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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.

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Preface

Food security, more particularly the nutritional food security is a global concern and is getting more attention in most parts of our country due to population explosion, increasing pressure on land, rapid environmental degradation, frequent natural calamities and inequitable distribution of resources etc. In India pig husbandry plays a pivotal role in the socio-economic upliftment of rural population and is an occupation for livelihood and nutritional security of the rural people, especially in North-Eastern region. 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.

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 15 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. B. S. Prakash, Assistant Director General (Animal Physiology and Nutrition), 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.

The untiring efforts made by the Former Director, Dr. D.K. Sarma in bringing the institute to the lime light is duly acknowledged.

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 2017-18 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)

कार्यकारी सारांश

भा.कृ.अनु.प.–राष्ट्रीय शूकर अनुसंधान केन्द्र ने सफलतापूर्वक 15 साल पूरे किए हैं और शूकर पालन व शूकर मांस प्रसंस्करण से जुड़े उद्योगों में किसानों, विस्तार श्रमिकों और नीति निर्माताओं की उत्कृष्टता जारी रखी है। वित्तीय वर्ष 2017–18 के दौरान, संस्थान ने 11 वैज्ञानिकों, 06 तकनीकी कर्मचारियों और 06 प्रशासनिक और लेखा कर्मियों के साथ काम किया था। कुल योजना और गैर–योजना बजट आवंटन 1985.70 लाख रुपये थे और वित्तीय वर्ष के दौरान कुल व्यय 1966.28 लाख रुपये था। इस अवधि के दौरान संस्थान ने राजस्व के रूप में 142.9 लाख रुपये कमाए। संस्थान के वैज्ञानिकों ने अनिवार्य रूप से जनादेश के अनुसार छह प्रमुख कार्यक्रमों के तहत परिभाषित अनुसंधान और विस्तार से संबंधित विभिन्न लक्ष्यों को प्राप्त करने के लिए काम किया।

पशु आनुवंशिकी और प्रजनन

रानी और आशा क्रॉसब्रेड किस्मों को बनाए रखने के अलावा, हैम्पशायर शूकर की 75% विदेशी विरासत भी हैम्पशायर नर और रानी मादा के साथ शुरू की गई और प्रदर्शन का मूल्यांकन विभिन्न उत्पादक, प्रजनन और अनुकूली लक्षणों के लिए किया गया। शूकर लक्षणों की छवि–आधारित पहचान जैसे कान, कान शिरा–रचना, आईरिस, रेटिना, थूथन छाप और तस्वीर का अध्ययन किया गया । अंतिम में गया कि शूकर में कान शिरा–रचना पैटर्न और थूथन छाप को व्यक्तिगत पहचान के लिए इस्तेमाल किया जा सकता है। फोरेंसिकली न्यूक्लियोटाइड सीक्वेंसिंग (एफआईएनएस) के आधार पर प्रजातियों के भेद के लिए मिटोकॉन्ड्रियल जीन को लक्षित करके एक विधि को विकसित किया गया। सामान्य शूकर से बीमारियों के रोग के लिए आईआरटी छवियों की उपयोगिता का अध्ययन किया गया और सिंथेटिक रोग–विशिष्ट लक्षण ज्ञान आधार भी बनाया गया। स्थानीय स्वदेशी नस्लों और शूकर की विदेशी नस्लों के बीच संकरण के संभावित प्रभावों की जांच की गई और शूकर की स्वदेशी और विदेशी नस्लों के बीच फाईलोजेनेटिक संबंधों का विश्लेषण किया गया, पूर्वोत्तर में पाए जाने वाले शूकर के पहले पूरे एमटीडीएनए फाईलोजेनेटिक चित्र का निर्माण किया गया, और संख्या संरचना और उप–विशिष्ट संबंधों के बीच पहचान की गई। ताजा और प्रसंस्कृत मांस उत्पादों की प्रजातियों के प्रमाणीकरण के लिए, प्रजातियों के विशिष्ट पॉलीमरेज़ चेन रिएक्शन, आरएपीडी तकनीक और लूप–मध्यस्थ इथोथर्मल एम्पलीफिकेशन और डीएनए अनुक्रमण द्वारा घरेलू पोर्क, गोमांस और शिवोन से जंगली शूकरपोर्क की पहचान, पता लगाने के लिए रिपोर्ट अवधि के दौरान अध्ययन किया गया।

पशुओं का आहार

नियमित फ़ार्म आहार, संतुलित भोजन के साथ पूरक आहार और संतुलित भोजन के साथ फील्ड आहार की जांच की गई और यह पाया गया कि संतुलित फ़ीड के पूरक शूकर उत्पादन प्रदर्शन में सुधार करते हैं। इसके अलावा, यह पाया गया कि वृद्धि, पोषक उपयोग, फ़ीड रूपांतरण दक्षता में सुधार और फ़ीड लागत को कम करने के लिए उत्पादक पोषक भोजन को बढ़ने वाले क्रॉसब्रेड शूकरों में 18.9% प्रोटीन की खुराक को प्रतिस्थापित करके 3% स्तर पर पूरक किया जा सकता है। शूकरों को खिलाने के लिए स्थानीय रूप से उपलब्ध खाद्य संसाधनों की पहचान और विशेषता का प्रदर्शन किया गया और दिखाया गया कि किसान ज्यादातर शूकरों को खिलाने के लिए चावल पॉलिश, गेहूं, सूखी मछलियों, ताजा स्क्वैश, पेड़ के पत्तों आदि जैसे स्थानीय खाद्य संसाधनों का उपयोग करते हैं। एन.ई.एच. राज्यों के शूकर पालन क्षेत्रों में एक सर्वेक्षण कार्य शूकर पालन प्रक्रियाओं की वर्तमान स्थिति को दस्तावेज करने के लिए किया गया।

पशु शरीर क्रिया

गर्म वातावरण (जयपुर, राजस्थान) और मध्यम तापमान (गुवाहाटी, असम) में जानवरों के बीच तुलना की गई ताकि किसी भी विशिष्ट जीन अभिव्यक्ति पैटर्न की जांच हो सके ताकि बढ़ते थर्मोटोलरेंस वाले जानवरों की पहचान और चयन किया जा सके। प्रारंभिक परिणामों ने सुझाव दिया कि गर्मी शॉक प्रोटीन (एचएसपी 27, एचएसपी 70, एचएसपी 9 0, एचएसपी 105) के एमआरएनए स्तर में वृद्धि एचएसपी 70 और एचएसपी 9 0 जीन से उच्च प्रतिक्रिया के साथ गर्मी और ठंडे सदमे के तनाव का प्रमाण देती है। गर्मियों और सर्दियों के मौसम के दौरान स्वदेशी (माली) और विदेशी (हैम्पशायर) शूकरों में पूरे ट्रांसक्रिप्टम परिवर्तन की जांच की गई। इसके अलावा, शूकर में गर्मी के तनाव के दौरान शारीरिक प्रतिक्रियाओं के विनियमन में, माइक्रो आरएनए के लक्ष्यों की पहचान करने के लिए, एक आरएनए इम्यूनोप्रिएरी (आरआईपी) परख का उपयोग किया गया। आरआईपी प्रोटोकॉल को मानकीकृत किया गया और सीडीएनए लाइब्रेरी के रूप में विकसित किया। प्रजनन मार्करों के विकास के लिए, आरएनए–सीक का उपयोग करके प्रजनन में भिन्न होने वाले शूकर के शुक्राणुजन्य ट्रांसक्रिप्टोम और संस्थान के ए.आई. कार्यक्रम में उपयोग किए जाने वाले शूकर की प्रजनन स्थिति की तुलना में जांच की गई।

पशु प्रजनन

कृत्रिम गर्भाधान से फार्म व किसान क्षेत्र में क्रमश: 974 व 7395 सूकर पैदा हुए। बिना एंटीबायोटिक के जेपस विस्तारक में 20% एगयोक व हर्बल डी.टि.ई.के साथ वीर्य हिमीकरण की विधि मानकीकृत की गई। मानकीकृत प्रोटोकॉल के अनुसार तीन प्रकार के वाणिज्यिक रूप से उपलब्ध विस्तारकों (I, II, III) की तुलना करने के लिए प्रयोग किए गए, जहां पूरक वाणिज्यिक विस्तारकों (I, II) की तुलना में विस्तारक–III एक बेहतर विस्तारक पाया गया। हालांकि, समग्र स्वीकार्य पोस्ट–थॉ प्रजनन क्षमता हासिल नहीं हो पाई, और प्रयोग जारी रहेगा। इसके अलावा, विटामिन ई और सेलेनियम का पूरक फॉरोइंग तनाव को कम करने हेतु बेहतर पाया गया और भविष्य में, हार्मोनल प्रशासन से पहले इस तरह के पूरक को जानवरों में विलिंग से एस्ट्रस अंतराल को कम करने में उपयोग किया जा सकता है।

पशु स्वास्थ्य

सूक्ष्म महामारी विज्ञान और जूनोटिक क्षमता सहित शूकरों के पेट में *हेलिकोबैक्टर* संक्रमण के प्रसार पर अध्ययन किए गए। पशु प्रयोग के माध्यम से पैथोजेनेसिटी परीक्षण *हेलिकोबैक्टर* प्रजातियों के लिए लिया गया। असम की शूकर आबादी में जेईवी संक्रमण के प्रसार पर अध्ययन किए गए। *साल्मोनेला, कैम्पिलोबैक्टर* और *स्टाफिलोकोकस* प्रजातियों के विशेष संदर्भ के साथ पोर्सिन उत्पत्ति के जूनोटिक रोगजनकों पर अध्ययन किए गए। नवजात शिशु मृत्यु दर में कमी के लिए प्रयुक्त प्रोहिलेक्टिक / उपचारात्मक उपाय, भ्रूण ऊतकों से पीपीवी की तीव्र पहचान के लिए विकसित नैदानिक विधि और संगठित शुकरपालन में नवजात शिशु मृत्यु दर के लिए जिम्मेदार गैर संक्रामक कारक निर्धारित किए गए। एआईसीआरपी के विभिन्न शूकर से प्राप्त नवजात शिशु मृत्यु दर का विश्लेषण किया गया और नवजात शिशु मृत्यु दर के लिए जिम्मेदार प्रमुख कारणों / कारकों का मूल्यांकन किया गया। शूकर मांस से *स्टाफिलोकोकस ऑरियस* के तेजी से पता लगाने के लिए एक लूप मध्यस्थ आइसोथर्मल एम्पलीफिकेशन (एलएएमपी) परख विकसित किया गया।

पशुधन उत्पाद प्रौद्योगिकी

भारतीय शूकर शवों और प्रासंगिक शूकर मांस ग्रेडिंग के लिए एक सिस्टम जिसमें अलग ग्रेड (गिल्ट / बैरो में ग्रेड 1, 2, 3 और 4 और शूकरी में ग्रेड 1, 2, 3 और सी) और गुणवत्ता ग्रेड (ग्रेड पी, आई, एन और डी) विकसित किया गया। गिल्ट / बैरो और शूकरी कार्सास के लिए ग्रेड के विभिन्न वर्गों को आवश्यक पैरामीटर के बीच परिवर्तन के पैटर्न में अलग अंतर के कारण जरूरी था, जो सीधे शव उपज को प्रभावित करते थे जैसे ठंडा शव वजन, पिछली वसा मोटाई और प्रारंभिक कटौती की प्रतिशत उपज। विभिन्न नस्लों और किस्मों से आंकड़ों को नौ वर्षों की अवधि में एकत्रित किया गया और उन्हें संबंधित ग्रेड में सौंपा जाने से पहले गंभीर रूप से विश्लेषण किया गया । इसके अलावा, अलग-अलग गिल्ट / बैरो और शूकरी के लिए विभिन्न शूकर शव के ड्रेसिंग परिचालन में समानता सुनिश्चित करने और ग्रेडिंग की सुविधा के लिए, ठंडा शव वजन के आधार पर मानक ड्रेसिंग विनिर्देश विकसित किए गए। रिटॉर्ट प्रोसेसिंग टेक्नोलॉजी का उपयोग करके शेल्फ स्थिर शूकर मांस उत्पादों की छह संख्या विकसित की गई। रिपोर्ट की अवधि के दौरान कार्यात्मक शूकर मांस उत्पादों की सेवा के लिए तैयार पोर्क का विकास शुरू किया गया । एमओएफपीआई के वित्तीय समर्थन के तहत गुणवत्ता नियंत्रण प्रयोगशाला स्थापित करने की प्रक्रिया प्रगति पर है। आईएस 17025 प्राप्त करने की प्रक्रिया के लिए 2017 प्रमाणीकरण शुरू किया गया है। ग्रामीण शूकर वध घर (प्रति दिन 5-6 शूकर के लिए) के लिए एक लागत प्रभावी (5 लाख रुपये) डिजाइन तैयार किया गया और ग्राम पंचायत रानी, के सहयोग से रानी बाजार में एक मॉडल इकाई स्थापित की गई। मॉडल इलेक्ट्रिकल आश्चर्यजनक, उन्नत कैरस ड्रेसिंग, स्वच्छता फैब्रिकेशन और पोर्क के पैकेजिंग के प्रावधान प्रदान करता है। पब्लिक-प्राइवेट-पार्टनरशिप (पीपीपी) मोड के तहत विकसित प्रौद्योगिकियों को लोकप्रिय बनाने और छोटे पैमाने पर उद्यमियों के साथ घनिष्ठ संबंध स्थापित करने के लिए प्रयास किए गए, जो सुधारित प्रौद्योगिकियों को लेने के इच्छुक हैं, जैसे मैसर्स अरोहान फूड्स प्राइवेट लिमिटेड, गुवाहाटी और मैसर्स सयुरी फार्म, गुवाहाटी ।

शूकर पर एआईसीआरपी और मेगा सीड परियोजना

वर्तमान में शूकर पर एआईसीआरपी (15 केंद्र) और शूकर पर मेगा सीड (07 केंद्र) परियोजना देश भर के विभिन्न केंद्रों में जारी है। पिछली एआईसीआरपी समीक्षा बैठक 1-2 जुलाई, 2017 को श्री वेंकटेश्वर पशु चिकित्सा विश्वविद्यालय, तिरुपति में आयोजित की गई थी। दो नए एआईसीआरपी केंद्र गुरु अंगद देव पशु चिकित्सा एवं विज्ञान विश्वविद्यालय, लुधियाना और क्रांतिसिंह नाना पाटिल पशु चिकित्सा विज्ञान कॉलेज, शिरवल के में खोले गए। शूकर की मेगा सीड परियोजना के तहत 2017-18 में वितरण के लिए कुल 5879 नंबर पिगलेट की बेहतर विविधता का उत्पादन किया गया। मेगासीड पर एक नया केंद्र पशुपालन और पशु चिकित्सा सेवा विभाग, सिक्किम में खोला गया ।

कृषि विज्ञान केंद्र

के.वी.के. गोलपाड़ा ने 130 प्रशिक्षणों का आयोजन किया। वर्ष 2017-18 में किसानों के अभ्यास करने के लिए 90, ग्रामीण युवाओं के लिए 34 और विस्तार कार्यकर्ताओं के लिए 6 जिसमें क्रमश: 1314, 968 और 79 प्रशिक्षुओं को लाभान्वित किया गया। उद्यमियों को तकनीकी मार्गदर्शन देने के लिए कालीन बुनाई पर सात दिन का प्रशिक्षण आयोजित किया गया। इस अवधि में केवीके गोलपाड़ा ने 11 ओएफटी आयोजित किए। विभिन्न विषयों के तहत फार्म ट्रायल (ओएफटी) में से सस्य विज्ञान में 03, बागवानी में 01, संयंत्र संरक्षण में 04, पशु विज्ञान में 01, कृषि इंजीनियरिंग में 01 और होम साइंस में 01 ओएफटी आयोजित किए। विभिन्न विषयों के तहत 09 फ्रंट लाइन प्रदर्शन (एफएलडी) को आयोजित किए। 0 9 में से सस्य विज्ञान में 03, बागवानी में 01, संयंत्र संरक्षण में 02, पशु विज्ञान में 01, कृषि इंजीनियरिंग में 01 और होम साइंस में 01 एफएलडी आयोजित किए।

अन्य

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

EXECUTIVE SUMMARY

The ICAR-National Research Centre on Pig has successfully completed 15 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 2017-18, the Institute functioned with 11 scientists, 06 technical staff and 06 administrative and accounts personnel. The total plan and non-plan budget allocations were Rs 1985.70 lakh and the total expenditure was Rs 1966.28 lakhs during the financial year. The institute has generated Rs 142.9 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

Besides maintaining Rani and Asha crossbred varieties, 75% exotic inheritance of Hampshire pig was also initiated by crossing Rani female with Hampshire males and performance was evaluated for different productive, reproductive and adaptive traits. Image-based identification of pig traits viz., ear contour, ear venation, iris, retina, muzzle imprint and picture of pigs were studied. It was finalized that auricular venation pattern and muzzle imprint in pig can be used as a tool for individual identification. A method for species differentiation based on Forensically Important Nucleotide Sequencing (FINS) was developed targeting mitochondrial genes. Usefulness of IRT images for discriminating disease from normal pigs was studied and a synthetic disease-specific symptom knowledge base is also created. The potential effects of hybridization between local indigenous breeds and exotic breeds of pig were examined and analyzed the phylogenetic relationship between indigenous and exotic breeds 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. For species authentication of fresh and processed pork products, identification of pork by species-specific Polymerase Chain Reaction and DNA sequencing, RAPD technique to detect wild pork from domestic pork, beef, and chevon and identification of pork by Loop-Mediated Isothermal Amplification was studied during reported period.

Animal Nutrition

Comparison among regular farm diet, field diet without supplementation and field diet with balanced diet was investigated and it was found that supplementation of balanced feed improve the production performance of pigs. Further, it was found that that silkworm pupa meal can be supplemented @ 3 % level by replacing 18.9 % protein supplements in grower crossbred pigs to improve growth, nutrient utilization, feed conversion efficiency and also to reduce the feed cost. Identification and characterization of the locally available feed resources for feeding of pigs was done and showed that farmers mostly used local feed resources like rice polish, wheat bran, dry fishes, fresh squash, tree leaves etc for feeding of pigs. A survey work in the pig rearing regions of NEH states to document the present status of pig husbandry practices was carried out.

Animal Physiology

A comparison was made between animals reared in hot environment (Jaipur, Rajasthan) and moderately warm environment (Guwahati, Assam) to examine any specific gene expression pattern to identify and select animals with increased thermotolerance. Preliminary results suggested that increased mRNA levels of heat shock proteins (HSP27, HSP70, HSP90, HSP105) respond to heat and cold shock stress with highest response from HSP70 and HSP90 genes. The whole transcriptome changes in indigenous (Mali) and exotic (Hampshire) pigs during summer and winter season was examined. Further, in order to identify targets of micro RNA, in regulation of physiological responses during heat stress in pigs, a RNA immunoprecipitation (RIP) assay was used. RIP protocol was standardized and cDNA library developed from the immunoprecipitated RNA. For development of fertility markers, 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 was examined.

Animal Reproduction

The total numbers of piglets born in the farm and in the farmers' house were 974 and 7395 respectively. Semen freezing protocol in GEPS extender 20% egg yolk and without antibiotic containing a herbal DTE compound was standardized. Experiments were conducted to compare three types of commercially available extenders (I, II, III) as per the standardized protocols, where in extender III one was found superior in comparison to supplemented commercial extenders (I, II). However, overall acceptable post-thaw fertility was not achieved and experiments are in continuation. Further, supplementation of Vitamin E and Selenium was found to improve the post farrowing parameters by possible mitigation of peri and post farrowing stress and in future, such supplementation before hormonal administration, may be used in animals having prolonged weaning to estrus interval.

Animal Health

Studies on prevalence of *Helicobacter* infection in the stomach of the pigs including molecular epidemiology and zoonotic potential were carried out. Pathogenecity trial through animal experimentation was taken for *Helicobacter* species. Studies on prevalence of JEV infection in pig population of Assam undertaken. Studies on zoonotic pathogens of porcine origin with special reference to *Salmonella*, *Campylobacter* and *Staphylococcus* species were carried out. Formulated prophylactic / therapeutic measures for the reduction of neonatal piglet mortality. Developed diagnostic method for rapid detection of PPV from foetal tissues. Non-infectious factors responsible for neonatal piglet mortality in organized pig farms were determined. Analyzed neonatal piglet mortality data obtained from different pig farms of AICRPs on Pig and evaluated the major causes / factors responsible for neonatal piglet mortality. Developed a loop mediated isothermal amplification (LAMP) assay for rapid detection of *Staphylococcus aureus* from pork.

Livestock Products Technology

A more relevant pork grading system was developed for Indian pig carcasses with distinct yield grades (Grade 1, 2, 3 & 4 in case of gilt/barrow and Grade 1, 2, 3 and C in case of sow) and quality grades (Grade P, I, N and D). Different classes of grades for gilt/barrow and sow carcasses was necessitated due to distinct difference observed in the pattern of change among the parameters which were directly affect the carcass yield viz. chilled carcass weight, back fat thickness and percent yield of primal cuts. Data were collected from different breeds and varieties over a period of nine years and critically analyzed before assigned them to the respective grades. Also, to ensue uniformity in the dressing operations of different pig carcass and to facilitate grading, standard dressing specifications were developed based on chilled carcass weight, separately for gilts/barrows and sows. Developed six numbers of shelf stable pork products using retort processing technology. Development of pork based ready to serve functional pork products was initiated during the reported period. The process of establishing a quality control laboratory under financial support of MoFPI is in progress. The process for obtaining IS 17025:2017 certification for the said lab has been initiated. A cost effective (Rs.5 lakhs) design for rural pig slaughter house (for 5-6 pigs per day) has been designed and a model unit has been established at Rani Market in collaboration with Gram Panchayat, Rani. The model offers provision for electrical stunning, elevated carcass dressing, hygienic fabrication and packaging of pork. Efforts were taken to popularize the developed technologies and to establish close linkage with small scale entrepreneurs who are willing to take up the improvised technologies, notably through M/s Arohan Foods Pvt. Ltd., Guwahati and M/s Sayuri Farms, Guwahati under Public-Private-Partnership (PPP) mode.

AICRP and Mega seed Project on Pig

Presently the AICRP on Pig (15 centers) and Mega seed Project on Pig (07 centres) are continuing in different centers across the country. The last AICRP review meet was conducted at Sri Venkateswara Veterinary University, Tirupati on 1-2nd July, 2017. Two new AICRPs Centre were opened at Guru Angad Dev Veterinary and Animal Science University, Ludhiana and Krantisinh Nana Patil College Of Veterinary Science, Shirval. A total of 5879 nos. of improved variety of piglets were produced for distribution in 2017-18 under Mega seed Project on Pig. A new centre on Megaseed was opened in Department of Animal Husbandry and Veterinary Services, Sikkim.

Krishi Vigyan Kendra

KVK Goalpara organized 130 nos. trainings under subheads of 90 for practising farmers, 34 for rural youth and 6 for extension functionaries benefitting 1314, 968 and 79 trainees respectively in the year 2017-18. A seven days hands on carpet weaving training was also conducted for encouraging and giving technical guidance to entrepreneurs. In this period KVK Goalpara has conducted 11 nos. of On Farm Trial (OFT) under various disciplines. Out of 11 nos. of OFTs 03 nos. were in Agronomy, 01 no. was in Horticulture, 04 nos. were in Plant Protection, 01 no. was in Animal Science, 01 no. was in Agricultural Engineering and 01 no. was in Home Science. It also conducted 09 nos. of Front Line Demonstration (FLD) under various disciplines. Out of 09 nos. of FLDs 03 nos. were in Agronomy, 01 no. was in Horticulture, 02 nos. were in Plant Protection, 01 no. was in Animal Science, 01 no. was in Agricultural Engineering and 01 no. was in Home Science.

Others

The Institute also observed various official functions such as Republic Day, Independence Day, Hindi Pakhwada, Institute Foundation Day and World Environment Day. Various social events were also organized by the Recreation Club for the 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.

SALIENT ACHIEVEMENTS DURING 2017-2018

1. Developed a crossbred pig variety with 75% exotic inheritance of Hampshire pig by crossing Rani female with Hampshire males and their performances were evaluated.
2. An IT based tool for the holistic development of the pig farming under the project E-Varaha was undertaken and developed an information system for Safe Pork Production in North Eastern India.
3. Phylogenetic analysis of Pig mitochondrial genome sequences revealed that there is a close relationship between native pigs of NER with the wild counterpart.
4. Standardized species authentication techniques for fresh and processed pork products as well as developed kits for species authentication of pork.
5. Comparisons were made using different types of pig rations both at farm and field level. It was found that supplementation of balanced feed improve the production performance of pigs.
6. Studies revealed that silkworm pupa meal can be supplemented @ 3 % level in pig ration to improve growth, nutrient utilization, feed conversion efficiency as well as to reduce the feed cost.
7. Studies on whole transcriptome in indigenous (Mali) and exotic (Hampshire) pigs during summer and winter season could identify some differently expressed novel genes, indicating difference in the response of indigenous and exotic breeds of pig during thermal stress in different seasons of the year.
8. Studies on zoonotic pathogens of pigs such as Japaneese Encephalitis, *Salmonella*, *Compylobactor* and *Staphylococcus* spp. were carried out with special emphasis on epidemiology and development of diagnostics.
9. Developed diagnostic method for rapid detection of poricine parvovirus from biological samples of pig.
10. Developed a loop mediated isothermal amplification (LAMP) assay for rapid detection of *Staphylococcus aureus* from pork.
11. A more relevant pork grading system was developed for Indian pig carcasses with distinct yield grades (Grade 1, 2, 3 & 4 in case of gilt/ barrow and Grade 1, 2, 3 and C in case of sow) and quality grades (Grade P, I, N and D).
12. A cost effective (Rs.5 lakhs) design for rural pig slaughter house (for 5-6 pigs per day) has been designed and a model unit has been established at Rani Market in collaboration with Gram Panchayat, Rani.
13. Organized one National Satellite Seminar on 'Emerging and Remerging infectious diseases and their impact on Pig Health' and a Winter School on 'Advances in Molecular Techniques in Animal Health and Production with particular reference to Pigs' during the reported period.
14. Institute has organized 16 numbers of training programs in the areas of scientific pig farming, artificial insemination, clean pork production and value addition.
15. KVK Goalpara organized 130 nos. trainings under subheads of 90 for practising farmers, 34 for rural youth and 6 for extension functionaries benefitting 1314, 968 and 79 trainees respectively in the year 2017-18.
16. Institute has generated Rs. 142.9 lakh as revenue during 2017-2018.

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 08 scientists are in position.

Sanctioned posts of the insitute as on 31-03-2018

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

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 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

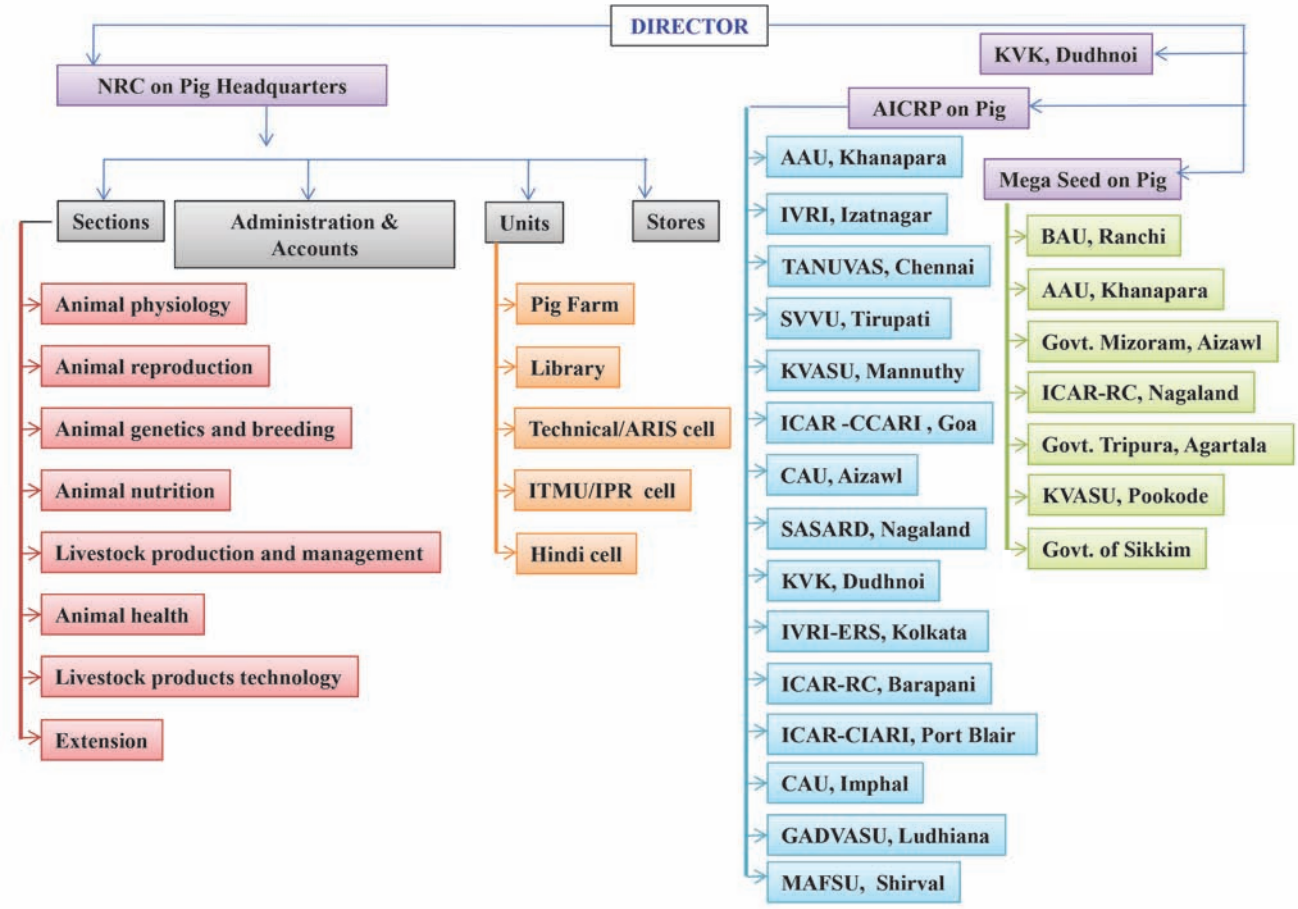
Statement showing the sub head wise expenditure under plan and non-plan budget (Rs in lakh):

Name of the Scheme/ Project		Pay and allowances	TA	Rec. Contingency	Repair & Maint-enance under Admin.	Lives-tock	Furniture	Equip.	Works	IT	HRD	Others	TOTAL
ICAR-NRC ON PIG (Main Scheme)	R.E.	375.00	15.00	-	376.20	9.00	10.00	75.40	59.00	5.00	3.00	05.00	932.60
	EXP	372.50	12.03	-	367.83	9.00	9.65	73.97	59.00	1.85	2.40	1.85	913.18
AICRP ON PIG	R.E.	170.00	15.00	334.40	40.00	15.00	5.00	21.00	112.00	0.00	0.00	0.00	712.40
	EXP	170.00	15.00	334.40	40.00	15.00	5.00	21.00	112.00	0.00	0.00	0.00	712.40
MEGA SEED ON PIG	R.E.	0.00	4.50	220.00	20.00	12.00	0.00	16.00	68.00	0.00	0.00	0.00	340.70
	EXP	0.00	4.50	220.00	20.00	12.00	0.00	16.00	68.00	0.00	0.00	0.00	340.70
Total	R.E.	545.00	34.50	554.60	436.20	36.00	15.00	112.40	239.00	5.00	3.00	5.00	1985.70
	EXP	542.50	31.53	554.60	427.83	36.00	14.65	110.97	239.00	4.95	2.40	1.85	1966.28

REVENUE GENERATION

Sl. No.	Particulars	Revenue (Rs)
1	Sale of livestock, farm products, pork and pork products etc.	10032285.20
2	Other receipts	4263747.00
Total		**14296032.20**

ORGANIZATIONAL SETUP



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

Physical Progress

PHYSICAL PROGRESS

Modern pig sheds

Two numbers of modern pig sheds were constructed during the reported period. The sheds have automatic water dispensing nipples and the internal partitions are made of galvanized iron bars. The sheds can accommodate 40 breeding boars in total.

Fig. Modern pig sheds

Feed godown cum pelleting unit

Institute has established a feed godwon cum pelleting unit for processing pelleted feed for the pigs. The unit can process approximately 1000 kg of pelleted feed per day.

Fig. Feed pelleting unit

Quality Control Laboratory

A quality control laboratory (QC Lab) for analyzing the quality of pork and pork products has been set up in the institute with the financial assistance received from ICAR as well as Ministry of Food Processing Industries. Dr. Trilochan Mohapatra, Honourable Secretary, DARE and Director General, ICAR, New Delhi has inaugurated the laboratory on 3rd September 2017. This laboratory has the facilities to test different microbial pathogens, pesticide and drug residues present in pork and pork products. Inauguration programme was co-ordinated by Dr.Dilip Kumar Sarma, Director ICAR-NRC on Pig and was attended by Dr. R.S.Gandhi, ADG (AP&B), ICAR, and Dr. Devinder Dhingra, Nodal officer and Principal Scientist (Process Engineering), ICAR. This state of the art facility is of first kind in the country which will definitely help in import and export certification of pork and pork products.

Fig. Quality control laboratory

Research Projects

I. ANIMAL GENETICS AND BREEDING

Institute Project: Development of suitable crossbred pig

S. Banik, M.K. Tamuli, S. Rajkhwoa, K. Barman and R. Thomas

Under the project tow improved crossbred variety namely Rani and Asha was developed. Rani crossbred variety was developed with 50 percent exotic inheritance of Hampshire and Ghungroo pigs characterized with higher growth rate, larger litter size at birth and weaning for better economic return to the breeder farmers. The generation-wise breeding data was systematically analyzed for the developed variety. Selection of animals is done on the basis of performance records maintained at the farm. The developed variety was studied for different productive, reproductive and carcass characteristics for selection under inter-se-mating system. The breed characters of Rani crossbred has been stabilized for consistent crossbreeding of six generations. The terminal cross was done by crossing Rani females with Duroc male to get a three breed synthetic strain, Asha (H25G25D50). The performance of different productive, reproductive, adaptive and carcass characteristics of developed crosses was evaluated and supplied to farmers. Ten sire lines of Hampshire and 19 dam line of Ghungroo was used to develop the Rani animals. Mating ratio of 1:2.5 (M: F) was followed. Initially the mating was done by natural mating. However, since 2011 all the mating is done by artificial insemination (AI). Though the breeding plan was started in 2009, now a sizable number of crossbred animals are available in the institute as well as at farmers' field.

Besides maintaining and systematic breeding of developed Rani and Asha crossbred variety, 75% exotic inheritance of Hampshire pig was also initiated by crossing Rani female with Hampshire males. The performances of this cross were also evaluated for different productive, reproductive and adaptive traits.

Salient economically important traits of 75% exotic inheritance (H75G25) Cross

Productive and reproductive performance	
Avg. Litter size at birth (no.)	9.39±0.94
Avg. Litter weight at birth (kg)	10.04±0.85
Avg. weight/piglet at birth (kg)	1.11±0.02
Avg. Litter size at weaning (no.)	8.61±0.55
Avg. Litter weight at weaning (kg)	53.22±3.85
Avg. weight/piglet at weaning (kg)	6.13±0.10
Weaning Period (days)	42
Pre-weaning growth rate (g/d)	139.33±0.67
Post-weaning growth rate (g/d) (Weaning to 8 months)	327.77±20.19
Weight at 8 m of age/slaughter (kg)	68.44±1.74
Adaptive traits	
Pre-weaning mortality rate (%)	5.8%
Post-weaning mortality rate (%)	4.95%

The developed 75% cross can gain almost 70 kg body weight at slaughter age of 8 months which is slightly lower than Rani crossbred variety, however the difference is non-significant.


Rani pig


Rani Piglets


Asha


75% Piglet with sow


75% Grower


75% Piglet

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

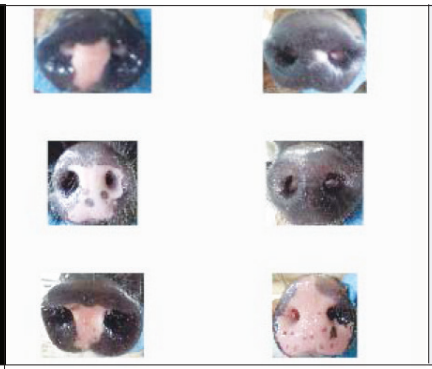
S. Banik, Mohan. N.H and S. R. Pegu

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 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. Branch points (upto secondary branching) of the ear venation pattern were considered in the analysis. Considering the specific co-ordinate value of branch points; calculation of the Euclidean distance between two participating image branch points was determined. After detail study it was concluded that average Euclidean distance of venation pattern of same individual is less than 20. At a time the developed technique can match 5 images and calculate the average distance individually.

For muzzle analysis, Breeds such as Duroc, Ghungroo and Hampshire show a lot of internal details as they tend to come from rougher environments compared to Yorkshire. There is a gradation in the number and density of these interest points which can be used to segregate breeds (this patch density conjecture has been verified through rigorous experimentation). First the gradient magnitudes are computed at each point using a Gaussian Smoothened Differentiation parameterized by a standard deviation parameter □. A high number of interest points mainly hair/cilia, pores and contour curvatures are captured by setting □=1 (window size is 7×7, which absorbs speckle noise and other forms of impulse noise due to dust particles while preserving the other details). Gradient based features were Developed and successfully adapted for both Individual as well as breed classification. Results are promising and can be stretched to a larger scale.

The captured image of iris of goat 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 80 percent matching was achieved for repeated image of same individual.

Ear venation pattern imaging of pigs
(Collaboration and photo courtesy: Kalyani Govt. Engineering College)



Muzzle pattern profiling of pig
(Collaboration and photo courtesy: IIT Guwahati)

Iris profiling of goat for individual identification
(Collaboration and photo courtesy: Kalyani Govt. Engineering College)

Identification of candidate biometrical trait(s) for measurement of whole body contour for indigenous goat and pig breeds was standardized. The image-based identification of breed was successfully carried out by using multi-layer neural networks procedure and segmentation method. More than 50 pictures randomly collected form organized farm, field, internet and other sources of five breeds of pig viz. Large White Yorkshire, Duroc, Ghungroo, Niang Megha and Hampshire and three breeds of goats viz. Black Bengal, Jamunapari and Sirohi were used for TensorFlowTM study. TensorFlowTM is a framework created by Google for creating Deep Learning models, a machine learning process (algorithms) by using multi-layer neural networks. Among the different category of neural network, TensorFlowTM is using Convolution Neural Network (CNN or ConvNET) which has proven to be very effective in areas such as image recognition and classification. The framework successfully recognized all breeds of pigs and goats fed to the network. However the programe failed to detect crossbred individuals due to admixture of phenotypic appearance of different pure bred animals. The open source software TensorFlowTM can be used as a tool for breed identification of pig and goat.

For segmentation by HUE analysis 800 pictures were captured for four different pig breeds viz., Ghungroo, Large White Yorkshire, Hampshire and Duroc. The HSV color wheel is depicted as a cone or cylinder. HUE is the color portion of the color model, and is expressed as angular measurement from 0 to 360 degrees. HUEs are described by a number that specifies the position of the corresponding pure color on the color wheel, as a fraction between 0 and 1. In the study, only HUE value is taken for identification of breeds both pigs and goats. It was observed that whole body cannot be represented by one color due to variation of colour of different parts of body. Hence, body colors of animals are represented by range of minimum and maximum HUE value. The segmentation method was able to classify the breeds of pigs and goats.

Tensor FlowTM showed 99% matching result for breed identification of pigs

Image	Segmentation	
		**Hue range:** 0.068 to 0.866 **Degree** 18 to 51.2 degree approx

Identification of breed by Segmentation process
(Collaboration and photo courtesy: Kalyani Govt. Engineering College)

Institute Porject: 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

Pig (*Sus scrofa*) is one of the most valued animal and is distributed in the diverse climatic conditions in the world from temperate to hot and humid zone. Although it has the raising history more than 8,000 years, the domestication and origin of pigs found in India need to be reclassified. 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 origin and domestication of pigs of this region. North East India is one of the regions originally feed pigs and the differences in climate and geography have contributed to the development of different indigenous pig breeds, many of which have special and unique characteristics. Most of the native breeds found in North East India are considered rare, have a small population size, and are under increasing pressure from the introgression of modern commercial breeds. This makes investigations of both population structure and genetic diversity increasingly important. The purpose of this study was to investigate the origin and domestication of pigs of Northeast India by using mitochondrial genomic sequences.

Amplification of complete mtDNA sequence of Pig found in NE region

The blood samples were collected from different indigenous pig breeds found in NE region. This includes Ghoongroo from Tarai region (NRCP farm), Niyang Megha from Meghalaya (RC-NER, Barapani), Tenyi Vo (from Nagaland), Zovawk (from Mizoram), Mali (from Tripura), Doom (from lower Assam), Non descript (from upper Assam), Rani- Crossbred (NRCP farm),Asha-Cross bred (NRCP farm) Wild Pig- Wildlife rescue centre. A total of 30 primer were designed covering whole mtDNA genome of pigs. While designing primer it was kept in mind that primer should have overlap segments, so that exact sequences can be achieved. Each 25µl polymerase chain reactions (PCR) reaction consist of 12.5µl PCR Master Mix, 1.0µl DNA template, 0.5µl of each primer (10 pm), and 10.5µl nuclease-free water. The PCR thermocycler was set at an initial denaturation at 94°C for 5 min, followed by 30 cycles of 94°C for 30 s, 58 to 60°C based on the primer sequences for 30 s, and 72°C for 50 min, with a final extension at 72°C for 10 min. The product

sequence length was checked by 1.5% agarose gel electrophoresis (Fig.1). PCR products were purified by PCR Purification Kit. The complete mtDNA genomes of ten indigenous pig breeds of NE were sequenced using ABI Sanger Sequencing. The DNA sequences were assembled using Clustal X and exported to FASTA file. The complete sequence was annotated using MITOS and DOGMA. Evolutionary history of the indigenous pig breeds of NE was inferred using the neighbor-joining (NJ) method. Partially derived phylogenetic tree clearly distinguish the pig sequences of North East region by geographical definition. By using modern sequencing technologies to obtain whole mtDNA genome sequences from different indigenous pig breed of North East and wild cattle 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.

Fig.1.Amplification of Complete mtDNA genome of NE Pig using 30 primers

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

Pork is an important component of food basket of consumers in eastern and northeastern states of India. However, there exists a taboo on consumption of pork by certain communities. Adulteration of pork with other meat is a possibility and needs to be checked for protecting consumers trust and halal authentication. Another urgent need for authentication of fresh and processed pork is that wild boar which are related closely to domestic pigs are protected species under Wild Life Act, 1972. Being a protected species their hunting and consumption are prohibited in India. Poaching of wild boars and consumption in the name of pork is often reported from different parts of North Eastern Region. Samples involving such issues are sent to food analysts for authentication. ICAR-National Research Centre on Pig, Guwahati being a premier Institution working on piggery need to develop techniques for authentication of pork and its differentiation from other meat animal species. Currently, molecular techniques followed for species identification are PCR based which

require sophisticated equipment like thermocycler, electrophoresis units, and gel documentation system. Under the project, a Loop-Mediated Isothermal Amplification (LAMP) technique developed which enabled amplification of the targeted gene at constant temperature and result can be interpreted easily based on the color change in the solution. The technique is simple, can be easily undertaken by semiskilled person and can be done easily with simple instruments. In addition, different laboratory confirmation tests based on PCR are also developed under this project.

Meat/ blood samples of wild pigs were collected from Bilaspur Zoo, Chattisgarh. The meat of domestic pigs was collected from Experimental abattoir of ICAR-NRC on Pig, Guwahati. As part of the project, a method for species differentiation based on Forensically Important Nucleotide Sequencing (FINS) was developed targeting mitochondrial genes. Primers targeting mitochondrial Cytochrome B gene, Cytochrome C Oxidase, D loop were designed and utilized for PCR amplification. While published primers of mt 12S rRNA gene were utilized for PCR amplification. PCR amplification was achieved with all primers. PCR amplicons of all the genes were got sequenced. Nucleotide sequences were aligned using Megalign program of DNA STAR software. Nucleotide similarity and divergence scores of different genes of the domestic and wild pig are given in table 1 to 4. Sequencing of different mitochondrial genes of the domestic and wild pig was done in this work. Whereas, mitochondrial gene sequences of cattle, buffalo, sheep, goat, and chicken were downloaded from National Centre for Biotechnology Information (NCBI) database.

Identification of pork by species-specific Polymerase Chain Reaction and DNA sequencing

PCR amplicons of different mitochondrial genes of domestic and wild pigs run on the agarose gel is given in Fig. 1. Sequence analysis and alignment with different sequences revealed that all the selected genes could authentically differentiate biological samples originated from domestic pigs. Mitochondrial 12S rRNA gene of domestic pig showed 76.4, 76.5, 75.5, 62.2 and 75.6 % identity with Cattle, buffalo, goat, chicken, and sheep respectively. Sequence identity and divergence of mt 12S rRNA gene, mt D loop gene, mt Cytochrome Oxidase I gene and Cytochrome gene were sufficient to differentiate biological samples originated from the domestic pig with that of other closely related livestock species. Sequence analysis revealed that mitochondrial 12S rRNA gene sequence of wild pig showed 99.7 % identity with domestic pig while it showed 88.2, 89.3, 87.7, 72.8 and 88.2 % identity with Cattle, buffalo, goat, chicken, and sheep respectively. Mt Cytochrome B gene did not reveal the differences required for differentiation between domestic and wild pig while the sequence differences were sufficient enough for its differentiation from other meat animal species. Mitochondrial Cytochrome B gene showed the highest polymorphism for differentiating biological samples derived from domestic and wild pigs. Mitochondrial D loop and Cytochrome C Oxidase revealed 97.3 and 97.7 % identity with that of the domestic pig. Results revealed that species authentication of biological samples derived from wild pigs can successfully be achieved by Forensically Important Nucleotide sequencing targeting mitochondrial genes.

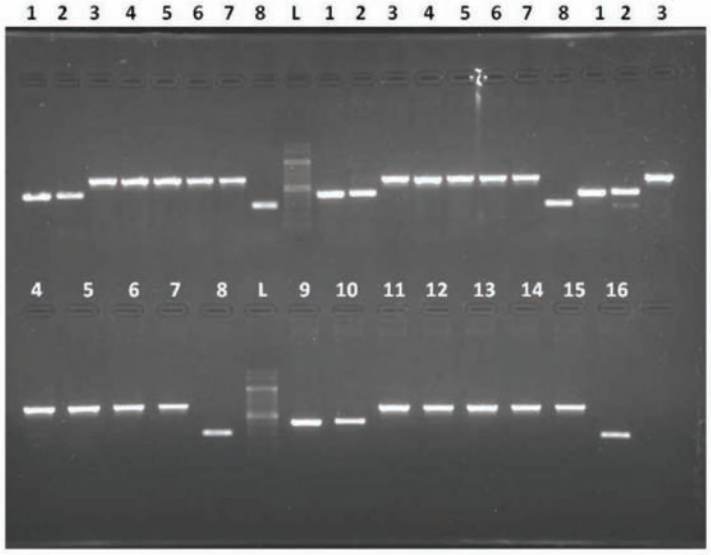
RAPD technique to detect wild pork from domestic pork, beef, and chevon

For RAPD PCR process was conducted using 50 µl volume of the reaction mixture prepared in an Eppendorf tube containing 5 µl of 10xPCR buffer, 7.5 µl of 25mM MgCl2, 250mM dNTP, 2 U Taq DNA polymerase, 25pmol 10-nt primer and 5µl target DNA. The sequence of the 10-base primer used was used to detect wild pork from domestic pork, beef and chevon. The thermocycler was programmed for a 45-cycle PCR. Each cycle was composed of denaturation at 950C for 5 min followed by holding at 940C for 1 min, at 340C for 1 min and at 720C for 2 min. A 15-mL portion of the amplified DNA fragments was run on the agarose gel (1.5%) at 100 volts for 2 h for electrophoresis. The resulting gel was stained using ethidium bromide (0.5mg/mL) and visualized using a UV transilluminator and photographed. Results indicated that the RAPD profiles generated using the 10-base primer from domestic pigs, wild pig, beef and goat meats were distinctly different from each other and visually distinguishable (Fig. 2).

Identification of pork by Loop-Mediated Isothermal Amplification

Samples of meat from pig, cattle, buffalo, sheep, goat, and chicken were obtained from local market and DNA was extracted from meat by using DNeasy tissue DNA extraction kit. Two sets of primers for Loop-mediated isothermal amplification was designed by targeting mitochondrial D loop gene by using Primer Explorer V5 software. For LAMP PCR was conducted using Reaction mix containing 10 X Thermopol buffer (3 µl), 5 M Betaine (3 µl), 50 mM MgSo4 (3 µl), 10 mM dNTP mix (4 µl), 10 pmol F3 primer (1 µl), 10 pmol B3 primer (1 µl), 40 pmol FIP primer (4 µl), 40 pmol BIP primer (4 µl) and template DNA (5 µl) was heated at 95º C for 5 min for denaturation. After denaturation step, 8 units (1 µl) of BstI enzyme was added to reaction

mix and incubated at 65º C for 1 hour. It was followed by heating at 80º C for 2 min for inactivation of BstI enzyme. The negative control without addition of DNA was used for every experiment. After LAMP reaction, amplification was visualized by addition of 1 µl of 1:10 SYBR green I dye (10000 X). The positive reaction was indicated by green color whereas negative reaction yielded orange color. In the present work, a rapid method for authentication of pork by Loop-mediated isothermal amplification (LAMP) is reported. The novel set of primers specific to pig was designed targeting mitochondrial D loop gene. LAMP reaction was visualized by adding SYBR Green I dye. Positive amplification yielded green color whereas negative amplification yielded orange color (Fig.3). LAMP gave positive amplification in pig and no amplification could be seen in other meat animal species viz., cattle, buffalo, sheep, goat, and chicken. LAMP technique was applicable for species authentication even in meat samples treated at 121º C for 30 min. The technique was also validated in commercial pork products viz., breakfast sausage, cocktail sausage, masala sausage, kababs and ham square rolls sold in the local market. The LAMP is economical as only essential equipment required for both DNA extraction and LAMP in this method is a dry bath. The technique takes only 2 hours to complete.



Lane 1: mt 12S rRNA gene amplification in wild boar;
Lane 2: mt Cyt B amplification in wild boar;
Lane 3 - 7 : Mt Cyt C oxidase amplification in wild boar;
Lane 8: Mt D loop amplification in wild boar
Lane 9: mt 12S rRNA gene amplification in domestic pig;
Lane 10: mt Cyt B amplification in domestic pig;
Lane 11 - 15 : Mt Cyt C oxidase amplification in domestic pig
Lane 16: Mt Cyt C oxidase amplification in domestic pig;
Lane L: 100 bp DNA ladder

Fig.1.PCR amplification of different mitochondrial genes in wild and domestic pig DNA samples

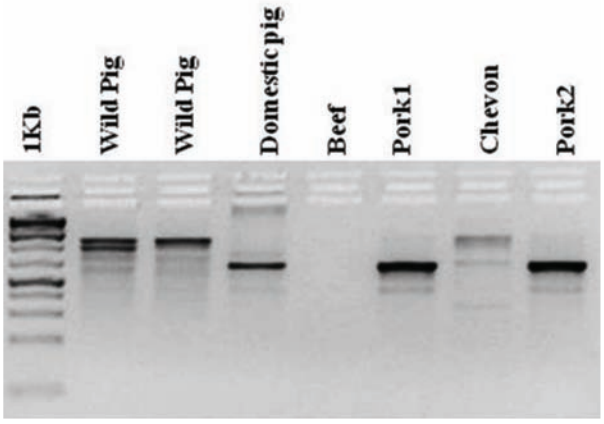


Fig.2.RAPD technique detects wild pork from domestic pork, beef and chevon

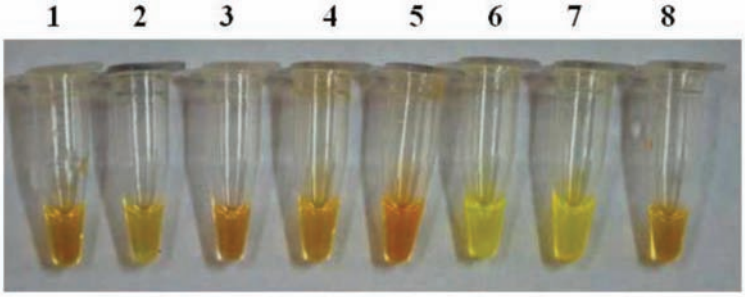


Fig.3.Species identification of pork by Loop Mediated Isothermal Amplification

Percent Identity

Divergence

	1	2	3	4	5	6	7	
1		99.7	88.2	89.3	87.7	72.8	88.2	1
2	0.3		76.4	76.5	75.5	62.2	75.6	2
3	13.1	23.6		86.2	84.1	63.1	84.3	3
4	11.2	21.9	13.1		86.1	63.0	86.2	4
5	13.7	21.3	15.8	15.7		62.4	89.5	5
6	31.1	45.3	44.2	42.9	43.3		61.8	6
7	12.8	21.4	15.6	15.5	11.5	43.3		7
	1	2	3	4	5	6	7	

1 Wild Boar 12S rRNA
2 Sus Scrofa mt
3 Bos taurus Mt
4 Bubalus bubalis Mt
5 Capra hircus mt
6 Gallus gallus mt
7 Ovis aries

Table 1: Nucleotide sequence similarity (upper triangle, %) and divergences (lower triangle, %) of mitochondrial 12S rRNAgene of different meat animal species.

Percent Identity

Divergence

	1	2	3	4	5	6	7	
1		97.3	51.7	87.0	88.9	92.0	7.3	1
2	2.7		76.4	76.5	75.6	75.5	62.2	2
3	0.0	24.4		86.2	84.3	84.1	63.1	3
4	0.0	22.5	13.2		86.2	86.1	63.0	4
5	0.0	22.0	15.9	15.8		89.5	61.9	5
6	0.0	21.9	15.9	16.1	12.0		62.4	6
7	143.4	53.7	51.5	50.1	49.7	49.7		7
	1	2	3	4	5	6	7	

1 Wild boar D loop
2 Sus Scrofa mt
3 Bos taurus Mt
4 Bubalus bubalis Mt
5 Ovis aries mt
6 Capra hircus mt
7 Gallus gallus mt

Table 2: Nucleotide sequence similarity (upper triangle, %) and divergences (lower triangle, %) of mitochondrial D loop gene of different meat animal species.

Percent Identity

Divergence

	1	2	3	4	5	6	7	
1		97.7	81.0	79.4	82.0	82.4	78.4	1
2	2.4		76.4	76.5	75.5	75.6	62.2	2
3	22.1	23.6		86.2	84.1	84.3	63.1	3
4	24.4	21.9	13.1		86.1	86.2	63.0	4
5	20.7	21.4	15.8	15.7		89.5	62.4	5
6	20.3	21.4	15.6	15.5	11.5		61.9	6
7	25.7	45.6	44.2	42.9	43.1	43.2		7
	1	2	3	4	5	6	7	

1 Wild boar Cyt Oxidase 1
2 Sus Scrofa mt
3 Bos taurus Mt
4 Bubalus bubalis Mt
5 Capra hircus mt
6 Ovis aries mt
7 Gallus gallus mt

Table 3: Nucleotide sequence similarity (upper triangle, %) and divergences (lower triangle, %) of mitochondrial Cytochrome C Oxisase I of different meat animal species.

Percent Identity

	1	2	3	4	5	6	7	
1		95.5	77.3	80.0	79.3	77.6	73.3	1
2	4.7		76.4	76.5	75.5	75.6	62.2	2
3	26.3	23.9		86.2	84.1	84.3	63.1	3
4	23.5	22.1	13.1		86.1	86.2	63.0	4
5	24.4	21.6	15.8	15.7		89.5	62.4	5
6	26.9	21.6	15.6	15.5	11.5		61.9	6
7	33.5	45.9	44.5	43.0	43.3	43.3		7
	1	2	3	4	5	6	7	

Divergence

1 Wild boar Cytochrome B
2 Sus Scrofa mt
3 Bos taurus Mt
4 Bubalus bubalis Mt
5 Capra hircus mt
6 Ovis aries mt
7 Gallus gallus mt

Table 4: Nucleotide sequence similarity (upper triangle, %) and divergences (lower triangle, %) of mitochondrial Cytochrome B gene with different meat animal species.

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

P.J. Das, Girish P.S., S. Banik, K. Barman, S. Rajkhowa and S.R.Pegu

Pigs play a pivotal role in meeting the nutritional requirements of ever-increasing Indian population owing to its unique attributes such as high fecundity, shorter generation interval, early sexual maturity, higher dressing percentage and low cost of production. Piggery is instrumentally contributing to food basket of the North Eastern Region (NER) of India. NER with 8% of the geographical area and 4% of the population possesses 38.38% of the country's pig population. One of the biggest challenges facing 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. In the wake of enactment of Food Safety & Standards Act, 2006, producing pork hygienically is mandatory. Scientifically, clean/ safe pork indicates meat free from physical, chemical, microbiological and parasitical hazards. 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. The project is initiated to visualize the importance of using different 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. This, in turn, would pave way for the rural development and in the long term, it would contribute to the nutritional security. Rapid pig health monitoring using Infra-Red (IR) imaging, microbial quality evaluation using Biosensors, image-based faecal analysis for detecting parasitic load and farm-to-fork traceability system for pork are the novel approaches used under this project. To achieve the targeted goal all the technical information for software development along with questionnaires for the survey has been completed during report period. Structural schedule for recording Pig marketing information from Pig Farmers, Pig traders and Pork traders' is developed. Based on the questionnaires, mobile and desktop application for survey system successfully implemented and deployed. It is currently working and is being used by all institutes to feed survey data. Already information was collected from 150 Pig farmers/Pig traders/Pork traders. The present survey documented that live pigs are brought from a major pig market located in Assam (Morigaon), Meghalaya (Byrnihat) and Nagaland (Dimapur) which are then transported by pig traders to a market in Shillong (Iewduh), Meghalaya and other parts of the region. Survey information revealed that pigs are traded from Garo Hills, Jaintia Hills to Shillong. Survey information also revealed that Diphu, Amguri, New Bongaigaon, Gogamukh, and Jonai are few major pig markets in Assam.As per the surveyed data; the four major states on the movement of pigs within the NE region are Assam, Meghalaya, Nagaland, and Mizoram. Data collected from pig traders in NE region revealed that most pigs are brought from Uttar Pradesh and Delhi to a major pig market located in Byrnihat (Assam)

which acts as an entry point to all the NE states. An international border between Mizoram and Myanmar serves as an entry point from other country as revealed from the surveyed data. Myanmar an adjoining country is involved in the import and export of live pigs to the NE region. Survey data revealed that pork and pork products are produced locally in the Kamrup district for local consumers and supply to different markets in NE region. Most pork and pork products are produced in the NE region are consumed (approx. 80%) locally and brought by tourist to different States of India (approx. 20%). There is no organized market channel for sale the pork and pork product in NE region. Mizoram is a deficit State in the supply of pork products in the market. In the major markets of Mizoram like Aizawl, Lunglei, Kolasib etc. other than local pork products, a lot of branded and packaged pork products are also available. There is no record of export of pork or pork products from Mizoram to any other states or outside the country. Development of IT-based systems for examining the health status of slaughter pigs and post-mortem examination of carcasses is another major objective of the study. Under which a sophisticated infra-red thermal camera has been procured. Different images of body temperature of the normal and diseased pigs were taken at different times by using the Infra-red Thermal camera (Fig.1). Different images of body temperature of the pig were taken at pre-slaughter and post-slaughter level for examining pig and pork quality. Preliminary work has shown that usefulness of IRT images for discriminating disease from normal pigs. A synthetic disease-specific symptom knowledge base is also created (Fig.2). A web-based Decision Support System (DSS) on different diseases of the pig has been developed to arrive at a decision on which pig can be converted into consumable quality pork.

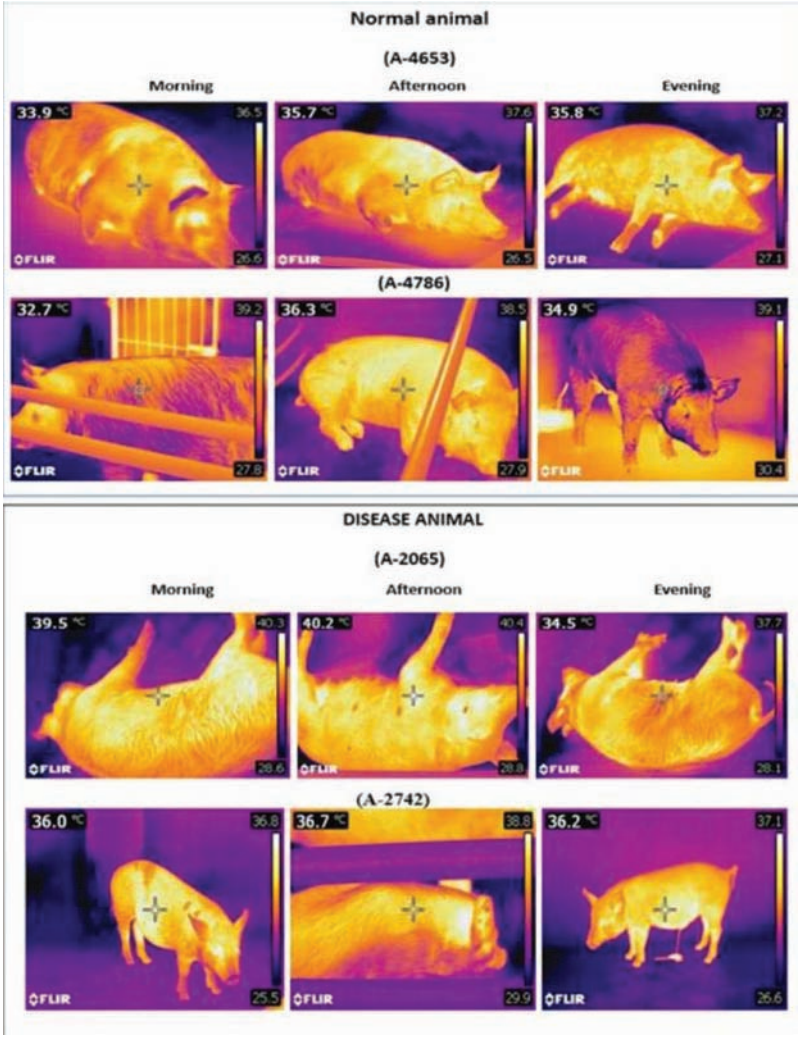


Fig.1. IRT images for discriminating disease from normal pigs

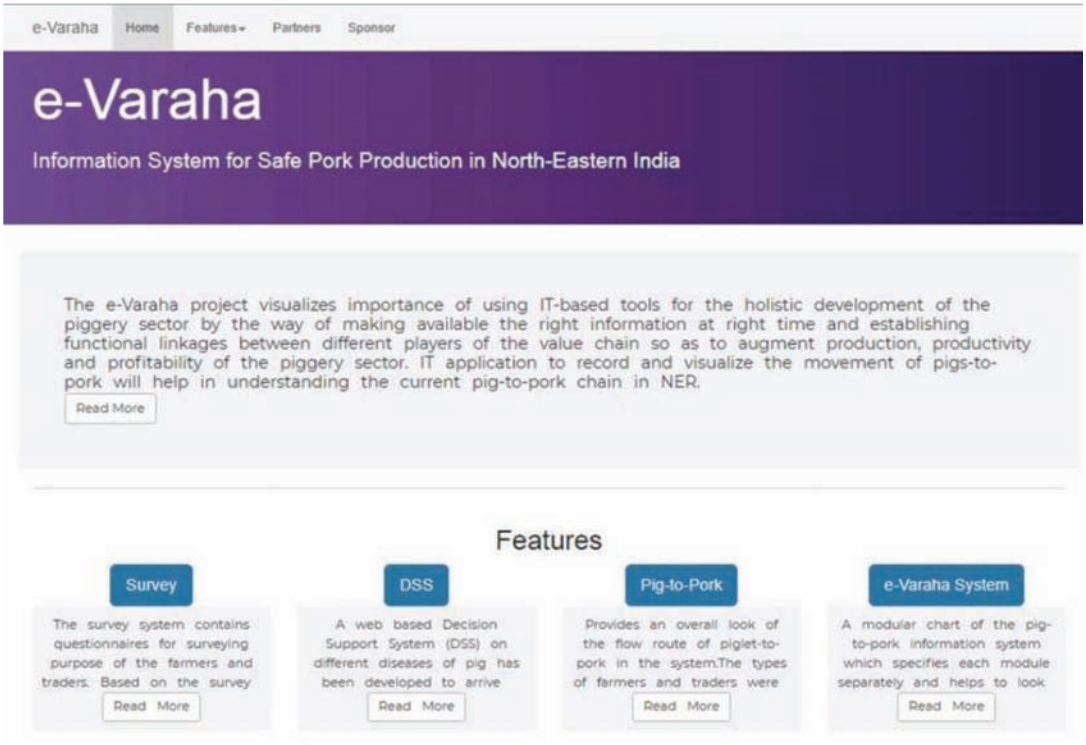


Fig.2. Web base system for Piggery Management in North Eastern Region

II. ANIMAL NUTRITION

Institute Project: Identification and strategic supplementation of limiting nutrients in pig feeding systems

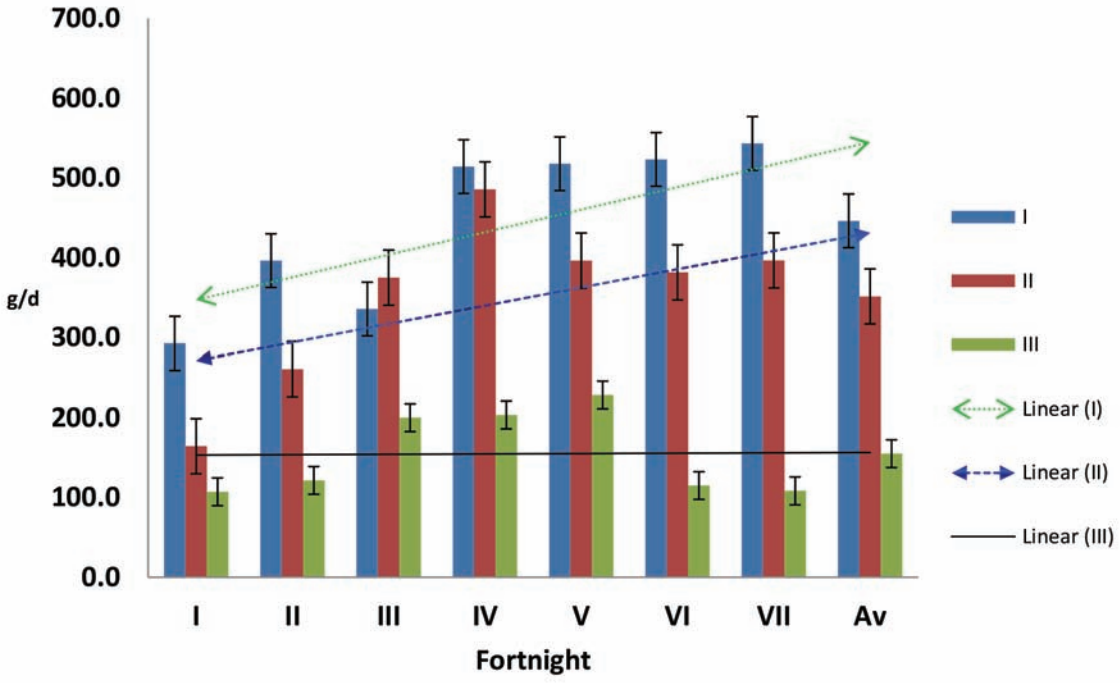
K. Barman, D. K. Sarma, Mohan.N.H and R. Thomas

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. Beside 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: Nutrient utilization in experimental animals with regular farm diet, field diet with balanced nutrition and field diet without supplementation

Parameters	T_1	T_2	T_3	Level of significant	P value
Feed intake, kg/d	1.242^{a}±0.11	1.155^{b}±0.05	1.055^{c}±0.08	**	0.000
Initial Body wt, kg	22.90±2.83	21.75±1.97	21.20±1.27	NS	0.848
Final Body wt, kg/d	53.30^{a}±2.68	45.20^{b}±1.36	30.58^{c}±1.22	**	0.0004
Growth, g/d	446.3^{a}±11.0	351.5^{b}±11.9	154.9^{c}±5.5	**	0.000
FCR (Feed : Gain ratio)	3.06^{a}±0.08	3.90^{b}±0.12	8.85^{c}±0.31	**	0.000
Feed cost/kg gain, Rs	76.6±1.9	83.3±2.6	88.65±3.10	NS	0.080

T1: Regular farm diet; T2: Field diet with balanced nutrition and T3: Field diet without supplementation a,b,c different superscript in a row differ significantly (**, P<0.01)



Fortnightly body weight gain of experimental animals at different dietary conditions

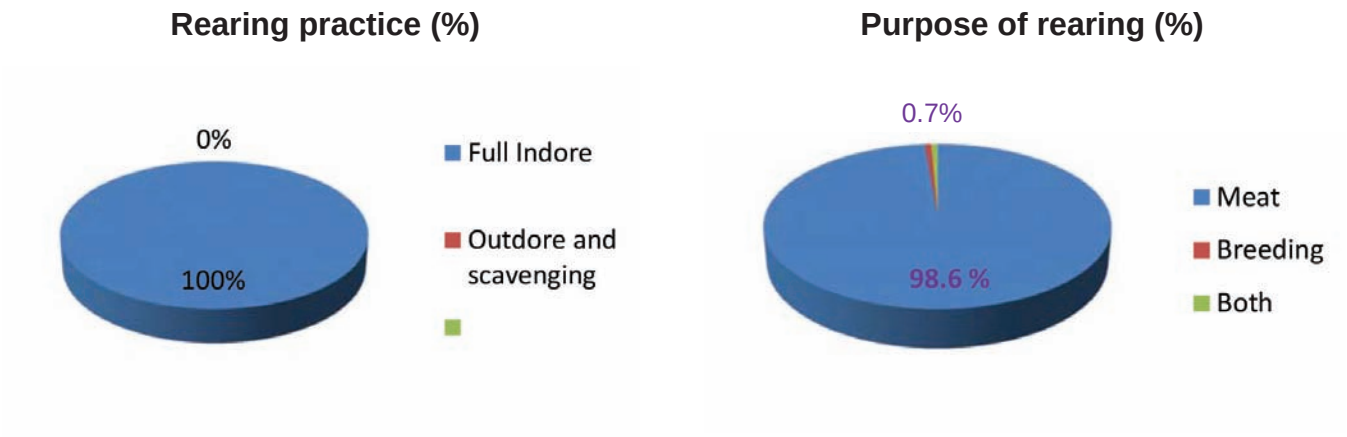
NMSH Project: Himalayan Agriculture under National Mission for Sustaining the Himalayan Ecosystem

K. Barman, D. K. Sarma and S. Rajkhowa

A survey work in the pig rearing regions of NEH states to document the present status of pig husbandry practices Survey was conducted in Nagaland. i.e. Lakhuti Village of Wokha District District. It is located in the Himalayan ecosystem. A total 143 households 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.

Scenario Lakhuti Village of Wokha District

The survey in the Lakhuti Village of Wokha District was carried out at Sanis block on 11th to 14th December 2018. The pigs are mostly reared by the poor people and traditionally local tribal of these areas. About 100 % of the pig farmers of the Lakhuti village raised their pigs by full indoor practice. The 98.6 % of the farmers rear their pigs for meat purpose, 0.7% for breeding purpose and 0.7% of farmers for both the purpose.



Pig Farming Scenario in Lakhuti Village

Housing Management:

Wooden wall housing system was provided to the pigs in the indoor system of rearing practice.

Housing systems

Feeding Management:

Pigs are fed individually or group in a pail. The pigs are supplied with rice polish, kitchen waste, vegetable waste, different fodders grown in the field. The source of water in most of the household is well. Water is mixed with feed and provide to the pigs 2-3 times a day. In this area most of the farmers (i.e. 100%) fed the pigs both raw and cooked feeds. Farmers mostly used local feed resources like rice polish, wheat bran, dry fishes, fresh squash, tapioca, tree leaves etc for feeding of pigs. Some of the tree leaves used for pig feeding is shown below:


Squash leaves


Hanthav leaves

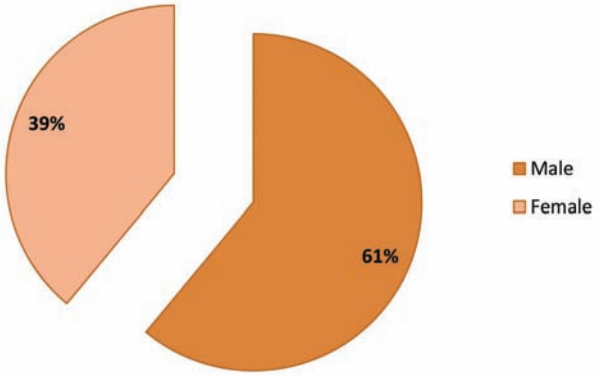

Thumu leaves


Tchutsung leaf

Breeding Management:

Out of the total household surveyed 99.3% of the pigs reared by the farmers are of local type and 0.7% are Cross breed type. Pigs are mostly kept for fattening purpose and rarely for breeding purpose. Breeding is done by natural mating.


Pig breeds mostly rear by farmers



Sex Ratio Involved In Piggery Farming

Sex Ratio Involved In Piggery Farming:

In most cases it can be observed that majority respondents belonged to male category. About 91.61 percent respondents belonged to male category while 8.39 percent of respondents belonged to female category.

Marketing:

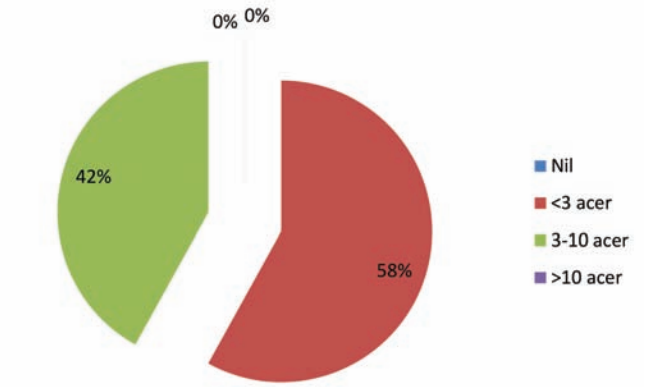
In most cases the finishing pigs are picking up by the trader. Some farmers sell pork of their own in nearby market @ Rs. 200/kg pork. The sale price per kg live weight of pig is Rs. 140/-.

Health Management:

The farmers are not giving any vaccine to their pigs. The pigs in the survey areas have not suffered from major infectious diseases during the last one year. However, few cases of parasitic infestation, pneumonia, lameness and piglet anaemia.

Agricultural Land Holdings:

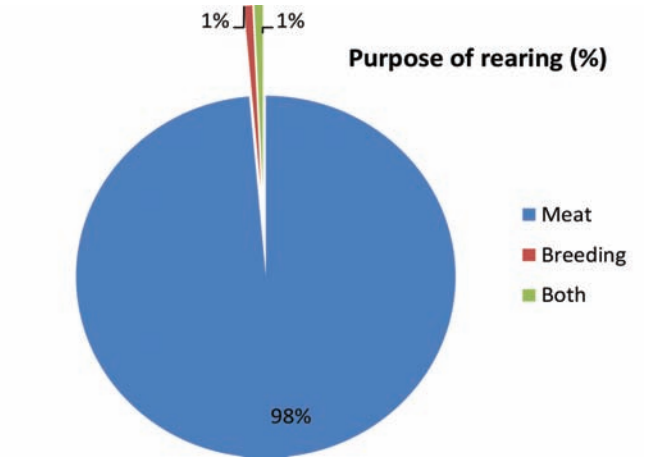
In Lakhuti village 58.5 percent (<3 acre) respondents belongs to small farmers, 42.3 percent (3-10 acre) respondents belonged to semi medium farmers and there is no landless and marginal (10 acer) farmers present.



Agricultural Land Holdings

Purpose of Rearing:

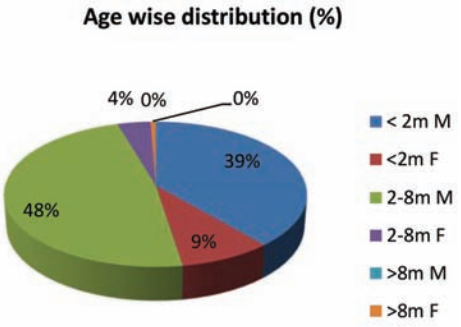
Most of the farmers rear the pigs for meat purpose only. About 98.6 percent farmers in Lakhuti village rear their pigs for pork only, 0.7 percent rear pigs for breeding and 0.7 percent for both breeding and meat purpose.



Purpose of Rearing

Age wise distribution

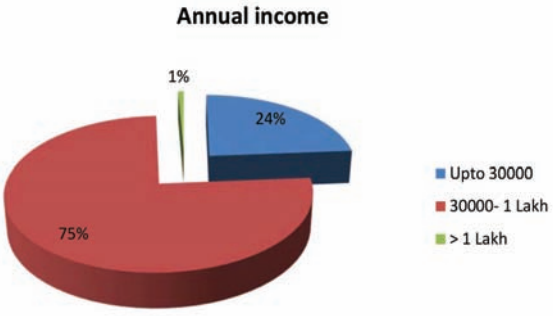
Farmers in Lakhuti village have 39 % of male pigs between the age group of <2 months while females in the same age group range are 9%. Most of the farmers have 4% gilts in the age group of 2-8 months while they have 48% male in the same age group. Among the farmers, they have only 1% of >8 months female pigs and no male pigs are present in this age group.



Age wise distribution

Annual Income

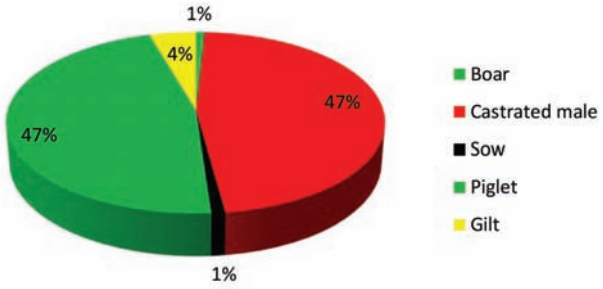
About 23.8 % farmers in Lakhuti village have annual income upto Rs 30,000 , 75.5 % farmers have income ranged from Rs 30,000 to Rs.1 lakh and only 0.7 % farmers have annual income that cross Rs.1 lakh.



Annual income

Types of Animal Reared

In the pig rearing pockets of Lakhuti village farmers have 47 percent castrated male, 47 percent piglets, 4 percent gilt,1 percent sow and 1 percent boar. Farmers do not rear boar for breeding purpose and when require some of the farmer hire the natural service from outside the village.



Types of Animal Reared

Institute project: Identification and characterization of the locally available feed resources for feeding of pigs

K. Barman

Farmers mostly used local feed resources like rice polish, wheat bran, dry fishes, fresh squash, tree leaves etc for feeding of pigs.

Table. 1. Proximate composition of tree leaves fodders used by farmers of Lakhuti village for pig feeding

Sample Name	DM	OM	CP	Ash	EE	CF	NFE
Bobovo	28.42±2.96	95.16±3.35	16.54±0.29	4.84±3.35	3.33±0.50	14.53±2.65	60.77±6.79
Khontsungpen	17.00±0.11	98.11±0.23	16.04±0.00	1.89±0.23	2.66±0.45	12.09±1.61	67.32±2.29
Kothearo	12.10±0.06	98.77±0.01	12.96±0.17	1.23±0.01	1.58±0.10	13.20±0.79	71.03±1.04
Hanthan	11.95±0.03	98.73±0.18	10.82±0.23	1.27±0.18	1.51±0.17	17.34±0.41	69.06±0.29
Tlungnunghan	9.27±0.62	98.58±0.22	13.92±0.40	1.42±0.22	1.78±0.25	9.60±0.10	73.28±0.47
Squash	10.20±0.60	97.97±0.12	11.58±0.26	2.03±0.12	1.39±0.28	6.52±0.33	78.48±0.24
Mhatso	20.06±3.94	94.87±0.66	12.00±0.12	5.13±0.66	0.74±0.25	7.34±2.19	74.79±1.89
Thumo	23.33±2.05	97.28±0.25	10.94±0.24	2.72±0.25	4.99±0.23	9.00±0.24	72.36±0.002
Manitong	8.80±1.55	97.56±0.53	12.03±0.55	2.44±0.53	1.25±0.25	4.26±0.24	80.01±0.03
Jankian	20.69±0.23	98.04±0.01	14.59±0.22	1.96±	1.81±0.46	3.67±0.03	77.96±0.20
Maku	25.57±1.20	97.09±0.46	14.79±0.21	2.91±0.46	0.70±0.24	10.13±0.08	71.46±0.35
Tchitsang	30.35±0.46	96.95±0.38	10.25±0.04	3.05±0.38	1.17±0.24	11.54±0.17	73.98±0.75

Table 2. Chemical composition of other feed ingredients used by farmers for pig feedings

Sample	OM %	CP %	CF%	EE %	Ash %	NFE %
Snail cover	6.02	3.32	0.61	1.24	93.98	0.85
Snail content	79.41	42.88	2.31	2.88	20.59	31.34
Crap cover	43.10	23.33	8.33	0.42	56.90	11.02
crap content	68.31	34.56	5.59	7.00	31.69	21.16
Earth worm	87.18	51.04	1.37	7.69	12.82	27.08
Silk worm	92.86	73.33	10.26	1.45	7.14	7.82
Guava	95.29	9.63	41.53	3.83	4.71	40.30
Maggi	96.41	7.99	0.00	26.96	3.59	61.46
Aangsha	80.52	21.67	11.43	0.47	19.48	

Institute Project: To maintain sustainable production and productivity of pig at farmers' field

K. Barman

A trial was carried out to evaluate the nutritional value of silkworm pupae (Bombyx mori) and to see the effect of replacement of conventional protein sources on feed intake, growth, nutrient utilization and nitrogen balance. It was found that that silkworm pupa meal can be supplemented @ 3 % level by replacing 18.9% protein supplements in grower crossbred pigs to improve growth, nutrient utilization, feed conversion efficiency and also to reduce the feed cost. The average body weight gain (g/day) was found higher (P>0.05) in silkworm pupa supplemented groups. The cost (Rs/kg gain) was reduced (P>0.05) in T2 and T3 groups in comparison to T1 group. The feed conversion efficiency (FCR) was higher (P>0.05) T2 and T3 groups than control group (Table 1).

Table 1. Effect of supplementation of silkworm pupa meal on nutrient utilization in crossbred grower pigs

Parameters	T_1	T_2	T_3	P Value
DMI, g/day	804.60±1.54	804.17±0.18	805.91±1.03	0.518
ADG, g/day	506.25±52.58	525.00±52.36	564.50±36.34	0.648
FCR (Feed gain ratio)	1.84±0.19	1.76±0.15	1.61±0.11	0.598
Feed cost/kg gain (Rs)	44.87±4.64	44.78±3.80	42.80±2.83	0.911

T1: 0 % Silkworm pupa meal; T2: 1.5 % silkworm pupa meal; T3: 3.0 % silkworm pupa meal; DMI=Dry matter intake; ADG= Average daily Gain; FCR= Feed Conversion Ratio

Silkworm Pupa

III. ANIMAL REPRODUCTION

Institute Project: Value Chain in Semen Production, Evaluation, Preservation and Fertility Improvement through Artificial Insemination in Pig.

M. K. Tamuli, Sunil Kumar, Mohan, N.H., S. Banik and K. Barman

A total of 798 semen ejaculates were collected during the year. Semen ejaculates showing more than 85% sperm motility were processed for further evaluation. Altogether, 386 ejaculates were processed for semen preservation. The total numbers of piglets born in the farm and in the farmers' house were 974 and 7395 respectively. During the year, 101 numbers of new farmers from different distant villages registered for taking services for AI for their pig.

Institute Project: Development of frozen semen protocol for sustaining fertility and litter size in pig

M. K. Tamuli, Mohan, N.H. and S. Banik

Semen ejaculates (3 nos.) at weekly interval were collected by 'gloved-hand' technique sow into a pre-warmed (38°C) metallic thermo flask. Collected ejaculates with > 90% motility were considered for further processing. Aliquots of semen samples were allowed for room temperature incubation. The incubated semen spinned and supernatants were immediately decanted and then pellets were reconstituted with its equal volume with Part-I of the extender, GEPS with 20% egg yolk without antibiotic containing a herbal DTE compound. The reconstituted pellets were pooled together and allowed to cool down to 17°C. The concentration of spermatozoa was adjusted to at least 50 million/ml after final dilution with Part-II extender. The diluted semen in Part-I and the Part-II extender together allowed to cooled to 4°C. Glycerolated semen then filled and sealed in straws and allowed to equillibrate. The equilibrated semen straws were racked and frozen in the liquid nitrogen vapour inside styrofoam box. The frozen straws were transferred to goblet for further storage in the liquid nitrogen.

Institute Project: Development of protocol for boar semen cryopreservation

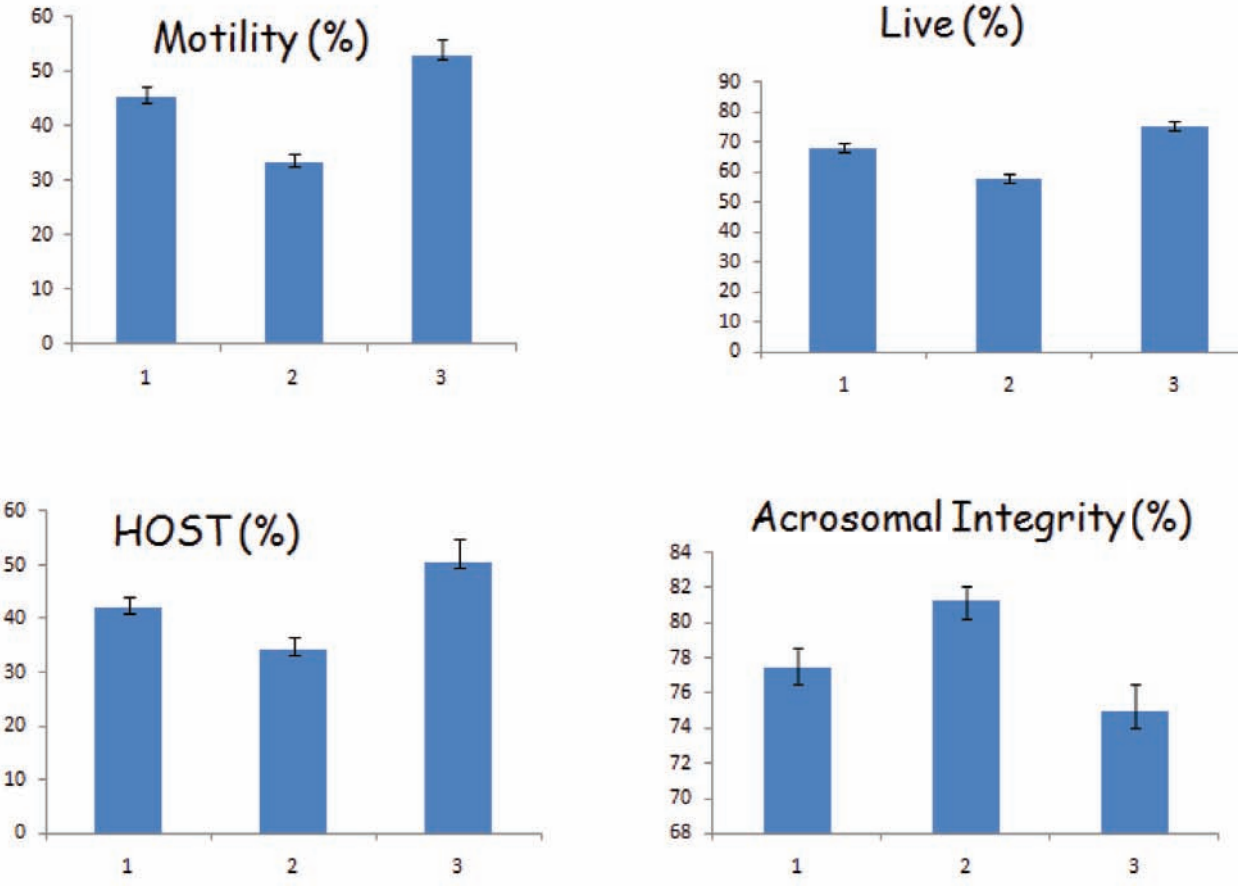
Sunil Kumar, M. K. Tamuli, S. Banik, and K. Barman

Comparison of commercially available extenders for boar semen cryopreservation was the target. Experiments were conducted to compare commercially available extenders at the standardized protocols. The comparison was done in fresh, cooled and frozen semen and in vitro functional fertility was estimated with extenders (I, II, III). Superiority of extenders in terms of post thaw semen characteristics was extender III> extender II> Extender I. However, overall acceptable fertility has not been achieved. Experiments are in continuation.

Semen Evalution was done in fresh, cooled and post thaw conditions for motility, live, acrosomal integrity and hypoosmotic swelling test percentages for three extenders tested in the experiment.

Table.1 Comparison of cooled sperm parameters preserved in different extenders

Parameter (%)	Fresh (n=24)	Extender - I (n=16)	Extender - II (n=16)	Extender - III (n=8)
Motility	90.83±0.65	33.45^{a}±1.49	45.31^{b}±1.90	53.12^{b}±2.74
Live dead	89.26± 0.57	67.50±2.14	57.50±1.88	75±1.88
AR Integrity	87.70±0.90	77.50±1.11	81.25±0.85	75.00±1.53
HOST	82.7±1.53	41.87±2.27	34.37±2.40	50.62±4.14
Values with different superscripts between extender columns differs significantly at p < .05 n; number of ejaculates				



Representation for cooled semen evaluation in Extender-I (1), Extender-II (2) and Extender-III (3) extenders

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

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

Sows (n=5) in anestrus were identified at ICAR-NRC on Pig, Farm complex. Hormones used hCG and PMSG @ 400 I.U. + 200 I.U. per animal. The average duration from day of injection to induction of heat was 96.00±13.14 hrs. The average litter size was 4.4±2.76. The repeat breeder incidence was 60 % (3/5). Further, supplementation of Vitamin E and Selenium as antioxidants to combate farrowing stress has been studied for subsequent preparation before hormonal administration. In the treatment group (n=6), preparation containing Vitamin E 100 mg/g and Selenium 200mg/g was fed @10g per animal for seven days before expected date of farrowing and production parameters were compared with control (n=6) sows of 2-4th parity. Different parameters studied between control and experimental sows were gestation period (115.16±0.40 vs 114.83±0.47 days), litter size at birth (9.66±0.88vs 7.5±0.92), litter size at weaning (8.5±0.34 vs 6.8±0.87), litter weight at birth (10.51±0.84 vs 8.3±1.07 kg), litter weight at weaning (72.13±3.84 vs 54.58±5.7 kg) and mortality (1.16±0.65vs 0.66±0.33). Statistical relationship in studied parameters was significant for litter size at birth ($p < .10$), litter size at weaning ($p < .10$), litter weight at birth ($p < .10$) and litter weight at weaning ($p<0.05$). Post farrowing pus like discharge was observed in three control sows but none of the sow in the treatment group showed any pus like discharge. Therefore, it was concluded that supplementation of Vitamin E and Selenium improved the post farrowing parameters by possible mitigation of peri and post farrowing stress and such supplementation before hormonal administration, may be used in future in animals having prolonged weaning to estrus interval. In such cases, this supplementation may improve the effectiveness of hormones.

IV. ANIMAL PHYSIOLOGY

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

Mohan.N.H

***In vitro* studies using fibroblast model**

Western blotting and immune fluorescence studies: Cells were subjected to acute heat shock by incubating at 41°C in a humidified atmosphere with 5% CO2 for one hour. The control cell line (maintained at 37°C) and treated (41°C for 1 hr) were user for experiments. Incubation of fibroblasts with thapsigargin at 0.5µM concentration for a period of 6 hours induced of ER stress. Western blotting (Fig 1) and immune fluorescence studies (Fig 2) were under taken with specific antibodies against heat shock proteins.

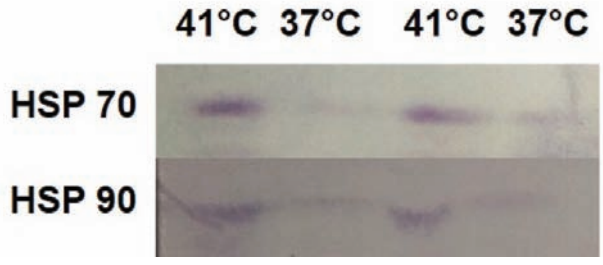
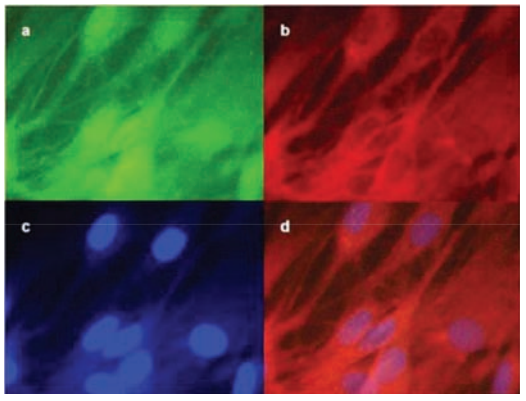
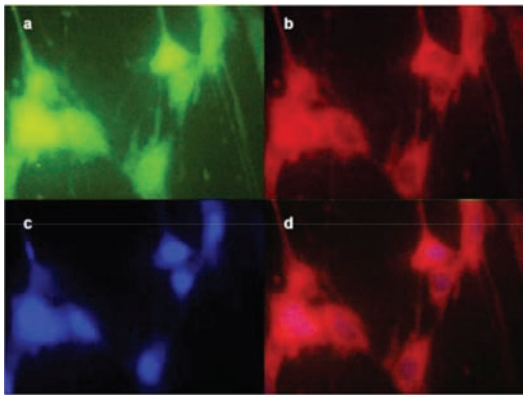


Fig 1. Western blotting of HSP 70 and HSP 90 after heat shock treatment of fibroblasts



Fibroblasts at 37^{0}C



Fibroblasts after shock at 41^{0}C

Fig 2. Expression of HSP 70 and HSP 90 proteins after heat stress and basal conditions (100X)

(a) Localization of HSP 70 (b) Localization of HSP 90 (c) cell nuclei stained with H33342, merged image (d). Specific antibody tagged with FITC and Texas Red was used for localizing HSP70 for HSP 90, respectively. Heat stress induces morphology of cells to shrinkage, reduction in staining of nuclei. The HSP70 can be localized in both cytoplasm as well as nucleus, whereas HSP90 was mostly confined to cytoplasm. Increased intensity of green and red signals observed in cells after heat shock, indicates higher expression of HSP70 and HSP90 respectively.

The immunofluorescence studies further confirms the western blotting showing increased amount of HSP70 and HSP90 in response acute heat shock.

Real time PCR for detection of expression levels of heat shock proteins and other genes related to stress: Experimentation was done to assess expression levels of heat shock proteins (HSP27, HSP70, HSP90 and HSP105) and markers of endoplasmic reticular stress (sXBP1, usXBP, TXBP, ATF4, Bip, GRP78 and EDEM) using real time PCR (Fig 3). The RNA isolated from the cultured fibroblasts after subjecting to heat shock (24 and 41°C and controls at 37°C) were used for the study.

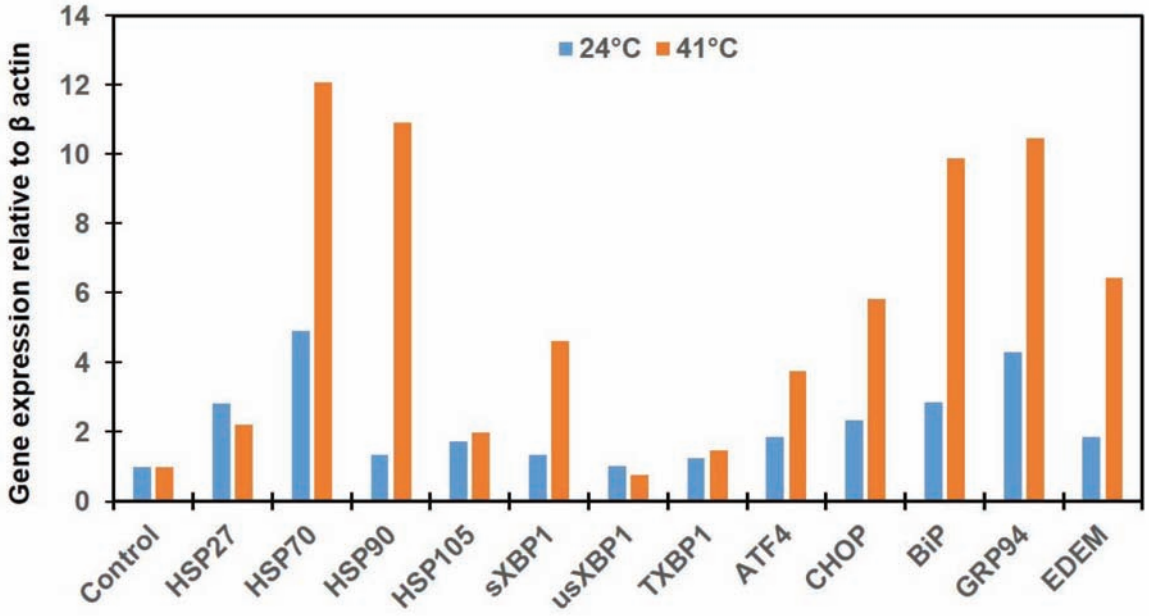
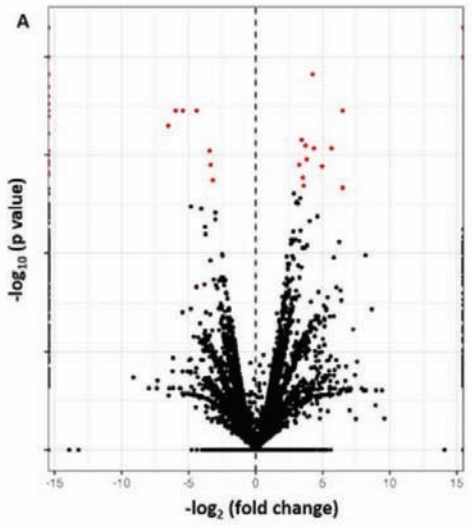


Fig 3: Expression of heat shock protein and ER stress responsive genes in fibroblasts under acute thermal stress.

The preliminary results suggest increased mRNA levels of heat shock proteins (HSP27, HSP70, HSP90, HSP105) respond to heat and cold shock stress with highest response from HSP70 and HSP90 genes. The levels of total X box binding protein (TXBP) increased insignificantly in response to heat stress, but the levels of spliced XBP increased significantly in response to acute thermal shock, indicating key role of XBPs in cellular responses. The pro-apoptotic factors, ATF4 and CHOP were higher after the thermal shock, to other chaperon facilitating BiP and EDEM gene levels. It can be seen that heat stress induces transcription of both HSP70 and HSP90, further supporting the results of western blotting and immunofluorescence.

Whole transcriptome studies

A comparison was made between animals reared in hot environment (Jaipur, Rajasthan) and moderately warm environment (Guwahati, Assam) to examine any specific gene expression pattern 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 blood samples were collected, RNA isolated and cDNA library was sequenced using next generation sequencing to elucidate whole transcriptome. The sequencing has been completed and preliminary results are presented as Fig 5-8.



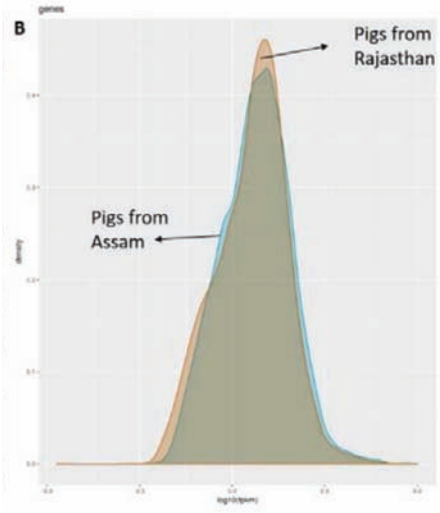
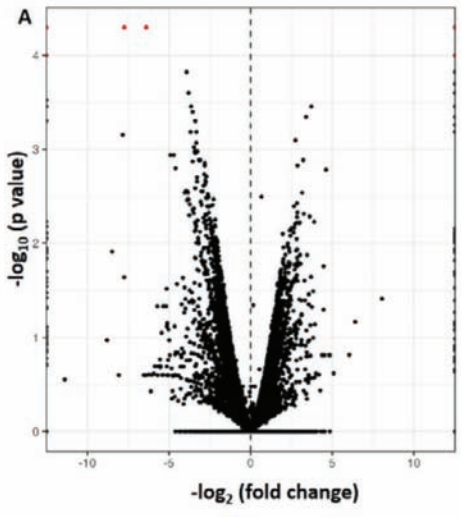


Fig. 4. Volcano plot (A) and gene density distribution (B) showing differentially expressed genes in pigs reared in Assam and Rajasthan.

The volcano plot shows genes with significantly expressed genes (red). The gene density distribution shows close similarity between animals reared in two different environments, even though there are differences in genes can be seen.



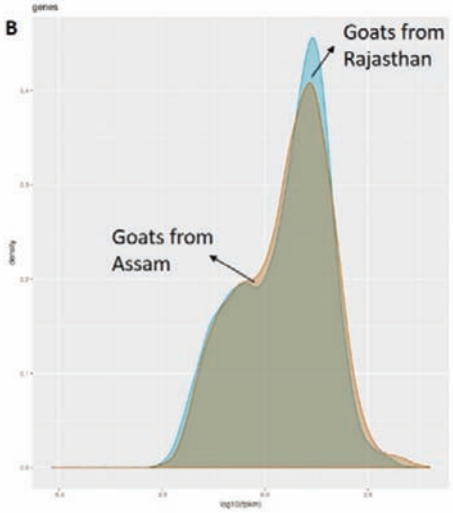


Fig. 5. Volcano plot (A) and gene density distribution (B) showing differentially expressed genes in goats reared in Assam and Rajasthan.

The volcano plot shows genes with significantly expressed genes (red). The gene density distribution shows close similarity between animals reared in two different environments, even though there are differences in genes can be seen.

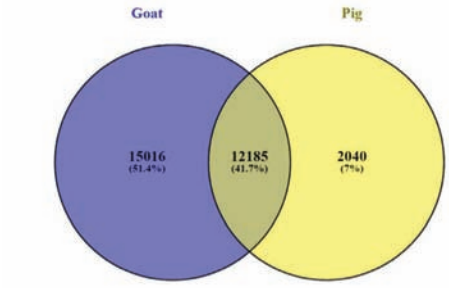


Fig 6. Total number of transcripts identified in pigs and goats

About 41.7% of the expressed genes were common between two species at the time of sampling.

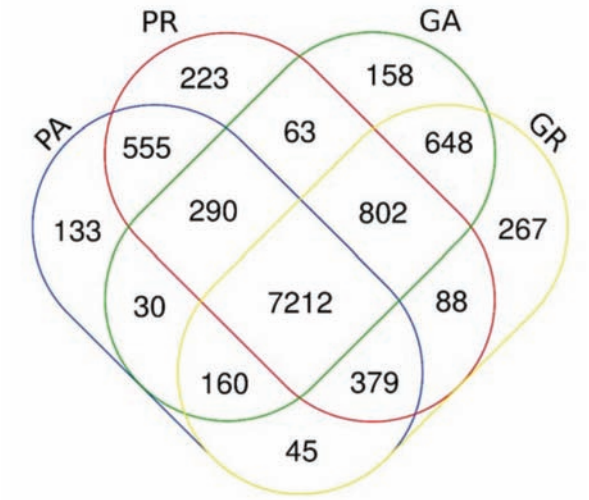


Fig. 7 Distribution of genes among pigs and goats reared in Assam and Rajasthan

PA and PR- Pigs reared in Assam and Rajasthan respectively

GA and GR- Goats reared in Assam and Rajasthan respectively

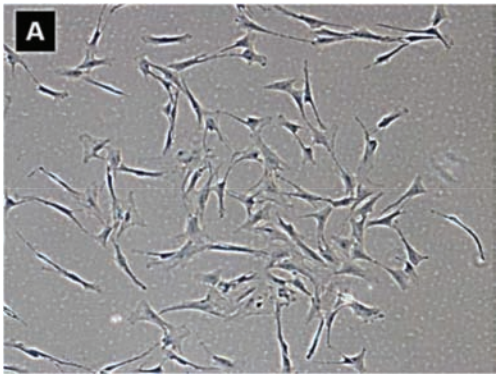
The data generated is under analysis and will be reported further in due course of time.

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

Mohan.N.H

Establishment of a cell line for studies related to stress

Dermal fibroblasts were isolated using an enzymatic digestion method. The cell were maintained, passaged in DMEM with 10% fetal bovine serum with antibiotic-antimycoticsThe media was replaced every 4 days until the cells become confluent (Fig 8). The confluent flaks were trypsinized and passaged in 1:4 ratio. The cell flasks with 70% confluency were used for experiments.



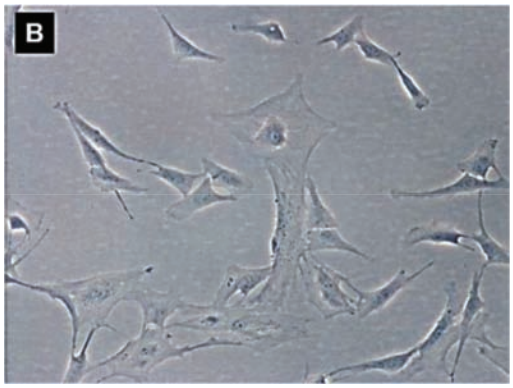


Fig 8. Porcine fibroblast cell line

Analysis of total RNA with special reference to micro RNA

The fibroblast cells were subjected to acute heat shock and processed for isolation of RNA and subsequently processed for synthesis of cDNA library, expression of selected genes. Simultaneously, high quality RNA was subjected to RNA sequencing study to identify all the microRNAs/ transcripts. The samples/data are under analysis.Further, in order to identify targets of micro RNA, RNA immunoprecipitation (RIP) assay was used. RIP protocol was standardized, cDNA library developed form the immunoprecipitated RNA. The samples are under further processing and will be reported in due course of time.

DBT project : Evaluation of physio-genomic responses to heat stress and development of potential marker(s) for assessment of stress in pigs (Inter-institutional project)

Lead Centre: ICAR-NRC on Pig

Mohan.N.H, M.K.Tamuli, R.Thomas and Gokuldas.P.P

Collaborative centre- IVRI Eastern Regional Station, Kolkata

Co-PIs from collaborative centre- B.C.Das, Shyamal Naskar and A.K.Das

Whole transcriptome analysis

The whole transcriptome changes in indigenous (Mali) and exotic (Hampshire) pigs during summer and winter season was examined. The whole transcriptome study was designed based on the preliminary experimental and genomic data available. The differential expression pattern of genes were reported earlier.The distribution of gene on the FPKM basis is shown in table 1. The changes in expression of different heat shock proteins in two breeds of pigs with respect to two seasons is shown in table 2.

Breed of pig	Hampshire		Mali	
FPKM	Summer	Winter	Summer	Winter
Above 10000	21	17	4	9
1000-10000	95	109	80	70
100-1000	336	584	412	308
10.0-100.00	2804	2805	3074	2809
1.0-10.0	6050	4746	5579	6648
0.1-1.0	3148	2962	3534	3192
0.0001-0.1	899	670	1114	1528
Total transcripts	13353	11893	13797	14564

Table 1: Distribution of gene density among Hampshire and Mali pigs on FPKM basis

Major heat shock responsive genes	Fold change in gene expression	
	Hampshire	Mali
HSF1	2.10	2.43
HSF2	0.50	0.73
HSF2BP	2.28	1.33
HSF4	3.47	0.70
HSH2D	0.48	2.90
HSP70.2	45.02	2.16
HSP90AA1	1.13	2.01
HSP90AB1	1.45	1.33
HSP90B1	0.35	1.53
HSPA13	0.49	0.19
HSPA1A	0.15	1.91
HSPA1B	2.50	2.04
HSPA2	2.72	1.22
HSPA4	0.49	1.05
HSPA5	0.74	2.02
HSPA9	0.84	1.17
HSPB1	0.38	4.99
HSPB11	0.10	0.98
HSPBAP1	0.37	0.76
HSPBP1	18.44	2.10
HSPD1	0.59	1.29
HSPE1	0.62	0.67
HSPH1	1.72	0.76

Table 2: Expression of different heat shock proteins in two breeds of pigs with respect to two seasons

The study generated data on differentially expressed and novel genes, indicating difference in the response of indigenous and exotic breed of pig during thermal stress in different seasons of the year.

Institute project: Development of early fertility markers in pigs

Mohan. N.H, M.K.Tamuli and R.Thomas

Evaluation of semen quality through microscopic analysis of morphology, acrosome, cell membrane and functional tests such as spermatozoal motility, methylene blue reduction, mitochondrial potential has been used effectively assess the male fertility and fertilisation related events. However, increasing number of idiopathic infertility and inability of explain differential fertility of boars with similar motility and morphological parameters points to the inadequacy of conventional methods for more precise assessment of fertility. In the present study, we examined the spermatozoal transcriptome of boars differing in fertility using RNA-seq and compared with the fertility status of boars used in the AI programme of the institute. The expression statistics of genes during spermatozoal RNA sequencing was reported earlier. Based on the transcriptome, 30 genes were selected representing roles in the spermatogenesis, spermatozoa, fertilisation and zygote development. We compared the expression profile of these 15 genes in the spermatozoa of 18 boars with known fertility status to validate the transcriptome study.

Networking and pathway of genes

The pathways of important differentially expressed genes were analysed. Some of the novel interlinked pathways are shown in figure 1 and 2.

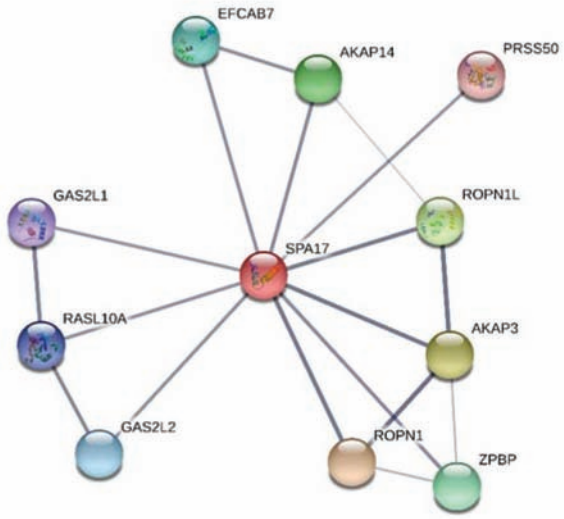


Fig.1 Network of SPA17 gene, identified as one of fertility markers

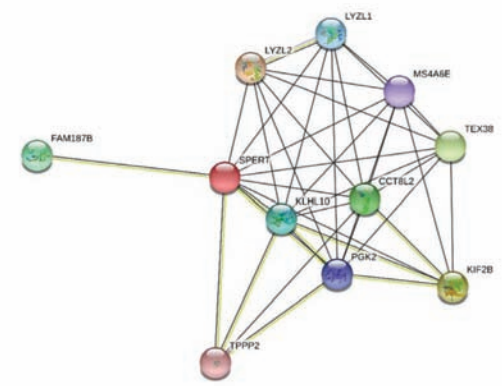


Fig.2 Network of SPERT gene, identified as one of fertility markers

Identification of differential splicing

Some of the genes were identified to have differentially spliced in boars with high/low fertility (Fig. 3), viewed in integrated genome viewer.

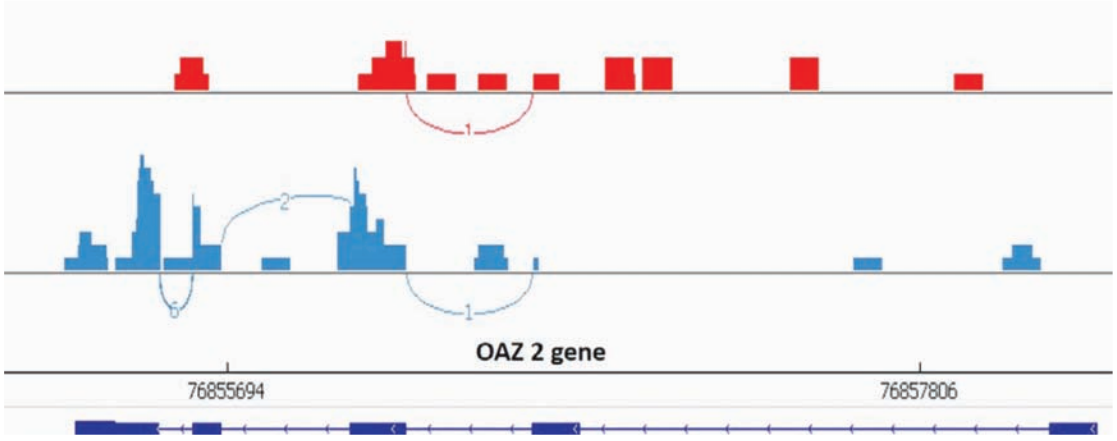


Fig.3 Differential splicing of OAZ 2 gene in high fertile Vs low fertile boar

In vitro fertilization and parthenogenetic activation of *in vitro*-matured oocytes

To elucidate the role of boar sperm, experiment was designed to compare IVF developed embryos with parthenogenetically developed embryos. The IVF and pathenogenetic embryos were successfully developed. The gene expression pattern of single cell transcriptome analysis is shown in figures 4-5.

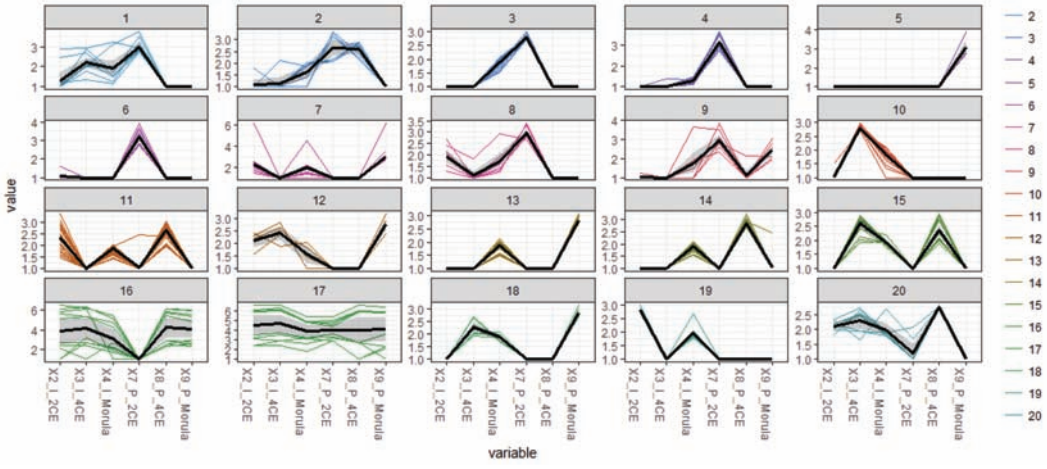


Fig.4 Differential expression of cluster of genes in IVF and parthenotes

Several different patterns of gene expression were identified during the course of embryonic development.

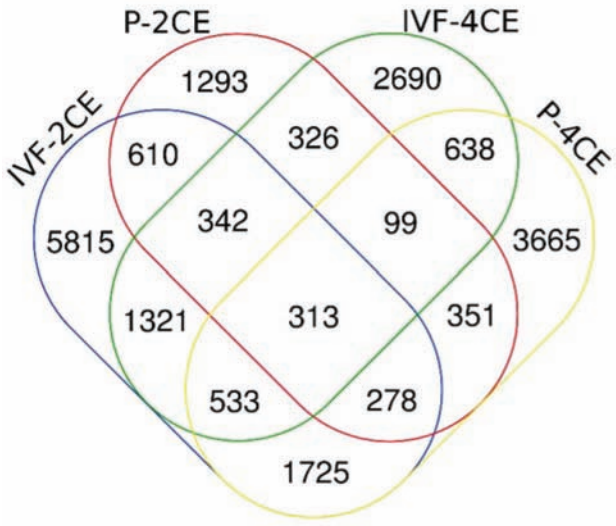


Fig.5 Venn diagram showing expression of genes in IVF embryos and parthenotes

Software application development

Mohan N.H.

Assisted in the preparation of "IVRI – PashuPrajanan App" in Assamese Language along with Dr. Barnali Talukdar, SRF. The original material prepared by group led by Dr. Rupasi Tiwari and Dr. Triveni Dutt from ICAR-IVRI, Izatnagar in English language was translated to Assamese and is now available in public domain.

V. ANIMAL HEALTH

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

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

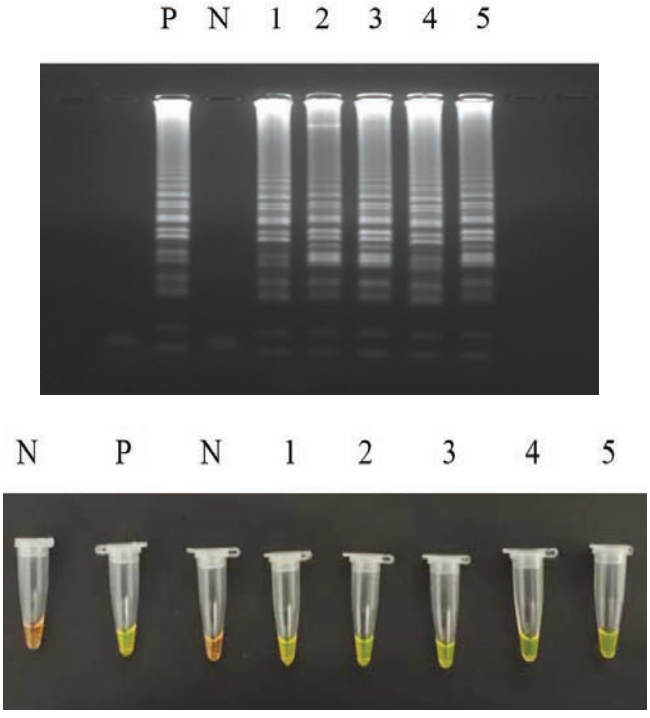
Under this project during the reported period we could isolate 48 *Staphylococcus* species, 8 *Salmonella* and 18 *Campylobacter* species from different samples of pig. *Staphylococcal* organisms were confirmed up to the genus level by amplification of 16S rDNA gene. Of these 48 isolates, 39 could be identified up to species level [(*S. aureus*- 30 (11 are MRSA) and *S. hyicus*-9)]. Out of 8 *Salmonella* isolates, 75% isolates were confirmed as *S. typhimurium* through use of species-specific PCR. It was also observed that out of 18 *Campylobacter* species isolated from pig during the reported period, maximum isolates were confirmed as *Campylobacter* coli (66.7%) whereas rest isolates belonged to *C. jejuni*. Biotyping of the *Campylobacter* spp. revealed that *C. coli* biotype I (75%) was the most common biotype of C. coli in the study, while *C. jejuni* biotype I (66.7%) was also common.

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

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

Under this project during the reported year we could isolate 31 *E. coli* from 107 diarrhoeic faecal samples of piglets up to 1 month of age. Pathotyping revealed that nine isolates were enterotoxigenic *E. coli* (ETEC), 14 were Shigatoxin producing *E. coli* (STEC) and four isolates belonged to atypical enteropathogenic *E. coli* (EPEC). We could isolate 10 *Salmonella* strains during the reported period of which 7 isolates were confirmed as *S. typhimurium* using species –specific PCR. Clostridium organism could be isolated from 4 diarrhoeic piglets and confirmed as *C. perfringens* type A. Characterized *Staphylococcus* species isolated from pigs with respiratory problems by molecular means and we could detect involvement of both *Staphylococcus* aureus and *S. hyicus* in respiratory tract infection of neonatal piglets. *Streptococcus suis* (11) isolated from various disease conditions (arthritis, pericarditis and pneumonia) of piglets were

confirmed through detection of *gdh* gene as well as by sequencing of amplicons. We could detect group A rotavirus in 11.21% (12 out of 107) piglets of which 25% had mixed infection with *E. coli*. Detected porcine circovirus (PCV 2) and porcine parvovirus (PPV) in foetal tissues of stillbirths / mummified piglets through RT-PCR. Determined the parasites associated with neonatal piglet diarrhoea and parasites recorded were *Cryptosporidium* species, *Eimeria* species, *Strongyloides ransomi* and *Balantidium coli*. 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. Formulated prophylactic / therapeutic measures for the reduction of neonatal piglet mortality. Developed diagnostic method for rapid detection of PPV from foetal tissues. Non-infectious factors responsible for neonatal piglet mortality in organized pig farms were determined. Analyzed neonatal piglet mortality data obtained from different pig farms of AICRPs on Pig and evaluated the major causes / factors responsible for neonatal piglet mortality.

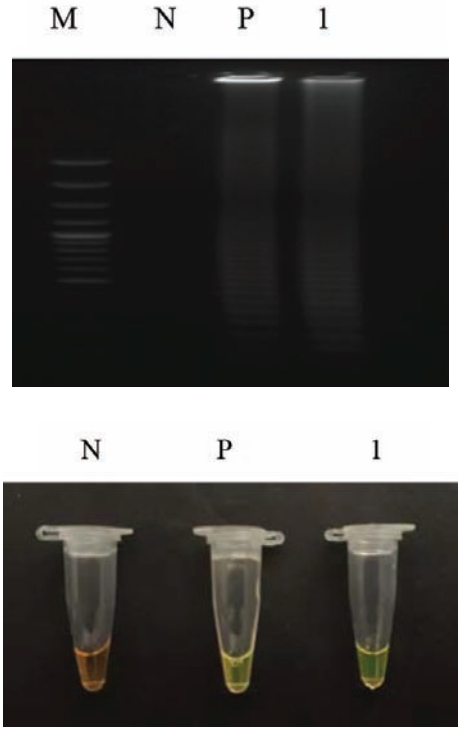


Development of a field diagnostic (LAMP) assay for rapid detection of porcine parvovirus (PPV) from pigs, P : Positive Control, N : Negative Control, Lane 1-5 : Test samples

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

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

Under this project during the reported period total 199 meat samples from pig were collected and analyzed (Rani market=61, Azara = 32, Mirza= 27, Beltola = 38 and Slaughter house , NRCP=41) for the presence of targeted bacterial pathogens. The number of pigs positive for *E. coli*, *Salmonella* and *Staphylococcus* species were 28, 10 and 33, respectively. Out of 28 *E. coli* isolates 8 were ETEC, 16 were STEC and 4 were AEEC. Out of 10 *Salmonella* species 8 were confirmed as *S. typhimurium*. Out of 33 *Staphylococcus* species, 26 were *S. aureus* (of which 12 were MRSA) and 7 were *S. hyicus*. Developed a loop mediated isothermal amplification (LAMP) assay for rapid detection of *Staphylococcus aureus* from pork.



Development of a field diagnostic (LAMP) assay for rapid detection of *Staphylococcus aureus* from pork, M: Molecular marker, P : Positive Control, N : Negative Control, Lane 1 : Test sample

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

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

Under this project during the reported period characterized the porcine circovirus (PCV) isolates circulating among pig population in North eastern states of India. In this study majority (60%) of the isolates circulating among pigs in NER was found to be PCV2a. We also characterized group A rotavirus from pigs and analysis of sequence data of VP7 gene (G genotype) and VP4 gene (P genotype) of porcine group A rotaviruses (Po-RVAs) revealed the presence of G4, G6, and P[6], genotypes in our study. 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) pathogens of pigs during the reported period.

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 *Streptococcus suis* infection which is recognized as one the major bacterial diseases in pigs having economic impact on pig production and the causative agent is also an emerging zoonotic bacteria.

Institute Project: Prevalence of Helicobacter organism in pigs particularly in cases of Gastritis

S. R. Pegu, D. K. Sarma,S. Rajkhowa, Mohan N.H. and R. Thomas

Studies on prevalence of *Helicobacter* infection in the stomach of the pigs using different diagnostic methods.

Gastric ulceration is a well-known problem in swine where intensive pig production occurs and that can lead to growth retardation, bleeding and death in pigs. An association between gastrospirillum-like organisms (GLO) and ulcerative lesions in the pars oesophagea in stomachs of swine has been claimed. In view of the close association of *Helicobacter pylori* with peptic ulcer disease in human beings and the recent discovery of the microorganism “Gastrospirillumsuis,” a so far uncultured inhabitant of the stomach of swine, the present study was undertaken to investigate the prevalence of this microorganism in the gastric mucosa of slaughterd and dead pigs particularly in cases of gastritis by various diagnostic assay.

So far a total of 403 stomach samples from slaughtered pigs from different slaughter points and 74 necropsied pigs from different pig farms of Assam were collected. Mild to severe Gastristis were detected 214 cases and gastric ulcers were detected in 49 cases. Histopathological examination revealed pyloric mucosa of pig with chronic gastritis. Other histopathological findings include coagulative necrosis with hemorrhage, leucocytic infiltration with neutrophils and macrophages as the main cell types. Lymphoid aggregates(Lymphoid follicle) one of the major lesions associated with *Helicobacter* spp. infection in the gastric mucosa of few stomach samples. Grams staining of andgastric mucosal samples reveilledof gram negative Gastrospirilum like organisms in the stomach examined at ×100 magnification. Scanning Electron Microscopy of the urease positive stomach samples reveilledtightly coiled *Helicobacter* bacterium (spiral-shaped) found in the mucous lining of the stomach (SEM) .

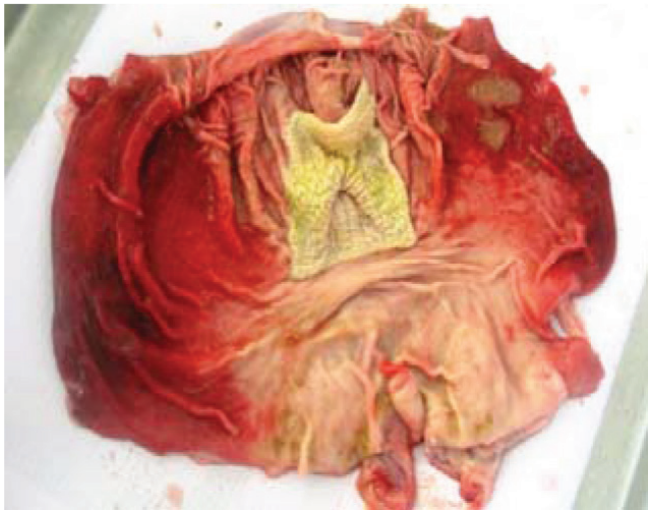


Fig:1. Gastric lesions in pig

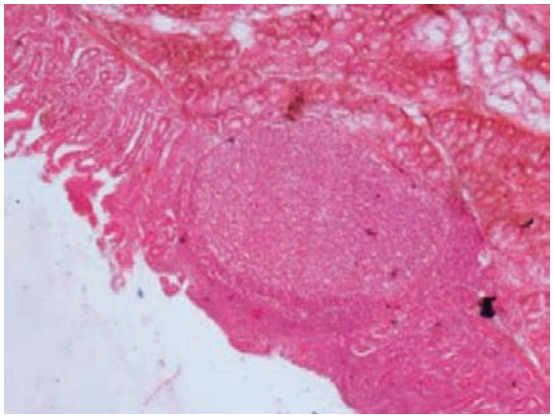


Fig.2. Lymphoid follicle in the gastric mucosa of a pig(H & E X 4x).

Fig.3. Urease enzyme positive gastric mucosal samples in RUT dry test.

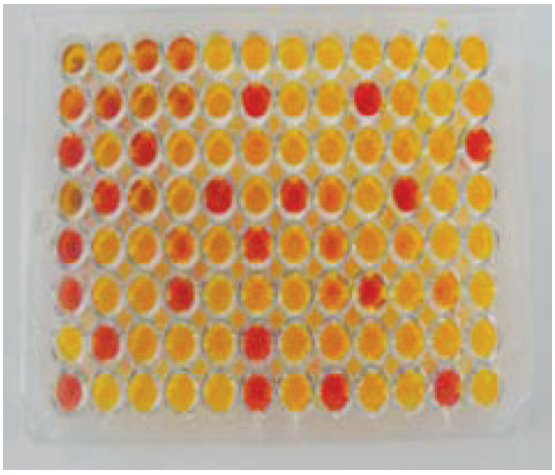


Fig:4.Rapid Urease Test detected the urease enzyme of *Helicobacter* in gastric mucosal samples of slaughtered and necropsied pigs with gastritis.

DNA from each gastric sample was extracted and *Helicobacter* genus-specific primer set was used to determine *Helicobacter* infection. In 41 samples (17 slaughtered pigs and 24 from necropsied pigs) were found positive for *Helicobacter* spp. by PCR.

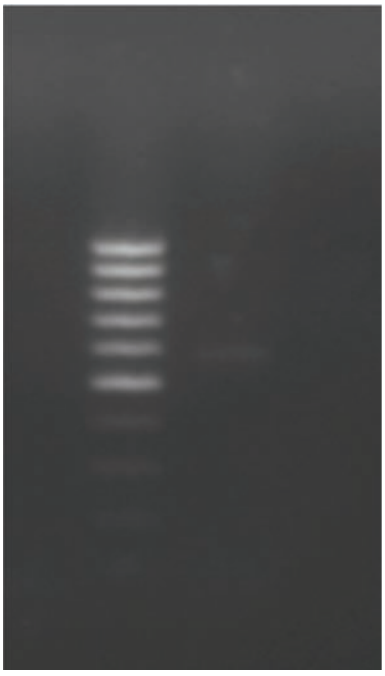


Fig. 5.PCR detection of *Helicobacter suis* in stomach samples of pigs from field
M : 100bp DNA MARKER
S1,S2 AND S3 : Stomach sample of pig

Studies on the molecular epidemiology and zoonotic potential of *Helicobacter* species in pigs.

Analysis of feed samples: A total of 93 feed samples were collected from different pig rearing villages and organized pig farms of Assam. The feeds were mostly juguli,kitchen waste, rice husk and other locally available items. All the feed samples were analyzed for presence of *Helicobacter* organism through PCR. And 5 no.s of feed samples were found positive for *Helicobacter* spp.

Fig.6. Juguli based pig feed

Fig.7. Kitchen waste based pig feed

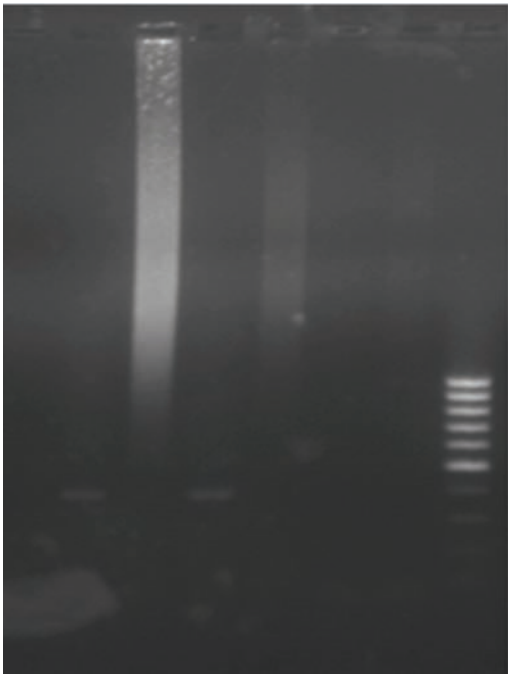
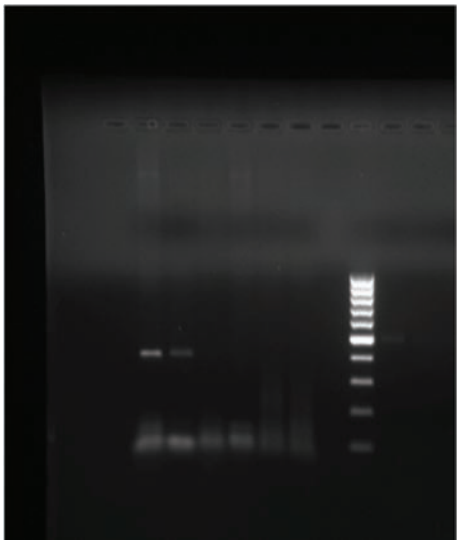


Fig.8.PCR detection of *Helicobacter* spp. in feed samples of pigs
M : 100bp DNA MARKER
S1, S2, S3, S4, S5, S6 : Feed samples of pigs
S1 and S3 are showing positive for *Helicobacter* genus specific

Fig.9.Urease enzyme positive fecal samples of human in RUT dry test.



376 bp

Fig.10.PCR detection of *Helicobacter* spp. in fecal samples of pig farmers
M : 100bp DNA MARKER
S1, S2, S3, S4, S5, S6, S7 : Fecal samples of human
S1 and S2 are showing positive for *Helicobacter* genus specific

Analysis of human fecal samples: 47 no.s of fecal samples collected from pig farmers and pig handlers to study the incidence of *Helicobacter* infection among pig rearers or pig farmers. All the fecal samples were analyzed through rapid urease test and PCR assay. 2 no.s of fecal samples were PCR positive for *Helicobacter* spp. and 7 no.s of samples fecal sample showed positive urease reaction.

Phylogenetic analysis:PCR positive samples isolated from gastric mucosa were sent for sequencing and phylogenetic analysis were carried out. *Helicobacter* 16S rDNA gene sequences were compared to similar sequences reported for thegenus *Helicobacter*. A phylogenetic tree using the Clustal method was constructed (Fig.8). Sequence analysis of PCR positive *Helicobacter* stomach samples of pig from the field revealed 97% IDENTITY with 16S rRNA GENE of *Helicobacter sp.*, *H. suis*, *H.heilmannii*, *H. pylori*.

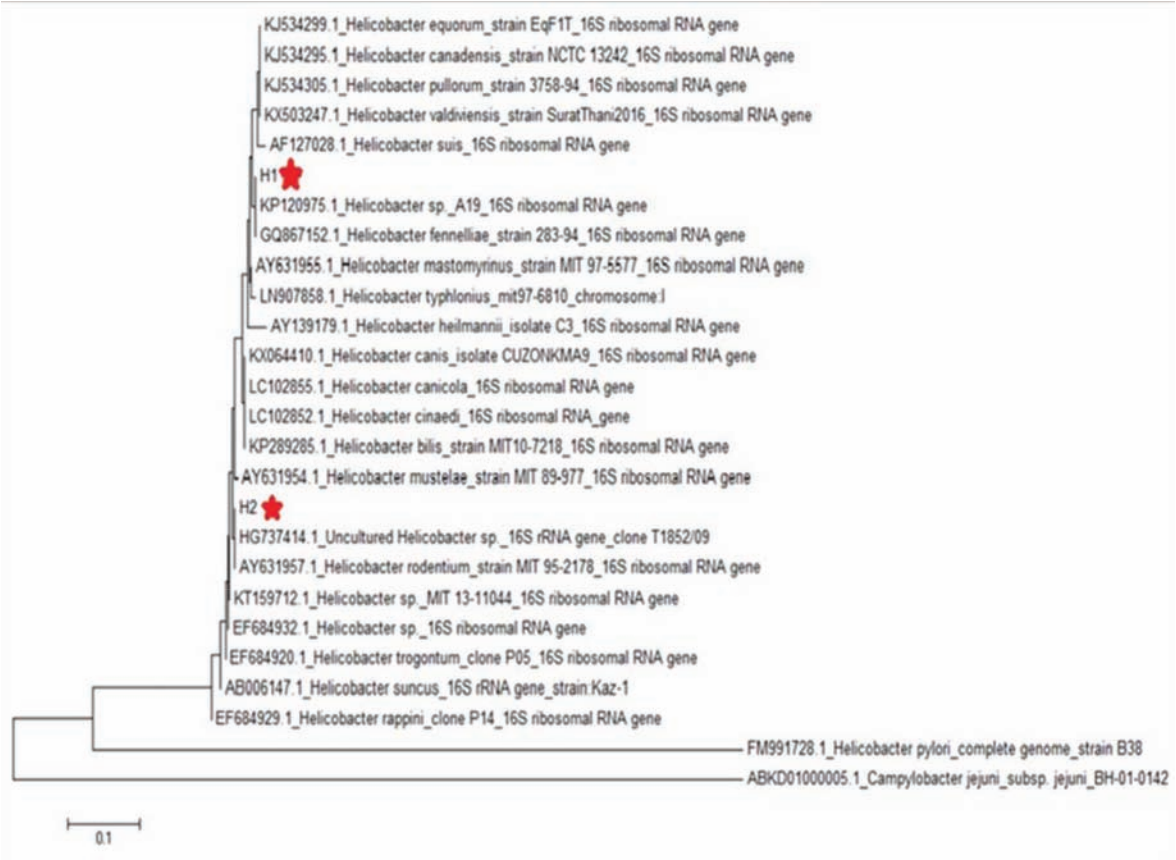


Fig.11.Phylogenetic tree of *Helicobacter* genus from field samples. SEQUENCE ANALYSIS OF PCR POSITIVE *Helicobacter* stomach samples of pig from the field revealed 97% IDENTITY with 16S rDNA GENE of *Helicobacter sp.*, *H. suis*, *H. heilmannii*, *H. pylori. Campylobacter jejuni* is used as outgroup for the present study and the samples analyzed in the present study are indicated by a red star.

Pathogenecity trial through animal experimentation :Challenge study was undertaken in four healthy piglets of 45 days old consisting three animals in treatment group and one animal in control group.Treatment group animal showed varying degrees of gastric lesions in the Post moretm examination. There was mild congestion in the cardiac mucosa of the control animal. Two animals with gastritis was found positive for *Helicobacter* spp. by PCR.Urease test positive in the treatment group animals.

Fig.12.Gastric lesions in experimental pigs

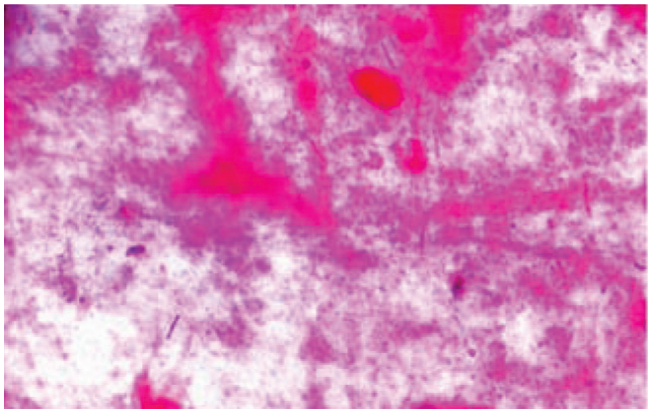


Fig.13. Tightly spiraled bacteria in the gastric mucosa of a challenged pig (Gram's staining X 100 x)

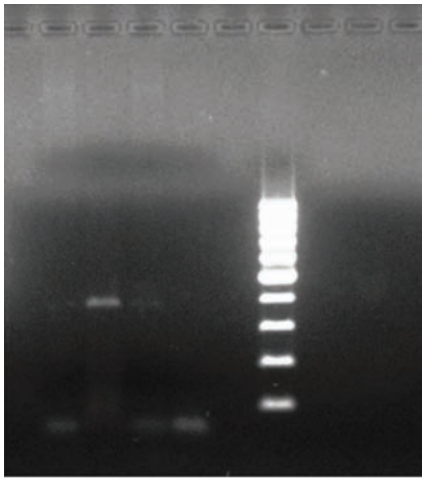


Fig.14.PCR detection of *Helicobacter* spp. in the pig stomach sample (experimental)
M : 100bp DNA MARKER
S1, S2, S3, S4, S5 : pig samples sample
S1,S2 and S3are showing positive for *Helicobacter* genus specific

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

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

A new DBT funded project entitled Molecular Epidemiology of Japanese Encephalitis Virus in Pigs and Mosquitoes in Assam has been initiated from 12.1.2017. Japanese encephalitis (JE) is a viral disease caused by an RNA virus under family Flaviviridae. Itis the leading cause of viral encephalitis in the world, with 30,000– 50,000 cases and10,000 deaths reported annually. Japanese Encephalitis Virus (JEV) maintained in a zoonotic cycle which involves pigs, birds and Culex species of mosquitoes causing fatal encephalitis and it is endemic in most of Asia, as far as Australia from its putative origin in Indonesia and Malaysia. The natural cycle of JEV consists of pig-mosquito-pig or bird-mosquito-bird and pigs serve as a biological amplifiers and reservoirs. Assam is mostly vulnerable for Japanese encephalitis (JE) infection as compared to other states in India. It shares approximately 46.95% of total Japanese encephalitis (JE) positive cases reported all over the country in 2014 (www.nvbdcp.gov.in).Therefore, the present study aims at identifying the temporal transmissionpattern of JEV infection by tracking the sentinel pigs, mosquito vectors based onthe areas of incidence of human JE cases in Assam.

Studies on prevalence of JEV infection in pig population of Assam

A total of 295no.s serum samples,90 whole blood and 51 tissue from pigs of four districts-Kamrup, Jorhat, Dibrugarh, Dhemaji, Golaghat and Lakhimpur have been collected during the reported period. Screening for JE antibody was done by ELISA and HI.The envelope protein of JE virus was targeted by RT-PCR. 19 blood samples and 5 tissue samples were found to be positive by RT-PCR assay.

Pathological examination of the stillborn fetuses from two sow and one gilt revealed hydrocephalous, cerebellar hypoplasia, skeletal deformity and subcutaneous edema.

Fig.1. Stillborn foetus with skeletal deformity

Fig.2. Stillborn foetus showing hydrocephalousin the brain

Fig.3. Stillborn foetus showing cerebellar hypoplasia

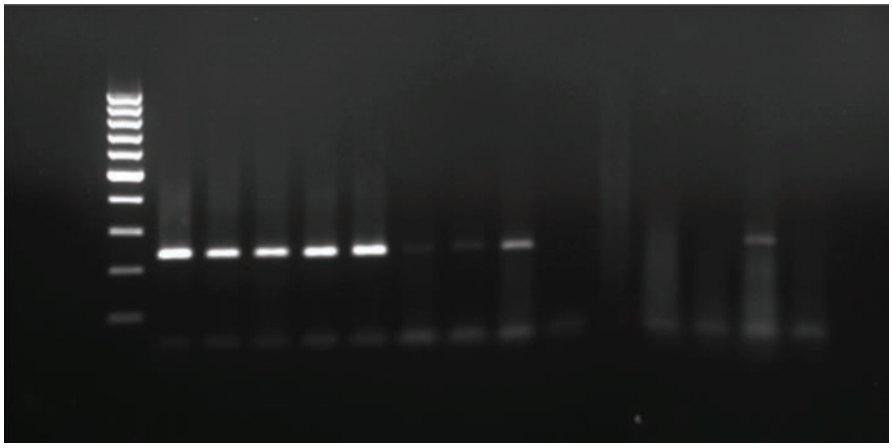


Fig. 4 : Detection of JEV IN porcine samples by RT-PCR
M: Molecular marker, 100bp DNA ladder; P : JEV Positive control;
N : Negative control; Lane 1-7,11 : JEV positive samples; Lane 8-10,12:
JEV negative samples

Phylogenetic Analysis

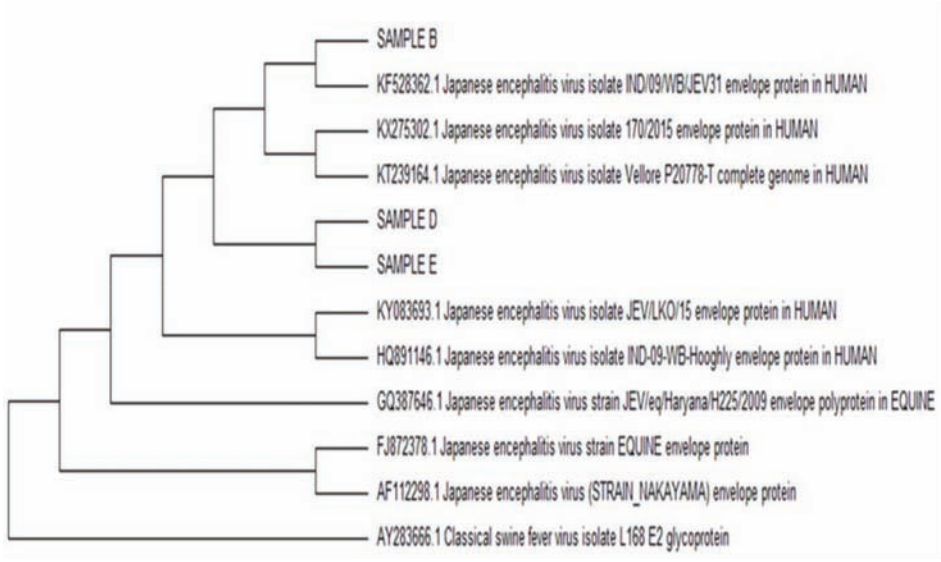


Fig.5 : Phylogenetic tree of Japanese encephalitis virus from field samples. The bootstrap analysis by Maximum Likelihood was performed using MEGA 6 program. Classical swine fever virus was considered as an outgroup in the analysis.

Japanese Encephalitis virus samples of pig from the fields revealed 100% identity with JEV envelope protein of Human and Equine from West Bengal, Vellore, Haryana and Lucknow

VI. LIVESTOCK PRODUCTS TECHNOLOGY

Institute Project: Development of grading system for carcasses of Ghungroo and its crosses

R. Thomas, Girish P.S. and S. Banik

In order to facilitate a) commercial pig rearing practices in India, b) to bring the pork to the mainstream market, c) to promote the availability of quality pork to the consumers and d) to facilitate export of pork from India, ICAR-National Research Centre on Pig in collaboration with Agricultural and Processed Foods Export Development Authority (APEDA), has developed the 'guidelines for export of fresh pork and pork products from India' (Thomas 2015). The existing Indian Standard for 'Specification for pork' i.e. IS: 1723-1973 specifies two grades of pork i.e. Grade 1 and Grade 2, irrespective of sex and age of the pigs, which is based only on two parameters viz. weight of the dressed carcass and fat thickness at the loin. In order to compete in the international market and to meet the current marketing requirements, it is high time for the country to have a better grading system in place. Therefore, a more relevant pig carcass grading system was developed through in-depth research and analysis of data of over 400 ghungroo pig carcasses.

Part I: Yield grades for Indian pig carcasses

The grading system mentioned hereunder categorizes carcasses by yield and quality, and provides producers, wholesalers, retail meat operations, and restaurants the information they need to purchase a grade of meat that suits their particular needs. It is also intended to ensure that the consumer has a choice in selecting a consistent and predictable quality of meat. This article describes the parameters and procedures developed for the grading of barrow, gilt, and sow carcasses. Grades were not provided for boar carcasses, as the meat from boar is unacceptable/not-preferred for marketing owing to the boar taint. A similar practice is being followed in United States (USDA 1985) and EU (Commission of the European Communities 2008). Four distinct classes of yield grades were developed separately for gilt/barrow (Grade 1, 2, 3 and 4; Table 5) and sow (Grade 1, 2, 3 and C; Table 2) carcasses. This different classes of grades for gilt/ barrow and sow carcasses was necessitated due to distinct difference observed in the pattern of change among the parameters which were directly affect the carcass yield viz. chilled carcass weight, back fat thickness and percent yield of primal cuts. In case of gilt/ barrow carcasses, it was observed that the chilled carcass weight increased linearly with increase in the back fat thickness (Fig.1). Also, a proportionate linear increase was observed in the 'yield of primal cuts' with increase in the 'chilled carcass weight'. Therefore, to facilitate ease of documentation at processors level, only the 'chilled carcass weight' parameter had been considered for gilt/ barrow carcasses. However, an additional / secondary criteria viz. back fat thickness, was taken into account to give more credibility to the final grading (Table 3). In other words, the final grade may be determined according to chilled carcass weight, and adjusting up or down one grade for back fat thickness. For example, barrow and gilt carcasses with 45 kg – 54.9 kg 'chilled carcass weight' will be graded as 'Grade 2' if their back fat thickness between 10th and 11thrib positions is less than 15-19.9 mm. However, if the back fat thickness is less than 14.9 mm, carcasses with 'chilled carcass weight' of 45 kg – 54.9 kg will be graded as 'Grade 1' instead of 'Grade 2'. In case of sow carcasses, it was observed that the 'percent yields of primal cuts' were similar in carcasses with similar back fat thickness (Fig.2). However, they had shown wide differences in 'chilled carcass weight' as the back fat thickness changed (Fig. 2). Therefore, back fat thickness for a particular grade was kept constant in similar 'percent yield of primal cut' groups to take into account the variations observed in 'chilled carcass weight' (Fig.2 and Table 3). Also, an additional / secondary criteria viz. back fat thickness, was taken into account (Table 3) and the final grade may be determined according to chilled carcass weight, and adjusting up or down one grade for back fat thickness, as described in case of gilt and barrow carcasses. In contrary to the simple grading system mentioned in this article, the yield grades for pig carcasses established by USA (US Grade 1, 2, 3 & 4), South Africa (PORCUS) and other leading pork producing countries are mostly based on percent of lean meat yield which in turn requires sophisticated equipments to measure carcass and meat quality parameters. Also, these grades are assigned based on prediction equations. Under the current circumstances, such a system will not be viable in India until and unless the quality of raw material (pig/pork), in terms of body conformation and meat quality, improves substantially. Further, the need of using equipments to measure the carcass parameters will not be practicable under the current pig slaughter system.

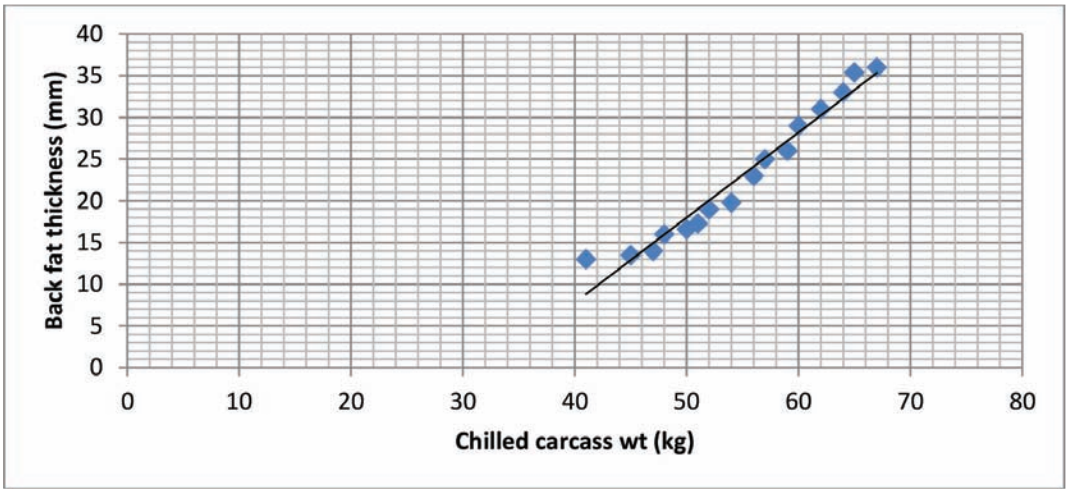


Fig. 1. The pattern of change of carcass weight with respect to back fat thickness in gilts and barrows

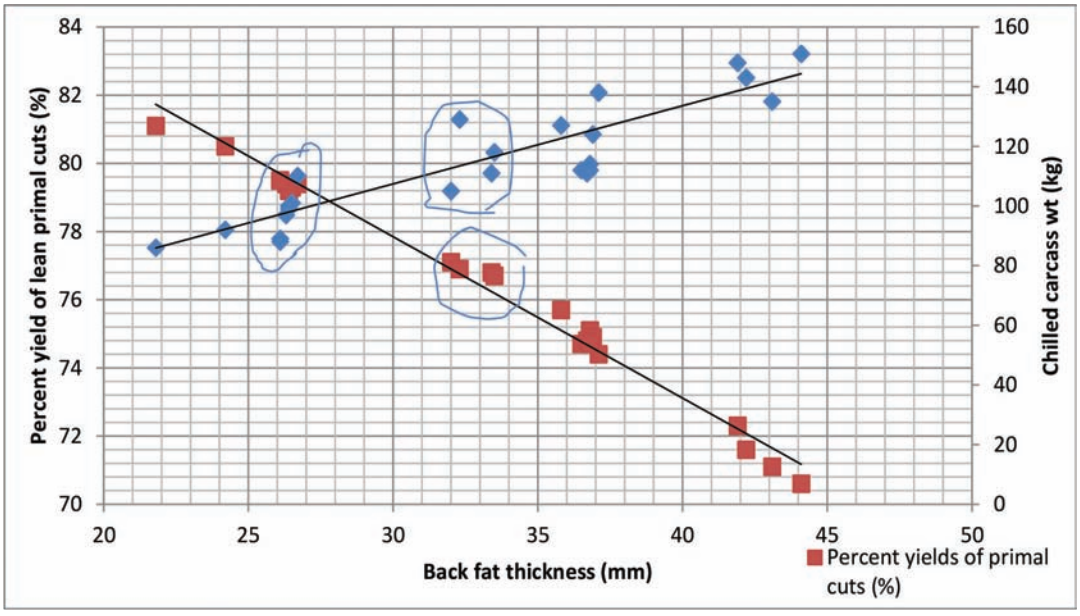


Fig. 2. Pattern of change in percent yield of lean primal cuts and chilled carcass weight with respect to back fat thickness in sow carcasses

Table 1. 'Dressing coefficient reductions' developed based on chilled carcass weight

Chilled carcass weight (kg)	Tongue out, KFKD out	Tongue in, KFKD out	Tongue out, KFKD in	Tongue in, KFKD in
	Deductions in kg			
< 50	0	0.25	0.60	0.85
50.5-74.5	0	0.30	0.80	1.10
75 – 99.5	0	0.30	1.30	1.60
> 100	0	0.30	1.80	2.10
*The coefficients are applied in addition to the 2% hot carcass weight rebate				

KFKD – Kidney fat, kidney and diaphragm

Table 2. Yield grades for gilt and barrow carcasses

Primary criteria		Secondary criteria / additional criteria	
Grade	Based on chilled carcass weight	Grade	Based on back fat thickness
Grade 1	≤ 44.9 kg	Grade 1	<14.9 mm
Grade 2	45 kg – 54.9 kg	Grade 2	15-19.9 mm
Grade 3	55 kg -64.9 kg	Grade 3	20-24.9 mm
Grade 4	≥ 65 kg	Grade 4	>25 mm
Note: The final grade may be determined according to chilled carcass weight, and adjusting up or down one grade for back fat thickness.			

Table 3. Yield grades for sow carcasses

Primary criteria		Secondary criteria / additional criteria	
Grade	Percent yield of primal cuts	Grade	Based on back fat thickness
Grade 1	≥70 %	Grade 1	25 mm – 34 mm
Grade 2	65 % – 69.9 %	Grade 2	35 mm- 44 mm
Grade 3	60 % – 64.9 %	Grade 3	45 mm or more
Grade C*	≤ 59.9%	Grade C*	24 mm or less
* 'C' represents 'cull' grade Note: The final grade may be determined according to chilled carcass weight, and adjusting up or down one grade for back fat thickness.			

Part-B: Quality grades for Indian pig carcasses

Pork quality refers to the expected eating characteristics (tenderness, juiciness and flavour) of the cooked product. The quality grades mentioned hereunder are developed to reflect differences in expected eating quality among slaughter pigs and their carcasses. Conventional methods for carcass quality measurement, such as meat colour, degree of marbling and firmness in back fat were considered for developing quality grades for Indian pork carcasses. Four different quality grades (Grade P-IND) were developed (Table 4), wherein Grade P and Grade I indicates pork carcasses with highly acceptable characteristics while Grade N and Grade D indicates carcasses with less acceptable characteristics. For example, pork carcasses (irrespective of age and sex) with reddish pink colour, firm back fat and moderate marbling, which are indications of good quality, will be graded as 'Grade P'. Similarly, those carcasses with very soft back fat, gray colour and no/ negligible marbling will become 'Grade N' while those with dark red meat, very firm back fat and abundant marbling will be graded as 'Grade D'. In other words, eating quality will be most desirable for "Grade P and Grade I" and least desirable for "Grade N and Grade D". The letters used in the naming of grades i.e. P, I, N and D were selected in order to indicate the pork (P) from India (IND). The quality classes of pig carcasses established by EU (SEUROP) encompass both quality and yield parameters and are based on objective carcass data. The quality grading system described in this article is purely based on subjective evaluation of the carcass and is simple to perform under the current slaughter and processing system exists in India.

Table 4. Quality grades for Indian pig carcasses

Grade	Meat colour	Firmness of back fat	Degree of marbling
Grade P	Light red- Reddish pink	Firm	Moderate – Slightly abundant marbling
Grade I	Pinkish gray	Soft to slightly firm	Slight marbling
Grade N	Gray	Very soft	No/negligible marbling
Grade D	Dark red	Very firm	Abundant marbling

MoFPI Project: Setting up of food testing laboratory (Infrastructure development project)

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

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. So far, the construction of laboratory building was completed. Twenty nos. of the approved equipments were procured and installed using 1st installment received (Rs. 145.16 lakhs). Process for obtaining IS 17025:2017 certification for the lab has been initiated.

Table 1. Details of equipment purchased and installed under grant in aid released by ministry of food processing industries in the food testing laboratory.

Sl. No.	Name of PAC approved equipment	Make/ Model
1	Micro-centrifuge with PCR tube adaptor	Make: Thermo Fisher Scientific Model: Pico-21
2	Ultra low temperature freezer with accessories	Make: Eppendorf Model: U410
3	Deep freezer -400L	Make: Bluestar Model: CHF 400
4	ELISA unit with accessories	Make: Thermo Fisher Scientific Model: Multiskan FC
5	Water purification system with accessories	Make: Merck-Millipore Model: Milli Q Reference/ Elix Reference 10
6	Deep freezer -200 L	Make: Bluestar Model: CHF 200
7	Mini incubation oven	Make: Bio-Rad Model: 166-0521EDU
8	Spectrophotometer	Make: Agilent Technologies Model: CARY 60
9	Electrophoresis workstaion	Make: Bio Rad Model: Gel doc EZ
10	Bio safety cabinet, Type –II, A2	Make: Esco Micro PTE Ltd Model: AC2-4G8
11	Real time PCR with accessories	Make: Applied Biosystems Model: Quant Studio 5
12	Ultra low temperature freeze dryer with accessories	Make: Labogene Model: CS 110-4
13	Electronic precision balance	Make: Sartorius Model: Practum 213
14	Analytical balance	Make: Sartorius Model: Qunitix 224
15	Tube roller	Make: Bio Rad Model: 1660722EDU
16	Digital dry bath with heating blocks	Make: Bio Rad Model: 1660563EDU
17	Microprocessor based refrigerated centrifuge with accessories	Make: Hermle Model: Z 36HK
18	Hot air oven	Make: Nuve Model: FN 120
19	Digital water bath	Make: Nuve Model: K 52 007
20	Trinocular microscope with camera and accessories	Make: Zeiss Model: Axio Lab A1

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 to be developed include the following categories:

1. PUFA enhanced
2. Fibre enriched
3. Antioxidant rich
4. Low salt
5. Low fat/ low calorie

Preliminary laboratory trails were initiated to find out the effects of incorporation of the following compounds/ substances in the pork products:

1. Sodium alginate
2. Sodium casenate
3. Isolated soy proteins
4. Textured soy proteins
5. Bamboo shoot extract
6. α- tocopherol/ Vitamin –E
7. Potassium chloride

Different parameters studied include pH, cooking yield, proximate composition/nutritional value, water activity, hunter colour values, texture profiles and Warner-Bratzler shear force, physico-chemical parameters- Proximate composition/ Nutritional value, TBARS value, Tyrosine value, Free Fatty Acid, Titratable acidity, Microbiological parameters- Aerobic count, Psychrotropic count, Coliform count, *Salmonella* sp. count, *Lactobacillus* count, *S. aureus* count, Yeast and mold count and Sensory characteristics- Appearance, Flavour, Juiciness, Texture, Binding, Overall acceptability.

MoFPI Project: Development of shelf stable pork products using retort processing technology

R. Thomas, Girish Patil. S., S. Rajkhowa and K. Barman

Under this project a State of the art retort processing facility was established in the R&D Pork processing plant of ICAR-National Research Centre on Pig. As per the proposed objectives, an elaborative survey was undertaken to know different pork products consumed and preferred by consumers. Special emphasis was given on traditional pork products of NER. Survey was carried out with about 140 families and 30 restaurants in the region using a structural schedule. Apart from the survey, intensive interactions were held with processors having knowledge of different traditional pork products. Based on the survey and discussions about sixty processed products were identified for further study. Pork products identified were tested for acceptability and suitability for retort processing. For this purpose about sixty different identified products were produced in the laboratory. Many of the products are traditional products of north eastern region. These products were analyzed for acceptability by sensory evaluation. Their proximate composition was evaluated using standard methodology. Based on preliminary trials, the following pork products were found suitable for thermal processing and production of retort processed shelf stable pork products: Pork with Thekera *(Garcinia pedunculata)*; Pork with Outenga; Pork with fermented bamboo shoots; Pork curry with mixed vegetables; Sizzling mushroom pork; Mushroom pork; Chilly Pork; Pork with curry leaves; Pork with curry leaves; Pork with mixed herbs; Pork curry with tomato; Pork with Fresh bamboo shoots; and Pork curry with naga chilly. Thermal processing schedules (F0 value) for production of identified shelf stable ready-to-eat pork products were standardized. Quality parameters of these products were evaluated and storage stability studies of thermally processed pork products were carried out. Financial evaluation was done based on the input costs (recurring and non-recurring) and evaluation of the income for seven years period as per bank requirements. The developed products were commercialized through PPP mode.

Retort processed pork curry products

Designing and construction of small scale pig slaughter units for improving hygienic status of pork produced in the rural India.

R. Thomas and D. K. Sarma

A cost effective (Rs.5 lakhs) design for rural pig slaughter house (for 5-6 pigs per day) has been designed and a model unit has been established at Rani Market in collaboration with Gram Panchayat, Rani. The model offers provision for electrical stunning, elevated carcass dressing, hygienic fabrication and packaging of pork.

Mini pig slaughter house

INSTITUTE VILLAGE LINKING PROGRAMME UNDER TRIBAL SUB-PLAN

Key Associates: D.K. Sarma, K. Barman, M.K. Tamuli, S. Rajkhowa, S. Banik, Mohan. N.H, P.J. Das, R. Thomas, S.R. Pegu and Sunil Kumar

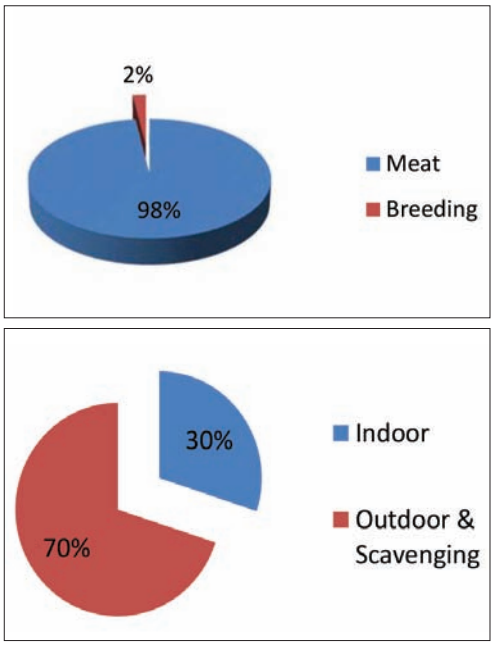
ICAR-NRC on Pig is dedicating its services for the welfare of the tribal community with the mandate of bringing up excellence in pig production not only in the North Eastern Region, but in the country as a whole where pig loving population are living. Therefore, all the institute activities are directly 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

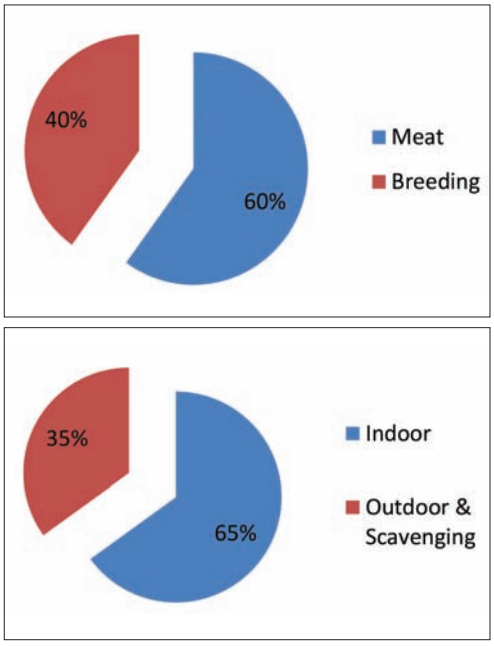
At present ICAR-NRC on Pig is adopting 05 numbers of villages in Rani Block of Kamrup district under its TSP plan and one in Karbialong district i.e. Balipather in Bokajan. These are Batabari, Moirapur, Belguri, sattargaon and Garlic villages.

Performance of pigs at Belguri village

Belguri village has total 100 households and has 100 % tribal inhabitant. People mostly depend on agriculture including pig and other livestock farming. Every household use to keep 1-2 pig of their own. This village has been adopted by ICAR-NRC on Pig in the month of January 2017. Initially, this institute has given 22 numbers of female pigs (Rani variety) to 11 numbers of beneficiaries along with 1 kg feed/per pig/day for six months. Later on 04-09-17, 10 numbers of Rani variety female piglets were distributed among 5 beneficiaries. Total 16 % of families of Belguri village received improved pig variety. Besides these, villagers of Belguri have received feed ingredients, mineral mixture, swine fever vaccines and anthelmintic along with technical guidance with respect to scientific pig husbandry practices. Before intervention, almost all farmers used to rear their pigs for meat purpose only. However, after intervention by ICAR-NRC on Pig, Rani, 40 % of the farmers kept their pigs for breeding purpose and about 50 % of the gilts become pregnant. Before intervention by ICAR-NRC on Pig, 30 % pig farmers raised their pigs in full indoor system while 70 % follow outdoor and scavenging system. However, after intervention by ICAR-NRC on Pig, 65 % pig farmers raised their pigs in full indoor system while 35 % are still following outdoor and scavenging system of rearing.



Scenario before intervention by ICAR-NRC on Pig under TSP



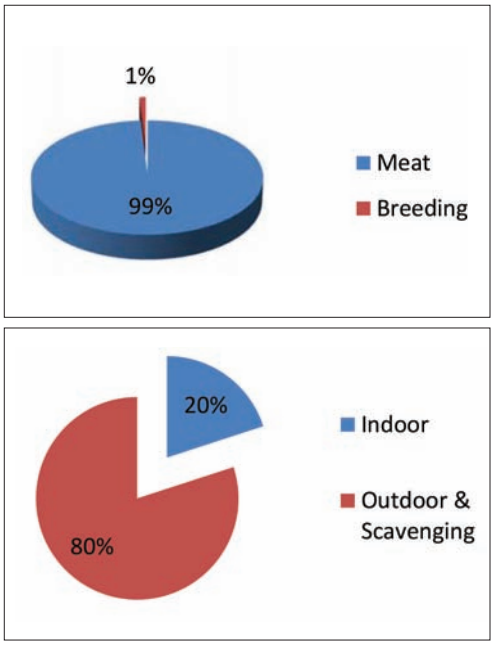
Scenario after intervention by ICAR-NRC on Pig under TSP

Fig.1 Pig Farming Scenario in Belguri village

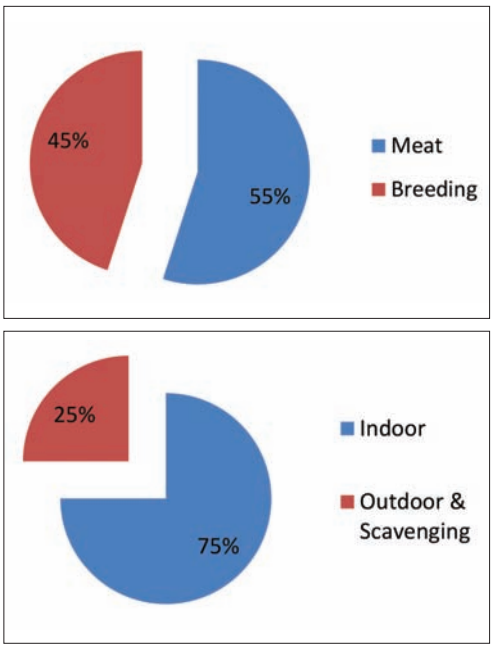
Performance of pigs at Sattargaon village

Sattargaon village has total 62 households and has 100 % tribal inhabitant. People mostly depend on agriculture including pig and other livestock farming. This village has been adopted by ICAR-NRC on Pig in the month of June 2017. Initially, this institute has given 26 numbers of female pigs (Rani variety) to 13 numbers of beneficiaries along with 1 kg feed/per pig/ day for six months. Later on 04-09-17, 2 numbers of Rani variety female piglets were distributed to one beneficiary. Total 22.6 % of families of Sattargaon village received improved pig variety. Besides these, villagers of sattargaon have received feed ingredients, mineral mixture, swine fever vaccines and anhelmintic along with technical guidance with respect to scientific pig husbandry practices from time to time. Before intervention, almost all farmers used to rear their pigs for meat purpose only. However, after intervention by ICAR-NRC on Pig, Rani, 45 % of the farmers kept their pigs for breeding purpose and about 60 % of the gilts become pregnant and two animal furrowed. One sow having 12 piglets and one sow having 11 piglets.

Before intervention by ICAR-NRC on Pig, 20 % pig farmers raised their pigs in full indoor system while 80 % follow outdoor & scavenging system. However, after intervention by ICAR-NRC on Pig, 75 % pig farmers raised their pigs in full indoor system while 25 % are still following outdoor & scavenging system of rearing.



Scenario before intervention by ICAR-NRC on Pig under TSP



Scenario after intervention by ICAR-NRC on Pig under TSP

Fig.2 Pig Farming Scenario in Sattargaon village

Performance of pigs at Garlic village

Garlic village has about 230 households and has 100 % tribal inhabitant. People mostly depend on agriculture including pig and other livestock farming. This village has been adopted by ICAR-NRC on Pig in the month of March 2017. Initially, this institute has given 14 numbers of female pigs (Rani variety) to 7 numbers of beneficiaries along with 1 kg feed/per pig/day for six months. Total 3 % of families of Garlic village received improved pig variety. Besides these, villagers of Garlic have received feed ingredients, mineral mixture, swine fever vaccines and anthelmintic along with technical guidance with respect to scientific pig husbandry practices from time to time. Before intervention, almost all farmers used to rear their pigs for meat purpose only. However, after intervention by ICAR-NRC on Pig, Rani, 20 % of the farmers kept their pigs for breeding purpose and 80 % for meat purpose. About 40 % of the gilts become pregnant and one sow furrowed 10 numbers of piglets.

Before intervention by ICAR-NRC on Pig, 25 % pig farmers raised their pigs in full indoor system while 75 % follow outdoor & scavenging system. However, after intervention by ICAR-NRC on Pig, 70 % pig farmers raised their pigs in full indoor system while 30 % are still following outdoor and scavenging system of rearing.

Table : TSP Programmes conducted during 2017-18

Sl No	Title of the training (sponsoring organization if any)	Duration	Category of trainee (say Farmers, technical etc.)	Number of participants	States represented	Total piglet distributed	Other item distributed
1	Conduction of Pig health and Awareness programme at Village Sattar Gaon, Rani under TSP	One day (19-04-17)	Farmers	62	Assam	-	62 kg mineral mixture has been distributed
2	Conduction of pig feed distribution programme for the beneficiaries of Village Batabari	One day (25-04-17)	Farmers	40	Assam	-	20.10 quintals of feed has been distributed
3	Conduction of pig feed distribution programme for the beneficiaries of Village Sattargaon, Moirapur, Garlic and Belguri	One day 03-05-17	Farmers	58	Assam	-	25.50 quintals of feed has been distributed
4	Conduction of piglet distribution programme for the Village Sattargaon	One day (24-06-17)	Farmers	72	Assam	26 nos	34.50 quintals of feed has been distributed
5	Pig feed distribution programme conducted for the beneficiaries of village Batabari	One day (07-07-17)	Farmers	26	Assam	-	72.00 quintals of feed has been distributed
6	Pig feed distribution programme conducted for the beneficiaries of village Moirapur	One day (12-07-17)	Farmers	08	Assam	-	14.40 quintals of feed has been distributed
7	Pig feed distribution programme conducted for the beneficiaries of village Garlic	One day (21-07-17)	Farmers	07	Assam	-	25.20 quintals of feed has been distributed
8	Pig feed distribution programme conducted for the beneficiaries of village Sattargaon	One day (25-07-17)	Farmers	24	Assam	-	53.40 quintals of feed has been distributed
9	Pig feed and piglets distribution programme conducted for the beneficiaries of village Bokajan, Karbialong District	One day (29-07-17)	Farmers	53	Assam	15 nos piglets has been distributed	45 quintals of feed has been distributed

10	Pig feed distribution programme conducted for the beneficiaries of village Pub Borsorkuchi and Pub Barsiral of Nalbari District	One day (01-08-17)	Farmers	65	Assam	-	53.60 quintals of feed has been distributed
11	Pig feed distribution programme conducted for the beneficiaries of village Belguri, Rani	One day (03-08-17)	Farmers	24	Assam	-	59.40 quintals of feed has been distributed
12	Pig feed distribution programme conducted for the beneficiaries of village Belguri, Rani	One day (08-08-17)	Farmers	15	Assam	-	37.80 quintals of feed has been distributed
13	Piglets and pig feed distribution programme conducted for the beneficiaries of village Belguri and Sattargaon Rani	One day (04-09-17)	Farmers	06	Assam	12 nos of piglets has been distributed	21.6 quintals of feed has been distributed
14	Pig feed distribution programme conducted for the beneficiaries of village Rangapara and Nampara , Rani	One day (23-09-17)	Farmers		Assam	-	12 quintals of feed has been distributed
16	Conduction of one day workshop on Farmers' Scientist Interface on 17-03-18	One day (17-03-18)	Farmers	100	Assam	-	Scientist were Interacted with farmers for scientific piggery farming practices
17	Conduction of Pig health and Awareness programme at Village Belguri, Rani under TSP	One day (27-03-18)	Farmers	70	Assam	-	Swine fever vaccines, anthelmintics, liver tonic, antibacterial ointment etc were distributed among the farmers

Capacity building programmes organized under Tribal-Sub-Plan scheme during the reported period

'Programme on Pig Health and Awareness at Sattargaon

Distribution of mineral mixture at village Sattargaon, Rani block

Piglets and pig feed distribution among beneficiaries of village Sattargaon

Vaccination of pigs against swine fever at village sattargaon

Pig feed distribution among beneficiaries of village Balipather at Karbialong District

Piglets and pig feed distribution among beneficiaries of village Balipather at Karbialong District

Awareness on Scientific Pig farming and feed distribution programme conducted at Nalbari District

Pig feed distribution among beneficiaries of Pub Barsiral village of Nalbari district

Pig feed distribution among beneficiaries of Belguri village of Kamrup district

Pig feed distribution among beneficiaries of Sattargaon village of Kamrup district

Visit of adopted village under TSP by Hon'ble members of RAC

Pig feed distribution among beneficiaries of Pub Barsorkuchi village of Nalbari district

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 2017-18

Sl No	Items	No/kg
1	Pig feed distributed	497.7 quintals
2	Feed supplements (Mineral) distributed	152 kg
3	Anthelmintic dose distributed	478 doses
4	No. of Vaccination against Classical	610 nos
5	Numbers of AI done among tribal farmers	164 nos
6	No of tribal villages covered under AI	24 nos
7	No of faecal samples screen pathogens	100 nos
8	No of blood samples analyzed for viral/bacterial diseases	70 nos
9	No of nasal swab screened pathogens	50
10	No of households benefited	2074 nos
11	Name of pig village adopted by this Institute	Batabari, Moirapur, Sattar Gaon, Garlic village, Belguri village, Balipather-Bokajan

AICRP & MEGA SEED

ALL INDIA COORDINATED RESEARCH PROJECT ON PIG

AICRP on pig was launched in IVth Five Year Plan (1970-1971) with the main objective of studying 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 Sri Venkateswara Veterinary University, Tirupati on 1-2nd July, 2017

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 is maintaining HD-K75 crossbred germplasm developed by crossing of Hampshire (75%) and local pig (25%) of Assam. The center has conducted several training programme and extension activities to popularize piggery in the state of Assam and adjoining states.

HD-K75 crossbred sow with piglets

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 major activities of this center are to conduct research on various aspects of pig production, operate as an instructional farm to students, production and distribution of good quality piglets to farmers and to function as a demonstration unit to farmers. Mannuthy White is well adapted to humid tropical agro-climatic conditions and suited to low input rearing system of Kerala. The developed variety is useful for mitigating demand of improved pig germplasm of the state of Kerala and adjoining areas.

Distribution of Piglets from AICRP on Pig centre, Kerala

SRI VENKATESHWARA VETERINARY UNIVERSITY, TIRUPATI

The AICRP on Pig at SVVU Center, Tirupati is maintaining Large White Yorkshire pigs and its crosses under optimum managemental conditions. During the reporting year the center has released a crossbred pig variety namely SVVU T-17 by crossing of LWY (75%) with local pig of Andhra Pradesh. The performance of this developed variety was found to be superior to the indigenous germplasm. The litter size at birth and weaning during the reporting period were recorded as 8.1±0.36 and 7.52±0.37, respectively.

Release and distribution of SVVU T-17 crossbred pigs at AICRP centre

ICAR-CENTRAL COASTAL AGRICULTURAL RESEARCH INSTITUTE, GOA

Goa is traditionally recognized as one of the leading consumer of Pork in the country with more than 50% of its population consuming Pork. AICRP on Pig centre of Goa is attempting to provide these 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. AI is the strictly followed practice for breeding. The disposal pattern of farm waste is drained to biogas and digested slurry is used for horticultural plantations of the institute.

Artificial insemination at farmers' field by AICRP centre

INDIAN VETERINARY RESEARCH INSTITUTE, IZATNAGAR, BARIELLY

AICRP on Pig center of IVRI is maintaining Landrace and its crosses. The crossbred animals showed better performance in terms of growth, feed conversion efficiency, reproduction, litter and carcass traits. Prophylactic measures were taken to minimize the mortality rate. Nutritional experimentation was done, which revealed that the immune responses of pigs were found to be better than dairy animals. Attempt was made to characterize the local pig germplasm of Uttar Pradesh by this centre.

Crossbred pig Germplasm at AICRP centre

TAMILNADU VETERINARY AND ANIMAL SCIENCE UNIVERSITY, KATTUPAKKAM

TANUVAS Centre is maintaining inter-se population of 75% crossbred (LWY x Desi) pigs. During the period the center has released the developed crossbred variety as TANUVAS KPM Gold. The performance of this developed variety was higher than the local pigs of Tamilnadu. Growth promoters such as yeast extract, nicotinic acid, cyanocobalamin and amino acids or combination of calcium, phosphorus and vitamin D3 and vitamin B12 were given to the weak or runt piglets, pregnant and lactating sows to boost growth and health.

TANUVAS KPM Gold crossbred pig

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

The CVSc &AH, CAU centre maintains Zovawk, Large White Yorkshire and its crosses. During the reporting period the center registered Zovawk Pig of Mizoram. Average litter size at birth was 8.5 ±2.25, 5.6±1.36 and 9±1.21 in 75% crossbred, Zovawk and LWY respectively. A large number of LWY breed of piglets were supplied to the farmers as well as NGO.

Newly Registered Zovawk Breed (Accession No. INDIA_PIG_2700_ZOVAWK_09007)

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

The AICRP on pig, Nagaland centre started the project maintaining local Indigenous pig (Tenyivo) and studied the performance of the local breed and up-grade the local germplasm by crossing with exotic Hampshire boar. Presently the centre is maintaining Tanyivo, Hampshire and its crosses. The average litter size and weight of 75% crossbred animals at birth were 8.37±0.37 and 9.09±0.04 kg, respectively. The successfully upgraded piglets which performed well in the farmer's field under local housing and feeding system were supplied. AI is practiced using Hampshire boar semen in the farm and in the farmer's field.

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, pig breed (Andaman Local pigs) are produced, maintained and supplied to farmers. The litter size at birth and weaning during the reporting period were recorded as 5.4±1.4 and 5.0±1.49, respectively.

Andaman Local Pig at AICRP on Pig centre

COLLEGE OF AGRICULTURE, CAU, 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. The center is maintaining Rani crossbred animal developed at ICAR-NRC on Pig. The center has conducted several health camp and training on scientific pig farming in different districts of the state.

Rani crossbred pig at AICRP on Pig centre

ICAR RESEARCH COMPLEX FOR NEH REGION, BARAPANI

The AICRP on Pig, ICAR Research Complex for NEH region has successfully developed and released Lumsniang crossbred variety of pig which is suitable for hilly terrine of India. Besides crossbred the center is also maintaining the indigenous Niang Megha pig. The center conducted several training, extension activities in farm and farmers' field.

ICAR-INDIAN VETERINARY RESEARCH INSTITUTE EASTERN REGIONAL STATION, KOLKATA

ICAR-AICRP on pig in IVRI, Kolkata was established with an idea to develop an elite flock of Ghungroo germplasm through selective breeding, propagate and supply the superior germplasm to cliental which indirectly increase the pork production. The average litter size and weight at birth is 8.40±0.25 and 9.51±0.25 kg, respectively. The average litter size and weight at weaning is 8.05±0.18 and 68.19±1.68 kg, respectively. Besides maintaining Ghungroo germplasm the center conducted several training to the farmers for popularization of the breed.

Grower Ghungroo Pig at AICRP on Pig centre

KVK-GOALPARA, ICAR-NRC ON PIG

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 average litter size and weight at birth is 5.04±1.56 and 2.48±0.88 kg, respectively. The average litter size and weight at weaning is 1.55±0.12 and 7.63±0.17 kg, respectively.

Doom Pig at AICRP on Pig center

GURU ANGAD DEV VETERINARY AND ANIMAL SCIENCE UNIVERSITY, LUDHIANA

Looking to the scope and importance of piggery sector in the state of Punjab, the Council sanctioned one centre of AICRP on Pig at GADVASU, Ludhiana during 2017.

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.

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 eight different centres. Under this project improved variety of piglets were produced and distributed to the farmers. Total 18027 piglets of improved variety were produced for distribution during XIIth Plan Period. A total of 5879 nos. of improved variety of piglets were produced for distribution in 2017-18.

ASSAM AGRICULTURAL UNIVERSITY, KHANAPARA, GUWAHATI

Under Mega Seed Project on pig this centre maintained three genetic groups viz. 50% Hampshire, Ghungroo Cross. The average litter size at birth and the litter size at weaning at weaning of 50% Hampshire were found as 7.96±0.11 and 6.66 ±0.13, respectively. The pre-weaning and post-weaning mortality (%) were recorded as 2.20 and 2.50, respectively. A total of 1321 piglets were produced under the project.

Crossbred sow with piglet at Mega Seed Centre

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. Mega Seed Project is supplying improved variety of Jharsuk pig to the farmers. Approximately more than 300 second line pig producer have been identified who are supplying improved germplasm of pig to the neighbouring farmers. A total of 1340 pigs were produced during the reporting period.

ICAR RC FOR NEH, NAGALAND CENTRE

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. A total of 872 pigs were produced during the reporting period. Artificial insemination in pig has been popularized widely in the state of Nagaland to enhance the production of piglets from superior breeding stock.

Artificial Insemination in Mega Seed Centre

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. A total 653 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.

KERALA VETERINARY AND ANIMAL SCIENCES UNIVERSITY, MANNUTHY CENTRE, KERALA

The centre was started in 2014 and maintaining 75% LWY X Desi crossbred. A total of 1089 pigs were produced during the reporting period.

ANIMAL RESOURCES DEVELOPMENT DEPARTMENT, TRIPURA

The centre was started in 2014 and maintaining Landrace LWY X Desi crossbred. A total of 675 no. of pigs were produced during the reporting period.

ANIMAL HUSBANDRY AND VETERINARY SERVICES, SIKKIM

Looking to the scope and importance of piggery sector in the state of Sikkim the Mega Seed Project on Pig was sanctioned at Animal Husbandry and Veterinary Services, Govt. of Sikkim. The work for establishment of pig farm at the centre was initiated during the reporting period.

Crossbred pigs at Mega Seed centre of Mannuthy

KRISHI VIGYAN KENDRA

KRISHI VIGYAN KENDRA ACTIVITIES

KVK Goalpara organized 130 nos. trainings under subheads of 90 for practising farmers, 34 for rural youth and 6 for extension functionaries benefitting 1314, 968 and 79 trainees respectively in the year 2017-18. A seven days hands on carpet weaving training was also conducted for encouraging and giving technical guidance to entrepreneurs. In this period KVK Goalpara has conducted 11 nos. of On Farm Trial (OFT) under various disciplines. Out of 11 nos. of OFTs 03 nos. were in Agronomy, 01 no. was in Horticulture, 04 nos. were in Plant Protection, 01 no. was in Animal Science, 01 no. was in Agricultural Engineering and 01 no. was in Home Science. KVK Goalpara also conducted 09 nos. of Front Line Demonstration (FLD) under various disciplines. Out of 09 nos. of FLDs 03 nos. were in Agronomy, 01 no. was in Horticulture, 02 nos. were in Plant Protection, 01 no. was in Animal Science, 01 no. was in Agricultural Engineering and 01 no. was in Home Science.

Details of On Farm Testing (OFT) Programmes

OFT on Performance of Rapeseed Var. "TS 46" under rainfed condition

Rapeseed and mustard is the most important rabi oilseed crop of Goalpara district of Assam. The area under this crop is around 7,400 ha with an average productivity of 4.55 q/ha only. Seed is the major input for which farmers are dependent on seed retailers or their own. But quality is not assured and there are many instances of susceptibility of these varieties for pest and diseases. However, The potential yield of recommended high yielding varieties of rapeseed in Assam is 10-12 q/ha and average state yield is 6.67 q/ha, which indicates that there is a large scope for increasing the productivity and returns. The reasons for lower productivity is poor quality seed material and late sowing of the crops as they grow rapeseed after harvesting of sali rice.

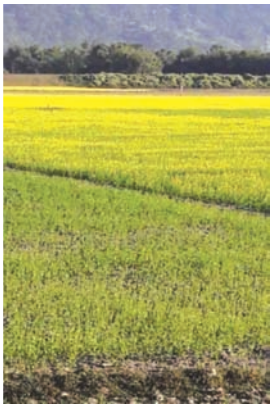
Hence, it was felt necessary to conduct an OFT on "Performance of rapeseed var TS 46 under rainfed condition" at five different locations of Goalprar district of Assam. The rapeseed variety TS 46 is 90-95 days duration and suitable for late sowing. The yield potential is 10-12 q/ha. The assessment of suitable technologies for correcting the yield gap by the KVK Goalpara has resulted in to a positive outcome in terms of adoption of rapeseed variety "TS 46" by the farmers of the district. The result of the OFT is summarized in the below table.

Table 1. Parameters Recorded during the OFT programme

Crop	Pl Height (cm)	No of branches /pl	No of siliqua /pl	No of seeds / siliqua	1000 seed wt. (g)	Cost of Cultivation (Rs)	Yield (q/ha)
Rapeseed (TS 46)	90.22	5.65	92.25	18.38	3.23	16600	6.9
Local var (Sorioh)	93.24	4.5	76.7	16.52	3.19	16600	4.5

Table 2. Details of the trial conducted during the OFT

Crop / Enterprise	Farming Situation	Problem diagnosed	Technology (give details)	Title of OFT	No. of trials	Parameters on Assessment/ Refined	Prdn. per unit	Net return (Rs/ha)	B:C Ratio (GR/ GC)
Rapeseed	Medium low land	Low yield of local var	TS 46, Agronomic management	Performance of Rapeseed var. TS 46 under rainfed condition	4	Yield and Yield attributing character	TS 46 = 6.9 q/ha Local (Sorioh) = 4.5 q/ha	23000 20000	1.8 1.4



Var. TS 46

Local var Sorioh

OFT on Varietal evaluation of medium duration rice var. TTB 404.

Sali rice is the most important crops of Goalpara district with an average production and productivity is 9807.75 thousand tones and 2.55 t /ha respectively. Although, most of the farmers grows high yielding varieties but they also prefer to cultivate some local varieties which are generally long durational crop. Due to long durational nature as well as climatic factors (mainly rainfall) farmers often gets very less time for field preparation of rabi crops. It's results late sowing of rabi crops. TTB 404 is a medium short duration of 130- 135 days winter paddy variety developed by RARS, Titabor, AAU which is not evaluated in Goalpara district. The yield potential of this variety is 6-6.5 t/ha. Therefore, an OFT on "Varietal evaluation of medium duration rice var. TTB 404" was conducted to know the performance under rice based cropping system. The result are summarized in the table below.

Table 3. Parameters Recorded

Crop	Pl Height (cm)	Days to 50% flowering	No of Panicle m^{-2}	No of grain / Panicle	HI	Cost of Cultivation	Yield (t/ha)
Rice Var. TTB 404	151.4	118	234	128	0.42	21375	5.2
Local var. Phul pakhri	141.5	136	209	115	0.35	21375	3.55

Table 4. Details of the trial

Crop / Enterprise	Farming Situation	Problem diagnosed	Technology (give details)	Title of OFT	No. of trials	Parameters on Assessment/ Refined (Pl. mention)	Prdn. per unit	Net return (Rs/ ha)	B:C Ratio (GR/ GC)
Sali Rice	Medium low land	Low yield local var	Var. TTB 404	Varietal evaluation of Sali paddy TTB 404	4	Yield and Yield attributing character	TTB 404 = 5.2 t/ha Pet pakhri (local) = 3 .55 t/ha	21300 20800	1.88 1.45

Rice var. TTB 404

OFT of scientific rearing of Assam hill goat

Table 5. Details of the trial

Livestock	Problem diagnosed	Technology (give details)	Title of OFT	No. of trials	Parameters on Assessment/ Refined	Prdn. per unit livestock/ enterprise	Net return (Rs/Unit)	B:C Ratio (GR/GC)
Assam hill goat	Less body weight and not desirable result of Beetle x Black bangle goat	AAU, 2014	Popularization of Assam Hill Goat rearing in terms of Income generation	08	1. Body weights and body measurements at 1 months interval 2. Age at first estrus 3. Age at conception 4. Age at kidding 5. Gestation period 6. Nos. of kids /kidding	1. Av. 2 kids/ doe	Av. Rs. 18,000/ unit	3:1

Growth performance record both in Assam Hill goat and Black Bengal goat

Assam Hill goat:

Body weight: Male: 23.36±2.82 kg

Female: 17.52±2.54 kg

Body measurement (Adult):

Body length: 59.39±1.17 cm

Body height: 52.48±1.35 cm

Chest girth: 69.93±1.37 cm

Paunch girth: 83.19±2.29 cm

Black Bengal

Body weight: Adult male: 11.47±1.82, kg

Adult female: 9.87±2.31 kg

It was observed that the growth performance of Assam hill goat was more higher than the Black Bengal goats.

Table 6. Mean ± SE of the reproductive traits of Assam Hill and Black Bengal goat

Reproductive traits, days	Black Bengal	Assam Hill goat
Age at first estrus	193 ±2.18	266 ± 2.71
Age at Conception	227±2.65	295± 2.97
Age at first kidding	372±2.69	439±3.21
Gestation Period	147±1.63	149 ±1.02

It was observed that Black Bengal goat has the shortest age at puberty, age at first conception, age at first kidding and gestation period in comparison to Assam Hill goat.

Assam Hill goat at farmers house

OFT on Integrated nutrient management in tomato

Integrated Nutrient Management refers to the maintenance of soil fertility and of plant nutrient supply at an optimum level for sustaining the desired productivity through optimization of the benefits from all possible sources of organic, inorganic and biological components in an integrated manner. It is seen that farmers are not aware of the judicial use of fertilizers and use it in an inappropriate and inadequate manner. Keeping this in view, an OFT on Integrated nutrient management in tomato was undertaken in KVK farm and farmers field with the objectives to demonstrate scientific cultivation practices of tomato, to demonstrate integrated nutrient management in tomato and also to create awareness among the farmers about proper and adequate use of fertilizer. The treatment under the OFT was use of both organic and inorganic fertilizers (1t vermicompost: 10t FYM: 75% of recommended dose of Fertilizer). Incidence of bacterial wilt was observed but could be controlled with organic fungicide i.e mixture of asafoetida and turmeric.

Harvesting in progress

OFT on Low cost Polyhouse

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.

Low cost Polyhouse

OFT on Modified Improved double pot cook stove

To reduce the drudgery of women in firewood collection and cooking, one OFT was conducted on Modified Improved double pot cook stove. The modified double biomass cook stove having two pot holding places is designed to meet the cooking requirement of women. The special feature of the cook stove is bigger size of firebox and the pots are connected to a chimney trough which the smoke releases outside. To enhance the life of the structure a mixture of cement and sand is used. Use of this chulha reduced drudgery in both firewood collection and cooking. Smoke emission is less benefitting the health of women.

Double pot cook stove

OFT : Integrated Management Practices For Panama Disease of Banana

Thematic area - Integrated disease management

Problem identified- Plant mortality due to panama disease

Source of Technology – AAU, Jorhat

No. of trial: 05

Treatments undertaken:

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

Crop / Enterprise	Farming Situation	Problem diagnosed	Technology (give details)	Title of OFT	No. of trial	Prdn. per unit	Net return (Rs/h	B:C Ratio (GR/ GC)
Banana	Up land	Plant mortality	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	"Integrated Management Practices For Panama Disease of Banana"	05	250q/ ha	250,000	3.1:1

Integrated Management Practices For Panama Disease of Banana

OFT : Integrated Management Practices of Viral disease of King Chilli

Crop: King Chilli	Up land	Probels: Plant mortality, low yield	Treatments T1: Spray neem product T2: Netting with nylone cover the plot T3: Spray with Imidaclopid 15 days interval	"Integrated Management Practices of Viral disease of King Chilli (Bhut Jolokia)"	Number of trials: 05	Production: 90q/ha	Net Profit: 1,50,000	B:C ratio 3.5:1

Integrated Management Practices of Viral disease of King Chilli

Details of Front Line Demonstration programmes

FLD on Linseed variety T-397

Based on the performance and economics of the Linseed variety T-397 were found to be suitable for demonstration after cultivation of rice under rainfed condition. A total 10 ha of area was covered with 32 nos of demonstrations. The details are given in Table below.

Yield details

Crop	State Yield (q/ha)	District Yield (q/ha)	Potential Yield (q/ha)	Yield obtained in the demon (q/ha)	
				Demo	Check
Linseed	6.67	7.15	12	7.5	5.25

Economic Parameters : (Rs / ha)

Crop	**Farmer's plot**				**Demonstration Plot**			
	Gross cost	Gross return	Net Return	B:C Ratio	Gross cost	Gross return	Net Return	B:C Ratio
Linseed	13900	19000	5100	1.4	14700	22350	7650	1.52

Others

Crop	**Farmer's plot**				**Demonstration Plot**			
	Gross cost	Gross return	Net Return	B:C Ratio	Gross cost	Gross return	Net Return	B:C Ratio
Linseed	13900	19000	5100	1.4	14700	22350	7650	1.52

Linseed Var. T397

FLD on Black gram var. PU -31

With a view to popularize the black gram variety PU-31 among the farmers, a Front Line Demonstration programme was conducted at different villages of Goalpara district of Assam. The objective of this demonstration is to give awareness among the farmers on the importance and scope of growing pulses and practical demonstration gave hands on training to the farmers. A total 10 ha of area was covered with 30 nos of demonstrations. The details are given in Table below.

Yield Details

Crop	**State Yield (q/ha)**	**District Yield (q/ha)**	**Potential Yield (q/ha)**	**Yield obtained in the demon (q/ha)**	
				Demo	**Check**
Black Gram	8.5	8.22	12	8.75	6.5

Economic Parameters : (Rs / ha)

Crop	Farmer's plot				Demonstration Plot			
	Gross cost	Gross return	Net Return	B:C Ratio	Gross cost	Gross return	Net Return	B:C Ratio
Black Gram	18250	33500	15250	1.83	23240	44600	21360	1.9

Others

Training organized	Field visit	No of village involved	No of farmers adopted	Total area (ha)
1	15	2	18	10


Black Gram Var. PU-31

FLD: Piglet production through AI

Activities

1. AI was done in 117 sows and the conception rate was 81.82%.
2. 12 nos. of trainings were given to the farmers on Reproductive parameters and piglet management.
3. 5 nos. of rural youths were trained to do AI in pig
4. Already formed society named as "Sarpak Livelihood Promotion Society" expanded their area of operation to another two villages.
5. Awareness programme were also conducted to another villages for adoption of AI in Pig.
6. Gilts/sows produced 1046 nos. of piglets with an average litter size of 10.89±0.19.

Parameters covered

Parameters	**AI born Pigs**	**local**
Av. Litter size at birth	10.89±0.19 no.	6.42±0.31 no.
Av. Litter size at birth	9.53±0.27 no.	4.36±0.64 no.
Av. Litter weight at birth	9.35±0.18 kg	4.85±0.24 kg
Av. Litter weight at weaning	27.67±2.05 kg	9.54±0.86 kg
Mothering ability	Good	poor
Age at first heat	7.24±0.57 months	8.12±0.43 months
Prize of piglets at 2 months	Rs. 2500	Rs. 1800

A.I. in Pig

A.I. born piglets

FLD: Cultivation of oyster mushroom in rice straw

Cultivation of oyster mushroom

FLD: Integrated Disease Management Practices of Bacterial Wilt of Brinjal

Integrated Disease Management Practices of Bacterial Wilt of Brinjal

Crop Enterprise	Technology demonstrated	Demonstration Yield (Qt/Ha) / kg/unit			Yield of local Check	% increase/ change in avg. yield over local	Gross Cost (Rs/ha)/ (Rs./ unit)	Gross Return (Rs/ha)/ (Rs./ unit)	Net Return (Rs/ha)/ (Rs./ Unit)	B:C Ratio (GR/ GC)
		H	L	A	(Qt/ha)	%				
Mush-room	Cultivation of oyster mushroom in rice straw	1.4	1	1.2 kg/ bag	800g/ bag	150	12,000	40,000	28,000	3.3:1
Brinjal	IDM in Bacterial wilt in Brinjal	280	220	250 q/ ha	180	139	70,000/ ha	2,00,000	1,30,000	2.8:1

FLD on Rejuvenation of arecanut orchard

Arecanut is one of the major cash crop of Goalpara district of Assam. Since last 15 years arecanut plantations of Goalpara district has been suffering from ganoderma disease leading to declination of the arecanut orchards putting the farm families in economic difficulties. Keeping this in view, a front line demonstration on Rejuvenation of arecanut orchard was undertaken for rejuvenating the senile and unproductive orchards in five villages of Goalpara district namely Udaypur, Lela, Siluk, Kochdhowa and Darrangiri comprising 10 ha area. Under this FLD awareness, demonstration cum training programme were organised and healthy saplings of arecanut var. Kahikuchi from ICAR-CPCRI, Guwahati were distributed to the farmers of above mentioned villages for replanting in the existing orchards after uprooting the diseased plants. Field day was organized on 28/02/2018 at Siluk village of Kochdhowa developmental block. Regular monitoring on the arecanut plantation is carried out. The programme is on progress.

Rejuvenation of arecanut orchard

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

Polythene Mulching in Pineapple

FLD on Tying and dyeing of clothes

Tie and dye is one of the oldest method of decorating the fabric. Various dyes are available for home use and they can be used for renovating shabby and discoloured clothes, loose covers, curtains etc., as well as for completely changing the colour of an article. To develop tie and dye as a new entrepreneur avenue among rural women, five female SHGs were selected and equipped with required technical know how & resources. After learning about the technique, the SHGs started producing items like bedcovers, cushion cover and handkerchief. Rather than throwing old and shabby clothes they started reusing the clothes for home decoration. The programme is still in progress.

FLD on tying and dyeing of clothes

Success stories/Case studies

Banana farming

A progressive farmer from Goalpara district of Assam, Mr. Debabrat Rabha started cultivation of banana in 2011 in 5 bighas of land with 1000 suckers. At present 300 bighas of land is under banana cultivation with an annual turnover of Rs. 2 Crores. Mr. Debabrat Rabha was awarded “Krishi Bota” in 2017 by RHAC, Dudhnoi. He was awarded Ambedkar Leadership Award in 2017 by Prakriti Suraksha Samity, Assam. At present providing employment to more than 200 nos. of rural youths. KVK intervention is in the form of training and demonstration.

Black Rice

Mr. Upendra Rabha is pioneer of black rice cultivation in Assam. Due to his untiring effort, black rice is popularly known as Upendra Rice. A single seed was germinated in 2011 which was provided by KVK Goalpara. A Society was formed and registered. Black rice was cultivated in 1500 bigha in 2017. Several value added product (cake, cheera, bhujia, pitha)are developed which are in high demand. The farmer has begged number of awards including Innovation Award of IARI. Nominated to 15 progressive farmers Vietnam Visit team on May 2018. KVK intervention is in the form of training and demonstration.

Pig Seed Village (AI)

A pig seed village project was taken up by KVK Goalpara at Paschim Dairong Village. At present total Farm family involved were 215. Total 164 AI were done. Now 48 nos. of pregnant sows are in the village. The present stock of AI born piglets are 1078. A total of 85 families benefitted from this programme.

ALL INDIA COORDINATED RESEARCH PROJECT ON PIG, KVK-GOALPARA CENTRE

S. Banik, M.K. Tamuli, 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. 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 Pig Shed

Selection of animals from farmers' field

Doom pig at its conservation unit

Other extension activities of KVK Goalpara during 2017-18

1. Awareness programme on Oil palm cultivation at Hatigaon, Goalpara- 150
2. New India Manthan -Sankalp se siddhi programme- 250
3. Soil health day-257
4. Mahila Kisan Diwas-30
5. Farmers' training camp on Horticulture-121
6. Agricultural Education Day-15
7. Exhibition-05
8. Exposure Visit-03
9. Field Days-06
10. Group Discussion-05
11. Method demonstration-14
12. Newspaper coverage
13. Soil health Card issued-155
14. Pradhan mantri Fasal Bima Yojana-700
15. Jai Kisan Jai Vigyan-100

Special days observed

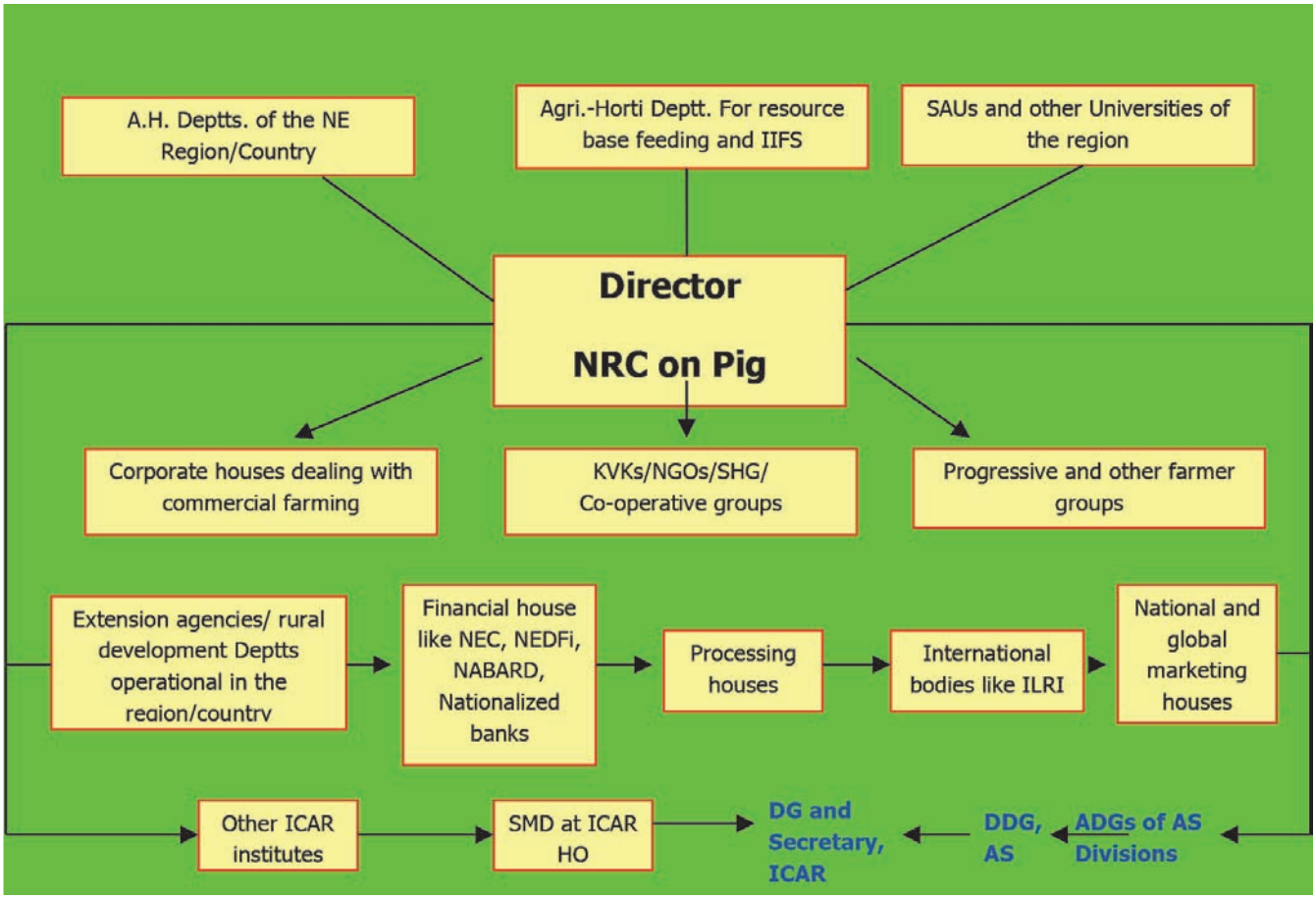
1. Sankalp se Siddhi-Farmer's Doubling income- 01-700
2. Participatory Rural Appraisal (PRA)- 01
3. World Environment Day-01
4. Krishi Unnati Mela at IARI, New Delhi: 50 Farmers gathered to see the Live telecast of PM lecture

Functional Linkages

1. ATMA, Goalpara
2. APART, Goalpara
3. Deptt. of Agriculture, Goalpara, Govt. of Assam
4. Deptt. of Veterinary, Goalpara, Govt. of Assam
5. Deptt. of Fishery, Goalpara, Govt. of Assam
6. District Rural Development Agency,Goalpara
7. Rabha Hasong Autonomous Council
8. National Horticulture Board
9. NABARD
10. Lead Bank,Goalpara
11. RSETI,Goalpara
12. Assam Agricultural University
13. NGOs:

- Assam Mahila Samata Society
- SRIJAN NGO
- Bosco Reach Out

LINKAGE AND COLLABORATION OF ICAR-NRC ON PIG



Meetings & Other activities

MEETINGS AND OTHER ACTIVITIES

Research Advisory Committee Meeting

Members	Designation
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. C.S. Prasad Former Vice-Chancellor, MAFSU, Maharashtra	Member
Dr. Sushil Kumar Former Director, ICAR-NDRI, Karnal	Member
Dr. Gaya Prasad Vice-Chancellor, SVPUAT, Meerut	Member
Dr. D.K. Sarma Director, ICAR-NRC on Pig	Member
Dr. M.S. Raju Professor and Head, Deptt. of Animal Reproduction, RGCOVAS, Puduchery	Member
Dr. Mohan, N.H. Principal Scientist, ICAR-NRC on Pig	Member Secretary

Eleventh Research Advisory Committee meeting of the Institute was held during 15-16th May, 2017 under the Chairmanship of Dr. V. K. Taneja, Ex-Vice-Chancellor, GADVASU, Ludhiana and Ex DDG (AS), ICAR, New Delhi. The meeting was also attended by two of the IMC members of the institute viz. Dr. R. Borpuzari, Professor, C.V.Sc., A.A.U. and Shri Pankaj Kumar Pathak, Representative Agricultural /Rural Interest, and the Scientists of the institute. Dr. D.K. Sarma Director, ICAR-NRCP welcomed the honourable Chairman and other members of the RAC for the meeting and briefed about the Institute activities and achievements for the appraisal of the committee members. The briefing by the Director was followed by the presentations of research projects carried out under different approved research programmes, by the Scientists of the Institute. Each presentation was followed by comments from the Chairman and members of the RAC. The Chairman and members expressed their satisfaction over the progress.

The major recommendations of the 11th RAC meeting are listed below.

1. RAC suggested that comparative genetic and economic evaluation of various crossbred types based on first and overall lifetime productivity should be studied to identify best crossbred type/ types for commercial farming under farm and field conditions.
2. For addressing concerns on impending climate change, studies on physio-genomics of adaptation for identification of stress tolerance markers in different breeds of pigs and development of ameliorative measures at field level should be continued.
3. Focus on nutritional research should be in strategic supplementation of the limiting nutrients with locally available feed resources to improve production and reproduction in pigs.
4. Monitoring of diseases and providing diagnostics should receive high priority and sample from pig herds and environment should be screened for presence of swine pathogens, zoonotic pathogens and on antimicrobial resistance.
5. The RAC emphasized on need to develop novel pork products including nutrient fortification, smart packaging for increasing shelf life and development of ready to eat meat products.

11th RAC meeting is in progress

Institute Research Council meeting

Eleventh IRC meeting of the Institute was held on 19-20th June, 2017 under the Chairmanship of Dr. D.K. Sarma, Director of the institute. Dr. V. Bhasin Pr. Scientist (AG &B) from ICAR HQ, New Delhi was also present for evaluation of the projects in the IRC. 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.

11th IRC meeting is in progress

Quinquennial Review Team (QRT) Meeting

Members	Designation
Dr. B.B. Mallick, Former Vice Chancellor, WBUAFS, Kolkata	Chairman
Dr. Sushil Kumar, Former Director & Vice Chancellor, NDRI, Karnal	Member
Dr. Kusumakar Sharma, Former ADG (HRD), ICAR, New Delhi	Member
Dr. D.K. Singh Dron, Former Director of Research, BAU, Ranchi	Member
Dr. B.C. Deka, Professor, Deptt. of Animal Reproduction, C.V.Sc., A.A.U.	Member
Dr. Swaraj Rajkhowa, Principal Scientist, ICAR- NRC on Pig	Member Secretary

The QRT meeting of ICAR- NRC on Pig was held during 26-28 July, 2017 at the ICAR- NRC on Pig, Rani, Guwahati. The Chairman of the QRT briefed all the members of QRT about guidelines for review. Director of the institute, Dr. D.K. Sarma made a brief presentation about the achievements of the institute during the last five years. QRT team has evaluated the activities conducted / progress made by the institute during 2012-2017. QRT has interacted with other committees of the institute viz. IMC etc. to understand the requirements of the institute for the next five years. The team has also visited the adopted villages under tribal sub plan. In addition the members has visited some of the AICRP on Pig centers. The committee has submitted the final report along with recommendations to the Council.

Quinquennial Review Team (QRT) Meeting in Progress

Quinquennial Review Team (QRT) team visits R & D pork processing plant

Institute Management Committee meeting

Members	Designation
Dr. D.K. Sarma Director, ICAR-NRC on Pig	Chairman
Dr. R.S. Gandhi ADG (AP&B), ICAR	Member
Dr. A.K. Pattanayak Director, Vivekanand Parvatiya Krishi Anusandhan Sansthan, Uttarakhand	Member
Dr. R. N. Goswami Dean, CVSc, AAU	Member
Dr. A. Chakraborty Director of Research (Vety), CVSc, AAU	Member
Dr. R.N. Borpuzari Professor, CVSc, AAU	Representative Agricultural / Rural Interest
Director Director, Department of AH & Vety., Chenikuthi	Member
Director, SIRD, Khanapara	Member
Dr. G.C. Acharya Principal Scientist, Central Horticultural Experimental Station, Orissa	Member
Dr. Mohan N.H. Principal Scientist, ICAR-NRC on Pig	Member
Shri. G. Ghosh FAO, ICAR-RC for NEH, Umiam	Member
Shri. Pankaj Kumar Pathak Guwahati	Representative Agricultural / Rural Interest
Mr. M. Besra Administrative Officer, ICAR-NRC on Pig	Member Secretary

Fifteenth Institute management Committee Meeting of the institute was held on 30th Oct., 2017 under the chairmanship of the Director, ICAR-NRC on Pig. The IMC members also held an interactive meeting with the Chairman and members of QRT team of 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.

IMC meeting in progress

Institute Bio Safety Committee Meeting

Members	Designation
Dr. D.K. Sarma Director, ICAR-NRC on Pig	Chairman
Dr. B.C. Sarmah Ex-Professor an Head, AAU	Member
Dr. V. K. Dubey Professor, IIT-Guwahati	DBT Nominee
Dr. P. Chakravarty Principal Scientist, ICAR-NRC on Pig	Member
Dr. S. Rajkhowa Principal Scientist, ICAR-NRC on Pig	Member
Dr. Girish Patil, S Principal Scientist, ICAR-NRC on Pig	Member
Dr. Mohan N.H Principal Scientist, ICAR-NRC on Pig	Member Secretary

Third meeting of Institute Bio Safety Committee (IBSC) meeting was held on 20th April, 2017 under the chairmanship of Dr. D. K. Sarma, Director of the Institute to streamline the research projects involving rDNA works. The external members present in the meeting were Dr. V. K. Dubey, Professor, Department of Biosciences, IIT, Guwahati and Dr. B. Sarmah, Head, Department of Animal Physiology, C.V.Sc., Khanapara, Guwahati, The Scientists of the institute presented the research projects involving rDNA works for approval by the committee. The committee carefully examined each project submitted by the scientists and raised certain queries, which were replied in a satisfactory manner by the concerned PIs of the project. Based on the declaration made by PIs and information given in the application, the IBSC concludes that all the projects are in Biosafety I and II category for which necessary infrastructure is available in the institute. The IBSC has visited the laboratories and facilities available for handling and disposal of the research materials and satisfied that they are as per relevant biosafety rules. After careful scrutiny of applications and declaration of PIs, the IBSC approves the execution of technical programme of the project as agreed upon. The PIs were requested to stick to the technical programme and any deviation may be brought to the notice of IBSC.

Biosafety meeting organized at the Institute

Institute Animal Ethics Committee meeting

Members	Designation
Dr. D. K. Sarma, Director, NRCP, Rani, Guwahati	Biological Scientist, Chairman
Dr. A. Chakaborty, Director of Research (Veterinary), A.A.U., Khanapara, Guwahati	CPCSEA Main Nominee
Dr. P. Chattopadhyay, Scientist, DRDO, Tezpur	CPCSEA Link Nominee
Dr. C.C. Baruah, Professor, Department of Pharmacology, C.V.Sc., Khanapara, Guwahati	Scientist from outside the institute
Dr. Sashanka Sekhar Dutta, Beltola, Guwahati	Socially Aware Nominee
Dr. Swaraj Rajkhowa, Pr. Scientist, NRCP, Rani, Guwahati	Scientist from different discipline
Dr. Sunil Kumar, Scientist, NRCP, Rani, Guwahati	Scientist Incharge of Animal House facility
Dr. Rajib Kumar Das, NRCP, Rani, Guwahati	Veterinarian
Dr. Keshab Barman, Pr. Scientist, Rani, Guwahati	Member Secretary

Institute Animal Ethics Committee (IAEC) meeting was held on 16th December, 2017 under the chairmanship of Dr. D. K. Sarma, Director of the Institute. The members discussed on the use of pig for research inculcation with welfare of the animals.

IAEC Meeting in Progress

Hindi Parliamentary Committee Meeting

Hindi Parliamentary Committee Meeting was held on May 3, 2017 at Guwahati to review the status of implementation of Hindi in the institute communications under the Chairmanship of Dr. Sataynarayan Jatia, Hon'ble Member of Parliament. Dr. Prasanna Kumar Patsani, Hon'ble Member of Parliament was the Convener of the committee. The committee reviewed the progress of implementation of Hindi and expressed their satisfication for the commendable effort taken by the institute in the day to day office correspondences.

Others

Round table meeting to discuss 'augmenting pig production system in NER'

One day round table meeting to discuss 'augmenting pig production system in NER' was organized at ICAR–National Research Centre on Pig, Guwahati (ICAR - NRCP) in collaboration with Agricultural and Processed Food Products Export Development Authority (APEDA) on 9th September, 2017. The meeting was intended to create a platform for the stakeholders to interact and discuss issues related to piggery sector and to identify the critical gaps and the possible strategies to bridge the gaps, especially in the NE Region. The programme was attended by over 40 participants, which include representatives from APEDA; ICAR-NRC on Pig; State Animal Husbandry Departments of NE States; Department of Animal Husbandry, Dairying and Fisheries (DAFD), Govt. of India; British High Commission; British Pig Association; Assam Livestock and Poultry Corporation; Meghlaya Institute of Entrepreneurship; ICCo; Rashtriya Gramin Vikas Nidhi; PHD Chamber of Commerce; commercial pig farmers, entrepreneurs; exporters of pork and pork products etc.

The meeting begun with the address by Dr. Dilip Kumar Sarma, Director, ICAR–NRC on Pig. In his address to the house, Dr. Sarma has given an overview of the piggery sector in the country, its strengths and weaknesses to the delegates. Mr. Upendra Kumar Vats, General Manager, APEDA gave a detailed report on the status of export and import of pork and pork products with respect to India. Mr. Vats also suggested

the 'hub and spoke' model for augmenting the supply chain/ value chain for piggery and pork processing in the country. In his inaugural address, Dr. D.K. Sarma, Director, ICAR-NRC on Pig has emphasized that piggery is one of the few agricultural sectors, which has the real potential to double the farmer's income in short span of time. Directors/ Joint Directors/officials from the state animal husbandry departments of North Eastern Region have briefed about the status of piggery in their respective states. Mr. Chris Jackson, President, British Pig Association has briefed the house about the pig production practices followed in UK, availability of high quality genetic material which will be of use for improving the genetic make of Indian breeds, disease control strategies followed etc. Mr. Chris also highlighted the need for promoting those breeds with better FCR to tackle the issue of high feed cost.

Dr. Sulekha S.L., Assistant Commissioner, Department of Animal Husbandry, Dairying and Fisheries has provided a realistic picture of status of pork import to the country. Dr. Sulekha has elaborated about the 'innovative project' being implemented by DADF towards augmenting the pig production scenario in the NE states. She informed the house that the said project include three state programme viz. a) establishment of nucleus pig farms in each NE states, b) import of live pigs from UK/Canada/Germany to these states to improve the existing stock and c) establishment of multiplier units for distribution of quality pig germplasm to the farmers. She also reiterated that development and notification of a pig breeding policy is must for every state government and DADF will shortly come up with a national pig breeding policy and guidelines for import of pig germplasm.

Assam Livestock and Poultry Corporation has stressed the need for developing a database on the availability of pig germ plasm in the region and creation of a warehouse for storage of maize in the region. Meghalaya Institute of Entrepreneurship has pointed out the need to set up pig development centres to ensure better dissemination of service facilities to the pig farmers. Entrepreneurs and commercial farmers have stressed the need for pig focused schemes for financial assistance towards setting up of large scale farms/ processing units. They also reiterated the urgent need for a vaccination policy to be introduced in the Government schemes, with respect to CSF and FMD.

The house has spent sufficient time to discuss various key issues related to augmenting the piggery sector during the meeting. The following major action plans were evolved during the discussion:

1. State Animal Husbandry Departments has to speed up the procedures and set a time limit for import of pig germplasm.
2. In the first instance focus may be given on import of large white Yorkshire, Hampshire and Landrace.
3. Animal Husbandry Departments has to speed up the notification of pig breeding policy with respect to the respective states.
4. A quality assurance unit for pig feed need to be established for independent third party checking of the quality of feed.
5. Cooperative pig farming need to be strengthened to ensure implementation of better production practices and completing the pig value chain with ultimate benefit to the pig producers.
6. State Animal Husbandry Departments need to take up the issue of setting up of pig abattoirs in their respective states towards ensuring clean pork to the consumers.

Delegates participating in the round table meeting

CELEBRATIONS

Institute Foundation Day

The 16th Foundation Day of ICAR-National Research Centre on Pig was celebrated with a day long programme on 4th September, 2017 in the institute campus at Rani. An open session was organized on the occasion in which Shri. Naveen Verma, Secretary, DoNER, Shillong was the Chief Guest and Dr. T. Mohapatra, Secretary DARE and DG, ICAR, New Delhi and Dr. K.M. Bujarbaruah, Vice- Chancellor, A.A.U., Johrat (Assam) and Former DDG (A.S.), ICAR, New Delhi and Dr. R.S. Gandhi, ADG (AP &B), ICAR, New Delhi, graced the occasion. Shri. Naveen Verma, Secretary, DoNER appreciated the role of ICAR-National Research Centre on Pig on promoting pig husbandry in the country and invited the farmers to take advantage of scientific practices and technologies developed by the institute for improving their economic conditions. Dr. T. Mohapatra while presenting the statistics of pig production and demand pertaining to North Eastern India, stressed the need to expand the activities to minimize the gap between production and demand. Dr. Dilip Kumar Sarma, Director, ICAR-NRC on Pig presided over the open session and expressed thanks and gratefulness to all those concerned towards the development of the pig husbandry by adopting the technologies developed by the institute and also those involved in the growth of the institute. Farmers- Scientists interaction, piglet distribution to the farmers, cultural programme and illumination were other programmes where the scientists of the institute, Krishi Vigyan Kendra, Dhudnoi, Goalpara, farmers and entrepreneurs participated.

Hon'ble Secretary, DARE & DG, ICAR inaugurated the 16th Foundation Day.

Glimpses of Institute Foundation Day

Swachh Bharat Mission

Swachh Bharat Mission at ICAR-NRC on Pig, Rani, Guwahati was initiated with the celebration of Swachhta Pakhwada 15 Sept- 2 Oct., 2017. On this occasion, Institute staff actively participated in plantation of saplings in the premises of the Institute campus. Under Swachh Bharat Mission, a cleanliness programme was carried out inside the laboratories of the Institute as a part of Swachh Bharat Abhiyan. Subsequently a cleanliness programme was carried out in front of the Artificial Insemination Laboratory and Institute Farm Complex. Staffs of ICAR -NRC on Pig conducted an awareness programme on clean meat production in Rani Bazar, adjacent to the Institute. All meat, fish sellers were advised on how to produce and sell clean meat and fish. Poster and banners were also displayed in different parts of the market as a part of cleanliness programme.

Participants in the Swachh Bharat Mission

Glimpse of Swachh Bharat Mission initiated by ICAR-NRC on Pig

Distribution of medicine at village Belguri

Mera Gaon Mera Gaurav Programme

As directed by the ICAR, the Institute implemented the Mera Gaon Mera Gaurav (MGMG) programme for the benefit of farmers. Five villages in the state of Assam were adopted under this scheme. Team of Scientists and technical staffs of the institute periodically visited the villages to collect base line data, discuss with farmers about the existing problems and provide the suggestions/inputs for overcoming the problems related to animal husbandry. Capacity building and skill development in the form of workshops and demonstrations were conducted in the villages.

Conduction of Pig Health and Awareness Program at village Belguri

Pregnancy detection in pig at adopted village

Training programme conducted for farmers

Farmers' Scientist Interface meeting

Field visit programme for trainees

Vigilance Awareness Week

Vigilance Awareness Week was celebrated from 30th October to 4th November, 2017, started with pledge taking ceremony of Vigilance Awareness Week in the auditorium of the institute. The Director, Dr. D. K. Sarma leaded the ceremony and chanted the pledge and immediately after each phrase, the Scientists and staff from Administration, Finance, Farms and Laboratories had followed to pronounce the phrases. On the day 4th of November, 2017 the staff of the institute along with scientists, technicals and all the temporary research staff assembled in the auditorium to carry out the discussion on the theme. The vigilance officer had leaded the discussion and two of the officers from accounts and administrations respectively spoken on the occasion. The Director of the institute at the end leaded the pledge taking ceremony for Citizen's Integrity Pledge.

Celebration of Vigilance awareness week

Hindi Pakhwara

Hindi Pakhwara was celebrated from 14th to 28th September, 2017. All the staff members of the Institute actively participated in various competitive events like typing, essay writing, debate, quiz and the winners of the events were awarded with cash prizes.

Celebration of Hindi Pakhwara

Independence Day

71th Independence Day was celebrated at the Institute with full enthusiasm where all the staff of the institute participated actively in different events organized for the occasion. The Director of the institute also delivered a speech emphasizing the importance of the day for each citizen of the country and achievements of the country since its independence.

Celebration of Independence Day at the Institute

Republic Day

Institute has celebrated the 69th Republic Day on 26th January, 2018 where all the staff members of the Institute actively participated. Dr. Swaraj Rajkhowa, Director, ICAR-NRC on Pig expressed his gratefulness to all those concerned towards the development of the pig husbandry by adopting the technologies developed by the institute and also those involved in the growth of the institute.

Celebration of Republic Day

Constitution Day

Constitution Day was celebrated on 26th November, 2017.

Celebration of Constitution Day

National Science Day

National Science Day was celebrated on 28th February, 2018.

Celebration of National Science Day

AWARDS & RECOGNITIONS

Dr. D. K. Sarma

Received Fakhruddin Ali Ahmed Award for Outstanding Research in Tribal Farming Systems 2016 of Indian Council of Agricultural Research. Dr. M. K. Tamuli, Dr. Mohan N.H. and Dr. R. Thomas were the co-applicants.

Dr. S. Banik

Recognized as IMC member of ICAR-NRC on Yak, Arunachal Pradesh.

Acted as Executive Member of Indian Society of Animal Genetics and Breeding.

Acted as a Member of Expert Committee for Pig Breeding Policy formulation for the state of Punjab, Arunachal Pradesh, Assam, Manipur and Tripura.

Dr. Mohan N.H.

Fakhruddin Ali Ahmed Award for Outstanding Research in Tribal Farming Systems 2016 of Indian Council of Agricultural Research as Co-Applicant.

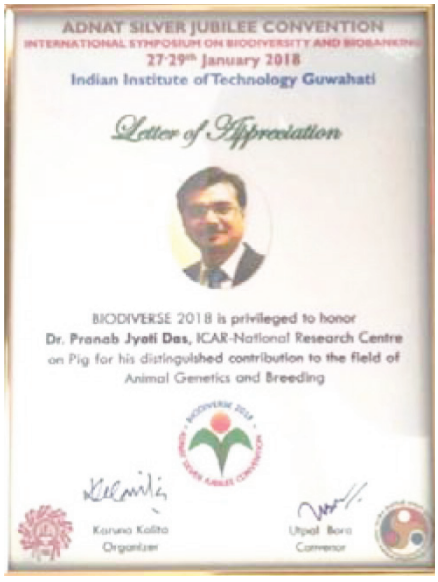
J.N.Pandey Memorial Best poster award of the Society of Animal Physiologists of India.Dr.N.H.Mohan For the poster on 'Analysis of spermatozoa transcriptome in boars with varying fertility. Co-authors: P.P.Gokuldas, L.Buragohain, M.K.Tamuli and D.K.Sarma.

Selected for ICAR-National Fellow position of Indian Council of Agricultural Research.

Dr. P.J. Das

Received Breed Registration Award certificate from Honourable Minister of Agriculture and farmers' welfare Govt. of India for registration of Arunachali Yak as a unique breed of yak.

Received Letter of Appreciation for the contribution of Animal genetics and breeding by International Symposium on Biodiversity and Bio-Banking, 2018.



Dr. R. Thomas

Received 'Fakhruddin Ali Ahmed' Award (ICAR) for the year 2016 for Outstanding Research in Tribal Farming Systems as Co-Applicant.

Received consultancy worth Rs. 1.25 lakhs from ICCo, New Delhi for providing design, drawing and estimate to establish a pig slaughter house and retail outlet at Jaluki, Paren District, Nagaland. The work is in progress.

Represented the institute in FAD 18/P-5 and FAD 18/P-3 panels to review Indian Standards under FAD 18 to align the same with the corresponding Codex standards and FSSAI regulations and to review the Indian standards older than 20 years in FAD-18 sectional committee.

Dr. S.R. Pegu

Received a 'Member of Scientific Advisory Board in recognition of outstanding contribution to quality of the International Journal of Livestock Research in the year 2017.

Reviewed manuscript as reviewer of journals such as Journal of parasitic diseases, International Journal of Livestock Research.

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

Life membership of Indian Association of Veterinary Anatomy 2017.

Dr. Sunil Kumar

Secured Grade 'A' Certificate in FOCARS programmes by ICAR-NAARM, Hyderabad.

Awarded Institutional Prizes in Hindi Essay Writing (First), Hindi Writing (First), Hindi Tankan (Second) and General Knowledge quiz competition (Third) on occasion of celebration of Hindi Pakhwada from 14/09/2017 to 29/09/2019 at ICAR- NRC on Pig, Rani.

Member of core faculty in Winter School Organized at ICAR-NRC on Pig, Rani.

Invited as expert by International Livestock Research Institute, NEIDA, and Directorate of A.H. & Vety. Services, Kohima, Nagaland, Govt. of Nagaland in joint programme for A.I. in Pigs and delivered 4 lectures and practical demonstration on 5-6th Oct., 2017 at CVO, Dimapur, Govt. of Nagaland.

Dr. Utpal Kumar Bhattacharyya

Awarded with K. P. V. Menon Third Best Poster Commendation Award entitled "Molecular analysis of mild cross protecting strain of Citrus tristeza virus for management of disease" at the 70th Annual meeting of the Indian Phytopathological Society and National Symposium on "Diagnosis and Management of Plant Diseases: Integrated Approaches and Recent Trends" organized at Assam Agricultural University held during 15-17th February, 2018.

HUMAN RESOURCE DEVELOPMENT

Human Resource Development

Dr. Swaraj Rajkhowa

1. Attended (10th January, 2018) Breed Registration Certificate Award ceremony meeting at Krishi Bhavan, New Delhi.
2. Attended (19th January, 2018) Inter-phase meeting of QRT and IMC meeting of ICAR-NRC on Yak at ICAR-NRC on Pig, Guwahati, Assam.
3. Attended (30th January, 2018) Annual Review meet of ITRA project: ImageIDGP: Image based systems for identification of individuals, breeds and disease of pigs and goats at ICAR-NRC on Pig, Guwahati, Assam.
4. Attended (6-7th February, 2018) pre-conclave discussion on animal husbandry sector for perspective planning during resurgent agriculture & allied sector conclave at Itanagar organized by Govt. of Arunachal Pradesh.
5. Attended (20th February, 2018) consultative meeting of Agriculture and Horticulture convened by North Eastern Council, Ministry of DoNER, Govt. of India at Shillong, Meghalaya.
6. Attended (8-9th March, 2018) Director's conference held at NASC complex , New Delhi

Dr. Santanu Banik

1. Attended workshop to finalize the Pig Breeding Policy organized by Govt. of Meghalaya held at ICAR-NRC on Pig on 10th August, 2017.
2. Attended workshop to finalize the Pig Breeding Policy organized by Directorate of Animal Husbandry, Govt. of Punjab held at Directorate of Animal Husbandry, Govt. of Punjab, Chandigarh on 24th August, 2017.
3. One day satellite seminar on Emerging and reemerging infectious diseases and their impact on pig health" as member of technical committee organized at ICAR-NRC on Pig by IAVMI on 20th November, 2017.
4. Attended the crossbred variety (TANUVAS KPM-Gold) pig release programme by AICRP on Pig centre of TANUVAS, Chennai held at TANUVAS, Chennai on 30th June, 2017.
5. Attended the crossbred variety (SVVU T-17) pig release programme by AICRP on Pig centre of SVVU, Tirupati held SVVU, Tirupati on 1st July, 2017.
6. Quarterly Review of ITRA project; ImageIDGP: Image based systems for identification of Individuals, Breeds and Diseases of Pigs and Goats at ICAR-RC for NEH, Barapani on 24th April, 2017.
7. Attend Annual Review Meet of AICRP and Mega Seed Project on pig held at SVVU, Tirupati (A.P.) on 1-2 July, 2017.
8. Half yearly review meet of ITRA project; ImageIDGP: Image based systems for identification of Individuals, Breeds and Diseases of Pigs and Goats at ICAR-RC for NEH, Barapani on 24th July, 2017.
9. 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 on 14th September, 2017.
10. Meeting for finalization of Assam Pig Breeding Policy Assam at Office of the Director, Animal Husbandry and Veterinary Department, Govt. of Assam, Chenikuthi, Guwahati on 1st December, 2017.
11. Inter-phase meeting of QRT and IMC committee of ICAR-NRC on Yak at ICAR-NRC on Pig, Guwahati on 19th January, 2018.
12. Attended Annual Review meet of ITRA project; Image IDGP: Image based systems for identification of Individuals, Breeds and Diseases of Pigs and Goats at ICAR-NRC on Pig, Rani, Guwahati, Assam on 30th January, 2018.
13. Attended Pre-conclave discussion on animal husbandry sector for perspective planning during resurgent agriculture & allied sector conclave at Itanagar organized by Government of Arunachal Pradesh on 6-7 February, 2018.
14. Consultative meeting of Agriculture and Horticulture convened by North Eastern Council, Ministry of DoNER, Govt. of India at Shillong, Meghalaya on 20th February, 2018.

Dr. Keshab Barman

1. National Seminar on Smart farming for enhancing input use efficiency, income and environmental security (SFEIES 2017) organized during 19-21 Sept, 2017 at ICAR Research Complex for NEH Region, Umiam,
2. XVII Biennial Animal Nutrition Conference on Nutritional Challenges for Raising Animal Productivity to Improve Farm Economy held from February 1-3, 2018, at Junagadh organized by Junagadh Agricultural University, Junagadh & Animal Nutrition Society of India.
3. Training on Competency Enhancement Programme on Effective Implementation of Training Functions by HRD Nodal Officers of ICAR organized at ICAR-NAARM, Hyderabad during 15-17th February, 2018.

Dr. Mohan N.H.

1. NextGen Genomics, Biology, Bioinformatics and Technologies (NGBT) Conference. 2-4th October, 2017, Mayfair convention centre, Bhubaneswar.
2. XXVI Annual Conference of SAPI and National Symposium on Physiological Innovations to Forecast the Impact of Climate Change and to Evolve Strategies for Sustainable Livestock Production from 21- 22 December, 2017 at Veterinary College, Bidar, Karnataka.

3. Festival of Innovation and Entrepreneurship (FINE) held during March 19 - 23, 2018 at RashtrapatiBhawan, New Delhi

Dr. P.J. Das

1. Attended 17th Indian Vet Congress & National Symposium on "New Generation Vaccines, Diagnostics for Improvement of Animal Health & Productivity vis-à-vis Genomic Interventions for the Societal Benefit" 8-9 April 2017 at ICAR- IVRI, Izatnagar, Bareilly, UP.
2. Attended and half-yearly review meeting on ITRA projects on ITRA: e-Varaha: Information System for Safe Pork Production in North Eastern India. Held at ICAR Research Complex for NEH Region, Umiam, Barapani. Meghalaya on 24th July 2017.
3. Attended National Seminar on Smart Farming for Enhancing Input Use Efficiency, Income and Environmental Security (SFEIES-2017). Organized at ICAR regional Complex for NEH Region, Umiam, Meghalaya in collaboration with Indian Association of Hill farming during 19-21st, September 2017.
4. Attended Satellite Seminar on "Emerging and re-emerging infectious diseases and their impact on Pig health. Organized by ICAR-National Research Centre on Pig, 20th Nov. 2017.
5. Attended NE Zone Regional Agrifare-2017, Drive to Double Farmers' Income. 6-9th January 2018, ICAR Research Complex for NEH Region, Umiam, Barapani. Meghalaya.
6. Attended International Symposium on Biodiversity and Bio banking held at IIT, Guwahati from 27-29th January 2018.
7. Attended and delivered the presentation at Annual review meet of ITRA Project on "e-Varaha: Information System for Safe Pork Production in North Eastern India" held at ICAR-NRC on Pig, 30th January 2018.
8. Attended the Indo-Japan Bilateral symposium on Future prospective of Bioresource utilization in North East India" held from 2nd -4th February 2018 at IIT Guwahati, organized by IIT Guwahati in collaboration with GIFU university of Japan.
9. Attended National workshop on "Yak Resource towards Doubling Highland farmers' Income" organized by ICAR- National Research Centre on Yak, Dirang West Kameng, Arunachal Pradesh, from 15-16th March 2018.

Dr. R. Thomas

1. Participated in 5 days FSSAI sponsored training programme on 'Analysis of Veterinary Drug Residues using LC MS/MS technology' held at Punjab Bio-Technology Incuabator, Mohali during 6-10th February, 2018.
2. Participated in the training programme on 'Sophisticated analytical instruments (GC-MS/MS and HPLC) and their application' organized by Guwahati Bio-Tech Park during 12-13th October, 2017.

Dr. Seema R. Pegu

1. Pariticipatedin National Seminar on Smart Farming for Enhancing Input use efficiency from 19 to 21 September 2017 organized by Indian Association of Hill Farming and ICAR-Research Complex for NEH Region, Umium, Meghalaya.
2. Participated inSatellite Seminar on Emerging and Re-emerging Diseases and their Impact on pig health on 20th November, 2017 organized by ICAR-NRC on Pig,Rani Guwahati, Assam in association with IAVMI at ICAR-NRC on Pig, Rani Guwahati, Assam.
3. Participated in one day seminar on Molecular Diagnosis and pathology of emerging diseases of livestock and poultryorganized by IAVP(Assam chapter) in collaboration with the Indian Association of Veterinary Pathologist at C.V. Sc., Khanapara on 25th Feb., 2018.
4. Attended three days writeshop on Fast –track to scientific outputs-ILRI, PHFI and partners in India, at Guwahati, Assam from 22-25 Feb., 2018.

Dr. Sunil Kumar

1. Attended Satellite Seminar on Emerging Infectious Diseases and their Impact on Pig Health at ICAR-NRC on Pig, Rani, Guwahati (Assam) on 20th November, 2017
2. Attended Round Table Meeting on Pig Production System in NER in collaboration with APEDA at ICAR-NRC on Pig, Rani on 9th September, 2017
3. Attended Review meeting of ITRA and eVarah Project at ICAR-NRC on Pig, Rani on 30th January, 2018

Staffs of KVK, Dudhnoi

1. SMSs/ ACTOs and Programme Assistants/ TOs of KVK Goalpara Participated and completed a 2 days Officers/ Extension Workers/ Input Dealers Training programme on "Scientific Cultivation Practices of Oilpalm" during 13/03/2018 to 14/03/2018 at KVK Goalpara organized by Shivasai Oilpalm Pvt. Ltd. in association with Subdivitional Agricultural Officer, Dudhnoi Deparment of Agriculture Govt. of Assam under national Oilseeds and Oilpalm Mission.
2. Dr. Utpal Kumar Bhattacharyya SMS (Plant Protection) of ICAR KVK Goalpara Dudhnoi Participated and completed a 21 days ICAR sponsored Training on "Recent Developments in Organic Production Systems" organized by the Centre of Advanced Faculty Training in Organic Farming Department of Soil Science Faculty of Agriculture Assam Agricultural University, Jorhat Assam from 7-27th February, 2018.

TRAINING PROGRAMS ORGANIZED

TRAININGS ORGANIZED

The institute has conducted a series of training programmes in different aspects of pig production, artificical 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.

1. Training on Scientific Pig Husbandry Practices' (w.e.f. 5-7th April, 2017) organized for the farmers from Baksa and Nowgaon and Lakhimpur districts of Assam.
2. Training on Scientific Management of Piggery (w.e.f. 13-17th June, 2017) sponsored by the Department of Animal Husbandry, Punjab, Chandigarh organized for the Veterinary Officers of Punjab.
3. Training on Scientific Management of Piggery (w.e.f. 20-24th June, 2017) sponsored by the Department of Animal Husbandry, Punjab, Chandigarh organized for the Veterinary inspectors of Punjab.
4. Training on Good Management Practices for Pig Farm (w.e.f. 4-8th July, 2017) sponsored by Mising Autonomous Council, Dhemaji, Assam organized for the pig farmers of Lakhimpur, Dhemaji, Tinsukia and Golaghat districts of Assam.
5. Training on Advanced Pig Husbandry Practices (w.e.f. 11-15th July, 2017) organized for the stakeholders associated with pig husbandry from different states of India.
6. Training on Good Management Practices for Pig Farm (w.e.f. 8-12th August, 2017) sponsored by Mising Autonomous Council, Dhemaji, Assam organized for the pig farmers of Lakhimpur, Dhemaji, Tinsukia and Golaghat districts of Assam.
7. Training on Good Management Practices for Pig Farm (w.e.f. 22-26th August, 2017) sponsored by Mising Autonomous Council, Dhemaji, Assam organized for the pig farmers of Lakhimpur, Dhemaji, Tinsukia and Golaghat districts of Assam.
8. Training on Advanced Pig Husbandry Practices (w.e.f. 19-23rd September, 2017) organized for the stakeholders associated with pig husbandry from different states of India.
9. Training on Good Management Practices for Pig Farm (w.e.f. 10-14th October, 2017) sponsored by Mising Autonomous Council, Dhemaji, Assam organized for the pig farmers of Lakhimpur, Dhemaji, Tinsukia and Golaghat districts of Assam.
10. Training on Good Management Practices for Pig Farm (w.e.f. 23-27th October, 2017) sponsored by Mising Autonomous Council, Dhemaji, Assam organized for the pig farmers of Lakhimpur, Dhemaji, Tinsukia and Golaghat districts of Assam.
11. Organized 03 days training programme on 'Skill up-gradation of meat personnel for clean pork production' in collaboration with Meghalaya Institute of Entrepreneurship from 3rd to 5th May, 2017.

12. Organized 05 days training programme on 'Training of Trainers programme (ToT) on clean pork production and value addition' in collaboration with Meghalaya Institute of Entrepreneurship from 8-12th January, 2018.

13. Organized 5 days training on 'Artificial Insemination for VFAs/Para-Vets' from 5-9th June, 2017, in collaboration with Meghalaya Institute of Entrepreneurship, Shillong.

14. Organized 5 days training programme on 'Good management practices for pig farm' from 25th to 29th July, 2017 in collaboration with Soil and Water Conservation Division, Govt. of Meghalaya.

15. Organized 03 days training programme on 'Skill up-gradation of meat personnel for clean pork production' in collaboration with Meghalaya Institute of Entrepreneurship from 29-31st August, 2017.

16. Organized 05 days training programme on 'Skill up-gradation of farmers for scientific pig production' in collaboration with Meghalaya Institute of Entrepreneurship from 6-10th November, 2017.


Training on
'Scientific Pig Husbandry Practices'


TRAINING ON
GOOD MANAGEMENT PRACTICES FOR PIG FARM


TRAINING ON
SCIENTIFIC PIG HUSBANDRY PRACTICES


Training programme
on
Advanced Pig Husbandry Practices'
11th to 15th July, 2017


Training on


TRAINING ON
SCIENTIFIC MANAGEMENT OF PIGGERY
(13-17 June, 2017)

Seminars / Winter School Organized

Satellite Seminar

A National Satellite Seminar on 'Emerging and Remerging infectious diseases and their impact on Pig Health' was organized in collaboration with IAVMI at National Research Centre on Pig, Rani, Guwahati –781 131 (India) on 20th November, 2017, Dr. P.K. Uppal, Advisor, Dept. of Animal Husbandry, Govt. of Punjab inaugurated the Seminar. Dr. M.P. Yadav, Former Vice Chancellor, SVPUAT, Merrut also witnessed the seminar. Researcher made presentations in the seminar and the seminar was concluded with the outcomes focusing on development of penside diagnostics and vaccine for healthy pig production as well as judicious use of antimicrobials to combat antimicrobial resistance.

Winter School

A DBT sponsored Winter School on 'Advances in Molecular Techniques in Animal Health and Production with particular reference to Pigs' was organized for researchers and academician of the country Meghalaya from 24th Nov. to 14th Dec. 2017. Dr. Ashok Kumar, Assistant Director General (Animal Health) has delivered a lecture on zoonotic diseases of pigs. This Winter School was sponsored by the Department of Biotechnology, Ministry of Science & Technology, Government of India and total 20 researchers participated in this training. The trainees were provided training on various aspects of diagnosis of various pig diseases. Course Director of the winter school was Dr. S. Rajkhowa.

Glimpses from Satellite Seminar

Glimpses from Winter School

RESEARCH PROGRAMMES & PROJECTS

LIST OF RESEARCH PROJECTS

Funding	Project title	Principal Investigator
Flagship programme		
Institute	Artificial Insemination in Pigs	Dr. M.K.Tamuli
Programme-1: Conservation and genetic improvement of indigenous pigs		
Institute	Development of suitable crossbred pig	Dr. S. Banik
Institute	Phylogenetic analysis of pig mitochondrial genome sequences of native pigs of North East India	Dr. P.J. Das
ITRA	Image based systems for identification of individuals, breeds and diseases of pigs and goats	Dr. S. Banik / Dr. Mohan. N.H
ITRA	e-Varaha: Information System for Safe Pork Production in North Eastern India	Dr. P.J.Das
ICAR	All India Coordinated Research Project on Pig: KVK, ICAR-NRC on Pig centre	Dr. S. Banik
Programme-2: Improvement of physiological and reproductive efficiency in pigs		
Institute	Value chain in semen production, evaluation, preservation & fertility improvement through Artificial Insemination in Pig	Dr. M.K.Tamuli
Institute	Development of protocols for boar semen cryopreservation in pigs.	Dr. Sunil Kumar
Institute	Development of frozen semen protocol for sustaining fertility and litter size in Pig.	Dr. M.K.Tamuli
Institute	Development of early fertility markers in pigs	Dr. Mohan. N.H
Institute	Effect of Dietary Fibres From Different Sources on Reproductive Performances in Pigs.	Dr. Keshab Barman
Institute	Hormonal interventions for induction of cyclic ovarian activity in pre-pubertal gilts and anestrous sows.	Dr. Sunil Kumar
DBT	Evaluation of physio-genomic responses to heat stress and development of potential marker(s) for assessment of stress in pigs	Dr. Mohan. N.H
I C A R - L B S Award Project	MicroRNA mediated regulation of physiological responses during heat stress in pigs	Dr. Mohan. N.H
ICAR-National Fellow Project	Development of thermo-tolerant pig through biomarker assisted selection	Dr. Mohan. N.H
Programme-3: Standardization and improvement of Good Management Practices (GMP) for pig husbandry		
Institute	Identification and strategic supplementation of limiting nutrients in pig feeding systems	Dr. Keshab Barman
MoEF	National Mission for Sustaining the Himalayan Agriculture	Dr. Keshab Barman
Programme-4: Continuous monitoring, recording of pig diseases and development of disease management protocol		
Institute	Studies on zoonotic pathogens of porcine origin with special reference to *Salmonella*, *Campylobacter* and *Staphylococcus* species	Dr. S. Rajkhowa

Institute	Development of loop mediated isothermal amplification (LAMP) assay for rapid detection of important zoonotic bacterial pathogens of pigs	Dr. S. Rajkhowa
Institute	Prevalence study of helicobacter infection in pigs with particular reference to gastritis	Dr. Seema Rani Pegu
DBT	DBT-NER centre for Advanced Animal Disease Diagnosis and Management Consortium (ADMaC)	Dr. S. Rajkhowa
ICAR	Network Project on Neonatal Mortality in farm animals	Dr. S. Rajkhowa
DBT	Molecular epidemiology of *Japanese Encephelitis* virus in pigs and mosquitoes in Assam	Dr. Seema Rani Pegu
DBT	Development of rapid laboratory and field based assays for microbiological quality assessment of pork	Dr. S. Rajkhowa
Programme –5: Technology upgradation of post-harvest handling, processing and value addition of pig products		
Institute	Development of kits for species authentication of fresh and processed pork products.	Dr. P.J. Das
Institute	Development of grading system for carcasses of Ghungroo and its crosses.	Dr. R. Thomas
Institute	Development of pork based ready to serve functional products.	Dr. R. Thomas
MoFPI	Setting up of quality control laboratory.	Dr. R. Thomas
MoFPI	Development of shelf stable pork products using retort processing technology for promoting entrepreneurship in North Eastern states of India.	Dr. R. Thomas / Dr. Girish P.S.
Programme-6: Institute-stakeholder linkages and skill development		
Institute	IVLP programme under TSP	Dr. K. Barman

PERSONNEL

PERSONNEL

ICAR-NRC ON PIG

Scientific staff

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

Dr. Dilip Kumar Sarma, Ph.D., Director & Project Coordinator (Tenure completed on 31-12-2017)

Dr. Madan Kumar Tamuli, Ph.D., Principal Scientist (Animal Reproduction) (Retired on 31-12-2017)

Dr. Kishore Kumar Baruah, Ph. D., Principal Scientist (Animal Physiology) (till 30-06-2017)

Dr. Prithviraj Chakravarty, Ph.D., Principal Scientist (Animal Physiology) (till 30-06-2017)

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. Girish, P.S., Ph.D. Senior Scientist (Livestock Products Technology) (till 14-06-2017)

Dr. P. J. 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 Gynaecology)

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 Mahadeb Besra, Administrative Officer

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

Shri. Uttam Prakash, Assistant Administrative Officer

Smt. Jonali Nath, Upper Division Clerk

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

Supporting staff

Shri Naren Chandra Deka, Skilled Supporting Staff

Shri Ratul Baishya , Skilled Supporting Staff

Krishi Vigyan Kendra, Dudhnoi

Dr. U. K. Baruah, Ph. D., Programme Coordinator

Dr. Hitu Choudhury, Ph. D., ACTO, Animal Science

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

Bhattacharjya, B. K., K. Barman, S. Yengkokpam, D. Debnath, P. Das, N. Sharma, S. R. Pegu, A. K. Yadav, S. Borah, K. K. Sarma, P. Gogoi, A. Kakati, D. K. Sarma, B. P. Mohanty And B. K. Das. (2017). Recycling of commercial piggery wastes in semi-intensive carp polyculture under rain-fed pond environment in assam: an economic analysis, J. Inland Fish. Soc. India, 49 (1): 35-45.

Bhattacharyya, U. K., Godara, S., Kumar, P., Monga, D. and Biswas, K. K. (2107). Recent status and distribution pattern of cotton leaf curl disease in Northwest India: an alarming situation in future cotton cultivation. Indian Journal of Agricultural Sciences 87 (5): 624–33.

Chakraborty, A., S Soren, S Borah, G Bordoloi, S Payeng, K Barman, S Pathak, UR Tamuly, SS Deka, P Chabukdhara, K Saikia, K Boruah. (2017). Physiological Responses in Growing Pigs Reared under Scavenging and Semintensive System. Int. J. Curr. Microbiol. App. Sci, 7:534-537.

Chatterjee, N., Dhar, B., Bhattacharya D, Deori S, Doley J, Bam J, Das PJ, Bera AK, Deb SM, Devi NN, Paul R, Malvika S, Ghosh SK. (2017). Genetic assessment of leech species from yak (Bos grunniens) in the tract of Northeast India. Mitochondrial DNA. 29(1):73-81.

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Kaushik, P., Banik S., Barman K., and Sarma. D. K. 2017. Pre-weaning growth performance of Large White Yorkshire Piglets. North East Veterinarian 17(2):37-38.

Kaushik, P., S Banik, S Naskar, K Barman, AK Das, DK Sarma. 2017. Effect of different genetic and non-genetic factors on pre weaning litter and growth performance of pigs. Indian J. Anim. Res, 51: 179-181.

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Pegu, S. R., Sarma, D. K. Rajkhowa, S., Choudhury, M., Sarma, D. and Das, J.P. (2017). Detection of Group A Rotavirus and histopathological studies in diarrhoiec piglets of Kamrup districts, Assam. Indian Journal of Animal Research. 51 (4): 742-746.

Pegu, S. R., Sarma, D..K., Rajkhowa, S. and Choudhury, M. (2017). Sero-prevalence and pathology of important viral pathogens causing reproductive problems in domestic pigs of NE India. Journal of Entomology and Zoology Studies. 5(4): 1816-1818.

Rajkhowa, S., Sarma, D. K. and Pegu, S. R. (2017). Virulence markers and antimicrobial resistance of *Streptococcus suis* isolated from diseased pigs. Indian Journal of Animal Sciences.87 (5): 581-583.

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