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भा.कृ.अनु.प.-राष्ट्रीय शूकर अनुसंधान केन्द्र
राणी, गुवाहाटी-781 131, असम

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

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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.

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Preface

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 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 16 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. J.K. Jena, Deputy Director General (Fisheries & Animal Sciences) and Dr. K. M. Bujarbaruah, Vice Chancellor, Assam Agricultural University. I am thankful to Dr. R. S. Gandhi, 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 2018-19 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)

भा.कृ.अनु.प.–राष्ट्रीय शूकर अनुसंधान केंद्र ने स्थापना के 16 साल सफलतापूर्वक पूरे किए हैं इस दौरान केन्द्र ने विस्तार श्रमिकों, नीति निर्माताओं, शूकर पालन और पोर्क प्रसंस्करण से जुड़े उद्योगों में अपनी उत्कृष्टता जारी रखी है। वित्तीय वर्ष 2018–19 के दौरान, संस्थान ने 13 वैज्ञानिकों, 06 तकनीकी कर्मचारियों और 06 प्रशासनिक और लेखा कर्मियों के साथ काम किया। वित्तीय वर्ष के दौरान कुल योजना और गैर–योजना बजट में आवटिंत 2228.19 लाख रुपए थे। इस अवधि में संस्थान को राजस्व के रूप में 140.00 लाख रुपये की आय हुई है। संस्थान के वैज्ञानिकों ने जनादेश के अनुसार छह प्रमुख कार्यक्रम के तहत परिभाषित अनुसंधान और विस्तार से संबंधित विभिन्न लक्ष्यों को प्राप्त करने के लिए अथक प्रयास किया।

पशु आनुवंशिकी और प्रजनन

विकसित रानी क्रॉसब्रेड शूकर प्रजाति का पीढ़ी–दर–पीढ़ी आनुवांशिक मूल्यांकन किया गया। विकसित रानी क्रॉसब्रेड किस्म ने पीढ़ीयों पर स्थिर प्रदर्शन दिखाया है। इन जानवरों ने क्षेत्र मूल्यांकन में भी प्रदर्शन लक्षणों में स्थिरता दिखाई। शूकर और बकरी की नस्लों की छवि–आधारित पहचान शुरू की गई। शूकर की 6 नस्लों और बकरी की 20 नस्लों के साथ अन्य संभावित विदेशी और क्रॉसब्रेड शूकर जर्मप्लाज्म की स्वदेशी आबादी को प्रलेखित किया गया। दो अनोखे मोबाइल एप्लिकेशन स्वाइन एप्प (हिन्दी–ईंगलिश)तथा स्वाइनप्रो विकसित किए गए। तीन पेटेंट और दो कॉपीराइट परियोजना से विकसित प्रौद्योगिकी से दायर किए गए हैं। पूर्वोत्तर क्षेत्र में एक आईटी आधारित ''ई–वराह'' का नॉर्थ ईस्टर्न इंडिया में सुरक्षित पोर्क उत्पादन मूल्यांकन किया गया। शूकर की प्रजनकता के लिए MSY (Y गुणसूत्र के पुरुष–विशिष्ट क्षेत्र) जीन की विशेषता और अभिव्यक्ति रूपरेखा का अध्ययन किया गया। उत्तर पूर्व भारत के देशी शूकरों के शूकर माइटोकॉन्ड्रियल जीनोम अनुक्रमों के फ्लोजेनेटिक विश्लेषण से पता चला है कि पूर्वोत्तर के देशी शूकर केवल हाल ही में एक–दूसरे से अलग हुए है और विदेशी यूरोपीय शूकरों से अलग थे। विभिन्न मांस नमूनों के प्रजातियों के प्रमाणीकरण के लिए LAMP, RAPD, और प्रौद्योगिकी जैसे प्रयोगशाला परीक्षण विकसित किए गए।

पशु पोषण

पोषण मूल्य के लिए विभिन्न फलों और सब्जियों के अपशिष्ट की जांच की गई। फलों और सब्जियों के अपशिष्ट में ऊर्जा का अच्छा स्तर और निम्न से मध्यम स्तर का प्रोटीन पाया गया। नियमित फार्म आहार, पूरक के बिना क्षेत्रीय आहार और संतुलित आहार के साथ क्षेत्रीय आहार की तुलना की गई। सब्जी विकसित के अपशिष्ट का उपयोग करके साइलेज तैयार किया गया और क्रॉसबेड उत्पादक शूकरों में उत्पादन प्रदर्शन पर सब्जी साइलेज के प्रभाव का अध्ययन किया गया। हिमालयन परियोजना में राष्ट्रीय मिशन के तहत मिजोरम, सिक्किम और मेघालय राज्यों में सर्वेक्षण किया गया। सर्वेक्षण के दौरान, किसानों की स्थिति और पशुओं के प्रकार, पशुओं की देखभाल, शूकर पालन, पशु पालन, प्रजनन प्रक्रियाएं, शूकरों और मांस के विपणन के साथ–साथ टीकाकरण के संदर्भ में पशु स्वास्थ्य प्रबंधन के बारे में जानकारी दी गई। इलाके मे बीमारियों के प्रकार प्रचलित, एहतियाती उपायों के बाद बीमारियों के प्रकोप आदि को दर्ज किया गया। संस्थान ने आदिवासी उपयोजना के तहत संस्थान गांव को जोड़ने के कार्यक्रम के माध्यम से शूकर उत्पादन में उत्कृष्टता लाने के जनादेश के साथ आदिवासी समुदाय के कल्याण के लिए सेवाएं प्रदान कीं। संस्थान ने टीएसपी योजना के तहत मासिक आधार पर चयनित लाभार्थियों को शूकर शावक फ़ीड और पूरक आहार प्रदान किए। संस्थान ने नियमित रूप से गोद लिए गए पांच गांवों में शूकरों के स्वास्थ्य, विकास और प्रबंधन की निगरानी की और आवश्यकता पर आवश्यक स्वास्थ्य उपचार और एआई सेवाएं दीं। यूरिया, SSP और MoP के साथ HQPM, स्वीट कॉर्न और बेबी कॉर्न के लिए मक्का का बीज को 65 लाभार्थियों को वितरित किया गया है।

पशु प्रजनन

शूकरों में कृत्रिम गर्भाधान पर तीन विशिष्ट प्रशिक्षण दिए गए। इसके अलावा कुल 19 प्रशिक्षण तथा 30 जागरूकता कार्यक्रम आयोजित किए गए जहां कृत्रिम गर्भाधान के लिए व्यावहारिक प्रदर्शन किया गया। गर्भाधान बढ़ाने वालों के अध्ययन का प्रभाव और पाया गया कि गर्भाधान दर को बढ़ाकर मेलाटोनिन की तुलना में ऑक्सीटोसिन और प्रोस्टाग्लैंडीन प्रभावी हैं। इसके अलावा कुछ एडवांस स्पर्म फंक्शन टेस्ट को मानकीकृत किया गया। प्रजनन क्षमता के अनुकूलन के लिए एक कार्यप्रणाली विकसित की गई। पोस्ट–था वीर्य विशेषताओं के संदर्भ में योज्य की श्रेष्ठता एसडीएस> विट– ई> डीईएफ> आयन चैनल ब्लॉकर्स पाई गई। अन्य प्रयोग में, वीर्य को प्लाज्मा के साथ मिलाया गया। स्वीकार्य प्रजनन क्षमता हासिल नहीं हुई है, आगे के प्रयोग प्रगति पर हैं। तरल वीर्य संरक्षण के लिए एक दीर्घकालिक विस्तार मानकीकरण के तहत है।

कार्यकारी सारांश

पशु शरीर क्रिया

इन विवो और विट्रो प्रयोगों दोनों के माध्यम से थर्मल तनाव से संबंधित मार्गों की पहचान करने के लिए प्रयोगों का आयोजन किया गया। विश्लेषण के आधार पर एक 21 डीएनए बाइंडिंग न्यूक्लियोटाइड सर्वसम्मति अनुक्रम TDKHKYYYHWYWT-BYWTTT की पहचान की गई, जो जीनोम में गर्मी उत्तरदायी तत्व से जुड़ा हो सकता है। गर्म वातावरण (जयपुर, राजस्थान) और मध्यम गर्म वातावरण (गुवाहाटी, असम) में पाले गए जानवरों के बीच तुलना की गई ताकि पहली बार उच्च तापमान के अनुकूल जानवरों के लिए किसी विशिष्ट जीन अभिव्यक्ति की जांच की जा सके। पूरे ट्रांसस्क्रिप्टोम के प्रारंभिक विश्लेषण के आधार पर, राजस्थान में शूकर और बकरियों के लिए 223 और 267 जीन अभिव्यक्तियां अद्वितीय थीं (गर्म अर्ध शुष्क जलवायु क्षेत्र), जबकि शूकरों और बकरियों को असम (आर्द्र उपोष्णकटिबंधीय जलवायु) में पाला गया, जिसमें क्रमश: 133 और 158 जीन अभिव्यक्ति पैटर्न थे। उनके लिए यह अद्वितीय है। शूकरों में प्रारंभिक प्रजनन मार्करों के विकास के लिए, शुक्राणुजाल गतिशीलता, मेथिलीन ब्लू, माइटोकॉन्ड्रियल क्षमता, आकृति विज्ञान, एक्रोसोम, कोशिका झिल्ली और कार्यात्मक परीक्षणों के सूक्ष्म विश्लेषण के माध्यम से वीर्य की गुणवत्ता का मूल्यांकन प्रजनन क्षमता और निषेचन से संबंधित मूल्यांकन के लिए प्रभावी ढंग से किया गया। RNA-seq का उपयोग करके प्रजनकता में अंतर करने वाले शूकरों के शुक्राणुजाल प्रतिलेखन की जाँच की और संस्थान कृत्रिम गर्भाधान कार्यक्रम में उपयोग किए जाने वाले शूकरों की प्रजनन स्थिति के साथ तुलना की गई।

पशु स्वास्थ्य

साल्मोनेला, कैम्पिलोबैक्टर और स्टैफिलोकोकस प्रजातियों के विशेष संदर्भ के साथ पोर्सिन उत्पत्ति के जूनोटिक रोगजनकों पर अध्ययन किए गए। शूकर के विभिन्न नमूनों में 49 स्टैफिलोकोकस प्रजाति, 24 साल्मोनेला और 28 कैंपिलोबैक्टर प्रजातियां शामिल हैं। एमआरएसए के तेजी से पता लगाने के लिए विकसित मल्टीप्लेक्स पीसीआर को भी सूचित अवधि के दौरान मान्य किया गया है। फार्म एनिमल्स में नवजात मृत्यु दर पर ऑल इंडिया नेटवर्क प्रोग्राम के तहत, 174 पिगलेट (24.13%) और 7 (4.59%) साल्मोनेला उपभेदों से 42 ई-कोलाई (प्रति शूकर में 1) को अलग किया गया। 8 स्टिलबर्थ पिगलेट्स के भ्रूण टिशू (फेफड़े और हृदय) में पोर्सिन सर्कोवायरस 2 (पीसीवी 2) और जापानी इन्सेफेलाइटिस वायरस (जेईवी)दो स्टिलबोर्न तथा 8 मादा से प्राप्त हुए। एंटीबायोटिक उपचार के विकल्प के रूप में नवजात शूकरों में दस्त व श्वसन पथ के संक्रमण में दो अन्य जड़ी बूटियों के खिलाफ जड़ी बूटी का मूल्यांकन जीवाणुरोधी गतिविधि के लिए किया गया। पोर्क के सूक्ष्मजीवविज्ञानी गुणवत्ता मूल्यांकन के लिए तेजी से प्रयोगशाला और क्षेत्र आधारित लैम्प के विकास के लिए, शूकर से मांस के नमूनों को एकत्र किया गया और लक्षित बैक्टीरियल रोगजनकों की उपस्थिति के लिए विश्लेषण किया गया। शूकर सिरको वायरस टाईप 2 (पीसीवी -2) और पोर्सिन परवो वायरस (पीपीवी) का तेजी से पता लगाने के लिए किट का मानकीकरण किया गया। स्टेफिलोकोकस ऑरियस के तेजी से पता लगाने के लिए एक क्षेत्र निदान परख (एलएएमपी) विकसित किया गया।

पशुधन उत्पाद प्रौद्योगिकी

उपभोक्ता स्वीकार्यता के साथ मूल्यवर्धित पोर्क उत्पादों के वाणिज्यिक प्रसंस्करण के लिए व्यवहार्य प्रौद्योगिकियों का विकास किया गया। मूल्य वर्धित पोर्क उत्पादों की विभिन्न श्रेणियों के प्रसंस्करण के लिए विभिन्न योगों को विकसित और मानकीकृत किया गया। विकसित किए गए प्रौद्योगिकियों के पायलट पैमाने पर परीक्षण और बाजार अध्ययन तीन अलग-अलग ब्रांड नामों के तहत किए जा रहे हैं। जिनके नाम है LUIT PORK, CHOICE PORK NATURAL और PIGZEE'S। क्वालिटी कंट्रोल लैब का निर्माण पूरा हो चुका है। NABL मान्यता प्राप्त करने के लिए, परियोजना से जुड़े वैज्ञानिक कर्मचारियों में से तीन, मानकीकरण के लिए राष्ट्रीय प्रशिक्षण संस्थान, BIS, नोएडा में ISO 17025-2017 प्रशिक्षण कार्यक्रम (प्रयोगशाला गुणवत्ता प्रबंधन और आंतरिक लेखा परीक्षा) के तहत गए हैं। मूल्य श्रृंखला अभिनेताओं के क्षमता निर्माण कार्यक्रमों के तहत, संस्थान ने 13 जिलों के पशु चिकित्सा डॉक्टरों को चार प्रशिक्षण कार्यक्रम आयोजित किए हैं। प्रशिक्षण कार्यक्रमों का विषय ''वैज्ञानिक सुअर खेती पर एएचवीडी कर्मचारियों के लिए मास्टर प्रशिक्षण (टीओटी) कार्यक्रम'' था। इसी तरह, पिग बन्धु के लिए दो प्रशिक्षण कार्यक्रम यानी ''स्थानीय सेवा प्रदाता (पिग बंधु)'' के लिए मास्टर ट्रेनिंग (टीओटी) कार्यक्रम का आयोजन किया गया और कुल 40 पिग बधुंओ ने इस कार्यक्रम में भाग लिया। विभिन्न खाद्य जनित सूक्ष्मजीवों का पता लगाने और उन्हें निर्धारित करने के लिए तकनीकों के मानकीकरण के लिए प्रारंभिक प्रयोगशाला अध्ययन भी शुरू किया गया। पोर्क

और पोर्क उत्पादों के लिए एक फार्म-टू-फोर्क प्रबंधन प्रणाली का विकास चल रहा है। FSSAI लाइसेंस, प्रदूषण नियंत्रण बोर्ड क्लीयरेंस और आईएसओ 9001-2015 प्रमाण पत्र वर्ष 2018-19 के दौरान प्राप्त किए गए।

अखिल भारतीय अनुसंधान समन्यवन तथा मेगा सीड परियोजना

केन्द्र ने परिषद एवं समीक्षा बैठक के परामर्श से सभी समन्वयन (15) व मेगा सीड परियोजनाओं (07) की तकनीकी तथा वित्तिय निगरानी रखी है। 23-24 नवंबर, 2018 को भा.कृ.अनु.प.-राष्ट्रीय शूकर अनुसंधान केन्द्र में समीक्षा बैठक आयोजित की गई थी। एआईसीआरपी परियोजना के तहत विभिन्न कृषि-जलवायु स्थिति में शूकरों के प्रदर्शन का अध्ययन देश भर के विभिन्न केंद्रों में जारी है तथा गुणवत्ता जर्मप्लाज्म सहित प्रक्रियाओं के क्षेत्र-विशिष्ट पैकेज को विकसित करना और स्वदेशी जर्मप्लाज्म का संरक्षण करना भी शामिल है।

कृषि विज्ञान केन्द्र

केवीके गोलपारा द्वारा वर्ष 2018-19 के दौरान 9,458 प्रशिक्षुओं को शामिल करते हुए कुल 247 प्रशिक्षण आयोजित किए गए। इनमें से 125 प्रशिक्षण कृषि-कल्याण अभियान के तहत आयोजित किए गए। केवीके गोलपारा ने कृषि कल्याण अभियान चरण -I में नंबर 1 रैंकिंग हासिल की और एटीएआरआई, गुवाहाटी द्वारा केकेए के दौरान उत्कृष्ट प्रदर्शन के लिए सर्टिफिकेट ऑफ एप्रिसिएशन प्राप्त किया। केन्द्र ने प्रौद्योगिकी हस्तांतरण को बढ़ावा देने के लिए विभिन्न विषयों के तहत ऑन फार्म ट्रायल और फ्रंट लाइन डिमॉस्ट्रेशन का आयोजन किया। केन्द्र ने पश्चिम डेरांग गाँव को शूकर बीज गाँव या 'बोराह ग्राम' के रूप में अपनाया और शुकर उत्पादन के लिए कृत्रिम गर्भाधान तकनीक की शुरुआत की। केवीके द्वारा गाँव में योजना और कार्यक्रमों को देखने के लिए ''सर्पक लाइवलीहुड प्रमोशन सोसाइटी'' नाम का एक समाज बनाया गया। एआई के माध्यम से 1500 से अधिक उन्नत शूकरों का उत्पादन किया गया। समाज की चेयरपर्सन, श्रीमती दीपिका राभा को कृषि मंत्रालय, भारत सरकार की ओर से महिला किसान सम्मान और माननीय राज्यपाल, असम सरकार द्वारा सम्मानित किया गया। सोसायटी को अब नवंबर, 2018 के महीने में 'सरपैक एग्रो फार्मर प्रोड्यूसर कंपनी' के नाम से एक कंपनी के रूप में पंजीकृत किया गया है।

अन्य गतिविधियों

संस्थान ने गणतंत्र दिवस, स्वतंत्रता दिवस, हिंदी पखवाड़ा, संस्थान स्थापना दिवस और विश्व पर्यावरण दिवस जैसे विभिन्न आधिकारिक क्रार्यक्रमों 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

The ICAR-National Research Centre on Pig has successfully completed 16 years since inception and continued its excellence in catering the farmers, extension workers, policy makers and industries associated with pig farming and pork processing. During the financial year 2018-19, the Institute functioned with 13 scientists, 06 technical staff and 06 administrative and accounts personnel. The total plan and non-plan budget allocations were 2228.19 lakh during the financial year. The institute has generated Rs 140.00 lakh as revenue during the period. The scientists of the Institute relentlessly worked for achieving various targets related to research and extension, defined under the six major programme as per the mandate.

Animal Genetics and Breeding

The generation-wise genetic evaluation of the evolved rani cross bred pig variety was taken up. The developed Rani crossbred variety showed stable performances over the generations. The animals also showed stability in performance traits in field evaluation. The image-based identification of pigs and goat breeds was initiated. Indigenous population of 6 breeds of pig and 20 breeds of goat along with other potential exotic and crossbred pig germplasm were documented. Two unique mobile applications namely *SwineApp*, *SwineAppHindi;* standalone data recording software for pig farm namely *SwinePro* was developed. Three patents and two copyrights have been filed out of the technology developed from the project. Development of an IT based tool "E-Varaha: Information System for Safe Pork Production in North Eastern India" was taken up to appraise pig farming in NE region. Characterization and expression profiling of Pig MSY (male-specific region of the Y chromosome) genes for boar fertility' was undertaken. Phylogenetic analysis of Pig mitochondrial genome sequences of native pigs of North East India, revealed that native pig of Northeast was only recently diverged from each other and distinctly different from exotic European pigs. Laboratory tests like LAMP, RAPD, and technology for species authentication of different meat samples were developed.

Animal Nutrition

Different fruits and vegetable wastes were screened for their nutritive value. Good level of energy and low to moderate level of protein was found in fruits and vegetable wastes. Comparison among regular farm diet, field diet without supplementation and field diet with balanced diet was investigated. Silage was prepared using vegetable waste and effect of vegetable silage on production performance in crossbred grower pigs was studied. Survey was conducted in state of Mizoram, Sikkim and Meghalaya under National Mission in the Himalayan Project. During survey, information regarding household status, management practices followed by the farmers and types of animal maintained, herd information of pigs, feeding practices, breeding practices, marketing of pigs and meat along with information regarding animal health management in terms of vaccination followed in that localities, types of diseases prevalent, preventive measures followed during outbreak of diseases etc were recorded. Institute provided services for the welfare of the tribal community with the mandate of bringing up excellence in pig production through Institute village linking programme under Tribal Sub Plan. The institute provided female piglets, concentrate feed and supplements to the selected beneficiaries on monthly basis under the TSP plan. The Institute monitored health, growth and management of the pigs in the five adopted villages regularly and provided necessary health care and AI services as and whenever required. Maize seed for HQPM, sweet corn and baby corn along with fertilizer namely urea, SSP and MoP have been purchased and distributed to 65 beneficiaries.

Animal Reproduction

Three specific trainings in A.I. in Pigs were conducted for Veterinarians & Para-vets of Dept. of Animal Husbandry, Govt. of Sikkim and AICRP on Pig, C.A.U. Imphal centre and for farmers and entrepreneurs of Arunachal Pradesh. A total of 19 trainings were conducted where practical demonstration for artificial insemination was done. A total of 30 awareness programmes for farmers were conducted. Effect of conception enhancers studied and found that oxytocin and prostaglandin are effective than melatonin in enhancing conception rate. Further, advance sperm function tests were standardized. A methodology was developed for optimizing reproductive efficiency/combate anestrus in gilts. Superiority of additive in terms of post thaw semen characteristics was SDS> Vit- E> DEF> Ca channel blockers. In other experiment, semen was frozen with seminal plasma. Acceptable fertility has not been achieved, further experiments are in progress. A long term extender for liquid semen preservation is under standardization.

Animal Physiology

Experiments were conducted to identify the pathways related to thermal stress through both *in vivo* and *in vitro* experiments. 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. A comparison was made between animals reared in hot environment (Jaipur, Rajasthan) and moderately warm environment (Guwahati, Assam) to examine any specific gene expression for the animals adapted to high temperature was undertaken for the first time. 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), whereas pigs and goats reared in Assam (humid subtropical climate) had 133 and 158 gene expression patterns, respectively unique to them. For the development of early fertility markers in pigs, 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 to assess the male fertility and fertilisation related events. 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.

Animal Health

Studies on zoonotic pathogens of porcine origin with special reference to *Salmonella*, *Campylobacter* and *Staphylococcus* species were carried out. Isolated 49 *Staphylococcus* species, 24 *Salmonella* and 28 *Campylobacter* species from different samples of pig. Multiplex PCR developed for rapid detection of MRSA has also been validated during the reported period. Under All India Network Programme on Neonatal Mortality in Farm Animals, forty two (42) *E. coli* (1 isolate per piglet) from 174 piglets (24.13%) and 7 (4.59%) *Salmonella* strains were isolated. Detected porcine circovirus 2 (PCV2) in foetal tissues (lungs and heart) of 8 stillbirth piglets obtained from 8 sows and Japanese encephalitis virus (JEV) in two stillborn foetuses. Evaluated antibacterial activity of herb (*Typhoniumtrilobatum*) against respiratory tract infections and two other herbs [(*Centellaasiatica* (Bormanimuni and *Psidiumguajava*)] against diarrhoea in neonatal pigs. Developed a strategy for effective treatment of respiratory tract infections and diarrhoea in neonatal pig by using herbal formulation as an alternative to antibiotic treatment. For the development of rapid laboratory and field based assays for microbiological quality assessment of pork, meat samples from pig were collected and analyzed for the presence of targeted

Executive Summary

bacterial pathogens. Developed a loop mediated isothermal amplification (LAMP) assay kit for rapid detection of Porcine Circo Virus TYPE 2 (PCV-2) and Porcine Parvo Virus (PPV). Developed a field diagnostic assay (LAMP) for rapid detection of *Staphylococcus aureus* fromm pig. Identified the prevalence of Helicobacter infection in pig gastric mucosa. The sequence analysis of PCR positive JEV samples revealed 100% identity with JEV envelope protein of Human and equine from West Bengal, Vellore, Haryana and Lucknow which also truly reflects on the Phylogenetic tree. Isolated 49 *Staphylococcus* species from meat (28) and nasal and skin (21) samples of pig which were confirmed by conventional method and were finally confirmed and validated by using developed multiplex-PCR assay.

Livestock Products Technology

Viable technologies were developed for commercial processing of value added pork products with consumer acceptability. Different formulations were developed and standardized for processing different categories of value added pork products. The pilot scale testing and market studies of the technologies developed are being carried out under three different brand names viz. LUIT PORK, CHOICE PORK NATURAL and PIGZEE'S. Construction of a Quality Control Lab has been completed. Towards obtaining NABL accreditation, three of the Scientific staffs, who are associated with the project have under gone the ISO 17025:2017 training programme (Laboratory Quality Management and Internal Audit) at National Institute of Training for Standardization (NITS), BIS, Noida. Under the capacity building programmes of value chain actors, institute has conducted four 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". Similarly, two training programmes for the Pig Bondhus i.e. "Master Training (ToT) programme for local service provider (*Pig Bondhu*)" were organized and a total of 40 pig bondhus participated in the programme. Preliminary laboratory studies were also initiated for standardization of techniques for detection and quantification of different food borne microorganisms. In the first phase emphasis was given to the detection of *E. Coli* (with emphasis on *E. coli O157:H7*) and *Salmonella spp.* (with emphasis on *Salmonella* Typhimurium) in pork and pork products. Estimation of hazards viz. residues of pesticides, antibiotics and heavy metals are in progress. Development of a farm-to-fork risk management strategy for pork and pork products in underway. FSSAI license, Pollution Control Board Clearance and ISO 9001:2015 certifications were obtained during the year 2018-19.

AICRP and Mega seed project on Pig

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-National Research Center on Pig, Guwahati on 23-24th November, 2018. 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. Under mega seed project on pig, improved variety piglets were produced and distributed to the farmers.

Krishi Vigyan Kenda

A total of 247 numbers of trainings were organized by KVK Goalpara covering 9,458 trainees during the year 2018-19. Out of these 125 trainings were conducted under Krishi- Kalyan Abhiyan. KVK

Goalpara achieved No. 1 ranking in Krishi Kalyan Abhijan Phase – I and received Certificate of Appreciation for outstanding performance during KKA – I by ATARI, Guwahati. The KVK conducted On Farm Trials (OFT) and Front Line Demonstrations (FLD) under various disciplines to promote the technology transfer. The KVK adopted Pacchim Dairong village as pig seed village or 'Borah gram' and introduced Artificial Insemination (AI) technology for piglet production. A society named as "Sarpak Livelihood Promotion society" was formed by the KVK to look after the plan and programmes in the village. More than 1500 of upgraded piglets were produced through AI. The chairperson of the society, Mrs. Dipika Rabha received Mahila Kisan award from Ministry of Agriculture, Govt of India and felicitation from honourable Governor, Govt of Assam. The society has now been registered as a company in the name of 'Sarpak Agro Farmer Producer Company' in the month of November, 2018. The piglets produced from AI generated more than Rs. 40 lakhs. A total of 37,625 numbers of Soil Health Card were distributed among farmers of Goalpara during the year 2018-19.

Other activities

The Institute also celebrated different events 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 staff. The Institute is regularly conducting activities under "Swachh Bharat Abhiyan" with the resolution to work towards realizing the 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.

Executive Summary

SALIENT ACHEIVEMENTS

1. Generation-wise genetic evaluation of the evolved Rani cross bred pig variety was taken up and the variety showed stable performances over the generations. The animals also showed stability in performance traits in field evaluation.
2. Two unique mobile applications namely *SwineApp*, *SwineAppHindi;* standalone data recording software for pig farm namely *SwinePro* was developed.
3. Phylogenetic analysis of Pig mitochondrial genome sequences of native pigs of North East India, revealed that native pig of Northeast was only recently diverged from each other and distinctly different from exotic European pigs.
4. The institute has provided female piglets, concentrate feed supplements to the selected beneficiaries on monthly basis under the TSP plan and monitored health, growth and management of the pigs in the five adopted villages regularly and gave necessary health treatment and AI services as and whenever required.
5. Advanced sperm function tests were standardized and a methodology developed for optimizing reproductive efficiency in gilts.
6. Developed loop mediated isothermal amplification (LAMP) assay kit for rapid detection of Porcine Circo Virus TYPE 2 (PCV-2) and Porcine Parvo Virus (PPV). Also developed a field diagnostic assay (LAMP) for rapid detection of *Staphylococcus aureus* from pig.
7. Viable technologies and formulations were developed and standardized for processing different categories of value added pork products. The pilot scale testing and market studies of the developed technologies were carried out under three different brand names viz. LUIT PORK, CHOICE PORK NATURAL and PIGZZEE'S.
8. The AICRP 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.
9. The Krishi Vigyan Kendra of ICAR-NRC on Pig has conducted On Farm Trials (OFT) and Front Line Demonstrations (FLD) under various disciplines to promote the technology transfer and achieved No. 1 ranking in Krishi Kalyan Abhijan Phase – I and received Certificate of Appreciation for outstanding performance during KKA – I by ATARI, Guwahati.
10. The 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 Mera Gaon Mera Gaurav programme.

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 eight 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 13 scientists, 06 adiministrative/supporting and 06 technical staffs are in position.

Sanctioned posts of the institute as on 31-03-2019

Sl. No.	Discipline	Approved	In position	Vacant
A.	**RMP**	01	0	01
B.	**Scientific Posts**			
1.	Principal Scientist	02	01	01
2.	Senior Scientists	06	03	03
3.	Scientists	12	09	03
Total		**21**	**13**	**08**
C.	**Administration & Supporting staff**	**Approved**	**In position**	**Vacant**
1.	Administrative Officer	01	0	01
2.	AAO	01	01	0
3.	AF & AO	01	01	0
4.	Assistant	04	0	04
5.	Personal Assistant	01	0	01
6.	Junior Steno	01	01	0
7.	UDC	01	01	0
8.	LDC	01	0	01
9.	Skilled Supporting Staff	03	02	01
Total		**14**	**06**	**08**
D.	**Technical staff**	**Approved**	**In position**	**Vacant**
1.	T-3/T-4	04	03	01
2.	T-1/T-2	03	03	0
Total		07	06	01

Introduction

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 V.K. Taneja, Former Vice-Chancellor, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana is the chairman of the committee. The other members include scientists and professors from the field of Animal Genetics and Breeding, Animal Nutrition, Biotechnology, Microbiology, Animal Reproduction 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 in excellence in pig production, health and product processing through innovative research in order to provide technology backstopping for enhanced pork production, employment generation and poverty reduction among socially and economically weaker sections through the medium of pig husbandry.

MISSION

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

MANDATE

The mandate of the institute is:

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

RESEARCH PROGRAMMES

Programme-1 : Conservation and genetic improvement of indigenous pigs

Programme-2 : 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 under plan and non-plan budget (Rs in lakh):

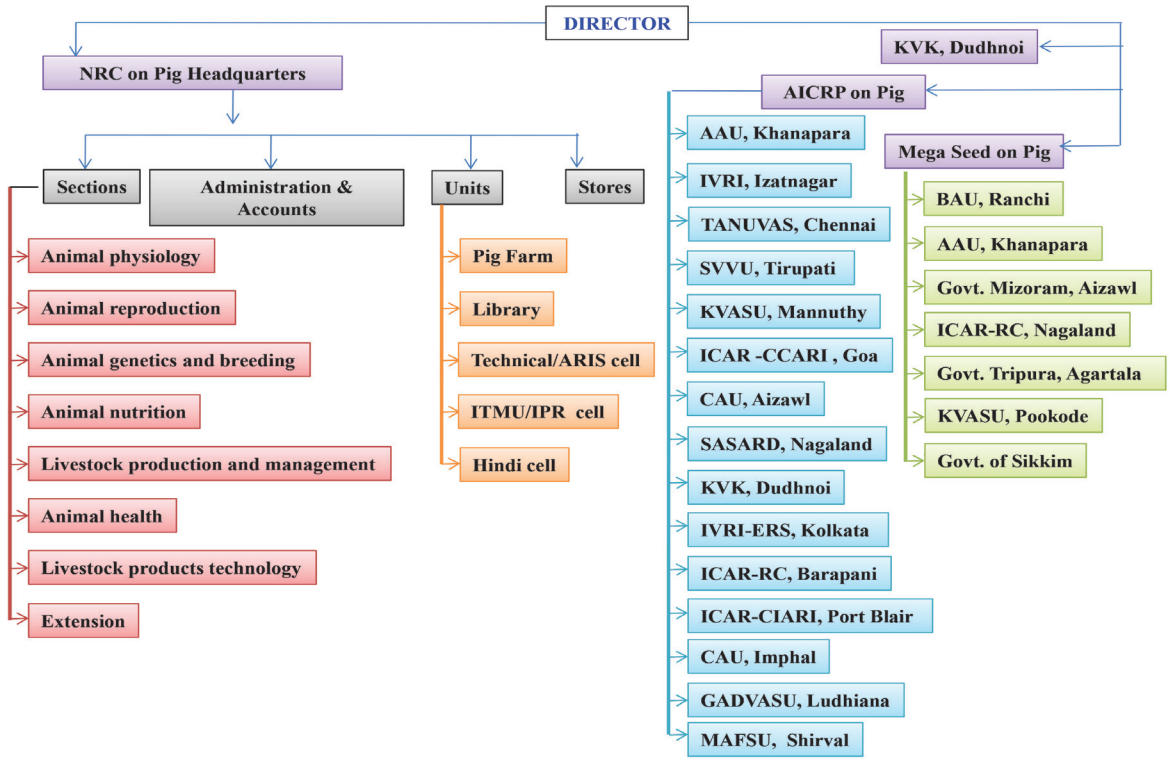
Name of the Scheme/ Project		Pay and allowances	TA	Recurring Contingency	Works	Equipment	IT	Library	Livestock	Furniture	Others	Repair and Maintenance	HRD	Publicity	Others/ MISC	Total
ICAR-NRC on Pig (Main scheme)	R.E	447.72	13.00	250.00	104.50	32.50	5.00	6.00	15.00	9.70	23.30	123.00	5.00	1.00	23.00	1058.72
	EXP	444.56	12.35	240.82	104.46	32.49	4.69	5.80	15.00	9.19	23.16	122.53	4.85	1.00	21.13	1042.03
AICRP on Pig	R.E	150.00	8.95	490.12	156.66	6.00	0.00	0.00	16.00	0.00	0.00	0.00	0.00	0.00	0.00	827.73
	EXP	150.00	8.95	490.12	156.66	6.00	0.00	0.00	16.00	0.00	0.00	0.00	0.00	0.00	0.00	827.73
Mega Seed on Pig	R.E	0.00	3.31	262.00	75.12	9.50	0.00	0.00	8.50	0.00	0.00	0.00	0.00	0.00	0.00	358.43
	EXP	0.00	3.31	262.00	75.12	9.50	0.00	0.00	8.50	0.00	0.00	0.00	0.00	0.00	0.00	358.43
Total	R.E	597.72	25.26	1002.12	336.28	48.00	5.00	6.00	39.50	9.70	23.30	123.00	5.00	1.00	23.00	2244.88
	EXP	594.56	24.61	992.94	336.24	47.99	4.69	5.80	39.50	9.19	23.16	122.53	4.85	1.00	21.13	2228.19

EXPENDITURE STATEMENT

Sl. No.	Particulars	Revenue
1	Revenue Target during 2018-19	Rs. 120.94 lakhs
2	Revenue Generation during 2018-19	Rs. 140.00 lakhs

Introduction

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

Sewage treatment plant

A sewage treatment plant (STP) with 50 KLD capacity has been installed in the Farm Complex of the institute. The plant is intended to treat the solid and liquid wastes originating from the institutional pig farm and thereby to maintain hygiene in the farm premises.

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.

Acquisition and site development in the new plot

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.

Physical Progress

Construction of recreation hall, overhead and underground water tanks

Institute has initiated the construction of a recreation hall in the campus for the welfare of the staffs. To cater the water requirement in the Farm Complex and Processing unit, institute has initiated the construction of a separate underground (50000 lit) as well as an overhead (25000 lit) water tanks.

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

Rani crossbred pig variety was developed and released for breeder farmers after performance evaluation by conducting multi location trials at field level. The generation-wise genetic evaluation of the evolved cross were taken up in the project. The crossbred variety is presently being maintained by inter-se- mating. The generation-wise performance of different productive, reproductive and carcass characteristics were evaluated.

Rani grower pig

Rani Pig at farmer' field

Rani sow with piglet

The generation-wise genetic gain and performance of Rani cross are given in Table 1 and 2, respectively.

Table 1. Generation-wise genetic gain of Rani cross

Parameters	Generation Wise Genetic Gain						
	GG_{1GEN}	GG_{2GEN}	GG_{3GEN}	GG_{4GEN}	GG_{5GEN}	GG_{6GEN}	GG_{7GEN}
(Re) productive traits							
Litter size at birth	12.96	1.58	0.41	-1.96	3.16	0.61	0.10
Litter weight at birth	27.82	4.12	0.38	-1.97	2.39	1.78	0.55
Litter size at weaning	13.79	4.85	-0.58	-1.16	2.94	0.69	0.23
Litter weight at weaning	17.31	1.19	1.61	-1.46	3.85	4.10	3.92
Weaning weight	0.61	-3.47	1.41	0.92	0.76	5.00	1.15
Pre-weaning growth rate (g/d)	-1.50	-4.62	1.71	1.12	1.07	5.76	1.29
Post-weaning growth rate (g/d)	10.54	0.89	-4.47	4.48	1.60	2.48	1.17
Weight at 8 month	9.54	0.49	-3.95	4.14	1.52	2.70	1.17
FCR	-7.54	-0.26	0.53	1.84	-2.06	-1.32	-1.33
Adaptive traits							
Pre-weaning mortality rate	-13.11	-5.66	2.00	13.73	-10.34	0.00	0.00
Carcass trait							
Dressing percentage	1.73	-0.01	0.44	0.56	0.00	0.13	-0.13
Carcass length	3.17	0.95	-0.32	1.27	1.89	2.81	0.02
Back fat thickness							
Loin eye area	-6.02	-7.12	0.38	-10.31	-5.53	-10.81	-0.51

Table 2. Performance of Rani cross

Parameters	Parental Generation			Filial Generation						
	P_2 (H)	P_1 (G)	Mean (P_1+P_2)	G_1	G_2	G_3	G_4	G_5	G_6	G_7
(Re)productive traits										
Litter size at birth	7.91±0.23	8.91±0.15	8.41	9.50±0.22	9.65±0.35	9.69±0.39	9.50±0.68	9.80±0.42	9.86±0.32	9.87±0.40
Litter weight at birth	8.01±0.34	7.95±0.22	7.98	10.20±0.26	10.62±0.22	10.66±0.35	10.45±0.75	10.70±0.52	10.89±0.42	10.95±0.50
Litter size at weaning	7.00±0.22	7.5±0.15	7.25	8.25±0.15	8.65±0.32	8.60±0.57	8.50±0.55	8.75±0.35	8.81±0.23	8.83±0.31
Litter weight at weaning	50.28±3.52	42.93±3.29	46.605	54.67±3.55	55.32±2.87	56.21±3.84	55.39±3.99	57.52±3.11	59.88±2.56	62.23±3.55
Weaning weight	7.23±0.42	5.95±0.52	6.59	6.63±0.35	6.40±0.62	6.49±0.52	6.55±0.75	6.60±0.43	6.93±0.39	7.01±0.32
Pre-weaning growth rate (g/d)	148.43±12.36	126.44±10.53	137.435	138.91±12.55	132.49±11.1	134.75±9.83	136.25±13.45	137.70±10.53	145.64±9.32	147.51±12.35
Post-weaning growth rate (g/d)	308.6±16.75	280.8±20.43	294.7	325.75±21.53	328.65±24.52	313.95±29.35	328.00±25.63	333.25±23.53	341.5026.35±	345.50±23.85
Weight at 8 month	68.95±3.89	62.11±4.28	65.53	71.78±3.29	72.13±3.52	69.28±4.29	72.15±4.56	73.25±3.88	75.23±3.72	76.11±4.22
FCR	4.01±0.25	4.21±0.23	4.11	3.80±0.28	3.79±0.31	3.81±0.19	3.88±0.17	3.80±0.33	3.75±0.23	3.70±0.20
Adaptive traits										
Pre-weaning mortality rate	6.0±0.52	6.2±.65	6.1	5.30±0.45	5.00±0.67	5.10±0.32	5.80±0.44	5.20±0.52	5.20±0.51	5.20±0.50
Carcass trait										
Dressing percentage	74.00±2.33	72.00±3.12	73	74.26±2.11	74.25±2.22	74.58±2.58	75.00±3.21	75.00±2.99	75.10±3.01	75.00±2.81
Carcass length	90.10±4.58	78.55±5.89	84.325	87.00±4.92	87.83±5.22	87.55±4.32	88.66±5.98	90.34±5.62	92.88±4.87	92.90±4.02
Back fat thickness	2.78±0.15	3.20±0.12	2.99	2.81±0.11	2.61±0.15	2.62±0.12	2.35±0.11	2.22±0.12	1.98±0.08	1.97±0.10
Loin eye area	4.59±0.13	4.39±0.23	4.49	4.59±0.12	4.62±0.14	4.63±0.13	4.59±0.11	4.62±0.22	4.63±0.09	4.65±0.11

The developed Rani crossbred variety showed stable performances over the generations. The animals also showed stability in performance traits in field evaluation.

ITRA Project: IMAGEIDGP- Image based systems for identification of individuals, breeds and diseases of pigs and goats

S Banik, Mohan N.H. and S. R. Pegu

The objective of the project envisaged image-based identification of pigs and goat breeds as well as individuals. Different traits were studied *viz.*, ear contour, ear venation, iris, retina, muzzle imprint and picture of pigs and ear contour, ear venation, iris, retina, tail and nostril imprint in goats. It was finalized that auricular venation pattern and muzzle imprint in pig and iris image in goat can be used as a tool for individual identification. The project is in collaboration with IIT Guwahati, Guwahati; Kalyani Govt. Engineering College, Kalyani; ICAR-RC for NEH, Barapani; Uttar Banga Krishi Viswavidyalaya, Cooch Behar, ICAR-RC for NEH, Tripura center, Agartala and Assam University, Silchar. Individual animal identification not only allows producers to keep records of animal's parentage, birth, production records, health history but also useful for precision farming system and implementation of different Governmental plans and policies to animal farming. Traditional methods of animal identification *viz.* ear notching, tattooing, branding, tagging, use of RFID do not provide secure animal identification due to possibilities of theft, falsification and duplication and certain animal ethics issues including invasive procedures. On the contrary, the image based IT solution for identification of animals are non-invasive, cheap and permanent in lifetime. Large part of pig and goat population of NE region having high chance of surreptitious depletion and yet to be characterized and documented. With the effort, animals from many groups may possibly be classified under breed or insipient breed status which can be recognized by breed identification system.

The database of pig and goat genetic resources of India was generated. Indigenous population of 6 breeds of pig and 20 breeds of goat along with other potential exotic and crossbred pig germplasm were documented. For image based identification, traits like iris in case of goat, auricular vein pattern and muzzle in case of pig was found to have promising potential for individual identification. Images for the said traits were captured at a regular interval by the agricultural institutes after standardization and confirmation by the IT partners. Blood samples were collected from selected breeds of pig and goat for DNA based analysis. mt-DNA based analysis was done and unique cluster was found among different breeds. Algorithms were developed for individual identification with the help of image of iris from goat and ear vain pattern and muzzle from pig.

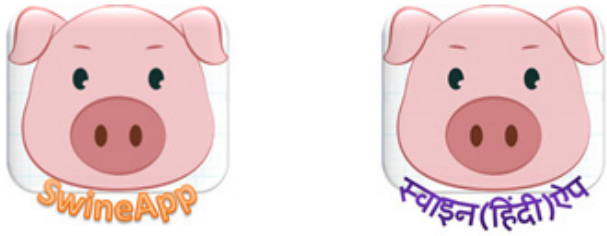
After analyzing the iris images of pig and goat, it was found that the iris of goat may be used as an identification trait. Due to the unique anatomical feature, large part of the iris of pig remained covered by the eyelids which make it difficult to work with. In goat the iris was captured by SLR camera with specific modifications. The captured image has been preprocessed for segmentation with the help of contour tracing algorithm and filters. The segmented iris was normalized and templates were generated and were stored along with the identification of goat in database for the purpose of animal recognition in future. For verification, the template of the recaptured image from the same goat was tested for matching with the stored database. Up to 77 percent matching was found when a freshly captured image of an animal was tested with stored database but the same yielded a matching value below 55 per cent when compared with other individual in all case of testing. According to the report, this has been claimed that even with 72% of matching in the process of verification in human eye chances of a false interpretation is one in 1,33,000 individual.

Auricular vein pattern has been identified as a trait for individual identification in pig was also undertaken. Like iris, the image of ear for vein pattern was processed for segmentation followed by generation of auricular-vein tree. Those vein trees were used for generating template database for recognition of pig. More than 90% matching was achieved in this case.

Research Projects

An algorithm has been developed to amplify certain hidden features in the muzzle by constructing a gradient significance map and the corresponding patch statistic profile. The gradient significance map extracted from the muzzle images of pigs tends to amplify the pore and ciliary arrangement on the muzzle surface, which may be expected to be distinct for each pig. This pattern can therefore be used as a bio-identifier for segregating individual pigs not just within the same breed but also across breeds. With a suitable classifier (e.g. SVM or Random forest) applied to the gradient based statistics derived from muzzle images, a classification accuracy of up to 97% was obtained for individual pig recognition.

As offshoot activities of the programme two unique mobile applications namely ***SwineApp***, ***SwineAppHindi;*** standalone data recording software for pig farm namely ***SwinePro*** was developed. Three patents and two copyrights have been filed out of the technology developed from the project.



Logo of Android based mobile application available in Google Play Store

AICRP Project: All India coordinated research project on pig, KVK-Goalpara centre

S Banik, S. Rajkhowa, K. Barman and H. Choudhury

As per mandate of the project creation of all the facilities including infrastructure viz. 30-sow pig shed, feed godown etc. Characterization of Doom pig variety of Assam was done. 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. Presently the genetic improvement programme is being done by selective breeding among Doom pig. The herd is maintaining 30 sow unit of Doom pig.

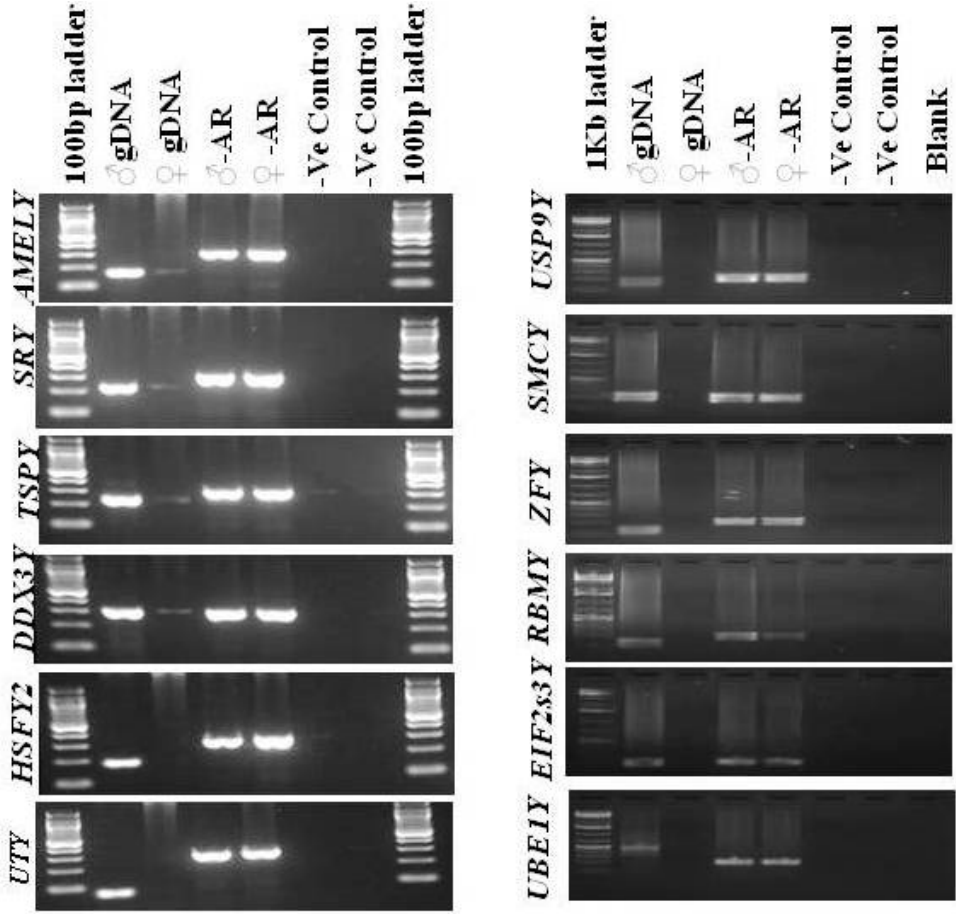
Newly constructed AICRP pig farm

Doom pig in the AICRP farm

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

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

Over the past few years, comprehensive work has been done on genome sequence analysis of many mammals that dealt with Y chromosome gene sequencing and understanding of diverse phenotype due to genetic variation. However, very limited information is available regarding MSY genes and their functional profiling. Although whole genome draft sequence of Pig is completed recently, the complete sequence annotation is still not available. Mammalian sex is determined by XX: XY chromosome arrangement system. Female has two X with a few notable exceptions whereas male genome contains one X and a Y chromosome. The y chromosome is the smallest acrocentric, heterochromatic sex chromosome in mammals which contains master-switch genes responsible for gender differentiation. The Y chromosome which is specific for male sex development encompasses male-specific region (MSY) as well as the pseudoautosomal region. Around 95% of the Y chromosome is male-specific which does not recombine with X during male meiosis, while only 5% are the pseudoautosomal region which facilitates recombination with the X chromosome. The male-specific region of the Y chromosome has been studied for a wide number of mammals ranging from mouse, cattle, horse, yak, and human, which essentially play the role towards the development of male viability that includes sex determination, hormone regulation, testicular development, spermatogenesis, and male fertility.



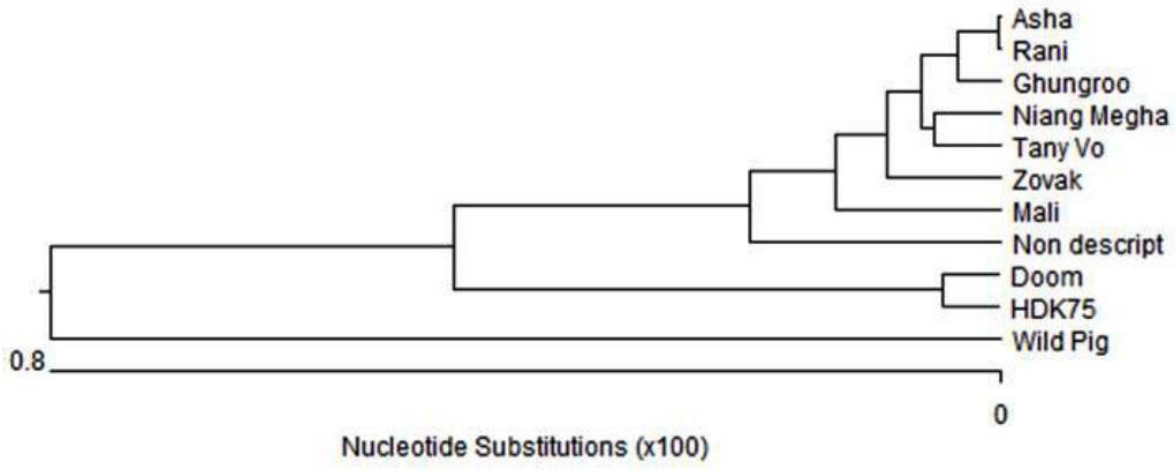
Amplification of 12 MSY genes in pig genome

A number of Y specific genes have been discovered in Pig but negligible works have been done on its expression profiling. The present study has identified twelve Pig MSY genes which have been very critical for male fertility across the eutherian mammals. For amplification of these twelve genes been blood and tissue sample have been collected and DNA & RNA isolated following standard protocol. Primer has been designed to amplify to 12 critical MSY genes, 6 control genes from Pig and 20 fertility related miRNA. To understand this novel complexity, these twelve MSY (male-specific region of the Y chromosome) genes have been studied detailed in the pig. Targeted genes were amplified in male and female genomic DNA and confirm the male-derived specificity **(Fig.1)**. Moreover, tissue panel from the pig, as well as sperm, have been collected to understand novel complexity of these MSY genes in expression profiling. With this novel idea, we have been trying to determine the expression levels of sperm-derived RNAs which will be indicative of boar fertility and also to determine the expression levels of sperm-derived miRNA expression between fertile and subfertile sperm of boar. For this experiment fresh ejaculate from an adult, boar was collected using an artificial vagina. The main aim of this study will be to analyze and confirm the presence of the male-specific genes, thereby rediscovering the male-specific genes in Pig and to study the expression pattern of these genes in male reproductive tissues and there linked with boar fertility.

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

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

Northeast India is one of the most bio-diverse regions in the country, which have numbers of indigenous pig breeds. In India, pig husbandry is very much predominant in Northeast India and one of the major hotspot of pig domestication in India and developed numbers of indigenous pig breeds in recent times. But very limited studies were conducted to understand the origin and domestication of pigs of this region. Previous limited studies showed that these indigenous pigs might be independently domesticated in the different breeding tract of the regions. The purpose of the present study was to investigate the origin and evolution of indigenous pig breeds pigs using complete mitochondrial genomic sequences (mtDNA) from exotic European and Asian and pigs and wild boars. The complete mtDNA genomes of Ghungroo, Niang Megha, Tenyi-Vo, Doom, Non-descript, Mali, Zovawk, Rani, Asha, and HDK75 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 neighbor-joining (NJ) method. Thirty primer pairs were designed to determine the mtDNA sequences of all native pigs of NE and wild pig. The phylogenetic statuses of indigenous pigs were investigated by comparing the mtDNA sequences of complete coding regions and D-loop regions respectively amongst Asian breeds, European breeds, and wild boars. The analyzed results by cluster methods contributed to the same conclusion that all pigs were classified into different major groups, European clade, and Asian clade. 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. The phylogenetic tree clearly distinguishes the pig sequences of North East region by geographical definition (Fig.1). By using modern sequencing technologies to obtain whole mtDNA genome sequences from different indigenous pig breed of North East and wild pig in this study, we have examined the potential effects of hybridization between local indigenous breed and exotic breeds of pig, analyzed the phylogenetic relationship between indigenous and exotic breed of pig, constructed the first whole mtDNA phylogenetic tree of pig found in northeast, and identified population substructure and subspecific relationships among these pig populations.



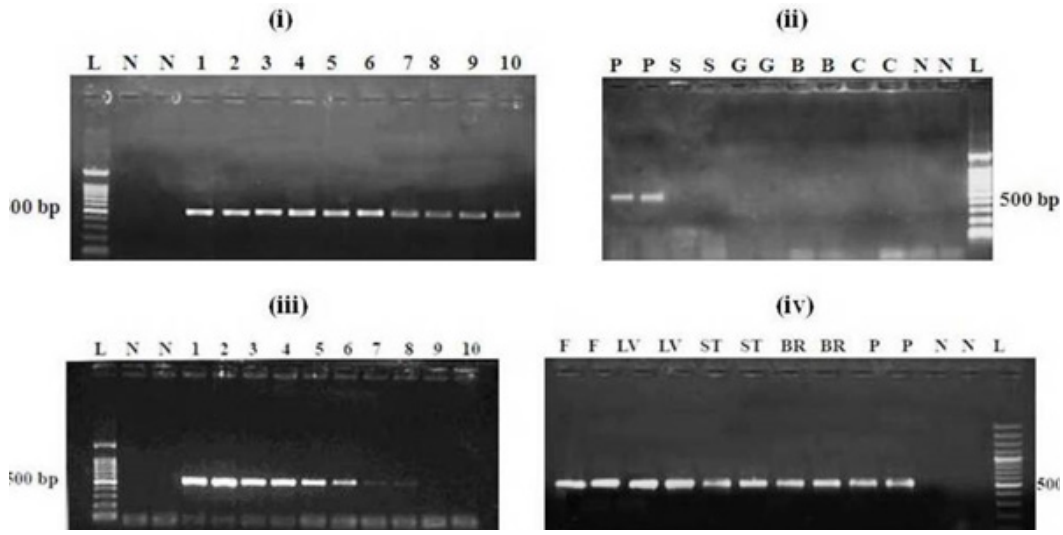
Phylogenetic tree constructed from complete mtDNA distinguishes the indigenous pig breeds of North East region

Institute project: Development of techniques for species authentication of fresh and processed pork products.

P.J.Das, Girish P.S, S. Banik, R. Thomas, and S. Rajkhowa

Authentication species for food safety and food control are very much imperative in today's marketplace in the world. Identification source of meat from different species of animals is crucial because of social, public health and forensic reasons. As minced meat is added in most of the processed meats, certification of processed food with meat labeling is must since constituents may include allergic or toxic substances, gain consumer trust, and promote fair trades in local and international markets. Detection of pork in commercially processed meats is one of the most critical issues in the prospect of modern food inspection because of religious food ethics, medical purposes, and deliberate adulteration to reduce production cost. Poaching of wild boars and consumption of its meat in the name of pork is very widespread in various parts of the north-eastern region of India. The present study aims to develop reliable, accurate, sensitive and easily performable techniques for determination of species authentication of fresh and processed pork products. In this study, a method for species differentiation based on Forensically Informative Nucleotide Sequencing (FINS) targeting three mitochondrial genes *Cytochrome B* gene, *Cytochrome C Oxidase*, *12SrRNA*, and d-loop region have been developed (Fig.1). For the first time, in this project, the use of Loop-Mediated Isothermal Amplification (LAMP) technique, as a rapid analytical tool for detection of pork adulteration in meat samples and commercial pork products has been analyzed. The results can be interpreted easily on the basis of colour change in the solution and moreover, the technique is simple, time-saving and can be easily undertaken by semiskilled persons. Currently, molecular techniques reported for species identification are PCR based, which require sophisticated equipment like thermocycler, electrophoresis units, and gel documentation system. The present investigation also reports about the development of RAPD laboratory level kits for authentication of pork as well as develop different confirmatory molecular biology technique for species authentication of pork using pig mitochondrial genome. The output of this study will have an impact on quality control of meat and meat products. Technology reported in this study can be used by stakeholder for confirmatory laboratory tests for species authentication of pork and pork products. The results obtained will not only improve the process of adulteration of pork but also other meat like beef, chevon, chicken, etc. 'No adulteration

tag' on meat products using confirmatory diagnostic procedure developed in this study will fetch higher market price if implemented and regulated by the statutory body. Because LAMP is isothermal, which eradicates the need for expensive thermocyclers used in conventional PCR, it may be a particularly useful method for diagnosis of infectious disease in north-eastern remote areas of the country. In addition to this, findings of this study will provide a new basis for identification of pig and pork sample on the arena of forensic applications.



Species- specific PCR assay for authentication of pork using mitochondrial d-loop amplicon. (i) Optimization of annealing temperature of pig specific PCR assay. Lane L: 100bp ladder; N-N: Negative control, Lane 1-2: 58^0 C, Lane 3-4: 60^0 C, 5-6: 62^0 C, Lane 7-8: 64^0 C, Lane 9-10: 66^0 C. (ii) Specificity of the pig specific PCR assay. Lane L: 100bp DNA ladder; Lane P: Pork; Lane S: Sheep; Lane G: Goat; Lane B: Buffalo; Lane C: Cattle, Lane N-N: Negative control, lane L: 100bp ladder. (iii) The sensitivity of the quantity of pig DNA for PCR assay. Lane 1-2: 20ng/µl; Lane 3-4: 2ng/µl; Lane 5-6: 0.2ng/µl; Lane 7-8: 0.02ng/µl; Lane 9-10: 0.002ng/µl. (iv) Sensitivity test for DNA isolated from by-products. Lane M: 100bp ladder; Lanes A: Negative; Lane B: Bristles'; Lane ST: Stomach; Lane LV: Liver; Lane F: Fat; Lane P: Pork.

ITRA Project: E-Varaha: Information System for Safe Pork Production in North Eastern India

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

This project visualizes the importance of using IT-based tools for the holistic development of the piggery sector by the way of making available the right information at right time and establishing functional linkages between different players of the value chain so as to augment production, productivity, and profitability of the piggery sector in the Northeast Region. This, in turn, would pave the way for rural development and in the long term, it would contribute to the nutritional security of the nation. Rapid pig health monitoring using Infra-Red (IR) imaging, microbial quality evaluation using the diagnostic kit, image-based faecal analysis for detecting parasitic load and farm-to-fork traceability system for pork are the novel approaches conducted under this project. Meat animal like pigs plays a very important role in meeting the nutritional requirements of ever-increasing country's population owing to its unique attributes such as high fecundity, shorter generation interval, early sexual maturity, higher dressing percentage, and low production cost. One of the biggest challenges

facing the piggery sector in India especially in NER is ensuring 'safe pork production'. Most of the pigs are reared by small/ marginal farmers with only a few animals and very little inputs in terms of feed and health management. Also, pigs are slaughtered, processed and marketed under unscientific conditions. Physical hazards like soiling, contamination, etc. can be minimized by increasing awareness on hygienic production practices among meat handlers while chemical hazards are minimal in NER because of less use of therapeutic drugs, pesticides, growth promoters, etc. These challenges are addressed keeping in mind varied pig rearing (unorganized/ organized) and harvesting practices (small/ large abattoirs). The project output ensures that quality of pork in terms of disease hazards, and Decision Support and Traceability System developed greatly help small as well as an organized farm for economically sustainable pig framing. Another successful feature of this project is to meet the supply gap in the region since either pigs or pork are imported from other Indian states or adjoining countries to meet the huge demand. Previously there was a lack of systematic study about the movement of pig/ pork into or out of the region and marketing channel operating *i.e.* farm-to-fork supply chain. Understanding these underlying factors was essential for devising strategies for hygienic pork production; this project envisages a systematic study of piggery sector in NE to understand the dynamics of pig/pork flow across the NE states to address this gap (http://www.iitg.ac.in/cseweb/tts/evaraha/). To aid in the selection of healthy animals free from parasitic infestation an IT-based faecal examination technique is developed. Presence of parasites, parasitic eggs in faecal sample detected by the system will indicate parasitic load or gastrointestinal disorders which will help in deciding the suitability of the pigs for slaughter (http://agnee.tezu.ernet.in:8022/varaha/). Comprehensive quality control requires appropriate traceability system to link various stages of the value chain from 'farm to fork' which facilitates the flow of information across the value chain (http://www.iitg.ac.in/cseweb/tts/evaraha/evaraha_system/index.php). It involves identification of animal through individual/ batch specific coding and barcode labeling of market pork with traceability details. An online database has designed for storing and managing traceability information along with Decision Support System based on Correspondence Analysis of Data generated through IT-based tools for monitoring the health of slaughter pigs and evaluating microbial quality at Critical Control Points in the abattoir (http://www.iitg.ac.in/cseweb/ddd). Access to *e-Varaha* would be enabled through smartphones or a desktop application which would help in reaching of farmers and stakeholders scattered across regions so as to entail least financial burden on the core stakeholders as well as completely remove the middlemen system in the piggery sector.

ANIMAL NUTRITION

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

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

Different fruits and vegetable waste was screen for their nutritive value (Table 1 & 2). Both fruits and vegetable waste contains a very good level of energy and low to moderate level of protein.

Comparison among regular farm diet, field diet without supplementation and field diet with balanced diet was investigated. Supplementation of balanced feed improve the production performance of pigs. Performance of pig was significantly ($P<0.01$) higher on supplementation of balanced feed at farm condition than field condition. While pig with balanced diet at field condition performed better ($P<0.01$) than pigs without supplementation. Besides feeding of balanced diet, other factors like housing, environment etc also affect the production performances of pigs. The nutrient utilization of experimental animals at different diets is shown at Table 1 and fortnightly growth rate is shown at Fig 1 .

Table 1. Chemical composition (% DM) of fruit waste

Components	DM	CP	CF	EE	Ash	NFE
Banana stems	5.1±0.2	2.4±0.1	20.5±0.3	2.3±0.1	14.3±0.2	60.5±0.3
Banana leaf meal	94.1±0.1	9.9±0.1	24.0±0.2	11.8±0.3	8.8±0.1	45.5±0.4
Fresh banana leaves	19.5±0.2	11.4±0.2	28.3±0.4	13.1±0.2	10.9±0.3	44.6±0.3
Green bananas	20.9±0.1	4.8±0.1	3.3±0.2	1.9±0.1	4.8±0.1	85.2±0.4
Ripe bananas	31.0±0.4	5.4±0.1	2.2±0.1	0.9±0.0	3.3±0.1	88.2±0.6
Guava	94.7 ±0.2	9.4±0.5	6.3±0.5	5.3±0.2	5.3±0.2	73.5±1.3

Table 2. Nutritive value of various vegetable wastes

Name	% Composition (DM)					
	OM	CP	EE	CF	Ash	NFE
Cabbage waste (*Brassica oleracea var capitata*)	87.60 ±0.12	10.12 ±0.15	2.91 ±0.22	13.82 ±0.24	12.40 ±0.12	60.75 ±0.32
Cauliflower waste (*Brassica oleracea var botrytis*)	89.62 ±0.14	18.12 ±0.06	4.92 ±0.11	14.50 ±0.21	10.38 ±0.14	52.08 ±0.23
Brinjal waste (*Solanum melongena*)	91.74 ±0.17	17.42 ±0.19	3.10 ±0.15	22.55 ±0.45	7.82 ±0.17	49.11 ±0.28
Pumpkin waste (*Cucurbita pepo*)	94.58 ±0.11	15.12 ±0.16	3.98 ±0.23	14.79 ±0.25	5.42 ±0.11	60.60 ±0.27
Bottle guard waste (*Lagenaria siceraria*)	92.14 ±0.08	16.05 ±0.17	2.55 ±0.19	15.69 ±0.27	7.59 ±0.08	58.12 ±0.29
Radish (*Raphanus sativus*)	85.70 ±0.31	12.80 ±0.42	2.10 ±0.13	9.98 ±0.07	14.30 ±0.31	60.82 ±0.25
Potato skin (*Solanum tuberosum*)	90.33 ±0.05	12.75 ±0.23	3.40 ±0.17	9.34 ±0.23	9.67 ±0.05	64.84 ±0.23
Cassava tubers (*Manihot esculenta*)	97.19 ±0.22	3.56 ±0.34	1.92 ±0.13	3.36 ±0.04	2.81 ±0.22	88.35 ±0.06

Silage was prepared using vegetable waste to see its characteristics and effect on growth and production performances of crossbred grower pigs. The different characteristics of prepared vegetable waste are shown in Table 3.

Table 3. Silage characteristics prepared using vegetable wastes

Attributes	Silage I (3 % Jaggery)	Silage II(4 % Jaggery)	Silage III(4 % Jaggery+wheat bran 10%)
pH	4.4	4.3	4.4
Colour	light greenish	light greenish	light brown
Smell	Sweet Lactic acid aroma	Sweet Lactic acid aroma	Sweet Lactic acid aroma
Texture	Firm; softer material undetachable	Firm; softer material undetachable	Firm; softer material undetachable

Picture			

Effect of vegetable silage on production performance in crossbred grower pigs

Eighteen crossbred (HS x Ghungroo) grower 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 diet ranged from 17.94±0.04 T1 to 18.31±0.01 in T3 while protein content of silage was 19.55±0.55. Dry matter intake significantly reduced ($p<0.01$) with increased level of silage in the diet. There was no significant difference on nutrient digestibility except crude fiber digestibility which was reduced ($p<0.05$) with increased level of silage in the diet. 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 % supplementation of vegetable silage in the diet (Table 4).

Table 4. Effect of vegetable waste silage on nutrient utilization in crossbred grower pigs

Parameter	T_1	T_2	T_3	P Value
DMI, g/d	910.00±5.30	819.00±2.31	773.50±3.61	0.000**
ADG. g/d	261.5±2.2	259.0±11.0	252.6±66.8	0.986
FCR (Feed intake per kg gain)	3.48±0.01	3.17±0.13	3.45±0.75	0.863
Feed cost/kg gain	88.00±0.26	74.23±3.06	77.48±16.72	0.609

T_1= Grower ration containing 0 % vegetable waste silage, T_2= Grower ration containing 10 % vegetable waste silage, T_3= Grower ration containing 15 % vegetable waste silage; ^{a,b,c} superscript in a row differ significantly, $p<0.0$.

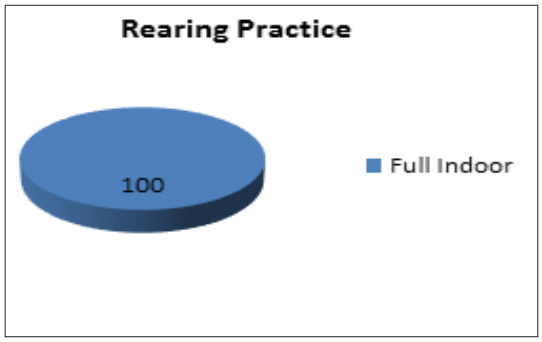
NMSHE Project: Himalayan Agriculture under National Mission for Sustaining the Himalayan Ecosystem

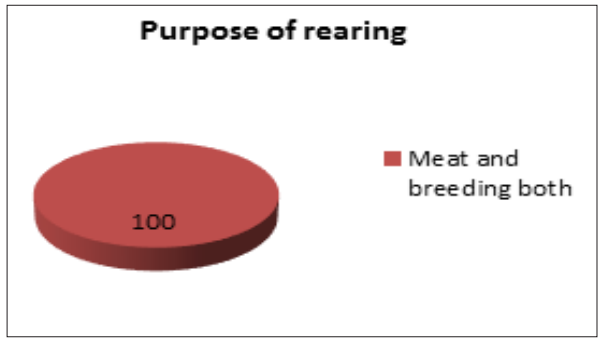
Keshab Barman and Swaraj Rajkhowa

Survey on pig production system in rural villages: Survey was conducted in state of Mizoram, Sikkim and Meghalaya. In Mizoram four villages namely Selesih Gosan Vang, Durtlang (Leitan), Durtlan (ramthar) and Zuangtui of Aizawl District; Basilakha, Namchepong, Nandok, Assam Lingzey and Raigaon of East Sikkim District and Goeracre, Dalu, Agilangre, and Rongkhon villages in West Garo Hills district of Meghalaya. All these villages are located in the Himalayan ecosystem. A total 54 households at Aizwal district of Mizoram, 60 household in East Sikkim district of Sikkim and 57 household in West Garo Hills district of Meghalaya was surveyed in different location. During survey, information regarding household status, management practices followed by the farmers and types of animal maintained, herd information of pigs, feeding practices, breeding practices, marketing of pigs and meat along with information regarding animal health management in terms of vaccination followed in that localities, types of diseases prevalent, precautionary measures followed during outbreak of diseases etc were recorded.

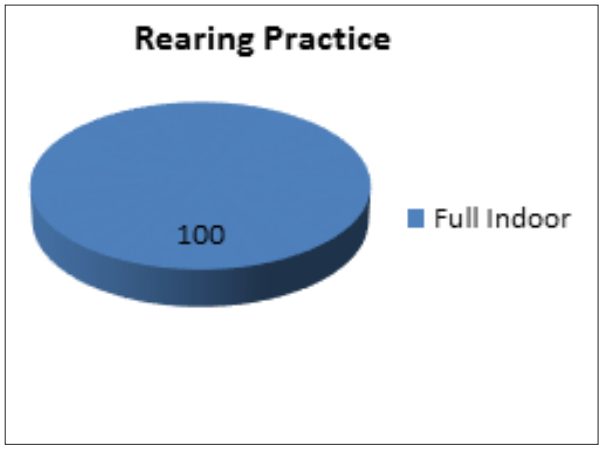
Research Projects

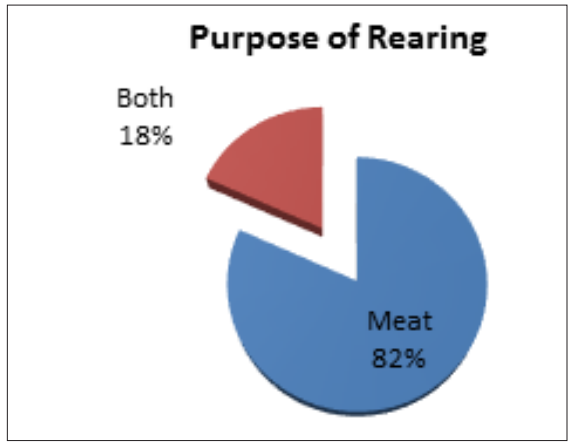
The pigs are reared by the Mizo community of the Aizawl district. Mostly the pig farmers of Aizawl district (i.e., 100 %) raised their pigs by full indoor system. The respondents (100%) in this district reared their pigs for meat production and also for breeding purpose. The pigs are reared by the Rai, Supba, Lepcha, Limbu and Sherpa community of the East Sikkim district. Mostly the pig farmers of East Sikkim district (i.e., 100 %) raised their pigs by full indoor system. The respondents in this district reared their pigs mostly for meat production and very few for breeding and both purpose. The pigs are reared by the Garo community of the West Garo Hills district of Meghalaya. Mostly the pig farmers nearly 93 % raised their pigs by semi intensive system. The majority (91.2) of the farmer raised their pigs both for meat and breeding purposes and only 8.8 % farmers raise their pigs for meat purpose.



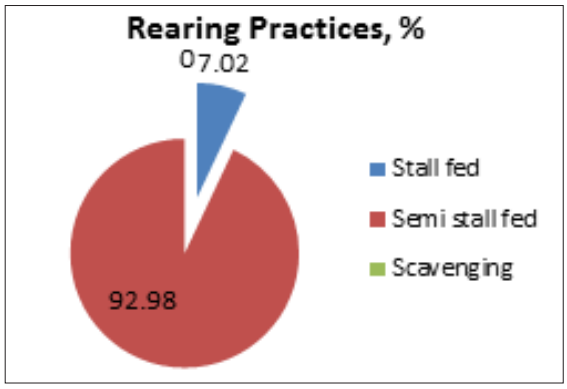


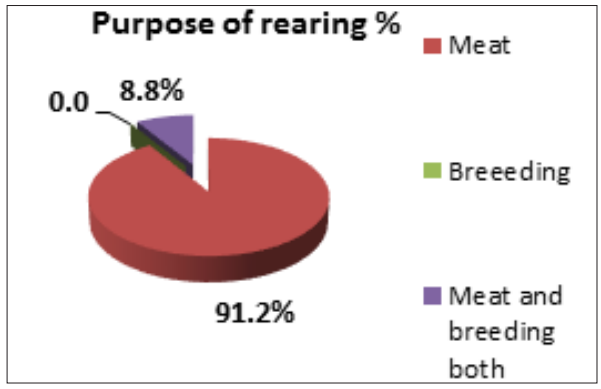
Pig Farming Scenario in Aizawl district





Pig Farming Scenario in East Sikkim district





Pig Farming Scenario in West Garo Hills district

Housing Management: Some special bamboo or wooden wall housing system was provided to the pigs. The respondents provide housing for their pigs for whole the day and night. Scavenging system was not seen in those particular areas.


Housing systems of pig farming in Aizawl district

Housing systems of pig farming in East Sikkim district


Housing systems of pig farming in West Garo Hill district

Feeding Management: Most of the farmers of the surveyed villages in Aizwal district (i.e. 100%) of Mizoram and East Sikkim District of Sikkim fed their pigs individually in a pail while 80.7 % of the farmers in surveyed district in Meghalaya fed their pigs individually in a pail and about 19.3 % farmers fed their pigs in groups. The pigs are supplied with rice polish, kitchen waste, vegetable waste, jugli (end product of rice beer), colocacia and occasionally wheat bran. They also added mineral in their pig ration. The source of water in most of the household is supplied water by Department of PHE. Water is mixed with feed and provide to the pigs 2-3 times a day. Most of the farmers provided raw feed (i.e. 100%) to their pigs.

Raw and Cooked Feeds stuff for pig in East Sikkim district

Breeding: Out of the total household surveyed in Mizoram, 100% of the pigs reared by the farmers are of cross breed type. The farmers followed only artificial insemination (100%) for breeding of their pigs. They did not allow natural mating. This is completely opposite in case of Sikkim, where, Out of the total household surveyed half of pigs are crossbreed, some are local and very few exotic breeds of the pigs that are reared by the farmers. The farmers followed only natural mating (100%) for breeding of their pigs. They did not have sources for artificial insemination. In the state of Meghalaya, out of the total household surveyed 35.1% of the pigs reared by the farmers are of cross breed type and 64.9 % farmers have local pigs only. The farmers followed both artificial insemination and natural service for breeding of their pigs. They did not allow natural mating.

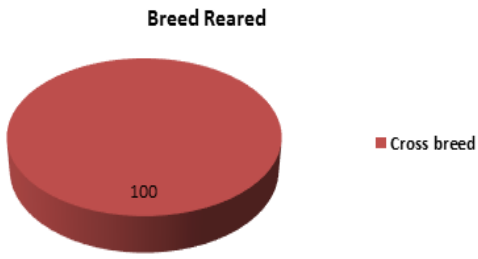


Fig. Pig breeds mostly reared by farmers in Aizawl District

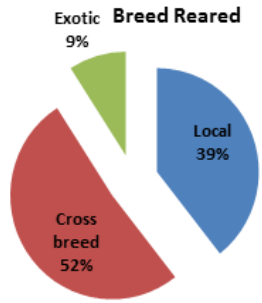


Fig: Pig breeds mostly reared by farmers in East Sikkim District

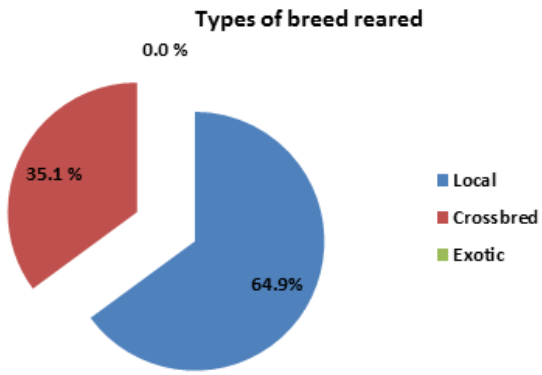


Fig. Pig breeds mostly reared by farmers in West Garo Hills District

Sex Ratio Involved In Piggery Farming: In most cases it was observed that majority respondents in Mizoram belonged to male category. About 77.8% respondents belonged to Male category while only 22.2% of respondents belonged to female category. Similarly, in Sikkim also majority of respondents belonged to Male category. About 63.33% respondents belonged to male category while only 36.67% of respondents belonged to female category. In case of Meghalaya, also majority respondents belonged to male category. About 77.2% respondents belonged to Male category while only 22.8% of respondents belonged to female category.

Marketing: The farmers of Aizawl district marketing their pigs by both self marketing or by trader. They sale their piglet and also pork in nearby market and the sale price were Rs. 4500/ piglet and Rs. 300/kg of pork. The sale price per kg live weight of pig is Rs. 180 was observed in the surveyed area. Similarly, the farmers of East Sikkim district marketing their pigs by both self marketing or by trader. They sale their piglet and also pork in nearby market. The sale price were Rs. 4500/ male piglet, Rs. 3500/ female piglet and Pork cost Rs. 200/kg. The sale price per kg live weight of pig is Rs. 180 was observed in the surveyed area. Where as, most of the farmers (87.7%) of West Garo Hills district marketing their pigs through traders and only 12.3 % farmers follow self marketing. They sale their piglet and also pork in nearby market and the sale price were Rs. 3000/ piglet and Rs. 250/kg of pork. The sale price per kg live weight of pig is Rs. 180 was observed in the surveyed area.

Health Management: The farmers of the Aizawl district followed vaccination programme and it was observed that they only gave classical swine fever vaccine to their pig. The pigs of those particular areas suffered from various diseases and most frequently occurred diseases were CSF, FMD, pneumonia, coccidiosis and parasitic infestation. In case of Sikkim, vaccine are not available frequently to farmers of the East Sikkim district as a result farmers does not followed vaccination schedule. If available only gave for classical swine fever vaccine to their pig. No deworming schedule is followed The pigs of those particular areas are reported to suffered from various diseases and more frequently die due to diarrhoea and fever like symptom. In case of Meghalaya, the farmers of the West Garo Hill district do not followed vaccination programme and it was observed that few farmers only gave classical swine fever vaccine to their pig. The pigs of those particular areas suffered from various diseases and most frequently occurred diseases were CSF, FMD, pneumonia, coccidiosis and parasitic infestation.

Agricultural Land Holdings: In Aizawl district most of the respondents (100%) belongs to small farmers i.e., they had less than 3 acre agricultural land. Similarly, in East Sikkim district most of the respondents (95%) possess more than 3 acre agricultural land. In West Garo Hills district most of the respondents (100%) belongs to marginal farmers i.e., they have 3-10 acre of agricultural land.

Purpose of Rearing: The farmers of the surveyed areas of Aizawl districts reared their pigs for both meat and breeding purpose (100%) i.e., they reared the pig for both pork and piglet production. The farmers of the surveyed areas of East Sikkim districts reared their pigs mostly for meat and very few for breeding purpose. Similarly, the farmers of the surveyed areas of West Garo Hills districts reared their pigs for both meat and breeding purpose (91.2%) i.e., they reared the pig for both pork and piglet production.

Types of Animal Reared: In the pig rearing pockets of Aizawl district farmers had 5.9% Boar, 42.5% castrated male, 13.3% Sow and 38.3 % piglets. In the pig rearing pockets of East Sikkim district farmers had 11.92% Boar, 54.3% castrated male, 1.99% Sow, 8.61 % piglets and 23.18% gilt. In similar way, farmers of West Garo Hills district have 11.9% Boar, 31.9% castrated male, 5.9% Sow and 49.6 % piglets.

Age wise distribution: Farmers in Aizawl district had 39 % of male pigs between the age group of <2 months while females in the same age group range are 30%. Farmers had 16% gilts in the age group of 2-8 months while they have 8% male in the same age group. Among the farmers, they had 7% of >8 months male pigs and only one percent of female pigs in same age group. Similarly, farmers in East Sikkim district had 11.92% of male pigs between the age group of <2 months while females in the same age group range are 2.65%. Farmers had 11.92% gilts in the age group of 2-8 months while they have 47.68% male in the same age group. Among the farmers, they had 13.91% of >8 months male pigs and 11.92% percent of female pigs in same age group. In a similar manner, farmers in West Garo Hills district have 22.1 % of male pigs between the age group of <2 months while females in the same age group are 33.1%. Farmers have 14% gilts in the age group of 2-8 months while they have 25.7% male in the same age group. Among the farmers, they have5.1 % of >8 months female pigs and none of the farmers have male pigs in same age group.

Annual Income: About 94.4 % pig farmers in Aizawl district had annual income up to ranged from Rs30,000 to Rs.1 lakh and only 5.6 % farmers had annual income that cross Rs.1 lakh. Similarly, about 85% pig farmers in East Sikkim district had annual income up to ranged from Rs30,000 to Rs.1 lakh and 15% farmers had annual income that cross Rs.1 lakh. While, in case of Meghalaya, about 61.4 % pig farmers in West Garo Hills district have annual income ranged from Rs. 2 lakhto Rs.3 lakh and 28.1 % farmers have annual income that cross Rs.3 lakh.

Monitoring of health of pigs: All together 491different samples namely Serum (250), blood (90), tissue (59), nasal swab (62) and faecal (30) were collected from nearby villages of Kamrup districts for prevalence of diseases studies. Out of this 15 % serum samples were found positive for PCV- 2, 23 % serum samples were found positive for CSF, 1 % samples for PRRS, 3 % of faecal samples were found positive for Rota virus, 11 % nasal swab found positive for *Streptococcus suis* and *Staphylococcus aureus*.

ICAR Project: Maize production in NEH region for sustainable livestock production

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

This is a collaborative project sponsored by Indian Institute of Maize Research, Ludhiana. In pig production, feed cost more than 70 % of the total cost of production. Maize constitutes 50-60 % of the total diets, thus accounting for 35-42 % of total cost of production. As maize is not grown as a regular crop in the NE region, the cost of maize is approximately Rs.1800 per quintal and it accounts for Rs. 6.30 to Rs.7.56 per kg of pig feed in this region. If farmers take an initiative to grow QPM maize it will reduce the cost of feed for pig by about Rs.2.10 to Rs.2.52 per kg of feed. Moreover, QPM variety maize contains a very high level of lysine which is an essential amino acid for pig and poultry for enhancing productivity. It will also reduce the quantum of protein needs for pig as lysine spares protein needs for the pig for enhancing productivity. In this project focus will be given for growing QPM variety maize and their impact on cost of pig production. Additionally, other variety of maize such as baby corn and sweet corn will also be used for cultivation in small scale to encourage the economic growth of farmers/beneficiaries through their sale and also value addition. The preliminary works has been initiated under this project and followings are the brief description of the works done so far.

Under manpower one young professional is recruited. Maize seed for HQPM, sweet corn and baby corn along with fertilizer namely urea, SSP and MoP have been purchased as details given below and have been distributed among beneficiaries. A total 65 Numbers of beneficiaries have received the maize seeds namely QPM seed (HQPM 1)- 254.5 Kg; Sweet Corn seed (Sweet corn 77)- 3.9 Kg and Baby Corn seed (baby corn 617) -14.8 kg for cultivation in 22 hectares of land. Moreover, fertilizers such as Urea: 1,491 kg, SSP: 2,651 kg and MOP: 7,45.6 kg was also distributed.

Distribution of maize seed and fertilizer

HQPM-1 at NRC on Pig, Rani

Sweet corn 77 at NRC on Pig, Rani

Hybrid baby corn 617 at NRC on Pig, Rani

Sweet corn 77 at NRC on Pig, Rani

HQPM-1 at farmers filed

Research Projects

ANIMAL REPRODUCTION

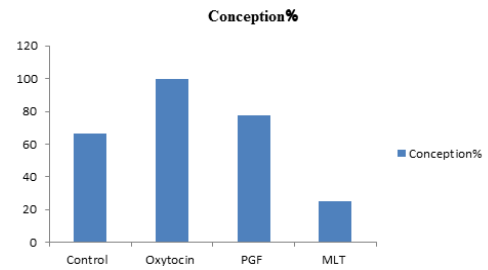
Flagship programme: Artificial Insemination in Pigs

Sunil Kumar

A total of 19 trainings sponsored by Missing Autonomous council, Meghalaya institute of Entrepreneurship, and Tribal Sub plan were conducted where practical demonstration for artificial insemination in pigs were done. Three specific trainings in A.I. in Pig were conducted for Veterinarians & Para-vets of Dept. of Animal Husbandry, Govt. of Sikkim and AICRP on Pig,C.A.U. Imphal centre and for farmers and entrepreneurs of Arunachal Pradesh. Technical advisory provided to establish A.I. Laboratories to Depts. of Animal Husbandry, Govt. of Sikkim & Govt of Assam, AICRP & MSP on Pig Centres. Under APART project, A.I. Satellite centers are going to be established with State Veterinary Dept., Govt. of Assam at Sibsagar, Johrat and Khanapara. A total of 30 awareness programmes for farmers were conducted in collaboration with SANJEEVNI (A socioeconomic welfare organization), Dept. of Animal Husbandry, Govt. of Arunachal Pardesh, ALPACO, LADP and TSP. Three large breeding units establishments has been initiated. During the reported period 10 new farmers were trained for self employment generation. Modern Boar Semen Production centre is under construction in collaboration with NEC, DoNER, Shillong. Effect of conception enhancers studied and found that oxytocin and prostaglandin are effective than melatonin by enhancing conception rate. Three conception enhancers namely Oxytocin (5I.U. /Dose), PGF (0.5mL/Dose) and melatonin (MLT) (1uM:10uL/Dose) were used. The study is in progress.

Comparison of conception rate for different conception enhancers

Parameter	Control	Oxytocin	PGF	MLT
Total AI	6	8	9	8
Conceived	4	8	7	2
Conception%	66.66	100	77.77	25.00



Comparison of conception rate for different conception enhancers

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

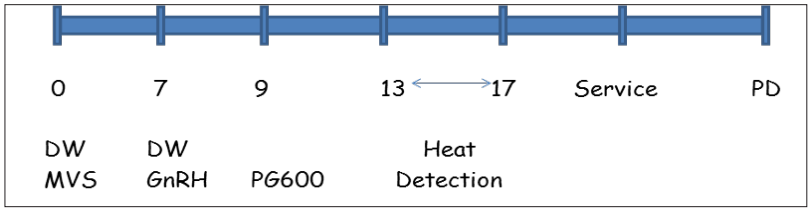
Institute project: Hormonal interventions for induction of cyclic ovarian activity in pre-pubertal gilts and anestrous sows

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

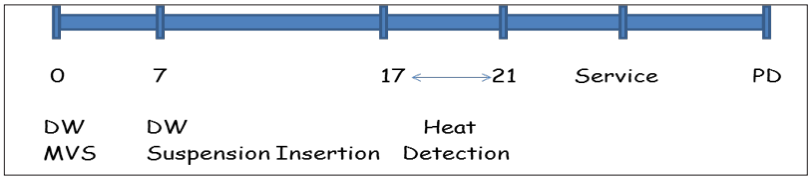
A methodology was developed for optimizing reproductive efficiency/combate anestrus in gilts. A total of 23 females where sows (n=6) and gilts (n=17) were used in the study. Out of these, deep anestrous (n=9) and cyclic condition (n=14) was the ovarian status of females. Further at the Farmer's Field: n=5 and Farm complex: n=23 was the status. Hormonal agents were PG 600 (hCG and PMSG @ 400 I.U. + 200 I.U. /animal) and GnRH (10 ug/animal) for the Method-I. While Intravaginal Suspension was used in Method-II where 20mg/kg Progesterone in vaginal mucosa. The study is in further progress.

Distribution of animals for Method –I and II

Method –I (23)					Method-II (5)
Estrus Induction (9)			Estrus synchronization (14+9=23)		Estrus Induction (5)
S/G	S	G	S	G	G
Total	6	3	0	14	5
Field	0	0	0	0	5
Farm	6	3	0	14	0



Schematic representation of methodology -I



Schematic representation of methodology -II

For estrus induction in method –I, the average duration from day of PMSG+hCG injection to induction of heat was 102.85±02.59 hrs. The induction of estrus rate was 77.77% (7/9). The average litter size was 5.83±2.34 (for 6 farrowings).For estrus synchronization in method –I, The average duration from day of PMSG+hCG injection to induction of heat was 119.56±05.61 hrs. The synchronization rate was 78.26% (18/23) The average litter size was 7.75±1.46 (for 11farrowings). For estrus induction in method –II using Intravaginal Suspension induction rate was 60% (3/5).

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

Sunil Kumar, Santanu Banik, K. Barman

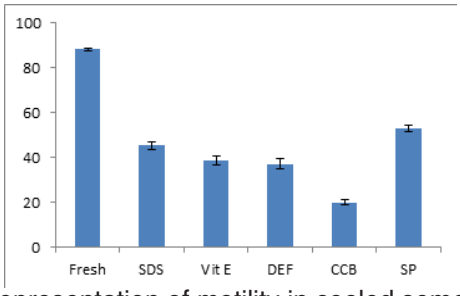
Ejaculates (n=36) collected by gloved hand method. A commercial extender was used for cryopreservation. Effect of supplementation of additives such as SDS (300mg/100mL), Vit-E (400mg/100mL), Calcium channel blocker (CCB) (10mg/100mL) and a cryoprotectant in replace of

glycerol DEF (1.5mg/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 using student's t-test was carried out. Superiority of additive in terms of post thaw semen characteristics was SDS> Vit- E> DEF> Ca channel blockers. Acceptable fertility has not been achieved, further experiments are in progress. A long term extender for liquid semen preservation standardized.

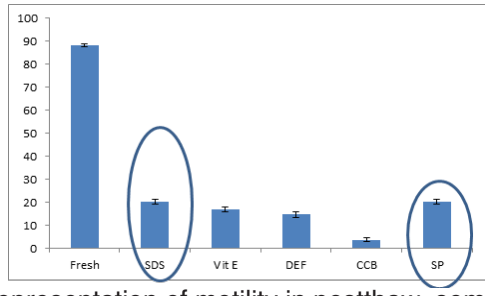
Comparison of Motility of semen (n=36) preserved with different additives in cooled and post thaw semen

Additives	Fresh	Cooled	Post thaw
SDS	$88.19^{a}\pm0.60$	$45.27^{bA}\pm1.80$	$20.13^{cC}\pm1.09$
Vit-E	$88.19^{a}\pm0.60$	$38.47^{bA}\pm2.07$	$16.08^{cC}\pm1.09$
DEF	$88.19^{a}\pm0.60$	$37.22^{bA}\pm2.24$	$14.72^{cC}\pm1.22$
Ca Channel Blocker	$88.19^{a}\pm0.60$	$20.00^{bB}\pm1.22$	$03.75^{cD}\pm0.87$
Seminal Plasma	$88.19^{a}\pm0.60$	$53.05^{bA}\pm1.24$	$20.24^{cE}\pm1.09$

Values with different superscripts differs significantly at $p < .05$



Representation of motility in cooled semen

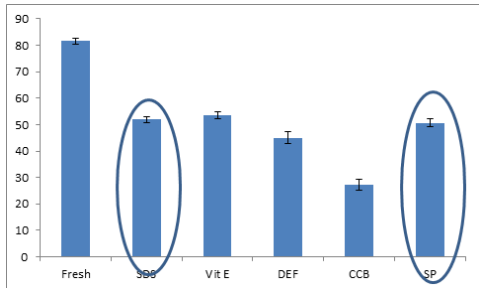


Representation of motility in postthaw semen

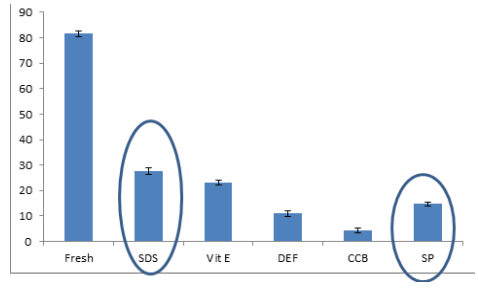
Fertility parameters in modified Long term Extender under standardization

Paratme.	Fresh	0 hr	48 hr	96 hr	144 hr	168 hr
Motility	91.66±0.48	86.55±0.65	68.61±1.26	60.13±1.25	31.11±1.26	15.41±0.87
Live %	80.41±1.00	67.91±1.38	61.25±1.50	53.33±1.38	--	48.33±1.26
HOST %	78.88±0.87	72.08±1.09	65.13±1.04	54.16±1.00	--	44.44±0.97

Values with different superscripts differs significantly at $p < .05$



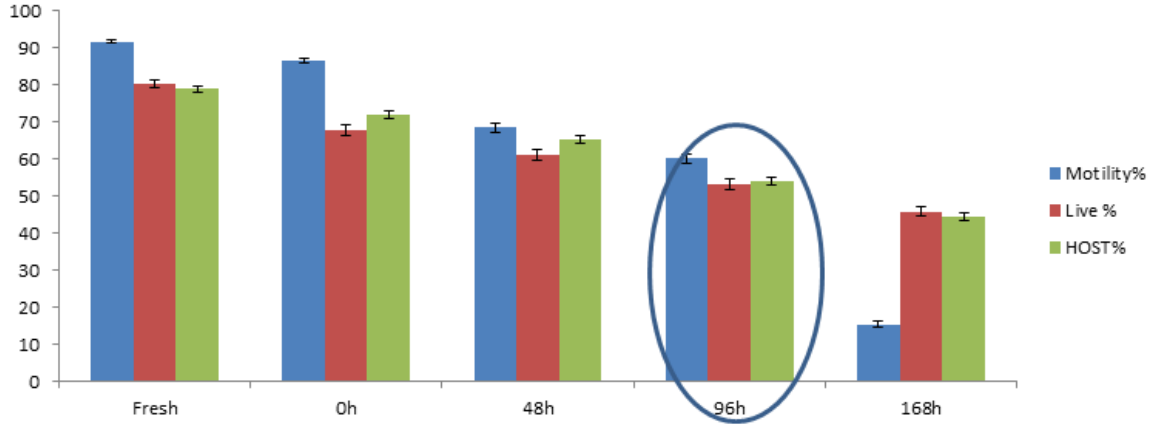
Representation of vitality in cooled semen



Representation of vitality in cooled semen

Fertility parameters in modified Long term Extender under standardization

Paratme.	Fresh	0 hr	48 hr	96 hr	144 hr	168 hr
Motility	91.66±0.48	86.55±0.65	68.61±1.26	60.13±1.25	31.11±1.26	15.41±0.87
Live %	80.41±1.00	67.91±1.38	61.25±1.50	53.33±1.38	--	48.33±1.26
HOST %	78.88±0.87	72.08±1.09	65.13±1.04	54.16±1.00	--	44.44±0.97



Representation of fertility parameters in modified Long term Extender under standardization

ANIMAL PHYSIOLOGY

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

Mohan.N.H

During the period of report 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 expression, which were common and unique to animals reared in hot semiarid climate of Rajasthan. The functional annotation of the whole

transcriptome has been completed. Based on the genomic data and previous studies, a 15Kdraft array 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 will be subjected to variable temperature and humidity in a recently built (March 2019) controlled climate chamber and will be initiated in the month of April 2019. Serum isolated from blood samples collected for biochemical estimations were stored and will be processed together. A trial with few pigs has been conducted and results will be reported in due course of time.

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.

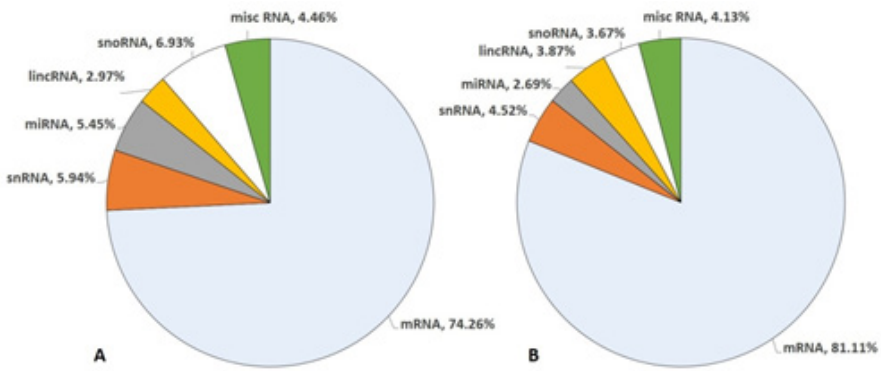


Fig. 1. Distribution of various gene promoters bound to heat shock factor-1 (HSF1) signaling based on ChIP assay in porcine fibroblasts. A-Control (37°C); B-Heat shock treated (41°C for 1hr). mRNA includes all known protein coding RNAs; Misc RNA includes RNAs coding for rRNA, scaRNA and pseudogenes.

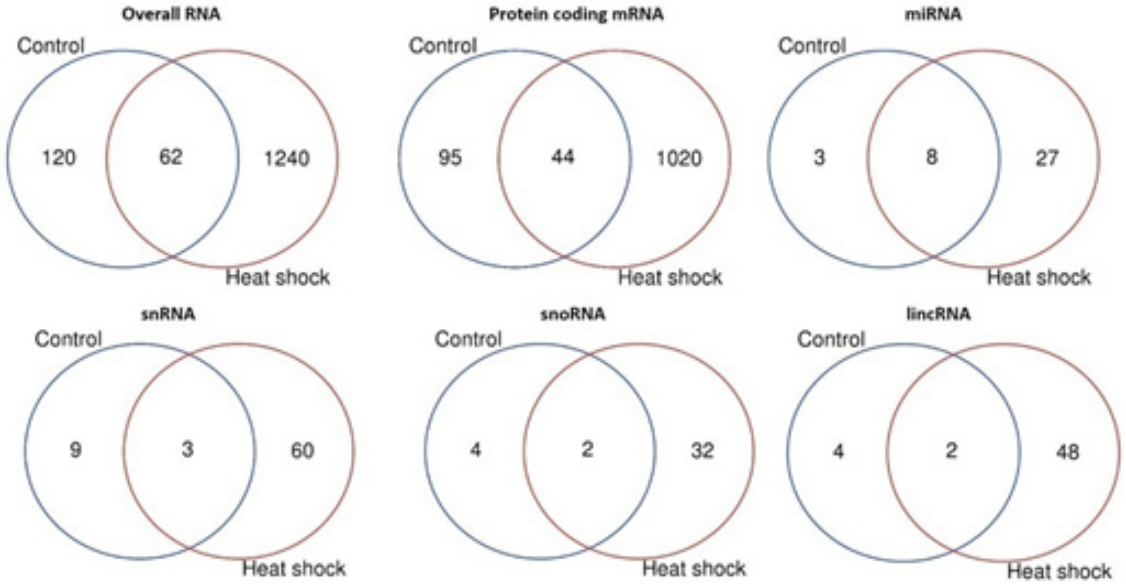


Fig.2. Distribution of types of promoters coding for RNAs bound to heat shock factor-1 (HSF1) signaling based on ChIP assay in porcine fibroblasts. A-Control (37°C); B-Heat shock treated (41°C for 1hr)

The heat shock factor-1 (HSF-1), one of key mediator of heat shock response in pigs 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. The results of analysis is presented in table 1 showing enriched genes related to heat shock response. Key genes related to heat shock response and adaption and their possible regulation factor with special reference to chromatin remodeling is only shown. A model showing the cellular response to heat shock in relation with gene expression and its regulation through modification of accessibility to chromatin is shown in fig 3.

Table 1: Enriched promoters of key genes related to heat shock response and chromatin remodeling

Function/cell component	FDR*	Genes
Intracellular organelle lumen	3.24E-09	CARM1, CTNNB1, DNAJB1, ECD, HDAC9, HIST1H1D, HSBP1, HSF1, HSF2, HSP90AA1, HSP90AB1, HSPA1A, HSPE1, NR3C1, PRDM1, RBBP7, SMARCA1, SMARCA4, STAT1, TRAP1
Chromatin	1.54E-05	CTNNB1, HIST1H1D, HSF1, RBBP7, SMARCA1, SMARCA4, STAT1
Nuclear chromatin	2.80E-05	CTNNB1, HIST1H1D, RBBP7, SMARCA1, SMARCA4, STAT1
Intracellular organelle part	3.75E-05	CARM1, CTNNB1, DNAJB1, ECD, HDAC9, HIST1H1D, HSBP1, HSF1, HSF2, HSP90AA1, HSP90AB1, HSPA1A, HSPE1, NR3C1, PRDM1, RBBP7, SMARCA1, SMARCA4, STAT1, TRAP1

Euchromatin	0.00013	CTNNB1, HIST1H1D, HSF1
Membrane-bounded organelle	0.00015	CARM1, CTNNB1, DNAJB1, ECD, HDAC9, HIST1H1D, HSBP1, HSF1, HSF2, HSP90AA1, HSP90AB1, HSPA1A, HSPA4, HSPE1, NR3C1, PRDM1, RBBP7, SMARCA1, SMARCA4, STAT1, TRAP1
Intracellular membrane-bounded organelle	0.00042	CARM1, CTNNB1, DNAJB1, ECD, HDAC9, HIST1H1D, HSBP1, HSF1, HSF2, HSP90AA1, HSP90AB1, HSPA1A, HSPE1, NR3C1, PRDM1, RBBP7, SMARCA1, SMARCA4, STAT1, TRAP1
Perinuclear region of cytoplasm	0.00066	CTNNB1, HSF1, HSP90AA1, HSP90AB1, HSPA1A, STAT1
SWI/SNF superfamily-type complex	0.00066	RBBP7, SMARCA1, SMARCA4
Dendritic growth cone	0.00077	HSP90AA1, HSP90AB1
Cell	0.00083	DNAJB1, HSP90AB1
Protein-containing complex	0.0026	CARM1, CTNNB1, HDAC9, HIST1H1D, HSF1, HSP90AA1, HSP90AB1, HSPA1A, NR3C1, RBBP7, SMARCA1, SMARCA4, STAT1
Nuclear euchromatin	0.0028	CTNNB1, HIST1H1D
Ficolin-1-rich granule lumen	0.0028	HSP90AA1, HSP90AB1, HSPA1A
Transcription factor complex	0.0029	CARM1, CTNNB1, HDAC9, HSP90AB1
Axonal growth cone	0.0031	HSP90AA1, HSP90AB1
Intracellular part	0.0062	CARM1, CTNNB1, DNAJB1, ECD, HDAC9, HIST1H1D, HSBP1, HSF1, HSF2, HSP90AA1, HSP90AB1, HSPA1A, HSPA4, HSPE1, NR3C1, PRDM1, RBBP7, SMARCA1, SMARCA4, STAT1, TRAP1
Intracellular non-membrane-bounded organelle	0.0079	CTNNB1, DNAJB1, HIST1H1D, HSBP1, HSF1, HSPA1A, NR3C1, RBBP7, SMARCA1, SMARCA4, STAT1
Cytosol	0.0117	CARM1, CTNNB1, DNAJB1, ECD, HSF1, HSP90AA1, HSP90AB1, HSPA1A, HSPA4, NR3C1, RBBP7, STAT1
Histone deacetylase complex	0.0118	HDAC9, RBBP7
Histone methyltransferase complex	0.0126	HDAC9, RBBP7
Dendrite	0.0128	DNAJB1, HSP90AA1, HSP90AB1, STAT1
Inclusion body	0.0189	HSP90AB1, HSPA1A
Cell projection membrane	0.0236	CTNNB1, HSP90AA1, HSP90AB1
Spindle	0.0241	CTNNB1, HSF1, NR3C1
Nucleoplasm part	0.0241	HDAC9, HSF1, HSPA1A, NR3C1, RBBP7

Microtubule organizing center	0.0267	CTNNB1, HSF1, HSPA1A, NR3C1
Melanosome	0.0272	HSP90AA1, HSP90AB1
RNA polymerase II transcription factor complex	0.0436	CARM1, CTNNB1
Spindle pole	0.0491	CTNNB1, HSF1
Plasma membrane bounded cell projection part	0.0491	CTNNB1, DNAJB1, HSP90AA1, HSP90AB1, STAT1

*False discovery rate

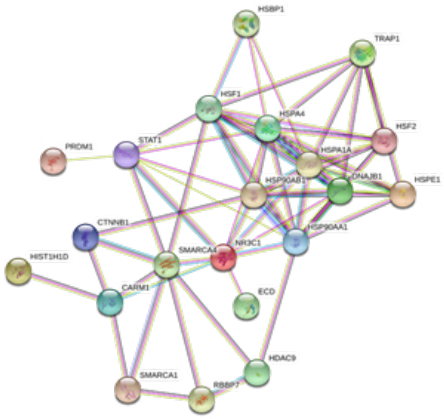


Fig 3. Network showing gene involved in cellular response to heat shock and chromatin modification. The changes in chromatin modification in turn alters the gene expression pattern as response to thermal stress.

Based on the overall analysis a 21 DNA binding nucleotide consensus sequence TDKHHKYYYYHWYWTBYWTTT was identified, which could be associated with heat responsive element in the genome (Motif logo is shown in fig 4).

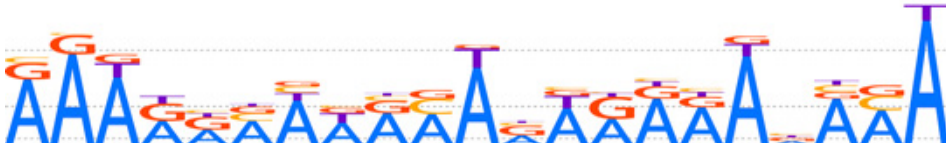


Fig 4.Motif logo showing consensus DNA sequences in heat treated cells

To develop candidate biomarker(s) for identification of pigs with increased thermal tolerance and optimized production potential: Currently, a comparison was made between animals reared in hot environment (Jaipur, Rajasthan) and moderately warm environment (Guwahati, Assam) to examine any specific gene expression for the animals adapted to high temperature was undertaken for the first time. Such data could be very valuable to identify and select animals with increased thermotolerance. The pig and goat samples were obtained from native animals reared in Jaipur, Rajasthan and Guwahati, Assam. Jaipur (26.9°N, 75.8°E) has a hot semi-arid climate (Bsh), whereas Guwahati (26.1°N, 91.7°E) has a humid subtropical climate (Cwa) as per Köppen climate classification, respectively. The pigs under study, 8-9m old, belonging to Rajasthan local and Mali breeds, were reared by Jaipur Piggery, Jaipur and ICAR-NRC on Pig, respectively. The goat breeds

included for the study were 12-14m old Sirohi (Rajasthan) and Assam local (Assam) reared in farmers field and ICAR-NRC on Pig respectively. The temperature humidity index at the time (12:00-13:00hrs) of collection of blood samples was 84.76 and 72.14 in Jaipur and Guwahati, respectively. The animals were apparently healthy and reared under standard management conditions. The total blood RNA was isolated and subjected to RNA sequencing as per standard protocols. The genes aligned to pig genome were further subjected to bioinformatics and the distribution of different genes among different group of animals is shown in fig 5.

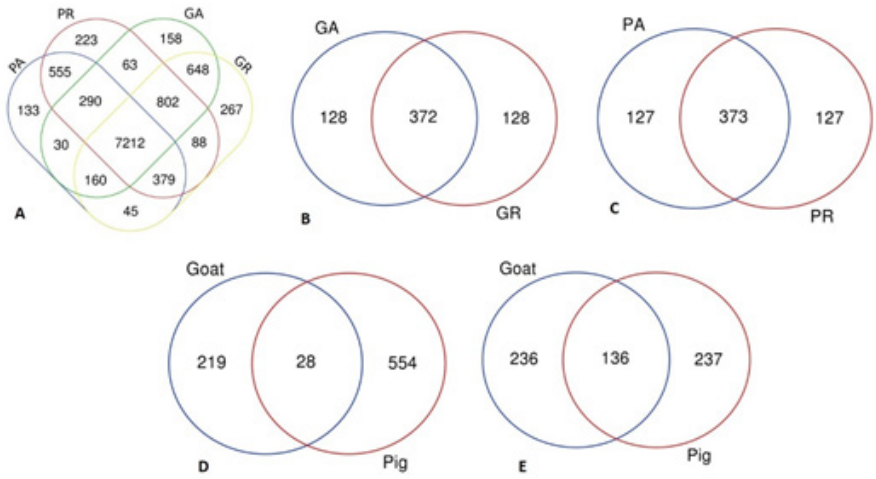


Fig. 5 Distribution of genes among pigs and goats reared in Assam and Rajasthan

PA and PR- Pigs reared in Assam and Rajasthan respectively

GA and GR- Goats reared in Assam and Rajasthan respectively

A-Distribution of all identified transcripts among the animals; B- Distribution of top 500 genes with highest expression in goats; C- Distribution of top 500 genes with highest expression in pigs; D- Comparison of differentially expressed genes among pigs and goats from Rajasthan in comparison with Assam with $p<0.05$. E- Common genes among the top 500 genes between goats and pigs;

Differential expression of genes related to heat stress: The expression pattern of heat shock responsive genes, various heat shock transcription factor (HSF) and heat shock proteins were examined in all the groups. A consolidation expression pattern is shown in fig 6.

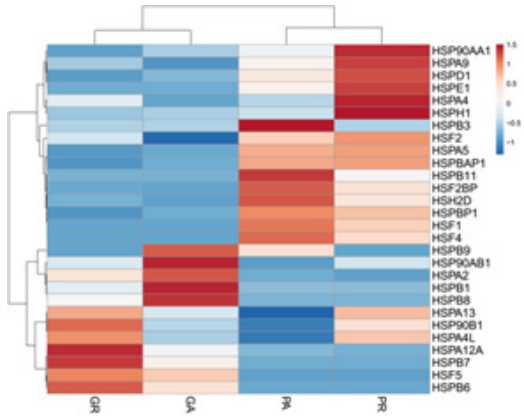


Fig 6. Expression pattern of different heat shock related genes in different groups

PA and PR- Pigs reared in Assam and Rajasthan respectively.GA and GR- Goats reared in Assam and Rajasthan respectively.

Based on the genomic/expression data generated in the current project as well the information already available from previous projects literature, the animals will be screened. 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 thermo tolerance related genes. The animals were selected based on performance of parents and individual animal for maker screening. Blood samples were collected (n=15) were processed for RNA isolation, CDNA synthesis and Real-time PCR. The experiments to subject pig to with variable temperature and humidity in a controlled climate chamber has been designed and were initiated. The results of screening along with effect of heat stress under controlled conditions will be reported in due course of time.

ICAR-LBS award project: MicroRNA mediated regulation of physiological responses during heat stress in pigs

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). Since the transcript list is exhaustive, only summary is included in the annual report. There were 255 and 396 differentially expressed genes (DEG) that were up- and down-regulated respectively (P<0.05) (Fig.1 and 2).

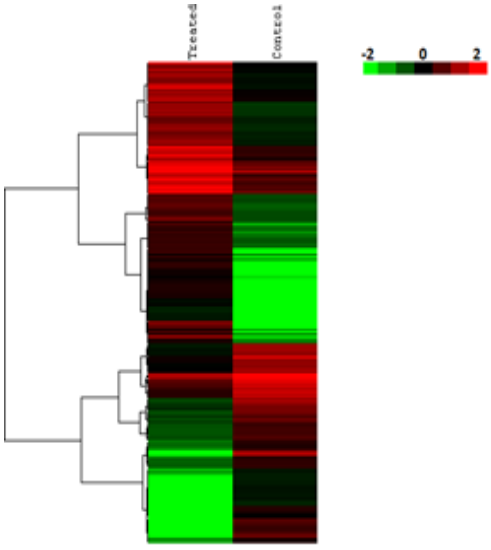


Fig1: Heat map showing differentially expressed genes control and treated samples

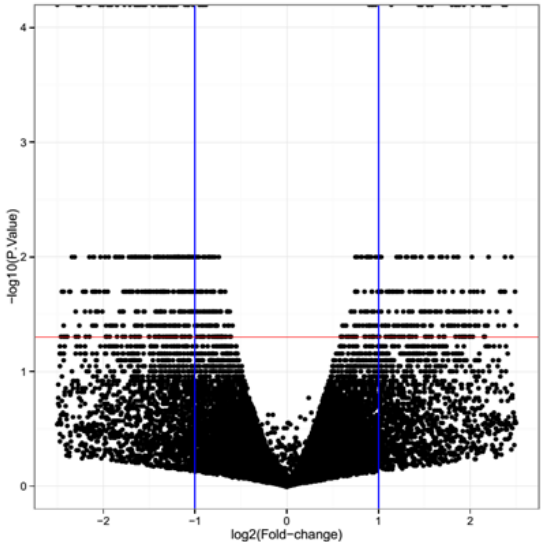


Fig2: Volcano plot showing expressed transcripts in control and treated samples with fold changes against the p values.

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. The results of GO analysis is shown in fig 3.

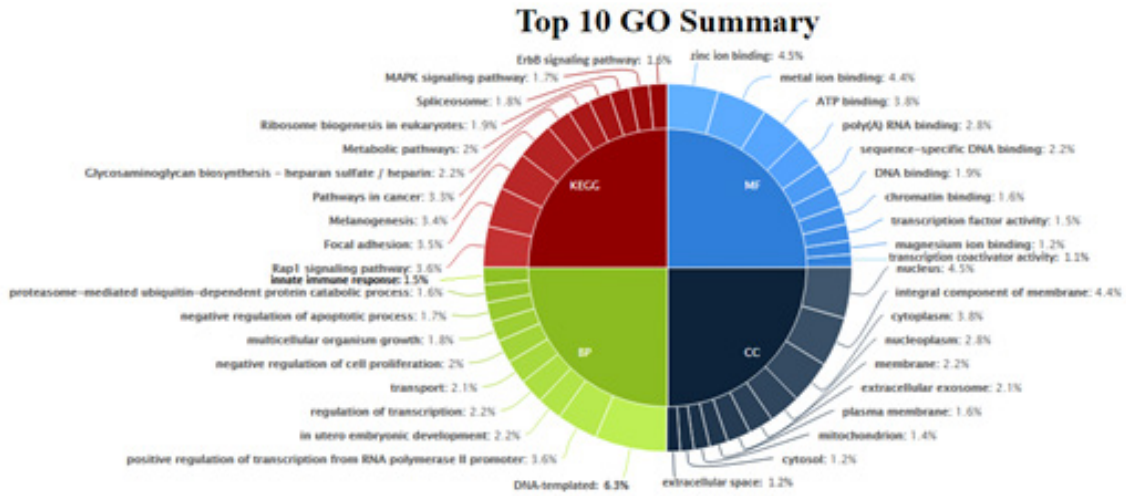


Fig 3.GO analysis of top 10 significant pathways and functions in DEGs

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.

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

miRNA	log2FoldChange	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 beads 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 fig 4 shows the distribution of transcription start site (TSS) in relation with peaks obtained during RIP.

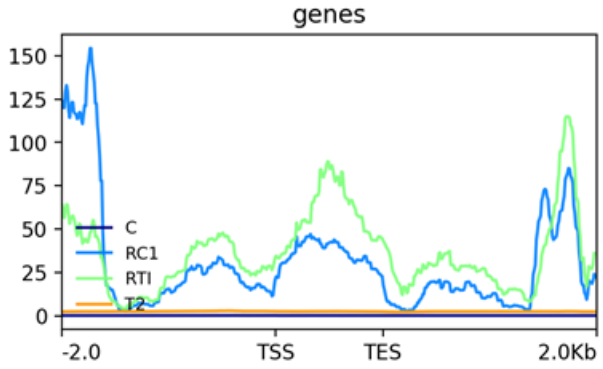


Fig 4: Plots showing peaks 200KB upstream/downstream of Transcription start site
Heat shock treated- RT1; control RC1

Estimation of cortisol in body fluids and excreta: Cortisol levels in plasma, saliva and faeces from pigs were estimated during two consecutive days to assess the suitability of various biological samples for estimation of cortisol that could be collected non-invasively (urine, saliva and faeces) to assess stress. The results of cortisol levels and its correlation in different biological samples are shown in fig 5. The bivariate plot graphs indicates the relationship between cortisol levels in different biological samples measured on the individual samples, revealing the degree and pattern of relation between the two variables. Mean cortisol levels in plasma and saliva was 24.12±2.26 and 0.69±0.11µg/dl, respectively. The ratio of plasma to salivary cortisol was 1:0.03. The mean urinary cortisol values expressed as function of creatinine was 14.52±1.15µg/g and was correlated to values

in plasma (r=0.18) and saliva (r=0.17), respectively after one hour of blood collection. After the end of two hours, the urinary cortisol levels as expressed in terms of creatinine excretion decreased marginally (11.74±0.41µg/g of creatinine), however, the correlation with plasma (r=0.42) and saliva (r=0.21), increased, reflecting the metabolism of the hormone. The faecal reactive metabolite levels after 24hrs was weakly correlated to plasma, saliva and urinary (1hr) cortisol values (-0.19, -0.20 and -0.22 respectively). Similarly, the correlation between plasma, salivary and urinary (1hr) with faecal cortisol and reactive metabolites was also insignificant (r= -0.12, 0.13 and 0.20, p>0.05), respectively. Saliva sampled, almost at the same time as that of blood, urine and faeces collected at the end of 1 or 2hrs and 24 or 48hrs, respectively provides an opportunity to examine their utility for assessing short, mid and long term levels of cortisol/stress in pigs. From the results of the study, it was concluded that the salivary cortisol values reflect its plasma levels at the time of collection most closely amongst other biological samples studied. Urinary cortisol levels, almost 2hours after the blood collection also partially suggestive of plasma cortisol levels. Salivary and urinary cortisol levels obtained through minimally invasive methods could be used as predictor of plasma cortisol level, hence indirectly extent of stress in pigs on acute or short term basis, respectively. However, utility of faecal cortisol may require identification and quantification of metabolites along with time course of their excretion.

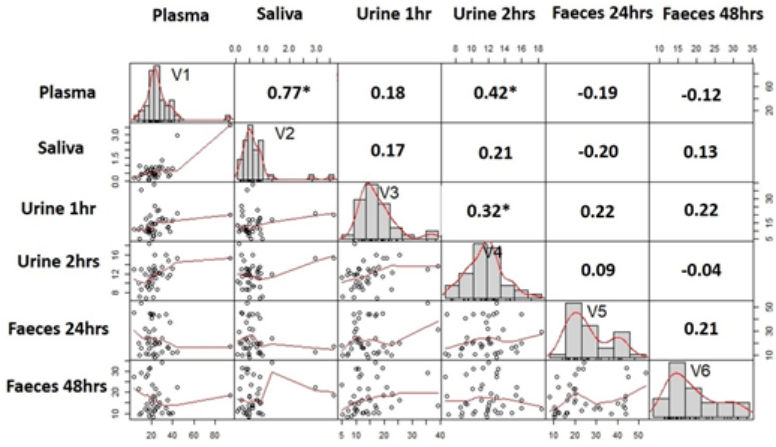


Fig 5. Distribution of cortisol levels in pigs from biological sources

Distribution of hormone levels in different samples across the animals are shown as histogram.

Bottom of the diagonal: the bivariate scatter plots showing relationship between two different samples with line fitting.

Top of the diagonal: correlation values and significant ones are indicated with * (P<0.05)

Values outside the frame shows the cortisol levels in difference. (Plasma and saliva-µg/dl; Urine-µg/g creatinine; Faeces- ng/g). The numbers V1 to V6 merely indicate samples source as separate variables.

Institute project: Development of early fertility markers in pigs

Mohan.N.H., Sunil Kumar, 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 (Fig6). Due to incidence of PRRS in pig farm the sampling was affected from July 2018 to Jan 2019.

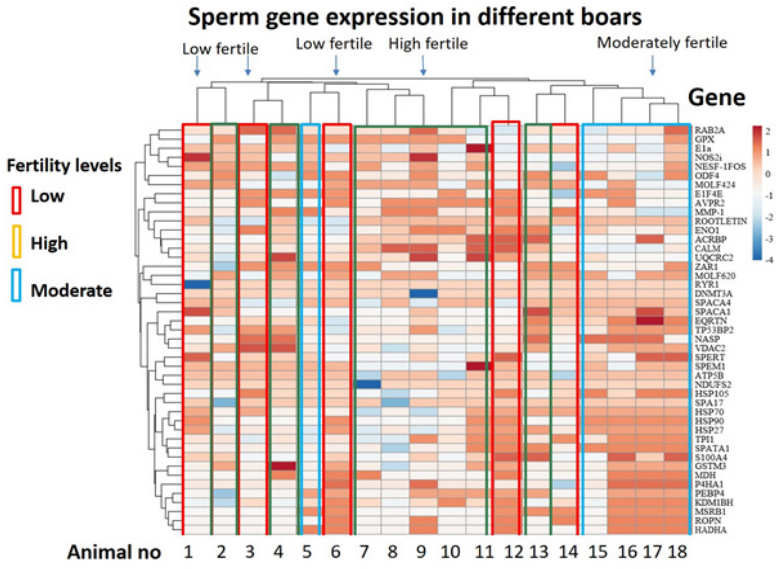


Fig 1. Relationship between various fertility markers and fertility in 18 boars

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

Further data analysis is in progress and the composite index will be modified, if required.

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 and R. Thomas

Under this project during the reported period we could isolate 49 *Staphylococcus* species, 24 *Salmonella* and 28 *Campylobacter* speciesfrom different samples of pig. Staphylococcal organisms were confirmed up to the genus level by amplification of 16S rDNA gene. Of these 49 isolates, 35 could be identified up to species level [(*S. aureus*- 28(9 are MRSA) and *S. hyicus*-7)]. Out of 24 *Salmonella* isolates, 16 isolates were confirmed as *S. typhimurium* through use of species-specific

Research Projects

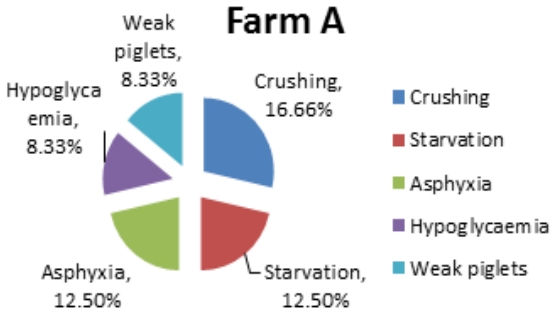
PCR. It was also observed that out of 28 *Campylobacter* species isolated from pig during the reported period, maximum isolates were confirmed as *Campylobacter coli* (18) whereas rest isolates belonged to *C. jejuni*. Biotyping of the *Campylobacter* spp. revealed that *C. coli* biotype I was the most common biotype of *C. coli*in the study, while *C. jejuni*biotype I was alsocommon. Multiplex PCR developed for rapid detection of MRSA has also been validated during the reported period.

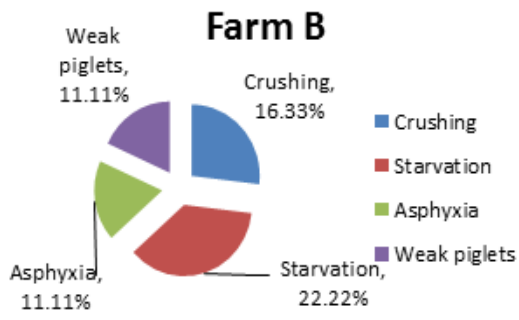
ICAR Project: All India Network Programme on Neonatal Mortality in Farm Animals

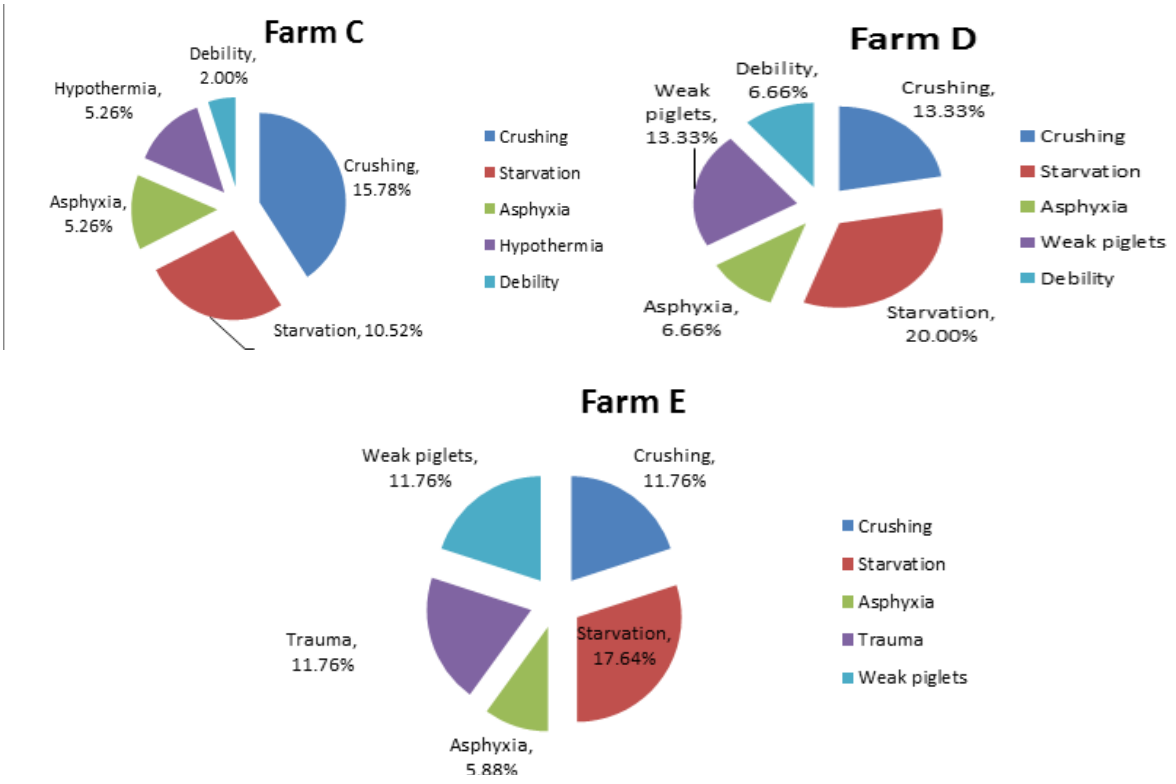
S. Rajkhowa and S. R. Pegu

Under this project during the reported year we could isolate forty two (42) *E. coli* (1 isolate per piglet) from 174 piglets (24.13%). Of these 42 isolates, 11 were confirmed as enterotoxigenic*E. coli* (ETEC), 19 were Shigatoxin producing *E. coli* (STEC) and 3 isolates were confirmed as atypical enteropathogenic*E. coli* (EPEC). We could isolate 7 (4.59%) *Salmonella* strains during the reported period of which 5 isolates were confirmed as *S. typhimurium* using species –specific PCR. *Clostridium* organism could be isolated from 5 (2.87%) diarrhoeic piglets. The isolates were initially identified based on biochemical tests and further confirmed by PCRs using specific primers. All the isolates were confirmed as *C. perfringens* type A. During the reported period we could detect porcine circovirus 2 (PCV2) in foetal tissues (lungs and heart) of 8 stillbirth piglets obtained from 8 sows. PCV 2 could also be isolated from 2 weak piglets which subsequently died on 2nd day of birth. We could also detect porcine parvovirus (PPV) in 3 mummified foetuses obtained from 3 sows. Mixed infection with both PCV2 and PPV was observed in 2 cases. Interestingly we could detect Japanese encephalitis virus (JEV) in two stillborn foetuses during the reported period which were detected through PCR and subsequently also confirmed by sequence analysis. Mixed infection with ETEC and rotavirus was recorded in 3.44% cases. Parasites were found in total 19 (10%) diarrhoeic piglets of which 11 (6.32%), 5 (2.87%) and 3 (1.72%) were Coccidian species, *Strongyloidesransomi* and *Cryptosporidium* species, respectively.

Evaluated antimicrobial susceptibility of selected bacteria (*E. coli*, *Salmonella species*, *C. perfringens*, *S. suis*, and *Staphylococcus species*) associated with neonatal piglet mortality/ clinical disease in neonatal piglets. Main non –infectious causes responsible for neonatal piglet mortality were also evaluated. Evaluated antibacterial activity of herb (*Typhoniumtrilobatum*) against respiratory tract infections and two other herbs [(*Centellaasiatica* (Bormanimuni and *Psidiumguajava*)] against diarrhoea in neonatal pigs.Developed a strategy for effective treatment of respiratory tract infections and diarrhoea in neonatal pig by using herbal formulation as an alternative to antibiotic treatment.







Non-infectious causes of neonatal piglet mortality in organized farms (Famr A to E)

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

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

Under this project during the reported period total 205 meat samples from pig were collected and analyzed for the presence of targeted bacterial pathogens. The number of pigs positive for *E. coli*, *Salmonella* and *Staphylococcus* species were 35, 8 and 45, respectively. Out of 35 *E. coli* isolates 10 were ETEC, 18 were STEC and 3 were AEEC. Out of 8 *Salmonella* species 5 were confirmed as *S. typhimurium.* Out of 45 *Staphylococcus* species, 36 were *Stah. aureus*(of which 8 were MRSA) and 9 were *S. hyicus.* Developed a loop mediated isothermal amplification (LAMP) assay for rapid detection of STEC from pork.

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

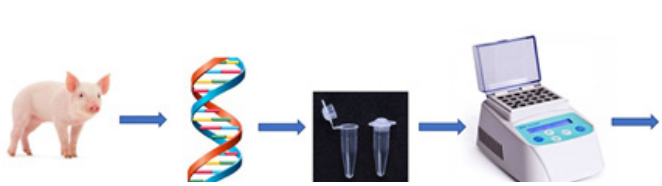
S. Rajkhowa and S. R. Pegu

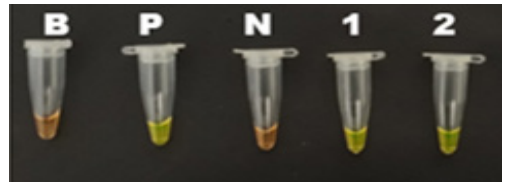
Under this project during the reported period characterization of the important viral and bacterial pathogens of pigs such as porcine circovirus (PCV2),porcine parvo virus, porcine rotavirus, CSFV, *S. suis*, Clostridial species circulating among the pig population in North eastern region of India were done. Pigs from major pig rearing districts of Assam were also screened against the economically important viral (PCV2, PPV, CSF, PRRSV) and bacterial (*Clostridium* species, *S. suis*, ETEC, Salmonella) pathogens of pigs during the reported period.

Research Projects

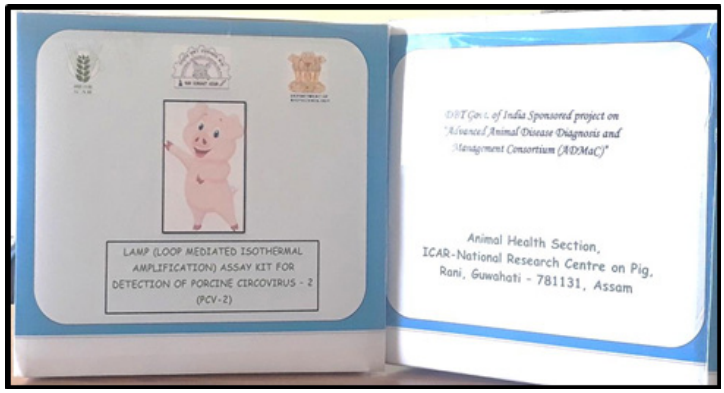
DIAGNOSTIC KITS DEVELOPED UNDER DBT-ADMAC PROJECT

KIT 1 - LOOP MEDIATED ISOTHERMAL AMPLIFICATION ASSAY KIT FOR DETECTION OF PORCINE CIRCO VIRUS TYPE 2 (PCV-2)





Developed by	
Dr. Swaraj Rajkhowa, Dr.Seema Rani Pegu, Ms. Manjisa Choudhury, Dr. Dilip Kumar Sarma	B – Blank, P- Positive Control, N – Negative Control, Test Samples – 1,2



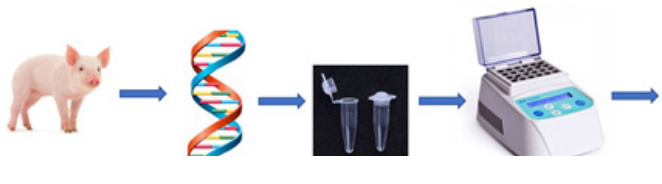
About the Product/Technology

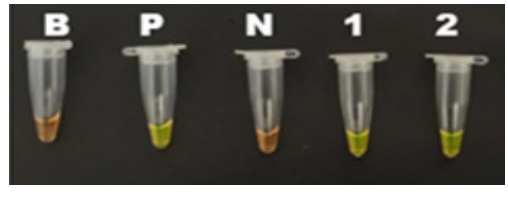
Novelty : Rapid, highly sensitive, cost effective, potential use as a field based tool, results ready within 35 minutes

Application : Detection of Porcine Circovirus -2 (PCV-2) from biological samples of pig

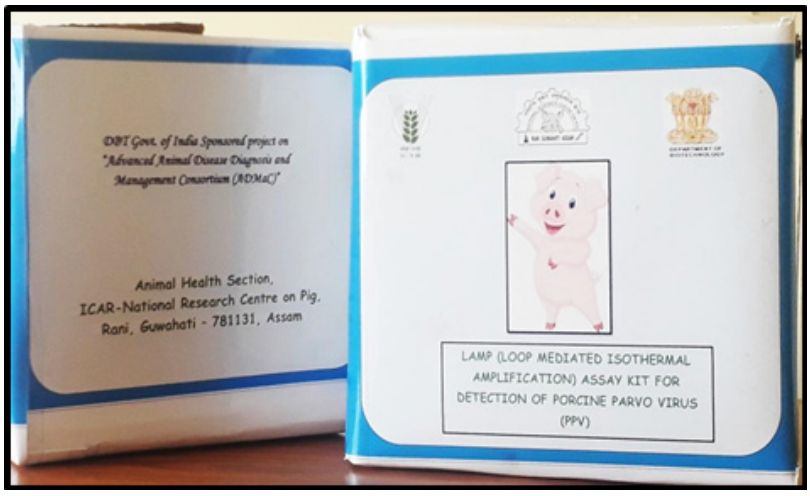
Current status : Completed screening of 536 porcine field tissue samples and the LAMP has been distributed to 8 State Diagnostic Labs NE Region.

KIT 2 - LOOP MEDIATED ISOTHERMAL AMPLIFICATION ASSAY KIT FOR DETECTION OF PORCINE PARVO VIRUS (PPV)





Developed by	
Dr. Swaraj Rajkhowa, Dr.Seema Rani Pegu, Ms. Manjisa Choudhury, Dr. Dilip Kumar Sarma	B – Blank, P- Positive Control, N – Negative Control, Test Samples – 1,2



About the Product/Technology

Novelty : Rapid, highly sensitive, cost effective, potential use as a field based tool, results ready within 35 minutes

Application : Detection of Porcine Parvovirus (PPV) from biological samples of pig

Current status : Completed screening of 452 porcine field tissue samples and the LAMP kit has been distributed to 8 State Diagnostic Labs NE Region.

Developed under ADMaC and the test has 99.1% (105/106) diagnostic sensitivity and 100% (105/106) diagnostic specificity.

Institute Project: Development of loop-mediated isothermal amplification (LAMP) assay for rapid detection of important zoonotic bacterial pathogens of pig.

S. Rajkhowa and S. R. Pegu

Under this project developed a field diagnostic assay (LAMP) for rapid detection of *Staphylococcus aureus* form pig.

Institute Project:Prevalence of helicobacter organism in pigs particularly in cases of gastritis

S.R.Pegu, S.Rajkhowa, Mohan N.H. and R. Thomas

This study revealed the prevalence of Helicobacter infection in pig gastric mucosa. Total 477 stomach samples from slaughtered and necropsied pigs from different slaughter points and different pig farms of Assam were examined and PCR analysis of the gastric samples revealed 20.1% presence of Helicobacter spp 1.4% were found positive for Helicobacter suis by PCR analysis. Sequence analysis from gastric mucosa samples positive for Helicobacter spp. showed 99% homology with the 16S rRNA gene of Helicobacter. Analysis of fecal samples of pig handlers revealed 4.25% helicobacter positive by PCR.Antimicrobial resistance profile of the isolated helicobacter spp and H. suis have been determined and observed that most of the commonly used antibiotics like enrofloxacin, cetriacxone, amoxycillin showed resistance against the bacteria isolated and sensitivity found only against only amikacin.

Research Projects

DBT Project: Molecular Epidemiology of Japanese Encephalitis Virus in Pigs and Mosquitoes in Assam

S.R.Pegu and S.Rajkhowa

Seroprevalence of molecular detection of JEV in different districts of Assam

Seasonal distribution of JE seropositiveity in pigs were evaluated from February 2017 to December 2018. A total of 1357sera samples were collected from eight districts of Assam in different seasons and out of 1357 pigs, 228 sera samples (16.80%) were detected positive for JEV antibodies, indicating high JEV seropositivity in pig population of the region. A total of 149 whole blood samples and 78 tissue samples were collected from different pig farms and screened for JEV by RT-PCR. The envelope protein of JE virus was targeted by RT-PCR. 21 blood samples and 9 tissue samples were found to be positive by RT-PCR.

Disease forecasting by studying temporal transmission pattern in sentinel pigs

Sentinel pig seroconversion was studied in 3-4 months old pigs in two pig farms for 8 months. JEV seroconversion was seen in pigs starting from May 18 i.e. within two months with a peak in August and September18.It was observed that the seroconversion of pigs during June to September month coincide with the abundance of Cx. tritaeniorhynchus mosquito vector.

Identification of JE Vector mosquito

JEV infection in mosquitoes were also screened based on seasonal distribution. Mosquitoe samples were collected from three districts of Assam (Jorhat, Lakhimpur and Kamrup) .The most prevalent vectors identified were Culextritaeniorhynchus, Cx. Gelidus and Mansonia spp. and found significantly higher during summer season (April -September) than in winter months (December-February). Cx. tritaeniorhynchus and mansonia were the most dominant mosquito species followed by Cx. Gelidus in the three districts

Culex and Mansonia

Sequencing and Phylogenetic analysis

RT-PCR positive amplicons were purified using MinElute Gel Extraction Kit (Qiagen, Germany) and were sequenced from both ends (Agri-Genome, Chennai). Phylogenetic analysis of JEV positive samples was performed for the envelope protein gene. Nucleotide sequences of 3 sequenced JEV positive samples along with 50 reference sequences retrieved from the NCBI. GenBank nucleotide database were analyzed to establish their genetic relationship. Phylogenetic and molecular evolutionary analyses were conducted with MEGA 6 software using neighbour joining method. The robustness of the groupings in the neighbour-joining analysis was assessed with 1000 bootstrap replicates. The sequence analysis of PCR positive JEV samples revealed. 100% identity with JEV envelope protein of Human and equine from West Bengal, Vellore, Haryana and Lucknow which also truly reflects on the Phylogenetic tree.

LIVESTOCK PRODUCTS TECHNOLOGY

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

R. Thomas and K. Barman

In order to cater the needs of the health conscious consumers, a project has been initiated to develop 'functional pork products'. The project is indented to develop value added functional pork products through the addition of critical ingredients and to evaluate the nutritional, physico-chemical, microbiological and sensory attributes of developed products. The project was initiated in the month of October, 2017. 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. As envisaged in the technical progarmme, different formulations were developed and standardized for processing different categories of value added pork products. 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. The pilot scale testing and market studies of the technologies developed are being carried out under three different brand names viz. LUIT PORK, CHOICE PORK NATURAL and PIGZEE'S.

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 by CPWD, under the 1st Grant, for housing the sanctioned equipments under the current project. 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 under gone the ISO 17025:2017 training programme (Laboratory Quality Management and Internal Audit) at National Institute of Training for Standardization (NITS), BIS, Noida.

Following equipments were procured and installed under the project so far.

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

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

APART has entered into a Memorandum of Understanding (MoU) with ICAR-National Research Centre on Pig, Guwahati on 12th July, 2018 to provide technical advisory services for piggery value chain improvement in Assam under the World Bank funded project. With respect to preparation of database for ration balancing, guidelines for feed sample collection, packaging and transportation is prepared and submitted to AHVD. Required facilities for estimation of feed parameters were arranged at ICAR-NRCP viz. equipments for estimating the proximate principles, micro and macro minerals etc. The feed samples from the field are awaited and the matter has been pursued constantly with 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 undertook 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 the these districts are being analyzed for the JEV antibody.

Under the part of capacity building of value chain actors in the project, institute has already conducted four 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 100 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, two training programmes for the Pig Bondhus i.e. "Master Training (ToT) programme for local service provider (*Pig Bondhu*)" were organized and a total of 40 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.

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 has started w.e.f. 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 as envisaged in the project has been initiated. In the initial phase 03 North Eastern States were covered i.e. Assam, Meghalaya and Nagaland. Thirty five numbers of pig farms (backyard and small) and 26 numbers of pork retail units (roadside shops and organized shops) were visited during February-March, 2019 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.

Preliminary laboratory studies were also initiated for standardization of techniques for detection and quantification of different food borne microorganisms. In the first phase emphasis is being given to the detection of *E. Coli* (with emphasis on *E. coli O157:H7*) and *Salmonella spp.* (with emphasis on *Salmonella* Typhimurium) in pork and pork products. For the standardization of the Biochemical as well as PCR steps, ATCC standard cultures were already procured. Laboratory studies are also initiated for authentication of meat species in case of adulteration cases. Brief details of these preliminary trials are presented below.

Detection and confirmation of *E. coli* in pork

Isolation of organism: For identification of bacterial contamination in pork, 25 g of meat samples were collected from the slaughtered pig and taken in a sterile container. Each sample was assigned with an individual unit number and analyzed immediately. For identification of *E. coli*, 25 g of meat samples were taken into 225 ml of Brain Heart Infusion broth. The mixture was homogenized. The homogenate was then incubated for 10 min at room temperature with periodic shaking and then allowed to settle by gravity for 10 min. The medium was decanted into a sterile container and incubated for 3 h at 35ºC to resuscitate injured cells. The contents were transferred to 225 ml of Mac Conkey broth and incubated for 20 h at 44 ± 0.2° C. After incubation, a loop full of Mac Conkey broth was streaked on Mac Conkey agar plate and again incubated for 20 h at 35°C. Pink coloured colonies were observed on the plates indicating the presence of *E. coli* in pork.

Biochemical tests: The colonies were subjected to gram's staining and various biochemical tests for further confirmation. Gram negative and rod shaped colonies were observed under microscope. When subjected to biochemical tests, it was found that the colonies were positive for indole and catalase tests. The colonies were negative for citrate and oxidase tests. The results of these tests clearly indicated that the samples were contaminated with *E. coli*.

PCR for the confirmation of *E. coli*

The DNA from *E. Coli* colonies were extracted by using kit as well as boiling method. In boiling method, one or two sloop full pure colony of bacterial culture was taken in a centrifuge tube and 50-70 µL TE buffer was added. The tube was boiled for 15 min and immediately chilled at -20°C for 15 min. The sample was then thawed and centrifuged at 8000 rpm for 15 min. The supernatant which contained template DNA was stored at -20°C till use. Five µL of the supernatant was used as template DNA for PCR. Published literatures were reviewed for targeting relevant genes. Based on the literature search the following genes were selected for further studies (uidA, Flic, Stx-2A, Stx-2B and rfb). Following primers were designed using Primer Expression software/ NCBI site. The study is in progress.

Target gemes	*E. coli* specific primers
uidA-F	CGGTGATATCGTCCACCCAG
uidA-R	TACCGACGAAAACGGCAAGA
uidA-F	GCGCAAATCCGCATCTTCAT
uidA-R	GAAGGGCGAACAGTTCCTGA
Flic-F	TCAGAGAGGCACCGTCACTA
Flic-R	AGACGATGCAGGCAACTTGA
Flic-F	TAGTGACGGTGCCTCTCTGA

Flic-R	CGGAGCTACTGGAGTGGTTG
Stx2A-F	ATGTGGCCGGGTTCGTTAAT
Stx2A-R	TGCTGTCCGTTGTCATGGAA
Stx2B-F	ACAGTGAAGGTTGACGGGAA
Stx2B-R	CTTCAGCAAATCCGGAGCCT
rfb-F	TGAAGATTGCGCTGAAGCCT
rfb-R	TCGTGACAACCATTCCACCT
rfb-F	CGGACATCCATGTGATATGG
rfb-R	TTGCCTATGTACAGCTAATCC
Flic-F	GCGCTGTCGAGTTCTATCGAG
Flic-R	CAACGGTGACTTTATCGCCATTCC
Stx2-F	GGCACTGTCTGAAACTGCTCC
Stx2-R	TCGCCAGTTATCTGACATTCTG
uidA-F	TGGTAATTACCGACGAAAACGGC
uidA-R	ACGCGTGGTTACAGTCTTGCG

Detection and confirmation of *Salmonella spp.* in pork

Isolation of organism: For identification of *Salmonella spp.* in pork, 25 g of meat samples were collected from different parts of the slaughtered pig and taken in a sterile container. Each sample was assigned with an individual unit number and analyzed immediately. 25 g of sample was taken into a sterile wide mouth container with screw cap and 225 mL of sterile Lactose broth was added to the sample.A uniform suspension was made by blending and the cap container was kept at room temperature for 60 min. It was then incubated at 35°C for 24±2 h. The incubated sample mixture was shaken gently and 1 mL of the sample mixture was transferred to 10 mL of Selenite Cystine broth and 1 mL of Tetrathionate broth. It was incubated at 35°C for 24±2 h. The incubated sample was mixed well and a loop full of incubated Selenite Cystine broth was streaked on selective media plates of Xylose Lysine Deoxycholateagar. The plates were incubated at 35°C for 24±2 h. The plates were observed for typical *Salmonella* colonies and no pink colonies with black centers were observed suggesting negative culture.

Biochemical tests: The colonies were subjected to gram's staining and various biochemical tests for further confirmation. Gram positive colonies were observed under microscope. When subjected to biochemical tests, it was found that the colonies were positive for indole and oxidase tests. The colonies were negative for citrate and catalase tests. The results of these tests clearly indicated that the samples were not contaminated with *Salmonella spp*. The work is in its very initial phase and further refinement and standardization will be carried out in the coming months with considerably more number of samples.

Primers designed for standardization of PCR steps

Even though, the biochemical studies yielded negative results, for standardization of the PCR protocol for detection of Salmonella spp., published literatures were reviewed for targeting relevant genes. Based on the literature search the following genes were selected for further standardization *viz.* InvA, FilC, rfb and SefA. The process of standardization of the steps using standard culture (ATCC) is in progress.

Research Projects

INSTITUTE ORIENTATION TRAINING PROGRAMME

During the year 2018-19, five new Scientists have joined ICAR-National Research Centre on Pig. All the newly joined scientists of ICAR-NRCP (Dr. Amiya Ranjan Sahoo, Dr. Satish Kumar, Dr. Ajay Kumar Yadav, Dr. Jaya and Dr. Misha madhavan M.) have undergone a one month institute orientation training at ICAR-NRCP, Rani, Guwahati from 09/10/2018 to 08/10/2018 as part of their FOCARS training program. They visited all the labs, library and farm in the institute and also interacted with the scientific, administrative and technical staff during this training period. The interaction with scientific staff mostly highlighted on the ongoing research projects, and the need based future research prospects of the Institute. A visit to ICAR-Research Complex for NEH region, Umiam was also organised as part of this training programme. The newly joined scientists learned more about the institute by visiting the farm and also by interacting with the beneficiaries in adopted villages.

PROFESSIONAL ATTACHMENT TRAINING REPORTS

As a part of FOCARS training programme the newly joined scientists have undergone 3 months professional attachment training at different institutes. The brief report of the research work carried out by each Scientist is mentioned hereunder.

Dr. Amiya Ranjan Sahu

Institute: ICAR-CCARI, Goa; Mentor: The Director, ICAR-CCARI, Goa

Research work done: The research work carried out was on "Polymorphism study of heat tolerance genes in Gir, Sahiwal and Shwet Kapila cattle breeds and estimation of genetic variability in Agonda Goan pig and its crossbreds". The details of work are given below:

Objective 1: To detect the polymorphism of HSP90AA1 and HSP70 genes in cattle

Blood samples were collected in sterile vacutainers containing EDTA as an anticoagulant from the cattle breeds of each of seven animals of Sahiwal and Gir, and non-descript Shwet Kapila (under process of registration by NBAGR) maintained in ICAR- Central Coastal Agricultural research Institute, Goa. Immediately after collection, the samples were labeled and transported to the Animal Science Section Laboratory of the institute in an ice flask and stored at 4^0C till further processing. The genomic DNA was isolated by the ReliaPrep™ Blood gDNA Miniprep system (Promega). Quality of the DNA was checked by agarose gel electrophoresis and, purity and concentration of DNA was estimated by Bio-spectrophotometer (Eppendorf, USA). The PCR amplification was carried out using thermal cyclers (Eppendorf Mastercycler ep gradient S and Applied Biosystems 2720 models) to amplify *HSP90 AA1* and *HSP70* genes. The amplified products were checked by agarose gel electrophoresis

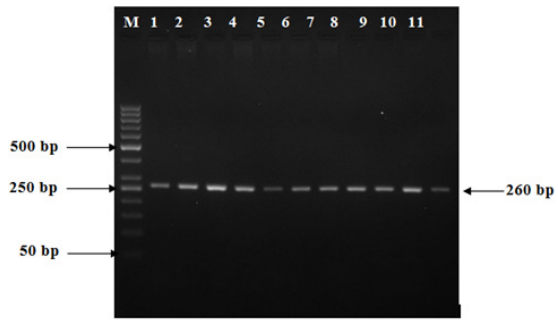


Fig. 1. PCR amplicons of HSP90AA1 gene in cattle

(M: 50 bp DNA ladder (GeneRulerTm) and 1-11: 260 bp PCR amplicon in 2% agarose).

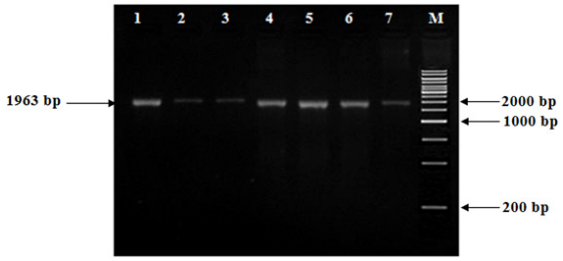


Fig. 2. PCR amplicons of HSP70 gene in cattle

(M: 1kb DNA ladder (GeneRulerTm) and 1-7: 1963 bp PCR amplicon in 2% agarose).

(**Fig. 1 and Fig. 2**) and sent for sequencing. Sequence data were analyzed by SeqMan program of LASERGENE software (DNASTAR Inc., USA).

Objective 2: To estimate the genetic parameters in different pig breeds

Data pertaining to three genetic groups i.e. Agonda Goan, Large White Yorkshire (LWY) and 75% LWY-Agonda Goan crossbreds were used in the present investigation. Piglets were weaned at 40th day of age. The body weights at different ages i.e. birth, Weaning, two, three, four, five, six, seven, eight, nine and ten months of age were recorded. The growth performance in different generations among breeds was also analyzed. The statistical analysis was done by using least squares analysis by HARVEY software for comparing the growth data. The least squares mean body weight (kgs) of Agonda Goan at birth, weaning (40 days), two, three, four, five, six, seven, eight, nine and ten months of age in first generation were 0.52, 3.32, 4.02, 7.02, 12.52, 19.78, 23.41, 30.69, 33.97, 39.30 and 43.07, respectively; and in second generation were 0.59, 3.30, 4.29, 8.04, 11.32, 15.53, 22.65, 28.89, 32.83, 37.17 and 38.96, respectively. There was significant difference in body weights between the breeds of Agonda Goan and LWY, and the 75% crossbred line at birth, weaning, and marketing age. The findings indicate that there is scope for improvement through selection and the 75% crossbred line is well thrive in this coastal climatic condition.

Dr. Misha Madhavan M.

Institute: CGIAR- IFPRI South Asia Office, New Delhi; Mentor: Dr. Anjani Kumar, Research Fellow

Research work done: A research work entitled as "Krishi Vigyan Kendras (KVKs) in indIia: Evolution, growth and impact" has been carried out during the professional attachment training at CGIAR-IFPRI. The research work was formulated with the following objectives

1) To identify the determinants for access to KVKs by farmers
2) To quantify the impact of KVKs on farm household economic welfare
3) To estimate the return to investments in KVKs

The study was conducted by using representative data from situation assessment survey of agricultural households collected by National Sample Survey Office (NSSO), in 2003 (59th round) and 2013 (70th round). In 2003, only 0.99 per cent of the respondents accessed KVK services, whereas in 2013 it increased to 5.45 per cent. We used Propensity Score Matching (PSM) models, Ordinary Least Squares (OLS) regression models, Linear Probability Model and Logit regression model to assess the determinants and impact. We used net farm income and annual per capita consumption expenditure as indicators of farmers' economic welfare. The results show that access to KVK is strongly associated with the socio-economic and demographic characteristics of households. The reported effects of access to KVK, are robust on all outcome indicators. The access to KVKs has

potential to increase agricultural households' net farm income by Rs. 3568 per hectare and annual per capita consumption expenditure by Rs.1073. We examined the impact of KVK on large and small farmers separately. The results showed that large farmers turned out to be greater beneficiaries as compared to the smaller farmers. This has important policy implications on the functioning of KVKs and suggests developing some mechanism to better target the small holder farmers instead of 'one size fits all' approaches. Further, the benefit cost ratio of expenditure in KVKs is estimated to be 7.8. These findings reveal the impressive contribution made by KVKs in India and justify for higher budgetary allocation for KVKs. These findings underline the crucial role that investment in KVK may play in improving the welfare of rural poor farm households. The results of this study have profound significance in justifying the establishment of institutional innovations for training of farmers, rural women and youth. By spending minimum amount in vocational trainings for improving farmers' knowledge and skill, KVKs can contribute significantly in sustainable agriculture.

Dr. Satish Kumar

Institute: ICAR-IVRI, Izatnagar; Mentor: Dr. Amit Kumar, Senior Scientist, AG & B

Research work done: The work carried out during PAT at was on "Analysis Pipeline by PLINK for Genome Wide Association Study on GBS data and Analysis of Animal Breeding Data Using Wombat and SAS".

PLINK is a comprehensive, open-source command-line tool for genome-wide association studies (GWAS) and population genetics research. For analysis of GWAS it require PLINK software and data file in VCF format (Variant Call Format). VCF is a text file. It contains meta-information lines, a header line, and then data lines, each containing information about a position in the genome. There are 8 fixed fields per record. All data lines are tab-delimited. Text PLINK data consist of two files, Ped file which contains information on the individuals and their genotypes. The fields in a PED file are Family ID, Sample ID, Paternal ID, Maternal ID, Sex (1=male; 2=female; other=unknown), Affection (0=unknown; 1=unaffected; 2=affected), Genotypes (space or tab separated, 2 for each marker. 0=missing. Map file contains information on the genetic markers. The fields in a MAP file are Chromosome, Marker ID, Genetic distance and Physical position. Binary PLINK data consist of three files; bed File, fam File and bim File. By following standard commands we can do the GWAS analysis of genotypic data for association between SNPs and the trait of interest.

Dr. Jaya

Institute: ICAR-IVRI, Izatnagar; Mentor: Dr. Mihir Sarkar, Principal Scientist, Division of Physiology and Climatology

Research work done: Conducted research work on the topic "Editing of VEGFA gene in bubaline corpus luteum through CRISPR/Cas9 mediated gene editing technology", with the objectives 1. To standardize the protocol for CRISPR/Cas9 mediated knocking out of the VEGF gene in bubaline luteal cells and 2. To detect the VEGF knock-out luteal cells, wherein the major research achievements were establishment of bubaline luteal cell culture system and determination of cell viability. Once the cell culture system was established, production of VEGF Knock Out bubaline luteal cells was undertaken using the CRISPR/Cas9 genome editing system. For the purpose VEGFA gene specific guide RNA was designed and Single guide RNA synthesis was done. For preparation of Cas9 mRNA the px330 plasmid carrying the wild-type Cas9 was used as the DNA template for amplification of the Cas9 coding sequence in a polymerase chain reaction. Then the transfection of cultured luteal cells was done using lipofectamine. Finally, T7E1 Assay was used for validation of knocking out, which concluded the successful knock out of desired sequence and standardization of the methodology involved.

INSTITUTE VILLAGE LINKING PROGRAMME UNDER TRIBAL SUB-PLAN

Key Associates: Keshab Barman, S. Rajkhowa, S. Banik, Mohan NH, P.J. Das, R. Thomas, S.R. Pegu and Sunil Kumar

ICAR-NRC on Pig 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 2 female 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. The Institute is monitoring health, growth and management of the pigs in the adopted villages regularly and giving necessary health treatment and AI services as and when required.

Adopted villages by NRC on Pig: At present ICAR-NRC on Pig is adopting 05 numbers of villages namely Batabari, Moirapur, Belguri, Sattargaon and Garlic villages in Rani Block of Kamrup district under its TSP plan and one in Karbialong district i.e. Balipather in Bokajan.

List of health camps and awareness programme and feed/piglet distribution programmes conducted during 2018-19

Sl. No.	Programmes	Date	Activities	No. of farmers benefited
1.	Conduction of feed distribution programme	16-05-19	• Distributed 810 kg pig feed	39
2	Conduction of Pig health and awareness programme at Damra Patpara Village, Goalpara under Tribal Sub Plan Scheme	31-08-18	• Distributed 1500 kg pig feed • 200 doses anthelmintic • 100 doses ointment • 50 doses swine fever vaccine	80
3	Conduction of Pig health and awareness programme at village Kachubari, Rangjuli Block, Goalpara under Tribal Sub Plan Scheme	01-09-18	• Distributed 1500 kg pig feed • 200 doses anthelmintic • 100 doses ointment • 50 doses swine fever vaccine	75
4	Conduction of Pig health and awareness programme at village Kahibari, Tamulpur, Baksa under Tribal Sub Plan Scheme	06-09-18	• Distributed 1500 kg pig feed • 200 doses anthelmintic • 100 doses ointment • 50 doses swine fever vaccine	65
5	Conduction of Pig health and awareness programme at Maharipara Village, Goreswar Block, Baksa	18-09-18	• Distributed 1500 kg pig feed • 200 doses anthelmintic • 100 doses ointment • 50 doses swine fever vaccine	70

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6	Conduction of Pig health and awareness programme at Belguri, Rani of Kamrup District of Assam	22-12-18	• 50 doses anthelmintic • 50 doses ointment • Swine fever vaccine: 50	60
7	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
8	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
9	Conduction of Pig health and awareness programme at Tezpur in Sonitpur District of Assam	16-02-19	• 35 doses anthelmintic • 25 doses ointment	50

Table: Capacity building programme organized under TSP

Sl. No.	Name of the training	Date	Sponsored by
1	Advance Pig Husbandry Practices	3rd -7th July, 2018	Institute Sponsored
2	Advance Pig Husbandry Practices	22nd -26th Oct, 2018	Institute Sponsored

Table: Farmers benefited under TSP during 2018-19

Sl No.	Items	Numbers of farmers benefited
1	Capacity building programme: Training/demonstration/ awareness/ orientation programmes, scientist interaction etc	1200 tribal families benefited
2	Technical guidance, input support and follow up on scientific pig farming practices at Kamrup, Baksa, Goalpara, Dhemaji and Lakhimpur districts	1150 house hold benefited
3	Distribution of pig feed and mineral mixture	882 house hold benefited
4	Distribution of swine fever vaccine and anthelmintic for pig	1000 house hold benefited
5	Distribution of mineral mixture supplements to tribal farmers	650 house hold benefited
6	Health coverage to different species of animals through animal health camp including deworming, treatment etc.	1050 house hold benefited
7	Establishment of model pig fish farming at tribal villages	27 house hold benefited
8	Awareness programme on Scientific pig husbandry practices	1475 house hold benefited

Table: 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 2018-19

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, districts	Number	1600
3	Distribution of pig feed	Kg	22880
4	Distribution of mineral mixture	Kg	144
5	Distribution of swine fever vaccine	Dose	600
6	Distribution of anthelmintic for pig	Dose	1800
7	distribution of piglets	No	20
8	Development of integrated pig fish farm at farmers field	No	2



Glimpses of programmes organized under TSP

AICRP & MEGA SEED

ALL INDIA COORDINATED RESEARCH PROJECT ON PIG

The main objective of AICRP on pig which launched in IVth Five Year Plan (1970-1971) was to study the performance of pigs in different agro-climatic condition of the country. Subsequently the project was mandated to develop region-specific package of practices including quality germplasm. Few centers are mandated for conservation of indigenous germplasm. Presently the programme is continuing in 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-National Research Center on Pig, Guwahati on 23-24th November, 2018.

ASSAM AGRICULTURAL UNIVERSITY, KHANAPARA, GUWAHATI

The ICAR-AICRP on pig, AAU, Khanapara has played an important role since its inception for development of pig production in the state and neighboring states through various ways like attending training, awareness program, exhibition, demonstration, distribution of leaflet /booklet. The center has conducted several training programme and extension activities to popularize piggery in the state of Assam and adjoining states. This centre has played a significant role in developing piggery sector by selling of quality piglets, elite gilts/ sows and boars at nominal price 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. The total herd strength of the HD-K75 crossbred germplasm was 324 as on 2018-18 financial year.

Collection of Semen for A.I. & Demonstration, Khanapara

KERALA VETERINARY AND ANIMAL SCIENCE UNIVERSITY, MANNUTHY CENTRE, KERALA

KVASU, Mannuthy Center is maintaining Large White Yorkshire, Desi and Mannuthy White crossbred variety developed by crossing of LWY (75%) with local pig of Kerala. The Centre imparted scientific knowledge to the progressive pig farmers in establishing the piggery units with respect to health care, feeding and breeding management, waste disposal and other problems faced on a day to day basis through telephone and by direct personal contact. Mannuthy White is well adapted to humid tropical agro-climatic conditions and suited to low input rearing system of Kerala. Centre had supplied 421 fattening piglets to 60 farmers. Total 187 numbers of crossbred 50% and 77 numbers crossbred 75% was available as on 2018-18 financial year.

Training to farmers, Mannuthy

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 conditions. Survey work on conservation of indigenous germplasm has been completed in 5 districts viz. Chittoor, Kadapa, Kurnool, Ananthapur and Vizag. During the period under report 225 piglets were born and 204 animals were sold.

Field Unit of AICRP on Pig, Tirupati

ICAR-CENTRAL COASTAL AGRICULTURAL RESEARCH INSTITUTE, GOA

AICRP on pig, Goa centre is providing scientific know how to the pig growers of the region through training's and demonstrations and also providing farmers with quality breeding stock. The center is maintaining Agonda Goan (Local), Large White Yorkshire and its crosses. The center disseminate training on suitable breeding practice, controlled breeding using synchronization and AI, standard balanced feeding, comfortable housing of pigs etc. which lead to improved pig production.

Swine fever vaccination at Pig Farm, Goa

INDIAN VETERINARY RESEARCH INSTITUTE, IZATNAGAR, BAREILLY

ICAR-IVRI AICRP centre maintain 75% exotic blood line by inter-se mating for which minimum 30 breedable sows are maintained with a sex ratio of 1:3 with 10 sires. During this year, a total of 496 CB (75%) animals were born. A total of 462 CB pigs were supplied to different farms, farmers as well as divisions for experimental purpose. 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).

Visit of Oklahoma university faculties, Kattupakkam

TAMILNADU VETERINARY AND ANIMAL SCIENCE UNIVERSITY, KATTUPAKKAM

TANUVAS Centre is maintaining *inter-se* population of TANUVAS KPM Gold (75% crossbred) pigs. Besides regular training, survival modeling was carried out by the center with the objectives to model the survivability of pigs over time and identify the deterministic factors of survivability among pigs.

Registered local pig of Rohilkhand region

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

The centre maintains Zovawk, Large White Yorkshire and its crosses. The basic principle of the center is to develop a farmer's friendly package of practices for improved piggery in the state. Initially, researches are being considered to conserve of local indigenous pigs for

preserving the indigenous gene pool and promote low input animals for rural and less developed areas. Presently, four breeds namely Zovawk, 50% Crossbred, 75% Crossbred and Large White Yorkshire are maintained at the farm. At present a total of 31 breeding sows and 15 boars of 75% LWY and 25% Zovawk genetic group are available.

Zovawk Sow with piglets

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

Presently the centre is maintaining Tenyivo, Hampshire and upgraded Tenyivo (75%) using Hampshire boar. Centre has is disseminating technical knowhow of improved pig production practices to the farmers by training and demonstration. The total 199 piglet were born during this year. AI is practiced using Hampshire boar semen in the farm and in the farmer's field.

Hands on training on pig Management, Nagaland

ICAR-CENTRAL ISLAND AGRICULTURAL RESEARCH INSTITUTE, PORT BLAIR

AICRP on Pig programme of this centre has been 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. During this reporting year total 12 farrowing have been recorded with 66 piglets born. Salient parameters like litter size at birth (no.), litter weight at birth (kg) and litter size at weaning (no.),were recorded as 5.5 ±0.95, 10.23 ± 1.64 and 4.33 ±0.90 respectively.

Andaman Local Pig at Farmers herd

COLLEGE OF AGRICULTURAL, CENTRAL AGRICULTURAL UNIVERSITY, IMPHAL

AICRP on Pig at Manipur Centre was sanctioned with the main objective of development of region specific package of practices for improved pig husbandry in the state of Manipur. During the reporting year 2018-19 also, the center continue its mandate to study the various performance characteristics of the Rani breed, under Manipur condition. Works on characterization of Indigenous local pigs of Manipur were also started during the year. At the end of this financial year, AICRP on Pig, Manipur Centre, is maintaining a total strength of 167 nos. of Rani pigs.

Rani sow with piglets at AICRP on Pig centre, Imphal

ICAR RESEARCH COMPLEX FOR NEH REGION, BARAPANI

Lumsniang Pig Breeding Unit, Barapani

The center has successfully developed and released Lumsniang crossbred variety of pig which is suitable for hilly terrine of India. Besides crossbred the center is also maintaining the indigenous Niang Megha 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. About 500-700/ year through different AI delivery models and obtained farrowing rate of 72-75% and litter size of 8-12. To popularize the crossbred pig variety, "Lumsniang", 3670 piglets were distributed to the farmer thought TSP farmer first, KVK, TSP and other external project.

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

Ghungroo sow with piglet at IVRI ERS

ICAR-AICRP on pig in IVRI, Kolkata was established with an idea to develop an elite flock of Ghungroo germplasm through selective breeding, propagate and supply the superior germplasm to cliental which indirectly increase the pork production. The average litter size and weight at birth is 6.75±0.65 and 8.10±0.45 kg, respectively. The average litter size and weight at weaning is 6.00±0.43 and 64.50±1.71kg, respectively. Besides maintaining Ghungroo germplasm the center conducted several training to the farmers for popularization of the breed.

KVK-GOALPARA, ICAR-NRC ON PIG

Doom Pig at AICRP on Pig center, Goalpara

Looking to importance of the indigenous Doom pig in the state, the AICRP on pig unit was sanctioned with the objective to conserve Doom pig of Assam and maintain it with selective breeding. The center is maintaining conservation unit of Doom pig. The average litter size and weight at birth is 3.52±1.27 and 1.60±0.13 kg, respectively. The average litter size and weight at weaning is 2.89±0.67 and 7.68±0.56 kg, respectively.

GURU ANGAD DEV VETERINARY AND ANIMAL SCIENCE UNIVERSITY, LUDHIANA

Due to high importance of piggery sector in the state of Punjab the Council sanctioned one centre of AICRP on Pig at GADVASU, Ludhiana during 2017. The center is maintaining Large White Yorkshire pigs. The total herd strength of the centre was 35 pigs of LWY breed. The Litter size at birth was 9.3 ± 1.8 and Litter size at weaning was 8.6 ± 1.8.

AI in gilts, AICRP Ludhian 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 breeding is in progress in newly purchased pigs.

AICRP on Pig center at Shirval

MEGA-SEED PROJECT ON PIG

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

ASSAM AGRICULTURAL UNIVERSITY, KHANAPARA, GUWAHATI

The center is maintaining HD K75 crossbred pigs. A total of 979 piglets were produced from the center during the reporting period. The average litter size at birth and litter size at weaning were found as 7.79 ± 1.14 and 7.40 ± 0.14, respectively in 50%H and the corresponding values for HD-K75 were found as 8.67 ± 2.27 and 8.50 ± 1.61. The pre-weaning and post-weaning mortality (%) were recorded as 4.16 and 2.54, respectively.

Crossbred sow with piglet at Mega Seed Centre, Guwahti

BIRSA AGRICULTURAL UNIVERSITY, RANCHI, JHARKHAND

The 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. The center is supplying improved variety of Jharsuk pig to the farmers. A total of 1160 piglets were born during the reporting period. Approx 257 progressive/2nd line breeder of Jharsuk pigs have been enrolled with the center who partially meet the local demand.

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. In the reporting year a total of 47 breedable sows and 5 boars of Rani crossbreed were maintained. Altogether 606 no. of piglets were

Rani cross sow with piglets, Nagaland

farrowed during the reporting period. These were supplied to the beneficiaries in Nagaland, Assam and Manipur. Artificial insemination in pig has been popularized widely in the state of Nagaland to enhance the production of piglets from superior breeding stock.

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. Since there was state wide PRRS outbreak in April of 2018, complete shutdown of Artificial Insemination and movement of animal was enforced by Mizoram State Government from April 2018 to October 2018 in the state which resulted to reduction in the production of piglets. A total 163 Large White Yorkshire piglets were produced during the reporting year. The centre has also supported a few farmers in the state for scientific pig production and management.

Selecting piglet for breeding purpose, Aizawl Center

KERALA VETERINARY AND ANIMAL SCIENCES UNIVERSITY, MANNUTHY CENTRE, KERALA

The mandate of the centre is to produce and supply Mannuthy White crossbred germplasm in the state. A total 1014 piglets were produced during the reporting year. The centre has successfully fulfilled the demand of 40 farmers by supplying 842 fattening piglets. Artificial insemination is being regularly practised to avoid inbreeding depression and proper utilisation of genetic potential of superior males.

Crossbred pigs at Mega Seed centre of Mannuthy

ANIMAL RESOURCES DEVELOPMENT DEPARTMENT, TRIPURA

The centre was started in 2014 and maintaining Landrace, LWY X Desi crossbred. A total of 439 piglets were born during the reporting period. The quality germplasm was supplied to the stake holders of the state.

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 heard strength of the farm is 83. The center is maintaining HD K75 and Rani crossbred variety. A total of 150 piglets were born during the reporting period.

First Farrowing Litter Size HDK75, Sikkim

KRISHI VIGYAN KENDRA

A total of 247 numbers of trainings are organized by KVK Goalpara covering 9,458 nos. of trainees during the year 2018-19. Out of these 125 nos. of trainings were conducted under Krishi-Kalyan Abhiyan. KVK Goalpara achieved No. 1 ranking in Krishi Kalyan Abhijan Phase – I and received Certificate of Appreciation for outstanding performance during KKA – I by ATARI, Guwahati.

Details of On Farm Testing (OFT) Programmes

OFT on Evaluation of backyard rearing of Kadaknath breed of poultry for its productive performance in agro-climatic conditions of Goalpara district : An indigenous breed of poultry found in large areas of Western Madhya Pradesh mainly in Jhabua and Dhar districts of Madhya Pradesh is Kadaknath. Kadaknath birds have lower cholesterol than normally available in other poultry breeds and also contain high level of essential amino acids as well as hormones which are essential for human body. Therefore, conservation and improvement of this bird is highly essential. The birds are jet black in colour and reared mainly for their meat, which is also black in colour but softer than that of other desi birds.

Keeping in view the nutritive, medicinal properties of Kadaknath birds, 300 nos. of bird were distributed to the 30 female farmers and 200 nos. kept for demonstration unit at KVK Goalpara farm complex This demonstration unit will help to the rural resource poor people, SHGs and unemployed youths to adopt this poultry breeds for backyard farming. Following were the objectives of this On Farm Trial –

1. To evaluate a new poultry variety.
2. To aware about the beneficial affects of Kadaknath meat and egg.
3. To aware the farmers to produce egg and meat through minimum financial involvement.

Following were the programmes undertaken for the beneficiaries –

I. Selection of beneficiaries from six villages
II. Distributed 5 Kadaknath chicks to 60 female farmers
III. Vaccination on Ranikhet has done on the day of distribution
IV. Training organised for better management of the distributed chicks
V. Demonstration on construction of low cost poultry shed with an open enclosure

Distribution of Kadaknath birds
birds in backyard farming"

Training on "management of Kadaknath


Demonstration on low cost housing with open enclosure

Present status of Kadaknath birds at KVK demomstration unit

OFT on Off season cultivation of cucumber under polyhouse: Seasonal glut in the market and non availability of off season cucumber are some of the major problems faced by the cucumber farmers of Goalpara district. Keeping this problems in view an OFT on "Off- season cultivation of cucumber under polyhouse" was undertaken at the KVK farm and farmer's field in Madang village, Rangjuli. Under this programme, cucumber seeds were sown in the month of August and scientific cultivation practice of cucumber (var. Mahy Sedona) was demonstrated wherein local check used was cucumber *var.* Malini. Observations and results are mentioned below:

Sl. No.	Parameters	Mahy Sedona
1.	Days to 1st male flower	32 days
2.	Days to 1st female flower	38 days
3.	Avg. No. of fruits per plant	6 nos.
4.	Avg. weight per fruit	315 gm
5.	Avg. length per fruit	26.2 cm
6.	Yield /plant	1.890 kg
7.	B.C ratio	2.43:1

OFT on 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. The programme is in progress.

OFT on Integrated management of bacterial wilt of brinjal:

Details of technology:

1. Use of healthy seeds (Balijan brinjal) (Local)
2. Application of bleaching powder @ 1.5 Kg /bigha mixed with furrows at the time of ploughing at least one month before planting.
3. Application of lime @ 3 kg/bigha land
4. Drench 100 ml solution per plant of Ashafoetida (Hing) 5 gm + 50 gm turmeric powder + 50 liter water mixture.

Crop Enterprise	Demonstration Yield (Qt/Ha)			Yield of local Check	% increase/ over local	Gross Cost Rs/ha	Gross Return Rs/ha	Net Return Rs/ha	B:C Ratio GR/GC
	H	L	A						
Brinjal	280	220	250	180	139	70,000	2,00,000	1,30,000	2.8:1

Brinjal plants cv. Balijan (Local)

OFT plot at farmer field, Balijana, Agia

OFT plot at farmer field

Balijana brinjal fruits

At OFT plot and farmers were motivated with new technology

OFT on Integrated Management Practices for Panama Disease of Banana:

Details of technology:

T1 : Planting of healthy sucker

T2 : Apply lime @ 1 kg/pit

T3 : Apply 1% Bavistin solution soil drenching

T4 : Apply 2% Bavistin solution @ 3 ml/comb

T5 : Flooding

T6 : Shifting cultivation

Results:

Prdn. per unit	Net return (Rs/h	B:C Ratio (GR/GC)
250q/ha	250,000	3.1:1

Banana plantation Cv. Malbhog

Banana plantation Cv. Malbhog

Panama diseased infested banana plant

Farmer trained with OFT technology

Systemic fungicide SAAF (Bavistin)

Healthy banana plants

OFT on 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 on 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 on Low cost polyhouse construction : Polyhouse construction is necessary for growing off season vegetables. Low cost polyhouse using 200µ LDPE with Bamboo structure could be a viable alternative for farmers. The technology standardised at AAU, Jorhat was successfully tested for field applicability in Goalpara condition.


Details of Front Line Demonstration programmes

FLD on Production of upgraded piglets through Artificial Insemination : KVK Goalpara adopted Pacchim Dairong village as pig seed village or 'Borah gram' and introduced Artificial Insemination (AI) technology for piglet production. A society named as "Sarpak Livelihood Promotion society" was formed by KVK Goalpara to look after the plan and programmes formulated by KVK office in the village.Till date, more than 1500 nos. of upgraded piglets have been produced through AI. The chairperson of the society, Mrs. Dipika Rabha has received Mahila Kisan award from Ministry of Agriculture, Govt of India and felicitation from honourable Governor, Govt of Assam. The society has now been registered as a company in the name of 'Sarpak Agro Farmer Producer Company' in the month of November, 2018. The piglets produced from AI generated more than Rs. 40 lakhs.

Gradually five more neighbouring villages have joined in this company to bring positive impact and to develop pig breeding farms in their respective villages. Female members of the society in addition to their male counterparts, even the chairperson of that society, Mrs. Deepika Rabha were actively involved in doing Artificial Insemination (AI) in Pig as an AI technician. This is the clear sign of women empowerment in Goalpara district as the women farmers of the society established themselves as first female AI technician in Pig in India.


FLD on 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.

FLD on High density planting of papaya hybrid 'Red Lady': FLD on high density planting of papaya hybrid Red Lady was carried out in two villages - Junaimari and Patpara under Kuchdhowa Agricultural Developmental block of Goalpara, comprising 1 hectare area with the involvement of twenty farmers. The papaya hybrid 'RedLady'has duration of about 2 years and suitable for cultivation in Assam condition.The fruit quality is excellent with firm red flesh, aromatic and very sweet with13-14% sugar content.The plants are highly tolerant to Papaya Ring Spot Virus. The planting of the papaya seedlings were done at a spacing of 1.5m x 1.5m (high density planting) against the normal spacing of 1.8m x 1.8m to accommodate 46 percent more plants. The fruits were harvested at 8 to 9 months from sowing.An average of 40 fruits per plant was recorded with individual fruits weighing around 750 grams. The average yield per plant recorded was 30 kg.

FLD plot at farmers' field at Junaimari, Dudhnoi.

FLD on Cultivation practices of oyster mushroom

Crop Enterprise	Demonstration Yield (kg/5 Kg bag)			Yield of local Check	% increase/ over local	Gross Cost (Rs/ha)	Gross Return (Rs/unit	Net Return (Rs/unit)	B:C
	H	L	A	(kg/5 Kg bag)	%				
Mushroom	1.4	1	1.2	0.8	150	12,000	40,000	28,000	3.3:1

Oyster mushroom spawn

Oyster mushroom bags hanging on

Fruiting stage

Oyster mushroom fruiting at KVK farm

Fruiting at farmers home (Makri)

Fruting at farmers home (Balachara)

Fruting at farmers home (Damra)

Farm Women farmer training

Commercial cultivation of oyster mushroom at farmers home (Dhupdhara)

FLD on Integrated management of banana fruit scaring beetle:

Source of Technology: AAU, Jorhat

Details of Technology:

1. Clean cultivation, weed removal, mulching was done for retention of moisture. Dried banana leaves were cut down and used for preparation of vermicompost. Regular irrigation was done during dry spill period.
2. Bagging of banana bunch using polythene bags before fruit set and removing bag after fruit setting.
3. Spraying of 0.1% Malathion 50 EC was done on the bunches immediately after emergance. Second spray was done at 30 days interval.

Crop Enterprise	Demonstration Yield (Q/Ha)			Yield of local Check	% increase/ over local	Gross Cost (Rs/ha)/ (Rs./ unit)	Gross Return (Rs/ha) / (Rs./ unit)	Net Return (Rs/ha	B:C
	H	L	A	(Q/Ha)	%				
Banana	172	159	167	132	26.51	125000	517700	392700	4.14:1

Well managed banana plot cv. Malbhog

FLD farmers are interacted with officials

Bagging with white polythene bags

Bagging with white polythene bags

FLD on 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 cook stove and chimney

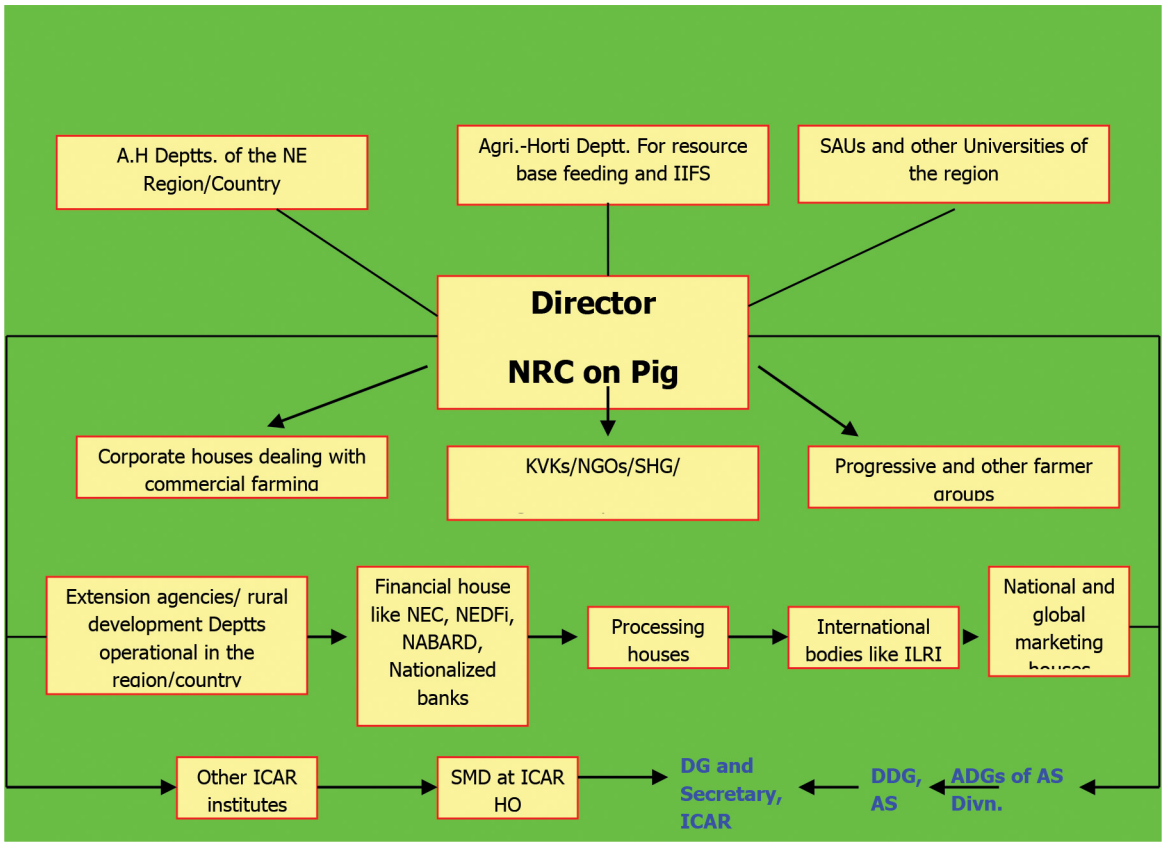
FLD on Polythene Mulching in Pineapple: Mulching of Pineapple is very effective in soil moisture conservation, weed control and thereby enhancing production and productivity. 50µ black polythene is a suitable material for mulching Pineapple crop. Therefore use of 50µ black polythene is conducted to evaluate performance of the technology in farmer's field in Goalpara condition. The farmers are provided hands on experience on plastic mulching for cultivation of Pineapple. The programme is in progress.


Distribution of Soil Health Cards: A total of 37,625 numbers of Soil Health Card were distributed among farmers of Goalpara during the year 2018-19.

Krishi Kalyan Abhiyan: For Krishi Kalyan Abhiyan (Phase I), KVK Goalpara achieved Rank 1 position among the 117 aspiration district of India and received Certificate of Appreciation from ATARI, Ghty.

Activities	Target (Nos.)	Achievements (Nos.)	No. of farmers benefitted
Training	25	26	2068
Distribution of Soil Health Card	5709	5709	5709
Distribution of Mini Kits of pulses and oilseeds or paddy	1428	2078	-
Distribution of Horticultural plants	12500	34050	2740
Making NADEP Pits	500	516	516
Distributions of agricultural implements	250	860	860
Sheep and Goat vaccination for eradication of PPR	100%	6137	1883
Bovine vaccination(FMD)	100%	11933	3566
Demonstration on micro irrigation	1	2	152

Linkage and Collaboration of ICAR-NRC on Pig



MEETINGS & OTHER ACTIVITIES

MEETINGS AND OTHER ACTIVITIES

Research Advisory Committee Meeting (RAC)

Members	Position in RAC
Dr. V. K. Taneja Former Vice-Chancellor, GADVASU, Ludhiana and Former DDG (AS), ICAR, New Delhi	Chairman
Dr. R. S. Gandhi Assistant Director General (AP & B)	Member
Dr. Sushil Kumar Former Director, ICAR-NDRI, Karnal	Member
Dr. C. S. Prasad Former Vice-Chancellor, MAFSU, Maharashtra	Member
Dr. Gaya Prasad Vice-Chancellor, SVPUAT, Meerut	Member
Dr. M. S. Raju Professor and Head, Dept. of Animal Reproduction, RGCOVAS, Puduchery	Member
Dr. Swaraj Rajkhowa Director, ICAR-NRC on Pig	Member
Dr. Mohan N. H. Principal Scientist, ICAR-NRC on Pig	Member Secretary

The XIIth Research advisory Committee Meeting of the institute was organized on 31st July to 1st August 2018 under the chairmanship of Dr. V. K. Taneja, Former Vice- Chancellor, GADVASU, Ludhiana and Ex DDG (AS), ICAR, New Delhi. The Director of the institute briefed about the achievement of the institute and the ongoing activities. The scientists of the institute then presented the ongoing research works and the progress. The committee critically evaluated all the works and gave their valuable comments. The major recommendations of the XIIth RAC are listed below.

1) Present number of Scientists in the institute is only 8 (including Director), against the approved cadre strength of 20. RAC opinions that increase in the cadre strength of Scientists will improve output and carrying out mandated activities of the institute more effectively.

2) Almost all the AICRP centres have developed varieties of pigs which have been released formally by ICAR. Strengthening farmer interaction with AICRP on Pig centres and percolation of developed breeds are essential for increased productivity and income generation under field conditions. External experts may be invited during annual review meetings of AICRP on pig and Megaseed Project on pig.

3) Through AI programme of the institute more than thirty seven thousand piglets have been born under field conditions in last five years. The programme should be further strengthened by involving more farmers through awareness creation and training. The institute should promote farmers to establish large breeding units for upscaling pig production across the country. Linkages with state veterinary departments in NE states should be further strengthened for providing trainings and technologies to strengthen the pig farming on scientific lines.

12th RAC meeting is in progress

Institute Research Council meeting (IRC)

The XI[th] Institute Research Council (IRC) meeting of ICAR-NRC on Pig was held on 5-6th April, 2018, under the Chairmanship of Dr.Swaraj Rajkhowa, Director (Acting), ICAR-NRC on Pig. The Chairman, IRC welcomed Dr.Vineet Bhasin, Principal Scientist at ICAR HQ, Dr. D. K. Sarma, Professor, College of Veterinary Science, AAU & Former Director of the institute and Scientists of the institute. 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.

Institute Management Committee (IMC)

Members	Position in IMC
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 16[th] IMC Meeting in progress

The 16th Institute Management Committee Meeting was organized on 14th September, 2018 at the Institute. During the meeting, the Chairman briefed the various activities of the Institute including various research endeavours, and the action taken for the recommendations of the preceeding meeting held was confirmed and agreed by the IMC. Different agenda items such as procurement of equipments, infrastructure development etc. were discussed in the meeting and the proposals were recommended by the IMC.

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. The Tenure of present IJSC is valid upto 04.12.2019.

IJSC Staff Side Members		
1.	Shri. Uttam Prakash, AAO, ICAR-NRCP, Guwahati.	IJSC Secretary (SS) & Member (SS) Admin Category.
2.	Ms. Kabyawati Rabha, Jr. Stenographer, KVK, Goalpara	Member (SS) Admin Category.
3.	Dr. Anil Kumar Das, Sr. Technical Assistant, ICAR-NRCP, Guwahati.	IJSC Member (SS) Tech. Category
4.	Shri. Kailash Choudhury, Sr. Technician, ICAR-NRCP, Guwahati.	IJSC Member (SS) Tech. Category
5.	Shri. Dhruba Rabha, SSS, KVK, Goalpara	IJSC Member (SS) SSS Category
6.	Shri. Ratul Baishya, SSS, ICAR-NRCP, Guwahati.	IJSC Member (SS) SSS Category
IJSC Oficial Side Members		
1.	Dr. K. Barman, Principal Scientist, ICAR-NRCP, Guwahati.	Secretary (Official Side).
2.	Dr. R. Thomas, Sr. Scientist, ICAR-NRCP, Guwahati.	Member (Official Side)
3.	Dr. Hitu Choudhury, ACTO, KVK, Goalpara.	Member (Official Side)
4.	Dr. Seema Rani Pegu, Scientist, ICAR-NRCP, Guwahati.	Member (Official Side)
5.	Dr. S.Banik, I/C AO, ICAR-NRCP, Guwahati.	Member (Official Side)
6.	Shri. P.K Nayak, AF & AO, ICAR-NRCP, Guwahati.	Member (Official Side)
Central Joint Staff Council (CJSC) Staff Side Member		
1.	Shri. Uttam Prakash, AAO, ICAR-NRC on Pig, Guwahati, Assam.	Member CJSC

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

Annual Review Meet of All India Coordinated Research Project on Pig and Mega Seed Project on Pig

To review the scientific progress made in the AICRP on Pig and Mega Seed Project on Pig, the annual review meeting was held on 23-24th November, 2018 at ICAR-National Research Center on Pig, Rani, Guwahati, Assam. During the Inaugural session on 23rdNovember, Dr. Santanu Banik, Pr. Scientist and incharge, AICRP on Pig, ICAR-NRC on Pig, Guwahati welcomed the Chief Guest Dr. R.S. Gandhi, ADG (AP&B), ICAR, Dr. S. Rajkhowa, Director (ICAR- NRC on Pig), Dr. VineetBhasin (Pr. Scientist, AG&B), ICAR and PIs of all the coordinating units.

Participants in AICRP and Megaseed review meeting

Earlier, on 22ndNovember, 2018 evening, Deputy Director General (Animal Science), ICAR, New Delhi, Dr. J.K. Jena reviewed the Coordinating Unit's report presented by Dr. Swaraj Rajkhowa, Director, ICAR-NRC on Pig and Project Coordinator. Dr. Jena stressed upon the potential of piggery sector for doubling farmers' income. He also suggested to intensify the work of genetic characterization of available indigenous pig germplasm. Dr. R.S. Gandhi elaborated the impact of the newly developed high-producing crossbred pig germplasm to mitigate the demand-supply gap of pork. Dr. Vineet Bhasin (Pr. Scientist, AG&B) stressed upon propagation of these improved variety at farmers' field for increasing production potential in the sector. The Technical session was chaired by Dr. R.S. Gandhi. During the technical session PI of different AICRP on Pig and Mega Seed Project Centers presented the action taken reports and the research work done in 2017-18 and reviewed by the committee. The meeting reviewed the performance and recommended the future activities of the projects.

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):

Sl. No.	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

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

National Technical and Implementation Committee (NTIC) on "Pig Development Plan for North East"

Meeting of National Technical and Implementation Committee (NTIC) on "Pig Development Plan for North East" organized on 11th September 2018 at ICAR-National Research Centre on Pig, Rani.

NTIC meeting in progress

Participation in Agri Business Conclave

ICAR-National Research Centre on Pig has participated and showcased the technologies in the Agri-Startup conclave and Exhibition during 16-17th October 2018 for Agri-Start-ups and Innovations at NASC Complex, New Delhi.

Participation in Agriculture Science Congress (ASC)

ICAR-NRC on Pig, Rani Participated in the ASC-Expo at Mela Ground of IARI, New Delhi from 20-24 February 2019. Dr. T. Mohapatra, DG, ICAR & Secretary DARE along with, Dr. J.K. Jena, Deputy Director General (Animal Science), Prof. Panjab Singh, President, NAAS and Dr. A.K. Singh, Director, IARI visited the NRCP exhibition stall of ICAR-NRCP during the Expo.

CELEBRATIONS

Institute Foundation Day

ICAR-National Research Centre on Pig has celebrated its 17th foundation day on September 4th, 2018 with a day long programme. Dr. A.K. Tripati, Director, ATARI-VI was the Chief Guest of the programme and Dr. B. Saikia, Dean, CVSc and Dr. N. Mohan, Retd. Professor, AAU 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. 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

The vigilance awareness week was observed at the institute from 29th October to 3rd November 2018. The Director of ICAR Research Complex for NEH Region, Dr. N. Prakash was the chief guest for the elocution competition organized at the institute on the theme “Eradicate corruption- Build a new India”. He highlighted the need for employees’ commitment towards honesty, transparency and integrity on this occasion. The Director, Dr. Swaraj Rajkhowa lead the oath taking ceremony in which all the institute staff reassured their contribution in eradicating the corruption. As part of the programme, vigilance awareness campaign was also organized for the rural youth in the nearby villages.

Celebrations

Director of ICAR Research Complex for NE Hill region highlighting the importance of vigilance awareness

Oath taking by all institute staff to eradicate corruption and to build a new India

Creating vigilance awareness among the rural youth in the nearby villages of the institute

National Consumer Day

The institute organised National Consumer Day on 24th December, 2018 with Directorate of marketing and inspection, Regional office, Guwahati. The theme of the program was "Timely disposal of consumer complaints". Mrs. Sunita Rai, Asst. General Manager, APEDA was the chief guest of the program. The director of the institute throws light on the consumer protection act and different safeguards available for the consumers to help themselves against the exploitations in market.

Independence Day

The institute celebrated 72nd Independence Day of our country on 15th August 2018. 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.


Independence Day

Republic Day

The Institute celebrated 69th republic day of India on 26th January 2018 with a flag hosting ceremony. All the institute staff joined together to honour the date in which our constitution came into effect. Director of the institute expressed his views during the event.

Republic Day

National Unity Day

The National Unity Day was celebrated on 31st October, 2018 to honour Sardar Vallabhbhai Patel on his 143rd birth anniversary. All the staff members of the institute took pledge on this occasion to withhold unity, integrity and security of our country to build a more stronger nation. The director emphasized the importance of celebrating this day by sighting some milestones from the history.

National Unity Day

Gandhi Jayandhi

The Institute celebrated 150th birth anniversary of Mahatma Gandhi on 2nd October, 2018 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.

Gandhi Jayandhi

Swachh Bharat Abhiyan (Clean India Mission)

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 hi Seva Campaign in nearby villages, Workshop on Swachhta, Swachhta

Celebrations

Pakhwada, Awareness campaign on Swachhta and planting trees in the campus were the different activities organized.

a) Swachhta hi Seva Campaign

The institute organized swachhta hi seva campaign from 15th septembet to 2nd October, 2018 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.



b) Workshop on Swachhta

A workshop on swachhta was organized at the institute on 24th December, 2018. Farmers from the nearby villages participated in the workshop.

Workshop on Swachhta

c) Awareness camp on swachhta

An awareness camp on swachhta was organized at Sattargaon village on 22nd December, 2018. The Director of the institute highlighted the need for cleanliness in villages on this occasion.

d) Swachhta Pakhwada

Swachhta Pakhwada was observed at the institute from 16th to 31st December 2018. 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.


Awareness camp on swachhta



Kisan Diwas

The institute organized Kisan Diwas celebration at Sattargaon village on 23rd December, 2018. As part of the celebration, a farmer-scientist interaction was also arranged in the village. The Director and senior scientists from the institute addressed the queries raised by pig farmers. They also introduced the new technologies developed at the institute to farmers.

Tribute to Late Sh. Atal Bihari Vajpayee, Former Primer Minister

The institute and ICAR-ATARI, Zone VI together paid tributes to former Prime Minister Late Sh. Atal Bihari Vajpayee on 16th September, 2018.

Mann ki baat

The Institute organized live video tele-casting show of Mann Ki Baat Programme of Prime Minister Shri. Narendra Modi on 20/06/2018 and 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.

Celebrations

New Year Celebrations

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.

Participation in zonal sports tournament

ICAR-NRC on Pig, Guwahati participated in Inter Zonal Sports Tournaments organized by ICAR-IINRG, Ranchi from 5th-8th October'2018. Following officials participated in the tournaments.

SL.No	Name of the Officials	Participated as	Participation in events	Performance
1.	Shri. Uttam Prakash	Chief De-Mission (CDM), Team Manager and Participant	Shot put throw, Javelin throw, 1500M Race, 800M Race.	Consolation
2.	Shri. Siba Chandra Deka	Participant	Carom Board, 400M Race, Long Jump	Consolation
3.	Shri. Jitumoni Kalita	Participant	Carom Board, 100M Race, 200M Race, High Jump.	Consolation

Glimpses from ICAR zonal sports meet

राजभाषा प्रकोष्ठ

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

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

कार्यालय में प्रत्येक तिमाही को राजभाषा कार्यन्वयन समिति बैठके 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।

राष्ट्रीय सूकर अनुसंधान केंद्र, राणी, 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 अधिनियमो एवं अन्य सभी आदेशों / अनुदेशों का अनुपालन कार्यालय द्वारा वर्ष में सफलतापूर्वक किया गया।

राष्ट्रीय सुकर अनुसंधान केंद्र, राणी, गुवाहाटी में हिंदी सप्ताह का आयोजन

राष्ट्रीय सूकर अनुसंधान केंद्र, राणी, गुवाहाटी में 14 सितम्बर 2018 से 20 सितम्बर 2018 तक हिन्दी सप्ताह का आयोजन किया गया।

हिन्दी सप्ताह का सुभारम्भ डा. स्वराज राजखोवा, निदेशक, राष्ट्रीय सूकर अनुसंधान केंद्र, राणी, गुवाहाटी द्वारा किया गया। निदेशक महोदय ने हिंदी भाषा का महत्त्व और सरकारी दफ्तरों में इसकी उपयोगिता के बारे में बताया तथा कार्यालय के सभी कर्मचारियों को अधिक से अधिक कार्य हिंदी में करने का आहवाहन किया। तद्पश्चात श्री उत्तम प्रकाश सहायक प्रशासनिक अधिकारी एवं प्रभारी राजभाषा अधिकारी ने माननीय गृह मंत्री, भारत सरकार द्वारा भेजा गया संदेश पढ़ सुनाया और हिंदी राजभाषा अधिनियम से सम्बंधित जानकारीया कर्मचारियों से साझा की तथा वर्ष भर कार्यालय द्वारा हिंदी कार्यों से संबधित प्रगति अवगत कराई। उन्होने बताया की कार्यालय नगर राजभाषा कार्यान्वयन समिति का सदस्य और समिती की बैठको में भाग ले रहा है। कर्मचारियों को उन्होंने हिंदी सप्ताह के दौरान होने वाली विभिन्न प्रतियोगिताओं एवं कार्यक्रमों के बारे में बताया।

हिंदी सप्ताह में निम्नलिखित कार्यक्रमों का आयोजन किया गया

दिनांक 14.09.2018	निबंध एवं हिंदी लेखन प्रतियोगता, स्थान, समिति कक्ष, समय : 3.30 बजे से
दिनांक 15.09.2018	छात्रों का निबंध लेखन प्रतियोगता स्थान : राणी हाई स्कूल, समय : 11.00 बजे से ।
दिनांक 15.09.2018	हिंदी कार्यशाला-01 (श्री उत्तम प्रकाश), स्थान : समिति कक्ष, समय : 3.00. बजे से।
दिनांक 17.09.2018	हिंदी कार्यशाला-02 (डा.सुनील कुमार), स्थान : समिति कक्ष, समय : 12.30. बजे से।
दिनांक 18.09.2018	हिंदी कार्यशाला-03 (श्री उत्तम प्रकाश), स्थान : समिति कक्ष, समय :12.30. बजे से।
दिनांक 19.09.2018	हिंदी कार्यशाला-04 (विशिष्ट अतिथि,डा.अचुत शर्मा,सह-प्राध्यापक,हिंदी विभाग, गुवाहाटी विश्वविद्यालय), स्थान : समिति कक्ष, समय :12.30. बजे से ।

दिनांक 20.09.2018	हिंदी कार्यशाला-05 (विशिष्ट अतिथि, श्री बद्री यादव, अनुसंधान अधिकारी एवं कार्यालय प्रमुख,क्षेत्रीय कार्यान्वयन कार्यालय,गुवाहाटी) स्थान : समिति कक्ष, समय :10.00 बजे से।
दिनांक 20.09.2018	वाद-विवाद प्रतियोगता, स्थान : समिति कक्ष, समय : 11.00 बजे से ।
दिनांक 20.09.2018 :	गायन प्रतियोगता, स्थान :समिति कक्ष, समय : 12.00 बजे से
दिनांक 20.09.2018	समापन सत्र

15/09/2018 हिंदी सप्ताह के दौरान स्थानीय स्कूल (राणी हाई स्कूल के कक्षा 7वी से कक्षा 10वी के छात्रों के बीच निबंध लेखन प्रतियोगता का आयोजन किया गया तद्पश्चात स्वच्छता अभियान के अंतर्गत छात्रों, अध्यापको एवं कार्यालय के कर्मचारियों द्वारा स्वच्छता कार्यक्रम किया गया। 18/09/2018 को कार्यालय में भारत रत्न एवं भूतपूर्व प्रधानमंत्री श्री अटल बिहारी बाजपेयी जी को श्रद्धांजलि दी गयी एवं इस कार्यक्रम में भा.कृ.अनूप - कृषि तकनिकी अनुप्रयोग संस्थान, गुवाहाटी के निदेशक एवं क्रमचारियों ने भी भाग लिया, इस पावन अवसर पर स्वर्गीय श्री अटल बिहारी बाजपेयी जी का कविताओ का पाठ कर उन्हें याद किया गया। 20/09/2018 कार्यक्रम के समापन अवसर पर विशिष्ट अतिथि श्री बद्री यादव अनुसंधान अधिकारी एवं कार्यालय प्रमुख, क्षेत्रीय कार्यान्वयन कार्यालय, गुवाहाटी एवं निदेशक राष्ट्रीय सुकर अनुसंधान केंद्र, राणी, गुवाहाटी ने संस्थान द्वारा लिखी हिंदी पुस्तक 'सूकर उत्पादकों के लिए हस्त पुस्तिका' का विमोचन किया। कार्यक्रम के समापन में राणी हाईस्कूल के छात्रों द्वारा सांस्कृतिक कार्यक्रमों का आयोजन किया गया निदेशक महोदय द्वारा हिंदी सप्ताह के समापन से पूर्व राणी हाई स्कूल के छात्रों एवं कार्यक्रम के विजयी प्रतिभागियों को पुरस्कृत कर सभी से अपील कि, की वे हिंदी भाषा में अधिक से अधिक कार्य कर राजभाषा को गौरावान्वित करे। श्री उत्तम प्रकाश, सहायक प्रशासनिक अधिकारी एवं प्रभारी राजभाषा अधिकारी ने सभी अतिथि गणों सभी कर्मचारियों एवं राणी हाई स्कूल के छात्रों एवं अध्यापको को धन्यवाद ज्ञापन के साथ कार्यक्रम का समापन किया।



Training Programs 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.

Sl. No.	Name of the training	Date	Sponsored by
1	Scientific Pig Farming	24th -28th April, 2018	Self sponsored
2	Advance Pig Husbandry Practices	15th -19th May, 2018	Mising Autonomous Council, Assam
3	Advance Pig Husbandry Practices	3rd -7th July, 2018	Institute Sponsored
4	Advance Pig Husbandry Practices	16th -20th July, 2018	Mising Autonomous Council, Assam
5	Scientific Pig Husbandry Practices	06th to 10th August , 2018	Mising Autonomous Council, Assam
6	Advance Pig Husbandry Practices	22nd -26th Oct, 2018	Institute Sponsored
7	Artificial insemination in Pig	29th -31st Oct, 2018	Govt of Arunachal
8	Artificial insemination in Pig	28th -30th Nov, 2018	Govt of Sikkim
9	Scientific Pig Husbandry Practices	11th -15th Dec, 2018	Individually sponsored
10	Artificial insemination in Pig	23rd -25th Jan, 2019	AICRP of Pig, Imphal centre
11	Trainer's training programme on clean pork production and value addition of pork	8th -12th Jan, 2018	Meghalaya Institute of Entrepreneurship
12	Trainer's training programme on skill up-gradation in clean pork production and value addition of pork	11th -14th Sept, 2018	Meghalaya Institute of Entrepreneurship
13	Trainer's training programme on scientific pig production practices	8th -12th Oct, 2018	Meghalaya Institute of Entrepreneurship
14	Trainer's training programme on scientific pig production practices	26th -30th Nov, 2018	Meghalaya Institute of Entrepreneurship
15	Trainer's training programme on skill up-gradation in clean pork production and value addition of pork	3rd -7th Dec, 2018	Meghalaya Institute of Entrepreneurship

Training Programs Organized

16	Master Training Programme for AHVD staff on Scientific Pig Farming	18th- 22nd Dec, 2018	APART, Govt of Assam
17	Master Training Programme for AHVD staff on Scientific Pig Farming	28th-1st Feb, 2019	APART, Govt of Assam
18	Master Training Programme for local service provider	4th-8th March, 2019	APART, Govt of Assam




Winter School

ICAR sponsored winter school on Climate change and pig production systems: Impact and mitigation strategies was successfully organized from 1st to 21st November 2018 at ICAR-NRC on Pig, Rani,Guwahati for the benefits of scientific, teaching and extension faculties from different organizations across the India. Twenty five participants from different states viz. Punjab, Kerala, Assam, Meghalaya and Mizoram participated in the programme. The 21 days winter school classes have covered diverse topics related to effect of climate change and mitigation strategies to be adopted by the pig rearers.

Training Programs Organized

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 Pigon19.2.2019 to 20.2.2019 . More than sixty scientists, specialist, 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 farmers 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" organized at ICAR-NRC on Pig on 23/03/2019

A day long National Workshop on "Biosecurity for Effective Management of Emerging Infectious Diseases of Pigs in NER" was organized on 23/03/2019 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.

AWARDS & RECOGNITIONS

Dr. Mohan N. H.

J.N.Pandey Memorial Best poster award of the Society of Animal Physiologists of India. Dr.N.H.Mohan. Award was received during annual conference of SAPI in NovEMBER 2018.

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 one Ph.D. Dissertation (Animal Genetics Breeding) of College of Vety. Sciences and Animal Husbandry of Assam Agricultural University.

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

Received "ICAR-Lal-Bahadur Shastri Outstanding Young Scientist Award – 2017" on 16th July, 2018.

Received First prize/ award for the oral presentation for the paper entitled "A more relevant grading system for Indian pig carcasses" during 8th Conference of Indian Meat Science Association, organized by WBUAFS, Kolkata during 22-24th November, 2018.

Empanelled as Expert in Meat Plant Inspection Committee by APEDA vide letter no. MPD/ MT/38/ 2018/124 dated 16-04-2018.

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 member in "Scientific Panel on Food Additives, Flavourings, Processing Aids and Materials in contact with food" under FSSAI.

Awards & Recognitions

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 Institutional Prizes in Hindi Essay Writing (First), Hindi Writing (First) on occasion of celebration of Hindi Pakhwada from 14/09/2018 to 29/09/2018 at ICAR- NRC on Pig, Rani.

Awarded first prize as co-author for presentation on Rani: a crossbred multiplier pig for doubling farmer's income in International Seminar on Animal Agriculture for doubling farmer's income from 27-28th Feb., 2019 at C.V.Sc., Khanapara.

Invited as expert on A.I. in Pigs by SANJEEVNI (Socio economic Welfare organization), Jharobari, Assam delivered 2 lectures and practical demonstration.

Dr. Misha Madhavan M.

Received best trainee award for securing 1st Rank in the 108th Foundation Course for Agricultural Research Service (FOCARS) organized from July 2nd to September 29th, 2018 at ICAR-NAARM, Hyderabad.

Received Ph.D. (Agricultural Extension Education), bronze medal and merit certificate for academic excellence during seventeenth convocation of ICAR-NDRI organized on 23rd March, 2019 at Karnal, Haryana.

Received second prize in the elocution competition organized as a part of vigilance awareness week from 29/10/2018 to 03/11/2018 at the institute.

Dr. Jaya

Invited lecture in CAFT in Veterinary Physiology on "Cataloging temporal and spatial variations in cell physiology using SAGE" at ICAR-IVRI, Izatnagar, Bareilly, U.P.

1st prize in elocution competition during observation of vigilance awareness week by ICAR-NRC on Pig from 29 Oct to 3rd Nov 2018

Dr. Amiya Ranjan Sahoo

Awarded Ph.D degree in Animal Genetics and Breeding from ICAR-Indian Veterinary Research Institute, Izatnagar, Bareilly, Uttar Pradesh.

Dr. Satish

2nd prize in Essay competition in 'Hindi Pakhwara Samaroh' at ICAR-NAARM

HUMAN RESOURCE DEVELOPMENT

Dr. Swaraj Rajkhowa

1. Attended the training on laboratory quality management at National Institute of Training for Standardization (NITS), Noida during 25-28th June, 2018.
2. Attended a Workshop on Development of Piggery Value Chain Ecosystem for Cooperative Sector in the North East Region, Jointly organized by NCDC, ICAR and Govt. of Meghalaya at State Convention Centre, Meghalaya on 22nd November, 2018.
3. Attended VIBCON 2018 Conference held at ICAR-NRC on Mithun, Jharnapani, Nagaland during 13-15th December, 2018
4. Attended State level farmers fair cum farmers-scientists' interaction on "doubling farmers income by 2022 at ATARI, Guwahati during 16-17th December, 2018.
5. Attended IAVMI conference at Bihar Agricultural University, Patna during 4-5th February, 2019
6. Attended National *Agri- business* Entrepreneurship *Conclave* held at ICAR Research Complex for NEH region, Umiam, Meghalaya during 9-11th February, 2019
7. Attended the meeting of the Directors with DDG (AS) at New Delhi on 24th April, 2018
8. Attended the Mid-term review of regional committee meeting held at Umiam, Meghalaya on 11th May, 2018.
9. Attended Regional meeting on piggery value chain at NABARD, organized jointly by ICAR-NRC on Pig and NABARD, Guwahati on 4th July, 2018.
10. Attended Director's Conference held at NASC complex, New Delhi on 16th July, 2018.
11. Attended the review meeting of international consulting assignments by agriculture production commissioner at ARIAS society office, Khanapara on 25th July, 2018.
12. Attended Annual Review meeting of AINP-NM at NRC-E, Hisar on 4th August, 2018.
13. Attended annual review meeting of AICRP on poultry breeding held at ICAR Res Complex for NEH region, Umiam, Meghalaya on 23rd August, 2018.
14. Attended the review meeting of ABI held at NASC complex, New Delhi on 28th August, 2018.
15. Attended meeting of Breed registration committee at Krishi Bhawan, New Delhi on 5th September, 2018.
16. Attended 4th State Level Executive Committee (SLEC) of the National Livestock Mission (NLM), Assam held at Assam Secretariat, Dispur on 10th September, 2018.
17. Attended 4th Meeting of the State Project Coordination Committee (SPCC) of World Bank funded APART Project held at Khanapara on 29th September, 2018.
18. Attended 3rd Meeting of National Technical and Implementation Committee (NTIC) for "Pig Development Plan for North East" at Krishi Bhawan, New Delhi on 5th November, 2018.
19. Attended Director's Conference at NASC complex, New Delhi during 31st Jan to 2nd February, 2019.

Dr. Santanu Banik

1. Interactive workshop on breed registration at NASC Complex Delhi
2. XVI Annual convention of ISVIB and National conference VIBCON-2018 on 'Innovative biotechnological approaches for improving animal health and productivity' organized by ICAR-NRC on Mithun, Medziphema, Nagaland.
3. State Level Farmers' Fair for Assam on 'Doubling farmers Income by 2022 in Assam: Technology approach and way forward" organized by ATARI Zone-IV, Guwahati.
4. 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. Attended Workshop on Intellectual Property Rights and Biodiversity Laws at ICAR- NRC on Pig, Guwahati
6. International seminar on 'Animal agriculture for doubling farmers' income: technology, policy and strategy options' at CVSC, AAU, Khanapara
7. Second Meeting of technical committee for formulation of Assam Pig Breeding Policy Assam at Office of the Director, Animal Husbandry and Veterinary Department, Govt. of Assam, Chenikuthi, Guwahati.
8. SAC meeting of KVK Goalpara, Dudhnoi
9. Federation of Indian Chambers of Commerce & Industry (FICCI) meeting at IIT, Guwahati
10. ICAR-Regional Committee Meeting at ICAR-RC for NEH, Barapani.
11. Attended Agricultural Conclave for resurgent agriculture & allied sector at Itanagar organized by Government of Arunachal Pradesh
12. Meeting of technical committee for formulation of Assam Pig Breeding Policy Assam at CVSc, Khanapara
13. Meeting with Hon'ble Minister of State, Ag Sri GS Shekhawat on Doubling Farmers Income at Taj Vivanta
14. Meeting of technical committee for formulation of Assam Pig Breeding Policy Assam at Office of the Director, Animal Husbandry and Veterinary Department, Govt. of Assam, Chenikuthi, Guwahati.
15. Meeting for piggery development on recommendation of Inter Ministerial committee at Guwahati
16. Meeting on formulation of pig breeding policy of Arunachal Pradesh at NRC on Pig, Guwahati
17. Meeting of technical committee for formulation of Assam Pig Breeding Policy Assam at Office of the Director, Animal Husbandry and Veterinary Department, Govt. of Assam, Chenikuthi, Guwahati.
18. National Livestock Mission (NLM) meeting at AH and Vety Dept., OTI Building, Khanapara
19. Meeting of ITRA project; ImageIDGP: Image based systems for identification of Individuals, Breeds and Diseases of Pigs and Goats at Kalyani Govt. Engg. College, Kalyani, Nadia.
20. Meeting with DADF and state officials for import of pig by NE states
21. Review meet of NEC funded project at NEC office, Shillong
22. Meeting with NCDC and state Govt. officials at Shillong
23. Annual Review meet of AICRP on Pig and Mega Seed Project on pig at NRC on Pig, Guwahati
24. Attended Review meet of ITRA project; ImageIDGP: Image based systems for identification of Individuals, Breeds and Diseases of Pigs and Goats at ICAR RC, Barapani.
25. First meeting of NSC (National Steering Committee) Piggery Development Plan for North East at ICAR-NRC on Pig
26. Interactive meeting on Biotech Kissan Project at ICAR RC, Barapani.
27. IMC meeting of ICAR-NRC on Yak at ICAR-NRC on Yak, Dirrang, Arunachal Pradesh

Dr. P.J. Das

1. Participated in the "International Seminar on Animal Agriculture for Doubling Farmers' Income: Technology, Policy and Strategy Options" held at College of Veterinary Science, Khanapara, Guwahati, on 27th and 28th of February, 2019.
2. Attended and deliver a lecture in the seminar on "Doubling Farmers' income through Biotechnological Application" in relation to the Golden Jubilee year 2018-19 celebration of Assam Agricultural University at District Library auditorium, Lakhimpur, Assam on 22nd of January, 2019.

3. Attending Yak Mela and 5th Interface Meeting at ICAR-NRC on Yak, Dirang on the topic "Improving Yak Husbandry through Technological Interventions – Way forward for Livelihood Security of Yak Farmers" on 16-17th November 2018.
4. Participated in one day workshop "Genomic selection and its implementation in India: the Way Forward" organized by ISAGB and ICAR-Indian Veterinary Research Institute at Indian Veterinary Research Institute on September 17, 2018.
5. Act as programme co-coordinator for one day workshop on farmers Scientist Interface at Dudhnoi, Goalpara along with scientists from National Institute of Animal Biotechnology, held at primary school Damora Patpar, Goalpara on 31st August 2018.
6. Conducted one day workshop on farmers scientist interface at KVK, Dhudhnoi, Goalpara on 2nd July 2018.
7. Attended State Conclave on Perspective Planning for Resurgent Agriculture & Allied Sector in Arunachal Pradesh held on Itanagar Secretariat on 18th to 19th May 2018. Organized by Arunachal Govt., NABARD, and CCRD.
8. Attended a workshop on Intellectual Property Rights and Biodiversity Laws from Feb 19-20, 2019 at ICAR-National Research Centre on Pig, Rani, Guwahati, Assam.
9. Represented in the Review meeting of Krishi Kalyan Abhiyan on 8th June 2018 at Assam Administrative Staff College, Khanapara Guwahati.
10. Attended the Regional Meeting on Piggery Value Chain organized by ICAR-NRC on Pig and NABARD on 4th July 2018.
11. Pre-review meeting with ITRA-Barapani to discuss the latest update of ITRA-e-Varaha. The meeting was held on 18th August at ICAR-NRC on Pig.
12. Attended ITRA project meeting on "E-Varaha: Information System for Safe Pork Production in North Eastern India" held at Department of Computer Science & Engineering of IIT, Guwahati, on 30th August 2018.
13. Attend the half-yearly Pre-review and review meeting of the project entitled "e-Varaha: Information System for Safe Pork Production in North East India" held at Kolkata & Kalyani Govt. Engineering College, University of Kalyani, Kalyani, West Bengal 741235 on 4th & 5th September 2018.
14. Attended meeting on "Policy for Private Investment Promotion in Livestock Sector in Assam" held on 28th November 2018 organized by Animal Husbandry and Veterinary Department & Dairy Development Department, Assam.
15. Attend Breed Registration Certificate distribution ceremony held on 12th December 2018 at Krishi Bhavan, New Delhi.
16. Attended meeting on "Buyer-seller Meet on Piggery" organized by NABARD, Guwahati on 17th December 2018.
17. Attended exhibition and shared information about of central government's schemes and programmes regarding piggery which is held at Khanapara, Guwahati, Assam on 4th May 2018. Vibrant North East-2018, May 3-5, 2018.

Dr. Mohan N. H.

1. Training Programme on Advanced Bioinformatics tools and its Applications in Agriculture" from 25-29th September 2018 at ICAR-NAARM, Hyderabad.
2. International training under LBS outstanding young scientist from 29.03.2018 to 28.06.2019 at Institute of Molecular Biology, Mainz, Germany
3. Meeting of the committee for revisiting compensation mechanism due to Avian Influenza, Glanders and PRRS on 11.06.2018 and 02.07.2018

4. Review Committee Meeting of National Agriculture Innovation Fund (NAIF) at NASC, New Delhi on 28 August 2018.
5. Meeting of National Technical and implementation committee on Pig development plan for North East, Organised by ICAR-NRC on Pig and DADF, Govt of India on 11th September 2018.
6. XXVII Annual Conference of Society of Animal Physiologists of India & National Symposium on Augmentation of Animal Productivity under Changing Socio-Economic Scenario ICAR-National Dairy Research Institute, Karnal (Haryana) from 27-28th November 2018.
7. XXV Annual conference of Indian Society of Veterinary Immunology & Biotechnology (ISVIB) (VIBCON- 2018) on Innovative Biotechnological Approaches for Improving Animal Health and Productivity organised by ICAR-National Research Centre on Mithun and ISVIB from 13-15th December 2018.
8. Regional Workshop on Biodiversity Laws for Scientists and Researchers organised at National Law University & Judicial Academy, Assam at NLU Assam- Guwahati in collaboration with National Law School of India University, Bangalore (NLSIU) and National Biodiversity Authority of India, and United Nations Development Programme-Global Environmental Finance (UNDP-GEF) from 22-23rd December, 2018.
9. 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
10. 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.
11. Agri-Startup conclave and Exhibition from 16-17th October 2018 forAgri-Start-ups and Innovations. NASC Complex, New Delhi.
12. Display of institute activities and technologies. State Level Farmers Fair Cum Farmers-Scientists' Interaction on "Doubling Farmers Income by 2022 from November 23-24, 2018organised by ICAR-ATARI, Guwahati, Assam.
13. 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.

Dr. R. Thomas

1. Completed 04 days training programme on "Laboratory Quality Management System and Internal Audit as per IS/ISO/IEC 17025:2017" held during 25-28th June, 2018 at National Institute of Training for Standardization, Bureau of Indian Standards, Noida, U.P.
2. Completed 08 days Skill development programme on "DNA techniques in Forensic Food Analysis" during 02-09th July, 2018 at ICAR-National Research Centre on Meat, Hyderabad.
3. 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.
4. Participated and delivered lecture in "Workshop on Intellectual Property Rights and Biodiversity Laws" organized by ICAR-NRC on Pig during 19-20th February, 2019.
5. Participated and presented paper in "National Agri-Business Entrepreneurship Conclave" held at ICAR-RC for NEH, Umiam during 9-11th February, 2019.
6. Participated and presented research paper in the International Symposium entitled "Technological Innovations in Muscle Food Processing for Nutritional Security, Quality and Safety" organized by WBUAFS, Kolkata during 22-24th November, 2018.

7. 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.
8. Delivered invited lecture in "Workshop on Intellectual Property Rights and Biodiversity Laws" organized by ICAR-NRC on Pig during 19-20th February, 2019.
9. Delivered Lead paper in "National Agri-Business Entrepreneurship Conclave" held at ICAR-RC for NEH, Umiam during 9-11th February, 2019.

Dr. Seema R. Pegu

1. Attended LQM training on IS 17025:2017 at NITS, Noida during 25th -28th June, 2018.
2. Attended Conference cum Workshop in "Host microbe Interaction" in IASST, Boragaon, Guwahati, Assam: 1st -2nd February 2019.
3. Attended International seminar at C. V. Sc, Khanapara, Assam Agricultural University, Guwahati-781022 from 27th to 28th February, 2019.
4. 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.
5. 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.

Dr. Sunil Kumar

1. Participated in National Workshop on Pig Biosecurity on 23rd March, 2019 at ICAR- NRC on Pig, Rani
2. Participated in Agricultural Science Congress from 20-23 Feb., 2019 at IARI, New Delhi
3. Participated in Workshop cum conference on Host Microbe Interactions from 1-2 Feb., 2019 at IASST, Ghy.
4. Participated in International Seminar from 27-28th Feb., 2019 at C.V.Sc., A.A.U., Khanapara
5. Participated in Workshop on IPR & Biodiversity laws on 23rd March, 2019 at ICAR-NRC on Pig, Guwahati
6. Participated in National Steering committee meeting on Piggery development plan for North East on 18th Jan., 2019 at ICAR-NRC on Pig, Rani
7. Participated in National Technical and Implementation committee on Pig Development plan for North East on 11th Sept., 2018 at ICAR-NRC on Pig, Rani
8. Participated in Workshop on Indian livestock farming and use of biotechnology (MILAN2017-18) with NIAB, Hyderabad on 2nd July, 2018 at KVK, Goalpara
9. Participated in Annual Review Meet of AICRP on Pig on 9th September, 2018 at ICAR-NRC on Pig, Rani

Dr. Jaya

1. Foundation course for Agricultural Research Service (FOCARS 108): ICAR- NAARM, Rajendranagar, Hyderabad.
2. Orientation training: ICAR- NRC on Pig, Guwahati, Assam.
3. Professional attachment training: ICAR-IVRI, Bareiily.

4. National workshop on "Biosecurity For Effective Management of Emerging Infectious Diseases of Pigs in NER" held at ICAR-National Research Centre on Pig, Guwahati, Assam.
5. Workshop on "Intellectual Property Rights And Biodiversity Laws organized by intellectual property management unit of ICAR-NRCP, Guwahati
6. Annual conference on propelling transition towards sustainable food production through rekindling physiological strategies for addressing contemporary challenges at ICAR-IVRI, Izatnagar, Bareilly, U.P.

Dr. A.R. Sahoo

1. 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.
2. Coastal Agri Expo 2019 held at ICAR-Central Coastal Agricultural Research Institute, Goa during 2-4 March 2019.
3. Contributed in Swatchh Bharat Abhiyan programme, PM Mann Ki Baat, Womens day programme
4. Foundation course for Agricultural Research Service (FOCARS 108): ICAR- NAARM, Rajendranagar, Hyderabad during 02-07-2018 to 29-09-2018.
5. Orientation training: ICAR- NRC on Pig, Guwahati, Assam during 09-10-2018 to 08-11-2018.
6. Professional attachment training: ICAR-CCARI, Goa during 12-11-2018 to 11-02-2019.

Dr. Satish Kumar

1. National workshop on "Biosecurity For Effective Management of Emerging Infectious Diseases of Pigs in NER" held at ICAR-National Research Centre on Pig, Guwahati, Assam.
2. Workshop on "Intellectual Property Rights And Biodiversity Laws organized by intellectual property management unit of ICAR-NRCP, Guwahati
3. Foundation course for Agricultural Research Service (FOCARS 108): ICAR- NAARM, Rajendranagar, Hyderabad.
4. Orientation training: ICAR- NRC on Pig, Guwahati, Assam.
5. Professional attachment training: ICAR-IVRI, Bareiily

Dr. Misha Madhavan M

1. Participated in the 108th Foundation course for Agricultural Research Service (FOCARS 108) organised at ICAR-NAARM, Rajendranagar, Hyderabad from July 2nd to September 29th, 2018.
2. Participated in the one month orientation training organised at ICAR- NRC on Pig, Guwahati, from 09-10-2018 to 09-11-2018
3. Attended three months professional attachment training at CGIAR- International Food Policy Research Institute (IFPRI), South Asia Office, New Delhi from 12-11-2018 to 11-02-2019.
4. Participated in the High-level Symposium on "Emerging Food Systems in South-Asia: Policy Challenges and Opportunities" jointly organized by IFPRI and NITI Aayog on December 4, 2018.
5. Participated in the Stakeholder meeting on "Climate Change Induced Salinity Intrusion & its Implications on Agriculture" jointly organised by IFPRI and Climate Change, Agriculture and Food Security (CCAFS) on December 18, 2018.
6. Attended workshop on "Intellectual Property Rights and Biodiversity Laws" organized by Intellectual Property Management Unit of ICAR-NRC on Pig, Guwahati

RESEARCH PROGRAMMES & PROJECTS

LIST OF INSTITUTE FUNDED RESEARCH PROJECTS

Project title	Principal Investigator
Flagship programme	
Artificial Insemination in Pigs	Dr. Sunil Kumar
Programme-1: Conservation and genetic improvement of indigenous pigs	
Development of suitable crossbred pig (Project code: IXX01640)	Dr. S.Banik
Phylogenetic analysis of pig mitochondrial genome sequences of native pigs of North East India (Project code: IXX13503)	Dr. P. J. Das
Characterization and expression profiling of Pig MSY (male-specific region of Y chromosome) genes for boar fertility. (Project code: IXX14211)	Dr. P. J. Das
Generation-wise genetic evaluation of rani crosses (Project code: IXX14634)	Dr. S. Banik
Programme-2: Optimization of physiological and reproductive efficiency including identifying markers for early detection of fertility	
Development of protocols for boar semen cryopreservation in pigs	Dr. Sunil Kumar
Development of early fertility markers in pigs (Project code: IXX12418)	Dr. Mohan. N. H.
Hormonal interventions for induction of cyclic ovarian activity in pre-pubertal gilts and anestrous sows (Project code: IXX12500)	Dr. Sunil Kumar
Development of protocol for boar semen cryopreservation in pigs	Dr. Sunil Kumar
Programme-3: Characterization of production system, feeding practices and their optimization for enhancing pig production, especially under field conditions	
Identification and strategic supplementation of limiting nutrients in pig feeding systems (Project code: IXX12839)	Dr. Kesab Barman
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	
Studies on zoonotic pathogens of porcine origin with special reference to Salmonella, Campylobacter and Staphylococcus species (Project code: IXX11238)	Dr. S. Rajkhowa
Development of loop mediated isothermal amplification (LAMP) assay for rapid detection of important zoonotic bacterial pathogens of pigs	Dr. S. Rajkhowa
Prevalence study of helicobacter infection in pigs with particular reference to gastritis (Project code: IXX12312)	Dr. Seema Rani Pegu
Programme–5: Technology upgradation of post-harvest handling, processing and value addition of pig products	
Development of kits for species authentication of fresh and processed pork products (Project code: IXX12375)	Dr. P. J. Das
Development of pork based ready to serve functional products (Project code: IXX13650)	Dr. R. Thomas
Development of grading system for carcasses of Ghungroo and its crosses	Dr. R. Thomas
Programme-6: Institute-stakeholder linkages and skill development	
IVLP programme under TSP	Dr. Keshab Barman

LIST OF EXTERNALLY FUNDED RESEARCH PROJECTS

Name of the project	Principal Investigator	Funding agency
DBT-NER centre for Advanced Diagnostics and services on Animal Health and diseases(ADMaC)	Dr. S. Rajkhowa	DBT, Govt. of India
Al India Network Programme on Neonatal Mortality in Farm Animals	Dr. S. Rajkhowa	ICAR
All India Coordinated Research Project on Pig: KVK, ICAR-NRC on Pig centre	Dr. S. Banik	ICAR
National Mission for Sustaining the Himalayan Agriculture	Dr. K. Barman	MoEF, Govt. of India
Image based systems for identification of individuals, breeds and diseases of pigs and goats	Dr. S. Banik	ITRA, Govt of India
e-Varaha: Information System for Safe Pork Production in North Eastern India	Dr. P. J. Das	ITRA, Govt of India
Molecular epidemiology of Japanese Encephelitis virus in pigs and mosquitoes in Assam	Dr. Seema Rani Pegu	DBT, Govt. of India
Development of Rapid Laboratory and Field Based Assays for Microbiological Quality Assessment of Pork	Dr. S. Rajkhowa	DBT, Govt. of India
MicroRNA mediated regulation of physiological responses during heat stress in pigs	Dr. N. H. Mohan	ICAR-LBS Award Project
Development of thermo-tolerant pig through biomarker assisted selection	Dr. N. H. Mohan	ICAR-National Fellow Project
Maize production in NEH region for sustainable livestock production	Dr. K. Barman	ICAR-Indian Institute of Maize Research
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
Setting up of quality control laboratory	Dr. R. Thomas	MoFPI, Govt. of India
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

PERSONNEL

ICAR-NRC ON PIG

Scientific staff

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

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. 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., Scientist (Veterinary Pathology)

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

Dr. Amiya Ranjan Sahu, M.Vsc.., 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, M.Vsc., 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 Clark

Ms. Hira Moni Thakuria, Jr. Stenographer cum Computer Operator

Supporting staff

Shri Naren Chandra Deka, Skilled Supporting Staff

Shri Ratul Baishya , Skilled Supporting Staff

Personnel

Krishi Vigyan Kendra, Dudhnoi

Dr. Hitu Choudhury, Ph. D., Programme Coordinator (i/c)

Mr. 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 cum Computer Operator

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

PUBLICATIONS

Research papers

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बनिक, शान्तनु, कुमार, सुनील, दास, प्रणब ज्योति, बर्मन, केशब, राजखोवा, स्वराज 2019। सूकर पालन – किसानों के लिए मैनुअल । भा.कृ. अनु. प.– राष्ट्रीय शूकर अनुसंधान केन्द्र, राणी, गुवाहटी, असम (77 पृष्ठ) ।

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