2022

ANNUAL REPORT- 2022

वार्षिक प्रतिवेदन - 2022

ICAR-NATIONAL RESEARCH CENTRE ON PIG

Rani, Guwahati- 781 131, Assam

भा.कृ.अनु.प.–राष्ट्रीय शूकर अनुसंधान केन्द्र

राणी, गुवाहाटी – ७८१ १३१, असम

भाकृअनुप
ICAR

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NATIONAL RESEARCH CENTRE ON PIG
RANI GUWAHATI ASSAM

NRCP

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Citation

ICAR-NRC on Pig, Annual Report, 2022

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Published by

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Guwahati, Assam

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Printed at : Digits Enterpirse
Maligaon, Guwahati -11

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Preface

Pig husbandry in India holds immense potential to contribute to food security, economic growth, and rural development. However, addressing the existing challenges, such as infrastructure gaps, disease management, and market constraints, is crucial for the sustainable growth of the sector. By focusing on breed improvement, capacity building, market development, and disease control measures, India can leverage its pig husbandry resources to unlock the sector's full potential, benefiting both farmers and the nation as a whole. People of certain ethnic groups in the country prefer to keep pigs, especially the black coloured ones, for festivals and ceremonial purposes. The highest pig population is observed in eastern and north eastern (NE) states, followed by northern, southern, central and western India. Although the long tradition of pork consumption in India includes variation across different times, places and social relations, the smallholder model of raising pigs as part of diverse crop and livestock agro-ecosystems, coupled with only occasional meat eating, defines much of the country's pig and pork history. Pork consumption has witnessed an increase in India due to its affordability and high nutritional value. Pig rearing can contribute to improving the availability of animal protein, especially in rural areas, where malnutrition and protein deficiency persist. The 21st century agricultural and dietary changes however represent radical departures from the small holder production system and consolidation of industry is clearly visible in the last two decades. It should be noted that the industrialization of pig production is a relatively recent phenomenon globally. Pigs are versatile animals, well-suited for adapting to diverse climatic conditions and can thrive in both small-scale and commercial farming systems.

With the adoption of improved pig rearing practices under rural conditions, there will be significant increase in the income of some of the poorest people in the country who traditionally rear pigs.Pig farming offers livelihood options to small and marginal farmers, landless laborers, and women, empowering them with a sustainable income source. The sector has the potential to uplift rural economies, reducing poverty and unemployment. Scientific piggery could not only contribute towards piling-up of quality animal protein at affordable prices in India but also could help in achieving multiplying the income of farmers in short periods. In entrepreneurship point of view pig farming requires smaller investment and gives quick as well as high return.

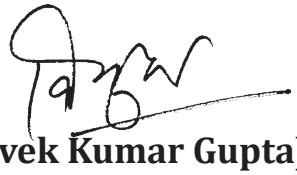
Outbreaks of diseases like African Swine Fever (ASF) pose a significant challenge to pig farming in India. Effective disease surveillance, biosecurity measures, and awareness campaigns are crucial to prevent and control such outbreaks. Relatively slow pace of growth in the Indian piggery sector is attributed to the factors like reduced availability of quality breeding germplasm, poor growth rate of the indigenous breeds, lack ofsound breeding programs, increase incidence of diseases, lack of post-harvestinfrastructure, lack of structured marketing channel etc.

During the last 20 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 15 All India Coordinated Research Project on Pig and 06 Megaseed centres 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 Institutewere awarded/ honoured in various platforms.

I wish to express my sincere thanks and gratitude for the constant support and encouragement received from Dr. Dr. Himanshu Pathak, Secretary, DARE & Director General, ICAR and Dr.B.N. Tripathi, Deputy Director General (Animal Sciences). I am thankful to Dr. V. K. Saxena, Ex-ADG (AP&B), Dr. A.K. Tyagi, ADG (ANP), Dr. Ashok Kumar, Assistant Director General (Animal Health), Dr. P.K Rout, ADG (AP&B, Acting) and other staff of Animal Science Division, ICAR, Krishi Bhawan, New Delhi for their continuous support in facilitating the activities at Head Quarter.

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.

It is my privilege to present you the salient achievements of the Institute in the form of annual report 2022 for your perusal and critical comments. The report will serve as a reference to those engaged in the field of scientific pig production and pork processing.



(Vivek Kumar Gupta)
Director

कार्यकारी सारांश

भाकृअनुप- राष्ट्रीय शूकर अनुसंधान केंद्र ने अपनी स्थापना के बाद सफलतापूर्वक 20 गौरवशाली वर्ष पूरे कर लिए हैं और किसानों, प्रसार कार्मिकों, नीति निर्माताओं और शूकर पालन और शूकर-मांस प्रसंस्करण से जुड़े उद्योगों को पूरा सहयोग करने में अपनी उत्कृष्टता जारी रखी है। संस्थान अपनी स्थापना के बाद से देश में वैज्ञानिक शूकर उत्पादन और शूकर वध के बाद के प्रबंधन को लोकप्रिय बनाने के साथ-साथ अपनी संबद्धता इकाइयों, अर्थात् कृषि विज्ञान केंद्र (केवीके) तथा देश के विभिन्न हिस्सों में स्थापित शूकर पर अखिल भारतीय समन्वित अनुसंधान परियोजना के पंद्रह केंद्रों और शूकर पर मेगा बीज परियोजना के छह केंद्रों के साथ शूकर क्षेत्र के सर्वांगीण विकास के लिए ईमानदारी से प्रयास कर रहा है। वर्ष 2022 के दौरान, संस्थान ने 20 वैज्ञानिकों, 06 तकनीकी कर्मचारियों और 06 प्रशासनिक और लेखा कर्मियों के साथ कार्य किया। वित्तीय वर्ष के दौरान कुल योजना और गैर-योजना बजट आवंटन 2322.15 लाख थे। संस्थान ने इस अवधि के दौरान राजस्व के रूप में 22.77 लाख रुपये अर्जित किए हैं। संस्थान के वैज्ञानिकों ने अधिदेश के अनुसार छह प्रमुख कार्यक्रमों के तहत परिभाषित अनुसंधान और प्रसार से संबंधित विभिन्न लक्ष्यों को प्राप्त करने के लिए लगातार कार्य किया। वर्तमान में, भाकृअनुप- राष्ट्रीय शूकर अनुसंधान केंद्र को "भारतीय कृषि अनुसंधान परिषद" की छत्रछाया के तहत सबसे जीवंत संगठनों में से एक माना जाता है और यह एक आईएसओ / आईईसी 17025: 2017 मान्यता प्राप्त और आईएसओ 9001: 2015 प्रमाणित संस्थान है।

शूकरों का संरक्षण और आनुवंशिक सुधार

भाकृअनुप- राष्ट्रीय शूकर अनुसंधान केंद्र द्वारा हैम्पशायर (नर) और घुंघरू (मादा) शूकरों का उपयोग करके विकसित उन्नत क्रॉसब्रेड शूकर किस्म 'रानी' के पीढ़ी-वार आनुवंशिक प्रदर्शन को दर्ज और मूल्यांकन किया गया था। शूकरों की स्वास्थ्य स्थिति की जांच के लिए आईआरटी छवि-आधारित प्रणालियों पर अध्ययन ने स्थापित किया है कि इन्फ्रारेड थर्मोग्राफी द्वारा शूकरों की वल्वर त्वचा के तापमान की निगरानी करके इस्ट्रस में शारीरिक परिवर्तनों का मूल्यांकन करने की क्षमता है। शूकर के प्रजनन क्षमता के लिए शूकर एमएसवाई (वाई क्रोमोसोम का नर-विशिष्ट क्षेत्र) जीन की अभिव्यक्ति प्रोफाइलिंग पर काम ने नर-विशिष्ट जीन की उपस्थिति की पुष्टि की है, जिससे शूकर में नर-विशिष्ट जीन के साथ-साथ नर प्रजनन ऊतकों में इन जीनों के स्थापित अभिव्यक्ति पैटर्न को चिह्नित किया गया है और वहां नर शूकर प्रजनन क्षमता से जुड़ा हुआ है। एकल न्यूक्लियोटाइड बहुरूपता के रूप में एफएसएच, लेप्टिन, ईएसआर 1, ईएसआर 2, लेप्टिन रिसेप्टर (एलईपीआर), आरबीपी 4 और पीआरएलआर जीन में आनुवंशिक परिवर्तनशीलता का पता स्वदेशी शूकर आबादी में प्रजनन लक्षणों के साथ उनके संबंध के लिए लगाया गया था। एसएनपी की जीनोटाइपिंग से पता चला है कि 38 एसएनपी में से 30 भारतीय शूकर आबादी में बहुरूपी थे।

शूकर फार्म प्रबंधन प्रथाओं में सुधार

बढ़ते देसी और क्रॉसब्रेड शूकर का एथोग्राम विकास और कल्याण मूल्यांकन किया गया है। घुंघरू , रानी और एलडब्ल्यूवाई (यॉर्कशायर) के व्यवहार को लगातार 24 घंटे तक दर्ज किया गया। घुंघरू, रानी और एलडब्ल्यूवाई ने क्रमशः 71.2±0.9%, 71.0±1.1% और 66.7±0.9% समय लेटने की स्थिति में बिताया। घुंघरू, रानी और एलडब्ल्यूवाई उत्पादक शूकर में एक दिन में खोजपूर्ण व्यवहार में बिताया गया समय क्रमशः 8.1±0.8%, 6.2±0.9% और 13.9±0.7% था। दिन के समय (सुबह 6:00 बजे से शाम 18:00 बजे तक) उत्पादक घुंघरू, रानी और एलडब्ल्यूवाई शूकर ने आराम की स्थिति में क्रमशः 59.2%, 57.8% और 48.6% समय बिताया, जिसमें बैठने और लेटने के व्यवहार में बिताया गया समय शामिल है। शूकर उत्पादन में फ़ीड और बिजली पर पानी के फुट प्रिंट के आकलन से संकेत मिलता है कि शेड धोने में अधिकतम पानी की आवश्यकता होती है। रानी शूकरों में गर्मियों के दौरान फिनिशर/ड्राई या वयस्क मादा शूकर, और पिगलेट, ग्रोअर्स, प्रेग्नेंट मादा शूकर और नर शूकर के लिए शेड धोने के लिए इस्तेमाल किया जाने वाला पानी क्रमशः 19±2.1, 28.8±1.24, 4.6±0.27 और 23.5±1.23 लिटर था। इसी अवधि के दौरान परीक्षण के तहत जानवरों ने क्रमशः 7.1±0.44, 9.4±0.66, 2.8±0.27, 8.2±1.006 और 6.1±0.44 लीटर का उपभोग किया। वर्षा ऋतु के दौरान फिनिशर/ड्राई मादा शूकर, और पिगलेट, उत्पादकों, गर्भवती मादा शूकर और नर शूकरों के लिए औसत

पेयजल खपत क्रमशः 6.4±0.80, 6.8±1.15, 2.4±0.27, 7.4±1.24 और 5.1±0.60 लीटर थी। शूकरों के लार के नमूनों के मेटाजीनोमिक विश्लेषण ने संकेत दिया है कि आर्किया, वायरस, यूकेरियोट्स और बैक्टीरिया क्रमशः 0.01%, 0.1%, 0.01% और 79.45% पर मौजूद थे। जबकि, गैस्ट्रो-आंतों के नमूनों में, आर्किया, वायरस, यूकेरियोट्स और बैक्टीरिया क्रमशः 0.05%, 0.09%, 0.03% और 54.48% मौजूद थे। शेष जीनोम अवर्गीकृत माइक्रोबायोम का प्रतिनिधित्व करते थे।

लाभदायक शूकर उत्पादन के लिए पोषण संबंधी हस्तक्षेप

शूकरों में सब्जी के साईलेज आधारित आहार खिलाने के एंटी-ऑक्सीडेंट स्थिति पर प्रभाव के अध्ययन ने संकेत दिया कि सीरम में औसत एसओडी, कैट और जीपीएक्स स्तरों के लिए उपचार समूहों के बीच कोई महत्वपूर्ण अंतर मौजूद नहीं है। टी0, टी1 और टी2 के लिए एसओडी (27.90, 26.57 और 26.49 नैनोग्राम/मिली) और जीपीएक्स (24.97, 23.39 और 22.91 नैनोग्राम/मिली) के आवधिक मान क्रमशः एक-दूसरे के साथ तुलनीय थे, जबकि प्रारंभिक अवधि में आवधिक कैट स्तर उत्पादक और फिनिशर चरण की तुलना में काफी अधिक (पी<0.05) था। औसत एमडीए स्तर (μM /L) T0, T1 और T2 उपचार समूह के लिए क्रमशः 38.74, 39.71 और 39.56 के रूप में दर्ज किए गए थे और सभी उपचार समूहों में सांख्यिकीय रूप से समान (पी >0.05) थे। आहार उपचार समूहों के औसत एचए टिट्रे (लॉग2 टिट्रे) को टी0, टी1 और टी2 समूह के लिए 3.81, 4.31, 4.21 के रूप में दर्ज किया गया था। उन समूहों के बीच एचए टिट्रे में एक अत्यधिक महत्वपूर्ण अंतर (पी<0.001) पाया गया जहां समूह टी0 ने कम मूल्य दिखाया, जबकि टी1 और टी2 समूह तुलनीय थे।

शूकरों में शारीरिक दक्षता में सुधार

माली शूकर में सर्दियों के मौसम की तुलना में गर्मियों के मौसम के दौरान कोलोन ऊतक में एमसीटी 1, एमसीटी 2, एचएसपी 27, एचएसपी 70 और एचएसपी 90 के सापेक्ष एमआरएनए अभिव्यक्तियां काफी अधिक (पी <0.05) पाई गईं। माली और घुंघरू शूकर में विभिन्न मौसमों के दौरान एमसीटी और एचएसपी जीन की प्रतिलिपि संख्या में सापेक्ष परिवर्तन गर्मी तनाव के बाद के नकारात्मक प्रभावों के अनुकूल होने के लिए उनकी थर्मो अनुकूलनशीलता और तनाव प्रतिक्रिया मार्गों के मॉड्यूलेशन को दर्शाता है। रानी शूकर में विभिन्न मौसमों के दौरान गर्मी तनाव उत्तरदायी जीन एचएसपी 70, एचएसपी 105 और एचएसएफ 1 जीन की अभिव्यक्ति गतिशीलता ने थर्मल तनाव के लिए उनकी थर्मो-अनुकूलनशीलता का खुलासा किया है।

स्वदेशी (घुंघरू और माली) और विदेशी (हैम्पशायर और लार्ज व्हाइट यॉर्कशायर) का पूरा जीनोम सीक्वन्स किया गया था और जीनोम का औसत आकार लगभग 2.55 जीबी था। औसतन, जीनोम में 40% दोहराए जाने वाले तत्व थे, जिसमें विभिन्न शूकर जीनोम के बीच मामूली अंतर होता है। जीनोम में दोहराए गए तत्वों के विश्लेषण को वर्ग I रेट्रोट्रांसपोसन (LINEs) 17.3%; लघु फैले हुए परमाणु तत्व (SINEs) 3.3%; कुल लंबे टर्मिनल रिपीट तत्व(LTR) 6.8% के रूप में पहचाना गया था। अध्ययन में विदेशी जानवरों में 4145 की तुलना में स्वदेशी शूकर नस्लों में 15809 सामान्य एसएनवी की पहचान की गई। माली (23 नंबर) और घुंघरू (42 नंबर) जीनोम में हीट शॉक प्रोटीन जीन के अद्वितीय रूपों की पहचान की गई, जिसमें स्वदेशी जानवरों की अनुकूलनशीलता पर प्रभाव पड़ा।

शूकरों में डिम्बग्रंथि समारोह के विनियमन में नॉच सिग्नलिंग की जांच के परिणामस्वरूप 8,709 एलएनसीआरएनए प्रतिलेख की पहचान हुई है, जिनमें से केवल 376 (4%) एलएनसीआरएनए (वर्ग कोड "=") के रूप में जाने जाते थे और अन्य नए थे। पहचाने गए नए एलएनसीआरएनए प्रतिलेखों में से, 3550 (41%) इंटरजेनिक (वर्ग कोड "यू"), 1828 (21%) पूरी तरह से इनट्रोनिक (वर्ग कोड "आई") थे, 1793 (21%) में नकारात्मक स्ट्रैंड (वर्ग कोड "एक्स") पर संदर्भ के साथ एक्सोनिक ओवरलैप थे, 827 (9%) ज्ञात जीन (वर्ग कोड "जे") के नए आइसोफॉर्म थे और 335 (4%) एक्सॉन में थे जो संदर्भ प्रतिलेख (वर्ग कोड "ओ" के साथ अतिव्यापी थे)। विभेदक जीन अभिव्यक्ति विश्लेषण ने कूपिक और ल्यूटियल चरण तुलना के बीच 1957 डीईजी (एफडीआर < 0.05) का खुलासा किया, जिनमें से 745 को डिम्बग्रंथि के रोम की तुलना में ल्यूटियल ऊतकों में विनियमित किया गया था और 1212 को डाउनरेगुलेट किया गया था, जो ल्यूटियल ऊतकों के विशेष कार्य के कारण कम ट्रांसक्रिप्शनल गतिविधि का संकेत देता है। अपरेगुलेटेड डीईजी का लॉग 2एफसी 11.939 से 1.335 तक था और डाउनरेगुलेटेड डीईजी -10.136 से -1.247 तक था।

शूकरों में प्रजनन क्षमता में सुधार

संरक्षण के विभिन्न घंटों में शूकर शुक्राणुओं की गतिशीलता पर एडिटिव्स की विभिन्न सांद्रता के प्रभाव के मूल्यांकन ने संकेत दिया है कि शुक्राणु की गतिशीलता 5 डिग्री सेल्सियस पर 24, 48 और 72 घंटे के संरक्षण पर एडिटिव्स की विभिन्न सांद्रता के बीच काफी भिन्न (पी <0.05) थी। ≤50% की स्वीकार्य गतिशीलता 5 डिग्री सेल्सियस पर 24 घंटे तक संरक्षण के लिए पाई गई थी, जो वीर्य के नमूने में विस्तारित थी। 5 डिग्री सेल्सियस पर भंडारण के 24 घंटे, 48 घंटे और 72 घंटे पर एडिटिव्स की विभिन्न सांद्रता में जीवित शुक्राणुओं का प्रतिशत भिन्न (पी<0.05) था। इसके अलावा, होस्ट प्रतिक्रिया वाले शुक्राणु और विस्तारक में एडिटिव्स की सभी सांद्रता में 50% से अधिक थे, जिसमें भंडारण के 24 घंटे पर 55.00 से 60.66 तक के मान थे। किसानों के फार्म में गुणक इकाइयों की स्थापना के लिए कृत्रिम गर्भाधान के प्रचार के परिणामस्वरूप ग्यारह इकाइयों की स्थापना हुई है और उन्होंने 6+1 मादा शूकर वाली इकाई का आकार हासिल कर लिया है। शूकर वीर्य संरक्षण के लिए आवश्यक नियंत्रित तापमान के रखरखाव के लिए कम लागत वाले वीर्य संरक्षण उपकरणों को मानकीकृत और मूल्यांकन किया गया है। कम और उच्च उपजाऊ वीर्य के बीच भेदभाव के लिए एक रसायन आधारित परख मानकीकृत किया गया था।

शूकर रोग की निगरानी और निगरानी

पोर्सिन सीरम नमूनों की जांच से पता चला कि 705 नमूनों में से 15 नमूने एएसएफ के लिए सकारात्मक पाए गए। पीआरआरएस के खिलाफ स्क्रीनिंग के लिए कुल 437 सीरम नमूने एकत्र किए गए थे और चार नमूने सकारात्मक पाए गए थे। स्वाइन इन्फ्लूएंजा के खिलाफ 213 सीरम नमूनों की जांच की गई, जिनमें से 98 नमूने सकारात्मक पाए गए। चार वायरस - एएसएफ, पीआरआरएस, जेईवी और सीएसएफ का एक साथ पता लगाने के लिए एक मल्टीप्लेक्स पीसीआर परख का अनुकूलन किया। संबंधित प्राइमरों के लिए मल्टीप्लेक्स पीसीआर को ग्रेडिएंट पीसीआर का उपयोग करके अलग-अलग एनीलिंग तापमान द्वारा अनुकूलित किया गया था। मल्टीप्लेक्स पीसीआर के अंतिम निदान के लिए इष्टतम एनीलिंग प्राइमर 57 डिग्री सेल्सियस का उपयोग किया गया था। एएसएफ 112 बीपी, पीआरआरएस 126 बीपी, जेईवी, 137 बीपी और सीएसएफ 156 बीपी के मल्टीप्लेक्स पीसीआर पॉजिटिव एम्प्लिकॉन का अनुकूलन।

विश्लेषण किए गए 79 मल नमूनों में से कुल 24 सकारात्मक नमूने कोकिडिया प्रजाति के देखे गए। जिन 7 मामलों में सी सुइस पाया गया था, 4 मामलों में यह 10 दिन से कम उम्र के पिगलेट्स में था और विशेष रूप से एक मामले में सी सुइस का पता 5 दिन के पिगलेट में लगाया गया था। धेमाजी जिले में प्रकोप से एएसएफवी आइसोलेट का संपूर्ण जीनोम अनुक्रमण पूरा हो गया है और एनसीबीआई परिग्रहण संख्या ओके 236383 प्राप्त की गई है। मवेशियों में उपयोग के लिए वाणिज्यिक एफएमडी वैक्सीन के साथ टीकाकरण किए गए शूकरों में प्रेरित एफएमडी वायरस सीरोटाइप विशिष्ट सुरक्षात्मक एंटीबॉडी प्रतिक्रिया के कैनेटीक्स पर अध्ययन ने सीरोटाइप के खिलाफ कोई टाइटर नहीं दिखाया। शूकरों के पोस्टमार्टम नमूनों में पीआरआरएस वायरस एंटीजन का पता लगाने के लिए एक अप्रत्यक्ष एलिसा विकसित किया गया है। पोर्सिन सीडी 163, पीआरआरएसवी सेलुलर रिसेप्टर, का उपयोग पीआरआरएसवी एंटीजन का पता लगाने के लिए एक नैदानिक तकनीक बनाने के लिए किया जा सकता है।

शूकर मांस प्रसंस्करण और मूल्य संवर्धन

पीएच तनाव के लिए साल्मोनेला टाइफीम्यूरियम की प्रतिक्रिया यानी नींबू और किण्वित बांसशूट के बिना पतला और पतला रस कार्बनिक एसिड और कमजोर पड़ने वाले कारक की प्रकृति के आधार पर बहुत भिन्न पाया गया। टिट्राटेबल अम्लता की समान सीमा के साथ नींबू का रस और साइट्रिक एसिड ने एस टाइफीम्यूरियम को एक्सपोजर के 2 घंटे के भीतर 3.95 से 4.19 लॉग तक कम कर दिया था। आणविक डॉकिंग परिणामों से पता चला है कि 3-एथिल-2-हाइड्रॉक्सी-2-साइक्लोपेंटेन-1-वन, 4-एथिल-1,3-बेंजीनडिओल और 2,3-डाइमेथोक्सीबेंजोइक एसिड सबसे कम बाध्यकारी ऊर्जा (-5.502, -5.543 और -5.6 किलो कैलोरी/मोल) के साथ प्रतिक्रिया करने के लिए शीर्ष तीन लिगेंड हैं, जबकि रेसोर्सिनोल, 4-एथिल-1,3-बेंजीनडियोल और बेंजेनेडिक एसिड के साथ प्रतिक्रिया करने वाले शीर्ष तीन लिगेंड हैं। असम नींबू, स्टार फ्रूट और सरसों से अर्क की एंटी-बायोफिल्म और कोरम सेंसिंग इनहिबिशन (क्यूएसआई) गतिविधियों का अध्ययन किया गया। सिलिको विश्लेषण में आणविक डॉकिंग का उपयोग करके वाई

एंटरोकोलिटिका के येएनआर क्षेत्र के खिलाफ किया गया था ताकि सी लिमोन, ए कारम्बोला और बी जुन्सिया के अर्क में पहचाने गए यौगिकों की एंटी क्यूएस गतिविधि की पुष्टि की जा सके।

शूकर उत्पादन में प्रसार हस्तक्षेप और कंप्यूटर अनुप्रयोग

असम में छोटे धारकों के बीच वैज्ञानिक शूकर उत्पादन प्रथाओं को अपनाने को बढ़ावा देने के लिए काम किया गया था। शैक्षिक हस्तक्षेप या प्रयोग के रूप में तीन गांवों में आईसीटी-आधारित विस्तार कार्यक्रम आयोजित किए गए थे। परिणामों से पता चला कि शैक्षिक हस्तक्षेप (7.956 ± 0.25) के बाद प्रयोग गांवों के किसानों के वैज्ञानिक शूकर उत्पादन प्रथाओं पर ज्ञान हस्तक्षेप से पहले के ज्ञान स्तर (4.30 ± 0.18) की तुलना में काफी अधिक है। 'फार्मर फील्ड स्कूल' कार्यक्रम ने आदिवासी महिला प्रतिभागियों को अधिक प्रदर्शन और ज्ञान प्रदान करके सशक्त बनाया। क्षमता विकास अभ्यास जिसने उन्हें शूकर पालन पर वैज्ञानिक ज्ञान से अवगत कराया, ने एक उद्यमी मानसिकता बनाई। इसने उन्हें लाभ प्राप्त करने के लिए शूकर पालन का अधिक प्रभावी ढंग से अभ्यास करने में सक्षम बनाया। शूकर पालन क्षेत्र में ड्रोन डिलीवरी का उपयोग करने की संभावना का पता लगाया गया है। ड्रोन दूरस्थ स्थानों में संक्रमित जानवरों के इलाज के लिए चिकित्सीय दवाओं की सटीक निश्चित-बिंदु डिलीवरी करने के लिए पाए जाते हैं।

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

टीएसपी और एससीएसपी के तहत वर्ष 2022 के दौरान कुल 46 शूकर स्वास्थ्य और जागरूकता शिविर सह इनपुट वितरण कार्यक्रम आयोजित किए गए। असम और मेघालय के विभिन्न गांवों के 2612 आदिवासी लाभार्थियों के बीच कुल 312 टन शूकर दाना वितरित किया गया था। इसके अलावा, 110 आदिवासी युवाओं और किसानों को लाभान्वित करने के लिए 09 प्रशिक्षण आयोजित किए गए। एससीएसपी के तहत शूकर फ़ीड और दवाओं के साथ बेहतर गुणवत्ता वाले क्रॉसब्रेड पिग, आवश्यक जैव सुरक्षा आइटम और फ़ीड सप्लीमेंट 545 किसानों को 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 25 प्रशिक्षण कार्यक्रम आयोजित किए हैं ताकि प्रतिभागियों को लाभदायक शूकर पालन के लिए नस्ल/किस्मों/स्ट्रेन और प्रजनन रणनीतियों के चयन, शूकरों की विभिन्न श्रेणियों के भोजन और गैर-पारंपरिक फ़ीड सामग्री के उपयोग की मूल बातें प्रदान की जा सकें। शूकरों की विभिन्न श्रेणियों की देखभाल और प्रबंधन, वीर्य प्रयोगशाला के एक्सपोजर विजिट, वीर्य संग्रह, कृत्रिम गर्भाधान के लिए शूकर वीर्य का प्रसंस्करण और मूल्यांकन, वैज्ञानिक शूकर पालन के लिए आवास की आवश्यकता, शूकरों के सामान्य रोग और टीकाकरण अनुसूची, खेत की सफाई, कीटाणुशोधन, नियमित फार्म संचालन प्रथाओं, पिगलेट के बधियाकरण और सुई दांतों की कतरन और शूकर में दवाओं के प्रशासन के विभिन्न तरीकों सहित उनका प्रबंधन और शूकरों की विभिन्न श्रेणियों के लिए फ़ीड के निर्माण का प्रदर्शन।

प्रौद्योगिकी हस्तांतरण और व्यापार इनक्यूबेशन समर्थन

भाकृअनुप- राष्ट्रीय शूकर अनुसंधान केंद्र ने 03 प्रौद्योगिकियों का विकास किया है और इन प्रौद्योगिकियों के व्यावसायीकरण और हस्तांतरण के साथ-साथ परामर्श, अनुबंध अनुसंधान और अनुबंध सेवाओं जैसी विभिन्न सेवाओं के लिए विभिन्न उद्यमियों, स्टालधारकों और संगठनों के साथ 03 समझौता ज्ञापनों पर हस्ताक्षर किए हैं। संस्थान ने 2022 के दौरान 02 पेटेंट, 14 कॉपीराइट, 04 ट्रेडमार्क और 03 डिजाइन के लिए आवेदन किए हैं। भाकृअनुप- राष्ट्रीय शूकर अनुसंधान केन्द्र ने 2022 के दौरान एबीआई के तहत 03 उद्यमियों/स्टार्टअप को शामिल किया है। प्रौद्योगिकी हस्तांतरण समझौता वाणिज्यिक शूकर पालन, संबद्ध सेवा क्षेत्रों और पोर्क में मूल्य संवर्धन के क्षेत्रों में उद्यमिता कौशल विकास गतिविधियों सहित इनक्यूबेशन और व्यवसाय विकास कार्यक्रम पर केंद्रित है। संस्थान ने उद्यमियों को अपने स्टार्ट-अप को प्रभावी ढंग से स्केल करने के लिए व्यावसायिक डोमेन में आधुनिक प्रौद्योगिकी-आधारित व्यावसायिक विचारों और मॉडल विकसित करने के लिए तकनीकी परामर्श और संरक्षक कनेक्शन, मार्गदर्शन और प्रशिक्षण के संदर्भ में सक्रिय और मूल्य वर्धित व्यावसायिक सहायता प्रदान करके भी मदद की है।

कृषि विज्ञान केंद्र

वर्ष के दौरान 2326 प्रतिभागियों को शामिल करते हुए कुल 85 प्रशिक्षण कार्यक्रम आयोजित किए गए। कृषि विज्ञान केंद्र गोलपाड़ा ने नई उत्पन्न कृषि प्रौद्योगिकियों पर 12 ऑन फार्म ट्रायल आयोजित किए। रिपोर्ट की गई अवधि के दौरान 10 एफएलडी और 04 सीएफएलडी आयोजित किए गए थे। इसके अतिरिक्त, कृषि विज्ञान केन्द्र ने विभिन्न स्कीमें/परियोजनाएं अर्थात् पोषण संवेदनशील कृषि संसाधन और नवाचार (एनएआरआई), जनजातीय क्षेत्रों में ज्ञान प्रणालियां और होमस्टेड कृषि प्रबंधन (केएचएएमएसटीए), किसानों की आय दोगुनी करना (डीएफआई), मेरे गांव मेरा गौरव (एमजीएमजी) और स्वच्छता अभियान का आयोजन किया है।

आजादी का अमृत महोत्सव

भारतीय स्वतंत्रता के 75 वें वर्ष के उत्सव के हिस्से के रूप में, भाकृअनुप- राष्ट्रीय शूकर अनुसंधान केंद्र ने स्वतंत्र भारत में शूकर क्षेत्र के विकास और उपलब्धि और शूकर पालन अनुसंधान, विस्तार और वैज्ञानिकों द्वारा अपने संबंधित क्षेत्रों में दिए गए तकनीकी प्रयास के विभिन्न क्षेत्रों में भविष्य की संभावनाओं की समीक्षा करने के लिए एक व्याख्यान श्रृंखला शुरू की थी। वर्ष 2022 के दौरान कुल 23 व्याख्यान आयोजित किए गए।

स्वच्छ भारत

भाकृअनुप - राष्ट्रीय शूकर अनुसंधान केंद्र, रानी ने र पूरे वर्ष समय-समय पर "स्वच्छता अभियान" का आयोजन सक्रिय रूप से किया। नियमित गतिविधियों के अलावा, 01.10.2022 से 31.10.2022 तक विशेष अभियान 2.0 और 16-31 दिसंबर 2022 के दौरान एक स्वच्छता पखवाड़ा आयोजित किया गया, जिसमें 23 दिसंबर 2022 को 'किसान दिवस' भी शामिल था। कार्यक्रम के दौरान, स्कूलों में जागरूकता कार्यशालाएं आयोजित करके संस्थान के आस-पास के गांवों में जन जागरूकता पैदा की गई, बच्चों और युवाओं के लिए भाषण प्रतियोगिता आयोजित की गई।

शूकर पर एआईसीआरपी और मेगा बीज परियोजना

संस्थान ने परिषद के परामर्श से तकनीकी और वित्तीय निगरानी और समीक्षा बैठक के संचालन के माध्यम से शूकर पर एआईसीआरपी (15 केंद्र) और शूकर पर मेगा बीज परियोजना (06 केंद्र) की प्रगति की नियमित निगरानी जारी रखी। डॉ. बी. एन. त्रिपाठी, उप महानिदेशक (पशु विज्ञान), भाकृअनुप, नई दिल्ली की अध्यक्षता में 25-26 अगस्त, 2022 को "शूकर पर आईसीएआर-एआईसीआरपी" और "शूकर पर एमएसपी" की वार्षिक समीक्षा बैठक आयोजित की गई। एआईसीआरपी परियोजना देश भर के विभिन्न केंद्रों में विभिन्न कृषि जलवायु स्थितियों में शूकरों के प्रदर्शन का अध्ययन करने, गुणवत्ता वाले जर्मप्लाज्म सहित प्रथाओं के क्षेत्र-विशिष्ट पैकेज को विकसित करने और स्वदेशी जर्मप्लाज्म के संरक्षण के लिए 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 कार्य भी किए। रिक्रिएशन क्लब द्वारा कर्मचारियों के लिए विभिन्न सामाजिक कार्यक्रमों का भी आयोजन किया गया। कार्यालय और परिसर परिसर को स्वच्छ और पर्यावरण के अनुकूल बनाए रखने के लिए विभिन्न पहल की गई। इसके अतिरिक्त, किसानों के लाभ के लिए वैज्ञानिक विशेषज्ञता का विस्तार करने के लिए, संस्थान ने मेरा गांव मेरा गौरव कार्यक्रम लागू किया है।

EXECUTIVE SUMMARY

The ICAR-National Research Centre on Pig has successfully completed 20 glorious years since its inception and continued its excellence in catering the farmers, extension workers, policy makers and industries associated with pig farming and pork processing. The institute is taking sincere efforts for popularizing the scientific pig production and postharvest 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), fifteen centers of All India Coordinated Research Project on Pig centres, and six centers of Mega seed Project on Pig, spread over different parts of the country. During the year 2022, the Institute functioned with 20 scientists, 06 technical staff and 06 administrative and accounts personnel. The total plan and non-plan budget allocations were 2322.14 lakh during the financial year. The institute has generated Rs 22.77 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 ISO9001:2015 certified Institution.

Conservation and genetic improvement of pigs

The generation-wise genetic performance the improved crossbred pig variety 'Rani', developed by ICAR-NRC on Pig using Hampshire (male) and Ghoongroo (female) pigs, was recorded and evaluated. 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. Works on expression profiling of pig MSY (male-specific region of the Y chromosome) genes for boar fertility has confirmed the presence of the male-specific genes, thereby characterizing the male-specific genes in Pig as well as the established expression pattern of these genes in male reproductive tissues and there linked with male pig fertility. The genetic variability in the FSHβ, Leptin, *ESR1, ESR2,* Leptin Receptor *(LEPR), RBP4* and *PRLR* genes in the form of single nucleotide polymorphism was explored for their association with reproduction traits in indigenous pig population. The genotyping of SNPs has shown that out of 38 SNPs 30 were polymorphic in the Indian population.

Improvement in pig farm management practices

Ethogram development and welfare assessment of growing Desi and crossbred pig has been carried out. Behaviour of Ghoongroo, Rani and LWY were recorded for a continuous 24 hours.The Ghungroo, Rani and LWY spent 71.2±0.9, 71.0±1.1 and 66.7±0.9% of the time in lying conditions, respectively. The time spent in exploratory behavior was 8.1±0.8, 6.2±0.9 and 13.9±0.7 of a day in Ghungroo, Rani and LWY grower pig, respectively. In the day time (morning 6:00 am to evening 18:00 pm), the grower Ghungroo, Rani and LWY pig spent 59.2, 57.8 and 48.6% time, respectively in resting condition which includes time spent in sitting and lying behavior. Assessment of water foot print on feed and electricity in pig production has indicated that the shed washing accounts for maximum water requirement. In Rani pigs the water used for shed washing for finisher/ dry sow, dam & piglets, growers, pregnant sows, & boar were 19±2.1, 28.8±1.24, 4.6±0.27 and 23.5±1.23, respectively, during summer. During the same period animals under trial consumed

7.1±0.44, 9.4±0.66, 2.8±0.27, 8.2±1.006 and 6.1±0.44 litres, respectively. During rainy season the average drinking water consumption were 6.4±0.80, 6.8±1.15, 2.4±0.27, 7.4±1.24 and 5.1±0.60 litres, respectively for finisher/dry sow, dam & piglets, growers, pregnant sows, andboars. Metagenomic analysis of salivary samples of pigs has indicated that archaea, viruses, eukaryotes and bacteria were present at 0.01, 0.1, 0.01 and 79.45%, respectively. Whereas, in gastro-intestinal samples, archaea, viruses, eukaryotes and bacteria were present at 0.05, 0.09, 0.03 and 54.48%, respectively. The rest of the genome represented unclassified microbiome.

Nutritional interventions for profitable pig production

Studies on the effect of feeding vegetable silage based diet on anti-oxidant status in pigs indicated that there exist no significant difference among the treatment groups for the mean SOD,CAT and GPx levels in serum. The periodic values of SOD (27.90, 26.57 and 26.49 ng/ml) and GPx (24.97, 23.39 and 22.91 ng/ml) for T0, T1 and T2, respectively were comparable to each other, whereas the periodic CAT levels at initial period was significantly higher ($p<0.05$) than the grower and finisher phase. The mean MDA levels (µM/L) were recorded as 38.74, 39.71 and 39.56, respectively for T0, T1 and T2 treatment group and were statistically similar ($p>0.05$) in all treatment groups. The mean HA titre (log2 titre) of the dietary treatment groups was recorded as 3.81, 4.31, 4.21 for T0, T1 and T2 group. A highly significant difference ($p<0.001$) was found in HA titre among the groups where group T0 showed a lower value, while the T1 and T2 groups were comparable.

Improvement of physiological efficiency in pigs

Relative mRNA expressions of MCT1, MCT2, HSP27, HSP70 and HSP90 were found to be significantly ($p<0.05$) higher in colon tissue during summer season compared to that of winter season in Mali pig. The relative change in the copy number of MCT and HSP genes during different season in Mali and Ghoongroo pig shows their thermo adaptability and modulation of stress response pathways to adapt to the subsequent negative effects of heat stress. The expression dynamics of heat stress responsive genes HSP70, HSP105 and HSF1 genes during different season in Rani pig has revealed their thermo-adaptability to thermal stress.

Whole genome of indigenous (Ghungroo and Mali) and exotic (Hampshire and Large White Yorkshire) was undertaken and the mean size of the genome was about 2.55 GB. On an average, the genome contained 40% of repetitive elements, with minor differences between various pig genomes. The analysis of repeated elements in genome were identified as class I retrotransposons (long interspersed nuclear elements (LINEs), 17.3%; short interspersed nuclear elements (SINEs), 3.3%; total long terminal repeat elements, 6.8%). The study identified 15809 common SNVs in indigenous pig breeds as against 4145 in exotic animals. Unique variants of heat shock protein genes were identified in Mali (23) and Ghungroo (42) genome, with implications on adaptability of indigenous animals.

Investigation of notch signalling in regulation of ovarian function in pigs has resulted in identification of 8,709 lncRNA transcripts, out of which only 376 (4 %) were known lncRNAs (class code "=") and others were novel.Among the novel lncRNAs transcripts identified, 3550 (41 %) were intergenic (class code "u"), 1828 (21 %) were completely intronic (class code "i"), 1793 (21 %) had exonic overlaps with the reference on the negative strand (class code "x"), 827 (9 %) were novel isoforms of known genes (class code "j") and 335 (4 %) had exons that overlapped with the reference transcript (class code "o").Differential gene expression analysis revealed 1957 DEGs (FDR < 0.05) between follicular and luteal phase comparison, of which 745 were upregulated and

1212 were downregulated in luteal tissues in comparison to ovarian follicles, indicating lower transcriptional activity due to specialized function of luteal tissues. The log2FC of the upregulated DEGs ranged from 11.939 to 1.335 and downregulated DEGs ranged from -10.136 to -1.247.

Improvement of reproductive efficiency in pigs

Evaluation of the effect of different concentration of additives on motility of boar spermatozoa at different hours of preservation has indicated that 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 24 h of preservation at 5°C in semen sample extended in all the combinations in AND extender. The percentage of live spermatozoa was significantly ($p<0.05$) differ in different concentrations of additives at 24h, 48h and 72 h of storage at 5°C. Further, the HOST reacted spermatozoa was higher than 50% in all concentrations of additives in AND extender with the values ranging from 55.00 to 60.66 at 24h of storage. Propagation of Artificial Insemination for establishment of multiplier units at farmers' field has resulted in establishment of eleven units and they have achieved a farm size of 6+1 sow unit. Low cost semen preservation tools has been standardized and evaluated for the maintenance of controlled temperature required for boar semen preservation. A chemiluminance based assay for discrimination between low and high fertile semen was standardized.

Pig disease monitoring and surveillance

Screening of porcine serum samples revealed that among 705 samples, 15 samples were found positive for ASF. A total of 437 serum samples were collected for screening against PRRS and four samples were found positive. Among 213 serum samples screened against swine influenza, 98 samples were found positive. Optimized one multiplex PCR assay for simultaneous detection of four viruses -ASF, PRRS, JEV and CSF. Multiplex PCR for respective primers were optimized by different annealing temperature using gradient PCR. The optimal annealing primer 57°C was used for final diagnosis of multiplex PCR. Optimization of multiplex PCR positive amplicons of ASF 112 bp, PRRS 126 bp, JEV, 137 bp and CSF 156 bp respectively.

A total of 24 positive samples *Coccidia sp.* were observed among 79 fecal samples analyzed. Of the 7 cases in which *C. suis* was found, in 4 cases it was in piglets below 10 days of age of age and in specifically one case C. suis was detected in a 5 day old piglet. Whole Genome Sequencing of ASFV Isolate from the outbreak in Dhemaji District has been completed and obtained NCBI accession number OK236383. Studies on kinetics of FMD virus serotype specific protective antibody response induced in pigs vaccinated with commercial FMD vaccine intended for use in cattle did not show any titre against serotypes. An indirect ELISA has been developed for detecting PRRS virus antigen in post mortem samples of pigs. Porcine CD163, the PRRSV cellular receptor, can be exploited to build a diagnostic technique for the detection of PRRSV antigen.

Post harvest processing and value addition of pork

The response of Salmonella Typhimurium to pH stress i.e. to undiluted and diluted juices of lemon and fermented bambooshoot was foundvary greatly depending on the nature of the organic acid and dilution factor. Lemon juice and citric acid with the same range of titratable acidity has reduced S. Typhimurium from 3.95 to 4.19 logs within 2 h of exposure. The molecular docking results showed that 3-ethyl-2-hydroxy-2-cyclopenten-1-one, 4-ethyl-1,3-benzenediol and 2,3-dimethoxybenzoic acid with the lowest binding energy (-5.502, -5.543 and -5.6 kcal/mol, respectively) are top three ligands to interact with MdfA , while resorcinol, 4-ethyl-1,3-benzenediol and benzeneacetic acid, alpha,4-dihydroxy-methyl ester were the best interacting

phytochemicals from fermented bambooshoot to interact with RamA. Anti-biofilm and Quorum Sensing Inhibition (QSI) activities of extracts from Assam lemon, Star fruit and Mustard greeen on Yersinia enterocoliticawere studied. In silico analysis using molecular docking was performed against the YenR region of Y. enterocolitica to further corroborate the anti QS activity of the identified compounds in the extracts of *C. limon, A. carambola* and *B. Juncea*.

Extension interventions and computer applications in pig production

Work was undertaken to foster the adoption of scientific pig production practices among small holders in Assam. ICT-Based extension programmes were organized in three experiment villages as the educational intervention or experiment. The results revealed that the knowledge on scientific pig production practices of the farmers of experiment villages after the educational intervention (7.956 ± 0.25) is significantly higher than the knowledge level before the intervention (4.30 ± 0.18). The 'Farmer Field School' programme empowered the tribal women participants by providing greater exposure and knowledge. The capacity development exercise that exposed them to scientific knowhow on pig farming created an entrepreneurial mindset. This enabled them to practice pig farming more effectively to gain profits. Possibility of using drone delivery in piggery sector has explored. 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 46 numbers of pig health and awareness camp cum input distribution was conducted during 2022 under TSP and SCSP Total 312 tons of pig feed was distributed among 2612 tribal beneficiaries of different villages of Assam and Meghalaya. Further, 09 trainings were organized for benefitting 110 tribal youths and farmers. Under SCSP superior quality crossbred Pig along with pig feed and medicines, essential biosecurity items and feed supplements were distributed to 545 farmers.

Trainings and capacity building

ICAR-NRC on Pig has conducted 25 training programmes in different aspects of pig production,artificial insemination, pork processing and value addition to provide exposureto participants on the basics of selection of breed/ varieties/strain and breeding strategies forprofitable pig farming, feeding of different categories of pigs and use of non-conventional feedstuffs for swine feeding, care and management of different categories of pigs, exposure to semenlab, 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 andneedle 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 03 MoUs with different entrepreneurs, stallholders and organization to commercialize and transfer these technologies as well as for various services like consultancy, contract research and contract services. Institute has applied 02 Patents, 14 Copyrights, 04 Trademarks and 03 Designs during 2022. ICAR-National Research Centre on Pig has inducted 03 numbers of Entrepreneurs/Startups under ABI during 2022. 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 85 training programmes were conducted covering 2326 number of participants during the year. The Krishi Vigyan Kendra Goalpara has conducted 12 On farm Trial on newly generated agricultural technologies. Ten numbers of FLDs and 04 CFLDs were conducted during the reported period. In addition, KVK has organized different schemes/ projects viz. Nutrition Sensitive Agriculture Resources and Innovation (NARI), Knowledge Systems and Homestead Agriculture Management in Tribal Areas (KSHAMTA), Doubling Framers Income (DFI), Mere Gaon Mera Gaurav (MGMG) and Swchhata Abhiyan.

Azadi Ka Amrut Mahotsav

As part of the celebration of the 75th Year of Indian Independence, ICAR-National Research Centre on Pig had initiated a Lecture Series to review the development and achievement of pig sector in the Independent India and the prospects for the future in various fields of pig husbandry research, extensions and technological endeavour delivered by scientists in their respective fields. A total of 23 lectures were organized during the year 2022.

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 2.0 was organized from 01.10.2022 to 31.10.2022 and one Swachhata Pakhwada during l6th -31st December 2022 including 'Kisan Diwas' on 23rd December 2022. During the programme, the public awareness was created in the nearby villages of the institute by conducting awareness workshops in schools, elocution competition for children and youths.

AICRP and Mega Seed Project on Pig

The Institute continued regular monitoring of the progress of AICRP on Pig project (15 centers) and Mega seed project on pig (06 centers) through technical and financial monitoring in consultation with the council and conduction of review meet. The Annual Review Meeting of "ICAR-AICRP on Pig" and "MSP on Pig" held on 25-26th August, 2022 at ICAR-CIARI, Port Blair under the Chairmanship of Dr. B.N. Tripathi, Deputy Director General (Animal Science), ICAR, New Delhi. 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 eventswere also organized by the Recreation Club for the staff. Various initiatives were taken to maintain the office and campus premises clean and environment friendly. Additionally, to extend the scientific expertise for the benefit of farmers, the Institute has implemented Mera Gaon Mera Gaurav programme.

Introduction

Rani Crossbred Pig Variety

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 postharvest 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), fifteen centres of All India Coordinated Research Project (AICRP) on Pig, and six centres of Mega seed Project on Pig, spread over different parts of the country. All India Coordinated Research Project on Pig and Mega seed Project on Pig are 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 germplasm are the focus of the two programmes respectively.

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 20 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	01	01
3	Senior Scientist	04	04	00
4	Scientist	18	14	04
	Total	25	20	05

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	03	02	05	04	01
2	T-3	04	00	04	03	01
3	T-4	00	03	03	03	00
4	SMS/STO/T-6	00	06	06	05	01
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, U.P, 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 Cell) 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 porkproduction, 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 2022-23 **(Rs. in lakh)**

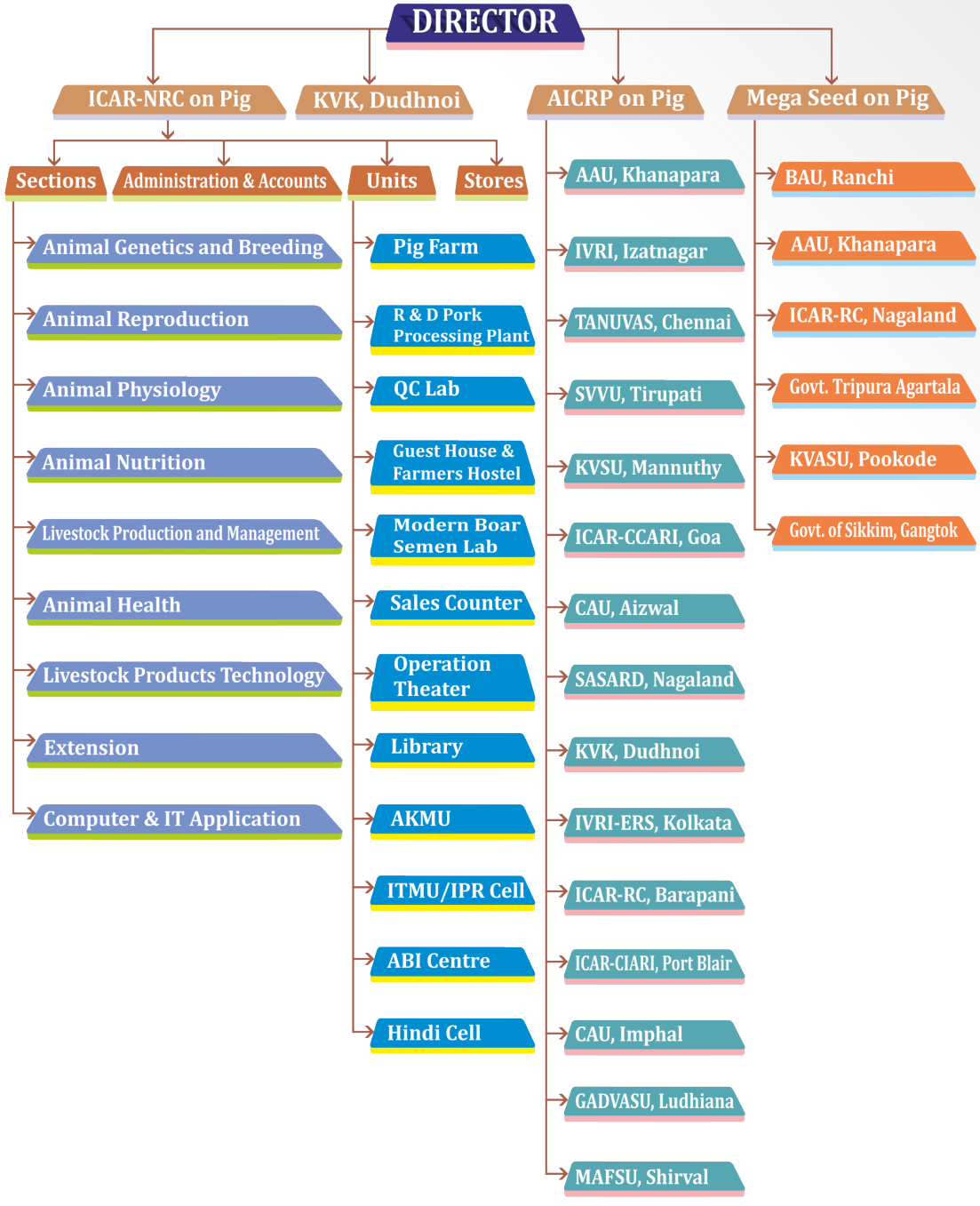
NAME OF THE SCHEME /PROJECT	DETAILED	PAY & ALLOWANCES	GENERAL	CAPITAL	TOTAL
ICAR-NRC ON PIG, MAIN SCHEME	R.E.	792.80	511.00	128.00	**1431.80**
	EXP.	792.80	511.00	128.00	**1431.80**
AICRP ON PIG PROJECT	R.E.	97.34	414.00	73.00	**584.34**
	EXP.	97.34	414.00	73.00	**584.34**
MEGASEED ON PIG PROJECT	R.E.	0.00	273.00	33.00	**306.00**
	EXP.	0.00	273.00	33.00	**306.00**

REVENUE GENERATION

(Rs. in lakh)

Sl. No.	Particulars	Revenue
1	REVENUE TARGET DURING 2022-23	**38.90**
2	REVENUE GENERATION DURING 2022-23	**22.77**

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

Asha Crossbred Pig Variety

PHYSICAL PROGRESS

Boar semen production, processing centre and training hall

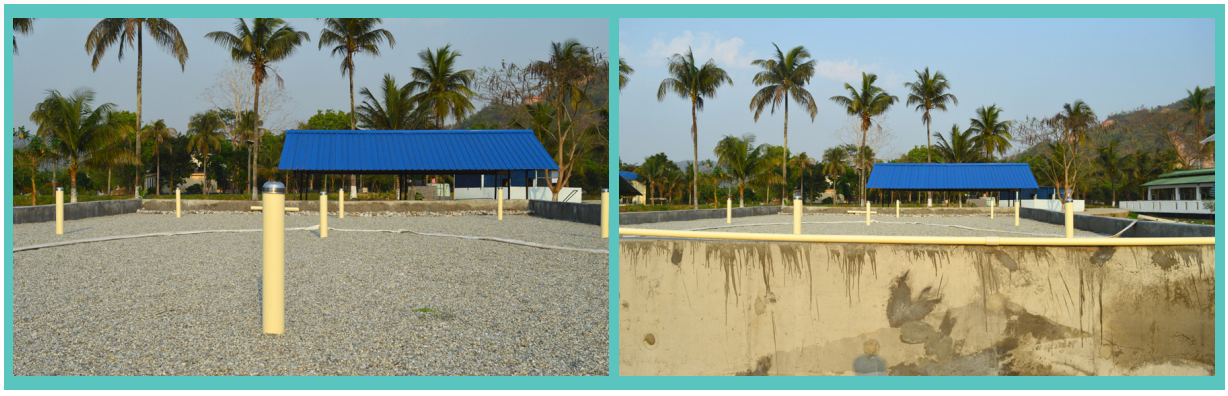
Boar semen production-cum-processing centre and training hall, established with the financial support from North Eastern Council (NEC), Ministry of DoNER, Govt. of India, was inaugurated by Dr. Bhupendra Nath Tripathi, Deputy Director General (Animal Science) on 4th November 2022 in the presence of Dr Vivek Kumar Gupta, Director, ICAR-NRC on Pig and Dr Dilip Kumar Sarma, Former Director, ICAR-NRC on Pig.

Biosecurity Unit

A biosecurity unit was established at the entry gate of farm complex during the year 2022. This said facility has four bath area, one change room having 24 lockers. The purpose of the biosecurity room is to keep farm and animals free from any disease exposure. The farm workers before entering in the farm have to take bath and change their clothes, wear gumboots and then only they can enter in the farm.

Infrastructure under Jalopchar programme

This innovative and eco-friendly way of decentralized wastewater treatment facility was established at the institute with the support of ICAR-IARI's JalopcharTM technology. This facility is enabled to treat waste water generated from farm and after wastewater treatment its local reuse.



Research Projects

HDK-75 Crossbred Pig Variety

Annual Report-2022
ICAR-NRCP

RESEARCH PROJECTS

ANIMAL GENETICS AND BREEDING

Institute Project: Generation-wise genetic evaluation of Rani crosses

S. Banik, P. J. Das, K. Barman, R. Thomas, S. R. Pegu and Sunil Kumar

An intensive planned crossbreeding programme over the generations resulted in development of Rani crossbred pig with 50 percent exotic inheritance of Hampshire and 50 percent indigenous inheritance of Ghungroo pigs and characterized with higher growth rate, larger litter size at birth and weaning for better economic return to the breeder farmers. The developed variety was released for breeder farmers after performance evaluation by conducting multi location trials at field level. The crossbred variety is presently being maintained by inter-se-mating. The breed characters of the developed variety was stabilized for consistent crossbreeding and completed nine generation of inter-se-mating. The generation-wise genetic performance of different productive, reproductive, adaptive and carcass characteristics of developed cross was carefully recorded and evaluated for the study. Ten sire lines of Hampshire and 19 dam line of Ghungroo was initially used to develop the Rani animals. Mating ratio of 1:2.5 (M: F) was followed. Top 3 and 8 percent of male and female were selected for producing subsequent generation based on performance traits. Generation interval was estimate as 1.5 years. Presently the tenth generation animals are maintained at the farm.

Table. Performance of Rani cross

Parameters	Performance of 9th generation animals
(Re) productive traits	
Litter size at birth	9.91±0.40
Litter weight at birth	11.2±0.42
Litter size at weaning	8.92±0.32
Litter weight at weaning	67.82±3.41
Weaning weight	7.15±0.41
Pre-weaning growth rate (g/d)	150.50±11.19
Post-weaning growth rate (g/d)	349.85±25.55
Weight at 8 month	77.12±4.11
FCR	3.65±0.20
Adaptive traits	
Pre-weaning mortality rate	4.95±0.40
Carcass trait	
Dressing percentagew	75.15±2.95
Carcass length	93.1±4.20
Back fat thickness	1.96±0.11
Loin eye area	4.67±0.14

Large scale propagation of these developed varieties coupled with use of scientific package of practices was done by distribution of animals through different mandated institute activities and

through artificial insemination which ensured sustainable livelihood among the tribal masses.

Rani piglets and grower at the farm

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

S. Banik, V.K. Gupta, P.J. Das, B.C. Das, R. Thomas, S.R. Pegu, and Satish Kumar

A multi-institute, multi-disciplinary project was initiated under funding form National Agricultural Science Fund (NASF) during the current year. The project envisages to develop a blockchain-based traceable pork value chain system for the NE region of India along with development of Decision Support Systems (DSS) for ante mortem (AM) and post mortem (PM) determining acceptability threshold for pork quality and safety at the points of animal purchase and the slaughter house. Data collection for facial imagebased identification of animals, identification of nodes in piggery value chain and symptom-based diagnosis of diseases for DSS was initiated.

ICAR Funded: All India Coordinated Research Project on Pig, KVK-Goalpara

S. Banik, P.J. Das, K. Barman, S. Rajkhowa and Satish Kumar

The main objective of the All India Coordinated Project (AICRP) on Pig center of KVK-Goalpara is to act as conservation unit of Doom pig of Assam. The center is maintaining 30 sow unit of Doom pig for conservation and subsequent genetic improvement purpose. Necessary steps were undertaken to conserve this unique pig 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 scientific management practice to conserve the breed was done. Presently the genetic improvement programme is being done by selective breeding among Doom pigs. Besides conservation and popularizing the breed, regular training and demonstration of scientific pig production practices were conducted by the center. The farm has completed four generation of inter-se-mating of the breed. The performance of Doom pig in the farm is given in the following table.

Table : Performance of Doom Pig

Parameters	Performance of animals
Litter size at birth (no.)	4.50±0.22
Litter weight at birth (kg)	4.19±0.35
Litter size at weaning (no.)	4.40±0.19
Weaning weight (kg)	3.20±0.44w
Litter wt. at weaning (kg)	15.22±0.60
Pre-weaning growth rate (g/d)	56.72±9.71

Post-weaning growth rate (g/d)	184.60±15.12
Weight at 8 months (kg)	40.12±4.29
Dressing percentage (%)	74.58±2.58
Carcass length (cm)	48.14±4.32
Back fat thickness (cm)	2.74±0.12
Loin eye area (sq. inch)	2.36±0.13

AICRP on Pig Shed

Doom pig in conservation unit

Institute Project: Development of IRT image-based systems for examining the health status of pigs

P. J. Das, S. Banik, Sunil Kumar, S. R. Pegu, S. Rajkhowa

The infrared thermal camera is gaining popularity as a diagnostic tool for evaluating human and animal health. In the present study, thermal imaging cameras have been used to map the surface body temperature, which detects the internal temperature of the tissues and the outer surface temperature of the body of a pig. Infrared thermography has been used to establish the causes of injuries, inflammations, and lameness; to detect normal, diseases and oestrus temperature in the pig; to study animal welfare and environmental and physiological stress levels. The advantage of using the thermal camera in disease diagnostics is its non-invasive nature i.e. it perceives heat emissions and does not require direct physical contact with the surface examined, thus allowing the monitoring of temperature distribution non-invasively. Because of its fast, non-invasive, reliable and non-contact requirement nature, it is considered a safety device for the pig. It considerably lowers the risk of spreading infections, since touching the subject is needless and also in pigs, this is advantageous as handling and restraint increase stress, causing an effect on the surface temperature.

The study was undertaken to identify the thermal profile of normal healthy pigs for diagnosis of the thermal behaviour of diseased pigs compared to the normal as well as to identify a sow /gilt that is in an oestrous stage thus addressing the thermal profile of female reproductive parameters. Since IR thermography was performed by taking into anticipated temperature differences between healthy and diseased pigs (suffering from some health conditions). Healthy farm pigs (n=1000) of ICAR NRC on Pig were used for recording IR thermography between January to December 2019-2021. Variation in pig's body temperature during different times of the day was recorded; IRT images were captured at three different locations viz., head, chest and back on three different occasions in a day viz., morning, afternoon and evening. The recorded IR thermography in pigs shows that the lowest and highest temperatures were observed during the morning and

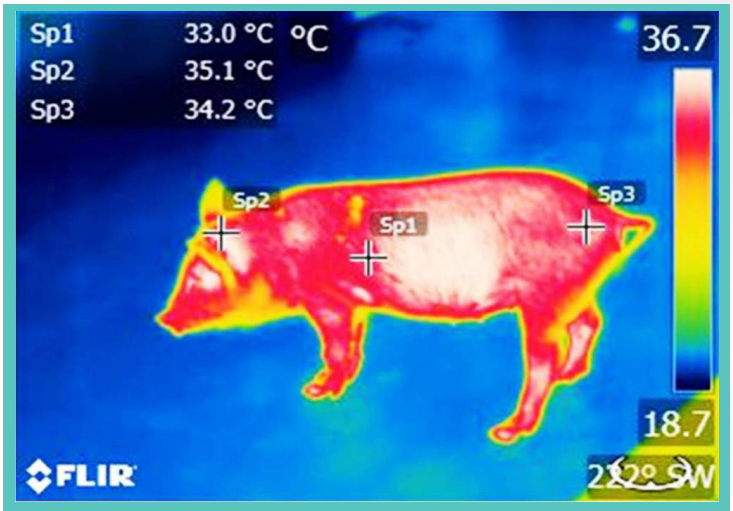
afternoon hours. Temperatures recorded from different body parts differed significantly with the highest temperature at the back and lowest at the head. To determine the ovulation period, it has been shown earlier that oestrogen administration can induce an increase in vaginal blood flow measured through a rise in vaginal thermal conduction. The results of the study indicated significant differences among oestrus and non-oestrus animals for different temperature (oC) parameters estimated such as VST (36.78± 0.29 Vs 35.94±0.19), GST (33.44± 0.24 Vs 35.51±0.14) and VGT (3.34± 0.26 Vs 0.43±0.11). In conclusion, infrared thermography can be used to identify gilts and sows in oestrus effectively.

The average thermal temperatures of normal and diseased pigs at their different affected body parts are depicted in the table. Thermal temperatures of normal animals were recorded to be 33.0°C±0.38 for the head, 25.68°C±0.85 for the muzzle, 35.1°C±0.87 for the chest, 34.2°C±0.88 for the back and 33.8°C±0.36 for foot area in the day time. Thermal values from the chest area have been observed to be slightly higher than rest of the body parts throughout the study. Since the heart propels blood to the entire organism to execute all the necessary activities, the surge in temperature in the chest region is obvious. The present thermal investigation on pigs confirmed that IRT can be considered a promising non-invasive screening technology to rapidly identify infected animals for confirmatory diagnostic testing during FMD outbreaks. Combining thermography with other standard methods of FMD detection on the animal farm would improve the efficiency and understanding of diagnostic competencies of thermography. Although difficulties exist in restraining agile animals like a pig to establish a standardized IRT camera position, nowadays in an organised farm it is possible to control the animal in a restraining structure without disturbing the normal physiological conditions of the animal, which makes it easier to use non-invasive techniques like IRT images for diagnosis of different diseases in a primordial state. The clinical relevance as observed was that thermography can be attuned to account for ambient temperature and can be applied to detect changes in mean body surface temperature and radiant heat production due to febrile response in pigs. Thermal pictures of heat emissions illustrated the early detection of signs of diseases from pigs orally challenged with *Salmonella typhimurium* and *Escherichia coli.* The method has been regarded as convenient to measure skin temperature continuously without contracting or stressing the animals and with minimal risk of injuries. This study reports on the feasibility of monitoring the radiated temperature of groups of animals as a biomarker of immune response using vaccination as a model for febrile disease.

Table : Captured IRT temperatures of normal and diseased pigs at different body parts

Health Status of Pig	Head	Muzzle	Chest	Back	Foot/Leg
Normal	35.1°C±0.11	25.68°C±0.09	33.0°C±0.18	34.2°C±0.28	33.8°C±0.16
FMD	NA	37.2°C±0.05	38.1°C±0.09	36.2°C±0.16	38°C±0.12
Lameness	33.2°C±0.23	NA	35.3°C±0.13	34°C±0.14	37.1°C±0.07
Diarrhoea	36.0°C±0.21	NA	37.1°C±0.10	36.1°C±0.09	NA
Respiratory disease	36.5°C±0.08	37.6°C±0.03	37.1°C±0.12	36.8°C±0.11	NA

Infrared thermography has contributed to numerous applications in biology, which is credible due to its explicit qualities like non-invasiveness, versatility, high sensitivity and rapid screening ability. It has been widely welcomed as a quick, easy-to-use remote method for measuring surface skin temperature in various diagnostic and screening applications in veterinary science. The study is a comprehensive survey, describing a broad field of applications of IRT, especially in pig husbandry intending to illustrate multiple new opportunities of this technology. IRT allows



IRT image of a healthy pig

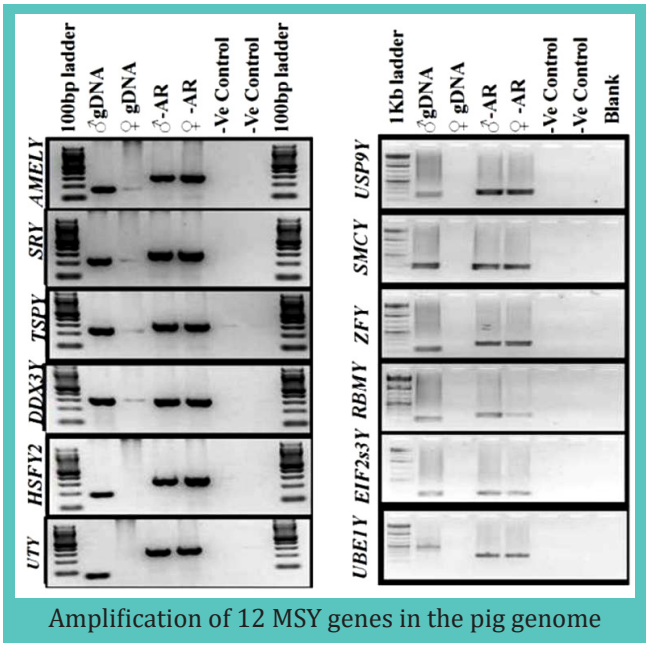
studies quickly and simply by avoiding any contact with the pig and perceiving information about the surface temperature of the complete body. Thermography may not always reveal any specific pathological details of any disease however, it serves in early recognition of the disease in the infected by identifying the area of inflammation/injury or increased metabolism or decreased heat (reduced blood flow) as well as heat detection of the sow or gilt. Because of its extreme sensitivity, accuracy and precision, IRT can be regarded as a reliable tool for the early detection of disease in rapid succession even before the appearance of clinical conditions. IRT imaging probed for the disease-infected animal is not a confirmatory diagnosis but an added disease diagnosis supporting system for a veterinarian for confirmatory diagnosis of the same. This early detection prevents the spread of disease within the pig population as well and facilitates early treatment intervention. Further to the above for its non-invasive nature, the observed animal does not have to be restricted or sedated, which significantly reduces stress levels without influencing the actual result of the measurement. In contrast to manual palpation, the technology is extremely sensitive for detecting minute temperature variations. The present study reports on the use of thermal imaging in the diagnosis of pig diseases. The data generated from this study can be processed to develop a computational program so that images generated from an IRT camera, irrespective of disease and normal condition can be easily diagnosed through a machine learning process. Proper handling of the instrument in a controlled environment is preferred to obtain precise information because environmental issues like air, temperature, humidity, dirt and debris can affect the thermographic scanning, which in turn will cause variance in results. Crucial research including metrological advances for exact measurements is essential to formulate IRT as an unfailing standardized method for the detection of changes in body surface temperatures due to fever, lesions, inflammation, stress, the pain too and so forth. Regardless of their limitations, thermal cameras for their ease of handling, rapidity, lack of invasiveness and relevance of results can undoubtedly be regarded as the first-line screening tool in disease diagnosis shortly.

Institute Project: Characterization and expression profiling of Pig MSY (male-specific region of the Y chromosome) genes for boar fertility.

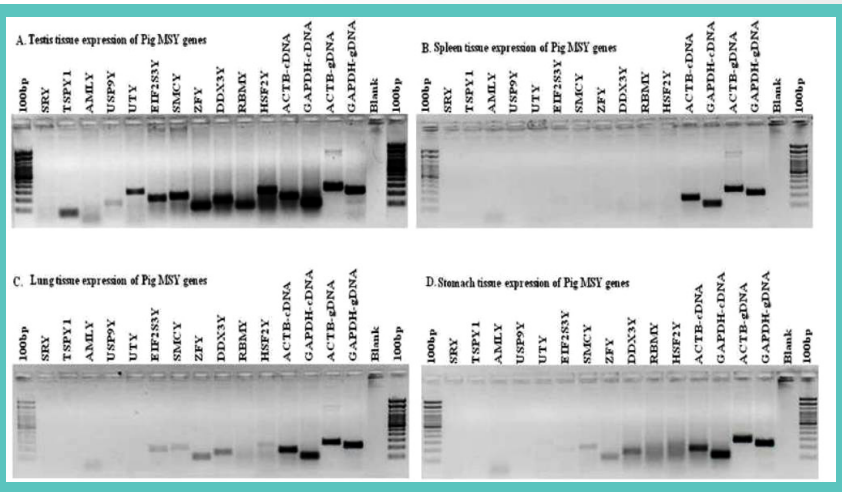
P. J. Das, S. Banik, Sunil Kumar and S. Rajkhowa

Over the past few years, comprehensive work has been done on genome sequence analysis of many mammals that dealt with Y chromosome gene sequencing and understanding diverse

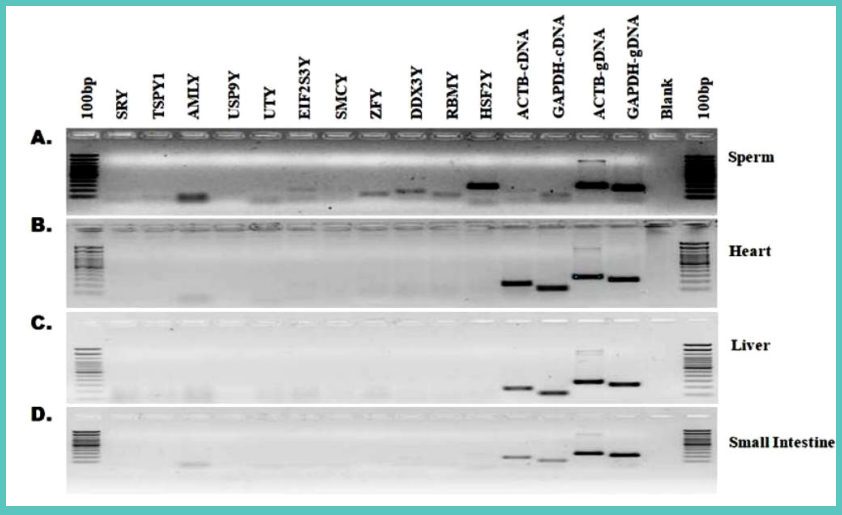
phenotypes due to genetic variation. However, very limited information is available regarding the male-specific region of the Y chromosome (MSY) genes and their functional profiling. Although the whole-genome draft sequence of Pig is completed recently, the complete sequence annotation is still not available for Pig Y chromosome. It is well established now across the eutherian mammals that the non-recombination area of the Y chromosome genes is male-specific (MSY) and directed related to male fertility. Despite the importance of this chromosome in male fertility, particularly the development of testis and spermatozoa, this chromosome has not been studied well in pigs. Since Pigs are an economically important domestic species. Recalling that several Y chromosomal loci contribute to infertility in males, expectations are that important regulators of male biology are present also in the Pig Y chromosome. The pig Y-chromosome remains, however, poorly characterized to understand male reproductive performance. In this study, we are generating comprehensive functional profiling of the male-specific region of the pig Y chromosome to elucidate the functional profiling of the pig Y chromosome. The amplification of testis-expressed genes and the identification of a novel sequence class provide novel insights into the evolution and function of this unique chromosome. Fresh blood and tissue samples from slaughtered pigs have been collected aseptically and both DNA & RNA have been isolated following standard protocol. For amplification of MSY genes primers have been designed for twelve MSY genes, and 6 control genes from Pig. Targeted genes were amplified in male and female genomic DNA and confirmed the male-derived specificity. The tissue panel from the pig, as well as sperm, have been collected to understand the novel complexity of these MSY genes in expression profiling. Moreover, testis-specific expression of MSY genes was distinct among the different tested tissues viz. liver, lung, kidney, pancreas, heart, spleen, skeletal muscle, ovary and testis. The identified MSY genes can be used to establish male-specific characteristics of pigs and to differentiate male and female pigs genotypically. Fertility profile of spermatozoa with different motility showed that the sperm good fertility record showed higher expression of Pig MSY genes compare with sperm low motility and low sperm concentration. The expression of MSY genes are also more pronounced in male reproductive tissue like testis which is also clearly validated by quantitative real-time PCR, The Phylogenetic analysis of Pig MSY genes shows that pig MSY genes viz. SRY, DDX3Y TSPY1 and ZFY positioned unique relationships among eutherian mammals like humans, cattle, sheep, goats, sheep, horse and dogs.



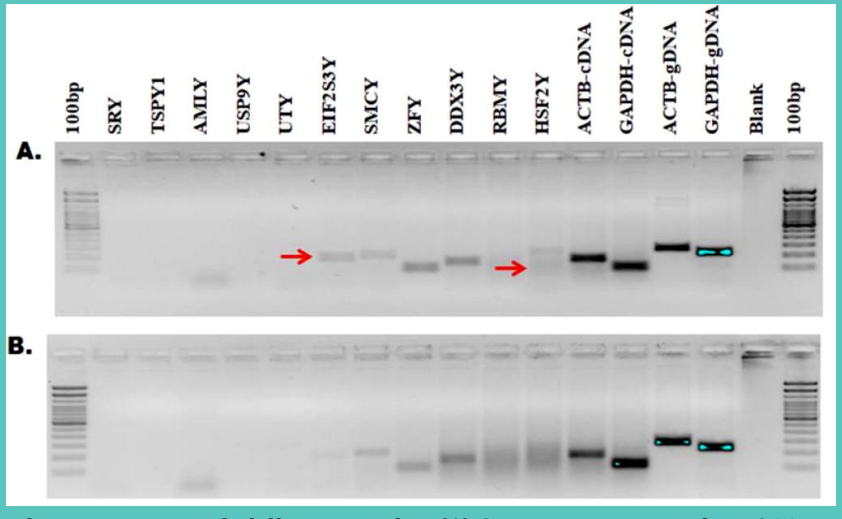
Amplification of 12 MSY genes in the pig genome



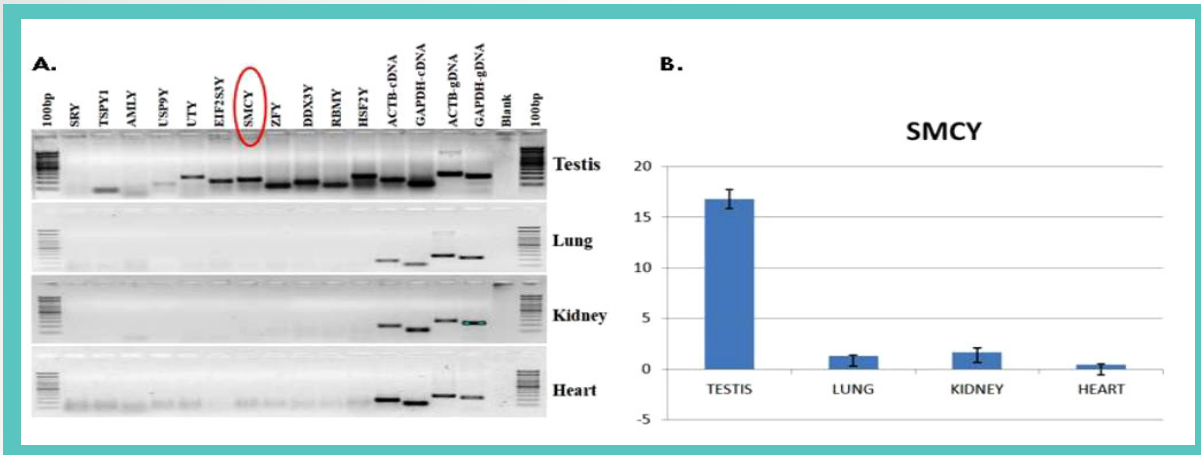
Expression analysis of 12MSY genes in four different tissues of Pig. (A) Testis; (B) Spleen; (C) Lung; (D) Stomach.



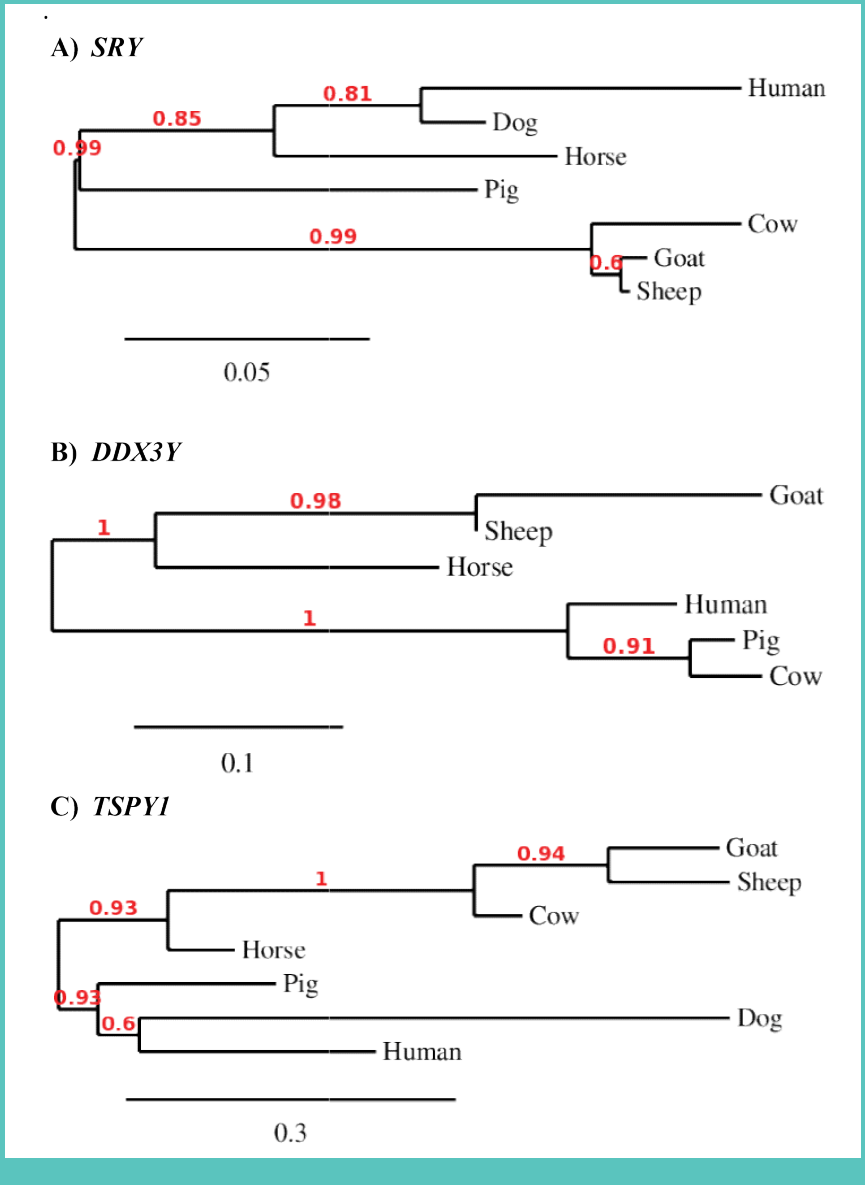
Expression analysis of 12 MSY genes in four different tissues of Pig. (A) Sperm, (B) Heart, (C) Liver, (D) Small intestine.

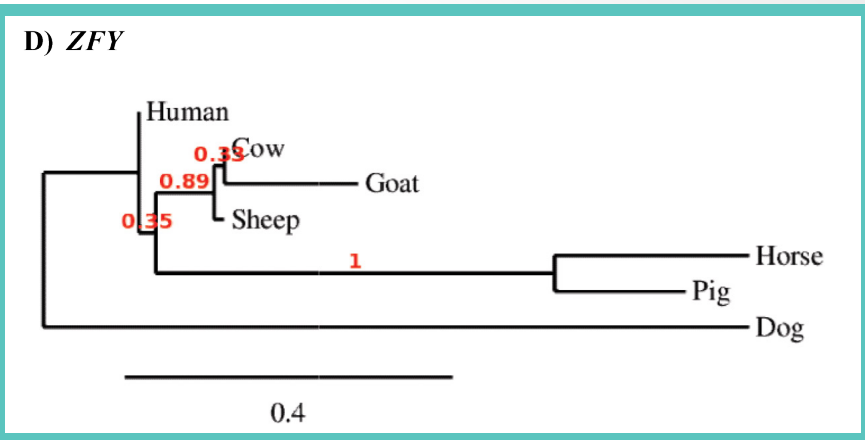


Fertility Profile of spermatozoa with different motility (A) Spermatozoa-animal No-3117-Hampshire Good fertile expression of Pig MSY genes, (B) Spermatozoa-animal No-21854-Ghungroo with low motility and low sperm concentration expression of Pig MSY genes



Validation of transcript level by Real-time PCR for SMCY genes in Testis, Lung, Kidney, Heart. Pig MSY gene showing significantly showing higher level of transcript in testis tissue in (A) RT-PCR, lane-8 and validated same in (B) in real time PCR





MSY genes of Pig showing a unique Phylogenetic structure with other eutherian mammals with gene sequences of pig (A) SRY, (B) DDX3Y, (C) TSPY1 and (D) ZFY

In conclusion, the present study revealed that Pig MSY encompasses rich transcripts which are transcriptionally dynamic and vigorous during spermatogenesis and testicular functions. It also directly showed that the Y-chromosome of pig has unique from other eutherian mammals with broad transcriptional activity. The results revealed that the majority of the yak MSY genes are predominantly expressed in the testis indicating their necessity in spermatogenesis to support the physiological functions of male reproduction.

Institute Project: 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 and Jaya

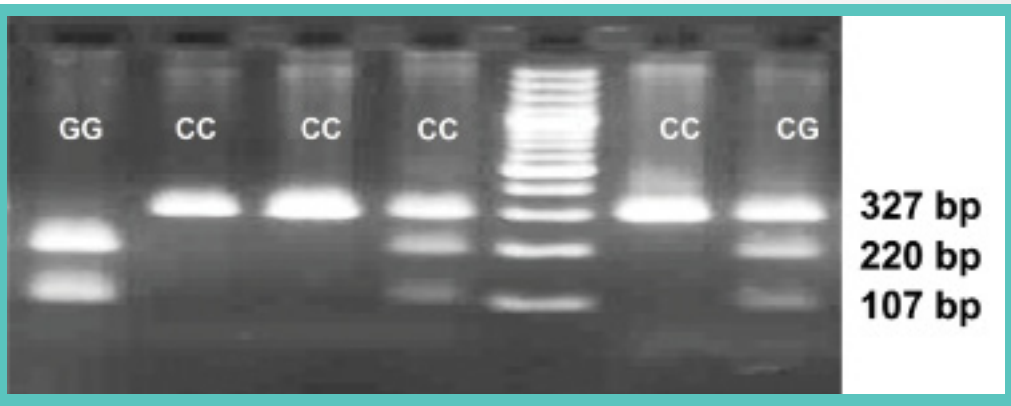
The genetic variability in the FSHβ, Leptin, ESR1, ESR2, Leptin Receptor (LEPR), RBP4, PRLR Gene in the form of Single nucleotide polymorphism was explored for their association with reproduction traits in indigenous pig population. all the SNPs were targeted. The SNPs in exonic region of these genes and accessible by PCR-RFLP technique were selected and suitable primers were designed by Primer3 online available software. A total of 25 set of primers were standardized by gradient PCR for appropriate annealing temperature for genotyping of 38 SNPs. The primers were amplified by PCR using Thermocycler such that it comprises the desired SNPs. The genotyping of SNPs was done by PCR-RFLP technique. The amplified PCR products were digested using specific Restriction enzyme. The RE was selected using online available software NEBcutter V2.0. Based on the resolved gel images and presence of different fragments, the genotype of each animal was determined for all the SNPs.

Table : The size of different fragments and their corresponding genotypes

SNPs	Amplicon size	RE	1st Homo-zygous	Heterozygous	2nd Homozy-gous
rs789053059	288	*AccI*	288	288, 206, 82	206, 82
rs338948692	310	*BSAHI*	310	310,199,111	199, 111
rs81213577	419	*PvuII*	419	245,174,419	245, 174
rs45431507	375	*BstAPI*	375	165,210,375	165, 210
rs45431505	375	*BtgI*	375	204, 171, 375	204, 171

rs701423985	375	*BsaHI*	375	230,145, 375	230,145
rs45431504	403	*HinfI*	403	99, 304, 403	99, 304
rs1110706811	436	*TaqI*	436	65, 371, 436	65, 371
rs793436160	313	*AluI*	313	119, 194, 313	119, 194
rs695579307	313	*AgsI*	313	123, 190, 313	123, 190
rs1113239558	313	*TaiI (MaeII)*	313	125, 188, 313	125, 188
rs694660564	327	*PsuI (BstYI)*	327	107, 220, 327	107, 220
rs1113972516	327	*HpyCH4V*	327	141, 186, 327	141, 186
rs322393640	361	*Alw26I (BsmAI)*	361	161, 200, 361	161, 200
rs704329019	311	*Cac8I*	311	131, 180, 311	131, 180
rs707640403	386	*Eco47I (AvaII)*	386	116, 270, 386	116, 270
rs699440955	277	*Eco81I (Bsu36I)*	277	175, 102, 277	175, 102
rs708729773	259	*Eco32I (EcoRV)*	259	103,156,259	103,156
rs790299157	409	*ApeKI*	409	174, 235, 409	174, 235
rs343283407	409	*BseNI (BsrI)*	409	175, 234, 409	175, 234
rs322495865	409	*BtsIMutI*	409	283, 126, 409	283, 126
rs708345040	360	*Mph1103I (NsiI)*	360	116, 244, 360	116, 244
rs342775108	360	*Hin1II (NlaIII)*	360	145,215,360	145,215
rs1112366020	360	*AdeI (DraIII)*	360	116, 244, 360	116, 244
rs1112875579	245	*BclI*	245	89,156,245	89,156
rs336266062	282	*HpyAV*	282	113,169,282	113,169
rs702631546	404	*PagI (BspHI)*	404	129,275, 404	129,275
rs693805542	311	*BseGI (BtsCI)*	311	134, 177, 311	134, 177
rs703419496	311	*AflIII*	311	142,169,311	142,169
rs698912981	309	*AcuI*	309	178, 131, 309	178, 131
CAMB0000347	394	*Bsh1236I (BstUI)*	394	74, 320, 394	74, 320
rs707092198	394	*DpnI*	394	98,296, 394	98,296
rs691411429	394	*BseGI (BtsCI)*	394	116,278,394	116, 278
rs335601877	400	*HpyCH4IV*	400	135, 265, 400	135, 265
rs80947737	421	*BglI*	421	123, 298,421	123, 298
rs80878671	421	*Eam1104I (EarI*	421	148,273,421	148,273
rs80995712	371	*Hpy166II*	371	267,104, 371	267,104
rs55618789	363	*Eco24I (BanII)*	363	141, 242, 363	141, 242
rs1109638302	363	*Eco0109I (DraII)*	363	116,247,363	116, 247
rs80815247	363	*NcoI*	363	128, 235, 363	128, 235

The genotyping of SNPs shown that out of 38 SNPs 30 were polymorphic in the many SNPs were polymorphic in our population. The allele and genotype frequencies for all the primers were determined.



Genotypic profile of SNP rs694660564 using PsuI RE by PCR-RFLP

Institute Project: Molecular characterization of indigenous pig breeds

Satish Kumar, S. Banik, P. J. Das, Sunil Kumar and A. R. Sahu

The indigenous pig breeds viz. Ghoongroo, AgondaGoan, Doom and Tenyivo were targeted to characterize by microsatellite markers. The markers used for molecular characterization were selected based on ISAG–FAO recommendation. The primers were standardized for suitable annealing temperature by thermo cycler gradient temperature. The primers that were amplified in our indigenous population were labelled by fluorescent tag for multiplex PCR. The multiplex PCR for genotyping the animals was standardized and 7 multiplex PCR reactions were formed with different primers based on the annealing temperature and the fluorescent tag.

Table : Details of multiplexing with respective primers and annealing temperature

Multiplex	Primer	Allele size	5' labelled
M1 (52 °C)	SW240	92-124	HEX
	SW936	90-116	AT-550
M2 (54 °C)	SW72	100-112	FAM
	SW632	148-168	HEX
	SW1828	82-110	HEX
	SW1067	136-176	AT-550
M3 (56 °C)	S0005	203-243	FAM
	SW2410	104-122	FAM
	S0097	135-155	HEX
	SW1941	202-216	AT-550
	SW24	95-124	AT-565
M4 (58 °C)	S0026	88-96	FAM
	S0226	192-198	FAM
	SW122	107-121	HEX
	IGF1	195-207	HEX
	SW857	141-159	HEX

	S0090	227-249	AT-565
M5 (60 °C)	S010	200-216	FAM
	SW830	178-202	HEX
	SW2008	95-103	HEX
	S0355	244-271	AT-565
M6 (62 °C)	S0002	190-216	FAM
	S0155	142-162	HEX
	SW911	149-173	AT-550
	SW0218	158-205	AT-565
M7 (64 °C)	S0068	219-239	FAM
	SW2406	223-235	HEX
M8 (65.3 °C)	S0143	151-167	FAM
	S0178	108-124	HEX
	S0228	220-246	AT-565

LIVESTOCK PRODUCTION AND MANAGEMENT

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

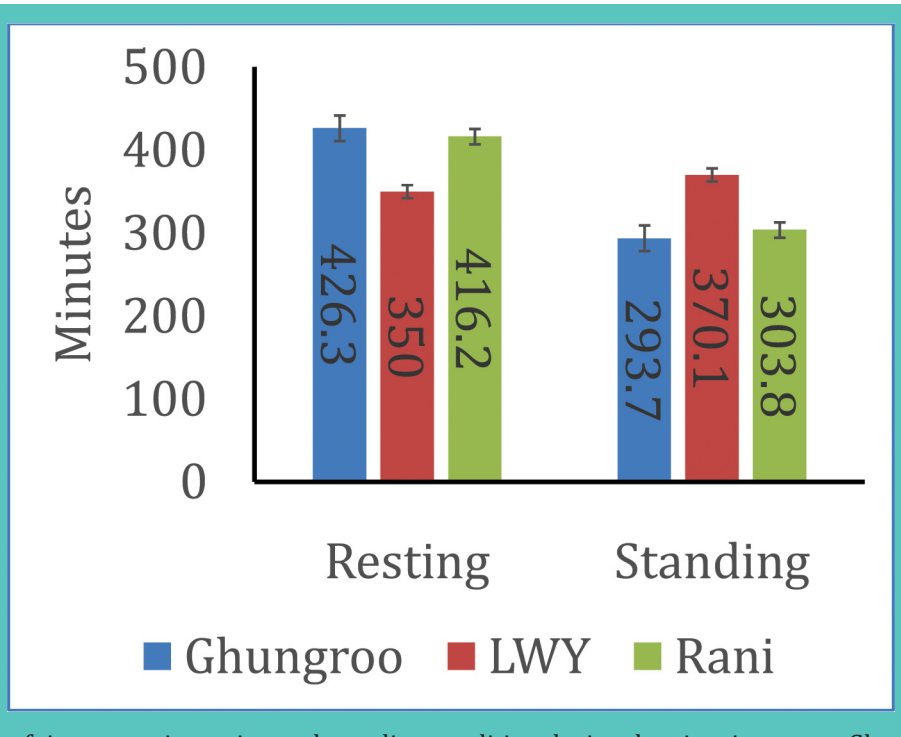
Kalyan De, Nitin M Attupuram, S. Paul, R. Islam, N. H. Mohan and B. C. Das

Time budget of newly developed high performing grower pig and desi pig: To develop an ethogram of grower pigs, the behaviour of Ghungroo, Rani and Large White Yorkshire (LWY) were recorded for a continuous period of 24 hours. For this purpose, behaviors were recorded for six days from 24 pigs of each breed. The lying, sitting, feeding, movement, exploration to the environment, exploratory, agonistic, interaction with pen mate and sexual behaviour were observed. The pig is designated to be in lying condition when it lie-down down with eyes open and interact with something or other pigs or with eyes closed and without movement. The sitting behavior is denoted when the animals' hindquarters are on the floor, sitting like a dog (dog-sitting position). The pig is in feeding when the pig standing near and towards the drinking trough or feeding trough and chewing or taking feed. Pig is stated in moving condition when it shows slow movement with walking in the pen. When the animal showed exploratory functions, like; investigating the environment, nuzzling, sniffing or biting some element of the pen then the pig is exploring the environment. However, when the pig explores the floor with its head down, it is said in exploratory behavior. The agnostic behavior is denoted when pig shows confrontation, headbutts, fights or chases a partner in the pen. When the pig nuzzles some part of another pig, playing then it is said that the pig is showing interactive behavior. Sexual behavior is denoted when it mounts or lets a partner mount. The grower pig spent most of their time in lying conditions followed by exploratory behavior. The Ghungroo, Rani and LWY spent 71.2±0.9, 71.0±1.1 and 66.7±0.9% of the time in lying conditions, respectively. The time spent in exploratory behavior was 8.1±0.8, 6.2±0.9 and 13.9±0.7 % of a day in Ghungroo, Rani and LWY grower pig, respectively. In the day time (morning 6:00 am to evening 18:00 pm), the grower Ghungroo, Rani and LWY pig spent 59.2, 57.8 and 48.6 % time, respectively in resting condition which includes time spent in sitting and lying behavior. The standing time was 40.8, 42.25 and 51.5 %, respectively in grower Ghungroo, Rani

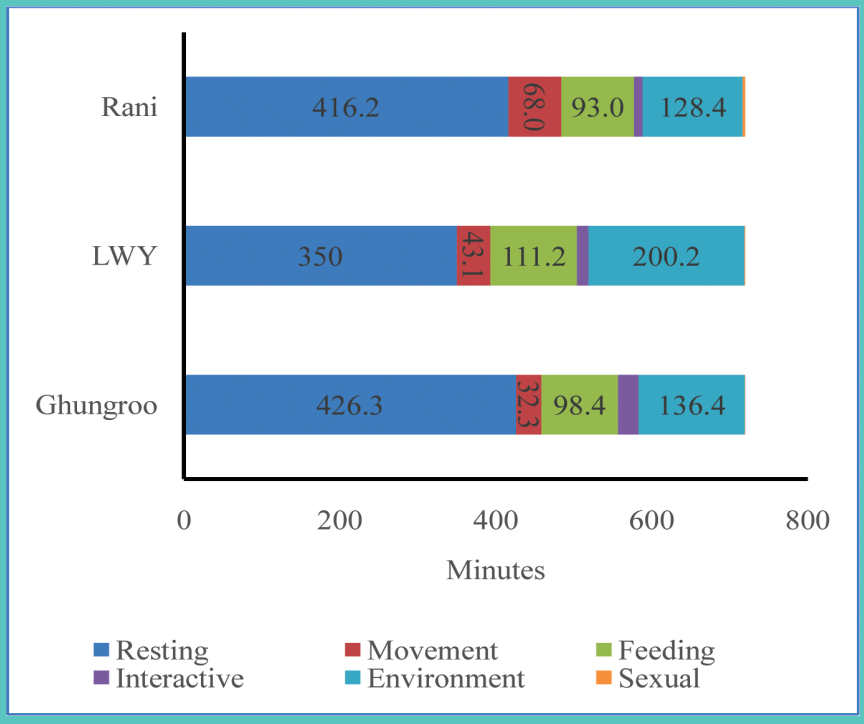
and LWY pig during day time. A Ghungroo grower pig spent 59.2, 4.5, 13.7, 3.6 and 0.1 % of their day time in resting, movement, feeding, interacting with pen mate, environment exploration and sexual behavior, respectively. A Rani grower pig also showed almost similar trend in percentage of time expenditure in different activities in day time which include 57.8 % time resting, 9.8 % time in movement, 12.9 % time in feeding, 1.6 % time in interaction with penmate, 17.8 % time in exploring environment and 0.4 % time in sexual behavior. However, the LWY grower pig spent 48.6, 6.0, 15.4, 2.1, 27.8 and 0.1 % of their day time in resting, movement, feeding, interacting with pen mate, environment exploration and sexual behavior, respectively.

Table : Percentage of time spent and total time spent in a day in different behavior in growing Ghungroo, large white Yorkshire and Rani pigs.

Behavior	Percentages			Minutes		
	Ghungroo	LWY	Rani	Ghungroo	LWY	Rani
Lying	71.2±0.9	66.7±0.9	71±1.1	1025±13.5	960±13	1022±16.4
Sitting	3.1±0.4	4.4±0.4	2.8±0.5	44.8±5.8	63.3±5.6	40.8±7
Feeding	7.2±0.4	7.9±0.4	7.1±0.5	103.2±6.3	114±6	102±7.6
Movement	2.8±0.4	3.8±0.4	7.5±0.5	40.1±5.6	55±5.4	107.6±6.8
Exploring environment	3.9±0.3	2.0±0.3	3.5±0.3	56.2±4.1	29±3.9	50.5±5
Exploratory	8.1±0.8	13.9±0.7	6.2±0.9	116.2±10.9	200.5±10.5	88.8±13.2
Agonstic	2.6±0.1	0.3±0.1	0.9±0.2	37±1.8	4.5±1.7	13.6±2.2
Interacting	1.2±0.1	0.9±0.1	0.8±0.2	16.9±1.9	13±1.9	11.4±2.3
Sex	0±0	0.1±0	0.2±0.1	0.5±0.7	0.8±0.7	3.2±0.9



Percentage of time spent in resting and standing condition during day time in grower Ghungroo, LWY and Rani pigs



Time spent in different behavior during day time in Ghungroo, LWY and Rani grower pig

Welfare assessment of grower pig through tear stain: Now a days tear staining in the pig is used for assessing animal welfare on farm in European countries in experimental basis. Tear staining is, the accumulation of a dark red-brown stain in the medio-ventral corner of the eye. The area of staining is used as an indicator of distress and compromised welfare in pigs. On the basis of area of stain, different scores were given to assess the welfare. "0" score was given when there was no stain; "1" score was given when staining is barely detectable and area stained does not extend below the eyelid; "2" score was given when the staining is obvious and area stained is approximately <50% of total eye area; "3" score was given when the area stained is approximately 50 to 100% of total eye area; "4" score was given when staining is severe, area stained is approximately ⩾100% of the total eye area. Based on the designated scores 20 LWY, 20 Rani and 20 Ghungroo pigs were evaluated. One months later again the same animals were revaluated for tear stains. The result showed that irrespective of breed the tear stain increased after one months. This could be due to morphological changes in the participating glands with age or a prolonged experience of a stressful environment. The tear stain is quite prominent in white-coloured pigs like LWY. The practical problem in evaluating tear stain in black-colored breed like Ghungroo and Rani is that it is not so clearly visible. For evaluating the tear stain, the observer needs to minutely and carefully observe the dark tear stain.

Table : Tear stain score in LWY, Rani and Ghungroo pig

	LWY	**Rani**	**Ghungroo**			
	Initial	1 month later	Initial	1 month later	Initial	1 month later
Mean	1.78	2.06	1.48	1.94	1.54	1.89
Over all SD	0.73	0.89	0.79	0.85	0.85	0.76

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

Nitin M. Attupuram, Kalyan De, R. Thomas, K. Barman, N. H. Mohan

Estimation of water consumption and factors influencing water usage pattern in organized pig production: The water requirement of the Ghungroo and Rani pigs maintained at ICAR- NRC on pig was evaluated using customized water recording device. Water supplied twice daily was measured and residual volume was estimated before the filling the drinkers subsequently. The resultant water disappearance rate was considered as the quantity consumed for estimation purpose. Water consumption at various stages of growth viz., pregnant sow, dam with piglets before weaning, growers, finishers and boars were estimated during summer and rainy seasons. Moreover, water usage pattern for various management operations like shed washing and animal washing were also estimated.

The results indicated that the shed washing accounts for maximum water requirement. In rani pigs the water used for shed washing for finisher/dry sow, dam & piglets, growers, pregnant sows, & boar were 19±2.1, 28.8±1.24, 4.6±0.27 and 23.5±1.23 litres, respectively, during summer. During the same period animals under trial consumed 7.1±0.44, 9.4±0.66, 2.8±0.27, 8.2±1.006 and 6.1±0.44 litres, respectively. During rainy season the average drinking water consumption were 6.4±0.80, 6.8±1.15, 2.4±0.27, 7.4±1.24 and 5.1±0.60 litres, respectively for finisher/dry sow, dam & piglets, growers, pregnant sows, & boars.

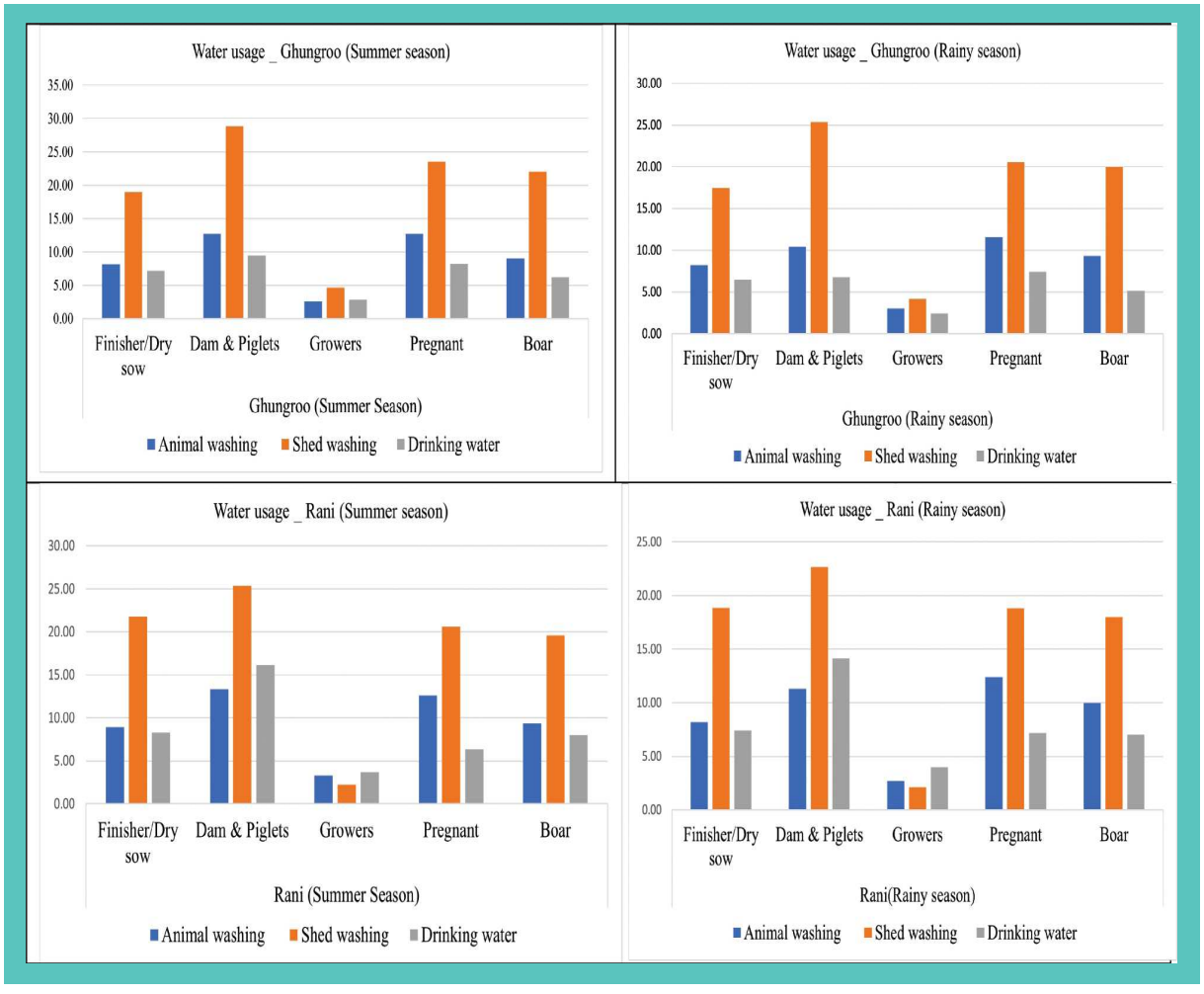


Table : Season-wise water usage pattern in Ghungroo pigs

Season	Water requirement (in Litres)						
	Category	Animal washing		Shed washing		Drinking water	
		Mean±SE	Range	Mean±SE	Range	Mean±SE	Range
Summer season	Finisher/ Dry sow	8.1±0.64	5-11	19±2.1	13-32	7.1±0.44	5.5-9
	Piglets	12.6±1.25	9-18	28.8±1.24	25-34	9.4±0.66	7-11
	Growers	2.5±0.29	1.6-3.5	4.6±0.27	3.5-5.5	2.8±0.27	2.0-4.0
	Pregnant	12.6±1.02	10-16	23.5±1.23	19-27	8.2±1.006	6-12.2
	Boar	9±1.52	7-12	22±2.3	18-26	6.1±0.44	5.5-7
Rainy season	Finisher/ Dry sow	8.2±0.72	5-11	17.44±1.89	12-28	6.4±0.80	4-12
	Piglets	10.4±1.02	8-14	25.4±0.74	24-28	6.8±1.15	4-11
	Growers	3.0±0.39	1.6-4	4.17±0.47	3-6	2.4±0.27	1.5-3
	Pregnant	11.6±0.92	10-15	20.6±1.53	16-24	7.4±1.24	4-10
	Boar	9.3±2.40	6-14	20±2	16-22	5.1±0.60	4-6

Table : Season-wise water usage pattern in Rani pigs

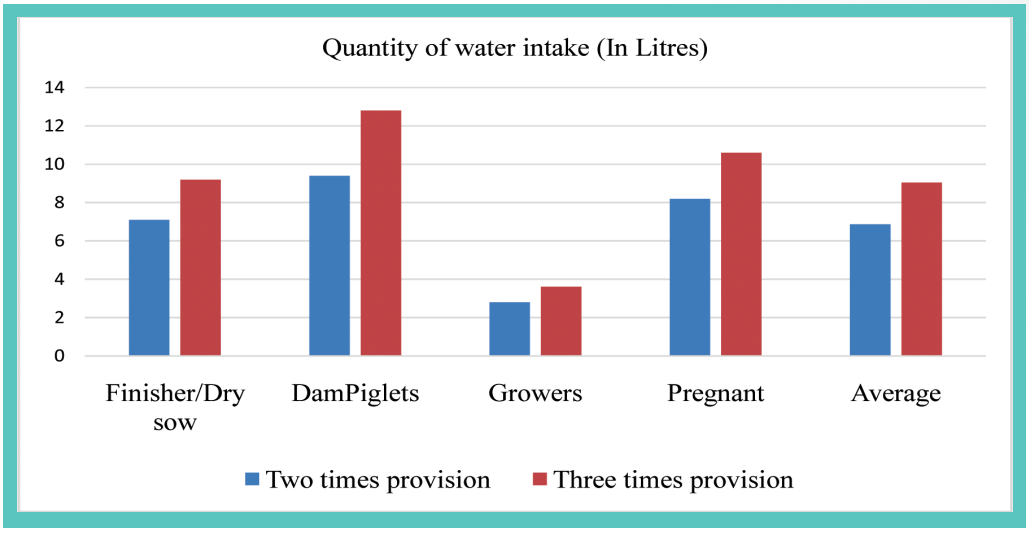
Season	Water requirement (in Litres)						
	Category	Animal washing		Shed washing		Drinking water	
		Mean±SE	Range	Mean±SE	Range	Mean±SE	Range
Summer season	Finisher/Dry sow	8.9±0.48	6-12	21.7±2.17	12-38	8.2±0.65	4.5-12
	Piglets	13.3±1.52	10-20	25.3±3.38	15-36	16.1±1.79	12-24
	Growers	3.3±0.4	2-5	2.2±0.21	1.33-3	3.7±0.37	2.5-6
	Pregnant	12.6±2.01	8-19	20.6±2.03	14-25	6.4±0.92	4-9
	Boar	9.4±0.92	7-12	19.6±1.74	16-25	8±1.41	4-12
Rainy season	Finisher/ Dry sow	8.16±0.64	5-12	18.8±1.65	12-28	7.4±0.98	4-15
	Piglets	11.3±0.98	8-14	22.6±4.03	12-36	14.1±2.22	9-24
	Growers	2.6±0.29	2-4	2.1±0.22	1.33-3	4±0.37	3-6
	Pregnant	12.4±1.86	8-18	18.8±2.81	10-25	7.2±0.91	5-9
	Boar	10±1.95	5-14	18±2.44	12-22	7±1.29	4-10
	Total	8.5±0.35	1.6-20	17.2±0.81	1.33-38	7.2±0.34	1.5-24

Influence of frequency of water supply on the quantity of intake

The influence of the frequency of water supply on the water intake volume was investigated. For this study, the drinking water provision to drinkers of the animal sheds was restricted to twice and thrice a day, during intermittent weeks. It was observed that the average water intake during two times feeding was 6.88 litres while three times water supply significantly increased the water uptake (9.05 litres). In two provision water supply regimen, the water intake were 7.1±0.44, 9.4±0.66, 2.8±0.27, and 8.2±1.01 litres for dry sows, dam, piglets, growers, and pregnant sows, respectively. While in the three-time water supply regimen, the average water intake were 9.2±0.64, 12.8±0.70, 3.6±0.33 and 10.6±1.21 litres for dry sows, dam, piglets, growers, and pregnant sows, respectively.

Table : Quantity of water intake under various water supply regimens

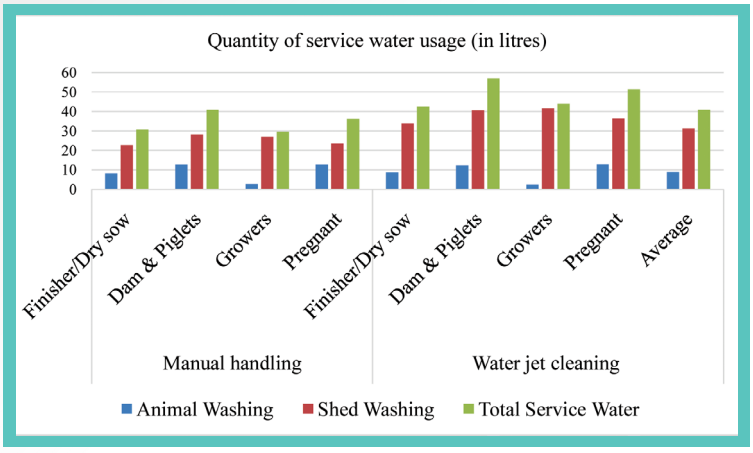
Sl No.	Category	Water intake (in Litres)	
		Two times provision	Three times provision
1	Finisher/Dry sow	7.1±0.44	9.2±0.64
2	Dam & Piglets	9.4±0.66	12.8±0.70
3	Growers	2.8±0.27	3.6±0.33
4	Pregnant sows	8.2±1.01	10.6±1.21



Influence of solid manure management on water usage: Water requirement with respect to the management of solid waste in a pig production system was investigated. For the present study management practice of waste removal using water jet was compared with the practice of manual handling of solid wastes before routine washing. The total service water requirement was estimated by adding the water utilized for animal washing and shed washing. It was estimated that in group 1, where manual removal of solid wastes was practised before washing, the mean service water requirement were 30.7±2.24, 40.8±1.95, 29.5±1.92, and 36.1±1.24 litres, for dry sows, dam, piglets, growers, and pregnant sows, respectively. Whereas, when water jet wash was employed for solid waste removal the quantity of service water utilized was, 42.6±2.51, 56.8±2.13, 44±2.26, and 51.3±1.40 litres for dry sows, dam, piglets, growers, and pregnant sows, respectively.

Table: Quantity of water usage under different solid manure management practices

Management practise	Category	Water requirement (in Litres)		
		Animal Washing	Shed Washing	Total Service Water
Manual handling	Finisher/Dry sow	8.1±0.64	22.6±2.47	30.7±2.24
	Dam & Piglets	12.6±1.25	28.1±0.79	40.8±1.95
	Growers	2.5±0.29	27±1.93	29.5±1.92
	Pregnant	12.6±1.021	23.5±1.23	36.1±1.24
Water jet cleaning	Finisher/Dry sow	8.7±0.66	33.9±2.83	42.6±2.51
	Dam & Piglets	12.3±1.021	40.5±3.45	56.8±2.13
	Growers	2.4±0.26	41.5±2.31	44±2.26
	Pregnant	12.8±0.70	36.3±2.72	51.3±1.40



Institute Project: Dynamics of gut to dietary management and antibiotic treatment in pigs

Nitin M. Attupuram, Kalyan De, R. Thomas, S. R. Pegu, K. Barman, R. Islam, NH Mohan

Shotgun metagenomic profiling of salivary and gastrointestinal microbiome of Ghungroo pigs: Metagenomic DNA was isolated from the pig saliva (Group S) and rectal samples (Group F) using commercially available Qiagen DNA Mini Kit and Qiagen stool DNA Kit. The quality and quantity of the isolated metagenomic DNA samples were checked on NanoDrop followed by 0.8% Agarose gel. DNA samples were sequenced on the Illumina NovaSeq6000 platform shotgun metagenomic library protocol (Illumina DNA Prep).

Data Statistics and Quality control: A total of 49.15 Gb of sequence data were obtained, corresponding to ~20.34 million reads for each sample. The sequenced raw data were processed to obtain high-quality clean reads using Trimmomatic v0.39 to remove adapter sequences, ambiguous reads (reads with unknown nucleotides "N" larger than 5%), and low-quality sequences (reads with more than 10% quality threshold (QV) < 25 phred score). A minimum length of 100 nt (nucleotide) after trimming was applied. After removing the adapter and low-quality sequences from the raw data high-quality reads were obtained. These high-quality (QV>25), paired-end reads were used for de-novo assembly. Details of the high-quality reads are given in table below.

Table : High-Quality Read Statistics

Sample	No. of PE Reads	Total no. of bases	Data in Gb
S1	19,643,124	5,824,206,640	5.82
S2	20,176,586	6,062,821,006	6.06
S3	20,454,589	6,126,126,859	6.13
S4	18,950,537	5,655,003,489	5.66
F1	19,022,831	5,692,995,072	5.69
F2	19,639,154	5,851,927,441	5.85
F3	17,615,545	5,298,505,765	5.3
F4	17,223,694	5,147,674,361	5.15

De-novo Metagenome Assembly and Gene prediction: The filtered high-quality reads were assembled into scaffolds using SPAdes v3.12.0 (metaSPAdes mode). Statistics of assembly are given in table below. Genes were predicted from the assembled scaffolds using Prodigal-2.6.3 with default parameters. Statistics of genes are given in table below.

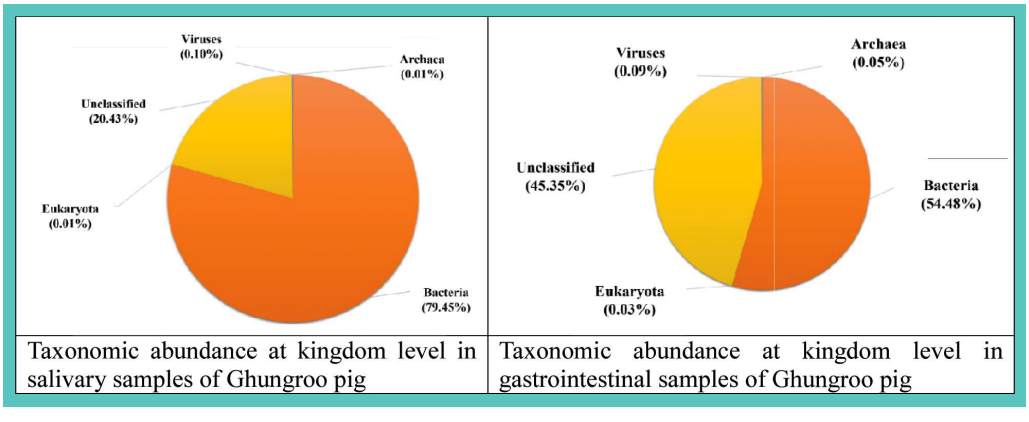
Table : Assembly statistics

Sample	Number of Scaffolds	Total length of the assembly (bp)	Average length of scaffolds (bp)	Scaffold N50 (bp)	Maximum length of scaffold (bp)
S1	64879	133364537	2056	4756	553080
S2	161733	255821602	1582	2284	258279
S3	107527	184218459	1713	2928	217867
S4	82849	128217057	1548	2221	261673
F1	246291	311784443	1266	1448	359737
F2	308782	353554414	1145	1219	193983
F3	245545	345713280	1408	1783	376862
F4	233319	313794338	1345	1638	272235

Table. Gene Prediction Statistics

Sample	Number of genes	Average gene length (bp)	Maximum gene length (bp)	Minimum gene length (bp)
S1	166142	707	29292	60
S2	359629	638	14172	60
S3	241173	677	19686	60
S4	175719	644	15552	60
F1	459988	607	13047	60
F2	550749	576	22245	60
F3	359629	638	14172	60
F4	469440	598	14952	60

Taxonomic Analysis : Taxonomic analysis of the predicted genes of the samples was carried out using Kaiju (kaiju.binf.ku.dk), which is a program for sensitive taxonomic classification of high-throughput metagenomic sequencing data. Kaiju uses either the set of available complete genomes from NCBI RefSeq or the microbial subset of the NCBI BLAST non-redundant protein database "nr", optionally also including fungi and microbial eukaryotes. The salivary samples archaea, viruses, eukaryotes and bacteria were present at 0.01, 0.1, 0.01 and 79.45%, respectively. Whereas, in gastro-intestinal samples, archaea, viruses, eukaryotes and bacteria were present at 0.05, 0.09, 0.03 and 54.48%, respectively. The rest of the genome represented unclassified microbiome. Further, taxonomic classification at phylum, class and genus level were also performed.



Taxonomic abundance at kingdom level in salivary samples of Ghungroo pig

Taxonomic abundance at kingdom level in gastrointestinal samples of Ghungroo pig

ANIMAL NUTRITION

Institute Project: Development of vegetable waste/fruit waste based pig feeds

K. Barman, R. Thomas and S. R. Pegu

Effect of feeding vegetable silage based diet on anti-oxidant status of experimental animals: Eighteen crossbred (HS x Ghungroo) growing-finisher pigs (36.24 ±1.28 kg BW) were divided into three groups using randomized block design and they were supplemented with vegetable waste silage based diet as details below to investigate the effect of different fiber levels on anti-oxidant status and immunity status of experimental animals.

T0: Basal diet (6% CF for grower and 8% CF for finisher pigs)

T1: Diet with maize silage (8% CF for grower and 10% CF for finisher pigs)

T2: Diet with vegetable waste silage (8% CF for grower and 10% CF for finisher pigs)

The serum antioxidant profile in terms of SOD (ng/ml), CAT (ng/ml), GPx (ng/ml) and MDA (µM/L) estimated in three different periods (starter, grower and finisher phase) of feeding trial. The mean SOD level was estimated as 27.22, 26.88 and 26.85ng/ml, respectively for T0, T1 and T2 dietary group, while CAT level for T0, T1 and T2 groups was recorded as 5.66, 5.53 and 5.66 ng/ml serum, respectively. The levels of serum GPx of pigs fed different experimental diets was measured as 23.64, 23.57 and 24.05ng/ml for T0, T1 and T2, respectively. There was no any significant difference among the treatment groups for the mean SOD, CAT and GPx levels in serum. The periodic values of SOD (27.90, 26.57 and 26.49 ng/ml) and GPx (24.97, 23.39 and 22.91 ng/ml) for T0, T1 and T2, respectively were comparable to each other, whereas the periodic CAT levels at starter period was significantly higher ($p<0.05$) than the grower and finisher phase. The mean MDA levels (µM/L) were recorded as 38.74, 39.71 and 39.56, respectively for T0, T1 and T2 treatment group and were statistically similar ($p>0.05$) in all treatment groups. The MDA levels in different periods of growth indicated a significantly higher value ($p<0.001$) in grower and finisher phase compared to starter phase.

Table : Anti-oxidant status of experimental animals

Treatment†	Period			Treatment mean	SEM	Significance		
	Initial	Grower	Finisher			T	P	T*P
SOD (ng/ml)								
T0	28.53±0.89	26.48±1.69	26.65±0.58	27.22±0.66	0.375	0.904	0.235	0.949
T1	27.24±1.43	26.65±1.78	26.77±0.73	26.88±0.77				
T2	27.92±0.90	26.58±0.71	26.05±0.58	26.85±0.44				
Period mean	27.90±0.62	26.57±0.81	26.49±0.35					
Catalase (ng/ml)								
T0	6.27±0.36	5.47±0.46	5.23±0.28	5.66±0.23	0.120	0.883	<0.05	0.999
T1	6.04±0.41	5.34±0.24	5.20±0.33	5.53±0.20				
T2	6.20±0.27	5.48±0.53	5.29±0.24	5.66±0.22				
Period mean	6.17^{X}±0.19	5.43^{Y}±0.24	5.24^{Y}±0.16					

GPx (ng/ml)								
T0	24.97±0.41	23.44±0.81	22.51±1.01	23.64±0.49	0.374	0.852	0.071	0.990
T1	24.86±1.05	22.86±1.27	22.98±1.27	23.57±0.69				
T2	25.07±1.05	23.85±1.51	23.24±1.32	24.05±0.74				
Period mean	24.97±0.49	23.39±0.69	22.91±0.67					
MDA (μM/L)								
T0	37.30±1.30	37.62±1.22	41.31±1.34	38.74±0.81	0.458	0.650	<0.05	0.813
T1	38.50±1.26	39.82±1.73	40.82±1.68	39.71±0.89				
T2	37.37±1.69	40.01±1.77	41.29±1.05	39.56±0.76				
Period mean	37.72^{Y}±0.62	39.15^{X}±0.91	41.14^{X}±0.76					

†T0: Basal diet (6% CF for grower and 8% CF for finisher pigs)
T1: Diet with maize silage (8% CFfor grower and 10% CF for finisher pigs)
T2: Diet with vegetable waste silage (8% CFfor grower and 10% CF for finisher pigs)
XY Means bearing different superscripts within a row differ significantly (p<0.05)

Immune status of experimental animals

Cell-mediated immune (CMI) responses: A delayed-type hypersensitivity (DTH) response was assessed through intra-dermal injection of PHA-p in the experimental pigs. A significant DTH response (p<0.01) in terms of skin thickness (mm) was observed in all treatment groups. The mean skin thickness (mm) up to 36 hours of post intra-dermal injection of PHA-p mitogen were 3.87, 4.60 and 5.12, respectively for T0, T1 and T2 treatment group where skin thickness of T0 group was significantly lower (p<0.01) than T1 and T2 groups. The skin thickness (mm) was gradually increased and reached peak level at 24 h after post-inoculation and declined in the subsequent period in all the dietary groups. There was found a non-significant (p>0.05) TxP interaction among all the treatment groups.

Table : Cell-mediated immunity of experimental pigs measured as DTH response (skin thickness in mm) against PHA-p

Treatment†	Period					Treatment mean	SEM	Significance		
	0h	6h	12h	24h	36h			T	P	T*P
T0	2.66± 0.17	3.15± 0.17	4.33± 0.36	5.31± 0.54	3.88± 0.28	3.87 ± 0.20^{B}	0.102	<0.001	<0.001	0.255
T1	2.91± 0.13	3.54± 0.15	5.25± 0.49	6.45± 0.35	4.83± 0.52	4.60 ± 0.25^{A}				
T2	2.69± 0.20	3.93± 0.34	5.63± 0.56	7.44± 0.70	5.90± 0.38	5.12 ± 0.33^{A}				
Period mean	2.75^{Z}± 0.10	3.54^{Z}± 0.15	5.07^{Y}± 0.29	6.40^{X} ±0.35	4.87^{Y}± 0.28					

†T0: Basal diet (6% CF for grower and 8% CF for finisher pigs)
T1: Diet with maize silage (8% CF for grower and 10% CF for finisher pigs)
T2: Diet with vegetable waste silage (8% CF for grower and 10% CF for finisher pigs)
AB/XYZ Means bearing different superscripts within a column (AB) or row (XYZ) differs significantly (P<0.01)

Humoral immune responses: Humoral immune response was measured in the serum collected at 0, 14 and 21 day of intra-muscular injection of 20 per cent SRBC to experimental pigs. The haemagglutination assay (HA) titre was measured as serum antibody responses to SRBC. The mean HA titre (log2titre) of the dietary treatment groups was recorded as 3.81, 4.31, 4.21 for T0, T1 and T2 group. A highly significant difference ($p<0.001$) was found in HA titre among the groups where group T0 showed a lower value, while the T1 and T2 groups were comparable. The periodic HA titre in all treatment groups was significantly higher ($p<0.01$) at 14-day post-inoculation of SRBC than the zero day and antibody titre gradually declined thereafter at 21-day (HA titre 4.10).

Table : Humoral immunity (log_2titre) in experimental pigs measured as antibody response to sheep RBC

Treat-ment†	Period			Treatment mean	SEM	Significance		
	0-d	14-d	21-d			T	P	T*P
T0	3.69±0.09	4.00±0.09	3.75±0.09	3.81^{B}±0.06	0.042	<0.001	<0.01	0.964
T1	4.13±0.16	4.50±0.13	4.31±0.16	4.31^{A} ±0.16				
T2	4.00±0.13	4.38±0.12	4.25±0.13	4.21^{A}±0.08				
Period mean	3.94^{Y}±0.08	4.29^{X}±0.08	4.10^{XY}±0.09					

†T0: Basal diet (6% CF for grower and 8% CF for finisher pigs)

T1: Diet with maize silage (8% CF for grower and 10% CF for finisher pigs)

T2: Diet with vegetable waste silage (8% CF for grower and 10% CF for finisher pigs)

AB/XYZ Means bearing different superscripts within a column (AB) or row (XYZ) differs significantly ($P<0.01$)

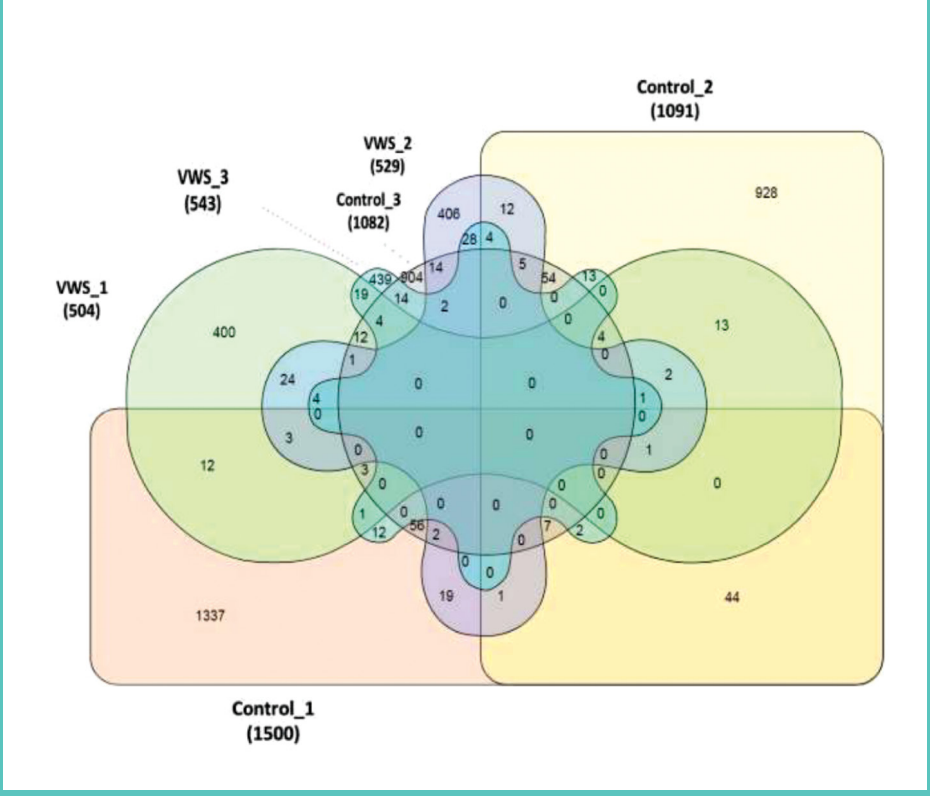
Inter-Institutional Project: Maize Production in NEH region for sustainable livestock production (With IIMR, Ludhiana)

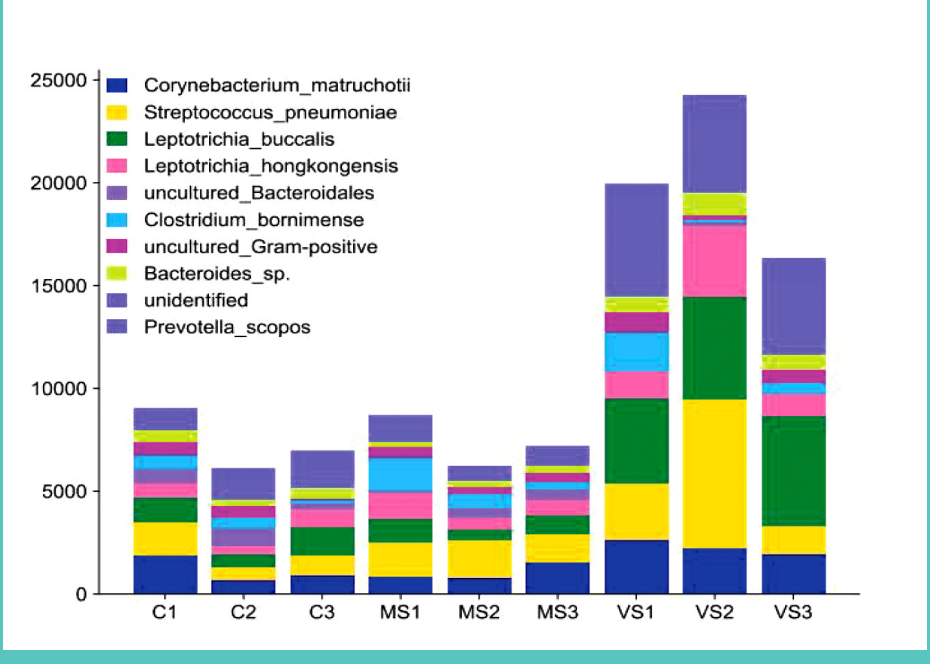
K. Barman, S. Banik, S. R. Pegu, Sunil Kumar and S. Rajkhowa

Effect of vegetable silage and maize fodder silage supplementation on faecal microbiome of crossbred pigs: A trial was conducted in crossbred grower pigs (Hampshire x Ghungroo) by feeding diet containing different fiber sources from normal ingredients, maize fodder silage and vegetable waste silage at 8, 10 and 12 % level to see its effect on faecal microbiota using 16S rRNA. It was found that microbial abundancy in faeces of experimental pigs did not vary with the source and level of fibre in diets. But total faecal microbial counts were higher in group fed vegetable waste silage (VWS) followed by group fed maize fodder silage. Firmicutes, Proteobacteria, Bacteroidota, Actinobacteriota and Fusobacteriota were the five most abundant phyla in the faeces of all the dietary groups.

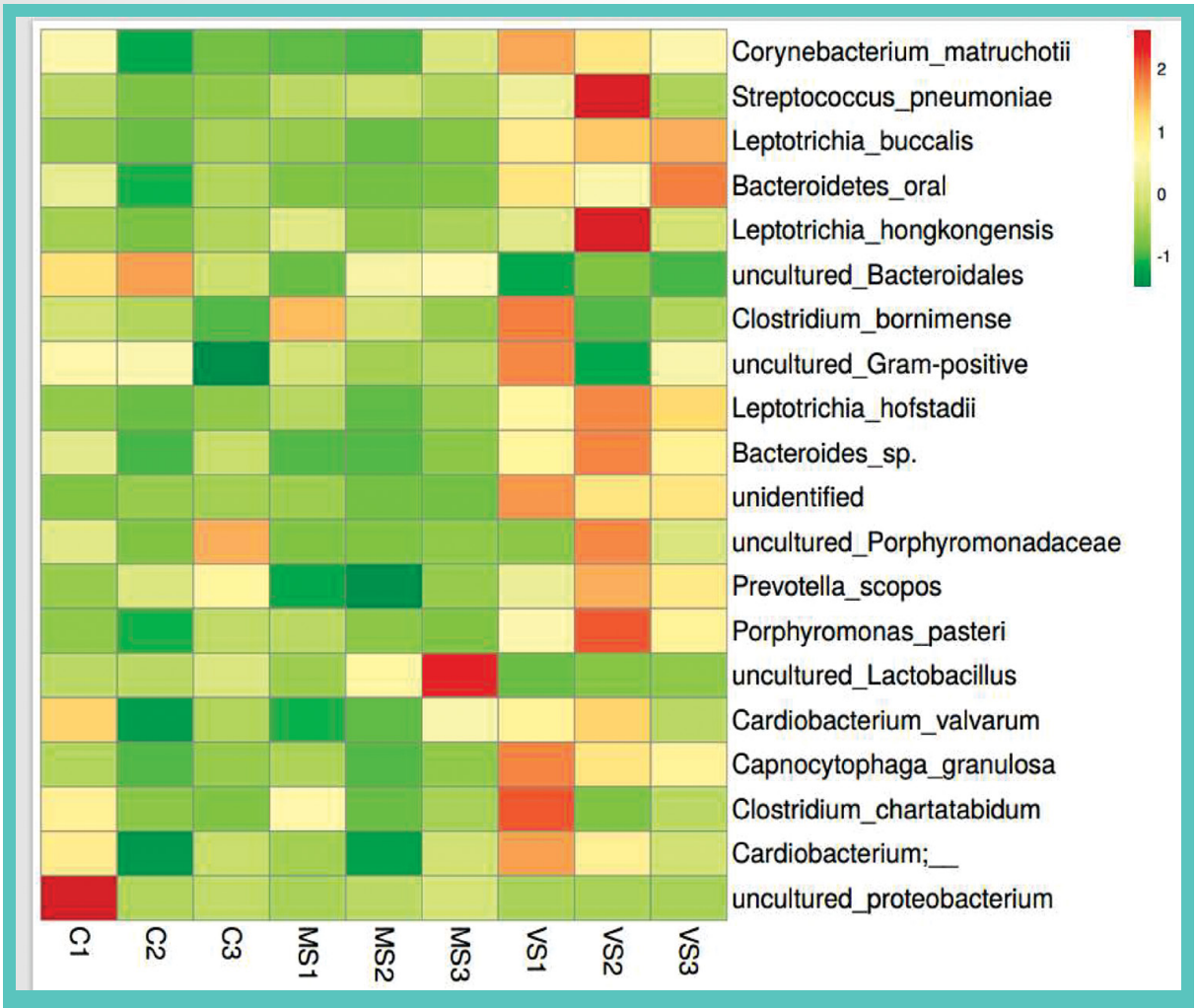
The present findings corroborated with the reports of Xiao et al. (2016) who performed the metagenomic sequencing of faecal DNA of different pigs and revealed that Firmicutes and Bacteroidetes were the predominant phyla. The abundance of microbial species *L. buccalis*, *C. matruchotii* and *Bacteroides sp.* were higher in VWS fed groups. The observation of alpha diversity gives the idea of species richness in a particular ecosystem. The Sympson's diversity index of faecal microbiota of all the dietary groups were nearest to one that showed highly diverse microbial population in all the groups. When species richness and evenness increases, the diversity increases. The dietary groups fed lower level of fibre from common feed sources had greater

sample diversity as compared to high fibre dietary groups. The total species richness based on the number of singleton and doubleton species (Chao-1) was higher in VWS fed group which revealed that sources of fibre might influence the microbial population in large intestine.





Most abundant species in faecal samples of experimental pigs. (C1, C2 and C3 containing 8, 10 and 12 % crude fiber from T0; MS1, MS2 and MS3 containing 8, 10 and 12 % crude fiber from T2 and VS1, VS2 and VS3 containing 8, 10 and 12 % crude fiber from T2 groups)



The heatmap depicts the relative percentage of 16S rRNA gene sequences assigned to each bacterial species (y axis)

Institute Project: Molecular detection of aflatoxins producing *Aspergillus* species

K. Barman, P. J. Das, S. R. Pegu, R. Deb and Sunil Kumar

Mycotoxicosis causes great loss to livestock farm and is caused by feeding of contaminated feeds to the animal. It causes moderate to very severe loss to the farm depending upon the concentration of mycotoxins in the contaminated feeds. Mycotoxins are produced primarily by the fungi which belong to *Aspergillus*, *Penicillium* and *Fusarium* genera. Fungi proliferate to produce secondary metabolites under favourable environmental conditions, when temperature and moisture are suitable. In India, particularly in Assam there is high temperature and humidity, that provide a conducive environment for production of mycotoxins in pig feed ingredients by *Aspergillus* species of fungi. Low levels (20 to 200 ppb) can affect pig performance through reduced feed intake and suppression of the immune system. Therefore, to identify the conserve region of aflatoxins producing species mainly *Aspergillus* species, one set nested PCR primers were designed and synthesized as details given below. The positive aflatoxin gene were identified by visualizing 850 bp amlicon in first round PCR followed by 460 bp aplicon in the second round PCR.

External Project: Establishment of modern boar semen production centre and creation of extension facilities for capacity building of piggery stakeholders (Funded by North Eastern Council)

S. Banik, Sunil Kumar, R. Islam and V.K. Gupta

The Boar Semen Production cum Processing Centre and Training Hall, established through funding support from North Eastern Council (NEC), Ministry of DoNER, Govt. of India, was commissioned by Dr Bhupendra Nath Tripathi, Deputy Director General (Animal Science), Indian Council of Agricultural Research, New Delhi in the presence of Dr V.K. Gupta, Director, ICAR-NRC on Pig and Dr D.K. Sarma, Former Director, ICAR-NRC on Pig on 04.11.2022. The commissioning ceremony was attended by current and former scientists of the institute, other staff members and progressive farmers.

The centre will support research and production of boar semen for increased outreach of artificial insemination (AI) and training of various stakeholders for promoting pig husbandry in the North Eastern region specifically and country in general.

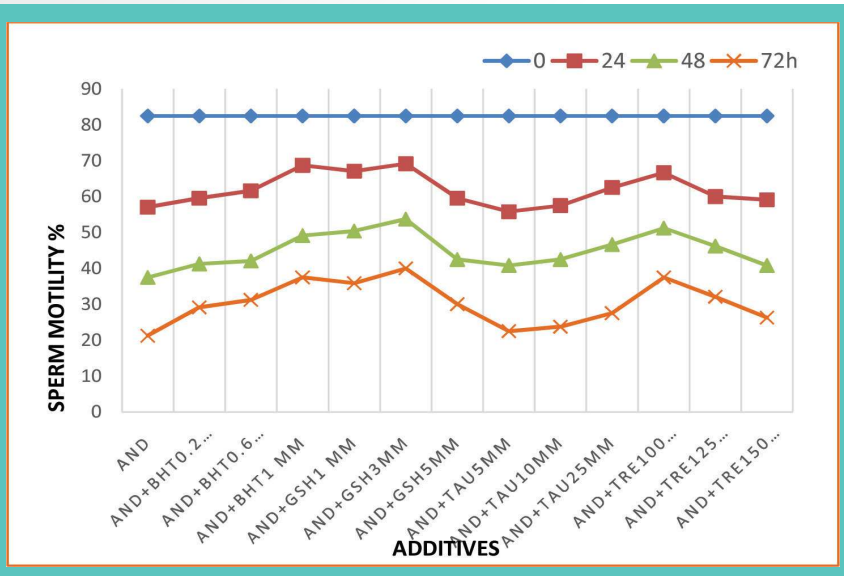
Institute Project: Preservation of boar semen using different additives in liquid and frozen state

R. Islam, Sunil Kumar, K. Barman and S. Banik

Due to the higher susceptibility to cold and cryo shock, fresh and liquid boar semen are exclusively used in pig artificial insemination. Maintenance of fertilizing capacity of the stored boar spermatozoa at low and sub-zero temperature for longer duration is important for the use of superior boar for artificial insemination service in the distant places in the field. The present study was planned to improve the quality of boar spermatozoa during storage at 5°C with the addition of antioxidants and nonpermeable cryoprotectant like trehalose. The temperature of equilibration is also 5°C, which is practiced prior to cryopreservation.

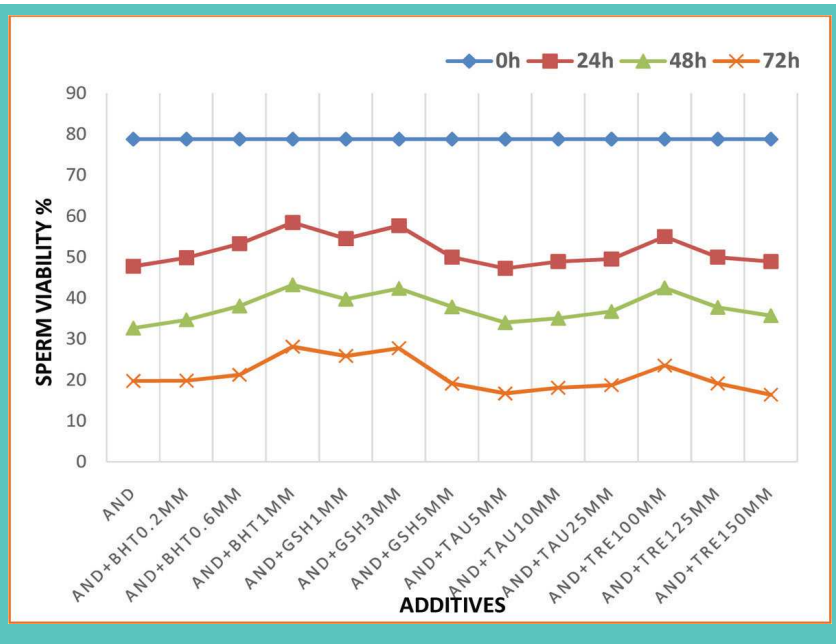
Semen samples with optimum quality was stored at 5°C in a refrigerator up to 72h in androhep (AND-Control) extender and also with the addition of different concentrations of antioxidants viz. butylated hydroxytoluene (BHT-0.2mM, BHT-0.6mM and BHT-1mM); reduced glutathione (GSH-1mM, GSH-3mM and GSH-5mM); taurine (TAU-5mM, TAU10mM and TAU-25mM) and sugar trehalose in AND extender. 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 differed 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 24 h of preservation at 5°C in semen sample extended in all the combinations in AND extender. The spermatozoa showing ≤50% motility was recorded in AND+GSH1mM (50.41d±1.56), AND+GSH3mM (53.75±1.52) and AND+TRE100mM (51.25±1.08) at 48h of storage. The significantly ($p\leq0.05$) higher sperm motility was recorded in AND+GSH3mM (40.00±0.87%), AND+GSH1mM (35.83±1.20) AND+BHT1mM (37.50±0.97) and AND+TRE100mM (37.50±1.15) at 72h of storage at 5°C than the other combinations.

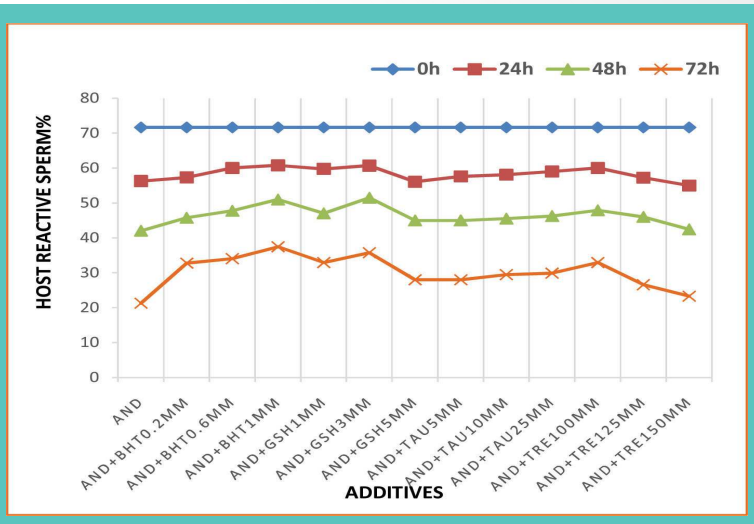


Effect of different concentration of additives on motility of boar spermatozoa at different hours of preservation in Androhep Extender at 5°C (AND- Androhep, BHT-Butylated Hydroxytoluene, GSH-Glutathione reductase, TAU- Taurine, TRE- Trehalose)

Percentage of live spermatozoa differed significantly ($p \leq 0.05$) different concentrations of additives in AND extender at 24, 48 and 72 h of storage at 5°C. The live sperm count of boar spermatozoa was significantly ($p \leq 0.05$) higher in in AND+BHT1mM (58.45±0.98) and AND+GSH3mM (57.70±0.47) than other combinations at 24h of storage. The viability was also significantly higher for AND+BHT1mM (43.25±1.07), AND+GSH3mM (42.37±0.73) and AND+TRE100mM (42.50±0.67) than the other additives concentrations at 48h of preservation. At 72 h, AND+BHT1mM (28.12±0.55) and AND+GSH3mM (27.75±0.73) followed by AND+GSH1mM (25.87±0.74) maintained significantly higher live sperm count than other combinations.

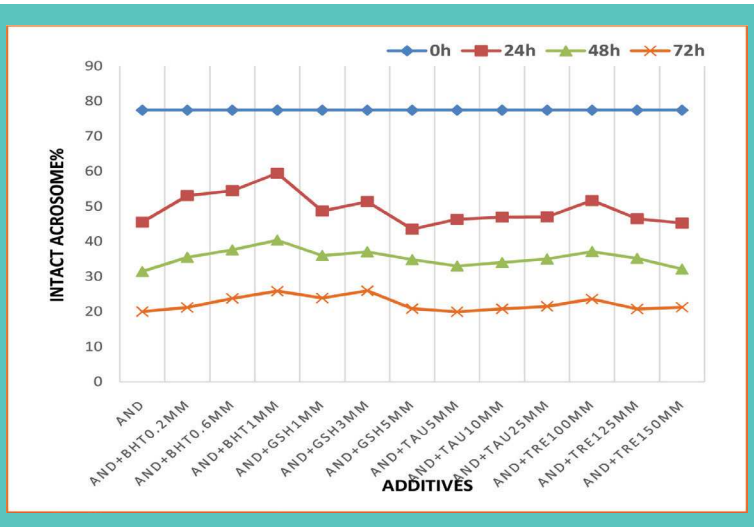


Effect of different concentration of additives on viability of boar spermatozoa at different hours of preservation in Androhep Extender at 5°C



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

Percentage of HOST reacted spermatozoa differed significantly ($p \leq 0.05$) between different concentrations of additives in AND extender at 24, 48 and 72 h of storage at 5°C. The HOST reacted spermatozoa was higher than 50% in all concentrations of additives in AND extender with the values ranging from 55.00 to 60.66 at 24h of storage. The HOST reactive spermatozoa was significantly higher for AND+BHT1mM (51.00±0.61) and AND+GSH3mM (51.50±0.55) than the other concentrations of additives in AND extender during storage up to 48h. Similarly, AND+BHT1mM (37.45±0.64) and AND+GSH3mM (35.75±0.58) also maintained significantly higher membrane integrity of boar spermatozoa stored up to 72 h than the other concentrations of additives in AND extender.



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

Percentage of intact acrosome in boar spermatozoa differed significantly ($p \leq 0.05$) between different concentrations of additives in AND extender during preservation at 5°C from 24 to 72h of storage. The AND+BHT1mM (59.50±1.33) maintained significantly higher acrosomal integrity than other concentrations of additives in AND extender at 24h of preservation. Similarly,

AND+GSH3mM (51.41±0.38) and AND+TRE100mM (51.70±0.32) maintained significantly higher intact acrosome percent than the other two GSH and TRE concentrations in AND extender. AND+BHT1mM, BHT0.6mM, GSH3mM, GSH1mM and TRE100mM improved the percentage of intact acrosome than other concentrations of additives during 48 and 72h storage in AND extender. Though the values were seen to be highest in AND+BHT1mM (40.37±1.23) at 48h and in AND+GSH3mM (26.00±0.92) at 72 h of storage. It could be concluded from the present study that addition of antioxidants (BHT and GSH) and sugar trehalose improved sperm quality during storage of boar spermatozoa at 5°C up to 72h of storage. GSH3mM and BHT 1mM followed by Trehalose100mM is beneficial for improvement boar spermatozoa during storage at 5°C out of the 3 different concentrations of 4 different additives were used in control Androhep extender up to 72h.

Service Project: Artificial Insemination in Pigs

R. Islam and Sunil Kumar

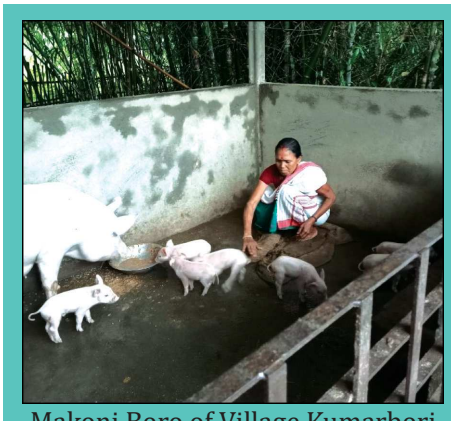
A total of 133 ejaculates were collected from healthy boars during the year and a total of 921 liquid boar semen doses were produced and supplied by the Institute for artificial insemination in pigs at the farmers' field and organized farms in 77 villages. Out of this, 202 doses were given to tribal farmers under TSP, 37 under SCSP, 96 to organized farm and rest 586 doses were sold to other category of farmers. One self-sponsored three-day National Training on Artificial Insemination in Pig was conducted for farmers across the country. Another three training programmes of 3-7 days durations on artificial insemination in pig were also conducted for ST/ SC farmers. One Front-Line Demonstrations (FLD)on Artificial Insemination techniques in pigs was conducted. Demonstrations and lectures on artificial insemination in pigs were delivered in different other trainings and awareness programmes conducted under SCSP, TSP, EDP etc. organized by ICAR-NRC on Pig, Rani. Regular advisory services were provided to the farmers at their doorstep and also through telephonic conversations.

New inseminators trained

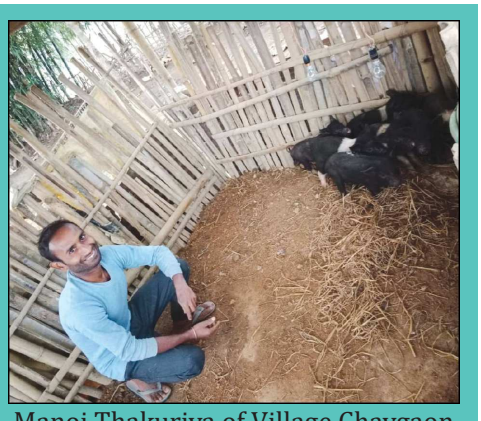
- During the year 174 new entrepreneurs/ farmers were trained as inseminators for self-employment generation through artificial insemination in pigs with liquid boar semen.

New farmers registered

- During the reported period, 35 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.



Makoni Boro of Village Kumarbori with the 8 piglets borned by AI



Manoj Thakuriya of Village Chaygaon with his 10 piglets borned by AI

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

Sunil Kumar, R. Islam, S. Banik, P. J. Das and K. Barman

Propagation of Artificial Insemination for establishment of Multiplier units at farmers' field: Several farmers were demonstrated A.I. in Pig and they were provided AI doses and insemination was done. Main emphasis was given on providing the technical knowledge for establishment of units and kknowledge scaling up of farmers. Synchronization of animals also done. Some of the sows and gilts farrowed. Pregnancy diagnostic and necessary veterinary aids were provided whenever needed. Mineral Mixture, Anti-helminthics and liver tonics were supplied to some of needy farmers. Currently, the eleven units have achieved self sustaining 6+1 sow unit. It was observed that most of the animals were lost due to sudden mortality and sale of some animals due to fear of incoming outbreak in the herd. The different constrains faced by the farmers are also studied. The main constraint was the inability to purchase the dry concentrate feed followed by timely lack of Veterinary aids. Performa prepared for feedback from farmers maintaining multiplier units. Feed back and impact assessment by as per criteria suggested by Likert (1932) and Edward (1957). Impact calculation by benefit cost ratio (BC Ratio) method. For three units, the BC Ratio and % increase over base year income is tabulated below. Further multiplication of pigs at their units is in progress.

Multiplier units at Farmers'field

Table : Performa prepared for feedback from farmers maintaining multiplier units

			Weightage		Agree/disagree				
SN	**Inputs**	**Statements**	**RW**	**MRS**	**5**	**4**	**3**	**2**	**1**
1	Knowledge scaling up	In utero care of embryos/fetuses	0.77	>75%					
2		Birth to weaning growth (g/d) 300-600							
3		Deworming, vaccination of weaners							
4		Weaning							
5		Selection of male weaners							
6		Selection of female weaners							
7		Group housing of weaner males							
8		Group housing of weaner females							
9		Boar effect use for puberty induction							
10		Hormonal use to prevent delayed puberty							
11		Flushing in gilts							
12		use of boar for heat detection							
13		Gilts service at second heat							
14		Male or AI for service							
15		Single service or double service							
16		Avoiding service between sibs							
17		AI/ Service with skilled knowledge							
18		Restricted feeding							
19		21 Days post service heat detection							
20		Pregnancy detection							
21		Prefarrowing care and management							
22		Farrowing care and management of dam							
23		Supplementation of Vit-E and Se in periterm							
24		Maintaining BCS of dam							
25		Postweaning restricted feeding							
26		Post weaning Flushing							
27		Postweaning immediate service							
28		Use of Hormones in post weaning anestrum wwww							
29		Record keeping							
30	A.I. service	Artificial insemination service							
31	Hormones	Hormones for estrus synchronization							
32	USG services	Ultrasonographic services for pregnancy diagnosis							
33	Veterinary aids	Needful Veterinary aids as when needed							

34	Technical guidance	Technical guidance as when needed							
35	Physical inputs	Inputs- dewormer, feed, supplements , Mineral mixture							

Table : BC ratio and income calculation

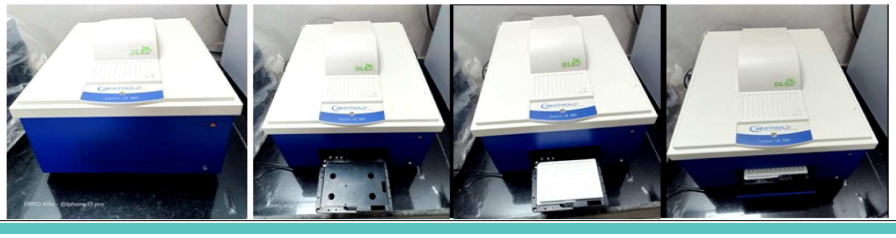
SN	BC Ratio	Income (%) increase over base year
1	2.34	>50
2	2.54	>50
3	2.45	87.17

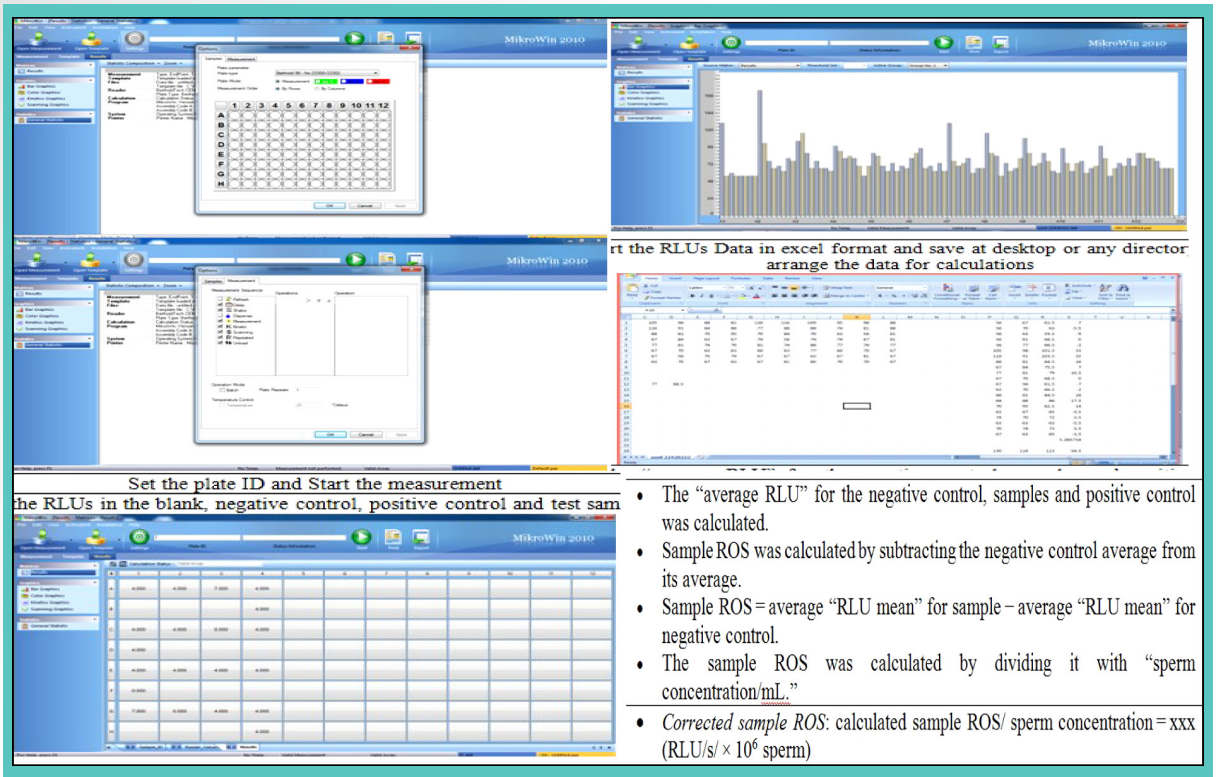
Low cost boar semen preservation tools: Low cost semen preservation tools has been standardized and evaluated for the maintenance of controlled temperature required for boar semen preservation. The devices have been designed as portable one as well as for laboratory use also. The accuracy of temperature maintained is excellent at par with standards. Two types of tools have been standardized. First is Boar semen storage and transportation box and second is Boar semen storage cabinet.

Low cost estrus induction and synchronization methods for optimizing reproductive efficiency: Estrous synchronization was done in female pigs (n=26) at farmers' field. The estrus induction was done using Folligon alone (FSH/PMSG). In results, it was estimated that estrus induction rate 76.54%, and injection to estrus induced interval was 81.54±6.78.

Standardization of Chemiluminance based assay for demarcating low and high fertile semen: Levels of ROS in the neat sample or unprocessed samples are reflective of the ROS produced by spermatozoa and all the other cells present in the seminal ejaculate. The screening of good and poor semen based on ROS level estimation using chemiluminescence detection can provide newer opportunities for prediction of semen quality. A chemiluminance based assay for discrimination between low and high fertile semen was standardized. The assay is very simple and easy to perform. It gives a direct cut off value between the low and high fertile boar's semen sample. Gel free ejaculates were collected by double gloved hand method from healthy boars and subjected to sperm function tests as per standardized procedures. The samples were processed as mentioned in the figure. The RLU per million sperms in tested samples was 5.28 RLU/ million sperms in high fertile semen while in low fertile boar the calculated value was 8.10 RLU/million sperms. Further refinement of the test is under progress.

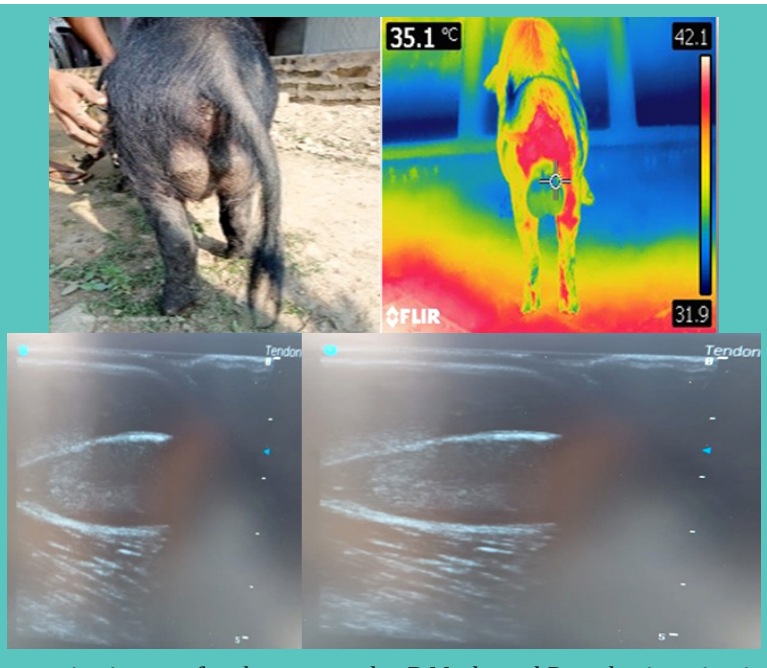
Solution	Blank Wells (Triplicate)	Negative control Wells(Triplicate)	Positive control Wells(Triplicate)	Test ejaculate Wells (L/H)
PBS	200	200	200	-
Sample	-	-	-	100
Reagent X	-	-	50	-
Reagent Y	-	50	50	50
Mix gently all the solutions				
Turn on the instrument, set the programme in the instrument, select the wells, select the kinetics and measurements				



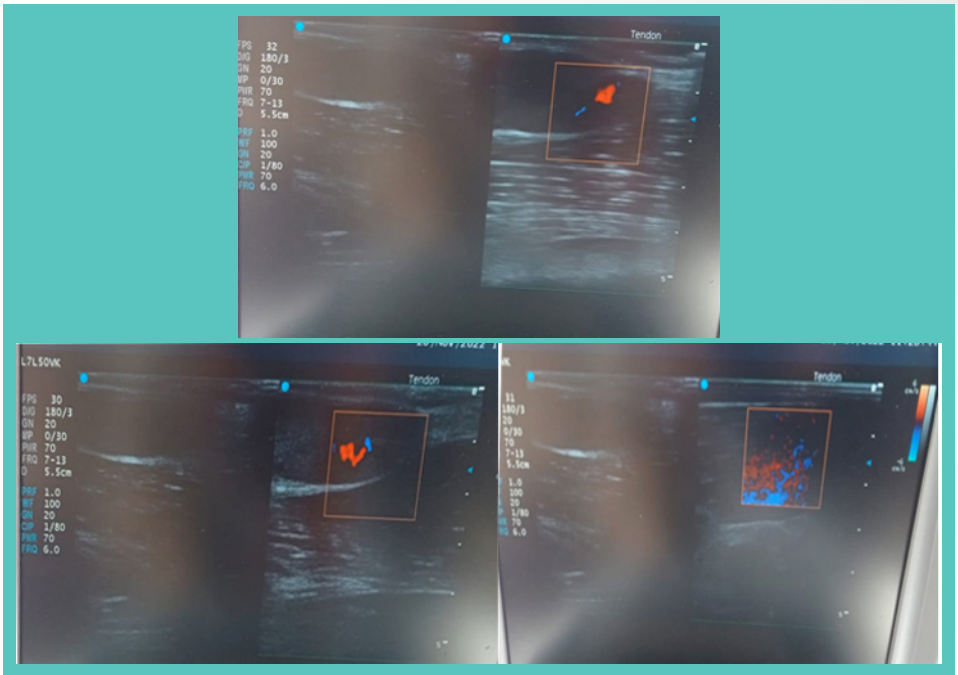


Steps followed in chemiluminance based assay for discrimination between low and high fertile semen

B-Mode, Color 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 and vascular characteristics of the testicles and pampiniform plexus. Thermal imaging was started to carry out scrotal surface mean temperature. Boar scores are under generation. Correlation with respect to seminal attributes and field fertility is yet to done.

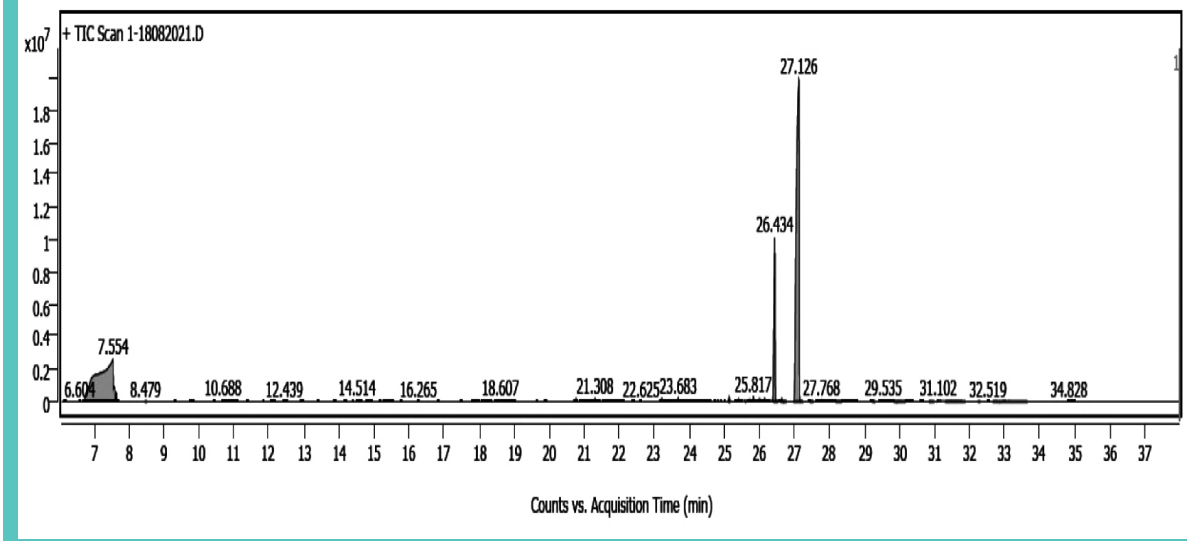


Representative images for thermography, B Mode and Doppler imaging in boars



Representative images for B Mode and Doppler imaging in boars

Metabolomic analysis in sperm and seminal plasma of low and high fertile boars : Metabolite profiling of sperm cell and seminal plasma can help in identification of potential indicator of sperm dysfunctions among ejaculates. In continuation to our previous results, it was found that most of the metabolites are involved in metabolism of galactose, amines (glutamine, arginine, histadine, alanine, arginine and proline) and amides (glutamate, aspartate), nitrogem, butanoate, sucrose, glutathione, glyoxylate, dicarboxylate, nucleotide sugar and amino acyl-tRNA biosynthesis. The relationship between identified metabolites and the field fertility of boars is under progress. Hence, it is concluded that the identified metabolites are involved in different sperm function and functional processes. The current study may help in identification of metabolites and increased knowledge of their biological functions and differential expression associated with fertile and infertile male semen qualities, serving as biomarker candidates.

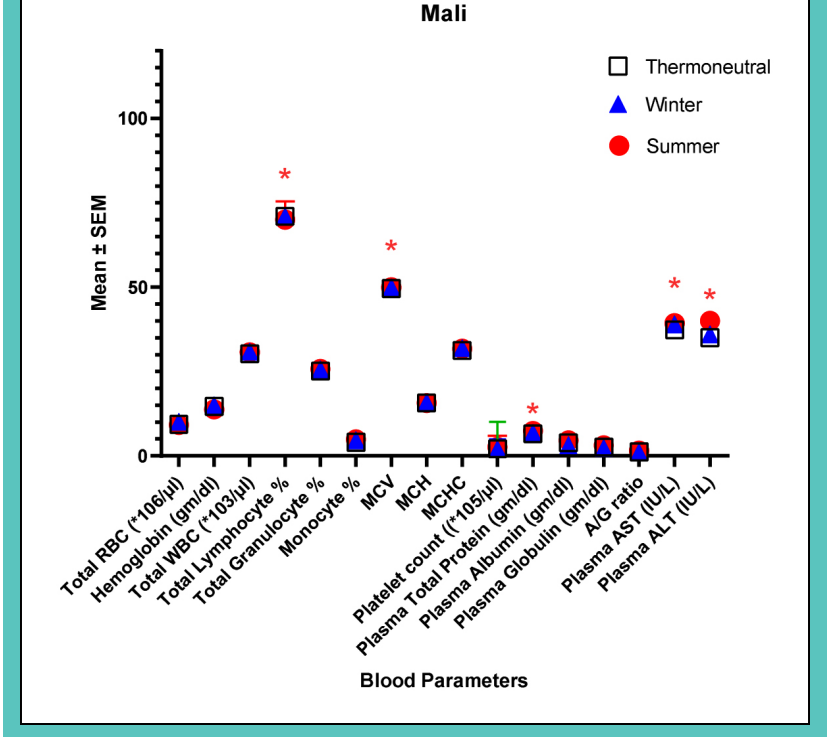


Chromatogram of the semen sample

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

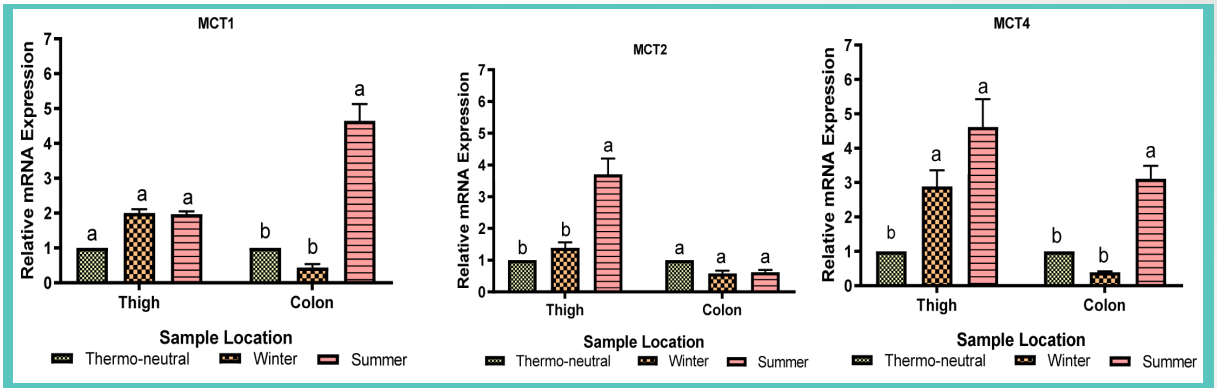
In order to evaluate the expression pattern of various *HSP* and *MCT* genes in the thigh muscle under various seasonal conditions in indigenous Mali and Ghoongroo and crossbreed Rani pigs, samples were collected from local slaughter places. Total RNA was isolated by Trizol method, cDNA was synthesized and primers were optimized for qPCR. Blood profile was analysed for Mali pigs. Among the blood parameters, WBC count, total lymphocyte, total plasma protein, plasma AST and ALT differed significantly ($P < 0.05$) among the different temperature groups in Mali pigs.



Blood profile analysis of Mali pigs during different seasons

Expression profile of MCT genes in Mali pigs

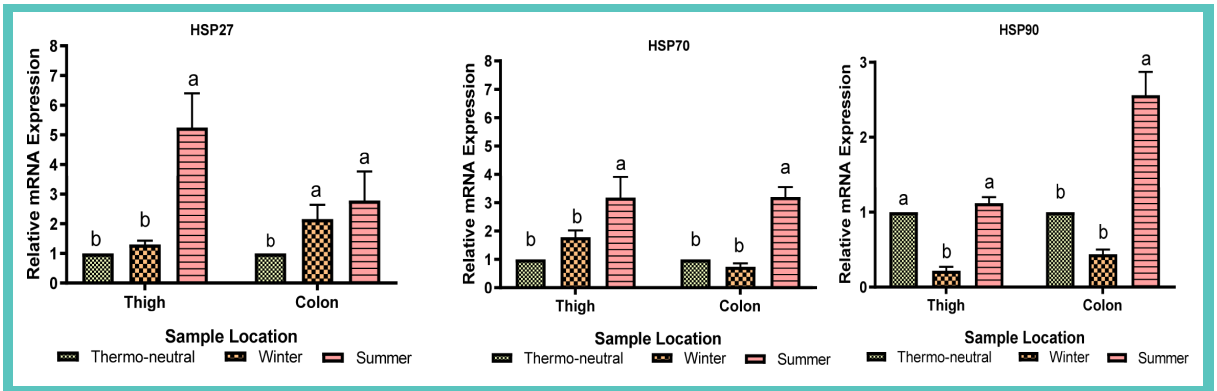
In all the analysis the thermo-neutral season was used as calibrator for obtaining relative mRNA expression. Relative mRNA expression of MCT1 was found to be significantly higher ($p < 0.05$) in colon tissue during summer season compared to that of winter season in Mali pig. However, MCT1 expression was not significantly different in thigh muscles. The relative fold changes of MCT2 were significantly higher ($p<0.05$) in thigh region during summer season compared to that of winter season in Mali pig. However, no significant difference in expression of MCT2 mRNA was observed for colon region in either of the season. Interestingly, the transcripts of MCT4 were found to be significantly higher ($p<0.05$) in thigh tissue during both summer and winter season compared to that of thermo-neutral season in Mali pig. Moreover, a significant increase in copy number of MCT4 was observed during summer season for colon tissue than that of the winter season.



Expression profile analysis of MCT genes in Mali pigs during different seasons

Expression profile of HSP gene in Mali pigs

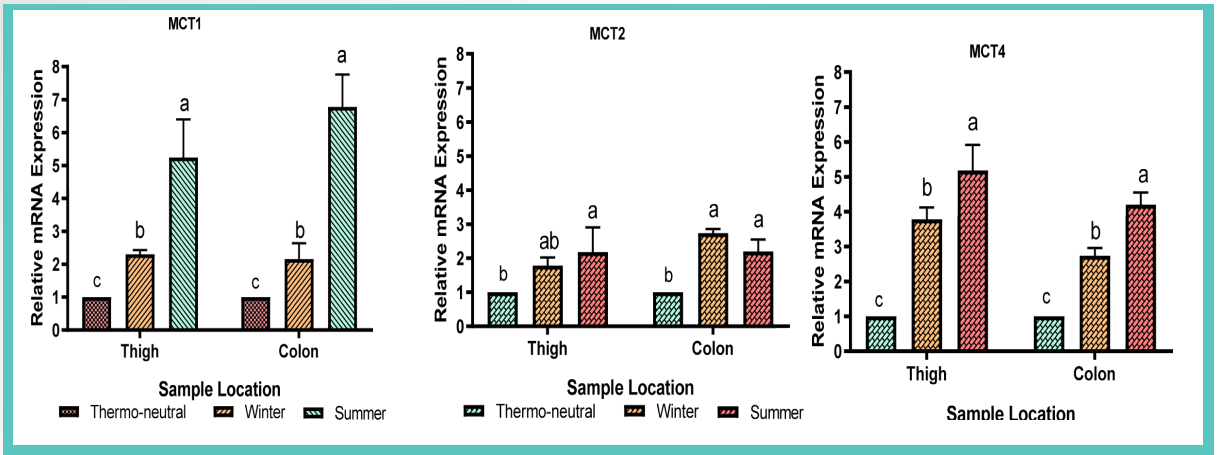
During the summer season, the relative expression of mRNA of HSP27 in thigh region was found to be significantly ($p<0.05$) higher compared to that of winter season in Mali breed of pig. However, no significant difference in relative expression was observed in colon tissue.The relative fold changes of HSP70 mRNA was significantly ($p<0.05$) upregulated during the summer season in thigh region as compared to winter season in Mali pig.Moreover, a similar pattern in upregulation of HSP70 transcripts was also observed for colon tissue during summer season.The relative changes in the copy number of HSP90 mRNA was significantly upregulated ($p<0.05$) in colon tissue during summer season compared to that of winter season in Mali pig. However, no any significant difference in expression pattern of HSP90 transcripts was observed for thigh region in summer season, but was significantly decreased in winter season.



Expression profile analysis of HSP genes in Mali pigs during different seasons

Expression profile of MCT genes in Ghoongroo pigs

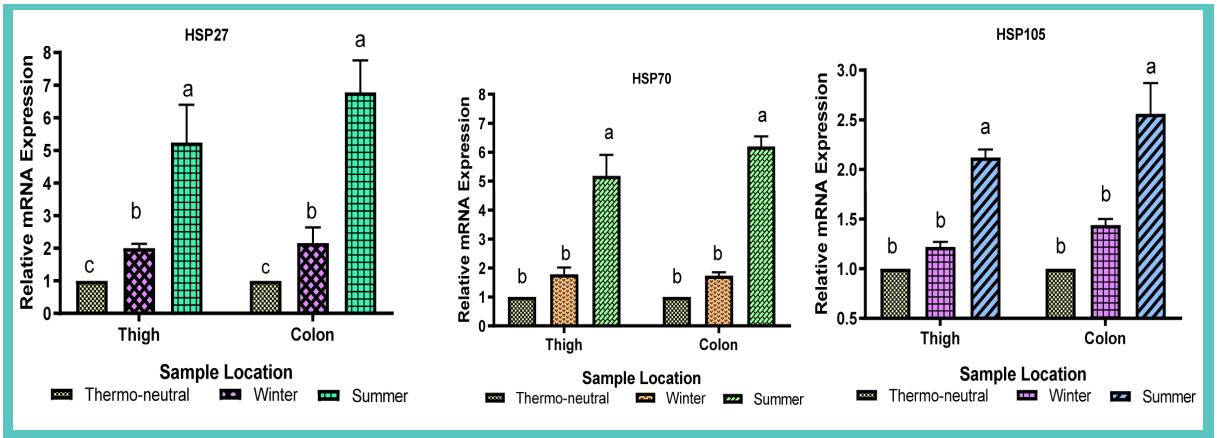
Relative mRNA expression of MCT1 was found to be significantly higher ($p<0.05$) in both thigh muscle and colon tissue during summer season compared to that of winter season in Ghoongroo pig. The relative fold changes of MCT2 were not significant in thigh muscle and colon tissue during both summer and winter season comparison. However, MCT2 was up regulated in colon tissue in comparison to thermo-neutral. MCT2 showed significant difference ($p<0.05$) only during summer season in comparison with thermo-neutral. The transcripts of MCT4 were found to be significantly higher ($p<0.05$) in thigh tissue during both summer and winter season compared to that of thermo-neutral season in Ghoongroo pig. Moreover, a significant increase in copy number of MCT4 was observed during summer season for colon tissue than that of the winter season.



Expression profile analysis of MCT genes in Ghoongroo pigs during different seasons

Expression profile of HSP genes in Ghoongroo pigs

During the summer and winter season, the relative expression of mRNA of *HSP27* in both thigh muscle and colon region was found to be significantly ($p<0.05$) higher compared to that of winter and thermo-neutral season in Ghoongroo breed of pig. The relative fold changes of *HSP70* mRNA were significantly ($p<0.05$) up regulated only during the summer season in thigh and colon region as compared to winter season in Ghoongroo pig. The relative changes in the copy number of *HSP105* mRNA was significantly up regulated ($p<0.05$) in thigh muscle and colon tissue during summer season compared to that of winter season in Ghoongroo pig. However, no any significant difference in expression pattern of *HSP70* and *HSP105* transcripts was observed for both thigh muscle and colon region in winter season, in comparison to thermo-neutral control.



Expression profile analysis of HSP genes in Ghoongroo pigs during different seasons

Expression profile of HSP70, HSP105 and HSF1 genes in Rani pigs

The relative fold changes of *HSP70* mRNA were significantly ($p<0.05$) up regulated only during both the summer and winter season in thigh and colon region as compared to thermo-neutral season in Rani pig. The relative changes in the copy number of *HSP105* mRNA was significantly up regulated ($p<0.05$) in thigh muscle and colon tissue during both winter and summer season compared to that of thermo-neutral control season in Rani pig. The expression pattern of heat shock factor 1 *(HSF1)* transcripts was observed equally for both thigh muscle and colon region in winter season and thermo-neutral control. However, during summer season, Rani pigs had significantly high mRNA expression of *HSF1.*

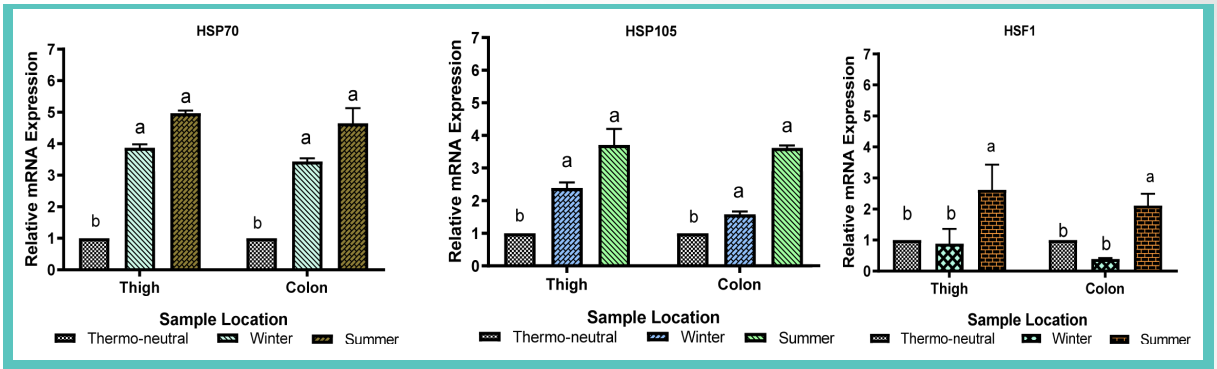


Fig. Expression profile analysis of HSP and HSF1 genes in Rani pigs during different seasons.

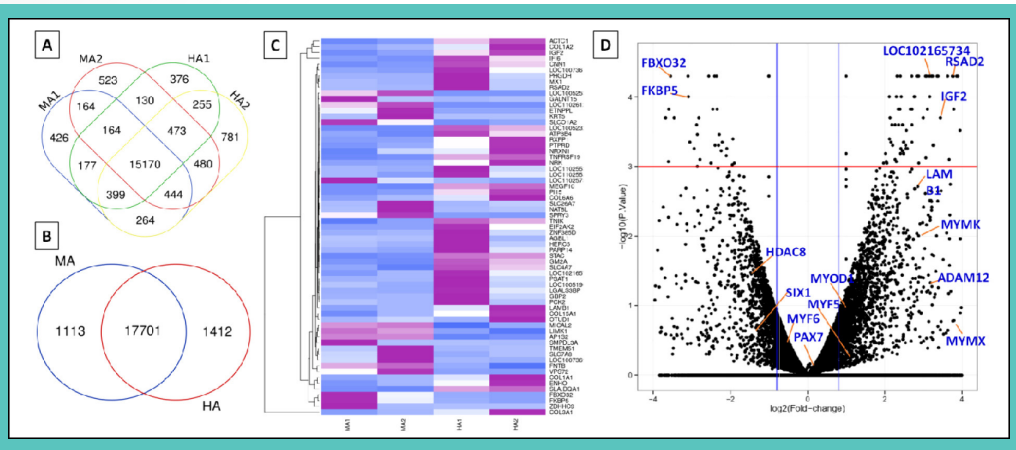
The relative change in the copy number of MCT and HSP genes during different season in Mali and Ghoongroo pig shows their thermo adaptability and modulation of stress response pathways to adapt to the subsequent negative effects of heat stress. The expression dynamics of heat stress responsive genes HSP70, HSP105 and HSF1 genes during different season in Rani pig shows their thermo-adaptability to thermal stress.

Institute Project: Investigations on molecular mechanisms in differential muscle growth in different breeds of pigs

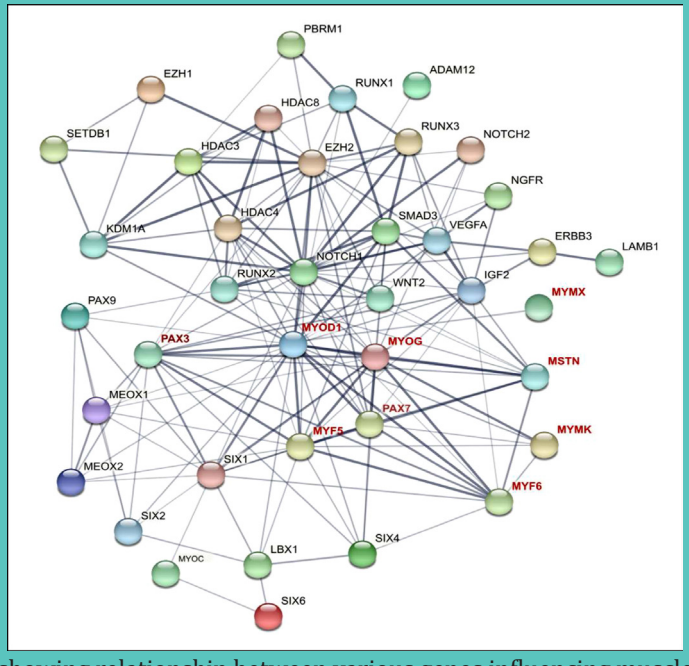
Mohan N.H. and R. Thomas

Concurrent transcriptome and methylome analysis of pig breeds with varying muscularity: Improvement of muscle traits is an important priority of pig breeding programmes and there is considerable variability in muscularity among the pig breeds. The objective of the study was to obtain insights into myogenesis in two breeds of pigs with divergent muscularity (Mali and Hampshire). Muscle transcriptome and methylome data was integrated with histology, immunofluorescence and meat yield) to identify difference between breeds during early growth phase. The diameter of the muscle fiber in Mali breed was 1.20 times more than that in Hampshire. On the other hand, the number of fibers per fascicle was more in Hampshire (1.25 times) than Mali breed of pig. Overall muscle fiber area was more in Hampshire than in Mali breed. The percentage of cells expressing specific myogenic marker proteins (*MYOD1, MYOG* and *PAX7*) was calculated after immunofluorescence microscopy. There were more cells in Hampshire breed muscle samples than in Mali expressing myogenesis related proteins-*MYOD1, MYOG* and *PAX7*. The expression of principal myogenic genes (*MYOD1, MYF5, MYF6, MYOG*) were 1.09-2.38 fold higher (P>0.05) in Hampshire as compared to Mali pigs. Interestingly, there were significant differences in the expression levels of genes related to myoblast fusion, Myomaker (*MYMK*) and Myomixer (*MYMX*, Myomerger or Minion). The expression of *MYMX* (LOC110261530) and *MYMK* was 13.89 and 7.12 times, respectively, higher in Hampshire as compared to Mali pigs (p<0.05). The expression of other myogenesis associated genes such as *EYA2* (1.97 FC), *MEF2C* (1.23 FC), *PITX1* (2.28 FC), *PITX3* (3.90 FC), *TWIST1* (2.24 FC), *TWIST2* (2.86 FC), *PAX7* (1.26 FC)were also higher (P>0.05) in Hampshire breed in comparison to Mali pigs. However, expression of SIXhomeoproteins (SIX1, SIX2 and SIX4) were higher in Mali pigs (1.16-1.56 FC) than in Hampshire.Transcript levels of growth factors, FGF6 (2.87 FC), FGF18 (4.05 FC), FGF10 (6.16 FC) were also elevated (p>0.05) muscle structure and function (ACTC, CNN1, COL15A1, COL1A1, COL1A2, COL3A1, COL6A6, LAMP1, ENHO, ATP8B4), protein synthesis and metabolism (EIF2AK2, HERC5) were upregulated (P>0.05) in Hampshire as compared to Mali. The network of differentially distributed transcripts shows interactions between various myogenic regulators (MYOD1, MYF5, MYF6, MYOG) with several other factors

associated with myogenesis. The expression of myosin heavy chain genes MYH7, MYH2, and MYH1 representing type I, IIA, and IIX myofibers, respectively was higher (p>0.05) in Hampshire as compared to Mali. However, MTH4 gene expression (representing type IIB, glycolytic fibers) was higher in Mali muscle than Hampshire.Interaction network showing relationship between various genes influencing muscle development. Common transcripts both in Mali and Hampshire muscle samples revealed enrichment of genes (P<0.01; >1.5 fold enrichment) related to various myogenic process (myotube development, myoblast proliferation, fusion, myosin complex, cytoskeleton and myofibril development, regulation of morphogenesis, muscle fibre adaptation and satellite cell regulation, cellular response to cytokine stimulus). Among cellular pathways, JAK-STAT signalling, WNT ligand, biogenesis and trafficking, regulation of pluripotency, myogenesis, RUNX, Mitogen-Activated Protein Kinase (MAPK) Hedehog signalling were significantly enriched (P<0.01)



Distribution of differentially distributed muscle transcripts in Hampshire (HA) and Mali (MA) breed of pigs (A) Distribution of transcripts in Hampshire (HA1 and HA2) and Mali (MA1 and MA2) pigs (B) Overall distribution transcript in combined Hampshire (HA) and Mali (MA) muscle. (C) Heatmap shows differentially expressed genes in Hampshire (HA1 and HA2) and Mali (MA1 and MA2) muscle. (D) Volcano plot showing distribution of fold changes in expression of transcripts in muscle.



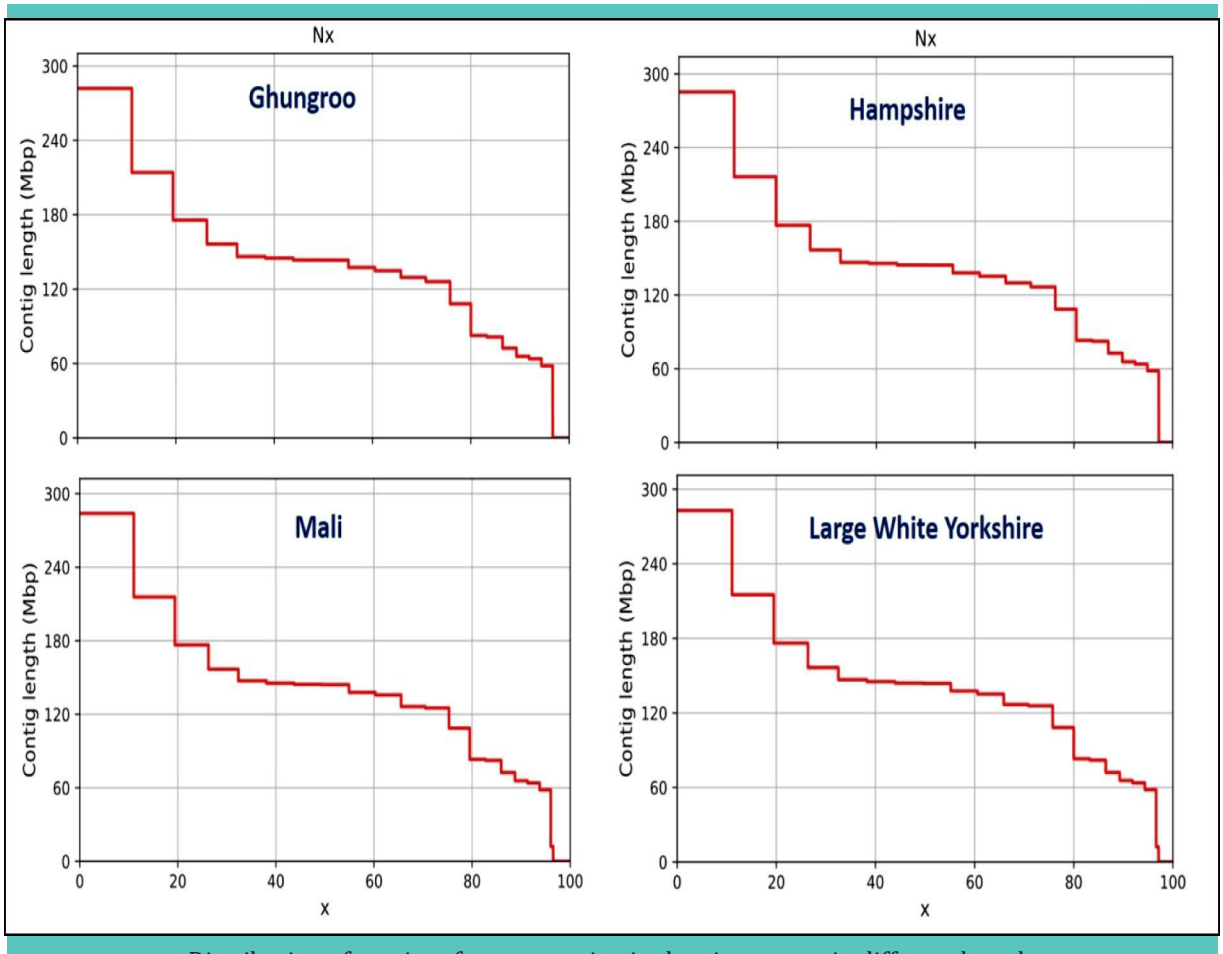
Interaction network showing relationship between various genes influencing muscle development. Major myogenic factors are indicated in red colour.

In the present study, higher number of fibers observed during histology of Hampshire muscle further supports the gene expression studies. Besides these, the expression of genes related to myogenic differentiation (PITX), pre- and post-natal myogenesis in pigs (ANKRD2, MYBPC1, NEB and MYL2) and structure (heavy and light chain myosin) were higher in Hampshire as compared to Mali pigs. The genes associated muscularity in pigs (GATA3, HMGA2, NRAP, SMC6L1, SPP1, TJP1)22 were also higher in Hampshire as compared to Mali pigs.

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

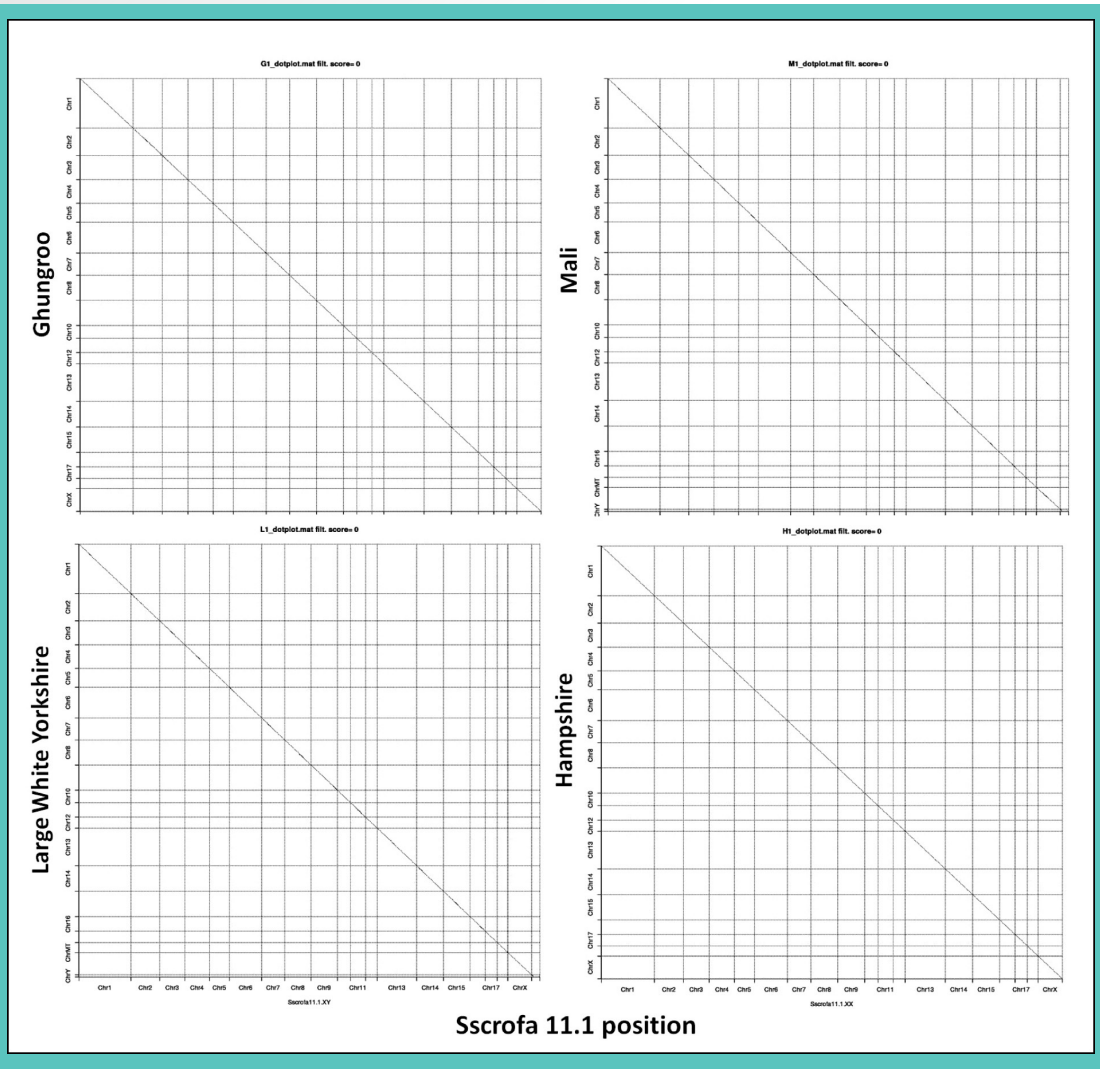
Mohan N. H.

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 for the first time. The mean size of the genome was about 2.55 GB. The assemble genomes showed colinearity with the reference genome *(Sscrofa 11.1).*

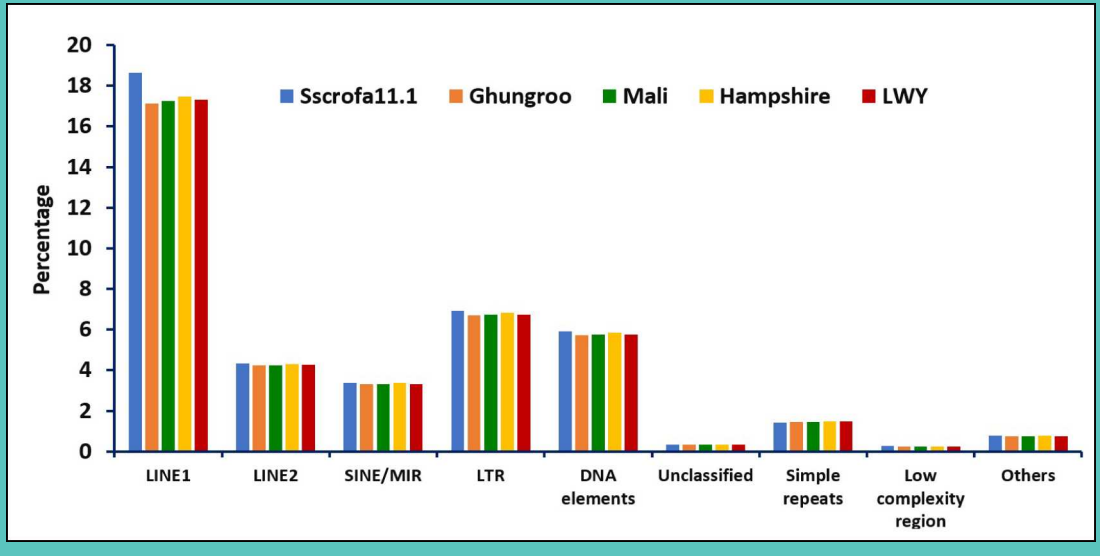


Distribution of contigs after sequencing in the pig genome in different breeds

On average, the genome contained 40% of repetitive elements, with minor differences between various pig genomes. The analysis of repeated elements in genome were identified as class I retrotransposons (long interspersed nuclear elements (LINEs), 17.3%; short interspersed nuclear elements (SINEs), 3.3%; total long terminal repeat elements, 6.8%).

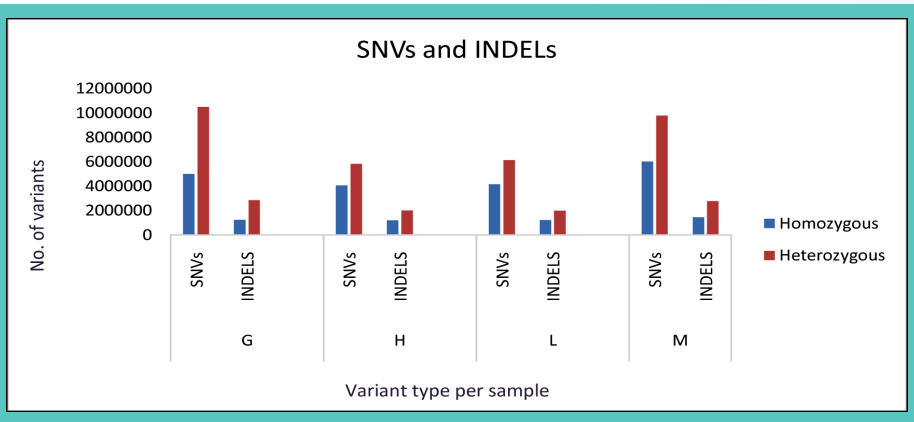


Comparison of four assembled genomes are in colinearity with reference genome *(Sscrofa11.1)*



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. The study identified 15809 common SNVs in indigenous pig breeds as against 4145 in exotic animals. Unique variants of heat shock protein genes were identified in Mali (23) and Ghungroo (42) genome, with implications on adaptability of indigenous animals. Various classes of variants were identified through genome-level comparison of Ghungroo, Hampshire, Mali and LWY genomes with the reference assembly *Sscrofa11.1.* Analysis revealed about 100864 Structural Variants (SV) in the genomes of four breeds, with 46687 deletions, 352 duplication, and 53825 insertions.

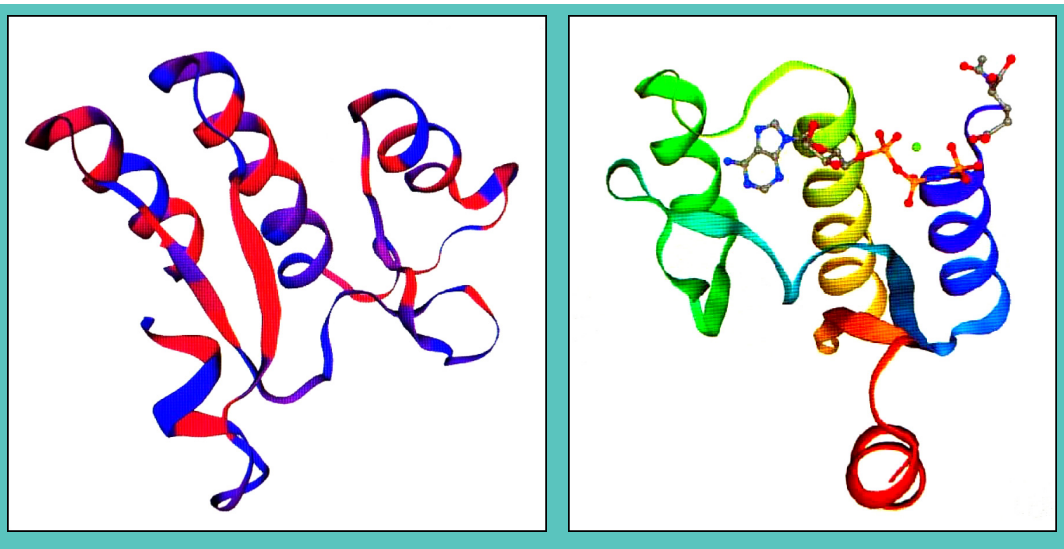


Distribution of single nucleotide variants and Insertion-Deletions in four breeds of pigs. G-Ghungroo; H- Hampshire; M-Mali and L-Large White Yorkshire

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

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

The project aims to develop a multi-epitope protein(s) using in sillicoimmunoformatics, express the recombinant protein and assess immune potential for future applications in assay development. Considering contextual importance, proteins from African Swine Fever, were identified from NCBI database, initially screened and epitopes were identified using online tools. After selecting epitopes, a draft model of protein was developed.



Structure of draft multi-epitope protein showing various motifs

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)

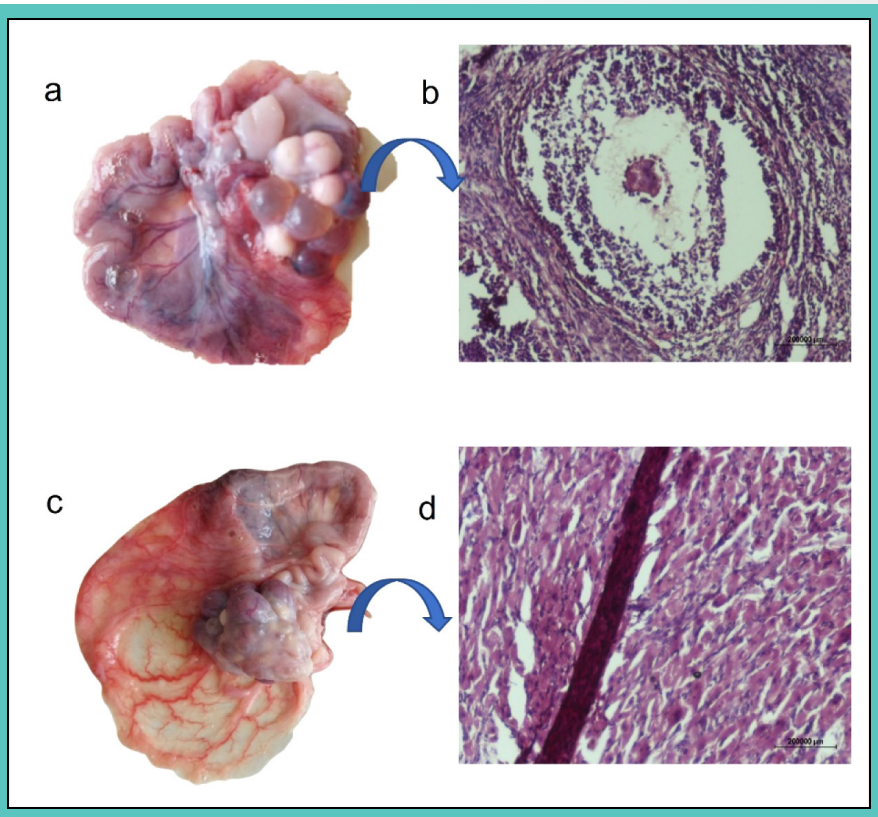
B. C. Das, K. Barman, S. Banik, P. J. Das, S. R. Pegu, S. Paul, Kalyan De, R. Deb, Sunil, Kumar, Jaya, M. Madhvan (till Aug, 2022), N. M. Attupuram, S. J. Devi, S. Baishya, H. Choudhary, A. Debnath, S. Das, E. Debbarman, S. Roy, T. Bhowmik

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 Karbianglong District, Assam and Dhalai District, Tripura covering eight villages. Demonstration of scientific and hygienic pig rearing, demonstration of value added products from pork and demonstration of backyard poultry farming among farmers in two districts. 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, Improvement through promotion of low cost, climate resilient housing, scientific feeding inputs and training of stakeholders/ farmers and organizing Pig health awareness camps/workshops/ kisan melas for judicious health management of pigs leading to better economic gain and disease free pork production.

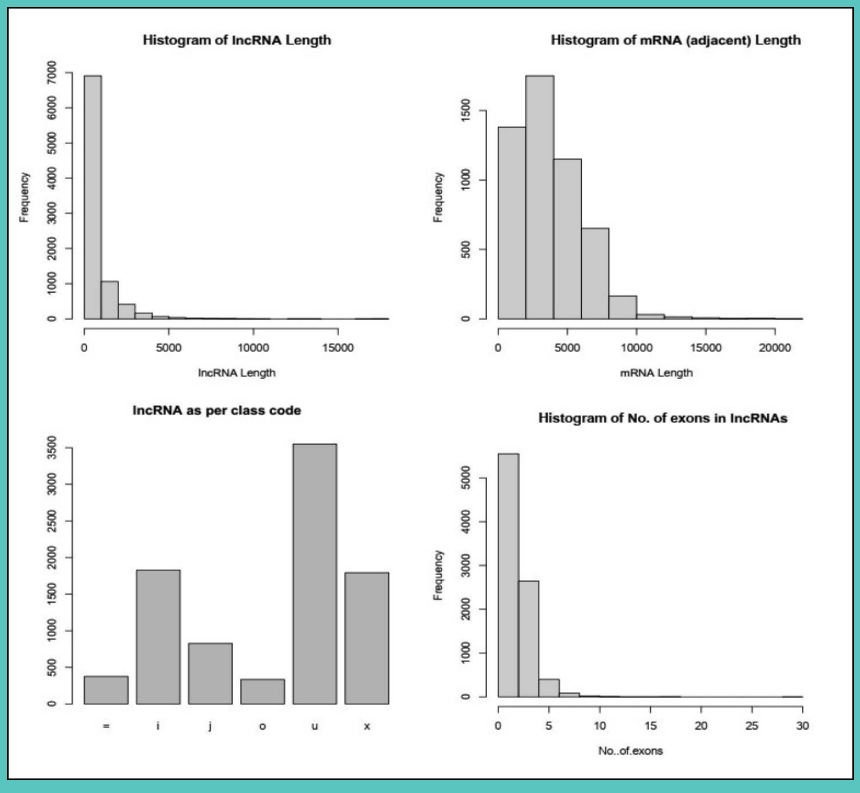
Institute Project: Investigation of Notch Signalling in Regulation of Ovarian Function in Pigs

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

An integrated analysis of mRNAs and long non-coding RNAs (lncRNAs) were undertaken to explore the novel signalling pathways regulating follicular to luteal phase transition in pigs. Ovarian samples were collected and classified into follicular and luteal phase based on its physiological characteristics and histological study of tissues were conducted to ascertain the tissue type and characteristics (Fig. a-d). RNA-seq data from luteal and follicular stage were subjected to bioinformatics analysis to obtain the global profile of mRNAs and lncRNAs, which was further explored to obtain differentially expressed genes (DEGs) and lncRNAs (DElncRNAs). A total of 8,709 lncRNA transcripts were identified, out of which only 376 (4 %) were known lncRNAs (class code "=") and others were novel. The length of lncRNAs ranged from 200 to 5000 bases whereas the length of its adjacent mRNAs (± 10 kb) ranged from 200 to 14000 bases. Among the novel lncRNAs transcripts identified, 3550 (41 %) were intergenic (class code "u"), 1828 (21 %) were completely intronic (class code "i"), 1793 (21 %) had exonic overlaps with the reference on the negative strand (class code "x"), 827 (9 %) were novel isoforms of known genes (class code "j") and 335 (4 %) had exons that overlapped with the reference transcript (class code "o"). Furthermore, the identified lncRNAs had few exons, with 2 exon being the most common in 4548 lncRNAs (52.2 %), followed by 3 exons in 1983 lncRNAs (22.8 %), 1 exons in 1003 lncRNAs (11.5 %) and 29 exons as the highest number in 1 lncRNA (< 0.1 %). The histogram of length distribution of lncRNAs, their adjacent mRNAs, class code and exon numbers.

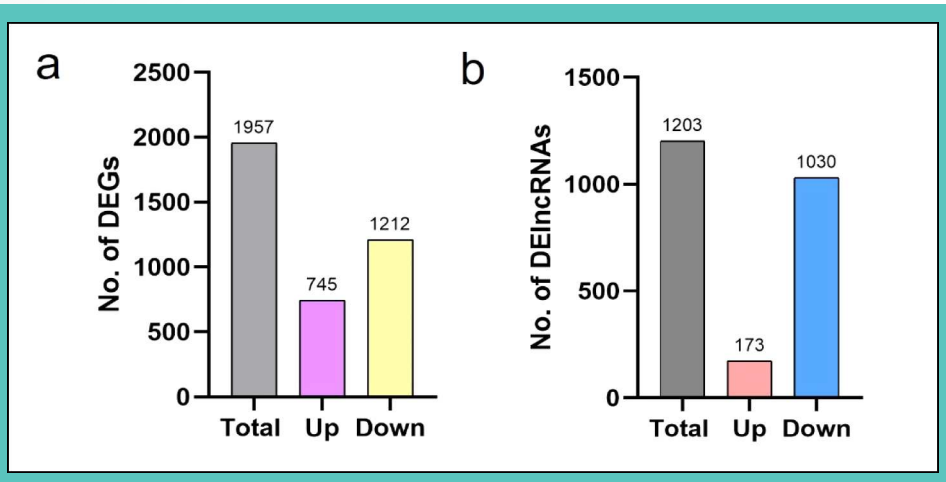


Ovarian samples. (a) Follicular stage; (b) Histological study of follicular tissue; (c) Luteal stage; (d) Histological study of luteal tissue

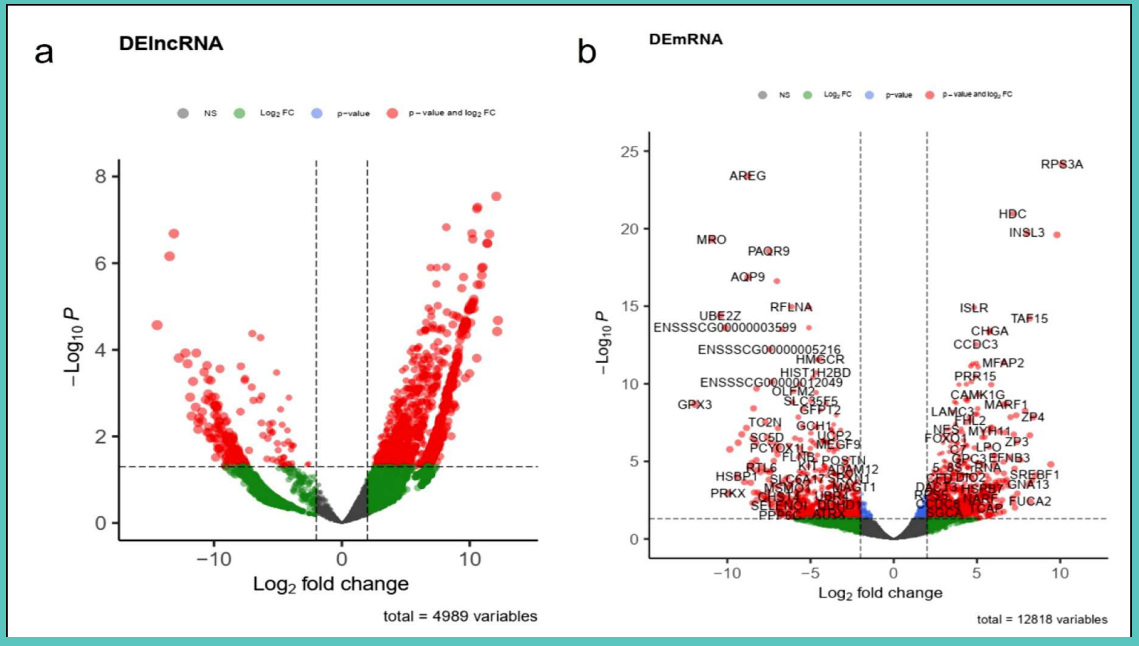


Features of lncRNA. (a) The histogram of lncRNA length distribution; (b) length of their adjacent mRNAs; (c) Class code; (d) Exon numbers

Differential gene expression analysis revealed 1957 DEGs (FDR < 0.05) between follicular and luteal phase comparison, of which 745 were upregulated and 1212 were downregulated in luteal tissues in comparison to ovarian follicles, indicating lower transcriptional activity due to specialized function of luteal tissues. The log2FC of the upregulated DEGs ranged from 11.939 to 1.335 and downregulated DEGs ranged from -10.136 to -1.247. The lncRNAs with an average count per million values of less than one was filtered for differential expression analysis with FDR < 0.05, which yielded 1203 DElncRNA, of which 173 were upregulated and 1030 were downregulated in luteal tissues in comparison to ovarian follicles. The log_2FC of the upregulated DElncRNA ranged from 14.436 to 2.595 to and downregulated DElncRNA ranged from -12.346 to -2.552. The volcano plot of differentially expressed mRNAs and lncRNAs depicts the expression dynamics of genes and lncRNAs regulating physiological development of ovarian follicle into corpus luteum.

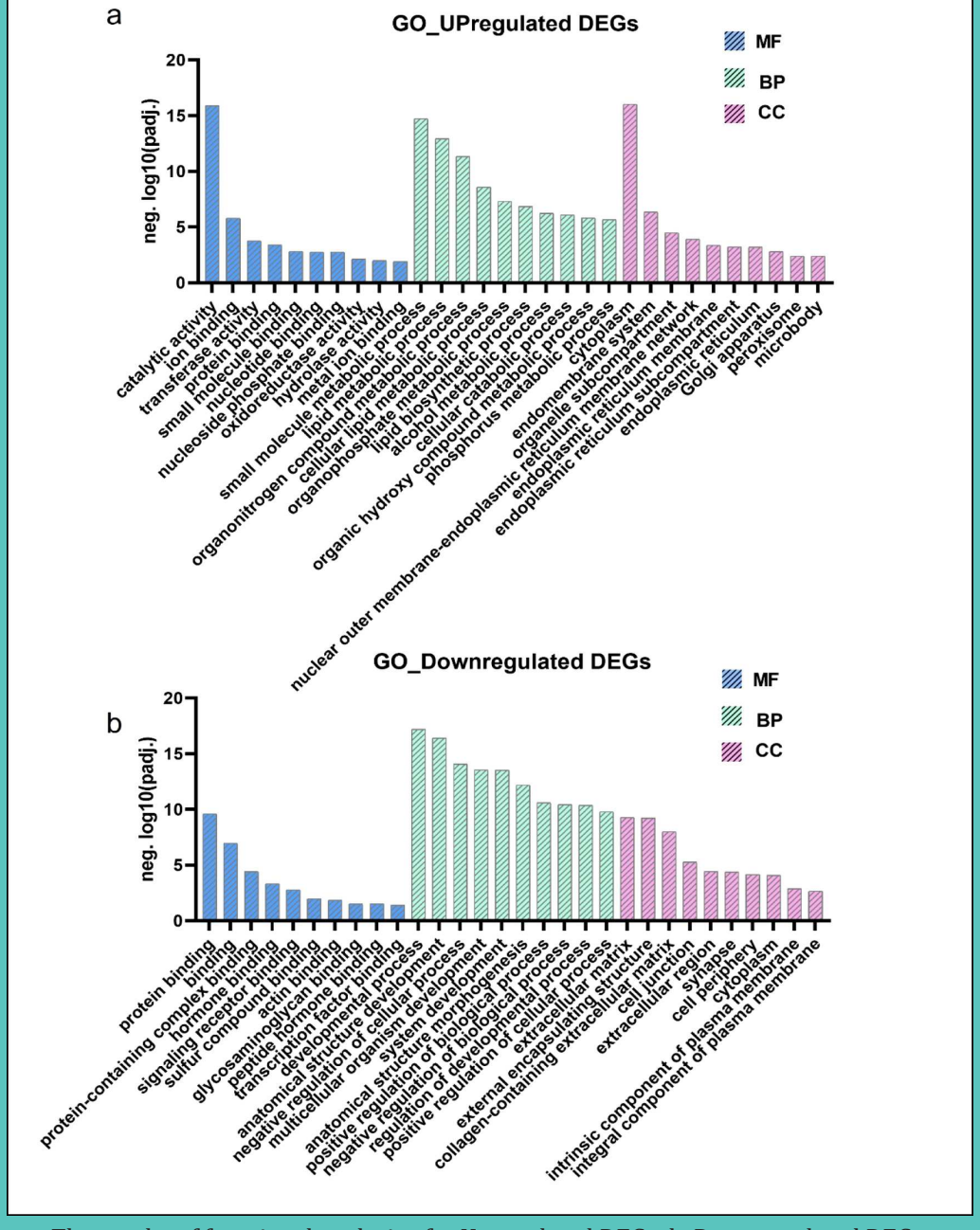


(a) Total number of upregulated and downregulated DEmRNAs in luteal tissues in comparison to ovarian follicles; (b) Total number of upregulated and downregulated DElncRNAs in luteal tissues in comparison to ovarian follicles



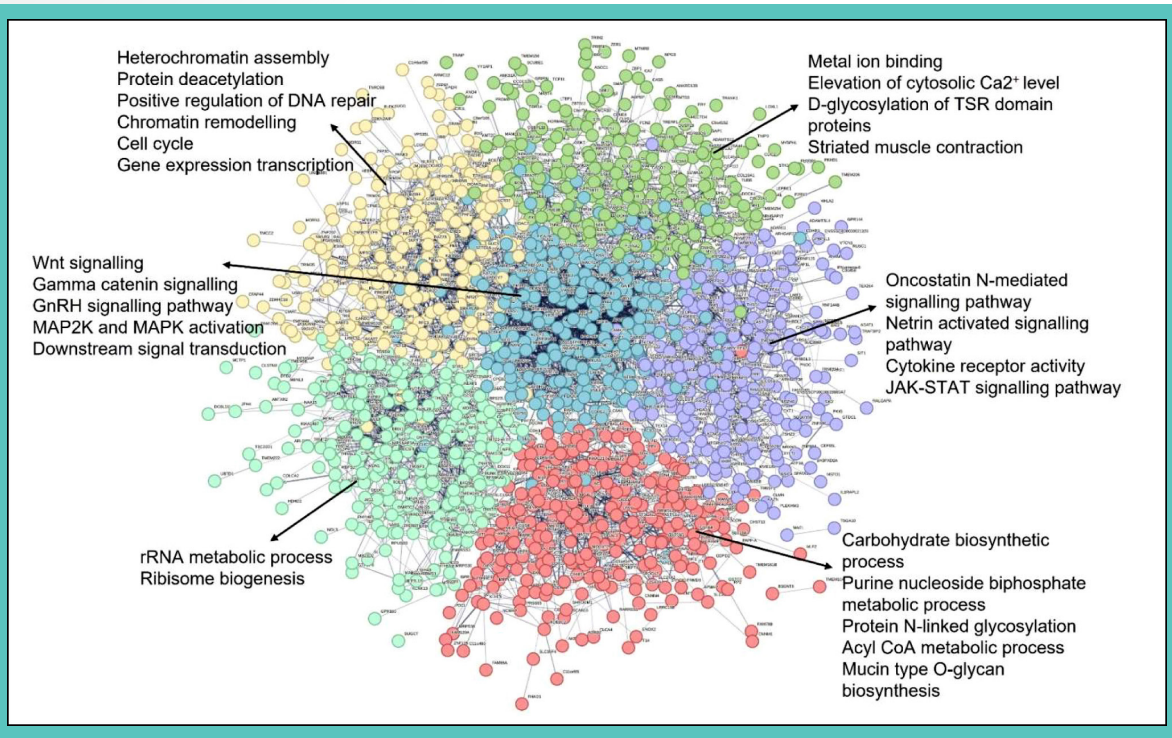
The volcano plot of differentially expressed (a) mRNAs; (b) lncRNAs regulating physiological development of ovarian follicle into corpus luteum.

The DEGs were subjected to functional analysis using g:Profiler, which revealed upregulation of 74 gene ontology (GO) categories (50 BP, 12 MF and 12 CC) in luteal tissues, whereas 217 GO categories (80 BP, 12 MF and 25 CC) were downregulated in comparison to ovarian follicles, indicating that follicular stage is more transcriptionally active and performs greater variety of biological processes compared to luteal tissues, which are mainly oriented for production of progesterone hormone. The KEGG pathways active in luteal stage comprised of metabolic pathway, steroid biosynthesis, peroxisome, terpenoid backbone synthesis and fatty acid metabolism, whereas KEGG pathways active in follicles comprised of ribosome, ECM-receptor interaction, hedgehog signalling, focal adhesion and axon guidance, indicating differences in the functionality of two tissues of similar origin, yet differentiated to perform different function.

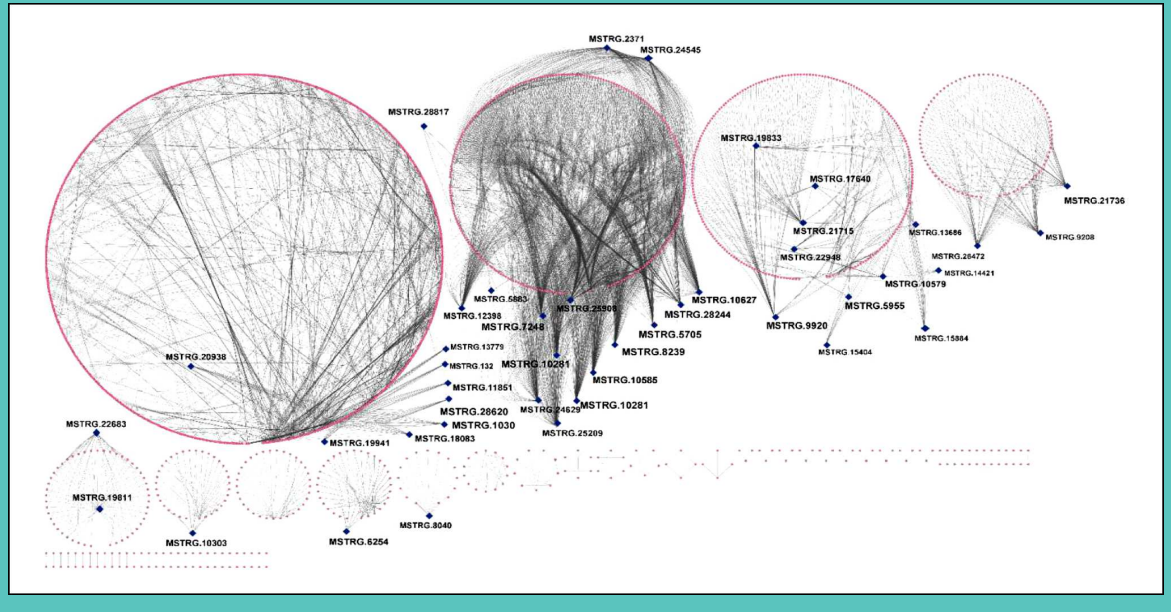


The results of functional analysis of a. Upregulated DEGs; b. Downregulated DEGs.

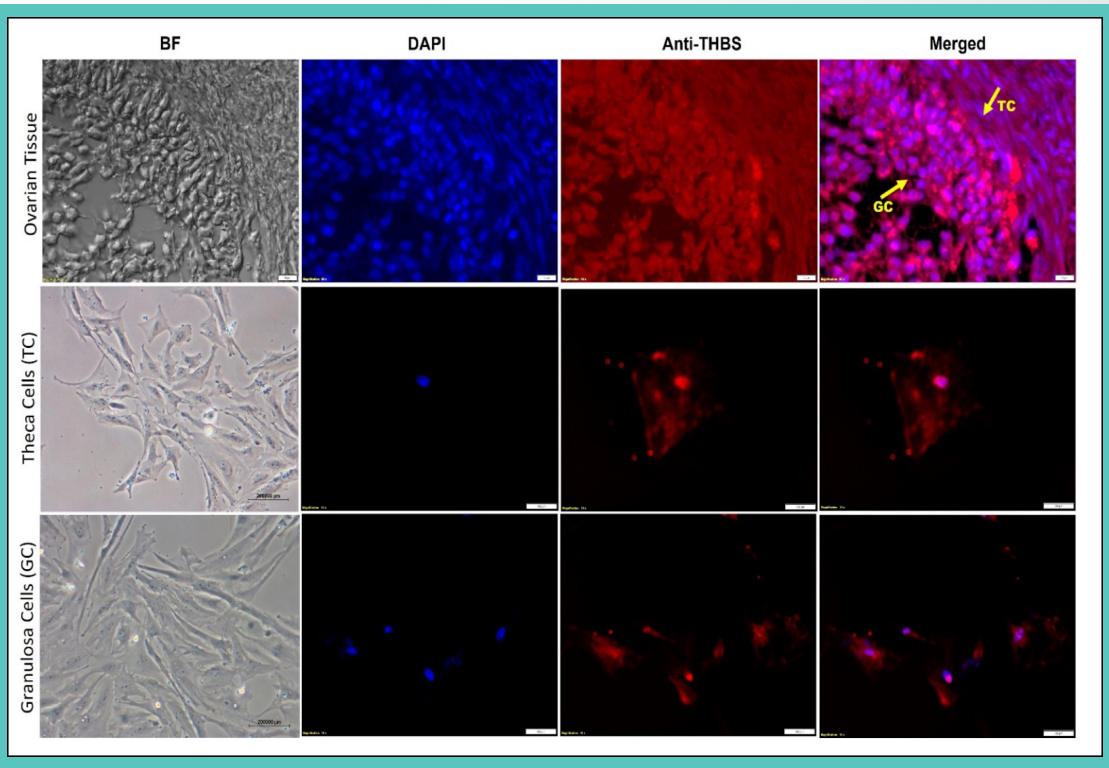
Since lncRNAs act either in cis or trans to regulate gene expression, we explored the potential target genes (PTGs) of lncRNAs, whose expression was highly correlated with the mRNAs. The genomic region spanning ± 10 kb of lncRNA were mined to obtain PTGs of lncRNAs, which revealed 2678 lncRNAs regulating 1839 protein coding genes, and can be considered as potential PTGs. Functional annotations of these PTGs, associated them with 369 GO terms (274 BP, 36 MF and 59 CC), which formed six clusters on K-means clustering and were related to KEGG pathways like cAMP signaling pathway, ErbB signaling pathway, neurotropin pathway, calcium signaling pathway, axon guidance and focal adhesion.



The different clusters (indicated by colours) formed on K-means clustering with their related KEGG pathways



The lncRNA-mRNA interactions with lncRNA regulating > 10 mRNA marked in the figure.



Immunolocalization of differentially expressed gene thrombospondin (THBS) in both theca and granulosa cells in ovarian tissue as well as in cell culture experiments.

There were 5711 lncRNA-mRNA interactions with interaction score > 0.9, indicating critical role of lncRNAs in ovarian physiology during follicular to luteal transition. These lncRNA-mRNA interactions are shown in the figure, wherein lncRNA regulating > 10 mRNA is marked in the figure. The density of edges connecting the nodes of lncRNA shows the strength of regulatory role of lncRNA in cellular functionality during the transitional change in ovarian follicles differentiating into luteal tissues. One such differentially expressed gene thrombospondin (THBS) has been shown immunolocalized in both theca and granulosa cells in ovarian tissue as well as in cell culture experiments.

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

Retrospective disease data of the area under study: Before collection of samples from the area under study, we obtained available retrospective disease data (number of confirmed cases recorded during 2016-2021) with regards to the diseases selected for study under this project. The area under study (as assigned) for ICAR-NRC on Pig is the state of Sikkim and all the districts of North Bank of Assam. The number of confirmed cases recorded in the State of Assam (for whole Assam) for selected diseases such as brucellosis, tuberculosis, Japanese encephalitis (JE), cysticercosis, lumpy skin disease (LSD), African swine fever (ASF), porcine reproductive and respiratory disease syndrome (PRRS), listeriosis and salmonellosis were 143, 2, 75, 23, 12, 167,

2, 12 and 146, respectively. The number of confirmed cases recorded for brucellosis and Japanese encephalitis in the state of Sikkim were 59 and 3, respectively. Interestingly during the current year (2022), outbreaks of African swine fever (confirmed cases: 43 nos.) and Porcine reproductive and respiratory disease syndrome (confirmed cases: 6 nos.) have been recoded from Sikkim and this the first report of occurrence of these two diseases (ASF and PRRS) in the state of Sikkim.

Screening of porcine serum samples against assigned diseases: During the reported period total 705 (599+106) serum samples were collected (including 106 additional samples) against targeted 599 samples from Assam for screening against ASF. Of these (599) samples screened, 15 samples (percent positivity:2.5%) were found positive for ASF. Similarly, a total of 100 (20+80) serum samples were collected (including 80 additional samples) against targeted 20 samples from Sikkim for screening against ASFV. Of these (20) samples screened, only one sample (additional sample) was found positive for ASF. A total of 437 (328+109) serum samples were collected (including 109 additional samples) against targeted 328 samples from Assam for screening against PRRS. Of these (328) samples screened, four samples (percent positivity:1.2%) were found positive for PRRS. Similarly, a total of 40 (20+20) serum samples were collected (including 20 additional samples) against targeted 20 samples from Sikkim for screening against PRRS. Of these (20) samples screened, none of the sample was found positive for PRRS.

A total of 213 serum samples were collected against targeted 213 samples from Assam for screening against swine influenza (SIV). Of these (213) samples screened, 98 samples (percent positivity:46.0%) were found positive for SIV. Similarly, a total of 20 serum samples were collected against targeted 20 samples from Sikkim for screening against SIV. Of these (20) samples screened, 11 samples (percent positivity:55.0%) were found positive for SIV.A total of 166 serum samples were collected against targeted 537 samples from Assam for screening against JEV. Of these (166) samples screened, 38 samples (percent positivity:22.89%) were found positive for JEV.

Table : Statistically defined sample size and serological test results of Assam

Disease	Target sample no	Sample tested	Percentage tested	No. of Positive	Percentage positive	Additional sample tested	Additional positive
ASF	599	599	100%	15	2.50%	106	0
PRRS	328	328	100%	4	1.20%	109	0
SIV	213	213	100%	98	46.00%	0	0
JEV	537	166	30.91%	38	22.89%	0	0
Brucellosis	105	105	100%	7	6.66%	77	0

Table : Statistically defined sample size and serological test results of Sikkim

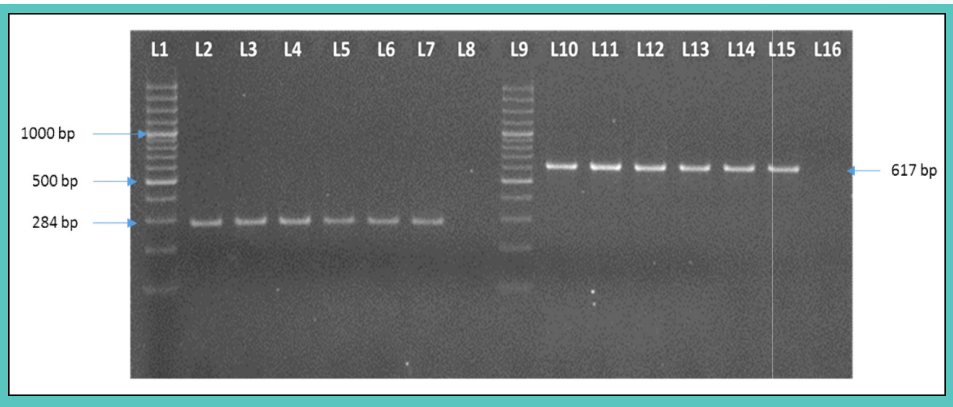
Disease	Target sample no	Sample tested	Percentage tested	No. of Positive	Percentage positive	Additional sample tested	Additional positive
ASF	20	20	100%	0	0.00%	80	1
PRRS	20	20	100%	0	0.00%	20	0
SIV	20	20	100%	11	55.00%	0	0
Brucellosis	20	20	100%	4	20.00%	39	7

Screening of meat samples for detection of Salmonella: A total of 168 meat samples (Assam: 148 & Sikkim: 20) were collected from the assigned districts of Assam and Sikkim for the

detection Salmonella in these meat samples. For this purpose, samples were initially screened by conventional method (bacterial culture, Gram staining, and biochemical test) and further confirmed by PCR using specific primers. For the confirmation of Salmonella two genes namely invasion protein (invA) gene and enterotoxin (stn) gene were targeted. Out of 168 samples tested, 88 (52.38%) were found positive for the presence of Salmonella using both conventional and PCR tests.

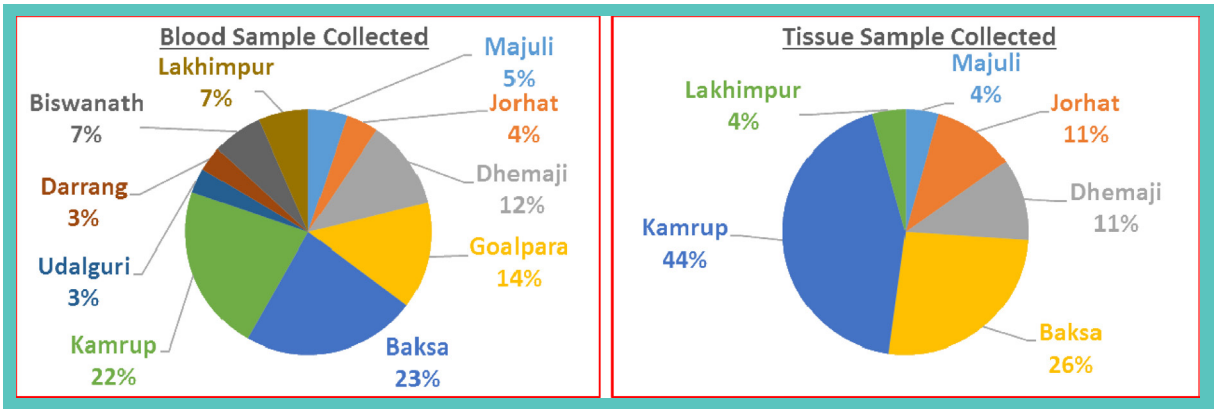
Table : Statistically defined sample size and test results of Salmonella

Target sample no	Sample tested	% tested	No. of Positive	% positive	Additional sample tested	Additional positive	Additional positive
252	148	58.73%	84	56.76%	0	0	1
20	20	100%	4	20%	0	0	0



Detection of Invasion protein (invA) gene (L2 to L8) and enterotoxin (stn) gene (L10 to L16) of *Salmonella* spp. in PCR from different meat samples. Here, L1 and L9: 100bp plus ladder, L2 and L10: Positive control, L8 and L16: Negative control, L3 to L7 and L11 to L15: test samples

Molecular detection of selected pathogens from biological samples of pig: Apart from serological screening for the assigned diseases under the project, relevant samples were also collected from outbreak cases and from clinical cases to confirm the presence of the etiological agent of the disease by molecular means. For this purpose, a total of 213 blood, 46 pooled tissue and 147 nasal swab samples were collected from different districts of Assam during different outbreaks cases. The samples were tested for the presence of ASFV, PRRSV, SIV & JEV by RT-PCR. A total 70 blood sample and 30 tissue samples were tested positive for ASFV. A total of 13 blood sample and 2 tissue samples were tested positive for PRRSV. A total 4 blood sample were tested positive for JEV. All nasal swabs were found negative for SIV. Total percentage of samples positive (both blood and tissue samples included) for ASF, PRRS and JE were 38.61, 5.41 and 1.54 %, respectively.



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)

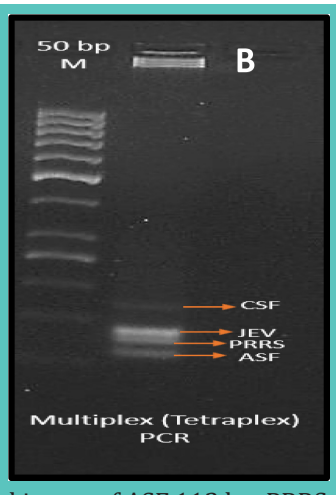
S. R. Pegu, S. Rajkhowa, P. J. Das, R. Deb and V. K. Gupta

Expression and purification of porcine capsid viral (CAP) protein for the development of ELISA & LFA for PCV2 diagnosis has been accomplished. Optimized precise and rapid diagnosis of ASF and PRRS by probe based qRT-PCR. Developed two multiplex PCR assay for simultaneous detection ASF, PCV & PPV and PRRS, CSF & JEV and validated in three different research organizations.

PiggyplexD $^{ASF, PCV2 \&PPV}$ Assay

Piggyplex R $^{CSF, JE \& PRRS}$ Assay

Optimized one multiplex PCR assay for simultaneous detection of four viruses -ASF, PRRS, JEV and CSF. Multiplex PCR for respective primers were optimized by different annealing temperature using gradient PCR. The optimal annealing primer 57°C was used for final diagnosis of multiplex PCR. Optimization of multiplex PCR positive amplicons of ASF 112 bp, PRRS 126 bp, JEV, 137 bp and CSF 156 bp respectively.



Optimized Multiplex PCR agarose gel image of ASF 112 bp, PRRS 126 bp, JEV, 137 bp and CSF 156 bp.

Service project: Surveillance and Monitoring of Swine Diseases in NER

S. Rajkhowa, S.R. Pegu, S. Paul, J. Doley, R. Deb

Sero-prevalence and molecular epidemiology of important porcine viral diseases in pigs

in northeastern part of India with special reference to Assam: A total 323 pig sera samples were collected/received from five districts of Assam viz. Goalpara, Dhemaji, Tinsukia, Kamrup, sonitpur, Baksa and four other NE sates– Sikkim, Manipur, Meghalaya, and Tripura. 23 samples (7.12%) were positive for PRRS, 25 samples (7.73%) positive for JEV, PCV2 positive for 26 samples (8.045), 48 positive (14.86%) for ASFV and 56 samples (17.33%) positive for CSFV. In addition, 146nos. of tissue samples and 145 blood samples were analyzed by PCR and LFA for the presence of CSFV, ASFV, PCV2, JEV and PRRSV. 14 samples (4.81%) were positive for ASFV, 7 samples (2.40) positive for JEV, 25 samples (8.59%) positive for PCV2 and 24 samples (8.24%) were positive for ASFV and CSFV were found positive in 20 samples (6.87%).

In addition, 237 samples of tissue and fecal samples were collected from different pig farms and slaughter unit of Sikkim and Assam for screening of important bacterial pathogens of pig. 32(13.50%) positive for E coli, 5 positive for *Pasteurella maltocida* (2.10%), *Streptocococcus suis* (3.79%), 4 samples (1.68%) positive for clostridium spp and 12 samples (5.06%) positive for *Staphylococcus aureus* from the total 237 screened samples. A total of 102 fecal samples, skin scrapings and blood samples were collected from different backyard and organized pig farms of three districts of Assam (Darang, Nalbari and Kamrup) for screening of important parasites of pig. Out of all 102 samples, 20 samples (19.60%) positive for coccidian, 11 samples(3.78%) and 4 samples (1.37%) were found positive for *Sarcopticmanges* infestation. None of the blood samples were found to be positive against blood hemoprotozoan parasite.

Further, 48 piggery waste samples were subjected for antibiotic sensitivity testing using different classes of beta lactam antibiotics. Among different beta lactam antibiotics, it was observed that the resistance of cefoxitin (35.41%) was higher followed by oxacillin (22.91%), cefuroxime(18.75%), cefazolin (14.58%), ampicillin (10.41%), cefepime (6.25%) and cefotoxime (4.16%). However, we could not get any resistance against meropenem. A total of 25 post-mortem 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, haemorrhagic spots on the lower abdomen, ear and facial region, spleenomegaly with hemorrhages, hemorrhagic lymphadenitis, severe petechial hemorrhage in the kidney, Pneumonia in the lungs and Necrotic palatine tonsil. Histopathological& ultrastructural examination revealed the depletion of lymphocyte in the lymphoid organs, hemorrhages in multi organs.

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

S. Paul, S. Rajkhowa, S. R. Pegu, J. Doley, Kalyan De, R. Deb, S. Banik

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.

Coccidiosis due to Eimeria spp. – symptoms and clinical manifestations observed: Coccidial infections generally receive little attention and are often overlooked because clinical symptoms are rarely apparent. Most Eimeria spp. are considered to be only mildly pathogenic because they live in superfcial epithelial cells, athough in case of some (e.g. *E. debliecki, E. scabra*, and *E. spinosa*) diarrhoea has been seen in piglets. *Eimeria scabra* infection lead to diarrhoea and anorexia accompanied by signs of nonhemorrhagic enteritis faecal samples showed numerous oocysts at different stages. Although, eimerian infections were generally asymptomatic but dehydration, wasting, poor growth, sloppy diarrhea, were evident and faeces may occasionally be tinged with blood. The infection lead to loss of production mainly from retarded growth, delayed fertility, reduced productivity, high morbidity, it damages the intestinal mucosa and thus impairs the normal intestinal functions and processes.

Coccidiosis due to Cystoisopora spp. – symptoms and clinical manifestations observed: In contrast to *Eimeria* infection, where development of pathological signs are not common, even light infection of C. suis may cause mild to severe symptoms in neonatal piglets. Infection is most common in piglets which are just 7-14 years old, in one case *C. suis* was found in 5 day old piglet. The typical symptoms consisted of non-haemorrhagic pasty to watery diarrhoea with strong acidic odour, later the stool becomes pasty with lot of gas bubbles there may be dehydration, rough hair coat, loss of weight and weakness. The morbidity is high and mortality is low to moderate. One interesting phenomena observed was that in the same litter all piglets are not affected evenly, some show frank symptoms while the rest of the litter remains healthy. This disease may be one of the major reason for unequal weaning weights.

Coccidiosis due to Cryptosporidium spp. - symptoms and clinical manifestations observed: *Cryptosporidium* infections were the most common in piglets more than one month but generally less than six months of age. In fact, infections were detected less frequently in piglets younger than one month. It was found that, *Cryptosporidium* infections were more common in 5-9 week week-old piglets. Also, infections were more common at weaning time. This may be due to combination of stress and reduction in maternal immunity by time. General symptoms included anorexia, occasional diarrhoea with intermittent oocyst shedding. Vomiting may some times occur in addition to diarrhoea but it may be due to secondary bacterial/viral infections.

Winter Coccidiosis: Samples could be collected during winter (Nov-Jan). Total 79 samples were collected from farm and farmer's flock. Spring, summer and rainy season samples could not be collected due to restrictions imposed due to ASF outbreak in the state. Of the total 79 samples 47 were collected from farm and 32 were collected from various farmer flocks (Garopara, Umsur, Nongpo, Ganapati village, garo village, Rajapanichanda).

Samples collected from farmer herd (semi intensive/ backyard) (n=32)				
Age Group (approx)	0-15 days	15-30 days	30-45 days	45-60 days
Samples collected	08	11	04	09
Samples positive	*C. suis* -03	*Eimeria* spp.- 07 *C. suis*- 02	*Eimeria* -02	*Eimeria* spp. – 03 *Cryptosporidium* - 02

Samples collected from farm (n=47)					
Age Group (approx)	0-15 days	15-30 days	30-45 days	45-60 days	60-90 days
Samples collected	07	06	06	06	22
Samples positive	*C. suis* -01	*Eimeria* spp.- 02 *C. suis*- 01	*Eimeria* -03	*Eimeria* spp. – 04	*Eimeria* spp. – 03 *Cryptosporidium* - 02

Of the 7 cases in which *C.* suis was found, in 4 cases it was in piglets below 10 days of age of age and in specifically one case C. suis was detected in a 5 day old piglet, which corroborates the fact that *C. suis* is a primary enteropathogen. 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. As in this case it was observed that *2 C. suis* positive piglets died at about 22 days of age. And *C. suis* oocysts were not found in animals beyond one month of age, which might coincide with establishment of preimmunity 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 86 days in few cases. In postweanedpiglets infection with *Eimeria* spp. and *Cryptosporidium* were increasingly found which indicates that weaning stress is a major factor in coccidian disease dynamics.

Disease threshold level: The threshold Oocyst per gram (OPG) level for different coccidian parasites were estimated with quantitative faecal examination by McMaster technique. Presence of diarrhoea, body condition etc was correlated with the OPG count to arrive at conclusion.

Threshold limit	Upper limit	Lower limit	median
Coccidia species			
C. suis	3800	2200	2800
Eimeria spp	11200	5600	8500
Cryptosporidium spp	---	---	---

Detection threshold level: Although oocysts are often present in high numbers in individual samples, detection by concentration before microscopic examination can be hampered by the high content of fat in suckling piglets' faeces and especially in cases of steatorrhea as described for cystoisosporosis; which can both prevent detection of oocysts by flotation and impede correct diagnosis in smears as lipid droplets may be taken for unsporulated oocysts. Concentration of oocysts from faecal material of suckling piglets can be problematic since the high fat content may lead to aggregation of a lipid layer with enclosed oocysts on top of the flotation solution after centrifugation. Several modifications of standard protocols are described in the literature. The most common flotation medium for *C. suis* oocysts is Sheather's sugar solution or modifications of it. In our hands, however, none of the applied flotation solutions, even with the use of detergent, could prevent the formation of fat plugs.

An alternative to remove most of the fat in piglet faeces is the use of Percoll® in an

additional sedimentation step. Percoll® is a density gradient separation medium of low viscosity, low osmolarity and low toxicity. It has been used as flotation solution for *C. suis* in piglet faeces with good success. It is, however, most suitable for concentration of oocysts from faeces by sedimentation for further processing of oocyst. But it is expensive and therefore attempts were made to replicate similar results with sugar-salt flotation medium. We, tried to concentrate oocysts from pooled samples with sugar-salt flotation solution and also sheather's solution. Then we counted the oocysts in the purified fraction and then did spiking with that oocyst fraction in plain tap water. The results of spiking experiment are shown below.

Oocyst Concentration	**10000**	**8000**	**5000**	**1000**	**800**	**600**	**500**	**200**	100
Salt flotation	√	√	√	√	×	×	×	×	×
Sugar floatation	√	√	√	√	×	×	×	×	×
Sheather's floatation	√	√	√	√	√	√	√	×	×
Sugar-Salt Floatation	√	√	√	√	√	√	√	√ / ×	×

It was found that Sheather's flotation as well as Sugar-Salt floatation was the most effective method, with the later able to detect upto 300 oocyst / sample.

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

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

To study the sero-prevalence of ASFV in the region, two hundred and Eighteen (218) serum samples collected from different districts of Assam during various outbreaks. Serum samples were screened for detection of antibodies against ASFV using Commercial ELISA kit (Ingezim) and six (06) samples were found positive for ASFV. More samples needs to be collected for sero-epidemiological studies in the whole North Eastern region of the Country

Area	**Samples collected**	**Samples Positive**
Majuli	11	0
Jorhat	09	0
Dhemaji	65	1
Goalpara	30	0
Baksa	27	0
Kamrup	45	2
Lakhimpur	16	3
Nalbari	15	0
Total	218	6

To study the molecular diversity of ASFV in the region: Suspected tissue samples were collected from different districts of Assam and Manipur. The samples were screened by PCR and was sent to ICAR-Indian Veterinary Research Institute for further confirmation of the ASF virus. In collaboration with ICAR-Indian Veterinary Research Institute. Whole Genome Sequencing of ASFV Isolate from the outbreak in Dhemaji District has been completed and obtained NCBI accession number OK236383. Whole Genome Sequencing Isolate from Manipur has been also been done. Further, more samples are to be collected from different states of North Eastern Region for epidemiological studies

Institute Project: Kinetics of FMD virus serotype specific protective antibody response induced in pigs vaccinated with commercial FMD vaccine intended for use in cattle

J. Doley, S. R. Pegu, R. Islam, Kalyan De, N. H. Mohan, R. P. Singh, J. K. Mohapatra, C. Jana, N. R. Sahoo, M. Rout, A. Sahoo, R. Ranjan and S. A. Khulape

Screening of piglets of 8-12 weeks of age at NRC on Pig for FMD virus antibodies by NSP ELISA, SPCELISA and VNT. Commercial vaccines was used for vaccination in pigs (n = 6 for intramuscular group, n=5 for intradermal group and n=2 for the control group under each regimen). Vaccination was given after 12 weeks, booster at 28 days and repeat vaccination every 4 months/ 6 months .Serum sampling was done at 0, 7, 14, 21, 28d, post-primary vaccination and subsequently at monthly intervals was done and tested by both SPCELISA and VNT for serotype specific seroconversion titre .Non-vaccinated or placebo control group of pigs have been maintained throughout the experiment and sampled and tested by all three assays. Experiments were conducted to evaluate the magnitude and persistence of neutralizing and binding antibody response in pigs vaccinated for FMD under various regimens in order to determine the usefulness of w/o single oil emulsion commercial FMD vaccine (licensed for use in cattle, buffalo, sheep and goat in India) in pigs. In the intradermal group, serum samples subjected to VNT employing serotype 0, A and Asia 1 virus, have shown marginal titre antibodies [22 (61066) & 32 (61067)] in the 21st day against serotype O. In the intramuscular group, serum samples subjected to VNT employing serotype 0, A and Asia 1 virus, have shown marginal titre antibodies [22 (61070),22 (61071) and 22 (61079)] in the 21st day against serotype Whereas in the control group, serum samples subjected to VNT employing serotype 0, A and Asia 1 virus, did not show any titre against serotypes. Results of the experiments suggests that the immunization with commercial vaccine for cattle being used in pigs under the experimental results through Intradermal and Intramuscular group did not elicit protective antibody response in the vaccinated animals.

Institute Project: Molecular and Serological detection of Porcine Parvovirus (PPV) and its characterization

J. Doley, R. Deb, S. R. Pegu, P. J. Das, S. Paul, P. Deka, N. H. Mohan and S. Rajkhowa

Sero-prevalence studies for PPV in the pig population were carried out from different areas in Districts in Assam. Two hundred and twelve (212) serum samples were screened for detection of antibodies against Porcine Parvovirus employing commercial ELISA kit (Ingezim PPV). The overall percent sero-positivity rate of PPV (36/212) was found to be 16.98 % in Kamrup district and adjoining areas. Samples from areas of Kamrup, Baksa, Goalpara, Nalbari, Majuli, Jorhat, Dhemaji, and Lakhimpur districts showed percent sero-positivity of 22.8, 18.5, 0, 20.0, 18.1, 17.02 and 18.7 % for PPV infection

Percent positivity of PPV			
Area	Samples collected	Samples Positive	Percent positivity
Kamrup	57	13	22.8
Baksa	27	05	18.5
Goalpara	30	---	---
Nalbari	15	03	20.00

Majuli	11	02	18.18
Jorhat	09	01	11.12
Dhemaji	47	9	17.02
Lakhimpur	16	03	18.75
	212	36	16.98

To identify and characterize PPV associated with swine reproductive problems, out of the total of 40 samples (tissue sample- Placenta, aborted foetuses, Lymph nodes, Liver, Lungs) screened by PCR for detection of PPV antigen, 5 samples were found positive. Positive samples showed amplification 242bp specific to *NS1* gene of PPV.

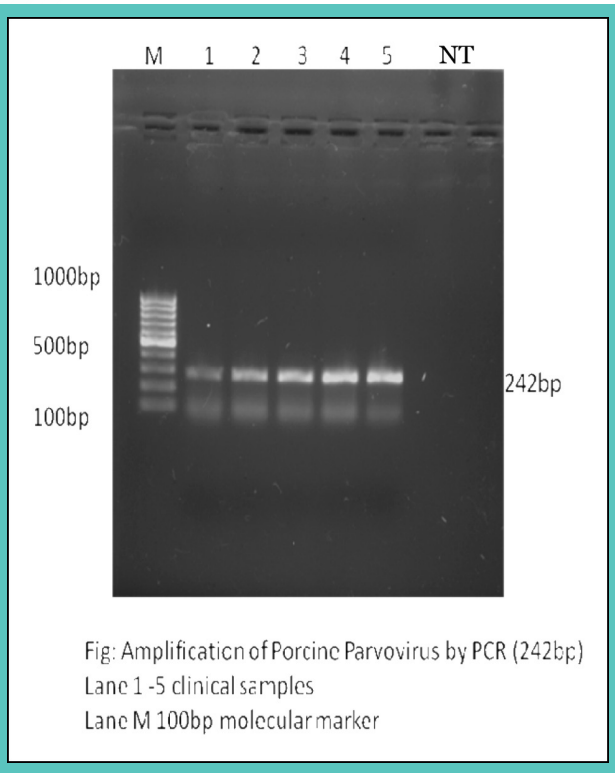


Fig: Amplification of Porcine Parvovirus by PCR (242bp)
Lane 1 -5 clinical samples
Lane M 100bp molecular marker

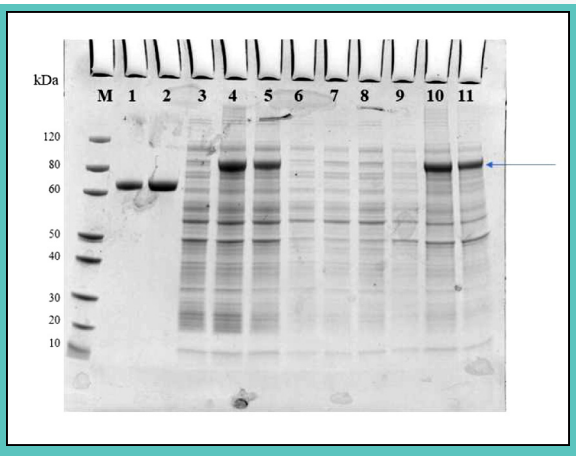
Development and standardization of PCR method for detection of PPV using self-designed primers has been achieved. Studies for molecular characterization by Whole Genome Sequencing of PPV have been undertaken for collected samples screened positive by PCR for PPV.

Institute Project: Development of CD163 host receptor based sero-diagnostic for early detection of porcine respiratory and reproductive syndrome virus

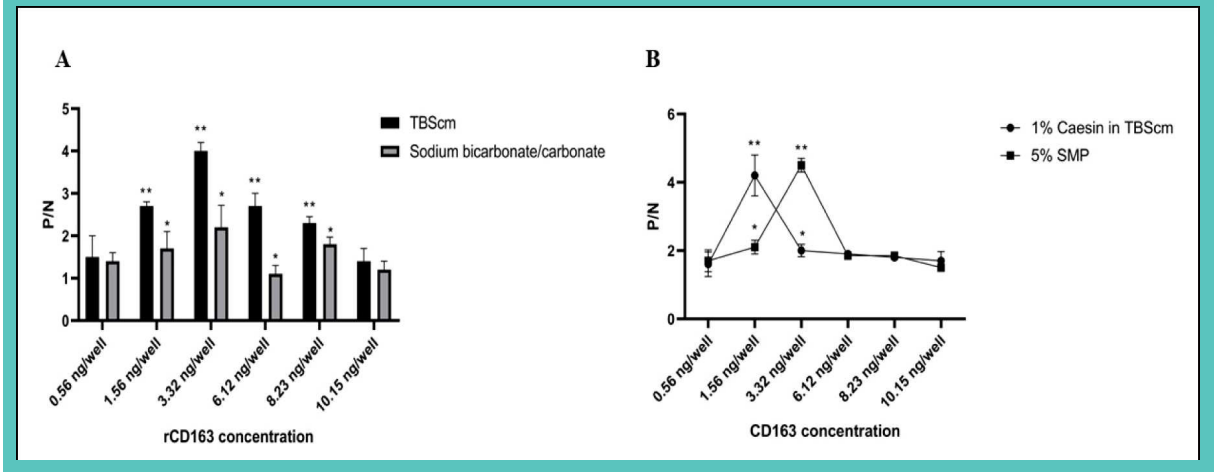
R. Deb, S. Rajkhowa S. R. Pegu, J. Doley, S. Paul

Development of PRRSVCD163-iELISA for detecting PRRSV antigen in piggery post mortem samples: Porcine reproductive and respiratory syndrome (PRRS) is an important economical disease in the global swine industry. The accurate detection of the PRRS virus (PRRSV) antigen is essential for the disease control and prevention programme. In this study, an indirect enzyme-linked immunosorbent test (PRRSVCD163-iELISA) was developed for the detection of the PRRSV antigen in samples of post-mortem swine tissue using the recombinant pig CD163 receptor protein as the capture ligand. The test was found to be specific for PRRSV, with no cross-reactions with other prevalent pig viral pathogens. The assay was validated by testing 217 post-mortem porcine

tissue samples and the results were found to be satisfactory with a relative accuracy of 88.88%. Our assay is also quite precise, with intra- and inter-assay CVs of 6% and 10%, respectively. These findings imply that the PRRSVCD163-iELISA developed is capable of detecting the PRRSV antigen in swine post-mortem tissue samples. This research showed that porcine CD163, the PRRSV cellular receptor, can be exploited to build a diagnostic technique for the detection of PRRSV antigen.



SDS-PAGE analysis of recombinant porcine CD163 receptor protein expressed in in pET-30a (+) expression vector.



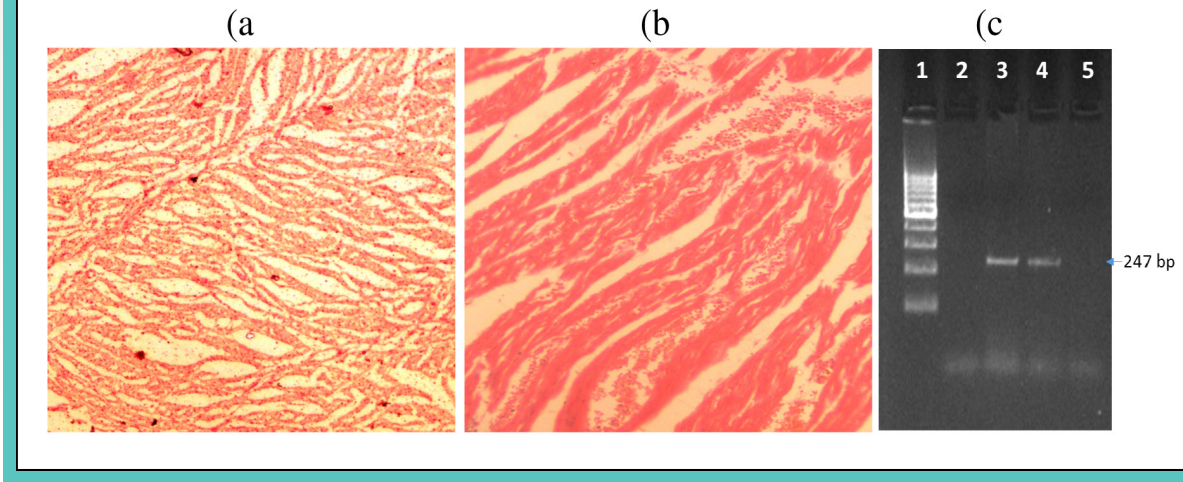
The parameters of the CD163 PRRSV-iELISA were optimized. (A) Coating buffer optimization. (B) Blocking buffer optimization

External Funded Project: Development of a virus like particle- based vaccine against Indian isolate of Porcine Circovirus

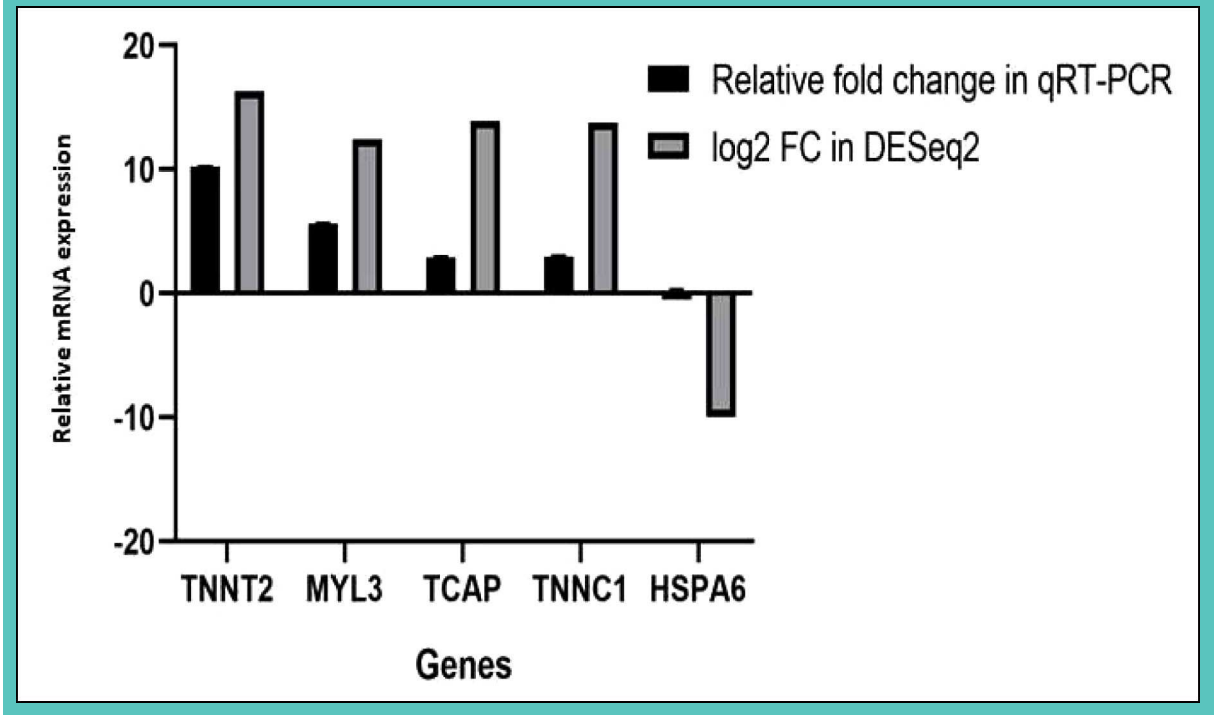
R. Deb, S. Rajkhowa, J. Doley, H. K. Maity (WBUAFS), A. P. Acharya (WBUAFS), S. De (NDRI)

Porcine circovirus type 2 infected myocardial tissue transcriptome signature: The goal of this study was to compare the global gene expression profile in cardiac tissues of pig infected with porcine circovirus 2 (PCV2) to that of healthy cells. Since PCV2 infection causes severe cardiovascular lesions, the myocardial tissue model was chosen for this study. In High-throughput transcriptome analysis, DESeq2 and CLC genomics workbench analyses revealed a total of 196 significantly differentially expressed genes (DEGs) (p-value < 0.05). Furthermore, 194 transcripts were upregulated, while only two were downregulated (HSPA6 and DNAJA1), with fold changes

ranging from 16.293 to -10.002. Among the KEGG canonical pathways targeted by the DEGs in the functional analysis, adrenergic signalling in cardiomyocytes, Cardiac Muscle Contraction, Hypertrophic Cardiomyopathy (HCM), and Dilated Cardiomyopathy (DCM) tends to be enriched. The differentially expressed highly connected (DEHC) biomarker genes in pathogenicity of PCV2 infection, such as LDB3, MYOZ2, CASQ2, TNNT2, MLC2V, MYBPC3, ACTC1, TCAP, TNNI3, TRDN, CSRP3, MYL3, RYR2, LMOD2, MYH7, etc., were identified using protein-protein interaction (PPI) network analysis. The study might provide detailed information on the dysregulated genes and biological pathways in infected myocardial tissues that may be essential for PCV2-related heart pathology.



Histopathology of Myocardial tissue and PCR confirmation of PCV2 genes. (a) Myocardial necrosis with cellular infiltration H&E X 4. (b) Haemorrhage in the myocardium of Heart H&E X 20. (c) PCR amplified products



Relative mRNA expression of *TNNT2, MYL3, TCAP, TNNC1* and *HSPA6* in the post-mortem porcine myocardial tissues infected with PCV2 in qRT-PCR and RNA-seq analysis

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

R. Thomas, K. Barman and S. R. Pegu

In-silico molecular dynamics evaluation of phytochemicals against Salmonella enterica Typhimurium combined with in-vitro antimicrobial and acidic stress responsive studies: A study was conducted to determine the response of *Salmonella* Typhimurium when ground pork was artificially contaminated with S. Typhimurium and subsequently treated with lemon and fermented bamboo shoot juices. Further, in-silico molecular docking and simulation studies were performed to understand the possible interaction of phytochemicals with the outer membrane proteins which are critically important for survival of S. Typhimurium under stress condition.The presence of S. Typhimurium in the field meat samples were assessed by performing the culture based method, followed by PCR detection. Culture based detection of S. Typhimurium was further confirmed by amplification of invA gene and rfbjgene.

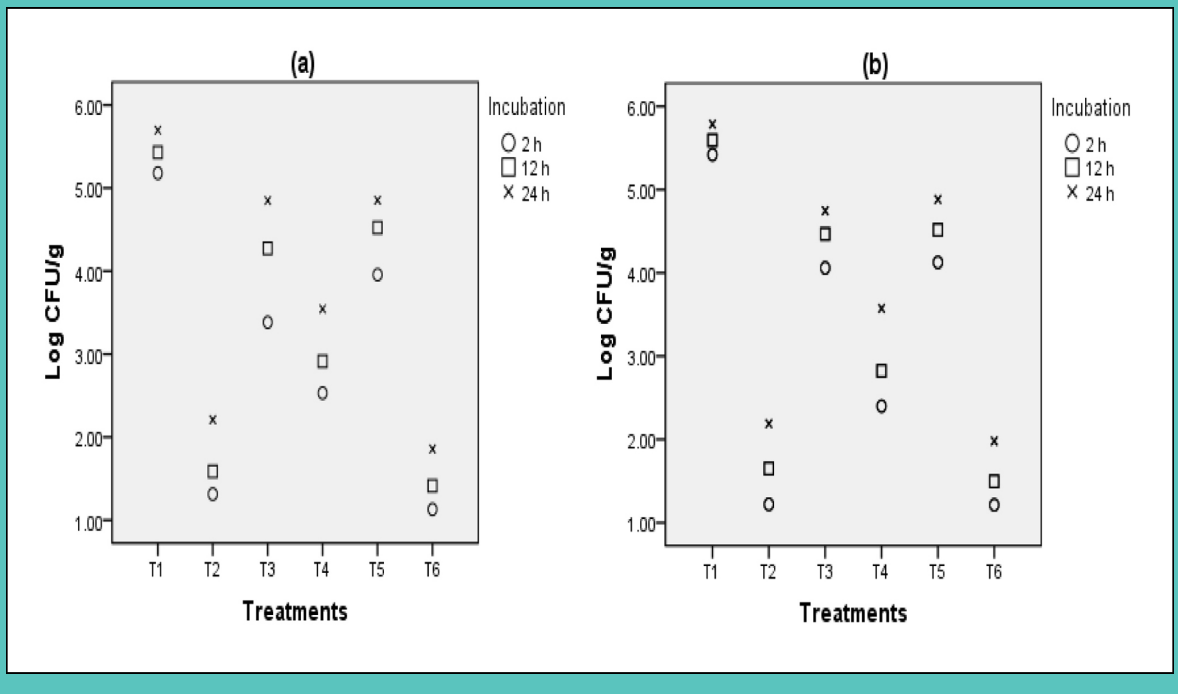
The response of S. Typhimurium to undiluted and diluted juices of lemon and fermented bambooshootvaried greatly depending on the nature of the organic acid and dilution factor. Decline in viable cells of S. Typhimurium was observed after exposure to treatments for 2 h, 12 h and 24 h expressed as log CFU/g. Ground pork mixed with undiluted lemon juice and citric acid monohydrate have shown highest reduction of strains of S. Typhimurium (ATCC14028 and SM059) within first 2 h of exposure. Lemon juice and citric acid with the same range of titratable acidity has reduced S. Typhimurium from 3.95 to 4.19 logs within 2 h of exposure.The mean reduction in cell population was found to be significantly ($P< 0.05$) higher in lemon juice marinade than that of fermented bambooshoot. The response of S. Typhimurium to undiluted lemon juice and the positive control (citric acid monohydrate) was comparable.Mean reduction of the reference strain of S. Typhimuriumin undiluted bambooshoot marinade were 1.88, 1.16 and 0.86 after 2, 12 and 24 h of exposure at 4°C, respectively. The responses of the field isolate to the treatments were 1.36, 1.12 and 1.04 at 2, 12 and 24 h, respectively.

The GC-MS analysis of the methanolic extracts have revealed the presence of 16 compounds each in lemon and fermented Bambooshoot extracts. Among the phytochemicals identified in C. limon, 6-azabicyclo [3, 2, 0] heptan-7-one was the most abundant followed by 6-methoxy-3(2h) - pyridazinone having an area percentage of 11.7 and 8.24% respectively, of the total plot area. Similarly, in B. polymorpha, acetic acid was found to be most abundant having an area percentage of 9.48%. In addition the extracts had substantial quantities of paracresol, Phenol-2-ethyl, 2, 3-dimethoxybenzoic acid, propanoic acid and 2-methoxy-4-methyl-phenol. All phytochemicals thus identified were subjected to molecular docking and dynamics studies to evaluate the favorable in-silico molecular interaction evidenced from the docking score and H-bond energy.

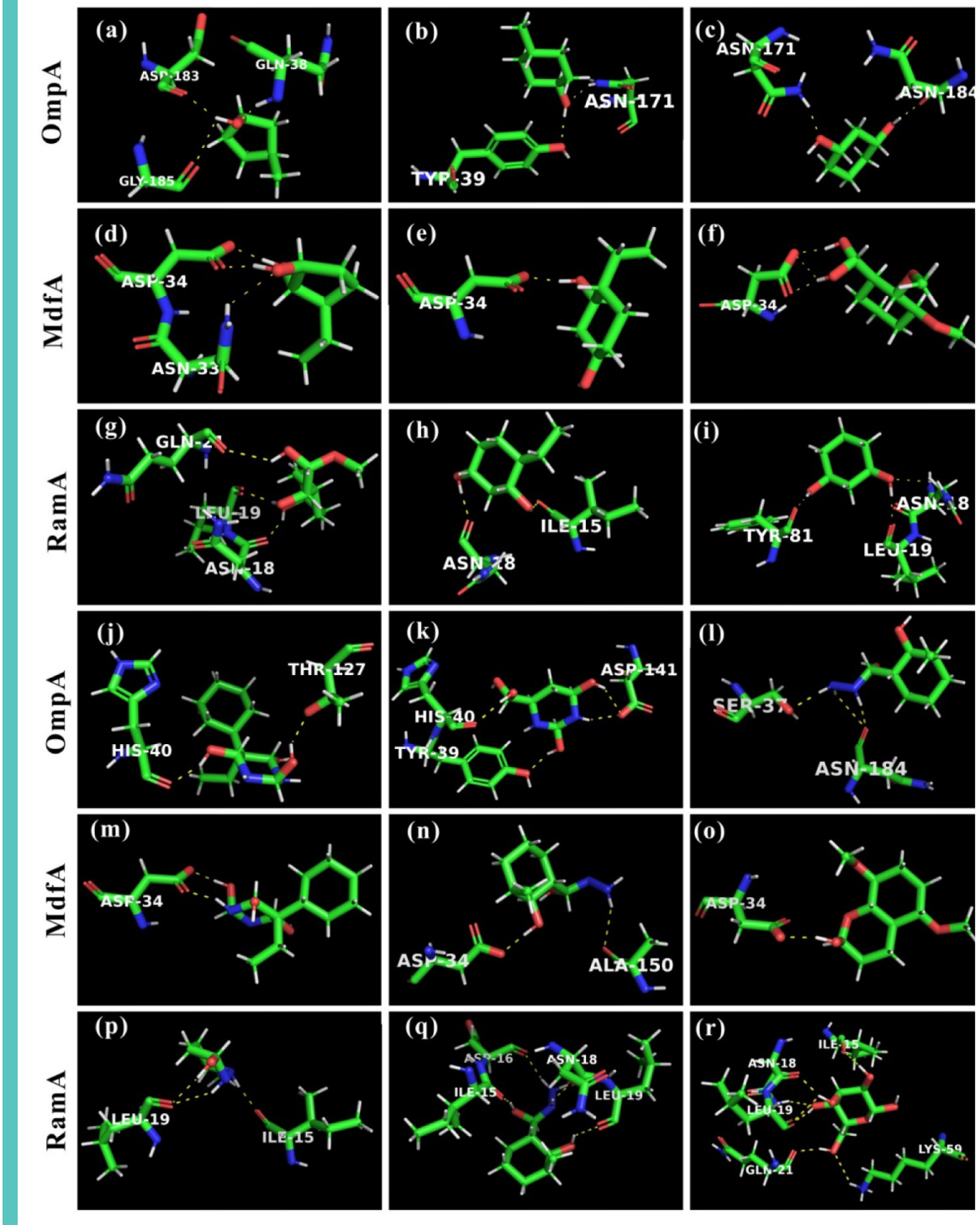
The molecular docking results showed that 3-ethyl-2-hydroxy-2-cyclopenten-1-one, 4-ethyl-1,3-benzenediol and 2,3-dimethoxybenzoic acid with the lowest binding energy (-5.502, -5.543 and -5.6 kcal/mol, respectively) are top three ligands to interact with MdfA , while resorcinol, 4-ethyl-1,3-benzenediol and benzeneacetic acid, alpha,4-dihydroxy-methyl ester were the best interacting phytochemicals from fermented bambooshoot to interact with RamA. This study has revealed the phytochemicals in lemon as potential inhibitor of the key efflux pump regulator proteins. Cyclobarbital, 3-methylsalicylhydrazide and 5, 8-dimethoxycumarin was found to be

forming bonds mostly with Asp (34) and Ala (150) of the MdfA with bond length ranging from 1.6-2.5 Å. Furthermore, lemon derived compounds such as 6-methoxy-3(2h)-pyridazinone showed highest binding affinity towards RbmA (-7.89 kcal/mol). In comparison to the reference standards, phytochemicals from lemon and fermented bambooshoot tends to have higher affinity for RamA. D-allose interacts with the highest numbers of residues in the selected binding pocket of RamA. D-allose formed highest hydrogen bonds with 7 residues viz. Ile-15(2.8 Å), Asn-(1.9 Å), Leu-19(2.6 Å), Leu-19(1.7 Å), Asn-18(2.4 Å), Gln-21(1.9 Å) and Lys-59(2.8 Å).

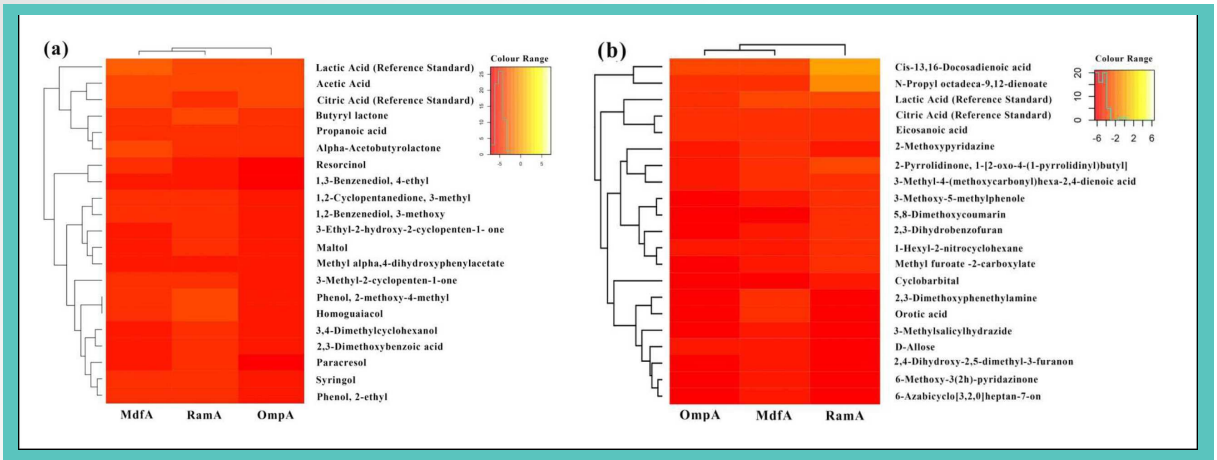
The stability of the docked complexes was further evaluated using molecular dynamics (MD) simulation. Backbone deviation of complexes was plotted against function of time. The structural changes and dynamic behaviour of the protein-ligand complexes were investigated using the root mean square deviation (RMSD), root mean square fluctuation (RMSF), radius of gyration (Rg) and hydrogen bond. The best docked compounds of C. limon, i.e. 3-methylsalicylhydrazide and cyclobarbital, 5,8-dimethoxycumarin and cyclobarbital and 3-methylsalicylhydrazide and D-allose having lowest binding energy to OmpA, MdfA and RamA, respectively and compounds from B. polymorpha such as paracresol and resorcinol, 4-ethyl-1,3-benzenediol and 2,3-dimethoxybenzoic acid and resorcinol and 4-ethyl-1,3-benzenediol were further subjected to simulation in order to observe the variations and stability of the complex formed for the timescale of 10 ns. The RMSD values of MdfA-cyclobarbital complex (green) and MdfA-5, 8-dimethoxycumarin complex (blue) was in the range of 0.1-0.15 nm. Both the complexes have shown minimal deviation within 10ns timescale. Rest of the complexes have revealed deviations in the range of 0.15 nm to 0.35 nm throughout the simulation; however RMSD values for most of the complexes were within the acceptable range i.e. below 0.3 nm.



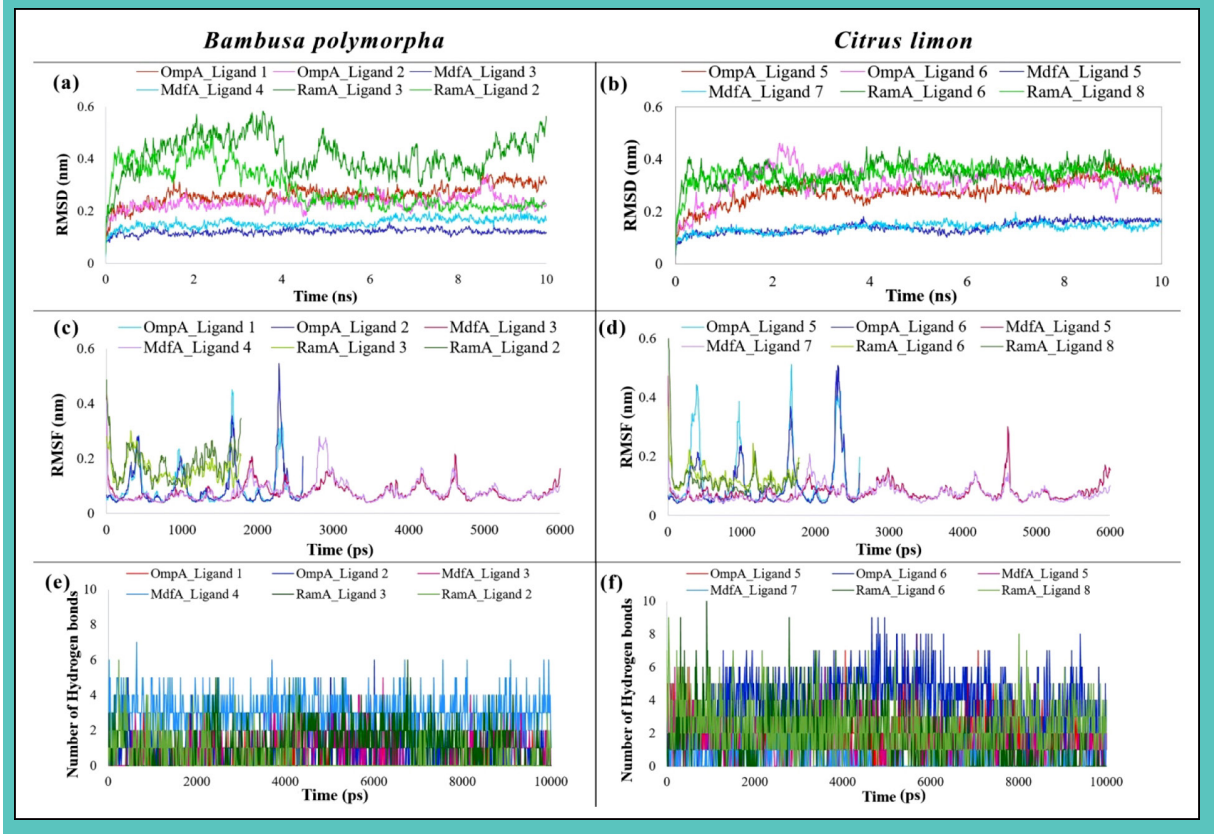
Survival of strains of S. Typhimurium (a) ATCC14028 and (b) SM059 on ground pork incubated for (o) 2 h, (□) 12 h and (x) 24 h at 4oC [Note: T1-distilled water (negative control), T2- undiluted lemon, T3-undilted fermented bambooshoot, T4-diluted lemon juice, T5-diluted fermented bambooshoot, T6-citric acid (positive control)]



3D representations of the receptor proteins with three potential phytochemicals identified in B.polymorpha (a-i). Interaction of phytochemicals were depicted in (a) 3-methyl-2-cyclopenten-1-one (b) paracresol (c) resorcinol with OmpA, (d) 3-ethyl-2-hydroxy-2-cyclopenten-1- one (e) 1, 4-ethyl-3-benzenediol (f) 2,3-dimethoxybenzoic acid with MdfA and (g) methyl alpha,4-dihydroxyphenylacetate (h) 4-ethyl-1,3-benzenediol (i) resorcinol with RamA. Visual representations with C. limon were depicted in (j) cyclobarbital (k) orotic acid (l) 3-methylsalicylhydrazide with OmpA, (m) cyclobarbital (n) 3-methylsalicylhydrazide (o) 5,8-dimethoxycumarin with MdfA, (p) 6-methoxy-3(2h)-pyridazinone (q) 3-methylsalicylhydrazide; (r) D-Allose with RamA.



Heatmap representing interaction of all the compounds identified in (a) *B. polymorpha* and (b) *C. limon* with reference molecules towards outer membrane protein and efflux pump regulator proteins based on molecular docking score



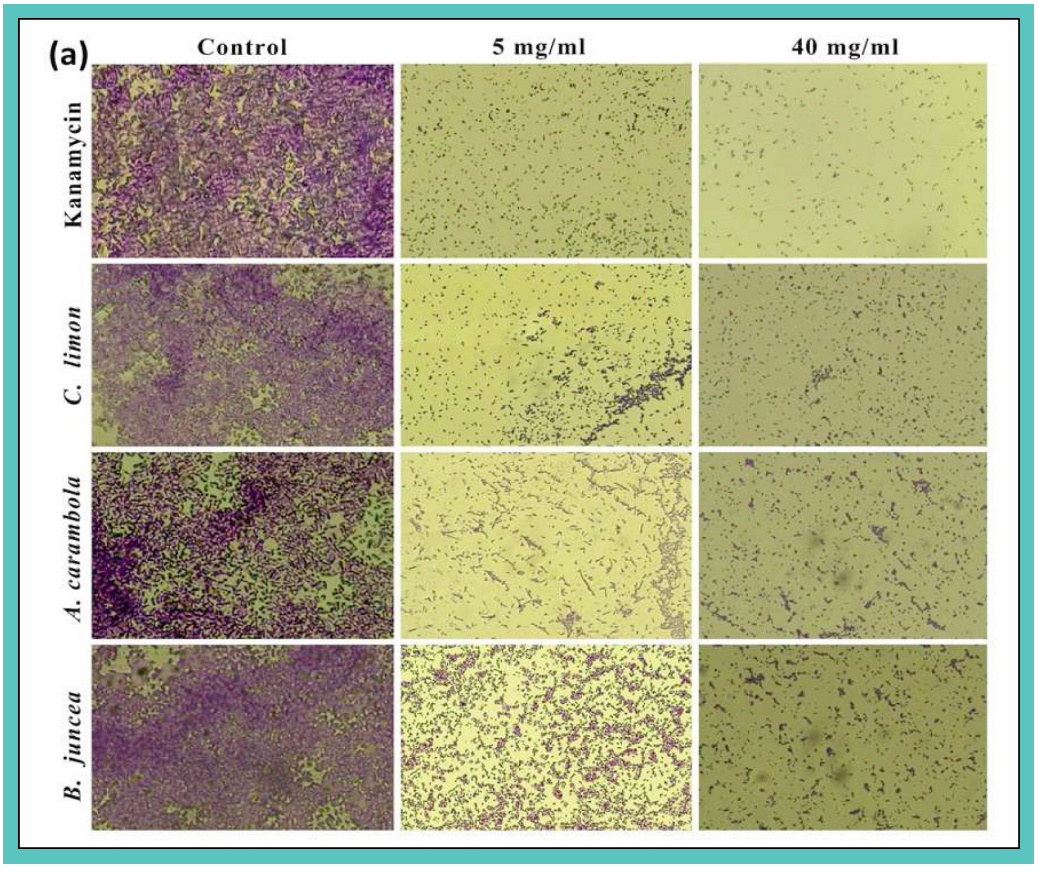
Root mean square deviation (a,b), root mean square fluctuation (c, d), dynamics of hydrogen bonding (e, f) of the protein-lignad complexes formed between *B. polymorpha* and *C. limon* phytochemicals and receptors of *S.* Typhimurium. Here, the ligand numbers are depicted as follows, ligand 1: paracresol, ligand 2: resorcinol, ligand 3: 4-ethylbenzene-1,3-diol, ligand 4: 2,3-dimethoxybenzoic acid, ligand 5: cyclobarbital, ligand 6: 3-methysalicylhydrazide, ligand 7: 5,8-dimethoxycumarin, ligand 8: d-allose

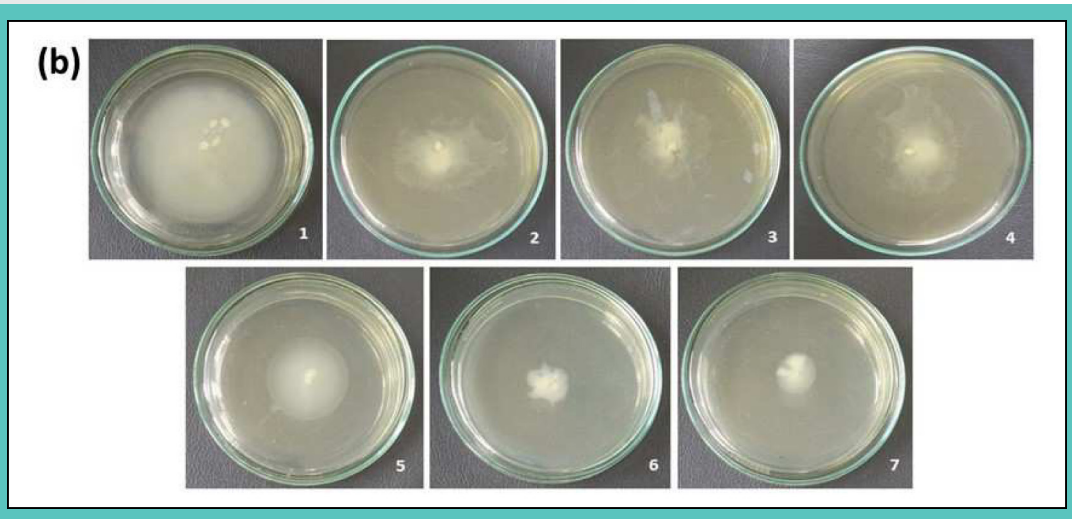
Studies on anti-biofilm and Quorum Sensing Inhibition (QSI) activities of extracts from Assam lemon, Star fruit and Mustard greeen on Yersinia enterocolitica : In search for natural therapeutic agents with anti-biofilm activity, phytochemicals in methanolic extracts of fruits of Citrus limon (Assam lemon/ Kajinemu) and Averrhoea carambola (Kordoi) and leaves of Brassica

juncea (Lai shak) were identified by GC-MS analysis and screened for anti-QS agents against Y. enterocolitica. The potential of these phytochemicals to inhibit QS based swarming motility and their anti-biofilm activities have been investigated. In furtherance, the effectiveness of these phytochemicals against Y. enterocolitica QS yenR receptor protein along with their respective ADMET (absorption, distribution, metabolism, excretion, and toxicity) properties were ascertained using in-silico molecular docking studies.

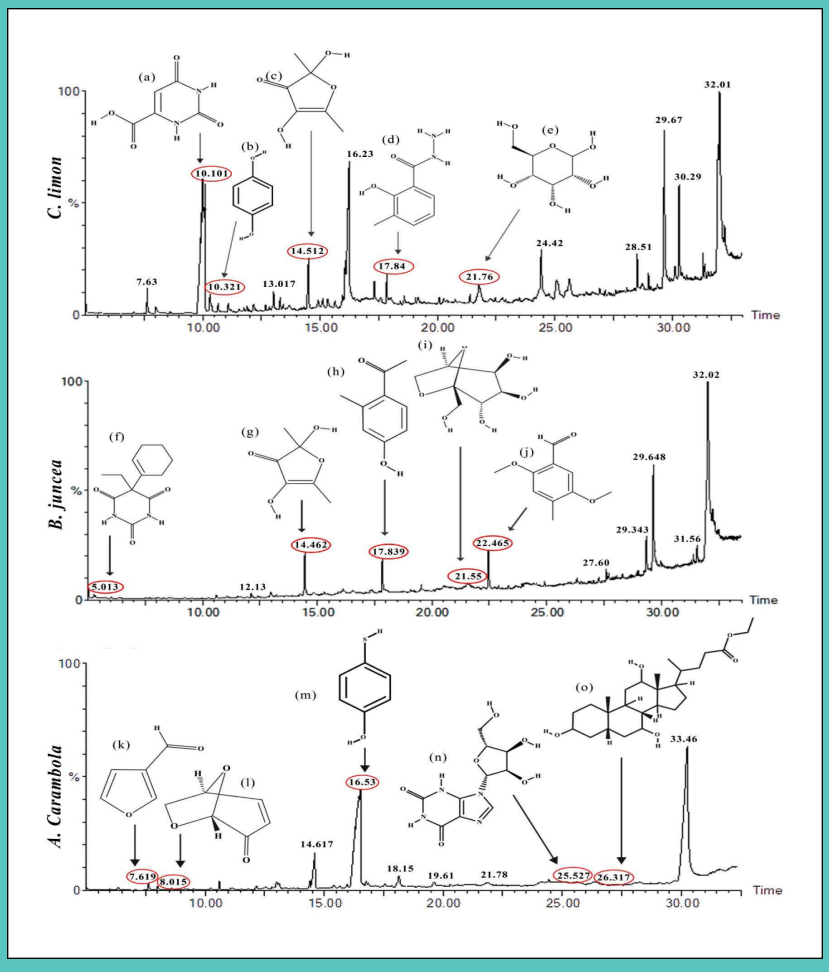
Extracts from B. juncea had the highest phenolic content (159.897 µg GAE/mg) while *C. limon* had the highest flavanoid content (55.83 µg QE/mg). The phenolic contents in the extracts of C. limon and A. carambola were 129.821 and 110.231 µg GAE/mg, respectively while the flavonoid contents in A.carambola and B. juncea were 49.71 and 32.21 µg QE/mg, respectively.A dose dependent (10 -1000µg/ml) radical scavenging activity of DPPH was observed for all the three extracts and the same has been compared with ascorbic acid. C. limon had the highest relative inhibition percentage (80.34%) followed by B. Juncea and A. carambola (71.01% and 68.99%, respectively) at 1000µg/ml. The GC-MS analysis of the methanolic extracts revealed the presence of 10 compounds in C. limon and 8 compounds each in A. carambola and B.juncea.

In silico analysis using molecular docking was performed against the YenR region of *Y. enterocolitica* to further corroborate the anti QS activity of the identified compounds in the extracts of *C. limon, A. carambola* and *B. Juncea*. Docking score, including number of hydrogen bonds and the hydrogen bonding interaction, of the phytochemicals against *Y. enterocolitica* yenR receptor protein along with their respective ADMET properties were depicted. The phytochemicals viz. D-allose, 3-Furaldehyde and 2,4-dihydroxy-2,5-dimethyl-3(2h)-furan-3-one from *C. limon,* A. carambola and B. juncea, respectively exhibited the highest docking scores (-6.894, -6.325 and -6.318 Kcal/mol, respectively).

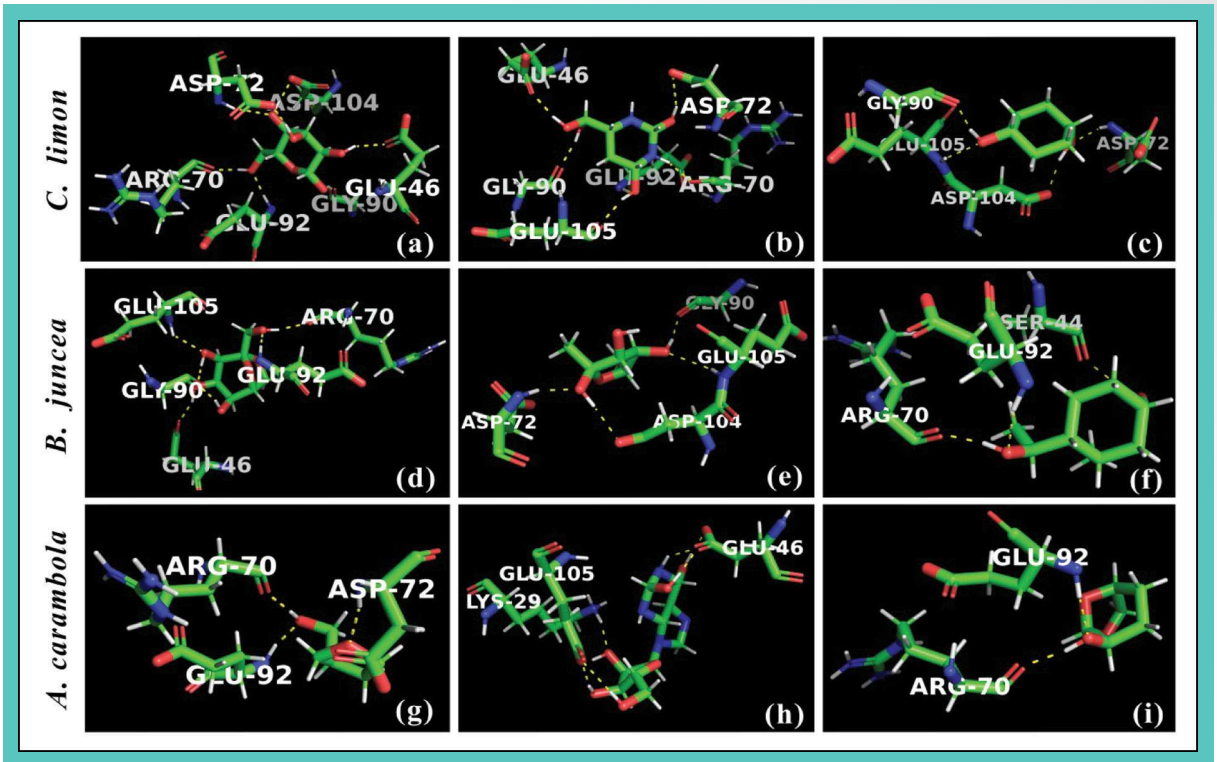




a) Pattern of inhibition of Y. enterocolitica biofilm formation on glass slides (40X); b) Swarming motility of Y. enterocolitica on agar plate: 1-Control, 2 to 4- Extracts of A. carambola C. limon and B. junecaat 5mg/ml, 5 to 7- Extracts of A. carambola C. limon and B. juneca at 40mg/ml, respectively.



Chromatogram of GC-MS analysis of the extracts of *C. limon:* (a) Orotic acid, (b) Hydroquinone, (c) 2,4-Dihydroxy-2,5-dimethyl-3(2h)-furan-3-one, (d) 3-Methylsalicylhydrazide, (e) D-Allose; B. juneca: (f) Cyclobarbital, (g) 2,4-Dihydroxy-2,5-dimethyl-3(2h)-furan-3-one (h) 4-Hydroxy-2-methylacetophenone (i) Sedoheptulosan, (j) 4-Methyl-2,5-dimethoxybenzaldehyde; and A. carambola: (k) 3-Furaldehyde, (l) Levoglucosenone, (m) 4-Mercaptophenol, (n) Xanthosine, (o) Ethyl iso-allocholate.



3D pictures of the docked phytochemicals against 5lo7 of YenR receptor of *Y. eneterocolitica*; (a) D-allose (b) Orotic acid; (c)Hydroquinone; (d) Sedoheptulosan , (e) 2,4-Dihydroxy-2,5-dimethyl-3(2h)-furan-3-one; (f) 4-Hydroxy-2-methylacetophenone; (g) 3-Furaldehyde; (h) Xanthosine; (i) Levoglucosenone

External Funded: Setting up of food testing laboratory (MoFPI)

R. Thomas, S. R. Pegu and S. Rajkhowa

The infrastructural development project was sanctioned by Ministry of Food Processing Industries with an outlay of Rs. 365.00 lakhs to set up a state-of-the-art NABL Accredited testing laboratory for pork and pork products at ICAR-NRC on Pig. The project has been completed as on 31-03-2022 after obtaining all the objectives satisfactorily. All the 32 numbers of equipments approved by PAC has been purchased and installed. Also, successfully obtained ISO/IEC 17025:2017 Accreditation for the lab.

NABL
ISO / IEC 17025
Accredited

External Funded: Technical advisory services for piggery value chain improvement in Assam, under World Bank funded Assam Agri-business and Rural Transformation Project (APART)

R. Thomas, S. R. Pegu, K. Barman, Sunil Kumar and S. Rajkhowa

Institute is focusing on four thrust areas under this project viz. analysis of feed resources for ration balancing; sero-sampling for JEV to inform targeted measures to decrease mosquito transmitted virus to pigs; support in creation/up-gradation of liquid boar semen processing labs and conducting capacity building programme for master trainers. Regarding capacity building of value chain actors in the project, institute has already conducted 05 training programmes to Veterinary Doctors from 16 districts. The theme of the training programmes was "Master Training (ToT) programme for AHVD staff on Scientific Pig Farming". A total of 115 Veterinarians were trained in these programmes. Similarly, five training programmes for the Pig Bondhusi.e. "Master Training (ToT) programme for local service provider (Pig Bondhu)" were organized and a total of 145 pig bondhus participated in the programme. They were exposed to basics of pig farm management, feeding management, breeding management and the biosecurity measures to be followed to avoid/ reduce the incidence of disease outbreaks in pig farms. Special emphasis was given to artificial insemination in pigs and proper heat detection. Hands-on training sessions were organized on artificial insemination in female pigs using liquid semen samples.

Capacity building programmes for Pig Bondhus under APART

External Funded: Establishment of STI Hub for Mising and Bodo women of Assam for economic empowerment through technology interventions in the pig value chain

R. Thomas, J. Doley, Misha M. M. (till Aug, 2022) and V. K. Gupta

A DST sponsored project of 36 month duration has been initiated with an outlay of Rs. 261 lakhs with the objectives of introducing unique identification cum traceability system for the pigs in the cluster; developing an IoT based remote meat inspection system for ante-mortem and post-mortem of pig/pork for the first time in India; establishing a "Pig Help Line" system to attend the issues of pig farmers, not only belong to the target group, but also from across the country and to develop and transfer the technologies for processing shelf stable pork products, especially traditional products to the target group. It is envisaged to develop a suitable software to act as the basic platform to document the data pertinent to pig production and management conditions, including GPS identification of premises as well as health management. Also, IoT based remote meat inspection system will be developed and will be placed into operation in the existing pig abattoirs under the control of FPC, with the central database management at ICAR-NRCP. The system will support on-time virtual inspection of slaughter pigs (ante-mortem) and pig carcasses (post mortem) for their suitability for slaughter and subsequent release for human consumption, respectively by Veterinarian. The STI extension Hub will be established in Dhemaji/Lakhimpur Districts on a pilot scale. One number of trademark titled "IndPOtrace" has been registered for the traceability software to be developed under the project.

EXTENSION

Institute Project: Fostering the adoption of scientific pig production practices among small holders in Assam

Misha M.M, N. H. Mohan, K. Barman, S. Banik, R. Thomas, S. R. Pegu and Sunil Kumar

As part of the ongoing institute project, two educational tools were developed for conducting field level educational interventions. Ninety farmers were selected as experiment group from three

villages and 90 farmers as control group from another three villages in same districts as shown below. No programme was conducted in the control villages. We have collected data from the selected farmers in both experiment and control group before and after the interventions. After showing the video and distributing the bulletin as interventions, two months gap was provided until the post evaluation. The knowledge test developed under the project was used for assessing the pre and post knowledge of the respondents.

Table : Distribution of respondents selected from experiment and control villages

Sl. No.	Experiment Villages	Selected farmers	Control Villages	Selected farmers
1	Nabagram, Goalpara	30	Thekasu, Goalpara	30
2	Baghbari, Kamrup	30	Bangalikuchi, Kamrup	30
3	Ambari, Tamulpur	30	Borkhata, Tamulpur	30
	Total	90		90

ICT- Based Extension Programmes

ICT-Based extension programmes were organized in three experiment villages as the educational intervention or experiment. During the programme, a film on "Scientific Interventions for Upscaling Rural Piggery (In Assamese)" was projected in front of the selected farmers in experiment group. The video depicted all the scientific pig production practices which are applicable to small scale pig farmers for improving their production. Further, the newly developed technical bulletin in Assamese was also provided to the farmers. The bulletin contains all the information as shown in the video which was provided as a supporting document for reading. Then, the scientists from ICAR-NRCP described the important practices shown in the video and clarified the doubts. The glimpses of the three programmes organized are shown below.

Glimpses of the ICT based extension programmes organized

Knowledge before and after educational intervention

The data collected from experiment and control group farmers were assessed to see the effect of educational interventions carried out using the newly developed educational tools. The change in farmers knowledge was tested using Mann-Whitney "U" test. The results revealed (Table 2) that the knowledge on scientific pig production practices of the farmers of experiment villagesafter the educational intervention (7.956 ± 0.25) is significantly higher than the knowledge level before the intervention (4.30 ± 0.18). But there is no significant change in the knowledge level of farmers in the control villages after a period of 2 months. This clearly showed the effect of ICT based extension programmes organized in the experiment village. Hence the educational tools used in the programme was also found effective in improving the farmers knowledge.

Table : Difference in knowledge level of farmers before and after the educational interventions

		Mean ± SE	U Statistics	P value
Experiment (n=90)	Before	4.300 ± 0.18254	765	<0.0001
	After	7.956 ± 0.25029		
Control (n=90)	Before	3.689 ± 0.215877	4106.500	0.869
	After	3.700 ± 0.215877		

ICAR-NASF Project: Pork marketing chains in North East India for Sustainable Livelihood of Tribal Women (Assam, Meghalaya and Nagaland)

Misha Madhavan M and Mohan N H

Capacity building of the selected cluster of tribal women through 'Piggery Farmer Field School'

Under the NASF project, ICAR-NRC on Pig, Guwahatifor empowering a group of 25 selected tribal women from Barmura village, Rangia, Kamrup. For this we have organized a 'Piggery Farmer Field School' as a pioneer attempt to build the capacity of selected tribal women. An organizing committee was formed at ICAR-NRC on Pig with four coordinators. A six-month timeframe was fixed for the Piggery FFS, from January to June 2022, following the FAO guidelines for organizing FFS for small-scale livestock producers.

Identification of village and beneficiaries

Barmura village in Rangia Block, Kamrup Rural District, Assam was selected purposively consideringcriterias like the predominance of tribals in it, the active participation of women in self-help groups (SHGs) and the active participation of women in backyard pig farming. It was ensured that no capacity development programme on piggery had been organized before in the village by any other institution. After organizing aFGD, we briefed the participants about the FFS programme, its objectives and the need for active involvement and group cohesiveness. The problems and opportunities in pig farming were discussed with the participants. Later a one-page questionnaire in Assamese, the local language, was given to the participants, with questions pertaining to age, education, experience in piggery, interest in training, etc. Based on the information collected, 25 tribal women were selected from the village for the FFS programme. The women were members of four different SHGs in the village. So, a new group of 25 selected tribal women who are interested in pig farming and ready to attend a long-duration programme was formed. The group selected two leaders among them to organize the FFS meetings.

Agro-ecosystem analysis

As part of the FFS meetings, an agro-ecosystem analysis was undertaken to know more about the resources available in the village. The FFS participants were divided into four groups and asked to list the resources each group had regarding piggery. After the group discussion, a representative of each group presented the points of discussion on the existing resources and their use. The findings were then analyzed to understand where improvements could be made.

Group discussion and presentation by participants for Agro-Ecosystem Analysis

Demonstrations

Two frontline demonstrations were made in the village by the scientists of ICAR-NRC on Pig. The first one was on silage making with vegetable waste and tapioca tubers and the second one on artificial insemination in pigs using a dummy. The active participation of all the participants was ensured and they were given a chance to practice using the technology. Guidelines regarding the use of technologies were shared with them. Both the demonstrated technologies can be used by the farmers to generate additional income. Using silage from vegetable waste can considerably reduce the cost of feeding.

Demonstrations organized for FFS participants

Comparative experiments

Comparative experiments were conducted as a part of the FFS. Free inputs like mineral mixture packets and deworming tablets were given to all the participants to conduct comparative experiments in the field. They were instructed on how to feed both to their pigs and asked to observe changes in the growth rate of the animals in comparison with their previous experiences.

Exposure visit

An exposure visit was organized for all the 25 participants to ICAR-NRC on Pig, Rani, on 23 March 2022. The farmers were taken to the slaughter house and R&D pork processing plant of the institute. The institute staff demonstrated the different equipment used in the slaughter house and their use. The scientists spoke about the different pork products and the need for quality maintenance during the production process. Later, hands on training was given to the women farmers on how to make pork sausages and pork pickle. This was followed by an interaction with the Director of ICAR-NRC on Pig. Feedback was sought on the FFS programme from the participants. This feedback was used as concurrent evaluation of the FFS programme in its mid-way.

Glimpses of exposure visit by FFS participants to ICAR-NRCP

Glimpses of exposure visit by FFS participants to ICAR-NRCP

Use of multimedia and distribution of literature in local language

The participants were shown a film in the local language (Assamese) on scientific interventions for upscaling rural piggery. The supporting technical bulletin in the local language was shared with them.

Creation of linkages for entrepreneurship development

As part of the FFS programme, some linkages were established for the participants. A successful women entrepreneur involved in the pork processing industry was invited to interact with the participants. She motivated them to start their own pork processing business and also promised them initial marketing support. A veterinarian from the state animal husbandry and veterinary department was invited to interact with the participants. He briefed them about the ongoing schemes and the support provided by the state department.All the scientific staff of the institute interacted with the participants during the FFS meetings. The officer in charge of the Agri-Business Incubation centre described the procedure to obtain incubation support from the institute. Support for starting a business was ensured by ICAR-NRC on Pig. The FFS has found to facilitate to improve the knowledge on scientific pig production practices, entrepreneurship development, adoption of integrated pig-fish farming and empowerment of tribal women.

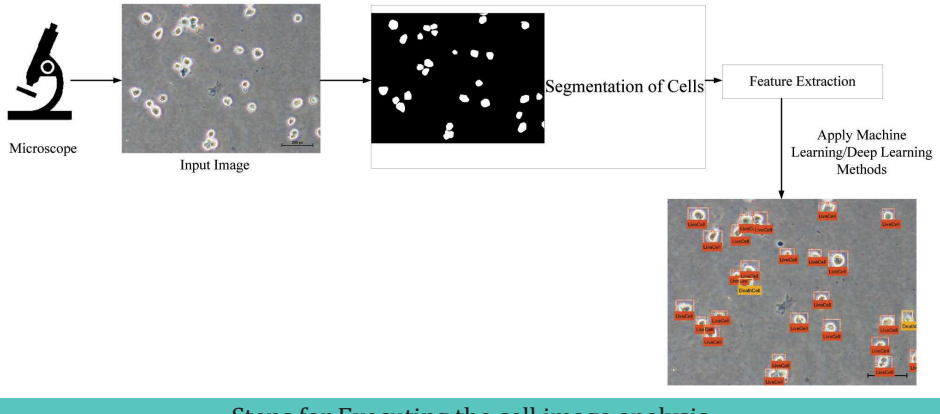
COMPUTER APPLICATION AND IT

Institute project: Machine learning assisted identification of different cells of porcine origin

S. J. Devi, Jaya and N. H. Mohan

Image analysis plays a significant role in the biomedical research field because of its wide range of applicability in the quantitative measurements. Now adays image analysis techniques are used for critical understanding of various features of cell biology. Cell is the basic structural, functional and biological unit in all living organisms. The ability to extract the features of image and to study cells and their sub cellular compartments is essential in various research areas of biomedical studies. With the development in advance research, the application of high-resolution microscopes, image processing techniques has become more reliable and profound impact on biological science research. The most common aspects in biological science are the cell imaging, image quantification and analysis. Biologist are increasingly interested in using image processing techniques to analyse the microscopic images and convert to useful quantitative information.

In cell analysis, the difficulties of visual interpretation of cell counting, quantitative measurements of specific molecules of interest can be done efficiently by implementing an automated image-based algorithms. Image analysis using various image processing techniques has wide range of possible applications in comparisonto manual analysis due to the ability of simultaneously measuring several features of the image. The main purpose of adoption of image processing techniques is to combine the wet laboratory results with the computerised image analysis results thereby resulting more useful and accurate information.



Steps for Executing the cell image analysis

The analysis of cell image can also help in the identification of phenotypic feature of cell including the shape and texture. Quantitative analysis of cell morphology is important in understanding the physiology of normal cells and aid in diagnosis of diseases. Cell analysis can be performed to evaluate and measure the current state of cells, such as cell integrity, toxicity, and viability and various other research applications. Cell analysis is a key issue for identification of any abnormalities and its classification. Earlier, microscopic techniques were applied to study the structural details of cells, but with the recent advances in research, it has been increasingly necessary for the determination of cell number, its area, perimeter, localization, concentration, densitometry analysis, etc. for molecular level studies. The advancement in the study and analysis of cell have been accompanied by the evolution of computing capabilities and the development of novel techniques in computer vision and machine learning for image segmentation and classification. Accurate, generic and robust whole cell segmentation is still a persisting need to precisely quantify its morphological properties, phenotypes and sub cellular dynamics.

The recent advances in light microscopy and the need for accurate and high-throughput analysis of cells, automated algorithms need to be developed for segmenting and analysing the cells in microscopy images. Machine learning and neural networks algorithms have been demonstrated in recent years to be an efficient tool for image analysis. The cell classification in machine learning is a challenging task in computer vision. This type of classification plays a significant role in bio-medical research. Artificial intelligence-based cell classification can be built by training the microscopic images. Cell classification plays a vital role in medical science such as medical diagnosis, disease prevention and even in personalised treatment. Therefore, the challenging task is the classification of cell types with high accuracy and precision.

ICAR Funded project : Applications of Drone in augmenting production and productivity of piggery sector

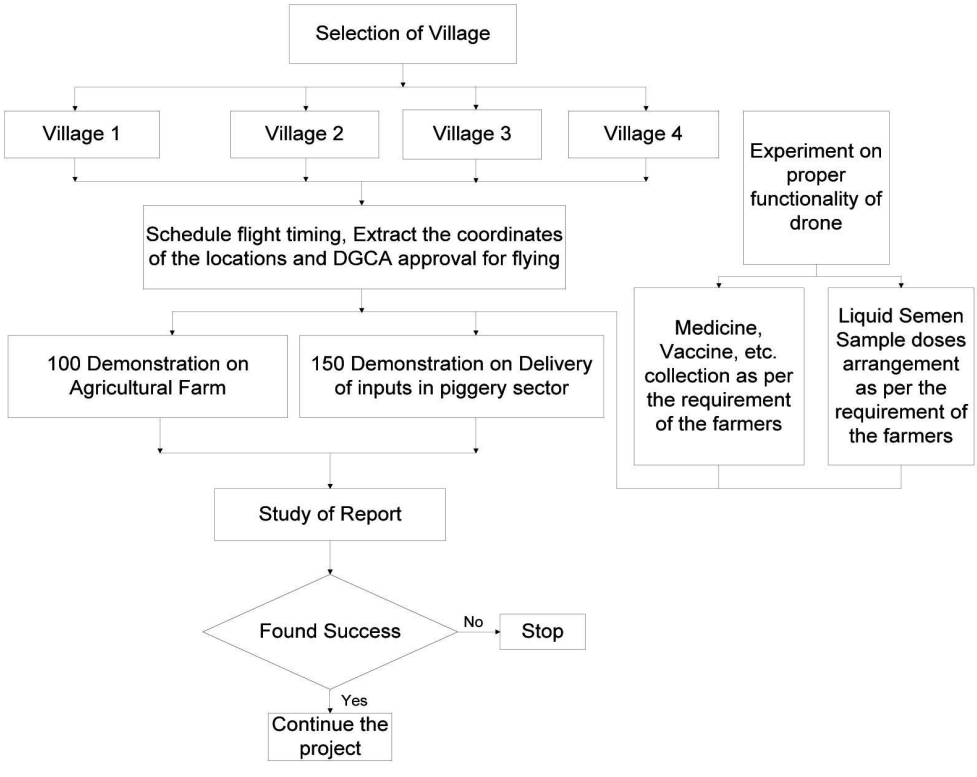
S. J. Devi, Satish Kumar, B. Kaman, J. Doley, Sunil Kumar, N. H. Mohan, S. Banik

The agricultural sector in India employs more than half of India's population and contributes 18% to India's Gross Domestic Product (GDP). For India to double its farmer incomes there is an immediate need for the agricultural sector to adopt cutting edge precision agriculture technologies to improve farm productivity. Livestock plays an important role in the Indian economy which contributes 4.11% to the country's GDP and 25.6% to total Agriculture GDP. Among the different livestock species, pigs occupy an important place as they are being reared by socio-economically weaker sections of the society. Pigs comprise 1.7% to the total livestock population and this sector contributes about 6.7% of the total meat production in the country. The North Eastern region of India accounts for 46% of pig population of India. The pig farming sector is also considered as one of the most sustainable industries in India. As compared to larger livestock species, pigs are resilient and have a great potential by providing faster economic return to the farmers, due to certain inherent traits like better-feed conversion efficiency, high fecundity, early maturity and short generation interval. The adoptions of precision modern technologies, such as drones, in pig husbandry will have great potential to revolutionise Indian agriculture by ensuring nutritional and economic security for the weaker sections of the society.

Unmanned/uncrewed/unoccupied aerial vehicles (UAVs) popularly known as drones are one such technology that has the potential to revolutionise the farming industry through need based precise and focused application that will directly enhance the input use efficiency, farmer's safety and lowering the overall costs. Drones are already in active use in various sectors like the

defence, scientific research, healthcare and are slowly making their way into agriculture. Drones are facilitating acquisition of real time data, guiding in taking apt decisions, and minimizing cost compared to manual tasks. Besides, it also provides personnel safety by reaching to inaccessible terrains and in difficult circumstances. The drone industry in India is emerging and will play a major role in empowering farmers and modernising their livelihood. In North Eastern part of India most of the pigs rearing villages are located in rural areas that are often difficult to access. In rural areas, there is still lack of veterinary care, proper infrastructure, connectivity and motorable roads. Most of the rural areas are often difficult to access thus, delivering of logistics becomes complicated and local contracting facility is limited. Therefore, in such situation, it is imperative to adopt drone system for delivering necessary logistics for healthcare of pigs, semen sample for AI in pigs, deliver medicine to a particular region.

In piggery sector, good quality liquid semen sample for AI in pig is very important for pig breeding purposes. The main challenge faced by piggery sector is the transportation of semen to the breeders. Pig semen requires rapid delivery in order to be effective. Farmers from remote places are unable to reach the semen production centre for purchasing the good quality AI semen dose. To overcome this problem, drone delivery system is the need of the hour in piggery sector for facilitating access to improved germplasm for sustainable pig production.Drones can perform accurate fixed-point delivery of therapeutic drugs to treat infected animal in remote places. There are other advantages of using drone in piggery sector as they can save time, money, human labour and avoid spreading of transmittable diseases.Therefore, drone technology is expected to play a pivotal role in piggery sector for delivering the farmers requirements in the fastest and safest manner by reaching to pig farmers doorstep in inaccessible and remote locations. Thus, Indian pig farming sector may be benefitted largely by adoption of drone technologies.



Drone demonstration work plan

Out-reach Programmes

Lumsniang Crossbred Pig Variety

Annual Report-2022
ICAR-NRCP

OUT-REACH PROGRAMMES

TRIBAL SUB-PLAN SCHEME

Dr. V. K. Gupta, Dr. P. J. Das, Dr. B. C. Das, Dr. S. Rajkhowa, Dr. S. Banik, Dr. K. Barman, Dr. Mohan N. H, Dr. R. Islam, Dr. R. Thomas, Dr. S. R. Pegu, Dr. J. Doley, Dr. S. Paul, Dr. R. Deb, Dr. Kalyan De, Dr. Sunil Kumar, Dr. Jaya, Dr Satish Kumar, Dr. S. J. Devi, Dr. Nitin M. Attupuram

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 2022, a total of 37 such programs were conducted in the tribal-dominated area of Meghalaya and Assam, in which a total of 2256 numbers of tribal Pig farmers directly benefited through these programmes. Among these farmers, a total of 232 tonnes of Pig feed and different small inputs like LED lights, Steel buckets, Gumboots, Umbrellas, Raincoats, Gamla, Sanitizers, Pig for breeding, Digital Thermometers, Sprayers, Water pumps, Mixer, Mineral mixture, Hormone for oestrous synchronization (doses) and different scientific leaflets on piggery management in local languages were distributed. Among the 37 capacity building program, three nos. of three days residential training programs, one seven days program, two numbers of Front Line Demonstrations (FLDs) and other demonstrations, Six awareness camps, four field days, three ICT-based residential training programmes, four Research-Extension-Farmers interface meetings, one Farmers fair/Exhibition, five Animal Health Camps, one three days Promotion of Agri-entrepreneurship program, two Participatory Rural Appraisal (PRA) Programs and eight number of Monitoring and Evaluation program conducted during 2022. 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 : Details of Tribal Sub Plan Program

Sl. No	Program Name	Place	No. of beneficiaries
1	Research-Extension-Farmers Interface Meeting and Input Distribution Programme	Jhargaon Village, Udalguri, Assam	50
2	Participatory Rural Appraisal (PRA) cum awareness programme and input distribution	Deulkuchi Village, Tamulpur District, Assam	58
3	Participatory Rural Appraisal (PRA) cum awareness programme and input distribution	Bardangarikuchi Village, Kamrup Rural, Assam	52
4	Focus Group Discussion (FGD) to assess the impact of 'Rani' crossbred variety	ICAR-NRC on Pig, Rani, Guwahati, Assam	15
5	Research-Extension-Farmers interface meeting and Field Day cum input distribution Programme	Manas Eco-Tourism Society, Kamar Doisa, Baksa, Assam	101
6	Awareness camp cum input distribution and an ICT-based extension programme	KVK Dhudhnoi, Goalpara, Assam	120

7	Front Line Demonstration Programme (FLD) on "Capacity building of the tribal farmers through demonstration of Artificial Insemination techniques in pigs	KVK Dhudhnoi, Goalpara, Assam	100
8	Three Day Residential Training Programme on 'Reproductive Management and AI in Pig	ICAR- NRC on Pig, Rani, Guwahati, Assam	19
9	Awareness Camp cum Field day and Input distribution programme	KVK Moopun, Thadlaskein, Jaintia hill, Meghalaya	76
10	Research-Extension-Farmers interface meeting and Input distribution programme	Kaniha, Rangia, Kamrup, Assam	60
11	ICT-based extension programme and input distribution	Simla Hazuwa, Chapaguri Koklabari Primery Sahitya Bhawan, Baksa, Assam	125
12	Three days Residential Training Programme on Scientific Pig Farming for Livelihood and Nutritional Security	ICAR- NRC on Pig, Rani, Guwahati, Assam	21
13	Exhibition/Farmers Fair and input distribution programme" under Institute TSP during celebration of National Tribal Day	Indian Institute of Technology, Guwahati, Assam	08
14	Front Line Demonstration (FLD) programme on Capacity building of the tribal farmers through demonstration of silage making and storage for feeding of pigs and Input distribution	KVK Dudhnoi, Goalpara Assam	151
15	Animal Health Camp and Input distribution Programme	Umsur, Mataikhar, Kamrup, Assam	120
16	Field Day and Input distribution Programme	Khetri, Dimoria block, Kamrup, Assam at	125
17	Field Day and Input distribution Programme	Jirang, Ri Bhoi District, Meghalaya	135
18	Awareness camp and field demonstration of silage making as well as Input distribution Programme	Kailajuli, Pavoi, Biswanath Chariali, Assam	110
19	Animal health Awareness Camp and Input distribution Programme	Rajapara Village, Rajapara, Kamrup (R), Assam	104
20	Training and Demonstration Scientific Slaughtering of Pig to Tribal Butchers	KVK Dhudhnoi campus, Goalpara	10
	Basic Hands-on training for Tribal Science graduate students	ICAR- NRC on Pig, Rani, Guwahati, Assam	18
21	Three days workshop cum training on "Promotion of Agri-entrepreneurship on Scientific Pig Production Practices and Value Addition of Pork	ICAR-National Research Centre on Pig, Rani, Guwahati, Assam	15
22	Seven Days Residential Training Programme on 'Assisted Reproductive technologies for augmenting production in pig	ICAR-National Research Centre on Pig, Rani, Guwahati, Assam	16
23	Monitoring and evaluation drive of tribal pig farmer directly benefited through institute TSP programme as well as to collect the success stories	Koklabari, Choudhury para, Hazarapara of Baksa disrtict	07
24	Monitoring and evaluation drive of tribal pig farmer directly benefited through institute TSP programme as well as to collect the success stories	Gargara and Bikripara under Umsur and Rajapara, Kamrup, Assam	02

25	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 area of Baksa District of Assam	09
26	Monitoring and evaluation drive of tribal pig farmer directly benefited through institute TSP programme as well as to collect the success stories	Govardhan, Batakuchi, Ghramae villages under Chaygaon block of Assam	09
27	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	04
28	Monitoring and evaluation drive of tribal pig farmer directly benefited through institute TSP programme as well as to collect the success stories	Jirang, Jirang, Ri Bhoi District, Meghalaya	07
29	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, Assam on 7th March, 2023.	12
30	Fertility awareness camp for reproductive management in pigs using hormones for estrus synchronization and distribution of small inputs	Loharghat and Kathalguri and adjoin areas of Kamrup, Assam	12
31	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	Umsur, Kamrup, Assam	03
32	Animal health Camp and input distribution program	Gosaihat, Uparpara, Kamrup, Assam	40
33	Research-Extension-Farmers interface meeting and input distribution Program	College of Community Science, Tura, Meghalaya	146
34	Animal Health Camp and input distribution Program	Boko, Kamrup Assam	102
35	Animal Health Camp and input distribution	Dhuwapara, Village, Palasbari, Kamrup(R)	61
36	Animal Health Camp and input distribution	Mataikhar Village, Umsur Kamrup(R)	103
37	Field Day and input distribution Programme	Singimari, Borpani, Nagaon Assam	130



First Line Demonstration (FLD) and Input Distribution
TRIBAL SUB



ICT-BASED EXTENSION PROGRAMME
AND INPUT DISTRIBUTION
TRIBAL SUB PLAN

Three Days Training on

SCHEDULED CASTE SUB-PLAN

Dr. V. K. Gupta, Dr. Kalyan De, Dr. B.C. Das, Dr. S. Rajkhowa, Dr. S. Banik, Dr. K. Barman, Dr. Mohan N.H, Dr. R. Islam, Dr. P. J. Das, Dr. R. Thomas, Dr. S. R. Pegu, Dr. J. Doley, Dr. S. Paul Dr. R. Deb, Dr. Sunil Kumar, Dr. Jaya, Dr Satish Kumar, Dr. S. J. Devi, Dr. Nitin M. Attupuram

ICAR-National Research Centre on Pig, Rani exuberantly implemented Scheduled Caste Sub-Plan (SCSP) this year. The programmes were carried out with the objective of poverty Alleviation and employment generation of scheduled caste (SC) farmers, income generation opportunities among SC farmers, human resource development, and ultimately economic and social upliftment of vulnerable SC farmers. For this purpose, Research-Extension-Farmer interface meeting was organized, baseline survey and PRA were also used organised to know the problem of SC farmers in pig farming and accordingly suggestions were provided by the eminent scientist of the institute. Further, 9 input distribution programmes were organised at different villages of Darrang, Goalpara, Kamrup, Tamulpur and Udalguri districts. Different farm utensils viz. spade, shovel, hoes, emergency lights, umbrellas, steel buckets, water pumps, sanitizer sprayers and gumboots were distributed during the input distribution programmes in pig farms for scientific pig production and maintenance of biosecurity in their pig farms. The farmers were supplied with 80 tonnes of pig grower feed and more than 400 kg of mineral mixture packet as a critical input for pig farming. Furthermore, five awareness camps and ICT based extension programmes were organized to create awareness among the SC pig farmers regarding farm biosecurity for protecting pigs from diseases with special reference to African swine fever, the use of unconventional and locally available feed resources for reducing input cost in pig farming etc. Under SCSP, a field day was also organized in which more than 70 farmers participated actively. Kisan Diwas was celebrated with the SC pig farmers on 23rd December 2023. During SCSP programmes, pig entrepreneurship promotion was carried out among the SC pig farmers to become self-reliant to contribute to “Atmanirbhar Bharat”. This year two 3 days training programme and one 7 days training programme were carried out for SC pig farmers for developing human resources for scientific pig farming and hygienic pork production. Through these SCSP-sponsored training programmes, books on pig management and farming, training kits, study materials, food and lodging were provided free to the SC participants. More than 50 pig farmers were trained under these programmes during the last year. Under the SCSP programme, ICAR-National Research Centre on Pig, Rani supported more than 550 SC pig farmers by proving critical inputs, knowledge, and technical support for their improvement of pig farms to boost the economy of vulnerable SC community farmers and betterment of their social status and life.

Table : Programmes organized under SCSP

Sl No	Programme	Date	Beneficiary	Place
1	R-E-F Interface Meting and Input Distribution Programme	30/06/2022	50	Jagannathjhar village, Udalguri
2	Awareness Programme& input Distribution	6/8/2022	25	Maroi village, Darrang
3	Awareness Programme& Input Distribution	6/9/2022	70	Koikara, Shipajhar Block, Darrang District
4	ICT based extension programme& input distribution	19/10/2022	60	Kaniha, Rangia of Kamrup District
5	Awareness camp cum baseline survey & Input distribution programme	25/11/2022	50	Jhilkapara, Kalaigoan, Darrang District
6	Field day cum base line survey	9/12/2022	70	Dhantula, Rampur block, Kamrup District
7	Kisan Diwas& Input Distribution Programme	23/12/2022	70	Simlitola, Rangjuli block, Goal Para District
8	Awareness camp cum Input distribution Programme	27/12/2022	72	Gargara Village, Rani block, Kamrup District
9	Pig-entrepreneurship promotion and input distribution programme	30/12/2022	78	Khatarbari, Block-Nagrijuli, of Tamulpur District




Sensitization programme on "Enhancing commercial pig production, including organic pig production in NE India with focus on export prospects"

ICAR-National Research Centre on Pig, Rani, Guwahati in collaborator with APEDA has organized a sensitization workshop on 20th October, 2022 on 'Enhancing commercial pig production in NE India with focus on export prospects' towards creation of an ecosystem that not only enables the different stakeholders to interact each other but also to tap into the vast market opportunities

presented by the domestic as well as export markets. The programmes were organized at Dhemaji, Majuli, Sivasagar and Kokrajhar districts of Assam and Agartala, Tripura during 2022. Participants were sensitized on different aspects and prospects of commercial pig farming and pork processing to tap the domestic demand and the export markets in the neighboring (Bhutan, Myanmar, Nepal, China) as well as South East Asian countries. Emphasis was given on the need to maintain quality of the production and the need to promote processing sector in NE region wherein the institute has assured all the possible technical support and knowhow to the stakeholders.

Aicrp And Mega Seed Projects

Mannuthy White Crossbred Pig Variety

Annual Report-2022
ICAR-NRCP

AICRP and MEGA SEED PROJECTS

ALL INDIA COORDINATED RESEARCH PROJECT ON PIG

The AICRP on pig was launched in IVth Five Year Plan (1970-1971) with the objective 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 centres are mandated for conservation of indigenous germplasm. Presently the programme is continuing in fifteen different centres 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. The Annual Review Meeting of ICAR-AICRP on Pig and MSP on Pig for the year 2020-21 was held on 03rd March 2022 in virtual mode and for the year 2021-22 was held on 25-26th August, 2022 at ICAR-CIARI, Port Blair under the Chairmanship of Dr. B.N. Tripathi, Deputy Director General (Animal Science), ICAR, New Delhi.

Assam Agricultural University, Khanapara, Guwahati

The ICAR-AICRP & MSP on pig, AAU, Khanapara has played an important role for development of pig sector in the state through training, awareness program, exhibition, demonstration, distribution of leaflet/booklet, selling of quality piglets, elite gilts/ sows, and boars at nominal price to the interested farmers of the state. The centre is maintaining HD-K75 crossbred germplasm developed by crossing of Hampshire (75%) and local pig (25%) of Assam. The herd strength at the beginning and end of the year 2021-22 was 81 and 101 respectively of HD- K75 genetic group. A total of 283 piglets were produced from 39 Sows during 2021-22. The average litter size at birth, litter weight at birth, litter size at weaning and litter weight at weaning were found as 7.26 ± 0.65, 7.52 ± 0.60, 6.77 ± 0.65 and 59.34 ± 0.92 kg, respectively. A total of 217 piglets were sold to 32 farmers.

Kerala Veterinary and Animal Science University, Mannuthy, Kerala

As per the technical programme a foundation stock of indigenous pigs was established in the Centre the same were raised for cross breeding with Large White Yorkshire. Inter-se mating of 75% crossbreds was done during the year 2021-22. The centre has successfully fulfilled the demand of the farmers by supplying 325 fattening piglets (75% crossbreds). During the reporting period 406, 94 and 312 piglets were produced of Desi, 50% crossbred and 75% crossbred, respectively. Total 183 desi, 35 crossbred 50%, 105 crossbred 75% and 43 LWY was available at the end of 2021-22 financial year.

The average Litter size at birth and weaning was 10.38±0.23 and 10.09±0.19 respectively in 75% crossbreds.

Sri Venkateshwara Veterinary University, Tirupati

The AICRP on Pig at SVVU Centre, Tirupati is maintaining Large White Yorkshire pigs and its crosses under optimum managemental conditions. During the year 2021-22, 23rd generation data up to 10 months was recorded. A total of 24 farrowings were recorded during this period. A total of 192 piglets were born out of which 104 are males and 88 are female piglets. Further, 83 pigs were sold to the beneficiaries for breeding purpose. The average 8 months body weight was 63.16 kg. The feed conversion efficiency was recorded as 4.05. At the end of 2021-22 total herd strength was 290. The average Litter size at birth and weaning was 8.0±0.24 and 7.33±0.34 respectively in 75% crossbreds.

ICAR-Central Coastal Agricultural Research Institute, Goa

AICRP on pig, Goa centre provided fundamental knowledge for scientific management and breeding practices to the pig farmers through different trainings, demonstrations and by providing improved germplasms for breeding. As per approved technical programme centre produced and recorded growth performance data of Crossbreed Pigs (75% exotic – LWY and 25% Desi – Agonda Goan). Total herd strength at the end of financial year 2021-22 was 176 including 51 adult females and 17 adult males. During this period total 298 piglets were born and 227 piglets sold to farmers. The average litter size at birth and weaning was 8.51±0.956 and 8.11±0.514 of 75% crossbred population.

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). Total herd strength at the end of financial year 2021-22 was 230. During this period total 419 piglets were born and 568 piglets were sold/transferred to farmers. The average litter size at birth and weaning, litter weight at birth andlitter weight at weaning was 8.56 ± 0.36, 7.52 ± 0.52, 8.76 ± 0.51 kg and 62.78 ± 5.00 kg of 75% crossbred population. Average individual weight at birth and weaning was 1.01 ± 0.03 and 8.76 ± 0.51 kg. Average daily gain of pre-weaning and post weaning piglets was

185.91 and 445.34 gm/d, respectively in 75% crossbreds. The overall mortality at the farm was 10.98%.

Tamilnadu Veterinary and Animal Science University, Kattupakkam

TANUVAS Centre is maintaining inter-se population of TANUVAS KPM Gold (75% crossbred LWY x Desi) pigs. Besides regular training, the center is presently involved for characterizing the local pig population of the state. Total herd strength at the end of financial year 2021-22 was 104 pigs. During this period total 300 piglets were born, 381 were added internally and 550 piglets were sold to farmers while 374 pigs were transferred internally. The average litter size at birth and weaning was 8.71 ± 0.78 and 8.25 ± 0.67 of 75% crossbred population.

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. Total herd strength of Zovawk at the end of financial year 2021-2022was 38. During this period total 59 piglets were born and 127 deaths were reported due to ASF. The average litter size at birth and weaning was 7.38± 0.42 and 4.88± 1.47, respectively. The average individual weight (kg) at birth and weaning of Zovawk was 0.60±0.02 and 3.78±0.08, respectively.

SASARD, Nagaland University, Medziphema Campus, Nagaland

The Centre is conserving and propagating Tenyi Vo pig breed through selective breeding. Total herd strength of Tenyi Vo at the end of financial year 2021-22 was 166. During this period total 171 piglets were born and 81 piglets were sold to farmers. The average litter size at birth and weaning was 5.14+0.39 and 4.28+0.62 of Tenyi Vo. The centre has enabled forty eight (48) rural farmers for establishing backyard Tenyi Vo piggery through supply of weaned piglets and imparting basic training on pig feeding, management and breeding.

ICAR-Central Island Agricultural Research Institute, Port Blair

The AICRP on Pig centre is maintaining Nicobari pig and supplied to farmers. Characterization work for Andaman local pig is initiated by the center. Total herd strength of Nicobari at the end of financial year 2021-22 was 102. During this period total 266 piglets were

born from 41 farrowing and 267 piglets were sold to farmers. The average litter size at birth and weaning was 7.20 ±0.16 and 6.71 ±0.21 of Nicobari.

College of Agricultural, CAU, Imphal, Manipur

The centre is mandated to study the various performance characteristics of the Rani breed under Manipur condition. The Centre was maintaining 82 Rani Crossbred in the beginning of the reporting year. However, due to the outbreak of African Swine Fever disease of pigs in Manipur and in the AICRP Pig farm during the month of August and September, Rani sow with piglets 2021, about 61 pigs maintained by the farm have died from the disease. During the reporting period 91 piglets were born while 101 piglets were sold. The average litter size at birth and weaning was 9.10 ± 0.71 and 8.30 ± 0.79, respectively.

ICAR Research Complex for NEH Region, Barapani

The AICRP on Pig, ICAR Research Complex for NEH region has successfully developed and released Lumsniang crossbred variety of pig which is suitable for hilly terrine of India. Besides Lumsniang the centre is also maintaining the indigenous Niang Megha pig and 50% cross of Hampshire, Wak Chambil and Niang Megha. The total herd strength in 2021-22 was 253 pigs (171 Lumsniang, 31 crossbred (50%), 21 (Niang Megha) and 30 Wak Chambil). During this period total 524 piglets were born and 323 piglets were sold to farmers. The litter size at birth and weaning was 9.13±0.54 and 8.37±0.89, respectively for Lumsniang variety. Breed characterization work for Wak Chambil, a new indigenous pig breed, specifically found in West Garo hills has been completed and registration was done by NBAGR, Karnal. The centre 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.

ICAR-IVRI, Eastern Regional Station, Kolkata

ICAR-AICRP on Pig, Eastern Regional Station of Indian Veterinary Research Institute, Kolkata is a conservation unit of indigenous Ghungroo pig germplasm conservation through intensive selection, breeding, propagation, and distribution of superior germplasm to the entrepreneur and farmers to increase the pig population, pork production in the region. Total herd strength of Ghungroo at the end of financial year 2021-22 was 146. During this period total 439 piglets were born and 302 piglets

were sold to farmers. The average litter size at birth and weaning was 8.78±0.30 and 7.39±0.32 of Ghungroo. A total 115 farmers were trained on "scientific pig farming" through online mode. One MVSc student completed her master's programme.

KVK-Goalpara, ICAR-NRC on Pig

The AICRP on pig unit of KVK Goalpara is mandated to conserve Doom pig of Assam and maintain it with selective breeding. The genetic improvement programme of the breed was carried out in the center. As conservation approach, identification of breeding tract, supply of quality germplasm at field and mass-awareness by training and demonstrations were carried out. Total herd strength of Doom pigs at the end of financial year 2021-22 was 69. During this period total 13 piglets were born. The average litter size at birth and weaning was 4.85±0.32 and 4.85±0.32.

Guru Angad Dev Veterinary and Animal Science University, Ludhiana

Looking to the scope and importance of piggery sector in the state of Punjab the Council sanctioned one centre of AICRP on Pig at GADVASU, Ludhiana during 2017. The centre is currently maintaining a total of 65 pig heads including 33 breeding sows and 10 adult boars. During the period total 121 piglets were born while 118 were sold to farmers. Procurement of pigs purchased by the Government of India, housed in Nabha has been accomplished. The average litter size at birth and weaning was 8.7±0.4 and 8.5±0.4, respectively.

Krantisinh Nana Patil College of Veterinary Science, Shirval

The AICRP on Pig center at Krantisinh Nana Patil College of Veterinary Science, Maharashtra Animal and Fishery Sciences University, Shirval was established during 2017. The survey about pig genetic resources and population of indigenous pigs available in various districts/regions of Maharashtra state have been completed. Assessment and study of this stock of indigenous breed is in progress. The total herd strength of indigenous pigs at the end of 2021-22 was 60. During this period total 38 piglets were born and 14 piglets were sold to farmers. The average litter size at birth and weaning was 5.88± 0.88 and 4.88 ± 1.04, respectively.

MEGA-SEED PROJECT ON PIG

The rapid urbanization has increased the demand for quality pork and its products. However, the growth of piggery sector has been hampered due to various major constraints like non-availability of superior quality seed stock, low-cost feed ingredient, imbalanced ration at reasonable price, unscientific management, lack of financial support and marketing channel, etc. To mitigate the demand of quality pig germplasm among the farmer's field, an attempt was made by launching Mega Seed Project on Pig in 2008 which consists of eight different centres. Under this project improved variety of piglets were produced and distributed to the farmers.

Assam Agricultural University, Khanapara, Guwahati

The centre is maintaining HD-K75 and 50% Hampshire crossbred pigs. The herd strength at the end of 2021-22 was 102. A total of 135 piglets were produced while 159 piglets were sold to farmers. The average litter size at birth and weaning were 7.11 ± 1.15 and 6.37 ± 1.10, respectively.

Birsa Agricultural University, Ranchi, Jharkhand

Mega Seed Project on pig is supplying Jharsuk pig variety to the farmers. The centre is developing second line breeder for further propagation of the variety. Centre is maintaining 100 breedable sows along with followers. During 2021-22 total 1052 piglets were produced and 1068 piglets were sold. 380 progressive/2nd line breeder of Jharsuk pigs, they are partially meeting the local demand of farmers.

ICAR RC for NEH Centre, Nagaland

Pig is one of the most important livestock which plays an important livestock in improving the socio-economic status of the tribal and weaker section of the society of Nagaland. Mega Seed Project has made an approach to propagate quality pig germplasm at to farmer's field. The centre is maintaining and distributing Rani crossbred pig variety to the stake-holders of the state. The total herd strength at the end of 2021-22 was 223 Rani Crossbred pigs including 82 breedable pigs. Altogether 812 piglets were farrowed and 607 piglets were supplied to 95 beneficiaries including district KVKs and other govt agencies and departments from Nagaland as well as other states. A total of 578 farmers also availed AI service during the year.

Kerala Veterinary and Animal Sciences University, Mannuthy, Kerala

The mandate of the centre is producing and supplying Mannuthy White crossbred germplasm. Artificial insemination is being regularly practised to avoid inbreeding depression and proper utilisation of genetic potential of superior males. During the year 2021-22, the centre has successfully fulfilled the demand of 46 farmers by supplying 454 fattening piglets (75% crossbreds). The total herd strength at the end of year was 214 including 133 breedable pigs. A total 645 piglets were born and 545 were sold to farmers.

Animal Resources Development Department, Tripura

The centre was started in 2014 and maintaining Landrace, LWY. The centre was actively involved in characterization of local pig of Tripura. The total herd strength at the end of 2021-22 was 121 pigs. During 2021-22 total 456 piglets were produced and 511 piglets were sold.

Animal Husbandry and Veterinary Services, Sikkim

The Mega Seed Project on Pig was sanctioned at Animal Husbandry and Veterinary Services, Govt. of Sikkim. The centre is maintaining HD K75 and Yorkshire pigs. The total herd strength was 172 at the end of 2021-22. A total of 322 piglets were produced and 340 piglets were sold to farmers.

ICAR-Krishi Vigyan Kendra, Goalpara

TANUVAS KPM Gold Crossbred Pig Variety

Annual Report-2022

ICAR-NRCP

ICAR-KRISHI VIGYAN KENDRA, GOALPARA

ICAR-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, 2022 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 85 training programmes were conducted covering 2326 participants during the year. The 39 training programmes conducted for farmers and farm women covering 1108 participants; 35 trainings for rural youth covering 986 participants; 11 trainings for extension functionaries covering 232 participants; 7 long duration sponsored trainings covering 303 participants.


Glimpses of trainings conducted

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 No.1. Performance of microbial consortium bio-fertilizer using rice seedling root dip technique: An OFT on Performance of Microbial Consortium Bio-fertilizer Using Rice Seedling Root Dip Technique was conducted for assessment to solve the problem of low availability of phosphorus and micronutrients by crops leading to low yield & crop damage. The trials were conducted in three replications under rain-fed condition. The Microbial Consortium Biofertilizers (Nitrogen fixation, P & Zn solubilizing, IAA production and Stress tolerant ability) @ 2.5 lit/ha was used as root dip treatment of the rice seedlings.

Technology details:

- TOI: 50% RDF + Microbial Consortium
- TO2: 100 % RDF (60:20:40)
- TO3: Farmer Practice (Urea 35 kg/ha, DAP 20 kg/ha (check)
- Seed Treatment: Mencozeb 2.5 g/kg seed
- Spacing : 20 x 15 cm
- Weeding: At active tillering stage

Parameters assessed:

Parameter	TO1	TO2	TO3
Duration (Days)	150	155	155
Average tiller No	15	13	9
Yield (q/ha)	51.5	47	40.5
Net Return (Rs)	52,750	46,000	30,550
B C ratio	1.70	1.5	1.35

Rice seedling root dip technique with microbial consortium bio-fertilizer

OFT No. 2: Assessment for retting process of Jute by application of CRIJAF- SONA microbial consortium : An OFT on assessment for Retting Process of Jute by Application of CRIJAF- SONA Microbial Consortium was undertaken to solve the problem of low yield and quality due to poor management practices of retting.

Technology details:

TO1: Microbial Consortium (Species of Bacillus)

- The dust formulation i.e. Species of bacillus microbial consortium power was applied evenly spread over each of the layer of Jute bundles during steeping.
- Water hyacinth was used as weight materials.
- TO2: Local practice (without Consortium application)

Result :

Parameter	TO1	TO2
Retting Duration (Days)	18	32
Yield (q/ha)	27.5	23
Fibrecolour	Golden	Grayish
Root Content %	4	13
Luster	Bright	Dull

Retting process of jute by application of crijaf- sona microbial consortium.

OFT No. 3: Assessment trial on shoot pruning and GA application for higher yield in Assam Lemon : An On Farm Trial on shoot pruning and GA application for higher yield in Assam Lemon was conducted in three different locations in Goalpara district. The OFT was aimed to assess the increase in yield by increasing shoot formation and thereby increasing fruiting, since it bears fruit in new current shoot. The source of technology is CAU, Imphal 2018.

Technology details :

TO1:

- Plants > 5 years old
- Shoot pruning up to 15 cm with 50 ppm GA 3 spray during January and August
- 100:100:100g N: P: K/plant/year in two split doses in February-March and October-November.

TO2:

- Plants > 5 years old
- 100:100:100g N: P: K/plant/year in two split doses in February-March and October-November.

OFT No. 4: Performance trial of short duration French bean variety Arka Sharath and Suvidha: An on farm trial short duration French bean variety Arka Sharath and Arka Suvidha was conducted in three locations in Goalpara district. The OFT was conducted to solve the problem of non-availability of suitable short duration variety. The source of the technology is IIHR, 2018

Technology details:

- TO1: Arka Sharath
- TO2: Arka Suvidha
- TO3: Arka Komal (check variety)
- Seed rate: 60 kg/ha
- Spacing: 45 x 30 cm
- Manure and fertilizer: FYM @ 20t, N 30 kg, P2O5 40 kg and K2O 20 kg/ha.

Performance trial of short duration French bean variety Arka Sharath and Suvidha

OFT No.5: Integrated Pest and Disease Management Module for Jute: An OFT programme on Integrated Pest and Disease Management Module for Jute was taken under plant protection aimed to increase yield of the crop by reducing pest and disease infestation. Source of this technology is AAU, 2015 and was conducted in 5 different locations in Goalpara district.

Technology details: TO1: (i) Application of *Trichoderma viride*@ 2.5 kg/ha (mixed with 150 kg FYM, covered with moist gunny bag and incubated for 48 hours in shade) in soil at the time of sowing.

(ii) Hand picking and destruction of egg masses & larvae of Bihar hairy caterpillar and erection of bamboo perches @ 40 nos./ha.

(iii) Two sprays of neem oil @ 4 ml/litre of water at 2nd week of June and first week of July

TO2: Farmer's practice

TO3: Control (No treatment)

Results:

Parameter	TO1	TO2	TO3
Pest Incidence(%)	7	15	27
Pest Infestation (%)	5	1	22
Yield loss (q/ha)	5	35	50
Yield (q/ha)	220	185	170
Net return (Rs/ha)	1,76,000	105,000	85,000
B: C ratio	2.80	2.1	1.8

Integrated Pest and Disease Management Module for Jute

OFT No. 6: Year-round cultivation of Oyster mushroom: An OFT programme was undertaken under plant protection on year round cultivation of oyster mushroom. Oyster mushroom cultivation is very much popular among women farmers/ SHG members in the Goalpara district of Assam. Several varieties are now available for cultivation of Oyster mushroom in summer season also. Normally oyster mushroom (Pleurotusspp) (10-28^{0}C) can be grown during September to April (8 months) of a year. Pleurotus florida is a warm temperature strain. Pleurotus ostreatus can also grow in summer season. Pink oyster mushroom (Pleurotusdjamor) (20-30^{0}C) grows really fast, producing fruits in as little as 3-4 weeks. They can be cultivated during March to August of a year. Thus year round oyster mushroom can be grown commercially.

Technology details : TO1: Year round cultivation of Oyster mushroom TO2: Farmers practice: Winter season cultivation of Oyster mushroomSource: DMR, Solan. Total number of trials:

Parameter	TO1	TO2
Yield per bag (kg)	1.55	1.30
Yield (kg/unit)	1560	800
Net return	2,25,000	1,20,000
B: C ratio	3.80	3.0
Farmer's reaction	V good	Good

Year-round Cultivation of Oyster mushroom

OFT No.7: Performance trial of Rani pig breed for higher productivity: An OFT was conducted to assess the Rani breed of pig in 3 replications in different locations of Goalpara district to increase pork production and for profitability in pig farming. The Rani breed of pig is introduced to overcome the low productivity of existing pig population in Goalpara district. 09 numbers of piglets (03 male and 06female) were distributed to farmers under the programme.

Parameter	TO1	TO2 (HS crossbred)
Average body weight at weaning (kg)	12.26±3.52	11.46±4.35
Average body weight at 4 months (kg)	22.34±3.24	16.54±4.35
Average body weight at 6 months (kg)	34.52±6.58	26.63±5.35
Average body weight at 7 months (kg)	49.52±6.58	39.±2.37
Age of first estrous (months)	6.2	6.8
Litter size at birth (nos.)	10.5	8

Performance trial of Rani pig breed for higher productivity

OFT No. 8: Performance trial of fermented banana pseudo-stem feed for grower pig: An OFT was conducted on performance trial of banana pseudo-stem feed for grower pig to replace the high-cost commercial feed. The ingredients of the feed are Banana pseudo-stem (90%), Molasses (10%) and Probiotics (106 CFU/gm feed). The technology was released by ICAR RC, Barapani, Meghalaya in the year 2018.

Flowchart of processing of banana pseudo-stem into fine mesh powder form

Parameter	TO1	TO2	TO3
Average daily body wt. gain (g)	240	210	150
Cost of feed (Rs /kg)	21	19	15
Disease incidence (%)	2%	2%	3%
Mortality (%)	Nil	Nil	Nil
B:C ratio	4.78	4.20	2.94

Results shows that Banana pseudo stem as low-cost feed for grower pig can be recommended for FLD.

OFT No. 9: Evaluation of Tractor drawn seed drill: A seed drill is an innovative agriculture tool that helps sow the seeds for crops. It positions the seed in the soil and buries them to a specific depth to be distributed equally. The seed drill machine for tractor help put the seeds in a continuous stream in furrows at a uniform rate to cover the seed with soil. This invention or technology provides good control over the depth and ability to cover the seeds, resulting in an increased germination rate and high crop yield. The Utilization of seed drill machine for agriculture also facilitates weed control. The various parameters to be assessed are field capacity, efficiency, productivity, and cost of operation. The programme is in progress.

OFT No. 10: Impact assessment on food consumption pattern of rural households after establishment of Nutrition Garden: An OFT on impact assessment on food consumption pattern of rural households after establishment of Nutrition Garden was conducted in 5 villages in Goalpara District to mitigate with the problem identified that lack of poor nutritional accessibility leads to insufficient food consumption pattern.

Technology details

Methodology:

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

TO1**:** Beneficiaries of nutrition garden

TO2**:** Non beneficiaries of nutrition garden

Results: Vegetable production, consumption from nutrition garden and their calorie distribution/day

Category	Production (Kg/day)	Consumption (Kg/day)	Calorie intake (Kcal)
Nutrition garden established	4.75	2.77 per family	314.9
Control	1.3	1.3 per family	147.7
Differences	3.45	1.47 per family	167.2
Percent increase	72	53.0	53.0

Impact assessment on food consumption pattern of rural households after establishment of Nutrition Garden

OFT No. 11. Development and standardization of value-added products prepared from banana peel: An OFT was conducted on development and standardization of value-added products prepared from banana peel to maximize the waste utilization of banana peel after consumption process.

Technology details

TO1: Development of products

-Ready to cook curry mix

- Sauce.

TO2: Farmer's Practices: Alkaline solution *(Khar)*

Name of the products	Cost of the product/kg(Rs.)	Product recovery	Shelf life	B.C Ratio
RTC curry mix	180.00	950 gm/kg	08 months	2.67
Sauce	250.00	1.5 lit/kg	06 months	3.0
Farmer's practice (khar)	50.00	1lt/kg	04 months	1.0

Organoleptic Attributes (9 point hedonic scale)

Product	Appearance	Colour	Taste	Flavour	Overall Acceptability
Mushroom Papad	7.5	8.0	8.5	8.0	8
Mushroom Pickle	8.5	8.0	7.5	8.0	8

Development and standardization of value-added products prepared from bananapeel

OFT No. 12: Assessment of Value Added Products of Mushroom

Mushrooms have huge health and nutritional benefits and can solve many problems of under-nutrition and malnutrition. Despite this fact mushroom cultivation and its utilization is not catching up fast because mushrooms are highly perishable. Thus, it is important to process mushrooms into value added products which will not only cater to the protein and micronutrient requirement of the farming community but at the same time will solve the problem of short shelf-life and postharvest losses. Hence an OFT was conducted on assessment of Value Added Products of mushroom. The source of the technology is TNAU, Coimbatore, 2018.

Technology details:

- Mushroom Papad: It was prepared using methods like drying, grinding and sieving, of powder mixed with Besan, Suji etc. and dough was prepared with spices. The dough was rolled into papad, sundried and packed.
- Mushroom Pickle: It was prepared by blanching in hot water for 05 minutes. Add lemon juice and salt in water and dried till moisture evaporates. Oil and spices were added and filled in bottle.

Parameters	Product recovery	Income (Rs.)	Shelf life	B.C Ratio
Mushroom Papad	100 gm powder	450	In progress	2.25
Mushroom Pickle	400 gms/kg	300	In progress	1.50
Farmers practice (Fresh Mushroom)	1 kg fresh mushroom	200		

Table : Organoleptic Quality (9point hedonic scale)

Product	Appearance	Colour	Taste	Flavour	Overall Acceptability
Mushroom Papad	7.5	8.0	8.5	8.0	8
Mushroom Pickle	8.5	8.0	7.5	8.0	8

Assessment of Value Added Products of Mushroom

Demonstration of newly proven technology for large scale adoption through FLD and CFLD Programme

FLD No. 1: Front Line Demonstration on Rapeseed Var. Topeswari

Rapeseed also known as rape is a bright-yellow flowering member of the family Brassicaceae, cultivated mainly for its oil-rich seed, which naturally contains appreciable amounts of erucic acid. It is one of the predominant oilseed crop in Goalpara district of Assam because of the prevailing climatic conditions and early duration of the crop and enables the farmers to go for the summer crop after its harvest. A FLD to demonstrate cultivation of rapeseed Var. Topeswariwas undertaken in 4 different locations in Goalpara district covering 5 ha of area. The cropping system followed was Rice followed by rapeseed.

Technology demonstrated:

- Rapeseed var. Topeswari
- Seed rate – 10 kg/ha
- Spacing - 20 cm X 15 cm
- Fertilizer NPK : 40:35:15 and FYM 2 t/ha

The programme is in progress.

FLD No. 2: Front Line Demonstration on Rice Var. CR Dhan 801

CR Dhan 801 is a climate smart variety developed by National Rice Research Institute (NRRI), Cuttack. Drought and submergence stress tolerance are the unique characteristics of this variety. Keeping these unique characteristics in view a FLD on cultivation of this rice variety was undertaken in 4 different locations in Goalpara district covering 4 ha area.

Technology demonstrated:

- Rice var. CR Dhan 801
- Line sowing - Spacing 25 cm × 25 cm
- Fertilizer NPK : 60:20:40 and FYM 2 t/ha
- Plant Protection: Systemic Pesticides

Variety	No of Tillers	No of Panicle	No of grain / panicle	Insect / disease infestation	Yield (q/ha)
CR Dhan 801	17	17	201	0.25% sqm	45.5
Phulpakri (Local)	7	5	155	3% sqm	27 .25
Farmers feed back	Very good response on var. CR Dhan 801				

Front Line Demonstration on Rice Var. CR Dhan 801

Demonstration on Nutri-Cereals (Millets):

Millets have been an integral part of our diet for centuries. They are small - grained, annual, warm - weather cereals belonging to grass family. They are rain - fed, hardy grains which have low requirements of water and fertility when compared to other popular cereals. They are highly tolerant to drought and other extreme weather conditions. They are highly nutritious, non-glutinous, non acid forming foods with high dietary fibre. With the aim to create awareness and increase production & consumption of millets, a demonstration on cultivation of finger millet was carried out in the KVK farm in an area of 0.1 ha.

Technology demonstrated:

- Crop & Variety: Finger Millet Var. Gossaigaon Maruadhan
- Sowing and Transplanting Time: August and September
- Seed rate: 12 kg/ha Spacing = 25 cm X 15 cm
- N: P: K = 20:10:10 kg/ha

Table : Yield attributes and Economics of crop

Effective tillers m -2	20.5
Nos. of grains ear head -1	1275
Nos. of fingers ear head -1	5
Length of finger (cm)	8.5
Yield (q/ha)	15.5
Cost and Benefit ha-1	1:3.5

Demonstration on Nutri-Cereals (Millets)

Demonstration on Natural Farming Model: Natural farming is emerging as a new dimension for sustainability and enhanced farmers income. It is urine-based farming system that does not involve any external chemical or organic fertilizers. It is known by various names like Zero Budget Natural Farming, Prakrithik Krishi, Cow Based Natural Farming, Shashwat Kheti, Chemical Free Agriculture, etc. The various advantages of natural farming are it reduces cost of cultivation, reduces water requirement of crops, reduces risks in farming, it is climate change resilient, it helps in rejuvenation of farm lands, helps in production of safe and healthy food, utilisation of the available cattle (Desi Cow) as valuable resource and also helps in arresting growing needs for fertilizer and reduces subsidy burden. Keeping all these benefits in view a demonstration on Natural Farming was carried out in the KVK farm in an area of 1.15 ha by following recommended Principles and Practices of Natural Farming (ICAR-IIFSR). The programme is in progress.

Technology demonstrated

- Crops Combinations: Cow pea, Beans, Potato, Sunflower, Pumpkin, Tomato, Cabbage, Brinjal, Rapeseed and Maize
- Mulching Materials: Rice Straw, Water Hyacinth, Jute stem.
- Source of Microbes & Nutrients: Jeevamrit, Ghana-jeevamrit
- Plant Protection: Beejamrit, Neemastra, Agniastra, Brahmastra

Demonstration on Natural Farming Model

Demonstration on Arecanut Based Multistoried Cropping System under Natural Farming: A demonstration on Arecanut Based Multistoried Cropping System is established under natural farming in the KVK farm in an area of 1 ha. The programme is in progress.

Technology demonstrated:

- Crops Combinations: Arecanut, Assam Lemon, Cow pea, Beans, Turmeric, Ginger & Maize
- Mulching Materials: Rice Straw, Water Hyacinth
- Source of Microbes & Nutrients: Jeevamrit, Ghana-jeevamrit
- Plant Protection: Beejamrit, Neemastra, Agniastra, Brahmastra

Demonstration on Arecanut Based Multistoried Cropping System under Natural Farming

Demonstration on Input Preparation for Natural Farming: A demonstration on input preparation for Natural Farming was carried out in the KVK farm and in this regard a Natural farming lab was established for preparation of the formulations for source of microbes & nutrients and plant protection. Method Demonstrations on preparation of Microbial consortium, nutrients and natural pesticides were also carried out.

Demonstration on Input Preparation for Natural Farming

FLD 3: Popularization of multiple disease resistant Tomato variety Arka Abhed (H -397)

Tomato variety Arka Abhed is a high yielding F1 hybrid with multiple disease resistance to Tomato Leaf Curl Disease, Bacterial wilt, Early blight and Late blight. Plants are semi-determinate with dark green foliage. Fruits are firm, oblate round & medium large (90-100g). It is suitable for summer, kharif & rabi cultivation. Keeping this in view a FLD on multiple disease resistant tomato variety Arka Abhed was conducted in five locations in Goalpara district in an area of 1 ha comprising 20 nos. of farmers. The source of technology is IIHR, 2018.

Technology demonstrated:

- Variety: Tomato hybrid Arka Abhed (H-397)
- Seed rate: 400g/ha,
- Spacing: 60 cm x 45 cm
- Nutrient Management: FYM: 5t / ha, NPK: 120:80:60 kg / ha
  The programme is in progress and the results are yet to come.

Popularization of multiple disease resistant Tomato variety Arka Abhed (H -397)

FLD 4: Popularization of Okra F1 hybrid Arka Nikita

Arka Nikita is a high yielding F1 hybrid of okra developed by IIHR, 2017. It produces dark green, medium, smooth and tender fruits with excellent cooking quality, nutritionally rich in antioxidant activity, high mucilage content and high edible fiber content. Keeping this in view, a FLD on popularization of this variety among the farmers of Goalpara district was conducted in five locations in Goalpara district covering an area of 1 ha.

Details of Technology:

- Variety: Arka Nikita
- Seed rate: 7kg/ha,
- Spacing: 45 cm x 30 cm
- Nutrient Management: FYM: 10t / ha, NPK: 50:50:50 kg / ha

Days to first flower appearance	40
Days to first picking	55
Yield (q/ha)	145
B:C ratio	3.86

Popularization of Okra F1 hybrid Arka Nikita

FLD 5: Management of Rhizome rot Disease in Ginger

Rhizome rot, also called soft rot, is one of the most devastating fungal diseases of ginger. Initial symptoms of the disease appear as light yellowing of leaf tips which gradually spread down to the leaf blade and leaf sheath along the margin. Keeping in view the prevailing incidences of rhizome rot in ginger and its devastating nature in the farmer's fields in Goalpara district, a FLD was conducted to demonstrate the management practices for this disease in 5 different locations. The programme is in progress.

Details of Technology:

- Rhizome treatment with Copper oxychloride (COC) @ 3 g/ Lit + Streptomycin (0.2g/Lit) for 45 minutes followed by shade drying and planting
- Two soil drenching with COC @ 3 g/Lit at 60 and 90 days after planting
- Source:AAU, Jorhat / 2015
- Variety: Local

Crop Enterprise	Demonstration Yield (q/ha)			Yield of local Check	% increase/ over local	Gross Cost (Rs/ha)	Gross Return (Rs/ unit)	Net Return (Rs/ unit)	B:C
	H	L	A	(q/ha)	%				
Ginger	180	130	155	120	29	1,20,000	2,10,000	90,000	1.75

Management of Rhizome rot disease in Ginger

FLD 6: Management of fruit fly in Pumpkin by using pheromone trap

Fruit fly is a serious pest not only of cucurbits but other also of vegetable crops causing huge losses to farmers of Goalpara district. Environment-friendly management of fruit flies involving pheromones is useful in reducing the undesirable pest populations responsible for decreasing the yield and the crop quality. Keeping this in mind, a FLD on use of pheromone trap for effective management of fruit fly in pumpkin crop was undertaken in 5 different locations in Goalpara district. The programme is in progress.

Details of Technology: Application of pheromone traps @35 nos./ha (Put trap with 5cm x 5cm plywood impregnated with 10% methyl eugenol & 0.1% of cypermethrin)

Management of fruit fly in Pumpkin by using pheromone trap

FLD 7: Integrated Duck–Fish–Horti farming

Integrated farming system is a sustainable agricultural system that integrates livestock, crop production, fish, poultry, tree crops, plantation crops and other systems that benefit each other. IFS

approach is considered to be the most powerful tool for enhancing profitability of farming systems especially for small and marginal farmers to make them bountiful. Keeping this in view, a FLD on Integrated Duck–Fish–Horti farming was undertaken in 2 different locations in Goalpara district with a goal to enhance productivity per unit area, proper waste management and generation of continuous income round the year. The programme is in progress.

Details of Technology:

- Size of pond: 0.14 ha
- No. of birds: 200 (100 ducklings/demo)
- No of fingerlings: 1150 nos/demo
- Horticulture: 10 nos. Areca nut & 05 nos. Coconut seedlings/demo.

Demonstration plot of Integrated Duck – Fish – Hort. farming

FLD 8: Polythene mulching in Pineapple

The major problem in pineapple cultivation is water loss due to weeds. The leaching of soil nutrients during the rainy season and low moisture stress during dry season poses a great threat to pineapple growth. Mulching can overcome this problem to some extent. Besides improving the soil properties, it arrested the weed growth completely. The black plastic mulch is durable, economical, conserves the soil moisture, and helps in the growth of the crop during a dry spell. Keeping this in view a FLD on polythene mulching in pineapple was undertaken in 3 different locations in Goalpara district covering an area of 0.4 ha. The source of the technology is AAU, Jorhat.

Details of Technology :

Use of 50 micron mulching polythene at 1ftX2ft planting. 1ft gap between mulching plastics.

Parameter	Demo	Control
No. of plants/ha	37500	22,500
No. of fruits/ha	26,250	15076
Unit weight (kg)	1.88	1.23
Productivity	49.22 t/ha	18.54 t/ha
Weed (%)	5%	20%

Polythene mulching in Pineapple

FLD 9: Use of walk behind type paddy transplanter

The walk-behind rice transplanter is designed for transplanting rice seedlings into a puddled and levelled field. It is recommended for small to medium sizes of farms. This requires less time than the manual transplanting and minimizes the drudgery and cost of rice transplanting. Hence a FLD on use of walk behind type paddy transplanter was conducted to demonstrate the ease of transplanting of paddy in the farmers field in 3 different locations in Goalpara district. It also aimed at overcoming the problem of shortage of labour during rice transplanting period. The source of technology is CIAE, Bhopal.

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

Use of walk behind type paddy transplanter

FLD 10: Improved spreading tool (Lakhimi) for sun drying of paddy grains

Sun drying is a traditional drying method for reducing the moisture content of paddy by spreading the grains under the sun which is mostly done with conventional spreading tool which is less efficient and labour intensive. A grain spreading tool – "Lakhimi" developed by AAU, 2013 had enhanced the efficiency of the farm women and reduced drudgery to a greater extent. Conventional spreading tool was modified on the basis of anthropometric measurements of farm women to reduce the physiological workload. Hence, a FLD on this modified grain spreading tool – "Lakhimi" was demonstrated in 3 different locations in Goalpara district.

Parameter	Improved Tool	Conventional Tool
Drudgery reduction	• Increase in length of handle reduces postural stress in lumbar region • Modification in length and width of the blade helps to increase the holding capacity	Backache due to postural stress
Spreading Time	3.2 ton/hr	1.92 ton/hr
Output	Increase in output by 67 %.	

Improved spreading tool (Lakhimi) for sun drying of paddy grains

CFLD 1: Cluster Front Line Demonstration on CFLD on Black gram Var. IPU-02-43

KVK Goalpara conducted cluster frontline demonstration (FLDs) to demonstrate the production potential of newly released technologies on the farmer's fields at different location in a given farming system and organized farming and extension activities for farmer and extension workers for dissemination of various technologies under National Food Security Mission (NFSM). A total of 20 hectare area was covered for cluster demonstration on black gram crops through a total of 50 demonstrations.

Technology demonstrated:

- Black Gram var. IPU-02-43
- Seed rate – 22.5kg/ha
- Fertilizer NPK: 10:35:15 and FYM 2 t/ha
- Rhizobium cultures & PSB: 50 g/kg seed

Demonstration Yield (qt/ha)			Yield of local Check	% in-crease	Gross Cost (Rs/ha)	Gross Return (Rs/ha)	Net Re-turn (Rs/ha)	B:C Ratio (GR/GC)
H	L	A						
9.15	6.25	8.1	5.5	49	21,500	47,800	26300	1.80

CFLD on Black gram Var. IPU-02-43

CFLD 2: Cluster Front Line Demonstration on Sesamum Var. Champaboti

KVK Goalpara conducted cluster frontline demonstration (CFLDs) to demonstrate the production potential of newly released technologies on the farmer's fields at different location in a given farming system and organized farming and extension activities for farmer and extension workers for dissemination of various technologies under National Mission on Oilseed and Oil Palm (NMOOP). A total of 10 hectare area was covered for cluster demonstration on sesamum crops through a total of 25 demonstrations.

Technology demonstrated

Sesamum var. Champaboti

Seed rate - 4 kg/ha

Spacing - 30 X 15 cm

Fertilizer NPK: 30:20:20 and FYM 2 t/ha


CFLD on Sesamum Var. Champaboti

CFLD 3: Cluster Front Line Demonstration on Groundnut Var. TG38

KVK Goalpara conducted cluster frontline demonstration (CFLDs) to demonstrate the production potential of newly released technologies on the farmer's fields at different location in a given farming system and organized farming and extension activities for farmer and extension workers for dissemination of various technologies under National Mission on Oilseed and Oil Palm (NMOOP). A total of 20 hectare area was covered for cluster demonstration on groundnut crops through a total of 50 demonstrations.

Technology demonstrated

- Groundnut var. TG38
- Seed rate - 70 kg/ha
- Fertilizer NPK: 20:40:30 and FYM 2 t/ha

CFLD on Groundnut Var.TG38

CFLD 4: Cluster Front Line Demonstration on Rapeseed Var. TS-38

KVK Goalpara conducted cluster frontline demonstration (CFLDs) to demonstrate the production potential of newly released technologies on the farmer's fields at different location in a given farming system and organized farming and extension activities for farmer and extension workers for dissemination of various technologies under National Mission on Oilseed and Oil Palm (NMOOP). A total of 20 hectare area was covered for cluster demonstration on rapeseed crops through a total of 50 demonstrations.

Technology demonstrated

- Rapeseed var. TS-38
- Seed rate – 10 kg/ha
- Spacing - 20 X 15 cm
- Fertilizer NPK: 40:35:15 and FYM 2 t/ha

CFLD on Rapeseed Var.TS-38

KVK Farm Activities

A number of new demonstration units have been established at KVK Goalpara farm during the reported period viz. Natural farming block, Natural farming laboratory, goatery unit, poultry unit, arecanut based multistoreyed cropping system under natural farming, tapioca block etc. Production of seed and planting materials is an important activity of KVK Goalpara. During the reported period, 0.5 Quintals of Black gram (IPU-02-43), 0.5 Quintals of Sesamum (Champawati) and 05 Quintals of finger millet were produced in KVK farm whereas 5 Quintals of paddy var. CR Dhan 801, 10 Quintals of Rapeseed var. Topeswari, 1Quintal of Black gram var. IPU-02-43 and 5 Quintals of Sesamum var. Champawati and 1Quintal of millet were produced in farmer's field. A total of 8500 numbers of fruits, vegetables, spices and agroforestry seedlings were produced in KVK Farm under participatory mode whereas 1,25,000 numbers of fruit and spice seedlings were produced in farmer's field.

Glimpses of KVK Farm

Gramin Krishi Mausam Sewa/DAMU Programme

- Preparation of agromet advisory bulletin and dissemination is the main objective of Gramin Krishi Mausam Sewa (GKMS). The AAS bulletins are being prepared biweekly and were being disseminated through whatsapp as well as via DSS portal both English as well as in local languages (Assamese). All total 783 total bulletins were prepared throughout the year out of which 87 district level and 696 numbers of block level bulletins.
- Data record keeping of automatic weather station is another objective. Daily weather data were being collected, analyze and maintained data both in hard copy as well as in soft copy format.
- Information regarding extreme weather events was also being disseminated among the farmers in advance.

Automatic Weather station & Bulletins

CELEBRATION OF IMPORTANT EVENTS

Krishi Mela cum Farmers' Seminar: The ICAR-Krishi Vigyan Kendra, Goalpara and the ICAR-National Research Centre on Pig, Guwahati, Assam jointly organized the "Krishi Mela-cum-Farmers' Seminar" from 21st to 22nd March, 2022 at KVK Goalpara which was sponsored by Rabha Hasong Autonomous Council (RHAC), Dudhnoi, Goalpara District, Assam. Er. Shri Tankeswar Rabha, Chief Executive Councilor, Rabha Hasong Autonomous Council (RHAC), Dudhnoi, Goalpara District, Assam marked his presence as the Chief Guest along with Dr. H.C. Bhattacharyya, Dean, Daffodil College of Horticulture, Khetri; Shri Charu Mohan Rabha, Chairman, RHAC, Dudhnoi; Shri Bhupen

Roy, Former MLA, North Abhayapuri and Dr. K.M. Bujarbaruah, Former Vice-Chancellor, Assam Agricultural University, Jorhat, Assam as the Guests of Honor during the occasion.

The various activities undertaken during the Mela are listed below:

- An exhibition was organized with 23 stalls to showcase the technologies related to agriculture, livestock farming and farm machinery.
- A Farmer - Scientist interaction programme was organized with an objective to imbibe scientific knowledge among the farmers. During the interaction experts from various fields of agriculture and allied disciplines discussed and gave remedies about the problems brought by the farmers which they were facing during their day to day life.
- Two seminars were organized on technological options for doubling of farmers and climate resilient and nutria-sensitive agricultural practices for augmenting farm income.
- Various competitions such as pig show, best agricultural produce (fruits, vegetable and flowers) and innovative products were also organized. 03 farmers were awarded best farmer award and cash prizes with certificates were distributed.

Glimpses of Krishi Mela-cum-Farmers' Seminar

"Krishi Mela-cum-Farmers' Seminar" was attended by 1564 practising farmers, farm women and rural youth from different corners of Goalpara district and guests and dignitaries from Rabha Hasong Autonomous Council (RHAC), Dudhnoi, Goalpara, various agricultural institutes, and Line Departments of Goalpara district. KVK Goalpara also successfully organised various other events from time to time viz. Swatchata Abhiyan, Kisan Bhagidari Prathamikta Hamari Mela, Fertilizer Awareness Campaign, Kisan Samman Sanmelan, Jal Shakti Abhiyan, Poshan Abhiyan Campaign, World Zoonosis day, World Soil Day , Har Ghar Tiranga Campaign etc.

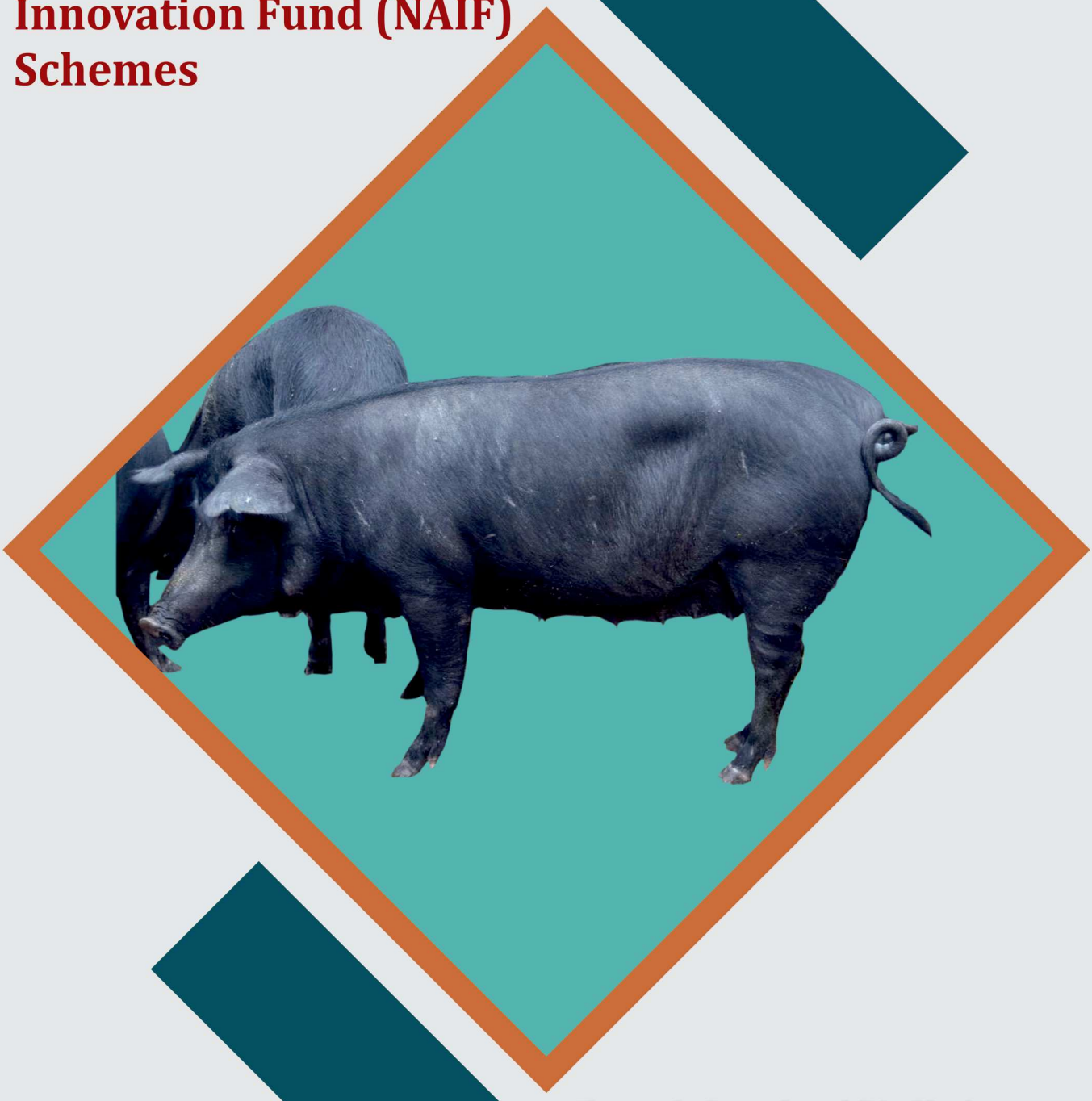
Extension Activities carried out by KVK Goalpara

A number of extension activities were carried out for dissemination of agricultural technologies and information by the KVK during this period which is presented in table 1.

Sl.No.	Activity	Nos.
1.	Field Visits	348
2.	Advisory Services	546
3.	Celebration of Important Days	14
4.	Exposure Visits	4
5.	Farmer's Visit to KVK	2854
6.	Field day	7
7.	Awareness camp	16
8.	Newspaper Coverage	14
9.	Electronic Media	08
10.	TV Programme	06
11.	Seed distribution programmes	08
12.	PRA	02

Glimpses of Extension Activities

National Agriculture Innovation Fund (NAIF) Schemes



Jharsuk Crossbred Pig Variety

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NATIONAL AGRICULTURE INNOVATION FUND (NAIF) SCHEMES

Institute Technology Management Unit (ITMU)

In-charge: Dr. Pranab J. Das, Pr. Scientist

During the year 2022, Institute Technology Management Unit, ICAR-National Research Centre on Pig has taken several programmes for the technologies developed by the Institute and providing that information to pig stakeholders for economically sustainable pig husbandry. In this connection Institute Technology Management Unit (ITMU) which is funded by the National Agriculture Innovation Fund has also taken many forward steps for transfer of technology and commercialization of different pork products, diagnostic kits, low-cost feed formulation etc. as well as provide consultancy, contract research and contract services in piggery sector of India. The Centre has trained numbers of Pig farmers, stakeholders and pork processors for scientific pig rearing and value addition of pork and pork products. These efforts were intended to nurture and support unemployed youth who would be future piggery entrepreneur and thereby boosts the economy of the sector. ICAR-National Research Centre on Pig also taking initiative in making hygienic pork and pork products with good taste and flavour to popularize supply of "Hygienic and clean Pork" which is also help in get rid of zoonotic diseases that may arise from pork and pork product. With the continuation of its effort to develop and transfer of technologies, institute has applied and process three Patents, four trademarks, fifteen Copyrights and three Designs. During 2022-2023 institute has developed three nos. of technologies and signed three nos. of MoUs with stallholders and 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.

Management of IP portfolio

NEW TECHNOLOGY ENDORSED FOR COMMERICIALIZATION

IPRs	Name of Institute	Application/ Registration No.	Name of Innovation/ Technology/ Product/ Variety	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	Complete Specification 01.03.2021 11/01/2022 MoU with NBA 19.08.2022
	ICAR-NRCP	201931040074	LAMP Primer System for Rapid visual Detection of Streptococcus Suis from Pigs and Application Thereof	FER, 29th August, 2022, NBA Approval 19.09.2022

Trade-marks	ICAR-NRCP	5535233	INDPOTRACE	Processed 09.08.2022
	ICAR-NRCP	5747847	NUCLEOFAST	Processed
	ICAR-NRCP	5747848	PIGGYPLEX(D)	Processed
	ICAR-NRCP	5747849	PIGGYPLEX(R)	Processed
Copy-rights	Scientific Pig Production (English)	12157/2022-CO/L	Literary work	Diary nos., October 2022
	Scientific Pig Production Practice (Assamese)	12158/2022-CO/L	Literary work	October 2022
	Scientific Interventions For Upscaling Rural Piggery (Hindi)	12243/2022-CO/CF	Cinematograph films work	Diary nos., October 2022
	Scientific Interventions For Upscaling Rural Piggery (Assamese)	12240/2022-CO/CF	Cinematograph films work	Diary nos., October 2022
	Biosecurity in Scientific Pig Production (Hindi)	12256/2022-CO/CF	Cinematograph films work	Diary nos., October 2022
	Biosecurity in Scientific Pig Production (Assamese)	12246/2022-CO/CF	Cinematograph films work	Diary nos., October 2022
	Biosecurity in Scientific Pig Production (English)	12244/2022-CO/CF	Cinematograph films work	Diary nos., October 2022
	Artificial Insemination in Pig (English)	12156/2022-CO/L	Literary work	Diary nos., October 2022
	Scientific Interventions For Upscaling Rural Piggery (English)	12252/2022-CO/CF	Literary work	Diary nos., October 2022
	Entrepreneurial Guide for Scientific pig Production	Process	Literary work	Processed
	NucleoFAST Viral DNA isolation kit can be used for quick extraction of viral DNA (DNA Virus) from animal tissue samples	Processed	Literary work	Processed 15.12.2022
	Simultaneous diagnosis (ASFV), (PCV) & (PPV) in swine blood and tissue samples	Processed	Literary work	Processed 15.12.2022
	Simultaneous diagnosis of CSF, JE & PRRS in swine blood and tissue samples	Processed	Literary work	Processed 15.12.2022
	INSIGNIA	Process	Artwork	Processed

Design	Apparatus For Surface Microbial Decontamination Of Meat	367130-001	Machines and appliances for preparing food and drink	July 2022
	Boar Semen Preservation Cabinet	360850-002	Machines and appliances	Issued certificate 30.05.2022
	Boar Semen Preservation And Transportation Box	360850-001	Machines and appliances	FER submitted 09.05.2022

CONSULTANCY, CONTRACT RESEARCH, CONTRACT SERVICE

Sl. No.	Institute	Name of Technology	IP Protection (Yes/ No)*	Endorsement Date for Communication	Price for commercialization
1	ICAR-NRCP	Nucleo ^{Fast} Viral DNA isolation Kits	Under Process	13.01.2022	₹400000/
2	ICAR-NRCP	Multiplex ^{CSE,JE,PRRS} Assay Kit	Under Process	28.02.2022	₹400000/
3	ICAR-NRCP	Multiplex $^{ASFV,PCV\ \&\ PPV}$ Assay Kit	Under Process	06.07.2022	₹400000/

COMMERCIALIZATION OF TECHNOLOGIES (MoU/MoA SIGNED)

Sl. No.	Name of Service	Type of Service	Year	Name of clients	Total Revenue earned
1	Exchange of Resources	Co-operation in Education and R&D activities	10.03.2022	Indian Institute of Technology, Guwahati, Assam	NA
2	Exchange of Resources	Co-operation in Education and R&D activities	12.09.2022	All India Institute of Hygiene and Public Health, (Ministry of health and welfare, Govt. of India) JC-27, Sector-3, Salt Lake, Kolkata-700106	NA
3	Exchange of Resources	Co-operation in Education and R&D activities	16.11.2022	Assam Down Town University Sankar Madhab Path, Gandhi Nagar Panikhaiti, Guwahati, Assam 781026	NA

Capacity Building in IP Management

Sl. No.	Name	Location of Business Enterprise	Areas specific for Institutional Support	Technology Transfer fees	Date of MoU/ MoA Signing
9	Aqgromalin Farmtech Pvt. Limited	Chennai, Tamil Nadu	I. Knowledge Partner	25,000	06.04.2022

Training/workshop/Seminar etc. Attended

Sl. No.	Name of Programme (Training/ workshop/ Seminar etc.) attended	Organized By (Name of Institute)	Days of Programme (Date from - to)	Participant (Name)
1.	MSME Exhibition cum Sales Fair	District Industries and Commerce, Rajgarh, Dibrugarh, Assam	26-31st December 2022	Dr. Juwar Doley
2.	ICAR-Industry Stakeholders Consultation Meet	ICAR- National Dairy Research Institute, Karnal-132 001(Haryana). INDIA	18th January	Dr. Pranab J. Das Dr. Rajendran Thomas
3.	Vibrant NorthEast-2022	College of Veterinary Science Khanapara playground, Guwahati.	3rd -5th August 2022	Dr. Pranab Jyoti Das Dr.Rajendran Thomas, Dr. Sunil Kumar Dr. Misha Madhavan, Dr. Nitin M. Attupuram, Mr. Rana P. Kakati

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	An Interactive session and Exposure visit for the student of Downtown University	20th May 2022	35	Post graduate Science students
2	Sensitization of Institute Technologies for Economic Pig Farming and its Commercialization Prospect	30th November 2022	20	Scientist staff of the institute
3	Youth Entrepreneurship Development Programme	21st December 2022	60	Graduate and Post graduate students

Agri-Business Incubation (ABI) Centre

In-charge: Dr. R. Thomas, Senior Scientist

The Agri-Business Incubation (ABI) Centre at ICAR-National Research Centre on Pig focuses on finding new ways of doing business in commercial piggery, allied service sectors and value addition in pork by finding doors to unexplored markets. The centre is intended to help prospective entrepreneurs, by providing pro-active and value-added business support in terms of technical consultancy, infrastructure facility, experts' guidance and training to develop technology-based business ideas and establish sustainable enterprises. It will act as a platform for the speedy commercialization of the ICAR technologies, through an interfacing and networking mechanism between research institutions, industries and financial institutions.

Induction of ABI Entrepreneurs

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. ICAR-National Research centre on Pig inducted three numbers of Entrepreneurs/Start ups under ABI during the year 2022; who sought for the possible support from ABI centre for streamlining their business. A total of 01 number of technology transfer agreements has been signed with the Entrepreneurs and five numbers of technologies has been commercialized till date. 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.

Support extended to the Incubatees

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 startup 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.

Organized Entrepreneurship Development Programme

Agri-Business Incubation Centre of ICAR-National Research Centre on Pig had organized two Entrepreneurship Development Programme (virtually on Google meet application) on "Scientific Pig Production Practices and Value Addition on Pork" on 17th September, 2022 and 8-9th November, 2023, respectively. Both the training programmes were 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. 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.

Organized sensitization workshop jointly with ICAR-NAARM

A sensitization workshop on "Sharpening skills of startups & Investment opportunities (Virtual mode)" was conducted jointly with ICAR-NAARM, Hyderabad on 31-05-2022 for the entrepreneurs. Detailed deliberations were held during the workshop regarding the art of raising capital in business ventures, streamlining the roadmap for better business prospects etc. The meeting was conducted online where open interactions was done with the ABI Entrepreneurs, on pertinent topics related to future aspects and give insights into the recent facets of the piggery and pork processing industry. The meeting was mainly held to focus on these entrepreneurs to popularize their products and business.

List of Entrepreneurs registered with ABI during 2022

Sl No.	Name	Location of Business Enterprise	Areas specific for Institutional Support
1	Arohan Foods Pvt Ltd	Guwahati, Assam	1. Technology for establishing commercial pig breeding farm.
			2. Technology for establishing Micro Pig Abattoir
			3. Technology for establishing Pork Processing Units.

2	Amora Foods Pvt Ltd	Guwahati, Assam	1. Technology support for value added pork products
3	Sayuri Farms	Guwahati, Assam	1. Technology support for value added pork products
4	Symbiotic Foods Pvt Ltd	Sonitpur, Assam	1. Technology for establishing Artificial Insemination support
5	Borluit Farms	Guwahati, Assam	1. Technology for establishing a small processing unit
			2.Technology support for value added pork products
6	G.N Nagesh	Bangalore, Karnataka	1. Technology for establishing Micro Pig Abattoir
7	Paras Farm	Ranchi, Jharkhand	1. Technology for establishing micro pig abattoir
8	Rubul Deka	Dibrugarh, Assam	1. Technology for establishing Artificial Insemination support
9	Emergent Dream Works Infra Developers	Serillingampally, Hyderabad	1. Technology for establishing commercial pig breeding farm
			2. Technology for establishing a Micro Pig Abattoir.
			3. Technology for establishing Processing of common value added pork products
10	Directorate of Animal Resources Development Department	Agartala, Tripura	1. Technology for establishing a Micro Pig Abattoir
11	Majo Francis. A	Thissur, Kerela	1. Technology establishing Micro Pig Abattoir
12	Hester Bio-sciences Ltd	Ahmedabad, Gujarat,	1. Technology transfer of PIGMIN Technology
13	Arthur Foods Company Pvt Ltd	Bangalore, Karnataka	1. Quality testing of pork products
			2. Establishing a pork processing unit
14	Murali Jayaram Reddy	Bangalore, Karnataka	1. Establishing micro pig abattoir
			2. Technology for establishing pork processing unit
			3. Establishing a small feed mill
15	Rayan Firms LLP	Guwahati, Assam	1. Technology for establishing commercial pig breeding farm
			2. Technology for establishing Artificial Insemination support
16	Animal Resourcse Development Department (ARDD)	Agartala, Tripura	1. Technology Transfer for Chilled Boar Semen Processing Centre

17	Aqgromalin Farmtech Pvt. Limited	Chennai, Tamil Nadu	1. Technology for establishing commercial pig breeding farm
18	AB Foods & Beverages	Guwahati, Assam	1. Technology support for value added pork products
19	SRS Meat & Fish suppliers	Agartala, Tripura	1. Establishing Micro Pig Abattoir

Signing of MoU with startups in the area of pork processing and value addition

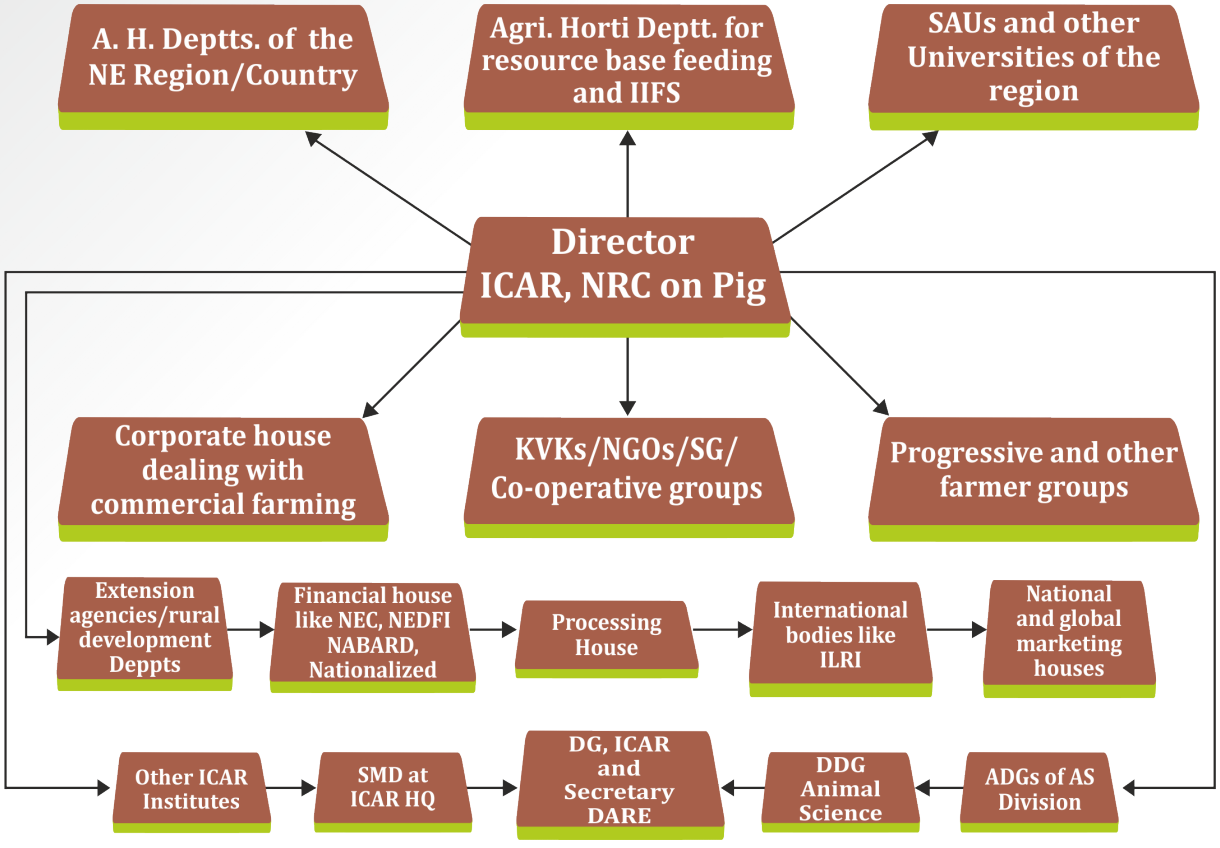
Capacity building programs for the new startups

SWACHH BHARAT MISSION

In-charge: Dr. Kalyan De, Senior Scientist

Swachhta Abhiyan: ICAR-National Research Centre on Pig, Rani actively participated and organized "Swachhta Abhiyan" from time to time throughout the year. In all the Swachhta Abhiyan programmes all the staff of the institute has taken part willingly and sincerely. This year the Swachhta Abhiyan programmes include; cleanliness drive, swachhta campaign, swachhta awareness camp, disposal of pending references, ensuring cleanliness in offices and workplaces etc., improve record management, space management, scrap disposal etc. As per the guidelines of Ministry of Personnel Public Grievances and Pensions, Special Campaign 2.0 was organized ICAR-National research Centre on Pig, Rani, Guwahati from 01.10.2022 to 31.10.2022. Furthermore, as per correspondence from the Cabinet Secretariat and directed by the Ministry of Drinking water and Sanitation, the Swachhta Pakhwada has also been organized during l6 -31st December 2022 including 'Kisan Diwas' on 23rd December 2022. This year five outdoor programmes were also carried out i.e., among the school children by organizing elocution competition and easy writing competition at Sri Sankardev High School at Bongra, Guwahati, and Loharghat Higher Sceondary School, Lowerghat, Kamrup; and among the farmers of Rangia village to create awareness about swachhta. During swachhta campaign different old files were cleared. The office scraps were disposed of to create space. Moreover, the e-office and e-filing were encouraged to prevent the usage of paper. Furthermore, a garden was developed where previously the garbages were used to dump. For that, a place of more than 4000 sq. ft. has been identified behind the car parking shed for farm workers nearby the pond of the institute. The place was a complete mess, full of garbage and debris. The place has been thoroughly cleaned, the land has been prepared and given a form of a nice roadside garden. Nowadays that place has completely changed into a new place blooming with seasonal flowers with nice fragrances.

Linkage and Collaboration of ICAR-NRC on Pig



Meeting And Other Activities

Landly Crossbred Pig Variety

Annual Report-2022
ICAR-NRCP

MEETING AND OTHER ACTIVITIES

Visit of Hon'ble DDG Animal Science

Dr. Bhupendra Nath Tripathi, Deputy Director General (Animal Science), ICAR visited ICAR-National Research Centre on Pig, Rani, Guwahati, Assam on 9th July 2022. Dr. Tripathi interacted with Scientists and visited all the Laboratories, Animal Farm, Boar Semen Laboratory, Quality Control Laboratory and Pork Processing Facility during his visit to the Institute. The Institute's technologies and literatures were also released by the DDG.

Institute Biosafety Committee Meeting

The institute biosafety committee meeting for the year 2022 was held on 10-11-2022 in the Committee room of ICAR-NRC on Pig under the chairmanship of Dr. V. K. Gupta, Director, ICAR -NRC on Pig, The DBT nominee for the committee Dr. N.N. Barman was also present in the meeting. The committee has critically reviewed the biosafety concern about the future project and given suggesstions for the proper biosafety majors to be followed.

Institute Research Committee meeting

The XVIth Institute Research Committee meeting of ICAR-NRC on Pig was held on 14-15th and 28-30th November 2022 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 outcome-based research. Each scientist must try to evaluate the research work conducted by himself. As the proceeding of the IRC is being used for many other evaluation purposes, all are requested to be careful while presenting their results. Every scientist must try to publish their tangible research to good impact factor journal once the work is over. As a "one and only" institute working on pig species, we should be in position to provide guidance in pig farming to whole country. 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 Ethic Committee

The CPCSEA nominated member Dr. Kishore Kumar Baruah, Retd. Principal Scientist, ICAR-RC for NEH region, Barapani was inspected the animal house facility of ICAR-NRC on Pig, Rani during the period. He inspected all the animal sheds like boar shed, grower shed etc. and also inspected the waste disposal system of animal sheds. The few photos of the same is given below:

Quinquennial Review Team (QRT)

The Indian Council of Agricultural Research, New Delhi constituted the Quinquennial Review Team (QRT) vide its office order No. F.No. AS 20/01/2022-IA-I dated 25.10.2022 to review the works done by the ICAR-National Research Centre on Pig, Rani, Guwahati for the period from 01.04.2017 to 31.03.2022 with the following as its Chairman and Members:

1.	Dr. V. K. Taneja, Former Vice Chancellor, GADVASU and Former Dy.Director General(AS), ICAR, New Delhi	Chairman
2.	Dr. Arjava Sharma, Former Director, ICAR-CIRC, Meerut and Former Director, ICAR-NBAGR, Karnal	Member
3.	Dr. V. V. Kulkarni Former Director ICAR-NRC on Meat, Hyderabad	Member
4.	Dr. K. K. Datta Former Principal Scientist, NIEP, New Delhi	Member
5.	Dr. S. K. Uppal Dean, PGS, GADVASU, Ludhiana Member	Member
6.	Dr. Kusumakar Sharma Former Assistant Director General (HRD), ICAR	Member
7.	Dr. N.H.Mohan Principal Scientist, ICAR-National Research Centre on Pig	Member Secretary

Research Advisory Committee: The Indian Council of Agricultural Research, New Delhi constituted the Research Advisory Committee (RAC) of ICAR -NRC on pig, Guwahati, with following as its chairman and members vide its office order No. F.No. F. No. AS 20/07/2022-lA-1 Dated: October 25th, 2022

1.	Dr. A. K. Srivastava Vice-Chancellor, DUVASU, Mathura, UP	Chairman
2.	Dr. Dharmeswar Das, Forrmer Joint Director (Academics), ICAR-IVRI/ Forrmer Dean, CVSc, AAU, Khanapara Assam	Member
3.	Dr. D. Swarup Former Director, ICAR- CIRG, Makhdoom	Member
4.	Dr. D.K. Agarwal, Former Head, Division of Animal Nutrition, ICAR- lVRl, lzatnagar, Bareilly (UP).	Member
5.	Dr. S.K. Mendiratta, Principal Scientist & Head, Division of LPT, ICAR-IVRI, lzatnagar, Bareilly (UP)	Member
6.	Dr. Hema Tripathi National Coordinator, NAHEP, ICAR	Member
7.	Dr. V. K. Gupta, Director, ICAR-NRC on Pig	Member
9.	Dr. Amrish Kumar Tyagi, Assistant Director General (AN&P), Indian Council of Agricultural Research	Member
10.	Dr. Khanindra Kalita VPO- Tarani, Rangia, Kamrup (Assam)	Member
11.	Shri. Aiboklang Diengdoh Shillong, Meghalaya.	Member
12.	Dr. N.H. Mohan, Principal Scientist, ICAR-National Research Centre on Pig	Member Secretary

CELEBRATIONS

Republic Day

The ICAR-National Research Centre on Pig celebrated Republic Day with great zeal and enthusiasm. The day began with the hoisting of the national flag by Dr V.K. Gupta, Director of the Institute followed by the national anthem.

International Women's Day

International Women`s day was celebrated at ICAR-National Research Centre on Pig, 8th March 2022. To mark the occasion, a workshop on "Scientific Pig Production Practices: Empowering Women and Bringing Prosperity" was conducted for farm women engaged in pig husbandry. The event was attended by 120 persons including 75 women farmers and entrepreneurs from Marabhitha, Dhantola and Rani village of Kamrup district, Assam. The programme comprised of three sessions, inaugural, workshop and activity involving farm women.

National Girl Child Day

The ICAR-National Research Centre on Pig, Guwahati, Assam organized 'National Girl Child Day' on 24th January, 2022 at Rani High School, Rani, Guwahati with 40 girl students. The programme was attended by scientists from ICAR-NRC on Pig and Assistant head master and teacher from the Rani High School. A speech was given to inspired the girl students by citing the examples of eminent women achievers in India and the importance of girl's education and motivated the children to be par with the boys in all aspects of life. A short video on "Gender sensitization and importance of health and hygiene for adolescent girls" was showed to the girl students.

International Yoga Day

The Institute has observed International Yoga Day on 21st June, 2022. All scientist, technical, administrative, RA's, SRF etc. together participated in the programme and honor the ancient practice that promotes physical, mental, and spiritual well-being.

Independence Day

The Institute celebrated 76th Independence Day of the country on 15th August 2022. All the staff of the Institute assembles with great ardor for hoisting the national flag and sing the national anthem. Dr V. K. Gupta, Director of the Institute delivered speech on the occasion by honouring the sacrifices of our freedom fighters and strive to build a better nation.

Har Ghar Tiranga

The staff of the Institute participated "Har Ghar Tiranga" campaign initiated by the Government of India by clicking a selfie with the India Flag. The aim of the campaign is to instil a sense of pride, patriotism and unity among people.

Institute Foundation Day

The ICAR-National Research Centre on Pig has celebrated its 21st foundation day on 4th September, 2022 by hoisting the Institutional Flag and holding a discussion session to recognize the hard work and dedication of the scientific and non-scientific staff of the Institute.

Cyber Jagrookta Diwas

ICAR-National Research Centre on Pig, Rani, Guwahati, Assam celebrated "Cyber Jagrookta Diwas" on 6th October 2022. The programme was chaired by the Director, Dr. V. K. Gupta along with the presence of scientific and non-scientific staff of the Institute. On this occasion a lecture on "Cyber Crime and Security" was delivered by Dr. Salam Jayachitra Devi, Scientist (Computer Application & Information Technology) to spread awareness on cyber-crime, precautionary measures to be taken, and about the cyber-crime portal launched by the Ministry of Home Affairs followed by an interactive session among the staff.

Vigilance Awareness Week

ICAR-National Research Centre on Pig, Rani, Guwahati, Assam Celebrated Vigilance Awareness Week from 31.10.2022- 06.11.2022. Different activities organized during vigilance awareness week-2022. Observance of Vigilance Awareness Week started taking integrity pledge and it was administered by Dr V. K. Gupta, Director, NRC on Pig on 31st October, 2022. All the employees of the institute took part in it with full enthusiasm. It was followed by workshop among the officers and staff on the theme "भ्रष्टाचार मुक्त भारत - वकिसति भारत" (Corruption free lndia for a developed Nation). Dr. V. K. Gupta deliberated on issues of corruption and discussed on how

individual should follow the transparency in their work. On this sensitization programme cum workshop, a talk on importance of vigilance was delivered by Dr B. C. Das, Vigilance officer of the institute. The programme included deliberation of lectures on different aspects of vigilance including group discussion. On 1st October, Workshop cum sensitization program on vigilance and use of social media with School children held at Kalaguru Jatiya Vidyalaya, Rani, Kamrup. Fruitful discussion held on theme "Corruption free India for a developed nation" among students, teachers of the school and Scientists of the institute. On 2nd October, essay completion held among staff of institute on corruption free India for a developed Nation and grievance redressal camp organized on 3rd November as per instruction of Council and CVC as well. Awareness Gram Sabha" was organized at village Belguri on 05-11-2022 in order to bring awareness of vigilance and dissemination of information regarding the menace of corruption and different measures that public can undertake to redress it. Around 31 numbers of villagers including school children were participated on the programme.

Three months campaign period (16th Aug-15th Nov, 22) done as per instructions of CVC for preventive vigilance cum internal housekeeping activities on focus areas viz. Property Management, Management of Assets, Record Management, Technological initiatives and updation of guidelines/ circular/ manuals. Elocution completion was organized among staff on Corruption free India for a developed Nation on 6th November followed by valedictory program. Winners for different competitions were awarded. Banners were prepared on the theme "भ्रष्टाचार मुक्त भारत वकिसति भारत" (Corruption free lndia for a developed Nation)" and were displayed at institute, in village and in school for creation of awareness. The institute observed Vigilance Awareness Week with great fervour to enhance the awareness, to display honesty by all of us, at all time and at all places.

Constitution Day

The Institute celebrated constitution day of our Country on 26th November 2022. The scientific staff and security personal of the institute assembled at committee room and a pledge was taken.

Azadi ka Amrit Mahotsav lecture series:

As part of the celebration of the 75th Year of Indian Independence, ICAR-National Research Centre on Pig had initiated a lecture series to review the development and achievement of pig sector in the Independent India and the prospects for the future in various fields of pig husbandry research, extensions and technological endeavour delivered by scientists in their respective fields. During the lecture series A session on "Emerging and re-emerging viral diseases of pigs" was delivered by Prof. Dilip Kumar Sarma, an eminent virologist and former director, ICAR-NRC on Pig. Dr V. K. Gupta, Director, ICAR- NRC on Pig, delivered a lecture on "Animal vaccines: Issues in R&D". The history and evolution of vaccine development and its present significance to the COVID pandemic were elaborated during the session. Apart from these 19 other lectures were organised in the lecture series.

HINDI CELL ACTIVITIES

राजभाषा प्रकोष्ठ, भा.कृ.अनु.प.-राष्ट्रीय शूकर अनुसंधान केंद्र

राजभाषा हिन्दी के सुचारु रूप से कार्यान्वयन के लिए भा.कृ.अनु.प.-राष्ट्रीय शूकर अनुसंधान केंद्र, गुवाहाटी में एक राजभाषा कार्यान्वयन समिति कार्यरत है। जिसमें 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 सचिव	डा. सतीश कुमार, वैज्ञानिक एवं प्रभारी, हिन्दी प्रकोष्ठ

राजभाषा कार्यान्वयन 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 को 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 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 जी 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।

राष्ट्रीय शूकर अनुसंधान केंद्र, राणी, गुवाहाटी में हिंदी पखवाड़ा-2022 का आयोजन

भा.कृ.अनु.प.-राष्ट्रीय शूकर अनुसंधान केंद्र, राणी, गुवाहाटी में 14 सितम्बर 2022 से 29 सितम्बर 2022 तक हिंदी पखवाड़ा 2022 का सफलतापूर्वक आयोजन किया गया। राजभाषा विभाग के निर्देशानुसार इस वर्ष हिन्दी पखवाड़ा का उद्घाटन गृहमंत्री श्री अमित शाह जी की अध्यक्षता में दिनांक 14.09.2022 को सूरत में किया गया। केंद्र में हिंदी पखवाडा का शुभारम्भ 16/09/2022 से श्रुतिलेख प्रतियोगिता से हुआ। 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 निम्नलिखित कार्यक्रम का आयोजन किया गया

दिनांक	कार्यक्रम	कार्यक्रम समन्वयक
16/09/2022	श्रुतिलेख प्रतियोगिता स्थान: समिति कक्ष, समय: संध्या 4.00 बजे	डॉ सतीश कुमार
17/09/2022	बाल काव्य पाठ प्रतियोगिता स्थान: समिति कक्ष, समय: संध्या 4.00 बजे	श्री उत्तम प्रकाश
19/09/2022	समयस्फूर्त भाषण (Extempore) प्रतियोगिता स्थान: समिति कक्ष, समय: संध्या 4.00 बजे	डॉ सौविक पॉल

20/09/2022	हिंदी निबंध प्रतियोगिता स्थान: समिति कक्ष, समय: संध्या 4.00 बजे	डॉ कल्याण डे
21/09/2022	विद्यार्थियों के लिए वाद-विवाद प्रतियोगिता स्थान: राणी हाईस्कूल समय: पूर्वाहन 11.00 बजे	डॉ सुनील कुमार
22/09/2022	हिंदी कार्यशाला: 1 (हिंदी टिप्पणी लेखन एवं हिन्दी पत्राचार) स्थान: समिति कक्ष, समय: संध्या 3.00 बजे	डॉ जया एवं डॉ सतीश कुमार
23/09/2022	विद्यार्थियों के लिए हिंदी निबंध प्रतियोगिता स्थान: राणी हाईस्कूल, समय: पूर्वाहन 11.00 बजे	डॉ सुनील कुमार
24/09/202	टंकण प्रतियोगिता (यूनिकोड से हिंदी टाइपिंग) गूगल फार्म से समय: संध्या 3.00 बजे	डॉ सलाम जयचित्र देवी
26/09/2022	प्रश्नोत्तरी प्रतियोगिता स्थान: समिति कक्ष, समय: संध्या 4.00 बजे	डॉ शांतनु बणिक
27/09/2022	हिन्दी कार्यशाला: 2 विशेष अतिथि: डॉ सचिन कुमार, प्रोफेसर, आईआईटी गुवाहाटी स्थान: समिति कक्ष, समय: पूर्वाहन 11.00 बजे	डॉ प्रणब ज्योति दास
29/09/2022	हिन्दी कार्यशाला: 3 एवं समापन समारोह विशेष अतिथि: श्री रविशंकर रवि, संपादक, दैनिक पूर्वोदय स्थान: समिति कक्ष, समय: पूर्वाहन 11.00 बजे	डॉ सतीश कुमार

हिंदी पखवाड़ा का सफलतापूर्वक समापन दिनांक 29-09-2022 को किया गया। इस समारोह के मुख्य अतिथि समाचारपत्र 'दैनिक पूर्वोदय' के संपादक श्री रविशंकर रवि 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। उन्होंने शोध परिणामों को भी हिन्दी या स्थानीय भाषा में प्रकाशित करने का सुझाव दिया। 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 तथा हिन्दी भाषा को देश के हर भाग से संवाद स्थापित करने का महत्वपूर्ण जरिया 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 एवं हिंदी प्रश्नोत्तरी शामिल थे। इसके अलावा तीन हिंदी कार्यशाला का आयोजन किया गया। प्रथम कार्यशाला में डॉ जया एवं 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 सचिन कुमार, प्रोफेसर, आईआईटी गुवाहाटी ने वैज्ञानिक विषय पर हिन्दी में व्याख्यान प्रस्तुत किया। तीसरे कार्यशाला में विशेष अतिथि श्री रविशंकर रवि, संपादक, दैनिक पूर्वोदय ने अपनी 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 डॉ सौविक पॉल के धन्यवाद ज्ञापन के साथ हुआ।

श्रुतिलेखन प्रतियोगिता

समय स्फूर्त भाषण प्रतियोगिता

निबंध प्रतियोगिता

राजभाषा कार्यशाला का आयोजन

पुरस्कार वितरण कार्यक्रम

विजेताओं के साथ निदेशक

राजभाषा कार्यशाला का आयोजन

प्रश्नोत्तरी प्रतियोगिता

राणी उच्च विद्यालय में राजभाषा कार्यक्रम

प्रश्नोत्तरी प्रतियोगिता

TRAINING CELL

ICAR-NRC on Pig has conducted a series of 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. These trainings have also provided exposure to the participants on basics of ante and post-mortem inspection, hands-on-training on scientific pig slaughter process, fabrication & packaging of pork, facilities required for hygienic slaughter, common diseases encountered during the slaughter operations and the importance of personnel hygiene. Information on value addition and further processing of pork and the avenues available in the utilization of different by-products arising out of pig slaughter operations were also disseminated during the training programmes.

Table : Training Programme organised

Sl. No.	Sponsorship	Name of the Training Program	Date	No. of Beneficiaries
1.	Institute TSP	Pig Disease and its Management	March 1-3, 2022.	18
2.	Institute SCSP	National Training Programme on "Hands on Training on Basic Molecular Biology Tools and Techniques"	March 3-5, 2022.	08
3.	Institute TSP	Artificial Insemination in Pig	March 4-5, 2022	20
4.	Self-sponsored	National Self-sponsored Training programme on "Scientific Pig Farming for Livelihoods and Food Security"	March 7-9, 2022	29
5.	Self-sponsored	National Self-Sponsored Training Programme on "Artificial Insemination in Pig"	March 14-16, 2022	23
6.	Institute SCSP	Scientific Pig Production and Management	March 21-23, 2022	19
7.	Institute SCSP	Artificial Insemination in Pig	March 24-26, 2022	23
8.	Institute ITMU	Exposure visit cum Interactive session with the B.Tech/ M.Tech Students of Assam Down Town University	May 20, 2022	40
9.	Institute	Six months "Piggery Farmers Field School" at Barmura Village, Rangiya, Assam	January to June, 2022	25

10.	MANAGE Hyderabad	Online Training on “Skills for Entrepreneurship Development in Pig Husbandry”	June 15-17, 2022	29
11.	APART & DOIC, Assam	Skill Workshop on "Entrepreneurship Development on Scientific Pig Farming"	June 23-25, 2022	20
12.	SERB	High-End Workshop (Karyashala) on “Training and Study Guide on Molecular Diagnostic Tools for Livestock Diseases”	July 5-18, 2022	25
13.	APART	Master Training Programme (ToT) for Local Service Provider (Pig Bondhus) under APART	August 10-12, 2022	35
14.	SCSP	Scientific Pig Farming for Livelihood and Nutritional Security	September 12-14, 2022	19
15.	Self-sponsored	Entrepreneurship Development Programme on Scientific Pig Production Practices and Value Addition of Pork (online)	September 17, 2022	05
16.	TSP	Front-Line Demonstrations (FLD) on "Capacity building of the tribal farmers through demonstration of Artificial Insemination techniques in pigs”	September 21, 2022	89
17.	TSP	Reproductive Management and Artificial Insemination in Pig	September 22-24, 2022	19
18.	TSP	Scientific Pig Farming for Livelihood and Nutritional Security	November 1-3, 2022	21
19.	SCSP	Scientific Pig Farming for Livelihood and Nutritional Security	November 15-17, 2022	16
20.	TSP	Front-Line Demonstrations (FLD) on Capacity building of the tribal farmers through demonstration of silage making and storage for feeding of pigs	November 16, 2022	151
21.	Gramya Vikash Mancha, Nalbari.	Exposure Visit-cum-Training Programme on Pig Farming for tribal farmers of Nalbari District	November 21, 2022,	18
22.	Institute	Institutional visit for 60 B.Tech students from the discipline of Biotechnology and Microbiology, AIMT, Guwahati at ICAR-NRC on Pig, Guwahati	December 08, 2022	39
23.	KVK Peren, Nagaland under NABARD sponsored funding	Capacity Building Programme for Adoption of Technology (CAT) and Interstate Exposure visit for 20 farmers from Peren district, Nagaland at ICAR NRC on Pig, Rani, Guwahati	December 09, 2022	21

24.	DBT, GoI, sponsored	Three days Popular Lecture Series for graduate and post graduate students of biotechnology	December 21-23, 2022	255
25.	Self-sponsored residential training programme	Scientific Techniques for Profitable Pig Farming	December 27-29, 2022	09

Training on Artificial Insemination in Pigs

Training on "Scientific Pig Farming for Livelihoods and Food Security"

Certificate distribution for training on "Scientific Pig Farming for Livelihoods and Food Security"

Certificate distribution for training on "Artificial Insemination in Pig"

Training on "Artificial Insemination in Pig"

Popular lecture series organized by ICAR-NRC on Pig sponsored by DBT, GoI

Group Photograph of training programme on "Scientific Techniques for profitable Pig farming"

Exposure visit of Students and Faculty from AIMT, Guwahati

Exposure visit of farmers from Peren district, Nagaland at ICAR NRC on Pig, Rani, Guwahati

SERB, GoI sponsored Karyashala on Molecular diagnostic tools for livestock diseases

Skill workshop on "Entrepreneurship Development on Scientific Pig Farming"

Participants at the Valedictory session of the Skill workshop

Awards and Recognitions

SVVU T-17 Crossbred Pig Variety

AWARDS AND RECOGNITIONS

Best Annual Report Awards From ICAR:

ICAR-National Research Centre on Pig received ICAR Award for the best Annual Report 2021. The award was received by Dr. V. K. Gupta, Director ICAR-NRCP from Shri Narendra Singh Tomar Ji, Hon'ble Minister of Agriculture & Farmers Welfare during ICAR Foundation Day, 16th July 2022.

Hindi Award:

भारत सरकार के राजभाषा विभाग द्वारा पूर्वोत्तर क्षेत्र स्थित कार्यालयों में वर्ष 2019-20 के दौरान राजभाषा कार्यान्वयन क्षेत्र में उल्लेखनीय कार्य निष्पादन के आधार पर भारतीय कृषि अनूसंधान परिषद-राष्ट्रीय शूकर अनुसंधान केंद्र, गुवाहाटी, असम को द्वितीय पुरस्कार प्रदान किया गया।

Dr Santanu Banik

- Best Oral Presentation Award in XIX Annual Convention (SOCDAB) National Symposium on "Contemporary Technology for Animal Genetic Resource (AnGR) Management" at ICAR-NBAGR, Karnal (21-22nd September, 2022).

Dr Seema Rani Pegu

- Awarded ICVP Diplomat 2022 at XXXIX Annual Conference of Indian Association of Veterinary Pathologists, and XIII Annual Meeting of Indian College of Veterinary Pathologists, P.V.Narsimha Rao Telangana Veterinary University Rajendranagar, Hyderabad-500030, India.

Dr Rajib Deb

- Received Prof. Chinkolkar Memorial Award, The Biotech Research Society of India (2022) at IIT-Guwahati
- Received INSA-Visiting Scientist Fellowship Award 2022
- Received National Academy of Dairy Science (India) Associate Fellowship award 2022
- Received Indian Society of Veterinary Immunology and Biotechnology Mid-career Scientist Award 2022

Dr Jaya

- Best Poster Presentation Award for the "Androgen Receptor gene is associated with luteal steroidogenesis in vitro as dissected through CRISP/Cas9 system" in the International Conference on Reproductive Healthcare & 32nd Annual Meeting of the Indian Society for the Study of Reproduction and Fertility held during 11th-13th February, 2022.
- Best Oral Presentation Award for the "Knock out of FOS gene through CRISPR/Cas9 reduces steroidogenesis of porcine luteal cells and makes them amenable to apoptosis in vitro". in the XXX Annual Conference of the Society of Animal Physiologists of India and National Symposium on "Shifting basic physiological paradigm towards clinico-therapeutic innovative interventions for improvement in livestock health and production" organized by Department of Veterinary Physiology, Nagpur Veterinary College, Maharashtra Animal and Fishery Sciences University, Nagpur during 17thto 19th February, 2022 in online mode.
- Best Research Article Award of SAPICON 2022 for the research paper: Jaya, B et al. "Transcriptome profiling of different developmental stages of corpus luteum during the estrous cycle in pigs." Genomics 113.1 (2021): 366-379.
- Best Poster Presentation Award (Second position) for the Jaya, Kumar, S., Mohan, N.H., and Das, B.C. "Transcriptome analysis reveals key genes and signalling pathways regulating ovarian follicular dynamics in Indian Ghoongroo pigs" at National Symposium on "Contemporary Technology for Animal Genetic Resource (AnGR) Management" on 22nd-23rd April, 2022, organized by Society for Conservation of Domestic Animal Biodiversity (SOCDAB) at ICAR-National Dairy Research Institute, Karnal-13200, Haryana, India.

Dr Satish Kumar

- Best Poster Presentation Award for the "Androgen Receptor gene is associated with luteal steroidogenesis in vitro as dissected through CRISP/Cas9 system" in the International

Conference on Reproductive Healthcare & 32nd Annual Meeting of the Indian Society for the Study of Reproduction and Fertility held during 11th-13th February, 2022.

- Best Poster Presentation Award (Second position) for the Jaya, Kumar, S., Mohan, N.H., and Das, B.C. "Transcriptome analysis reveals key genes and signalling pathways regulating ovarian follicular dynamics in Indian Ghoongroo pigs" at National Symposium on "Contemporary Technology for Animal Genetic Resource (AnGR) Management" on 22nd-23rd April, 2022, organized by Society for Conservation of Domestic Animal Biodiversity (SOCDAB) at ICAR-National Dairy Research Institute, Karnal-13200, Haryana, India.

Dr Misha Madhavan M

- Best paper presentation award in the International seminar on Sustainable urban agricultural systems and community resilient cities on 22nd March, 2022 organized by CoA, Vellayani, KAU, Thiruvanthapuram, Kerala on the topic "Animal waste management in urban and peri-urban dairy farms: Insights from National Capital Region (NCR), India.
- Best poster presentation award in the International seminar on Sustainable urban agricultural systems and community resilient cities on 22nd March, 2022 organized by CoA, Vellayani, KAU, Thiruvanthapuram, Kerala on the topic "Is urban pig farming sustainable?"

Dr Nitin Attupuram

- Best Poster Presentation Award in the International seminar on sustainable urban agricultural systems and community resilient cities, organized by Kerala Agricultural University on March 22, 2022.

Dr Salam Jayachitra Devi

- Most Innovative Article for the month awarded for the article entitled Artificial Intelligence for Welfare of Animals in Vigyan Varta: An International E-Magazine for Science Enthusiasts for the month of May, 2022.

RECOGNITIONS

Dr Santanu Banik

- Selected as member of National Advisory Committee for Animal Husbandry and Dairying sector for Piggery by Ministry of Fisheries, Animal Husbandry and Dairying, Department of Animal Husbandry and Dairying, GoI
- Acted as external examiner of one Ph.D. Dissertation (Animal Genetics Breeding) of College of Vety. Sciences and Animal Husbandry of Assam Agricultural University.

Dr N.H. Mohan

- Invited Lectures Mohan NH and Prajwalita Pathak (2022) Nutrigenomics and its application in animal science. 30th Annual Conference of Society of Animal Physiologists of India (SAPI) & National Symposium on Shifting basic physiological paradigm towards clinico-therapeutic innovative interventions for improvement in livestock health and production. 17-19 Feb 2022. Nagpur Veterinary College, MAFSU.
- Invited Lecture on "Physio-genomic responses to heat stress in Pigs" in International workshop on 'Sustainable Livestock Production under Impending Climate Change from

21-22, Dec 2022 at ICAR-Indian Veterinary Research Institute (ICAR-IVRI), Izatnagar, Bareilly, India under Australia-India Council project.

Dr Keshab Barman

- Appointed as external examiner for PhD viva voce examination of Dr. Biren Kuma Das, Roll No 2017-VDK-08, for award of PhD Degree in Animal Nutrition of AAU vide order no AAU/DPGS/PF/2022-23/322 dtd 20-04-2022.
- Appointed as External Examiner for M.V.Sc. thesis evaluation Dr. Dangshawa Morung, Roll No.2018-VMK-08 for M.V.Sc. Degree in Animal Nutrition. Degree in Animal Nutrition, vide order no AAU/DPGS/PF/2021-22/3140 dtd 03-02-2022. The thesis title: ''Effect of feeding nano-Fe on growth performance and nutrient utilization in grower pigs''.
- Appointed as External Examiner for M.V.Sc. thesis evaluation Dr. Aibaniairi Fancon, Roll No 2019-VMK-06 for M.V.Sc. Degree in Animal Nutrition, vide order no AAU/DPGS/PF/2021-22/3028 dtd 24-01-2022. The thesis title: 'Effect of feeding prebiotics, probiotics and symbiotic in broiler chicken fed on corn soya-based diet.

Dr Rafiqul Islam

- Dr. Rafiqul Islam, Principal Scientist (Animal Reproduction & Gynaecology) has been included as PG Faculty of ICAR-Indian Veterinary Research Institute (Deemed University), Izatnagar w.e.f. 18th May, 2022 in the discipline of Veterinary Gynaecology & Obstetrics (VGO).
- Reviewed two manuscripts as reviewer for Theriogenology, An International Journal of Animal Reproduction published by Elsevier.
- Certificate of appreciation received on 31 August, 2022 in recognition of an outstanding contribution to the quality of the "International Journal of Livestock Research" in the year 2021-22.
- Councilor 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.
- 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 Pranab Jyoti Das

- Invited reviewer for Journals Gene, BioCell, BMC Genomics, Frontiers in Veterinary Science during year 2022.
- Invited reviewer for Romanian Evaluation Process PED2021 - The Ministry of Education and Research and the Executive Agency for Higher Education, Research, Development and Innovation Funding, Romania (UEFISCDI - www.uefiscdi.gov.ro).
- Act as Editorial Board member for the Animal and Veterinary Sciences Journal – Science

Publishing Group, 2022.

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 19, 20 and 21st meeting of Scientific panel on meat and meat products of FSSAI during 2022.
- Represented the institute in FAD 18/P-1 and FAD 18/P-4 panels to review Indian Standards under FAD 18 to align the same with the corresponding Codex standards and FSSAI regulations and to review the Indian standards older than 20 years in FAD-18 sectional committee.
- Represented the institute as member of inspection team constituted by Commissioner, Animal Husbandry and Veterinary, Govt. of Assam to assess the infrastructure developed at Export Oriented Pork Processing Unit at Nazira, Sivasagar, Assam.
- Represented the institute and provided the required inputs in the Meeting of State Project Coordination Committee (SPCC) of World Bank funded APART Project during 2022.

Dr Seema Rani Pegu

- External examiner for evaluation of M.V.Sc. Thesis of Veterinary Pathology from College of Veterinary Science, Khanapara, Assam.

Dr Rajib Deb

- Acted as INYAS, INSA selection committee member 2022
- Editor-INYAS, INSA Monthly News Letter 2022
- Visiting Scientist at CSIR-Indian Institute of Chemical Biology, Kolkata, India

Dr. Kalyan De

- Delivered Lecture on " Is broiler pig possible? Methods and impact" the during Lecture series: Azadi Ka Amrit Mahotsav at ICAR-National Research Centre on Pig, Rani on 26 June 2022.
- Peer reviewer for the Journals - Journal of Veterinary Behavior, Journal of Thermal Biology, Animal Production Science, Journal of Applied Animal Welfare Science, Animal Production Science, Reproduction in Domestic Animals, Cogent Food and Agriculture

Dr Satish Kumar

- Invited as expert in Hello Kisan Programme "वैज्ञानिक शूकर पालन" of Doordarshan Kisan on 28-07-2022 streamed live on DD Kisan at 6:00 – 7:00 pm. https://youtu.be/rUEf9wmFD-o
- Deputed as an Expert to Conduct the joint survey with ICAR-NBAGR in breeding tract of Banda Pig to verify the claim prior to its registration during 11-13 March 2022
- Deputed as an Expert to Conduct the joint survey with ICAR-NBAGR in breeding tract of Wak Chambil Pig to verify the claim prior to its registration during 11-12 August, 2022,
- Deputed as an Expert to Conduct the joint survey with ICAR-NBAGR in breeding tract of Banda Pig to verify the claim prior to its registration during 13-15 August, 2022.

- Represented the Institute in six monthly meeting of नगर राजभाषा कार्यान्वयन समिति, केनद्रीय कार्यालय-2, at nambadi, Maligaon on 14/12/2022.
- Peer reviewer for three manuscripts for journal Veterinary Research communications (Springer)
- Peer reviewer for three manuscripts for journal Animal biotechnology (Taylor and Francis)

Dr Jaya

- Invited lecture on CRISPR/Cas9 mediated genome editing (Theory and Practical) in Short term hands-on training programme on 'Gene editing in mammalian cells using CRISPR/Cas system' organised by the Department of Animal Biotechnology, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati from 27th January to 2nd Feb 2022 sponsored by DBT, GoI, New Delhi.
- Invited lecture on "Advances in livestock adaptation research" on 29-06-2022 in the 21 days summer school on "Recent trends in sustainable livestock and crop production technologies vis-à-vis climate change", June 18 - July 8, 2022, organized jointly by ICAR-IGFRI, RRS, Srinagar, Bihar Veterinary College, Patna and NADCL, Baramulla, J&K.
- Peer reviewer for five manuscripts for journal Gene, three manuscripts for journal Research in Veterinary Science, three manuscripts for journal Theriogenology, three manuscripts for journal Cell stress and chaperons and one manuscript each for journal Frontiers in Bioengineering and Biotechnology, Heliyon, Journal of Cell Communication and Signaling, 3 Biotech, Journal of Inflammation Research and Reproductive Biology.
- Invited as expert in Hello Kisan Programme "वैज्ञानिक विधि से शूकर पालन" of Doordarshan Kisan on 3rd March, 12th May, 22nd Sept. and 22nd Dec. streamed live on DD Kisan at 6:00 – 7:00 pm.

Dr Sunil Kumar

- Invited as reviewer for Journal, The Haryana Veterinarian
- Acted as a resource/expert for providing technical support for AI lab establishment at Kokrajhar on 4-7 July, 2022 under APART Project

Dr Misha Madhavan M.

- Invited as subject expert in the National Workshop on Capacity building for sustainable livelihood of tribal women on 3rd February 2022, organized by Amity University, Noida, Uttar Pradesh
- Invited as member of panel of expert for Farmer's Scientist Interaction held in Krishi Mela cum Farmers' Seminar at KVK, Goalpara on 21st March, 2022.

Dr Nitin M. Attupuram

- Resource person for the 5-day training programme on "Pig production for rural farmers and unemployed youth" organized by Animal Husbandry Department, Maharashtra from 22nd to 26th February, 2022.

HUMAN RESOURCE DEVELOPMENT

Dr. Vivek Kumar Gupta

- Participated in the 94th Foundation Day of ICAR and received the award for 'Best Annual Report' on 16th July, 2022.
- Chief Guest in the two numbers of sensitization programmes organized in collaboration with APEDA on 'Enhancing commercial pig production, including organic pig production, in NE India with focus on export prospects' on 12th March, 2022 at Dhemaji and Majuli Districts of Assam.
- Chaired the sensitization programmes organized in collaboration with APEDA on 'Enhancing commercial pig production, including organic pig production, in NE India with focus on export prospects' on 21st September, 2022; 20th October, 2022 and 18th November, 2022 at Sivasagar, Assam; Agartala, Tripura; and Kokrajhar, Assam, respectively.
- Attended Annual Review Meeting of "ICAR-All India Co-ordinated Research Project on Pig" and "Mega Seed Project on Pig" (2021-22) held on 25-26th August, 2022 at ICAR-Central Island Agricultural Research Institute, Port Blair, Andaman and Nicobar Islands.
- Reviewed the activities of AICRP on Pig and Mega Seed project on Pig units at Nagaland University, Sasard and ICAR-RC NEH, Nagalanad Centre respectively.
- Reviewed the activities of Megaseed centre on Pig at State Animal Husbandry and Veterinary Department, Govt. of Sikkim during 7-8 June, 2022.
- Reviewed the activities of Megaseed centre on Pig at State Animal Husbandry and Veterinary Department, Govt. of Tripura on 21st October, 2022.
- Attended the National Business Meet on Boosting Export of Value Added Meat Products, 25th March, 2022, India Habitat Centre, New Delhi organized by APEDA.
- Member of Selection Committee as nominee of Director General, ICAR for selection of Assistant/Associate/Professors at Assam Agricultural University, Jorhat on 28th April, 2022.
- Delivered invited lecture at ICAR-RC for NEH, Umiam under Azadi Ka Amrit Mahotsav on 6th December, 2022.

Dr Swaraj Rajkhowa

- Attended CAS meeting of Scientists (as Member) in the discipline of Veterinary Public Health at ICAR-Research Complex for NEH Region, Umiam, Meghalaya on 7th April, 2022.
- Attended and deliver a lead lecture on "Current status of PRRS in India and scope for vaccine development" in Indian Veterinary Congress held at College of Veterinary and Animal Science, Udaipur from 8th to 9th April, 2022.
- Attended Review cum Interactive meet on one health consortium, NER chapter at CVSc, Khanapara on 22nd April, 2022.
- Appointed as an observer for Guwahati -1 centre for AO and FAO examination 2021 of ASRB held on 10th May, 2022.
- Attended meeting of Parliamentary standing committee on Agriculture from 25-26th May, 2022 at Radison Blue, Guwahati.
- Attended the meeting of the selection committee (as an expert) for the selection of Professor, Deptt. of Clinical Veterinary Medicine, North Lakhimpur College of Veterinary

Science, held at Khanapara on 3rd June, 2022.

- Conducted (as external examiner) the comprehensive viva-voce of a Ph. D. Scholar of Veterinary Public Health Department, CVSc, Khanapara on 24th August 2022.
- Conducted (as external examiner) the comprehensive viva-voce of a Ph. D. Scholar (Dr. Kabita Bala Kalita) of Dept. of Animal Biotechnology, CVSc, Khanapara on 2nd September 2022.
- Attended the Review meeting DBT –One Health Project at NIAB, Hyderabad from 15-16th September, 2022.

Dr Santanu Banik

- Attended XIX Annual Convention (SOCDAB) National Symposium on "Contemporary Technology for Animal Genetic Resource (AnGR) Management" at ICAR-NBAGR, Karnal through hybrid mode from 21-22nd September, 2022
- Attended Virtual Meeting for Developing National Breeding Policy for Mithun organized by ICAR-NRC on Mithun on 8th February, 2022
- Attended Interface Meet on Characterization and Documentation of Animal Genetic Resources of Haryana State: A Mission towards Zero Non-Descript Population" by NBAGR, Karnal on 10th February, 2022
- Attended Virtual meeting to discuss the suitable strategies, research priorities, institutional linkage, extension and monitoring mechanism for the Eastern Himalayas zone organized by ICAR-RC for NEH, Barapani on 15th February, 2022
- Attended SAC meeting, KVK Goalpara organized by KVK, Goalpara on 2nd March, 2022
- Attended Annual Review Meeting of ICAR-All India Co-ordinated Research Project on Pig and Mega Seed Project on Pig held on 3rd March, 2022
- Attended Meeting with State Government officials of Sikkim during visit to Mega Seed Center of Sikkim with Director, ICAR-NRC on Pig from 7-8th June, 2022
- Attended Executive committee meeting of Indian Society of Animal Genetics and Breeding (ISAGB) on 15th July, 2022.
- Attended IMC meeting of ICAR-National Bureau of Animal Genetic Resources, Karnal held on 19th July, 2022
- Attended Annual Review Meeting of "ICAR-All India Co-ordinated Research Project on Pig" and "Mega Seed Project on Pig" (2021-22) held on 25-26th August, 2022 at ICAR-Central Island Agricultural Research Institute, Port Blair, Andaman and Nicobar Islands
- Participated as Breed Registration Committee (BRC) for Registration of Livestock and Poultry Breeds under the Chairmanship of Dr. B N Tripathi, Deputy Director General (Animal Sciences) on 31st August, 2022
- Attended First meeting of National Advisory Committee under the Chairmanship of Hon'ble Minister (FAHD) along with Hon'ble Ministers of state (FAHD) on 28th October, 22 at Vigyan Bhawan, New Delhi
- Attended Breed Registration Committee (BRC) meeting under the Chairmanship of Dr. B N Tripathi, Deputy Director General (Animal Sciences) on 28th December, 2022.

Dr N.H. Mohan

- Attended 30th Annual Conference of Society of Animal Physiologists of India (SAPI) & National Symposium on Shifting basic physiological paradigm towards clinico-therapeutic

innovative interventions for improvement in livestock health and production. 17-19 Feb 2022. Nagpur Veterinary College, MAFSU.

- Attended International workshop on 'Sustainable Livestock Production under Impending Climate Change from 21-22, Dec 2022 at ICAR-Indian Veterinary Research Institute (ICAR-IVRI), Izatnagar, Bareilly, India under Australia-India Council project.
- Attended Society for Conservation of Domestic Animal Biodiversity XIX Annual Convention & National Symposium Contemporary Technology for Animal Genetic Resource (AnGR) Management 21-22nd September, 2022; ICAR-NBAGR Karnal
- Attended Annual Review Meeting of AICRP and Megaseed Project on Pig from 25-26 August 2022 at ICAR-CIARI, Port Blair.

Dr Rafiqul Islam

- Attended National Webinar on Advances of Veterinary Sciences during 75 Years of Indian Independence (1947-2022) jointly organized by ICAR-National Research Centre on Pig, Guwahati and Dr C.M. Singh Endowment Trust, Bareilly, UP held at ICAR-National Research Centre on Pig, Guwahati on 31st January 2022
- Attended online Day 19 programme of Techनींव@75; Strengthening Social Capital, Innovation Science Technology Entrepreneurship Development project; & Roundtable Discussion to Strengthen and Nurture the Local Innovation on 30th June 2022.
- Attended online programme of ICAR Foundation Day on July 16, 2022.
- Attended online meeting on "Piggery value chain in NER vis-à-vis promotion of piggery value chain in BTC" with the North East Council (NEC) and the Bodoland Territorial Council (BTC) virtually on 20th July, 2022.
- Attended Lecture delivered by Dr. Stephen A. Krawetz on "Sperm, their Passengers, Environment, and Health" organized by NAAS Regional Chapter, Bengaluru on 22nd July, 2022.
- Attended online Guest Lecture on "Overall Process involved in filing patent (IPR)" delivered by Mrs. Suman Lata Prasad, Asst. Principal Attorney and IP Specialist from L.S.Davar and Co organized by Dept. of Chemistry, Patna Women's College in association with L.S. Davar & Co on 10.11.2022.
- Attended virtually as Special Guest and delivered a brief lecture on importance of Sheep and goat in rural economy in the Webinar on Advancement of Pregnancy Diagnosis in Sheep and Goat organized by Satya Zero Grazing, Telangana, Hyderabad

Dr Pranab Jyoti Das

- Act as resource person and deliver lecture on Artificial Intelligence and Bioinformatics for Human Welfare for virtual Faculty Development Programme for faculty of science of Down Town University on 30th July 2022.
- Deliver lecture on "Breeding for disease resistant pigs" in the lecture series: Azadi Ka Amrit Mahotsav organized by ICAR-NRC on Pig on 27th February 2022.
- Attended Global Gene-banks and Biodiversity Management for Sustainable Agriculture organized in the occasion of International Biodiversity Day on 22nd May, 2022 by National Academy of Agricultural Sciences (NAAS).
- Act as a resource person for "Advanced Yak Management Course' was organized by ICAR-NRC on Yak, Dirang for ITBP Veterinary Cadre from 17th to 30th May 2022
- Participated in the Exhibition in the Vibrant NorthEast-2022 held from 3rd -5th August 2022 at Khanapara, Guwahati.

- Act as resource persons for the orientation programme on "Leadership Development and Motivating Students and Youths" held at Pabhoi Green, Biswanath Chariali, Pabhoi, Assam on 17th October organized by State Level Advisory Committee for Students & Youth Welfare, Govt. of Assam.

Dr Seema Rani Pegu

- Attended International Symposium on “Global Challenges in Rapid Diagnosis and Management of Animal and Poultry Diseases for Improved Health and Productivity and XXXIX Annual Conference of Indian Association of Veterinary Pathologist organized by C.V.Sc, Rajendra Nagar P.V.Narsimha Rao Telengana Veterinary University, Hyderabad from 17th -20th November 2022.
- Attended International Symposium on Zoonotic and transboundary Diseases: Breaking the Chain through Multidisciplinary Approach and XVIIIthAnnual Conference of Indian Association of Veterinary Public Health Specialists (IAVPHS) organized by ICAR Research Complex for NEH Region in collaboration with ILRI from 1st -2nd December 2022.

Dr. Juwar Doley

- Attended as a resource person on “Pig Farming and Processing” during the training at MSME Exhibition Cum Sales Fair at Rajgarh, Dibrugarh from 27-30, December, 2022

Dr Sunil Kumar

- Participated (on-line) in four days training entitled Metagenomic Data Analysis during October 18-21, 2022 at ICAR-Indian Agricultural Statistics Research Institute, Library Avenue, PUSA, New Delhi.
- Coordinated and participated as Exhibitor in “Momentum North East -2022 in Guwahati held on 24-25 March 2022
- Participated and exhibited institute technologies in Janjatiya Divas-2022 held at IIT Guwahati on 11th November, 2022
- Participated and exhibited institute technologies in Vibrant North East 2022 held at Khanapara from 26-28 August 2022.

Dr Satish Kumar

- Attended Dr C. M. Singh Birth Centenary Year Celebrations cum National Webinar on Advances of Veterinary Sciences during 75 Years of Indian Independence jointly organized by ICAR-National Research Centre on Pig, Guwahati and Dr C.M. Singh Endowment Trust, Bareilly, UP held at ICAR-National Research Centre on Pig, Guwahati on 31st January 2022 in online mode.
- Attended Annual Review Meeting of ICAR-All India Co-ordinated Research Project on Pig and Mega Seed Project on Pig held on 3rd March, 2022
- Attended online training programme on “Data Visualization in Agribusiness and Agricultural Research” organized by ICAR-NAARM, Hyderabad from 17-22nd January, 2022.

Dr Jaya

- Attended Dr C. M. Singh Birth Centenary Year Celebrations cum National Webinar on Advances of Veterinary Sciences during 75 Years of Indian Independence jointly organized by ICAR-National Research Centre on Pig, Guwahati and Dr C.M. Singh Endowment Trust, Bareilly, UP held at ICAR-National Research Centre on Pig, Guwahati on 31st January 2022 in online mode.

- Attended two days International Workshop on "Sustainable Livestock Production under Impending Climate Change" organized by ICAR-IVRI on 21-22, Dec. 2022 in hybrid mode.
- Attended International e-Training on "Applications of bioinformatics in genome analysis" organized by C.V.Sc. & A.H. NDVSU, Jabalpur on April 25-29, 2022.

Dr Misha Madhavan M

- Attended training program on "Data Visualization in Agribusiness and Agricultural Research" organized by ICAR-NAARM, Hyderabad (Virtual mode) 17.01.2022 to 22.01.2022
- Attended training program on "Extension: From TOT to Value chain extension" organized by MANAGE, Hyderabad (Virtual mode) from 09.02.2022 to 11.02.2022
- Attended international seminar on Sustainable urban agricultural systems and community resilient cities organized by CoA, Vellayani, KAU, Thiruvanthapuram, Kerala (Virtual mode) on 22.03.2022
- Attended Dr. C. M. Singh Birth Centenary Year Celebrations cum National Webinar on Advances of veterinary sciences during 75 years of Indian Independence (1947-2022) organized by ICAR-NRCP and Dr. C. M. Singh Endowment Trust, Bareilly, UP (Virtual mode) on 31.01.2022

Dr Nitin M. Attupuram

- Attended Online training on "Geospatial Analysis using QGIS & R" organized by ICAR – National Academy of Agricultural Research and Management, Hyderabad from 14th -19th February, 2022
- Attended Online training programme on "Metagenomic data analysis" organized by ICAR-Indian Agricultural Statistics Research Institute, New Delhi from 18th to 21st October, 2022

Dr S. Jayachitra Devi

- Attended five days training program on "Drone Pilot Training" for small category UAVs conducted by Amtron Drone School, Tech City, Bongora, Assam from 10th October to 14th October 2022.
- Attended two days International Conference on Electronics and Telecommunication for Real Time Applications (IERTA 2022) held during 25th-26th, August, 2022, organised by Department of Electronics and Communication Engineering & the Institute of Electronics and Telecommunication Engineers (IETE).
- Participated in four days training programme on "Metagenomic Data Analysis During October 18-21, 2022 at ICAR-Indian Agricultural Statistics Research Institute, Library Avenue, PUSA, New Delhi.
- Participated and exhibited Institute Technologies in Janjatiya Divas 2022 held at IIT, Guwahati on 12th November, 2022.
- Attended Dr C. M. Singh Birth Centenary Year Celebrations cum National Webinar on Advances of Veterinary Sciences during 75 Years of Indian Independence jointly organized by ICAR-National Research Centre on Pig, Guwahati and Dr C.M. Singh Endowment Trust, Bareilly, UP held at ICAR-National Research Centre on Pig, Guwahati on 31st January 2022 in online mode.

RESEARCH PROGRAMME AND PROJECTS

Ongoing Research Project during 2022

S. No.	Project name	PI	CoI	Funding
1	Generation-wise genetic evaluation of Rani crosses	S. Banik	P.J. Das, K. Barman, R. Thomas, S.R. Pegu, Sunil Kumar	Institute
2	Characterization and expression profiling MSY of Pig (male-specific region of Y chromosome) genes for boar fertility.	P.J. Das	S. Banik, Sunil Kumar, S. Rajkhowa	Institute
3	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	Institute
4	Molecular characterization of indigenous pig breeds	Satish Kumar	S. Banik, P.J. Das, Sunil Kumar, A.R. Sahu (ICAR-CCARI)	Institute
5	Development of IRT image-based systems for examining the health status of pigs	P.J. Das	S. Banik, Sunil Kumar, S.R. Pegu, S. Rajkhowa	Institute
6	All India Coordinated Research Project on Pig, KVK-Goalpara centre	S. Banik	P.J. Das, K. Barman, S. Rajkhowa and Satish Kumar	ICAR
7	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	Institute
8	Development of early fertility markers in pigs	N.H. Mohan	Sunil Kumar, Jaya, R. Thomas	Institute
9	Investigations on myogenesis in myostatin gene knockout cells through CRISPR-CAS9 based genome editing	N.H. Mohan	Jaya, B.C. Das	Institute
10	Development of thermo-tolerant pig through biomarker assisted selection	Mohan.N.H		ICAR NF
11	Investigation of notch signaling in regulation of ovarian function in pigs	Jaya	B.C. Das, N.H. Mohan, Satish Kumar	Institute
12	Preservation of boar semen using different additives in liquid and frozen state	R Islam	Sunil Kumar, K Barman, S Banik	Institute
13	Service project: Artificial Insemination in Pigs	R Islam	Sunil Kumar	Institute

14	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	Institute
15	Development of vegetable waste/fruit waste-based pig feeds	K Barman	S.R. Pegu, R. Thomas	Institute
16	Molecular detection of aflatoxins producing Aspergillus species	K Barman	P.J. Das, S.R. Pegu, R. Deb, Sunil Kumar	Institute
17	Maize Production in NEH region for sustainable livestock production	K. Barman	S. Banik, S.R. Pegu, Sunil Kumar and S. Rajkhowa	ICAR-IIMR
18	Assessment and optimization of the water footprint in pig production and processing	N M Attupuram	K. De, R. Thomas, K. Barman, N.H. Mohan	Institute
19	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	Institute
20	Ethogram development and welfare assessment of growing desi and crossbred pig	K. De	S. Paul, R. Islam, N.H. Mohan, B.C. Das	Institute
21	Processing condition optimizing for elimination of selected FSSAI listed food borne pathogens in pork and pork products	R Thomas	K. Barman, S.R. Pegu	Institute
22	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
23	Service Project: Servillance and monitoring of swine diseases in NER	S.R. Pegu, S. Rajkhowa, R. Deb, S. Paul and J. Doley		Institute
24	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	Institute
25	Molecular and Serological detection of Porcine Parvovirus (PPV) and its characterization.	J. Doley	P. Deka, R. Deb, S.R. Pegu, P.J. Das, S. Paul, N.H. Mohan, S. Rajkhowa	Institute
26	Expression and evaluation of diagnostic potential of immunogenic proteins of porcine reproductive and respiratory syndrome virus.	R. Deb	S R Pegu, P.J. Das and S. Rajkhowa	Institute

27	Development of CD163 host receptor based sero-diagnostic for early detection of porcine respiratory and reproductive syndrome virus.	R. Deb	S. Rajkhowa S.R. Pegu, J. Doley, S. Paul	Institute
28	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	Institute
29	Kinetics of FMD virus serotype specific protective antibody response induced in pigs vaccinated with commercial FMD vaccine intended for use in cattle	J Doley	S R Pegu, Rafiqul Islam, K. De and N H Mohan ICAR-DFMD: R P Singh, Jajati K Mohapatra, C Jana, N R Sahoo, M Rout, A Sahoo, R Ranjan and S A Khulape	Institute
30	Molecular biological studies on PRRS virus in pig population of North East Region of India for development of sustainable diagnostic and vaccine	S R Pegu (CCPI)		ICAR-NASF
31	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
32	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
33	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
34	Fostering the adoption of scientific pig production practices among small holders in Assam	M. Madhavan/N.H. Mohan	K. Barman, N.H. Mohan, S. Banik, R. Thomas, S.R. Pegu, Sunil Kumar	Institute
35	Pork Marketing chains in North-East India for sustainable livelihood of tribal women (Assam, Meghalaya and Nagaland)	M. Madhavan / N.H. Mohan	Mohan N.H	ICAR-NASF
36	Design and development of Image based growth rate estimation algorithm for different categories of pigs.	S. J. Devi	Kh. M. Singh R. Islam, S. Kumar, J. Doley	Institute

37	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
38	Outreach Programme on Monitoring Drug Residues and Environmental Pollutants (ORP-MDREP)	R. Thomas	N. M. Attupuram	ICAR
39	Traceable value chain for safe Pork in the North Eastern Region of India	S. Banik	P.J. Das, R. Thomas,S.R. Pegu, Satish Kumar, B.C. Das, V.K. Gupta	ICAR-NASF
40	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
41	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
43	Exploration of Genome-Wide Selection Signatures in Ghoongroo and Doom pigs of India	Satish Kumar	Jaya, S. Banik, P.J. Das	Institute
44	Design of recombinant multi-epitope protein(s) and their expression for assay development	N.H. Mohan	V.K. Gupta, Jaya, S. J. Devi	Institute
45	Machine learning assisted identification of different cells of porcine origin	S. J. Devi.	Jaya, N. H. Mohan	Institute
46	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	Institute

PERSONNEL

ICAR-National Research Centre on Pig

RMP and Scientist Cadre

Dr. Vivek Kumar Gupta	**Director**	
Dr. Bikash Chandra Das	**Principal Scientist Animal Physiology**	
Dr. Swaraj Rajkhowa	**Principal Scientist Veterinary Medicine**	
Dr. Santanu Banik	**Principal Scientist Animal Genetics & Breeding**	

Dr. Keshab Barman	**Principal Scientist (Animal Nutrition)**	
Dr. Mohan N.H	**Principal Scientist (Animal Physiology)**	
Dr. Rafiqul Islam	**Principal Scientist (Animal Reproduction & Gynaecology)**	
Dr. Pranab Jyoti Das	**Principal Scientist (Animal Genetics and breeding)**	

Dr. Rajendran Thomas	**Senior 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)**	

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)**	
Ms. 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)**	

Administrative Cadre

Shri. Utpal Ghosh	**Finance and Accounts Officer**	
Shri Uttam Prakash	**Assistant Administrative Officer**	

Smt Jonali Nath	**Upper Divisional Clerk**
Ms. 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**

KVK Staffs

Dr. Santosh Kumar Baishya	**Principal Scientist and Head Animal Reproduction and Gynaecology**	
Dr. Hitu Choudhury	**SMS/ACTO (Animal Science)**	
Dr. Biswajit Dey	**SMS/ACTO (Horticulture)**	
Dr. Utpal Kumar Bhattacharyya	**SMS/ACTO (Plant Protection)**	
Dr. Hari Charan Kalita	**SMS/ACTO (Agronomy)**	

Mrs. Poli Saikia	**SMS (Community Science)**	
Er. Benjamin Kaman	**Technical Officer (Soil & Water Conservation Engineering)**	
Mrs. Minakshi Borah Kaman	**Technical Officer (Community Science)**	
Mrs. Mousumi Bhuyan	**Technical Officer (Horticulture)**	

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

PUBLICATIONS

Banik, S., Barman, K., Choudhary, H., Das, P. J., Thomas, R., Kumar, S., and Rajkhowa. (2022) Performance appraisal and conservation need of Doom pig of Assam. *Indian Journal of Animal Sciences* 92 (1): 132–135.

Barman, K., Barman, K.C., Konwar, D., Banik, S., Das, P.J., Pegu, S.R., Rahman, J.I. and Das, H.K. 2022. Potential of ankasa (*Spilanthes acmella murr.*) as swine feed. *North East Veterinarian*, 21: 13-15.

Barman, K., Konwar, D., Sarma, D.K., Thomas, R.., Naskar, S., Pegu, S. R., Banik, S., Mohan, NH, Tamuli, M.K., Kaushik, P. and Rajkhowa, S. 2022. Effect of Supplementation of Methionine Chelated Trace Minerals on Growth, Nutrient Utilization and Blood Profiles in Crossbred (Hampshire X Ghungroo) Finisher Pigs. *Animal Nutrition and Feed Technology* 22(1) :31-39.

Deb R, Chaudhary P, De S (2022) CRISPR/cas9 cassette targeting Escherichia coli blaCTX-M specific gene of mastitis cow milk origin can alter the antibiotic resistant phenotype for cefotaxime, Animal Biotechnology, doi: 10.1080/10495398.2022.2053695.

Deb R, Fonsêca VDFC, Payan-Carreira R, Sejian V and Lees AM (2022) Editorial: Genetic Basis of Thermoregulation in Livestock. *Front. Vet. Sci.* 9:839612. doi: 10.3389/fvets.2022.839612.

Deb, R , Chaudhary, P., Pal, P., Tomar, R.S., Roshan, M., Ludri, A., Gupta, V.K. and De, S., 2022. Development of an on-site lateral flow immune assay based on mango leaf derived colloidal silver nanoparticles for rapid detection of Staphylococcus aureus in milk. *Journal of Food Science and Technology*, pp.1-15. doi.org/10.1007/s13197-022-05598-8.

Deb, R., Sonowal, J., Sengar, G.S., Pegu, S.R., Praharaj, M.R., Malla, W.A., Singh, I., Yadav, A.K., Rajkhowa, S., Das, P.J. and Bharati, J., 2022. Porcine Circovirus type 2 infected myocardial tissue transcriptome signature. *Gene*, *836*, p.146670.

Deb, R., Yadav, A.K., Sengar, G.S., Sonowal, J., Lalita, D., Pegu, S.R., Singh, I., Linda, N., Das, P.J., Kumar, S. and Pal, P., 2022. Development of CD163 receptor-based enzyme-linked immunosorbent assay for diagnosis of porcine reproductive and respiratory syndrome virus. *3 Biotech*, *12*(11), p.325.

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Social Media

दैनिक पूर्वोदय

राष्ट्रीय शूकर अनुसंधान केंद्र में मना हिंदी पखवाड़ा

▲ पूर्वोदय संवाददाता

गुवाहाटी, 1 अक्टूबर। राष्ट्रीय शूकर अनुसंधान केंद्र में विगत 15 दिनों (14-29 सितंबर) से चल रहे हिंदी पखवाड़ा का समापन गत 29 सितंबर को किया गया। इस समारोह के मुख्य अतिथि थे दैनिक पूर्वोदय के संपादक रविशंकर रवि। उन्होंने हिंदी भाषा के अधिक से अधिक प्रयोग पर बल दिया तथा हिंदी भाषा में स्थानीय भाषाओं के प्रचलित शब्दों को समाहित करने का सुझाव दिया ताकि हिंदी को सभी लोगों के बीच लोकप्रियता मिल सके। उन्होंने शोध परिणामों को भी हिंदी या स्थानीय भाषा में प्रकाशित करने का सुझाव दिया। संस्थान के निदेशक डॉ. विवेक कुमार गुप्ता ने हिंदी का प्रयोग सिर्फ हिन्दी पखवाड़ा तक सीमित न रखकर उसे वर्ष भर प्रयोग करने का सुझाव दिया। उन्होंने 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 डॉ. सतीश कुमार ने हिंदी पखवाड़ा के आयोजन का उद्देश्य हिंदी का अधिक उपयोग कर राजभाषा का विकास करना बताया।

हिंदी पखवाड़ा में विभिन्न प्रकार की प्रतियोगिताओं का आयोजन किया गया, जिसमें हिंदी श्रुति लेखन, निबंध प्रतियोगिता, वाद-विवाद प्रतियोगिता, समय स्फूर्त भाषण एवं हिंदी प्रश्नोत्तरी शामिल थी।

Social Media

দুধনৈস্থিত গোৱালপাৰা কৃষি বিজ্ঞান কেন্দ্ৰত গাহৰি পালন সম্পৰ্কত সজাগতা সভা

গাহৰি পালকক গাহৰি আৰু অন্যান্য সামগ্ৰী বিতৰণ

গণস্তম্ভ, দুধনৈ, ভবেশ চন্দ্ৰ ভাগৱতী ঃ দুধনৈস্থিত গোৱালপাৰা কৃষি বিজ্ঞান কেন্দ্ৰৰ পশু পালন বিভাগৰ উদ্যোগত যোৱা ৭ ছেপ্টেম্বৰত গোৱালপাৰা জিলাৰ গাহৰি পালক সকলৰ সুবিধাৰ্থে এখনি বিশাল সজাগতা সভা অনুষ্ঠিত হয়। এই অনুষ্ঠানত সৰ্বমুঠ ১৫৫ গৰাকী গাহৰি পালক উপস্থিত থাকে। সভাত উপস্থিত থকা বেচিসংখ্যক গাহৰি পালকেই হল কৃষি বিজ্ঞান কেন্দ্ৰ গোৱালপাৰাৰ পশু পালন বিভাগৰ বিশেষজ্ঞ ড° হিতু চৌধুৰীয়ে NABARD ৰ সহযোগত গাহৰি পালক সকলক লৈ আৰম্ভ কৰা ঠতুখ এখনৰ সদস্য। এই সজাগতা সভাখন আচলতে জনজাতীয় লোকসকলৰ উন্নয়নৰ বাবে ভাৰতীয় কৃষি অনুসন্ধান কেন্দ্ৰৰ বাষ্ট্ৰীয় গাহৰি গৱেষণা কেন্দ্ৰ, ৰাণী, গুৱাহাটীৰ TSP (Tribal Sub Plan) সহযোগত আয়োজন কৰা হৈছে। অনুষ্ঠানৰ আৰম্ভণিতে "Application of ICT in Pig farming" বিষয়ক লৈ এখনি প্ৰশিক্ষণ আৰম্ভ কৰা হয়। কৃষি বিজ্ঞান কেন্দ্ৰ গোৱালপাৰাৰ পশু পালন বিষয়ৰ বিশেষজ্ঞ ডক্টৰ হীতু চৌধুৰীয়ে আঁত ধৰা অনুষ্ঠানটোত উদ্বোধনী ভাষণ প্ৰদান কৰে কৃষি বিজ্ঞান কেন্দ্ৰৰ মুৰব্বী তথা মুখ্য বিজ্ঞানী ড° সন্তোষ কুমাৰ বৈশ্যই। সভাত বাষ্ট্ৰীয় গাহৰি গৱেষণা কেন্দ্ৰৰ প্ৰধান বৈজ্ঞানিক ড° প্ৰণব জ্যোতি দাসে "Application of ICT in Pig farming" ৰ ওপৰত ধুনীয়াকৈ ব্যাখ্যা কৰি উপস্থিত থকা গাহৰি পালক সকলক উপকৃত কৰে। সমান্তৰালভাবে বাষ্ট্ৰীয় গাহৰি গৱেষণা কেন্দ্ৰৰ আৰু এজন প্ৰধান বৈজ্ঞানিক ড° শান্তনু বনিকে ICT ৰ লগতে গাহৰি পালনৰ ওপৰত বৈজ্ঞানিক ভাবে কেনেকে গাহৰি পালন কৰিব পাৰি তাৰ ওপৰত ব্যাখ্যা আগবঢ়ায়। সভাত উপস্থিত থকা বাষ্ট্ৰীয় গাহৰি গৱেষণা কেন্দ্ৰৰ আন এগৰাকী প্ৰধান বৈজ্ঞানিক ড° সুনীল কুমাৰে সদ্যনাই হৈ থকা গাহৰিৰ বেমাৰৰ প্ৰতিকাৰৰ ওপৰত পৰামৰ্শ দি গাহৰি পালক সকলক উপকৃত কৰে। সভাৰ অন্তত উপস্থিত থকা সকলো গাহৰি পালকক ১০০ কেজি কৈ দানা আৰু গাহৰি ফাৰ্মত ব্যাবহাৰ কৰা কিছুমান অত্যাবশ্যকীয় সামগ্ৰী (দানাৰ বাচন, বেইন কোট, চেনিটাইজাৰ ইত্যাদি) প্ৰদান কৰা হয়। সৰ্বমুঠ ১৫ হেজাৰ কেজি দানা বিতৰণ কৰা হয়। বাষ্ট্ৰীয় গাহৰি গৱেষণা কেন্দ্ৰৰ দ্বাৰা পৰিচালিত হোৱা গোটেই ভাৰতবৰ্ষৰ ১৫টা AICRP centre আৰু ৬টা মেগা seed centre ৰ অন্যতম এটা কৃষি বিজ্ঞান কেন্দ্ৰ দুধনৈত স্থাপন কৰা হৈছে। এই AICRP কেন্দ্ৰত অসমৰ থলুৱা গাহৰিৰ জাত "Doom pig" ৰ সংৰক্ষণ আৰু ইয়াৰ সংখ্যা বৃদ্ধি কৰাৰ বাবে বখা হৈছে। সেয়েহে আজিৰ এই অনুষ্ঠানত ৪৫জন গাহৰি পালকক তিনি জনীয়াকৈ একোটা গ্ৰুপ কৰাই ১৫টা পূৰ্ণবয়স্ক গাহৰি বিতৰণ কৰা হয় ইয়াৰ সংখ্যা বৃদ্ধিৰ বাবে। এই সজাগতা সভা আৰু গাহৰি বিতৰণী অনুষ্ঠানত কেন্দ্ৰটোৰ উদ্যান শষ্য বিভাগৰ বিশেষজ্ঞ ড° বিশ্বজিৎ দেৱ লগতে কেবাগৰাকী বিষয় বৰিয়াই উপস্থিত থাকি পুৰুষ মহিলা গাহৰি পালকসকলক উৎসাহিত কৰে।


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