Vision 2030

NATIONAL RESEARCH CENTRE ON PIG
INDIAN COUNCIL OF AGRICULTURAL RESEARCH
RANI, GUWAHATI-781131

www.nrcp.in

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भारतीय कृषि अनुसंधान परिषद
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Foreword

The diverse challenges and constrains as growing population, increasing food, feed and fodder needs, natural resource degradation, climate change, new parasites, slow growth in farm income and new global trade regulations demand a paradigm shift in formulating and implementing the agricultural research programmes. The emerging scenario necessitates the institutes of ICAR to have perspective vision which could be translated through proactive, novel and innovative research approach based on cutting edge science. In this endeavour, all of the institutions of ICAR, have revised and prepared respective Vision-2030 documents highlighting the issues and strategies relevant to the next twenty years.

Livestock plays an important role in the rural economy to supplement family incomes and generate gainful employment in the rural sector, particularly among the landless labourers, small and marginal farmers and women. The piggery sub-sector is of considerable significance especially in North-eastern agrarian economy where it is a major source of income and employment for a sizeable rural population. The integration of piggery with conventional farming systems can provide a much needed boost to performance and economic returns to the farmers. The National Research Centre on Pig (NRCP) at Guwahati was established by Indian Council of Agricultural Research, is providing production to consumption technological backstopping for the benefit of pig growers and consumers and to make this sub-sector an effective tool for poverty alleviation and trade.

It is expected that the analytical approach and forward looking concepts presented in the *'Vision-2030'* document will prove useful for the researchers, policymakers, and stakeholders to address the future challenges for growth and development of the agricultural sector and ensure food and income security with a human touch.

Dated the 29th June, 2011
New Delhi

(S. Ayyappan)

Preface

Animal husbandry is an important sub-sector of agriculture in India and among various animals; piggery is the sector that directly influences the socio-economic status of the rural poor, more particularly the tribal population of the country as it acts as an insurance coverage for the downtrodden and socially weaker section of the society.

Considering the role of pigs in the poverty reduction of the disadvantageous group of the Indian population, ICAR initiated All India Coordinated Research Project (AICRP) on Pig now at 10 locations of the country and also established its first National Research Centre (NRC) on Pig in the IX Five Year Plan. The AICRP centres developed a number of technologies in the area of breeding, feeding and health cover measures. 75% upgraded variety together with developed production and health protection packages have gradually opened up the scope of multiple benefits from pig rearing. The NRC on Pig which is in formative stage at Guwahati, Assam also identified the researchable issues through an extensive survey of the existing production system and has drawn up its research agenda for XI five year Plan period. ICAR also initiated 4 Mega-seed centers on pig for production and distribution of pigs in different parts of the country.

A perusal of the pig population scenario over the decades indicated a decline in growth rate from 32.69% in 1961-1971 to 5.70% in 1991-2001 which is a cause of concern. The decline might be attributed to a high preference for pork over the years with resultant pressure on the available population with no concurrent steps to address the same. The challenge therefore, is to reverse the declining growth trend through the application of needed Science, Technology and Development measures. Together with this, research in the aspects of artificial insemination, multiple

farrowing, nucleic acid based pig disease diagnostic techniques, quality parameters in pork, resource based feeding etc are the other challenges. Yet another area awaiting tapping is the involvement of other stakeholders including NGOs and private partners in piggery sector development in the country.

Keeping the above challenges in view, the perspective plan has been prepared with an approach to carry out research in the areas of *in* and *ex-situ* conservation of indigenous pig, developing improved breed for better economic gain, developing resource based location specific feeding schedule, applying DNA technique for faster disease diagnosis, developing protocols for clean meat production, popularizing AI technique, developing pig based Integrated farming Systems, encouraging quality pig production centres involving private partners, establishing nucleus centres for organic pork production, initiating work on developing miniature pigs for family consumption and creation of pig village.

The Director wish to gratefully acknowledge the valuable and sagacious inputs received from Dr. S. Ayyappan, Secretary, DARE, Govt. of India and Director General, ICAR and Dr. K. M. L. Pathak, Dy. Director General (Animal Science), ICAR and other staff of Animal Science Division in the council Head Quarter. Inputs received from Dr. K. M. Bujarbaruah, Vice Chancellor, Assam Agricultural University and former Deputy Director General (Animal Science) is also duly acknowledged. Lastly, the input received from all the scientists of NRC on Pig is thankfully acknowledged.

Dated the 30th June, 2011
Rani, Guwahati.

Anubrata Das
Director

Preamble

Pig rearing is one of the most important occupations of rural society especially the tribal masses of India. They rear pigs under nomadic system (scavenging) both as a source of income and a choice of meat for consumption. Cost of inputs and returns were not a serious concern in this system. The bulk of the pig population in India is of indigenous type with poor growth rate and productivity. The share of pork to the total meat production has almost been static for last 15 years at about 10%. Average meat yield of pigs in India is 35 kg/animal, which is about 55% less than the corresponding value of world average (FAOSTAT, 2009).

Considering the importance of piggery sector in the region, Indian Council of Agricultural Research recommended establishment of National Research Centre on Pig after reviewing the work of the All India Coordinated Research Project (AICRP) on Pig at Rani, Guwahati, Assam. The foundation stone of the Institute was laid by the then Director General of ICAR, Dr. Panjab Singh on 4th September 2002. The pig farm of the Institute has been started functioning since August, 2007. The office cum Laboratory building was inaugurated on 20th May 2008.

Being the sole institute on piggery sector in the country, the National Research Centre on Pig is dedicated to conduct research for development of novel technology and promoting the pig husbandry practice in the region as well as throughout the country.

Vision 2030 documents has been prepared to bring out improvement in piggery sector and the opportunities thereby comes up for delivering an appropriate strategy and roadmap by National Research Centre on Pig for unprecedented improvement in the one of most neglected species of animals and pig farmers in the country.

Contents

Scenario of Piggery sector

Pig production, among other species has a high potential to contribute to high economic gain. This is because of two folds: First the pigs have high fecundity, high feed conversion efficiency, early maturing, short generation interval and relatively small space requirement. Secondly, they are multipurpose animals providing about 40% of meat consumed in the world market, and by-products like pig dung as manure and bristle for brush industry. It is produced under a variety of production systems ranging from simple backyard pigs, pigs living on garbage belts to family operated farms or large scale integrated pig industries with sophisticated bio-safety measures.

Pig is widely distributed in all the eco-regions of the country and is an important occupation of the rural society especially the tribal masses. People of certain ethnic groups prefer to keep pigs, especially black ones, for festivals and ceremonial purposes. Interestingly, these ethnic groups are mainly concentrated in the North-Eastern Region where almost 28% of the country's total pig population exists. According to FAO records, India's pig population is 13.84 million (FAOSTAT, 2009) and it constitute 1.47% of world pig population and our piggery sector is gaining slow but steady momentum during the past years. Majority of our pig population is held by marginal and small farmers. Further, the average pig population per thousand human populations is about 11.5. Among Indian states, Uttar Pradesh has the maximum number of pigs with about 17% of the total pigs followed by Assam (~12%), West Bengal (~10%) and Jharkhand (~8%).

Fig-1: Growth of pig population over the years (1961-2009)

According to ICMR recommendation, out of 60 gm daily protein requirement; 20gm should be from animal protein source. Considering a

Table 1: Pig and pork production in India and world (2009):

Item	Production		India's share (%)	Decadal Growth rate (1999-2009)	
	India	World		India	World
Pig (million)	13.84	941.78	1.47	3.40	5.00
Pork(MT)	0.48	106.33	0.45	3.40	15.45

Source FAOSTAT website

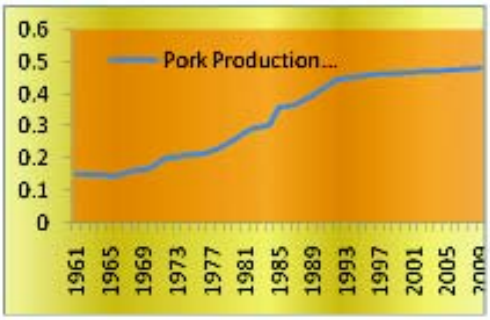


Fig-2: Growth of pork production over the years (1961-2009)

modest figure of 20% of total population consuming pork in the country today, and out of 20gm daily animal protein, assuming 10 gm from pork source; the total pork requirement is around 0.88 million ton (20% of 1210 million human population *i.e.* 242X0.010 kg X 365 days). Against this; the country as per FAOSTAT figure (2009), produces 0.48 million ton of pork in 2009. Thus the present shortfall is 0.40 million ton or 45.45%.

If the deficiency is not met through appropriate technological support the gap is to be widened to such an extent that the country might be forced to import pork by 2030.

Further the shrinking resources in terms of land availability, water as well as threats from the changing environment being conducive for emergence of new diseases are gradually expected to limit the capacity for pork production optimization. If the country

Table 2: Leading states in pork production in India

State	Pig population (in thousands)
Uttar Pradesh	2284
Assam	1543
West Bengal	1301
Jharkhand	1108
Bihar	672
Orissa	662
Nagaland	644
NE States	3816 (~28%)

Source: Livestock Census, 2003

does not take suitable step now to develop and execute scientific strategies to address the issues of bridging the gap between need and availability of pork, other countries, taking the advantage of WTO, shall make inroads to a sector that is so inextricably linked with the economic condition of rural poor in the country.

SWOT analysis of piggery sector:

Strength

A population of 13.84 million (2009) pigs is the strength to meet the animal protein deficiency experienced in the country. Ability of the pig to survive and produce under adverse husbandry practices is strength particularly for the weaker, tribal and landless population of the country. Increased demand for pork and pork products like sausage, bacon etc. is the strength for economic upliftment of the pig growers. Pig by-products, namely bristle and inedible offal are strength to support allied industries. Both commercialization and organic pork production are considered strengths to give a meat revolution to the country and thereby provide employment to a large section of the rural poor.

India still has around 250 million people below poverty line who go to bed hungry. Most of this population is again in the tribal belts of the country where the people are non-vegetarian in their dietary habit. Pork consumption being popular among these populations, improved pig husbandry programmes has been observed to be an important area in the poverty alleviation programme of the Government.

Weakness

Absence of sufficient numbers of breeder farmers throughout the country is a weakness for which sufficient numbers of quality pigs are not available for the fattener farmers as well as to the markets. Religious taboo attached with pork consumption is also a weakness for which marketing of pork has to be confined to a selective group. Tendency of the pig grower to raise pig to marketable age on zero to negligible inputs is another weakness. Preference of the consumers for pork from the local pig is another weakness for promotion of improved pig with lean meat quality. Lack of adequate support from the development and financial bodies to establish pork based industries is hindering the growth of pig to the desired extent. In the absence of supportive industries in and around the areas where pigs are grown, by-product utilization suffers a setback for which economic return is less.

Opportunities

Pigs being a live source of insurance particularly for the weaker section of the community, there is a tremendous opportunities to use pig as a medium of poverty reduction in the country.

Since regions like North East in the country where around 50% of country's pork is consumed by way of procuring live pigs from other parts to the tune of around 1.0 lakh pig heads per annum, a very good opportunity exists for opening up employment generation for rural youth in this sector. Self employment to at least 200 youths in the region would be ensured giving a target of production of 500 weaner pigs by each one of them per annum to produce marketable pigs of 1.00 lakh number. Each one of them could in turn, employ at least 10 pig-man to support the production i.e. 10 X 200 = 2000 numbers of unskilled persons employment. In addition to this, weaner pig purchasers (fattener farmer) get benefited through the enhanced income from the improved pigs they receive from the piglet producers. Self employment to another set of pork product processor and workers is yet another opportunities through pig husbandry not to mention about Self Help Group (SHG) personnel to be engaged in service delivery like A.I, Vaccination *etc*.

Since pig is a prolific breeder, achieving the targeted growth of 10% in meat sector is another opportunity through pigs.

Threats

More than 60% deficiency in concentrate feed sources is a threat to the pig industry which compete human for grains. Non availability of by product utilization facility particularly in areas where pig concentration and slaughter is maximum is another threat from public health point of view for which general public might offer negative views for the growth of pig industry.

National Research Centre on Pig

National Research Centre on Pig was established by Indian Council of Agricultural Research on recommendation of mid-term appraisal committee constituted by ICAR in 1990 after reviewing the work of the All India Coordinated Research Project (AICRP) on Pig. Accordingly, ICAR approved the institute to be established at Guwahati, Assam located in North-eastern part of country where 28% of country's pig population is distributed. Following the clearance for the site and also the approval of the EFC, a plot of land measuring 17 acres was taken over in the year 2002. The foundation stone of the Institute was laid by the then Director General of ICAR, Dr. Panjab Singh on 4th September 2002. The piggery farm of the Institute has been started functioning since August, 2007 and currently maintain two exotic (Hampshire and Duroc), two indigenous (Ghungroo and Niang-Megha) pig breeds and their crosses. The office cum Laboratory building was inaugurated on 20th May 2008.

Mandate

- To undertake basic, strategic and applied research in the areas of pig production and health including product/by-product processing, value addition through quality control measures and transfer of the evolved technologies to the client groups.
- To act as a repository of information on pig production and health for regional, national and global policy planning and implementation.

Jurisdiction of NRC on Pig:

Presently the institute is engaged in all aspects of basic,strategic and applied research on pigs besides trying its level best to bring overall

development in the piggery sector of the country. In addition, this institute has 10 All India Coordinated Research Projects on Pig (AICRP on Pig), 4 Mega-seed Projects on Pig and one Krishi Vigyan Kendra (KVK), each of which has separate activity with the ultimate aim of developing sustainable technology or packages or practices that can be transferred to the end users *i.e.* pig farmers.

Centers of All India Coordinated Research Projects on Pig:

- Assam Agricultural University, Guwahati
- Madhya Pradesh Pashu Chikitsa Vigyan Viswavidyalaya, Jabalpur
- Birsa Agricultural University, Ranchi
- Kerala veterinary and Animal Science University, Mannuthy
- Tamilnadu Veterinary Animal Science University, Kattupakkam
- Sri Venkateswara Veterinary University, Tirupati
- Indian Veterinary Research Institute, Izatnagar
- ICAR Research Complex for Goa, Old Goa.
- Central Agricultural University, Aizawl
- Nagaland University, Medziphema.

Centers of Mega-seed Projects on Pig:

- Assam Agricultural University, Guwahati
- Birsa Agricultural University, Ranchi
- Veterinary Department, Govt. of Mizoram, Aizawl
- ICAR RC for NEHR, Medziphema

NRC on Pig 2030

National Research Centre on Pig since its inception has been making a steady progress with utmost dedication to scientific research by a group of young dedicated scientists.

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 achieving household food, nutritional and economic security.

Focus

To accomplish vision and mission and to meet the challenges, the institute is giving highest priority to Pig and pig rearers of the country. To mitigate the deficit between demands and supply of quality pig germplasm and pork products the focus will be on the basic and applied research output through the following approaches that would help for adoption of strategies for sustainable development in the sector.

- Genetic improvement of indigenous pigs through molecular means; selective breeding and crossbreeding
- Improvement of physiological and reproductive efficiency of pig production
- Development of suitable techniques for early pregnancy diagnosis using biological fluids

- Assessment of local/regional feed resources and improvement of nutrient utilization for enhancing pig production
- Development of pig health management protocols
- Post harvest management and value addition of pork
- Institute-stakeholder linkage and skill developments for improved pig seed production

Harnessing Science

Genetic improvement of indigenous pigs through conventional and molecular means for increasing production and productivity

- Procured indigenous breeds *viz*. Niang-Megha (NM) and Ghungroo(GH) and exotic breeds *viz*. Hampshire (HS) and Duroc.
- Characterization, evaluation and conservation programme are going on for indigenous pigs.

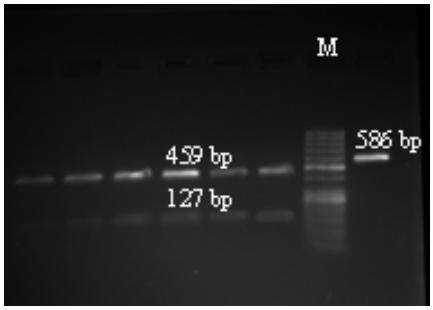
Ghungroo Pig with 17 litters at birth

- Crossbreeding programme between HS x GH and HS x NM has been undertaken and both the crossbreds are performing well.
- Inter-se-mating of 50 % exhotic inheritance of NM and GH are maintained for subsequent crossing.
- Subsequently, 50% exotic inheritance of Ghungroo have been crossed with Duroc in order to find out a suitable animal for the farmers (Significant increase in litter weight at birth and weaning).

Crossbred developed at institute farm

- Validation of upgraded variety (HS x GH) at farmers' field through IVLP (for creation of pig villages).
- For development of designer pork with low back fat content, a three breed cross of Duroc x HS x GH has been undertaken and the work is in progress (significant increase in body weight at 8 months up to 90 kg).
- Completed molecular screening of indigenous pigs for PSE (Pale, Soft and Exudative) condition and the results revealed the absence of deleterious mutation associated with PSE in pigs.

- Identification of candidate markers (estrogen receptor and FSH-β genes) for selected reproductive traits in first parity of Ghungroo pigs.
- Registration of Niang-Megha & Mali pig breeds has been initiated through NBAGR for recognition.



Molecular screening of PSS & PSE pork

Pig reproduction and physiological efficiency improvement to support production optimization

- Survey on pig husbandry practices in NER completed and documented.
- Artificial insemination in pig has been undertaken widely in the institute farm and neighboring area and so far 1566 AI born piglets are produced including 252 piglets at farmers' house.
- Eight protocols for synchronization of estrus in pigs and three protocols for treating infertile sows has been standardized.
- Gene expression for hormonal regulation of fatty acid synthesis and desaturation in pigs has been studied.


AI in farmers' field

Development of nutritional standards for different categories of pigs

- A nutritional requirement for starter pigs has been developed.
- Nutritional analysis of locally available unconventional feed recourses and optimizing the economic feeding practices for pigs through effective utilization is in progress.
- Formulation of economic rations for application in farmers' field has been standardized.

Development of pig health management protocols

- Standardized PCR protocols for detection of 2 important pathotypes (STEC & ETEC) of E. coli and different serotypes of Pasteurella multocida isolates in pigs.
- Identified most important bacterial agents (*P. multocida, S. suis, A. pleuroneumoniae & B. bronchiseptica*) responsible for respiratory tract disease in pigs and determined their antibiogram.
- Identified important bacterial agents responsible for piglet mortality and determined their antibiogram.

Pig Health monitoring at institute farm

Demonstration of Dentition in pig

Development of pig based integrated farming system

- Development of protocols for good management practices (GMP) for improved pig production is in progress.
- Shelter management for different climatic condition has been initiated with documentation of local pig housing system.
- Maintenance and special behaviour patterns of pigs belonging to different age groups and breeds were recorded.

Institute-stakeholder linkage development for improved pig seed production

- The upgraded varieties of pigs were validated at farmers' field (pig village concept).
- More than 1500 piglets were produced, sold and distributed to the farmers, state Govt. and different NGO's of North-eastern India.

Pork production to consumption chain research for domestic and export market tapping

- Quality characteristics and requirement of pork marketed in Kamrup District, Assam were documented to develop a baseline data.
- A model retail pork shop suited to rural India has been designed (minimum operational costs, off-floor operations, hygienic display and storage facilities) to facilitate clean pork production.
- Documentation of carcass characteristics of indigenous and crossbred pigs for developing a grading system suited to Indian pigs is in progress.
- Refinement and standardization of different value added pork products for their popularization is in progress.

Distribution of developed germplasm

Carcass evaluation of pig

AICRP and Mega-seed on Pig

- Exotic pigs such as Landrace, Large While Yorkshire and Hampshire could be successfully raised and multiplied under organized farm conditions.
- Genetic improvement of indigenous pigs through pure selection programme has been conducted in all the 10 centres of AICRP under different agro-climatic conditions.
- Significantly higher body weight was found in the animals injected with iron dextran under farm and village condition at BAU, Ranchi Centre.

- All groups of crossbred pigs had higher litter size, growth rate and better feed conversion efficiency than indigenous pigs.
- Large While Yorkshire and Hampshire crossbreds carrying 75% exotic inheritance had higher value of litter traits than their respective 50% upgraded animal.

Crossbred piglets in AICRP Centre

- Pigs can be utilized effectively as a component in integrated farming system which will act as an insurance cover against adverse conditions. Significant improvement on economic gain could be observed under integrated farming system.
- Locally available feed resources like root crops (tapioca, sweet potato, etc.) brewery waste, used tea leave and other vegetable waste like cabbage, colocasia, etc. could be used successfully for developing economic ration for pig.
- Under Mega-seed project on pig, improved variety piglets were produced and distributed to the farmers.

Strategy and Framework

To accomplish the vision and the goal of the institute and to achieve the target through scientific intervention the following strategies would be adopted. The framework has been developed in such a way that, using scientific expertise and research resources of NRC on Pig can improve pig husbandry practice in the country.

1. Achieving 10% growth rate in piggery sector:

Considering around 72% of the pig population in the country being from non- descript line with average litter size at weaning of 4.5, the strategy is to replace this population at the rate of 10% per annum with improved cross-bred pig so as to increase the percentage of cross-bred pig to the level of 60-70 % by next fifteen to twenty years.

The vision is to produce pigs that will yield a litter size of 7 at weaning i.e. a gain of 2.5 piglets per delivery.

Institute's Role:

- Perfection and popularization of A.I. technology in pig
- Production package delivery
- Linkage development for public- private partnership
- Market intelligence report
- Skill upgradation programme/Human Resource Development

2. Conserving indigenous pig germplasm:

4-5 strains of indigenous pigs from North Eastern India and neighboring states will be collected with a base population of 24 females and 6 males per strain. They will be evaluated upto 3-4 generations under improved managerial system. The best strain shall be selected for cross breeding as well as *in-situ* and *ex-situ* conservation. Blood polymorphic and DNA fingerprinting studies shall be carried out.

3. Developing improved breed of pig for high income and growth:

Together with the procurement of indigenous strains, exotic pigs like Hampshire, Duroc, Large White Yorkshire, Landrace with proven performance record shall be procured and comparative studies shall be carried out so as to use the best performed breed in developing improved verities using indigenous as dam line.

4. Developing economic but balanced feeding schedule

- Locally available feed resources like root crops (tapioca, sweet potato, radish, etc.), agro-industrial waste (FCI waste, cereals, pulses and oil seed byproducts), brewery waste, used tea leaf, other vegetables like colocacia, pumpkin etc. shall be collected, evaluated and proximate analysis carried out to identify crude protein and related nutrient rich items for developing economic ration for pigs.
- Integration of already available pig feed technological options, selection of promising ones and carrying out validation of the same with necessary refinement as per location to develop economic feed formula.
- Collaborative research with crop scientist/ agri-horti departments for horizontal expansion of area under crops like Quality Protein Maize (QPM), ground nut, sesamum etc. and involving pig growers/veterinary departments in buy-back arrangement to support pig production from improved stock.
- Efficacy of feed additives like probiotics, chelated amino acids, Ruchamax, Minovit forte *etc.* in augmenting nutritive value of economic rations so that development could be studied in relation to dose and safety level.
- Feeding trials with the developed rations *vis-a-vis* standard concentrate shall be taken up before large scale recommendation for different categories of pigs.

5. Developing rapid disease diagnosis mean

- Region wise mapping of pig diseases including their impact on production
- Assessment of the efficacy of existing vaccines against important diseases specially over storage and long distance transport and to evolve suitable measures to retain the potency.
- Development of capacity within the institute for nucleic acid based (molecular) diagnosis so as to ensure both faster diagnosis and service support. The institute shall also be geared up to develop biotechnologically effective vaccines/vaccine candidates for specific strain. Skill upgradation programme particularly for the field veterinarians is also envisioned to technically empower them to utilize the benefit of such diagnostic systems.
- Similar steps for parasitic diseases including the development of diagnostic kits for field veterinarian and progressive farmers is envisioned.

- Bacterial/parasitic load in pork and pork products are envisioned to be assessed for issuing for warning to the governmental and other agencies on the impending danger, if any, to the pork consumers in order to tackle the public health issue.
- Similar assessment is planned for all the zoonotic diseases likely to be transmitted through pig.
- In view of the increasing global temperature and frequent shift in weather parameters, pig production - weather relationship models are planned to be developed for the benefit of pig growers.
- In regions like North East, which is bounded by as many as five international borders, adequate quarantine measures are planned to be developed in a collaborative mode with the state veterinary departments to check any impending danger from pig fauna related piracy from across the border.
- Time tested indigenous technical knowledge (ITK) on pig disease control/treatment are envisioned to be validated and refined, wherever necessary to increase the efficacy of such ITKs
- Bio-extracts from the herbs/shrubs/weeds including the available medicinal plants are envisioned to be prepared both as feed additive (growth promoter) and control of some specific and non-specific diseases.
- Pig health calendar depicting season-disease relationship and preventive measures necessary to check disease occurrence are to be developed for pig growers.

6. Post harvest management and value addition of pork

- Assessment of public & private abattoirs with regards to pre & post slaughter hygiene & microbial loads.
- Microbial load assessment from abattoir to retailer/ processing unit to consumers' kitchen.
- Development of HACCP and GMP protocols suited for small/ medium sized pork processing plants.
- Refinement/development of a standard grading procedure suited to the carcasses from indigenous pigs based on Indian standards.
- Standardization of pig slaughter weight/age as per the type of pigs (indigenous/ exotic and crossbred) slaughtered under different management set up.
- Codification of procedure of value addition/packaging/ transportation and marketing of pork products to different client groups.

- Research on quality control parameters/sanitary measures and getting the local bodies adhere to the sanitary regulations so devised.
- Pork quality assessment under different stages of processing.
- Value addition to different pork products and development of shelf stable pork products through MAP & Retort processing.

7. Popularization of artificial insemination and reproductive management in pig

- Standardization of protocols for pig semen preservation both under standard refrigeration and frozen state
- Standardization of dose, time, method etc. for pig A.I
- Development of pregnancy diagnosis kits for pig
- Feasibility and Efficacy studies on ETT for genetic manipulation
- Development of oestrus synchronization protocols

8. Developing /maintain broiler pig

NE region is known to be the home of pigmy hog which weigh around 9kg. at 6-8 months. This type offers great scope for development of a broiler pig strain having quality of early maturity, higher litter size at birth and greater feed conversion efficiency.

The strategy shall be to apply intense selection pressure to develop a type of pig which will weigh around 6-8 kg at 3-4 months of age. Research on the needed nutritional package to support this shall also be carried out.

9. Promotion of pig based farming system

In order to provide technological support to small land holders who are desirous of practicing mixed farming for multiple Livelihood options, following strategies shall be followed to promote pig based integrated farming in regions like North East:

- Pig houses made of local materials shall be designed and developed to suit its placement around water conservation ponds.
- Fish species as per the suitability of the location shall be put in the pond and reared through a process of recycling of pig excreta.
- Cereal crops like maize cultivation shall be promoted.
- Vermi compost units with pig dung and other waste shall be established to support other agri-horti crops, thus brining in the concept of integration.
- Economic and impact analysis of the program shall be under taken.

10. Organic pork

Pork production by the tribal people is by and large 'organic' by default as they normally do not use any feed additive/antibiotic etc. in the diet. The diet source is also almost organic, particularly in the up-hill areas. Therefore, a strategy will be adopted to make pork production organic 'by process' in the following ways.

- Residue analysis of the feed given to pigs in such villages shall be carried out to trace the presence of inorganic compound residue beyond the admissible level.
- Organic standards laid down to procure piglets through organic pork production shall be applied to select piglets for the purpose.
- Weeds/herbs/shrubs etc extract prepared for use as growth promoters shall be tested for its efficacy to support organic pork.
- Ethno-veterinary medicines and indigenous technical knowledge (ITK) applied to manage pig diseases shall be validated and refined to control/check pig diseases.
- A unit with selected medicinal plants having their use value to pig diseases and growth shall also be established for its mass production.
- Organically allowed process shall be followed in slaughter houses for the purpose.

Known certification agencies shall be contacted for certification needed and also for certification of the produce.

11. Establishing of pig village

The institute shall identify pig strong hold villages (2-3 initially) and test the evolved technologies there to facilitate promotion of pig seed villages in partnership mode with State Governments, NGOs and other bodies.

12. Establishing by-product based industry

The slaughter house which will be attached to the institute shall be used to develop/standardize by-product collection, processing and value addition aspects after which the facility shall be opened up through SHGs to promote small scale slaughter house by product based industries. Establishing facility to standardize techniques of harnessing pure pituitary hormones *Viz.* FSH and LH in order to deal with infertility in other species of animals as well as pig.

13. Development of transgenic pig

The institute shall attempt to develop transgenic pigs by adopting following strategies

- Identification of genes of interest (disease resistance, xeno-transplantation etc. for introgression or knock out into porcine genome.
- Standard methods with necessary modifications will be adopted for transferring candidate gene.

The transgenic pigs shall be evaluated for gene expression, genome mapping, stability of gene expression etc.

Epilogue

National Research Centre on Pig, Rani Guwahati, Assam is dedicated institute 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 mandate of the institute is to undertake basic, strategic and applied research in the areas of pig production and health including product/by-product processing, value addition through quality control measures and transfer of the evolved technologies to the client groups; and too act as a repository of information on pig production and health for regional, national and global policy planning and implementation. The mission is 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 achieving household food, nutritional and economic security.

The National Research Centre on Pig will be the nodal centre of activities to provide input to various pig rearers and entrepreneurs of the sector for adopting scientific pig husbandry practice to augment production and productivity. The end user of the developed technology would be research organizations, agricultural universities, entrepreneurs, scientists, research officers and pig farmers of the country and abroad.

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Annexure 1: Strategic framework

Goal	Activity/Approach	Performance measure
Genetic improvement of indigenous pigs through molecular means; selective breeding and crossbreeding	▪ Genetic characterization of indigenous pig using frontier technology. ▪ Evaluation & Selection of Indigenous pig using molecular marker for traits of economic importance. ▪ *In-situ* and *ex-situ* conservation of the strain for short & long term use ▪ Documentation of economic traits. ▪ Development of suitable crossbred animal and distribution to the stakeholders ▪ Development of chimeric and transgenic pigs	▪ Contribution to research and generation of information ▪ Improved livelihood of pig farmers through high producing crossbred and genetically modified swine germplasm
Improvement of physiological and reproductive efficiency of pig production Development of suitable techniques for early pregnancy diagnosis using biological fluids .	▪ Assessment of fertility status as influenced by different production environment. ▪ Identification of factors responsible for lower fertility/ reproductive disorder & development of technology for countering the same. ▪ Enhancing efficiency of AI in pig using existing & immerging technology. ▪ Studies on physiology of lactation including stress physiology to address the issue of adaptation under different environments.	▪ Development of technologies for faster multiplication & dissemination of superior pig germplasm. ▪ Acceptance of AI in field and thus development of location specific variety/breed of pig for boosting up production ▪ Need based managemental system would come up compromising the stress of environmental change in order to maximize production

Goal	Activity/Approach	Performance measure
	▪ Study on behavioural pattern of indigenous and cross bred pigs under intensive system of rearing ▪ Adaptability of crossbred pigs and amelioration of climatic stress through housing and management practices	▪ Use of suitable techniques for pregnancy diagnosis will eliminate maintenance of pseudo-pregnant animals and will economize production
Assessment of local/regional feed resources and improvement of nutrient utilization for enhancing pig production	▪ Assessment of nutrient requirement by different categories of pig & balancing the ration accordingly with conventional/ non conventional feed resources as per the agro ecosystem. ▪ Enhancing bio availability of nutrient through use of feed additive & other supplement.	▪ Development of low cost pig ration with locally available feed staff.
Development of pig health management protocols	▪ Epidemiological mapping of important pig diseases in collaboration with other Institutes. ▪ Development of diagnostic protocol & kits in collaborative mode including molecular means. ▪ Establishing pig disease / parasites, weather – economic relationship. ▪ Development of appropriate prophylactic & control measures.	▪ Faster diagnosis of disease to favor proper management, improvement in pig health.
Post harvest management and value addition of pork	▪ Assessment of public & private abattoir with regards to pre & post slaughter hygiene & microbial loads. ▪ Microbial load assessment from abattoir to retailer/ processing unit to consumers' kitchen.	▪ Development of HACCP protocols and codification of procedure of value addition/ packaging/ transportation and marketing of pork products to different client groups

Goal	Activity/Approach	Performance measure
	▪ Pork quality assessment under different stages of processing. ▪ Value addition to different pork products and development of shelf stable pork products through MAP & Retort processing	
Institute-stake-holder linkage and skill devel-opments for im-proved pig seed produc-tion	▪ Identification of pig concentrate village for production of improved seed by the farmers themselves. ▪ Supply of selected nucleus seed by the Institute to the identified villages together with health & production package. ▪ Horizontal spread of improved pig through the development of a chain linking the first village with others. ▪ Validation of improved pig production technologies at farmers' field ▪ Development of package of good management practices (GMP) for improved pig production ▪ Establishment of linkage between producers and market personals to drain out production from farmers' door step.	▪ Economic upliftment of pig farmers through adoption of improved technologies.


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