under various seasonal conditions in indigenous Mali and Ghoongroo and crossbreed Rani pigs, samples were collected from local slaughter places.The relative mRNA expression was determined using delta-delta Ct method. The temperature humidity index (THI) was calculated from all round the year metrological data for year 2022-2023 using the following formula.

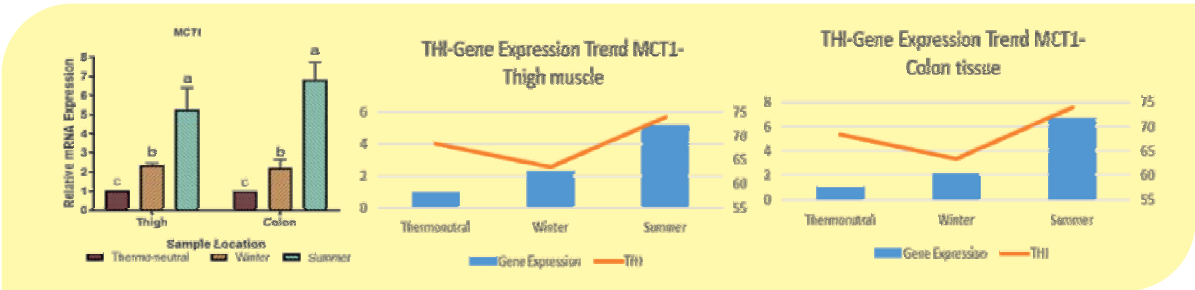
THI= [(1.8T)+32]-[0.55(RH/100)] X [((1.8T)+32)-58], where T= Air Temperature in oC and RH = Relative Humidity in %



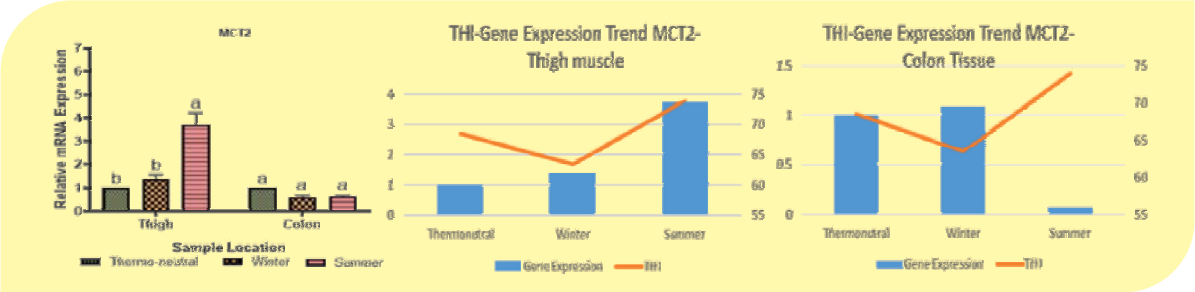
Expression trend of MCT1 genes with THI in Mali pigs



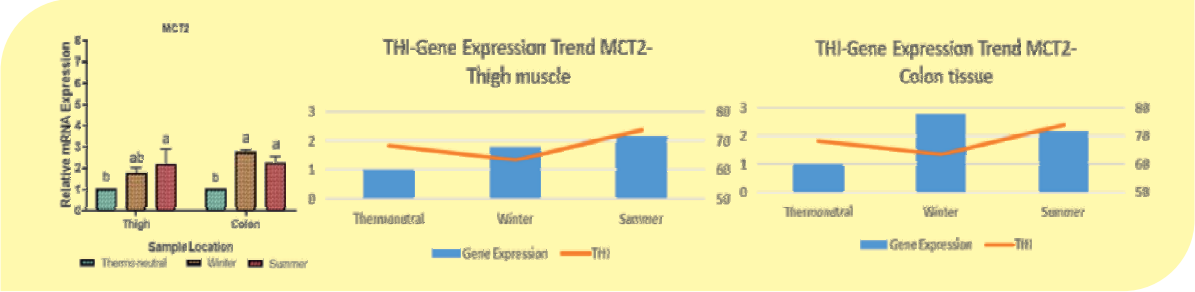
Expression trend of MCT2 genes with THI in Mali pigs



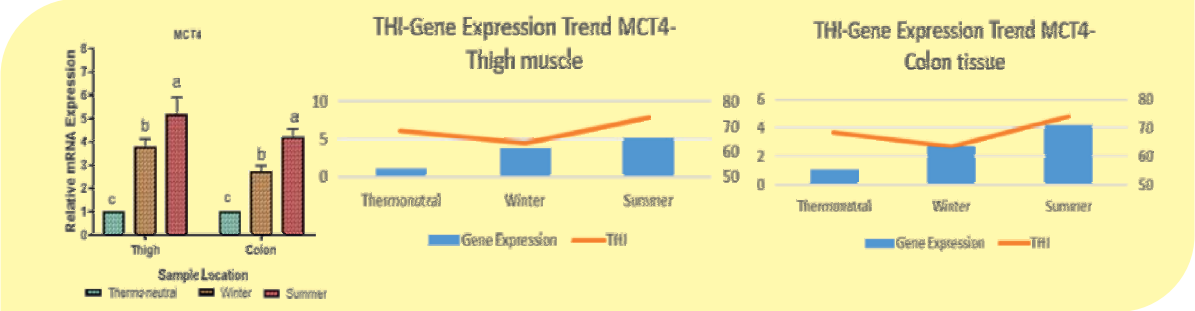
Expression trend of MCT4 genes with THI in Mali pigs



Expression trend of MCT1 genes with THI in Ghungroo pigs

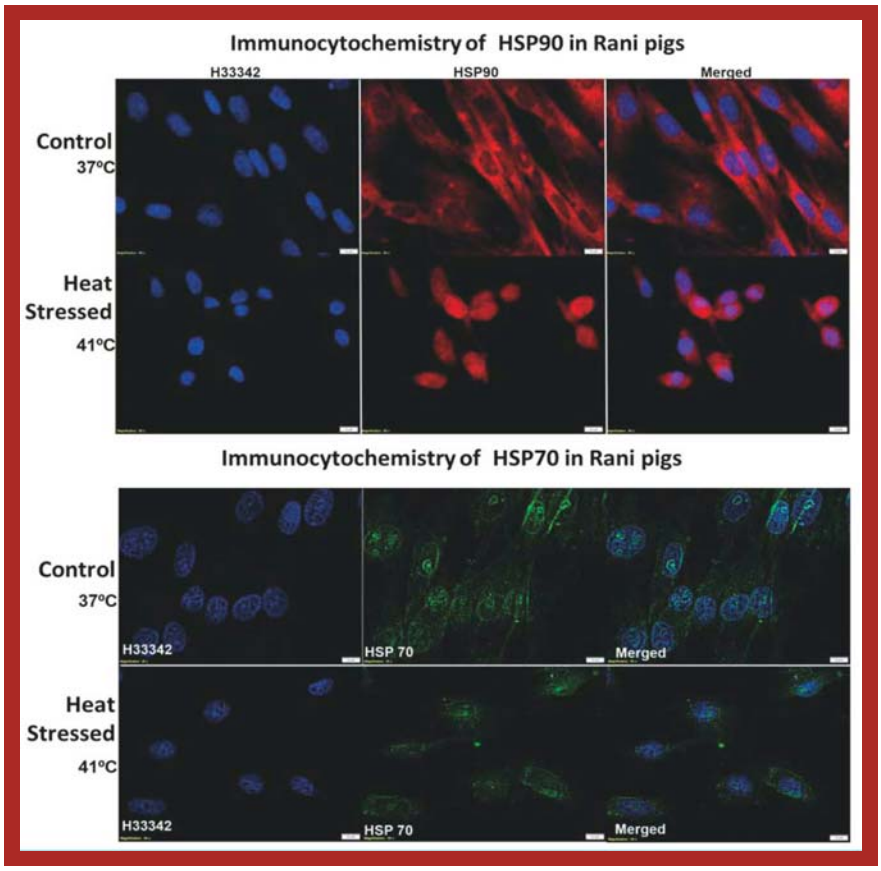


Expression trend of MCT2 genes with THI in Ghungroo pigs



Expression trend of MCT4 genes with THI in Ghungroo pigs

The relative changes in the copy number of HSP90 mRNA was significantly upregulated ($P<0.05$) in thigh muscle and colon tissue during both winter and summer season compared to that of thermo-neutral control season in Rani pig. With the increase in THI the relative mRNA expression of HSP70 was found to be increased in thigh muscle during summer season as compared to that of thermoneutral season. In colon tissue, expression was highest during summer THI and least during thermoneutral THI.



ICAR-National Fellow Project: Development of thermo-tolerant pig through biomarker assisted selection

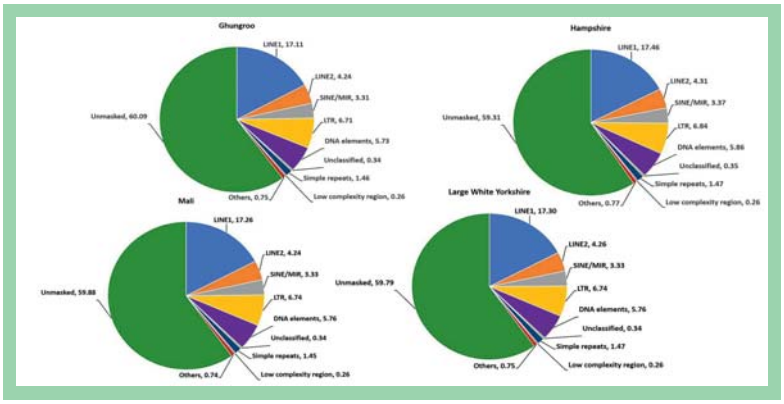
Mohan.N.H

Whole genome sequencing of pig genome: Whole genome of indigenous (Ghungroo and Mali) and exotic (Hampshire and Large White Yorkshire) was undertaken using Next Generation Sequencing and assembled upto chromosome level. The statistics of the genome assembly is shown in table

Table: Genome assembly statistics of different breeds of pigs

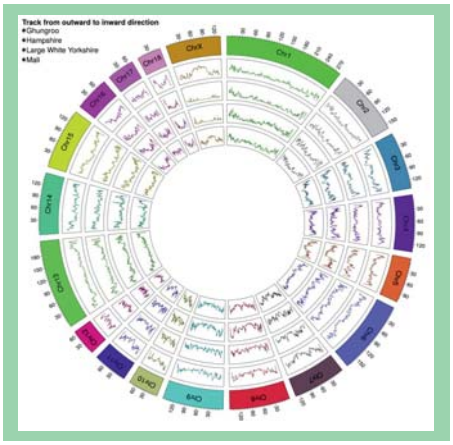
Genome assembly statistics	Ghungroo	Hampshire	Mali	LWY
Total sequence length(MB)	2552.09	2552.44	2576	2555.16
Total ungapped length (MB)	2430.73	2471.71	2466.86	2452.13
Gaps between scaffolds (bases)	360544	191404	264329	308577
Number of scaffolds	26224	15044	21979	19031
Scaffold N50	143.44	144.37	144.15	143.75
Scaffold L50	8	8	8	8
Number of contigs	334649	164045	228195	272093
Contig N50	12134	23314	16954	14848
Contig L50	56355	31718	42696	47658

On an average, the genome contained repetitive elements, with differences between various pig genomes. The repeated elements in genomes were identified as class I retrotransposons (long interspersed nuclear elements (LINEs), short interspersed nuclear elements (SINEs), and total long terminal repeat elements,)



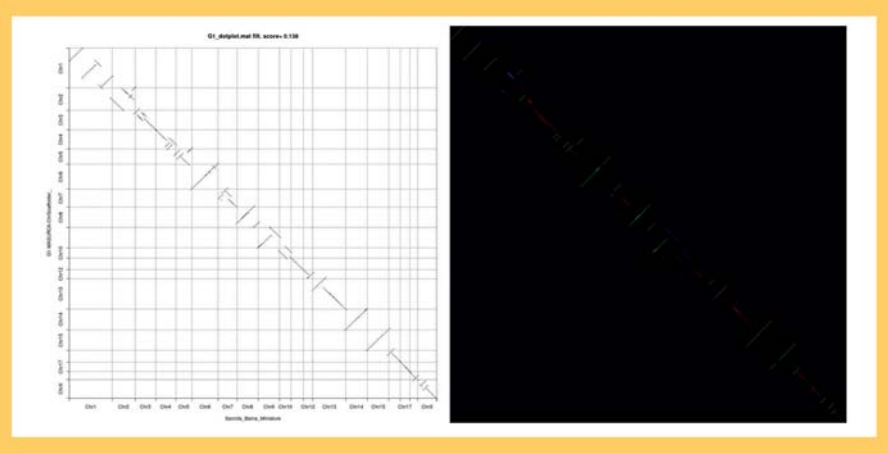
Distribution of repeat elements in Ghungroo, Mali, Hampshire and large white Yorkshire genomes as compared to reference genome *(Sscrofa* 11.1*)*

The processed raw data were aligned to *Sus Scrofa* 11.1 reference genome to identify variants. Various classes of variants were identified through a genome-level comparison of Ghungroo, Hampshire, Mali and LWY with the reference assembly Sscrofa11.1. Analysis revealed a total of 100864 Structural Variants in the genomes of four breeds, with 46687 deletions, 352 duplication, and 53825 insertions. Out of total deletions 25906 were present in the Ghungroo, 20132 in Hampshire, 19852 in LWY and 29749 in the Mali genome. A total of 129, 133, 121 and 164 gene duplications were present in Ghungroo, Hampshire, LWY and Mali genome, respectively. Similarly, out of total insertions, 26277 were present in the Ghungroo, 25404 in Hampshire, 22863 in LWY and 33117 in Mali genome. We identified a total of 150424 SNVs in protein coding regions of exons across the chromosomes some of them where unique to the breed.



Distribution of single nucleotide variants in four breeds of pigs

Pan-genome comparison: The assembled genomes were compared with various breeds of pigs and other species of domestic animals to develop synteny plots identifying conserved blocks across the chromosome. A representative figure of distribution of conserved blocks across the chromosome between Ghungroo and Bama miniature pig is shown.



Comparison of conserved elements across chromosome in Ghungroo and Bama miniature pig. Conserved blocks (red), inverted blocks (green) and transposed blocks (blue).

Genome-wide methylation in indigenous and exotic breeds of pigs: Genome methylation of indigenous (Ghungroo and Mali) and exotic (Hampshire and Large White Yorkshire) was undertaken through bisulphite conversion followed by Next Generation Sequencing for the first time. The sequencing generated methylation information at the average of 50X depth. The comparison with reference genome (sscrofa 11.1) with assembled genomes with the methylation data indicates that, on an average, the alignment was 99.96% and 99.88% with reference and assembled genomes, respectively indicating high quality of the genome assembly. The study revealed presence of about 29.2 million CpGs spread across 20 chromosomes and mitochondrial DNA in the porcine genome. The chromosome-wise differentially methylated, unmethylated and methylated regions were identified across the whole genome in all the breeds. The differential methylation analyses of indigenous vs exotic animals are in progress to identify genes differently methylated at promoter/gene regions and their functional ontology.

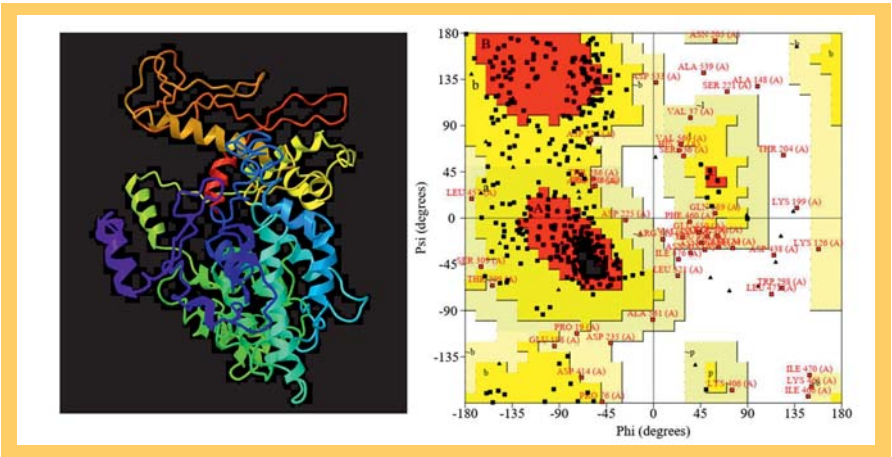
Table: Distribution of CpGs in different breeds of pigs

CPG levels (Million)	Ghungroo	Hampshire	Large white yorkshire	Mali
High	19.58	19.84	21.42	18.99
Medium	4.22	4.4	3.18	4.59
Low-Med	2.08	1.86	1.43	2.14
Low	3.37	3.13	3.26	3.57

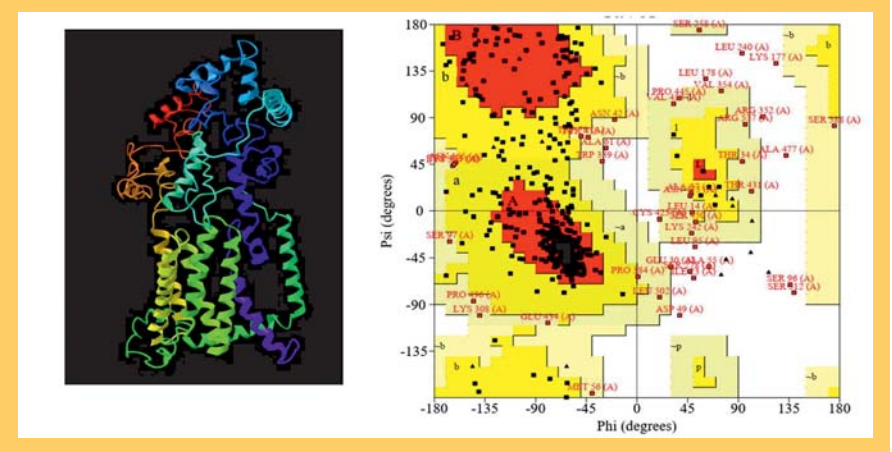
Institute Project: Design of recombinant multi-epitope protein(s) and their expression for assay development

Mohan.N.H., V.K. Gupta, Jaya, S.J. Devi

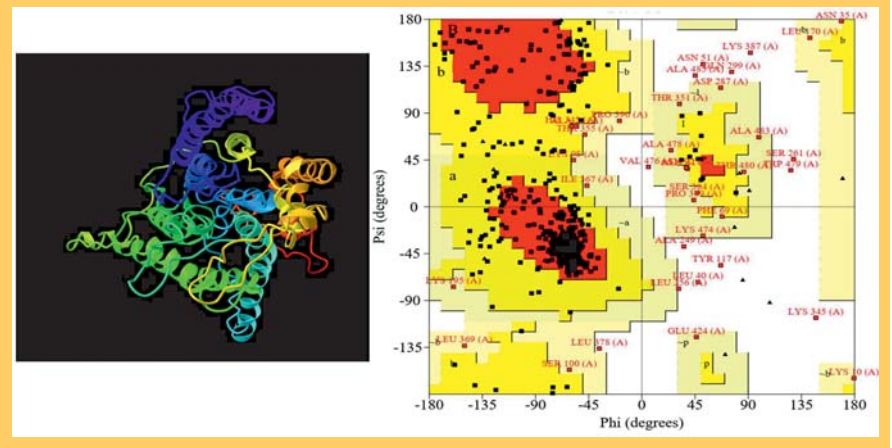
The project aimed to develop a multi-epitope protein(s) using in sillico immune-formatics, express the recombinant protein and assess immune potential for future applications in assay development. Considering contextual importance, proteins from African swine fever virus were identified from NCBI database, initially screened and epitopes were identified using online tools. After selecting epitopes, a draft model of protein was developed and the peptide structure was evaluated using Ramachandran plot.



Peptide 1 designed and evaluated using Ramachandran plot



Peptide 2 designed and evaluated using Ramachandran plot



Peptide 3 designed and evaluated using Ramachandran plot

Subsequently docking experiments were conducted using online tools to identify the binding energies with different SLAs, TLRs and MHCs

Table: Docking experiments of different peptides with other proteins

Peptide	Peptide 1		Peptide 2		Peptide 3	
Interacting Protein	Interacting points	Energy (kJ/Mol)	Interacting points	Energy (kJ/Mol)	Interacting points	Energy (kJ/Mol)
SLA-1	69	-1352.9	130	-1354.5	118	-1122.9
SLA-2	60	-1316.1	65	-1271.8	59	-1350.7
TLR-4	106	1346.2	45	-1622.9	64	-1526.9
TLR-8	48	-1936.3	41	-1877.2	67	-1830.9
TLR-9	56	-1495.7	73	1849.4	147	-1977.9
TLR-10	46	-1730.9	67	-1698	100	-1724.3
MHC-II-DR	133	-1096.4	100	-1238	127	-1252.5
MHC-II-DQ	67	-1634	161	-1397.6	79	-1686.6

External Funded: Development and promotion of Atmanirbhar pig production in tribal areas of NER states through need based and area specific customized scientific interventions in Goalpara District (Assam) and Dhalai District (Tripura) (DBT BioTech Kisan)

B. C. Das, P.J. Das, S.R. Pegu, S. Paul, K. De, R. Deb, S. Kumar, Jaya, N.M. Attupuram, S.J. Devi

The project aims to provide technology backstopping for enhanced pork production, employment generation and poverty reduction among socially and economically weaker sections, mostly tribal populations through the medium of pig husbandry. The project is implemented in Karbi Anglong District, Assam and Dhalai District, Tripura covering eight villages. The project focuses on creating awareness for Atmanirbhar pig husbandry and pork production value chain towards strengthening rural livelihood and improvement of socio-economic status, scientific intervention for scaling up / hygienic pork production; genetic improvement through supply of improved germplasm/ piglets and artificial insemination and improvement through promotion of low cost, climate resilient housing, scientific feeding inputs and training of stakeholders/ farmers and organizing, among others. A five days residential training programme on "Capacity building of farmers through scientific pig farming and pork processing for livelihood security" was conducted from 18-22 December, 2023 at ICAR-NRC on Pig, Rani on different activities.

Institute Project: Investigation of Notch Signaling in Regulation of Ovarian Function in Pigs

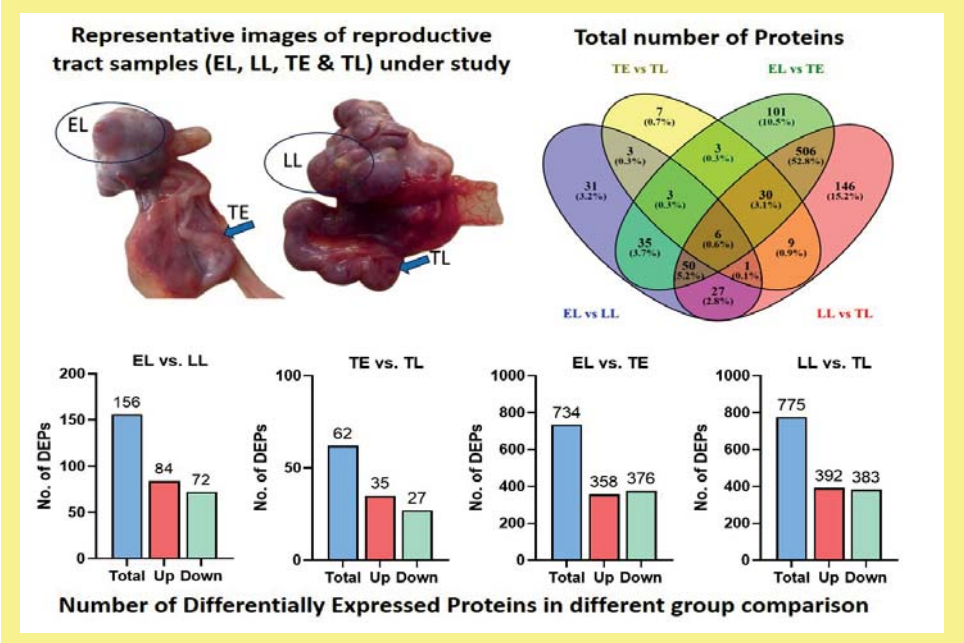
Jaya, Satish Kumar, Mohan N.H. and B.C. Das

Proteome profiling of corpus luteum and uterine tube in association with acquisition of luteolytic sensitivity in cycling pigs: Physiological intricacies of corpus luteum and uterine tube are critical determinants of optimal progesterone output, successful conception, positive gestation outcome and greater litter size in pigs. With

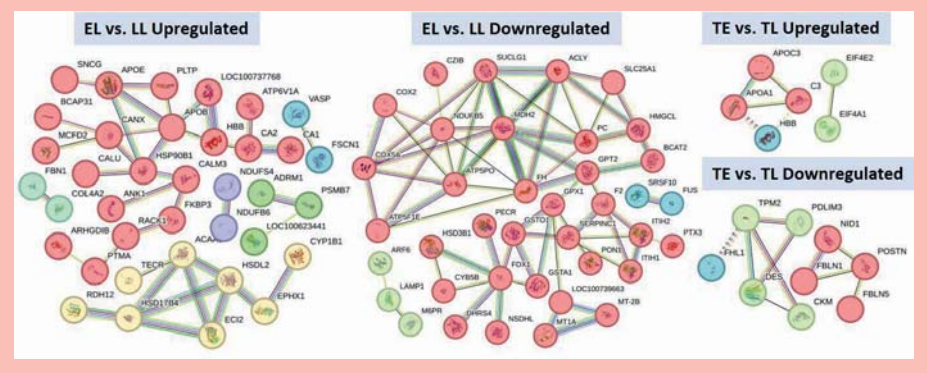
this background, investigations on the global change in proteome dynamics in corpus luteum and uterine tube during the early and late luteal phase of estrous cycle were undertaken to unravel the associated signaling pathways during physiological transition associated with acquisition of luteolytic sensitivity in pigs. The whole reproductive tract samples from gilts of 8 ± 1 months with approximate body weight of 60 ± 5 kg, were collected and graded for stage of estrous cycle viz. early, mid, late and regressed. The corpus luteum tissue from early luteal stage (EL; n= 3) and from late luteal stage (LL; n=3) along with the uterine tube tissue from early luteal stage (TE; n=3) and late luteal stage (TL; n=3) were carefully dissected, snap frozen in liquid nitrogen and stored at -80º C. Sample were processed for proteomics study and subjected to 6-plex tandem mass tag (TMT) labelling for quantitative comparison of proteomes between the study groups according to the standard protocol. The study yielded total number of PSMs = 3,75,677, peptides = 23,879 and proteins = 4260. The sample data were analyzed to obtain differentially expressed proteins (DEPs) with threshold fold change > 1.5 = Upregulated and fold change < 0.67 = Downregulated, with P-value ≤ 0.05). There were in 156 DEPs (84 upregulated and 72 downregulated) in EL vs. LL, 62 DEPs (35 upregulated and 27 downregulated) in TE vs. TL, 734 DEPs (358 upregulated and 376 downregulated) in EL vs. TE and 775 DEPs (392 upregulated and 383 downregulated) in LL vs. TL comparison groups. These DEPs formed well connected protein-protein interaction networks and were mainly associated with biological process of lipid and steroid metabolic process, cholesterol transport, small molecule biosynthetic process, regulation of hemostasis, and the pathways regulating peroxisomal protein import, scavenging by class A receptors, chylomicron remodeling, regulation of insulin-like growth factor transport, TCA cycle and PPAR signaling. This study indicates that acquisition of luteolytic activity is dynamically orchestrated event in corpus luteum, which also regulates the proteomic characteristics of the oviduct in pigs.

Transcriptomic profile of porcine granulosa cells during thermal challenge reveals role of immunogenic pathways and novel genes in cellular acclimation: Investigations on heat stress induced transcriptomic changes is critical to characterization of candidate genes for thermal adaptability in livestock. Continues spells of high ambient temperature due to climate change has amplified reproductive dysfunctions, which needs immediate attention. The aim of this experiment was to study the transcriptomic signature of heat stressed granulosa cells and signaling pathways regulating their adaptability to thermal challenge. The primary cell culture system of porcine granulosa cells isolated from small ovarian follicles was established, which was subjected to in vitro heat stress challenge at 42^{o}C for 6 hours. RNA sequencing was conducted for heat stressed (treated) and non-heat stressed (control) groups using Illumina NextSeq2000 sequencing platform. The significant DEGs were selected using NOISeq R package with cut-offs, probability value ≥ 0.95 and absolute log2(fold change) ≥1. Bioinformatics analysis of DEGs were conducted to explore functional annotations

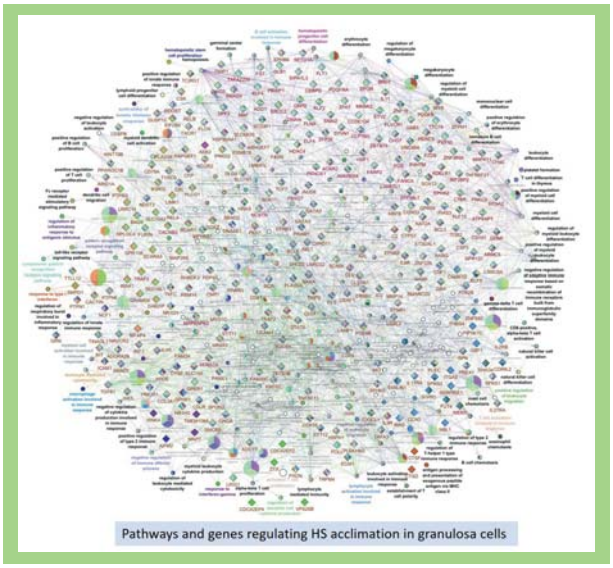
enrichment, protein-protein interaction network and hub genes regulating the cellular homeostasis and survivability during heat stress challenge. The analysis pipeline yielded a total of 12156 protein coding transcripts, which were expressed during heat stress challenge in granulosa cells, out of which 4904 were differentially (prob. ≥ 0.95) expressed; 2936 were upregulated and 1968 were downregulated. The large number of DEGs and gene ontologies in the study specifies the concerted mechanisms involving multiple genes, biological process and signaling pathways operating in the cell to maintain cellular homeostasis. The immune system process and signaling were also the key elements in granulosa cell stress, regulating multiple pathways and expression of transcription factors. The study observed high fold change and significance level in genes ENSSSCG00000061267 and ENSSSCG00000029160 which were upregulated and gene ENSSSCG00000009221 which was downregulated, and these can be regarded as novel candidate genes for stress adaptation in pigs.



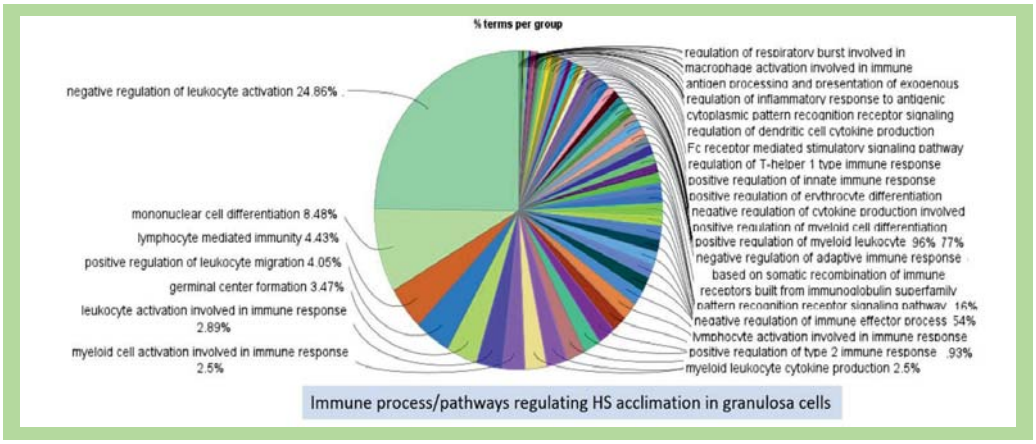
Number of differentially expressed proteins in reproductive tract samples



Protein-protein-interaction network diagram for the different groups



Interaction network pathway and genes regulating heat stress response in granulosa cells



Proportion of immune response process and pathways during heat stress in granulosa cells

Animal Health

External Funded: Establishment of a Consortium for One Health to address Zoonotic and Transboundary Diseases in India, including the Northeast Region (DBT)

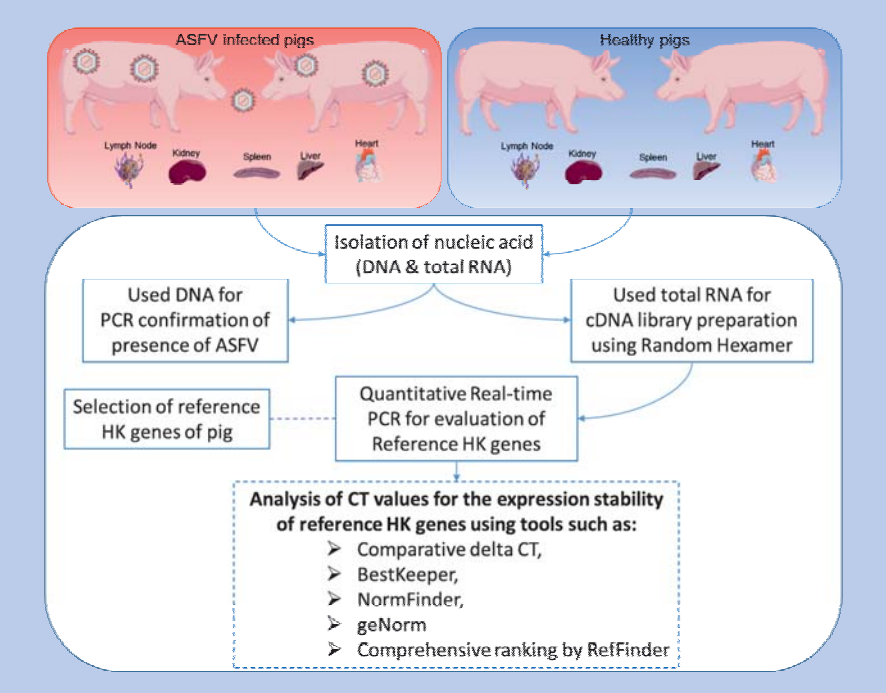
S. Rajkhowa, S. R. Pegu, J. Doley, S. Paul, R. Deb and V. K. Gupta

Investigation of African swine fever (ASF) outbreak cases from Assam: African swine fever (ASF) and Porcine Reproductive and Respiratory syndrome (PRRS) and are economically important diseases of pigs throughout the world. Although mixed infection of viral diseases is common and mixed infection of ASF with other important viral diseases have been reported from some pig producing countries of the world, no such reports are available from India. During an outbreak, all age groups of animals except piglets < one month of age were affected with symptoms of high fever, cutaneous haemorrhages, vomition with blood, diarrhoea,

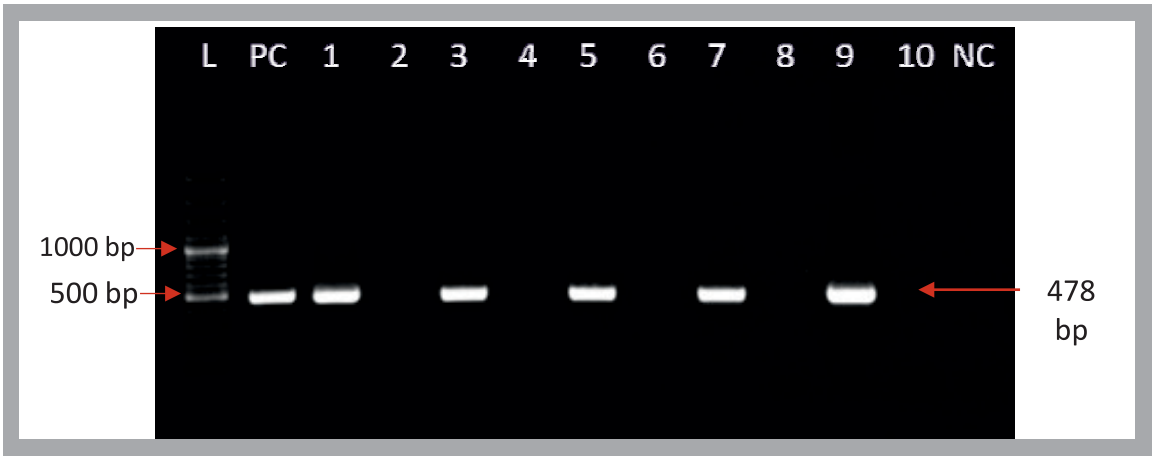
poor appetite, ataxia and death. The outbreak was confirmed by detection of N gene of PRRSV and VP72 gene of ASFV by PCR in representative blood samples from affected pigs followed by Sanger sequencing. Mixed infection was also confirmed by simultaneous detection of both the viruses using multiplex PCR. Phylogenetic analysis of both the viruses revealed that the outbreak was related to ASFV and PRRSV strains from China which were also closely related to the PRRSV and ASFV strains from recent outbreak from India. The study confirmed the involvement of Genotype II of ASFV and Genotype 2 of PRRSV in the present outbreak. Interestingly, PRRSV associated with the present outbreak was characterized as highly pathogenic PRRSV. Therefore, the present study indicates the possibility of future waves or further outbreaks of these diseases (PRRS and ASF) in this region. This is the first report of ASFV and PRRSV co-infection in pigs from India.

Assessment of reference genes for qRT-PCR normalization to elucidate host response to African swine fever infection: Transboundary diseases are responsible for huge economic losses to the livestock producers throughout the world. African swine fever (ASF) is one such economically important disease of pigs which are currently posing threat to the Indian pig sector. This disease has recently been reported from India (with recent introduction of ASF to India in 2020) and is responsible for enormous economic losses to the pig producers. The present study for the first time addresses the selection and validation of stable housekeeping genes through qPCR method in porcine tissues collected from naturally occurring ASFV outbreaks. These suitable reference genes can also be used as reference housekeeping genes for normalization of q-PCR in ASF infected pigs.

Viral infection disrupts the normal regulation of the host gene's expression. In order to normalise the expression of dysregulated host genes upon virus infection, analysis of stable reference housekeeping genes using quantitative real-time-PCR (qRT-PCR) is necessary. In the present study, healthy and African swine fever virus (ASFV) infected porcine tissues were assessed for the expression stability of five widely used housekeeping genes (HPRT1, B2M, 18S rRNA, PGK1 and H3F3A) as reference genes using standard algorithm. Total RNA from each tissue sample (lymph node, spleen, kidney, heart and liver) from healthy and ASFV-infected pigs was extracted and subsequently cDNA was synthesized, and subjected to qRT-PCR. Stability analysis of reference genes expression was performed using the Comparative delta CT, geNorm, BestKeeper and NormFinder algorithm available at RefFinder for the different groups. Direct Cycle threshold (CT) values of samples were used as an input for the web-based tool RefFinder. HPRT1 in spleen, 18S rRNA in liver and kidney and H3F3A in heart and lymph nodes were found to be stable in the individual healthy tissue group (group A). The majority of the ASFV-infected organs (liver, kidney, heart, lymph node) exhibited H3F3A as stable reference gene with the exception of the ASFV-infected spleen, where HPRT1 was found to be the stable gene (group B). HPRT1 was found to be stable in all combinations of all CT values of both healthy and ASFV-infected porcine tissues (group C). Of five different reference genes investigated for their stability in qPCR analysis, the present study revealed that the 18S rRNA, H3F3A and HPRT1 genes were optimal reference genes in healthy and ASFV-infected different porcine tissue samples. The study revealed the stable reference genes found in healthy as well as ASF-infected pigs and these reference genes identified through this study will form the baseline data which will be very useful in future investigations on gene expression in ASFV-infected pigs.



Schematic representation of methodology used for selection of suitable and stable housekeeping reference genes from different porcine tissues



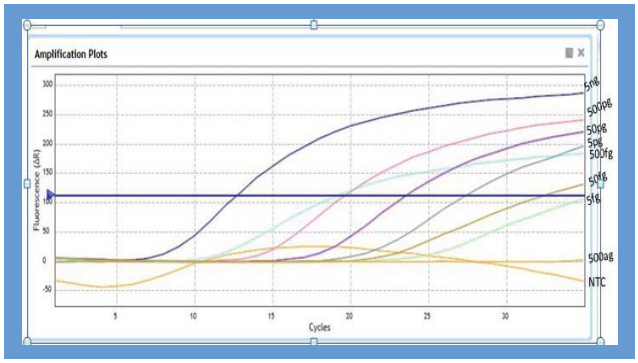
Confirmation of ASFV infection in porcine tissues. Agarose gel electrophoresis shows a specific PCR amplified product (478 bp size) in each ASFV infected porcine tissue and positive control sample. In healthy tissue samples, no ASFV amplicon was found. Here, L: 100 bp Plus DNA marker, PC: Positive control, Sample 1: infected liver tissue, Sample 2: healthy liver tissue, Sample 3: infected kidney tissue, Sample 4: healthy kidney tissue, Sample 5: infected heart tissue, Sample 6: healthy heart tissue, Sample 7: infected spleen tissue, Sample 8: healthy spleen tissue, Sample 9: infected lymph node tissue, Sample 10: healthy lymph node tissue and NC: negative control

External Funded: SWINOSTICS - A platform for development and validation of on-field diagnostics of important pig pathogens in NE Region of India for commercial exploration (DBT)

Seema Rani Pegu, S. Rajkhowa, Rajib Deb, P.J. Das and V.K. Gupta

The following diagnostic assays have been developed under the project.

qPCR assay for detection of Classical Swine Fever Virus: Developed assay can be able to detect the CSF viral load in clinical samples within 30 minutes (post nucleic acid extraction).Disclosed herein are the primers and probe sequences specific for detection of CSFV in clinical samples comprising of a) forward primer (Seq 1), b) reverse primer (Seq 2), c) probe sequence (Seq 3) comprising bases labelled with XX (at 5' end) &YY (at 3' end). Further, the disclosed is a process for quantitative detection of CSFV copy number in clinical samples within 30 minutes using the seq 1-3. The assay is specific for CSFV without any cross reactivity with other swine viral pathogens. The detection limits of the assay was 50 fg copies of standard plasmid DNA containing CSFV specific gene.

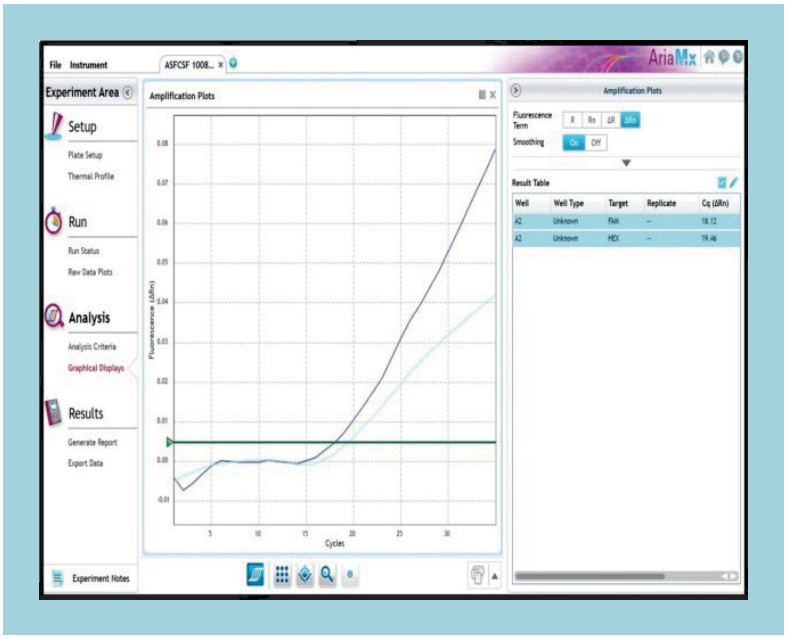


qRT-PCR based diagnosis of Classical Swine fever virus (CSFV) in the field samples of pigs with different Ct values indicates the viral load in samples and analytical sensitivity of hydrolysis probe based qRT-PCR for detecting CSFV

qPCRTP assay for detection of Porcine Reproductive and Respiratory Syndrome virus: Developed assay can be able to detect the PRRS viral load in clinical samples within 30 minutes (post nucleic acid extraction). Disclosed herein are the primers and probe sequences specific for detection of PRRSV in clinical samples comprising of a) forward primer (Seq 1), b) reverse primer (Seq 2), c) probe sequence (Seq 3) comprising bases labelled with XX (at 5' end) & YY (at 3' end). Further, the disclosed is a process for quantitative detection of PRRSV copy number in clinical samples within 30 minutes using the seq 1-3. The assay is specific for PRRSV without any cross reactivity with other swine viral pathogens. The detection limit of the assay was 5fg copies of standard plasmid DNA containing PRRSV specific gene.

qPCRTP assay for detection of African Swine Fever Virus: Due to its extremely high fatality rate, African swine fever (ASF), which is regarded as the most terrifying swine disease, first appeared in India in 2020. Hence, development of indigenous rapid and reliable diagnostics is always demanding in the present scenario. Here we developed an in-house built reliable, sensitive and specific quantitative assay for detection of ASV in clinical specimens. Developed assay can be able to detect the ASF viral load in clinical

samples within 30 minutes (post nucleic acid extraction). Disclosed herein are the primers and probe sequences specific for detection of African swine fever virus (ASFV) in clinical samples comprising of a) forward primer (Seq 1), b) reverse primer (Seq 2), c) probe sequence (Seq 3) comprising 23 bases labeled with ROXTM (at 5' end) & BHQTM (at 3' end). Further, the disclosed is a process for quantitative detection of ASFV copy number in clinical samples within 30 minutes using the seq 1-3. The assay is specific for ASFV without any cross reactivity with other swine viral pathogens. The assay was found to detect as low as 5 fg of ASF viral DNA.



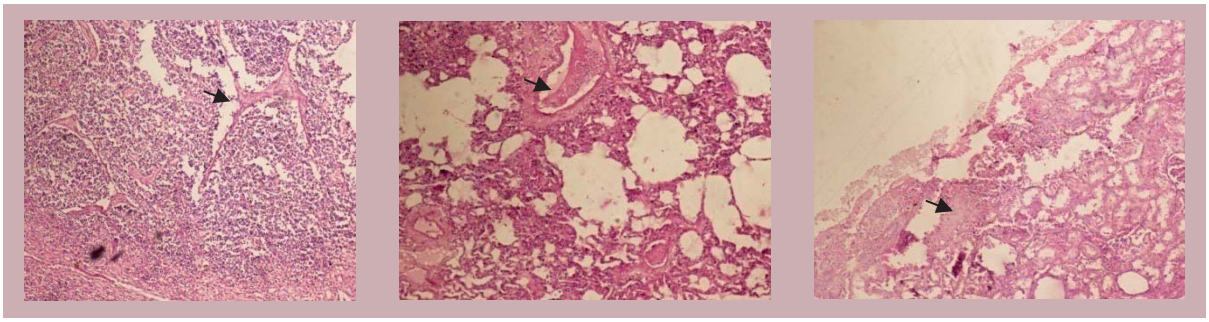
Duplex qPCRTP assay for detection of African Swine Fever Virus and Classical Swine Fever Virus in the field samples of pigs with different Ct values indicates the viral load in samples.

Service project: Surveillance and Monitoring of Swine Diseases in NER

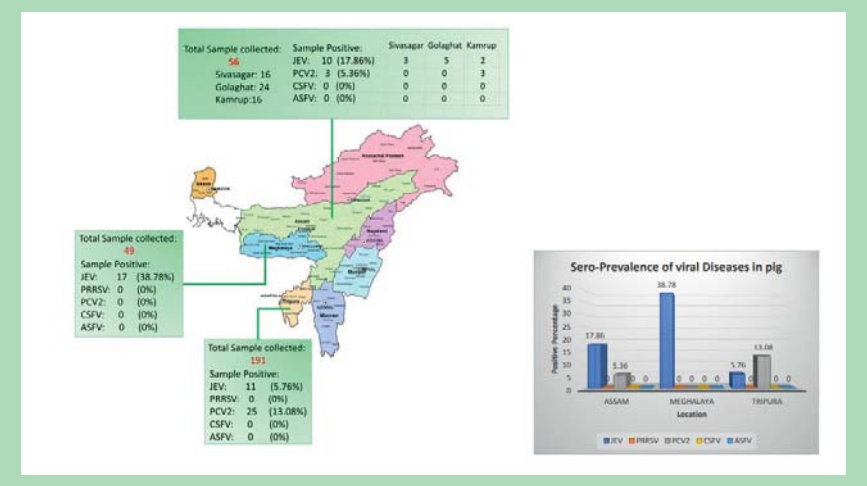
Seema R. Pegu, Souvik Paul, Rajib Deb, Juwar Doley and Swaraj Rajkhowa

A total 296 nos. of pig sera samples were collected/received from five districts of Assam viz. Sivsagar, Golaghat, Kamrup district Assam and two other NE sates– Meghalaya, and Tripura. 38 samples (12.83%) were positive for JEV and 29 samples (9.79%) positive for PCV2. In addition, a total of 207 nos. of whole blood samples and 80 nos. of tissue samples were analyzed by PCR and LFA for the presence of CSFV, ASFV, PCV2, JEV and PRRSV. 30 samples (4.81%) were positive for ASFV,7samples (2.40) positive for JEV,6 samples (8.59%) positive for PCV2 and 10 samples (8.24%) were positive for JEV, and CSFV were found positive in 1samples (6.87%). Pathological examination was conducted in dead pigs during the reported period. Gross and Histopathological examination was carried out for tentative diagnosis of the disease suspected. The typical pathological observations recorded in six animals suspected for ASF were oozing of blood form anal and nasal orifices, hemorrhagic spots less hairy parts like on the snout,

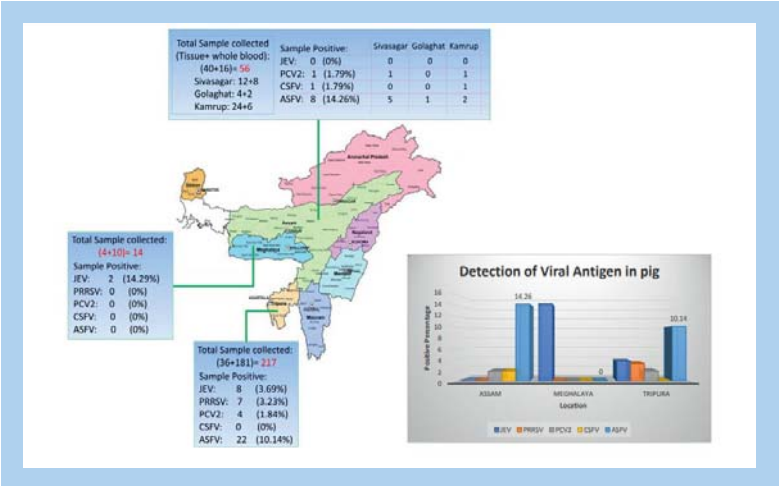
surrounding the eyelids, ears and lower abdomen, Gross pathological examination revealed haemorrhage in the kidney, lymphnode, heart, liver with pulmonary edema and spleenomegaly. Histopathological examination revealed the depletion of lymphocyte in the lymphoid organs, hemorrhages in multi organs.



Histopathological lesions in pigs died of ASF, a: Lymphoid depletion in the lymphnode(arrow), b: Edematous fluid accumulation in the bronchiols with intersitial pneumonia, c: Haemorrhage in the cortical area of kidney with tubular necrosis.



Screening of serum samples for detection of specific viral antibodies by ELISA



Screening of blood and tissue samples for screening of viral antigen by PCR and LFA

Institute Project: Epidemiology of Intestinal protozoan parasitic diseases of Pigs, with special reference to Cryptosporidium and Coccidia

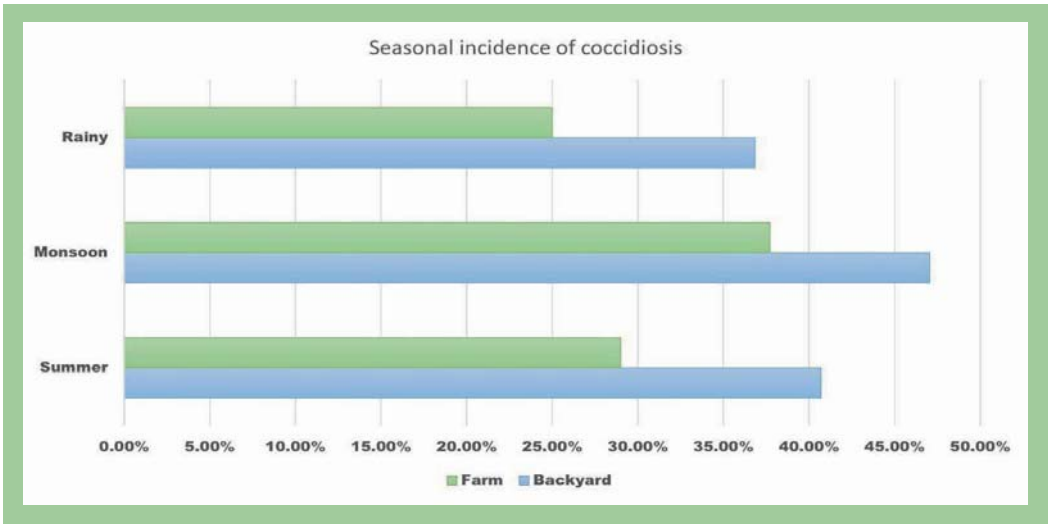
Souvik Paul, S. Rajkhowa, S.R. Pegu, J. Doley, K. De, R. Deb, S. Banik (Aug. 2023)

Coccidiosis in pigs: Coccidiosis is a gastrointestinal parasitic infection caused by various members of phylum Apicomplexa, which includes Eimeria spp, Cystoisospora spp., Cryptosporidium spp., Sarcocystis spp., Tyzzeria spp. Coccidiosis is one of the most common causes of diarrhoea in piglets, the intensity and duration of symptoms varies according to the initial infective load, immune and stress status of the animal, age of the animals and environmental condition like temperature and humidity. Coccidiosis is more common in the suckling piglets but occasionally growers, finishers and boars are also affected when they are introduced into endemically infected areas or heavily infected pens. Diarrhoea in young pigs that doesn't respond to antibiotic therapy is generally suggestive of coccidiosis. 13 Eimeria species have been reported from domesticated pigs so far (Sus scrofa domesticus). Although most Eimeria spp. infections are asymptomatic, diarrhoea, weight loss, and even death have been reported in weaned piglets. Although Eimeria spp. are not severely pathogenic, C. suis (syn. Isospora suis) is pathogenic and has huge impact on health of suckling piglets. Cystoisosporiasis is now considered as one of the most common causes of diarrhoea in neonatal piglets, with high prevalence rates all over the world.

Yearly incidence of Coccidiosis: Total 184 samples were collected from backyard piggery (80) and semi-intensive piggery units (104) under various villages (Garopara, Umsur, Nongpo, Ganapati village, garo village, Rajapanichanda, Kumarbari, Sattargaon, Loharghat etc). Seasonal distribution of data showed that highest incidence of porcine coccidiosis was during rainy season (41.7%). Followed by summer (34.48%) and winter (29.78%), which is as per the epidemiological pattern of coccidial disease, because in general hot and humid climate aids to the spread and development of intestinal protozoan diseases. In addition, the incidence of infection during monsoon was higher in weaners. This trend continued and in summer and winter also the incidence of infection was higher in weaners. Such finding corroborates our assumption that the aged animals are the source of infection and the disease could easily be prevented if the young animals are separated early from the aged and moved into a sanitized shelter.

Table: Details of Total samples collected

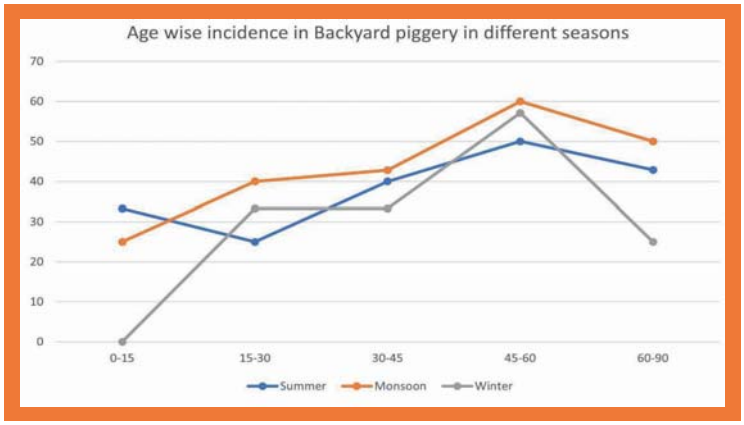
Tot al	Summer	Monsoon	Winter	Tot al
Samples collected	58	79	47	184
Samples Positive	20	33	14	67
Incidence	34.48 %	41.7 %	29.78%	36.41%



Seasonal incidence of Porcine coccidiosis

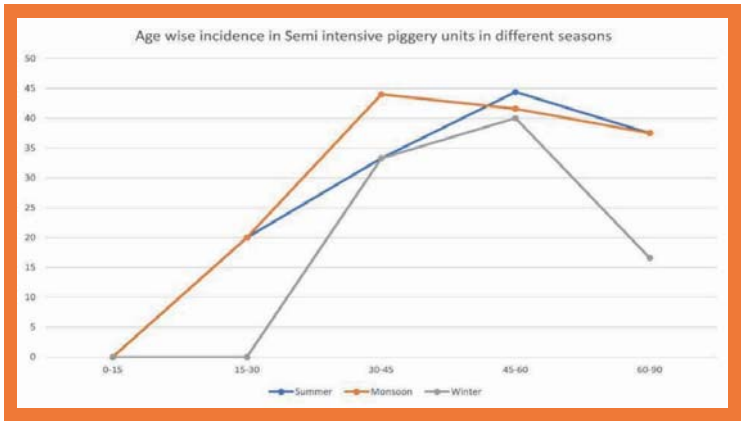
Seasonal dynamics of incidence among the backyard and semi-intensive units revealed that the incidence among the backyard piggery units were much higher than the semi-intensive units. The obvious reasons for this being the 'kutcha' (muddy floor) in backyard units which retains the infection for longer time, thus providing a niche of the infection to pass on to new animals. Additionally, as the backyard units typically houses 1-7 pigs in a closed space therefore chances of animal-to-animal transmission of infection is more. The general hygiene standards in backyard systems are also minimal. But, one thing that was typical was the highest incidence of coccidiosis during the monsoon months. The incidence of infection in summer was comparatively high in the backyard systems during winter and summer months. Reasonably higher infection in winter months suggests that the phenomena of 'winter coccidiosis' which is generally seen in ruminants may also be existent in pig production systems.

Dynamics of coccidiosis in backyard and semi intensive piggery units: Seasonal and age wise distribution of data presented a clear picture of coccidian dynamics in backyard piggery units. Piglets gets infected early in life and as usual the incidence were higher in monsoon and summer season. Therefore, the initial infection occurs during 0-15 days of age, thereafter, in next two weeks of life incidence remains stationery without any visible rise or symptoms as during this period the infection is mostly due to to various Eimeria spp. which are not that overtly pathogenic in case of pig. During initial phase the infection is mostly by *Cystoisopora suis.* Then sharp rise in incidence occurs during 45-60 days of life, this is the crucial period of porcine coccidiosis. Actually, this is the point there is weaning stress as well as infection with Cryptosporidium spp. And its infection along with weaning stress act complementarily to worsens the body weight gain. Thereafter, as the age of the piglet progresses then there is sharp decline in the incidence of coccidiosis, which may be due to development of species specific pre immunity against the disease.



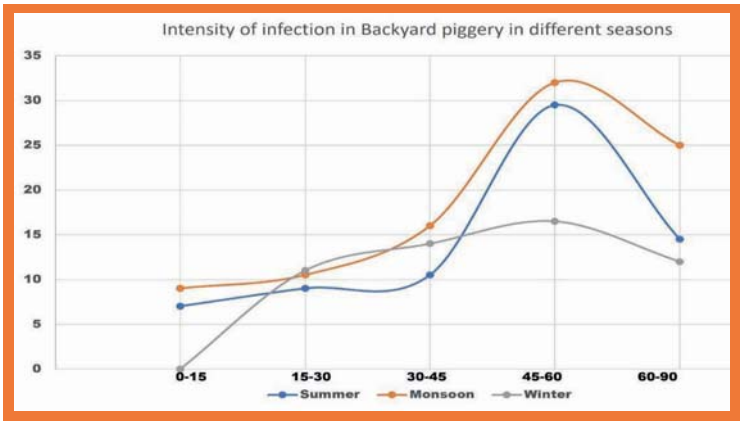
Age wise incidence in Backyard piggery in different seasons

Seasonal and age wise distribution of data from semi-intensive piggery units indicated piglets gets infected a bit later in life (4 weeks +) as compared with backyard units and as usual the incidence was higher in monsoon and summer season. Therefore, the initial infection occurs when the piglet is about 3-4 weeks in age, thereafter, in next two weeks of life incidence remains stationery without any visible rise or symptoms as during this period the infection is mostly due to various Eimeria spp. Then sharp rise in incidence occurs during 45-60 days of life, esp. in winter and monsoon months. But, in this case in was seen that the spike in infection in transition form 15-30 days and 30-45 days age group during summer season were almost same. Then beyond 60 days of age there was a sharp decline in the incidence of coccidiosis as seen in backyard piggery units

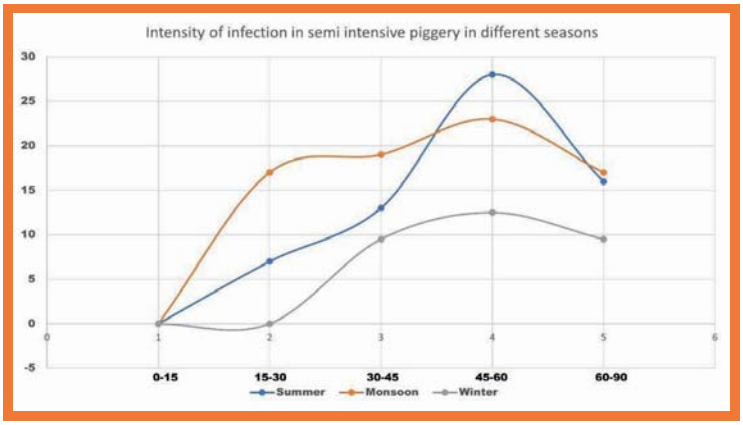


Age wise incidence in Semi intensive piggery units in different seasons

Intensity of infection in Backyard and semi intensive piggery units: Quantitative eggs per gram (epg) in faeces among backyard piggeries revealed that along with increased incidence the major spike in intensity of infection occurs during 1 month to 2 months of age and thereafter sharply declines at 3 month of age. Combination of different species of Eimeria spp. and Cryptosporidium spp. and weaning stress might be responsible for such spike. The difference of epg values during summer and monsoon were comparable, whereas considerable difference in intensity of infection during winter season was clearly evident. Whereas eggs per gram (epg) in faeces among semi-intensive piggeries showed similar trends but the spikes were less peaked, i.e., epg values were lesser than that of backyard piggery counterparts.

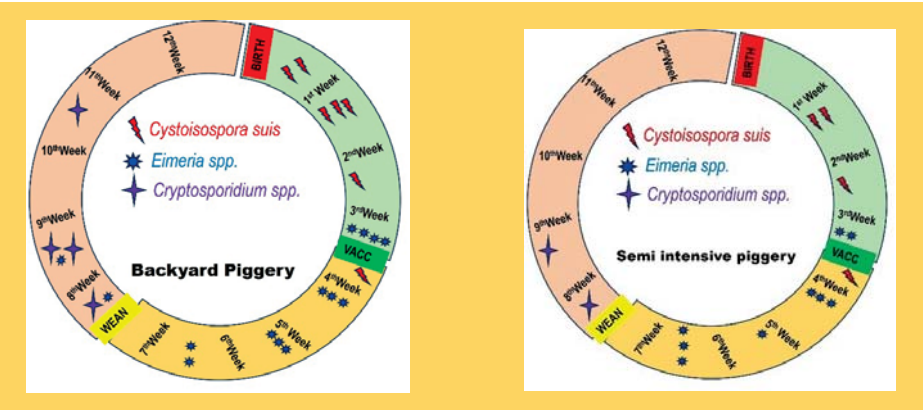


Intensity of infection in Backyard piggery in different seasons



Intensity of infection in semi intensive piggery in different seasons

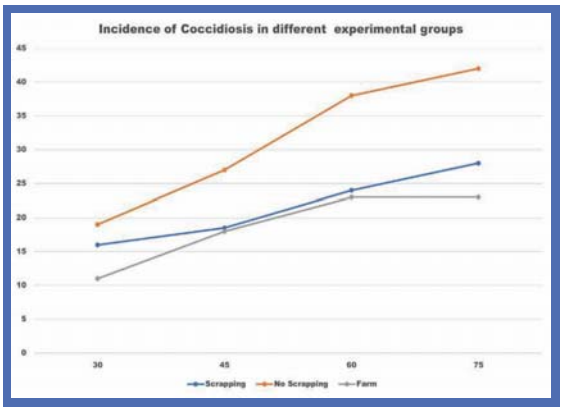
Infection dynamics of coccidiosis in herd: Few reference samples were processed for sporulation and speciation studies. Among the 9 cases in which *C. suis* was found, in 4 cases it was in piglets below 10 days of age of age, which corroborates the fact that *C. suis* is a primary entero-pathogen. And as the maternal antibodies provides some degree of protection to piglets during first few weeks of life therefore infection with bacteria or viruses are not so common during that period of time. Secondary infection later with bacteria or virus alters the course of disease and cause greater mortality. And *C. suis* oocysts were not found in animals beyond one month of age, which might coincide with establishment of pre-immunity against the parasite. In case of Eimeria species always a mixed infection with different species were observed. Although in cases where the intensity of diarrhoea was greater more number of oocysts of *E. debliecki, E. scabra,* and *E. spinosa* were found. But, in spite of these findings it is difficult to say whether the diarrhoea was solely due to eimerian infection. Eimerian infections were detected as early as 25-27th days in case of piglets and continued upto 75-80 days in few cases. In post-weaned piglets infection with Eimeria spp. and Cryptosporidium were increasingly found which indicates that weaning stress is a major factor in coccidian disease dynamics.



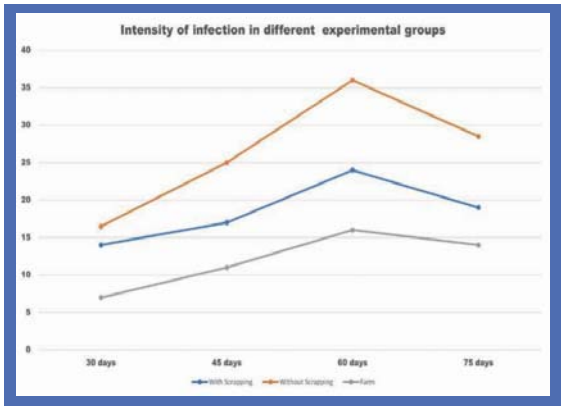
Infection dynamics of coccidiosis Backyard and semi intensive piggery units

Non- chemical control of Coccidiosis: Backyard piggery constitute the backbone in rural tribal ecosystem in the region. In backyard piggery the animals are reared in subsistence derived system, fed mainly with local feed resources along with kitchen/hotel wastes. Anti-protozoals for veterinary use in market are expensive, so farmers are reluctant to use. And especially in this post African swine fever period most of the backyard pig farmers are reluctant to invest so much in medicine. As we know that the coccidian parasites have direct life cycle and are transmitted through faeco-oral route. The muddy floor of piggery serves as main source of infection, doesn't matter how much it is cleaned. Therefore, if the source of infection could be checked and limited then the infection could be controlled even without any medical intervention. So a model experiment was set up, wherein backyard pig farmer's were advised to change the top soil layer of their backyard piggery every three weeks, and to replace it with fresh soil. Before introduction of pregnant sow or weaned pigs this must be done. Several backyard units at different locations were taken into consideration for sample collection, to see whether any effect on coccidial load existed. Total number of animals under the experiment were 74, of which 43 animals were from the units were regular top soil scrapping and replacement were done and 21 animals were from the units where it was not practiced. These data were compared to that of Farm data to conclusive findings. During 4 months of the study (July-Oct) 47% reduction of overall incidence was recorded among units practicing regular top soil scrapping and replacement. There was considerable reduction in quantitative coccidial load too.

As evident by the graphical representation in figure7, the incidence was almost similar in all the experimental groups but, there was steady increase in incidence in the units where regular top soil scrapping and replacement was not practice. Whereas, the incidence curve was flattened in case of units where regular top soil scrapping and replacement was practiced. The incidence rate during transition from 45-60 days, which was crucial because we have seen that the incidence remain highest at that point and there is also 'weaning' factor present at that time. It was seen that regular top soil replacement drastically reduced the incidence during this period and the incidence rate was almost comparable with that of intensive farm where stringent biosecurity measures are undertaken.



Incidence of Coccidiosis in different experimental groups

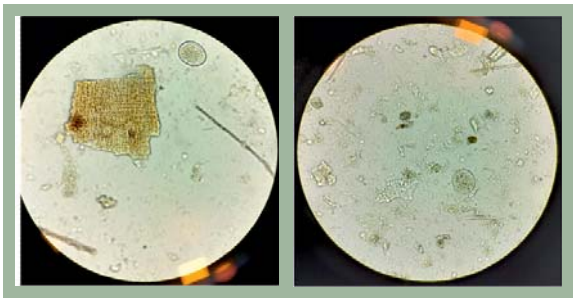


Intensity of infection in different experimental groups

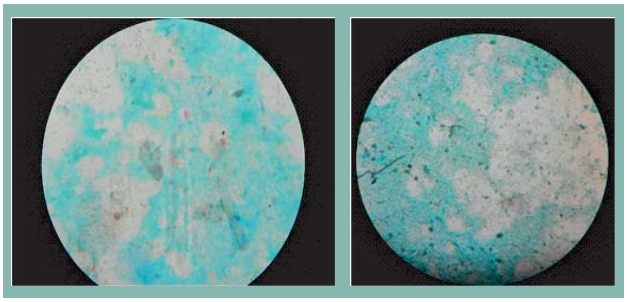
Along with reduced incidence the EPG level was also minimized by regular top soil scrapping and replacement (fig. 8), there was considerable reduction in EPG level as the infective load in the immediate microenvironment was reduced. The experimental data strongly suggested that this technique may be employed in backyard piggery system to minimize the incidence of coccidiosis. This technique may also be employed as a non-chemical control method in organic piggeries.

Before Soil replacement

After top soil replacement



Coccidian oocysts under Microscope



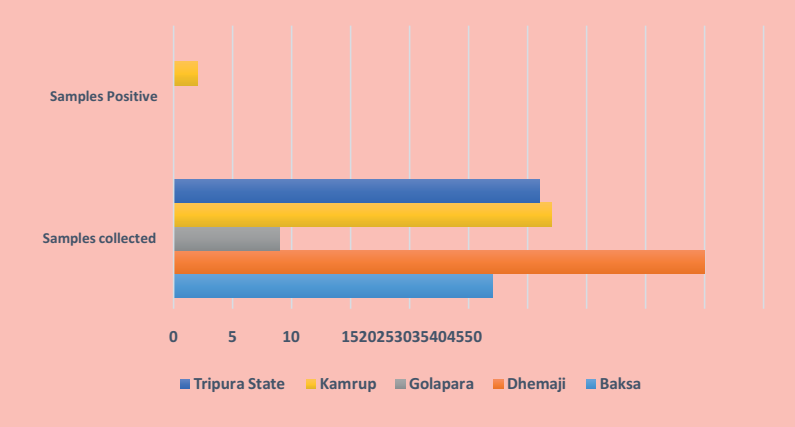
Cryptosporidium oocysts under Microscope

Effective control of Parasitic diseases under farm / semi-intensive conditions: Another experiment was set up wherein it was suggested that the sows should be treated with a suitable anthelmintic 5-7 days before transferring them to farrowing pen. Before transferring them to farrowing pen the sows should be thoroughly scrubbed and cleaned. The farrowing pen should be cleaned with steam or hot water before transferring the sows. young pigs should be treated before introduction to the herd or before transfer to finisher shed and then again treated 8 weeks later. Breeding boars should be treated every 3-6 months. Washing the boars before breeding also reduce the chances of infection. Young pigs after weaning should be transferred to pens which have been sanitized with steam or with hot water and caustic soda. These procedures were to reduce the incidence of ascariosis in the herd and at the same time to minimize the chemical footprint of anthelmintics. Initial results suggested that by following this regime pigs could be kept relatively Ascaris free under semi-intensive conditions using just 2-3 doses of anthelmintics, instead of using bimonthly dosage which is generally practiced by the semi intensive farms.

Institute Project: Epidemiology and Molecular Epidemiology of African Swine Fever Virus (ASFV) in North Eastern region of India

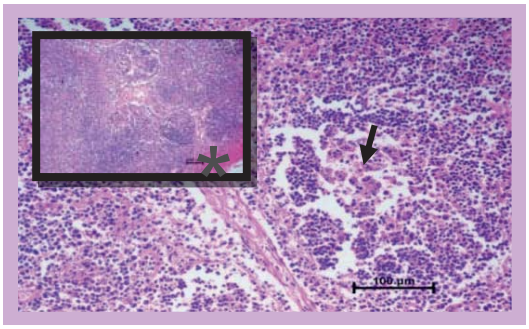
J. Doley, G.K. Sharma, S.R. Pegu, P.J. Das, S. Paul, S.J. Devi, N.H. Mohan, S. Rajkhowa

To investigate the prevalence of African Swine Fever Virus (ASFV), wherein 144 serum samples collected/ received from various districts of Assam (including Baksa, Dhemaji, Kamrup) and the Tripura region were screened for detection of antibodies against ASFV using commercial ELISA kit (Ingezim) in which two (02) samples were found positive for ASFV.

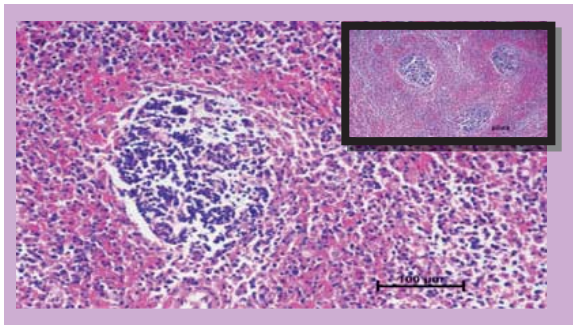


Prevalence of ASF in surveyed area in NE region

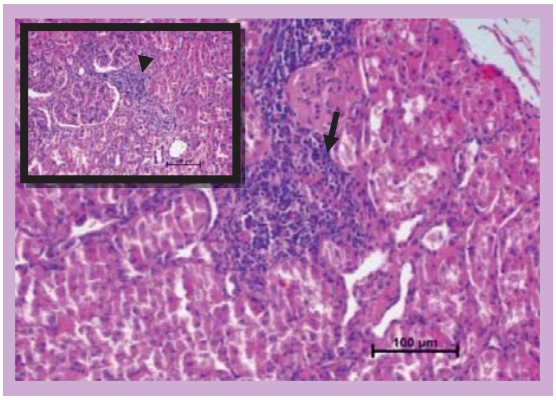
In order to assess the prevalence of ASF within both the backyard and organized pig farming sectors, questionnaire data has been gathered from 230 farmers/farms in Dhemaji, Baksa, Kamrup, and Goalpara. Besides, more samples will be collected from various states within the North Eastern Region for further epidemiological studies. Tissue samples suspected for ASF were collected and also received from different regions of Northeast. Subsequently, PCR screening was conducted, resulting in the detection of two positive samples. Histopathological findings in tissue samples:



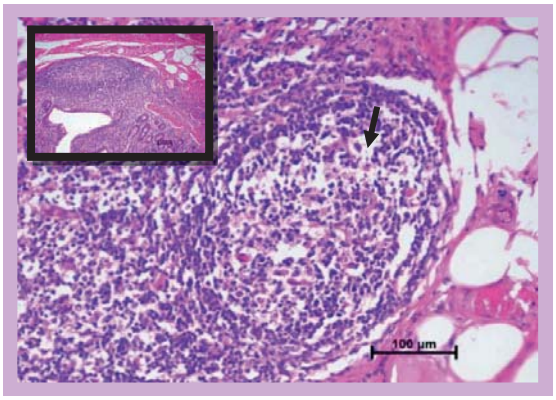
Lymph node showing hemorrhages in the perifollicular lymphoid tissue (*) with germinal



Spleen showing abundant red blood cells within the red pulp and severe lymphoid depletion



Lung showing severe hemorrhages in the septa as well as in the alveolar spaces. Infiltration of MNC in the alveolar septa and peribronchial areas (arrow)



Small intestine (ileum) with germinal centre necrosis and lymphoid depletion

Institute Project : Isolation and characterization of porcine Muscle Stem Cells for development of 3D culture

Juwar Doley, NH Mohan, Jaya, R. Thomas, Souvik Paul, and Vishal Rai

The projected global population rise to 9.7 billion by 2050 necessitates an increased meat production worldwide to fulfil human protein needs while ensuring environmental and financial sustainability. To achieve efficient meat production, a profound understanding of muscle growth and development is essential. The impressive reproductive capacity of sows, producing significant piglet numbers per litter and averaging two litters per year, positions pigs as highly efficient meat sources. Cultured meat represents a synthetic alternative to conventional meat, mimicking the qualities of fresh meat through the in vitro generation of muscle tissue. This innovative approach holds the potential to address challenges associated with traditional meat production, such as concerns over animal welfare and environmental pollution.

The potential of several cell types for initiating the production of cultured meat have been reported but with the most promising one being muscle stem cell (also termed as satellite cells). Muscle stem cells from domestic animals like pig's gain attention for their potential in cultured meat production, offering an alternative protein source to conventional meat, curbing animal welfare and environmental concerns. One of the primary challenges in cultured meat production is creating sizable muscle tissue that requires vascularization and perfusion to support the survival of inner cell layers. In vitro formation of skeletal muscle tissue necessitates myoblasts to undergo processes such as proliferation, migration, alignment, and fusion to form multinucleated myotubes. Cell alignment is particularly critical for engineering muscle tissues. Due to the pig's significance as both a preclinical model for human cell therapy and a vital food source, comprehending the physiology of pig myogenic progenitors, notably skeletal muscle satellite cells and myoblasts – is essential for addressing muscular diseases and enhancing meat production. However, a current technical limitation lies in the stem/precursor cells routinely obtained from muscle, as they constitute a mixed population with limited proliferative potential and low differentiation efficiency in vitro. There is limited understanding of Porcine Muscle Stem Cells particularly in the context of in vitro culture and meat

production, remain inadequately understood. Therefore, there is a need for more precise isolation methods for muscle stem cells tailored to porcine species. There is a need for establishment of optimal conditions that support their growth, proliferation, and differentiation specific to porcine cells which is crucial for successful long-term culture. It is essential for defining and characterization of specific markers for porcine muscle stem cells. Initial investigations into isolating and culturing appropriate porcine muscle cells for muscle stem cell research have been undertaken. Samples were obtained from different porcine cell sources, including muscle tissue and stem cells, using appropriate collection methods. Subsequently, the isolated pig cells were cultured using suitable cell culture techniques. Efforts to isolate and standardize protocols specific to porcine muscle stem cells, as well as to establish optimal growth conditions conducive to their long-term culture is ongoing.

External Funded: Indian network for fisheries and animal antimicrobial resistance (INFAAR)

Rajib Deb and Seema Rani Pegu

Isolation and characterization of extended spectrum β-lactamase producing Escherichia coli from piggery farming system and slaughterhouse: The current investigation seeks to identify and isolate Escherichia coli strains that produce extended spectrum β-lactamases (ESBLs) from samples taken from pig farms and slaughterhouses in West Bengal and Assam, India. A total 309 number of samples were taken from healthy pigs nasal swab (25), rectal swab (25), pen soil samples (45), faeces samples (55), slaughterhouse effluents (115) and slaughterhouse cleaning water (44). E coli isolates were detected in 309 samples from pig farms, including slaughterhouses in West Bengal and Assam, India, at a 49.8% rate. Out of 154 E. coli isolates, a total of 23 (14.9%) were found to be ESBL producer and these isolates were from pig rectal swabs (7.1%), faeces (10.7%), effluents from pig slaughterhouses (26.1%), and cleaning water (11.7%). Four ESBL E coli isolates (6.6%) from piggery slaughterhouse effluents were found to be phenotypically resistant to the imipenem group of β-lactam antibiotics, according to this investigation. Most of the β-lactamase-producing E coli were determined to be CTX-M and CMY producers, and every single one of them had the genotypes blaCTX-M (100%) and blaCMY (82.6%). Out of 17 ESBL E. coli isolates from piggery slaughterhouse effluents, we found that 2 (8.6%) had the genotype blaNDM1. These finding alarms that large scale monitoring of piggery farm samples as well as local slaughterhouses for identifying ESBL E coli for ensuring public health safety.

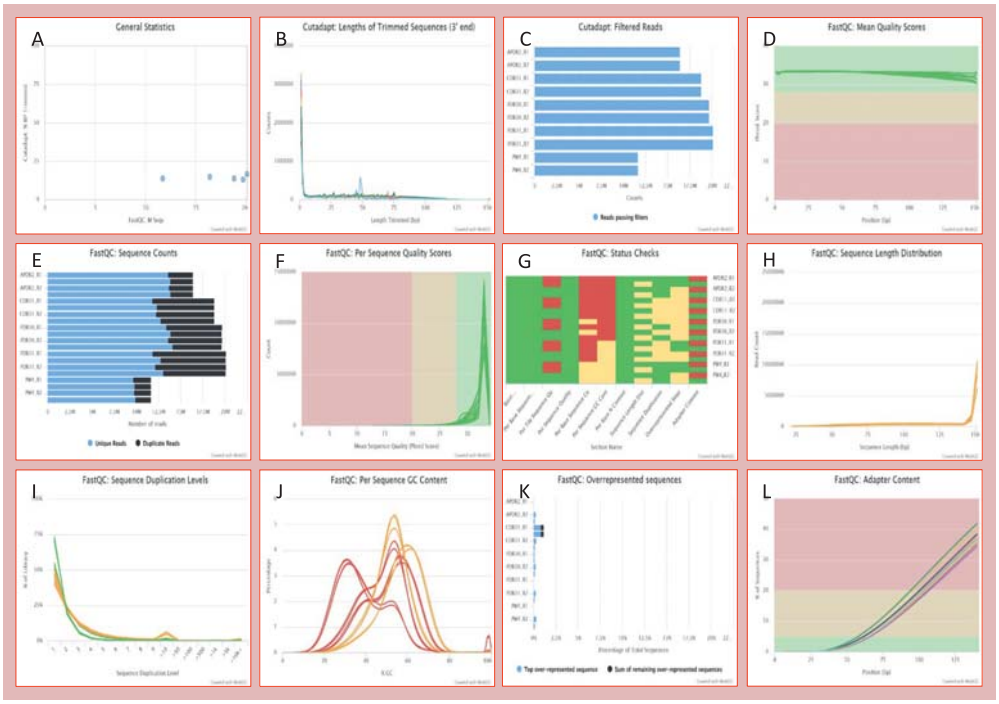
Table: Distribution of ESBL E coli isolates in piggery farm and slaughterhouse samples

Source of samples	Number of Samples	*E Coli* Isolates	ESBL *E coli* (%)
Nasal swab	25	11 (44)	-
Rectal swab	25	14 (56)	1 (7.1)
Pen soil samples	45	19 (42)	-
Faecal samples	55	28 (50.9)	3 (10.7)
Slaughterhouse effluents	115	65 (56.5)	17 (26.1)
Slaughterhouse cleaning water	44	17 (38.6)	2 (11.7)
Total	309	154 (49.8)	23 (14.9 %)

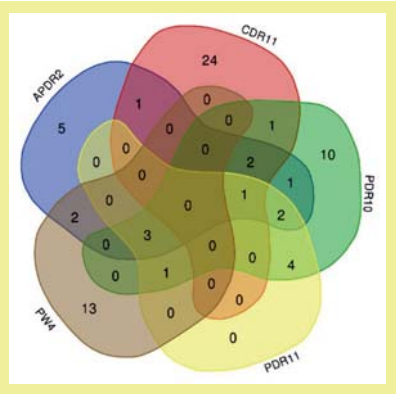
Table: Distribution of ESBL producing E. coli in different piggery farm samples

ESBL *E coli* isolates	Isolates carrying β-lactamase resistant genes			
	^{bla}OXA 1	^{bla}CMY2	^{bla}CTX-M1	^{bla}NDM1
Pig rectal swab (1)	0	1	1	0
Pig faecal samples (3)	0	3	3	0
Piggery s aughterhouse effluents (17)	7	14	17	2
Piggery s aughterhouse cleaning water samples (2)	1	1	2	0
Total (23)	8 (34.7%)	19 (82%)	23 (100 %)	2 (8%)

Whole genome sequencing-based cataloguing of antibiotic resistant genes in piggery waste borne samples: The growing use of antibiotics in livestock is one of the main causes of the rapid global spread of antimicrobial resistance (AMR). However, extensive research on AMR in animals is currently absent. In this article, we provide the bacterial antibiotic resistance genes (ARGs) from piggery waste samples in West Bengal, India, based on whole genome sequencing (WGS). We found several plasmids carrying multidrug-resistant Enterobacteriaceae including resistant to last-resort medications like colistin and carbapenems. Our findings will serve as a guide for developing AMR management policies for livestock in India and aid in understanding the current AMR profiles of pigs.



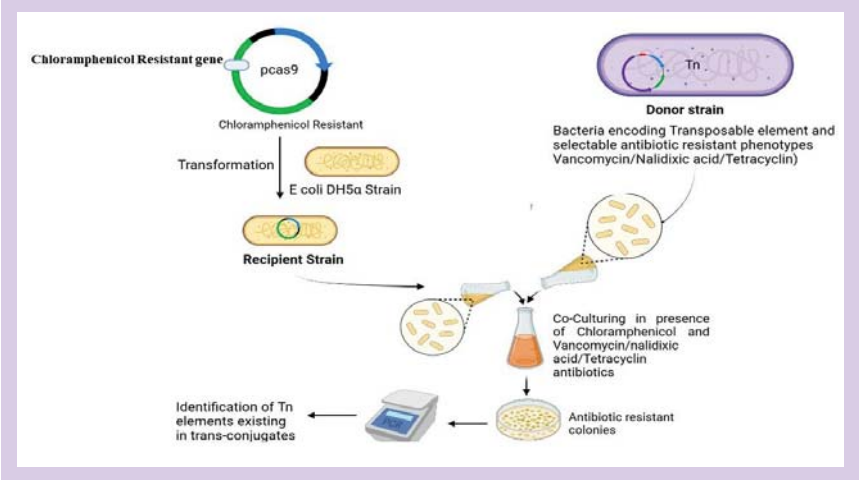
Representation of Multiqc_report of aggregate results from WGS analyses across the samples of present study into a single frame. Here, Multiqc_report shows (A) General Statistics; Cutadapt: (B) Filtered Reads, (C) Lengths of Trimmed Sequence (3' end); FastQC: (D) sequence counts, (E) Sequence Quality scores, (F) Mean quality scores, (G) Check Status (for each FastQC section showing whether results seem entirely normal (green), slightly abnormal (orange) or very unusual (red)), (H) Sequence length distribution, (I) Sequence duplication level, (J) Per sequence GC content, (K) Over represented sequences, (L) Adapter content etc.



Venn diagram depicting overlapping antimicrobial resistant genes among the piggery samples

PlasmidFinder results depicting pNDM plasmid. The circular map represents the reference plasmid as blue sector and assembled scaffold as green sector.

Characterization of piggery farm waste-borne bacterial transposable elements associated with antimicrobial resistance phenotypes: Even though there is a link between antibiotic resistance and the presence of transposable elements few research has looked at the prevalence and distribution of transposable elements/ integrons in piggery farm samples. Present study identified the prevalence of six transposable elements namely Tn6763 (Accession number: OQ409902), Tn6764, (Accession number: OQ565299), Tn6765 (Accession number: OQ409902), Tn2003 (Accession number: OQ503493), Tn6072 (Accession number: OQ565298) and Tn6020 (Accession number: OQ503493) in piggery farm waste from India which are belongs to Enterobacteriaceae family. In a conjugative experiment, Klebsiella isolates carrying Tn6020 having the resistant phenotypes for nalidixic acid was used as donor cells while Escherichia coli DH5α Cells carrying chloramphenicol resistant plasmid was employed as recipient cells. Transconjugant bacterial colonies were shown to carry the Tn6020 transposable elements with both nalidixic acid (donor cell origin) and chloramphenicol (recipient cell origin) resistant antibiotic phenotypes. Given the presence of transposable elements in 21.4% of resistant Enterobacteriaceae strains, preventative measures are vital for avoiding the spread of mobile genetic resistance determinants in the piggery sector and to monitor their emergence.

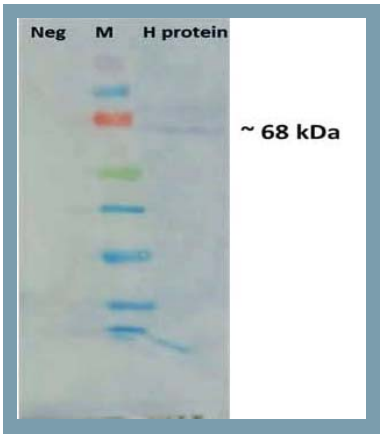


Schematic representation of trans conjugation experiment. Recipient i DH5alph strain carrying pCAS9 plasmid having chloramphenicol resistant phenotypes. Donor cell carrying transposable element and having different antimicrobial resistant phenotypes. Donor and recipient bacterial cells were cocultured in presence of selected antibiotics. Trans conjugates were confirmed by PCR based detection of transposable elements.

Expression of hemagglutinin protein of Canine distemper virus in insect cells (research work carried out during Professional Attachment Training as a part of FOCARS at ICAR-IVRI)

Vishal Rai

The research work carried out was on "Expression of hemagglutinin protein of Canine distemper virus in insect cells". The hemagglutinin gene was PCR amplified, cloned into pFastBac HT A donor vector and successfully transformed into DH10 bac competent cell. The recombinant bacmid was isolated and characterized. For protein expression, recombinant bacmid was transfected into Sf21 insect cells using cellfectin and recombinant baculovirus was produced. The titre of the recombinant baculovirus was amplified in the same cells before infecting Tn-5 cells to check for protein expression. Tn-5 cells successfully expressed the desired H protein of ~68 kDa. The specificity of the expressed protein was further confirmed using western blot where a specific band of the same size was observed.



Livestock Products Technology

Institute Project: Processing condition optimization for elimination of selected FSSAI listed food borne pathogens in pork and pork products.

R. Thomas, K. Barman (till September 2023) and Seema R Pegu

Response of pathogenic *E. coli* against thermal stress and adaptation which are relevant in food processing and storage environments was evaluated. The current study also determined the expression levels of virulence related genes namely *E. coli* attaching and effacing (eae), shiga like toxin (stx1 &stx2) and hemolysin (hlyA) in strains of pathogenic *E. coli* isolated from pork. A total of 187 pork samples were collected randomly over a period of 1 year from March 2019 to February 2020 from weekly markets, retail shops of Kokrajhar, Goalpara, Kamrup, Darrang, Sonitpur and Sivsagar districts of Assam.

Prevalence of Pathogenic E.coli Isolates in Pork: Based on the colony morphology and biochemical characteristics, a total of 176 *E. coli* isolates were recovered from the pork samples. The isolates were presumptively identified based on colony characteristics followed by identification using Gram's staining and biochemical tests. All isolates were observed to produce green metallic sheen on Eosin Methylene Blue and pink colonies on MacConkey agar. Results of the IMViC series done onthe isolates have shown positive results for Indole and Methyl Red and negative for Voges Proskauer and Citrate test. Among 176 *E. coli* isolates, 4 isolates (2.27%) were confirmed to be pathogenic *E. coli* based on the PCR based detection ofvirulentgenes. Two atypical EPEC were detected based on the amplicon size of 482 bp which corresponds to eae gene. While EM033 strain had only virulent eae gene, EM053 harboured two virulent genes i.e. hlyA and eae gene.On the contrary, 2 out of 4 isolates (EM085, EM087) were confirmed as EHEC based on the amplification of predominant toxin gene stx1 and stx2 genes.

16S rRNA Gene Amplification by PCR and Sequence Analysis: The 16S rRNA gene sequence-based phylogenetic tree for the E. coli isolates was constructed, exhibiting the evolutionary relationship between the isolates. The results indicated that all the isolates belonged to the genera *Escherichia coli*. The phylogenetic tree has also indicated that EM085 and EM033 shared a common ancestor with an *E. coli* strain from China (MG735731). Similarly, EM087 and EM053 were seen clustered in one clade with another *E. coli* strain (KJ803890). The evolutionary history was inferred using the Neighbor-Joining method. The tree has been drawn to scale, with branch lengths in the same units as those of the evolutionary distances, to infer the phylogenetic tree. The evolutionary distances were computed using the Maximum Composite Likelihood method in terms of the number of base substitutions per site. A total of 10 nucleotide sequences were analyzed and the codon positions included were 1st+2nd+3rd+Noncoding. All ambiguous positions were removed for each sequence pair (pairwise deletion option). There were a total of 1544 positions in the final dataset.

Thermal Resistance in Adapted Strains: Results showed that after habituation at 42 °C, isolated strains of EPEC and EHEC exhibited higher resistance against the thermal stress (60 °C and 65 °C). At the temperature of 42 °C, D60 °C value of EPEC was observed as 2.57±0.27while D60 °C value of EHEC was observed in the range of 1.23±0.06 to 3.34±0.01. D-values of all isolated strains were increased significantly ($p<0.05$) as adapted temperature increased from 4 °C to 42 °C, regardless of the serotypes. In addition, strains grown and adapted at lower temperatures (4 °C and 25 °C) have exhibited heat sensitivity compared to the control. Significant differences ($p<0.05$) in the D-value were observed among the strains with respect to the growth temperatures. The only exception was observed in D65 °C of ATCC43888 which was comparable to D65 °C of EM085 and D65 °C of EM033 to that of EM053 with no significant differences. In this study, highest D65 °C was obtained in EHEC strain at 42 °C, followed by EPEC strain.

Changes in Relative Expression Pattern in Virulence Related Genes: Relative expression of virulence related genes viz. eae, stx1, stx2 and hlyA of isolated strains of pathogenic E.coli are shown below. As represented in the said figure, adaptation of field isolates to 4 °C, 25 °C, 37 °C and 42 °C has resulted in significant changes in expression levels of virulent genes within the same group and between the groups. Despite belonging to the same group, EM085 and EM087 were significantly differ ($p<0.05$) in their expression of virulent genes. With the exception of a decline in the expression level of stx2 in EM085, rest of the isolated strain have shown significant ($p<0.05$) upregulation at 42 °C compared to control. The relative expression of eae in EM033, a representative from the group EPEC was found to be comparable with that of eae gene of EHEC (EM053 and reference strain ATCC43888) at lower temperature (4 °C) which remains unchanged at 25 °C as well. However, with the increase of adapted temperature to 42 °C, the expression levels of the virulent genes were rapidly elevated and a significant difference ($p<0.05$) was observed in the fold change among the eae containing isolates from both EPEC and EHEC.

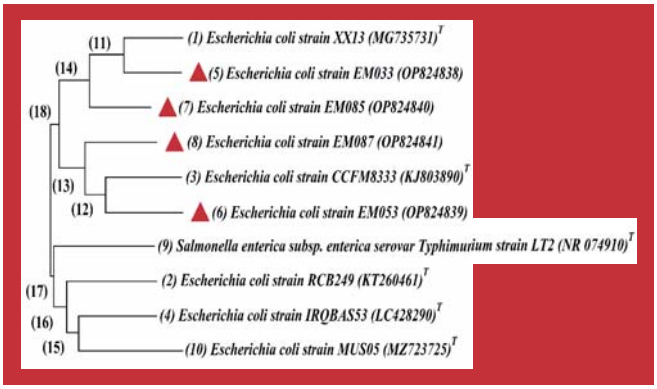
According to the results obtained, higher and lower temperatures have an impact on the transcription levels of virulence genes. At a lower temperature (4°C), the expression of eae was decreased by 74%, 11% and 26% in ATCC43888, EM053 and EM033, respectively. Similarly, it was also observed to be suppressed by 72%, 43% and 35% in ATCC43888, EM053 and EM033, respectively at 25 °C. However, the highest transcription level of eae (5.9 fold higher) was obtained in EPEC strain (EM033) maintained at 42°C , which

was much higher than EM053 and the reference strain (ATCC43888), where the fold changes were recorded 0.90 and 0.84, respectively. The results indicated that storage below 25 °C does not induce expression of eae and therefore associated with lower expression of virulence traits in strains of EPEC, where eae is considered as a major virulence factor. There was no significant difference ($p>0.05$) observed in the expression level of hlyA at 4 °C, 25 °C, and 37 °C, while at 42 °C, hlyA expression was induced to 4.19 fold higher compared to the control. Also, the result has clearly indicated a similar expression pattern for eae and hlyA genes at all tested temperatures. However, lower growth temperature has affected the transcription levels of stx1 and stx2 in the opposite ways. Transcription of stx2 was induced by 70% and 17%, respectively at 4 °C and 25 °C, while the transcription was reduced by 44% than control temperature at 42 °C. In contrast to stx2, stx1 transcription was increased by 0.77 and 1.22 times in strains grown at 25 °C and 42 °C, respectively and reduced its transcription levels to half to that of the control at 4 °C. This may be attributed to the fact that elevated temperature had no effect on inducing stx2 transcripts.

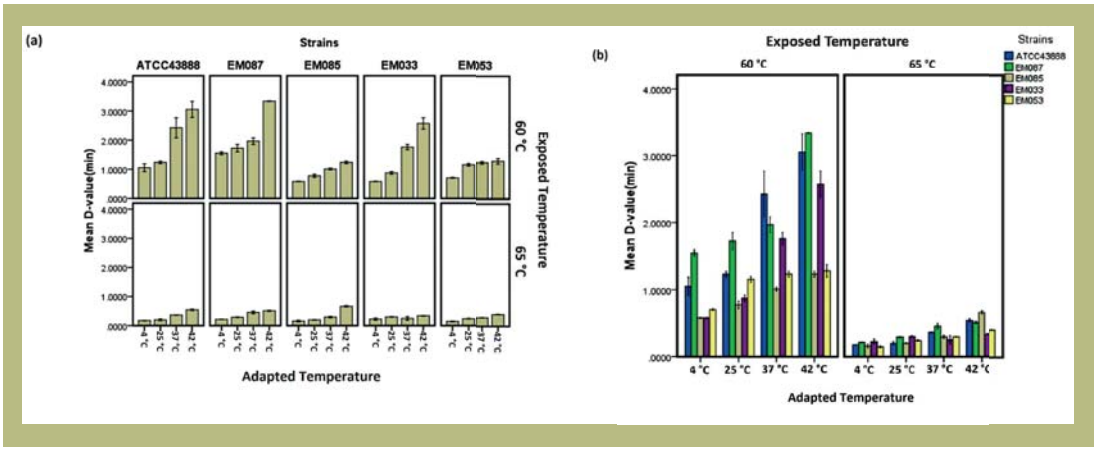
Table: Isolated strains of pathogenic E. coli tested by PCR

Isolated strains of *E. coli*	Category	No. of positive virulence gene in tested isolates										
		eae	*stx*1	*stx*2	*bfp*	*lt*	*st*	*vir*F	*ipa*H	*daa*E	*hly*A	*aaf*H
E033	EPEC	+	-	-	-	-	-	-	-	-	-	-
E053	EPEC	+	-	-	-	-	-	-	-	-	+	-
E085	EHEC	-	-	+	-	-	-	-	-	-	-	-
E087	EHEC	-	+	-	-	-	-	-	-	-	-	-

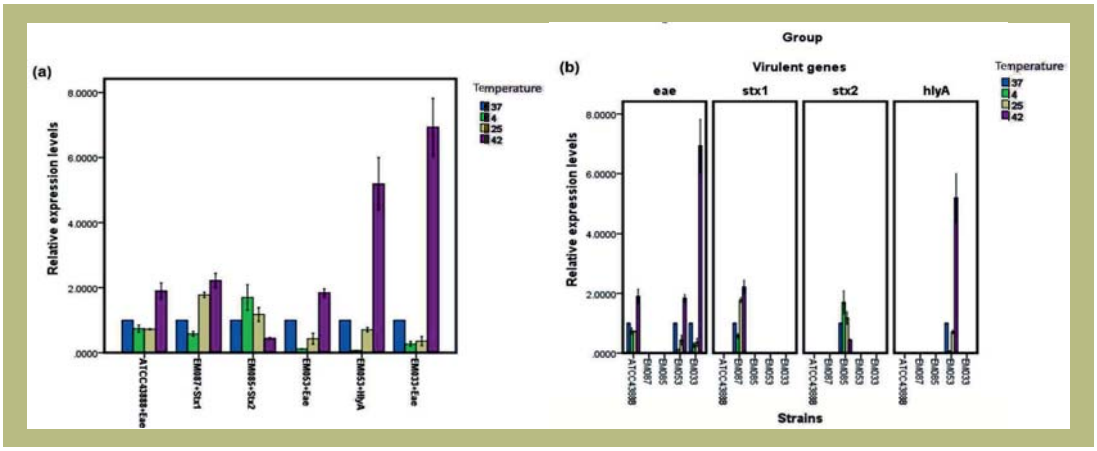
PCR based categorization of E. coli isolates (M: 100 bp ladder, NTC: Non-Template Control, 1: ATCC 43888, 2: EM033, 3: EM053, 4: EM053, 5: EM085, 6: Em087)



Phylogenetic tree based on 16srRNA gene sequences. The evolutionary distances were computed using the Maximum Composite Likelihood method. This analysis involved 10 nucleotide sequences. Codon positions included were 1st+2nd+3rd+Noncoding. The isolated obtained in this study were marked with red colored triangle. Numbers indicated on the branches represents Node Ids.



Effect of temperature adaptation at 4°C, 25 °C, 37 °C and 42 °C on (a) D-value of each pathogenic *E. coli* strains (b) D-value compared between isolated pathogenic *E. coli* strains in response to each adapted temperature.



Relative expression levels of (a) strains containing the respective virulent genes (eae, stx1, stx2 and hlyA) with respect to adapted temperature (b) virulent genes from different groups of pathogenic *E. coli* isolated from meat after adapted to four relevant food processing and preservation temperature (4°C, 25°C, 37 °C and 42°C).

According to the findings of this study, the presence of EPEC and EHEC in pork is a matter of concern because it might be a significant source of E.coli infection in humans. The study has also revealed that induced thermal stress tolerance in pathogenic E. coli might be triggered by prolonged high temperature exposure of these strains, which further contributed to their survival during thermal processing. However, increased heat sensitivity in low temperature adapted strains has provided an insight towards developing novel processing strategies to restrict the survival of pathogenic E. coli. The results have demonstrated that isolates of pathogenic E. coli grown and adapted at 42 oC had higher thermotolerance than cells grown at lower temperatures. However, expression of virulent genes viz. eae, stx1, stx2 and hlyA at elevated temperature might not be dependent on thermotolerance of the stain harboring these genes. In summary, thermotolerance did not contribute to upregulation of virulent genes, but increased transcription of stx2 at lower temperatures must be addressed to reduce the risk of shiga toxin during cold storage. The findings of this study revealed the overall impact of temperature adaptation on the thermotolerance and virulence of pathogenic *E. coli.*

External Funded: Initiated the establishment of STI Hub for Mising and Bodo women of Assam for economic empowerment through technology interventions in the pig value chain (DST)

R. Thomas, J. Doley and V.K. Gupta

New technologies for processing value added pork products have been developed and transferred to the beneficiaries, along with necessary machineries and capacity building. Skill development as well as training programmes were conducted with special focus on youth and women development. Adoption of newer technologies and access to modern machineries and scientific pig production practices with strict biosecurity measures have been enabling the beneficiaries for livelihood diversification and improvement in their household income. A trademark has been registered for the traceability cum meat inspection platform developed in the project, namely 'indPOtrace' which stands for 'Indian Pork Traceability'. This software has distinct components for 'traceability', 'real time meat inspection' as well as 'Pig help line' to cater the specific needs of stakeholders under DST STI Hub project. Selected beneficiaries are now trained to carry out hygienic pig slaughter operations and to process value added pork products, including traditional pork products. Introduction of scientific pig production practices coupled with balanced feeding options have enabled the farmers to reinvent the safe pig production practices after the devasting incidence of African Swine Fever, which has really crippled the pig farming in the project cite.

Organized Master Training programmes: The primary aim of the training programmes was to create master trainers to make them skilled enough to train other members in their group. The training programmes were divided into various sessions covered include breeds and breeding of pigs, low cost housing of pigs, balanced yet economic feeding and nutrition of pigs, diseases and biosecurity measures, artificial insemination in pigs using chilled semen and value addition of pork.

Trainees of Master Training Programme

Filed awareness programmes: Field level interaction with beneficiaries was carried out to inform about the DST STI Hub Project. This interaction session took place mainly in the villages scattered in both the districts of Lakhimpur and Dhemaji. In the sessions the women discuss about their rearing practices which include everything from their housing systems, feeding to taking care of their pigs. It is through these visits and interactions the actual scenario of the pig rearing systems has been documented. It's seen that, they mostly follow their traditional practices of rearing which they have been doing it since time immemorial. Most of the women are seen practicing small farms with 5-6 pigs and feed kitchen waste mixed with rice bran, mera, etc. This is done to only meet their own needs and consumption or to carry out their rituals and festivals in their villages. Large farms with the idea of business could be seen very few. During the sessions knowledge was shared about how pig rearing can be seen as a means of income generation, made them understand how hygienic and scientific rearing of pigs can bring them profit. The need of silage feed and the process of silage making was also explained to them. Moreover, it is found that the idea of value-added pork products is still minimal among them. Information was shared on to how from the meat different types of products can be processed and sold in the markets. The need and importance of biosecurity is also explained to them so as keep themselves away from facing unwanted loss in pigs.

Interaction with beneficiaries in the field

Organized Pork Dish Competition on World Food Day: On the ocassion of World Food Day, a virtual contest on pork dish was organized by ICAR NRCP, Rani under the DST STI Hub Project. In this competition, interested participants from the districts of Dhemaji and Lakhimpur were to showcase any of their exquisite tribal pork dish. With the announcement of the contest many interested participants came forward to give their names for the video. When interacted it was found that almost all of them have been engaging themselves into such activity for the first time. With great hope and enthusiasm everyone did their part and showcased varied pork dishes in their most ethnic style. Few of the pork dishes which were prepared during the contest are pork with bamboo shoots, pork with mix herbs, pork in chunga style, pork with elephant apple and pork with black dal.


Participants in the competition

Celebrated Janjatiya Gaurav Diwas/ National Tribal Day: field level awareness programmes were organized during 24th to 28th of November under the DST STI Hub project at Dhemaji, Assam. Awareness programs mainly covered various aspects of Hygienic Farm Practices as well as the growing importance of Bio-Security measures. The after effects of the ASF outbreak in the region back in 2020 can still be seen in various aspects. The herd size of most of the small-holding rearers has reduced further. Losses suffered in breeding farms have led them to focus more on fattening and the demand for castrated male piglets is growing leading to a shift in rearing practices. The awareness programs were designed by keeping in mind all these aspects and the relevance of following strict bio security measures for disease control was discussed in a detailed manner.




Celebration of National Tribal Day

Extension

Institute Project: Development of technology transfer models through Participatory Rural Appraisal in the piggery sector

Priyajoy Kar, N.H. Mohan, K. Barman (till September, 2023), P.J. Das, K. Dey, N.M. Attapuram, S. Jayachitra Devi

The project focusses on to identify the factors that contribute positively to the adoption of the new livestock technologies as well as those that represent the main constraints for the diffusion/adoption process. The gaps will be the main contention of the which generally prevails in the livestock technology diffusion process. Impact evaluation beyond its economic implications will be accessed in the project. In this context, preliminary data collection is going on to identify the production typologies and their characterization in the production system. The most prominent technologies in the different states have being identified through the stakeholder assessment. The preliminary data has been collected from three districts of Assam namely Goalpara, Chirang and Baksa covering different types of farmers according to the number of pigs they possess.

Table: Breed wise distribution of pigs

Types of Pig	Breed	Total
Indigenous	Non-descript local pig	63.67
	Ghungroo	10.87
	Total	74.54
Crossbreed and exotic	Rani	9.75
	Hampshire local cross	4.12
	White Yorkshire-local cross	2.37
	Duroc-local cross	4.07
	Hampshire	2.98
	Yorkshire	2.17
	Total	25.46

Table: Distribution of socio-economic parameters in the surveyed area

Characteristics	Respondents
Age Group	
Young (up to 35 years)	62.34
Middle Age (35-50 years)	29.73
Old (>50 years)	7.93
Gender	
Male	54.90
Female	45.10
Educational qualification	
Illiterate	19.54
Primary School	18.78
Middle School	23.82
High School	21.56

High School	21.56
Higher Secondary	8.94
Graduate	5.71
Graduate & above	1.65
Family size of farmers	
Small (up to 4 members)	44.79
Medium (5-8 members)	51.45
Large (>8 members)	3.76
Agricultural Land Holding	
Landless(nil)	12.34
Marginal (upto 2 bigha)	24.65
Small farmers (2 bigha-1 ha)	48.68
Semi-medium (1-2 ha)	13.36
Medium(>2ha)	0.97
Annual Income	
Up to 20,000	11.83
20,000-50,000	65.32
50,000-100,000	14.32
>100,000	8.53

Table: Standardized and Structure Co-efficient

Socio-economic/	Standardized co -effecients	Structure co-effecients
Independent Variables		
Age	-0.231	
Gender	-0.345	
Educational Qualification		0.585
Agricultural Landholding		0.621
Annual Income		0.620

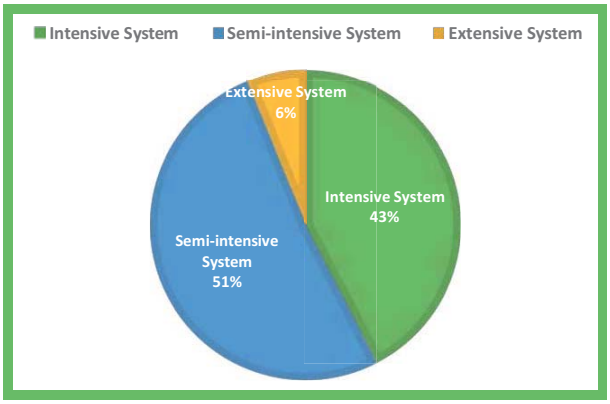
Table: Means of canonical variables

	Canonical variable means
Indigenous breed rearing farmers	0.412
Crossbred rearing farmers	-0.412

Table: Tests of Significance

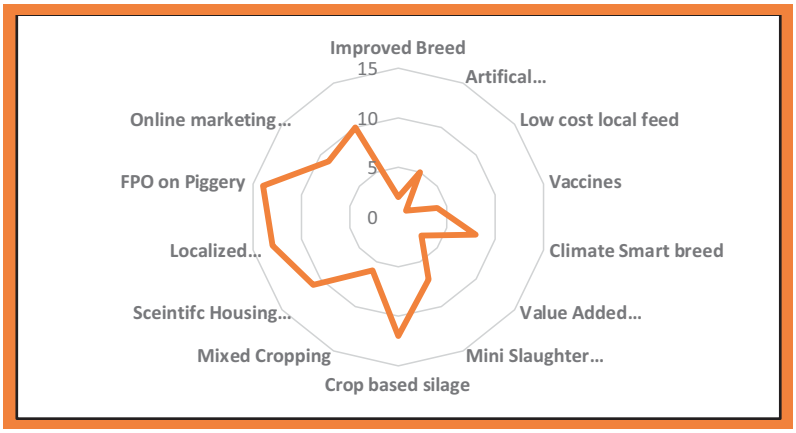
Eigen value	Canonical co-relation	Wilk's Lambda	Chi-square	df	Sig.
0.234	0.467	0.862	38.724	5	.000

In the surveyed area, 74.54% of the pig population consists of indigenous type and 25.46% belongs to the crossbred or exotic type origin. The improved breeds popularity is little less in the rural areas as the people of the area generally prefers local breed meat. The technology penetration (improved/exotic breeds) in the social dynamics of these districts are little less and needs to be looked upon. The age group rearing pigs mainly falls under the young age group. The gender deviation is not very much prominent as females are now encouraged to take up pig farming. Majority of the respondents falls under the educational qualification of middle school/high school. The family size and the land holding in the area mostly varies from small to medium. The average annual income of the farmers varies from 50 thousand-1lakh annually. Descriptive statistics and discriminant analysis were used to identify the socio-economic variables affecting the choice of pig breed of the farmers. Discriminant Function Analysis (DA) undertakes the same task as multiple linear regression by predicting an outcome in cases where dependent variable is categorical. This analysis was used to know the variables which discriminate indigenous rearing farmers from crossbred rearing farmers. The structure co-efficients were reported in the table.



Pig rearing systems practice in the survey area

It is evident that the most important discriminating variables on the basis of structure coefficients were educational qualification, landholding and annual income - each one having a coefficient more than 0.3. It can be observed from table 4 that there is considerable difference between canonical means of the two groups which indicates that the two groups can be differentiated from one another. Table shows different measures of significance. The Wilk's value (0.862) revealed that discriminant function was highly significant [0.000] and displayed a canonical correlation of 0.467. This canonical coefficient was interpreted by squaring it, which is 0.22, thus, 22 per cent of the variation in the dependent variable is explained by this model.

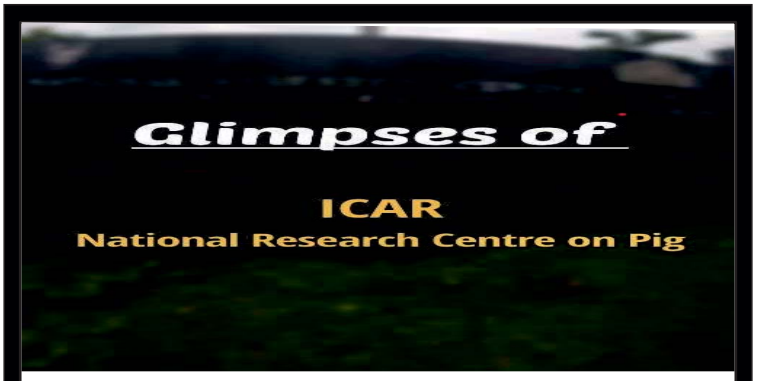


Stakeholder assessment of useful technologies for piggery sector

Institute Project: Development of e-learning knowledge products on scientific pig production

Priyajoy Kar, Nitin. M. Attapuram, and S. Jayachitra Devi

The project addresses critical needs in the piggery industry by leveraging digital technology to disseminate knowledge, promote sustainable practices, and empower farmers. It aligns with the goals of modernizing livestock industry and ensuring the long-term viability of the pig farming sector. Developing e-content allows for efficient and widespread dissemination of knowledge, bridging the knowledge gap and ensuring that farmers have access to up-to-date information. E-content can be accessed remotely through various digital devices, making it accessible to farmers in remote and underserved areas. The project team is focussing on making reels which are generally 60-90 seconds videos in the different aspects of pig production, processing and management. Video making/content creation is already in process and some of the videos are ready to be uploaded in the Youtube Channel of the institute. The team is focussing on developing contents on the aspects of biosecurity, feeding, routine farm operations, farrowing, breed identification, different trainings and outreach programs of the institute.



Reels on glimpses of the institute premises

Inter-Institutional Project: Development of Maize hybrids for enhancing productivity and ensuring nutritional security in the North Eastern Hill States (With ICAR-IIMR, Ludhiana)

Priyajoy Kar, K. Barman (till September, 2023)

The project encompasses opportunities to promote maize for increasing productivity and nutritional security of human beings as well as animals. This also focusses on demonstrating the bio-fortified hybrid LQMH-1 in different parts of Assam to increase its usage in the piggery feed and fodder. In the next phase of the project, feeding trials will be conducted on pigs for establishing the importance of maize as nutritional feeds for the animals. The project also includes training on different aspects and input distribution among the farmers for improved maize cultivation. The demonstration of the LQMH-1 hybrid is already being done in the KVK Dudhnoi, Goalpara. An area of 0.15 hac has been covered by the crop this season. The crop is nearly four months old and ready to be harvested. In the next phase of the project, the feeding trials on pigs will be conducted in the institute farm to know the varieties acceptance and utilization for pig feed and silage making. One field day cum training program has also been conducted in collaboration with KVK Dudhnoi to train and raise awareness among the farmers about the benefits and multipurpose use of maize in pig diets.

Demonstration of LQMH-1 in KVK Dudhnoi, Goalpara Campus

One day field day training program on 'Package of Practices on Rabi Maize Cultivation' conducted under ICAR-IIMR NEH Project

Computer Applications and IT

Institute Project: Machine learning assisted identification of different cells of porcine origin.

Salam Jayachitra Devi, Jaya and N. H. Mohan

Pixel based classification algorithm: The automatic cell image segmentation using pixel classification algorithm uses random forest classifier to classify each pixel independently. Random forest classifier is a commonly used supervised learning method that can be trained on pre labelled pixels i.e., Live Cell, Apoptotic Cell and Background. In the pixel classification algorithm, the random forest is trained on few manually labelled multiclass pixels. The first step computes a feature vector for each labelled pixel in the image. The feature vectors are generated by applying a set of filters to the given input images. Some of the filters used in the image analysis are basic filters that include gaussian blur, gaussian gradient magnitude, Laplacian of gaussian, and hessian eigen values, Sobel filter, Gabor filter and Structure tensor eigenvalues

with sigma values 1, 2, 4 and 8. A stack of feature is built by adding each pixel to their feature vector. The feature vectors generated are paired with their respective ground truth classes that constitute the training feature set. Later each pixel's feature vector is fed into the random forest for training, which then predicts the probability of the pixel belonging to a particular class. The random forest classifier used in this training procedure consists of 100 decision trees. This segmentation process utilizes the learned relationships from the training phase to categorize pixels throughout the entire image. The result is a segmented image where each pixel is assigned a probability of belonging to either Live Cell, Apoptotic Cell and Background. To assess its performance, we conducted experiments on ten stained and unstained images, respectively. The evaluation was based on recall, Intersection over Union (IoU), and F-measure metrics. The average performance metric values for each filter were calculated from the results obtained in the experiments on the ten images. The final outcomes were summarized in Tables. In Table, the results obtained from trypan blue stain images were depicted, whereas Table presented the results for unstained images.

Table: Apoptotic and Live Cell Segmentation using trypan blue stain images

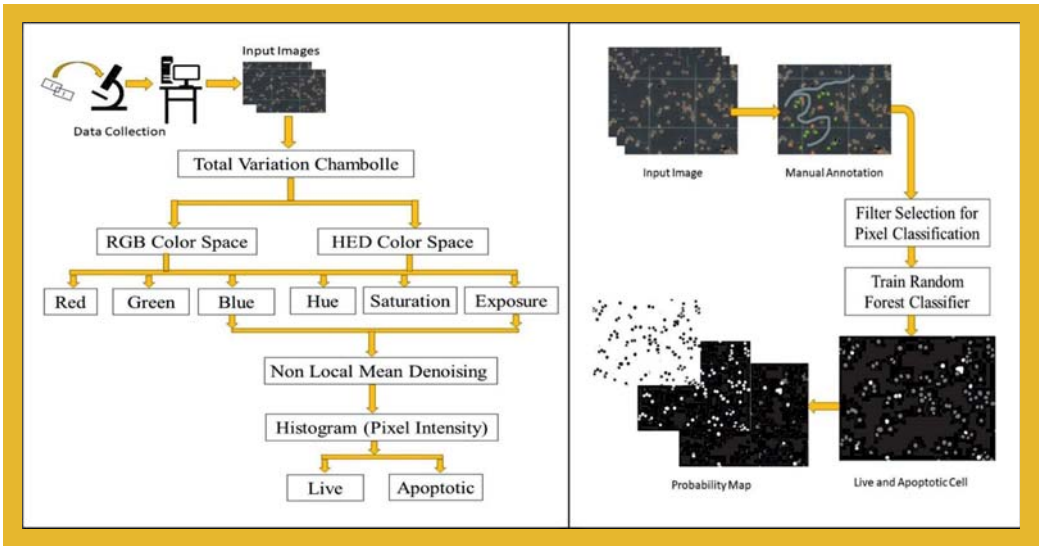
With Stain						
Types of Filter	Recall		IoU		F-measure	
	Apoptotic	Live	Apoptotic	Live	Apoptotic	Live
Basic	**0.930**	**0.866**	**0.917**	0.805	**0.552**	0.719
Gabor	0.861	0.714	0.75	0.806	0.527	**0.753**
Sobel	0.797	0.843	0.791	0.745	0.469	0.699
Structure Eigen	0.809	0.835	0.875	**0.851**	0.534	0.726

Table: Apoptotic and Live Cell Segmentation using images without stain

Without Stain						
Types of Filter	Recall		IoU		F-measure	
	Apoptotic	Live	Apoptotic	Live	Apoptotic	Live
Basic	**0.767**	0.903	0.595	**0.751**	0.504	**0.685**
Gabor	0.712	0.906	0.595	0.713	**0.508**	0.652
Sobel	0.672	**0.908**	0.595	0.559	0.472	0.551
Structure Eigen	0.681	0.896	0.595	0.636	0.476	0.539

Cellular viability analysis using color space: Analyzing cell images is a crucial component in various biomedical research fields that rely on in vitro cell culture models. However, the complexity of cellular structures, coupled with image noise and artifacts, poses challenges to effective analysis. To address these issues, a methodology has been developed on an image processing approach for cell image analysis, employing different color spaces. Specifically, the RGB and HED color spaces are utilized to extract features from porcine luteal cell images, facilitating image segmentation and the identification of live and apoptotic cells. The proposed approach involves four key steps: image processing, feature extraction, image segmentation, and the identification of live and apoptotic cells. The process begins with image preprocessing to eliminate noise and artifacts, utilizing the TV Chambolle and non-local means approach. Unlike traditional methods, this approach considers similar patches of pixels in the image, enhancing denoising by computing values based on patches rather than solely relying on neighboring pixels.

Subsequently, we extract individual color channels from the images using both RGB and HED color spaces. Features are then extracted based on histograms of these color channels, leading to the segmentation of live and apoptotic cells. Evaluation of the proposed approach involves testing on a dataset comprising 30 luteal cell images, with results compared to ground truth methods and ImageJ analysis. The proposed approach demonstrates higher accuracy compared to ImageJ and proves computationally efficient for small datasets. Its application holds significant implications for biomedical research, particularly in areas where cell culture experimentation is routine, providing a valuable tool for determining cellular viability. The graphical representation of this methodology is shown in the figure.



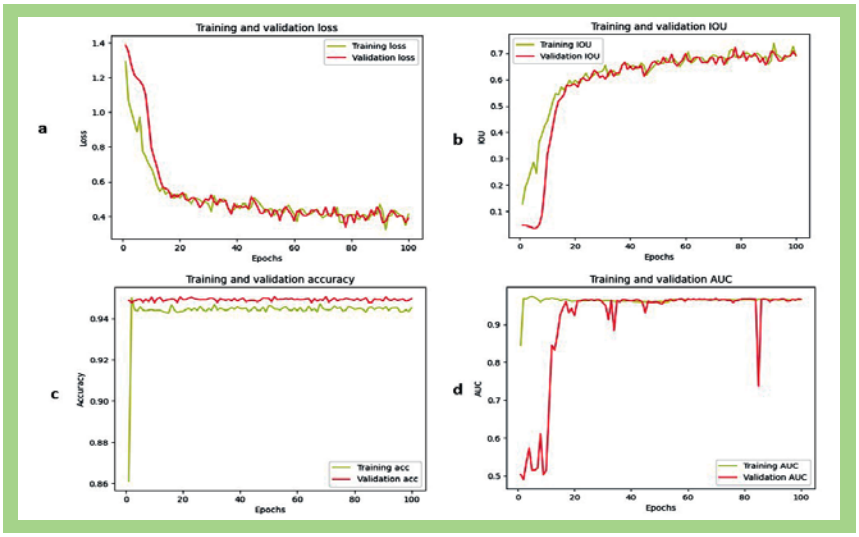
Graphical representation of the methodology used in the cellular viability analysis.

Table: Comparative Accuracy Evaluation between the Proposed Algorithm, Expert Assessment, and Image J Analysis.

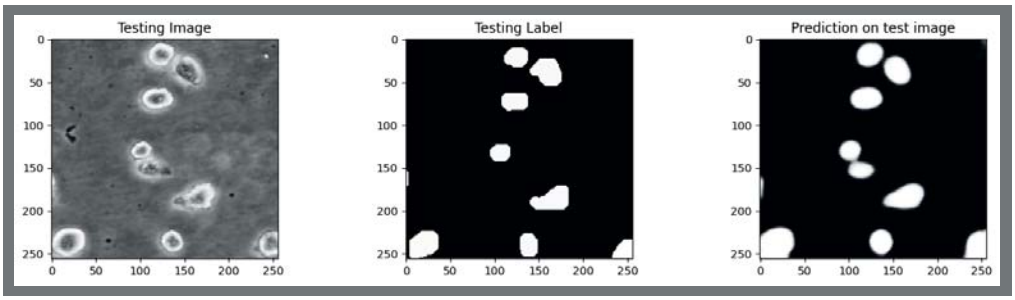
S.No.	Types of Counting	Channel	Accuracy %
1	New Methodology	Blue Channel	95%
		D Channel	97%
2	Manual Counting by expert	Original Image	100%
3	ImageJ	Original Image	92%

Deep Learning Based Cell Segmentation Model: The automated characterization of cells within cell cultures is a crucial aspect across various applications. Recent advancements in light microscopy, coupled with an increasing demand for precise and high-throughput cell analysis, have led to the development of automated algorithms designed to segment and analyze cells in microscopy images. Despite these significant advancements, there remains an ongoing requirement for a precise, versatile, and robust whole-cell segmentation method. Such a method is essential for accurately quantifying morphological properties, phenotypes, and sub-cellular dynamics, addressing the ongoing challenges in achieving comprehensive and reliable cell analysis across diverse research domains. This study introduces a cell segmentation technique aimed at assisting scientists and researchers in rapidly and accurately identify different cell types and viability. The proposed deep learning model is an enhanced U-Net model developed from scratch,

specifically designed for efficient small-size image segmentation to extract the local features. Moreover, various transfer learning approaches have been incorporated as the backbone of the U-Net architecture, including models such as InceptionV3, Seresnet50, Resnet34, Resnext50, among others. The performance of these models was evaluated using metrics such as Intersection over Union (IoU), Accuracy, Area Under Receiver Operating Characteristic Curves (AUC), and Time Taken. The deep learning models were executed on Google Colab GPU Tesla T4 with 15GB RAM, showcasing their computational efficiency and effectiveness in automating cell segmentation for advanced cellular analysis.



Graphical representations of training and validation data for 100 epochs, illustrating a) loss b) IoU c) Accuracy and d) AUC



Cell Segmentation Utilizing Deep Learning Model

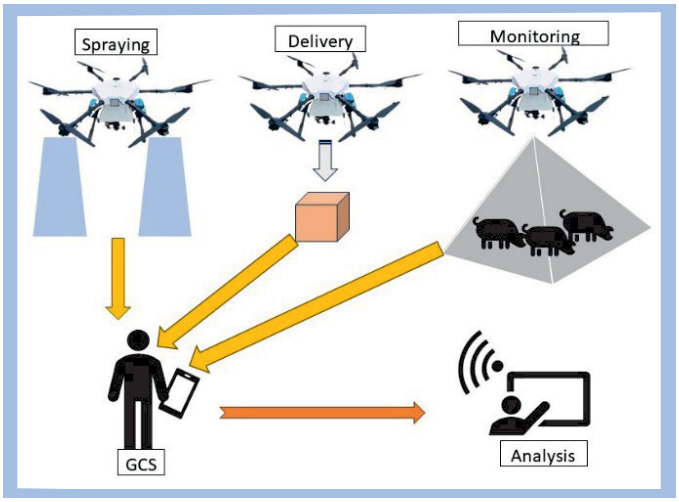
Table: Comparison of deep learning models based on different metrics

Models	IoU Scores	Accuracy Scores	AUC Scores	Time Taken
Inception V3	0.778	0.944	0.924	5062.151 secs
Seresnet 50	0.769	0.950	0.965	5954.295 secs
Resnet 34	0.787	0.943	0.865	4974.432 secs
Resnext 50	0.788	0.945	0.955	7636.499 secs
New Model	0.801	0.981	0.988	4625.784 secs

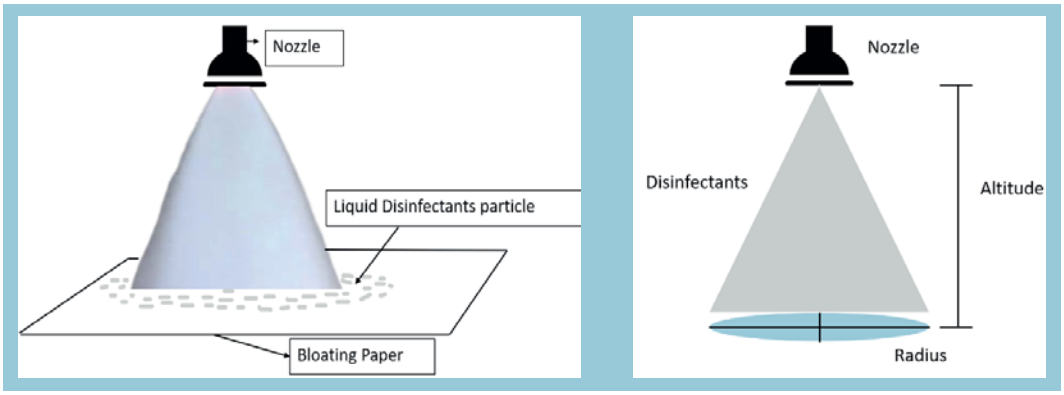
ICAR Project: Applications of Drone in Augmenting Production and Productivity of Piggery Sector

S. Jayachitra Devi, Satish K., Benjamin K., Juwar D., Sunil K., N.H. Mohan, N.M. Attupuram

As technology advances, drones have emerged as a promising tool to enhance various aspects of animal agriculture. In this context, drones are primarily employed for monitoring, data collection, and herd management. A key application of drones in animal agriculture is their ability to capture aerial footage, providing farmers with valuable insights into livestock health, behavior, and grazing patterns. Drones offer significant advantages in navigating difficult terrains and accessing remote locations, allowing for the efficient transportation of essential veterinary inputs to animal farms. The importance of drone technology becomes even more apparent in the face of epidemics that affect both humans and animals. Recent outbreaks of African Swine Fever in India underscore the widespread impact of such diseases. In response to these challenges, a preliminary study was conducted to explore the potential application of drones in disinfection on a pig farm. The study considered various parameters, including suitable flying altitude, wind speed, spray rate, and time requirements.

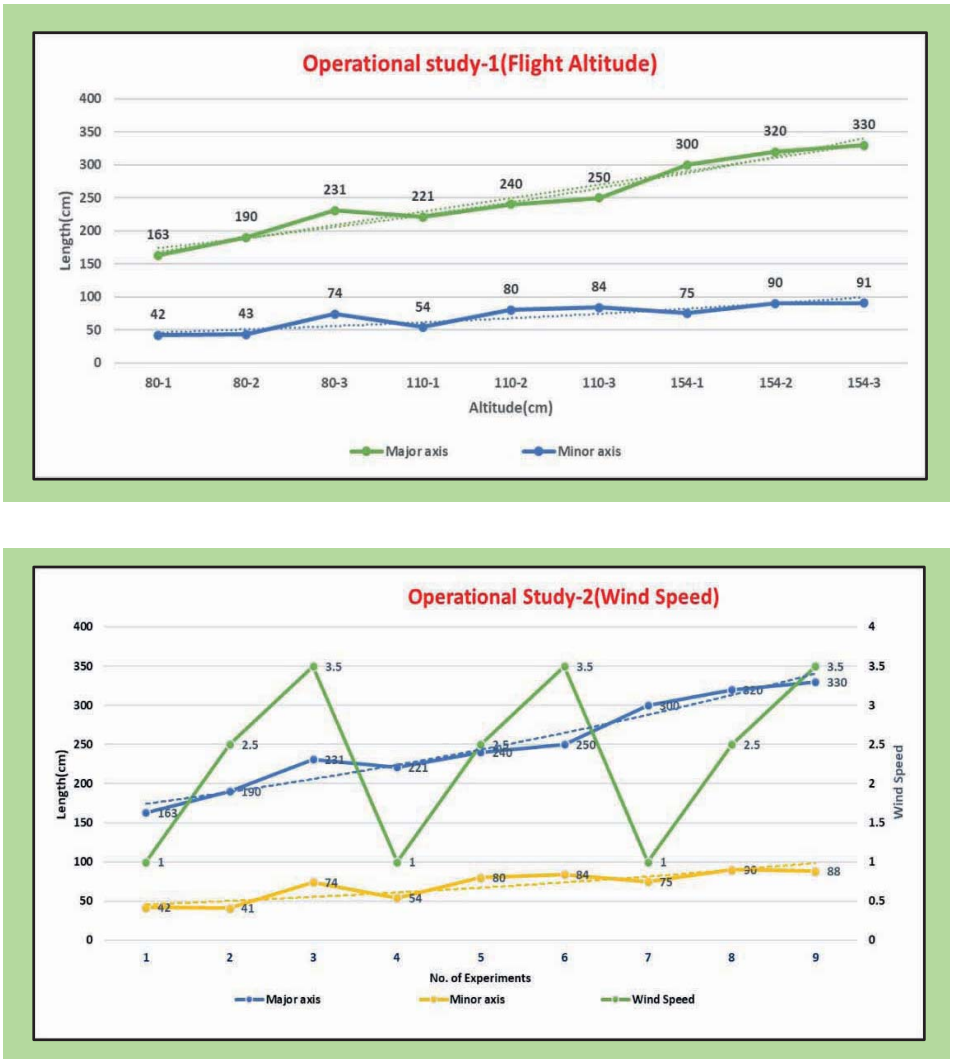


Applications of in animal agriculture



Given a nozzle of UAV at an altitude where the footprint of the sprinkler is given by an ellipse with minor axis and major axis.

Under the current experimental conditions, spraying of liquid disinfectants using the selected nozzle at different heights of 80, 110 and 154 centimeters above ground at constant time interval of 5 seconds under varying condition of wind speed was conducted. From the preliminary study, it was observed that 45 milliliter of liquid disinfectant was released on each count and the footprint dimensions of the disinfectant sprinkled on the bloating paper kept on the ground expand as the height increases. Furthermore, it was also observed that the wind influences the dispersion, affecting both the position and width of the footprint.



Operational studies for spraying disinfectants (a) Flight Altitude (b) Wind Speed

Annual Report-2023
ICAR-NRCP

OUTREACH PROGRAMMES

OUTREACH PROGRAMMES

Tribal Sub Plan

In charge: Dr. Pranab Jyoti Das, Principal Scientist

The basic objective of Tribal Sub Plan (TSP) is to channelize the flow of outlays from central ministries by earmarking funds for the development of the Scheduled Tribes population of India. The motivation for TSPs is to bridge the gap between the tribal populations and others by accelerating access to education and health services, housing, income-generating opportunities, and protection against exploitation and oppression. The ICAR-National Research Centre has taken a proactive role in the upliftment of the economic status of Tribal Pig frames by conducting different capacity-building programmes as well as distributing different inputs under the institute's Tribal sub-plan. In the year 2023, a total of 24 such programs were conducted in the tribal-dominated area of Meghalaya and Assam, in which a total of 3920 tribal Pig farmers directly benefited through these programmes. Among these farmers, Pig feed and different small inputs like LED lights, Steel buckets, Gumboots, Pig for breeding, Mineral mixture and different scientific leaflets on piggery management in local languages were distributed. Among the 24 capacity building program, one day training program, six nos. of three days residential training programs, one five days program, one numbers of Front Line Demonstrations (FLDs) and other demonstrations, Six awareness camps, three field days, one ICT-based residential training programmes, four Research-Extension-Farmers interface meetings and one three days Promotion of Agri-entrepreneurship program and one animal health camp. The maximum numbers of the programs were conducted at farmers' fields and scientists of the institute directly interact with farmers with the objective to imbibe scientific knowledge among the Pig farmers for sustainable piggery development in the region.

Table: Programmes conducted under Tribal Sub Plan in Year 2023

Sl. No	Program Name	Place and Date	No. of beneficiaries
1	Training and Demonstration Scientific Slaughtering of Pig to Tribal Butchers	KVK Dhudhnoi, Goalpara on 03.01.2023	**10**
2	Monitoring and evaluation drive of tribal pig farmer directly benefited through institute TSP programme as well as to collect the success stories	Koklabari, Hazarapara, Baksa on 5.01.2023	**07**
3	Monitoring and evaluation drive of tribal pig farmer directly benefited through institute TSP programme as well as to collect the success stories	Umsur and Rajapara, Kamrup on 13.01.2023	**02**
4	Monitoring and evaluation drive of tribal pig farmer directly benefited through institute TSP programme as well as to collect the success stories	Simla Bazar and Kamar Doisa, Baksa on 24.01.2023	**09**
5	Monitoring and evaluation drive of tribal pig farmer directly benefited through institute TSP programme as well as to collect the success stories	Chaygaon, Kamrup on 27.01.2023	**09**
6	Monitoring and evaluation drive of tribal pig farmer directly benefited through institute TSP programme as well as to collect the success stories	Nakuchi, Rangia, Kamrup on 10.02.2023	**04**
7	Monitoring and evaluation drive of tribal pig farmer directly benefited through institute TSP programme as well as to collect the success stories	Jirang, Ri Bhoi District, Meghalaya on 23.02.2023	**07**

8	Monitoring and Evaluation drive of Tribal Pig farmer directly benefited through institute TSP programme as well as to collect the information for success stories of and distribution of breedable Pig to Tribal Pig farmers	Dhudhnoi, Goalpara on 7th March, 2023.	**12**
9	Field Day and input distribution Programme	Mataikhar, Umsur, Kamrup on 17.05.2023	30
10	Research-Extension-Farmers interface meeting and Input distribution programme	Gogamukh, Dhemaji, on 16.06.2023	569
11	Awareness camp and field demonstration of silage making as well as Input distribution Programme	Bardangarikuchi, Kamrup on 28.06.2022	179
12	Research-Extension-Farmers interface meeting and Input distribution programme	Hajongbari, Chandrapur, Kamrup on 26.07.2023	206
13	Field Day and input distribution program	Dongarpar, Udalguri, BTR, on 03.08.2023	170
14	Awareness Campaign on Scientific Piggery and Input Distribution Program	Haflong, Umrangso, Dima haso on 29.08.2023	330
15	Awareness Campaign on Scientific Piggery and Input Distribution Program	Patharkhabba, Ribhoi, Meghalaya on 31.08.2023	161
16	One day Field training and demonstration	Boko, Kamrup(R), Assam on 14.09.2023	25
17	ICT based extension programme on Scientific Piggery and Input Distribution Program	Baithalangso, Karbi Anglong on 04.10.2023	260
18	Awareness Campaign on Scientific Piggery and Input Distribution Program	Maibong & Gunjung, Dima Hasao on 10.10.2023	224
19	Animal Health Camps and Input Distribution Program	Khabya, Borduar, Kamrup on 19.10.2023	93
20	Awareness Campaign on Scientific Piggery and Input Distribution Program	Panbari Range Chirang, Assam on 10.11.2023	224
21	Research-Extension-Farmers interface meeting and input distribution program	Thadlaskein, KVK, Jaintia Hill, Meghalaya on 24.11.2023	350
22	Awareness camp cum Piglet distribution programme	ICAR-NRC Pig, Rani, on 22.12. 2023	15
23	One day method demonstration programme on "Skill enhancement of the tribal farmers through demonstration of Artificial Insemination techniques in pigs	ICAR-NRC Pig, Rani, on 22.12. 2023	100
24	Research-Extension-Farmers interface meeting and input distribution programme	Goramur, Majuli, the river island district of Assam	800


TSP programme at Gogamukh, Dhemaji, Assam


TSP programme at Chandrapur, Assam


TSP programme at Goalpara


TSP programme at Jaintia Hill, Meghalaya

Scheduled Caste SUB Plan

In Charge : Dr. Kalyan De

The ICAR-National Research Centre on Pig, Rani, enthusiastically executed the Scheduled Caste Sub-Plan (SCSP) in the current year. The initiatives were undertaken with the aim of addressing poverty and unemployment among scheduled caste (SC) farmers, fostering income generation opportunities within the SC farming community, promoting human resource development, and ultimately facilitating the economic and social upliftment of vulnerable SC farmers. To achieve these objectives, the institute organized Research-Extension-Farmer interface meetings, conducted baseline surveys, and facilitated Participatory Rural Appraisal (PRA) sessions. These efforts were geared towards understanding the challenges faced by SC farmers in pig farming, and valuable suggestions were provided by distinguished scientists from the institute. Furthermore, five input distribution programe were organised in different villages of Chirang, Baksa, Darrang and Kamrup districts. As part of these initiatives, farmers were provided with various farm tools, and gumboots were distributed to uphold biosecurity standards in their pig farms. A total of 47 tonnes of pig grower feed and over 100 kg of mineral mixture packets were supplied as crucial inputs for pig farming. Additionally, five awareness camps were conducted to educate SC pig farmers about farm biosecurity measures, particularly focusing on safeguarding pigs from diseases such as African swine fever. The awareness sessions also emphasized the utilization of unconventional and locally available feed resources to reduce input costs in pig farming. Within the scope of the SCSP, an active participation of over 65 farmers was observed in a field day. Additionally, two farmers' days were conducted, attracting the participation of more than 150 farmers. In the pursuit of enhancing germplasm distribution, 30 Rani piglets, 96 HDK-75 piglets, and 3 adult breeding Doom pigs were allocated among 69 farmers in Hazo, Sonapur, and Goalpara, respectively. Comprehensive training initiative benefited over 35 SC pig farmers through a three-day and a four-day training program. These programs aimed at developing human resources for scientific pig farming and hygienic pork production. Sponsored by the SCSP, these training sessions provided SC participants with training manuals on pig management and farming, as well as training kits, study materials, and complimentary food and lodging. These efforts were consistently carried out over the past year under the umbrella of the SCSP. Through the SCSP program, ICAR-National Research Centre on Pig, Rani extended support to more than 460 SC pig farmers. This assistance involved crucial inputs, knowledge, and technical guidance to enhance their pig farms, fostering economic growth within the vulnerable SC community and promoting an improvement in their social standing and overall quality of life.

Table: Programmes organized under SCSP

Sl No.	Programme name	Place and Date	No. of Benficiaries
1	Progress evaluation, Feed Back and input distribution Program	Baksa on 05.01.2023	4
2	Progress evaluation, Feed Back and input distribution Program	Kamrup on 13.01.2023	4
3	Progress evaluation, Feed Back and input distribution Program	Darrang on 10.02.2023	4

4	Progress evaluation, Feed Back and input distribution Program	Udalguri on 13.03.2023	5
5	Pig Distribution Programme cum Animal Health Camp	Dhupguri, Sonapur, Kamrup on 20.03.2023	48
6	Pig Distribution Programme	KVK Goalpara, Dudhnoi on 27.03.2023	6
7	Awareness Camp cum Input Distribution Programme	Ulubari, Bijni, Chirang on 28.06.2023	64
8	Field Day and Input Distribution Programme	Maharipara, Goreshwar, Baksa on 25.08.2023	65
9	Baseline Survey cum Research-Extension-Farmers Interface meeting and Input Distribution	Sipajhar, Darang District on 01.09.2023	70
10	Farmers Day and Input Distribution.	Pijupara, Kamrup on 10.10.2023	100
11	Farmers Day and Input Distribution	Koniha, Rangia, Kamrup on 23.11.2023	44
12	Piglet Distribution Programme	ICAR-NRC Pig, Rani on 28.12.2023	15

Pig distribution programme cum animal health camp at Dhupguri, Sonapur, Kamrup

Awareness Camp cum Input Distribution Programme at Ulubari, Chirang


Field Day and Input Distribution Programme at Maharipara, Goreshwar, Baksa


Baseline Survey cum Research-Extension-Farmers Interface meeting and Input Distribution Under SCSP in Sipjhar Block, Darang District, Assam


Farmers Day and Input Distribution Programme under SCSP in Pijupara, Kamrup, Assam

Farmers Day and Input Distribution Programme under SCSP in Koniha, Rangia, Kamrup ® District, Assam

Annual Report-2023
ICAR-NRCP

ALL INDIA COORDINATED RESEARCH PROJECT (AICRP) ON PIG

AICRP

ALL INDIA COORDINATED RESEARCH PROJECT (AICRP) ON PIG

The main objective of AICRP on pig, which launched in IVth Five Year Plan (1970-1971), was to study the performance of pigs in different agro-climatic condition of the country. Subsequently the project was mandated to develop region-specific package of practices including quality germplasm. Few centers are mandated for conservation of indigenous germplasm. Presently the programme is continuing in twenty different centers across the country. ICAR-National Research Centre on Pig is regularly monitoring the progress of AICRP on Pig project through technical and financial monitoring in consultation with the Council and conduction of review meet.

Assam Agricultural University, Khanapara, Guwahati

The ICAR-AICRP centre of AAU, Khanapara is maintaining HD-K75 crossbred germplasm developed by crossing of Hampshire (75%) and local pig (25%) of Assam. During 2023, a total of 273 piglets were produced and an amount of Rs 31,29,730/- has been collected as revenue. One PhD research and 03 MVSc research are being conducted on Animal Nutrition and AGB students. One filed level training programme has been organized on "Scientific pig farming" in Sengapara, Darrang district on 27.12.2023 for 25 beneficiaries. One research article has been published in the International Journal of Veterinary Sciences and Animal Husbandry. A semen processing lab was constructed under ICAR-AICRP on Pig

Training conducted under AICRP

Kerala Veterinary and Animal Science University, Mannuthy Centre, Kerala

KVASU, Mannuthy Center is maintaining Large White Yorkshire, Desi and Mannuthy White crossbred variety developed by crossing of LWY (75%) with local pig of Kerala. A foundation stock of indigenous pigs was established in the Centre and the same were raised for cross breeding with Large White Yorkshire. Basic information with respect to management, disease prevalence and nutrition were collected in desi stock. Crossbred pigs (75%) were produced by inter-se mating and their production, reproduction and carcass traits were studied. A breeding unit of 45 indigenous pigs including 10 males are maintained to study the performance

of indigenous pigs under optimum conditions. The centre has produced 677 piglets and supplied 480 fattening piglets to 69 farmers. A total 52 Artificial Inseminations were done to exploit the genetic potential of superior males. Litter Size at birth and weaning were 10.30±0.20, 8.70±0.17, respectively. The Litter weight at birth and weaning were 11.17±0.21 kg, 81.69±0.53 kg respectively. Average individual weight at birth was 1.04±0.16 kg and average individual weight at weaning 8.43±0.46kg. Apart from this two one day trainings to 50 Assistant Directors of Animal Husbandry Department of Kerala were organized. Two post graduate research projects have been completed. Two doctoral and two post graduate research projects are undergoing. Two research papers were published in peer reviewed journal. The outbreaks of African swine fever in many parts of Kerala lead to fatal damage to pig farming. Severe restrictions were imposed for transportation and sale of animals during most of the period. The training and field extension activities were stopped to protect the nucleus herd from ASF outbreak.

Sri Venkateshwara Veterinary University, Tirupati

The AICRP on Pig at SVVU Center, Tirupati is maintaining Large White Yorkshire pigs and its crosses under optimum managemental conditions. During the calendar year 2023, A total of 53 farrowings were recorded during this period. A total of 385 piglets were born out of which are 213 males and 172 are female piglets. Further 159 pigs were sold to the beneficiaries for breeding purpose. A total number of 44 Artificial inseminations were conducted during this period. There is an improvement in the overall average body weights at 1,2,3,4,5,6,7,8 and 9 months of age compared to previous generation, which were recorded as 6.80, 11.79, 17.40, 23.72, 33.81, 43.05, 53.05, 65.35, 77.10 kg at respective ages. The average 8 months body weight was 65.35 kg. Improvement in 8 months body weight was observed in comparison with previous generation (63.16 kg in 23rd generation). A total of 26 animals were slaughtered to record the slaughter parameters during the reporting period. An amount of Rs. 8,66,153 was generated towards the sale of animals and pork during this period. A total number of seven training programmes were conducted on scientific pig farming for the benefit of farmers. A preliminary pilot study on characterization and registration of indigenous germplasm of indigenous pig was conducted in Rayalaseema region of Andhra Pradesh and was submitted during this period. A total of 5 publications were published in various national journals during this period.

Supply of germplasm to the beneficiaries

Training programme conducted

Training programme conducted

ICAR-Central Coastal Agricultural Research Institute, Goa

The crossbreed pigs developed by ICAR-CCARI, Goa are hugely popular amongst producers and consumers alike. Growth performance of crossbred pig variety (Goya) in the sixth generation was 1.125±0.05 kg (n=344) as birth weight, 6.25± 0.47 kg (n=269) as weaning weight after 30 days of weaning and 59.76±5.09 kg (n=15) as marketing weight at eight months of age. Mortality rate was 5.23% in pre-weaning and 0.92% in post-weaning period. Artificial insemination service was provided to the needy farmers at their doorstep and improved germplasms supplied for breeding. The centre provided fundamental knowledge to the farmers and entrepreneurs in scientific practices of pig rearing through different trainings, demonstrations and piggery farmers' field day. Beneficiaries under Tribal Sub Plan and Schedule Caste Sub Plan components were supplied with different inputs for self-sustainable farming and improvement of their livelihood. Total 67 number of AI was carried out in the year 2023 comprising 43 in the institute herd and 24 in the farmers' field. Total 286 piglets were produced in 41 numbers of farrowings from the sows. In this reporting year, total germplasms supplied were 216 numbers benefiting 85 farmers including beneficiaries under STC and SCSP. A total revenue of Rs. 7,67,726/- (Seven Lakh sixty-seven thousand seven hundred twenty-six only) was generated by supplying germplasm during 2023. Two trainings were conducted on scientific pig farming and 20 participants were benefited from its. Under Schedule Tribe Component (STC) programme of AICRP on Pig, total 47 farmer beneficiaries were distributed with crossbred piglets, feed, and medicinal supplements.

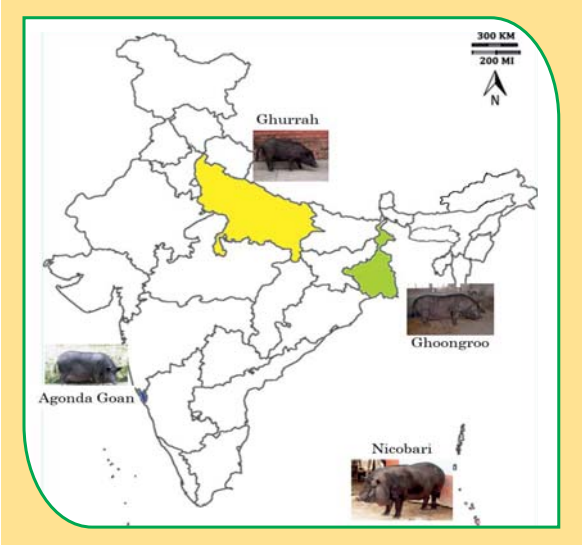
Distribution of feed and piglet sunder Schedule Tribe Component

Training-cum-Demonstration programme

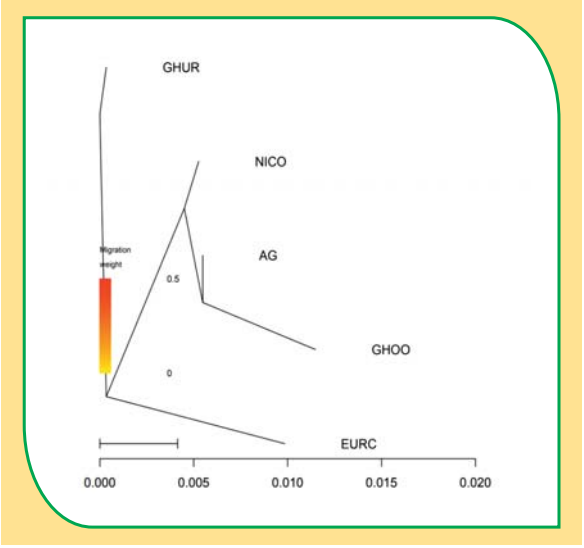
Piggery farmer's field day

Indian Veterinary Research Institute, Izatnagar, Bareilly

ICAR-IVRI AICRP centre maintains 75% exotic blood line by inter-se mating for which minimum 30 breedable sows are maintained with a sex ratio of 1:3 with 10 sires (2 sires from each 5 unrelated lines). The total herd strength was 296 including 132 crossbreds (75%), 97 Landrace, 49 Large White Yorkshire and 18 Desi pigs. Number of crossbred, Landrace, Large White Yorkshire and Desi piglets born during this period was 328, 209, 41 and 22. A total of 477 pigs/piglets (291 Crossbred, 163 Landrace and 23 Desi) were sold to farmers of different part of the country for strengthening / establishing their herd. The average litter size at birth, litter weight at birth, litter size at weaning, litter weight at weaning was 9.37±0.37, 10.35±0.42 kg, 9.0±0.41, and 67.34±3.33 kg, respectively in 75% crossbred sows. Average individual weight at birth and weaning was 1.11±0.03 and 8.76 ± 0.51 kg. Average daily gain of pre-weaning and post weaning piglets was 185.04 and 419.01 gm/d, respectively in 75% crossbreds. The overall mortality at the farm was 4.41%. Total revenue of Rs. 17, 24,294/- was generated during this year. The studies on genetic diversity, population structure and evolutionary relationships based on genome-wide data were conducted in four Indian domestic breeds of pig namely Agonda Goan (AG), Ghurrah (GHUR), Ghungroo (GHOO), and Nicobari (NC), of different agro-climatic regions of country. Study on the Evaluation of a customized feed supplement for early weaning of piglets was also conducted.



Pig population of different agroclimatic region was selected for diversity analysis



Evolutionary relatedness among different populations

Tamilnadu Veterinary and Animal Science University, Kattupakkam

TANUVAS Centre is maintaining inter-se population of TANUVAS KPM Gold (75% crossbred LWY x Desi) pigs. During this year, 208 piglets were produced. A total of 64 superior germplasm was supplied to the progressive pig farmers scattered across different districts of Tamil Nadu. Apart from breeding sales, 97 pigs were disposed under the slaughter sales benefitting the needs of local pork vendors and end customers. Brought in germplasm of 8 females and 2 males from outside into the breeding stock to enhance the genetic variability and thereby avoiding inbreeding related issues in future generation. Purchased one ultrasound scanning machine and enforced its usage towards the early pregnancy diagnosis as an effective breeding management tool. We had conducted two days training programs (2 Nos.) for 56 bourgeoning pig farmers from the different parts of Tamil Nadu state imparting knowledge and skill related to pig farming and harvesting procedures. Apart from two days training program, skill development program and hands on training was provided to four enthusiastic youth for a period of one month, who are interested to acquire pig husbandry so as to venture into it. With respect to research activities, four research abstracts and one full length article was published based on the research works carried out in this unit. One live television talk on pig farming topic was given in Doordarshan Podhigai TV channel with live question answer session with farmers in vernacular language. To a total of 106 farmers were provided with farm advisory services in all formats from telephonic to direct one to one contact method. As part of integrated farming activity, introduced 500 fish fingerlings in the demo fish pond so as to encourage the sustainable farming.

College of Veterinary Sciences & Animal Husbandry, CAU, Aizawl, Mizoram

The C.V.Sc & A.H, CAU centre maintains Zovawk to serve as genetic improvement unit. The basic principle of the project is to start a comprehensive study at institutional level to develop a farmer's friendly package of practices creating more assets and better opportunities for cash-starved populace. The herd strength was 204 pigs with production of 114 piglets (60 males and 54 females) during the year. A total 51 males and 67

females adults (above 8 months) were available for selection of the breeding parents. Fourteen 14 Zovawk (3 males and 11 females) had been purchased from its home tract of Mizoram so as to increase the genetic variability in the existing population at the centre. Conducted Hands on Training entitled "Scientific management of pigs" for the pig farmers on 6th -7th March, 2023. Two M. V. Sc. Students submitted their theses using the animals of the project. One nutritional experiment on "Effect of dietary supplementation of organic and nano zinc on performance of weaned pigs (Zovawk) as an M.V.Sc. Research work is almost completed. Two research articles are under submission for publication. The centre has contributed some inputs (Mineral mixture) for pig farmers during the CAU Agri-Fair held on Dec. 12 – 14, 2023 at Dimapur.

Nagaland University, SASRD, Medziphema Campus, Nagaland

The AICRP on pig, Nagaland centre is mandated to conserve and subsequent genetic improvement of local pigs of the state (TenyiVo). ICAR-AICRP on Pig, Nagaland Centre, NU-SAS is making all possible ways to reach out to the local pig farmers, students, educated unemployed and entrepreneurs through Research and motivational programs. The Centre has conducted twelve (12) awareness programs and hands on training on campus and off campus for pig farmers, school children and college students (44) covering the following topics: feeds and fodder preservation, pig management, zoonotic diseases, first aid and wound dressing, Deworming and pig vaccination, care of new born piglets, selection of breeding gilts and boar, biosecurity and personal health and hygiene for the farm Attendants. Three hundred twelve (312) beneficiaries attended the programs. The State Officials (20) pay visit to see the live Indigenous pig breed of Nagaland Tenyi Vo pig which is now less in population and is not easily available in the urban areas. Selling selected healthy piglets for breeding to the farmers and setting up local breeder at selected village in consultation with the village councils and GBs have been carried out. The centre conducted four research works using different types of test materials on the indigenous pig breed of Tenyi Vo. The centre has a total of eight hundred seventy-five (875) beneficiaries inclusive of participants during Hands on Training, awareness programs, procuring of selected breeding stocks, VIP visitation and other on spot learning groups of Officials, College Students /School Children and women rural farmers till date.

ICAR-Central Island Agricultural Research Institute, Port Blair

AICRP on Pig programme of this centre was initiated looking to the high demand of pork and scope of piggery in the region. Under this centre, Nicobari pig are maintained, produced and supplied to farmers. Andamani pig has been registered as a distinct breed with registration number (INDIA_PIG_3300_ANDAMANI_09014). As iron deficiency anemia (IDA) is the leading cause of piglet mortality, a novel oral iron supplementation regime to control IDA in piglets was formulated. The technology was used to control iron deficient anaemia in 356 piglets from farmers' field with more than 95 percent efficacy. Study on the probiotics supplementation to minimize weaning stress in piglets was also conducted and it was found that Supplementation of a multi-strain Bacillus-based probiotic formulation containing Bacillus mesentericus, Bacillus coagulans, Enterococcus faecalis, and Clostridium butyricum minimized the weaning stress of the piglets, thereby improving the feed intake, body weight, antioxidant activity, lipid profile, systemic and mucosal immunity, and overall growth performance of the weaned piglets under the hot and humid climatic conditions of the Andaman and Nicobar Islands.

Andaman Local pig with Piglets

College of Agricultural, CAU, Imphal, Manipur

AICRP on Pig at Manipur centre was sanctioned with the main objective of development of region-specific package of practices for improved pig husbandry in the state of Manipur. The center is mandated to conservation unit of indigenous Manipuri Black Pig. Centre is maintaining indigenous pig Manipuri black at the centre and various training programmes were organized at different district of Manipur. Various free vaccination cum health camp at different districts of Manipur was also conducted.

Manipuri Black at institute Farm

Training Programme conducted

Health Camp and input distribution

ICAR-Research Complex for NEH Region, Barapani

The AICRP on Pig, ICAR Research Complex for NEH region is maintaining Lumsniang, indigenous Niang Megha pig and Wak Chambil pigs. The center conducted several trainings, extension activities in farm and farmers' field. Artificial Insemination (AI) has been carried out regularly at farmers door step to produce the crossbred piglets. An experiment was conducted to investigate the effects of heavy metals, specifically arsenic (As), lead (Pb), and fluoride (F), on boar sperm quality parameters in vitro. The results showed a significant decrease in sperm progressive motility, viable sperm, membrane integrity, and MMP in samples treated with heavy metals under different incubation periods. The study concluded that As, Pb, and F is toxic to boar spermatozoa in vitro, causing reductions in sperm functional attributes. In another experiment, the impact of different concentrations of selenium nanoparticles (Se-NPs) in the Beltsville Thawing Solution (BTS) extender on the semen quality and fertility of Hampshire crossbred pigs was examined. Centre has published two research papers in high impact journals.

ICAR-Indian Veterinary Research Institute, Eastern Regional Station, Kolkata

ICAR-AICRP on pig in IVRI, Kolkata was established with an idea to develop an elite flock of Ghungroo germplasm through selective breeding, propagate and supply the superior germplasm to cliental which indirectly increase the pork production. The centre has achieved significant genetic gain of litter size at birth (LSB) 7.50 ± 0.65 to 9.85 ± 0.25 i.e. 31.33 % and litter size at weaning (LSW) from 6.65 ± 0.45 to 9.50 ± 0.30 i.e. 42.86 % over parent stock. The pre-weaning mortality has significantly reduced from 11.33 % to 3.55 %. A total 310 piglets were produced and a revenue of Rs. 846780 was generated. Centre has also developed suitable milk replacer for neonatal piglets along with and SOP of feeding scheduled. In addition, centre has developed a Polyherbal formulation to control post-weaned piglet diarrhoea and post weaning stress. Centre has conducted four short term training (3 days) on scientific pig farming and 5 interactions meet with famers. Centre has also published two research publications in reputed journals.

Sow with 12 piglets

Interaction meets with Progressive farmers

KVK-Goalpara, ICAR-NRC on Pig

The objective of the AICRP on Pig centre of KVK-Goalpara is to act as conservation unit of Doom pig of Assam. The centre is maintaining 30 sow unit of Doom pig for conservation and genetic improvement purpose. Necessary steps were undertaken to conserve this unique germplasm. For this purpose, identification of original breed rearers of the breeding tract, regular training of farmers' regarding importance of these germplasm and dissemination of quality germplasm and scientific management practice to conserve the breed was done. Presently the genetic improvement programme is being done by selective breeding among Doom pig. Besides conservation and popularizing the breed, regular training and

demonstration of scientific pig production practices are conducted by the centre. The farm has completed four generation of inter-se-mating of the breed. The litter size of birth and weaning was observed as 5.50±0.17 and 4.94±0.16, respectively during the period. Body weight at birth, weaning and 8 months of age was observed as 0.92±0.08, 2.22±0.17 and 46.28±1.68 kg, respectively. At present total 64 animals (Adult:33; Grower: 17; and Piglets: 14) were maintained at the centre. Centre has conducted 7 trainings on Scientific pig farming, one OFT on silage preparation from Tapioca and vegetable waste and one FLD on Pig AI was demonstrated through dummy animal to 100 pig farmers. Total 11 Doom pigs were distributed to farmer' field for breeding purpose. The adult doom pig (both male and female) distributed to the farmers is performing well. Pig farmers of Goalpara district have come to know about the disease resistance capacity of Doom pig and its capacity to utilize the locally available feed material which can reduce the cost of production. One FPO for pig farmers named as "Purbabanchal Pig Farmers Producers Cooperative Society Ltd. has formed in association with NABARD.

Guru Angad Dev Veterinary and Animal Science University, Ludhiana

The AICRP on Pig center of GADVASU, Ludhiana is maintaining Large White Yorkshire pigs. The center is engaged in training and demonstration to the farmers of Punjab. Tested the efficacy of Tris-egg yolk (TEY), Beltsville Thawing Solution (BTS) and Safe Cell (SFC) extenders on preservation of boar semen and determined that BTS was better than SFC and TEY in liquid preservation of boar semen at 17 oC owing to improved sperm characteristics and reduced oxidative stress. Conducted nutritional trials on evaluation of potato meal on growth performance, nutrient utilization, blood parameters and economics in growing pigs and concluded that the amount of potato meal increased the gain in body weight and the digestibility of nutrients decreased. Published research articles (01), abstracts (02), lead papers (01) and invited papers (02). One M.V.Sc Thesis pertaining to project work completed. Strict measures undertaken to reduce mortality in pig herd. The pre-weaning and post-weaning mortality were 8.1% and 0.0%, respectively. Delivered 13 lectures on scientific pig farming to pig farmers (n=125) in four training programmes and one Pashu Palan Mela.

Birsa Agricultural University, Ranchi, Jharkhand

The AICRP centre is maintaining Jharsuk pig variety to the farmers. The center is developing second line breeder for further propagation of the variety. Breeding of pigs is continued and centre have maintained 44 breedable females along with boar for breeding purpose. Data regarding Growth and reproduction is recorded. Research on utilization of nutritious green fodder to pigs and their effect on growth performance for economics. One of the progressive pig farmer/ 2nd line breeders have developed concentrate feed of different categories. The evaluation of these feed at field level along with their economics is continues. The

centre has conducted 11 training programmes for farmers on scientific pig farming and biosecurity and 137 farmers were benefitted. During the period 288 piglets were produced and 04 AI have been conducted. A total of 15 2nd line breeder developed.

ICAR RC for NEH Centre, Nagaland

The center is maintaining and distributing Rani crossbred pig variety to the stake-holders of the state. The center also popularized artificial insemination in pig in the state of Nagaland to enhance the production of piglets from superior breeding stock. The reporting year began with 57 breedable sows and 13 breeding boars of Rani pig. Altogether 682 piglets were farrowed with a farrowing rate of 71.01%. The improved pig germplasm 558 piglets were disseminated to 87 stakeholders. In addition, 2418 numbers of AI kit in pig was disseminated to 1012 farmers in 97 villages. In the field, 1373 animals were inseminated with the farrowing rate of 73.99% and average litter size of 9.05 (2-17) piglets per litter. A total of 9195 numbers of improved piglets were produced in the farmer's field through artificial insemination. An experiment was done to evaluate the effectiveness of prostaglandin F2alpha (PGF2α) administration on farrowing induction in swine.

Animal Husbandry and Veterinary Services, Sikkim

The center is maintaining HDK-75 crossbred variety. Centre has produced and supplied quality piglets to farmers. A Hand on training on care and management of breeding and lactating sow was also conducted along with one day health camp. Center have taken up the initiative on starting AI in swine which is not at its preliminary stage. Framers were encouraged to startup piggery farming as source of income.

Annual Report-2023
ICAR-NRCP

ICAR KRISHI VIGYAN KENDRA GOALPARA

ICAR-KRISHI VIGYAN KENDRA, GOALPARA

KVK Goalpara carried out different mandated activities through On Farm Testing (OFT) for identifying technologies in terms of location specific sustainable land use system; to organize training to update the extension personnel with emerging advances in agricultural research on regular basis; to organize short term and long term training courses in agriculture and allied vocations for the farmers and rural youths with emphasis on "Learning by doing" for higher production on farms and generating self-employment, and organizing front line demonstrations (FLDs) on various crops and livestock for large adoption by the farmers. In addition, KVK produces quality technological products (seed, planting material, bio-agents, livestock) and make it available to farmers, organize frontline extension activities, identify and document selected farm innovations and converge with ongoing schemes and programmes within the mandate of KVK. During the reported period from January to December, 2023 the following activities were carried out by the KVK.

Capacity development and training programme: For capacity building of farmers, rural youth and extension functionaries, a total of 60 training programmes in agromony, horticulture, animal science, home sciences, agri-engineering were conducted covering 1393 number of participants during the year. The training programmes conducted for farmers and farm women were 30 nos. covering 696 participants; training for rural youth were 22 nos. covering 417 participants; training for extension functionaries were 05 nos. covering 155 participants; long duration sponsored trainings were 3 nos. covering 125 participants.

Technology Assessment through on farm testing (OFT): The On farm Testing conducted by Krishi Vigyan Kendra Goalpara on different agricultural technologies are as follows:

OFT 1: Performance trial of Balijana brinjal under Natural Farming: An OFT was conducted on Performance trial of Balijana brinjal under Natural Farming to reduce the problem of high cost of cultivation. 03 numbers of trials were conducted in 0.4 ha area.

Details of Technology:

TO1: Natural Farming: Seed treatment : *Beejamritha, Jeevamritha @ 500l/ha* and Mulching (with dried leaves, paddy straw etc.)

TO2: Organic Farming (Vermicompost @5t/ha and Rock Phosphate @375kg/ha before transplanting)

TO3: Farmers' Practice

Seed rate: 700g/ha, Spacing: 45 cm x 45 cm

Table : Results

Parameter	TO1	TO2	TO3
Days to harvest	85	85	90
Average fruit weight (g)	430	440	350
Yield/plant (kg)	0.9	1.2	0.8
Yield (q/ha)	270	378	258
B:C ratio	7.20	5.25	2.8

OFT 2: Performance trial of Capsicum F1 Hybrid Arka Atulya: An OFT was conducted on Performance trial of Capsicum F1 Hybrid Arka Atulya to solve the problem of non-availability of suitable hybrid for off season cultivation. The programme is conducted in 03 locations.

Details of Technology:

TO1: Arka Atulya

TO2: Indra

TO3: Capsicum (check variety)

Seed rate: 200g/ha, Spacing: 45 cm x 45 cm

Manure and fertilizer: FYM @ 10t, N 120 kg, P2O5 60 kg and K2O 60kg/ha.

Parameters of Assessment:

1) Days to first picking
2) Total number of pickings
3) Yield/plant (kg)
4) Yield
5) B:C ratio

The programme is in progress.

OFT 3: Assessment of HD-K75 pig breed in Goalpara district: The main objective of this OFT is to assess the production performance of HD-K75 pig breed in Goalpara district to replace the nondescript pig which is available in many pig farms and to make pig farming a profitable one. To assess the HD-K75 pig breed, 7 nos. (5F + 2M) of piglets were distributed to 2 nos. of famers. Body weight at different ages and the reproductive parameters of the HD-K75 pig breed at the climatic conditions of Goalpara district will be assessed. The programme is in progress and till date the following parameters have studied and compared with the nondescript/crossbred pig.

Sl. No.	Parameters	HD-K75	Undescript/Crossbred
1.	Weaning age (days)	45	50-60
2.	Deworming age	Every 6 months	1-1.5 years
3.	Weaning Weight (Kg)	17	11
4.	Weight at 4 months (kg)	41	26

HD-K75 grower male pig at 4.5 months of age

HD-K75 grower female pig at 4.5 months of age

OFT 4: Feeding trial of Silage making through Tapioca and waste vegetables which can replace 50-60% of energy ingredients (Maize, wheat bran, etc.) of total feed : Out of the total cost of pig farming, almost 70% cost goes to the feed cost which is a major problem for the pig farmers. Moreover, commercial pig feed is not readily available in the rural areas in Goalpara district of Assam. This OFT was carried out to make tapioca and waste vegetables which are available in rural areas into silage to minimise the feed cost and to generate more income from pig farming. 05 nos. of trials have been conducted in different villages and prepared silage in following ways.

Methodology 1 (From Tapioca):

i. 50 kg polythene bag

ii. 50 kg half dried cutting Tapioca

iii. 2 kg molasses (3.5 – 4%)

iv. 125 gm salt

Silage will be ready after 28 days

Methodology 2 (From waste vegetables):

i. 50 kg polythene bag

ii. 50 kg half dried vegetable waste

iii. 2 kg molasses (3.5 – 4%)

iv. 125 gm salt

Silage will be ready after 21 days

After feeding silage from Tapioca and Waste vegetables, the following parameters will be assesses. The programme is in progress

i. Growth parameters at different ages

ii. Reproductive performance

iii BC ratio

50 kg half dried cutting Tapioca

Mixing of 2 kg molasses (3.5 – 4%) and 125 gm salt

Air tight packing of Tapioca after mixing of molasses and salt

50 kg half dried cutting vegetables

Mixing of 2 kg molasses (3.5 – 4%) and 125 gm salt

Air tight packing of waste vegetables after mixing

OFT 5 : Evaluation of Tractor drawn seed drill: An OFT was conducted on Evaluation of Tractor drawn seed drill to solve the problem of laborious seed sowing and covering up the soil. The technology is from CIAE, Bhopal. The programme is conducted in 03 places.

Table : Results

Parameter	Technology	Traditional practice
Field capacity	0.4 ha/hr	0.13 ha/hr
Field efficiency in sowing	97%	100%
Productivity	In progress	
Cost of operation	750.00	1500.00

OFT 6: Impact assessment on food consumption pattern of rural households after establishment of Nutrition Garden: An OFT was conducted on Impact assessment on food consumption pattern of rural households after establishment of Nutrition Garden to solve the problem of lack of poor nutritional accessibility which leads to insufficient food consumption pattern.

TO1 : Beneficiaries of Nutrition Garden

TO2 : Non beneficiaries of nutrition Garden

Results: Average Per Day Vegetable production, consumption from nutrition garden and their calorie distribution

Technology details

Methodology: 50 households (@10 from 5 villages) were selected through Purposive Sampling technique. Establish Nutrition Garden in their backyard after conducting awareness program on the importance of vegetables and seasonal fruits in ensuring nutrition security. Demonstration & training. Data collection method by questionnaire, Group meeting, 24 hour dietary recall method.

TO1 : Beneficiaries of Nutrition Garden

TO2 : Non beneficiaries of nutrition Garden

Table: Results: Average Per Day Vegetable production, consumption from nutrition garden and their calorie distribution

T02	0.0	1.3 per family	147.7
Difference	4.75	1.47 per family	167.2
% increase	100	53.0	53.0
Category	**Production (Kg/day)**	**Consumption (Kg/day)**	**Calorie intake (Kcal)**
TO1	4.75	2.77 per family	314.9

OFT 7: Assessing the suitability of foxtail millet (koni dhan) for value addition: An OFT was conducted on Assessing the suitability of foxtail millet (koni dhan) for value addition to address the problem of lack of poor Processing technology leading to insufficient food consumption pattern.

Technology details:

TO1 : Development of products

- Popped –puffed koni dhan
- Malted - konidhan flour

Farmer's Practices: traditional jolppan

Methods:

Popping	Malting
Millets moistened with 10%moisture	Millets steeped in 4 times of water for 20h
Equilibrated in a closed container for 4 h	Drained water and kept for germination at 253°C for 72 h.
Sand heated in Karai with temp. at 230 °C	Sprouted seeds were washed
Allowed the seeds to pop for 15s	Spread on a blotting paper and sun dried.
Sieved through 12 mesh size sieve	Millets were then ground to fine powder

Results: Organoleptic attributes based on 9 point hedonic scale

Product	Moisture level	Colour	Taste	Flavour	Overall Acceptability
Puffed koni dhan	**7.5**	**8.0**	**8.5**	**8.0**	**8**
konidhan flour	**8.5**	**8.0**	**7.5**	**8.0**	**8**

Demonstration of newly proven technology for large scale adoption through Front Line Demonstration (FLD) and Cluster Front Line Demonstration (CFLD) Programme

FLD 1: Stage wise application of N and K in Banana for higher yield: An FLD was conducted on Stage wise application of N and K in Banana for higher yield in 0.6 ha of area involving 15 farmers.

Details of Technology:

Fertilizer dose: 110gN, 33gP2O2, 330g K/plant
Nitrogen Fertilizer: 60% N at planting to 5 month stage, 20% N at shooting, 20% N at last hand opening
Potassium Fertilizer: 40% K at shooting to last hand opening, 60% of K at last hand opening to one

Results:

Demonstration Yield (qt/ha)			Yield of local Check	% increase	Gross Cost (Rs/ha)	Gross Return (Rs/ha)	Net Return (Rs/ha)	B:C Ratio (GR/GC)
H	L	A						
402	370	386	314	22	330000	1544000	1214000	4.67

FLD 2: Popularization of Khaki Campbell duck in Goalpara district: A FLD was conducted on "Popularization of Khaki Campbell duck in Goalpara district" and distributed 200 nos. of Khaki Campbell ducklings @ 20 ducklings/farmer. This FLD was conducted for livelihood promotion and nutritional security. Mostly the women farmers were selected in this programme which is a part of women empowerment. 10 nos. of beneficiaries were selected from 3 villages and it has been observed that Khaki Campbell duck is highly remunerative for the beneficiaries in terms of production performance and BC ratio. Details of different parameters of Khaki Campbell duck in farmers field are as follows:

Overall body weight at 30 days (g)	235.62±5.86
Overall body weight at 90 days (g)	607.71±8.25
Overall body weight at 180 day (Kg)	1.15±0.24
Average age at first laying (days)	120.12±5.17
Monthly egg production /duck (No.)	12.05±2.14
Feed Conversion Ratio up to 180 days	0.65±0.37
Mortality up to 180 days (%)	0.31.24±0.08

Adult Khaki Campbell duck in farmers field

FLD 3: Silage making by using High Density Polythene bag of size 7'x30" with a capacity of 250 kg (Silpaulin-90 GSM): FLD on **"Silage making by using High Density Polythene bag of size 7'x30" with a capacity of 250 kg (Silpaulin-90 GSM)"** was conducted in 05 dairy farmers field. The main objective of this FLD is to make minimise the feed cost of dairy cow management and to make availability of feed during scarcity period. Prepared the silage from fodder in farmer's field in the following ways. Initially for every demonstration, suitable fodder (preferably napier) was chopped and half dried to reduce the moisture content. Mixed 1.25 kg salt and 2.5 kg urea with the half dried chopped fodder. Then the mixed fodder was inserted into a 250 kg capacity high density polythene bag and kept in a dark place. The silage will be ready after 2 months. According to chemical and microbiological analyses the silage will be in good condition even after 6 months and weight losses were less than 3%. After completion of processing period the production performance of dairy cow will be studied. This study is in progress.

FLD 4 : Demonstration of drone for agricultural operation: An FLD was conducted on Demonstration of drone for agricultural operation addressing the problem of laborious pesticide application and disease diagnosis.

The programme is in progress.

FLD 5: Use of walk behind type paddy transplanter: An FLD was conducted on Use of walk behind type paddy transplanter to solve the problem of shortage of labour during rice transplanting period. 03 numbers of demonstrations were conducted under the programme.

Table: Results

Parameter	Technology	Control
Field capacity	0.13 ha/hr	0.01 ha/hr
Field efficiency	97 %	100 %
Hill density (hill/sqm)	12	18-20
Fuel consumption (lit/ha)	7.0	-
BCR	5.0	-

FLD 6: Popularisation of Jackfruit Chips: An FLD was conducted on Popularisation of Jackfruit Chips. The demonstration was conducted in 05 areas of Goalpara district.

Table: Results

Parameters	Product recovery	Income	Shelf life	B.C Ratio
Jackfruit Chips	1 kg Chips/Jackfruit	Rs.160/kg	03 months	1.6
Farmers practice (Raw Jackfruit)	1 Jackfruit	Rs. 40/-	-	

Organoleptic attributes based on 9 point hedonic scale

Appearance	Colour	Taste	Flavour	Overall Acceptability
7.5	7.0	7.5	7.0	7.0

FLD 7: Demonstration on Preservation Techniques of Ginger: An FLD was conducted on Demonstration on Preservation Techniques of Ginger. Two nos. of products were prepared. Ginger candy and ginger garlic paste. The products were well accepted by the farmers.

Technology:

Ginger Candy : Ginger-Slicing-Boiling-Mixing with Sugar-Boiling- Ginger pieces covered with powdered sugar- Packaging

Ginger Garlic Paste : Grinding Ginger and Garlic- Addition of salt and oil-Addition of Preservative- Bottling

Table: Results

Parameters	Product recovery	Income	Shelf life	B.C Ratio
Ginger Candy	750 gm candy/kg	Rs.375/-	In progress	1.8
Ginger Garlic Paste	900 gm/kg	Rs. 1000/-	In progress	2.85
Farmers practice (Fresh Ginger)	1 kg fresh Ginger	Rs. 150/ kg		


KVK Goalpara demonstration Farm Activities

KVK Goalpara demonstration farm is primarily devoted to showcase various agricultural techniques and technologies, new or improved crops to the farmers. Keeping this in view, a number of demonstration units have been established and maintained at KVK Goalpara farm.

Fish-Duck-Horticulture Integrated Farming System: An area of 0.15 ha has been utilized for a Fish-Duck-Horticulture Integrated Farming System Unit comprising 800 nos. under composite fish culture, 40 nos. of ducks and horticultural crops like arecanut, coconut, cocoa and banana.



Natural Farming system model: An area of 2 ha has been covered for cultivation of crops under Natural Farming which is a chemical free farming system based on livestock and locally available resources and rooted in Indian tradition. A natural farming laboratory has been established to prepare different inputs under natural farming like Jeevamrit, Ghana-jeevamrit, Beejamrit, Neemastra, Agniastra and Brahmastra.


Agri-Eco Park: An agri-eco park named "Pancharatna" has been initiated at KVK Goalpara farm with an objective to develop the farm site as an agricultural, educational, and recreational space and provide a fun farm with seasonal fruits and vegetables grown in open field.

A dragon fruit unit with 40 nos. of plants has also been established. In the mushroom production unit Grey oyster mushroom (Pleurotus sajor-caju) has been produced with 1.43 kg as an avg. production per cylinder. During this reported period a total of 755 kg of vermicompost has been produced.

Besides this, demonstration on cultivation of pea (var. Arkel), cultivation of potato (var. Kufri Surya) and cultivation of sesamum (var. Champaboti) has also been carried out in the farm. A FLD on Quality protein Maize (LQMH-1) in collaboration with ICAR- NRC on Pig, under ICAR-IIMR-NRCP-NEH Project has also been carried out at the KVK Goalpara farm.

Moreover, KVK Goalpara is well equipped with a Farm machinery bank and is maintaining a custom hiring centre for greater benefit of the farming community of Goalpara district. Production of seed and planting materials is another important activity of KVK Goalpara. During the reported period, 3.5 of Sesamum (var. Champaboti) was produced in KVK farm. A total of 5900 numbers of disease free planting materials of fruits, vegetables, were produced in KVK Farm under participatory mode whereas 1,45,000 numbers of fruit and spice seedlings were produced in farmer's field.

Other programmes implemented by KVK

Programme organized under Natural Farming 2023: A number of programmes were organised under the project "Natural Farming". 07 nos. of awareness programmes were conducted covering 531 nos. of participants. 03 nos. of trainings and exposure visits were conducted to 123 nos. of participants. 07 nos. of demonstrations were conducted covering 162 nos. of participants.

Swachata Abhiyan: Under Swachh Bharat Abhiyan, a no. of programmes were conducted, such as trainings, workshop for school children on hygiene and sanitation, jungle cleaning programme, publication of extension materials. One village named Balachari Amguri is adopted as Vermi village and training, demonstrations and inputs distributed accordingly.

International year of Millets 2023: To commemmorate International year of Millets 2023, a number of programmes were organised by KVK Goalpara. Training were organised on cultivation practices, health benefits and processing. Awareness programmes were also organised. Milletes recipe contest were organised among farm women and anganwadi workers.

Viksit Bharat Sankalp Yatra (22nd Nov, 2023 to 07th Jan, 2024): KVK Goalpara actively participated in Viksit Bharat Sankalp Yatra Programme in Goalpara, Assam along with the line departments reaching people in rural areas for giving them benefits of government schemes. 08 nos. of development blocks of Goalpara district covering 81 gram panchayats were visited.

Extension Activities carried out by KVK Goalpara

A number of extension activities were carried out for dissemination of agricultural technologies and information by the KVK during this period.

Sl. No.	Activity	Nos.
1.	Field Visits	219
2.	Advisory Services	187
3.	Celebration of Important Days	7
4.	Exposure Visits	4
5.	Exhibitions	3
6.	Farmer's Visit to KVK	1850
7.	Field day	3
8.	Awareness camp	40
10.	Newspaper Coverage	6
11.	TV Programme	4
12.	Seed distribution programmes	6
13.	Programme for School Children	10

Annual Report-2023
ICAR-NRCP

NATIONAL AGRICULTURE INNOVATION FUND (NAIF)

NATIONAL AGRICULTURE INNOVATION FUND (NAIF)

Institute Technology Management Unit :

PI: Dr. Pranab J. Das, Co-PI: Dr. Rajendran Thomas, Dr. Rajib Deb

During 2023, Institute Technology Management Unit, ICAR-National Research Centre on Pig has taken initiative for technology certification and commercialization. Institute Technology Management Unit (ITMU) which is funded by the National Agriculture Innovation Fund-I has also proactively working for granting different IPs like, Patent, Design, Copyright and Trademarks. During 2023 institute has granted, developed nos. of technologies and signed MoUs with stakeholders and other organization as well as participated in four national and regional exhibitions. The newly developed technologies under different aspects will further strengthen the intellectual property management and transfer the regime of ICAR and make a significant contribution to the upliftment of the economic status of pig farmers.

Institute Technology Management Committee

Chairman:	Director, ICAR-NRC on Pig
Member:	Dr. N.H. Mohan, Principal Scientist
	Dr. R. Thomas, Sr. Scientist
	Mr. Utpal Ghosh FAO/AO
	Mr. Uttam Prakash, AAO
External Member:	Dr.B.K Bhattacharjya, Pr. Scientist &Head, CIFRI Regional Station, Guwahati
Member Secretary:	Dr. Pranab J. Das, Pr. Scientist

Table: Management of IP Portfolio

IPRs	Name of Institute	Application/ Registration No.	Name of Innovation/ Technology/ Product/ Variety	Date of Filing/Registration	Application Granted/ Registered**
Patent	ICAR-NRCP	202211001562	PROCESS FOR PREPARATION OF A SPRAY FOR SURFACE DECONTAMINATION OF PORK CARCASSES USING FERMENTED BAMBOO SHOOT EXTRACT AND SPRAY THEREOF	19.07.2021	Complete Specification 01.03.2021 ,11/01/2022 MoU with NBA 19.08.2022 Form 18 , 23.03.2023 PUBLICATION DATE (U/S 11A): 14.07.2023
	ICAR-NRCP	201831043234	PIG RESTRAINING TOOL	16.11.2018	Patent No.478346 Granted on 30.01.2024
	ICAR-NRCP	201831033038	A PORTABLE FREE STANDING SMALL-ANIMAL RESTRAINING TOOL	03.09.2018	Patent No.478346 Granted on 07.12.2023

	ICAR-NRCP	201931040074	LAMP PRIMER SYSTEM FOR RAPIDVISUAL DETECTION OF STREPTOCOCCUS SUIS FROM PIGS AND APPLICATION THEREOF	03.10.2019	Patent No.495923 Granted on 08.01.2024
	ICAR-NRCP	202311029459	NOVEL PRIMERS FOR ISOTHERMAL AMPLIFICATION VIS A VIS VISUAL RAPID DETECTION AND QUANTITATIVE DETECTION OF AFRICAN SWINE FEVER VIRAL DNA	24.04.2023	Complete specification due on 24.08.2023
	ICAR-NRCP	202311041898	UNIVERSAL NOVEL SINGLE SET OF PRIMERS FOR SPECIFIC VIS-À-VIS SIMULTANEOUS DIFFERENTIATION OF *ESCHERICHIA COLI* AND *KLEBSIELLA SPECIES*	23.06.2023	Complete specification due on 23.09.2023
Trademarks	ICAR-NRCP	5535233	INDPOTRACE	19.07.2022	Certificate No. 3239789 Dated :26/07/2023 Notified in Journal No : 2116
	ICAR-NRCP	5747847	NUCLEOFAST	02.01.2023	Certificate No. 3302090 Dated : 10/11/2023 Notified
	ICAR-NRCP	5747848	PIGGYPLEX(D)	02.01.2023	Certificate No. 3302025 Dated : 10/11/2023 Notified
	ICAR-NRCP	5747849	PIGGYPLEX(R)	02.01.2023	Certificate No. 3305191 Dated : 12/11/2023 Notified
Copyrights	ICAR-NRCP (Literary work)	12157/2022-CO/L	SCIENTIFIC PIG PRODUCTION (ENGLISH)	May 2022	L-13111/2023 Registered On 28.07.2023
	ICAR-NRCP (Literary work)	12158/2022-CO/L	SCIENTIFIC PIG PRODUCTION PRACTICE (ASSAMESE)	May 2022	L-13111/2023 Registered On 28.07.2023
	ICAR-NRCP (Cinematogra	12243/2022-CO/CF	SCIENTIFIC INTERVENTIONS FO	May 2022	CF-5346/2023 Registered

	ph films work)		R UPSCALING RURAL PIGGERY (HINDI)		On 27.07.2023
	ICAR-NRCP (Cinematograph films work)	12240/2022-CO/CF	SCIENTIFIC INTERVENTIONS FO R UPSCALING RURAL PIGGERY (ASSAMESE)	May 2022	CF-5346/2023 Registered On 27.07.2023
	ICAR-NRCP (Cinematograph films work)	12256/2022-CO/CF	BIOSECURITY IN SCIENTIFIC PIG PRODUCTION (HINDI)	May 2022	Re-Scrutiny December 2023
	ICAR-NRCP (Cinematograph films work)	12246/2022-CO/CF	BIOSECURITY IN SCIENTIFIC PIG PRODUCTION (ASSAMESE)	May 2022	Registered Nov. 2023
	ICAR-NRCP (Cinematograph films work)	12244/2022-CO/CF	BIOSECURITY IN SCIENTIFIC PIG PRODUCTION (ENGLISH)	May 2022	Registered Nov. 2023
	ICAR-NRCP (Literary work	12156/2022-CO/L	ARTIFICIAL INSEMINATION IN PIG (ENGLISH)	May 2022	Registered Nov. 2023
	ICAR-NRCP (Literary work)	12252/2022-CO/CF	SCIENTIFIC INTERVENTIONS FO R UPSCALING RURAL PIGGERY (ENGLISH)	May 2022	Registered Nov. 2023
	(ICAR-NRCP) Literary work	Process	Entrepreneurial Guide for Scientific pig Production	23.06.2022	Processed
	ICAR-NRCP (Literary work)	21884/2023-CO/L	NucleoFAST Viral DNA isolation kit can be usedfor quick extraction of viral DNA (DNA Virus) from animal tissue samples	15th December, 2022	Registered 03/11/2023
	(ICAR-NRCP) Literary work	21911/2023-CO/L	Simultaneous diagnosis (ASFV), (PCV) & (PPV) in swine blood and tissue samples	15th December, 2022	Registered 30/11/2023
	(ICAR-NRCP) Literary work	21914/2023-CO/L	Simultaneous diagnosis of CSF, JE & PRRS in swine blood and tissue samples	15th December, 2022	Registered 25/01/2023
	(ICAR-NRCP) ARTWORK	Process	INSIGNIA	23rd Feb 2023	Processed
Design	(ICAR-NRCP) APPARATUS FOR	367130-001	Machines and appliances for preparing food and drink	02/07/2022	Design Registration on 02.07.2022 Certificate

	SURFACE MICROBIAL ECONTAMINATION OF MEAT				issued 22.05.2023
	(ICAR-NRCP) BOAR SEMEN PRESERVATION CABINET	360850-002	Machines and appliances	17/03/2022	Design Registration on 17.03.2022 Certificate issued 30.05.2022
	(ICAR-NRCP) BOAR SEMEN PRESERVATION AND TRANSPORTATION BOX	360850-001	Machines and appliances	17/03/2022	At Technical Examination of Amended Application (FER generated on 09/05/2022)
Plant Variety	NIL	NIL	NIL	NIL	NA
Biological Material/ Strains/ Resources	NIL	NIL	NIL	NIL	NA
Any Other	Following Six technologies of the institute is given **Technology Certification Awarded by ICAR in 2023** 1. Piggyplex (D) $^{ASFV, PCV \& PPV}$ assay kit 2. Piggyplex ® $^{CSF, JE \& PRRS}$ Assay Kit 3. Apparatus for surface microbial decontamination of meat 4. LAMP (Loop Mediated Isothermal Amplification) Assay Kit for Detection of Porcine Circovirus Type -2 (PCV-2) 5. LAMP (Loop Mediated Isothermal Amplification) Assay Kit for Detection of Porcine Parvovirus (PPV) 6. Multiplex PCR Kit for Simultaneous Detection of Porcine Circovirus 2 (PCV-2), Porcine Parvovirus (PPV) and Classical Swine Fever Virus (CSFV)				

Table: Commercialization of Technologies

S No	Name of Institute	Name of Technology/ Know-How	IP Protection (Yes/ No)*	Name of Contracting Party	Mode of Partnership**	Date of Licensing	Revenue Earned (₹)
1	ICAR-NRCP	Technology support for value added pork products	No	AB Foods & Beverages Tila path, Arunachal path, Zoo Road Tiniali, Guwahati, Assam	MoU	25.04.2023	₹10000/
2	ICAR-NRCP	Establishing micro pig abattoir	No	SRS Meat & Fish suppliers, Agartala	MoU	16.05.2023	₹10000/

***Note: (Mode of Partnership: eg. MoU/ MOA/ Licensing/Know-How etc)*

Professional Services

S No	Name of Institute	Name of Technology/ Know-How/Service Provided	IP Protection (Yes/ No)*	Name of Contracting Party	Mode of Partnership** *Consultancy/ Contract Service & Research)*	Date of MoU/ MoA Signing	Revenue Earned (₹)
1	ICAR-NRCP	Establishing micro pig abattoir	No	M/S SRS Meet and Fish Supplier, Agartala, Tripura	Consultancy	16.05.2023	NA
2	ICAR-NRCP	Exchange of Resources	No	Rahman Institute of pharmaceutical sciences and research Institute (RIPSR)Tepesia,Sonapur, Assam Pin 782402	Co-operation in Education and R&D activities	26.09.2023	NA
3	ICAR-NRCP	Exchange of Resources	No	NEPEDS College of Pharmaceutical Sciences, Gandhi Nagar, Tetelia, Sonapur, Kamrup Pin 782403	Co-operation in Education and R&D activities	26.09.2023	NA

Capacity Building in IP Management

Training/workshop/Seminar etc.

Sl. No.	*Name of Programme (Training/ workshop/ Seminar etc.) attended*	*Organized By (Name of Institute)*	*Days of Programme (Date from - to)*	*Participant (Name)*
1.	Vibrant NorthEast-2023	ICAF at Srimanta Sankaradeva Kalakshetra, Exhibition Ground, Gate No.2, Guwahati (Assam).	16th -18th May 2023	Dr. N. M. Attupuram, Dr. Anil Das, Dr. Gagan Bhuyan Mr. Rana P. Kakati
2.	North East Livestock-Aqua-Poultry (NELAP) Exhibition & Conference 2023	P2C Communications, Smart Agripost & Aqua Post, J-10, Green Park Main, New Delhi-110016Maniram Dewan Trade Centre in Guwahati	18th -20th April, 2023	Dr. Pranab Jyoti Das Dr. Rajendran Thomas Dr. Sunil Kumar Dr. N. M.Attupuram, Dr. Anil Das Mr. Rana P. Kakati
3.	North East Krishi Kumbha 2023, with the theme "Emerging opportunities in agriculture and allied sectors for income and employment generation"	ICAR Research Complex for NEH Region Umiam, Meghalaya	4th -6th January, 2023	Dr. Sunil Kumar, Dr. Satish Kumar Mr. Rana P. Kakati
4.	MSME Exhibition cum Sales Fair	District Industries and Commerce, Rajgarh, Dibrugarh, Assam	26th -31st December 2022	Dr. Juwar Doley
5.	Regional Livestock and Poultry Show in Guwahati	Animal Husbandry and veterinary Department, Assam and National livestock and Poultry show-2023	15th, 16th and 17th Feb. 2023"	Dr. R. Thomas Dr. Sunil Kumar, Dr. Satish Kumar, Dr. Jaya, Dr. N. M. Attupuram, Ms. S. Jayachitra Dev Mr. Rana P. Kakati
6	ICAR-Industry Stakeholders Consultation Meet	ICAR- National Dairy Research Institute, Karnal-132 001(Haryana). INDIA	18th Jan 2023	Dr.V.K. Gupta Dr. P. J. Das Dr. R. Thomas
7	North East Regional Food	Organized by Industries,	29th, 30th & 31st	Dr. P. J. Das

	Festival 2023	Commerce & PE Department, Assam under the aegis of Ministry of Food Processing Industries, Govt. of India at Maniram Dewan Trade Centre, Betkuchi (near ISBT), Guwahati on	March 2023	Dr. R. Thomas Dr. Sunil Kumar Dr. Satish Kumar Dr. N. M. Attupuram Mr. Rana P. Kakati
8.	Review-cum-workshop of ITMUs/ ZTMCs/ ABIs (through Virtual Mode	IP&TM Unit Indian Council of Agricultural Research(ICAR) Krishi Anusandhan Bhawan-I Pusa, New Delhi-110012	27th June' 2023	Dr.P.J.Das Dr. R. Thomas
9.	Participate in "Two days Sensitization Workshop of ICAR-Agri-Business Incubation Centers (ABIs)"	IP&TM unit of ICAR to be held NASC complex, New Delhi-110012	21st-22nd September, 2023	Dr.P.J.Das Dr. R. Thomas
10	Participation in XVI Agriculture Science Congress and Agri Expo	National Academy of Science (NAAS), New Delhi. Organized at Kochi, Kerala	10-13th October 2023	Dr. V.K. Gupta Dr. NH Mohan Dr. N.M. Attupuram Dr. S. Jaychitra Devi
11	**Attended 10th Indian Horticulture Congress 2023** held at the College of Veterinary Science, Assam Agricultural University Khanapara, Guwahati-22 from	Indian Association of Horticulture Society.	6th -9th November 2023	Dr. Pranab Jyoti Das Dr. Rajendran Thomas Dr. Nitin M. Attupuram, Scientist Dr. Anil Das Mr. Rana Pratap Kakati
12	Participate in Assam Diwas held at Tingkhong HS School ground, Tingkhong LAC, Dibrugarh, Assam from	Department of Cultural Affairs in association with the Department of Industries, Commerce, & Public Enterprises of Government of Assam	2nd -6th December 2023	Dr. Priyajoy Kar Dr. Gagan Bhuyan

Training/workshop/Seminar etc. (Organized)

Sl. No.	*Name of Programme (Training/ workshop/ Seminar etc.) Organized*	*Days of Programme (Date from - to)*	*Participants (No.)*	*Participant category **
1.	Sensitization of Institute Technologies for Economic	30th Nov. 2022	25	All Scientific Staff of the Institute
	Pig Farming and its Commercialization Prospect			
2.	An Interactive session and Exposure visit for the student of Downtown University"	26th May 2023	52	Faculty & Student
3.	Scientific and Technological exposure to the UG & PG (Science) students for Entrepreneurship development	26th May. 2023	50	Faculty & Student
4.	One-day workshop on "Awareness of intellectual property rights among young researchers"	28th November 2023	60	Scientist, Young researchers and students
5.	Celebrate World Intellectual Property Day 2023 with the theme "Women and IP: Accelerating Innovation and Creativity " on 26th April 2023	26th April 2023	25	All Scientific Staff of the Institute

Participation in “North East Regional Food Festival 2023" at Maniram Dewan Trade Centre, Betkuchi (near ISBT), Guwahati on 29th, 30th & 31st March 2023

Celebration of World Intellectual Property Day 2023 with the them "Women and IP : Accelerating Innovation and Creativity" on 26th April 2023

Signing of MoU with M/s SRS Meat and Fish Supplier, Agartala, Tripura on 15th May, 2023

Participated in the exhibition of North East Livestock-Aqua-Poultry (NELAP) Exhibition & Conference 2023 held from 18th to 20th April 2023 at Guwahati

Participated in “Vibrant North East-2023” exhibition organized by ICAF from 16th to 18th May 2023 at Srimanta Sankaradeva Kalakshetra, Exhibition Ground, Guwahati.

Participation in XVI Agriculture Science Congress and Agri Expo held on 10-13 October 2023 at Kochi, Kerala

One-day workshop on "Awareness of intellectual property rights among young researchers”

NELAP Expo 2023

ICAR National Research Centre on Pig, Guwahati participated the North East Livestock-AquaPoultry (NELAP) Exhibition & Conference 2023 held on 18th to 20th April 2023 at Maniram Dewan Trade Centre in Guwahati, organized by P2C Communications, Smart Agripost & Aqua Post, J-10, Green Park Main, New Delhi-110016 under the coordination of Dr P.J. Das, Pr. Scientist, Dr. R. Thomas, Sr. Scientist, Dr. Sunil Kumar, Scientist, Dr N.M. Attupuram, Scientist, Dr Anil Das Technical Officer, Mr. Rana Pratap Kakati, Sr. Technician.

Agri-Business Incubation (ABI) Centre

Technological support extended to Entrepreneurs/start-ups

In charge: Dr. R. Thomas, Senior Scientist

ABI centre of ICAR-National Research Centre on Pig through its mentorship connects to guide the entrepreneurs in the right direction for a better resolution and to become more agile, lean and mature as a start up company. The ABI unit also provided a more structured way to the start ups by extending the support by commercializing institute's technologies and infrastructure facility to its Entrepreneurs, which has opened up new entry points in the piggery value chains for the start ups, which in turn had use to access to the new potential markets. The ABI unit of National Research Centre on Pig also extended its valuable support to its entrepreneurs in providing processed pork and value added pork products from the institute. The ABI Unit also helped the entrepreneurs by providing them pro-active and value added business support in terms of technical consultancy and mentor connections, guidance and trainings to develop modern technology based business ideas and models in business domains in order to scale their start-ups effectively. Finally, in a more advanced state of business development, ABI also operated as conduits for the exchange of technologies, products, inputs and management methods for the entrepreneurs. The support extended to the Entrepreneurs/start-ups include the following-

Sl. No.	Technology/support	No. of Entrepreneurs/ Small Scale Start-ups
1	Establishing commercial pig breeding farm.	4
2	Establishing Micro Pig Abattoir	8
3	Establishing Pork Processing Units.	4
4	Support for value added pork products	5
5	Establishing AI support	3
6	Quality testing	1
7	PIGMIN Technology	1
8	Establishing a small feed mill	1
9	Chilled Boar Semen Processing Centre	1

As of now, a total of 19 Entrepreneurs/start-ups have been incubated in the ABI unit, ICAR-NRCP which are listed below-

S. No.	Name	Location of business entity
1	Arohan Foods Pvt Ltd	Guwahati, Assam
2	Amora Foods Pvt Ltd	Guwahati, Assam
3	Sayuri Farms	Guwahati, Assam
4	Symbiotic Foods Pvt Ltd	Sonitpur, Assam
5	Borluit Farms	Guwahati, Assam
6	G.N Nagesh	Bangalore, Karnataka
7	Paras Farm	Ranchi, Jharkhand
8	Rubul Deka	Dibrugarh, Assam
9	Emergent Dream Works Infra Developers	Serillingampally, Hyderabad
10	Animal Resources Development Department (ARDD)	Agartala, Tripura
11	Majo Francis. A	Thissur, Kerela
12	Hester Bio-sciences Ltd	Ahmedabad, Gujarat,
13	Arthur Foods Company Pvt Ltd	Bangalore, Karnataka
14	Murali Jayaram Reddy	Bangalore, Karnataka
15	Rayan Firms LLP	Guwahati, Assam
16	Animal Resourcse Development Department (ARDD)	Agartala, Tripura
17	Aqgromalin Farmtech Pvt. Ltd.	Chennai, Tamil Nadu
18	AB Foods & Beverages	Guwahati, Assam
19	SRS Meat & Fish suppliers	Agartala, Tripura

MoU Signing_AB Foods and Beverages

MoU Signing_SRS Fish and Meat suppliers

Induction of new incubates

ABI centre of ICAR-National Research Centre on Pig is intended to help and promote piggery focused enterprises by developing agri-business incubator networks in North East region and other parts of India to create a value chain in commercial piggery sector. A total of 5 ABI applications were received during the year 2023-24 who sought for the possible support from ABI centre for streamlining their business. These registered entrepreneurs/firms are currently discussing the modalities for the institute to extend its technical support.

Orientation programs organized

Agri-Business Incubation Centre of ICAR-National Research Centre on Pig had organized an Residential Entrepreneurship Development Programme on "Scientific Pig Production Practices and Value Addition on Pork" on 25th September, 2023. The training programme emphasized to impart the valuable knowledge and skills pertaining to scientific pig production as well as value addition of pork to the prospective individuals or entrepreneurs. A total of 15 entrepreneurs were attended the programme belonging to different states and backgrounds. The diversity of the trainees in terms of experience also helped in creating an knowledge exchanging environment. The trainings were focused on topics related to commercial pig farming; pork processing; artificial insemination; care and management of different categories of pigs; bio-security aspects; waste management; to tackle the challenges with respect to new and emerging diseases associated with pigs and value addition of pork value chain in piggery sector.

Entrepreneurship development programme (25th – 27th September, 2023)

Hands on training on processing and value addition of pork for AB Foods and Beverages

A hands on training on processing and value addition of pork was organized by the ABI unit for the firm AB Foods and Beverages, Guwahati on 01st November 2023. The firm had signed an MoU with ICAR-NRC on Pig on 24th April, 2023 for technology support in value addition of pork. Dr. R. Thomas, Sr. Scientist, demonstrated the preparation of pork products (e. g. Pork Sausages etc.) using the processing technology at the R&D and slaughterhouse facility of ICAR-NRC on Pig, along with extending technical guidance to the firm regarding value addition and processing of pork.

Moments from the Hands-on training on pork processing and value addition of Pork

Products of AB Foods and Beverages

Success Story

Startup created by ICAR-NRC on Pig "Khaisua Foods" has operationalized its processing facility

One of the startups created by ICAR-National Research Centre on Pig viz. Khaisua Foods Private Ltd located at Amingaon, Guwahati, Assam has operationalized its processing facility. The facility was inaugurated by Dr. Vivek Kumar Gupta, Director, ICAR-National Research Centre on Pig on 11th August, 2023. The unit has state-of-the-art facility for processing shelf stable products using retort technology. Khaisua Foods is an incubate of ICAR-NRC on Pig and the institute has supported the firm to develop and

optimize the technologies for processing different shelf stable pork products. The firm has adopted both online and offline business strategy for reaching out to its customers. Khaisua Foods offers shelf stable Assamese traditional pork dishes, among others, to satisfy the taste buds of the customers throughout the country. The startup is an initiative of two young entrepreneurs viz. Dhruba Jyoti Kalita and Sharanan Gogoi. The officials from DIC, Govt. of Assam, Assam Gramin Vikas Bank, marketing partners and well-wishers were also present during the inauguration programme.

Inauguration of the Khaisua Foods processing plant

SWACHH BHARAT MISSION

Incharge: Dr. Kalyan De

The ICAR-National Research Centre on Pig, Rani, has consistently engaged in and coordinated various "Swachhta Abhiyan" initiatives throughout the year. All institute staff have willingly and wholeheartedly participated in these programs. This year's Swachhta Abhiyan activities encompass cleanliness drives, swachhta campaigns, awareness camps, addressing pending references, ensuring cleanliness in offices and workplaces, enhancing record management, space organization, and scrap disposal, among other initiatives. Following the directives from the council, the institute orchestrated the "Swachhta hi Sewa" campaign from September 15th to October 2nd, 2023. Dr. Juwar Doley, Senior Scientist; Dr. Priyajoy Kar, Scientist; and Dr. Gagn Bhuyan, Technical Officer, spearheaded the coordination of all programs under the Swachhta hi Sewa initiative. Their efforts encompassed various activities as part of the Swachta Hi Seva Campaign, involving the cleaning of offices, corridors, and premises. Additionally, a comprehensive cleanliness drive was executed across different areas of the campus and nearby locations. The ICAR-National Research Centre on Pig, Rani, dedicated the Swachhata Hi Seva campaign to promoting a 'Garbage Free India,' emphasizing visual cleanliness and the well-being of SafaiMitras. The initiative also featured a 'Thank you SafaiMitra' campaign aimed at honoring and appreciating the contributions of sanitation workers.

ICAR-National Research centre on Pig, Rani organized Special Campaign 3.0 for institutionalizing Swachhata and minimizing pendency in Government offices from 2nd October -31st October 2023. During this period, various activities were organized, including a roadside weed cleaning drive on the campus, clearing weed and garbage, cleaning farm-gate roadside areas, conducting cleanliness drives at the farm office premises, and ensuring cleanliness in the recreation club and QC lab premises. The institute also took the initiative to create a nursery bed by removing roadside weeds. As part of the campaign, the institute's staff organized an outdoor camping and cleanliness drive at the local Rani Saturday market. Another significant event was the Farmers Day, coupled with an outdoor camping and cleanliness drive at Pijupara Village in the Kamrup (R) district of Assam. During this initiative, a Swachhta campaign was carried out at Rani High School, involving the active participation of teachers in cleaning the school premises. Simultaneously, a cleanliness awareness camp was conducted in the village of Khopbia, Kamrup, engaging approximately 100 villagers. Further, the institute conducted Swachhta campaigns at various locations, including the Lord Ganesha Temple, Nabajyoti Adarsh Vidyamandir Lower Primary School in Rani, and the local Rani Kapili picnic spot. The temple, school premises, and picnic spot were thoroughly cleaned by the dedicated efforts of the institute's staff during these occasions.

The ICAR-National Research Centre on Pig, Rani, celebrated Swachhta Pakhwada from December 16, 2021, to December 31, 2021. Swachhta Pakhwada officially started on December 16, 2023, with an inaugural address by Dr. V.K. Gupta, the Director of ICAR-NRC on Pig, Rani. During the address, Dr. Gupta emphasized the significance of Swachhta Pakhwada and unveiled the date-wise action plan. The program commenced with the administration of the Swachhata Pledge by Dr. V. K Gupta, and a Swachhta banner was prominently displayed at various locations within the center. Officers, officials, contractual staff, RA, and SRF of the National Research Centre on Pig actively participated in diverse activities throughout the Swachhta Pakhwada, contributing to the success of the event. The events include cleaning of campus,

office buildings, gardens, farms, residential colonies, roads etc. As part of the off-campus programs, activities such as local school cleaning, cleaning awareness campaigns in local shops, a cleanliness drive in the local temple, and an awareness camp for farmers were organized. Additionally, On December 23rd 2023, as part of Swachhta Pakhwada, the institute celebrated Kisan Diwas (Farmers' Day). On this special occasion, 20 farmers from Karbi Anglong District visited the institute and took part in a training program focused on "Enhancing the capabilities of farmers through the implementation of scientific practices in pig farming and pork processing for ensuring livelihood security." The Farmers' Day was celebrated to mark the significance of the farming community in promoting cleanliness and sustainability. The active participation and diverse initiatives undertaken during Swachhta Pakhwada displayed the commitment of ICAR-National Research Centre on Pig, Rani, towards promoting a clean and healthy environment within the institute and its surrounding areas.

A Glimpse of Programme

Swachhta Pledge

Campus cleaning

Kitchen gardening

Cleanliness Drive in Local School

Roadside cleaning

Farmers' Day Celebration

Cleanliness drive and awareness in local shop

Campus cleaning

Campus road cleaning

Farm Cleaning awareness

Cleanliness drive in local temple surroundings

Cleanliness drive in local Rani Saturday Market

Cleanliness drive in local Rani Saturday Market

Farmers Day cum outtdoor camping and cleanliness drive at Pijupara Village of Kamrup ® district in Assam

Farmers Day cum outdoor camping and cleanliness drive at Pijupara Village of Kamrup ® district in Assam

Swachhta campaign at nearly Rani High School


Swachhta campaign at nearly Rani High School


Swachhta campaign at nearby Lord Ganesha Temple


Swachhta campaign at nearby Nabajyoti Adarsh Vidyamandir Lower Primary School, Rani


Swachhta campaign was carried out at nearby local Rani Kapili picnic spot

MEETINGS AND OTHER ACTIVITIES

MEETING AND OTHER ACTIVITIES

Institute Biosafety Committee Meeting

Seventh Institutional Biosafety Committee (IBSC) of ICAR-National Research Centre on Pig, Guwahati, Assam was held on 09.05.23 in the committee room of the institute. At the onset, Dr. V. K. Gupta, Director and Chairman, IBSC welcomed all the members including Dr. N.N. Barman, Professor, CVSc, AAU, Khanapara & DBT Nominee, Dr. Dhireswar Kalita, Professor, CVSc, AAU, Khanapara & Outside Expert and Dr. Lk. Samaddar, Biosafety Officer. The welcome was followed by a presentation on Biosafety regulatory frameworks in India with respect to IBSCs by Dr. N H Mohan, Pr. Scientist and Member Secretary, IBSC. The presentation included various Biosafety measures adopted by ICAR-NRC on pig for safety and biocontainment and action taken on recommendations of previous IBSC meeting. The IBSC later considered the research proposals one by one followed by discussion with the Principal Investigators (Pis).

Institute Research Committee Meeting

The XVII Annual Institute Research Committee meeting of ICAR-NRC on Pig was held on 16th to 18th August 2023 in the Committee room of ICAR-NRC on Pig under the chairmanship of Dr. V.K. Gupta, Director, ICAR-NRC on Pig, Rani. Dr. Souvik Paul, Member Secretary, IRC and I/C PME Cell of the Institute extended formal welcome to the Director and scientists of the Institute. In his opening address, the Chairman IRC emphasized the need for executing outcome-based research projects. He also asserted that each scientist must try to evaluate the research work conducted by himself/herself and try to publish their tangible research to good impact factor journal once the work is over. Director has emphasized that project-based budgeting will be implemented for institutional projects. During the meeting the outcome of completed projects, progress of ongoing projects was critically evaluated by the committee and suggestion were given for improvement. The technical programs of new project proposals were presented by PIs and thoroughly reviewed.

Institute Animal Ethics Committee Meeting

The 5th Institute Animal Ethic Committee Meeting (IAEC) of ICAR-NRC on Pig was held in the committee room on 25/04/2023 of the ICAR-NRC in hybrid mode, under the chairmanship of the Director, ICAR-NRC on Pig. The meeting was attended by Dr. Birendra Nath Bhattacharyya (Main Nominee, CCSEA), Dr. Arundhati Phookan (Link Nominee, CCSEA), Dr. Pavan Kumar Samudrala (CCSEA nominee from other institutes) and Dr. Keshab Barman, (Member Secretary, IAEC and Principal Scientist, Animal Nutrition) in addition to scientists who presented their projects for IAEC approval. The committee has approved 15 proposals.

Annual Inspection of Animal House Facility by CCSEA Nominee

The large animal house facility at ICAR-NRC on Pig registered Committee for Control and Supervision of Experimentation on Animals (CCSEA) was conducted on the 22nd of December 2023. The inspection was carried out by Dr. Birendra Nath Bhattacharyya the external main nominee of CCSEA. The committee visited the animal shelters, biosecurity facility, and farm infrastructures after verifying the documents of animal management. The concluding session was presided over by the Chairman, IAEC & Director, ICAR-NRC on Pig, Guwahati and attended by the CCSEA nominee and members of IAEC.

Institute Management Committee Meeting

The 20th Institute Management Committee meeting was convened by the ICAR-National Research Centre on Pig, located in Guwahati, Assam, on 2nd February, 2023. The meeting took place in the committee room of the Institute and was chaired by Dr. V.K. Gupta, the Director of ICAR-NRC on Pig. Mr. Uttam Prakash, the Administrative Officer of ICAR-NRC on Pig, served as the member secretary. The meeting was attended by members representing different sectors viz. Dr. Arnab Sen, Principal Scientist at ICAR-RC in Barapani, Meghalaya; Director of Animal Husbandry & Veterinary Services, Government of Meghalaya, Shillong; Dr. B.K. Bhattacharyya, Head of ICAR, CIFRI Regional Station in Guwahati; Dr. Shyamal Naskar, Principal Scientist at ICAR-IVRI in ERS, Kolkata; Dr. Vijay Paul, in charge of FAO at ICAR-NRC on Yak in Dirang and Dr. Khanindra Kalita, VPO, Rangia, Kamrup. Dr. B.C. Das, Principal Scientist at ICAR-NRC on Pig represented scientists of the institute. Two additional members, Dr. Mohan N.H., Principal Scientist at ICAR-NRC on Pig, Guwahati, and Mr. Utpal Ghosh, FAO at ICAR-NRC on Pig, Guwahati, were also invited to the meeting.

Quinquennial Review Team (QRT)

ICAR National Research Centre on Pig, Guwahati conducted Quinquennial Review Team meeting on 2nd-3rd Feb, 2023 under the chairmanship of Dr. V. K. Taneja, Former Vice Chancellor, GADVASU and Former Dy. Director General (AS), ICAR, New Delhi. The external members of QRT include Dr. Arjava Sharma, Former Director, ICAR-CIRC, Meerut and Former Director, ICAR-NBAGR, Karnal; Dr. Kusumakar Sharma, Former, ADG (HRD), ICAR; Dr. V.V. Kulkarni, Former Director ICAR-NRC on Meat, Hyderabad; Dr K. K. Datta Former Principal Scientist, NIEP, New Delhi and Dr. S.K. Uppal, Dean, PGS, GADVASU, Ludhiana.


Research Advisory Committee Meeting

Research Advisory Committee meeting was held on 13th-14th April, 2023 at ICAR-NRC on Pig, Guwahati under the chairmanship of Dr A. K. Srivastava, Vice-Chancellor, UP Pandit Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwavidyalaya Evam Go-Anusandhan Sansthan and members Dr Dharmeswar Das, Former Joint Director (Acad.) IVRI and Dean, CVSC, Khanapara; Dr Devendra Swarup, Former Director ICAR-CIRG, Makhdum; Dr. D. K. Aggarwal, Former Head, Division of Animal Nutrition, IVRI, Izatnagar; Dr S. K. Mendiratta, Joint Director (Academics), IVRI, Izatnagar; Dr Hema Tripathi, National Coordinator, NAHEP, ICAR and Dr. Amrish Kumar Tyagi, ADG (AN& P), ICAR.




CELEBRATIONS

Republic Day

The ICAR-National Research Centre on Pig celebrated 74th Republic Day on 26th January 2023. On this occasion Dr. V. K. Gupta, the Director of the Institute, hoisted the national flag, which was followed by the singing of national anthem. The event was joyously attended of both scientific and non-scientific staff of the institute with great enthusiasm.




International Yoga Day

The ICAR-National Research Centre on Pig joyously observed the 9th International Yoga Day on 21st June 2023. All the staffs of the institute are engaged in various yoga activities and exercises based on the Common Yoga Protocol provided by Ministry of AYUSH, Government of India. The event highlighted the importance of yoga in enhancing overall health and fostering a harmonious connection between body, mind, and spirit.


Independence Day

ICAR-National Research Centre on Pig celebrated 77th Independence Day of the country on 15th August 2023. The staff of the Institute also celebrated "Har Ghar Tiranga" Campaign 2.0 in which all the staffs of the Institute participated by hoisting the national flag in their homes and celebrated Meri Maati Mera Desh by tree plantation campaign to honor our land and country on this significant day.

Institute Foundation Day

The ICAR-National Research Centre on Pig commemorated its 22nd Foundation Day on 4th September, 2023 at the institute campus in Rani. Dr. K.M. Bujarbaruah, former DDG (Animal Science), graced the occasion as the Chief Guest, while Dr. D.K. Sharma, former Director of ICAR-NRC on Pig, was honored as the Guest of Honour.

Vigilance Awareness Week

The ICAR-NRC on Pig celebrated Vigilance Awareness Week at from 30th October to 05th November, 2023. For the year 2023, the focus of Vigilance Awareness Week is "Say no to Corruption; Commit to the Nation". Observance of Vigilance Awareness Week was started by taking Integrity pledge under the administrative of Dr V.K. Gupta, Director NRC on Pig on 30th October 2023. All the staffs of the Institute took part with full enthusiasm. It was followed by Workshop cum Sensitization programme for employees and other stake holders on policies/procedures of organization and on preventive vigilance measures. Various competition such as essay writing and elocution competition were also conducted on the given theme. To extend awareness, the integrity pledge and educational initiatives were also extended to schools.

World Intellectual Property Day

The ICAR National Research Centre on Pig celebrated World Intellectual Property Day on 26th April 2023 at committee room of the institute. Under the theme "Women and IP: Accelerating Innovation and Creativity" lecture was delivered by Dr Pranab Jyoti Das, Pr. Scientist and Dr Priyajoy Kar, Scientist of the Institute.

HINDI CELL ACTIVITIES

राजभाषा प्रकोष्ठ

भा.कृ.अनु.प.-राष्ट्रीय शूकर अनुसंधान केंद्र, राणी, गुवाहाटी में राजभाषा हिन्दी के सुचारु रूप से कार्यान्वयन के लिए में एक राजभाषा कार्यान्वयन समिति कार्यरत है । यह समिति कार्यालय में राजभाषा के सुचारु रूप से कार्यान्वयन एवं राजभाषा हिन्दी के लिए निर्धारित लक्ष्य को प्राप्त करने के लिए निर्देश देती है । राजभाषा कार्यान्वयन समिति की बैठक कार्यालय में प्रत्येक तिमाही में एक बार होती है । समिति हिंदी के प्रचार व प्रसार के लिए सुझाव देती है एवं विगत तिमाही की प्रगति रिपोर्ट की समीक्षा करती है । कार्यालय उपयुक्त समय पर राजभाषा विभाग, नगर राजभाषा कार्यान्वयन समिति एवं परिषद को तिमाही रिपोर्ट प्रस्तुत करता है । इस वर्ष राजभाषा कार्यान्वयन समिति की चार बैठक का आयोजन किया गया जिसकी अध्यक्षता निदेशक, डॉ. वी के गुप्ता ने की । बैठक का कार्यवृत्त एवं कार्यवाही परिषद को सूचना के लिए भेजा गया । इसके अलावा संस्थान, गुवाहाटी नगर राजभाषा कार्यान्वयन समिति का सदस्य है एवं संस्थान ने नगर राजभाषा कार्यान्वयन समिति की सभी बैठकों में भाग लिया । राजभाषा विभाग के निर्देशानुसार वार्षिक कार्यक्रमों, राजभाषा अधिनियमों एवं अन्य सभी आदेशों/अनुदेशों का अनुपालन कार्यालय द्वारा सफलतापूर्वक किया गया ।

संस्थान की कार्यरत राजभाषा कार्यान्वयन समिति में निम्नलिखित सदस्य शामिल हैं -

क्रम. सं.	समिति	नाम
1.	अध्यक्ष	डॉ विवेक कुमार गुप्ता, निदेशक, राष्ट्रीय शूकर अनुसंधान केंद्र
2.	सदस्य	डा. प्रणव ज्योति दास, प्रधान वैज्ञानिक
3.	सदस्य	डॉ सौविक पॉल, वैज्ञानिक
4.	सदस्य	डॉ सलाम जयचित्रा देवी, वैज्ञानिक
5.	सदस्य	श्री उत्तम प्रकाश, सहायक प्रशासनिक अधिकारी
6.	सदस्य	श्री उत्पल घोष, वित्त एवं लेखा अधिकारी
7.	सदस्य सचिव	डा. सतीश कुमार, वैज्ञानिक एवं प्रभारी, हिन्दी प्रकोष्ठ

राष्ट्रीय शूकर अनुसंधान केंद्र, राणी, गुवाहाटी में हिंदी पखवाड़ा-2023 का आयोजन

भा.कृ.अनु.प.-राष्ट्रीय शूकर अनुसंधान केंद्र, राणी, गुवाहाटी में १४ सितम्बर २०२३ से २९ सितम्बर २०२३ तक हिंदी पखवाड़ा २०२३ का सफलतापूर्वक आयोजन किया गया । केंद्र में हिंदी पखवाडा का शुभारम्भ १५/०९/२०२३ को हिंदी कार्यशाला कार्यक्रम से हुआ जिसमें हिंदी टिप्पणी लेखन एवं

पत्राचार के बारे में जानकारी दि गई । प्रभारी राजभाषा अधिकारी एवं वैज्ञानिक, डॉ सतीश कुमार ने हिंदी पखवाड़ा के दौरान होने वाली विभिन्न प्रतियोगितायों एवं कार्यक्रमों के बार में सभी को जानकारी दी तथा माननीय कृषि एवं किसान कल्याण मंत्री भारत सरकार, श्री नरेन्द्र सिंह तोमर, माननीय कृषि एवं किसान कल्याण राज्यमंत्री, भारत सरकार, श्री कैलाश चौधरी जी का शुभकामना सन्देश पढ़ कर सुनाया गया ।

हिंदी पखवाड़ा के अंतर्गत निन्मलिखित कार्यक्रम का आयोजन किया गया

दिनांक	कार्यक्रम	कार्यक्रम समन्वयक
15/09/2023	हिंदी कार्यशाला (वक्ता: डॉ सतीश कुमार) विषय: हिंदी टिप्पणी लेखन एवं हिन्दी पत्राचार	डॉ जया
18/09/2023	श्रुतिलेख प्रतियोगिता	डॉ सौविक पॉल
19/09/2023	हिंदी निबंध प्रतियोगिता	डॉ सुनील कुमार
20/09/2023	समयस्फूर्त भाषण (Extempore) प्रतियोगिता	डॉ नितिन एम अत्तूपुरम
21/09/2023	विद्यार्थियों के लिए वाद-विवाद प्रतियोगिता, स्थान: राणी हाईस्कूल	डॉ जुवार डोले/ डॉ कल्याण डे
22/09/2023	विद्यार्थियों के लिए हिंदी निबंध प्रतियोगिता, स्थान: राणी हाईस्कूल	डॉ प्रियजय कर
25/09/2023	टंकण प्रतियोगिता (यूनिकोड से हिंदी टाइपिंग) गूगल फार्म पर	डॉ सलाम जयचित्र देवी
26/09/2023	काव्य पाठ प्रतियोगिता	डॉ सीमा रानी पेगु
26/09/2023	हिन्दी कार्यशाला (डॉ अच्युत शर्मा) समय: 3.00 बजे	डॉ प्रणव ज्योति दास
29/09/2023	प्रश्नोंत्तरी प्रतियोगिता स्थान: समिति कक्ष समय: 3.00 बजे	श्री उत्तम प्रकाश
29/09/2023	हिन्दी कार्यशाला (श्री बदरी यादव) एवं समापन समारोह, स्थान: समिति कक्ष समय: 4.00	डॉ सतीश कुमार

राष्ट्रीय शूकर अनुसंधान केंद्र में विगत 15 दिनों (14-29 सितंबर 2023) से चल रही हिंदी पखवाड़ा का सफलतापूर्वक समापन दिनांक 29-09-2023 को किया गया। इस समारोह के मुख्य अतिथि क्षेत्रीय कार्यान्वयन कार्यालय के परामर्शदाता एवं पूर्व उपनिदेशक श्री बदरी यादव जी थे। उन्होंने हिंदी भाषा के अधिक से अधिक प्रयोग पर बल दिया तथा हिन्दी भाषा में स्थानीय भाषाओं के प्रचलित शब्दों को समाहित करने का सुझाव दिया ताकि हिन्दी को सभी लोगों के बीच लोकप्रियता मिल सके। संस्थान के निदेशक डा. विवेक कुमार गुप्ता ने हिंदी का प्रयोग सिर्फ हिन्दी पखवाड़ा तक सीमित न रखकर उसे वर्ष भर प्रयोग करने का सुझाव दिया, जिससे हिंदी भाषा का अधिक से अधिक प्रसार एवं प्रचार हो सके। उन्होंने हिन्दी पखवाड़ा के आयोजन के लिए आयोजन समिति के प्रयास की सराहना भी की एवं इसे और बढ़ चढ़ आयोजित करने का सुझाव दिया। संस्थान के प्रभारी राजभाषा अधिकारी एवं वैज्ञानिक डा. सतीश कुमार ने हिंदी पखवाड़ा के आयोजन का उद्देश्य हिंदी का अधिक उपयोग कर राजभाषा का विकास करना बताया। उन्होंने हिंदी पखवाड़ा में बढ़-चढ़ कर भाग लेने के लिए संस्थान के सभी कर्मचारियों एवं वैज्ञानिकों का आभार प्रकट किया एवं राजभाषा के विकास में योगदान देने के लिए सभी को प्रेरित किया। हिंदी पखवाड़ा में विभिन्न प्रकार के प्रतियोगिताओं का आयोजन किया गया जिसमें हिंदी श्रुति लेखन, निबंध प्रतियोगिता, वाद-विवाद प्रतियोगिता, समय स्फूर्त भाषण, हिन्दी काव्य पाठ प्रतियोगिता एवं हिंदी प्रश्नोत्तरी शामिल थे। इसके अलावा तीन हिंदी कार्यशाला का आयोजन किया गया। प्रथम कार्यशाला में डॉ सतीश कुमार द्वारा हिंदी वर्णमाला, कार्यालय आवेदन पत्रों के प्रारूप एवं टिप्पणी लेखन आदि की जानकारी दी गई। दूसरे कार्यशाला के विशेष अतिथि डॉ अच्युत शर्मा, गुवाहाटी विश्वविद्यालय ने राजभाषा के विकास एवं इसके उत्थान के सफर के बारे में व्याख्यान प्रस्तुत किया। तीसरे कार्यशाला में विशेष अतिथि क्षेत्रीय कार्यान्वयन कार्यालय के परामर्शदाता एवं पूर्व उपनिदेशक श्री बदरी यादव जी हिन्दी की यात्रा एवं असमिया भाषा के साथ हिन्दी के सामंजस्य के बारे में व्याख्यान प्रस्तुत किया। संस्थान के निदेशक महोदय ने सभी प्रतियोगिताओं के विजेताओं को प्रमाण-पत्र एवं पारितोषिक देकर सम्मानित किया गया। इस अवसर पर वर्ष भर हिन्दी में कार्य करने के लिए विशेष पुरस्कार योजना के तहत संस्थान से दो कर्मियों को प्रशस्ति पत्र एवं पारितोषिक देकर सम्मानित किया गया। समारोह का समापन धन्यवाद ज्ञापन के साथ हुआ।


हिन्दी पखवाड़ा 2023


हिन्दी पखवाड़ा 2023


हिन्दी पखवाड़ा 2023


एकता की जान है, हिन्दी देश की शान है
हिन्दी पखवाड़ा 2023


कंप्यूटर पर सरल हिन्दी
टाइपिंग


nrcp
हिन्दी पखवाड़ा 2023


nrcp
हिन्दी पखवाड़ा 2023


nrcp
पखवाड़ा 2023


nrcp


nrcp

TRAINING CELL

Nodal Officer: Dr. Rafiqul Islam, Principal Scientist

The ICAR-NRC on Pig, Rani conducts regular training and skill development programmes for field functionaries nominated by various central/state government departments, entrepreneurs, farmers, students etc. The training programmes are conducted for different durations i.e. 3 days, 5 days, 7 days and 10 days based on the training needs of the participants. The training programmes are routinely conducted on the following areas for pig farmers/ entrepreneurs:

a) Scientific management techniques and practices in pig farming

b) Artificial insemination and reproductive management in pigs

c) Pork processing and value additions

In addition to the identified areas, training programme are also organized on other aspects of pig production and health, considering the training needs of the participants.

The training programmes are conducted under the following categories:

1. **Sponsored Training Programmes:** These programmes are sponsored by Central/ State government organizations, Non-governmental Organizations (NGOs), Krishi Vigyan Kendras (KVKs) etc. The candidates are selected by them for participating in the scheduled programmes at ICAR-NRC on Pig, Rani. The whole expenditures for the training are borne by the sponsoring organizations as per the fee structure of the Institute/Indian Council of Agricultural Research (ICAR). The candidates are accommodated in the Training Hostel of the Institute. A total of 20 candidates can be accommodated at a time in the training Hostel.

2. **Self-sponsored Training Programmes:** Thes Programmes are organized for the participants who put request for training at ICAR-NRC on Pig at their own level. Generally, the programmes are conducted for 3 days. The training expenditures have to be borne by the individual participants as per the fee structure of the Institute/ ICAR. A minimum of 7 candidates are required to organize a self-sponsored training programme. However, the Institute can accommodate a maximum of 25 candidates in the training programme. Both residential and non-residential training programmes are conducted under this category.

3. **Institute Sponsored Training Programmes:** The ICAR-NRC on Pig conducts few free trainings for the farmers under various schemes/ project. The participants need not to pay any fee for participating in these programmes. Generally training programmes of 3-7 days durations are conducted for Scheduled Tribe (ST) candidates under Tribal Sub Plan (TSP) and Scheduled Caste (SC) candidates under Scheduled Caste Sub Plan (SCSP). For participating in these programmes candidate has to submit an application along with his/ her Caste/ category certificate and an ID Proof to the Institute. Both residential and non-residential training programmes are conducted under this category.

4. **Exposure visits for farmers:** The Institute also arranges exposure visit and one day training programme for farmers. This programme is organized as a non-residential programme for giving a brief knowledge of the management techniques and practices in organized pig farming. The programme is generally sponsored by other organizations.

5. Online Training Programmes: Keeping the demand of the participants/ organization in view, the Institute also conducts training on online/ virtual mode. The duration varies from 1-5 days.

List of the training programmes conducted during January to December, 2023

Sl. No.	Sponsorship	Name of the Training Program	Date	Name of the Coordinators	No. of Beneficiaries
1.	Institute TSP	Residential training programme on "Basic hands-on training for tribal science graduate students"	January 3-5, 2023.	Dr. Rajib Deb Dr. Seema Rani Pegu	18
2.	Institute TSP	Promotion of Agri-Entrepreneurship on "Scientific Pig Production Practice and Value Addition of Pork"	January 18-20, 2023	Dr. R. Thomas Dr. P. J. Das Dr. K. De	15
3.	Institute SCSP	Residential Training on "Advances in Scientific Practices and Techniques in Pig Production"	January 31-February 6, 2023	Dr. Nitin M. Attupuram Dr. Kalyan De Dr. Santanu Banik	08
4.	Institute TSP	Residential Training on "Assisted reproductive technologies for augmenting production in pigs"	February 8-14, 2023	Dr. Sunil Kumar Dr. Rafiqul Islam Dr. Pranab Joyti Das	17
5.	APART	Master Training (TOT) programme for local service provider (Pig Bondhu)	March 13-15, 2023	Dr. R. Thomas Dr. Sunil Kumar	19

6.	Department of Industries and Commerce (DICC), Jorhat, Assam	Skill-Workshop and training program on Scientific Pig farming and Value Addition of Pork	April 25-27, 2023	Dr. Sunil Kumar Dr. R. Thomas Dr. Rafiqul Islam	25
7.	MANAGE, Hyderabad	Online collaborative Training Programme on "Livelihood Opportunities in Pig Husbandry" at ICAR-NRC on Pig, Rani	May 23-25, 2023	Dr. Rafiqul Islam Dr. Sunil Kumar Dr. Priyajoy Kar	34
8.	ADTU, Guwahati & ITMU, NRCP	Final Year BSc Biotechnology Student (6th Semester) from Faculty of Science, Assam Down Town University, Panikhaiti, Guwahati visited for advanced practical exposure	May 26, 2023	Dr. Juwar Doley	36
9.	Science and Engineering Research Board (SERB), GOI	High End Workshop (Karyashala) on Leveraging the molecular laboratory skills on the development of molecular gadgets for diagnosis and	June 15-28, 2023	Dr. Rajib Deb	25

		prevention of livestock diseases			
10.	Institute TSP	Reproductive management and artificial Insemination for profitable pig farming	August 21-23, 2023	Dr. Sunil Kumar Dr. Rafiqul Islam Dr. Pranab Joyti Das	25
11.	DST project	Master Training (TOT) Programme under DST STI Hub Project	August 24-25, 2023	Dr. Rajendran Thomas Dr. Juwar Doley	26
12.	APART	Training programme on boar semen collection and processing for newly selected Veterinary Officers & Laboratory Assistant under APART	August 31-September 1, 2023	Dr. Sunil Kumar Dr. Rafiqul Islam	7
13.	Institute TSP	Demonstration of technology on Artificial Insemination in pigs to tribal farmers	September 12, 2023	Dr. Sunil Kumar Dr. Rafiqul Islam Dr. Pranab Jyoti Das	94
14.	DST project	Master Training (TOT) Programme under DST STI Hub Project	Sept 14-15, 2023	Dr. R. Thomas Dr. Juwar Doley	26
15.	DBT project	Reproductive management and artificial insemination in pigs for entrepreneurship development and livelihood security	September 20-21, 2023	Dr. Sunil Kumar	32
16.	EDP/ABI	Entrepreneurship Development	September 25-27,	Dr. R. Thomas Dr. Sunil Kumar	15

		Programme on Scientific Pig Production Practices and Value Addition of Pork	2023		
17.	Institute TSP	Amelioration of Reproductive problems and application of artificial Insemination in Pig Farms	October 3-5, 2023	Dr. Sunil Kumar Dr. Rafiqul Islam Dr. Mohan N. H.	24
18.	Institute TSP	Skill development in pig farming for livelihoods and nutritional Security	October 10-12, 2023	Dr. Satish Kumar, Dr. Nitin M. Attupuram	26
19.	Institute TSP	Sustainable pig farming: nurturing success from piglets to profits	November 1-3, 2023	Dr. Juwar Doley Dr. Keshab Barman Dr. Souvik Paul	19
20.	Institute SCSP	Entrepreneurship in Pig Farming: Skills and Strategies for Success	November 7-9, 2023	Dr. Juwar Doley Dr. Souvik Paul Dr. B. C. Das	17
21.	Institute TSP	Scientific practices and techniques for enhancing production and reproduction in pigs	November 14-16, 2023	Dr. Jaya Dr. Seema Rani Pegu Dr. Rafiqul Islam	21
22.	NIRDPR, NERC, Guwahati	Training session/ Exposure visit on piggery management and piggery enterprise promotion	November 16, 2023	Dr. Rafiqul Islam Dr. Rajendran Thomas	27
23.	Institute TSP	Basic Hands-on Practices for molecular diagnosis of swine	November 21-23, 2023	Dr. Rajib Deb Dr. Seema Rani Pegu Dr. Swaraj Rajkhowa	21

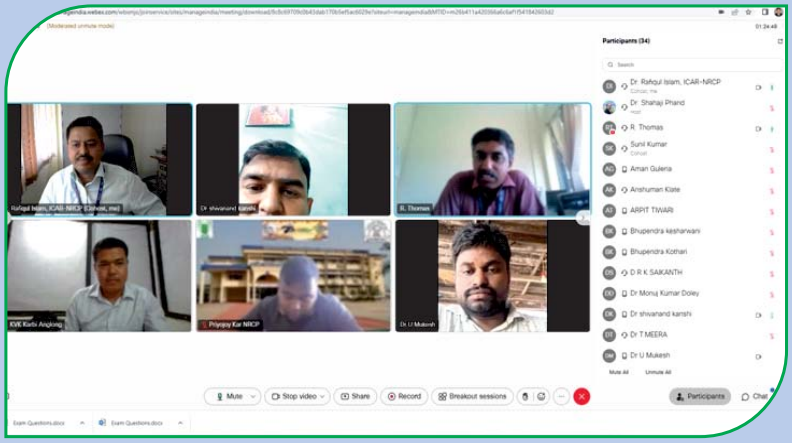
		diseases			
24.	AHVD, Meghalaya	Training on "Artificial Insemination on Pig" for Meghalaya Vets	November 28-30, 2023	Dr. Sunil Kumar Dr. Rafiqul Islam	20
25.	DST-STI Hub	Master Training (TOT) Programme under DST STI Hub Project	December 4-5, 2023	Dr. R. Thomas Dr. Juwar Doley	25
26.	Institute SCSP	Scientific Practices and Techniques for Economic Pig Production	December 6-9, 2023	Dr. Nitin M. Attupuram, Dr. Kalyan De Dr. Rafiqul Islam	18
27.	DST-STI Hub	Master Training (TOT) Programme under DST STI Hub Project	December 14-15, 2023	Dr. R. Thomas Dr. Juwar Doley	25
28.	DBT-BIOTECH KISAN	Capacity building of farmers through scientific pig farming and pork processing for livelihood security	December 18 -22, 2023	Dr. B. C. Das Dr. Sunil Kumar	14
29.	Institute TSP	Skill enhancement of the tribal farmers through demonstration of Artificial Insemination techniques in pigs	December 22, 2023	Dr. Sunil Kumar Dr. Rafiqul Islam Dr. Santosh Kr Baishya	100
30.	Institute TSP	Master Trainer's Capacity Building Programme on Commercial Pig Farming and Artificial Insemination	December 26-29, 2023	Dr. Sunil Kumar, Dr. Rafiqul Islam Dr. Swaraj Rajkhowa	22
Total number of participants Trained during 2023					**801**

Basic Hands-on training for Tribal Science graduate students from 3rd -5th January, 2023

Basic Hands-on training for Tribal Science graduate students from 3rd -5th January, 2023

Skill-Workshop and training program on Scientific Pig farming and Value Addition of Pork organized during April 25th -27th, 2023 sponsored by Department of Industries and Commerce (DICC), Jorhat, Assam

MANAGE, Hyderabad sponsored online collaborative Training Programme on “Livelihood Opportunities in Pig Husbandry” organized at ICAR-NRC on Pig, Rani during May 23rd-25th, 2023



B.Sc. (Biotechnology) 6th Semester students and teaching faculty from Faculty of Science, Assam Down Town University, Panikhaiti, Guwahati visited the Institute on May 26th, 2023 for advanced practical exposure

Science and Engineering Research Board (SERB), GOI sponsored High End Workshop (Karyashala) on “Leveraging the molecular laboratory skills on the development of molecular gadgets for diagnosis and prevention of livestock diseases” organized during June 15th-28th, 2023

Training Programme on "Skill development in pig farming for livelihoods and nutritional Security" organized during October 10th-12th, 2023

Training session/ Exposure visit on piggery management and piggery enterprise promotion facilitated by NIRDPR, NERC, Guwahati conducted on November 16th, 2023

Training programme on "Scientific practices and techniques for enhancing production and reproduction in pigs" organized under TSP during November 14th-16th, 2023

Training programme on “Scientific practices and techniques for enhancing production and reproduction in pigs” organized during November 14th-16th, 2023

Training programme on, “Sustainable pig farming: nurturing success from piglets to profits” organized during November 1st-3rd, 2023

Training programme on, “Entrepreneurship in Pig Farming: Skills and Strategies for Success” organized during November 7th-9th, 2023

Training programme on, “Entrepreneurship in Pig Farming: Skills and Strategies for Success” organized during November 7th-9th, 2023

Training programme on “Scientific Practices and Techniques for economic Pig production” organized during December 6th-9th, 2023

Release of Training Manual by respected Dr. V. K. Gupta, Director, ICAR-NRC on Pig, Rani during the Valedictory Programme of the Training programme on “Scientific Practices and Techniques for economic Pig production” dated December 6th-9th, 2023

AWARDS AND RECOGNITIONS

AWARDS AND RECOGNITIONS

Awards

Best Agricultural Extension Book Award

ICAR-National Research Centre on Pig has received 'Best Agricultural Extension Book' Award for “A-Z of Pig farming” book authored by Director and Scientists of the institute during 3rd MANAGE Agricultural Extension Awards 2022 held on 13.06.23 at MANAGE, Hyderabad.

Dr. Mohan N.H

- Dr. N.H. Mohan was elected as Fellow of National Academy of Academy of Agricultural Science.

Dr. Sunil Kumar

- Best Research paper Presentation award in International Conference on Challenges and Prospects of Bioresource Conservation in Eastern Himalaya- with special reference to UN-Sustainable Development Goals from May 3-4, 2023 organized by Gauhati University, Gauhati.
- Best Research paper Presentation award in 38th Annual ISSAR conference- "International Symposium on 'Frontiers in Theriogenology: Research and Practice" organized by Department of Veterinary Gynaecology and Obstetrics, COVS, KVASU, Mannuthy from Dec.,6-8, 2023.

Dr. Priyajoy Kar

- Received best poster presentation Award in 1st International Extension Education Congress (IEEC-2023) held at RARI, Durgapura, Jaipur from 18th-20th December, 2023.
- Received Young Scientist Award in 1st International Extension Education Congress (IEEC-2023) held at RARI, Durgapura, Jaipur from 18th-20th December, 2023.

Recognitions

Dr Rafiqul Islam

- Dr. Rafiqul Islam, Principal Scientist (Animal Reproduction & Gynaecology) has taught PG students virtually as PG Faculty of ICAR-Indian Veterinary Research Institute (Deemed University), Izatnagar in the discipline of Veterinary Gynaecology & Obstetrics (VGO) during Autumn Semester 2023.
- Reviewer Excellence Award has been received from Indian Journal of Animal Research, published by Agricultural Research Communication Centre, Karnal, Haryana, www.arccjournals.com
- Certificate of reviewing has been presented by Theriogenology; An International Journal of Animal Reproduction published by Elsevier for 6 reviews during Nov 2016 to January 2023.
- Reviewed one article for "International Journal of Livestock Research", Published by Pashupati Foundation India
- Councillor in the Executive Council of the Indian Association of Hill Farming for the year 2021-2024 by the Indian Association of Hill Farming, ICAR Research Complex for NEH Region, Umiam, Meghalaya.
- One Ph.D. Scholar (Dr. N. Linda) from College of Veterinary Science, CAU, Aizawl is being guided as On Station Guide for her Ph.D. Thesis Research.
- Editor, Animal Reproduction, Gynaecology & Obstetric Section for "Journal of Advanced Veterinary and Animal Research, https://bdvets.org/JAVAR/editorial-board.html
- Editorial Board Member for "Asian Pacific Journal of Reproduction", https://www.apjr.net/editorialboard. asp, Official Publication of Hainan Medical University, Hainan -571100, China.

Dr Rajendran Thomas

- Represented the Institute in FAD -18 Sectional Committee meeting of Bureau of Indian Standards

(BIS) to review Indian Standards under FAD 18 to align the same with the corresponding Codex Standards and FSSAI regulations.

- Represented the institute and provided the required inputs in the meetings of Scientific panel on meat and meat products of FSSAI during 2023.

Dr. Rajib Deb

- Nominated member for the national level "Essay competition" under the "Model G-20 Initiative", a National Level Youth Challenge supported by Ministry of Education, GoI and organized by IIT Hyderabad in collaboration with INYAS
- Nominated as an expert for evaluation of INYAS membership application-2024 by Indian National Science Academy, New Delhi
- Nominated Jury Member for INYAS competitive event, "Saransh – Thesis Competition for PhD students (2023)" (Category: Life Sciences) conducted by IIT-Kharagpur, Kharagpur, India
- Participated as an expert member from INYAS side for the Zoom session on 16 October ,2023 entitled "Flipping the Science Model – A Roadmap to Science Missions for Sustainability: Virtual Engagement on the report by the ISC Global Commission on Science Missions for Sustainability" convened by the International Science Council, Paris, France

Dr. Sunil Kumar

- Invited as a lead speaker in Technical session on Small Ruminant and Swine Reproduction session in the 38th Annual ISSAR conference- "International Symposium on 'Frontiers in Theriogenology: Research and Practice" organized by Department of Veterinary Gynaecology and Obstetrics, COVS, KVASU, Mannuthy from Dec.,6-8, 2023.
- Invited as reviewer for publications by the Journal, The Haryana Veterinarian
- Invited as resource person in training programme on Boar Semen Processing under APART-AHVD from 21st November, 2023 to 5th Dec., 2023 at Liquid Boar Semen Processing Centre, Khanapara
- Invited as resource person in training programme for Pig Bandhu under APART-AHVD. (22nd to 24th August,2023) at OTI building, Farm Gate, Khanapara, Guwaha-22
- Invited as resource person in training programme for Pig Bandhu under APART-AHVD. (29th to 31st August,2023) at OTI building, Farm Gate, Khanapara, Guwaha-22

Dr. Jaya

- Selected as Academic Editor of International Journal of Endocrinology (I.F. 2.8).
- Selected as Editorial Board Member of the Journal BMC Biotechnology (I.F. 4.0)
- Selected as Review Editor for section Animal Behaviour and Welfare of Journal Frontiers in Veterinary Science (I.F. 3.3)
- Recognized Peer reviewer for research manuscripts for journals Gene, Research in Veterinary Science, Veterinary Immunology and Immunopathology, Molecular Genetics and Genomics, Theriogenology, Tropical Animal Health and Production, Livestock Science, Journal of Obstetrics and Gynaecology, Veterinary Medicine International, Frontiers in Veterinary Science, Heliyon, Journal of Cell Communication and Signaling and Reproductive Biology.

- Invited as expert in Hello Kisan Programme "वैज्ञानिक विधि से शूकर पालन" of Doordarshan Kisan on 25th May 2023 streamed live on DD Kisan at 6:00 – 7:00 pm.

Dr. Satish Kumar

- Peer reviewed the seven manuscripts for the journals International Journal of Agricultural Sustainability (1), International Journal of Endocrinology (2), Haryana Veterinarian (1), Veterinary and Animal Science (1), Journal of Applied Animal Research (1), International Journal of Livestock Research (1)

Dr. Priyajoy Kar

- Editor-Food and Scientific Reports, Magazine
- Acted as a local co-ordinator in the MANAGE sponsored online collaborative training on "Livelihood Opportunities in Pig Husbandry" held during May 23rd-25th, 2023.

HUMAN RESOURCE DEVELOPMENT

Dr. Vivek Kumar Gupta

- Participated in the programme organized to commemorate the 'World Veterinary Day' at Vigyan Bhavan, New Delhi on 29th April, 2023.
- Guest of Honour in the 'Swadeshi Science Congress' organized by National Institute of Technology, Kozhikode, Kerala on 25th May, 2023.
- Visited and reviewed the activities of AICRP on Pig centre of KVASU, Mannuthy, Kerala on 26th May, 2023.
- Received 'Best Agricultural Extension Book Award' for "A-Z of Pig farming" book during 3rd MANAGE Agricultural Extension Awards 2022 held on 13.06.23 at MANAGE, Hyderabad.
- Participated in the 95th Foundation Day of ICAR held on 16th July, 2023 at NASC, New Delhi.
- Chaired the Departmental Promotion Committee at ICAR-RC for NEH at Umiam, Barapani, Meghalaya on 21st June, 2023.
- Chaired the ICAR Industry Meet organized by ICAR-NMRI, Hyderabad on 23rd September, 2023.
- Participated in the 16th Agricultural Science Congress organized by ICAR-CMFRI at Cochin during 10-12 October, 2023.
- Visited and reviewed the activities of AICRP on Pig centre of TANUVAS, Tamil Nadu on 13th October, 2023.
- Participated in the Breed Registration Committee meeting of ICAR at NASC, New Delhi on 5th December, 2023.

Dr. Swaraj Rajkhowa

- Delivered lecture as Invited speaker in SERB Sponsored High-End Workshop (Karyashala) On Leveraging molecular laboratory skills on development of molecular gadgets for diagnosis and prevention of livestock diseases (15th – 28th June 2023) Organized by ICAR-National Research Center on Pig, Guwahati, Assam
- Conducted (as external examiner) the Thesis viva-voce of a Ph. D. of Veterinary Epidemiology & Preventive Medicine, CVSc, Khanapara on 4th August 2023.
- Attended Mid-Term Review Meeting of the 25th Regional Committee Meeting (RCM) Zone-III held on 26th September, 2023 (through virtual mode)
- Delivered a lecture on "Antimicrobial Stewardship and its implication-one health perspective" on 21st November, 2023 in "World AMR Awareness Week (WAAW) held at ICAR-NRC on Pig from 18 - 24 November 2023
- Attended one day workshop on "Awareness on intellectual property rights among young researchers" organized by ITMU Unit, ICAR-NRC on Pig, Rani, Guwahati in collaboration with Indian National Young Academy of Sciences, New Delhi on 28th November, 2023.

Dr. Mohan N.H

- XVI Agricultural Science Congress and ASC Expo hosted by ICAR-CMFRI, Kerala, from 10th to 13th October, 2023.

- National Workshop on "Atlas on Climate Change Adaptation in South Asian Agriculture (ACASA)" with a special session on the Livestock Sector as expert panelist on 21st November, 2023 at ICAR-National Dairy Research Institute, Karnal, Haryana.
- Brainstorming session on "Greening of Livestock and Poultry Sector: Policy Options for Developing Sustainable Approaches" on 1st September, 2023 organized by National Academy of Agricultural Sciences in hybrid mode.
- GENE-SWitCH conference from 6th to 8th November, 2023 organized by GENE-SWitCH, consortia.

Dr Rafiqul Islam

- Attended virtually the Dr. D. Sundaresan Memorial Oration-2023 given by Dr. Himanshu Pathak, Director General (ICAR) & Secretary DARE on Mar 27, 2023
- Attended online Annual Conference of Directors of the ICAR Institutes, Vice Chancellors of SAU/CAU/CU and Industries with Hon'ble DG, ICAR during March 4-5, 2023, which was organized by ICAR, New Delhi
- Attended online meeting of World Association for Buiatrics organized by Japanese Society of Farm Animal Veterinary Medicine (Takeshi Osawa, Japan) and German Association for Buiatrics (Ingrid Lorenz, Germany) on May 16th 2023.
- Attended Virtual Meeting on 9.8.2023 organized by ICAR, New Delhi on various issues regarding reporting in Sparrow for Scientific and Technical Personnel in ICAR
- Attended Joint online meeting with the Director and other Officers of Animal Husbandry & Veterinary Department, Andaman & Nicobar Island and Director, ICAR-NRC on Pig, Rani and Scientist on 16.11.2023.
- Attended One -Day Workshop on "Awareness on Intellectual Property Rights among young researchers" organized by ICAR-NRC on Pig, Rani in collaboration with Indian National Young Academy of Science, New Delhi on 28th November, 2023.

Dr. Rajendran Thomas

- Successfully completed an 18 week long online course on "Introduction to Food Safety and Risk Assessment" offered by the International Research Livestock Institute in collaboration with the Royal Veterinary College, London.
- A Workshop on 'Relevance of standards and academia and industry collaboration in the standard development process' was organized at ICAR-National Research Centre on Pig in technical collaboration with Bureau of Indian Standards (BIS), New Delhi and Department of Science and Technology, Govt. of India on 5th October, 2023.

Dr. Seema Rani Pegu

- Attended three days webinar on Global consultation on African swine fever control organized by Food and Agricultural organization of the United Nations on virtual mode. From 12th to 14th December, 2023.

Dr. Juwar Doley

- Attended an 18-week online course on "Introduction to Food Safety and Risk Assessment" conducted by the International Research Livestock Institute in collaboration with the Royal Veterinary College

Dr. Sunil Kumar

- Participated in Regional Agricultural Fair (North East Krishi Kumbha 2023) held at ICAR Research Complex for NEH Region Umiam, Meghalaya with the theme "Emerging opportunities in agriculture and allied sectors for income and employment generation" from 4-6th January 2023.
- Participated in the Training Programme on Impactful ICT Applications and Technologies in Agriculture (Online mode) Organized by ICAR-NAARM, Hyderabad during 6-10 February, 2023
- Participated in the Training Programme on Advances in Mobile Application Development (Online mode) Organized by ICAR-NAARM, Hyderabad during 20-24 February, 2023
- Participated as Exhibitor in "Regional Livestock and Poultry Show in Guwahati on 15th, 16th and 17th Feb. 2023" organizing by Animal Husbandry and veterinary Department, Assam and National livestock and Poultry show-2023
- Participated in the National Training Workshop on "Big Data Analytics in Agriculture" (Online Mode) organized by ICAR-NAARM, Hyderabad during 09-10 March, 2023
- Participated in the Workshop on Genome editing in farm animals for improved productivity and health organized by Animal Biotechnology Division ICAR - National Dairy Research Institute, Karnal on March 03, 2023
- Participated and exhibited institute technology in "North East Regional Food Festival 2023" at Maniram Dewan Trade Centre, Betkuchi (near ISBT), Guwahati on 29th, 30th & 31st March 2023 organizing by Industries, Commerce & PE Department, Assam under the aegis of Ministry of Food Processing Industries, Govt. of India
- Participated in the International Conference on Challenges & Prospects of Bioresource Conservation in Eastern Himalaya– with special reference to UN-Sustainable Development Goals, 2023 from May 3-4, 2023 organized by Gauhati University, Gauhati.
- Participated in the International Bioresource Conclave & Ethnopharmacology Congress: International Conference on "Reimagine Ethnopharmacology - Globalization of Traditional Medicine" organized by the Institute of Bioresources and Sustainable Development (IBSD), Imphal, India and the Society for Ethnopharmacology, India during February 24-26, 2023 at City Convention Centre, Imphal, Manipur, India.
- Participated in the meeting on development of piggery in the Islands with Officials of Animal Husbandry Deptt, Andaman and Nicobar Islands, on 16.11.2023.
- Participated and made oral presentation in 67th Annual Technical Session of Assam Science Society, 2023 cum National Seminar on "Current Developments in Science and Technology to be organized by Bhattadev University, Bajali, Pathsala- 781325, Assam on 6th April, 2023.
- Coordinated the exposure visit under the training programme (Level B-144) for Assistant Section Officers (ASOs) of Central Secretariat Service (CSS) by Institute of Secretariat Training & Management (ISTM) working under the aegis of Department of Personnel & Training (DoPT), Govt. of India at ICAR- NRC on Pig, Rani on 22 May, 2023.
- Participated in online National Seminar (Webinar) on "IPR and Traditional Knowledge organized by Kaliabor College, Nagaon, Assam on 18th May, 2023.

- Participated in Online Training Programme on Next Generation Sequencing and Data Analysis organized by ICAR-NAARM, Hyderabad during 16-20 October, 2023
- Participate and exhibited institute technologies in the “North East Livestock-AquaPoultry (NELAP) Exhibition & Conference 2023" from 18th to 20th April 2023 at Maniram Dewan Trade Centre in Guwahati, organizing by P2C Communications, Smart Agri Post & Aqua Post, J-10, Green Park Main, New Delhi-110016.

Dr. Jaya

- Oral presentation on “Comprehensive transcriptomic analysis to decipher novel candidate gens regulating heat stress adaptability in pigs” at ISAGB-2023 on “Advances in genetics and genomics for sustainable livestock transformation” organized by ICAR-NBAGR, Karnal in hybrid mode.
- Attended training programme on “Data Visualization using R” organized by ICAR-NAARM on 1-3 March 2023 in online mode.
- Attended training programme on “Multivariate Data Analysis” organized by ICAR-NAARM on 20-27 March 2023 in online mode.
- Attended Hindi Workshop on “Application of Statistical Software for Analysis of Agricultural and Survey Data” organized by ICAR-IASRI on 6-13 Sept. 2023 in online mode.
- Attended training programme on “Next Generation Sequencing and Data Analysis” organized by ICAR-NAARM on 16-20 Oct. 2023 in online mode.

Dr. Satish Kumar

- Participated in ten days Online Training Programme on Omics Data Analysis: Genome to Proteome during October 09-18, 2023 organized by the Division of Agricultural Bioinformatics, ICAR-Indian Agricultural Statistics Research Institute, New Delhi
- Attended online Training Programme on Next Generation Sequencing and Data Analysis organized by ICAR-NAARM, Hyderabad during 16-20 October, 2023
- Attended online training Programme on “Data Visualization using R” organized by ICAR-NAARM, Hyderabad during 1-8 March, 2023
- Attended online training Programme on “Multivariate Data Analysis” organized by ICAR-NAARM, Hyderabad during 20-27 March, 2023
- Participated (online mode) in the National Conference of ISAGB-2023 on “Advances in Genetics and Genomics for Sustainable Livestock Transformation” held during 16-17th November, 2023 at ICAR-NBAGR, Karnal in online mode.

Dr. Salam Jayachitra Devi

- Attended Two-week short course on "Applications of RS and GIS in Agriculture and allied areas" from 21 Aug.-2 sept. 2023 organised by North Eastern Space Applications Centre, Govt. of India, Department of Space, Umiam, Meghalaya.
- Participated two days training on “Research methodology using Chat GPT and Artificial Intelligence tools” organised by College of Veterinary and Animal Sciences, Mannuthy Thrissur, Kerala, India

- Attended the XVI Agricultural Science Congress by the National Academy of Agricultural Sciences (NAAS), New Delhi and hosted by ICAR-Central Marine Fisheries Research Institute (ICAR-CMFRI) during 10-13th October, 2023 at Kochi, India

Dr. Nitin M. Attupuram

- Attended the XVI Agricultural Science Congress by the National Academy of Agricultural Sciences (NAAS), New Delhi and hosted by ICAR-Central Marine Fisheries Research Institute (ICAR-CMFRI) during 10-13th October, 2023 at Kochi, India

Dr. Priyajoy Kar

- Attended 3 days Online Training Programme on “Advances in Agricultural Extension Research" organised by RARS, KAU and MANAGE, Hyderabad during May 2nd-4th, 2023.

Dr. Meera K

- Attended training programme on “Basic Bioinformatics Tools for Genome Analysis” conducted by ICAR –NBAGR, Karnal in hybrid mode from October 16th - 20th 2023.
- Attended national hands-on training programme on “Fundamental Concepts of Bioinformatics in Biological Sciences conducted by the Department of Animal Genetics & Breeding, Lakhimpur College of Veterinary Science, AAU, Joyhing from December 21-22, 2023

RESEARCH PROGRAMME AND PROJECTS

Ongoing Institute Research Project

S. No.	Project name	PI	CoI
1.	Generation-wise genetic evaluation of Rani crosses	S. Banik/ Satish Kumar	P.J. Das, K. Barman, R. Thomas, S.R. Pegu, Sunil Kumar
2.	Exploring genetic variability in different candidate genes and their association with (re)production traits in pigs	Satish Kumar	S. Banik, P.J. Das, Sunil Kumar, Jaya
3.	Molecular characterization of indigenous pig breeds	Satish Kumar	S. Banik, P.J. Das, Sunil Kumar, A.R. Sahu (ICAR-CCARI)
4.	Physic-genomic responses and MCT profiling of exotic and Indigenous pig breeds in heat stress during different seasons	B.C. Das	N.H. Mohan, Jaya, K. De, J. Doley, A. Paul, N.M. Attupuram
5.	Investigation of notch signaling in regulation of ovarian function in pigs	Jaya	B.C. Das, N.H. Mohan, Satish Kumar
6.	Preservation of boar semen using different additives in liquid and frozen state	R. Islam	Sunil Kumar, K Barman, S Banik
7.	Service project: Artificial Insemination in Pigs	R. Islam	Sunil Kumar
8.	Propagation of Artificial Insemination for establishment of multiplier units and optimizing reproductive efficiency in pigs at farmers' field	Sunil Kumar	R. Islam, S. Banik, K. Barman, P.J. Das
9.	Molecular detection of aflatoxins producing Aspergillus species	K Barman	P.J. Das, S.R. Pegu, R. Deb, Sunil Kumar
10.	Assessment and optimization of the water footprint in pig production and processing	N. M. Attupuram	K. De, R. Thomas, K. Barman, N.H.Mohan
11.	Dynamics of gut microbiome to dietary management and antibiotic treatment in pigs	N. M. Attupuram	K. De, R. Thomas, S.R. Pegu, K. Barman, R. Islam, N.H.Mohan
12.	Ethogram development and welfare assessment of growing desi and crossbred pig	K. De	S. Paul, R. Islam, N.H. Mohan, B.C. Das
13.	Service Project: Servillance and monitoring of swine diseases in NER	S.R.Pegu, S. Rajkhowa, R. Deb, S.Paul and J. Doley	
14.	Epidemiology of Intestinal protozoan parasitic diseases of Pigs, with special reference to Cryptosporidium and Coccidia.	S. Paul	S. Rajkhowa, S.R. Pegu, J. Doley, K. De, R. Deb, S. Banik

15.	Epidemiology and Molecular Epidemiology of African Swine Fever Virus (ASFV) in North-Eastern region of India	J Doley	Gaurav Kumar Sarma, S R Pegu,P.J. Das, S. Paul, S.J. Devi, N H Mohan and S. Rajkhowa
16.	Exploration of Genome-Wide Selection Signatures in Ghoongroo and Doom pigs of India	Satish Kumar	Jaya, S. Banik, P.J. Das
17.	Design of recombinant multi-epitope protein(s) and their expression for assay development	N.H. Mohan	V.K. Gupta, Jaya, S. Jayachitra
18.	Machine learning assisted identification of different cells of porcine origin	S. J. Devi.	Jaya, N. H. Mohan
19.	Expression of chimeric proteins of African Swine Fever Virus (ASFV) in Baculovirus expression system	R. Deb	H.M. Maity, Arnab Sen, Sachin Kumar, S.R. Pegu, S. Rajkhowa, V.K.Gupta
20.	Processing condition optimizing for elimination of selected FSSAI listed food borne pathogens in pork and pork products	R Thomas	K. Barman, S.R. Pegu
21.	Functional characterization of novel genes regulating reproductive landscape in sows	Jaya	Satish Kumar, Mohan N.H, B.C. Das, S. Jayachitra Devi, Kalyan De, Rafiqul Islam
22.	Development of proteomic and transcriptomics atlas of porcine olfactory system	N.H. Mohan	Jaya, S. Jayachitra Devi, N.M. Attupuram
23.	Development of technology transfer models through participatory rural appraisal in the piggery sector.	Priyajoy Kar	N.H. Mohan, P.J. Das, Kalyan De, N.M. Attupuram, S. Jayachitra Devi
24.	Development of e-learning knowledge products in scientific pig production.	Priyajoy Kar	N.M. Attupuram, S. Jayachitra Devi
25.	Hormonal and herbal intervention for optimizing eutocic farrowing in pigs	R. Islam	Sunil Kumar
26.	Association of farrowing traits, piglet traits and colostrum characteristics on survivability and growth performance in desi and crossbreed neonates	Kalyan De	N.M. Attupuram, Jaya, Lokesha
27.	Development of a point of care colorimetric assay for detection of meat freshness	R. Thomas	J. Doley, V.K. Gupta
28.	Identification, Isolation and molecular characterization of pork borne zoonotic parasites	S. Paul	R. Thomas, Juwar Doley, Jaya, Vishal Rai
29.	Isolation, Characterization of Porcine Muscle Stem Cells for development of 3D culture	J. Doley	Jaya, Mohan N.H., Souvik Paul, Vishal Rai

Ongoing External Funded Research Projects

Sl. No.	Project Title	PI	CoIs	Funding
1.	Development of thermo-tolerant pig through biomarker assisted selection	Mohan.N.H		ICAR- National Fellow
2.	Maize Production in NEH region for sustainable livestock production	K. Barman/ Priyajoy Kar	S. Banik, S.R. Pegu, Sunil Kumar and S. Rajkhowa	ICAR-IIMR
3.	Technical Advisory Services for Piggery Value Chain Improvement in Assam, under the World Bank financed Assam Agribusiness and Rural Transformation Project (APART).	R. Thomas	S. R. Pegu, K. Barman, Sunil Kumar, S. Rajkhowa	APART
4.	SWINOSTICS: A platform for development and validation of on-field diagnostics of important pig pathogens in NE Region of India for commercial exploration	S R Pegu	S.Rajkhowa, P.J.Das, R. Deb and V.K.Gupta	DBT
5.	Establishment of a Consortium for One Health to address Zoonotic and Transboundary Diseases in India including North-East Region	S Rajkhowa	S.R. Pegu, J. Doley, R. Deb, S Paul	DBT
6.	Development of a virus like particle- based vaccine against Indian isolate of Porcine Circovirus	R. Deb	S. Rajkhowa, J. Doley, Hemanta Kumar Maity (WBUAFS), Aditya Pratap Acharya (WBUAFS), Sachinandan De (NDRI)	DBT
7.	Application of Drone in Augmenting Production and Productivity of Piggery Sector	S. J. Devi	Satish Kumar, B. Kaman, J. Doley, Sunil Kumar, Mohan N.H., Banik, S.	ICAR
8.	Outreach Programme on Monitoring Drug Residues and Environmental Pollutants (ORP-MDREP)	R. Thomas	N. M. Attupuram	ICAR

9.	Traceable value chain for safe Pork in the North Eastern Region of India	P. J. Das	R. Thomas, S.R. Pegu, Satish Kumar, B.C. Das, V.K. Gupta	ICAR-NASF
10.	Biotech- KISAN Development and promotion of atmnirbhar pig production scientific intervention	B.C. Das	K. Barman, S. Banik, P.J.Das, S.R. Pegu, S. Paul,K. De, R. Deb, Sunil, Kumar, Jaya, Misha Madhvan, N.M. Attupuram, S.J. Devi, S. Baishya, H. Choudhary, A. Debnath, S. Das, E. Debbarman, S. Roy, T. Bhowmik	DBT
11.	Establishment of STI Hub for Mising and Bodo women of Assam for economic empowerment through technology interventions in pig value chain	R. Thomas	J. Doley, V.K. Gupta	DST
12.	Cataloguing of genomic and transcriptomic signature in indigenous pig tolerant to African swine fever virus	P.J. Das	S. Banik, Satish Kumar, R. Deb, S.R. Pegu, S. Rajkhowa, V.K.Gupta	DBT
13.	Augmenting pig production by accretion of reproductive efficiency and AI for generation of livelihood security and entrepreneurship in NER	Sunil Kumar	R Islam, VK Gupta	DBT
14.	Indian Network for Fisheries and Animal Antimicrobial Resistance	R. Deb	SR Pegu	ICAR
15.	Structural and functional studies of peptidoglycan recognition proteins from sow colostrum	R. Deb	Nitin M. Attupuram, V. K. Gupta, SR Pegu	Interinstitutional with AIIMS

PERSONNEL

ICAR-National Research Centre on Pig

Name of the staff	Designation	Portrait
Dr. Vivek Kumar Gupta	Director	
Dr. Bikash Chandra Das	Principal Scientist (Animal Physiology)	
Dr. Swaraj Rajkhowa	Principal Scientist (Veterinary Medicine)	
Dr. Mohan N.H	Principal Scientist (Animal Physiology)	
Dr. Rafiqul Islam	Principal Scientist (Animal Reproduction &Gynaecology)	

Name of the staff	Designation	Portrait
Dr. Pranab Jyoti Das	Principal Scientist (Animal Genetics and breeding)	
Dr. Rajendran Thomas	Principal Scientist (Livestock Products & Technology)	
Dr. Seema Rani Pegu	Senior Scientist (Veterinary Pathology)	
Dr. Juwar Doley	Senior Scientist (Animal Biotechnology)	
Dr. Souvik Paul	Senior Scientist (Veterinary Parasitology)	

Name of the staff	Designation	Portrait
Dr. Rajib Deb	Senior Scientist (Animal Biotechnology)	
Dr. Kalyan De	Senior Scientist (Livestock Production Management)	
Dr. Sunil Kumar	Scientist (Animal Reproduction and Gynaecology)	
Dr. Jaya	Scientist (Animal Physiology)	
Dr. Satish Kumar	Scientist (Animal Genetics & Breeding)	

Name of the staff	Designation	Portrait
Dr. Salam Jayachitra Devi	Scientist (Computer App. And IT)	
Dr. Nitin M. Attupuram	Scientist (Livestock Production Management)	
Dr. Priyajoy Kar	Scientist (Agricultural Extension)	
Dr. Lokesha E	Scientist (Animal Nutrition)	
Dr. Vishal Rai	Scientist (Veterinary Microbiology)	

Name of the staff	Designation	Portrait
Dr. Meera K.	Scientist (Animal Genetics and Breeding)	

Name of the staff	Designation	Portrait
Shri. Utpal Ghosh	Finance and Accounts Officer	
Shri Uttam Prakash	Assistant Administrative Officer	

Smt Jonali Nath	Upper Divisional Clerk
Smt. Kabyawati Rabha	Personal Assistant
Ms. Hiramoni Thakuria	Personal Assistant
Sri Ratul Baishya	Lower Divisional Clerk

Technical Cadre

Dr. Rajib Kumar Das	Technical Officer
Dr. Anil Das	Technical Officer
Dr. Gagan Bhuyan	Technical Officer
Sri Siba Chandra Deka	Senior Technical Assistant
Sri Rana Pratap Kakati	Technical Assistant
Sri Kailash Choudhury	Sr. Technician

Supporting Staff Cadre

Sri Naren Chandra Deka	Skilled Supporting Staff

Krishi Vigyan Kendra, Goalpara

Name of the staff	Sanctioned Post	Present Designation	Portrait
Dr. Santosh Kumar Baishya	Senior Scientist and Head	Principal Scientist	
Dr. Hitu Choudhury	Subject Matter Specialist (Animal Science)	Chief Technical Officer	
Dr. Biswajit Dey	Subject Matter Specialist (Horticulture)	Chief Technical Officer	
Mrs. Poli Saikia	Subject Matter Specialist (Community Science)	Assistant Chief Technical Officer	
Er. Benjamin Kaman	Programme Assistant	Assistant Chief Technical Officer	

Name of the staff	Sanctioned Post	Present Designation	Portrait
Mrs. Minakshi Borah Kaman	Programme Assistant	Assistant Chief Technical Officer	
Mrs. Mousumi Bhuyan	Programme Assistant	Assistant Chief Technical Officer	

Mr. Jayanta Choudhury	Sr. Technician
Sri Jitumoni Kalita	Skilled Supporting Staff
Sri Drubha Lochan Rabha	Skilled Supporting Staff

PUBLICATIONS

Research Articles

Bharati Jaya, Kumar S, Mohan NH, Pegu SR, Borah S and Sarkar M. 2023. CRISPR/Cas genome editing revealed non-angiogenic role of VEGFA gene in porcine luteal cells: a preliminary report. Molecular Biology Reports. DOI : 10.1007/s11033-023-09115-8.

Bharati, Jaya, Kumar, S., Mohan, N.H., Das, B.C., Devi, S.J. and Gupta, V.K., 2023. Ovarian follicle transcriptome dynamics reveals enrichment of immune system process during transition from small to large follicles in cyclic Indian Ghoongroo pigs. Journal of Reproductive Immunology, 160, p.104164.

Deb R, Sengar G S, Chakravarti S, Ningthoukhongjam L, Pegu S R, Rajkhowa S, Das PJ, Gupta V K., 2023. A universal primer set for specific vis-à-vis simultaneous differentiation of Escherichia coli and Klebsiella species. Current Science. 125 (11):1157.

Deb R, Sengar GS, Pegu SR, Rajkhowa S, Das PJ, Gupta V K (2023) Antimicrobial property of rat-tailed maggots surviving in piggery excreta. Biotech Today 12(2): 05-12.

Devi, S. J., & Singh, B. (2023). Link prediction analysis based on Node2Vec embedding technique. International Journal of Computer Applications in Technology, 73(1), 79-89.

Devi, S. J., Bharati, J., & Mohan, N. H. (2023). Multiclass cell segmentation using a pixel classification algorithm. The Pharma Innovation Journal. 12(12S), 1922-1928.

Kar, P., Sendhil, R., Sharma, R., Jat, S. L., Jat, B. S., Rakshit, S., & Rakshit, S. (2023). Global overview of research on quality protein maize: A bibliometric perspective. Journal of Community Mobilization and Sustainable Development Vol. 18(1), January-March 2023, 1-5

Kumar, S., Islam, R., Banik, S., Barman, K., Das, P.J., Mohan, N.H., Kumar, S., Gupta, V.K. 2023. Hormonal Interventions for Optimizing Reproductive Efficiency in Pigs. Reproductive System & Sexual Disorders: Current Research. 12(6): 1000387

Kumar, S., Sankhala, G., Sendhil, R., Kar, P., & Sharma, P. R. Identifying and prioritizing the stakeholder linkages of dairy-based farmer producer companies in India: An analytical hierarchy process. The Indian Journal of Animal Sciences, 93(7), 727-733.

Kumar, Satish, Bhushan, B., Kumar, A., Panigrahi, M., Bharati, J., Kumari, S., Kaiho, K., Banik, S., Karthikeyan, A., Chaudhary, R. and Gaur, G.K., 2023. Elucidation of novel SNPs affecting immune response to classical swine fever vaccination in pigs using immunogenomics approach. Veterinary Research Communications, pp.1-13. https://doi.org/10.1007/s11259-023-10262-3

Maity, H.K, Samanta, K., Deb, R, Gupta, V.K., 2023. Revisiting Porcine Circovirus Infection: Recent Insights and Its Significance in the Piggery Sector. Vaccines 2023, 11, 1308.

https://doi.org/10.3390/ vaccines11081308.

Mitali Dutta, Govindaswami Kadirvel, Probodh Borah, Sudip Sinha, Kutubuddin Ahmed, Girin Hazarika, Rajeev Sharma, Hitu Choudhury, Sourav Deuri, Mohua Das Gupta, Ranjan Kumar. 2023. Effect of membrane stabilizers on semen quality and sperm membrane protein expression during cryopreservation of goat semen. CryoLetters, 44(5), 299-306.

Mohan NH, Gupta VK and Pathak P. (2023). Can virophages be used for management of viral infections? Medical Hypothesis. 182: 111250.

Mohan NH, Pathak P, Buragohain L, Deka J, Bharati J, Das AK, Thomas R, Singh R, Sarma DK, Gupta VK, Das BC. (2023). Comparative muscle transcriptome of Mali and Hampshire breeds of pigs: a preliminary study. Animal Biotechnology: 34: 3946-3961

Mohandas S, Shete A, Kumar A, Wakchaure K, Rai V, Mote C, Dighe H, Sarkale P, Gawande P, Yemul J, Suryawanshi A. Comparative pathogenicity of BA. 2.12, BA. 5.2 and XBB. 1 with the Delta variant in Syrian hamsters. Frontiers in Microbiology. 2023 Jun 22;14:1183763.

Niharika, J., Deb, R., Parihar, R., Thakur, P.K., Anjaria, P., Sengar, G.S., Chaudhary, P., Pegu, S.R., Attupurum, N., Antony, N. and Rajkhowa, S., Gupta V.K., 2023. Isolation and Characterization of Extended-Spectrum β-Lactamase Producing Escherichia coli from Pig Farms and Slaughterhouse. Indian Journal of Microbiology, pp.1-7.

Niharika, J., Thakur, P., Sengar, G.S., Deb, R., Parihar, R., Sonowal, J., Chaudhary, P., Pegu, S.R., Das, P.J., Rajkhowa, S. and Gupta, V.K., 2023. Whole genome sequencing-based cataloguing of antibiotic resistant genes in piggery waste borne samples. Gene, 887, p.147786.

Pal, P., Aggarwal, A., Rajput, Y.S., Deb, R., Joshi, V.G., Verma, A.K., Haldar, A., Singh, I., Grewal, S. and De, S., 2023. Development of B cell epitopes-based enzyme linked immune sorbent assay for detection of bovine anti-Mullerian hormone. 3 Biotech, 13(7), p.241.

Pegu SR, Das PJ, Sonowal J, Sengar GS, Deb R, Yadav AK, Rajkhowa S, Choudhury M, Gulati BR, Gupta VK. (2023). Japanese Encephalitis Virus Genotype III Strains Detection and Genome Sequencing from Indian Pig and Mosquito Vector. Vaccines; 11(1):150.https://doi.org/10.3390/ vaccines11010150

Pegu, S. R., Sonowal, J., Deb, R., Das, P. J., Sengar, G. S., Rajkhowa, S., & Gupta, V. K. (2023). Clinicopathological and ultrastructural study of African swine fever outbreak in North-East India. Microbial Pathogenesis, 106452. https://doi.org/10.1016/j.micpath.2023.106452.

Rajkhowa, S., Sonowal, J., Borthakur, U., Pegu, S.R., Deb, R., Das, P.J., Sengar, G.S., Gupta, V.K. (2023). Meta-Analysis of the Prevalence of Porcine Zoonotic Bacterial Pathogens in India: A13-Year (2010–2023) Study. Pathogens, 12, 1266. https://doi.org/10.3390/pathogens12101266.

Rajkhowa, S., Sonowal, J., Pegu, S.R. et al. (2023). Natural co-infection of pigs with African swine fever virus and porcine reproductive and respiratory syndrome virus in India. Braz J

Microbiol.https://doi.org/10.1007/s42770-023-01203-y.

Singha, S., R. Thomas, A. Kumar, D. Bharadwaj, J. N. Vishwakarma and V. K. Gupta. 2023. Presence of potent inhibitors of bacterial biofilm associated proteins is the key to Citrus limon's antibiofilm activity against pathogenic Escherichia coli. Biofouling, https://doi.org/10.1080/ 08927014. 2023.2199934.

Singha, S., R. Thomas, D. Bharadwaj, J. N. Vishwakarma and V. K. Gupta. 2023. Thermal Adaptation Alters Response to Thermal Stress and Expression of Virulent Genes (eae, stx1, stx2, and hlyA) in Pathogenic Escherichia coli Isolated from Pork. Current Microbiology, 80:330. https://doi.org/10.1007/s00284-023-03446-2

Thakur, P.K., Deb, R., Pegu, S.R., Parihar, R., Niharika, J., Das, P.J., Sengar, G.S., Sonowal, J., Chaudhary, P., Selvaradjou, A., Rajkhowa S, Raj, A., Gupta V K., 2023. Characterization of piggery farm waste-borne bacterial transposable elements associated with antimicrobial resistance phenotypes. Comparative Immunology, Microbiology and Infectious Diseases, p.102005.

Thomas, R., S. Singha, D. Bharadwaj, A. Kumar, and V. K. Gupta. 2023. In silico evaluation of phytochemicals present in Bambusa polymorpha and Citrus limon extracts against Salmonella enteric Typhimurium combined with in vitro antimicrobial and acidic stress responsive studies. Journal of Food Safety. 2023;43:e13074. https://doi.org/10.1111/jfs. 13074

Books

Gupta V.K., Kumar, S., Jaya, Kumar, S., et al. 2023. व्यावसायिक शूकर पालन: उद्यमियों एवं कृषकों के लिए एक समग्र पुस्तक. Today and Tomorrow Publisher. ISBN: 9789391734473

Policy Paper

Gupta, V.K., Thomas, R., Banik, S., Deb, R. and Tripathi, B.N. 2023. Policy paper on 'Piggery Sector in India-Potential, policy implications and emerging paradigms'. ICAR-NRC on Pig, Guwahati.

Book Chapters

Bhatt M, Rajak KK, Yadav AK, Sharma GK, Biswas SK, Rai V, Nandi S. Methods of Virus Quantification. InAdvanced Virological Techniques for Research in Life Science. 2023 (pp. 36-46). ISBN No.: 978-93-6039-346-5

Bhatt M, Rajak KK, Yadav AK, Sharma GK, Biswas SK, Rai V, Nandi S. Reverse Transcriptase PCR (RT-PCR): Principle, Methodology and Application in Detection of Viral Agents. InAdvanced Virological Techniques for Research in Life Science. 2023 (pp. 91-97). ISBN No.: 978-93-6039-346-5

Technical / Popular Article

Sunil Kumar, R. Islam and V.K. Gupta. 2023. Lead paper on Swine Reproduction: opportunities, challenges

and way forward. published in Compendium of "38th Annual ISSAR conference- "International Symposium on 'Frontiers in Theriogenology: Research and Practice" organized by Department of Veterinary Gynaecology and Obstetrics, COVS, KVASU, Mannuthy from Dec.,6-8, 2023

सुनील कुमार, रफीकुल इसलाम एवं विवेक कुमार गुप्ता.2023. शूकरो में कृत्रिम गर्भाधान. अप्रि शिअंक-1-2023). ISBN: 978-93-5913-497-0) भा.कृ.अनु.प.- राष्ट्रीय मांस अनुसंधान संस्थान, हैदराबाद. (pp88-92)

Devi, S.J., Juwar Doley and N. M. Attupuram (2023). Internet of Things in piggery sector. Sasthra-Magazine, Vol. 4, No. 5, Art. 7.

Kar, P. Anjaria, P., Sengar, G.S.,Pegu, S.R., Deb, R. and Gupta, V.K.(2023) Advancing Swine Health: Field-Based Perspectives on Pen-Side Diagnostic Tools. Food and Scientific Reports,4(12):39-43

Bhupender Kumar, S.L. Jat, B.S. Jat, Pradeep Kumar, L. Prischilla, Ph. Romen Sharma, Priyajoy Kar and M.C. Dagla (2023) 'Bharat meh makka utpadhan bartaman paridrishya aur atmanirbharata'. Krishi Chetna. ICAR-IIMR, Ludhiana, Ank-6

Bharat Bhushan, B.S. Jat, Pardeep Kumar Monoj Kumar Mahaveer, Bhushan Bimbe, Sumit Kumar Agarwal, Priyajoy Kar, Satish Kumar and M.C. Dagla (2023) 'Rangeen Makka: Prakar aur Khadhya Upoyogita' Krishi Chetna. ICAR-IIMR, Ludhiana, Ank-6

B.Kaman. 2023. Importance of Information and communication technology (ICT) in agriclture development" published in SAMBHOR, a souvenir published by Assam Press Correspondent Union, Goalpara on the occasion of 13th Biennial Conference & 30th Established Day.

Abstract in conference compendium

Sunil Kumar, R. Islam, Prantik Deka, Mrinmoy Choudhury, P.J. Das and Vivek Kumar Gupta.. 2023. Abstract and oral presentation on Deciphering and validation of therapeutic efficacy of bioresources for augmenting reproductive efficiency in pig published in Compendium of "38th Annual ISSAR conference- "International Symposium on 'Frontiers in Theriogenology: Research and Practice" organized by Department of Veterinary Gynaecology and Obstetrics, COVS, KVASU, Mannuthy from Dec.,6-8, 2023.

Sunil Kumar, R. Islam, Mrinmoy Choudhury, Prantik Deka, P.J. Das and Vivek Kumar Gupta. 2023. Abstract and oral presentation on Andrological and marker based investigation for fertility prediction in pig published in Compendium of "38th Annual ISSAR conference- "International Symposium on 'Frontiers in Theriogenology: Research and Practice" organized by Department of Veterinary Gynaecology and Obstetrics, COVS, KVASU, Mannuthy from Dec.,6-8, 2023.

Sunil Kumar, R. Islam, K. Barman and V.K. Gupta.2023. Abstract and oral presentation on Efficacy of local bioresources for augmenting reproductive efficiency and health in pigs. In compendium of International Conference on "Reimagine Ethnopharmacology - Globalization of Traditional Medicine" organized by International Society for Ethnopharmacology (ISE), Society of Ethno pharmacology and Institute of Bioresources and Sustainable Development during February

24-26, 2023 at City Convention Centre, Imphal, Manipur, India.

Sunil Kumar, R. Islam, P.J. Das and Vivek Kumar Gupta. 2023. Abstract and oral presentation on "Augmenting quality of boar spermatozoa using different additives in liquid state" in compendium of "67th Annual Technical Session of Assam Science Society, 2023 cum National Seminar on "Current Developments in Science and Technology" organized by Bhattadev University, Bajali, Pathsala- 781325, Assam on 6th April, 2023.

Jaya, Kumar, S., Mohan, N.H., and Gupta V.K. 2023. Comprehensive transcriptomic analysis to decipher novel candidate genes regulating heat stress adaptability in pigs. In compendium of ISAGB-2023 on "Advances in genetics and genomics for sustainable livestock transformation" organized by ICAR-NBAGR, Karnal.

Devi S.J., Attupuram, N. M., Satish Kumar, Juwar Doley, Mohan, N. H. and Gupta, V. K. "Harnessing Drone Technology for Advancing Animal Agriculture" at the XVI Agricultural Science Congress by the National Academy of Agricultural Sciences (NAAS), New Delhi and hosted by ICAR-Central Marine Fisheries Research Institute (ICAR-CMFRI) during 10-13 October, 2023 at Kochi, India

Kumar S., Sankhala G., and Kar P (2023) SWOT Analysis of Dairy-Based Farmer Producer Companies in India: An AHP Approach COMPENDIUM, IEEC-2023 (ISBN: 978-81-967860-4-5)

Kar P., De K, Sharma Ph., Nh. Mohan and Gupta V.K. (2023) AI Based Metanalysis of Global Trends in Research on Pig Production. COMPENDIUM, IEEC-2023 (ISBN: 978-81-967860-4-5)

Kar P., Meena H.R., Meena B.S., Kadian K.S., Sharma Ph, and Gupta V.K. (2023) Welfare Enhancing Effects of Farmer Led Innovations in Dairying: Evidence from Northern India. COMPENDIUM, IEEC-2023 (ISBN: 978-81-967860-4-5)

Kar P., Meena H.R., Meena B.S., Kadian K.S., Sharma Ph, and Gupta V.K. (2023) Economic Impact of the Farmer-Led Innovations in Dairying: A Field Level Exploratory Analysis. COMPENDIUM, IEEC-2023 (ISBN: 978-81-967860-4-5)

Meera, K., Deori, S., Katiyar, R. and Ghatak, S. 2023. IPR strategies for balancing biodiversity conservation and sustainable livestock farming in north-east India. In: ICAR- Agripreneurs meet cum National Symposium on Strategies for promotion of incubatee in Agriculture and Allied Sectors in the Northeastern Region, 2023, ICAR Research Complex for NEH Region, Umiam, Meghalaya, 4- 5 October, 2023. Pp: 137

Meera, K., Das, P.J., Zaman, G., Attupuram, N.M., Deori, S., Katiyar, R. and Ghatak, S. 2023. Comparative expression analysis of microRNAs targeting the PTEN gene in testes of indigenous, crossbred and exotic pigs. In: XVI Agricultural Science Congress & ASC Expo, Kochi, Kerala, 10-13 October, 2023. Pp: 241

Das, P.J and Meera, K. 2023. Pig as a fundamental animal model for biomedical research. In: National Symposium on Crosstalk between Animal Research & Alternatives, CSIR- North East Institute

of Science and Technology, Jorhat, Assam, 7-9 September, 2023. Pp: 13

NCBI Accession No

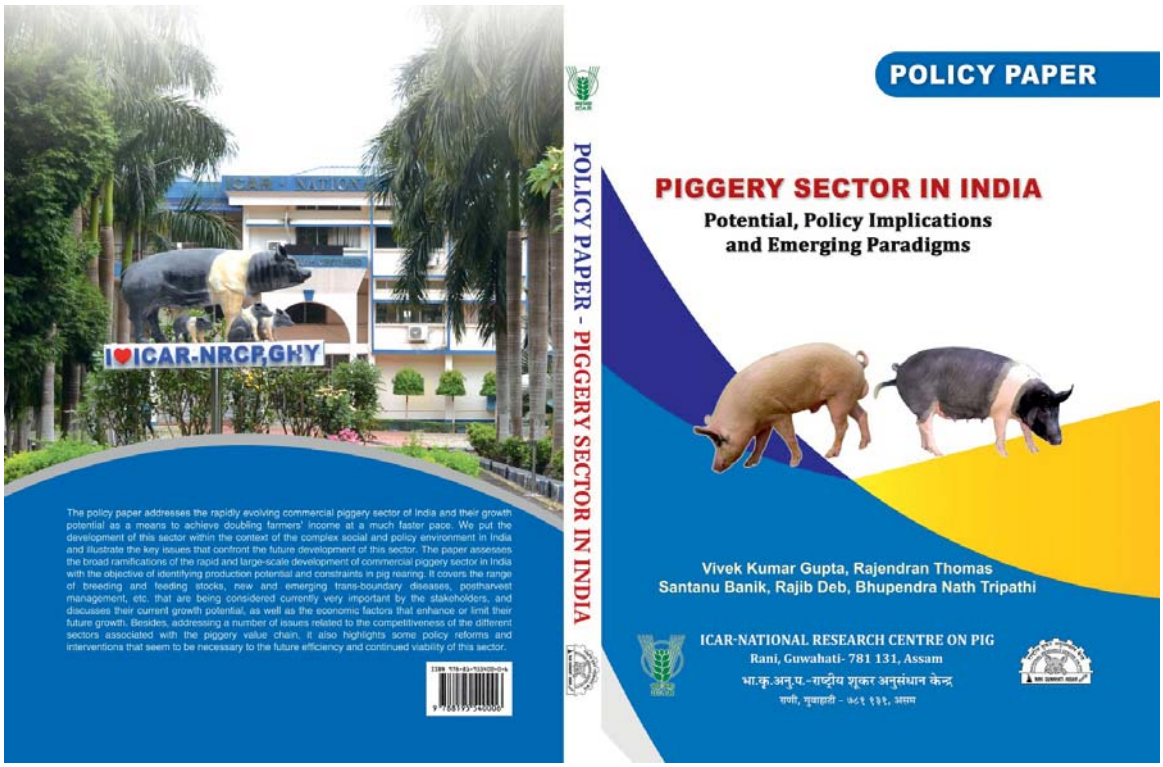
Jaya, S. Kumar, N.H. Mohan, B.C. Das, and V. K. Gupta. RNA-Seq study of small follicles and large follicles in Indian Ghoongroo pigs. 2023. GEO Accession GSE 228787.

Jaya, S. Kumar, N.H. Mohan and V. K. Gupta. Transcriptomic signature of in vitro heat stress challenged porcine granulosa cells. 2023 GEO Accession GSE 243234.

Das,P.J., Choudhury,M., Banik,S., Choudhury,H., Kumar,S., Kumar,S., Barman,K., Rajkhowa,S. and Gupta,V.K. Complete mitochondrial genome sequence of Doom (Sus scrofa domesticus) Pig of North East India. Sus scrofa domesticus breed Doom mitochondrion, complete genome GenBank: MZ846190.1

Mobile App

Sunil Kumar, Rafiqul Islam, Santanu Banik, Pranab Jyoti Das, Keshab Barman, Seema Rani Pegu, Swaraj Rajkhowa, Manish Kumar, Vivek Kumar Gupta, Nilotpal Biswas. 2023. Mobile App developed on Artificial Insemination in Pig. Developed by ICAR-NRC on Pig, Rani and published by Director, ICAR- NRC on Pig, Rani.



SOCIAL MEDIA


ICAR-National Research Centre on Pig, Guwaha @nrcpig · Oct 2, 2023
ICAR-NRC on Pig conducted Swachhata Hi Seva campaign on 'Garbage Free India' with focus on visual cleanliness and welfare of SafaiMitras. Thank you SafaiMitra campaign @icarindia @nstomar @swachhbharat


ICAR-National Research Centre on Pig, Guwaha @nrcpig · Oct 1, 2023
ICAR-National Research Centre on Pig undertook shramdaan under Swachhata Hi Seva campaign with a full spirit towards cleanliness and garbage free India on 01.10.2023 @icarindia @nstomar @swachhbharat


ICAR-National Research Centre on Pig, Guwah @nrcpi · Sep 29, 2023
राष्ट्रीय शूकर अनुसंधान केंद्र में विगत 15 दिनों से चली आ रही हिन्दी पखवाड़ा का सफलतापूर्वक समापन आज 29/9/2023 को हो गया। इस कार्यक्रम के मुख्य अतिथि श्री बदरी यादव, के.का.का., गुवाहाटी थे। @icarindia @nstomar @RajbhashaVibhag


ICAR-National Research Centre on Pig, Guwaha @nrcpig · Sep 4, 2023
ICAR-NRC on Pig celebrated 22nd Foundation Day on 4th Sept 2023 @icarindia @nstomar


ICAR-National Research Centre on Pig, Guwah @nrcpi · Aug 15, 2023
ICAR-NRC on Pig celebrates Independence Day. Glimpses of Har Ghar Tiranga and Meri Maati Mera Desh events @icarindia @nstomar


ICAR-National Research Centre on Pig, Guwaha @nrcpig · Jul 21, 2023
Students of Kendriya Vidyalaya, Borjhar, Guwahati on exposure visit to ICAR-NRCP for acquainting with R&D activities on 21.07.23 @icarindia @nstomar


B LIVE
ASSAM


ICAR-National Research Centre on Pig, Guwaha @nrcpig · Jun 21, 2023
ICAR-National Reseach Centre on Pig celebrated 9th International Yoga Day on 21.06.2023. #icarindia #nstomar


ICAR-National Research Centre on Pig, Guwaha @nrcpig · Jun 13, 202
A-Z of Pig farming book authored by Director and Scientists of ICAR-NRC on Pig receives Best Agricultral Extension Book during 3rd MANAGE Agril Extension Awards 2022 on 13.06.23 #nstomar #icarindia #manageHyd

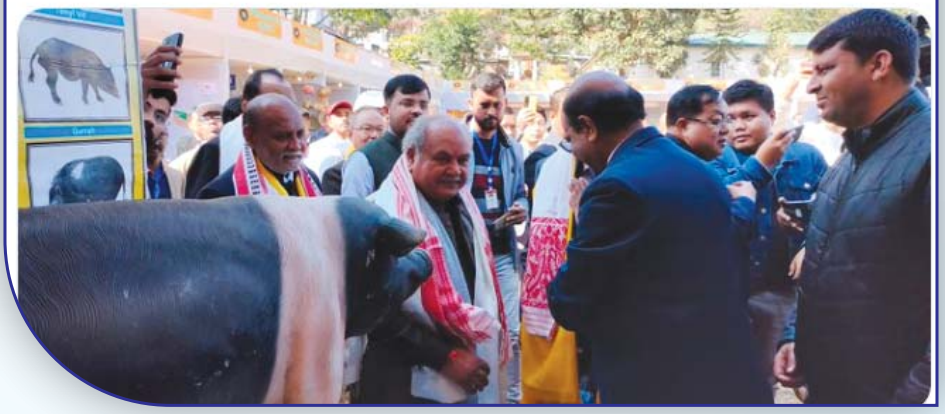

ICAR-National Research Centre on Pig, Guwahat @nrcpig · Apr 28, 202
Celebration of World Intellectual Property Day 26th April 2023 with the theme "Women and IP: Accelerating Innovation and Creativity"
NRC ON PIG


ICAR-National Research Centre on Pig, Guwaha @nrcpig · Apr 19, 2023
Awareness and Input distribution Programme Under Azadi ka Amrit Mahotsav was organised at ICAR-NRC on Pig on 18.04.2023


ICAR-National Research Centre on Pig, Guwaha @nrcpig · Jan 26, 202
ICAR-National Research Centre on Pig celebrated 74th Republic Day @icarindia

ICAR-National Research Centre on Pig, Guwaha @nrcpig · Jan 5, 202

Shri. Narendra Singh Tomar Ji, Hon`ble Minister of Agriculture and Farmers Welfare, Govt. of India visited ICAR-NRC on Pig stall during North East Krishi Kumbha-2023 at ICAR RC for NEH Region, Umiam, Meghalaya. @icarindia @nstomar



Indian National Young Academy of Sciences (INYAS)
@INYAS_INSA

KARYASHALA workshopon "Leveraging molecular laboratory skills on development of molecular gadgets for diagnosis and prevention of livestock diseases" has been co-organized by SERB jointly in collaboration with INYAS and conducted by ICAR-National Research Centre on Pig, Guwahati

4:22 PM · Jun 23, 2023 · 519 Views

আই চি এ আৰৰ উদ্যোগত পশু খাদ্য-সামগ্ৰী বিতৰণ
পশুপালনৰ জৰিয়তে স্বাৱলম্বী হোৱাৰ আহ্বান

राष्ट्रीय सूअर अनुसंधान केंद्र के निदेशक ने बीएयू का भ्रमण किया

विशेष संवाददाता

रांची : आईसीएआर के राष्ट्रीय सूअर अनुसंधान केंद्र, गुवाहाटी के निदेशक डॉ वीके गुप्ता ने बिरसा कृषि विश्वविद्यालय में चल रही वृहद सूअर बीज परियोजना के कामकाज का 20-21 फरवरी को निरीक्षण किया। उन्होंने कुलपति डॉ ओंकार नाथ सिंह और पशु चिकित्सा संकाय के डीन डॉ सुशील प्रसाद से मुलाकात की और वैज्ञानिकों, राज्य सरकार के सूअर प्रजनन केंद्र, कांके के अधिकारियों तथा सूकरपालकों को संबोधित भी किया। डॉ गुप्ता ने हजारीबाग के बड़कागांव तथा रांची के नामकुम एवं धुर्वा में कई प्रगतिशील सूअरपालकों के सूअर प्रक्षेत्र का भ्रमण किया और बेहतर लाभ हेतु पशुपालकों को आवश्यक परामर्श दिया। उन्होंने कहा कि नवोन्मेषी शोध द्वारा सूअर उत्पादन, स्वास्थ्य प्रबंधन और उनके प्रोडक्ट प्रोसेसिंग के लिए राष्ट्रीय सूअर अनुसंधान केंद्र कार्यरत है और सूअर पालन संबंधी किसी भी तकनीकी परामर्श के लिए उपलब्ध है।

बीएयू में में चल रही वृहद सूअर बीज परियोजना के प्रभारी वैज्ञानिक डॉ रविंद्र कुमार ने बताया कि निदेशक डॉ गुप्ता ने देश के कुल 21 केंद्रों पर चल रही वृहद सूअर बीज परियोजना में बीएयू केन्द्र को सर्वोत्तम बताया और कहा कि जनजातीय उप योजना के तहत बीएयू को अनुदान बढ़ाया जाएगा ताकि अधिक रोजगार एवं आय सृजन हेतु अधिकाधिक जनजातीय किसानों के बीच सूअर पालन की उन्नत तकनीक पहुंच सके।

सूकर बीज परियोजना का जायजा लिया

रांची : आइसीएआर के राष्ट्रीय सूकर अनुसंधान केंद्र, गुवाहाटी के निदेशक डॉ वीके गुप्ता ने मंगलवार को बिरसा कृ[illegible] विवि में चल रही वृहद सूकर बीज परियोजना के कामकाज का निरीक्षण कि[illegible] उन्होंने कुलपति डॉ ओंकार नाथ सिंह और वेटनरी कॉलेज के डीन डॉ [illegible]ल प्रसाद से मुलाकात की और वैज्ञानिकों, राज्य सरकार के सूकर प्रज[illegible] केंद्र, कांके के अधिकारियों तथा सूकर पालकों से बातचीत की. डॉ गुप्ता ने हजारीबाग के बड़कागांव तथा रांची के नामकुम और धुर्वा जाकर कई प्रगतिशील सूकर पालकों से मिले और उनके द्वारा पाले गये सूकरों की स्थिति को देखा तथा उन्हें आवश्यक सलाह दी. इस अवसर पर परियोजना प्रभारी डॉ रवींद्र कुमार भी उपस्थित थे.

Mising Autonomous Council মিচিং স্বায়ত্তশাসিত পৰিষদ
16 June 2023

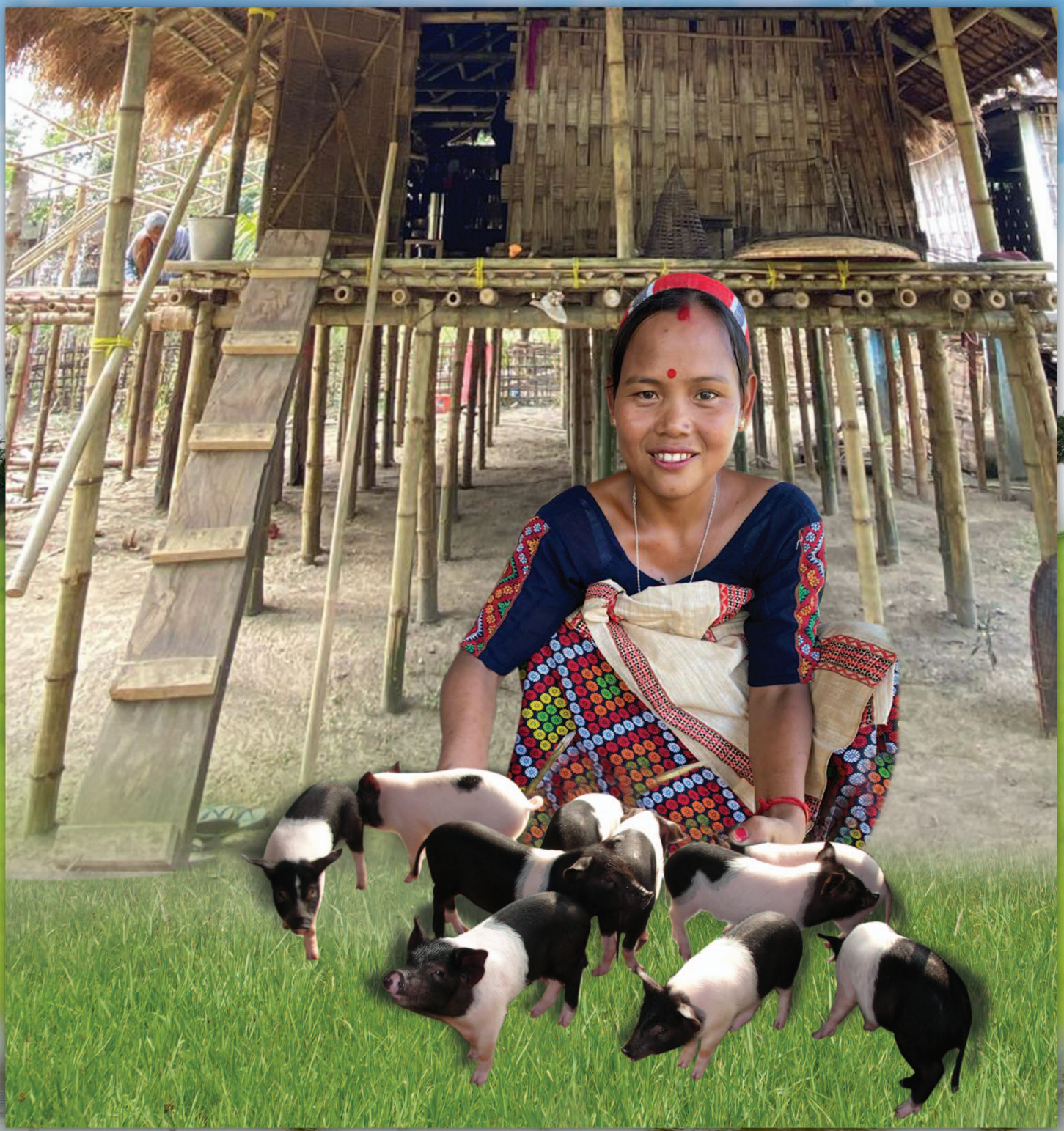
CMO Assam
Ranoj Pegu
Paramananda Chayengia CEM,MAC
Pradan Baruah
Bhubon Pegu
Deputy Commissioner Dhemaji
Jadav Pegu
Anil Kumar Pegu

See translation

Elegance Is Not Being Noticed, It's About Being Remembered

Sitting (L to R):Dr. Seema R. Pegu (Sr. Sci.,Veterinary Pathology), Dr. J. Doley (Sr. Sci., Animal Biotechnology), Dr. R. Thomas (Pr. Sci., LPT), Dr. R. Islam (Pr. Sci., ARG), Dr. N.H. Mohan (Pr. Sci., Animal Physiology), Dr. S. Rajkhowa (Pr. Sci., Veterinary Medicine), Dr. V.K. Gupta (Director), Dr. P.J. Das (Pr. Sci., AGB), Dr. B.C.Das (Pr. Sci., Animal Physiology), Sri. Rupesh S. (AO), Sri. Utpal Ghosh (FAO), Dr. Souvik Paul (Sr. Sci., Veterinary Parasitology).

Standing (L to R): Dr. Jaya (Sci., Animal Physiology), Dr. S.J.Devi (Sci., CA&IT), Dr. Meera K. (Sci., AGB), Dr. N.M.Attupuram (Sci., LPM), Dr. Priyajoy Kar (Sci., Agri Extension), Dr. Vishal Rai (Sci., Veterinary Microbiology), Dr. Lokesha E (Sci., Animal Nutrition), Dr. Kalyan De (Sr. Sci., LPM), Dr. Satish Kumar (Sci., AGB), Dr. Rajib Deb (Sr. Sci., Animal Biotechnology), Dr. Sunil Kumar (Sci., ARG), Sri. Uttam Prakash (AAO).



भाकृअनुप
ICAR

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद
Agrisearch with a human touch

राष्ट्रीय सूकर अनुसन्धान केन्द्र
NATIONAL RESEARCH CENTRE ON PIG
RANI GUWAHATI ASSAM
nrcp

0361-2847195 I +0361-2847195 I nrconpig@rediffmail.com I http://www.nrcp.icar.gov.in