वार्षिक प्रतिवेदन

Annual Report 2019

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

राणी, गुवाहाटी-७८१ १३१, असम

ICAR-NATIONAL RESEARCH CENTRE ON PIG

Rani, Guwahati-781 131, Assam

ANNUAL REPORT

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Cover Page Theme: The graphic depicts the Institute's research endeavour in understanding and promoting the scientific pig farming, clean pork production and value addition of pork in the country. It also reflects the importance of piggery in providing sustainable livelihood and nutritional security to the rural poor in the country.

Cover Page Designed by : Jishnu Jayakumar

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Preface

Pigs have a long history of providing food and fat for mankind. Also, pigs are an adaptable and rapidly growing species that can be attractive for small and beginning farmers seeking to incorporate livestock into their farm. The trend during the past 15 years clearly indicate that Indian pig rearing has been consistently moving away from backyard system to a more organized commercial production system, though the progress is slow. Pig production is an important secondary occupation for livelihood and nutritional security of the rural people, especially in North-Eastern region of India. Approximately 80% of tribal population in North Eastern India is involved in raising pigs on a small scale which are mostly reared under semi-intensive system of management. Pigs could provide direct and indirect employment to the people, the direct cash returns by sale of live pigs and pork, and the indirect returns in terms of manure and fuel. Scientific pig farming could not only contribute towards piling up of quality animal protein at affordable prices in India but also has vast prospects for quick monetary returns to the farmers thus contributing significantly to their economic uplifment. 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.

Major issues concerned with slow pace of growth in the Indian piggery sector are reduced availability of quality breeding germplasm, poor growth rate of the indigenous breeds, lack of sound breeding programs, increase incidence of diseases, lack of post harvest infrastructure, lack of structured marketing channel etc. Thus, it is very much essential to undertake coordinated piggery development programs along with stakeholders to ensure nutrition and livelihood security to millions of people in the country.

During the last 17 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 seven 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 of the Institute were awarded/ honoured in various platforms.

I wish to express my sincere thanks and gratitude for the constant support and encouragement received from Dr. Trilochan Mohapatra, Hon'ble Secretary, DARE & Director General, ICAR, Dr. B. N. Tripathi, Deputy Director General (Animal Sciences), Dr. J.K. Jena, Former Deputy Director General (Fisheries & Animal Sciences) and Dr. K. M. Bujarbaruah, Vice Chancellor, Assam Agricultural University. I am thankful to Dr. V. K. Saxena, Assistant Director General (Animal Production and Breeding), Dr. R. S. Gandhi, Former Assistant Director General (Animal Production and Breeding), Dr. Ashok Kumar, Assistant Director General (Animal Health), Dr. V. Bhasin, Principal Scientist (AG&B), Dr. Rajan Gupta, Pr. Scientist (AN) 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 staff 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 2019 for your perusal and critical comments. The report will serve as a reference to those in the field of scientific pig production and pork processing.

Swaraj Rajkhowa
Director (Acting)

Preface

कार्यकारी सारांश

पशु आनुवंशिकी और प्रजनन

रानी क्रॉस के जेनरेशन–वाइज जेनेटिक इवैल्यूएशन का अध्ययन किया गया और पाया गया कि रानी क्रॉसब्रेड की नस्ल के पात्रों को कई पीढ़ीयों के लगातार क्रॉसब्रेडिंग के लिए स्थिर किया गया। इसके अलावा, असम के डूम सुकर का संरक्षण रखरखाव के अधीन है। सुकर वाई गुणसूत्र के कार्यात्मक और प्रतिलेखीय रूपरेखा को स्पष्ट करने के लिए सुकर वाई गुणसूत्र के नर–विशिष्ट क्षेत्र की एक व्यापक कार्यात्मक रूपरेखा पीढ़ी के अधीन है। पूर्वोत्तर भारत के सूकरों की उत्पत्ति और विकास की जांच और विदेशी सूकरों और जंगली सूकरों से माइटोकॉन्ड्रियल जीनोमिक अनुक्रम (mtDNA) का उपयोग जारी है। सूकरों की स्वास्थ्य स्थिति की जांच के लिए आईआरटी छवि–आधारित प्रणालियों का अध्ययन किया गया। विभिन्न केंडिडेट के जीनों में आनुवंशिक परिवर्तनशीलता की खोज और सूकरों में फिर से (उत्पादन) लक्षणों के साथ अध्ययन चल रहा है।

पशु पोषण

सब्जियों के अपशिष्टों पर आधारित सब्जी का उपयोग करके स्थानीय रूप से उपलब्ध गोभी, फूलगोभी, गाजर, टमाटर आदि की साइलेज तैयार की जाती है और सूकरों द्वारा इसकी स्वीकार्यता और सूकरों में शरीर के विकास पर प्रभाव का अध्ययन किया गया। बड़े व्हाइट यॉर्कशायर, रानी क्रॉसबर्ड उत्पादक सूकरों में उत्पादन प्रदर्शन पर QPM मक्का के चारे के पूरक के प्रभाव, का अध्ययन किया गया था। यह पाया गया कि प्रति किग्रा फीड कॉस्ट में 2.98रु. की कमी हुई, QPM मक्का साइलेज के 5% सप्लीमेंट में क्रॉसब्रेड ग्रोअर सूकरों में मक्का के अनाज की जगह, जबकि फीड प्रति किग्रा गेन में 7.17रु. और 5.59 रु. पर 5% की दर से कमी आई। हिमालयन इकोसिस्टम को बनाए रखने के लिए राष्ट्रीय मिशन के तहत, विभिन्न व्यक्तिगत सुकर फार्म से नैदानिक और फ़ीड नमूने एकत्र किए गए थे और उनके पोषण मूल्य और रोग निदान के लिए एक ही विश्लेषण किया था।

पशु प्रजनन

किसानों की क्षेत्र स्थितियों के तहत गिल्ट और साओ में सिंक्रोनाइज़ेशन और एस्ट्रस इंडक्शन किया गया। इसके अलावा एडवांस स्पर्म फंक्शन टेस्ट को मानकीकृत किया गया। प्रजनन क्षमता को बढ़ाने के लिए एक कार्यप्रणाली विकसित की गई। पोस्ट पिघलना वीर्य विशेषताओं के संदर्भ में योज्य की श्रेष्ठता एसडीएस> विट– ई> मिफेप्रिस्टोन> ट्राइथेनॉलमाइन थी। अन्य प्रयोग

में, वीर्य को सिमन के प्लाज्मा के साथ मिलाया गया था। स्वीकार्य प्रजनन क्षमता हासिल नहीं हुई है, आगे के प्रयोग प्रगति पर हैं। तरल वीर्य संरक्षण के लिए एक लंबी अवधि के विस्तारक को मानकीकृत किया गया है। सूकर के जेल के जैव रासायनिक लक्षण वर्णन पर काम चल रहा है। सूकर सिमन जेल का संरक्षण मानकीकरण किया गया है। वीर्य संग्रह के लिए प्रशिक्षण के लिए और गिल्ट और साओ के लिए युवा पुरुषों में सूकर के जेल और लार के प्रभाव का अध्ययन किया गया है।

पशु फिजियोलॉजी

विवो और इन विट्रो प्रयोगों दोनों के माध्यम से थर्मल तनाव से संबंधित मार्गों की पहचान करने के लिए प्रयोगों का आयोजन किया गया था। इसके अलावा, सूकरों में गर्मी के तनाव के दौरान शारीरिक प्रतिक्रियाओं की माइक्रोआरएनए मध्यस्थता विनियमन का अध्ययन किया गया था। फाइब्रोब्लास्ट कोशिकाओं को तीव्र गर्मी के झटके (41 डिग्री सेल्सियस), (37 डिग्री सेल्सियस पर नियंत्रण) के अधीन किया गया और आरएनए के अलगाव के लिए संसाधित किया गया और बाद में सीडीएनए पुस्तकालय और विश्लेषण के संश्लेषण के लिए संसाधित किया गया। उच्च गुणवत्ता वाले आरएनए कोशिकाओं से शुद्ध पूरे ट्रांसक्रिप् ट के साथ विश्लेषण किया गया। और माइक्रो आरएनए विशिष्ट अनुक्रमण अध्ययन फाइब्रोब्लास्ट सेल लाइन में मौजूद सभी माइक्रोआरएनए / टेप की पहचान करने के लिए। कुल 24997 लिपियों को स्यूस्कोफेजेनोम में मैप किया गया था, जिसमें से 651 जीनों को अलग-अलग व्यक्त किया गया था (पी <0.05)। 255 और 396 अलग-अलग व्यक्त किए गए जीन (डीईजी) थे जो क्रमश: ऊपर और नीचे विनियमित थे (पी <0.05)। RNA-seq का उपयोग करके प्रजनन में भिन्न होने वाले सूकरों के शुक्राणुजाल प्रतिलेख की तुलना की गई और द्ध में उपयोग किए जाने वाले सूकरों की प्रजनन स्थिति की जांच की गई। दृश्य मूल्यांकन के आधार पर अलग-अलग शारीरिक चरणों में पोरियन अंडाशय की सूची बनाना और उनके ट्रांसक्रिपटेम प्रोफाइलिंग को डिम्बग्रंथि-प्रेरित और एंजियोजेनिक वृद्धि कारकों की भूमिका को उजागर करने के लिए डिम्बग्रंथि चक्रीयता के साथ लिया गया है, जो कि स्वाइन में ओव्यूलेशन-प्रेरित आणविक परिवर्तनों में होते हैं।

पशु स्वास्थ्य

साल्मोनेला और कैम्पिलोबैक्टर प्रजातियों के लिए तेजी से और संवेदनशील न्यूक्लिक एसिड आधारित नैदानिक परख का विकास चल रहा है। सूकर से एमआरएसए के तेजी से पता लगाने के लिए एक लूप-मध्यस्थ इज़ोटेर्मल प्रवर्धन (एलएएमपी) परख विकसित किया गया था। सूचित अवधि के दौरान दो लूप मध्यस्थ इज़ोटेर्मल प्रवर्धन परख मेथिसिलिन प्रतिरोधी स्टैफिलोकोकस ऑरियस और शिगा विष पोर्क से ई। कोलाई का तेजी से पता लगाने के लिए विकसित किया गया है। टाइफोनियम ट्रिलोबाटम पौधे के अर्क की रोगाणुरोधी गतिविधि को मैक्रोडिल्यूशन विधि का उपयोग करके इन विट्रो में अध्ययन किया गया था। संयंत्र निकालने के एमआईसी और एमबीसी का निर्धारण प्रगति पर है। रिपोर्ट की गई अवधि के दौरान सूकरों में जेई सीरो सकारात्मकता के मौसमी वितरण का मूल्यांकन किया गया था। 428 विभिन्न नमूनों की संख्या। नवजात मृत्यु दर का पता लगाने के लिए असम के विभिन्न संगठित और असंगठित सुकर फार्मों से मल (205), नाक स्वाब (103) और ऊतक का नमूना (120) एकत्र किया गया। पोर्सिन प्रजनन और श्वसन सिंड्रोम वायरस के लिए, एक ही शॉट पीसीआर प्रतिक्रिया में सभी तीन जीनों (एन, एम और ओआरएफ 5) का एक साथ पता लगाने के लिए एक पीसीआर विधि विकसित की है।

पशुधन उत्पाद प्रौद्योगिकी

विकसित मूल्य ने स्वास्थ्य के प्रति जागरूक उपभोक्ताओं की जरूरतों को पूरा करने के लिए और विकसित उत्पादों के पोषण, भौतिक, रासायनिक, सूक्ष्मजीवविज्ञानी और संवेदी विशेषताओं का मूल्यांकन करने के लिए महत्वपूर्ण सामग्री के अलावा कार्यात्मक पोर्क उत्पादों को जोड़ा। गुणवत्ता नियंत्रण प्रयोगशाला में, खाद्य गुणवत्ता प्रबंधन डेटाबेस का पता लगाने और विकसित करने के लिए विकसित किया गया है। गोपनीयता सुनिश्चित करने के लिए यूनिट में बायोमेट्री और सीसीटीवी सिस्टम लगाए गए थे। APART परियोजना के तहत, असम के विभिन्न जिलों में JEV की व्यापकता से संबंधित पृष्ठभूमि का अध्ययन फीड विश्लेषण और क्षमता निर्माण के अलावा किया गया था। आणविक साधनों द्वारा मांस और मांस उत्पादों में खाद्य जनित रोगजनकों का पता लगाया गया। इसके अलावा, माइटोकॉन्ड्रियल मूल के प्रजाति-विशिष्ट मार्करों द्वारा विभिन्न मीट की पहचान का भी अध्ययन किया गया था। एमेलोजिन और सेक्स-निर्धारण क्षेत्र वाई (एसआरवाई) जीन की पॉलिमरेज़ चेन रिएक्शन प्रवर्धन का उपयोग करके सुकर और मवेशी में लिंग पहचान की भी जांच की गई। परमाणु अवशोषण स्पेक्ट्रम द्वारा मांस, फ़ीड और पानी में भारी धातु प्रोफाइल निर्धारित किया गया था। प्रौद्योगिकी आधारित व्यावसायिक परियोजनाओं के संचालन के लिए एक अत्याधुनिक कृषि-व्यवसाय ऊष्मायन केंद्र बनाया गया था।

विस्तार शिक्षा

रिपोर्ट की अवधि के दौरान, तीन भाषाओं में सभी वैज्ञानिक सुकर उत्पादन प्रथाओं में अंग्रेजी, हिंदी और असमिया सहित तकनीकी बुलेटिन व वीडियो स्क्रिप्ट तैयार की गई। इस वीडियो का उपयोग किसानों के ज्ञान को समृद्ध करने के लिए एक शैक्षिक उपकरण के रूप में किया जाएगा। किसानो के लिए ज्ञान टेष्ट विकसित किया गया। कामरुप, गोलपारा, बक्सा में साक्षातकर परिशक्षन शुरु किया गया।

के.वी.के.

वर्ष के दौरान 2191 प्रतिभागियों को शामिल करते हुए कुल 110 प्रशिक्षण कार्यक्रम आयोजित किए गए। कृषि विज्ञान केंद्र गोलपारा ने नव निर्मित कृषि प्रौद्योगिकियों पर 12 कृषि परीक्षण का संचालन किया है। किसानों के खेत में दलहनी फसलों पर दो नंबर एफएलडी का आयोजन 2019–20 के दौरान किया गया। हरे चने की किस्म स्त्रष्ट 16 और काले चने की किस्म PU 31 ने प्रत्येक 20 हेक्टयर भूमि में प्रदर्शन किया। इस कार्यक्रम में कुल 83 किसान दलहन किसान शामिल हुए। अंतर्राष्ट्रीय योग दिवस का जश्न, जल शक्ति अभियान पर जागरूकता शिविर, उर्वरक अनुप्रयोग जागरूकता कार्यक्रम, सामूहिक वृक्षारोपण अभियान, स्वछता हाय सेवा और राष्ट्रीय एकता दिवस पर जागरूकता कार्यक्रम का आयोजन किया गया।

AICRP और मेगा सीड परियोजनाएं

संस्थान ने पिग परियोजना (15 केंद्र) पर एआईसीआरपी की प्रगति और सुकर पालन पर मेगा बीज परियोजना (07 केंद्र) की नियमित निगरानी जारी रखी, परिषद के परामर्श और समीक्षा बैठक के संचालन के साथ तकनीकी और वित्तीय निगरानी के माध्यम से। 27–28 सितंबर, 2019 को गुवाहाटी के सुकर, आईसीएआर–राष्ट्रीय अनुसंधान केंद्र में अंतिम एआईसीआरपी समीक्षा बैठक आयोजित की गई थी। विभिन्न कृषि–जलवायु स्थिति में सूकरों के प्रदर्शन का अध्ययन करने के लिए देश भर के विभिन्न केंद्रों में एआईसीआरपी परियोजना जारी है, गुणवत्ता जर्मप्लाज्म सहित प्रथाओं के क्षेत्र–विशिष्ट पैकेज को विकसित करना और स्वदेशी जर्मप्लाज्म का संरक्षण करना। सुकर पर मेगा सीड प्रोजेक्ट के तहत, बेहतर किस्म के कुल 18027 पिगलेट का उत्पादन XII वीं योजना अवधि के दौरान वितरण के लिए किया गया था। कुल 4403 नग। 2018–19 में वितरण के लिए विभिन्न प्रकार के पिगलेट का उत्पादन क्रमश: किया गया था।

क्षमता निर्माण

संस्थान ने सूकर पालन, कृत्रिम गर्भाधान, पोर्क उत्पादन पर 18 प्रशिक्षण आयोंजित किए।

अन्य

संस्थान ने गणतंत्र दिवस, स्वतंत्रता दिवस, हिंदी पखवाड़ा, संस्थान स्थापना दिवस और विश्व पर्यावरण दिवस जैसे विभिन्न आधिकारिक कार्यों का भी अवलोकन किया। मनोरंजन क्लब द्वारा कर्मचारियों के लिए विभिन्न सामाजिक कार्यक्रम भी आयोजित किए गए। महात्मा गांधी के 'स्वच्छ भारत' के सपने को साकार करने की दिशा में काम करने के संकल्प के साथ संस्थान नियमित रूप से 'स्वच्छ भारत अभियान' के तहत गतिविधियों का संचालन कर रहा है। कार्यालय और परिसर के परिसर को स्वच्छ और पर्यावरण के अनुकूल बनाए रखने के लिए कई पहल की गईं। इसके अतिरिक्त, किसानों के लाभ के लिए वैज्ञानिक विशेषज्ञता का विस्तार करने के लिए, संस्थान ने मेरा गाँव मेरा गौरव कार्यक्रम लागू किया है।

Executive summary

Executive summary

ICAR-National Research Centre on Pig has successfully completed 17 years since inception and continued its excellence in catering the needs/ requirements of farmers, extension workers, policy makers and industries associated with pig farming and pork processing. During the year 2019-20, the Institute functioned with 18 scientists, 06 technical staff and 06 administrative and accounts personnel. The total plan and non-plan budget allocations were 2072.21 lakh during the financial year. The institute has generated Rs 118.66 lakhs 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.

Animal Genetics and Breeding

Generation-wise genetic evaluation of Rani crosses was studied and it was found that breed characters of Rani Crossbred was stabilized for consistent crossbreeding of several generations. Further, the conservation of Doom pig of Assam is in progress. The work on comprehensive functional profiling of the male-specific region of the pig Y chromosome in order to elucidate the functional and transcriptomic profiling of the pig Y chromosome is in progress. Investigation of the origin and evolution of pigs of Northeast India using mitochondrial genomic sequences (mtDNA) from indigenous pigs and wild pigs is in progress. IRT image-based systems for examining the health status of pigs were studied. Studies on exploring genetic variability in different candidate genes and their association with reproduction traits in pigs is under progress.

Animal Nutrition

Vegetable waste based silage was prepared using locally available vegetable waste namely cabbage, cauliflower, carrot, tomato etc. and its acceptability by pigs and effect on body growth in pigs was studied. Effect of supplementation of QPM maize fodder on production performance in Large White Yorkshire, Rani crossbred grower pigs was studied. It was found that feed cost per kg gain was reduced by Rs.2.98 at 5 % supplementation of QPM maize silage by replacing maize grains in crossbred grower pigs while feed cost per kg gain was reduced by Rs.7.17 and Rs.11.59 at 5 % and 10 % supplementation of QPM maize fodder by replacing maize grains in LWY finisher pigs. Under National Mission for Sustaining the Himalayan Ecosystem, clinical and feed samples were collected from different individual pig farms and analyzed the same for their nutritive value & disease diagnosis.

Animal Reproduction

A methodology was developed for optimizing reproductive efficiency/combate anestrus in gilts and sows. Synchronization and estrus induction in gilts and sows under farmers' field conditions was undertaken. Further, advance sperm function tests were standardized. Superiority of additive in terms of post thaw semen characteristics was SDS> Vit- E>Mifepristone>Triethanolamine. In other experiment, boar semen was frozen with seminal plasma. A long term extender for liquid semen preservation has been standardized. Biochemical characterization of boar seminal gel is under progress. Preservation of boar seminal gel has been standardization. The effect of boar seminal gel and saliva has been studied in young males for training purpose for semen collection and in gilts and sows for estrus induction purpose.

Animal Physiology

Experiments were conducted to identify the pathways related to thermal stress through both *in vivo* and *in vitro* experiments. Further, MicroRNA mediated regulation of physiological responses during heat stress in pigs was studied. The fibroblast cells were subjected to acute heat shock (41^0C), (control at 37^0 C) and processed for isolation of RNA and subsequently processed for synthesis of cDNA library and analysis. High quality RNA purified from cells were analysed with whole transcriptome and micro RNA specific sequencing study to identify all the microRNAs/ transcripts present in the fibroblast cell line. A total of 24997 transcripts were mapped to *Sus scrofa* genome, out of which 651 genes were differentially expressed ($P<0.05$). There were 255 and 396 differentially expressed genes that were up- and down-regulated, respectively ($P<0.05$). The spermatozoal transcriptome of boars differing in fertility using RNA-seq and compared with the fertility status of boars used in the AI was examined. Cataloguing of porcine ovary into different physiological stages based on visual appraisal and their transcriptome profiling have been undertaken with ovarian cyclicity to uncover the role of immunogenic and angiogenic growth factors in ovulation-induced molecular changes in swine.

Animal Health

Development of rapid and sensitive nucleic acid based diagnostic assay is under progress for *Salmonella* and *Campylobacter* species. During the reported period two loop mediated isothermal amplification assay have been developed for rapid detection of Methicillin Resistant *Staphylococcus aureus* and Shiga toxin producing *E. coli* from pork. The antimicrobial activity of *Typhonium trilobatum* plant extract was studied in vitro using the macrodilution method. Determination of MIC and MBC of the plant extract is under progress. Seasonal distributions of Japanese Encephalitis Virus (JEV) sero positivity in pigs were evaluated during the reported period. Four hundred twenty eight numbers of various samples viz. faecal (205), Nasal swab (103) and tissue sample (120) from different organized and unorganized pig farms of Assam were collected for detection of neonatal mortality. For simultaneous detection of all the three genes (N, M and ORF5) of porcine reproductive and respiratory syndrome virus, a PCR based method was developed.

Livestock Products Technology

Value added functional pork products through the addition of critical ingredients were developed to cater the needs of the health-conscious consumers and evaluate the nutritional, physicochemical, microbiological and sensory attributes of developed products. Standardization of procedure for detection of FSSAI listed food borne pathogens in meat and meat products by molecular means was carried out. Further, Identification of different meats by species-specific markers of mitochondrial origin was standardized. Sex Identification in Pig and Cattle using Polymerase Chain Reaction Amplification of the Amelogenin and Sex-determining Region Y (SRY) Genes was also carried out. Profiling of selected heavy metals present in meat, feed and water

was performed using Atomic Absorption Spectroscopy. Food Quality Management Database has been designed and developed for handling the analytical samples with traceability in the QC Lab. Biometry and CCTV systems were installed in the unit to ensure confidentiality.

Extension

During the reported period, production of educational tools like video and technical bulletin have been initiated under the institute project on fostering the adoption of scientific pig production practices, A video script was prepared including all the scientific pig production practices in three languages i.e, English, Hindi and Assamese. The shooting, dubbing and editing activities were undertaken as a part of video production. A knowledge test was also developed to measure the knowledge of the farmers. A detailed interview schedule was prepared and base line data collection was also started in three districts Kamrup, Goalpara and Baksa.

KVK

A total of 110 training programmes covering 2191 participants were conducted during the year. The Krishi Vigyan Kendra Goalpara has conducted 12 'On Farm Trials' on newly generated agricultural technologies. Two numbers of FLD on pulse crops were conducted during 2019-20 at farmers' field. The green gram variety SGC 16 and black gram variety PU 31were demonstrated in 20 hectare of land each. A total of 83 numbers of pulse farmers were involved in this programme. Celebration of International day of Yoga, awareness camp on Jal Shakti Abhiyan, fertilizer application awareness programme, mass plantation drive, awareness programme on Swatchata hi Sewa and National unity day were organized.

AICRP and Mega Seed Projects

The Institute continued regular monitoring of the progress of AICRP on Pig project (15 centres) and Mega seed project on pig (07 centres) through technical and financial monitoring in consultation with the council and conduction of review meet. The last AICRP review meet was conducted at ICAR-RCNEH, Umiam, Barapani during 27-28th September, 2019. The AICRP project is continuing in different centers across the country to study the performance of pigs in different agro-climatic condition, to develop region-specific package of practices including quality germplasm and to conserve the indigenous germplasm. A total of 4403 piglets of improved varieties were produced in these centers for distribution to the farmers during the year 2019.

Capacity Building

The institute has conducted 18 numbers of training programmes in different aspects of pig production, artificial insemination, pork processing and value addition.

Others

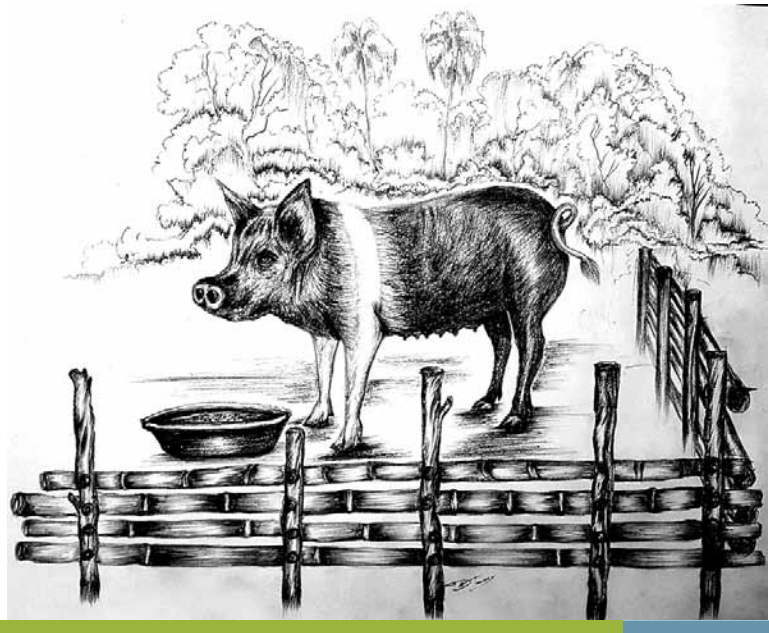
The Institute also observed various official functions such as Republic Day, Independence Day, Hindi Pakhwada, Institute Foundation Day and World Environment Day. Various social events were also organized by the Recreation Club for the staffs. The Institute is regularly conducting activities under "Swachh Bharat Abhiyan" with the resolution to work towards realizing Mahatma Gandhi's dream of "Swachh Bharat". 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.

Salient achievements during 2019

1. Generation-wise genetic evaluation of Rani Crosses were studied and it was found that breed characteristics of Rani crossbred were stabilized through consistent crossbreeding for several generations. Further, conservation of Doom pig of Assam is being carried out.
2. A comprehensive functional profiling of the male-specific region of the pig Y chromosome in order to elucidate the functional and transcriptomic profiling of the pig Y chromosome is under generation. Investigation of the origin and evolution of pigs of Northeast India using mitochondrial genomic sequences (mtDNA) from indigenous pigs and wild pigs is in progress.
3. Vegetable waste based silage was prepared using locally available vegetable waste namely cabbage, cauliflower, carrot, tomato etc. and its acceptability by pigs and effect on body growth in pigs were studied.
4. The institute has provided female piglets, concentrate feed supplements to the selected beneficiaries on monthly basis under the TSP plan and monitored the health, growth and management of the pigs in the five adopted villages regularly and gave necessary health treatment and AI services as and when required.
5. Preservation of boar seminal gel was standardized. The effect of boar seminal gel and saliva was studied in young males for training for semen collection whereas, in gilts and sows for estrus induction purpose. Piglets were produced at farmers' field and organised farms across the country using artificial insemination. A methodology was developed for optimizing reproductive efficiency in gilts and sows.
6. Institute has established a modern boar semen processing laboratory with the financial assistance received from North Eastern Council, Shillong.
7. MicroRNA mediated regulation of physiological responses during heat stress in pigs was studied. A total of 24997 transcripts were mapped to *Sus scrofa* genome out of which 651 genes were differentially expressed.

Salient achievements during 2019

8. A loop-mediated isothermal amplification (LAMP) assay for rapid detection of MRSA from pork was developed. During the reported period two other loop mediated isothermal amplification assay have been developed for rapid detection of *Staphylococcus aureus* and Shiga toxin producing *E. coli* from pork.
9. The antimicrobial activity of herb *Typhonium trilobatum* extract was studied *in vitro* using the macrodilution method. Developed a real-time PCR based rapid diagnostic assay for detection of JEV. Developed multiplex PCR assays for important porcine pathologens such as *Pasteurella multocida* , *E.Coli* and Methicillin Resistant *Staphylococcus aureus* and developed multiplex PCR for simultaneus diction of three genes of PRRS in single PCR reaction.
10. Developed value added functional pork products through the addition of critical ingredients to cater the needs of the health-conscious consumers and evaluated the nutritional, physicochemical, microbiological and sensory attributes of the developed products. Protocols for PCR based detection of FSSAI listed pathogenic organisms in pork were standardized. Standardized the procedure for PCR based authentication of meat from different species of food animals.
11. The AICRP on pig project is strengthened in different centers across the country to study the performance of pigs in different agro-climatic condition, to develop region-specific package of practices including quality germplasm and to conserve the indigenous germplasm. Under mega seed project on pig, improved variety of piglets were produced and distributed to the farmers.
12. Institute has filled 01 number each of patent and trade mark applications and 09 numbers of copyright applications during the reported period. Also a patent was granted during the year 2019.
13. Institute has established a state of the art ABI Centre and inducted 07 number of incubates during the reported period.
14. Institute has regularly conducted activities under "Swachh Bharat Abhiyan" with the resolution to work towards realizing the Mahatma Gandhi's dream of "Swachh Bharat". In order to extend the scientific expertise for the benefit of farmers, the Institute has implemented MeraGaon- Mera Gaurav programme.
15. The KrishiVigyan Kendra of ICAR-NRC on Pig has conducted 12 nos. of On Farm Trials (OFT) and 02 nos. of Front Line Demonstrations (FLD) under various disciplines to promote the technology transfer.



Introduction

Introduction

The ICAR-National Research Centre on Pig (ICAR-NRCP) was established in 2002 under the aegis of the Indian Council of Agricultural Research (ICAR) to bring in excellence in pig production, health and product processing through innovative research in order to provide technology backstopping for enhanced pork production, employment generation and poverty reduction among socially and economically weaker sections through the medium of pig husbandry. The institute has been trying its level best for popularizing the scientific pig production and post harvest management in the country since its inception as well as all round development of the piggery sector along with its affiliation units, namely Krishi Vigyan Kendra (KVK), fifteen centres of All India Coordinated Research Project on Pig, and seven 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 genetics 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 Goponath Bordoloi International Airport.

Faculty and Staff

The Institute is headed by the Director and currently 18 scientists, 05 administrative, 06 technical and 01 skilled supporting staffs are in position at ICAR-NRC on Pig. Also under the administrative control of ICAR-NRC on Pig, Krishi Vigyan Kendra, Dudhnoi is headed by programme coordinator and currently has 10 numbers of technical, 01 administrative and 02 skilled supporting staff.

Staff Position as on 31.12.2019

SCIENTISTS

Particulars	Sanctioned Strength	In-position	Vacant
Scientist	18	13	05
Senior Scientist	04	04	0
Principal Scientist	02	01	01
RMP Director	01	0	01
TOTAL	**25**	**18**	**7**

ADMINISTRATION

Particulars	Sanctioned Strength	In-position	Vacant
A.O	01	00	01
AAO	01	01	0
AF & AO	01	01	0
Assistant	04	0	4
P.A to Director	01	0	1
Jr. Stenographer	01	01	0
UDC	01	01	0
LDC	01	01	0
TOTAL	**11**	**05**	**06**

SKILLED SUPPORTING STAFF

Particulars	Sanctioned Strength	In-position	Vacant
SSS	04	01	03
TOTAL	04	01	03

TECHNICAL

Particulars	Sanctioned Strength	In-position	Vacant
T3/T4	04	03	01
T1	03	03	0
TOTAL	**07**	**06**	**01**

KVK CADRE STRENGTH as on 31.12.2019

Particulars	Sanctioned Strength	In-position	Vacant
Programme Coordinator	01	00	01
SMS	06	05	01
T3/T4	03	03	00
Assistant	01	00	01
Jr. Stenographer	01	01	00
SSS	02	02	00
T1/T-2 Drivers	02	02	00
Total	**16**	**13**	**03**

Priority setting and management

Priority setting and management

The Institute has a high powered Research Advisory Committee (RAC) comprising of eminent scientists and professor, who guide the research agenda of the institute and set research priorities. Dr N. Balraman, Former Vice-Chancellor, Tamil Nadu Veterinary and Animal Sciences University, Chennai is the chairman of the committee. The other members include scientists and professors from the field of Animal Genetics and Breeding, Animal Nutrition, Animal Health, Animal Physiology, Extension and Livestock Products Technology. The functioning of the institute is supervised by Institute Managemental Committee (IMC) headed by the Director of the institute as Chairman and members drawn from state government, university and public personnel. A number of internal committees such as Purchase, Library, Works, Official Language Implementation, ISO 9001- 2015 Implementation, Grievance, Publication, Priority Setting Monitoring and Evaluation Cell, Staff Welfare Club, IPR Cell, Institute Technology Management Unit, Agri-Business Incubation and ICC (women committee) have been constituted to decentralize the management with developed responsibilities for smooth functioning of the institute. The Institute Joint Staff Council has been constituted for promoting healthy and congenial work environment. The Institute Research Council (IRC) provides a platform for effective professional interactions in respect of review and implementation of various research projects.

VISION

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

MISSION

Performance appraisal and genetic cataloguing of indigenous pigs, development of improved pig variety together with production, health, product processing and pig based integrated farming

system technologies to facilitate the pig rearers of the country for achieving household food, nutritional and economic security.

MANDATE

The mandate of the institute is:

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

RESEARCH PROGRAMMES

Programme-1:	Conservation and genetic improvement of indigenous pigs
Programme-2:	Improvement of physiological and reproductive efficiency in pigs
Programme-3:	Standardization and improvement of Good Management Practices (GMP) for pig husbandry
Programme-4:	Continuous monitoring, recording of pig diseases and development of disease management protocol
Programme –5:	Technology upgradation of post harvest handling, processing and value addition of pig products
Programme-6:	Institute-stakeholder linkages and skill development

Expenditure Statement

Statement showing the sub head wise expenditure for the year 2019-20 (Rs in lakh):

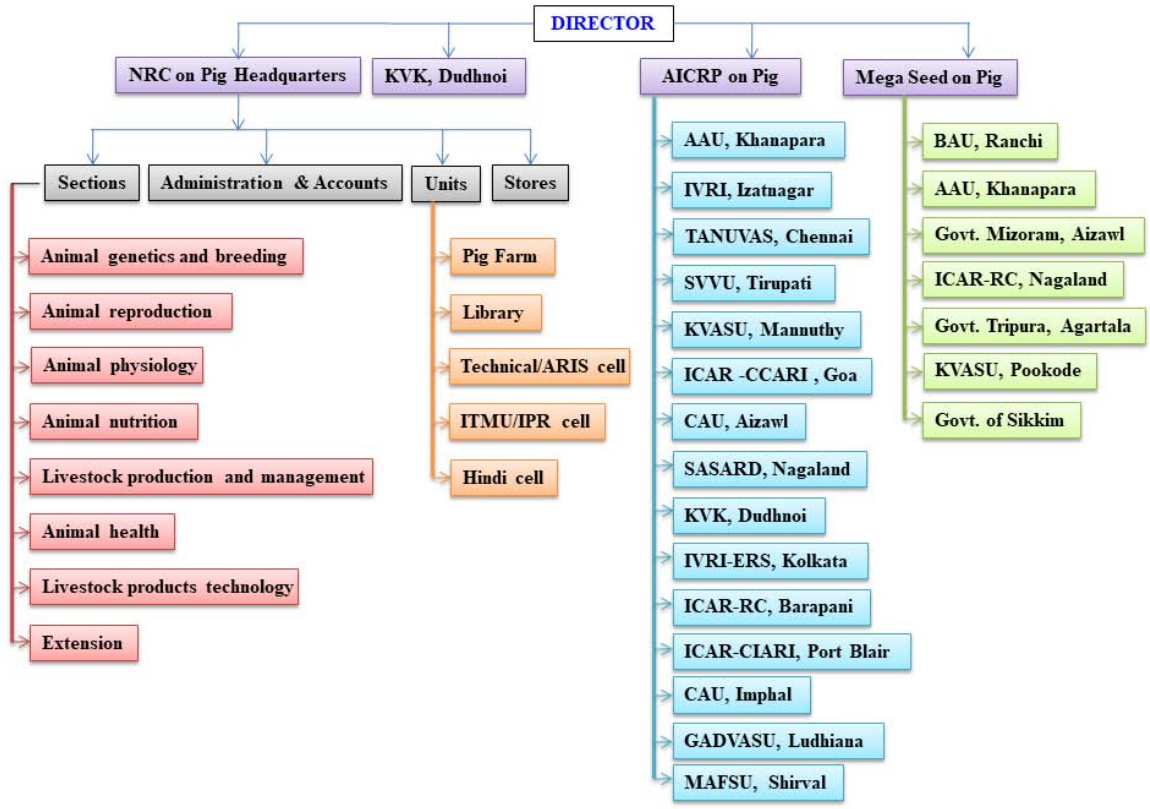
Name of the Scheme/ Project		Pay and allowances	TA	Recurring Contingency	Works	Equipment	IT	Library	Livestock	Furniture	Others	Repair and Maintenance	HRD	Publicity	Others/ MISC	Total
ICAR-NRC on Pig (Main scheme)	R.E	420.00	15.00	244.98	96.00	38.95	5.05	0.10	4.90	5.00	0.00	153.72	2.20	0	1.10	987.00
	EXP	419.75	14.45	244.91	95.98	38.75	4.99	0.06	4.83	4.72	0.00	153.41	2.19	0	1.08	985.12
AICRP on Pig	R.E	122.21	8.50	482.00	82.00	12.00	0.00	0.00	4.75	0.75	0.00	0.00	0.00	0.00	0.00	712.21
	EXP	122.21	8.50	482.00	82.00	12.00	0.00	0.00	4.75	0.75	0.00	0.00	0.00	0.00	0.00	712.21
Mega Seed on Pig	R.E	0.00	4.00	338.50	15.00	4.00	0.00	0.00	11.50	0.00	0.00	0.00	0.00	0.00	0.00	373.00
	EXP	0.00	4.00	338.50	15.00	4.00	0.00	0.00	11.50	0.00	0.00	0.00	0.00	0.00	0.00	373.00

Revenue Generation

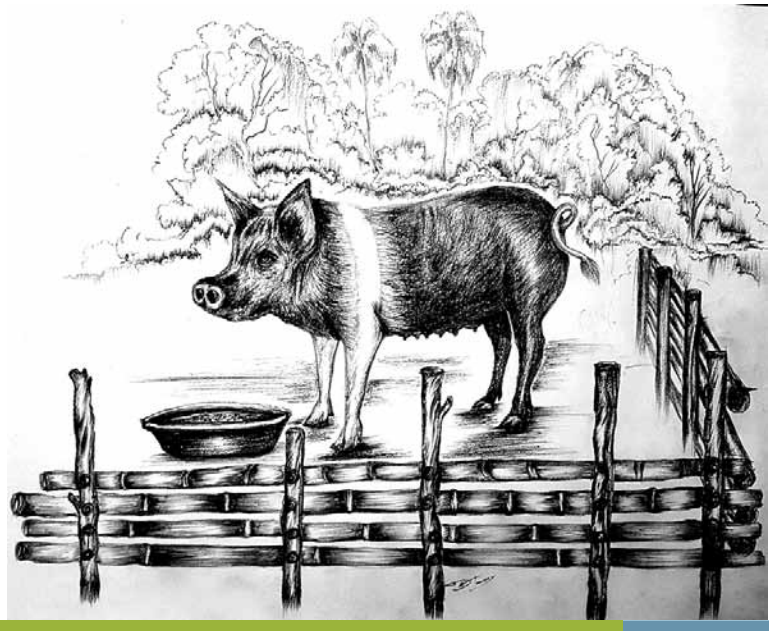
Sl. No.	Particulars	Revenue
1	Revenue Target during 2019-20	Rs. 83.54 lakhs
2	Revenue Generation during 2019-20	Rs. 118.66 lakhs

Expenditure Statement and Revenue generation

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

Agri-Business Incubation (ABI) Centre

Agri-Bussiness incubation (ABI) centre has been established with office facility for 08 number of incubatees at a time. The building also have provision for a business meeting room. The building was inaguated by Dr. T. Mohapatra, Secretary, DARE and DG, ICAR on 24th November, 2019. So far, 07 numbers of incubates were inducted in the unit.

Agribussiness Incubation Centre Building

Modern boar semen processing laboratory

Institute is in the process of establishing a modern boar semen processing laboratory with the financial assistance from North Eastern Council, Ministry of DoNER, Govt. of India. The lab will have facilities for processing boar semen from 50 Boars. Two modern sheds have already been constructed to maintain quality germplasm boars. Modern equipments like CASA will be installed in the semen processing centre. The centre will also have a training hall for training and awareness of stakeholders.

Modern boar semen processing laboratory under progress

Physical Progress

Site development

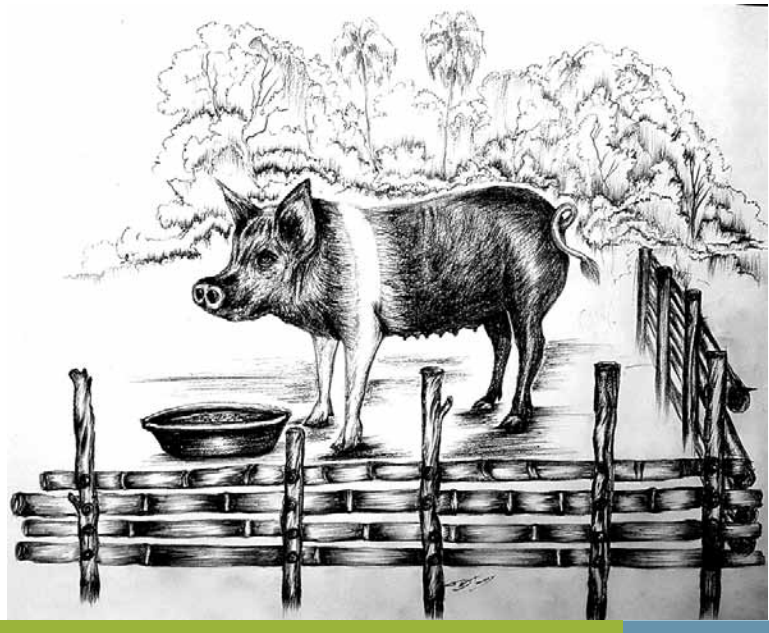
Institute has formally acquired around 3.5 acres (10 bigha 2 katha and 2 lesa) of land from Department of Animal Husbandry and Veterinary, Govt. of Assam and initiated the development of site including the construction of boundary wall, earth filling and planting of trees.

Site development in the new plot

Construction of Medical Unit

Institute has constructed a medical unit in the campus. This unit has the basic facility for the examination of patients. The Institute has hired the service of a medical doctor for ensuring treatment to the staffs.

Medical unit



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

A high producing crossbred pig variety Rani was developed and released for breeder farmers after performance evaluation by conducting multi location trials at field level. Pure parental lines of Hampshire and Ghungroo (female) pigs, maintained through selective breeding at pig breeding farm of ICAR-National Research Centre on Pig, Guwahati, was used as exotic and indigenous germplasm, respectively for crossbreeding programme.

The crossbred variety is presently being maintained by *inter-se*-mating. The breed characters of Rani crossbred was stabilized for consistent crossbreeding of several generations. 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 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 eighth generation of Rani crosses are maintained in the farm.

Now a sizable number of crossbred animals are available in the institute as well as at farmers' field. The selected boars of existing crossbred animals were trained for semen collection and all the mating was done by artificial insemination with pre-evaluated semen at the institute farm. Animals of Rani variety showed better performance with respect to production, reproduction, adaptive and carcass traits than local pigs at organized farm as well as farmers' field.

The planned crossbreeding program resulted in development of Rani crossbred animal with following features:

- Higher litter size at birth and weaning
- Higher litter weight at birth and weaning
- Promising growth rate
- Better adaptability
- Body condition of sow remain excellent up to fifth farrowing

The performance of seventh generation Rani crosses are given in table 1

Traits	Performance
(Re) productive traits	
Litter size at birth	9.87±0.40
Litter weight at birth	10.95±0.50
Litter size at weaning	8.83±0.31
Litter weight at weaning	62.23±3.55
Weaning weight	7.01±0.32
Pre-weaning growth rate (g/d)	147.51±12.35
Post-weaning growth rate (g/d)	345.50±23.85
Weight at 8 month	76.11±4.22
FCR	3.70±0.20

Adaptive traits	
Pre-weaning mortality rate	5.20±0.50
Carcass trait	
Dressing percentage	75.00±2.81
Carcass length	92.90±4.02
Back fat thickness	1.97±0.10
Loin eye area	4.65±0.11

Rani female pig

Rani sow with Piglets

Rani Grower

Institute project: Characterization and expression profiling of Pig MSY (male-specific region of the Y chromosome) genes for boar fertility. Project Code: IXX14388

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

The mammalian sex chromosomes evolved from a pair of autosome that diverged ~300 million years ago (MYA) after the Y chromosome accumulating male-specific region. During this evolution process, the Y chromosome reduced in size and gene content as it progressively losing its function of recombination with the X chromosome, except in the pseudoautosomal region (PAR) that maintains pairing during meiosis. The non-recombination area of the Y chromosome becomes male-specific (MSY) which contains male-specific genes. Despite the importance of this chromosome in male fertility, particularly development testis and spermatozoa, this chromosome has not been always neglected across the species. Pigs are an economically important domestic species. The pig meat or pork has always been popular meat -back before the explosion of beef, pork was considered the most popular meat because it was so easy to preserve, thanks to salting or smoking. But Pig has are typically selected based on pedigrees record, litter size and body weight, one of the most common concerns pig industry is boar subfertility. Recalling that a number of Y chromosomal loci contribute to infertility in male, expectations are that important regulators of male biology are present also in the Pig Y. 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 in order to elucidate the functional and transcriptomic 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. Although sporadic characterizations of Y specific genes have been discovered in Pig negligible works have been done on its expression profiling. The present study has identified twelve male-specific genes of Pig genes which have been very significant for male fertility across the mammalian species. 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, 6

control genes from Pig and 20 fertility-related miRNA. Targeted genes were amplified in male and female genomic DNA and confirm the male-derived specificity. The tissue panel from the pig, as well as sperm, have been collected to understand 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 pig and to differentiate male and female pig genotypically.

Institute project: Phylogenetic analysis of pig mitochondrial genome sequences of native pigs of North-East India. Project Code: IXX13503

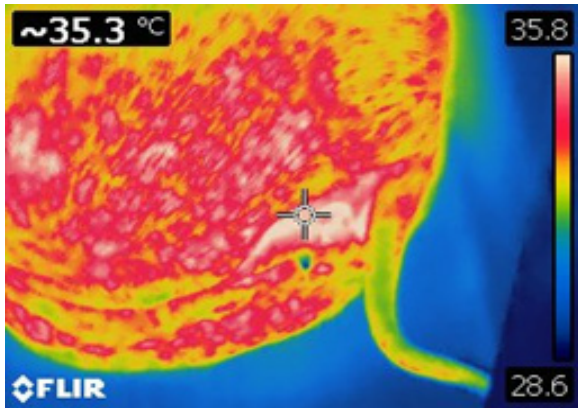
P.J.Das, S. Banik, S.R.Pegu and S. Rajkhowa

Pig (*Sus scrofa*) is one of the most valued animals, and it distributes in the diverse climatic conditions in the world from temperate to the hot and humid zone. Although it has the raising history more than 8,000 years, the domestication and origin of pigs found in India need to be reclassified. North East India is one of the regions originally feed pigs and the differences in climate and geography have contributed to the development of different indigenous pig breeds, many of which have special and unique characteristics. Most of the native breeds found in North East India are considered rare, have a small population size, and are under increasing pressure from the introgression of modern commercial breeds. This makes investigations of both population structure and genetic diversity increasingly important. The purpose of this study was to investigate the origin and evolution of pigs of Northeast India and using mitochondrial genomic sequences (mtDNA) from exotic pigs and wild pigs. The minimum blood five samples collected aseptically from indigenous pig breeds of NE region *viz*. Ghungroo, Niang Megha, Tenyi-Vo, Doom, Non-descript, Mali, Zovawk, Rani, Asha, Lumsiang, HDK75 and wild pig. A total of 30 pairs of primers were designed to amplify complete mtDNA genome from each breed as well as a pair of primer was designed to amplify the complete d-loop region of from minimum five individual from each breed. The mtDNA enriched DNA was isolated from the different samples and amplification was done using mtDNA specific primers. The complete mtDNA genomes of each breed as well as five each of whole mtDNA d-loop of Ghungroo, Niang Megha, Tenyi-Vo, Doom, Non-descript, Mali, Zovawk, Rani, Asha, Lumsiang, HDK75 and wild pig of NE were sequenced using ABI Sanger Sequencing. The DNA sequences were assembled using Clustal X and exported to the FASTA file. The complete sequence was annotated using MITOS and DOGMA. The evolutionary history of the indigenous pig breeds of NE was inferred using the neighbour-joining (NJ) method. The phylogenetic statuses of indigenous pigs were investigated by comparing the whole mtDNA sequences of complete and D-loop regions respectively amongst Asian breeds, European breeds, and wild boars. Neighbour-Joining trees constructed on the basis of mtDNA D-loop sequences and the whole mtDNA analysis clearly showed that the indigenous pigs of NE region were located in a separate branch. These data suggest that the indigenous breeds of pigs are different from other breeds. It revealed that native pig of Northeast was only recently diverged from each other and distinctly different from exotic European pigs. The Indian wild boar had a distant genetic relationship with all other domestic pigs as well as excludes the potential effects of hybridization between local indigenous breed and exotic breeds of pig. In this data analysis, it also suggests a high level of a subpopulation in the indigenous pigs of NE India. For conservation of the germplasm in the indigenous pigs of NE region, it is necessary to take measures for conservation for this rare genetic material.

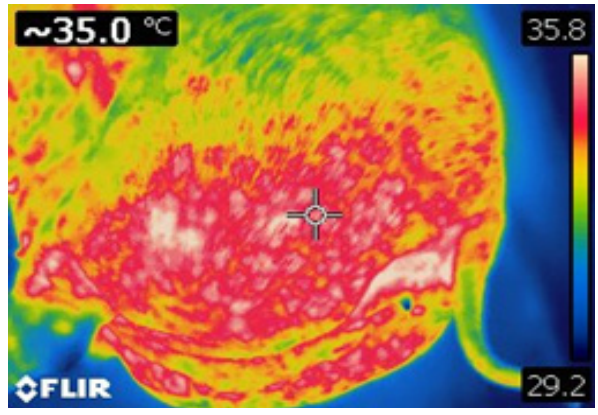
Institute project: Development of IRT image-based systems for examining the health status of pigs. Project Code: IXX15272

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

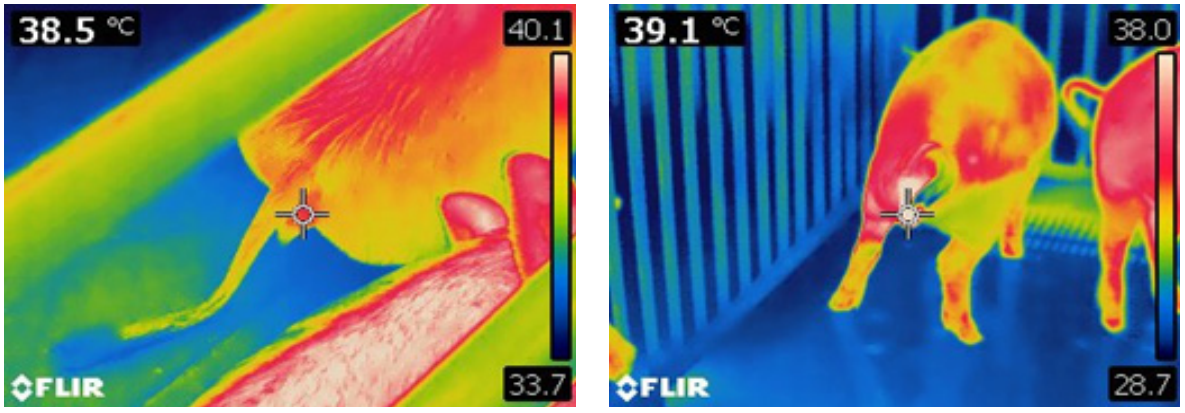
Infrared thermography is a modern, non-invasive, and safe technique that measures the temperature of a surface, based on its emission of infrared radiation. The infrared thermal camera is gaining popularity as a diagnostic tool for evaluating human and animal health. In veterinary science, thermal imaging 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. Infrared thermography has been used to establish the causes of injuries, inflammations, and lameness; to diagnose infectious diseases, oestrus, and pregnancy; ectoparasite infestation in livestock animals; to study animal welfare and environmental and physiological stress levels in. 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 as a safety device for the animals and the veterinarian. It considerably lowers the risk of spreading infections, since touching the subject is needless and also in animals, this is advantageous as handling and restraint increase stress, causing an effect on the surface temperature. The study was undertaken to identify a sow /gilt who are in an oestrous stage or are pregnant thus addressing the thermal profile of female reproductive parameters. It has been shown that oestrogen administration can induce an increase in vaginal blood flow measured through a rise in vaginal thermal conduction. The increased local blood flow linked to rising plasma estrogens is reflected by vulvar reddening and swelling that has been widely reported as typical signs of oestrus in the sow, Infrared thermography has the potential to evaluate these physiological changes by monitoring the evolution of the vulvar skin temperature of pigs in oestrus and not in oestrus. This study planned to distinguish variations of vulvar skin temperature (VST), gluteal skin temperature (GST) and the difference between vulvar and gluteal skin temperature (VGT) in the oestrous and non-oestrous stages of the cycle. The results of the study indicated significant differences among oestrus and non-oestrus animals for different temperature (°C) parameter 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.



(a)



(b)



(c) (d)

Fig. Infrared thermographic images of sows ; (a) vulvar skin temperature of non estrus sow, (b) gluteal skin temperature of non estrus sow, (c and d) vulvar skin temperature of estrous sow.

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

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

The center is acting as conservation unit of Doom pig of Assam as per mandate of the project. The center is maintaining 30 sow unit of Doom pig for conservation and 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 pig. New replacement stock of animal was purchased for subsequent breeding. The performance of Doom pig in the farm is given in table 2.

Traits/Characters	Performance
Litter size at birth (no.)	4.25±0.08
Litter weight at birth (kg)	1.45±0.11
Litter size at weaning (no.)	3.50±0.10
Litter weight at weaning (kg) 4.70±0.28	
Avg. Individual weight at birth (kg)	0.68±0.08
Avg. Individual weight at weaning (kg)	2.90±0.23
Avg. Individual weight at 8 months (kg)	42.54±3.81
Pre weaning growth rate (gm/d)	50.96±3.61
Post weaning growth rate (gm/d)	210.53±18.21
Overall growth rate (upto 9 m) (gm/d)	186.51±19.02

Pig shed at AICRP on Pig, KVK, Dudhnoi

Doom pig at its conservation unit

Institute project: Exploring genetic variability in different candidate genes and their association with re(production) traits in pigs. Project code: IXX14967

Satish Kumar, Santanu Banik, P J Das, Sunil Kumar, AR Sahu and Jaya

The project was formulated for exploring genetic variability in different candidate genes and their association with reproduction traits in pigs. The genetic variability was accessed in terms of SNPs in different candidate genes. The genes were selected on the basis of its functional and physiological role in reproduction of pigs. The genes selected were ESR, LIF, LIFR, LEP, LEPR, PRL, PRLR and FSHb genes. All the SNPs in the exonic regions of these genes accessable by PCR-RFLP were targeted for genotyping in the three pigs population namely Ghoongroo, Niang Megha and Doom indigenous pigs. The primers were designed by online available software Primer3 or NCBI primer designing tools or IDT primerquest softwares such that after digestion with RE the fragments will be resolved in the agarose gel so that genotyping of SNPs will be done. The restriction enzyme was selected by online available programme NEBCUTTER V.2. to give two or three fragments easily resolved in agarose gel electrophoresis. 5 ml Blood samples were collected from 21 Doom, 50 Ghoongroo and 15 Niangmegha sows from KVK Goalpara, NRC on Pig and ICAR- RCNEH Pig farm, Barapani respectively. The data related to reproductive traits have been collected from respective farms. The primers were standardized for PCR-amplification using gradient thermocycler for appropriate annealing temperature.

Institute project: Molecular characterization of indigenous pig breeds. Project code: IXX14968.

Satish Kumar, Santanu Banik, P J Das, E. B. Chakurkar, Amiya Ranjan Sahu, Sunil Kumar

The project was formulated for the purpose of molecular characterization of indigenous pigs of India. The genetic diversity among the indigenous pig breeds is wide and the specific characteristics of each breed are well recognized. But, there is no breed specific molecular information about these registered pig breeds. Hence, to explore the molecular basis of genetic variations and to study the genetic diversity among them is the basis of this project. To know the allelic profiles of microsatellite loci in indigenous pig breeds, 30 microsatellite markers has been chosen according to FAO guidelines and suitable primers have been designed. The primers were designed by online available software Primer3 or NCBI primer designing tools or IDT primer questsoftware. 5 ml Blood samples were collected from 25 Doom, 50 Ghoongroo and 15 NiangMeghapigs from KVK Goalpara, NRConpig and ICAR- RCNEH pig farm, respectively. The data related to reproductive traits have been collected from respective farms. The primers were standardized for PCR-amplification using gradient thermocycler for appropriate annealing temperature. The list of primers used are given in Table 1.

Sl. No.	Primer Name	Nucleotide sequence
1	S0026	5′- AAC CTT CCC TTC CCA ATC AC -3′
		5′- CAC AGA CTG CTT TTT ACT CC -3′
2	S0155	5′- TGT TCT CTG TTT CTC CTC TGT TTG -3′
		5′- AAA GTG GAA AGA GTC AAT GGC TAT-3′
3	S0005	5′- TCC TTC CCT CCT GGT AAC TA -3′
		5′- GCA CTT CCT GAT TCT GGG TA -3′
4	Sw2410	5′- ATT TGC CCC CAA GGT ATT TC -3′
		5′- CAG GGT GTG GAG GGT AGA AG -3′
5	Sw830	5′- AAG TAC CAT GGA GAG GGA AAT G -3′
		5′- ACA TGG TTC CAA AGA CCT GTG -3′
6	S0355	5′-TCT GGC TCC TAC ACT CCT TCT TGA TG-3′
		5′- TTG GGT GGG TGC TGA AAA ATA GGA -3′
7	Sw24	5′- CTT TGG GTG GAG TGT GTG C -3′
		5′- ATC CAA ATG CTG CAA GCG -3′
8	Sw632	5′- TGG GTT GAA AGA TTT CCC AA -3′
		5′- GGA GTC AGT ACT TTG GCT TGA -3′
9	Swr1941	5′- AGA AAG CAA TTT GAT TTG CAT AAT C -3′
		5′- ACA AGG ACC TAC TGT ATA GCA CAG G -3′
10	Sw936	5′- TCT GGA GCT AGC ATA AGT GCC -3′
		5′- GTG CAA GTA CAC ATG CAG GG -3′
11	S0218	5′- GTG TAG GCT GGC GGT TGT -3′
		5′- CCC TGA AAC CTA AAG CAA AG -3′
12	S0228	5′- GGC ATA GGC TGG CAG CAA CA -3′
		5′- AGC CCA CCT CAT CTT ATC TAC ACT -3′
13	Sw122	5′- TTG TCT TTT TAT TTT GCT TTT GG -3′
		5′- CAA AAA AGG CAA AAG ATT GAC A -3′
14	Sw857	5′- TGA GAG GTC AGT TAC AGA AGA CC -3′
		5′- GAT CCT CCT CCA AAT CCC AT-3′
15	S0097	5′- GAC CTA TCT AAT GTC ATT ATA GT -3′
		5′- TTC CTC CTA GAG TTG ACA AAC TT-3′

16	Sw240	5′- AGAAATTAGTGCCTCAAATTGG -3′
		5′- AAACCATTAAGTCCCTAGCAAA-3′
17	IGF1	5′- GCTTGGATGGACCATGTTG -3′
		5′- CATATTTTTCTGCATAACTTGAACCT-3′
18	Sw2406	5′- AATGTCACCTTTAAGACGTGGG -3′
		5′- AATGCGAAACTCCTGAATTAGC-3′
19	Sw72	5′- ATCAGAACAGTGCGCCGT -3′
		5′- TTTGAAAATGGGGTGTTTCC-3′
20	S0226	5′- GCACTTTTAACTTTCATGATACTCC -3′
		5′- GGTTAAACTTTTNCCCCAATACA-3′
21	S0090	5′- CCAAGACTGCCTTGTAGGTGAATA-3′
		5′- GCTATCAAGTATTGTACCATTAGG-3′
22	Sw2008	5′- CAGGCCAGAGTAGCGTGC-3′
		5′- CAGTCCTCCCAAAAATAACATG-3′
23	Sw1067	5′- TGCTGGCCAGTGACTCTG-3′
		5′- CCGGGGGATTAAACAAAAAG-3′
24	S0101	5′- GAATGCAAAGAGTTCAGTGTAGG-3′
		5′- GTCTCCCTCACACTTACCGCAG-3′
25	Sw1828	5′- AATGCATTGTCTTCATTCAACC -3′
		5′- TTAACCGGGGCACTTGTG-3′
26	S0143	5′- ACTCACAGCTTGTCCTGGGTGT-3′
		5′- CAGTCAGCAGGCTGACAAAAAC-3′
27	S0068	5′- AGTGGTCTCTCTCCCTCTTGCT -3′
		5′- CCTTCAACCTTTGAGCAAGAAC-3′
28	S0178	5′- TAGCCTGGGAACCTCCACACGCTG -3′
		5′-GGCACCAGGAATCTGCAATCCAGT -3′
29	Sw911	5′- CTCAGTTCTTTGGGACTGAACC-3′
		5′- CATCTGTGGAAAAAAAAAGCC-3′
30	S0002	5′-GAAGCCAAAGAGACAACTGC -3′
		5′- GTTCTTTACCCACTGAGCCA-3′

ANIMAL NUTRITION

Institute project: Development of vegetable waste/fruit waste based pig feeds: Project Code: IXX14389

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

Vegetable waste based silage was prepared using locally available of vegetable waste namely cabbage, cauliflower, carrot, tomato etc. First, before preparation of the materials was washed and then sun dried for 2-3 hours and used for silage making with 3 % Jaggery and 0.25 % salt. The materials was kept for 21 days in silage bags and then used for experimental purposed.

Fig: Silage prepared with 3 % Jaggery and 0.25 % salt

Effect of vegetable silage on production performance in crossbred finisher pigs

Eighteen crossbred (HS x Ghungroo) finisher pigs were divided into three groups using randomized block design and they were supplemented with 0, 10 and 15 % vegetable waste silage to the basal diet and designated as T_1, T_2 and T_3 respectively. The protein content of the experimental diet was 16.49±0.31, 16.48±0.15 and 16.77±0.73 respectively in T1, T2 and T3 groups while protein content of silage was 19.36±0.11. Dry matter intake was found similar across the treatment groups. There was no significant difference on nutrient digestibility across the treatment groups. Nitrogen balance was found positive and similar across the treatment groups. However, biological value was found higher (P>0.05) at T_2 and T_3 groups in comparison to T1 group. Similarly there was no significant difference on average daily gain (g/day), feed intake per kg gain (FCR) and feed cost per kg gain. However, FCR and feed cost per kg gain was found better at 10 % and 15 % supplementation of vegetable silage in the diet. Feed cost per kg gain was reduced by Rs.9.76 and Rs.12.69 at 10 % and 15 % supplementation of vegetable silage by replacing whole concentrate in crossbred finisher pigs.

Effect of supplementation of vegetable silage on nutrient utilization in crossbred finisher pigs

Parameters	T_1	T_2	T_3	p Value
DM intake, kg/d	1.38±0.03	1.38±0.03	1.32±0.08	0.661
Initial weight, kg	23.77±5.53	23.97±0.83	23.57±2.44	0.996
Final weight, kg	84.33±2.33	83.33±0.88	79.00±4.16	0.414
ADG, g/d	403.78±31.77	395.78±11.28	369.56±11.83	0.511
FCR	3.83±0.21	3.88±0.03	3.98±0.28	0.874
Feed cost per kg gain, Rs.	109.17±6.09	99.41±0.79	96.48±6.78	0.281

T_1= Finisher ration containing 0 % vegetable waste silage, T_2= Finisher ration containing 10 % vegetable waste silage, T_3= Finisher ration containing 15 % vegetable waste silage; ^{a,b,c} superscript in a row differ significantly, $p<0.05$.

Cutting of vegetable waste

Mixing of vegetable waste with Juggery and salt

Packing in silage bag

Pressing the materials in silage bag to remove excess air

Closing of silage bags

Final silage after 21 days

Preparation of silage using banana stem with cabbage and colocasia leaf

Silage with banana stem plus cabbage (60:40)

Silage with banana stem plus colocasia (60:40)

Chemical composition and feeding trial using various combination of banana stem with cabbage and colocasia are in progress.

ICAR-IIMR Funded: Maize Production in NEH region for sustainable livestock production

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

Effect of supplementation of QPM maize fodder on production performance in Large White Yorkshire grower pigs

Eighteen Large White Yorkshire grower pigs were divided into three groups using randomized block design and they were supplemented with 0, 5 and 10 % QPM maize fodder to the basal diet by replacing (wt/wt on DM) the maize grains and designated as T_1, T_2 and T_3 respectively. The protein content of the experimental diet was 18.63±0.25, 18.51±0.18 and 18.37±0.11 while protein content of QPM maize fodder was 7.95±0.04. Dry matter intake was found similar across the treatment groups. There was no significant difference on nutrient digestibility across the treatment groups. Similarly there was no significant difference on average daily gain (g/day), feed intake per kg gain (FCR) and feed cost per kg gain. However, FCR and feed cost per kg gain was found better at 5 % and 10 % supplementation of maize fodder in the diet. Feed cost per kg gain was reduced by Rs.7.17 and Rs.11.59 at 5 % and 10 % supplementation of QPM maize fodder by replacing maize grains in finisher pigs.

Effect of supplementation of QPM maize fodder on nutrient utilization in Large White Yorkshire grower pigs

Parameters	T_1	T_2	T_3	p Value
DM intake, g/d	1319.40±36.44	1313.55±22.62	1316.70±14.29	0.980
Initial weight, kg	40.93±4.65	41.04±3.36	40.67±4.84	0.996
Final weight, kg	67.88±2.34	67.94±2.25	67.49±4.43	0.990
ADG, g/d	306.25±29.53	305.68±22.42	304.77±27.57	0.998
FCR	4.42±0.50	4.15±0.32	4.01±0.39	0.661
Feed cost per kg gain, Rs	125.90±14.13	118.19±9.07	114.31±11.13	0.661

T_1= Grower ration containing 0 % maize fodder, T_2= Grower ration containing 5 % maize fodder, T_3= Grower ration containing 10 % maize fodder by replacing maize grain; $^{a, b,c}$ superscript in a row differ significantly, $p<0.05$.

Effect of supplementation of QPM maize grain on production performance of cross bred grower pigs

Eighteen crossbred (HS x Ghungroo) grower pigs (weight ranged from 40.4±1.31 to 40.69±3.73) were divided into three groups using randomized block design and they were supplemented with 0, 40 and 60 % QPM maize grain by replacing the normal maize to the basal diet and designated as T_1, T_2 and T_3 respectively. The protein content of the experimental diet was 18.40±0.02 18.14±0.20 and 18.08±0.25 respectively in T_1, T_2 and T_3 groups while protein content of QPM maize grain was 9.39±0.20. Dry matter intake was found similar across the treatment groups. There was no significant difference on nutrient digestibility across the treatment groups. Similarly there was no significant difference on average daily gain (g/day), feed intake per kg gain (FCR) and feed cost per kg gain. However, FCR and feed cost per kg gain was found better at 40 % and 60 % replacement of normal maize with QPM maize in the diet. Feed cost per kg gain was reduced by Rs.4.30 and Rs.1.40 at 40 % and 60 % replacement of normal maize with QPM in crossbred grower pigs.

Effect of supplementation of QPM on nutrient utilization in growing crossbred pigs

Parameters	T_1	T_2	T_3	P value
Feed intake	1180.0±37.4	1180.0±20.0	1190.0±10.0	0.949
Initial weight	40.4±1.31	40.76±2.71	40.69±3.73	0.992
Final weight	54.78±1.19	55.24±2.65	54.66±3.71	0.992
growth	319.8±33.5	321.8±9.7	310.4±7.1	0.917
FCR	3.81±0.28	3.69±0.16	3.84±0.1	0.917
Feed cost/kg gain	102.3±7.5	98.0±4.2	100.9±1.9	0.832

T_1=0 % replacement of normal maize with QPM, T2=40 % replacement of normal maize with QPM, T_3=60 % replacement of normal maize with QPM,

Effect of supplementation of QPM maize silage on production performance in crossbred grower pigs

Eighteen crossbred (GhxHS) grower pigs were divided into three groups using randomized block design and they were supplemented with 0, 5 and 10 % QPM maize silage to the basal diet by replacing (wt/wt on DM) the maize grains and designated as T_1, T_2 and T_3 respectively. The protein content of the experimental diet was 18.25±0.05, 18.23±0.15 and 18.29±0.09 while protein content of QPM maize silage was 17.63±0.13. Dry matter intake was found similar across the treatment groups. There was no significant difference on nutrient digestibility across the treatment groups except crude fiber digestibility which is decreased ($P<0.05$) significantly in T_3 groups in comparision to T_1 and T_2 groups. Similarly there was no significant difference on average daily gain (g/day), feed intake per kg gain (FCR) and feed cost per kg gain. However, FCR and feed cost per kg gain was found better at 5 % supplementation of maize silage in the diet. Feed cost per kg gain was reduced by Rs.2.98 at 5 % supplementation of QPM maize silage by replacing maize grains in crossbred grower pigs.

Effect of supplementation of QPM maize silage on Nutrient utilization in crossbred grower pigs

Particular	T_1	T_2	T_3	P value
DMI, g/d	1150.0±22.4	1180.0±20.0	1140.0±18.7	0.383
Initial Weight, kg	54.78±1.19	55.24±2.65	54.66±3.71	0.987
Final Weight, kg	67.1±1.4	68.16±2.46	66.86±3.79	0.938
ADG, g/d	308.5±11.6	323.0±15.1	305.0±34.8	0.842
FCR	3.75±0.14	3.68±0.12	3.93±0.46	0.805
Feed cost per kg gain	100.72±3.81	97.74±3.29	103.45±12.02	0.867

MoEF Funded: Himalayan Agriculture under National Mission for Sustaining the Himalayan Ecosystem: Project code: OXX03444

Keshab Barman and Swaraj Rajkhowa

To maintain sustainable production of pig at farmers' field

1. Serum samples

Total 70 pig sera samples and 100 faecal samples were collected from four Districts of Assam:

Location	Type of sample and total no. collected	
	Serum	Faecal
Jorhat, Lakhimpur, Golaghat, Kamrup, Nalbari, Sibasagar	120	140

All the serum samples were screened by RT-PCR. Details of screening is given below

- CSFV Antibody: 23 were positive for CSFV antibody
- PCV2 Antibody: 10 serum samples were found positive for PCV 2
- JEV Antibody: 16 samples were found positive for PPV

1. Total 140 fecal samples were analyzed for bacteriological examination and PCR

- Only 31 fecal samples found positive for *E coli* and *Clostridium perfringens*.

2. About 30 numbers of feed samples were collected from different individual pig farm and analyzed the same for their nutritive value and suggested the farmers for balancing the protein and energy value in the diet of pig.

The project has been completed in the 15th March 2020 and report has been submitted.

ANIMAL REPRODUCTION

Flagship programme: Artificial Insemination in Pigs. Project code IXX14962

Sunil Kumar and Rafiqul Islam

A total of 18 trainings sponsored by different agencies *viz.* Missing Autonomous council, Meghalaya institute of Entrepreneurship, National Livestock Mission, Dept. of Animal Husbandry & Veterinary, Govt. of Assam & Govt. of Arunachal Pradesh, KVK Baksa, Meghalaya Basin Development Agency and NRC on Pig-Tribal Sub plan were conducted where practical demonstration for artificial insemination in pigs were done. Three specific trainings on A.I. in Pig were sponsored by KVK Baksa, National Livestock Mission, Dept. of Animal Husbandry, Govt. of Assam and Govt. of Arunachal Pradesh. Further, under APART project, A.I. Satellite centers are being established at Diphu (Karbi Anglong), Sibsagar, Johrat and Khanapara in collaboration with State Veterinary Dept., Govt. of Assam. A total of 23 awareness programmes for farmers were conducted in collaboration with SANJEEVNI (A socioeconomic welfare organization), Dept. of Animal Husbandry, Govt. of Assam, Rural Self Employment Training Institutes (RSETI), Nalbari and Tribal Sub plan. During the reported period 98 new farmers were trained as inseminators for self employment generation. The institute developed technology of 'A.I. in Pig' was transferred to Symbiotic Foods Pvt. Ltd., Tezpur (Assam). Establishment of Modern Boar Semen Production centre at ICAR- NRC on Pig, Rani is under construction funded by North East Council, DoNER, Shillong. During the reported period, 109 new farmers have bred their sows by artificial insemination with liquid semen supplied by ICAR- NRC on Pig, Rani. Some of the success of such farmers is described below.



AI in Pigs (Awareness programme, Training and Capacity building)

Success Stories of Artificial Insemination

1. Mr. Sunil Ramchari, Sajjanpara Village

The technology was adopted by Mr. Sunil Ramchari, a farmer of Sajjanpara Village under Rani Block of Kamrup (Rural) District of Assam. The farmer approached ICAR –NRC on Pig, Rani and got the awareness and demonstration on Artificial Insemination in Pigs. He inseminated his gilt with a semen dose obtained from ICAR-NRC on Pig, Rani. The gilt became pregnant and on farrowing, gilt delivered nine (9) healthy piglets. The male and female ratio was 2:7. The average body weight of the piglet was 919.33± 34.78 g. All the piglets were healthy and no stillbirth and neonatal mortality was observed.

Gilt with litter produced by A.I. (Rt); Mr. Sunil performing A.I. (centre);Mrs.& Mr. Sunil Ramchari Boro showing litter (Lt)

2. Mr. Anil Rabha, Mahirapur Village

A.I. Technique was demonstrated to another tribal farmer, Mr. Anil Rabha. He got the semen dose from ICAR-NRC on Pig under Tribal Sub Plan Programme and inseminated his sow. The sow farrowed and total litter size was eleven with two stillbirths. All nine live piglets were healthy with average body weight 973.33±28.62g at birth. Male and female ratio was 5:4. Necessary preventive veterinary health care was provided to the piglets.

3. Mrs. Konika Rabha, Mahirapur village

A tribal lady farmer named Mrs. Konika Rabha of Mahirapur village of Kamrup district, learnt the A.I. technique and did A.I. in her gilt, the farrowing occurred and a live litter of five piglets with average body weight 960.00 ± 29.15 g obtained. Male and female ratio was 4:1. Necessary preventive veterinary health care was provided to the piglets. The semen dose was provided free of cost under Tribal Sub Plan scheme of the institute.

Mrs. & Mr.Anil Rabha (Rt); Mr. Rabha; Mrs.Konika Rabha (Lt) showing the litter due to A.I.

4. Mr. Rabin Rabha

Another farmer, Mr. Rabin Rabha of Kamrup District of Assam adopted the technology and inseminated his sow and the sow farrowed with a live litter size of 12. The male and female ratio was 9:3 and the average body weight of piglets at the time of birth was 975±16.66 g.

Institute project: Hormonal interventions for induction of cyclic ovarian activity in pre-pubertal gilts and anestrous sows

Sunil Kumar, N.H. Mohan and K.K. Baruah

Two protocols were developed for optimizing reproductive efficiency/combate anestrus in pigs. A total of 78 females were used in the study. In protocol I (n=59), combination of PMSG+ hCG (PMSG @ 400 I.U. and hCG @ 200 I.U. per animal) whereas in protocol II (n=19), prostaglandin F2α was used.

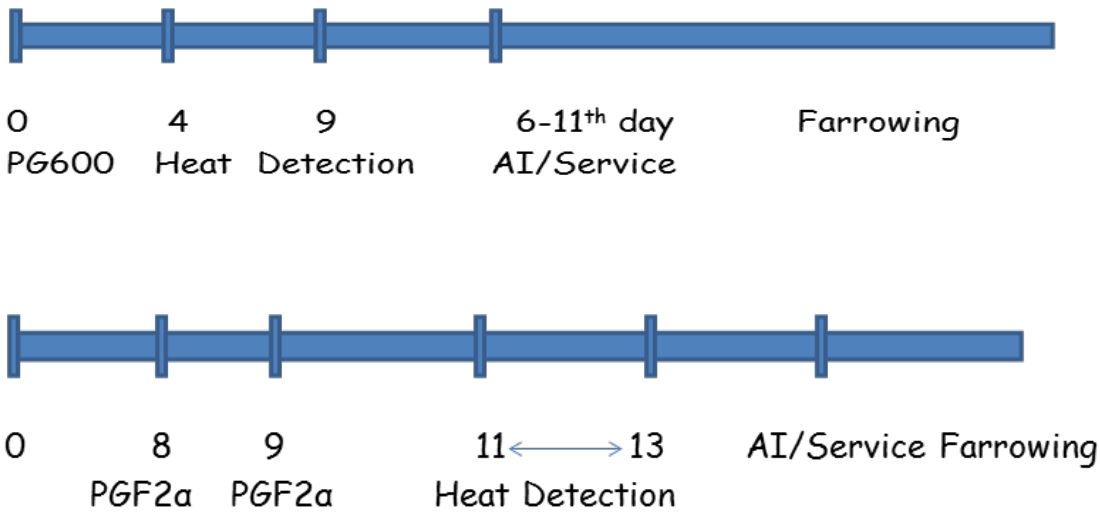


Table: Parameters studied under Protocol –I and II

Parameters	Protocol I	Protocol II
No of Animals Treated	59	19
Estrus Induced	48 (81.36%)	9 (47.36 %)
Interval of heat from day of injection (Hrs)	121.54±3.60	78.52±4.50
Farrowing rate (%)	40 (67.79 %)	7(36.84%)
Litter Size	7.90±0.47	6.44±0.72
Cost per animal (Rs.)	302	150

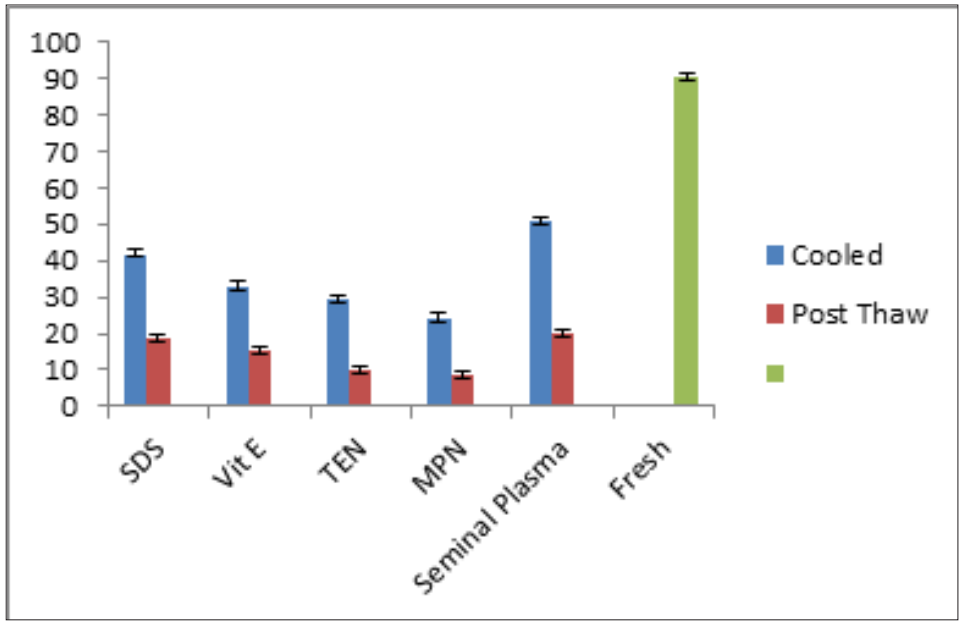
In conclusion, combination of PMSG+ hCG (PMSG @ 400 I.U. and hCG @ 200 I.U. per animal) found better than prostaglandin F2α for estrus induction. However, keeping in view of cost and easier availability in the market, use of prostaglandin F2α in female swine may be explored further.

Institute project: Development of protocol for boar semen cryopreservation in pigs

Sunil Kumar, Rafiqul Islam, Santanu Banik and K. Barman

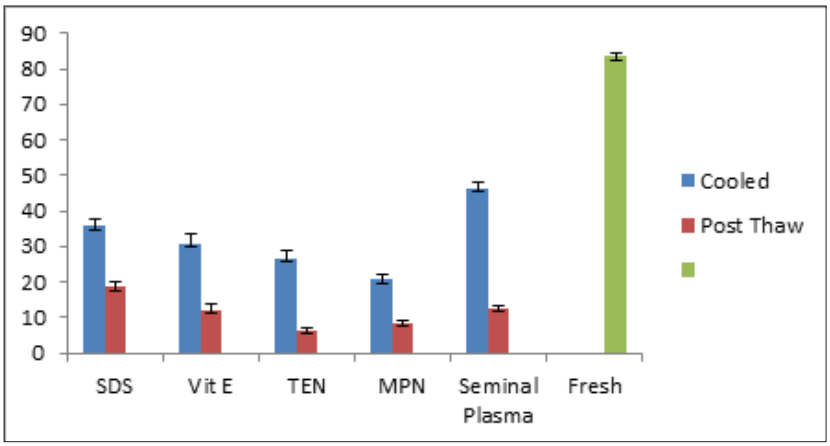
A total of 54 ejaculates (n=54) were collected by gloved hand method from healthy fertile boars . A commercial extender was used for cryopreservation. Effect of supplementation of additives such as Sodium dodecyl sulphate (SDS; 300mg/100mL), Vit-E (400mg/100mL), Triethanolamine (TEN;1.5mg/100ml) and Mifepristone (MPN;10mg/100mL) was studied. Further in another experiment seminal plasma was used for cryopreservation. Several combinations of freezing protocols were tried using different additives. Statistical analysis of the data was done using student's t-test. Superiority of additive in terms of post thaw semen characteristics was SDS> Vit- E> MFN>TEN. Acceptable post thaw quality of spermatozoa has not been achieved. Further, experiments are in progress. However, a long term extender for liquid semen preservation was standardized.

Sperm motility (%) in ejaculate was 88.19±0.60. Percentage sperm motility (cooled *vs* post thaw) in boar semen preserved with different additives such as SDS (41.83±1.42 *vs* 18.91±0.75), Vit-E (32.75±1.53 *vs* 15.50±0.85), TEN (29.16±1.59 *vs* 9.6±1.09), MPN (24.33±1.40 *vs* 08.58±0.85) and Seminal Plasma (51.05±0.89 *vs* 20.33±0.93) was reported



Sperm Motility (%) (n=54) in boar semen preserved with different additives in cooled and post thaw semen

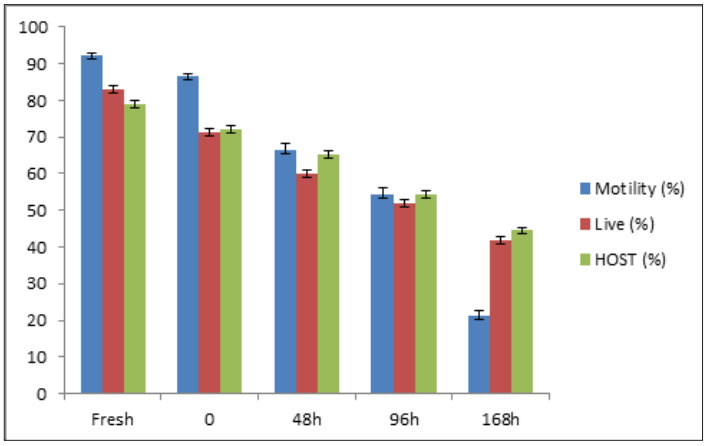
Live sperm (%) in ejaculate was 83.51±0.73 . Percentage sperm live (cooled *vs* post thaw) in boar semen preserved with different additives such as SDS (35.83±1.17 *vs* 18.51±1.33), Vit-E (30.83±2.70 *vs* 12.12±1.52), TEN (26.66±2.33 *vs* 6.29±0.96), MPN (20.74±1.50 *vs* 8.4±0.85) and Seminal Plasma (46.29±1.63 *vs* 12.68±0.67) was reported.



Live Sperm (%) (n=54) in boar semen preserved with different additives in cooled and post thaw semen

Table: Sperm quality in modified Long term Extender stored at 17 °C

Parameter	Ejaculate	0 hr (just after extension)	48 hr	96 hr	168 hr
Motility	92.36±0.42	86.52±0.65	66.52±1.64	54.44±1.84	21.38±1.20
Live %	83.05±0.82	71.38±1.53	60.13±1.53	52.08±1.568	41.66±1.80
HOST %	78.88±0.87	72.08±1.09	65.13±1.04	54.16±1.00	44.44±0.97



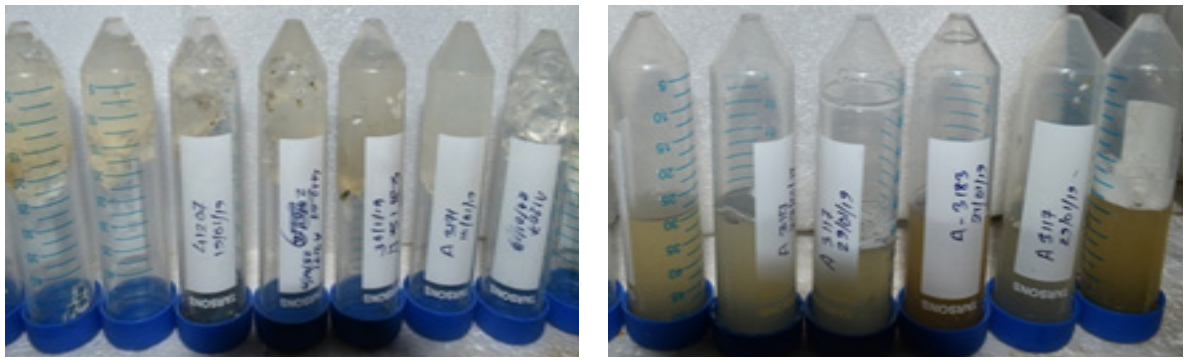
Sperm quality in modified Long term Extender stored at 17 oC

DBT-NECBH Funded: Biochemical Characterization of boar seminal gel and its application for biostimulation in Pigs (Project code: OXX04658)

Suni Kumar, Rafiqul Islam, Manish Kumar, Santanu Banik, P.J. Das, S.R. Pegu and Swaraj Rajkhowa

The project was sanctioned on 24.4.2019. Artificial insemination is the first generation biotechnology which has reached at farmer's door step. In this technique, training of males for semen collection is one of the toughest tasks. Training of the young males, requires patience, good understanding of the psychological behavior of the male, handler's experience and comfort environment. Further, only a very few reports are available on biochemical composition of boar seminal gel and its application with respect to biostimulation. Gel mass gets putrefied at room temperature over a period of more than 6 hours and subsequent to which it gives bad smell.

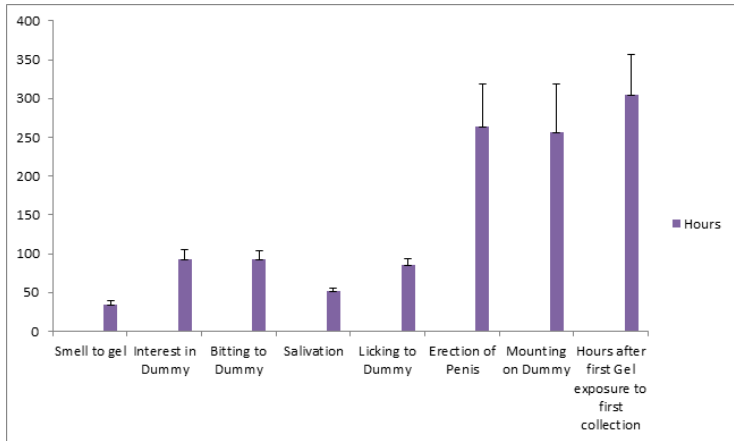
For the same, preservation of gel mass has been standardized. During the reported period, one preservative has been identified to keep the pheromonal properties intact so that it can be used for biostimulation purposes. A total of 149 samples of gel mass were collected. 81 samples were standardized for preservation as treatment group while remaining 68 were preserved in the sterile normal saline as control group. In both the groups, the gel mass kept in tubes at ambient temperature. The gel mass in tubes was observed for 30 days for putrefaction and adherence to walls. It was found that in treatment group, there was no putrefaction and the gel was intact, and adhered to the walls of storage tube while in control group, gel showed putrefaction and was not adhered to walls of the tube. The observations of 30 days indicate that a suitable preservative has been identified for prevention of putrefaction of the gel. The preserved gel was used for biostimulation in males and females. Further, investigation on biochemical properties for identification of active molecules is under progress.



Preserved gel mass (left) and gel mass failed to preserve (right)

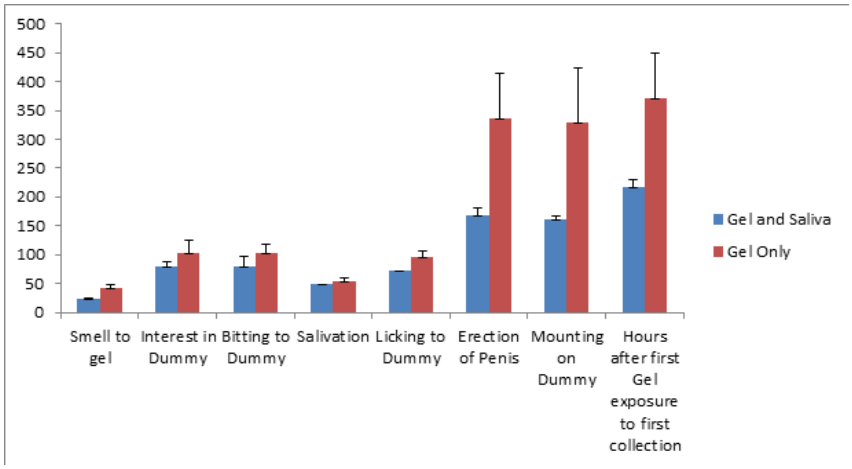
Estimation of biostimulatory effect of seminal gel for training of boars

The preserved gel mass was used for training of young males. For training of males, a total of 11 males were daily exposed to gel mass by rubbing on the dummy sow. Subsequent to which sexual behavioral parameters like hours taken to smell to gel, interest in dummy, biting to dummy, salivation, licking to dummy, erection of penis, mounting on dummy and hours after first gel exposure to first semen collection was estimated. A total of 11 males were used as experimental animals for exposure to seminal gel. Out of 11 males, 7 (63.63%) males were able to get trained. It was observed that boars get trained after 305.14±52.03 hours of daily exposure to seminal gel.



Young males. The semen was collected successfully in 7 males out of 11 (63.63%)

Further, three (3/11) animals were exposed to combination of seminal gel and boar saliva for the comparison of exposure of gel only and combined mixture of gel and saliva. It was found that time (hrs) taken by boars to get trained on exposure to combination of seminal gel and saliva (216±13.85) was lesser than on exposure to gel alone (372±76.83). In conclusion, seminal gel can be used as a measure to train the boars efficiently.



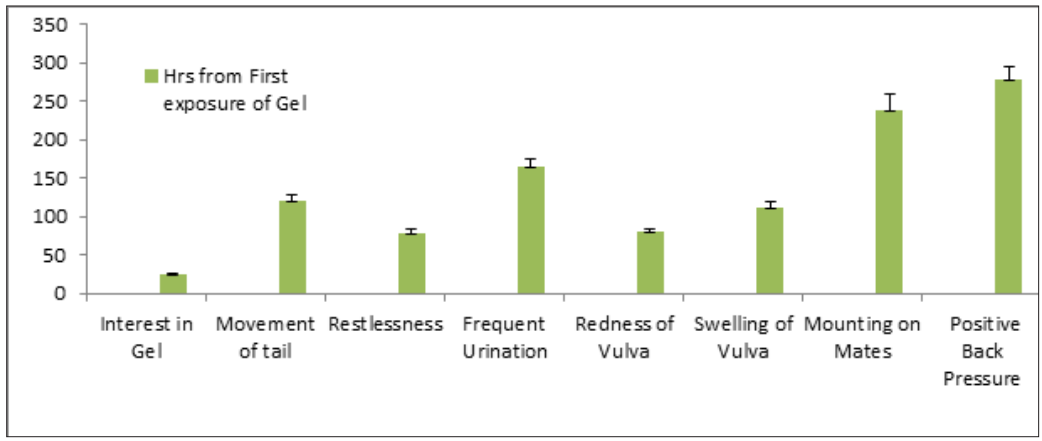
Comparison of effects on sexual behavior for boar training using seminal gel alone and combination of Gel and saliva. The graph indicates that sexual behavior parameters were observed faster on exposure to combination of Gel and saliva than Gel alone.

Table1. Comparison of effects on sexual behavior for boar training using seminal gel alone (4) and combination (3) of Gel & saliva and for all seven trained males using gel exposure

Treatment (No. of Animals)	Hours (Hrs) from treatment/exposure to observation of sexual behavior							
	Smell to gel	Interest in Dummy	Biting to Dummy	Salivation	Licking to Dummy	Erection of Penis	Mounting on Dummy	Hours after first Gel exposure to first collection
Gel + Saliva (3)	24	80±08	80±16	48	72	168±13.16	160±08	216±13.85
Gel (4)	42±06	102±22.71	102±15.09	54±06	96±9.79	336±78.99	330±93.65	372±76.83
Overall	34.28±4.84	92.57±13.27	92.57±11.02	51.42±3.42	85.71±703	264±54.42	257.14±60.78	305.14±52.03

Estimation of biostimulatory effect of seminal gel for estrus induction in gilts and sows

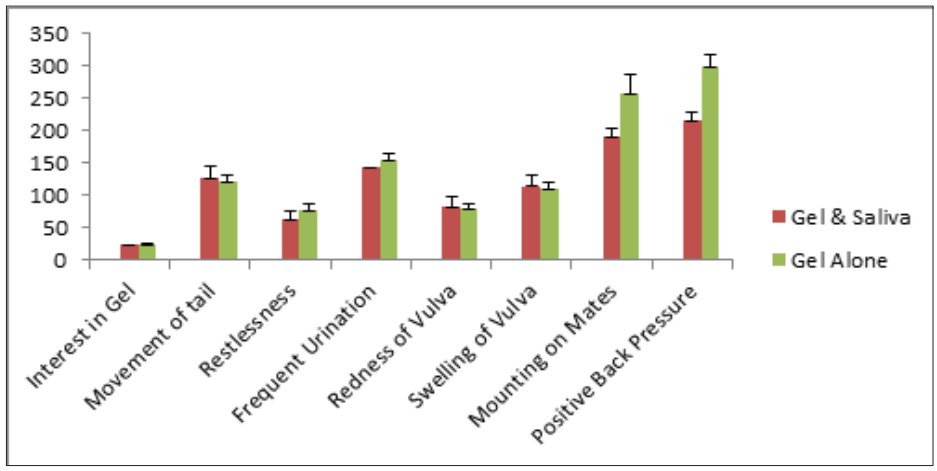
The preserved gel mass was used for estrus induction in females. A total of 58 females were exposed to gel mass by keeping in the pen of female near to snout as much as possible. Subsequent to which parameters like restlessness, urination, time taken to first mount on dummy, time taken to first ejaculate and time taken to proper mounting was calculated. Out of 11males, 7 males were able to get trained on exposure to gel mass. Further, for estrus induction and synchronization, gilts and sows were exposed to gel mass. The parameters such as restlessness, urination, homosexual mounting, vulvar swelling, and redness of vulva were noted. The heat was confirmed by back pressure test in combination with other visual signs. It was observed that 36 females (Gilts-18/30; Sows- 18/28) showed induction of heat after exposure to gel. The positive back pressure test in all estrus induced females was observed after 277.61±16.27 hrs. from first time exposure of gel. All heat induced animals did not showed the all the parameters undertaken to identify the females in heat.



Hours taken for expression of different signs of estrus by 36 females on daily exposure to boar seminal gel. It indicates that estrus was observed after 277.61±16.27 hrs. from first time of exposure of gel.

Table. Different Signs observed and hours taken for expression of different signs by estrus females on daily exposure to boar seminal gel and combination of Gel and saliva.

Estrus Signs observed after daily exposure of Gel/Saliva combination	Percentage different of Signs (36)	Hrs from First exposure of Gel/Saliva combination		
		Gel (36)	Gel Alone (26)	Gel +Saliva (9)
Interest in Gel	100	24.82±0.58	24.88±0.88	24
Movement of tail	100	120.85±6.74	121.84±10.11	128±18.76
Restlessness	100	77.14±5.49	78.22±8.36	64±13.26
Frequent Urination	16.66	164±11.45	156±9.79	144
Redness of Vulva	100	79.30±4.73	80.88±6.79	82.66±16.05
Swelling of Vulva	55.17	111.75±8.59	110.60±9.97	114.66±17.78
Mounting on Mates	88.88	237.68±21.33	258.76±29.16	192±12.39
Positive Back Pressure	100	277.61±16.27	298.14±19.85	216±12.64



Comparison of effects on observations of different signs of estrus using seminal gel alone and combination of Gel and saliva. The graph indicates that estrous was observed earlier on exposure to combination of Gel and saliva than Gel alone.

Further, to intensify the effect of gel, addition of boar saliva was also tried to induce the heat in the females. A total of 9 females showed heat in response to exposure to combination of gel and saliva. It was found that time taken to get in heat was lesser in females exposed to combination of gel and saliva than gel alone. In conclusion, it is shown that gel can be used effectively to induce the heat in females which can be intensified further in combination with boar saliva.

In conclusions, seminal gel can be used to induce estrus and synchronization in females and training of males for artificial insemination purpose in swine. Combination of seminal gel and saliva has more intense biostimulation effect than gel alone for training of males as well as induction of estrus in gilts and sows.

ANIMAL PHYSIOLOGY

ICAR-National Fellow Project: Development of thermo-tolerant pig through biomarker assisted selection (Project ID: 1009783)

Mohan.N.H

During the period of report (Jan to Dec 2019) experiments were conducted to identify the pathways related to thermal stress through both *in vivo* and *in vitro* experiments. For *in vitro* experiments a fibroblast based primary cell lines were used as a model for studying heat stress. For identification and mapping of heat shock response pathways the role of the heat shock factor-1 (HSF-1), one of key mediator of heat shock response in pigs was examined. It was found to bind to promoters/Transcription start sites (TSS) of 69 genes, out of which 12 are closely associated with thermal stress response. In addition, HSF-1 was also bound to exons of 53 genes and associated with at least 1643 genes. Out of the genes associated, 1237 are protein coding and eight pseudogenes. HSF-1 is also found to be associated with several types of RNAs (SNRNA-69, SNORA-54, SCARNA-2, miRNA-41,lincRNA-59), indicating a wide role for this protein in regulation of cell physiology, beyond the heat shock response. Based on the analysis a 21 DNA binding nucleotide consensus sequence TDKHHKYYYYHWYWTBYWTTT was identified, which could be associated with heat responsive element in the genome. For identification of genes associated with thermotolerance: Comparative transcriptome of native animals (pigs and goats) reared in two different agroclimatic zones was examined to identify heat tolerant transcriptomic signatures. Based on preliminary analysis of whole transcriptome, 223 and 267 gene expressions were unique to pig and goats reared in Rajasthan (hot semiarid climate zone), where are pigs and goats reared in Assam (humid subtropical climate) had 133 and 158 gene expression patterns, respectively unique to them. However, there were 88 gene expressions, which were common and unique to animals reared in hot semiarid climate of Rajasthan. The functional annotation of the whole transcriptome has been completed.

Experiments were undertaken in the primary fibroblast cultures isolated from porcine dermal tissue maintained in a humidified atmosphere with 5% CO_2 at 37°C in Dulbecco's Modified Eagle's Medium with 10% Foetal Bovine Serum (FBS) and antibiotic-antimycotics. Porcine fibroblast cells were subjected to acute heat shock by incubating at 41°C in a humidified atmosphere with 5% CO_2 for one hour. The control cell line (maintained at 37°C) and treated (41°C for 1 hr) were user for experiments. Experiments were conducted to heat shock signaling pathways, identify targets of heat shock factor-1 (HSF-1), one of key activator transcription factor of genes related to heat shock response. However, there are comprehensive details of genes activated by HSF-1, especially in in pigs it is unknown. Therefore, the experiment was designed to isolate and sequence those DNA sequences bound to HSF-1 through Chromatin

immunoprecipitation (ChIP) followed by sequencing of isolated DNA using NGS platform. The DNA is expected to provide the promoter sequences of all genes bound by HSF-1, hence will provide insights into initiation of heat shock signaling. The chromatin DNA specifically bound to HSF-1 antibody containing magnetic beads, which are targets of HSF-1 was isolated and purified using a column. The purified DNA was precipitated using ethanol and processed for cDNA library preparation. The cDNA was sequenced using next generation sequencing platform were aligned to the pig genome and subjected to bioinformatics analysis including generation of DNA motifs. The distribution of DNA sequences bound by HSF-1 is shown in figures 1 and 2. It can be seen that there is significant difference in the number of transcripts, especially protein coding RNAs during heat shock.

Further, extensive immunofluorescence experiments were conducted to understand role of HSF, its phosphorylations and various proteins related to protein synthesis during heat shock response.

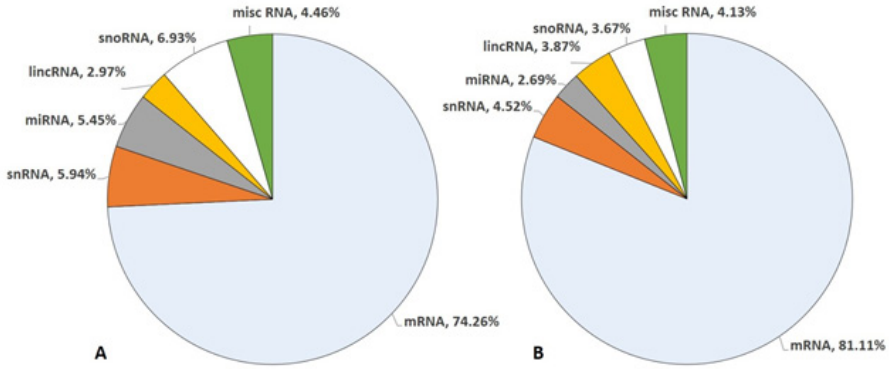


Fig. 1. Distribution of various gene promoters bound to heat shock factor-1 (HSF1) signaling based on ChIP assay in porcine fibroblasts. A-Control (37°C); B-Heat shock treated (41°C for 1hr). mRNA includes all known protein coding RNAs; Misc RNA includes RNAs coding for rRNA, scaRNA and pseudogenes.

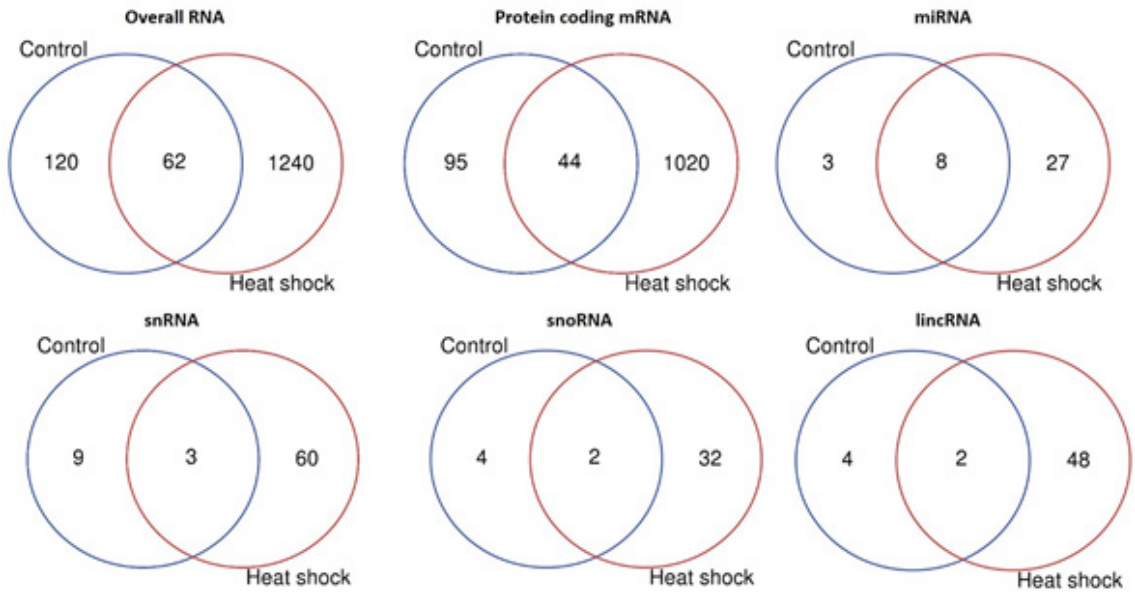


Fig.2. Distribution of types of promoters coding for RNAs bound to heat shock factor-1 (HSF1) signaling based on ChIP assay in porcine fibroblasts. A-Control (37°C); B-Heat shock treated (41°C for 1hr)

Nuclear changes due to heat shock

The nuclear changes were observed in porcine fibroblast nuclei subjected to heat shock (41degC) for 1hr. Heat shock induced increased chromatin condensation, shrinkage and pyknosis after heat shock, which could be seen in the density profile (Fig 3).

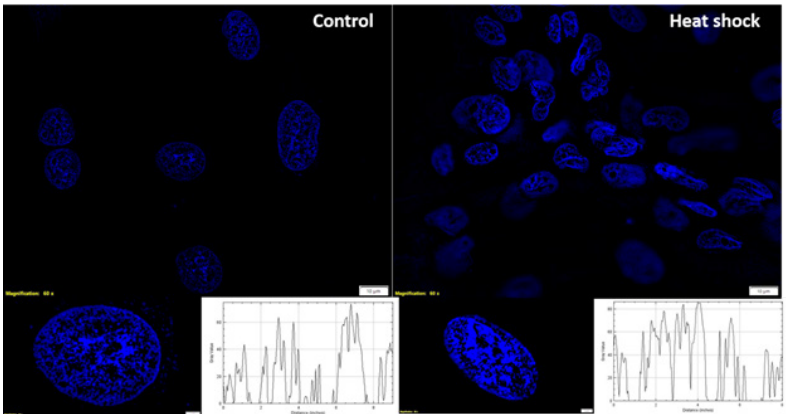


Fig.3 Nuclear changes following heat shock showing increased chromatin condensation, shrinkage and pyknosis

Immunofluorescence studies

The expression of various key proteins were examined using immunofluorescence. Expression of Heat Shock (HSF), its phosphorylation and proteins related to transcription and translation (Fig 4-8) fibroblast cells were analysed to understand their cellular localisation and heat shock responses.

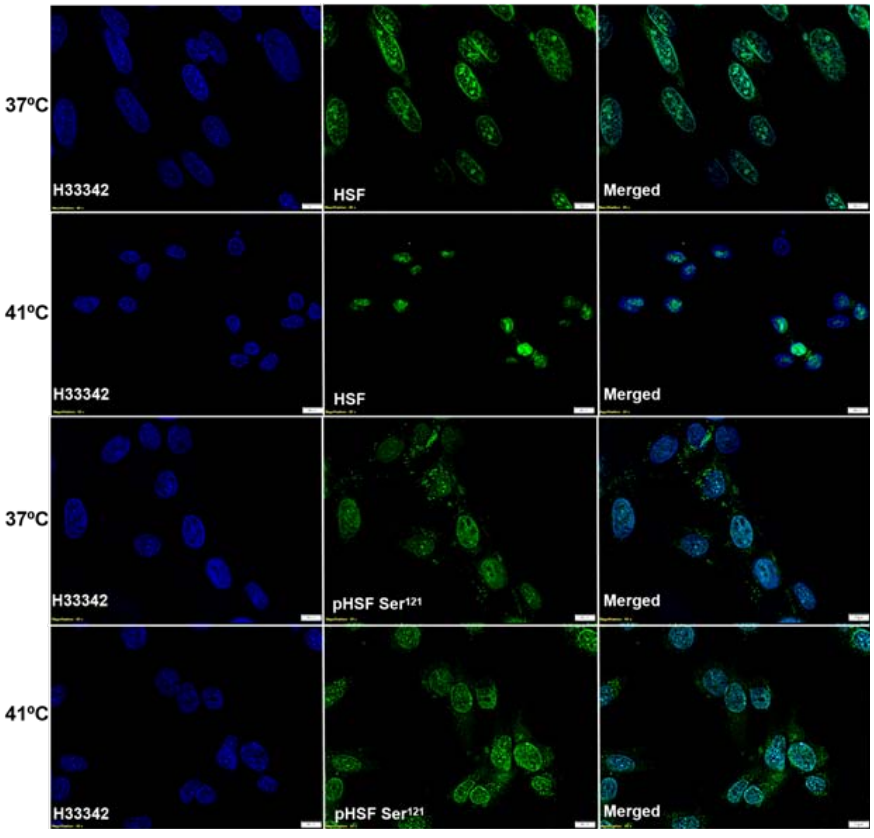


Fig. 4 Expression of Heat Shock (HSF) and amino acid phosphorylation (Ser121) during heat shock

The studies suggest that HSF is mostly located in the nucleus. As the heat shock was applied, there was nuclear condensation (Fig 3) and a reduction in the HSF immunofluorescence. There was increased phosphorylation at Ser^{121} position of HSF, but no changes in phosphorylation at Ser^{303} and Thr^{142} position of HSF during heat shock could observed.

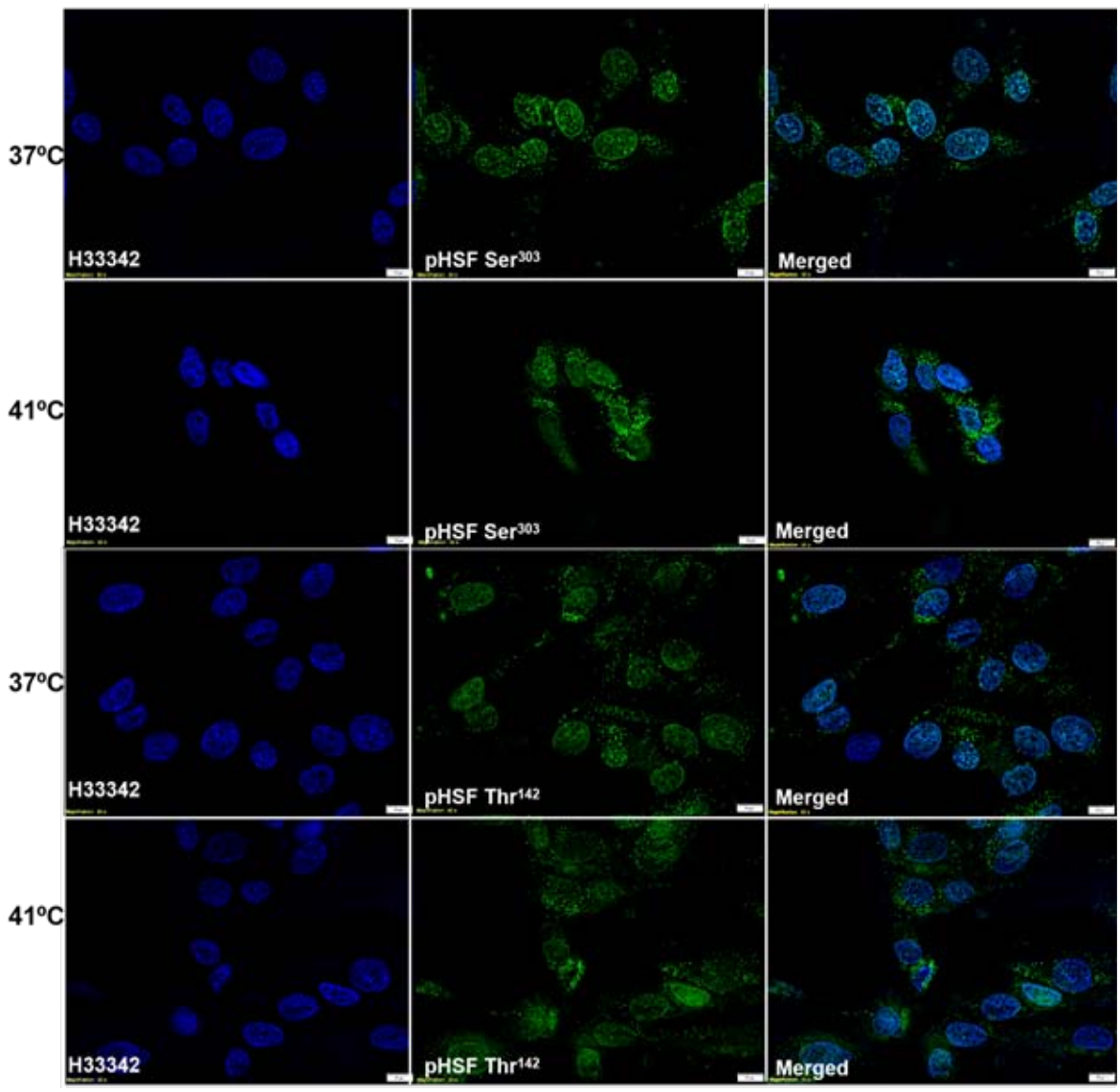


Fig. 5 Expression of phosphorylated Heat Shock (HSF Ser303 and HSF Thr142) during heat shock

The expression of RNA Pol 2A, was observed to be localised in nucleus and remained similar during heat shock response. However, CCCTC-binding factor (CTCF) is a highly conserved zinc finger protein and major regulator of transcription, levels decreased in response to heat shock and appears to have moved partly from nucleoplasm to cytoplasm. The distribution of chaperone, HSP90, location was in endoplasmic reticulum and mitochondria, concentrated around nucleus. During heat shock, the HSP 90 protein was transported to nucleus and cytoplasmic density apparently reduced (Fig 5).

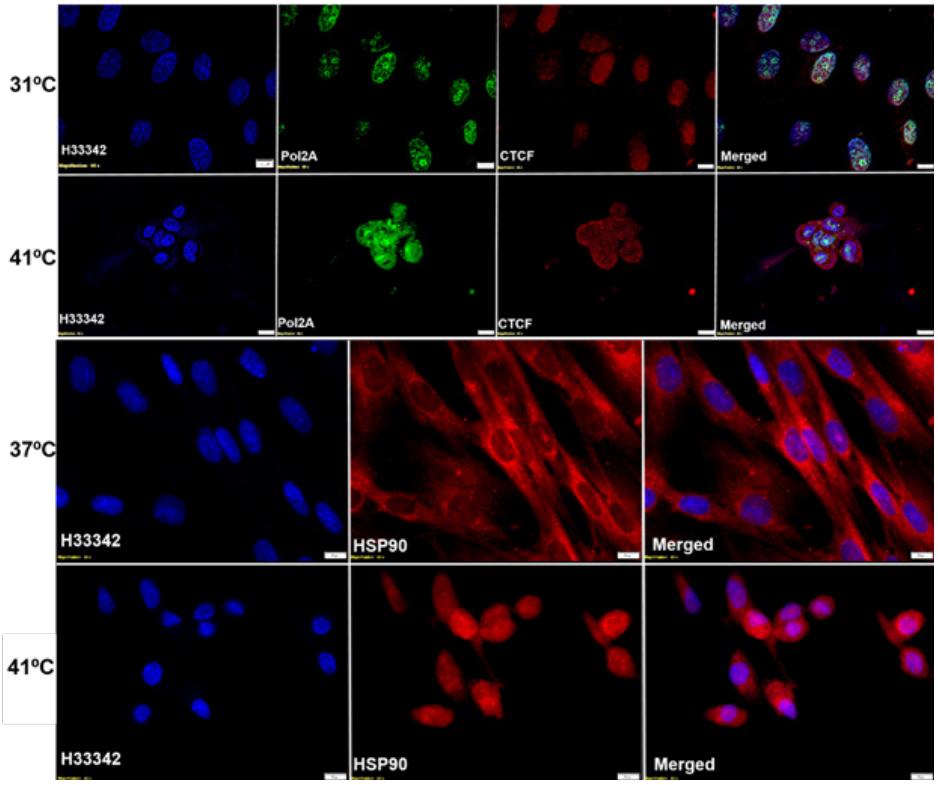


Fig. 6 Expression of RNA Pol 2A, CTCF and HSP90during heat shock

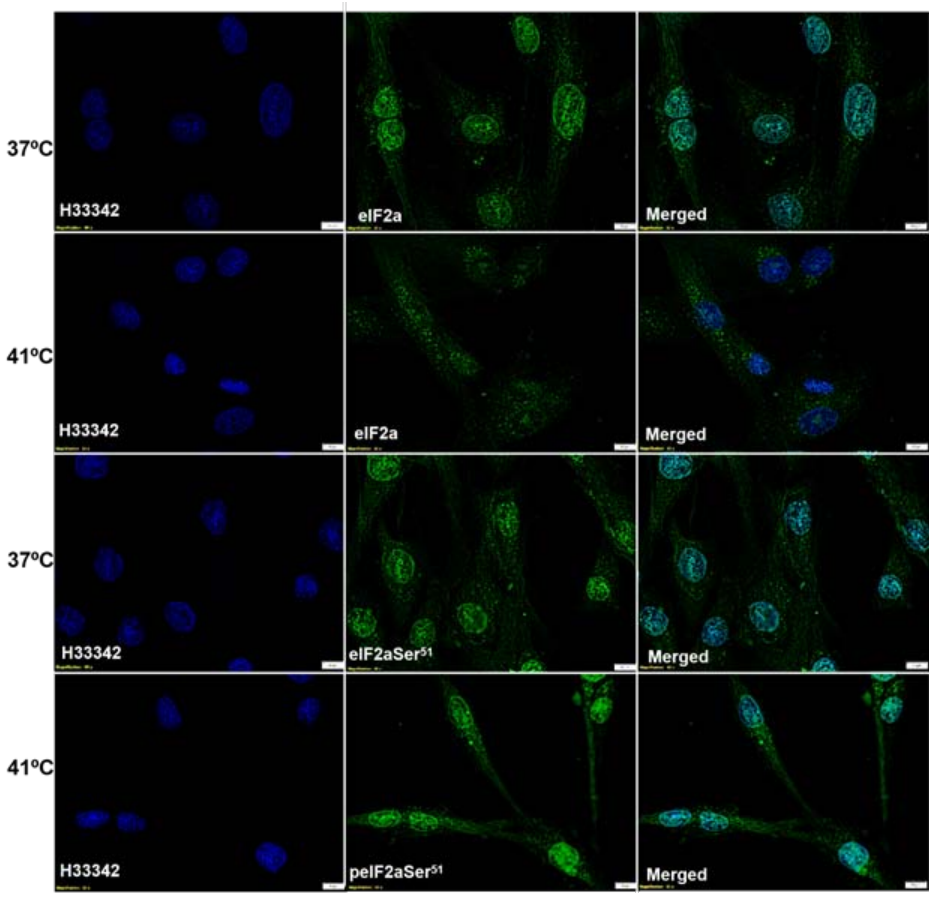


Fig. 7 Expression of Eukaryotic translation initiation factor 2A (eIF2A) and its Ser51 phosphorylation during heat shock

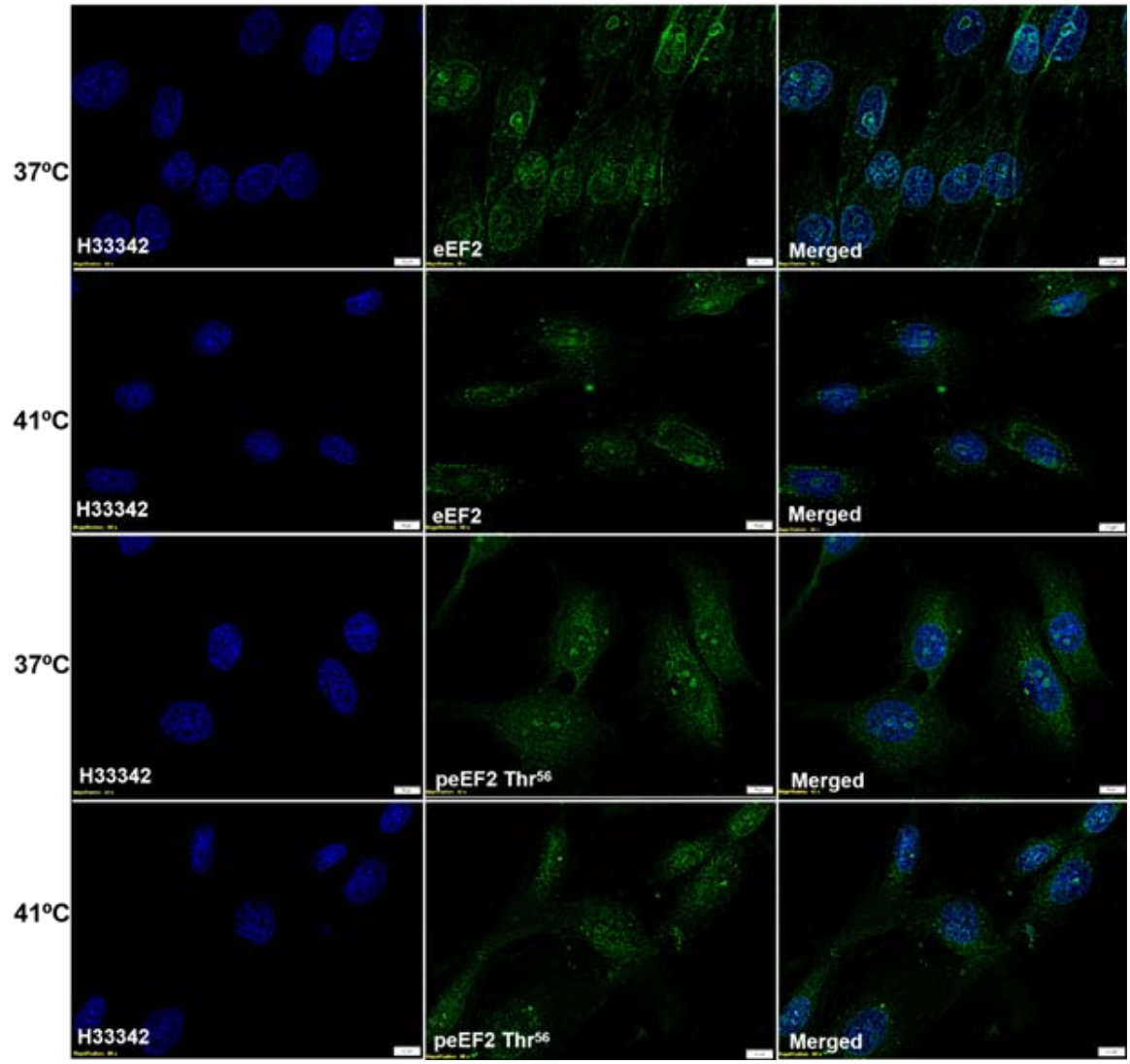


Fig. 8 Expression of Eukaryotic elongation factor 2 (eEF2) and its Thr56 phosphorylation during heat shock

The protein expression of Eukaryotic translation initiation factor 2A (eIF2A) and Eukaryotic elongation factor 2 (eEF2) and their phosphorylated forms were examined in response to heat shock.

Based on the genomic data and previous studies, a draft genomic/microarray has been designed for screening animals incorporating production as well as adaptation traits. For identification and development of heat tolerant animals, pigs from different breeds (Hampshire, Large White Yorkshire and Ghungroo) reared at ICAR-NRC on Pigs were identified and screening for presence/expression levels of thermotolerance related genes. The animals were selected based on performance of parents and individual animal for maker screening. Blood samples were collected were processed for RNA isolation, CDNA synthesis and Real-time PCR. The pigs of selected breeds (Ghungroo and Large white Yorkshire) were subjected to variable temperature and humidity in a controlled climate chamber. Serum isolated from blood samples collected for biochemical estimations were stored and will be processed together. Based on the screening of animals for expression profile of genes and in vitro transcriptomic changes during heat shock response signaling, the animals with higher heat tolerance will be used for breeding.

MicroRNA mediated regulation of physiological responses during heat stress in pigs (ICAR-LBS award project, Project ID: 1009540)

Mohan.N.H

The fibroblast cells were subjected to acute heat shock (41 deg C), (control at 37 deg C) and processed for isolation of RNA and subsequently processed for synthesis of cDNA library and analysis.High quality RNA purified from cells were analysed with whole transcriptome and micro RNA specific sequencing study to identify all the microRNAs/ transcripts present in the fibroblast cell line. A total of 24997 transcripts were mapped to *Susscrofa*genome out of which 651 genes were differentially expressed (P<0.05). There were 255 and 396 differentially expressed genes (DEG) that were up- and down-regulated respectively (P<0.05).

Gene ontology (GO) analysis

The functional annotation of the DEGs were conducted using online programmes (Pantherdb and g:Profiler) to generate information of the enriched pathways and functions associated with these genes (Fig 9).

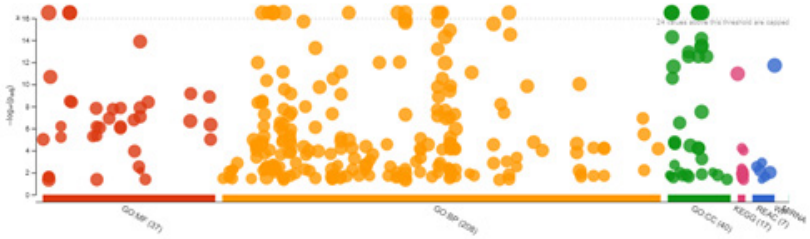


Fig 9.Gene ontology analysis of significant pathways and functions in DEGs

The overall correlation between experimental and control samples was 0.98%, indicating that 2% of the differently expressed genes play a significant role in determining acute heat shock response in cells. There were 651 and 565 control and treatment specific transcripts respectively.

MicroRNA (miRNA) analysis

During the study 285 miRNAs were identified in the porcine fibroblast cells. The differentially expressed miRNAs in relation with mRNA status is shown in table 1 and fig 10.

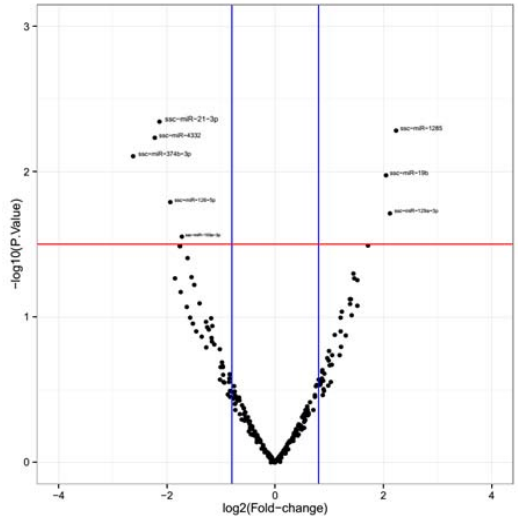


Fig 10: Volcano plot showing miRNA profile in porcine fibroblasts treated with heat shock (41degC for 1hr) with fold changes against the p values.

Table 1. Differentially expressed miRNA in heat shock treated cells against control

miRNA	log_2FoldChange	pval	mi_RNA_Status
ssc-miR-126-5p	-1.935	0.0162	Down_regulated
ssc-miR-136-5p	-1.744	0.0675	Down_regulated
ssc-miR-136-3p	-1.543	0.0534	Down_regulated
ssc-miR-193a-3p	-1.724	0.0282	Down_regulated
ssc-miR-1	-1.570	0.1008	Down_regulated
ssc-miR-218-5p	-1.760	0.0327	Down_regulated
ssc-miR-218b	-1.760	0.0326	Down_regulated
ssc-miR-218	-1.760	0.0327	Down_regulated
ssc-miR-21-3p	-2.135	0.0045	Down_regulated
ssc-miR-32	-1.518	0.1111	Down_regulated
ssc-miR-340	-1.615	0.0393	Down_regulated
ssc-miR-3613	-3.937	0.0003	Down_regulated
ssc-miR-369	-1.850	0.0543	Down_regulated
ssc-miR-374b-3p	-2.623	0.0079	Down_regulated
ssc-miR-4332	-2.224	0.0059	Down_regulated
ssc-miR-545-3p	-1.633	0.0852	Down_regulated
ssc-miR-1285	2.237	0.0052	Upregulated
ssc-miR-129a-3p	2.122	0.0194	Upregulated
ssc-miR-145-5p	2.563	0.0008	Upregulated
ssc-miR-19b	2.050	0.0106	Upregulated
ssc-miR-221-5p	1.716	0.0323	Upregulated
ssc-miR-491	1.520	0.0837	Upregulated
ssc-miR-500-5p	1.522	0.0559	Upregulated

In order to identify targets of micro RNA, Argonaute 2 (AGO2), a protein, which specifically assists miRNAs in the degradation of mRNAs was identified. Even though various members of Argonaute protein family plays a central role in RNA silencing processes, the endonuclease activity and thus RNAi-dependent gene silencing exclusively is restricted to AGO2. Therefore, the experiment was designed to isolate and sequence those RNAs bound to AGO2 through RNA immunoprecipitation (RIP) followed by RNA sequencing using NGS platform. RIP protocol was standardized for the porcine fibroblast cells. The control cells (at 37 deg C) and heat shock treated cells (at 41 deg C for 1 hr) were trypsined and washed twice with ice-cold PBS. The cells were pelleted by centrifugation at 200 x g, 5 minutes at 4 °C and suspended in 200µl of lysis buffer containing with protease inhibitor cocktail, ribonuclease inhibitor and mercaptoethanol. The cells per 75cm^2 flasks were about 1 million and two flasks were used for a single RIP reaction. The experiments were conducted in replicates (n=4). Twenty microliter of protein a magnetic bead were washed and suspended with 1µl of antimouse antibody and incubated for 30m at 4 deg C. Subsequently, washed magnetic beads were suspended in buffer containing 10µl of purified antiAGO2 antibody. The cell lysate was further incubated for 30 minutes and beads were recovered using a magnetic separator. The beads containing AGO2 antibody and RNA complexes were washed and proceeded for isolation of RNA. The purified RNA was precipitated using ethanol and was sequenced using NGS platform. The distribution of genes and consensus sequences were identified (Fig 11 and 12).

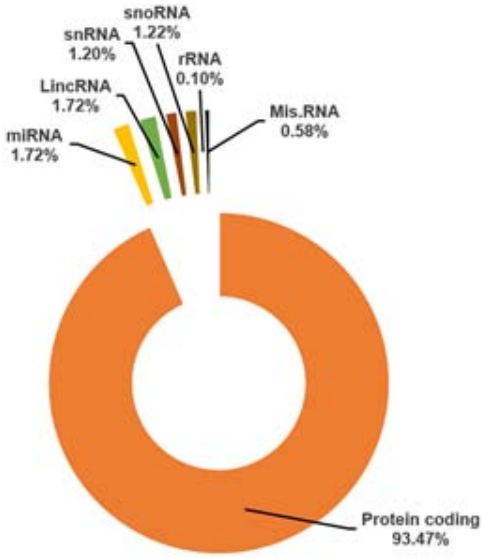


Fig 11 : Distribution of genes mediated by miRNA based on RIP assay

Fig 12 : Consensus sequence mediated by miRNA based on RIP assay

In the graphical representation of the consensus sequence the height of each nucleotide indicates the level of conservation.

The interaction between the miRNA and various genes related to heat shock response and chromatin modelling were represented as interactome networks (Fig 13 and 14).

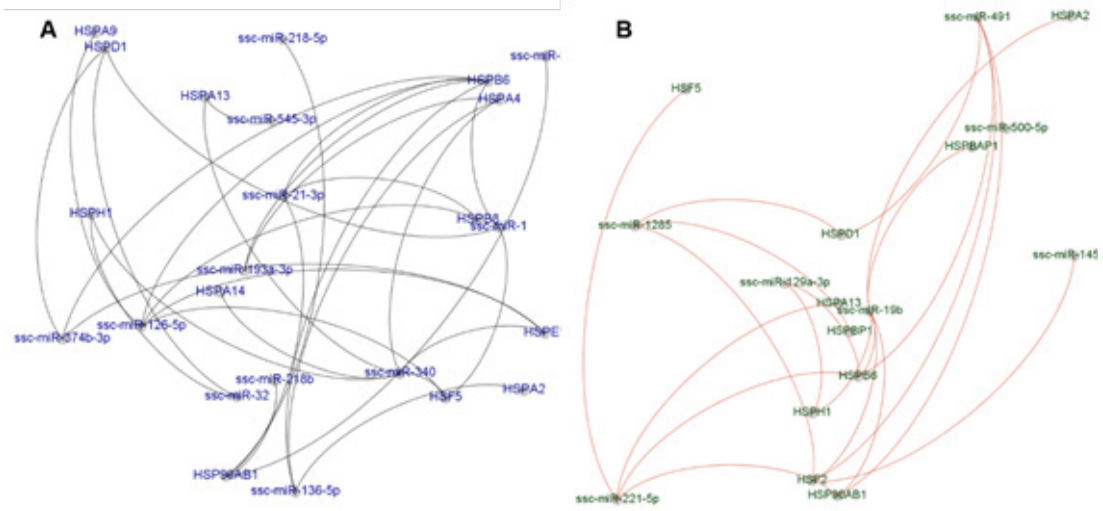


Fig 13. Interactome between various miRNA and heat shock signaling related genes. A. Downregulated miRNA; B. Upregulated miRNA

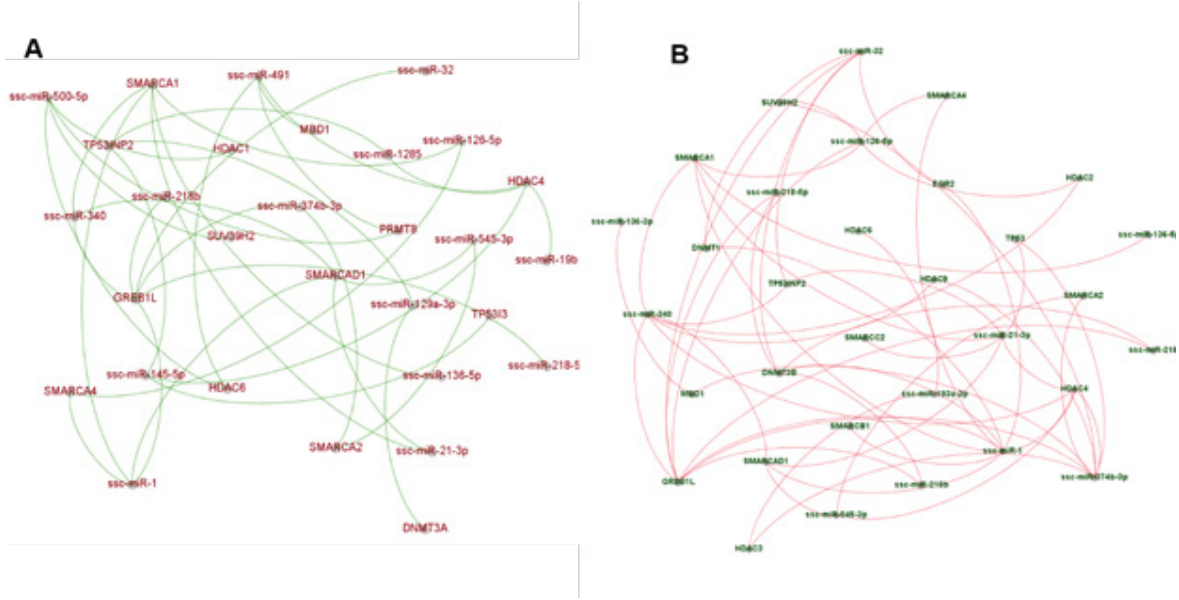


Fig 14. Interactome between various miRNA and chromatin dynamics related genes during heat shock responses. A. Downregulated miRNA; B. Upregulated miRNA

Institute project: Development of early fertility markers in pigs (Project ID: 1009828)

Mohan.N.H, Sunil Kumar and R.Thomas

Evaluation of semen quality through microscopic analysis of morphology, acrosome, cell membrane and functional tests such as spermatozoal motility, methylene blue reduction, mitochondrial potential has been used effectively assess the male fertility and fertilisation related events. However, increasing number of idiopathic infertility and inability of explain differential fertility of boars with similar motility and morphological parameters points to the inadequacy of conventional methods for more precise assessment of fertility. In the present study, we examined the spermatozoal transcriptome of boars differing in fertility using RNA-seq and compared with the fertility status of boars used in the AI programme of the institute. The expression statistics of genes during spermatozoal RNA sequencing was reported earlier. Based on the transcriptome, genes were selected representing roles in the spermatogenesis, spermatozoa, fertilisation and zygote development. The expression profile of these genes in the spermatozoa of 18 boars with known fertility status to validate the transcriptome study. During the period of report, semen from 18 existing boars in the ICAR-NRC on Pig were screened for more than 30 marker genes and their expression was correlated with fertility status (Fig 15 and 16). Due to incidence of PRRS in pig farm the sampling was affected from July 2018 to Jan 2019. A composite index for assessment of fertility in boars was developed and the boars were evaluated. This index could be valuable for selection of animals for breeding.

Composite fertility Index=0.5FSCR+0.5OCR+0.5NRR+1.5FR+2LSB-1.5NSC-RB

The multiple gene expression and fertility characteristics of the animals were correlated to understand the relation between each other.

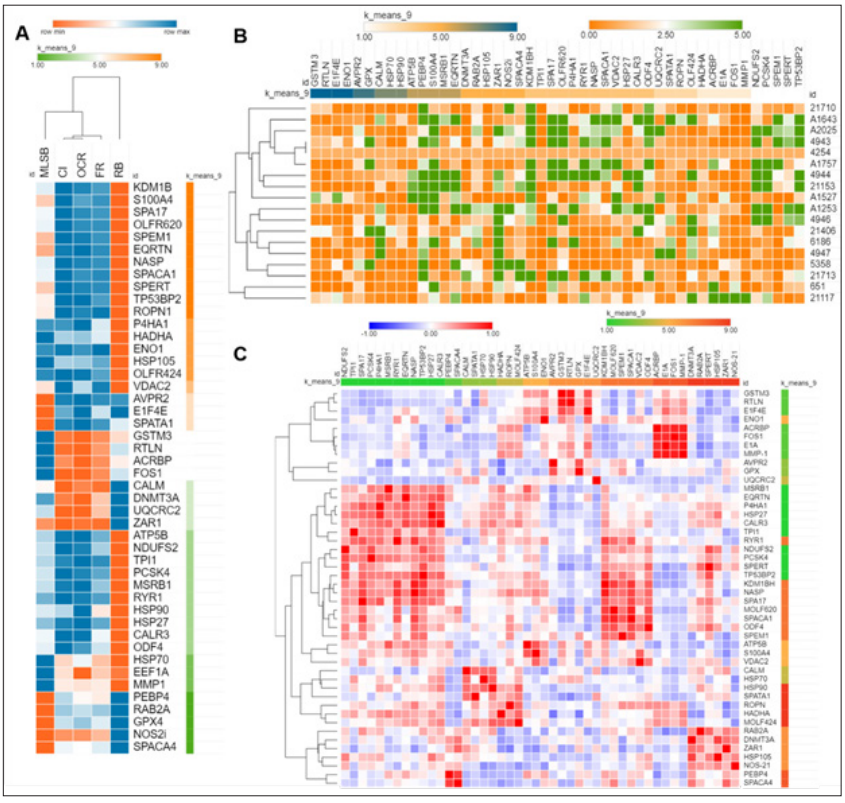


Fig 15 Relationship between various fertility markers and fertility in boars

A Relationship between gene expression profile and various fertility characteristics; Relationship between gene expression profile and fertility characteristics of various boars evaluated; C Relationship between co-expression profiles of various genes after hierarchical and K clustering

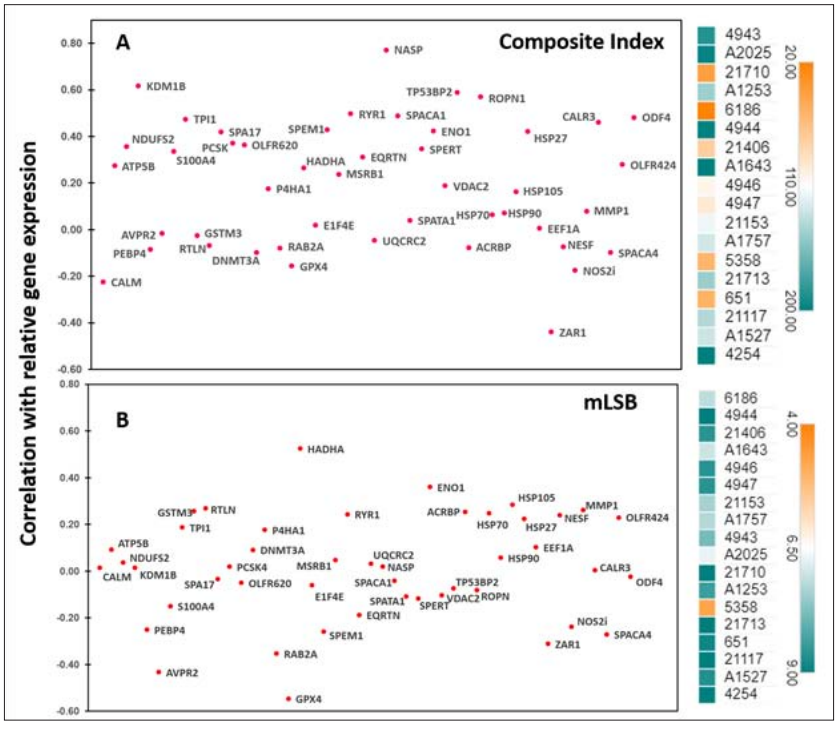


Fig 16 Relationship between various fertility markers and fertility in boars

A Relationship between gene expression profile and composite fertility index; B. Relationship between gene expression profile and mean litter size at birth

Further data analysis and screening of boars are in progress and the composite index will be modified, if required.

Institute Project: Characterization of immunogenic and angiogenic growth factors regulating ovarian function in pigs. Project code: IXX15063

Jaya, Mohan N.H., P.J. Das, Seema R. Pegu, Sunil Kumar and Satish Kumar

Cataloguing of porcine ovary into different physiological stages based on visual appraisal and their transcriptome profiling have been undertaken with ovarian cyclicity to uncover the role of immunogenic and angiogenic growth factors in ovulation-induced molecular changes in swine. For the purpose, entire reproductive tract from gilts/sows were collected from local slaughter places and were transferred to the laboratory at earliest. Only ovaries with morphological evidence of at least one recent cycle were selected for the study. According to their gross morphology, ovaries were assigned to functional stages of the oestrous cycle by carefully examining them for corpora haemorrhagica, corpora lutea, corpora albicans and developing follicles and their relative numbers, sizes, color, consistencies and degree of blood supply. The corpus luteum was assigned early luteal (EL), mid luteal (ML), late luteal (LL) and regressing (R) stages of estrous cycle (Fig. 1-5) and the tissues were processed for RNA sequencing.

Fig. 1: Porcine ovaries used for isolation of corpus luteum and follicles.

Fig. 2: Early Luteal Stage (EL)/Corpus Haemorrhagicum

Fig. 3: Mid Luteal Stage (ML)

Fig. 4: Late Luteal Stage (LL)

Fig. 5: Regressed CL(R)/Corpus Albicans and Large follicles

The expression dynamics of VEGF, FGF and IGF system in porcine corpora lutea during different luteal stages were demonstrated using qPCR (Fig. 6), which is indicative of their key physiological role in angiogenesis. The relative mRNA expression data obtained indicate that these locally produced angiogenic growth factors are expressed in a coordinated manner with stage specific differences in porcine corpora lutea suggesting they could possibly play important role in origin, development and function of corpus luteum in pigs.

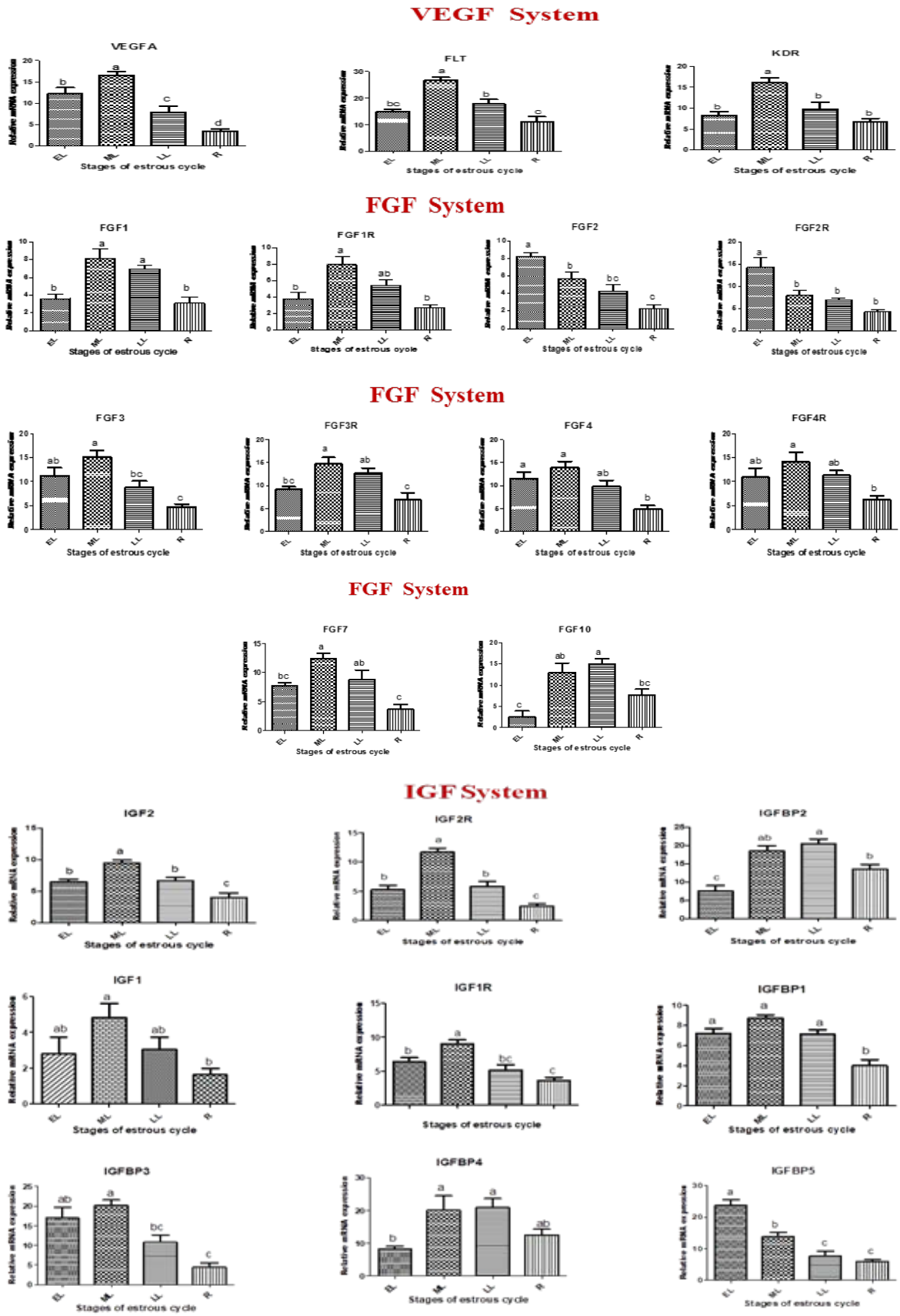


Fig. 6: Relative mRNA expression of VEGF, FGF and IGF system during different physiological stage of porcine corpus luteum

RNA Sequencing Analysis

The QC passed RNA samples from different luteal stages were processed for RNA-Seq paired end sequencing library preparation and was sequenced on NextSeq 500 platform using 2 x 75 bp chemistry. The three stages viz. EL, ML and LL were compared with R stage. Out of 13,348 DE genes in EL stage against R stage, 357 were significantly ($p<0.05$) upregulated and 171 were significantly ($p<0.05$) downregulated. Out of 12,650 DE genes in ML stage against R stage, 325 were significantly ($p<0.05$) upregulated and 149 were significantly ($p<0.05$) downregulated. Out of 13,262 DE genes in LL stage against R stage, 339 were significantly ($p<0.05$) upregulated and 196 were significantly ($p<0.05$) downregulated. There were 74 genes which were exclusively expressed in LL stage while 230 were in R stage. The DGE analysis revealed that process of signal transduction, protein processing, cytokine-cytokine receptor interaction, axonal guidance and cell rearrangement were most affected in EL, ML and LL stages where as those associated with apoptosis were most active in regressed stage. The differentially expressed genes were distributed among more than 27 different functional pathway categories in KEGG. Most of the annotated genes were found to be associated with carbohydrate, energy and lipid metabolism, translation, folding, sorting and degradation, signal transduction and immune system, endocrine system, development and regeneration system and environmental adaptation pathways. The preliminary results are presented in Fig.7-9.

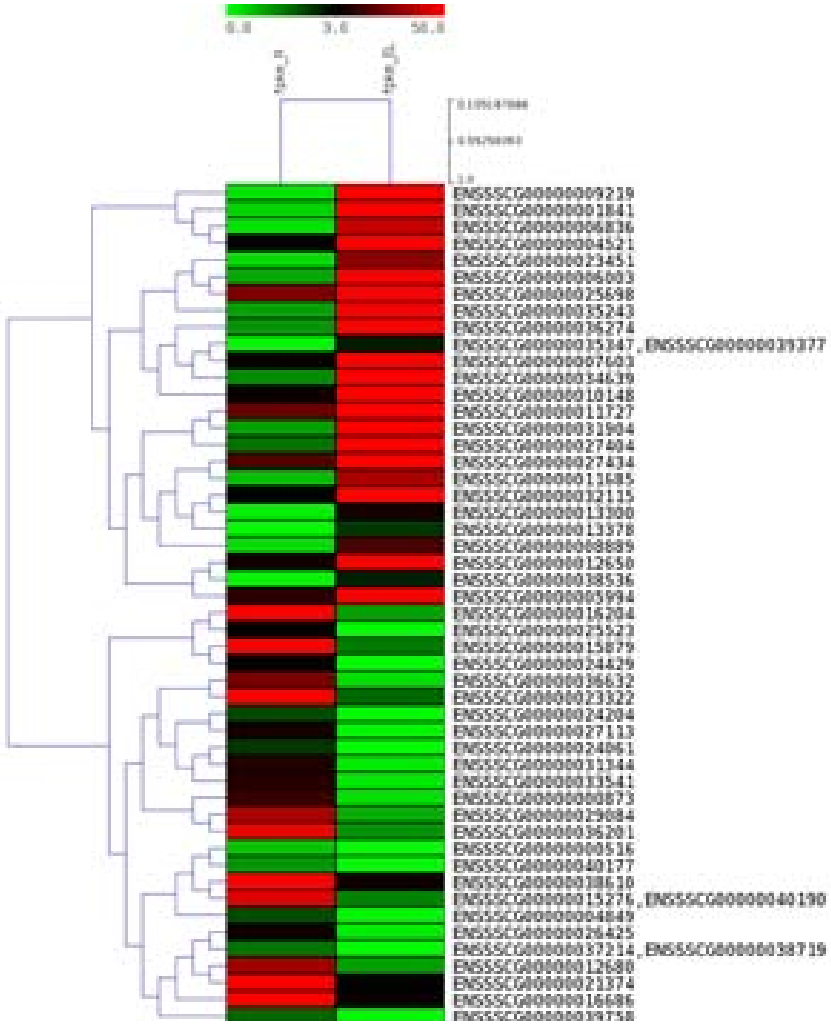


Fig. 7: Heat map showing differentially expressed genes between EL and R stage

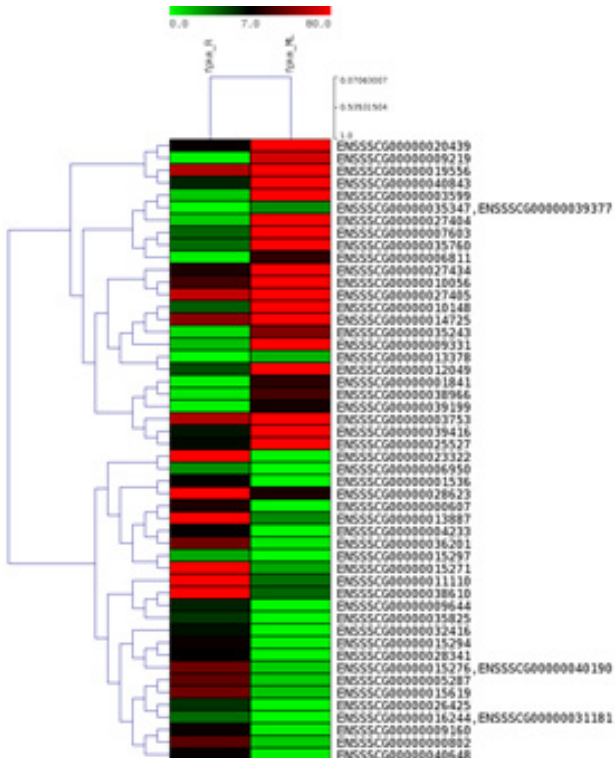


Fig. 8: Heat map showing differentially expressed genes between ML and R stage

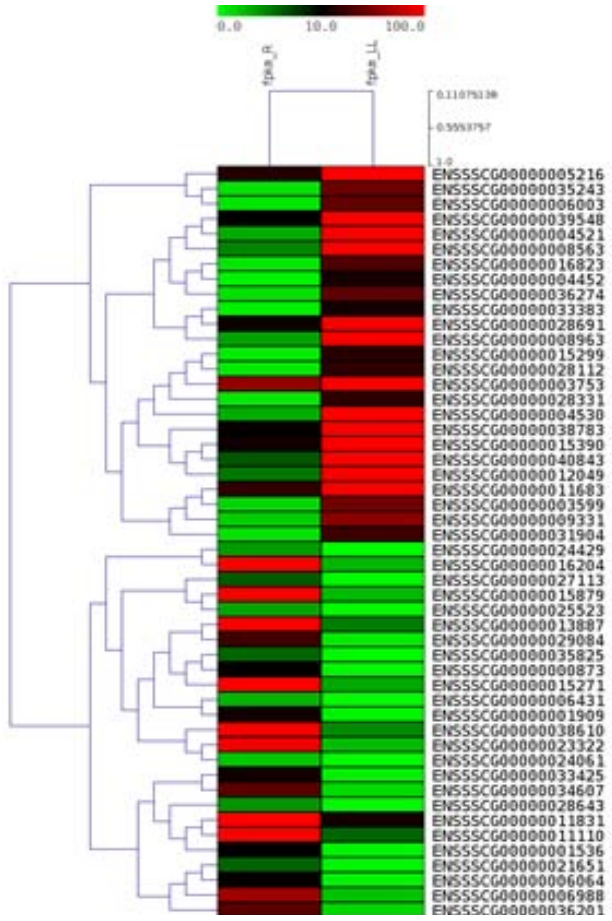


Fig. 9: Heat map showing differentially expressed genes between LL and R stage

Establishment of porcine granulose cell culture system

The follicular fluid was collected by aspiration from small, medium and large follicles, which were used for isolation of granulose cells. The cells were maintained and passaged in DMEM with 12.5 % fetal bovine serum and 1% antibiotics-antimycotics. Culture media was changed every third day until the cells become 80%-90% confluent (Fig.10). These cells are then harvested for total protein, total RNA isolation and cDNA synthesis, which will be used for downstream analysis.

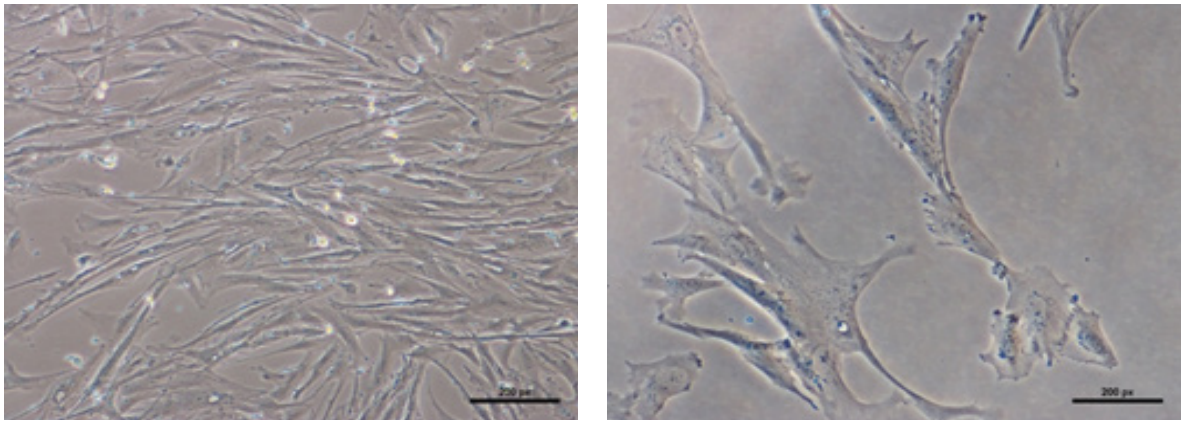


Fig. 10: Porcine granulosa cells

ANIMAL HEALTH

Institute Project: Studies on zoonotic pathogens of porcine origin with special reference to *Salmonella*, *Campylobacter* and *Staphylococcus species*

S.Rajkhowa, S.R.Pegu, D.K.Sarma and R.Thomas

During the reported period under this project analysed 305 samples from pigs including nasal swabs, faecal samples, tissues, abscesses, aborted foetuses etc. collected from different parts of Assam. Out of these samples isolated 59 *Staphylococcus* species from raw meat, skin, abscess, tissue samples and nasal swabs. Out of 59 isolates 14 samples were MRSA. Isolated 4 *Salmonella typhimurium* from tissue samples and 8 *Campylobacter jejuni* from tissue and diarrhoeic fecal samples of pigs. All the isolates were initially identified by conventional method and finally confirmed by species specific PCR assay. Development of rapid and sensitive nucleic acid based diagnostic assay is under progress for *Salmonella* and *Campylobacter* species. Developed a loop-mediated isothermal amplification (LAMP) assay for rapid detection of MRSA from pigs.

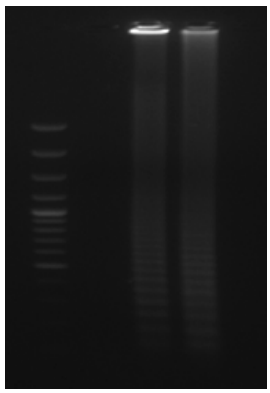
DBT Project: Development of rapid laboratory and field assays for microbiological quality assessment of pork

S.Rajkhowa, Girish Patil S. and S.R. Pegu

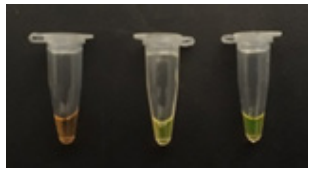
During the reported period total 240 meat samples from pig were collected from different slaughter points of Kamrup, Jorhat, Nalbari and Lakhimpur district of Assam and analyzed for the presence of targeted bacterial pathogens. The number of pigs positive for *E. coli*, *Salmonella* and *Staphylococcus* species were presented in Table.

Organism	No. of Isolates			
	Kamrup	Jorhat	Nalbari	Lakimpur
E. coli	14	7	3	5
Salmonella	2	-	-	-
Staph. aureus	7(MRSA 3)	2	3	4(MRSA 1)
Staph. hyicus	4	1	-	2

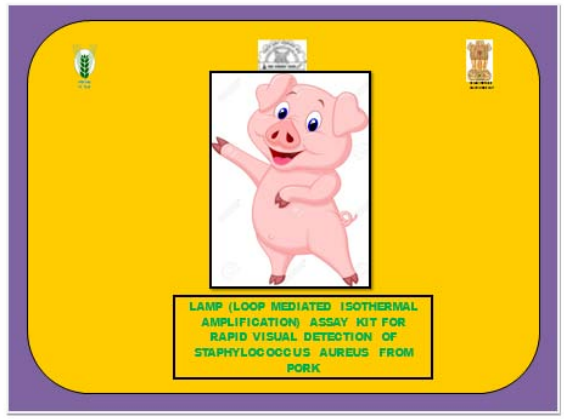
During the reported period two loop mediated isothermal amplification assay have been developed for rapid detection of *Staphylococcus aureus* and Shiga toxin producing *E coli* from pork.



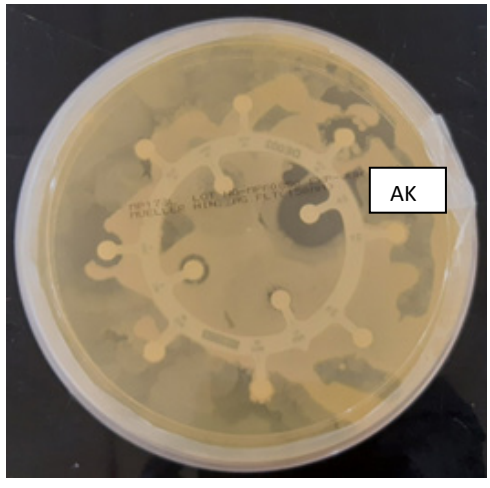
C – CONTROL
P – POSITIVE CONTROL
1 – TEST SAMPLE



Detection limit 50pg/µl



Kit: Development of LAMP assay for rapid visual detection of *Staphylococcus aureus* from pork



Antibiotic Sensitivity pattern of Methicillin Resistant *Staphylococcus aureus* isolated from pork by disc diffusion method. Sensitive to Amikacin (AK) 30mcg-24mm

Project Title: DBT-NER Centre for Advanced Animal Disease Diagnosis and Management Consortium (ADMaC)

S. Rajkhowa and S. R. Pegu

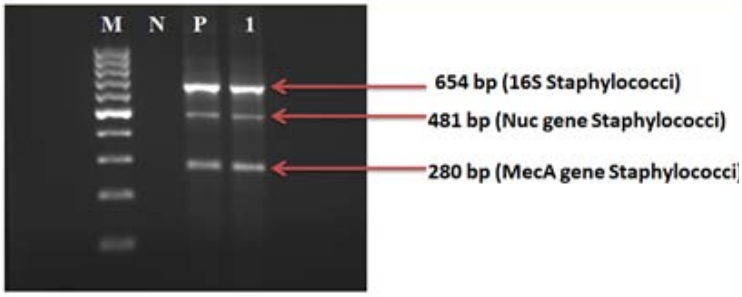
During the reported period, the following kits have been developed and validated under the DBT-ADMaC Project.

Diagnostic Kits Developed Under DBT- ADMaC Project

KIT 1 – Multiplex PCR kit for simultaneous detection of Porcine Circovirus -2 (PCV-2), Porcine Parvovirus (PPV) and Classical Swine Fever Virus (CSFV)

Developed by
Dr. Swaraj Rajkhowa, Dr.Seema Rani Pegu,
Ms. Manjisa Choudhury, Dr. Dilip Kumar Sarma

KIT 2 – Multiplex PCR Kit for Rapid Detection of Methicillin- Resistant *Staphylococcus aureus* (MRSA) from biological samples



Developed by
Dr. Swaraj Rajkhowa, Dr. Seema Rani Pegu, Ms. Manjisa Choudhoury

Institute Project : Evaluation of efficacy of *Typhonium trilobatum* schott tuber extract against important bacterial pathogens associated with respiratory tract infection in pigs

S.R.Pegu, S.Rajkhowa, A.K.Yadav, K. Barman, P. Das and D.K.Sarma

Indiscriminate use of antimicrobials in pig production as growth promoters and in treatment of bacterial infections has resulted in the emergence of antimicrobial resistance. Respiratory diseases of pigs have a significant impact around the world and are responsible for important productivity losses in pig herds. Among the bacterial species *Pasteurella multocida, Streptococcus suis* and *Staphylococcus aureus* etc are commonly found in the respiratory tract infection of pigs during the study. Antibiotic resistance bacteria not only complicate the treatment but also can easily be transferred from pigs to human beings particularly to the pig rearers and pork consumers. Out of the several ways to reduce the emergence of antibiotic resistance bacteria, one is the use of herbal compounds as drug to treat bacterial infections. Several herbal products are used in the treatment of various ailments of man and animals. Considering the abundance of *Typhonium trilobatum* (L.) Schott in India and its antimicrobial activities, the present study was undertaken to determine its efficacy against selected bacterial pathogens associated with respiratory tract infections of pigs as no study has so far been undertaken in India on this aspect.

Collection of plant material and Preparations of plant fractions

In hot extraction method, dried leaf powders of *T. trilobatum* were used for obtaining the hydro-ethanolic (6:4) extract with soxhlet apparatus for 24 h; the extract filtered and the filtrate was dried using rotary evaporator at 60^0c for 4 hrs. The hydro-ethanolic crude extract was subjected to bioassay-guided fractionation by solubilising in water and sequential partition with n-hexane, chloroform, ethyl acetate, dichloromethane and n-butanol, while the end product was termed as methanol-fraction. Each collected fraction was concentrated under reduced pressure for a dark residue.

Plant extract

Aqueous extract of *Typhonium trilobatum (L.) Schott* tuber was prepared and purified at the Science Foundation for Tribal and rural resources dvelopment centre, Odisa was used in the study.

Collection of samples for bacterial isolation:

During the reported period nasal swabs and tissue samples from pigs affected with respiratory tract infection were collected from different pig farms of Guwahati, Lakhimpur and Nalbari District of Assam. The samples were collected aseptically and immediately brought to laboratory for further downstream processing. Samples were cultured on suitable agar media and the bacterial isolates were identified by using standard biochemical procedures followed by Clinical and Laboratory Standards Institute (CLSI) guidelines. Standard microbial type culture collection (MTCC) strains of bacteria were used as reference controls. So far two Gram positives (GPs), MRSA, Streptococcus suis and two gram negative bacteria were isolated and used in this study.

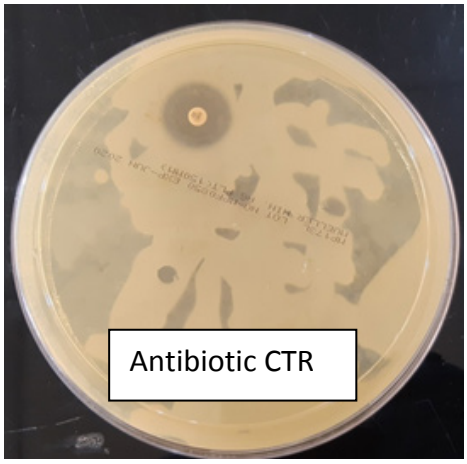
The antimicrobial activity of the plant extract was studied *in vitro* using the macrodilution method (NCCLS, 2000). Four different concentrations of the plant extract of viz. 50, 100, 200 and 300 mg/mL were prepared from the stock solution. One milliliter of broth culture of each of the four bacterial strains containing approximately 1x 10^8 CFU/mL was transferred to separate sterile tubes containing the plant extract in eachof the concentrations i.e.50-300mg/ml and incubated at 37^0 C for 24 hours. Commercially available biotrim DS tablet @ 200 mg /ml was

used as standard control against each of the four bacterial strains. The plant extract at lower concentrations viz.50 and 100mg/ml is unable to inhibit the growth of all the four bacteria whereas the plant extract at 200 and 300 mg/ml could inhibit the growth of the bacteria as indicated by the absence of turbidity in the tubes. Similarly the biotrim DS @200mg/ml could also inhibit the growth of the bacteria.

To compare the bacterial growth inhibition by the plant extract and other commercially available broad spectrum antibiotics, the disc diffusion method was performed (NCCLS, 2000). In this method, sterile discs impregnated with two concentrations i.e. 300mg/ml and 500mg/ml of the plant extract was dried in incubator and used in the test along with the commercially available three antibiotic discs and biotrim DS disc of 500mg/ml. Broth culture of the three bacteria containing approximately 1x 10^8 CFU/mL was uniformly spread separately over sterile nutrient agar plates and the discs containing the plant extract along with the commercially available antibiotic discs namely amikacin, ampicillin, Ceftriaxone and tetracycline antibiotic discs and biotrim DS disc were placed at uniform distance and incubated for 24 hours at 37^0 C. After incubation the zone of inhibition surrounding the discs was measured by using the Hi zone antibiotic scale; (Hi Media Laboratories Pvt. Ltd., Mumbai, India). Although all the broad spectrum antibiotics viz. teteracycline, ceftriazone, ampicillin and amikacin showed slightly higher zone of inhibition against the bacteria than the zone of inhibition produced by the plant extract @ 300mg/ml and 500mg/ml, Hence the plant extract which showed inhibition of growth and zone of inhibition of the bacteria at 300 and 500mg/ml could be the choice of treatment of respiratory infections of pigs mostly associated with the bacterial species. Determination of MIC and MBC of the plant extract is under progress.

Zone of inhibition of *Streptococcus suis* with plant extract by disc diffusion method

500mg/ ml –28mm



Zone of inhibition of *Streptococcus suis* with ceftriaczone by disc diffusion method

Ceftriaxone 30 mcg (CTR30) – 26mm

DBT-Twinning Funded: Molecular Epidemiology of Japanese Encephalitis Virus in Pigs and Mosquitoes in Assam

Seema R Pegu

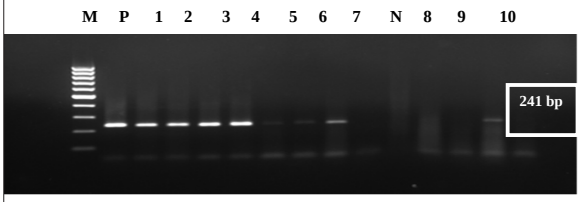
Seroprevalence of molecular detection of JEV in different districts of Assam:

Assam is one of the highly endemic states for Japanese encephalitis (JE) in India. Assam also has the largest pig population in the country as per 20th census. Abundance of rainfall, rice cultivation and pig farming near the vicinity of the paddy field makes Assam the most vulnerable state for spread of Japanese encephalitis. Therefore, this investigation was aimed to determine the prevalence of JEV in pig population of Assam. Seasonal distribution of JE sero positiveity in pigs was evaluated from January 2019 to December 2019. A total of 947 sera samples of pig were screened from Kamrup, Jorhat, Lakhimpur, Nalbari, Barpeta, Sivsagarand Sonitpur districts of Assam in the year 2019 and 9.18 % of sera samples showed positive antibody against JEV. In addition 65 whole blood samples and 54 tissue samples were screened for JEV by RT-PCR. The envelope protein of JE virus was targeted by RT-PCR. 11 blood samples and 5 tissue samples were found to be positive by RT-PCR. Seasonal distributions of vector Mosquitoes were screened from five districts of Assam. The mosquito vector identified were mainly *Culex tritaenorhinchus, Culex vishnoi, Culex pseudovishnoi*, *Culex* white more, *Culex gelidas* and *Masonia* spp. and found to be significantly higher during April to September (Monsoon months) than the December to February (winter months). Developed rapid diagnostic assay based on Real Time PCR for detection of JEV in pigs in collaboration with ICAR-National Research Centre on Equine, Hisar.

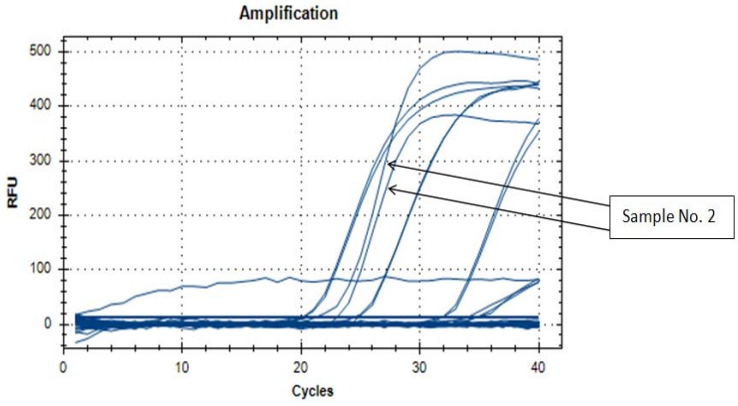
C. tritgeniarhynchus *M. annulifera* *C. vishnui* *C. pseudovishnui* *C. galidus*

Field Collection and Identification of Mosquito Vector

Detection of E-gene of JEV in porcine samples by RT-PCR



Diagnostics Developed : Real-time PCR detection of JEV from pig tissue samples



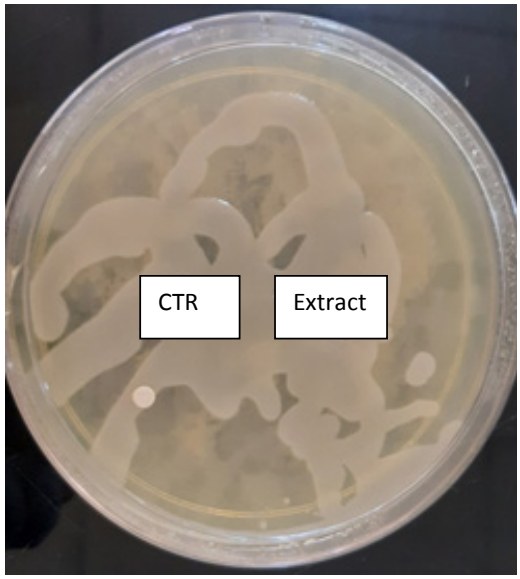
Sample No. 1: Negative – 0

Sample No. 2: Positive – as shown in curve number 3-4 [CT values 24.63 (RFU492) and 24.99 (RFU 371)]

ICAR Funded: All-India Network Project on Neonatal Mortality in Pigs

Swaraj Rajkhowa and S. R. Pegu

Under this project during the reported period we have analysed 428 numbers of various samples *viz.* faecal (205), Nasal swab (103) and tissue sample (120) from different organised and unorganised pig farms of Assam. We could isolate 28 numbers of *E. coli* from diarrhoeic faecal samples, out of this 28, 18 were found to be positive for ETEC and 10 were found to be positive for STEC. All the isolated *E. coli* were tested for antimicrobial resistance (AMR) and out of these 28, 11 were confirmed for AMR against commonly used antibiotics. During the reported period, we could isolate 4 numbers of *Pasteurella multocida* from tissue samples and nasal swabs of piglets. These isolates were initially identified based on staining morphology, biochemical tests and further confirmed by PCR using specific primers. Detected porcine circovirus type 2 (PCV2) in stillborn and weak piglets through PCR. Plant extracts of *Typhonium trilobatum* was tested for antibacterial sensitivity against *E. coli* multidrug resistant strain *in vitro* and found to be sensitive against the extract. Further sensitivity study is under progress in other diarrhoea causing organisms isolated from piglets.



Zone of inhibition of *Streptococcus suis* with ceftriacxone by disc diffusion method

Ceftriaxone 30 mcg (CTR30) – 26mm

Institute Project : Expression and evaluation of diagnostic potential of immunogenic proteins of porcine reproductive and respiratory syndrome virus

Ajay Kumar Yadav, Seema Rani Pegu, Rajib Deb, Pranab Jyoti Das and Swaraj Rajkhowa

Porcine reproductive and respiratory syndrome is a highly contagious disease of pig. The causative agent has single stranded positive sense RNA virus genome of ~ 15 kb, belongs to family arteriviridae and genus arterivirus. Porcine reproductive and respiratory syndrome (PRRS) can manifest as lowered farrowing rates, a marked increase in abortions, stillborn, mummified and weak live born piglets and deaths. The morbidity and mortality can be as high as 100%. There is also respiratory disease, which can be severe, particularly when other agents are present and can result in high death rates in suckling and weaned pigs. The virus causes huge economic loss in the piggery sector and also badly affects the socio-economic status of the pig farmers. The pig (Sus scrofa), whether domestic or feral, is the only species known to be naturally susceptible to this disease. Other species of wild pig and members of family Suidae may be susceptible. Now the disease occurs in most pig-producing countries and causes great economic loss to swine industry worldwide except for few countries including Switzerland, New Zealand and Australia. The first outbreak in India has been reported in 2013 from the Mizoram state. The outbreak confirmed that it belongs to highly pathogenic porcine reproductive and respiratory syndrome virus (HP-PRRSV) from China. The genesis of the project is based on to develop recombinant protein based diagnostics for the PRRSV as till now there is no specific and sensitive diagnostic (both for antigen and antibody) is available in India. The developed ELISA may be useful in the serosurveillance of PRRSV circulating in the country. The recombinant proteins will help in deeper understanding of the function/structure of the proteins. Role of neutralizing antibodies is controversial, as appear in late infection and as well as the role of non-neutralizing antibodies is not defined in PRRS infection. The recombinant proteins and monospecific sera will aid to understand the biology of the virus and may be useful to develop DIVA based diagnostics in future. We have targeted three antigenic proteins of PRRS virus viz; Nucleocapsid (N), Matrix (M) and Glycoprotein 5 (ORF5). The targeted genes will be amplified and cloned into suitable expression vector. The samples (n=35) (blood and tissues) were collected from the pig farms, local meat shops and filed outbreaks suspected for PRRSV infection. The total RNA was isolated by RNeasy kit (M/s Qiagen, Germany) and first strand cDNA synthesis was carried out using

random hexamer primers. All the three genes (N, M and ORF5) have been amplified successfully and cloned into pJET1.2 cloning vector. We have also developed a PCR method for simultaneous detection of all the three genes in a single shot PCR reaction. The patent for this modified PCR have been filed with application number 202011004699, dated 03/02/2020.

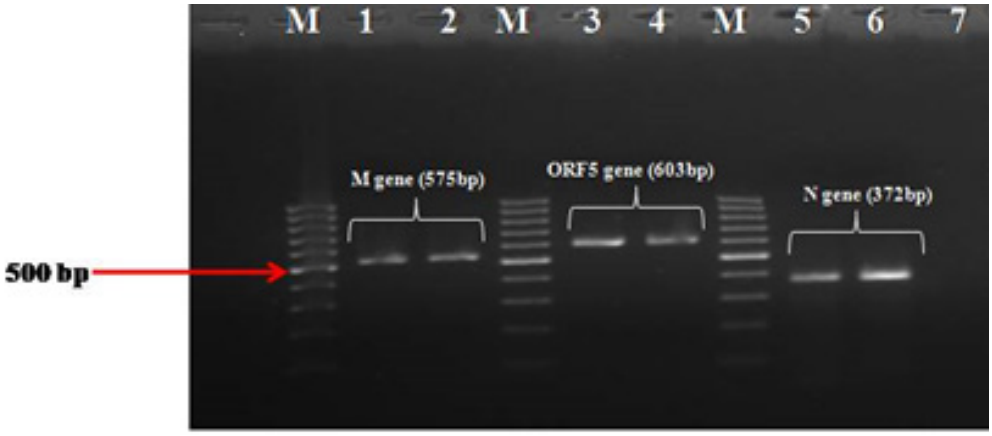


Figure 1: Amplification of Nucleocapsid (N), Matrix (M) and ORF5 gene from PRRS suspected pig. **Lane M:** 100 bp DNA ladder; **Lane 1 & 2:** M gene amplification (575 bp) using Set 3 primers; **Lane 3 & 4:** ORF5 gene amplification (603bp) using Set 2 primers; **Lane 5 & 6:** N gene amplification (372bp) using Set 1 primers; **Lane 7:** Non-Template Control (NTC).

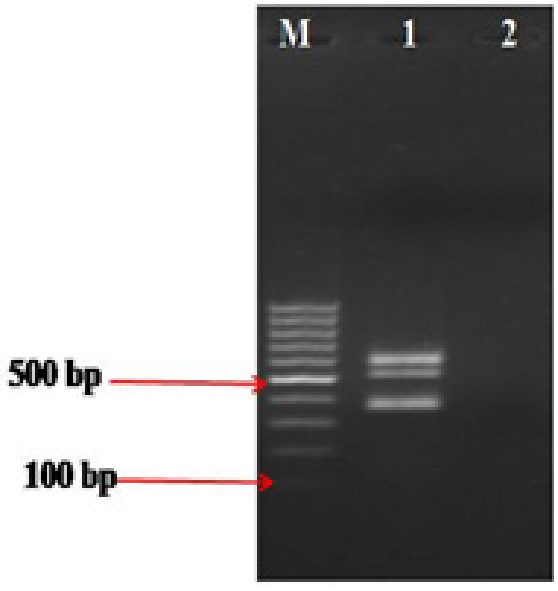


Figure 2: Simultaneous amplification of Nucleocapsid (N), Matrix (M) and ORF5 gene is a single step PCR from PRRS suspected pig. **Lane M:** 100 bp DNA ladder; **Lane 1:** N gene amplification (372 bp), M gene amplification (575bp) and ORF5 gene amplification (603bp) **Lane 2:** Non-Template Control (NTC).

LIVESTOCK PRODUCTS TECHNOLOGY

Institute project: Development of pork based ready to serve functional products

R. Thomas and K. Barman

The objective of the project was to develop value added functional pork products through the addition of critical ingredients to cater the needs of the health-conscious consumersand to evaluate the nutritional, physicochemical, microbiological and sensory attributes of developed products. Types of functional pork products developed include the following categories: 1. PUFA enhanced, 2. Fibre enriched, 3. Antioxidant rich, 4. Low salt and 5. Low fat/ low calorie. Different parameters studied on the day of processing include pH, cooking yield, proximate composition/ nutritional value, water activity, hunter colour values, texture profiles and Warner-Bratzler shear force. The parameters studied during the storage period include: Physico-chemical parameters - pH,Proximate composition/ Nutritional value, TBARS value, Tyrosine value, Free Fatty Acid and Titratable acidity; Microbiological parameters- Aerobic count, Psychrotropic count, Coliform count, Salmonella sp. count, Lactobacillus count, Staph. aureus count, Yeast and mold count and Sensory characteristics- Appearance, Flavour, Juiciness, Texture, Binding, Overall acceptability. Viable technologies were developed for commercial processing of value-added pork products with consumer acceptability. Simple processes were developed to incorporate the locally available medicinal plant parts (leaves/ fruits/ buds etc.) in the pork product's formulations. These materials were found to have positive effect on preventing microbial spoilage and fatty acid oxidation during the storage period. Scientific interventions were introduced in the packaging of pork and pork products to improve the brand value of the products during marketing. Both laboratory and pilot scale testing of the developed formulations were conducted before the commercialization of the products. Formulations were modified based on the suggestions received during the pilot scale marketing phase, in order to ensure market acceptability of the products. The technologies developed were commercialized through Public-Private- Partnership mode.

MoFPI Project: Setting up of food testing laboratory

R. Thomas, Seema 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. Construction of a separate building with an area of about 1900 sq. ft has already been completed for housing the sanctioned equipment. The said building has provisions for sample receiving and coding, sample processing, residue monitoring, adulteration detection and microbial analysis, of food samples especially of meat and meat products. Institute has initiated the process for applying for NABL accreditation of the laboratory. As the first step, three of the following scientific staffs, who are associated with the current project, have undergone the ISO 17025:2017 training programme (Laboratory Quality Management and Internal Audit) at National Institute of Training for Standardization (NITS), BIS, Noida. Also, an MoU has been signed with ICAR-CIFT, Cochin towards technology support in obtaining NABL accreditation for the lab. Food Quality Management Database has been designed and developed for handling the analytical samples with traceability. Biometry and CCTV systems were installed in the unit to ensure confidentiality.

Following equipment were procured and installed under the project so far:

S N	Name of PAC approved equipment	SN	Name of PAC approved equipment
1	Micro-centrifuge with PCR tube adaptor	14	Analytical balance
2	Ultra-low temperature freezer with accessories	15	Tube roller
3	Deep freezer -400L	16	Digital dry bath with heating blocks
4	ELISA unit with accessories	17	Microprocessor based refrigerated centrifuge with accessories
5	Water purification system with accessories	18	Hot air oven
6	Deep freezer -200 L	19	Digital water bath
7	Mini incubation oven	20	Trinocular microscope with camera and accessories
8	Spectrophotometer	21	Digital Autoclave
9	Electrophoresis workstaion	22	Rotary evaporator
10	Bio safety cabinet, Type –II, A2	23	Bomb calorimeter with accessories
11	Real time PCR with accessories	24	Atomic absorption spectrophotometer with accessories
12	Ultra-low temperature freeze dryer with accessories	25	Nitrogen Evaporator
13	Electronic precision balance	26	LC-MS/MS with accessories

APRAT Project: Technical Advisory Services for Piggery Value Chain Improvement in Assam, under the World Bank financed Assam Agribusiness and Rural Transformation Project (APART)

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

ARIAS Society, Govt. of Assam has signed a Memorandum of Understanding (MoU) with ICAR-National Research Centre on Pig, Guwahati to provide technical advisory services for piggery value chain improvement in Assam under the World Bank funded project. 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. With respect to preparation of database for ration balancing, guidelines for feed sample collection, packaging and transportation is prepared and submitted to AHVD. Those AHVD staffs and Pig Bondhus so far trained at the institute were given detailed narration about the sample collection and transportation process. With respect to Sero-sampling for JEV to inform targeted measures to decrease mosquito transmitted virus to pigs, the institute has already procured the required materials (sample collection Kit) for collection of blood/serum samples from the pigs in the affected areas. The institute has also undertaken a background study related to the prevalence of JEV in different districts of Assam and accordingly the following districts were identified for the study viz. Jorhat, Sivasagar, Kamrup, Nalbari and Lakhimpur. The blood samples received from these districts are being analyzed for the JEV antibody. Regarding capacity building of value chain actors in the project, institute has already

conducted five training programmes to Veterinary Doctors from 13 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. All the trainees were practicing veterinary doctors and the training has provided exposure to participants on basics of selection of breed/varieties/strain and breeding strategies for profitable pig farming, principles of swine feeding, feeding of different categories of pigs and use of non-conventional feed stuffs for swine feeding, care and management of different categories of pigs, neonatal piglet mortality and its management, 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, demonstration of formulation of feeds for different categories of pigs and financial avenues for augmenting backyard pig farming to homestead enterprise. Training has also imparted 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. Similarly, three training programmes for the *Pig Bondhus* i.e. "Master Training (ToT) programme for local service provider (Pig Bondhu)" were organized and a total of 59 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.

Participants in the capacity building programmes organized under APART project

ICAR-LBS Award Project: Farm-to-Fork Risk profiling of hazards associated with pork supply chain in India, developing a database on hazards and associated unique pig husbandry / processing practices, developing food safety interventions towards reducing hazards and effective risk communication strategies as guidance to the industry

R. Thomas

The project is being carried out since 01-01-2019 with the objective to undertake Farm-to-Fork Risk profiling of hazards (microorganisms of public health concern, veterinary drug residues, pesticide residues and heavy metals) associated with pork supply chain in India and to develop their database.The survey work envisaged in the project has almost completed. In the initial phase 05 North Eastern States were covered i.e. Assam, Meghalaya, Arunachal Pradesh, Mizoram and Nagaland. Samples were also collected from South India (Kerala, Karnataka, TN, Andhra Pradesh and Telengana); North India (Haryana, Punjab and Delhi) and East India (WB and Jharkhand). Sixty three numbers of pig farms (backyard and small) and 47 numbers of pork retail

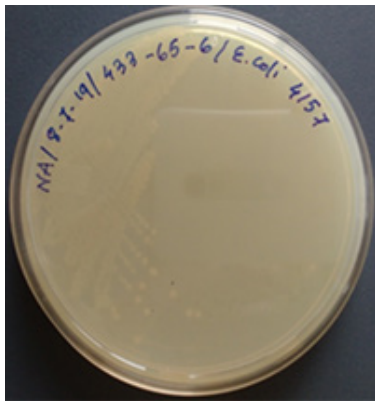
units (roadside shops and organized shops) were visited during the reported period. Details were collected w.r.t. the production practices, feeding practices, health management etc. Emphasis was given to identity and documents the probable factors which could contribute to the risks in the existing piggery and pork value chain. During the survey different samples (feed samples, pork samples, edible visceral organs etc.) were collected for evaluation of the probable risk factors associated with them which could enter into the pig/pork value chain at some point. Different quality characteristics (carcass measurements, physico-chemical and microbiological) of pork marketed in these areas were evaluated. Samples were taken to assess hygienic status of meat personnel/butchers and meat shops (which handle pork). Further, the project involved a survey to understand the quality awareness and requirements of pork consumers in the survey areas.

1. Detection of food borne pathogens in meat and meat products by molecular means

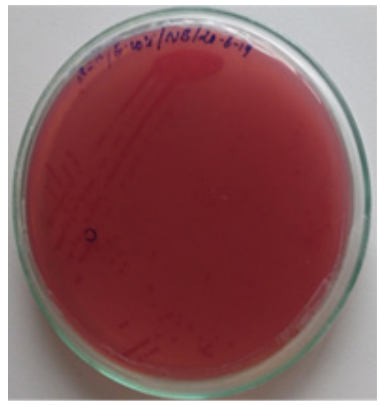
PCR based methods were developed for detection of FSSAI listed pathogenic bacteria viz. *Salmonella* Enteritidis; *Salmonella* Typhimurium; *Salmonella* Cholerasuis; *E. coli* O157:H7, *Compylobacter jejuni*, *Listeria monocytogenes*, and *Yersinia enterocolitica*. Moreover, methods have been developed to identify *Escherichia coli* and Staphylococcus aureus in meat and meat products. The American Type Culture Collection (ATCC) of these pathogenic microorganisms is taken as positive control and PCR based methods have been standardized for detection.

1.1. PCR amplification for confirmation of Escherichia coli

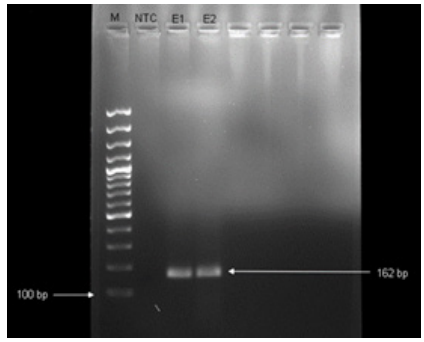
Possession of the gene lacZ, which codes for the β-galactosidase, is the most prominent feature of the coliforms, whereas β-D-glucuronidase, encoded by the gene uidA, is routinely used to specifically identify *E. coli*. The sequences of the primer used wereuidA- F: 5'-TGGTAATTACCGACGAAAACGGC-3', uidA- R: 5'-ACGCGTGGTTACAGTCTTGCG-3'. A band of 162 bp was observed which confirms *E. coli* colonies.



***E. coli* colonies on nutrient agar**



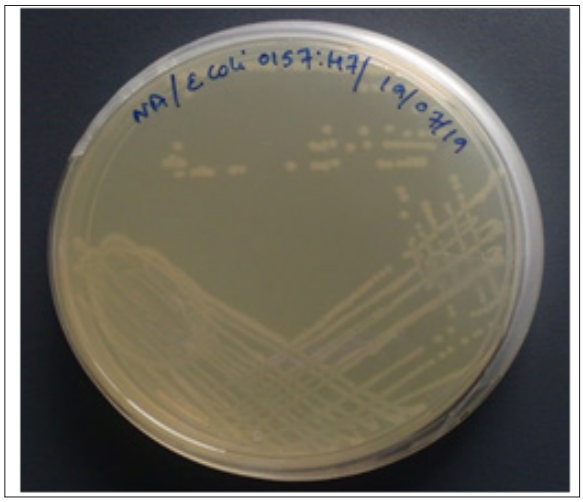
***E. coli* colonies on MacConkey agar**



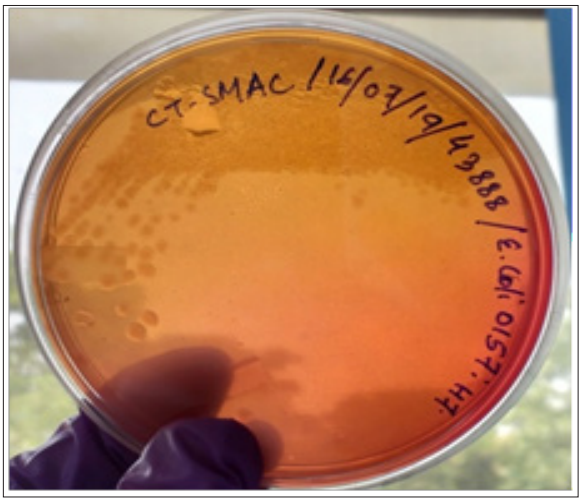
PCR amplification of E. coli DNA with uidA primer. The lanes are M= 100 bp, NTC= Non template control, E1 & E2= E. coli

1.2. PCR amplification for confirmation of *E. coli* O157:H7

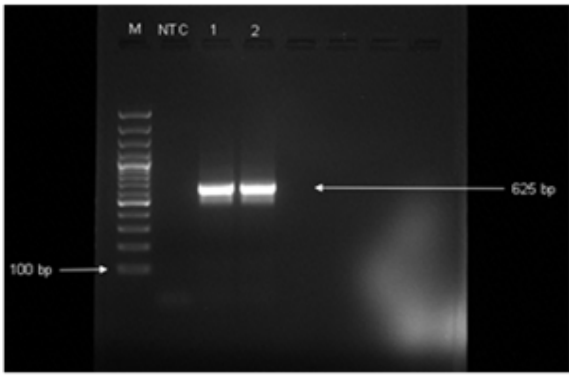
Escherichia coli O157:H7 serotypes are identified as enterohaemorrhagic *E. coli*. Screening of *E. coli* O157:H7 is based on the presence or absence of specific 'flicH7' gene encoding the flagellar antigen H7 and 'rfbO157' gene which encodes the somatic antigen O157.The sequences of the primers for flic H7 gene are flicH7-F: 5'-GCGCTGTCGAGTTCTATCGAG-3' and flicH7-R: 5'-CAACGGTGACTTTATCGCCATTCC-3'. The sequences of the primers for rfbO157 gene are rfbO157-F: 5'-CGGACATCCATGTGATATGG-3', rfbO157-R: 5'-TTGCCTATGTACAGCTAATCC-3'. The sizes of PCR products for flicH7 and rfbO157 genes amplification are 625 bp and 259 bp, respectively which confirmed *E. coli*O157: H7.



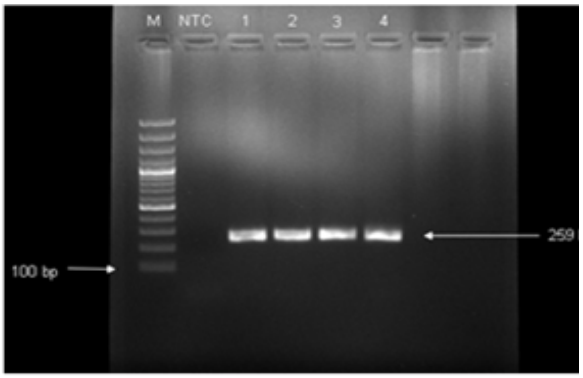
***E. coli* O157:H7colonies on nutrient agar plate**



***E. coli* O157:H7colonies on CT-SMAC plateplate**



PCR amplification of flicH7 gene of *E. coli* O157:H7. The lanes M= 100 bp DNA ladder, NTC= Non template control, 1 & 2 = *E. coli* O157:H7



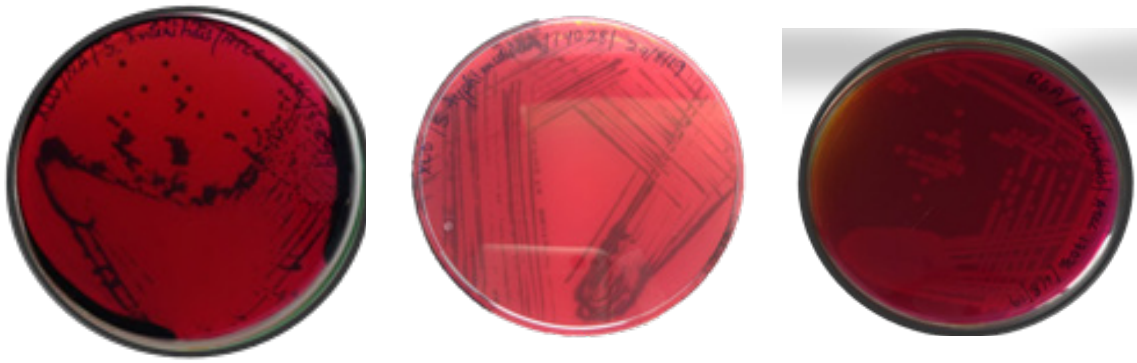
PCR amplification of rfbO157 gene of *E. coli* O157:H7. The lanes M= 100 bp DNA ladder, NTC= Non template control, 1-4 = *E. coli* O157:H7

1.3. PCR amplification for confirmation of *Salmonella* enterica serovar Enteritidis

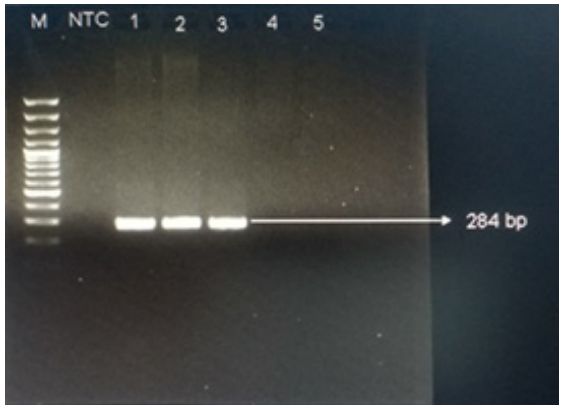
Screening of salmonella is based on the presence or absence of InvA gene as this gene is highly specific to all the members of genus Salmonella and absent in other genera (*Salmonella* Enteritidis, *Salmonella* Typhimurium and *Salmonella* Choleraesuis). It has been used as an important target for detection of Salmonella. InvA codes for protein in the inner bacterial membrane that is responsible for invasion of intestinal cells of the host. Detection of the serotype of *Salmonella* Enteritidis is based on a PCR method targeting the SefA gene. Salmonella Enteritidis produces

a distinct type of fimbriae named SEF14 and sefA encodes the structural subunit of SEF14. The oligonucleotide primer set used was InvA (Forward) 5'-GTGAAATTATCGCCACGTTCGGGCAA-3' and InvA (Reverse) 5'TCATCGCACCGTCAAAGGAACC-3'. The sequences of the primers for SefA gene are- SefAF: 5'- GCAGCGGTTACTATTGCAGC-3' and SefAR: 5' –TGTGACAGGGACATTTAGCG-3'. The size of PCR product for InvAgene is 284 bp which confirms Salmonella spp. (*Salmonella* Enteritidis, *Salmonella* Typhimurium and *Salmonella* Choleraesuis).The size of the PCR product for SefAgene is 310 bp which confirmed *Salmonella* Enteritidis.

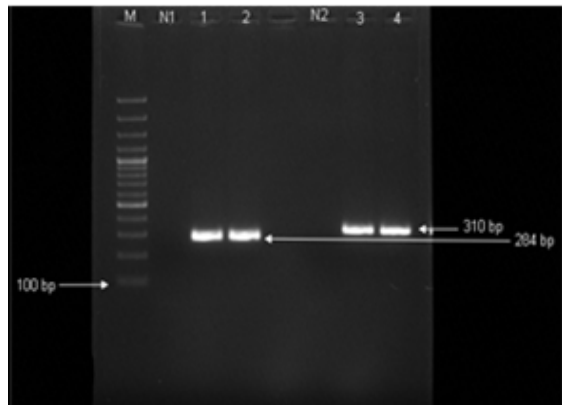
White colonies on nutrient agar plate (a) *Salmonella enteritidis* (b) *Salmonella typhimurium* (c) *Salmonella cholerae suis*



Red colonies with black center of a) *Salmonella* Enteritidison XLD agar (b) Red colonies with black center of *Salmonella typhimurium* on XLD agar and (c) White colonies of *Salmonella cholera* suis on XLD agar.



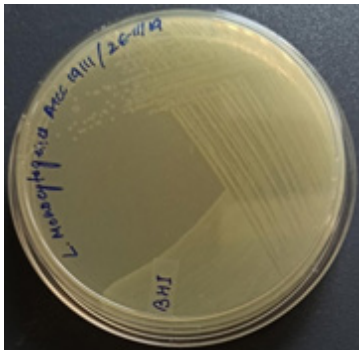
PCR amplification of *Inv*Agene. The lanes M= 100 bp DNA ladder, NTC= Non template control, 1= *S. Enteritidis*; 2=*S. typhimurium*; 3=*S. cholera suis*



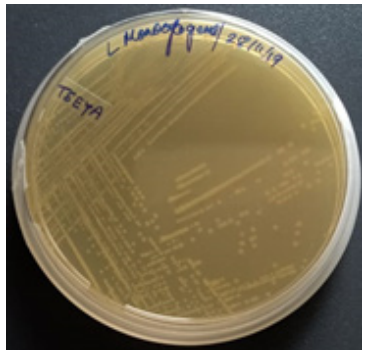
PCR amplification of InvA and SefAgenes. The lanes M= 100 bp DNA ladder, N1 and N2= Non template controls, 1 & 2 = *Salmonella enteritidis* with InvAgene; 3&4=*Salmonella enteritidis* with SefA gene

1.4. PCR amplification for confirmation of *Listeria monocytogenes*

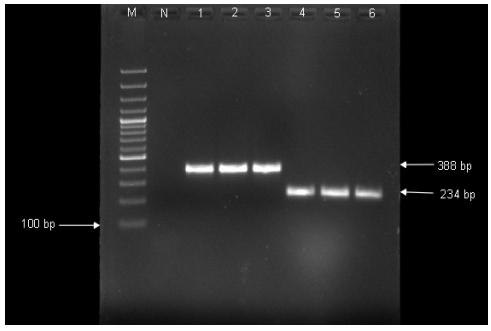
Haemolysin genes of *L. monocytogenes* can serve as very specific probes in DNA- hybridization assays for the identification of this organism. For PCR amplification, the primer set used were hlyA1 (F)-5'-GAATGTAAACTTCGGCGCAATCAG-3'; (R) -5'-GCCGTCGATGATTTGAACTTCATC-3'; hlyA2 (F): 5'-CGGAGGTTCCGCAAAAGATG-3';(R): 5'-CCTCCAGAGTGATCGATGTT-3'. Both the primers were worked well at the same reaction condition. First set of primer yielded 388 bp and second set yielded 234 bp of bands.



***Listeria monocytogenes* colonies on BHI agar plate**



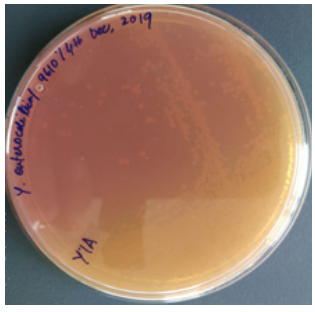
***Listeria monocytogenes* colonies on TSEYA plate**



PCR amplification of hylA1 and hylA2 genes. The lanes M= 100 bp DNA ladder, N= Non template control, 1 to 3= Listeria monocytogeneswith hylA1 gene; 4 to 6= Listeria monocytogenes with hylA2 gene

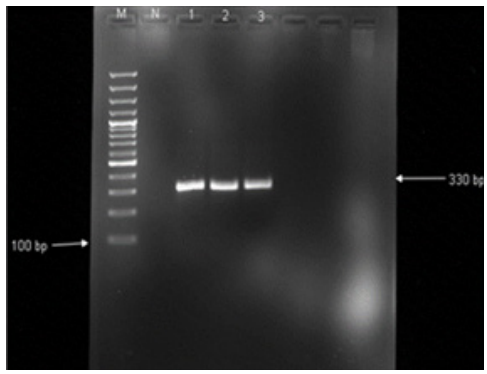
1.5. PCR amplification for confirmation of *Yersinia enterocolitica*

Y. enterocolitica has been isolated frequently from swine, poultry and ready-to-eat foods and for its detection in food systems, 16s rRNA is usually being targeted, which is the first choice of target to identify bacteria at the species level. The primer set used were- 16SrRNA (Forward) 5'-AATACCGCATAACGTCTTCG-3' and 16SrRNA (reverse) 5'-CTTCTTCTGCGAGTAACGTC-3'. The size of PCR product for 16SrRNA gene amplification was 330 bp.



***Yersinia enterocolitica colonies* on Yersinia isolation agar**

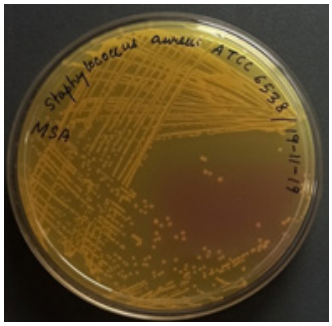
***Yersinia enterocolitica colonies* on MacConkey agar plate**



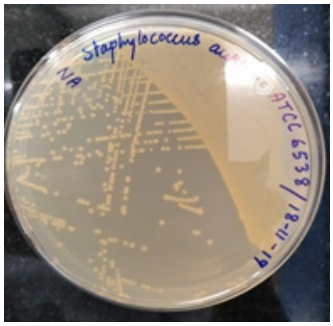
PCR amplification of 16S rRNAgene. The lanes M= 100 bp DNA ladder, N= Non template control, 1 to 3= *Yersinia enterocolitica*

1.6. PCR amplification for confirmation of *Staphylococcus aureus*

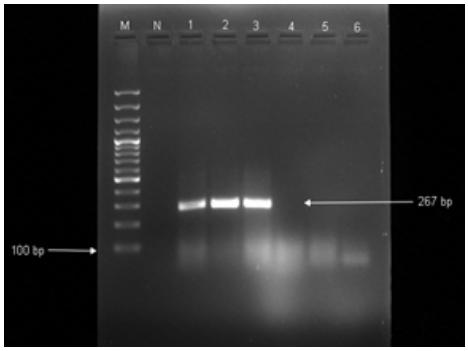
S. aureus is one of the most significant bacterial pathogens for human health and commonly involved in bacterial infections and food poisoning out-breaks worldwide. Methicillin-resistant *S. aureus* produce a low-affinity penicillin- binding protein (PBP 2' or PBP 2a) in addition to the usual PBPs. Available data show that the structural gene of this PBP (mecA) is present in the resistant strains but not in the susceptible ones. This assay detects 2 genes, the nuc gene, which encodes for a thermostable nuclease specific for *S. aureus*, and the mecA gene, which encodes for PBP2a that confers resistance to β -lactam antibiotics. The sequences of the primer are nucF: 5'-GCGATTGATGGTGATACGGTT-3'; nucR: 5'-AGCCAAGCCTTGACGAACTAAAGC-3' and mecA F: 5'-AAAATCGATGGTAAAGGTTGGC; mecA R 5'-AGTTCTGCAGTACCGGATTTGC-3'. For nuc gene, a band of 267 bp was observed which confirmed *S. aureus* colonies. There was no band observed in case of mecA gene which indicated that this strain was methicillin susceptible.



***S. aureus colonies* on Mannital Salt agar**



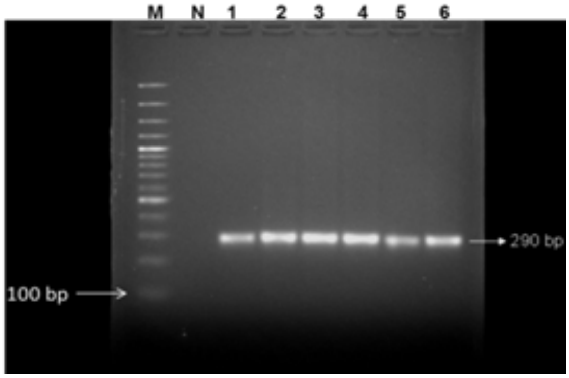
***S. aureus colonies* colonies on nutrient agar**



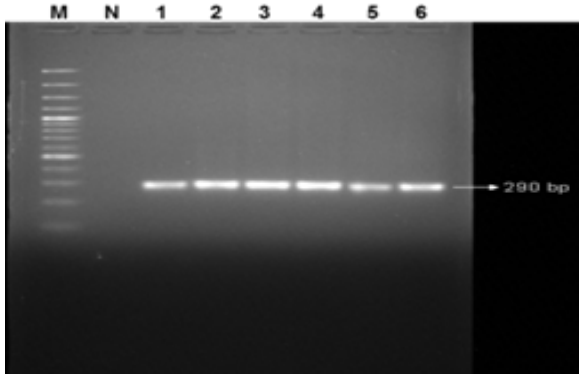
PCR amplification of *S.aureus with nuc* and mecA genes. M= 100 bp DNA ladder, N= Non template control, 1-3= S. aureus DNA amplified with nucgene, 4-6= S. aureus DNA amplified with mecA gene

2. Identification of different meats by species-specific markers of mitochondrial origin

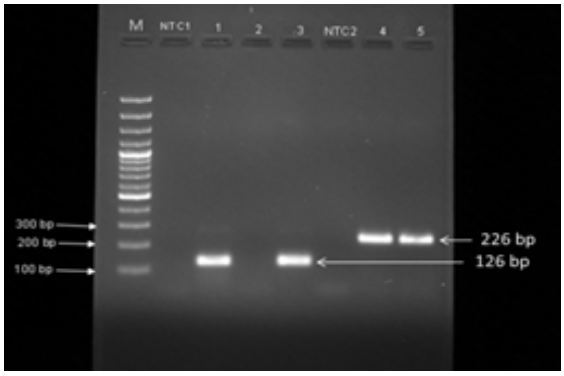
Food authenticity issues in the form of adulteration and improper description have been found for long time and probably for as long as food has been offered for sale. The adulterated food often enters the supply chain and jeopardizes the sentiments as well as health of the people. Substantial proportion of population has religious considerations towards the consumption of meat of an animal species. Hence, the meat adulteration has got social, religious, and economic and public health concerns. Such circumstances demand robust detecting techniques to detect the species of meat. Methodologies were standardized to identify pork, beef, carabeef, mutton, chevon, chicken, duck and dog using species-specific DNA markers of mitochondrial origin. Also, the amplification of species-specific marker of D-loop was carried out to detect pork in raw meat from different breeds/varieties of pig, processed and meat mixtures containing varying concentrations of pork. Further, the species-specific marker for pork was tested in raw meat from different breeds/ varieties as well as in processed pork products.



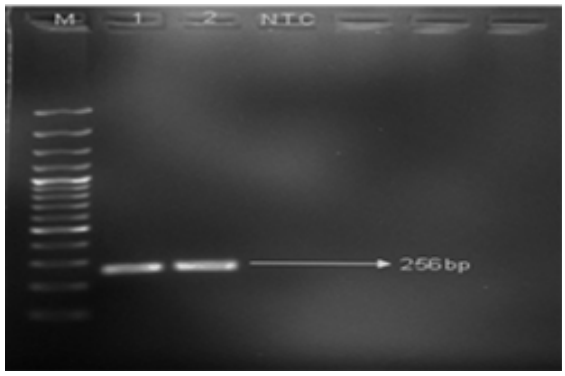
PCR amplification of DNA from different breeds/varieties of Pig with species-specific marker. The lanes are M= 100 bp DNA ladder, N= Non template control, 1= Hampshire, 2= Yorkshire, 3= Ghungroo, 4= Duroc, 5= Rani and 6= Asha.



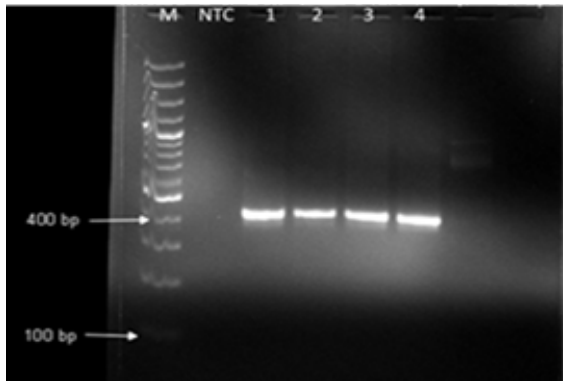
PCR amplification of DNA from different breeds/varieties of Pig with species-specific marker. The lanes are M= 100 bp DNA ladder, N= Non template control, 1= Hampshire, 2= Yorkshire, 3= Ghungroo, 4= Duroc, 5= Rani and 6= Asha.



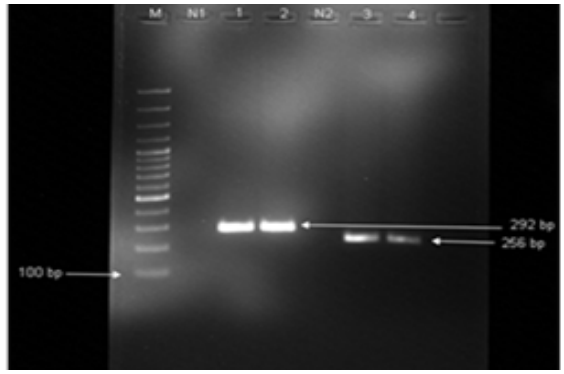
PCR amplification of Beef and Carabeef specific D-loop region of mDNA. The lanes are M= 100 bp ladder, NTC1 & 2= Non template controls, 1 &3= Beef DNA, 4-5= Carabeef DNA.



PCR amplification of mutton specific D-loop region of mitochondrial DNA fragment. The lanes are M= 100 bp DNA ladder, NTC= Non template control, 1 & 2= Sheep DNA.



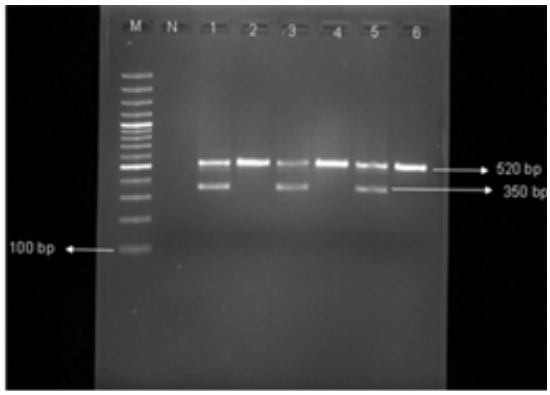
PCR amplification of Chevonspecific D-loop region of mitochondrial DNA fragment. The lanes are M= 100 bp DNA ladder, NTC= Non template control, 1-4 = PCR product obtained from Chevon DNA



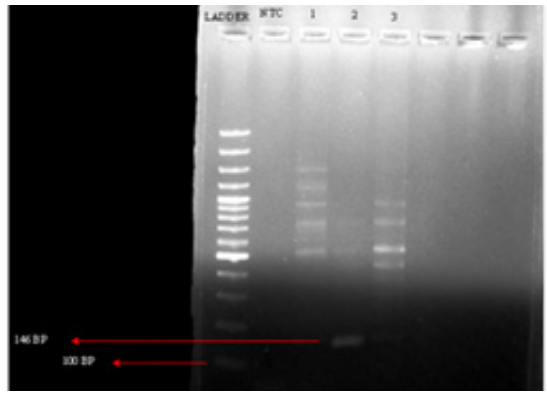
PCR amplification of Chicken and Duck specific D-loop region of mit. DNA fragment. The lanes are M= 100 bp DNA ladder, N1 & N2= NTC, 1 & 2= Duck DNA, 3 & 4= Chicken DNA

3. Sex Identification in Pig and Cattle using Polymerase Chain Reaction Amplification of the Amelogenin and Sex-determining Region Y (SRY) Genes

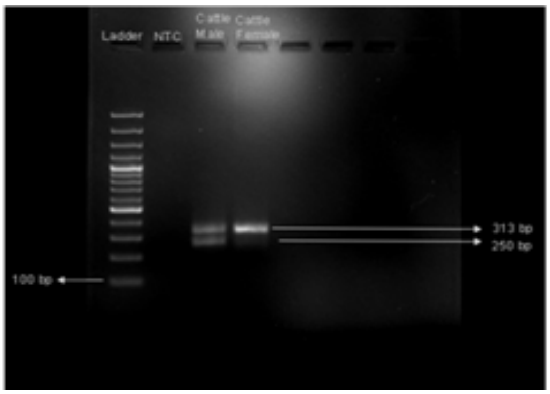
Sex identification methods include cytogenetic analysis, detection of H-Y antigen, measurement of X-linked enzymes before Barr body formation and Y-chromosome-specific probes. PCR-based systems for sex identification in various mammalian species involved amplification of the Amelogenin gene (AMEL) and the Sex-determining Region Y (SRY) gene. In most mammals, copies of AMEL are present on both the X (AMELX) and Y (AMELY) chromosomes and differences in the introns of these two alleles enable them to be distinguished from each other. The X- and Y-chromosome-specific sequences for AMEL have been incorporated into methods of sex identification for Cattle, Buffalo, Pig etc. The use of AMEL in PCR-based methods has simplified sex identification, because a single primer set can amplify both chromosome-specific forms of the gene. Sex identification can also be achieved by using PCR based method with sex-determining region Y (SRY) gene. SRY gene is Y chromosome specific. Within SRY, there is a conserved motif which is homologous with the high mobility group protein, HMG box. This domain of 70 residues, the HMG box, is characteristic of DNA binding proteins. Mutations at this site are associated with sex-inversion. Thus, sex identification of Cattle and Pig were done involving amplification of AMEL gene and HMG box.



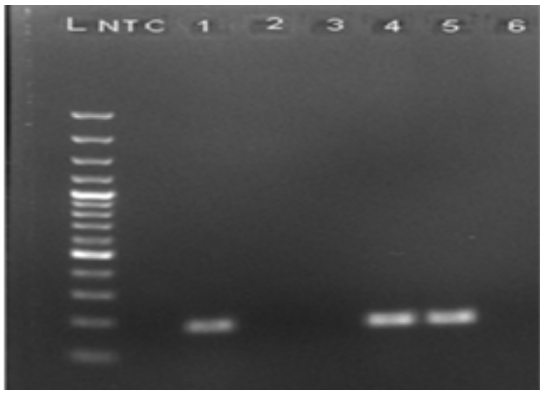
Boar and sow DNA with AMEL primer: 1. Gh (M), 2. Gh (F), 3. Rani (M), 4. Rani (F), 5. Yorkshire (M) and 6. Yorkshire (F)



Boar and sow DNA with SRY primer: 1&3 – Sow and 2. Boar



Cattle DNA with AMEL primer: 1. Male, 2. Female



Cattle DNA with SRY primer: 1,4 &5- Male and 2,3&6-Female

4. Determination of heavy metal profiles in meat, feed and water by Atomic Absorption Spectroscopy

Detection of heavy metals viz. tin, lead, cadmium, arsenic and mercury present in differentmatrixes especially in meat, feed and water was carried out by using GBC Atomic Absorption Spectroscopy (AAS), Savant AA model.Meat from different species, and different parts of carcass (liver, kidney etc.), feed and water samples were collected from different states of India for analysis.

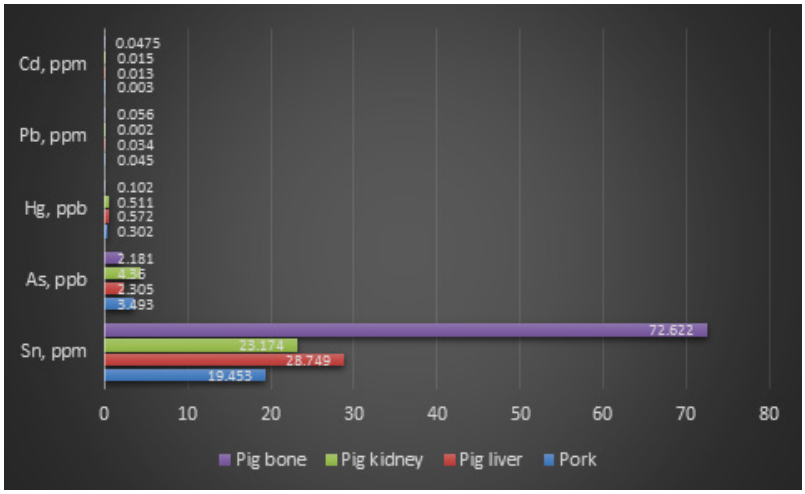


Fig. Level of different heavy metals in pork, liver, kidney and bone (n1-89, n2-31, n3-26 and n4-9)

EXTENSION

Institute Project: Fostering the adoption of scientific pig production practices among small holders in Assam (Project code: IXX14969)

Misha Madhavan M, Keshab Barman, Mohan N. H., Santanu Banik, R. Thomas, Seema R. Pegu and Sunil Kumar

This project aims the assessment of adoption rate of different scientific pig production practices among the small holders in Assam. It also intends to see the difference in knowledge and adoption of farmers after carrying out some educational interventions for them through field experiment method. During the period of report, a video script was prepared including all the scientific pig production practices in three languages i.e, English, Hindi and Assamese. Then

the video shooting was carried out at the institute farm as well as in the farmer's fields at Kamrup Rural District and Nalbari District of Assam. It was ensured that all the scientific practices were covered in the video. The dubbing part was also done. This video will be used as an educational tool for enriching the knowledge of farmers in the field.

As per the plan of action, a total of 72 scientific practices applicable to small holders were identified through the literature review. The scientific practices were arranged under 7 major dimensions as breeding, management, feeding, housing, health care, hygiene maintenance and bio security measures. The collected statements on scientific pig production were given to 12 experts for seeking opinion regarding the suitability for using in the adoption index. The Relevancy Weightage (RW) and Mean Relevancy Score (MRS) were calculated for each statement with the responses obtained. The 15 statements with RW<0.75 and MRS<2.25 were removed. As per the response obtained, some new statements were added and edited to get the final list.

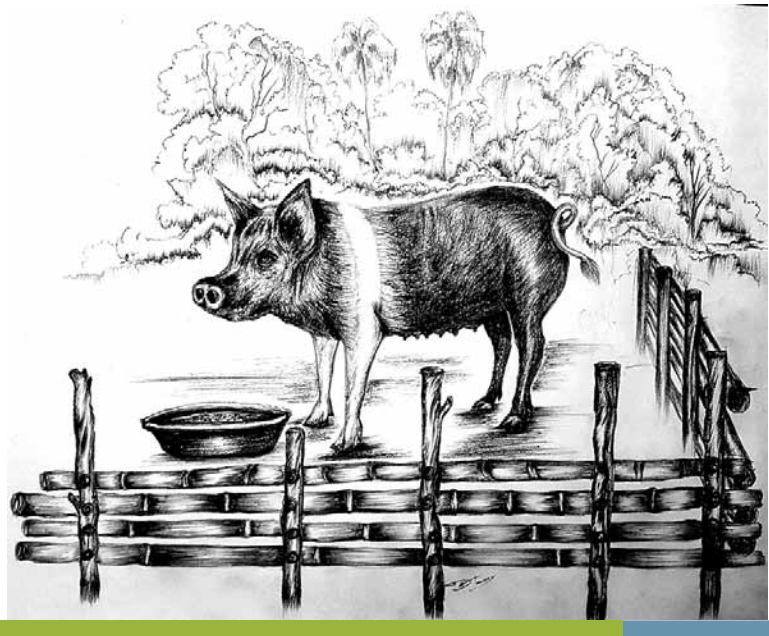
A knowledge test was developed for measuring the knowledge of farmers on scientific pig production practices. A semi-structured interview schedule was also prepared for the baseline survey. Codes for each variable were made after thorough literature review. Pre-testing of the prepared interview schedule was done from 30 respondents belong to non sampled villages. Necessary modification was done in the schedule after that. By using Open Data Kit (ODK) software the interview schedule was prepared in ODK build to enable the data collection with tablet. The base line data collection was started in three districts Kamrup, Goalpara and Baksa through personal interview method.

Glimpses of data collection

NASF project: Pork marketing chains in North East India for sustainable livelihood of tribal women (Assam, Meghalaya and Nagaland) (Project code: OXX04734)

Misha Madhavan M.

This is a collaborative project funded by National Agricultural Science Fund. This project aims to analyse pig/pork price determinants and to estimate the critical points to indicate the efficiency of value chain. The other objectives includes, assessment of the factors that pose challenges/health risk to women in participating in pork value chain, formulate an action plan and framework for tribal women to generate sustainable livelihood and economic empowerment with the family by participating in pork value chain and to design customized knowledge products and implement on pilot scale in one district of each state and assess their outcome. This is a three year project started from 1st December, 2019.



NAIF Scheme
ITMU & ABI

ITMU Project: Institute Technology Management Unit (Plan Scheme "NAIF" of ICAR)

Institute Technology Management Committee

Members	Position in ITMCR
Dr.S. Rajkhowa, Director (Acting)	Chairman
Dr. Santanu Banik, Principal Scientist	Member
Dr. Keshab Barman, Principal Scientist	Member
Dr. R. Thomas, Senior Scientist & PI, ABI	Member
Dr. Sunil Kumar, Scientist	Member
Shri. P.K. Nayak, AF&AO	Member
Shri. Uttam Prakash, AAO	Member
Dr. P.J. Das Senior Scientist	Member Secretary

IP Portfolio

IPRs	Application/ Registration No.	Name of Innovation/ Technology/ Product/ Plant Variety	Date of application Filed/ submitted	Date of Application Granted/ Registered
Patent	TEMP/E-1/9996/2019-KOL	Method for capturing goat iris image for individual identification of a goat	11.03.2019	Awaited
	296345	A portable insulated container for packaged meat	29.12.2009	Final Patent granted on 27.04.18
	201631026604	Pig hair based bio-composite and a method for its preparation	04.08.2016	Application filed (FER replied in 2019)
	879/KOL/ 2012	A primer composition for molecular sex typing in pigs and methodology	08.08.2012	Pending Submitted to Patent Office (FER received and reply in process-2019)
	319634	A corral apparatus and method for transport of animals	29.12.2009	Final. Patent granted on 31.08.2019
Trademarks	One	-	20.12.2019	Processed
Copyrights	Nine	-	20.12.2019	Processed

OUTREACH ACTIVITIES

Sl. No.	Programme Organized for Technology Commercialize/ Transfer	Number of Participants	Venue of Event	Remarks
1	One day work shop on sensitization workshop on Technology commercialization / Licensing"	30	ICAR-National Research Centre on Pig.	16-12- 2019
Other initiative taken for commercialization				
1	International Seminar on "Animal Agriculture for Doubling Farmers' Income - Technology, Policy and Strategy opinions" on 27th-28th February, 2019.	Exhibition	College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Assam.	Exhibition of Institute Technology
2	ASC-Expo at Mela Ground of IARI, New Delhi from 20-24 February 2019. (Exhibition)	Exhibition	IARI, New Delhi	Exhibition of Institute Technology

CAPACITY BUILDING IN IP MANAGEMENT

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.	Review Committee Meeting of National Agriculture Innovation Fund (NAIF) at NASC, New Delhi.	ICAR	4th & 5th October 2019	Dr. R. Thomas
2.	National Agri-Business Entrepreneurship Conclave" held at ICAR-RC for NEH, Umiam .	ICAR-RC for NEH, Umiam	9th-11th February 2019	Dr. S. Rajkhowa Dr. R. Thomas
3	E-Varaha: Information System for Safe Pork Production in North Eastern India. ITRA-Startup, Workshop and Technology Showcase of ITRA, New Delhi.	Information Technology Research Academy *(ITRA), Govt. of India, New Delhi*	21st-23rd July, 2019	Dr. P. J. Das

4	Eight week Entrepreneurship Bootcamp (virtual)	TiE Delhi-NRC for ITRA, Digital India Corporation, New Delhi	July-September 2019	Dr. P. J. Das
5	One day ABI-orientation Workshop	ICAR-National Research Centre on Pig	1st Oct, 2019	All scientist staff of ICAR-NRCP
6.	National Livestock & Poultry Show in Guwahati.	Animal Husbandry & Veterinary Department & Assam Livestock & Poultry Corporation	7th to 10th Nov. 2019	All the Scientific and Technical Staff of the institute

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.	Workshop on Intellectual Property Rights and Biodiversity Laws	19-20th Feb. 2019	60	Scientist/Faculty

ABI Project: Establishment of Agri-Business Incubation (ABI) Centre (Plan Scheme "NAIF" of ICAR)

ABI Management Committee

Members	**Position in ABI Committee**
Dr.S. Rajkhowa, Director (Acting)	Chairman
Dr. Santanu Banik, Principal Scientist	Member
Dr. Mohan N.H., Principal Scientist	Member
Dr. P.J. Das, Senior Scientist & PI, ITMU	Member
Dr. Juwar Doley, Scientist	Member
Dr. Misha Madhavan, Scientist	Member
Dr. G. Kadirvel, Principal Scientist, ICAR-RC, NEH, Umiam	Member
Dr. B.K. Bhattacharjya, Principal Scientist & Head, CIFRI, Guwahati	Member
Shri. P.K. Nayak, AF&AO	Member
Shri. Uttam Prakash, AAO	Member
Dr. R. Thomas, Senior Scientist & PI, ABI	Member Secretary

ICAR-National Research Centre on Pig, Rani, Guwahati has created a state-of-the-art Agri-business Incubation Centre to support operations on technology based business projects. The facility has incubation space for 08 incubatees, a meeting room and utility space. The incubation space is well equipped with computers and accessories with internet connectivity for running the office activities of the incubatees. The meeting room provides a very good space for the entrepreneurs to meet and interact with the investors and scientists. The Agri-Business Incubation (ABI) Centre on ICAR-National Research Centre on Pig, Rani, Guwahati was formally inaugurated by Dr. Trilochan Mohapatra, Secretary (DARE) & Director General (ICAR) on 24th November, 2019 in presence of Dr. Joykrushna Jena, Deputy Director General (Animal Science) and other dignitaries from ICAR. ABI Centre is providing all the necessary support to the entrepreneurs to validate and upscale the technologies and encourage their reach to the end user for an attractive business proposition. ABI Centre is also facilitating the innovator and the researchers to turn their ideas into commercial venture. The centre focuses on incubation and business development programmes, including entrepreneurship skill development activities.

Inauguration of ABI Centre of ICAR-NRCP by Dr. Trilochan Mohapatra , Secretary (DARE) & Director General (ICAR)

Five numbers of technology transfer agreements were signed with four numbers of entrepreneurs namely, M/s Arohan Foods Pvt. Ltd, Guwahati; M/s Symbiotic Foods Pvt. Ltd, Tezpur; M/s Sayuri Farms, Guwahati and M/s Amora Foods, Guwahati on 24th November, 2019 in presence of Dr. Trilochan Mohapatra, Secretary (DARE) & Director General (ICAR). The technology transfer agreements were envisaged to provide the necessary support for validation and up-scaling of technologies and encourage their reach to the user as an attractive business proposition. The agreement also focus 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 by finding doors to unexplored markets. Through these agreements, the ABI 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.

Transfer of Technology to the entrepreneurs inducted in the ABI

Dr. Trilochan Mohapatra, Hon'ble Secretary (DARE) and DG (ICAR), also unveiled the rural pig slaughter house technology developed by ICAR-NRCP and popularized by Arohan Foods Pvt Ltd. The technology offers the meat handlers in the rural areas to perform off- floor dressing operations to ensure better hygienic status for the final produce as per guidelines of Food Safety and Standards Authority of India at an affordable cost.

1. 'Orientation workshop' for the ABI incubatees organized

ICAR-National Research Centre on Pig has organized a one day Orientation Workshop on 01st October, 2019 for the newly inducted entrepreneurs under the Agri-Business Incubation Unit. The workshop was attended by 12 companies who have participated in the 'call for Expression of Interest (EoI) for Incubator support through Agri-Business Incubation (ABI) centre'. Thorough discussions were held on different aspects of Agri-Business, viz. Agri-Entrepreneurship scenario in India; ABI support mechanism to promote Agri-Business; and sources of funds and access to finance for entrepreneurs. The workshop was followed by one to one interaction with each of the newly inducted entrepreneurs for streamlining their business proposals.


Glimpses from the orientation workshop

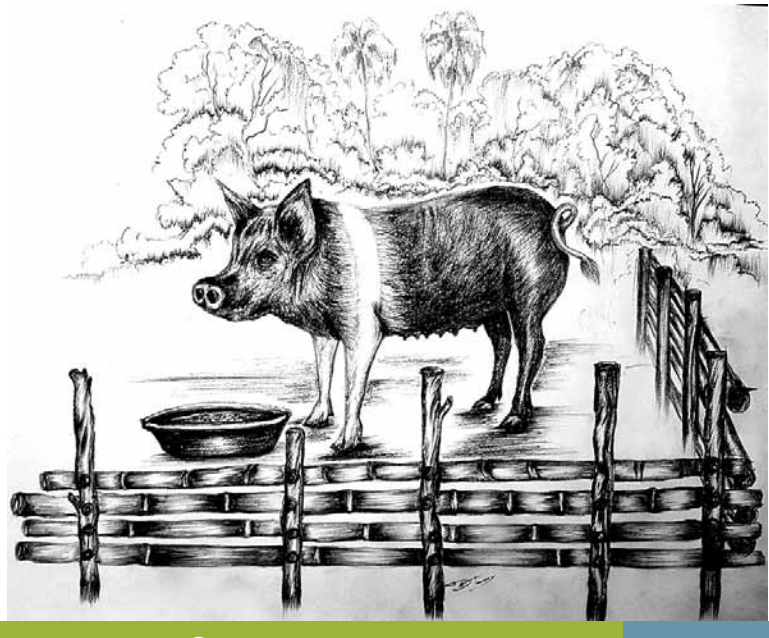
2. Workshop on 'Sensitization on Technology Commercialization Licensing' in collaboration with *Agrinnovate*

The Agri-Business Incubation (ABI) Centre of ICAR-National Research Centre on Pig, Rani, Guwahati organized a one day 'Sensitization Workshop on Technology Commercialization and Licensing' in collaboration with Agrinnovate India Limited, New Delhi on 16th of December 2019. Agrinnovate India Ltd was represented by Dr. Sudha Mysore, CEO and Shri. Amit Kalkal, Business Manager. Detailed discussions were held on 'Technology commercialization and incubation in the NARS system' and Technology transfer process through Agrinnovate India Ltd'. Dr. Sudha Mysore briefed the house about the various steps taken by ICAR in protecting, managing and commercializing the intellectual properties generated out of the research activities through establishment of ITMUs, ZTMCs, BPDs and ABIs etc. Thorough discussions were held on the factors to be considered for valuation and price fixation of technologies; technology disclosure process; revised guidelines regarding technology commercialization, licensing, contract research and consultancy projects; and the process flow for technology transfer through Agrinnovate India Ltd. for commercialization.


Sensitization workshop on technology commercialization licensing

Incubatee profile under ABI unit

Sl no.	Company Name/ Individual	Location Of Business Enterprise	Area of Institutional Support	Brand Name
1	Arohan Foods Pvt Ltd	ZN Road, Geetanagar, Kamrup- 781021	Commercial pig Breeding Farm, Establishing Pork Processing Units, Establishing rural slaughter houses	Choice Pork, Daily Pork
2	Amora Foods Pvt Ltd	Lokhra Road, Guwahati, Assam- 781090	Establishing Pork Processing Units	International House of Sausages
3	Sayuri Farms	Betkuchi, NH 37, Lokhra, Guwahati-34	Establishing Commercial Breeding Farm, Establishing Pork Processing Units	Pigzee's
4	Symbiotic Foods Pvt Ltd	Sonitpur, Assam- 784105	Establishing Artificial Insemination support, Establishing Pork Processing Units	--
5	Northeast Livestock Farming Pvt Ltd	Pauri, Garhwal, Uttrakhand- 246149	Establishing Pork Processing Units	--
6	Nirab Medhi	Fatashil, Guwahati, Assam- 781009	Assistance in setting up a pork processing plant	--
7	Borluit Farms	Dispur, Guwahati- 781005	Establishing a small processing unit, Establishing a small scale pork processing unit	--



Institute Village Linking Programme Under Tribal Sub-Plan

INSTITUTE VILLAGE LINKING PROGRAMME UNDER TRIBAL SUB-PLAN

Keshab Barman, S. Rajkhowa, BC Das, S. Banik, Mohan NH, Rafiqul Islam, P.J. Das, R. Thomas, S.R. Pegu, Jower Doley, Rajib Deb, Sunil Kumar, Souvik Paul, Kalyan De, Ajay Yadav, Satish Kumar, Jaya and Misha Madhavan M.

The people living in the North Eastern Region are mostly non-vegetarian and the tribal sub section of the population relish on pork and pork products. Almost every family in this tribal area maintains few pigs (3-10 nos.) for support of their livelihood. About 40 % of the total pig population (9.06 million, Livestock Census, 2019) of the country is in the North Eastern Region. The ICAR-National Research Centre on Pig is situated in Tribal area at Rani in the District of Kamrup (Rural). The institute is dedicating its services for the welfare of the tribal community with the mandate of bringing up excellence in pig production not only in the North Eastern Region, but in the country as a whole where pig loving population are living. Therefore, all the institute activities are directly or indirectly related to the welfare of the tribal communities for which the budgets are streamlined.

The institute is providing breedable piglets of 2-3 months of age along with concentrate feed (1kg/pig) and supplements on monthly basis under the TSP plan of the institute to the tribal beneficiaries. The Institute is monitoring health, growth and management of the pigs in the adopted villages regularly and giving necessary health coverage and AI services as and when required.

Adopted villages by ICAR-NRC on Pig

At present ICAR-NRC on Pig is adopting 07 numbers of villages namely Moirapur, Ganapati, Sajjanpara, Kumarbari, Garopara under Rani Block, Gossaihat village under Zarobori block of Kamrup district and Khara Par II village under Dudhnoi block of Goalpara district of Assam.

TSP programme conducted during the reported period:

List of health camps and awareness programme and other distribution programme conducted during 2019-2020

Sl. No	Programmes	Date	Activities	No of piglets	Numbers of farmers benefited
1	Conduction of Pig health and awareness programme at Johing Gaon of North Lakhimpur District of Assam	14-02-19	200 doses anthelmintic 200 doses ointment 200 doses swine fever vaccine	-	80
2	Conduction of Pig health and awareness programme at Tingri village, Gogamukh, Dhemaji District of Assam	15-02-19	200 doses anthelmintic 200 doses ointment 200 doses swine fever vaccine	-	100
3	Conduction of Pig health and awareness programme at Tezpur in Sonitpur District of Assam	16-02-19	35 doses anthelmintic 25 doses ointment	-	50

4	Feed distribution programme under TSP held on 03-04-19 for tribal beneficiaries of Sattargaon, Sajjan Para village, Pitbari, Thangapara village, Rani, Kamrup district, Assam	03-04-19	➢ 810 kg pig feed was distributed among the beneficiaries	-	42
5	Distribution of items under TSP programme of the Institute	10-05-2019	➢ Infrared thermometer ➢ Weighing balances	-	50
6	Feed distribution programme under TSP held on 16-05-19 for tribal beneficiaries of Sattargaon, Sajjan Para village, Pitbari, Thangapara village, Rani, Kamrup district, Assam	16-05-19	➢ 810 kg pig feed was distributed among the beneficiaries	-	42
7	Conduction of piglet and feed distribution programme at Goalpara	29-05-19	➢ 300 kg pig feed have been distributed ➢ Anthelmintic, ointment have been distributed	➢ 10 numbers of crossbred piglets	40
8	Piglets and Feed distribution programme under TSP held on 20-08-19 for tribal beneficiaries of Sajjanpara, village, Belguri village, Rani, Kamrup district, Assam	20-08-19	➢ 210 kg pig feed was distributed among the beneficiaries	7 numbers of crossbred piglets	13
9	Piglets and Feed distribution programme under TSP held on 23-08-19 for tribal beneficiaries of Mairapur, Sattargaon, Ganapati, Sajjanpara village, Rani, Kamrup district, Assam	23-08-19	➢ 900 kg pig feed was distributed among the beneficiaries	30 numbers of crossbred piglets	32

10	Feed distribution programme under TSP held on 7-08-19 for tribal beneficiaries of Sattargaon, Jonaki SHG Group Vill Pitbari, Surjyamukhi SHG of Thangapara village, Oikantic SHG of Ganapati Village, Surjyamukhi SHG of Sajjanpara village Rani, Kamrup district, Assam	07-08-19	➢ 810 kg pig feed was distributed among the beneficiaries	-	49
11	Piglets and Feed distribution programme under TSP held on 04-09-19 for tribal beneficiaries of Gossaihat village of Zarobari block, Rani, Kamrup district, Assam	04-09-19	➢ 150 kg pig feed was distributed among the beneficiaries	8 crossbred piglets	01
12	Distribution of items under TSP programme of the Institute Beneficiaries from village Sajjanpara, Mairapur village and Gossaihat village of zarobari	4-9-2019	➢ Weighing balances-02 of 1000 kg capacity each ➢ Weighing balances-01 of 200 kg capacity	-	03
13	Feed distribution programme under TSP held on 7-08-19 for tribal beneficiaries of Sattargaon, Jonaki SHG Group Vill Pitbari, Surjyamukhi SHG of Thangapara village, Oikantic SHG of Ganapati Village, Ma Manasha SHG of Morapur Village, Surjyamukhi SHG of Sajjanpara village Rani, Kamrup district, Assam	07-08-19	➢ 1140 kg pig feed was distributed among the beneficiaries	-	61
14	Feed distribution programme under TSP for tribal beneficiaries of village Belguri and Sajjanpara	20-08-19	➢ 210 kg pig feed was distributed among the beneficiaries	-	13

15	Feed distribution programme under TSP for tribal beneficiaries of village Ganapati, Belguri, Sajjanpara, Mairapur	23-08-19	➢ 900 kg pig feed was distributed among the beneficiaries	-	37
16	Feed distribution programme under TSP for tribal beneficiaries of Sattargaon, Pitbari, Thangapara village, Ganapati Village, Moirapur Village, Sajjanpara village and Sattargaon	19-09-19	➢ 1140 kg pig feed was distributed among the beneficiaries	12 crossbred piglets (returned back from Jonaki and Suryamukhi SHG)	61
17	Feed distribution programme under TSP for tribal beneficiaries of Gossaihat village	05-10-19	➢ 150 kg pig feed was distributed among the beneficiaries	-	01
18	Feed distribution programme under TSP for tribal beneficiaries of Gossaihat village	05-11-19	➢ 150 kg pig feed was distributed among the beneficiaries	-	01
19	Feed distribution programme under TSP for tribal beneficiaries of Ganapati Village, Moirapur Village, Sajjanpara village	16-11-19	➢ 1350 kg pig feed was distributed among the beneficiaries	-	37
20	Feed distribution programme under TSP for tribal beneficiaries of Garopara village	07-12-19	➢ 210 kg pig feed was distributed among the beneficiaries	-	12
21	Feed distribution programme under TSP for tribal beneficiaries of Gossaihat Village, Thangapara, Moirapur Village, Kumarbari and Sajjanpara village	21-12-19	➢ 1740 kg pig feed was distributed among the beneficiaries	-	49
22	Feed distribution programme under TSP for tribal beneficiaries of Sattargaon, Gossaihat, Kumarbari village, Garopara, Ganapati Village, Moirapur Village, Sajjanpara village	29-01-2020	➢ 1920 kg pig feed was distributed among the beneficiaries	-	62
23	Piglets and Feed distribution programme under TSP for tribal beneficiaries of Nalbari village	14-02-2020	➢ 180 kg pig feed was distributed among the beneficiaries	03 piglets	01

24	Pig health and awareness programme at Simla, Baksa district of Assam	02-11-2019	➢ 250 doses anthelmintic ➢ 100 doses ointment ➢ Swine fever vaccine: 250 ➢ Mineral mixture-50 kg	-	200
25	Pig health and awareness programme at Village Khatikuchi, Nalbari district of Assam	29-11-2019	➢ 200 doses anthelmintic ➢ 100 doses ointment ➢ 200 doses swine fever vaccine ➢ Mineral mixture-25 kg	-	200
26	Pig health and awareness programme at Village Ganapati, Kamrup district of Assam	24-12-2019	➢ 50 doses anthelmintic ➢ 50 doses ointment ➢ 50doses swine fever vaccine ➢ Mineral mixture-10 kg	-	50
Total			13080 kg	70	1487

Capacity building programme organized under TSP:

SN	Name of the training	Date	Sponsored by
1	Good Management Practices for pig farming	5-9th August 2019	Institute Sponsored
2	Good Management Practices for pig farming	14-18th Oct. 2019	Institute Sponsored
3	Training on Artificial insemination in Pig under TSP for the farmers of Baksa district	07-03-2020	Institute Sponsored
4	Pig health and awareness programme at Simla, Baksa district of Assam	02-11-2019	Institute Sponsored
5	Pig health and awareness programme at Village Khatikuchi, Nalbari district of Assam	29-11-2019	Institute Sponsored
6	Pig health and awareness programme at Village Ganapati, Kamrup district of Assam	24-12-2019	Institute Sponsored
7	Pig health and awareness programme at Village Khara Part II, Dudhnoi, Goalpara district of Assam	15-02-2020	Institute Sponsored

Farmers benefited under TSP during 2019

Sl No	Indicator activities	No of Beneficiaries	Outcome
1	Capacity building programme: Training/demonstration/awareness/ orientation programmes, scientist-farmers' interaction etc	600 tribal families benefited	Improved knowledge of participants towards scientific Pig production and management
2	Technical guidance, input support and follow up on scientific pig farming practices at Kamrup, Baksa and Goalpara districts	700 tribal families benefited	Improved production performances of pigs
3	Distribution of pig feed in tribal areas of adopted villages	350 tribal families benefited	Improved nutritional status of pigs and production
4	Distribution of swine fever vaccine and anthelmintic for pig in tribal areas of adopted villages	550 tribal families benefited	Improved health status of pigs
5	Distribution of mineral mixture in tribal areas of adopted villages	350 tribal families benefited	Improved nutritional status of pigs and production
6	Awareness programme on Scientific pig husbandry practices including animal health camp at tribal villages	450 tribal families benefited	Improved knowledge of participants towards scientific Pig production and management
7	Artificial Insemination at tribal villages	09 tribal families benefited	Improved the production performance by improving the genetic make of local pigs
8	Distribution of piglets	40 tribal families benefited	Increased the self employment of tribal farmers

Distribution of piglets, pig feed, feed supplements, medicine, vaccines, numbers of AI among tribal farmers, no of samples screen for diseases and facilities created in tribal areas during 2019-2020

Sl. No.	Description	Unit	Total
1	Capacity building programme: Training/demonstration/ awareness/ orientation programmes, scientist interaction etc	Number	38
2	Technical guidance, input support and follow up on scientific pig farming practices at Kamrup, Goalpara, Nalbari, Jorhat, Dhemaji, Lakhimpur, Barpeta, Udalguri, Darrang and Baksa districts of Assam	Number	1500
3	Distribution of pig feed	Kg	13080
4	Distribution of mineral mixture	Kg	135
5	Distribution of swine fever vaccine	Dose	800
6	Distribution of anthelmintic for pig	Dose	800
7	distribution of piglets	No	70

Institute Village Linking Programme Under Tribal Sub-Plan

Glimpses of programs conducted under TSP

Significant achievement/Success stories under TSP programme of the Institute

Success stories 1.

- Suryamukhi Self Help Group (Mrs. Sabita Rabha President and Mrs. Swapna Rabha, Secretary), Vill: Thangapara, Sikarhat, Rani, Kamrup, Assam had signed a MoU with ICAR-NRC on Pig on 21st day of March 2018 and had receipt 5 numbers of Rani crossbred female piglets (2-3 months of age) and one male piglets along with fifty percent pig feed and other health support from the Institute for 1 year under the TSP programme of the Institute. During the first farrowing from 2 sows they got 15 numbers of piglets. Out of which 6 numbers (five female and one male) piglets had returned back to ICAR-NRC on Pig as per the MoU and same was given to another SHG group namely Bishnujyoti SHG of village Kumarbari, Rani on 19th September 2019. They got total Rs. 61900/- from the sale of 2 female sows after first farrowing and 3 piglets. Now they have 4 adult female out of which 3 are pregnant and will be farrowed within 2 months. They had also additional income from the fishery pond as the piggery farming is integrated with fishery. Their initial before intervention and after intervention income chart shown below:

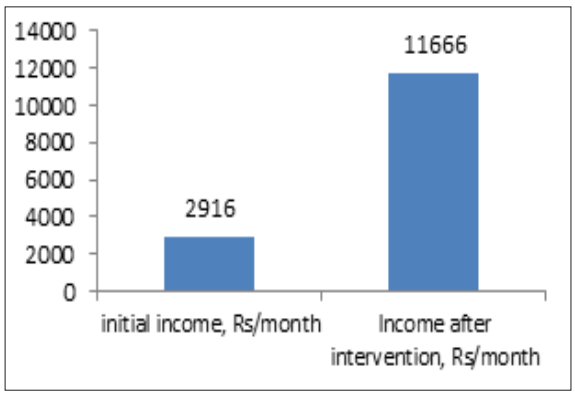


Fig. Before intervention and after intervention income (Rs./Month) chart of Suryamukhi Self Help Group

Success stories 2.

- Jonaki Self Help Group (Mrs. Mamani Rabha President and Mrs. Minati Kalita Rabha, Secretary), Vill: Pitbari, Sikarhat, Rani, Kamrup, Assam had signed a MoU with ICAR-NRC on Pig on 21st day of March 2018 and had receipt 5 numbers of Rani crossbred female piglets (2-3 months of age) and one male piglets along with fifty percent pig feed and other health support from the Institute for 1 year under the TSP programme of the Institute. During the first farrowing from 2 sows they got 15 numbers of piglets. Out of which 6 numbers (five female and one male) piglets had returned back to ICAR-NRC on Pig as per the MoU and same was given to another SHG group namely Bishnujyoti SHG of village Kumarbari, Rani on 19th September 2019. They got total Rs. 61900/- from the sale of 2 female sows after first farrowing and 3 piglets. Now they have 4 adult female out of which 3 are pregnant and will be farrowed within 2 months. They had also additional income from the fishery pond as the piggery farming is integrated with fishery. Their initial before intervention and after intervention income chart shown below:

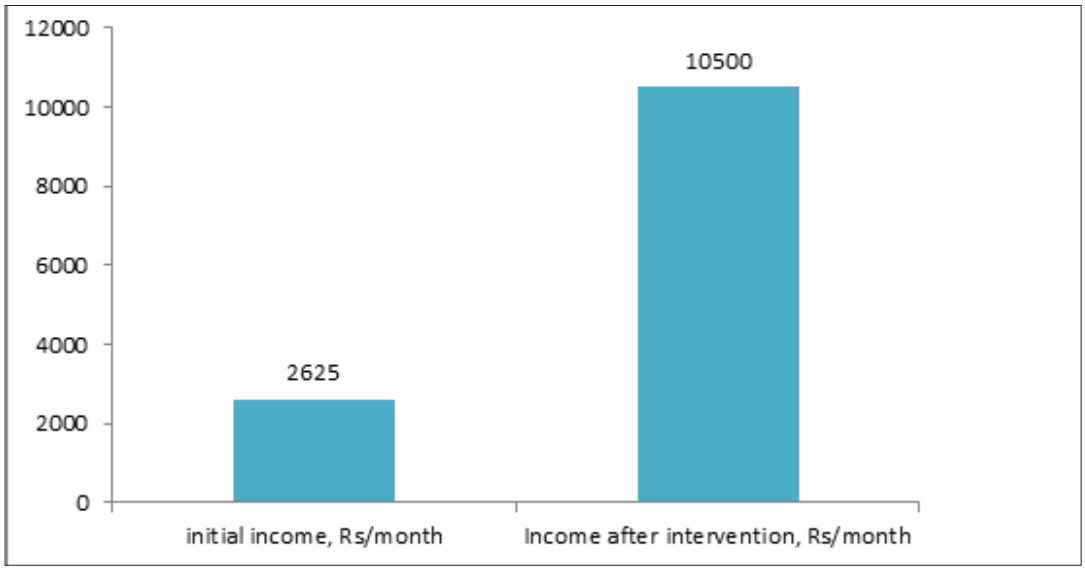


Fig. Before intervention and after intervention income (Rs./Month) chart of Jonaki Self Help Group

Success stories -3

- Mrs. Ramilla Rabha of village Belguri, Rani, Kamrup, Assam had received two Rani female piglets of 2-3 months of aged from ICAR-NRC on Pig on 21st day of March 2018 along with fifty percent pig feed and other health support from the Institute for 1 year under the TSP programme of the Institute. During the first two farrowing from 2 sows she got 32 piglets out of which she sold 21 numbers of piglets @ Rs.2500/ per piglets and both the sows and had received Rs.77500/-. Eleven numbers of piglets raised up to the market weight and she sold 5 numbers of pigs and she had received Rs. 54000/- and she have 4 pigs. Out of the 4 pigs one female is now pregnant. All total she had received Rs. 1,31,500.00. She used this money for construction of her home and also for children education. Her initial before intervention and after intervention income chart shown below:

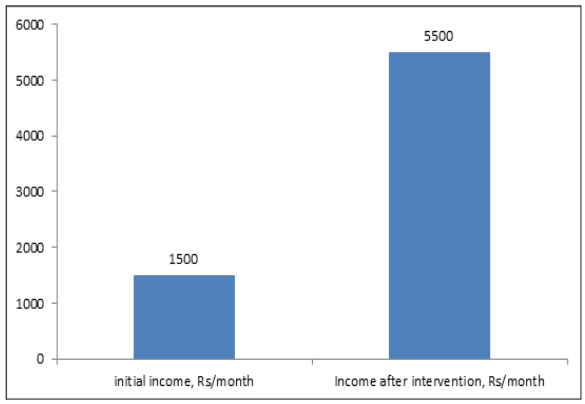


Fig. Before intervention and after intervention income (Rs./Month) chart of Mrs Ramilla Rabha

Success stories -4

- Mrs. Shanti Rabha W/O Satya Rabha of village Batabari, Rani, Kamrup, Assam had received two Rani female piglets of 2-3 months of aged from ICAR-NRC on Pig on October 2015 along with fifty percent pig feed and other health support from the Institute for 1 year under the TSP programme of the Institute. During the first farrowing from 2 sows she got 25 piglets out of which she sold 24 numbers of piglets @ Rs.2500/ per piglets and both the sows and had received Rs.101000/-. Again she had purchased two piglets for breeding purpose and got 20 piglets. After weaning she sold the piglets @ Rs.2500/- per piglet and sows @ Rs. 13000/- each and all total she received Rs. 76000/-. Now she has one number of castrated male pig. She used this money for construction of her home, pig sty and also for education of her two daughters reading in class VII and Class VIII. Her initial before intervention and after intervention income chart shown below:

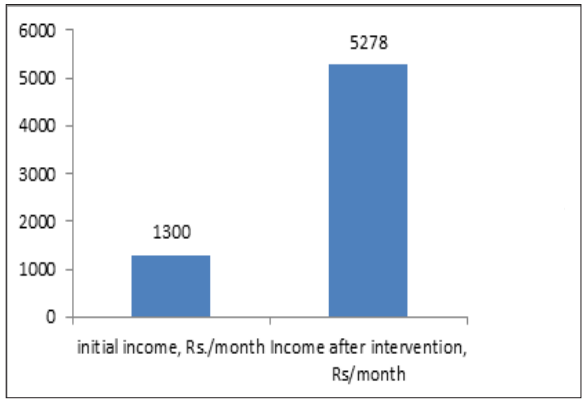


Fig. Before intervention and after intervention income (Rs./Month) chart of Mrs Shanti Rabha

Success stories -5

- Mrs. Putuli Rabha W/O Late Uma Rabha of village Batabari, Rani, Kamrup, Assam had received two Rani female piglets of 2-3 months of aged from ICAR-NRC on Pig on October 2015 along with fifty percent pig feed and other health support from the Institute for 1 year under the TSP programme of the Institute. During the first farrowing from 2 sows she got 19 piglets out of which she sold 16 numbers of piglets @ Rs.2500/ per piglets and both

the sows and had received Rs.70000/-. She raised 3 piglets up to the market weight and sold and had received Rs. 48000/-. All total she had received Rs. 118000/-. Again she has purchased one Rani cross female piglet for breeding purpose and now it is pregnant. She used the money from selling of pigs for construction of her home, construction of pig sty and also for routine home expenses. Her initial before intervention and after intervention income chart shown below:

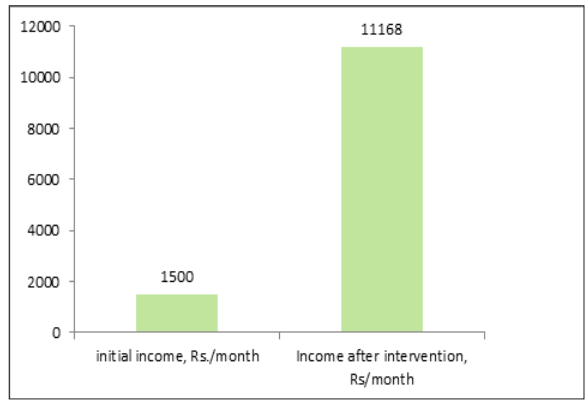


Fig. Before intervention and after intervention income (Rs./Month) chart of Mrs Putuli Rabha

Success stories -6

- Mrs. Sone Boro W/O Late Digen Boro of village Belguri, Rani, Kamrup, Assam had received two Rani female piglets of 2-3 months of aged from ICAR-NRC on Pig in the year 2016 along with fifty percent pig feed and other health support from the Institute for 1 year under the TSP programme of the Institute. She sold the two pigs at the age of 9 months and had received Rs.26000/- . From this she again purchased 2 piglet and raised to the market weight and sold at Rs. 25000/-. Again she has purchased 2 pigs. She used the money from selling of pigs for construction of her home, purchase of one bike for her son. Her initial before intervention and after intervention income chart shown below:

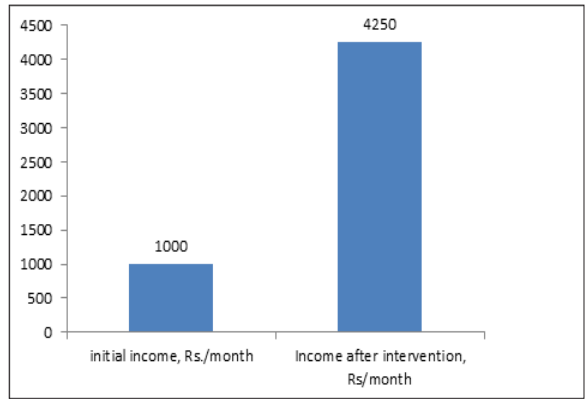


Fig. Before intervention and after intervention income (Rs./Month) chart of Mrs Sone Boro

Success stories -7

- Mrs. Labanya Rabha W/o Jogen Rabha of village Belguri, Rani, Kamrup, Assam had received three Rani female piglets of 2-3 months of aged from ICAR-NRC on Pig in the year 2017 along with fifty percent pig feed and other health support from the Institute for 1 year under the TSP programme of the Institute. She sold the these pigs at the age of 9 months and had received Rs.58000/- . From this she again purchased 4 piglet and raised to the market weight and sold at Rs. 48000/-. Again she has purchased 4 piglets. All total she has received Rs.106000/-. She used the money from selling of pigs for construction of her home and children education. Her initial before intervention and after intervention income chart shown below:

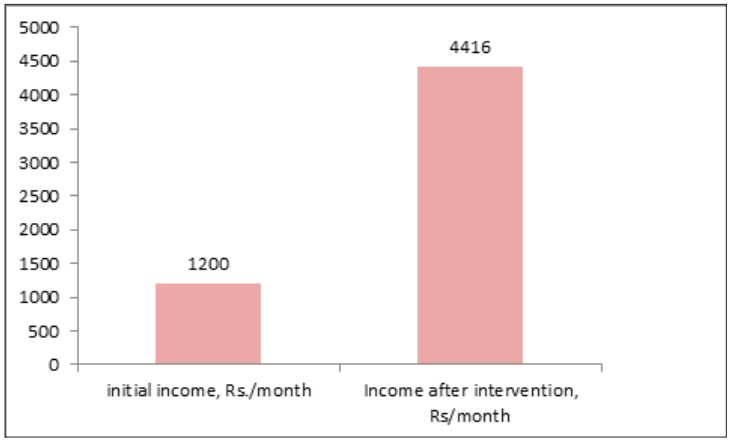


Fig. Before intervention and after intervention income (Rs./Month) chart of Mrs Labanya Rabha

Success stories -8

- Mrs. Gulapi Rabha W/o Prafulla Rabha of village Belguri, Rani, Kamrup, Assam had received two Rani female piglets of 2-3 months of aged from ICAR-NRC on Pig in the year 2016 along with fifty percent pig feed and other health support from the Institute for 1 year under the TSP programme of the Institute. She sold the pigs at the age of 10 months and had received Rs.33000/- . From this she again purchased 2 piglet and raised to the market weight and sold at Rs. 24000/-. Again she has purchased 2 piglets raised to the market weight and sold at Rs. 31000/-. All total she has received Rs.88000/-. She used the money from selling of pigs for construction of her home. Her initial before intervention and after intervention income chart shown below:

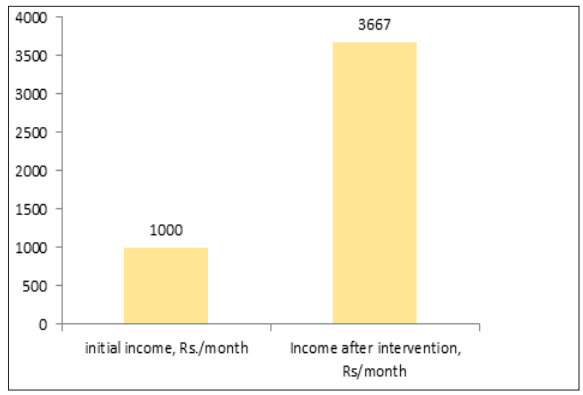


Fig. Before intervention and after intervention income (Rs./Month) chart of Mrs Gulapi Rabha

Success stories 9

- Ikantic Self Help Group (Debeswar Rabha, President and Mr. Ananta Kumar Boro, Secretary), Vill: Ganapatii, Rani, Kamrup, Assam had signed a MoU with ICAR-NRC on Pig on May 2019 and August 2019 had receipt 10 piglets in each period and all total they have received 20 numbers of Rani crossbred piglets (,3 male and 17 female of 2-3 months of age) along with fifty percent pig feed and other health support from the Institute for 1 year under the TSP programme of the Institute. Now, 4 female become pregnant and will be farrowed at the end of January 2020. They have also one pond of 3500 square feet and integrated this pond with one pig unit of two pigs. Recently this SHG group has sold piglets to the tune of Rs. 80000.00. Their initial before intervention and after intervention income chart shown below:

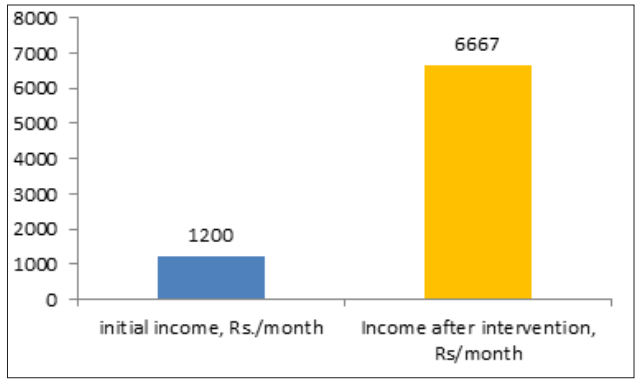
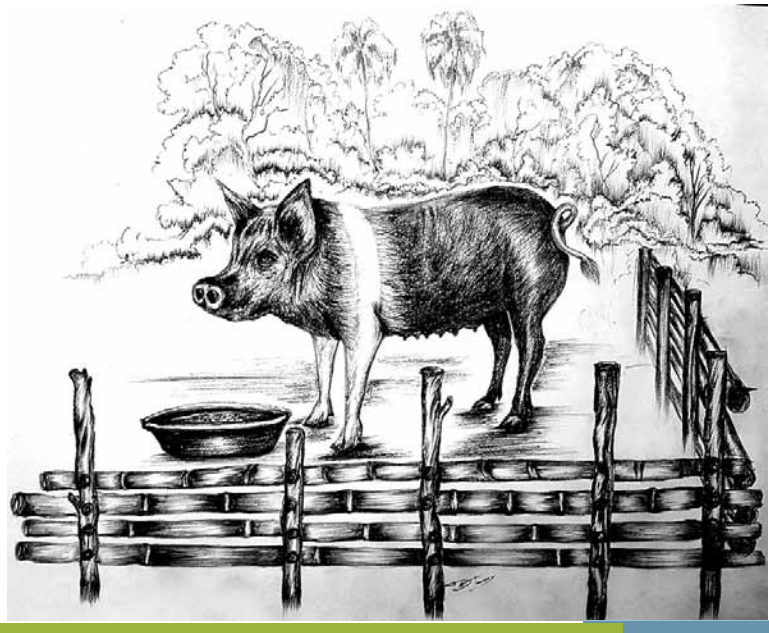


Fig. Before intervention and after intervention income (Rs./Month) chart of Mrs Gulapi Rabha



AICRP and Mega Seed Projects

AICRP AND MEGA SEED PROJECTS

The main objective of AICRP on pig which launched in IVth Five Year Plan (1970-1971) was to study the performance of pigs in different agro-climatic condition of the country. Subsequently the project was mandated to develop region-specific package of practices including quality germplasm. Few centers are mandated for conservation of indigenous germplasm. Presently the programme is continuing in fifteen different centers across the country.

ICAR-National Research Centre on Pig is regularly monitoring the progress of AICRP on Pig project through technical and financial monitoring in consultation with the Council and conduction of review meet. The last AICRP review meet was conducted at ICAR-Research Complex for NEH Region, Umiam, Meghalaya on 27-28th September, 2019.

ASSAM AGRICULTURAL UNIVERSITY, KHANAPARA, GUWAHATI

The AICRP on Pig center of AAU, Khanapara is playing a major role for development of pig production in NE region through various ways like organizing training, awareness program, exhibition, demonstration, distribution of leaflet / booklet etc.This centre has played a significant role in developing piggery sector by selling of quality piglets, elite gilts/ sows and boars to the interested farmers of the state. The center is maintaining HD-K75 crossbred germplasm developed by crossing of Hampshire (75%) and local pig (25%) of Assam.

HD-K75 sow at AICRP center, Khanapara

Distribution of piglets to farmers, Mannuthy

KERALA VETERINARY AND ANIMAL SCIENCE UNIVERSITY, MANNUTHY CENTRE, KERALA

This Center is maintaining Large White Yorkshire, Desi and Mannuthy White crossbred variety developed by crossing of LWY (75%) with local pig of Kerala. The major activities of thecentre are to conduct research on various aspects of pig production, operate as an instructional farm to students, production and distribution of good quality piglets to farmers and to function as a demonstration unit to farmers. Mannuthy White variety developed by the center is well adapted to humid tropical agro-climatic conditions and suited to low input rearing system of Kerala.

SRI VENKATESWARA VETERINARY UNIVERSITY, TIRUPATI

The AICRP on Pig at SVVU Center, Tirupati is maintaining Large White Yorkshire pigs and its crosses (SVVU-T17) under optimum managemental

Regular health care of AICRP on Pig, Tirupati

conditions. The center is also engaged in training, demonstration and distribution of quality germplasm to the field.

ICAR-CENTRAL COASTAL AGRICULTURAL RESEARCH INSTITUTE, GOA

AICRP on pig Goa centre providing knowledge of improved pig production to the pig growers of the region through trainings and demonstrations. Four breeds namely Agonda Goan, The center is maintaining Agonda Goan (Local), Large White Yorkshire and its crosses. The center is performing mass-scale artificial insemination (AI) to the farmers' field for propagation of quality germplasm.

Training on AI, AICRP on Pig center, Goa

Landlly sow with piglet at AICRP center, Bareilly

INDIAN VETERINARY RESEARCH INSTITUTE, IZATNAGAR, BAREILLY

ICAR-IVRI AICRP centre is maintaining Landrace and its 75% crosses (Landlly) with local animals. The local pig of Bareilly region (Gurrah) was characterized, documented and registered as 8th indigenous pig breed of the country (INDIA_PIG_2000_GHURRAH_09008). The center is also organizing training, demonstration and developed package of practices for improved pig husbandry for the region.

Field unit of AICRP on Pig center,

TAMILNADU VETERINARY AND ANIMAL SCIENCE UNIVERSITY, KATTUPAKKAM

TANUVAS Centre is maintaining *inter-se* population of TANUVAS KPM Gold (75% crossbred) pigs. Besides regular training, the center is presently involved for characterizing the local pig population of the state.

COLLEGE OF VETERINARY SCIENCES & ANIMAL HUSBANDRY, CENTRAL AGRICULTURAL UNIVERSITY, AIZAWL, MIZORAM

The centre was maintaining Zovawk, Large White Yorkshire and its crosses. Presently the center is mandated to conserve and subsequent genetic improvement of local pigs of the state (Zovawk). For this purpose the center will maintain 30 sow unit of Zovawk pig.

Zovawk boar at AICRP on Pig center, Aizawl

NAGALAND UNIVERSITY SCHOOL OF AGRICULTURAL SCIENCES AND RURAL DEVELOPMENT, MEDZIPHEMA CAMPUS, NAGALAND

The centre was maintaining Tenyivo, Hampshire and upgraded Tenyivo (75%) using Hampshire boar.Presently the center is mandated to conserve and subsequent genetic improvement of local pigs of the state (TenyiVo). For this purpose the center will maintain 30 sow unit of TenyiVo pig. The centre is also engaged in training on improved pig production.

Hands on training on pig Management, Nagaland

ICAR-CENTRAL ISLAND AGRICULTURAL RESEARCH INSTITUTE, PORT BLAIR

AICRP on Pig programme of this centre was initiated looking to the high demand of pork and scope of piggery in the region. Under this centre, Andaman Local pig are maintained, produced and supplied to farmers.The center is maintaining Nicobari pig. Characterization work for Andaman local pig is initiated by the center.

Andaman Local Pig at Farmers herd

COLLEGE OF AGRICULTURAL, CENTRAL AGRICULTURAL UNIVERSITY, IMPHAL

The center is mandated to study the various performance characteristics of the Rani breed under Manipur condition. Works on characterization of Indigenous local pigs of Manipur were also initiated during the year.

Rani grower pigs at AICRP on Pig centre, Imphal

ICAR RESEARCH COMPLEX FOR NEH REGION, BARAPANI

The center is maintaining the Niang Megha and Lumsniang pig. The center conducted several training, extension activities in farm and farmers' field. Artificial Insemination (AI) has been carried out regularly at farmers door step to produce the crossbred piglets.

Niang Megha pig at AICRP on Pig center, Barapani

ICAR-INDIAN VETERINARY RESEARCH INSTITUTE, EASTERN REGIONAL STATION, KOLKATA

ICAR-AICRP on pig in IVRI, Kolkata was established with an idea to develop an elite flock of Ghungroo germplasm through selective breeding, propagate and supply the superior germplasm to cliental which indirectly increase the pork production. Besides maintaining Ghungroo germplasm the center conducted several training to the farmers for popularization of the breed.

Ghungroo breeding boar at IVRI ERS, Kolkata

KVK-GOALPARA, ICAR-NRC ON PIG

The AICRP on pig unit of KVK Goalparais 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.

Doom Pig at AICRP on Pig center, Goalpara

GURU ANGAD DEV VETERINARY AND ANIMAL SCIENCE UNIVERSITY, LUDHIANA

The AICRP on Pig center of GADVASU, Ludhiana is maintaining Large White Yorkshire pigs. The center is engaged in training and demonstration to the farmers of Punjab.

Training on semen collection, AICRP Ludhiana Center

KRANTISINH NANA PATIL COLLEGE OF VETERINARY SCIENCE, SHIRVAL

Looking to the scope and importance of piggery sector in the state of Maharashtra the Council sanctioned AICRP on Pig center at Krantisinh Nana Patil College of Veterinary Science, Maharashtra Animal and Fishery Sciences University, Shirval during 2017.The center is maintaining Large White Yorkshire pigs. The center has initiated work on characterization and documentation of local pigs of Maharashtra.

Local pig of Maharashtra, AICRP on Pig, Shirval

MEGA-SEED PROJECT ON PIG

Rapid urbanization and increased population pressure has resulted in increased demand for quality pork production. The main constraints like non-availability of superior quality seed stock, low-cost feed ingredient, imbalanced ration at reasonable price, unscientific management or inadequate knowledge, lack of financial support as well as marketing channel etc. are hampering the growth and development of piggery sector of the country, therefore, ICAR has launched Mega Seed Project on pig in 2008 which is presently having seven different centres. The project was launched with an objective to produce and supply quality swine germplasm to the local farmers. Under this project improved variety of piglets were produced and distributed to the farmers. Total 18027 piglet of improved variety were produced for distribution during XIIth Plan Period. A total of 5879 and 4403 nos. of improved variety of piglets were produced for distribution in 2017-18 and 2018-19, respectively.

ASSAM AGRICULTURAL UNIVERSITY, KHANAPARA, GUWAHATI

The center is maintaining HD-K75 crossbred pigs developed under AICRP on Pig unit of this center. These animals are well adapted and acceptable to the farmers of different states of northeastern region.

Distribution of Piglet from Mega Seed Centre, Guwahati

BIRSA AGRICULTURAL UNIVERSITY, RANCHI, JHARKHAND

The rural people of Jharkhand have widely accepted the piggery sector as remunerative enterprises with great enthusiasm which in turn has provided tremendous employment opportunities to the local people. Mega Seed Project on pig supplying Jharsuk pig variety to the farmers. Recently the center has registered local pig of Jharkhand and Bihar as Purnea (Accession no: INDIA_ PIG_0325_ PURNEA_09010). The center is developing second line breeder for further propagation of the variety.

Pig rearing by new 2nd line breeder at Farmers' door, Ranchi

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 center is maintaining and distributing Rani crossbred pig variety to the stake-holders of the state. The center also popularized artificial insemination in pig in the state of Nagaland to enhance the production of piglets from superior breeding stock.

Training on AI in Pig, Mega Seed center, Nagaland

VETERINARY DEPARTMENT, GOVT. OF MIZORAM, AIZWAL

Mega Seed Project on Pig of Aizawl centre is mandated to supply quality Large White Yorkshire germplasm in the state. The production performance of the center was greatly affected by outbreak of PRRS in the state. The centre has also supported a few farmers in the state for scientific pig production and management.

LWY piglet for distribution, Mega Seed center, Aizawl

KERALA VETERINARY AND ANIMAL SCIENCES UNIVERSITY, MANNUTHY CENTRE, KERALA

The mandate of the centre is producing and supplying Mannuthy White crossbred germplasm developed under AICRP on Pig project. Artificial insemination is being regularly practised to avoid inbreeding depression and proper utilisation of genetic potential of superior males.

Mannuthy White pigs at Mega Seed centre, Mannuthy

ANIMAL RESOURCES DEVELOPMENT DEPARTMENT, TRIPURA

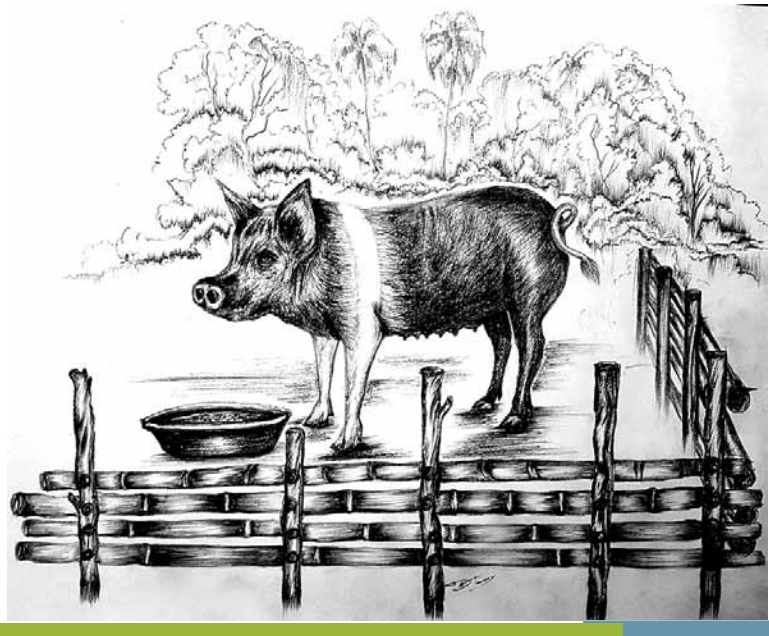
The centre was started in 2014 and maintaining Landrace, LWY X Desi crossbred. The center was actively involved in characterization of local pig of Tripura. The local pig of the state is recently registered as Mali (Accession No: INDIA_PIG_1900_MALI_09009).

LWY sow with piglet at Tripura center

ANIMAL HUSBANDRY AND VETERINARY SERVICES, SIKKIM

Mega Seed Project on Pig was sanctioned at Animal Husbandry and Veterinary Services, Govt. of Sikkim due to high scope and importance of piggery sector in the state of Sikkim. The center is maintaining HD K75 and Rani crossbred variety.

Sow with piglet of HDK75 variety, Mega Seed center, Sikkim



Krishi Vigyan Kendra Activities

KRISHI VIGYAN KENDRA ACTIVITIES

Trainings

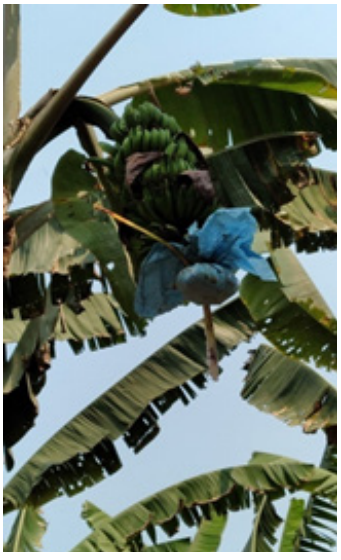
A total of 110 training programmes were conducted during the year. The training programmes included training for farmers and farm women – 70 nos covering 2191 participants; training for rural youth – 11 nos. covering 311 participants; training for extension functionaries – 3 nos. covering 83 participants; 09 vocational trainings covering 332 participants; 17 sponsored trainings covering 532 participants

On farm Trial (OFT)

The Krishi Vigyan Kendra Goalpara has conducted 12 'On Farm Trial' (OFT) on newly generated agricultural technologies.

OFT – 1 : Bunch feeding of banana

An On Farm Trial was conducted on "Bunch feeding of Banana" under the thematic area of Integrated Nutrient Management. The objective of the OFT is to address the problem of poor finger size of banana cultivated in Goalpara district. The technique involves blending of 7.5g of Urea and 7.5 g of K_2SO_4 in 500 g of fresh cowdung and applying the slurry to the denavelled stalk end of banana bunch after fruitset. The OFT is in progress and the results are awaited.



View of application of fertilizer mixture to denavelled stalk of banana bunch

OFT 2 : Domestication of wild vegetables (mandhania, mahsundori, puroi xak and durun)

Declination of the plant population of wild vegetables is an identified problem at Goalpara district. To ensure their availability as and when required and to create awareness among the farmers about the conservation of wild vegetables, an OFT on Domestication of wild vegetables has been undertaken with four nos. of crops namely *mandhania, mahsundori, puroi xak and durun.* Collection of propagules is done from wild vegetation and has been domesticated in the demonstration plots at KVK farm and two schools in Udaypur village, Dudhnoi.

OFT on Domestication of wild vegetables
(mandhania, mahsundori, puroi xak and durun)

OFT 3 : Ready to cook green jackfruit (Minimally processed)

Jackfruit (Artocarpus heterophyllus) is widely found in Goalpara district of Assam. The ripe fruits are nutritious and rich in vitaminsand minerals. The immature fruits are used as vegetable. As jackfruit is a seasonal fruit, so to make it available all year round preparation of value added products like ready to cook minimally processed jack fruit is a good option, thereby enhancing farm income and nutritional security of the farmers. Keeping this in view, an OFT was carried out to prepare ready to cook minimally processed jack fruit. The Source of the Technology is Horticulture Division, ICAR Research Complex for NEH Region, Umiam. In this technology Mature fruits (45-60 days after fruit set) were harvested, peeled and sliced into pieces. This was followed by blanching of the slices for 10 minutes. The blanched pieces are then filled into sterilized bottles and brine solution (8% salt + 0.2% KMS) is poured into it. The bottles are sealed and kept in cool dry place. The OFT is in progress.

OFT on Ready to cook green jackfruit (Minimally processed)

OFT 4 : Varietal evaluation of gerbera hybrids

Floriculture is a sunrise area in Goalpara district of Assam. In the recent years, it has been observed that farmers of the district are willing to enter into commercial floriculture sector out of which gerbera cultivation is one of the most polpular area. Gerbera (*Gerbera jamesonii*) is an attractive cut flower crop belonging to the Asteraceae family.The availability of wide range of exotic varieties and their adaptability to grow on wide range of climate makes it a profitable cut flower crop for the growers. But the major problem identified is non availability of good quality planting material in the region. Keeping this in view, an OFT was conducted to characterize the performance of hybrids of gerbera namely RCGH-22, RCGH-114, RCGH-12, RCGH-117 grown under open conditions in KVK farm and farmer's field in Matia block. The OFT is in progress.

OFT on varietal evaluation of gerbera hybrids

OFT 5 : Cultivation practices of Milky mushroom

An OFT programme on Cultivation practices of Milky mushroom (*Calocybe indica*) introduced in Goalpara district in the summer season of 2019. Spawns were collected from ICAR-DMR, Solan Himachal Pradesh. Growing season of Milky mushroom in Assam is during May-August (25-35^{0}C). Farmers found very much suitable for growing Milky mushroom during the summer season.


OFT on Cultivation practices of Milky mushroom

OFT 6 : Efficacy of different pheromones in controlling insect pest in horticultural crops

Fruit fly (*Bactrocera cucurbitae / B. dorsalis*) is a major insect pest causing heavy yield loss in different cucurbits crops viz. cucumber, pumpkin, ridge gourd, sponge gourd and pointed gourd. We suggested to use pheromone block fruit fly in cucurbits (Lure). Installation of pheromone traps at 30 days after planting @ 10 traps/ha to trap adult flies.It is evident from our OFT results that adoption of pheromone traps in place of insecticides for fruit fly management in cucurbits substantial economic benefits and reduction of agro-chemical pollution. It does not harm beneficial insects. Farmers found easy to monitor the trapped fruit flies and is wind and water proof.



OFT on Efficacy of different pheromones in controlling insect pest in horticultural crops

OFT 7 : Pitcher drip irrigation in Betelvine

Water stress during winter months being a perennial problem in traditional Betelvine cultivation requires addressing the problem. An OFT on "Pitcher Drip Irrigation in Betelvine" was introduced in farmer's field. The technology employs use of earthen pitcher with a small plugged hole for slow release of water placed at the base of the Betelvine plants @1.5 lit/day. Regular supply of regulated water has improved health of the plants during the dry periods. The technology is readily accepted by the farmers.

Pitcher drip irrigation in betelvine

OFT 8 : Natural Dye for dyeing of clothes

Due to the harmful effects of synthetic dyes and growing awareness towards eco friendly products, natural dyes are getting importance. Natural dyes are abundantly available in North Eastern part of the country throughout the year. Processing of natural dye is easy as well as safe from the environmental point of view. Small scale entrepreneurs can use it in order to satisfy the artistic and creative urge of craftsmanship as well as can provide a better economic return if marketed well.

Results –

- Dye source – onion peel, mint leaves, turmeric, bark of Arjun tree.
- Safe for hands and are biodegradable
- Colour fastness is more with cotton yarn
- Alum is found to be suitable as mordanting agent

Extraction of dye and fabric dyeing

OFT 9: Nutritional enrichment of diet through wild edible plants

Malnutrition is a major problem among children in Goalpara district of Assam. The diet of the people is mostly deficient in micronutrients irrespective of the presence of huge flora in the region. The present programme is undertaken to impart knowledge to school kids and mothers on importance of wild edible foods to meet the nutritional requirement. Nutritive value of the wild edible plants will also be evaluated. Local delicacies will be nutritionally enriched with addition of these wild edible plants.

Results –

- Herbs selected – Mint, *mandhonia, puroi, masundari, durum*
- Awareness programmes for both children and parents
- Celebration of events with kids
- Addition of the herbs in local delicacies like *pithali, pitha* and in *chutneys, pakodas*
- Acceptance by children, mother and school authority.

Awareness prog on wild edible plants and plantation in school premises.

OFT 10: Standardization of black rice cake recipes

An OFT was conducted to standardize the methods of black rice cake preparation. Black rice cake prepared by farmers varied in taste and texture and shelf life is also low. Inclusion of flavor and different ingredients is also done. Thus to maintain a similar taste, portion and yield control and incorporation of different flavours, the programme is conducted. The OFT is in progress.

Demonstration on black rice cake preparation

OFT 11: Preparation of Jackfruit chips

An OFT was conducted to prevent wastage of Jackfruit during surplus season. To prevent wastage and to provide economic benefits to farmers, Jackfruit chips are prepared with technology from CAU, Tura. Recovery of finished product, assessment of shelf life, palatability test, acceptance by farmers etc. were evaluated. The OFT programme is in progress.

Jackfruit chips preparation

OFT12: Assessment of Kadaknath bird in Goalpara district.

Kadaknath is an indigenous poultry breed found in western part of Madhya Pradesh mainly in Jhabua and Dhar districts. These birds are also available in bordering areas of Gujarat and Rajasthan adjoining Madhya Pradesh. The birds are jet black in colour and reared mainly for meat purpose, which is also black in colour but softer than that of other indigenous birds. Kadaknath bird's meat has lower cholesterol level than normally available in other poultry breeds. The meat also contains high level of essential amino acids as well as hormones that are essential for human body. Therefore, conservation and improvement of this bird is highly essential. Keeping in view the nutritive and medicinal properties of Kadaknath bird's meat and egg, an OFT was conducted for assessment of productive performance of this bird in Goalpara district. In this OFT, 300 nos. of Kadaknath chicks were distributed to the 3 women SHGs (30 members) @ 10 chicks/member and 200 nos. kept for low cost demonstration unit at KVK farm complex. The demonstration unit shall help the rural resource poor farmers, SHGs and unemployed youths to adopt this poultry breeds for backyard farming. The OFT was conducted also to create awareness about the beneficial effects of Kadaknath bird and to establish backyard farms through minimum financial involvement. The chicks were vaccinated against Ranikhet (Lasota) before distribution. Vaccination schedule against Ranikhet was followed as per schedule. 3 (three) numbers of trainings were also organised on management of Kadaknath birds in backyard farming. The performance of the distributed Kadaknath birds as well as the birds in the demonstration unit are as follows-

i) There was 7% mortality in the distributed birds whereas, 5% mortality in the demonstration farm till December, 2019.

ii) The average body weight of the male and female Kadaknath birds respectively after 8 months was 0.974±0.046 kg and 0.896±0.065 kg in the farmer's field, whereas it was 1.147±0.063 kg and 0.953±0.057 kg in the demonstration unit.

iii) The hens started laying eggs since 7th month and it has been continued till December, 2019.

iv) It has been observed that Kadaknath hens are poor brooders hence, 70% of the produced fertile eggs were distributed to the farmers field for production of Kadaknath chicks through natural or artificial brooding.




Demonstration of low cost housing with open enclosure

FRONTLINE DEMONSTRATION (FLD)

FLD-1: *Front Line Demonstration of Pulse Crops*

KVK, Goalpara conducted Cluster frontline demonstration (FLDs) under NFSM to demonstrate the production potential of newly released technologies on the farmer's field at different locations. Two numbers of FLD on pulse crops were conducted during 2019-20 at farmers' field. The green gram variety SGC 16 and black gram variety PU 31was demonstrated in 20ha of land each. A total of 83 numbers of farmers pulse farmer were involved in this programme. The results of the demonstration are described in tabular form

Crop	Area under demonstrations		No. of demonstrations		Major technologies demonstrated	Average Yield (q/ha)		Yield enhancement due to technology Name
	Allocated	Conducted	Allocated	Conducted		Demo.	Farmers Practice	
Black Gram	20	20	11	11	Var. PU-31	8.2	6.5	Var.
Green Gram	20	20	10	10	Var. SGC-16	8.5	6.7	Var.

Crop Demonstrated	Existing (Farmer's) Yield (q/ha)	Yield (q/ha) w.r.t.			Area in ha	Number of Farmers	Yield Obtained (q/ha)			
		District yield (D)	State Yield (S)	Potential Yield (P)			Max.	Min	Av.	% Increase
Black Gram	6.5	8.6	8.5	12	20	18	9.2	5.3	8.2	26.15
Green Gram	6.5	8.5	9	12	20	20	9	5	8.5	30.76


Front Line Demonstration of Pulse Crops

FLD-2: Front Line Demonstration of Oilseed Crops

KVK, Goalpara conducted Cluster frontline demonstration (FLDs) under National Mission on Oilseed and Oil Palm (NMOOP) to demonstrate the production potential of newly released technologies on the farmer's field at different locations. KVK, Goalpara also organized farming and extension activities for farmer and extension workers for dissemination of various technologies through demonstration. A total of 10 hectare of area was utilized for cluster FLD on Sesamum var ST 1683. The details of the demonstration are

summarized below.

Crop	Variety	Area under Demo.		No. of demo.		Average Yield (q/ha)		Yield enhancement due to technology Name
		Allocation	Conduct	A	C	Demo.	Farmers Practice	
Sesamum	ST-1683	20	20	10	10	4.5	2.2	ST-1683

Existing (Farmer's) Yield (q/ha)	Yield (q/ha) w.r.t.			Area in ha	Number of Farmers	Yield Obtained (q/ha)			
	District yield (D)	State Yield (S)	Potential Yield (P)			Max.	Min	Av.	% Increase
3.5	4	5	6	20	17	6.2	2.5	5	42.85

Sesamum ST1683

FLD-3: Community nursery of Rice (*var.* Ranjit sub-1) for flood affected area in Goalpara district of Assam

There was high rainfall for prolonged days during June to August 2019 in Goalpara district of Assam. For which, an area of 17,800 ha agricultural land, mainly rice crop area was divested. It was very hard task for raising rice seedling in such situation. To overcome the problem of rice grower, a community nursery of rice (Var. Ranjit Sub 1) was prepared for flood affected area in Goalpara district of Assam. The objective of this programme was to introduce the new flood tolerant HYV Ranjit Sub 1 and distribute the seedling to needy poor farmers under flood affected area. The programme was operationalized under disaster management cell with collaboration with District Agriculture Office Goalpara. A total of 45 ha area was covered for raising the seedling at two farm namely KVK Dudhnoi farm and State seed farm Krishnai. The variety Ranjit Sub 1 is developed by Assam Agricultural University and it is a high yielding variety which can survive under complete submergence of water for 2 – 3 weeks. A total of 4043 numbers of farmers were benefited by transplanting this variety and they covered 45,000 ha of land. The highest yield of this variety was recorded at 6.15 t/ha and average yield was 5.45 t/ha with benefit cost ratio (B:C) 2.46. The farmers are very happy for realizing the performance of this variety in low lying area where rice plant usually submerged under water for 2-3 weeks during kharif season.

Raising and distribution of rice seedling at KVK Dudhnoi farm

FLD – 4: Popularization of turmeric variety Megha Turmeric -1

Frontline demonstration on popularization of turmeric variety Megha Turmeric -1 was conducted in two locations each in Krishnai and Rongjuli development blocks and in one location in Kuchdhowa development block of Goalpara district. A total of 75 beneficiaries were covered under the FLD programme. The objective of the FLD programme was to popularize the variety Megha Turmeric-1 among the farmers of the district to overcome the problem of low yield and low curcumin content in traditionally cultivated turmeric varieties. The average yield in the demonstration plot was found to be 250 quintals per hectare which is 38 % more than the traditional variety. A benefit cost ratio 5.12 was recorded in the Frontline demonstration plots.

A view of the Megha Turmeric-1 crop in FLD plot.

FLD –5: Mixed cropping in arecanut cultivation with black pepper (var.Karimunda)

Arecanut is mainly grown as monocrop in the Goalpara district of Assam. But this crop is grown best under mixed cropping for supportive income to grower. In mixed cropping sysyem the biological efficiency is also increased considerably and the utilization of resources mainly light, water and nutrients is enhanced through a distribution of crop species in time and space. Keeping this in view a FLD on mixed cropping in arecanut cultivation with black pepper (*var. Karimunda*) was carried out in 2 villages namely: Tuplakhowa and Lela. Under this FLD, black pepper *var.* Karimunda saplings procured from ICAR-CPCRI, Guwahati were distributed among the farmers to be planted as mixed crop in existing arecanut cultivation where arecanut palms were used as live standards for training blackpepper. Other activities carried out included method demonstrations on planting of black pepper seedling in arecanut orchard and plant propagation technology of black pepper. The programme is in progress and regular monitoring of the seedlings is carried out.

Fig: Seedling distribution and demonstration on Mixed cropping in arecanut cultivation with black pepper (var.Karimunda)

FLD – 6: Scientific cultivation practices of okra var. Arka Anamika

Yellow vein mosaic virus is one of the major problems faced by the okra farmers of Goalpara district. Arka Anamika is an interspecific hybrid of okra developed by ICAR-IIHR, Bangalore resistant to Yellow vein mosaic virus. Keeping this in view an FLD on Scientific cultivation practices of okra var. Arka Anamika was carried out in farmer's fields in Rangjuli and Kuchdhowa blocks of the district as well as in the KVK farm. The programme is in progress.

Raising and distribution of rice seedling at KVK Dudhnoi farm

FLD – 7: Cluster Demonstration on Improved varieties of potato (Kufri Jyoti and Kufri Sindhuri) Year 2019-20

Under ICAR-IARI NEH component cluster demonstration on improved varieties of potato *Kufri Jyoti* and *Kufri Sindhuri*. Seeds of 100 quintal *Kufri Jyoti* and 50 quintal of *Kufri Sindhuri* were collected from ICAR-NRRC on Pig and distributed as cluster among different farmes in four blocks namely Dudhnoi, Krishnai, Matia and Rangjuli for the season 2019-20. Farmers have found both the varieties very suitable for Goalpara district agro-climatic situation. Both the varieties found to be immune to late blight fungus (*Phytophthora infestans*) and bacterial wilt (*Ralstonia solanacearum*). No major infestation late blight and bacterial wilt and insect pest observed in the cluster demonstration programme. Average yield of *Kufri Jyoti* was found to be 2.1 ton/ha and for *Kufri Sindhuri* it was 2.3 ton/ha.

FLD – 8: Use of Self propelled reaper

Harvesting of Paddy is a time consuming and labourious job. Cost involvement is also high and there is shortage of hired labourer during peak harvesting season. Self propelled reaper cum binder was demonstrated in farmer's field for awareness and popularization of mechanised harvesting in Goalpara condition. Field capacity recorded was 0.18 ha/hr. The technology was readily accepted by the farmers.

Use of Self propelled reaper

FLD – 9: Gradual conversion of bench terrace in hills

Slope land agriculture is associated with erosion of top soil leading to less productivity. This hinders beneficial use of slope land owned by the farmers. The technology used was gradual conversion of bench terraces in hills developed at ICAR Research Complex for NEH Region. The technology is under demonstration in farmer's field (FLD) during the period. The slopy land is in process of gradual conversion. The programme is in progress.

FLD – 10: Method Demonstration on Use of Adjustable Row Marker

Marking of rows in the prepared fields is an important task for row crops and it requires time and energy. Adjustable row marker was demonstrated in farmers field in Dubli, Dudhnoi in a 2 ha plot of potato. Field capacity was 0.22 ha/hr.

Use of Self propelled reaper

FLD – 11: Double pot improved biomass cookstove

The modified double pot improved cookstove saves fuel and cooking time. The smoke emitted is also less which has a positive effect on the health of the user. To reduce drudgery in firewood collection and low smoke emission, modified cook stove are established in farmers home.

Results –

- ❖ Smokeless environment of kitchen
- ❖ Saves fuel
- ❖ Saves cooking time
- ❖ Reduces drudgery of women in cooking and collection of fire woods
- ❖ Enable healthy indoor cooking


Homemaker with cookstove and chimney

FLD – 12: Development of shelf stable products from Tapioca

To prevent seasonal wastage of Tapioca, one FLD was conducted on Tapioca chips preparation with technology from CTCRI, Thruvananthapuram. There is lack of awareness among farmwomen for preservation of Tapioca. Thus a programme on Tapioca chips is undertaken where method of Tapioca chips preparation is shown to farmers. Processing time, shelf life, palatability test and acceptability by farmers were evaluated. The FLD is in progress.


Preparation of Tapioca chips

Field Visit and Farm Advisory Service:



World Environment Day celebration

World Environment Day was celebrated on 05 June, 2019 at Dudhnoi by KVK Goalpara by planting 50 no. of seedlings of Rainbow shower (*Radhashura*) in active participation of local peoples. The planting was done around the Public Cremation Ground of Dudhnoi to create awareness about the importance of trees in general. Dstribution of seedlings/saplings for afforestation through various programmes including KKA, Kisan mela etc. and in association with Social Forestry Department, Dudhnoi Range.


Celebration of International Day of Yoga

A Yoga camp was organised on the occasion of International Yoga Day on 21st June 2019 at the KVK committee hall where all staff members of KVK Goalpara participated.


Awareness camp on Jal Shakti Abhiyan

Rain water harvesting structures of 0.3 ha constructed inside KVK campus for effective insitu conservation of rain water. Process has been initiated for installation of aerators in the taps of the office. Awareness on need of rainwater harvesting and recycling through micro irrigation, conservation structures and watershed management and afforestation are done on a regular

basis since inception of the KVK Goalpara in 2006. During 2019-20, an awareness camp on Jal Shakti Abhiyan was organised at Khara Part-II village on 03/09/2019 with a participation of 44 nos. of farmers.

Fertilizer application awareness programme:

Fertilizer application awareness programme was organised by KVK Goalpara in association with Brahmaputra Valley Fertilizer Corporation Limited, Namrup at Janamandir, Dudhnoi on 22/10/2019 where 207 nos. of farmers participated. The programme was organised with an aim to disseminate knowledge among farmers on optimum usage of fertilizer nutrients based on various parameters to sustain agricultural productivity and also to make farmers aware of new developments in the field of fertilizer usage and management.

Mass plantation drive:

Mass tree plantation awareness campaign and seedling distribution programme was organised at KVK Goalpara on 17/09/2019. This programme was graced by the participation of 270 nos. of farmers of Goalpara district. At the end of the programme 7300 nos of samplings of various fruits were distributed among farmers encouraging the sense of responsibility for planting trees.

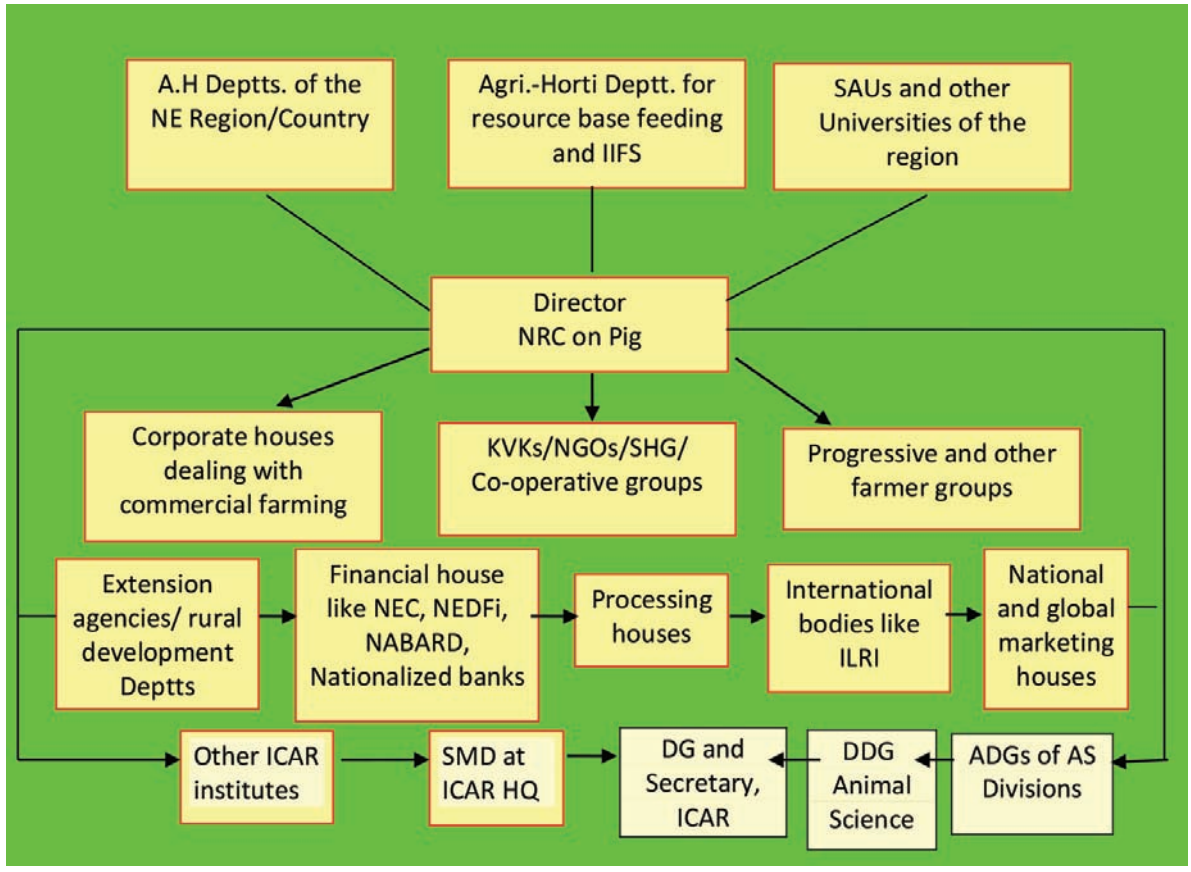
Awareness programme on Swatchata hi Sewa, 2019

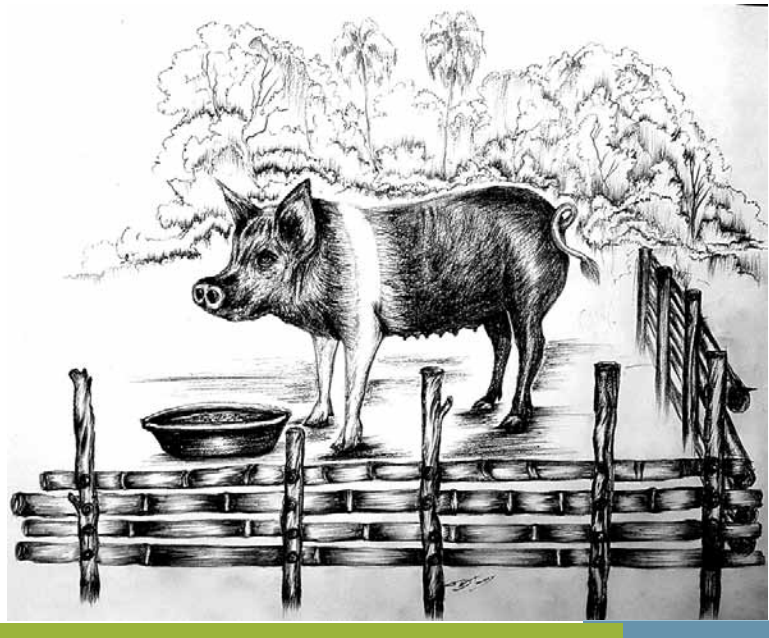
An Awareness programme on Swatchata hi Sewa was organized by KVK Goalpara at Sankardev Sishu Vidya Niketan, Dudhnoi on 02/10/2019 with a participation of 32 nos. of farmers and 43 nos. of students. The Swachhta hi Sewa 2019 theme was 'plastic waste awareness and management'. Keeping in view the urge of Honorable Prime Minister of India to all citizens to rid their house, offices and work spaces from single-use plastic, KVK Goalpara tried to make farmers and students aware and drew their attention to the hazardous effects of single-use plastic on the environment and the health of animals and aquatic life.

National Unity Day:

National Unity Day was celebrated on 31st October 2019 at KVK Goalpara. The programme was attended by the staff members of the KVK, Goalpara.

LINKAGE AND COLLABORATION OF ICAR-NRC ON PIG





Meetings and Other Activities

MEETINGS AND OTHER ACTIVITIES

Research Advisory Committee Meeting (RAC)

Members	Position in RAC
Dr. N. Balaraman, Former Vice- Chancellor, TANUVAS	Chairman
Dr. R. S. Gandhi Assistant Director General (AP & B), ICAR, New Delhi	Member
Dr. R.N. Goswami Former Dean, College of Veterinary Science, AAU Khanapara, Guwahati-781022	Member
Dr. C. Rajkhowa Former Director ICAR, NRC on Mithun, Nagaland	Member
Dr. J. Abraham Former Director, Centre for Excellence in Meat processing, KAU Mannuthy/Sharon, Mannuthy, Thrissur, Kerala-680651	Member
Dr. R.C. Upadhyay Former Head, Dairy Cattle Physiology Division ICAR-NDRI, Karnal-132001, Haryana	Member
Dr. (Mrs) Jancy Gupta Former Head, Dairy Extension Division ICAR-NDRI, Karnal-132001, Haryana	Member
Dr. Swaraj Rajkhowa Director, ICAR-NRC on Pig	Member
Nominated member by Hon'ble AM (a) Sh. Dhaneswar Deka, Bhunukuchi, Nalbari, Assam (b) Sh. Prema Datta, Dhemaji, Assam	Member
Dr. K. Barman Principal Scientist, ICAR-NRC on Pig	Member Secretary

The XIIIth Research Advisory Committee (RAC) meeting of ICAR-NRC on Pig was held during 19-20th August, 2019, under the Chairmanship of Dr. N. Balaraman, Former Vice- Chancellor, TANUVAS. Earlier, Dr.Swaraj Rajkhowa, Director, ICAR-NRC on Pig welcomed Chairman, all the members and scientific staffs & made appraisal about salient achievements and future research plan of the institute. Dr. Keshab Barman, Member Secretary made a brief presentation on the research programs of the institute and action taken report on the recommendations of previous RAC meeting. Each research project was presented as per programme followed by comments of the house. The scientists of the institute presented the ongoing research works and their progress. The committee critically evaluated all the works and gave their valuable comments. The major recommendations of the XIIIth RAC are listed below.

- Genomic selection has to be done based on important production traits including FCR for sustainable development. A status paper on genomic selection in pigs should be submitted. Whole genome sequencing of all indigenous breeds and varieties should be undertaken.
- Adaptive traits should be studied to produce climate resilient animals i.e. smarts pig.
- Molecular means of fertility should be linked to progeny testing programme for selection.

13th RAC meeting in progress

- Quality parameters of vegetable wastes are complex, which vary from place to place and also with seasons. This affects nutrient availability of waste. Therefore the quality parameters, types of waste and seasonal quality etc. of the waste should be evaluated.
- PPP model of development should be more strengthened and develop value chain.

In addition, Hon'ble Chairman and Members were participated in a tree plantation programme in the institute campus on 20th August, 2020. They also made a visit to the adopted pig villages of the institute viz. Thangapara, Belguri and Ganpati of Kamrup district, and interacted with the pig farmers. Hon'ble Chairman and Member of RAC also distributed piglets and feed to the selected farmers.

Institute Research Council meeting (IRC)

The XIIIth Institute Research Council (IRC) meeting of ICAR-NRC on Pig was held on 15th May, 2019, under the Chairmanship of Dr.Swaraj Rajkhowa, Director (Acting), ICAR-NRC on Pig. The Chairman, IRC welcomed Dr.Vineet Bhasin, Principal Scientist, ICAR HQ, New Delhi and scientists of the institute. Each research projects presentation was followed by comments of the house. The Chairman emphasized that the scientists should be critical in undertaking basic and applied research and mentioned that the new projects must comply with the Institute's mandate. He also mentioned that the scientists should make extra efforts to publish quality papers in the research journals with high impact factor. During the meeting, the outcome of completed projects, progress of ongoing Institute projects and the technical programmes of new project proposals were presented by the PIs and thoroughly reviewed.

The 13th IRC Meeting in progress

Institute Management Committee (IMC)

Members	Position
Dr. Swaraj Rajkhowa Director (Acting), ICAR-NRC on Pig	Chairman
Dr. R. N. Goswami Ex-Dean, CVSC, AAU, Khanapara	Member
Dr. S. Bandyopadhyaya Principal Scientist, ICAR-IVRI, ERS, West Bengal	Member
Dr. B. Mohanty Principal Scientist and Head of Division, ICAR-CIFRI, Kolkata	Member
Dr. G. Kadirval Principal Scientist, ICAR-RC for NEH Region, Umiam, Meghalaya	Member
Shri. Prashant Kumar Sr. Finance & Account Officer ICAR-RC for NEH Region, Umiam, Meghalaya	Member
Dr. S. Banik Principal Scientist and i/c AO, ICAR-NRC on Pig	Member Secretary

The 17th Institute Management Committee Meeting was organized on 3rd June 2019 at the Institute. During the meeting, the Chairman briefed the various activities of the Institute including various research endeavours. The actions taken for the recommendations of the preceeding meeting was confirmed and agreed by the IMC. Different agenda items such as procurement of equipments, infrastructure developments etc. were discussed in the meeting and the proposals were recommended by the IMC.

The 17th IMC Meeting on progress

Joint Consultative Machinery (JCM)

The scheme of Joint Consultative Machinery is a platform for constructive dialogue between the representatives of the staff side and the official side for peaceful resolution of all disputes between the Government as employer and the employees. The scheme was introduced in 1966 by Govt. of India with the objectives of promoting harmonious relations and securing the greatest measure of cooperation between the Central Government as the employer and the employees in matters of common concern and with the object of further increasing the efficiency of the public service combined with the well being of those employed. The scheme is a non statutory one mutually agreed upon between the staff side and the official side.

Under Joint Consultative Machinery, Institute Joint Staff Council (IJSC) is functioning in the Institute with following members.

STAFF SIDE MEMBERS		
1.	Shri. Uttam Prakash, AAO, ICAR-NRCP, Guwahati.	CJSC Member & IJSC Member (Administrative Category)
2.	Er. Benjamin Kaman, Technical Officer, KVK, Dudhnoi, Goalpara	IJSC Member Secretary & Member (Technical Category)
3.	Miss Jonali Nath, UDC, ICAR-NRC on Pig, Guwahati	Member (Administrative Category)
3.	Dr. Rajib Kumar Das, Sr. Technical Assistant, ICAR-NRCP, Guwahati.	Member (Technical Category)
4.	Shri Dhruba Rabha, SSS, KVK, Goalpara.	Member (SSS Category)
5.	Shri. Naren Cahndra Deka, SSS, ICAR-NRC on Pig, Guwahati	Member (SSS Category)
OFICIAL SIDE MEMBERS		
1.	Dr. P.J.Das, Sr. Scientist, ICAR-NRCP, Guwahati.	Member Secretary
2.	Dr. Seema Rani Pegu, Sr. Scientist, ICAR-NRCP, Guwahati.	Member
3.	Dr. Hitu Choudhury, ACTO, KVK, Goalpara.	Member
4.	Dr. S.Banik, I/C AO, ICAR-NRCP, Guwahati.	Member
5.	Shri. P.K Nayak, AF & AO, ICAR-NRCP, Guwahati.	Member

Internal Complaint Committee (Women Cell)

Internal Complaints Committee is meant to safe guard and promote well being of all women employees of an organization. It takes care of all complaints on sexual harassment of women at workplace and action taken for redressal of complaints. It also takes care of any act or conduct by a person in authority and belonging to one sex which denies equal opportunity in pursuit of carrier development or making the environment at workplace hostile or intimidating to a person belonging to other sex, only on the ground of sex.

Composition of committee at ICAR-NRC on Pig, Guwahati, Assam.

Dr. Seema Rani Pegu, Scientist, ICAR-NRC on Pig, Guwahati.	Chairperson
Mrs. Ritu Boro Bora, Advocate, Panjabari, Guwahati.	Member (External)
Dr. Poli Saikia, SMS, KVK, Dudhnoi, Goalpara	Member
Dr. Alpana Das, I/C Head & Sr. Scientist, CPCRI Regional Station, Kahikuchi, Guwahati.	Member
Mrs. Jonali Nath, UDC, ICAR-NRC on Pig, Guwahati.	Member
Administrative Officer I/C Administrative Officer, ICAR-NRC on Pig, Guwahati.	Member Secretary

Visit of Hon'ble Union MoS, Ministry of Fisheries, Animal Husbandry & Dairying to ICAR-National Research Centre on Pig

Dr. Sanjeev Kumar Balyan, Hon'ble Union Minister of State, Ministry of Fisheries, Animal Husbandry & Dairying, Government of India, visited ICAR-National Research Centre on Pig, Rani, Guwahati on 28th July, 2019. During the visit, he was appraised about the Institutional activities and salient achievements of the Institute. He visited the Farm Complex and R&D Pork Processing Plant of the Institute. While interacting with scientists of the Institute, he mentioned the importance of pig breeding for production of quality germplasm and subsequent dissemination to field for the benefit of the farmers and entrepreneurs. He also emphasized that there is an urgent need to import exotic germplasm to the Institute, being a premier Institute of the

Country, for enhancing the productive and reproductive performance of pigs. He also suggested the importance of nutrition in pig farming. He advised to take up research projects to increase the feed efficiency and use of alternate feed resources. He opined that, this will not only reduce the feed cost but also make piggery as a profitable and sustainable venture to the farming community. Earlier, Dr. Swaraj Rajkhowa, Director (Act.), ICAR-National Research Centre on Pig welcomed the Hon'ble Minister. The programme was attended by Scientists, Technical and Administrative Staff of the Institute

Visit of Hon'ble MoS at ICAR- NRC on Pig

Visit of Dr. T . Mohapatra, Secretary DARE and DG, ICAR to ICAR-National Research Centre on Pig

Dr. Trilochan Mohapatra, Secretary (DARE) & Director General (ICAR), visited ICAR-National Research Centre on Pig, Rani, Guwahati on 14th August, 2019. While interacting with scientists of the Institute, he was appraised about the Institutional activities and salient achievements of the Institute, AICRP on Pig and Megaseed Project on Pig. He asked about the developed pig varieties by the institute and AICRP centres He also emphasized that there is an urgent need to import exotic germplasm to country with special reference to lean meat production, enhanced productivity, FCR and Climate resilience. He advocated for digitalization of indigenous breeds and developed varieties as soon possible. He emphasized more strengthening of breeding strategies in farmer's field and selection by molecular means enhancing the productive and reproductive performance of pigs. He mentioned about the control and prevention of Classical swine fever (CSF) and Porcine respiratory and reproductive syndrome (PRRS) and advocated that there is urgent need to establish a vaccine production laboratory to fulfil the demand of vaccine supply to the stakeholders. The genome of common infectious agents in pigs should be characterized as soon as possible. He mentioned to strengthen institute activities for conservation of pig germplasm and import of exotic germplasm. The cost feed should be reduced with quality meat production. He mentioned that institute should boost the pork production and value addition as well as establishment of BIS standard for quality control, species authentication and adulteration and residues detection inn pork and pork products. He mentioned that institute should prepare a 100 day plan for 2022 and 2024.

Dr. Swaraj Rajkhowa, Director (Act.), ICAR-National Research Centre on Pig welcomed Dr. Trilochan Mohapatra, Secretary (DARE) & Director General (ICAR). The programme was attended by Scientists, Technical and Administrative Staff of the Institute.

The Institute Animal Ethics Committee

Vide order no F. No. 25/9/2010–AWD dtd. 03-11-2017, Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), the Government of India, under Ministry of Environment, Forest & Climate Change Animal Welfare Division has approved the members of the Institute Animal Ethic Committee for a period of five years. The Animal House Facility of institute establishment is now registered with CPCSEA for "Research and Breeding for in-house use of large animals (i.e. Pig)". The new registration number of establishment is 1658/GO/RBi/L/12/CPCSEA for Research and Breeding in-house of large animals (pig).

The CPCSEA has approved the following members from ICAR-NRCP as a part of IAEC:

Dr. Swaraj Rajkhowa, Chairperson

Dr. Sunil Kumar, Scientist In-charge of Animal House Facility

Dr. Rajib Kumar Das, Veterinarian

Dr. Keshab Barman, Scientist from different discipline, Member Secretary

CPCSEA also nominated the following members to the Institutional Animals Ethics Committee (IAEC):

SN	Members	Address	Designation
1	Dr. Apurba Chakraborty	Director of Research (Veterinary), Assam, Agricultural University	Main Nominee
2	Dr. P. Chattopadhyay	Scientist, Defence Research and Development Organization, Ministry of Defense	Link Nominee
3	Dr. Chandana Chodhary Baruah	Professor , Deppt of Pharmacology College of veterinary Science, AAU	Scientist from outside the Institute
4	Dr. Sashanka Sekhar Dutta	Kanaklata Path, Survey, Beltola, Guwahati	Socially Aware Nominee

The meeting was conducted on 3rd December 2019 at ICAR-NRC on Pig. The committed evlauted the research programmes and visited animal house facility of the institute.

IAEC meeting in progress

Others

National Steering Committee (NSC) meeting on Pig Development Plan for North East

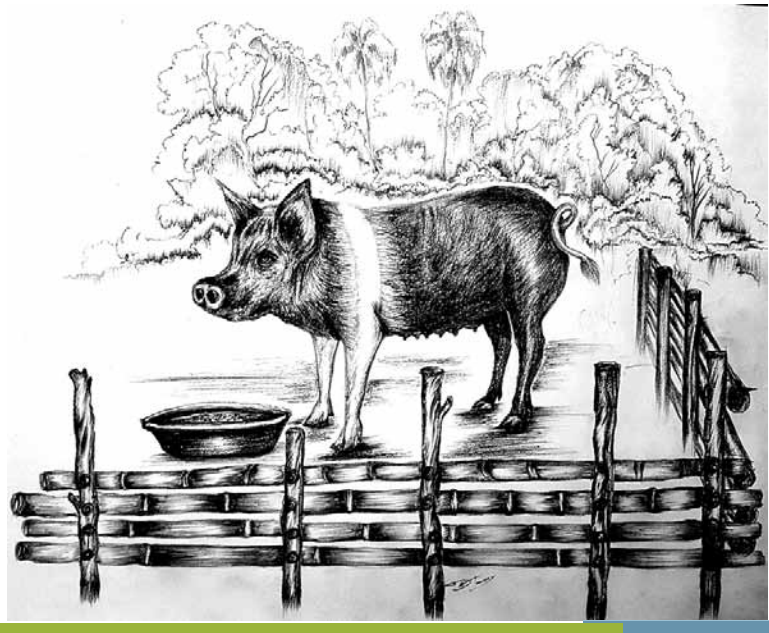
First meeting of National Steering Committee (NSC) on Pig Development Plan for North East organized on January 18, 2019 at ICAR-National Research Centre on Pig, Rani.

NSC meeting in progress

Participation in Livestock Expo

ICAR-NRC on Pig Participated in the Livestok expo held at Multipurpose Ground of C.V.Sc., Khanapara from 7-10 November 2019. Mr. Atul Boarh, Minster of Agriculture and Livestock, Govt. of Assam visited the NRCP exhibition stall of ICAR-NRCP during the Expo.

ICAR-NRCP stall in livestock expo



Celebrations

CELEBRATIONS

Institute Foundation Day

ICAR-National Research Centre on Pig has celebrated its 18th foundation day on September 4th, 2019 with a day long programme. Dr. K.M. Bujarbaruah, Former Vice- Chancellor, A.A.U. , Jorhat and Former DDG (Animal Science), ICAR, New Delhi was the Chief Guest of the programme and Dr. B. Saikia, Dean, CVSc, Khanapara and Dr. K.K. Baruah, Former Director, NRC on Yak, were the Guest of Honours. Dr. Swaraj Rajkhowa, Director of the institute addressed the gathering and explained the ongoing institute activities and the plan of work for the coming years. He also thanked all the staff and well wishers of the institute for joining their hands together in contributing to the institute progress. Speaking on the occasion, the chief guest appreciated the whole team of the institute for their significant contributions towards the development of pig sector in India. He also highlighted the role played by the institute in serving the small holders in North East India. All scientific, technical and administrative staff of the institute joined together to celebrate the day. Sports events and literary events were organized for institute staff and students of Rani High School respectively. A farmer-scientist interaction was also arranged as part of the event. The beneficiaries of the institute from the nearby villages came forward to express their gratitude and expectations from the institute.

Glimpses of Institute Foundation Day activities

Vigilance Awareness Week

Vigilance Awareness Week-2019 was observed in ICAR-National research Center on Pig, Rani, Guwahati, Assam from 28.10.2019 to 02.11.2019. During the Vigilance Awareness Week-2019 a number of activities were organized starting from pledge taking ceremony to conducting

of competitions, workshop, public display of banner etc. On 28.10.2019, The Pledge was taken by all the employees of the institute. Director of the institute, Dr. Swaraj Rajkhowa deliberated on issues of corruption and discussed how individual should follow the transparency in their work. A pamphlet was prepared by the Vigilance Officer of the institute covering basis aspects of vigilance. It also covered the do's and don'ts in daily office life keeping in view of vigilance. The pamphlet was distributed among all the staffs of the institute. On the same day, an essay writing competition on "Integrity-way of Life" was conducted among the staff members of the institute. A sensitization programme and talk on vigilance was delivered by Dr. M.K. Tamuli, Ex-Principal Scientist and Ex-Vigilance Officer of ICAR NRC on Pig on 31.10.19. A workshop on Vigilance Awareness was organized at the institute on 2.11.19. Audit Officer Mr. Biman Dutta, Chartered Accountant and his associates from S. Singhi Farm, Kolkata delivered lecture on different aspects of vigilance. Banners were prepared on the topic "Integrity-way of Life" and were displayed at public area for creation of awareness. Staffs of ICAR-NRC on Pig interacted with the local people about vigilance awareness. The institute observed Vigilance Awareness Week by organizing different activities with great fervor to enhance the awareness, to display honesty by all of us, at all time and at all places

Director of the Institute and Invited Guest highlighting the importance of vigilance awareness

National Unity Day

The institute organised National Unity Day on 31th October 2019 at ICAR –NRC on Pig, Rani. The director of the institute thrown light on the National Unity Day Importance and a pledge was taken by all the participants of the programme.

Independence Day

The institute celebrated 73nd Independence Day of our country on 15th August 2019. All the staff of the institute assembled with a great zeal for the flag hosting function. The Director of the institute delivered speech on this occasion by remembering all the martyrs who shed their blood in the freedom fight.

World Veterinary Day

The Institute celebrated World Veterianry Day on 27th April 2019 with theme "Value of Vaccination". All the institute staff including RAs and SRFs participated in the programme. Director of the institute expressed his views during the event.

International Women's Day

International Women's Day was celebrated at ICAR-NRC on Pig on 8th March, 2019. Live telecast programme of Ho'ble Prime Minister, Sh. Narender Damodar Modi was also organized on the occasion. All the staff members of the institute participated in the programme. Farmers were also invited in the programme.

Gandhi Jayanti

The Institute celebrated 150th birth anniversary of Mahatma Gandhi on 2nd October, 2019 to commemorate his immense contribution in freedom fight of India by following the way of non-violence. As part of the celebration, institute organized drawing competition for school children in the nearby villages and distributed certificates and prizes.

Swachh Bharat Abhiyan

As part of the 'Swachh Bharat Abhiyan' initiative of central government, the institute organized various activities throughout the year as per the ICAR guidelines. *Swachhta Pakhwada, Swachhta hi Seva* Campaign in nearby villages, Workshop on *Swachhta, Awareness campaign on Swachhta* and planting trees in the campus were the different activities organized.

Swachhta Pakhwada

Swachhta Pakhwada was observed at the institute from 16th to 31st December 2019. As part of the programme, institute staff planted trees in the campus and engaged in cleaning activities with great enthusiasm. Oath taking was also done by the staff in which they promised to take part in swachhta abhiyan by keeping clean surroundings. As part of the programme, institute also sponsored concrete waste bins in the nearby villages to encourage the villagers in maintaining cleanliness.

Swachhta hi Seva Campaign

The institute organized *swachhta hi seva campaign* from 15th septembet to 2nd October, 2019 in the nearby villages of the institute. The Director and institute staff visited villages and created awareness on swachhta abhiyan and encouraged the village people to keep their surroundings clean. The campaign was done at Maharipara village, Baksa District and Rani village, Kamrup District. Institute staff also participated in cleaning the villages.

Workshop on *Swachhta*

A workshop on swachhta was organized at the institute on 24th December, 2019. Farmers from the nearby villages participated in the workshop

Glimpses of activities carried out under Swachh Bharat Abhiyan

Celebrations

International Yoga Day

The institute has observed International Yoga Day on 21st June, 2019. Experts were invited for the programme. All scientist, technical, administrative, RAs, SRFs etc. participated in the programme.

Mann ki baat

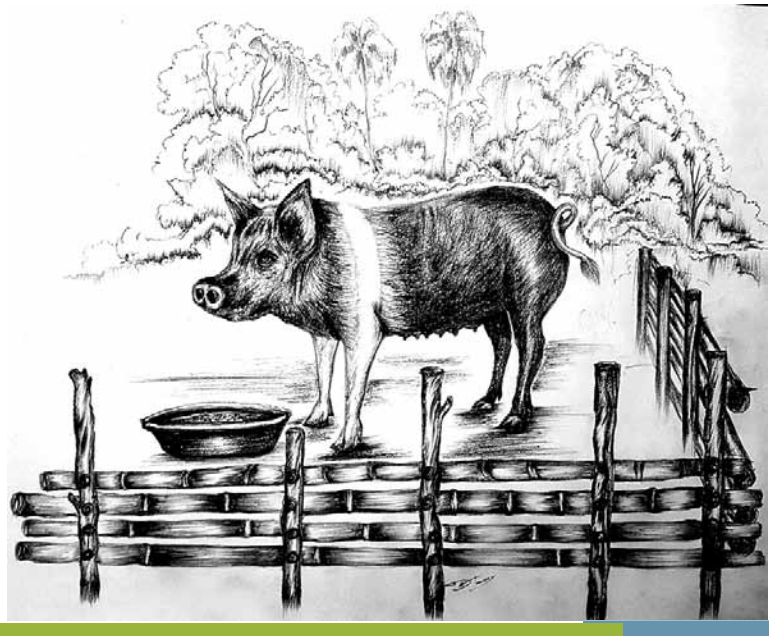
The Institute organized live video tele-casting show of Mann Ki Baat Programme of Prime Minister Shri. Narendra Modi on 24/02/2019 as per the ICAR guidelines. The local leaders and farmers from the nearby villages assembled at the institute to view the programme.

Awareness programme on J-Gate@CeRA

All the Scientist, technicals and research fellows of the institute participated in the awareness programme on J-Gate@CeRA on 23/08/2019. Mr. Mahendranath S, Training Manager, CeRA delivered a talk and demonstration on CeRA.

New Year Celebration

All the institute staff shared the joy of New Year by a cake cutting ceremony organized on 1st January, 2019 at the institute. Director expressed his new year wishes to all the staff on this occasion.



Hindi Cell

HINDI CELL

राष्ट्रीय सूकर अनुसंधान केंद्र, गुवाहाटी में निम्नलिखित राजभाषा कार्यान्वयन समिति कार्यरत है।

क्रं संख्या	समिति	नाम
1.	अध्यक्ष	डा.स्वराज राजखोवा, निदेशक
2.	सदस्य	डा.शान्तनु बानिक, प्रधान वैज्ञानिक
3.	सदस्य	डा.सीमा राणी पेगु, वरिष्ट वैज्ञानिक
4.	सदस्य	डा.सुनील कुमार, वैज्ञानिक
5.	सदस्य	श्री प्रभात कुमार नायक, सहायक वित्त एवं लेखा अधिकारी
6.	सदस्य	श्री उत्तम प्रकाश, सहायक प्रशासनिक अधकारी एवं हिंदी प्रभारी

कार्यालय में प्रत्येक तिमाही को राजभाषा कार्यान्वयन समिति बैठक करवाती है तथा हिंदी के प्रचार व प्रसार के लिए सुझाव देती है एवं प्रगति रिपोर्ट की समीक्षा करती है। कार्यालय समय समय पर राजभाषा विभाग को तिमाही रिपोर्ट प्रस्तुत करता है। कार्यालय में वर्ष में 4 राजभाषा कार्यान्वयन समिति बैठक का आयोजन किया गया।

राजभाषा कार्यान्वयन समिति की बैठक का कार्यवृत

तारीख	स्थान
15-02-2019, 3.00 बजे	समिति कक्ष, राष्ट्रीय सूकर अनुसंधान केंद्र, राणी, गुवाहाटी
7-05-2019, 11.00 बजे	राष्ट्रीय सूकर अनुसंधान केंद्र, राणी, गुवाहाटी
12-09-2019, 11.00 बजे	राष्ट्रीय सूकर अनुसंधान केंद्र, राणी, गुवाहाटी
15-11-2019, 3.00 बजे	राष्ट्रीय सूकर अनुसंधान केंद्र, राणी, गुवाहाटी

राष्ट्रीय सूकर अनुसंधान केंद्र, गुवाहाटी नगर राजभाषा कार्यान्वयन समिति का सदस्य है एवं संस्थान ने नगर राजभाषा कार्यन्वयन समिति की सभी बैठकों में भाग लिया।

राजभाषा विभाग के निर्देश अनुसार वार्षिक कार्यक्रमों, राजभाषा अधिनियोमो एवं अन्य सभी आदेशों/अनुदेशों का अनुपालन कार्यालय द्वारा वर्ष में सफलतापूर्वक किया गया।

राष्ट्रीय सूकर अनुसंधान केंद्र, गुवाहाटी में हिंदी पखवाड़ा का आयोजन

राष्ट्रीय सूकर अनुसंधान केंद्र, राणी, गुवाहाटी में 16 सितम्बर 2019 से 30 सितम्बर तक हिंदी पखवाड़ा का आयोजन किया गया ।

हिंदी दिवस का सुभारम्भ डा.स्वराज राजखोवा, निदेशक, राष्ट्रीय सूकर अनुसंधान केंद्र, राणी, गुवाहाटी द्वारा किया गया। निदेशक महोदय ने हिंदी भाषा का महत्व और सरकारी कार्यालय में इसकी उपयोगिता के बारे में बताया तथा कार्यलय के सभी कर्मचारियों को अधिक से अधिक कार्य हिंदी में करने का आह्वाहन किया । तद्पश्चात आमंत्रण किये गए विशिष्ट अतिथि दैनिक पूर्वोदय के संपादक श्री रवि शंकर रवि जी ने भी राजभाषा से जुड़े महत्वपूर्ण बातों के बारे में कर्मचारियों को संबोधित किया। इसके बाद श्री उत्तम प्रकाश सहायक प्रशासनिक अधकारी एवं हिंदी प्रभारी अधिकारी ने हिंदी दिवस के अवसर पर माननीय कृषि एवं किसान कल्याण ग्रामीण विकास और पंचायती राज मंत्री (भारत सरकार कृषि भवन, नई दिल्ली) जी का संदेश पढ़ कर सभी कर्मचारियों को सुनाया और साथ में हिंदी पखवाडा के दौरान होने वाले विभिन्न प्रतियोगितायो एवं कार्यक्रमों के बारे में बताया।

Hindi Cell

हिंदी सप्ताह में निम्नलिखित कार्यक्रमों का आयोजन किया गया

दिनांक	कार्यक्रम	आयोजन स्थल
16.09.2019, 3.00 बजे	उद्घाटन सत्र, निदेशक, राष्ट्रीय सूकर अनुसंधान केंद्र, राणी, गुवाहाटी द्वारा	समिति कक्ष
16.09.2019, 3.30 बजे	निबंध एवं हिंदी लेखन प्रतियोगिता (विशिष्ट अतिथि, श्री रवि शंकर रवि संपादक, दैनिक पूर्वोदय)	समिति कक्ष
18.09.2019,11.00 बजे	छात्रों का वाद-विवाद प्रतियोगिता	राणी हाईस्कूल, राणी
19.09.2019, 3.00 बजे	हिंदी कार्यशाला-01(डा. सुनील कुमार)	समिति कक्ष
19.09.2019, 3.30 बजे	सामान्य ज्ञान-प्रतियोगीता	समिति कक्ष
20.09.2019,12.30 बजे	हिंदी कार्यशाला-02(डा. सुनील कुमार) वाद-विवाद प्रतियोगिता	समिति कक्ष
25.09.2019, 11.00 बजे	हिंदी कार्यशाला-03 तथा गायन प्रतियोगिता (एकल)	राणी हाईस्कूल, राणी
28.09.2019,11.30 बजे	हिंदी कार्यशाला-04	समिति कक्ष
30.09.2019, 10.00 बजे	हिंदी कार्यशाला-05 (विशिष्ट अतिथि, श्री बद्री यादव, अनुसंधान अधिकारी एवं कार्यालय प्रमुख, क्षेत्रीय कार्यान्वयन कार्यालय, गुवाहाटी	समिति कक्ष
30.09.2019,11.30 बजे	गायन प्रतियोगिता (युगल) राणी हाईस्कूल, राणी	
30.09.2019, 12.30 बजे	गायन प्रतियोगिता (युगल)	
30.09.2019, 1.30 बजे	समापन सत्र	

18.09.2019 हिंदी पखवाड़ा के दौरान स्थानीय स्कूल (राणी हाईस्कूल के कक्षा 8वी से कक्षा 10वी के छात्रों के बीच वाद-विवाद प्रतियोगता का आयोजन किया। 30.09.2019 कार्यक्रम के समापन अवसर पर विशिष्ट अतिथि श्री बद्री यादव, अनुसंधान अधिकारी एवं कार्यालय प्रमुख, क्षेत्रीय कार्यान्वयन कार्यालय, गुवाहाटी की उपस्थितियों में गायन एवं सामान्य ज्ञान प्रतियोगिता का आयोजन किया गया। कार्यक्रम के समापन में राणी हाईस्कूल के छात्रों के बीच गायन प्रतियोगिता और छात्रों द्वारा सांस्कृतिक कार्यक्रमों का आयोजन भी किया गया। निदेशक महोदय द्वारा हन्दी पखवाड़ा के कार्यक्रम में सभी वजयी प्रतिभागियों को सन्मानित कर पुरस्कृत किया और सभी से अपील कि, हिंदी भाषा में अधिक से अधिक कार्य कर राजभाषा को गौरान्वित करे। श्री उत्तम प्रकाश, सहायक प्रशासनिक अधकारी एवं प्रभारी राजभाषा अधिकारी ने सभी अतिथि गणों, कर्मचारियों एवं राणी हाईस्कूल के छात्रों एवं अध्यापको को धन्यवाद ज्ञापन के साथ कार्यक्रम का समापन किया।

हिन्दी पखवाड़ा गतिविधियां

Training Programmes Organized

TRAINING PROGRAMMES ORGANIZED

The institute has conducted a series of training programmes in different aspects of pig production, artificial insemination, pork processing and value addition. These trainings have provided 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.

Also, these trainings have provided exposure to the participants on basics of ante & postmortem 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. Training has also provided 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.

List of training 2019-20 with budget and source of funding

SN	Name of the training	Funding agency
1	Master Training Programme for AHVD staff on Scientific Pig Farming from 28th-1st Feb, 2019	APART, Govt. of Assam
2	Master Training Programme for local service provider from 4th-8th March, 2019	APART, Govt. of Assam
3	'*Advance Pig Husbandry Practices'* scheduled from 20th to 24th May 2019	Sponsored training.
4	Master Training (ToT) Programme for AHVD Staff in Scientific Pig Farming w.e.f. 27th to 31st May' 2019	APART, Govt. of Assam
5	Master Training (ToT) Programme for Local Service Provider (Pig Bondhu), w.e.f. 10th to 14th June' 2019	APART, Govt. of Assam
6	Master Training (ToT) Programme for AHVD Staff in Scientific Pig Farming w.e.f. 24th to 28th June' 2019	APART, Govt. of Assam
7	Training on Artificial Insemination in Pig w.e.f. 10-12 June 2019	NLM, Govt. of Assam
8	*Scientific Pig Husbandry Practices for sustainable livelihood*' w.e.f. 25th to 29th June 2019	Biotech Kisan Project
9	Training on Artificial Insemination in Pig w.e.f. 23-25 July 2019	AHVD, Arunachal Pradesh
10	5 days training programme for farmers on "Good Management Practices for pig farming" for farmers under TSP of the Institute held from 5-9th August 2019.	Tribal Sub Plan of Institute
11	5 days training programme for farmers on '*Good Management Practices for Pig Farming'* scheduled from 26th to 30th August 2019.	Sponsored programme
12	'Scientific rearing practices for profitable Pig Farming" w.e.f. 21st September to 05th October 2019	Dept of Livestock, Fisheries and Animal Husbandry, Sikkim

Training Programmes Organized

13	*Scientific Piggery farming for sustainable livelihood'*for farmers w.e.f. 16-20th September 2019.	MAC, Dhemaji
14	"Good Management Practices for pig farming" for farmers under TSP of the Institute held from 14-18th October 2019	Tribal Sub Plan of Institute
15	5 days individually paid training programme on '*Piggery Farming for Sustainable Livelihood'*w.e.f. 26-30th November 2019.	Self Sponsored
16	Master Training (ToT) Programme for AHVD Staff in Scientific Pig Farming, w.e.f. 11th to 15th November' 2019	APART, Govt. of Assam
17	'*Scientific Piggery farming for sustainable livelihood'*for farmers w.e.f. 9-13th December 2019.	MAC, Dhemaji








Glimpses from the training programmes organized at ICAR-NRC on Pig

Workshop on Intellectual Property Rights and Biodiversity laws

Two days workshop on Intellectual Property Rights and biodiversity laws has been organized at ICAR-NRC on Pig on 19th and 20th February 2019. More than sixty scientists, specialists, students, research fellows, office staffs and representatives from NER-Barapani, College of Veterinary Science, AAU, Khanapara were participated in the workshop. Shri K.Chitrarasu, Advisor law, National Biodiversity Authority, Chennai, Mrs. P. Kanthi Meenakshi, Professional, National Biodiversity Authgority, Chennai and Dr. Topi Basar, Associate Professor, National Law University and Judicial Academy, Assam was the as guest of honourof the event. Workshop covered all the aspects of Intellectual Property Right and Biodiversity Laws like - Geographical

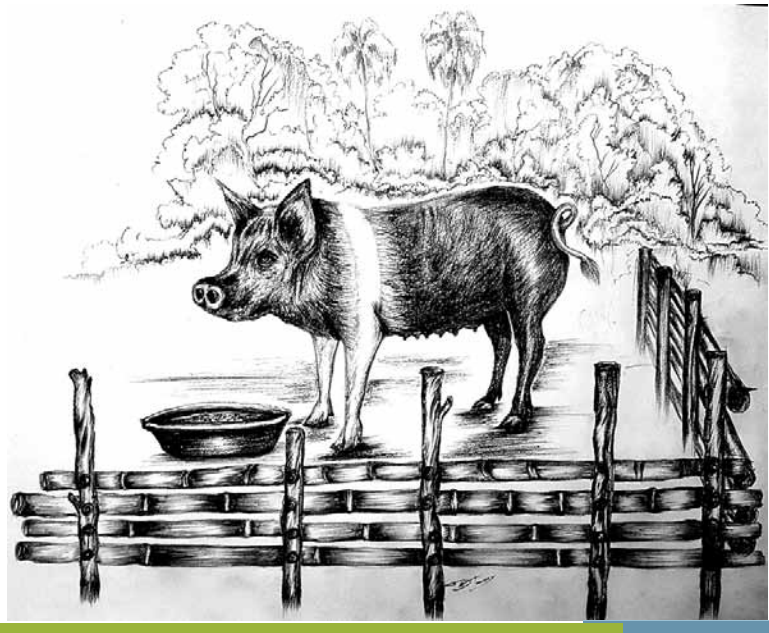
indication, Industrial design, protection of plant variety and farmer's right, importance of biodiversity act, protection of animal genetic resources and also the functional organizational structure of IP offices in the country.

National Workshop on Biosecurity for Effective Management of Emerging Infectious Diseases of Pigs in NER

A day long National Workshop on "Biosecurity for Effective Management of Emerging Infectious Diseases of Pigs in NER" was organized on 23rd March 2019 at ICAR-NRC on Pig, Rani, Guwahati. In the inaugural session, Welcome addresses by Dr. S. Rajkhowa, Director, ICAR-NRC on Pig was followed by addressing the gathering by Chief Guest, Dr. M.P. Yadav, President, Indian Association of Veterinary Microbiologists, Immunologists & Specialists in Infectious Diseases (IAVMI) and Guest (s) of honor Dr. S. K. Das, Prof. & Head (Vety. Microbiology), C.V.Sc., Khanapara & Dr. D.K. Sarma, Prof. (Vety. Microbiology) & Former Director, ICAR- NRC on Pig. Disease Investigation Officers (DIOs) & Representatives from State Vety. & Animal Husbandry Departments of NER states, In-charges of AICRP on Pig & Mega seed Project on Pig located in the NER and Scientists from other ICAR Institutes participated in the Workshop. Scientific persons from C.V.Sc., A.A.U., Khanapara and institutional staff also participated in the workshop. A compendium of invited lectures was released in the inaugural session.

Brain Storming Session on African Swine Fever

A day long Brain Storming Session on "Afrcian Swine Fever: Measures for its Prevention and Control" was organized on 28/06/2019 at ICAR-NRC on Pig, Rani, Guwahati. In the inaugural session, Welcome addresses by Dr. S. Rajkhowa, Director, ICAR-NRC on Pig was followed by addressing the gathering by Chief Guest, Dr. Parveen Malik, Animal Husbandry Commisioner, Govt. of India and Guest (s) of honor Dr. S. K. Das, Prof. & Head (Vety. Microbiology), C.V.Sc., Khanapara, Dr. D.K. Sarma, Prof. (Vety. Microbiology) & Former Director, ICAR- NRC on Pig and Dr. Arnab Sen, Head and Pr. Scienitst, Animal Health, ICAR-RCNEH, Barapani. Veterinary officers from AHVD, Assam and Scientists from other ICAR Institutes participated in the Workshop. Scientific persons from C.V.Sc., A.A.U., Khanapara and institutional staff also participated in the workshop.



Awards and Recognitions

AWARDS AND RECOGNITIONS

Dr.N.H.Mohan

- ICAR-NRC on Pig received certificate from Honourable Director General, ICAR for proactively implementing ICAR data management guidelines and uploading publications and technologies for past 6 year on 10.12.2019. The certificate was received by Dr.N.H.Mohan, Nodal Officer, Data Management, during the ICAR KRISHI nodal officers workshop in NASC from 10-11 Dec 2019 on behalf of ICAR-NRC on Pig.

Dr. Santanu Banik

- First best presentation award for Banik, S., Barman, K., Kumar, S., Das, P.J., Thomas, R. and Rajkhowa, S. 2019. 'Rani: A crossbred pig variety for doubling farmers' income' during Golden Jubilee celebration of Assam Agricultural University and International Seminar on 'Animal agriculture for doubling farmers' income: technology, policy and strategy options' (February 27-28th, 2019) at CVSC, AAU, Khanapara.
- Acted as external thesis evaluator of two Ph.D. Dissertation (Animal Genetics Breeding) of College of Vety. Sciences and Animal Husbandry of Assam Agricultural University.
- Judge, National Livestock and Poultry Show -2019. Organized by Animal Husbandry and Veterinary Department, Govt. of Assam.

Dr. P. J. Das

- Best presentation (First) award for Banik, S., Barman, K., Kumar, S., Das, P.J., Thomas, R. and Rajkhowa, S. 2019. 'Rani: A crossbred pig variety for doubling farmers' income' during Golden Jubilee celebration of Assam Agricultural University and International Seminar on 'Animal agriculture for doubling farmers' income: technology, policy and strategy options' (February 27-28th, 2019) at CVSC, AAU, Khanapara.

Dr. R. Thomas

- Empanelled as member in FAD 18/P-5 and FAD 18/P-3 panels to review Indian Standards under FAD 18 of BIS 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.
- Empanelled as Expert in Meat Plant Inspection Committee by APEDA vide letter no. MPD/ MT/38/ 2018/124.

- Empanelled as member in "Scientific Panel on Meat and meat products including poultry" under FSSAI.

Dr. Seema R. Pegu

- Reviewed manuscript as reviewer of journal – Indian Journal of Veterinary Pathology
- External examiner for evaluation of M.V.Sc. Thesis of Veterinary Pathology from College of Veterinary Science, Khanapara, Assam.

Dr. Sunil Kumar

- Awarded Second prize as co-author for presentation on Interservice Interval, Follicular dynamics and Fertility in crossbred cows in National Conference on Livelihood Improvement through Sustainable Livestock Production from November 3-4, 2019 at ICAR- Central Institute for Research on Cattle, Meerut Cantt.
- Awarded Institutional Prizes in Hindi Essay Writing (First), Hindi Writing (Third) and Quiz (Second) on occasion of celebration of Hindi Pakhwada from 14/09/2019 to 29/09/2019 at ICAR- NRC on Pig, Rani.
- Awarded Institutional Prizes in Sports events Cricket (First) and Badminton (Runner up) organized on occasion of celebrations of Institute Foundation day at ICAR- NRC on Pig, Rani.
- Invited as expert on A.I. in Pigs by SANJEEVNI (Socio economic Welfare organization), Jharobari, Assam delivered 2 lectures and practical demonstration on A.I. in Pig.

Dr. Misha Madhavan M.

- Invited lecture on the occasion of farmers' day program at Metuakuchi, Barpeta District, Assam on the topic "Effective Waste Management in Livestock Farms" in association with the Rural Extension Education Program of Syndicate Bank Regional Office, Guwahati on 23rd December, 2019
- Received second prize in debate competition organized as part of "swachhata hi sewa" program at ICAR-NRC on Pig on 2nd October, 2019.
- Received third prize in the debate competition organised as a part of Hindi Pakhwada-2019 at ICAR-NRC on Pig

Dr. Satish Kumar

- Second prize in Hindi Lekhan, Vad- Vivad, Third prize in Hindi Prashnotari, Hindi Nibandh.
- Ist prize in Debate competition on "swachhata hi sewa" on 2nd October 2019 at NRC on Pig
- Winner in Badminton Mixed doubles and Cricket; Runner up in Badminton Single, Badminton Doubles, Carrom Single, Carrom double and Table Tennis Doubles events in Annual sports meet during Foundation Day celebrations
- Nominated as expert from NRC on Pig for verify the claim of Purnea/Vananchal black pig prior to registration.

Human Resource Development

HUMAN RESOURCE DEVELOPMENT

Dr. Swaraj Rajkhowa

- Attended Review meeting of DBT funded project at DBT, New Delhi on 16th April, 2019.
- Delivered key lecture on topic "strategy for augmenting pig production in India" in Brain Storming Session On Sustainability of Livestock and Fishery Production Systems in India: Issues and Indicators held at ICAR-National Dairy Research Institute, Karnal on 20th April 2019.
- Visited the site as member of Site Selection Committee for shifting location of KVK Baksa on 29th April, 2019.
- Attended Annual Review Meeting of KVKs during 29th, 30th and 31stMay, 2019 at CIFRI Training Hall, Housefed Complex, Beltola.
- Conducted IRC meeting on 15th May, 2019.
- Attended meeting with DDG (AS) for finalization of SFC of the institute (2017-18 to 2019-20) w.e.f. 27-28th May, 2019.
- Conducted IMC meeting on 3rd June, 2019.
- Attended Technology Showcase meeting of ADMaC held at ICAR Res. Complex For NEH Region, Meghalaya w.e.f. 10-11th June, 2019.
- Attended the meeting of all the Directors of Animal science institutes of ICAR with the Hon'ble Union Minister of AHD& F at Krishi Bhawan, New Delhi on 17.6.19.
- Attended the meeting of Hon'ble Union Minister of AHD& F at Krishi Bhawan, New Delhi to discuss about the piggery sector of the country on 19.6.19
- Organized brainstorming session on "African Swine Fever: Measures for its prevention and control" at ICAR-NRC on Pig on 28th June, 2019.
- Attended one day brain storming session on "Livestock, poultry, dairy and fishery sector development in Assam organized by State Innovation and transformation Aayog (SITA) in collaboration with AAU on 2nd July at Assam Administrative Staff College, Khanapara.
- Attended the meeting of Directors of all the institutes of NER with the DDG (NRM), ICAR at NASC complex on 4th July, 2019 for discussion about the NEH component.
- Attended brain storming session of ADMaC on 13th July, 2019.
- Delivered a lecture on Quality Animals (Pig) in Enhancing Productivity – Issues" at Regional Advisory Group Meeting on Piggery organized by NABARD, Guwahati on 24th July, 2019.
- Conducted institute RAC from 19th to 20th August, 2019
- Conducted (as Chairman) the 4th National Technical & Implementation Committee (NTIC) meeting for pig development plan for Northeast at Krishi Bhawan, New Delhi on 28th August 2019.
- Conducted Annual Review Meeting of AICRP on Pig and Mega Seed Project on pig, the for the year 2018-2019 at ICAR Research Complex for NEH Region, Umiam, Meghalaya on 27th and 28th September, 2019.
- Attended the fifth edition of NITI Aayog Lectures at Vigyan Bhawan, New Delhi on 26th October, 2019.
- Attended the meeting (chaired by the Secretary DARE & DG, ICAR) for finalization of AICRP's plan of action held at NASC, New Delhi on 1st November, 2019.
- Attended Meeting with the Governor of Assam at Morigaon for development of piggery sector in the Morigaon district of Assam on 5th November, 2019.
- Attended National Livestock and Poultry show 2019 at Khanapara w.e.f. 7-10 November,

2019 organized by AH & Vety. Department, Govt. of Assam and Assam Livestock and Poultry Corporation.

- Attended and delivered a lecture in 2-days conference on "Strategies for comprehensive development of piggery sector in Assam" organized by AH & Vety Dept. Assam, NLM, Assam and RKVY at Officers Training Institute, Khanapara from 27-28th November, 2019.
- Attended the Review meeting of DBT funded ADMaC Project at DBT, New Delhi on 17th December, 2019.
- Attended 18th Annual Convocation cum Scientific Convention on Futuristic Technologies in Animal Health & Production held at Kamdhenu University , Gandhinagar w.e.f. December 26-27, 2019.
- Attended the Review Meet of All India Network Project on neonatal mortality (AINP-NM) in farm animals held on 6th January, 2020 at NASC, New Delhi.
- Attended the 3rd Biennial General Conference of AH and Vety. Service Association, Goalpara district Branch held at Goalpara from 18-20th January, 2020. Also acted as Co-Chairman of Technical session on "Äntimicrobial resistance trend: Current and future challenges.
- Attended the meeting of Breed Registration Committee at Krishi Bhawan, New Delhi on 24th January, 2020.
- Attended a brain storming session on Development of pig sector in Assam through breed improvement at Khanapara, Guwahati organized by AH & Vety. Dept., Govt of Assam and ILRI on 30th January, 2020.
- Attended the XXXIII Annual Convention of IAVMI held at IVRI, Izatnagar from 6-7 February, 2020
- Delivered a lecture on scope and opportunities for pig farming in NE India in the HRD training for the newly recruited SMSs of KVKs under ICAR-ATARI, Guwahati held at ATARI, Guwahati on 11th February, 2020.
- Organized a live telecast (farmer's Scientists interaction) programme of DD Kendra, Guwahati on 22nd February, 2020.
- Organized (as a Co-Chairman) a State level farmers fair cum farmers-scientists' interaction on "Farmers' prosperity through doubling farmers' income" at HRS, Kahikuchi, Guwahati from February 26th -27th, 2020. Also Co-chaired a technical session on theme : Livestock and Fisheries.

Dr. Santanu Banik

- Round table on "Pig Health and Production" during XXXII Annual convention of IAVMI and national conference on "scientific and technological innovations in animal healthcare for better production and trade" at Bihar Animal Sciences University, Patna (5.02.2019).
- Golden Jubilee celebration of Assam Agricultural University and International Seminar on 'Animal agriculture for doubling farmers' income: technology, policy and strategy options' (February 27-28th, 2019) at CVSC, AAU, Khanapara.
- North East summit for SC/ST entrepreneurs "Promoting Trade Opportunities for SC/ST Entrepreneurs in the North-eastern Region" organized by MSME, GoI on 22 & 23 November 2019, ManiramDewan Trade Centre, Guwahati, Assam.
- Meeting with DADF and state officials for import of pig by NE states (18.01.2019) at ICAR-NRC on Pig.
- Fourth National Technical and Implementation Committee (NTIC) for pig development plan for Northeast at Krishi Bhawan, New Delhi on 28th August, 2019.

- Visit to the AIRCP on Pig center, GADVASU center, Ludhiana (15.07.19-17.07.19).
- Visit to AICRP on Pig center at of ICAR-CIARI, Port Blair (31.4.19-2.04.2019).
- Visit to Mega Seed Project on Pig, Agartala, Tripura (14.11.2019-15.11.2019).
- Meeting for review of AICRP Projects chaired by Secretary, DARE and DG, ICAR. (1.11.2019)
- Meeting for registration of pig variety at ICAR-NBAGR, Karnal (14.10.2019).
- Annual Review meet of AICRP on Pig and Mega Seed Project on pig at NRC on Pig, Guwahati (27.9.2019-28.09.2019).
- Interactive meeting on Biotech *Kissan* Project at ICAR RC, Barapani. (22.02.2019).
- IMC meeting of ICAR-NRC on Yak at ICAR-NRC on Yak, Dirrang, Arunachal Pradesh(27.03.2019).

Dr. P.J. Das

- Attended Brainstorming session on "African swine fever: Measures for its prevention and control" held on 28th June, 2019 at ICAR-National Research Centre on Pig, Rani, Guwahati, Assam**.**
- Attended as expert to verify the registration of Mali pig breeds in the breeding tract. Visiting area included Tripura West, Khowai and Dhalai districts of Tripura from 9-11 July 2019.
- Participated 8-week Entrepreneurship Bootcamp, July-September 2019 organized by TiE Delhi-NRC for ITRA, Digital India Corporation, New Delhi.
- Participated one day ABI-orientation Workshop held on 1st Oct, 2019 at ICAR-National Research Centre on Pig organized by Agri-Business Incubation Unit.
- Participated National Livestock & Poultry Show held at Khanapara, Guwahati, Assam on 7-10 November 2019 organized by Animal Husbandry and Veterinary Department and Assam Livestock and Poultry Co-operation Limited.
- Attended one day work shop on sensitization workshop on Technology commercialization /Licensing" held at ICAR-National Research Centre on Pig on 16th December 2019 organized by Agri-business Incubation Centre of ICAR-NRC on Pig in collaboration with Agrinnovate India Ltd. New Delhi.

Dr. Mohan N. H.

- International training under LBS outstanding young scientist from 29.03.2019 to 28.06.2019 at Institute of Molecular Biology, Mainz, Germany.
- National Workshop on Biosecurity for effective management of emerging infectious diseases on pigs in NE Region, organised by ICAR-NRC on Pig on 23rd March 2019.
- 88th Annual Meeting of the Society and a conference on "Advances at the Interface of Biology and Chemistry" BARC, Mumbai Nov.1-3, 2019.
- AICRP/Megaseed Project on Pig annual review meet from 27-28 Sept 2019 at ICAR RC for NEH region, Umiam, Barapani, Meghalaya
- ICAR KRISHI nodal officer's workshop in NAS Complex, New Delhi from 10-11 Dec 2019.
- Particippated in International Seminar on "Animal Agriculture for Doubling Farmers' Income - Technology, Policy and Strategy opinions" on 27th-28th February, 2019. Organized by College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Assam
- Display of institute activities and technologies.International Seminar on "Animal Agriculture for Doubling Farmers' Income - Technology, Policy and Strategy opinions" on 27th-28th February, 2019. Organized by College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Assam.

- Organised a Workshop on Intellectual Property Rights (IPR) and Biodiversity laws from 19-20th Feb 2019 in collaboration with The Assam Science & Technology and Environment Council, National Law University and Judicial Academy-Assam and National Biodiversity Authority.

Dr. R. Thomas

- Participated and presented a Lead Paper in the International Seminar on "Animal Agriculture for doubling farmers' income: Technology, policy and strategy options" held at CVSc, AAU, Khanapra during 27-28th February, 2019.
- Participated and delivered lecture in "Workshop on Intellectual Property Rights and Biodiversity Laws" organized by ICAR-NRC on Pig during 19-20th February, 2019.
- Participated and presented paper in "National Agri-Business Entrepreneurship Conclave" held at ICAR-RC for NEH, Umiam during 9-11th February, 2019.
- Delivered a Lead Paper in the International Seminar on "Animal Agriculture for doubling farmers' income: Technology, policy and strategy options" held at CVSc, AAU, Khanapra during 27-28th February, 2019.
- Delivered invited lecture in "Workshop on Intellectual Property Rights and Biodiversity Laws" organized by ICAR-NRC on Pig during 19-20th February, 2019.
- Delivered Lead paper in "National Agri-Business Entrepreneurship Conclave" held at ICAR-RC for NEH, Umiam during 9-11th February, 2019.
- Attended orientation workshop on "Risk assessment framework structure-Novel foods and additives" held at FDA Bhawan, New Delhi, organized by FSSAI on 24th July, 2019.
- Inputs were provided time to time towards establishing a large animal slaughter house at ICAR-NRC on Mithun, Mezdiphema as a member of Technical Consultancy Committee.
- Associated with the "Awareness building programme on scientific pig production and processing for export linkages in different blocks of Assam" organized by Assam Livestock and Poultry Corporation during 8-9th May, 2019.
- Participated and provided inputs on Piggery Development-Present activities, ongoing schemes and 5 year action plan in the "Vet Con-2019: Hon'ble Chief Minister's Target and Goals of Animal Husbandry & Veterinary Department, Assam" on 27th September, 2019.
- Participated and provided inputs in the 40th Meeting of Scientific Panel on 'Food Additives, Flavourings, Processing aids and Materials in contact with Food' scheduled held on 26th April, 2019 at FDA Bhavan, FSSAI, New Delhi.
- Participated and provided inputs in the 41st Meeting of Scientific Panel on 'Food Additives, Flavourings, Processing aids and Materials in contact with Food' scheduled held on 21st June, 2019 at FDA Bhavan, FSSAI, New Delhi.
- Participated and provided inputs in the 42nd Meeting of Scientific Panel on 'Food Additives, Flavourings, Processing aids and Materials in contact with Food' scheduled held on 13th September, 2019 at FDA Bhavan, FSSAI, New Delhi.

Dr. Seema R. Pegu

- Attended LQM training on IS 17025:2017 at NITS, Noida during 25th -28th June, 2018.
- Attended Conference cum Workshop in "Host microbe Interaction" in IASST,Boragaon, Guwahati, Assam: 1st -2nd February 2019.
- Attended International seminar at C. V. Sc, Khanapara, Assam Agricultural University, Guwahati-781022 from 27th to 28th February, 2019.

- Participated and presented oral paper on the Topic: Serological evidence and molecular characterization of Japanese encephalitis virus in swine population of Assam in the Conference cum Workshop in "Host microbe Interaction" in IASST, Boragaon, Guwahati, Assam: 1st -2nd February 2019.
- Participated and presented oral paper on the topic Molecular Detection of Helicobacter spp. in pigs and pig handlers in the International seminar at C. V. Sc, Khanapara, Assam Agricultural University, , Guwahati-781022 from 27th to 28th February, 2019.
- Attended training on Fundamentals of "Bioinformatic and proteomic Research" conducted by Bioinformatics Infrastructure Facility, C.V.Sc, A.A.U, Khanapara, Guwahati from 26th to 29th November 2019.
- Attended National Symposium on Veterinary Pathology for Forcasting One Health, Food Security and Environment Protection at CAU, Selesih, Aizawl, Mizoram, India from 6th to 9th November, 2019.

Dr. Sunil Kumar

- Participated in National Workshop on Pig Biosecurity on 23rd March, 2019 at ICAR- NRC on Pig, Rani
- Participated in Agricultural Science Congress from 20-23 Feb., 2019 at IARI, New Delhi
- Participated in Workshop cum conference on Host Microbe Interactions from 1-2 Feb., 2019 at IASST, Ghy.
- Participated in International Seminar from 27-28th Feb., 2019 at C.V.Sc., A.A.U., Khanapara
- Participated in Workshop on IPR & Biodiversity laws on 23rd March, 2019 at ICAR-NRC on Pig, Guwahati
- Participated in National Steering committee meeting on Piggery development plan for North East on 18th Jan., 2019 at ICAR-NRC on Pig, Rani
- Participated in ABI –Orientation Workshop on 1st Oct., 2019 at ICAR- NRC on Pig, Rani
- Attended one day Sensitization workshop on Technology Commercialization/Licensing by Agriinnovate India Ltd. on Dec., 16, 2019 at ICAR-NRC on Pig, Guwahati, Assam.
- Participated in National Livestock and Poultry Show 2019 organized by Assam Live Stock And Poultry Corporation, AHVD, Govt. of Assam from 07-10/11/2019 at C.V.Sc., A.A.U., Khanapara.
- Participated in 35th annual convention of ISSAR and International symposium on Global Prospectives to enhance livestock fertility through modern reproductive techniques for doubling farmer's income organizes at VCRI, Namakkal, TANUVAS- 637 002 from 18-20 Dec., 2019.
- Participated in Workshop on "Writing Scientific Articles" organized at 35th annual convention of ISSAR and International symposium on Global Prospectives to enhance livestock fertility through modern reproductive techniques for doubling farmer's income organizes at VCRI, Namakkal, TANUVAS- 637 002 on 19th Dec., 2019.
- Participated in Workshop on "NECBH-DBT Funded projects" organized at Indian Institute of Technology, Guwahati on 29th April, 2019.

Dr. Jaya

- Attended one day Sensitization workshop on Technology Commercialization/Licensing by Agriinnovate India Ltd on 16-12-2019 at ICAR-NRC on Pig, Guwahati, Assam.

Dr. A.R. Sahoo

- National workshop on "Biosecurity for effective management of emerging infectious diseases of pigs in NER" on 23rd March 2019 held at ICAR-National Research Centre on Pig, Guwahati, Assam.
- Coastal Agri Expo 2019 held at ICAR-Central Coastal Agricultural Research Institute, Goa during 2-4 March 2019.
- Professional attachment training: ICAR-CCARI, Goa during 12-11-2018 to 11-02-2019.

Dr. Satish Kumar

- Attended one day workshop on Orientation workshop of Agribusiness incubation on 01-10-2019 at ICAR-NRC on Pig, Guwahati, Assam.
- Participated in National Livestock and Poultry Show held at College of Veterinary Science, Khanapara, Assam Agriculture University, Guwahati during 07-10, November, 2019.
- Attended one day Sensitization workshop on Technology Commercialization/Licensing by Agriinnovate India Ltd on 16-12-2019 at ICAR-NRC on Pig, Guwahati, Assam.

Dr. Misha Madhavan M

- Participated in the ABI-Orientation Workshop on 01-10-2019 at ICAR-NRC on Pig, Rani
- Participated in the National Livestock and Poultry Show 2019 organized at College of Veterinary Science, Khanapara on 7th to 10th November, 2019 under the aegis of Animal Husbandry & Veterinary Department and Assam Livestock and Poultry Corporation
- Participated in brainstorming session on "African Swine Fever: Measures for its prevention and control" organised on 28.06.2019 at ICAR- NRC on Pig, Rani
- Participated in Sensitization Workshop on Technology Commercialization/ Licensing by Agrinnovate India Ltd. on 16.12.2019 at ICAR- NRC on Pig, Rani
- Participated in the 'Method demonstration on silage making' organised at Sajjanpara Village, Kamrup District by ICAR-NRC on Pig, Rani on 20.11.19

Dr. Ajay Kumar

- Attended NATIONAL LIVESTOCK AND POULTRY SHOW-2019 at College of Veterinary Science Playground, Khanapara, Guwahati from 7/11/2019 to 10/11/2019 organized by Ministry of Agriculture and farmers Welfare in collaboration with Assam Govt. Animal Husbandry and Veterinary Department.
- Attended one day workshop on Orientation workshop of Agribusiness incubation on 01-10-2019 at ICAR-NRC on Pig, Guwahati, Assam.
- Attended one day Sensitization workshop on Technology Commercialization/Licensing by Agriinnovate India Ltd on 16-12-2019 at ICAR-NRC on Pig, Guwahati, Assam.

Dr. U.K. Bhattacharyya

- Participated in a special training programme organized by CAU, Imphal, Manipur and financed by ICAR-National Bureau of Agricultural Insect Resources (ICAR-NBAIR) for management strategies of Fall Army Worm (FAW) in the North East India. The training was entitled "*Biological control and compatible pest management modules for management of major pests in NEH region with emphasis on FAW*" at ICAR--National Bureau of Agricultural Insect Resources (ICAR-NBAIR) Hebbal, Bengaluru, 560024, Karnataka and held from from 16.09.2019 to 20.09.2019.

RESEARCH PROGRAMMES & PROJECTS

LIST OF INSTITUTE FUNDED RESEARCH PROJECTS

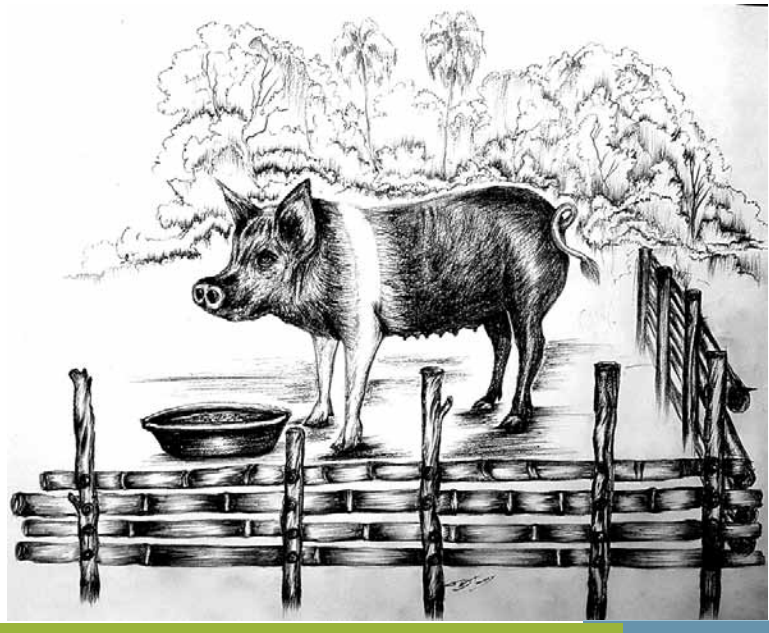
SN	Project title	Principal Investigator
	Flagship programme	
1	Artificial Insemination in Pigs	Dr. Sunil Kumar
	Programme-1: Conservation and genetic improvement of indigenous pigs	
2	Development of suitable crossbred pig (Project code: IXX01640)	Dr. S.Banik
3	Phylogenetic analysis of pig mitochondrial genome sequences of native pigs of North East India (Project code: IXX13503)	Dr. P. J. Das
4	Characterization and expression profiling of Pig MSY (male-specific region of Y chromosome) genes for boar fertility. (Project code: IXX14211)	Dr. P. J. Das
5	Generation-wise genetic evaluation of rani crosses (Project code: IXX14634)	Dr. S. Banik
6	Exploring Genetic Variability in different candidate genes and their association with reproduction and production traits in pigs	Dr. Satish Kumar
7	Microsatellite Profiling to detect polymorphisms associated with Production and Reproduction traits in Ghungroo and Doom pigs	Dr. A.R. Sahu/ Dr. Satish Kumar
	Programme-2: Optimization of physiological and reproductive efficiency including identifying markers for early detection of fertility	
8	Development of protocols for boar semen cryopreservation in pigs	Dr. Sunil Kumar
9	Development of early fertility markers in pigs (Project code: IXX12418)	Dr. Mohan. N. H.
10	Hormonal interventions for induction of cyclic ovarian activity in pre-pubertal gilts and anestrous sows (Project code: IXX12500)	Dr. Sunil Kumar
11	Development of protocol for boar semen cryopreservation in pigs	Dr. Sunil Kumar
12	Regulation of ovarian function by locally produced immunogenic and angiogenic growth factors in pigs.	Dr. Jaya
	Programme-3: Characterization of production system, feeding practices and their optimization for enhancing pig production, especially under field conditions	
13	Identification and strategic supplementation of limiting nutrients in pig feeding systems (Project code: IXX12839)	Dr. Kesab Barman
14	Development of vegetable waste/fruit waste based pig feeds (Project code: IXX14389)	Dr. Keshab Barman

Programme-4: Continuous monitoring, recording of pig diseases and development of disease management protocol		
15	Studies on zoonotic pathogens of porcine origin with special reference to Salmonella, Campylobacter and Staphylococcus species (Project code: IXX11238)	Dr. S. Rajkhowa
16	Development of loop mediated isothermal amplification (LAMP) assay for rapid detection of important zoonotic bacterial pathogens of pigs	Dr. S. Rajkhowa
17	Prevalence study of helicobacter infection in pigs with particular reference to gastritis (Project code: IXX12312)	Dr. Seema Rani Pegu
18	Evaluation of antimicrobial efficacy of Typhonium trilobautum Schott Tuber Extract against important bacterial pathogens ssociated with respiratory tract infections in pigs	Dr. Seema Rani Pegu
19	Development of IRT image based system for examination health status of pigs.	Dr. P. J. Das
20	Expression, characterization and evaluation of diagnostic potential of Nucleocapsid/Matrix/GP5/Non-structural protein7 (nsp7) of porcine reproductive and respiratory syndrome virus (PRRS)	Dr. Ajay Kumar
Programme–5: Technology upgradation of post-harvest handling, processing and value addition of pig products		
21	Development of kits for species authentication of fresh and processed pork products (Project code: IXX12375)	Dr. P. J. Das
22	Development of pork based ready to serve functional products (Project code: IXX13650)	Dr. R. Thomas
23	Development of grading system for carcasses of Ghungroo and its crosses	Dr. R. Thomas
Programme-6: Institute-stakeholder linkages and skill development		
24	IVLP programme under TSP	Dr. Keshab Barman
25	Fostering the adoption of scientific pig production practices among small holders in Assam	Dr. Misha. Madhavan M.

LIST OF EXTERNALLY FUNDED RESEARCH PROJECTS

SN	Name of the project	Principal Investigator	Funding agency
1.	Setting up of quality control laboratory	Dr. R. Thomas	MoFPI, Govt. of India
2.	Advanced Animal Disease Diagnosis & Management Consortium (ADMaC)	Dr. S. Rajkhowa	DBT, Govt. of India
3.	All India Network Programme on neonatal mortality in farm animals (AINP-NM)	Dr. S. Rajkhowa	ICAR
4.	All India Coordinated Research Project on Pig: KVK, ICAR-NRC on Pig centre	Dr. S. Banik	ICAR
5.	National Mission for Sustaining the Himalayan Agriculture	Dr. K. Barman	MoEF, Govt. of India
6.	Image based systems for identification of individuals, breeds and diseases of pigs and goats	Dr. S. Banik	ITRA, Govt of India
7.	e-Varaha: Information System for Safe Pork Production in North Eastern India	Dr. P. J. Das	ITRA, Govt of India
8.	Molecular epidemiology of Japanese Encephelitis virus in pigs and mosquitoes in Assam	Dr. Seema Rani Pegu	DBT, Govt. of India
9.	Development of Rapid Laboratory and Field Based Assays for Microbiological Quality Assessment of Pork	Dr. S. Rajkhowa	DBT, Govt. of India
10.	MicroRNA mediated regulation of physiological responses during heat stress in pigs	Dr. N. H. Mohan	ICAR-LBS Award Project
11.	Development of thermo-tolerant pig through biomarker assisted selection	Dr. N. H. Mohan	ICAR-National Fellow Project
12.	Farm-to-Fork Risk profiling of hazards associated with pork supply chain in India, developing a database on hazards and associated unique pig husbandry / processing practices, developing food safety interventions towards reducing hazards and effective risk communication strategies as guidance to the industry	Dr. R. Thomas	ICAR-LBS Award Project
13.	Maize production in NEH region for sustainable livestock production	Dr. K. Barman	ICAR-Indian Institute of Maize Research

14.	Technical Advisory Services for Piggery Value Chain Improvement in Assam, under the World Bank financed Assam Agribusiness and Rural Transformation Project (APART)	Dr. R. Thomas	APART, Govt. of Assam
15	Biotech Kisan Hub	Dr. S. Rajkhowa	DBT
16	Maize Production in NER for sustainable livestock production	Dr. K. Barman	IIMR, Ludhiana
17	Biochemical characterization of seminal gel and its application for bio-stimulation in pigs	Dr. Sunil Kumar	DBT
18	Pork marketing chains in North East India for sustainable livelihood of tribal women (Assam, Meghalaya and Nagaland)	Dr. Misha Madhavan M	NASF



Personnel

PERSONNEL

ICAR-NRC ON PIG

Research Management Position

Dr. Swaraj Rajkhowa, Ph.D., Director (Acting) & Project Coordinator

Scientific staff

Dr. B.C Das, Ph.D., Principal Scientist (Animal Physiology)

Dr. Santanu Banik, Ph.D., Principal Scientist (Animal Genetics & Breeding)

Dr. Keshab Barman, Ph.D., Principal Scientist (Animal Nutrition)

Dr. Mohan N. H., Ph.D., Principal Scientist (Animal Physiology)

Dr. Rafiqul Islam, Ph.D., Principal Scientist (Animal Reproduction and Gynecology)

Dr. Pranab Jyoti Das, Ph.D., Senior Scientist (Animal Genetics & Breeding)

Dr. Rajendran Thomas, Ph.D., Senior Scientist (Livestock Products Technology)

Dr. Seema Rani Pegu, Ph.D., Sr. Scientist (Veterinary Pathology)

Dr. Souvik Paul, Ph.D., Scientist (Veterinary Parasitology)

Dr. Juwar Doley, Ph.D., Scientist (Animal Biotechnology)

Dr. Rajib Deb, Ph.D., Scientist (Animal Biotechnology)

Dr. Kalyan De, Ph.D., Scientist (Livestock Production and Management)

Dr. Sunil Kumar, Ph.D., Scientist (Animal Reproduction and Gynecology)

Dr. Amiya Ranjan Sahu, Ph.D., Scientist (Animal Genetics & Breeding)

Dr. Satish Kumar, M.VSc., Scientist (Animal Genetics & Breeding)

Dr. Jaya, M.VSc., Scientist (Animal Physiology)

Dr. Misha Madhavan M., Ph.D., Scientist (Agricultural Extension)

Dr. Ajay Kumar Yadav, Ph.D., Scientist (Veterinary Microbiology)

Technical staff

Dr. Anil Kumar Das, Senior Technical Assistant

Dr. Gagan Bhuyan, Senior Technical Assistant

Dr. Rajib Kumar Das, Senior Technical Assistant

Shri Siba Chandra Deka, Senior Technician

Shri Kailash Choudhury, Senior Technician

Shri Rana Pratap Kakati, Senior Technician

Administrative staff

Shri. P. K. Nayak, Asst. Finance and Accounts Officer

Shri. Uttam Prakash, Assistant Administrative Officer

Smt. Jonali Nath, Upper Division Clerk

Ms. Hira Moni Thakuria, Junior Stenographer cum Computer Operator

Shri Ratul Baishya , Lower Division Clerk

Supporting staff

Shri Naren Chandra Deka, Skilled Supporting Staff

Krishi Vigyan Kendra, Dudhnoi

Dr. Hitu Choudhury, Ph. D., ACTO (Animal Science) and i/c Programme Coordinator

Dr. Biswajit Dey, Ph.D., ACTO (Horticulture)

Dr. Utpal Kumar Bhattacharyya, Ph.D., ACTO (Plant Protection)

Dr. Hari Charan Kalita, Ph.D., ACTO (Agronomy)

Mrs. Poli Saikia, SMS (Home Science)

Er. Benjamin Kaman, Programme Assistant (Soil and Water Conservation Engineering)

Mrs. Minakshi Barah Kaman, Programme Assistant (Home Science)

Mrs. Mousumi Bhuyan, Programme Assistant (Horticulture)

Ms. Kabyawati Rabha, Junior Stenographer

Mr. Mrinal Baruah, Senior Technician (Driver)

Mr. Jayanta Choudhury, Technician (Tractor Driver cum Mechanic)

Mr. Dhruba Lachan Rabha, Skilled Supporting Staff

Mr. Jitumani Kalita, Skilled Supporting Staff

New Joinings

Dr. B.C Das, Ph.D., Principal Scientist (Animal Physiology)

Dr. Rafiqul Islam, Ph.D., Principal Scientist (Animal Reproduction and Gynecology)

Dr. Souvik Paul, Ph.D., Scientist (Veterinary Parasitology)

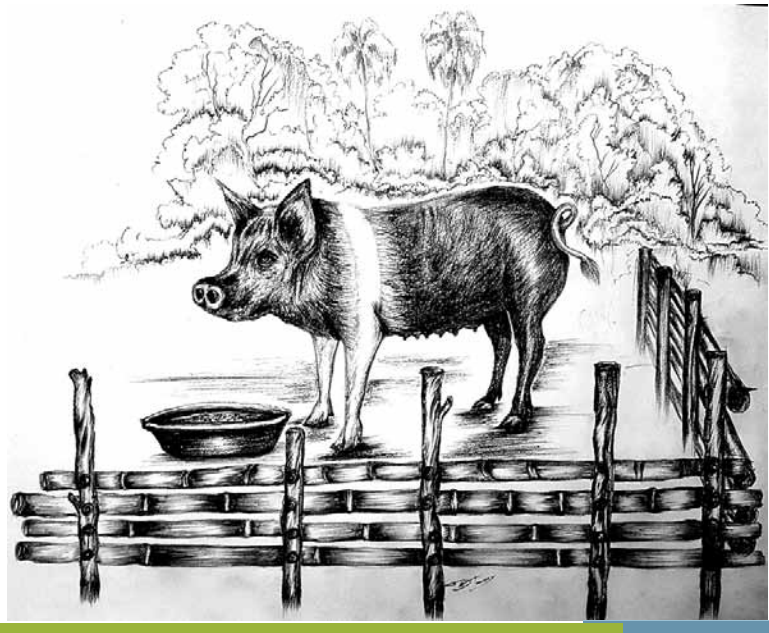
Dr. Juwar Doley, Ph.D., Scientist (Animal Biotechnology)

Dr. Rajib Deb, Ph.D., Scientist (Animal Biotechnology)

Dr. Kalyan De, Ph.D., Scientist (Livestock Production and Management)

Transfer

Dr. Amiya Ranjan Sahu, Ph.D., Scientist (Animal Genetics & Breeding)



Publications

PUBLICATIONS

Research papers

Baily M.P., Avila F., Das P.J., Kutzler M.A. and Raudsepp T. (2019). An Autosomal Translocation 73, XY, t(12;20)(q11;q11) in an Infertile Male Llama (*Lama glama*) with Teratozoospermia. *Frontiers in Genetics*. doi: 10.3389/fgene.2019.00344.

Bhatt, M., Rajak, K.K., Chakravarti, S., Yadav, A.K., Kumar, A., Gupta, V., Chander, V., Mathesh, K., Chandramohan, S., Sharma, A.K. and Mahendran, K. (2019). Phylogenetic analysis of haemagglutinin gene deciphering a new genetically distinct lineage of canine distemper virus circulating among domestic dogs in India. Transboundary and emerging diseases, 66(3), pp.1252-1267.

Biswas, K. K., Palchoudhury, S., Chakraborty, P., Bhattacharyya, U. K., Ghos, D. K., Debnath, P., Ramadagu, C., Keremane, M. L., Khetarpal, R. K. and Lee, R. F. (2019). Codon usage bias analysis of Citrus tristeza virus: Higher codon adaptation to Citrus reticulate host. Viruses 11. 331-347. Doi: 10.3390/v11040331.

Chakraborty, S., Karthik, K. and Banik, S. (2020). Investigation on the Muzzle of a Pig as a Biometric for Breed Identification. *Advances in Intelligent Systems and Computing* 1022. *Proceedings of 3rd International Conference on Computer Vision and Image Processing (CPIV 18)*, Bangalore, India, 2017,pp.71-83.doi:10.1007/978-981-32-9088-4_7. URL: https://link.springer.com/chapter/10.1007%2F978-981-32-9088-4_7

Das B., Das, A., Phookan A., Zaman G., Aziz A., Khomba T. C., Das P. J. and Bharali K. (2019). Genetic analysis of four indigenous duck populations of north-east India using microsatellite markers. *Indian Journal of Animal Sciences* 89(2): 209–211.

Das P.P, Krishnan G., Doley J., Biswas T.K., Paul Vijay., Chakravarty P., Deb S.M. and Das P.J. (2019). Identification and Expression Profiling of MSY (male-specific region of Y chromosome) Genes of Yak for Bull Fertility. *Journal of Genetics*. https://www.ias.ac.in/public/Resources/General/jgen/JGEN-D-18-00529.pdf.

Das P.P., Krishnan G., Doley J, Bhattacharya D, Deb SM, Chakravarty P and Das PJ.(2019). Establishing Amelogenin Gene as Sex-Specific Marker in Yak by Genomic Approach. *Journal of Genetics*. DOI: 10.1007/s12041-019-1061-x. IF:0.672.

Meeti P., Avishek P, Sai Kumar., Bosco J., Jaya B. and Mihir Sarkar. (2019). Role of VEGF A and FGF 2 in Cell Viability and Apoptosis in Cultured Bubaline Luteal Cells.Int.J.Curr.Microbiol.App. Sci. 8(11):1238-1244. doi: https://doi.org/10.20546/ijcmas.2019.811.145

Mohan N.H, Ankit Nath., R. Thomas., S. Kumar.,S. Banik., A. K.Das., R.K.Das and D.K.Sarma. (2019). Relationship between plasma, saliva, urinary and faecal cortisol levels in pigs. Indian Journal of Animal Sciences (accepted for publication, in press).

Sulabh, S., Panigrahi, M., Varshney, R., Gupta, J.P., Kumar Satish, Verma, A., Kumar, A., Asaf, V.M., Kumar, P. and Bhushan, B. (2019). In-vitro analysis of Interleukin-10 expression in cell cultures of Crossbred cattle, Tharparkar cattle and Murrah buffalo in response to mastitis causing antigens derived from *Staphylococcus aureus* and *Escherichia coli. Biological Rhythm Research*, pp.1-10.

Thomas R., Banik S., Barman, K., Mohan, N.H., Sarma D.K. (2019). Establishment of bilateral symmetry and accuracy of carcass data estimates in Ghungroo pig carcass. *Indian Journal of Animal Research.* 53 (4) 2019: 496-499. DOI:10.18805/ijar.B-3525.

Yadav, A.K., Rajak, K.K., Bhatt, M., Kumar, A., Chakravarti, S., Sankar, M., Muthuchelvan, D., Kumar, R., Khulape, S., Singh, R.P. and Singh, R.K., 2019. Comparative sequence analysis of morbillivirus receptors and its implication in host range expansion. Canadian journal of microbiology, 65(11), pp.783-794.

Technical/popular articles

Kumar A., Singh A. K., Saroj S., Madhavan M. M. and Joshi P. K. (2019). The impact of India's farm science centers (Krishi Vigyan Kendras) on farm households' economic welfare: Evidence from a national farmers survey. IFPRI Discussion Paper 1832. Washington, DC: International Food Policy Research Institute (IFPRI). http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/133226

Rajkhowa, S., Pegu, S.R., Banik, S. and Sarma, D.K. (2019). Pig farming for enhancing farmers' income. *In:* Compendium of Golden Jubilee celebration of Assam Agricultural University and International Seminar on 'Animal agriculture for doubling farmers' income: technology, policy and strategy options' (February 27-28th, 2019) at CVSC, AAU, Khanapara. Pp-37.

Books

Banik, S., Barman, K., Das, P.J., Kumar, S. and Rajkhowa, S. (2019). Pig farmers' manual. ICAR-National research Center on Pig, Rani, Guwahati, Assam (77 pages).

Kumar, S., Islam, R, Banik, Das, P.J., Barman, K., Pegu, S.R., Banik, S. and Rajkhowa, S. (2019). Artificial Insemination in Pig. ICAR-NRC on Pig, Rani Guwahati.

Book chapters

Sahu.A.R. and Das P.J. (2019). Advances in Molecular techniques and Automations in Poultry Sector. *Recent Trends in Poultry Production* Edited by Tiwari S.P ans Dinani O.P., IPSACON-2019. Chapter 29. Pp: 351-364.

Technical Manual/Bulletins/Reports

Banik, S., Barman, K. and Rajkhowa, S. (2019). All India Coordinated Research Project on Pig- XIIth Plan Perspective and Achievements (Pages 25).

Banik, S., Mohan, N.H. Barman, K. Das, P.J. and Kumar, S. (2019). Annual Report All India Coordinated Research project and Mega Seed Project on Pig (2018-19), ICAR NRC on Pig, Guwahati (Pages-120).

Banik, S.,K. Barman R. Thomas, Sunil Kumar and S. Rajkhowa (2019). Rani- A new crossbred pig for multiplier. ICAR-NRC on Pig.

Thomas, R., S. Banik, K. Barman and S. Rajkhowa (2019). Value added pork products: Meat-ing taste and quality. ICAR-NRC on Pig.

Leaflets

Sunil Kumar, Rafikul Islam, P.J. Das, K. Barman, S. R. Pegu, S. Banik and S. Rajkhowa. (2019). Success Story on Strengthening of tribal farmers in Pig production by adoption of Artificial Insemination.

Lead papers/Presentations in Conferences/Symposia/Seminars/other fora

Das P.J. (2019). E-Varaha: Information System for Safe Pork Production in North Eastern India. ITRA-Startup, Workshop and Technology Showcase of ITRA, New Delhi. Organized by *Information Technology Research Academy* (ITRA), Govt. of India at The Muse, Sarovar Portico, New Delhi from 21st-23rd July.

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