1. Molecular techniques for meat species and sex identification

Identification of sex of meat animals is an important issue as cow slaughter is banned in India in most of the states. Keeping this in mind a technology for identification of sex of the animal from which the meat is produced has been developed which involves PCR amplification of Amelogenin XY gene. The PCR amplification of AMEL gene gives amplicons of two sizes (217 & 280 bp) in male and only amplicon of single size (280 bp) in female DNA samples.

Polymerase chain reaction- restrictin fragment length polymorphism (PCR-RFLP) of mitochondrial cytochrome B gene of meat animals
L: 100 bp ladder; Lane C: Beef + $Msp$ I (252+198 bp); B: buffalo meat + $Msp$ I (450 bp);
S: sheep meat + $Msp$ I (450 bp); G: Goat meat + $Msp$ I (450 bp)

Analysis of forensic samples: 80 No’s (revenue generation: Rs.7 lakhs)

Training programmes conducted – 03

Technology transfer: Dept. Animal Husbandry, Govt. Punjab

2. Value added meat products processing technology

Technology for production of emulsion meat products, restructured meat products, enrobed meat products, cured and smoked meat products, dried meat products, speciality
meat products with health and nutritional benefits and technology for value added emu meat products have been developed and transferred to more than 400 micro, small and medium-scale entrepreneurs through hands-on training, MoU/agreement and extension activities.

![Chicken sausages](image1.png) ![Smoked chicken leg cuts](image2.png)

*Chicken sausages*  *Smoked chicken leg cuts*

*Meat products processing plant at NRC on Meat*

*Hands-on entrepreneurship training programmes conducted: 30*

*No. of trainees from different states: 500 trainees from 20 states*

*No. of MOU’s signed for technical know-how: 17*

3. **Retort pouch, super-chilling and sous-vide technology for improved shelf-life of meat and meat products**

Technology for production of shelf stable, ready to eat (RTE) meat products which can be stored at room temperature for 6-12 months has been developed. Super-chilling and vacuum packaging technologies for extending the shelf-life of buffalo meat steaks and mutton cubes up to 3 months without freezing with better quality attributes has been
developed. Technology for extending the shelf-life of chilled chicken drumsticks up to 1 month without freezing has been developed. Sous vide processing technology efficient in prolonging the shelf-life of chicken sausages to more than 90 days under refrigeration temperature (4 ± 1 °C) relative to aerobically processed control sausages which are stable for less than 20 days has been developed.

4. Technology for hygienic slaughter and dressing of food animals

NRC on Meat has developed the art of technology for slaughtering of sheep, goat, chicken and emu with chilling, deboning and cold storage facility. The Institute is providing hands on training and demonstrations in clean meat production to various stakeholders.
• **Technology provided to Farm-Fresh Pork Products, Vijayawada**

Farm Fresh Pork Products and Farms (Surya bacon products), Hanuman Junction, Vijayawada has made MoU with NRC on Meat for modernizing the pork processing unit. Necessary guidance and suggestions were provided in the area of hygienic pork production and processing, packing and also detailed information on setting up retail shop.

![Farm Fresh Pork Products](image1)

• **Technology provided to Krishna Emu Farm Products Ltd., Vijayawada**

The NRC on Meat has provided the technologies and consultancy to Krishna Emu Products Ltd., Vijayawada for construction of emu slaughter house and emu slaughter, hygienic emu meat production, packaging, chilling, storage and distribution. The farm is producing hygienic emu fat and meat for domestic consumption as well as for export.

![Krishna Emu Farm Products](image2)

*State-of-the-art semi-modern emu slaughterhouse constructed by Krishna Emu Farm Products Pvt. Ltd., Vijayawada under NRC Meat consultancy and technical help*

Training programmes conducted – 7

No. of people trained - **103**

MOU signed for technology transfer – **1**
5. **Traceability model for buffalo meat industry**

Buffalo meat traceability system using sixteen digit Radio Frequency Identification (RFID) ear tags, RFID reader and bar code has been developed to effectively trace back the source of meat. Collaborated with interested farmers and meat producers who have joined the traceability database created by NRC on Meat.

![Livestock Traceability Database](image)

Home page of livestock traceability database ([www.livestocktraceindia.com](http://www.livestocktraceindia.com))

6. **Establishment of feed processing unit and sheep slaughterhouse under NAIP, World Bank funded project**

Under the NAIP project, a model slaughterhouse was established at Veterinary College, SVVU, Tirupati. About 5000 ram lambs in the Mahabubnagar and the Nellore district were reared to larger weight by providing nutritional supplement and by convincing farmers to grow ram lambs to larger weight. Two feed processing units one each at Nellore and Mahabubnagar were commissioned.

![Feed Processing Unit](image)

Feed processing unit at Chennur, Nellore Distr. and sheep slaughterhouse at SVVU, Tirupati established by NRC on Meat
7. **Baseline data generation and national level survey**

- Baseline data has been generated on pesticide residues of organochlorine, organophosphorus and synthetic pyrethroids from chicken, by-products, feed, and water from several farms in and around Hyderabad. A similar study was conducted and data generated on pesticides residues in pond reared carps and shrimp of Kolleru region and East Godavri dist. (A.P.) was generated.
- Data on yield of meat and byproducts of cattle, buffalo, sheep, goat, pig, chicken and duck were collected from Andhra Pradesh, Maharashtra, Uttar Pradesh and Assam
- Studies on prevalence of Brucellosis in slaughtered large ruminants at Municipal abattoir, Hyderabad and its public health significance in abattoir personnel was conducted. Prevalence of Sarcocystosis in export buffalo meat plants from Telangana, Maharashtra and New Delhi were carried out.
- Effect of buffaloes slaughter and meat export policy on livestock, milk, draught power and eco-balance is being studied at Telangana, Maharashtra, Uttar Pradesh, Punjab and Gujarat.

8. **Meat on wheels – a mobile unit was launched under RKVY scheme for popularization of clean meat production and value added meat processing**

Under the Rashtriya Krishi Vikas Yojana (RKVY) scheme a mobile unit “Meat on Wheels” was designed to showcase the activities on clean meat production and value addition of meat and meat products. It is mass media vehicle and regularly visits various places for promotion and popularization of value addition, meat processing and clean meat production among consumers and meat processors.
9. **Proteomic based technique for meat species identification**

Proteomic based technology using two-dimensional gel electrophoresis, OFFGEL fractionator and mass spectrometry for detection of adulteration of sheep meat with buffalo meat up to 0.5-1.0% level was developed both for raw and cooked meat as an alternative to DNA based methods.

10. **Organic sheep production**

NRC on meat is working on organic sheep rearing protocols and production of value added products from organically produced mutton. Efforts are being made for developing protocols for organic meat production from sheep with an objective to establish referral laboratory or organic certifying agency at the Centre. Organic fodder certification has been obtained and the animal certification is in progress.

*Organic Fodder Certificate Obtained by NRC on Meat (Farm location: ICAR-CRIDA, Hyderabad)*