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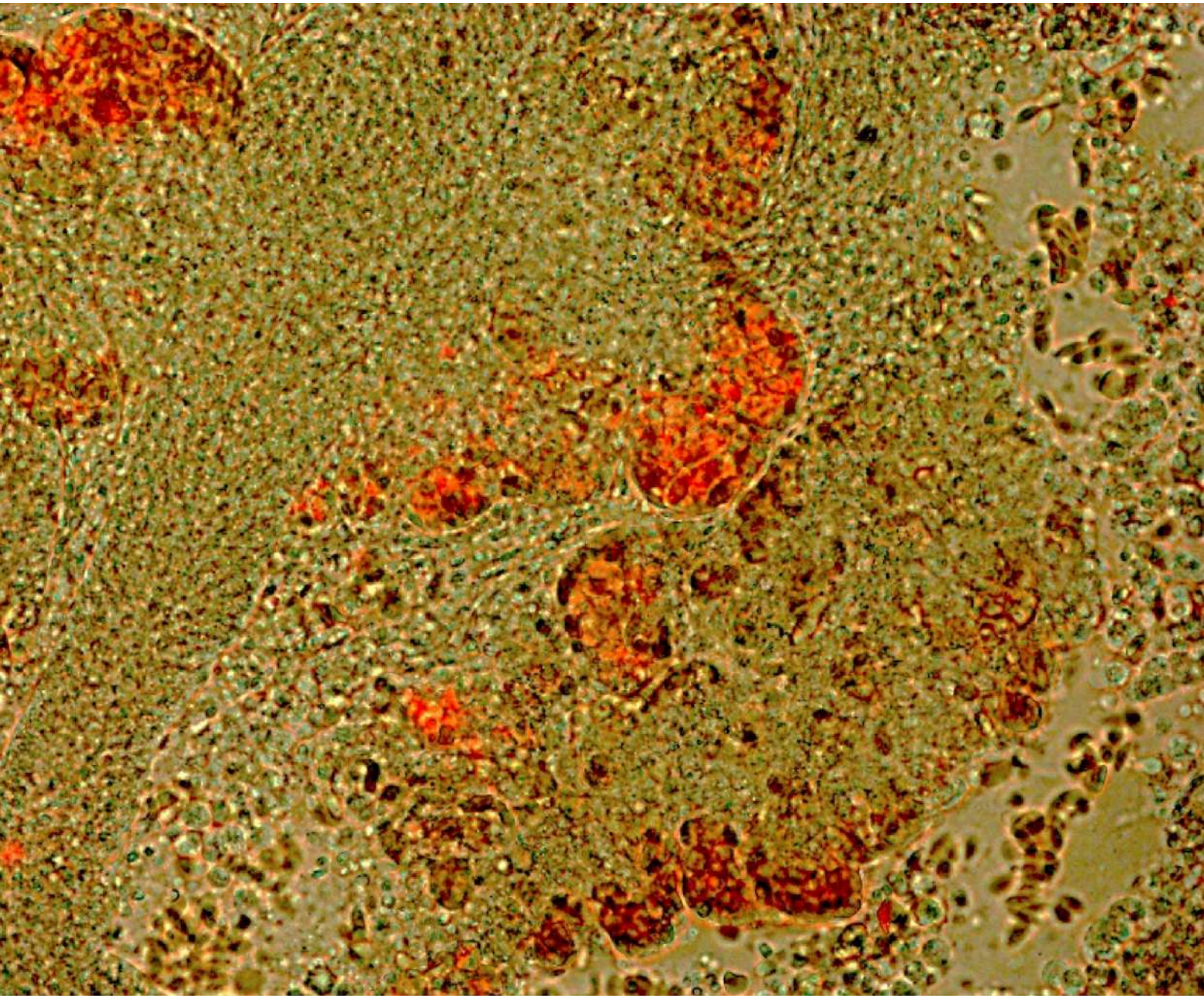
Annual Report 2025



ICAR-National Institute of Animal Nutrition and Physiology
Bengaluru

वार्षिक प्रतिवेदन

Annual Report
2025

भाकृअनुप
ICAR

भाकृअनुप - राष्ट्रीय पशु पोषण एवं शरीर क्रिया विज्ञान संस्थान
बेंगलुरु

ICAR-National Institute of Animal Nutrition and Physiology
Bengaluru

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Editors

A P Kolte

G Krishnan

N Ramachandran

A Mech

A V Elangovan

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ICAR-National Institute of Animal Nutrition and Physiology

Adugodi, Hosur Road, Bengaluru - 560 030, Karnataka, India

Tel. No: +91-80-25711304, 25711303, 25702546; Fax: +91-80-25711420

Email: director.nianp@icar.org.in; Website: http://www.nianp.res.in

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Front Cover Image: The microscopic image shows establishment of mCherry-labeled chicken primordial germ cells into the duck embryonic gonads. The cells were injected into the blastoderm on d12 of incubation. The photograph taken at 200x magnification under Olympus IX51 microscope equipped with Olympus DP72 camera and merged. **Courtesy: Dr Jotirmoy Ghosh**, Principal Scientist, Molecular Biology Laboratory, ICAR-NIANP, Bangalore

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Preface

The ICAR-National Institute of Animal Nutrition and Physiology, Bengaluru has been dedicated to the fields of animal nutrition and physiology for the past thirty years. Its mission is to boost the productivity and reproductive health of livestock through innovative nutritional and physiological strategies. In addition, NIANP serves as a vital centre for developing human resources, offering education, research opportunities, and training for postgraduate and doctoral students.

It gives me great pleasure to announce that ICAR-NIANP filed three patents of which one was granted for its technologies and received sixteen copyrights for its publications. Additionally, in 2025, the institute commercialized seven of its technologies on a non-exclusive basis through Agrinnovate India Limited, New Delhi, including Harit Dhara, non-conventional oil for enteric methane reduction in ruminants, Tamarind seed husk enriched complete feed block, brewery waste, PhytoVridh, and WastG. Additionally, the Animal Nutrition Society of India awarded the Animal Nutrition Division of ICAR-NIANP the "Best Department of Animal Nutrition Award 2025."

The institute successfully organized three national conferences viz., “Livestock nutrition and health care translating to human wellbeing”, “Climate resilient livestock production: Emerging concepts and technologies for sustenance” and “Bio agricultural research”. Further, two brainstorming workshops were organized on “Nanotechnology: Animal production and health” and “Laboratory animals and ethics in bioscience research”. In addition, the institute also organized three training and skill development programmes as capacity building with a focus on the advanced technologies in animal nutrition and physiology.

The institute is actively working on the "Development Action Plan for Scheduled Castes and Scheduled Tribes (DAPSC and DAPST)," reaching out over 3715 farmers across the nation. Numerous on- and off-farm training programs have been organized for the farmers with the objective of disseminating the scientific methodology for feeding dairy animals, ensuring clean milk production, and enhancing fodder production. In addition to the training sessions, farmers have also been provided with essential material inputs such as milk cans, dairy animal floor mats, cattle feed, feed supplements, fodder seeds, and veterinary medicines.

I am pleased to present the various initiatives and accomplishments of ICAR-NIANP during the year 2025. The scientists working in the field of animal nutrition and physiology will undoubtedly find this report to be a useful source of information. I am grateful to the Council for tremendous support, guidance and resources that were provided to the Institute. I convey my sincere gratitude to Dr Mangi Lal Jat, Secretary (DARE) & Director General, ICAR for their constant support and guidance. I sincerely acknowledge the encouragement and support from Dr. Raghavendra Bhatta, DDG (AS), ICAR. I am also thankful for the constant support, guidance and coordination extended by Dr. Ashis Kumar Samanta (ADG, A&P) and Dr Divakar Hemadri (ADG, AH) from the Council. My sincere gratitude is extended to the entire ICAR-NIANP staff as well as the editorial team for their commitment, contributions, and diligence in timely compiling this important report.

Artabandhu Sahoo

Executive Summary

The ICAR-National Institute of Animal Nutrition and Physiology (ICAR-NIANP) has successfully completed 30 years since its inception. During the journey, through relentless efforts and contributions, the ICAR-NIANP has become a premiere research institute in the field of animal nutrition and physiology. Currently, ICAR-NIANP is considered as one of the most vibrant organizations under the "National Agricultural Research System" and it is an ISO 9001:2015 certified Institution.

Scientists and students have participated in several conferences and earned accolades. Notably, Dr PSP Gupta was conferred SAPI fellow at SAPICON25. Dr PK Malik was conferred with Dr Tilak Dhiman Best Researcher Award for the year 2025 by the Animal Nutrition Society of India. Dr N Ramachandran was conferred with ISSGPU fellow. Dr M Gopi received Dr. UB Singh Memorial Young Scientist Award by Animal Nutrition Association during WANACON 2025. In addition, the Animal Nutrition Division of the Institute was adjudged as Best Animal Nutrition Division by Animal Nutrition Society of India.

During the reported period of January to December 2025, the Institute functioned with 39 scientists, 7 technical staff, 10 administrative and accounts personnel and 2 skilled supporting staff. The total budget allocation for the financial year 2025-2026 was ₹ 2862.56 lakh and the total expenditure was ₹ 2306.80 lakh during the period of April to December 2025. During the financial year of 2024-2025, total budget allocation was ₹ 2840.15 lakh and total expenditure was ₹ 2840.15 lakh (100%). The institute also generated ₹ 52.47 lakh revenue during the reported period. The scientists of the Institute dedicatedly worked for achieving the various targets related to research and technology development and demonstration, defined under the major programmes as per the mandate.

Research

Biogeography of Gut Microbes in Animals

The nutraceutical potential of post and parabiotics developed were effective against DSS induced colitis in rats at a dose rate of 1.2% of the diet and the prabiotic was more effective in alleviating the inflammation compared to the postbiotic. In an another study, the in ovo probiotic supplementation did not affect the feed intake but enhanced the body weight in broilers and in same birds, post hatch supplementation of postbiotic has enhanced cell mediated immunity.

In vitro degradation of the pesticide (chlorpyrifos) in the simulated ruminal environment revealed that the degradation of chlorpyrifos was due to the carboxylesterase activity of the ruminal microbes.

Under the ICAR-Network project on "Veterinary type culture - rumen microbes", a total of 473 bacterial cultures were revived and new 67 bacteria isolated from gut of different animals were accessioned. Five fibre degrading bacteria from the VTCC repository were evaluated against NDF isolated from 31 feeds the t1/2 was exceeding 24 hours.

Novel Approaches for Assessing and Improving Nutrient Bioavailability, Animal Reproduction and Productivity

To study the cryotolerance of the buffalo spermatozoa, proteomics study revealed ~900 proteins form the good and poor freezer semen samples. CRYODIL – a metabolite enriched buffalo semen extender has significantly higher post thaw progressive motility. The CRYODIL preserved semen was evaluated in the Bihar state and showed improvement in the fertility rate in AI. Under NASF project a novel metabolite-based semen extender, CATTASOL, developed using a combination of 12 validated metabolites, exhibited superior efficacy. The semen extender is under field trial, 83% of Holstein Friesian bulls responded positively to CATTASOL, with a increase in post-thaw motility.

Efforts were made to manipulate the chicken gonadal sex through in ovo supplementation of Fadrazole, however, the supplementation resulted into mortality in early and late stages of incubation. A new protocol was developed for molecular sex determination in day old chicks using feather follicles. In another study, successfully created the transgenic PGCs and injected into early embryo to demonstrate their settlement in the gonads of chicken and ducks. The lukemia inhibitory factor (LIF) is a cytokine that has a wide range of application in therapy and stem cell research. To develop a low cost LIF bioreactor in chicken eggs we have designed, cloned and produced the particles of lentiviral vectors suitable for

chicken PGC transduction. Transgenic poultry birds carrying LIF gene were produced using pLVX-LIF pseudoparticles and the female birds have shown presence of LIF protein in the egg albumen and the male birds are carrying the LIF gene in the genome.

Dietary Piper betle leaf essential oil supplementation at 0.05% in the broiler diet, improved immunity without affecting performance of broilers under LPS induced stress. To enhance the shelf life, chitosan coating fortified with 1.0% essential oil effectively reduced both protein and lipid oxidation in chicken meat during refrigeration. In ovo Injection of DETA NONOate enhanced resilience against the onset of diet induced Pulmonary Hypertension Syndrome (PHS) in broilers. The high energy diet offered to Ross broilers was found to reduce the pH and increase hardness of the pectoral muscle.

Supplementation of arginine in the diet is known to be beneficial for health as well as fighting against invading pathogens. 15 and 30% higher arginine in the diet showed potential anti-inflammatory and immunomodulatory effects in rats. Promising Lactobacillus (LAB3 isolate) that has selenium bioaccumulation ability was evaluated in rats and revealed better weight gain without increasing the feed intake. We have evaluated zinc biofortified rice developed by other ICAR Institutes in rats, the study revealed increased zinc bioavailability and antioxidant status, while no changes were detected in the vital organs.

To supplement the piglets born to sows with agalactia, a milk replacer formulation developed at NIANP was able to act as sole source of diet for piglets rearing.

To increase the developmental potential of the preantral follicle, different rhGH levels were evaluated, a dose rate of 2 mIU of rhGH was sufficient to decrease the ROS and MDA levels.

The MSCs were successfully isolated from the ovine ovaries and evaluated for stemness and clonogenicity. The coculture of the MSCs or their spent media was evaluated in culture to promote growth of the ovarian follicle.

To influence the sex ratio in cattle using nutritional supplements, the effect of divalent cation injections around the AI time was studied in 1000 cows, the injection resulted in birth of 68% female calves. In another study to increase the in vitro female embryo production, oocyte Na-K+ channel manipulation was effective in producing more female embryos.

To fine tune the existing oestrous induction protocols, P2 peptide developed at NIANP was evaluated over different doses, and finally 20 µg/kg dose rate was found suitable for oestrous induction in sheep. A new study has been initiated to evaluate effects omega-3 fatty acids on reproductive regulation in goats. Similarly, studies are also underway to correlate the production parameters with the body condition score in Hallikar breed.

To developed mineral based antimicrobials, green synthesis protocols are being developed to synthesize mineral nanoparticles using seaweed extracts and soil microbes. Studies undertaken under NASF project and synthesized nZnO–Cur as a safer and promising candidate for antimicrobial, antioxidant, and anti-inflammatory applications. The nZnO–Cur was used in a poultry feeding experiment @ 100 ppm exhibited improved FCR.

Under the AICRP project, feeding of 20% mulberry leaves as an effective dietary source of protein and magnesium improves the reproductive performance of sheep successfully. To prepare recombinant buffalo reproductive hormones, we have expressed recombinant α and β chains of buffalo LH and rabbit polyclonal antibody was produced against the expressed proteins. Attempt is also being made for production of bioactive recombinant buffalo FSH (rbu-FSH) in mammalian expression system.

Male subfertility is primarily driven by disruptions in mitochondrial function, energy buffering, and oxidative balance. Sperm proteins are majorly associated with calcium-mediated signaling, energy metabolism, RNA processing and proteasome-mediated degradation. The non-synonymous SNPs identified from sperm transcriptome, associated with genes involved in reproductive health, spermatogenesis, sperm function, fertilization and early embryonic development were used for development of genotyping assay using ARMS-PCR. Among the SNPs MAP1B, C>T and SPATA48 C>G can be used as a potential marker to predict overall semen quality.

Under the DST-SERB project, efforts were made to improve the efficiency of long-term cultured spermatogonial stem cells (SSCs) cryopreserved with additives and controlled freezing protocol. The cryopreservation of the SSCs using isopropyl alcohol-controlled freezing is better for cryo-survival rate. L-cysteine (15 mM) and ascorbic acid (250 µM) can be used to improve cryo-survivability of SSCs. Apoptotic inhibitor (Y-27632) improved post-thaw

viability and post-thaw SSC culture characteristics. The work is extended under NPGET project and produced MSTN edited spermatogonial stem cells with 21% indels using CRISPR Cas9 system. The MSTN edited SSC clonal population are propagated successfully in vitro through single cell propagation technique. In an another NPGET project to inhance the female population through genome editing, electroporation parameters were standardized for transfection of oocytes and embryos to maintain their developmental potential.

Under National Livestock Mission project, goat semen cryopreservation was standardized and found that cryovials are suitable for sheep and goat semen cryopreservation than regular straw. Percoll density-based sheep semen processing method was found suitable for the enrichment of motile X-sperm.

Feed Informatics, Feed Quality and Safety and Value Addition

Existing commercial chaff cutters continue to face several limitations, including rapid blade dulling, unsafe manual feeding, blockage with wet materials, limited adaptability to diverse crops, gender-skewed usage pattern, dependence on skilled operators, and lack of automation. To address these gaps, a collaborative initiative with ICAR-CIAE was undertaken to design an automated, coin- or card-operated community-based chaff cutter.

To develop a robust, automated computer models for reliable three tier (district, state and country) forecasting of animal feed resources availability, developed R programme based, data-driven robust platform for long-term assessment of feed availability-demand balance that supports evidence-based livestock policy and planning. The portal is currently hosted at ICAR-NIVEDI.

Under a consortia research project, straw from the Zn-Biofortified rice (DPR Dhan 48) were evaluated in lactating buffaloes revealed more zinc secretion in milk. Under residue control programme, chicken breast, liver and carabeef samples (156) were analyzed for pesticide residues, and no samples were positive for pesticide residue presence.

To add value to the coconut milk, fermentation with different lactobacilli was studied. Fermentation of coconut milk with Lactobacillus plantarum for 24 hours at 37°C resulted in maximum monolaurin production. Fermented coconut milk exhibits potent antibacterial activity against E. coli and Salmonella.

A study was conducted to assess the effect of boron deficiency correction and its effect on the fodder crop productivity under the AICRP Project on micro and secondary nutrients and pollutant elements in soil and plants. Soil application of one kg of boron per hectare improved green fodder yield of lucerne by over 12% (mean of five cuts), and boron content in fodder by 25 ppm as compared to the control.

Climate Change Impact on Livestock

The study on life cycle assessment of sheep farming in Bengaluru rural was performed. Seasonal variation in the grazing resources influence the carbon footprint of the sheep production. The study highlights enteric methane and feed production are the primary emission hotspots in both semi-intensive and intensive dairy farming systems. The intensive farms had higher CF 2.63 kg CO_2eq/kg FPCM compared to 1.76 kg CO_2eq/kg FPCM in semi-intensive farms.

Investigations were carried out under the ICAR-Outreach project on estimation of methane emission under different feeding systems and development of mitigation strategies. The project aims to develop region and season specific strategies for methane mitigation in ruminants. Biochar could not reduce methane production in IVGPT however, sulfur and nitrate could reduce the methane at and more than 3 and 2% in the diet, respectively.

Under the ICAR-ILRI Project on assessment of spatio-temporal variation in enteric methane emissions and development of primary based methane emissions inventory. Different straw-based rations were compared for enteric methane emissions. Paddy straw-based diets led to more enteric methane emission compared to sorghum kadbi.

Under an FAO-IAEA project, seaweed Kappaphycus alvarezii was evaluated as an antimethanogenic supplement in the ruminant diet. The studies indicated that enteric methane emission was lower in sheep fed 5% K. alvarezii.

Under NICRA project to establish novel approaches for climate and stress resilience in sheep, herbal supplements were evaluated for reducing the heat stress revealed their potential to ameliorate the heat stress response and improve growth. The study revealed that ruminal microbiome diversity was affected during heat stress could be restored with the herbal supplementation and enhanced the proportion of fibrolytic microbes.

Technology Translation to Connect Discovery with Application

Field study was conducted to assess the green fodder production and feeding practices in dairy farming and also cost and returns of production of green fodder. Adoption of green fodder cultivation by the farmers helped to reduce the per litre milk production cost form Rs 31 to Rs 25.

Under DPAST programme, prevalence of mastitis was assessed using the California Mastitis Test (CMT), revealing a high prevalence in Bramanaradinni village. Supplementation of Fertimin Plus (developed by ICAR-NIANP) to lactating cows resulted in improved milk fat (FCM) in 52% of the cases. Farmer training sessions were organized, and farm inputs were distributed to the farmers. In another programme, DAPSC, conducted 18 farmers scientist interaction meets, 4 training program, 5 animal health camps and distributed farm inputs to the SC farmers

Activities were conducted under the other ICAR-Farmer FIRST project ten technology interventions resulted in 4% area increase in cultivated fodder crops, mastitis incidence dropped by 64% and 16% increase in milk production in the project area. In another farmer first project in collaboration with IIHR, feeding advisory charts were prepared for fattening lamb production. Awareness campaigns were also conducted under DST-SEED project on scientific feeding and management practices for sheep.

Training and Capacity Building

During the reported period, various human resource development activities were organized at the Institute. A short course for veterinary students was conducted on frontier technologies to improve fertility in livestock. A book on Essential protocols in reproductive biology was released on the occasion. Two National workshops on Nanotechnology and laboratory animals & ethics in animal experiments were conducted for the scientists and students. A training programme was organized under NAIF project for Masters and PhD students for creating awareness about intellectual property fundamentals and its role in innovations. Under NPGET projects, a total of four training programmes were organized covering the different areas of research namely, Advanced biotechniques for improving reproductive and productive efficiency in livestock; emerging biotechniques for animal science research; Hands on skill development programme on molecular biology techniques and ten days skill development programme on cell culture and molecular techniques. Several off-farm training programmes were conducted for the farmers including skill improvement and input distribution, farmer-scientist meet on scientific feeding practices for dairy farmers, dairy farmers field day, etc.

Publications, Patent and Technology Assessment and Commercialization

During the reported period, 40 research papers, 14 review/technical articles, 5 books and 10 book chapters were published by the scientists of the Institute. Further, three technical documents/folders were published during the reported period. Two design patents were granted on "A device for quantifying greenhouse gases" and "Smart group feeder for goats with feed separation and residual feed recovery system". In addition, three patent applications were filed.

Five technologies developed by the institute were licensed for commercial production were Anti-methanogenic feed supplement "Harit Dhara" licensed to M/s EVerse.AI Pvt. Ltd, Nagpur and M/s ZeroEarth Pvt. Ltd, Kerala; WastG: a device for quantifying GHG emissions from animal excreta was licensed to M/s Eaga Tools & Instruments, Chennai, Tamarin Plus: tamarind seed husk enriched complete feed block for methane amelioration was licensed to M/s Gau Agritech Pvt., Ltd., Bengaluru, Brewery waste for reducing enteric methane emissions from ruminants was licensed to M/s Gau Agritech Pvt., Ltd., Bengaluru and PhytoVridhi developed by ICAR-NIANP licensed to M/s Keshav Merchandise, Krishnagiri, Tamil Nadu. Three technologies developed by the Institute scientists were certified by ICAR.

Linkage and Collaboration

The Institute established linkage and actively took part in the following collaborative programme: Research collaboration with the University of Gottingen and University of Kassel, Germany under the Indo-German (DFG) collaborative research programme; Research collaboration with the International Livestock Research Institute, CGIAR. The collaboration to jointly develop a 'Harit Dhara-SITA' platform for climate-smart dairying through SITA (Sink Traceability Alliance) platform, a digital system designed to ensure transparency and traceability in emission reduction initiatives developed by ZeroEarth Pvt. Ltd., Trivendaram,

Kerala. The agreement was signed on 14th May 2025 in the presence of Dr Raghavendra Bhatta, Deputy Director General (Animal Science), ICAR, New Delhi.

Others

The 30th meeting of the Research Advisory Committee of the Institute was held on 24th-25th March 2025 and several recommendations are made by the committee. The Annual Institute Research Committee (IRC) meeting was also conducted during the reported period. The ongoing institute and external projects were reviewed during the Annual IRC Meeting. The Institute Management Committee (IMC) meetings were held during the reported period and different agenda items such as procurement of equipment, manpower and infrastructure development were discussed in the meeting and the proposals were recommended by the IMC. The AICRP and Outreach project annual review meetings were also conducted under the chairmanship of Dr Raghavendra Bhatta, DDG (AS), ICAR, New Delhi.

The "Official Language Implementation Cell" worked with the objective of smooth implementation of Hindi as Official Language in the institute. Quarterly meetings were conducted by the cell to review the progress in implementation of Official Language in different divisions and sections. Four Hindi workshops were conducted for the staff to promote correspondence and usage of Official Language in the day-to-day work. The institute also observed Hindi Diwas and Hindi Week.

The Institute has organized a VII National Conference of the National Academy of Veterinary Nutrition and Animal Welfare (NAVN&AW) during 16th - 17th October 2025. The conference was inaugurated by the Dr Manmohan Singh IAS, Former Special Chief Secretary, Govt. of Andhra Pradesh and Vice-Chancellor, SVVU, Tirupati in presence of Dr KC Veerana, Vice-Chancellor, KVAFSU, Dr MC Sharma, Former Vice-Chancellor, IVRI, Dr N Ramaswami, IAS, Secretary, Animal Husbandry and Dairy Development Department, Govt. of Maharashtra. Dr NN Pathak, Founder President of the Academy, Dr SP Tiwari, President, NAVN&W graced the occasion. Another National Conference was organized on "Climate resilient livestock production: Emerging concepts and technologies for sustenance" during 23rd-24th November 2025 in collaboration with NICRA.

Smt. Alka Arora, Additional Secretary, Department of Agriculture, Research Education & Financial Advisor ICAR, Ministry of Agriculture & Farmers Welfare, Government of India visited ICAR-NIANP on 28th May 2025. She interacted with staff and scientists of the institute and emphasized the need for collaborative research to enhance the socioeconomic status of the farmers.

The Institute regularly conducted activities under the "Swachh Bharat Abhiyan" with the resolution to work towards Swachhta. Various initiatives were taken to maintain the office and campus premises clean and environment friendly and the "Swachhta Pakhwada" was observed. The Institute implemented digitalization of office records through e-office, GeM, PFMS, FMS etc. The scientists were also actively involved in "Mera Gaon Mera Gaurav" and Viksit Krishi Sankalp Abhiyan 2025, for extending technical expertise for the benefit of farmers.

Chapter - 1
Introduction

Genesis

Celebrating three decades of scientific distinction, the ICAR-National Institute of Animal Nutrition and Physiology (ICAR-NIANP) stands as a cornerstone of the "National Agricultural Research System". The National Commission on Agriculture recommended the creation of the Institute during the year 1976 to work on the fundamental and the basic principles involved in optimum nutrient utilization. Subsequently, realizing the national need for improvement of feed resources and their efficient utilization to improve animal productivity, the proposal for establishment of the institute was approved by the Planning Commission in the VIII five-year plan. The institute was established on 24 November 1995 as per the recommendations of the Stripe Review Committee to decode the fundamental principles of nutrient utilization. Since its inception, ICAR-NIANP has transitioned from a foundational research Institute into an ISO 9000:2015 certified Institution, driven by a relentless pursuit of excellence in animal nutrition, animal physiology and human resource development in the related areas.

Location

The institute is in the heart of sprawling Bengaluru city on the National Highway 7, Hosur Road, Adugodi, Bengaluru. The institute is 8 km away from the Bengaluru City Railway Station and 40 km from the Kempegowda International Airport.

Human Resource

The Human Resource composition as on 31st December 2025 is as below. The Institute is headed by the Director and currently 39 scientists including five women scientists are in position. The woman representation in the total staff is 33%. The total staff strength is 70% of the total sanctioned staff.

Staff Position as on 31 December, 2025

Category	Sanctioned Posts	Staff in position
Director	1	1
Scientific	44	39
Technical	12	7
Administration and Accounts	24	10
Multi Tasking Staff	3	2
Total	**84**	**59**

Vision

Productivity enhancement for profitable and sustainable livestock production.

Mission

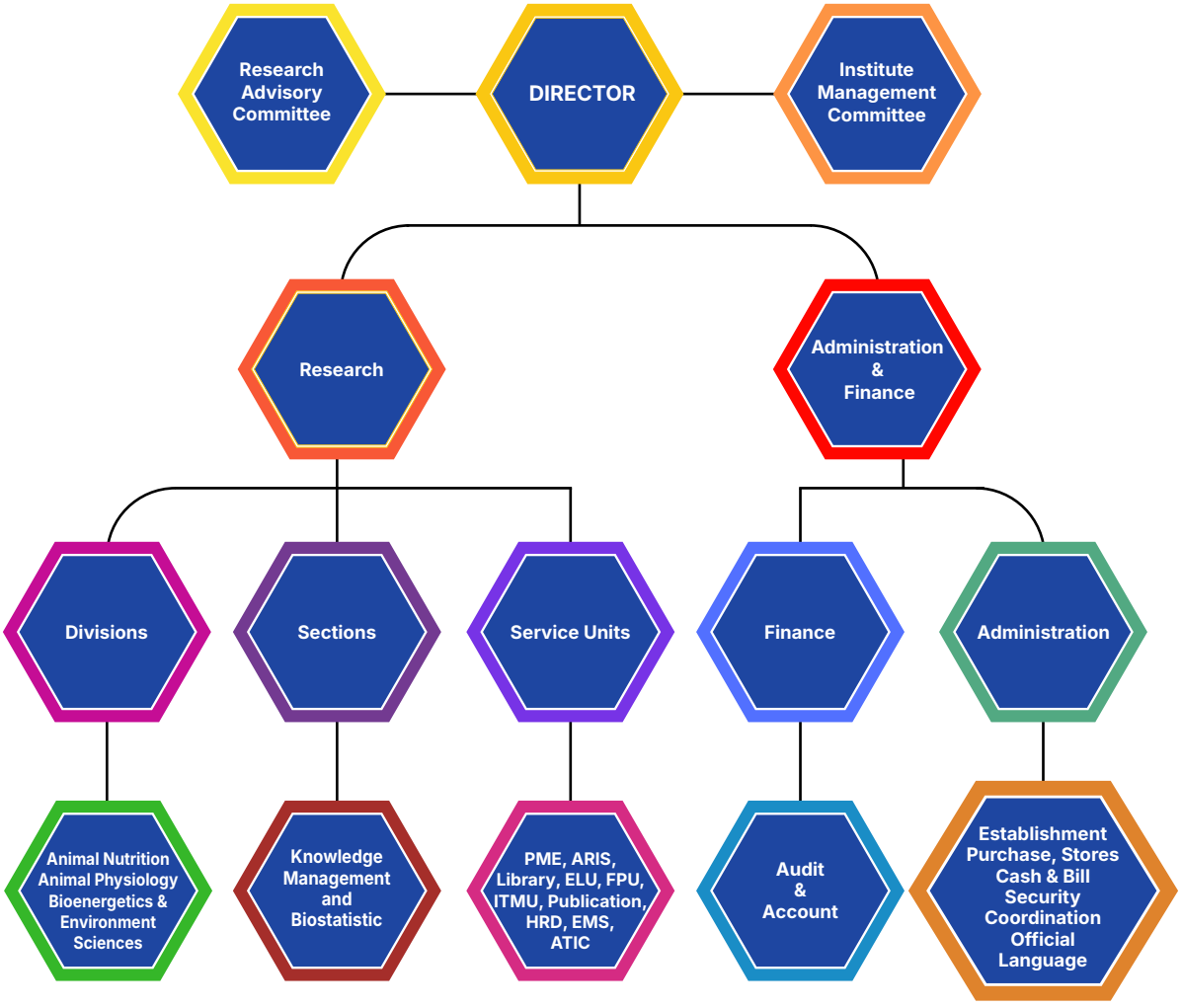
Improving production and reproductive efficiency in livestock through basic physiological and nutritional approaches.

Mandate

Basic and strategic research on physiology and nutrition for efficient livestock production.

Capacity development in animal nutrition and physiology.

Organizational Setup



The matrix mode of management is adopted in the research activities, which provide devolved responsibilities for effective implementation of multidisciplinary / interdisciplinary programmes. For administrative purposes, the Institute has identified three research divisions and one section with strong support of central facilities and computerized administrative set up. 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.

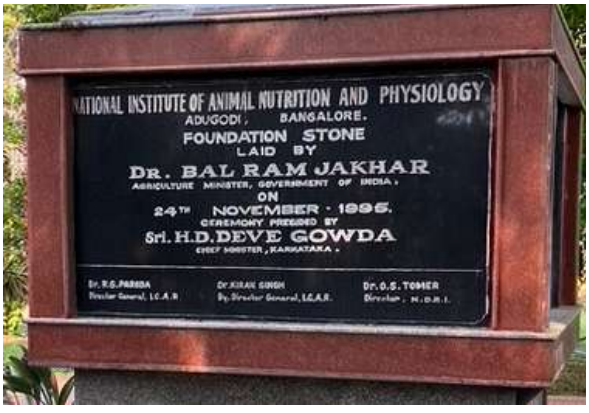
Priority Setting & Management

The Institute has a high-powered Research Advisory Committee (RAC) comprising of eminent scientists and professors, who guide the research agenda of the institute and set research priorities aligning with the priorities of the Nation and livestock farmers. The functioning of the institute is supervised by the Institute Management Committee (IMC) headed by the Director of the institute as Chairman and members drawn from state government, university and public including relevant industry personnel. A number of internal committees such as Central Purchase, Library, Official Language Implementation, Grievance, Publication, Priority Setting Monitoring and Evaluation (PME) Cell, Staff Welfare Club, IPR Cell and Institute Technology Management Unit have been constituted to decentralize the management with developed responsibilities for smooth functioning of the institute. The Institute Joint Staff Council promotes healthy and congenial work environment. The Institute Research Council (IRC) provides a platform for effective professional review and implementation of various research projects, which are also supported by an external evaluation committee. The PME Cell of the Institute plays a central role in prioritising the internal and external projects based on the mandate and thrust areas. Moreover, it has forward and backward linkages with the QRT, RAC and IRC in project monitoring and evaluation.

The Institute provides priority to the identified thrust areas to strengthen the basic and fundamental research. The Institute is coordinating the AICRP on "Nutritional and Physiological Approaches for Enhancing Reproductive Performance in Animal" with 11 collaborating centres and an Outreach project on "Estimation of methane emission under different feeding systems and development of mitigation strategies" with four collaborating centres. The prestigious Farmer FIRST Project on "Improving Livelihood Security of Farmers through Technological Interventions for Sustainable Livestock Farming" is implemented at two different locations in Bengaluru. The Institute is also a partner in the Outreach project on "Drug Residues and Environmental Pollutants", ICAR-CRP project on "Evaluating Value Added Cereal By Products for Animal Feeding", ICAR-Network project on "Veterinary Type Culture Collection" and Farmer FIRST Project on "Enriching Knowledge and Integrating Technology and Institutions for Holistic Village Development in Horticultural Based Farming Systems". In addition, the Institute is also involved in the international research collaborations with Germany, Hungary and International Livestock Research Institute (ILRI). Besides, the scientists were involved with several externally funded research projects. The institute is effectively implementing the farmer centric programmes like SCSP, TSP and "Swachh Bharat Abhiyan", and several trainings and workshops are regularly being organized for the stakeholders.

Research Programme

1. Biogeography of gut microbes in animals.
2. Novel approaches for assessing and improving nutrient bioavailability, animal reproduction and productivity.
3. Feed informatics, feed quality and safety and value addition.
4. Climate change impact on livestock.
5. Technology translation to connect discovery with application.



Objectives

- To carry out quantitative and qualitative assessment of feed resources and to develop district-wise information system.
- To enhance availability of nutrients through various approaches such as strategic supplementation, biotechnological interventions and feed-processing technologies.
- To enhance reproductive efficiency of livestock through physiological and nutritional interventions.
- To address issues of feed quality and safety.
- To develop strategies for validation of evolved technologies at users' level for production enhancement.

Expenditure Statement

Statement showing the sub head wise allocation and expenditure (April to December 2025) of funds for the financial year 2025-2026 (₹ in lakh).

Sub heads	RE (FY 2025-26)	Expenditure (Apr-Dec 2025)
A. Institute		
1. Works	79.58	70.07
2. Equipment and other capital expenditure	73.62	10.11
3. Establishment charges	1972.49	1622.08
4. Pension and other retirement benefits	108.50	73.06
5. Travelling allowances	16.38	11.72
6. HRD	2.52	2.30
7. Research and operational expenses	175.57	146.34
8. Administrative expenses	430.56	367.85
9. Miscellaneous expenses	1.34	1.27
10. Loans and advances	2.00	2.00
Total A	**2862.56**	**2306.8**
B. AICRP and Outreach projects	284.58	219.01
Grand total (A+B)	**3147.14**	**2306.80**

Statement showing the sub head wise allocation and expenditure of funds for the financial year 2024-2025 (₹ in lakh).

Sub heads	RE (FY 2024-25)	Expenditure (FY 2024-25)
A. Institute		
1. Works	57.78	57.78
2. Equipment and other capital expenditure	147.21	147.21
3. Establishment charges	1801.95	1801.95
4. Pension and other retirement benefits	62.71	62.71
5. Travelling allowances	12.63	12.63
6. HRD	2.87	2.87
7. Research and operational expenses	269.90	269.90
8. Administrative expenses	482.95	482.95
9. Miscellaneous expenses	1.65	1.65
10. Loans and advances	0.50	0.50
Total A	**2840.15**	**2840.15**
B. AICRP and Outreach projects	251.00	251.00
Grand total (A+B)	**3091.15**	**3091.15**

Revenue Generation

Statement showing the sub head wise revenue generation (January to December 2025).

Sub heads	Amount (₹ in lakh)
A. Sale of farm products, livestock etc.	1.88
B. Other receipts	
1. Sale of publications, CDs/royalty etc.	1.06
2. Analytical testing fees	2.65
3. Other receipts including LF/ Interest/ IRGS/ LS&PC	46.88
Grand total (A+B)	**52.47**

Chapter - 2

Research Projects

Biogeography of Gut Microbes in Animals

BGM 2.6: Production and evaluation of nutraceutical potential of post and parabiotics in lab animals

M Gopi, AP Kolte, RU Suganthi, N Ramachandran

- Administration of 1.2% parabiotic ameliorated the negative effects of DSS induced colitis in Wistar rats.
- At the same dose level, the parabiotic was more effective than postbiotic against colitis in rats.

The postbiotic metabolites and parabiotics of *Lactobacillus rhamnosus* grown in presence of prebiotic were administered to Wistar rats to assess the prophylactic and therapeutic effect in induced colitis. After initial feeding of postbiotics for 30 days at 0, 0.6 and 1.2% of feed intake, colitis was induced by 5.0% DSS through drinking water for 15 days. At day 45, the rats were sacrificed to examine the changes in vital organs as well as in the colon. DSS treatment resulted in significant reduction in the final weight, change in body weight (final-initial weight) and also the percent change in body weight. However, the feed intake was similar among the groups. Various degree of inflammatory changes were observed at colon in DSS administered groups, based on the severity were ranked as : Colitis groups (II) > Colitis + postbiotics (0.6%) (IV) > Colitis + postbiotics (1.2%) (VI) > postbiotics (0.6%) (III) > postbiotics (1.2%) (V) > Control.

In an another experiment, the protective effect of postbiotic and parabiotics supplementation at a dose rate of 1.2% v/w of feed was studied in induced colitis model. After induction of colitis, the post and parabiotics were administered to the rats for 20 days and the final body weight of the rats were recorded. On day 42, the rats were sacrificed under dissociative anaesthesia. The caecal microbiota showed significant ($p<0.05$) increase in the Lactobacillus count in post and parabiotics fed group compared control and challenged group. Similarly, the Lactobacillus to Coliforms ratio showed a significant increase ($p<0.05$) in the post and parabiotics supplemented groups (Table 1).

Table 1: Effect of colitis and post/parabiotic supplementation on caecal microbes in Wistar rats.

Group	Coliforms	Lactobacillus	L:C ratio
Control	1.49 ± 0.06	0.59^{d} ± 0.04	0.396^{d} ± 0.046
Colitis	1.37 ± 0.08	0.84^{cd} ± 0.21	0.608^{cd} ± 0.666
1.2% Postbiotic	0.96 ± 0.26	1.05^{bcd} ± 0.06	0.903^{bcd} ± 0.243
Colitis + 1.2% Postbiotic	1.48 ± 0.05	1.33^{ab} ± 0.10	1.089^{ab} ± 0.079
1.2% Parabiotic	1.19 ± 0.10	1.29^{abc} ± 0.12	1.080^{abc} ± 0.195
Colitis + 1.2% Parabiotic	1.27 ± 0.19	1.74^{a} ± 0.05	1.369^{a} ± 0.263
P value	0.114	0.001	0.041

BGM 2.7: Effect of graded chlorpyrifos on rumen fermentation, microbial degradation and bioaccumulation in visceral organs in lactating goats

PK Malik, AP Kolte, G Krishnan

- In vitro study revealed that the ruminal degradation of chlorpyrifos is affiliated to carboxylesterase activity.

The rumen metagenome obtained from the *in vitro* studies having control and chlorpyrifos treatments was analyzed and annotated for the presence of chlorpyrifos degrading enzymes following the EC and KOG approached. Results from the study indicated that the chlorpyrifos contamination did not affect the core rumen microbiota; however, the genes related to chlorpyrifos degradation were identified in the metagenome and were majorly affiliated to the carboxylesterase enzyme EC3.1.1.1. However, the animal study could not be taken up due to the non-availability of doe in the local area. The remaining work will be taken up in sheep after obtaining the CPCSEA approval.

BGM 2.8: Evaluation of functional characteristics of promising rumen microbes for augmenting the feed utilization

NM Soren, D Rajendran, M Chandrasekhariah, M Gopi, A Sahoo

- The NCVTC-RM sourced five fiber degrading bacteria were evaluated for degradation ability against the isolated NDF.
- Degradation kinetics of NDF isolated from 31 feed samples revealed the half-life ($t_{1/2}$) exceeding 24 hours for majority of samples.

Rumen microbes (bacteria, protozoa, fungi, archaea, and phages) form a symbiotic ecosystem in an anaerobic environment and are essential for ruminant nutrition. They convert low-quality feed into volatile fatty acids, providing about 70% of the energy, and are a primary protein source for the host. These microorganisms release enzymes and help in digestive functions like rumen fermentation, gastrointestinal health, and detoxification of plant secondary metabolites. The study envisages to study prominent ruminal microbes for their individual contributions to the rumen function.

Five promising fibre degrading bacteria namely *Ruminococcus albus*, *Ruminococcus flavefaciens*, *Fibrobacter succinogenes*, *Butyrivibrio fibrisolvens* and *Prevotella ruminicola* were selected from NCVTC-RM repository and revived in enriched media to study the functional characteristics in fibre degradation. For the study 30 different types of feed samples mostly roughages (paddy straw (5), wheat straw (3), pearl millet straw (3), ragi straw (3), maize stover (2), oats straw, areca sheath, coffee husk, horse gram straw, guar crop residue, groundnut crop residue, sorghum stover, Rhodes grass, sugarcane bagasse, hybrid napier, purple napier, guinea grass, para grass, marvel grass and alfalfa hay) were collected and NDF was extracted. The isolated NDF from above sources were evaluated by IVGPT (Fig. 1) to determine the fermentation kinetics (potential gas production, rate constant, t½). Isolated NDF of some common roughage sources is being tested with the promising fibre degrading bacteria for DM and OM digestibility, and rumen fermentation metabolites.

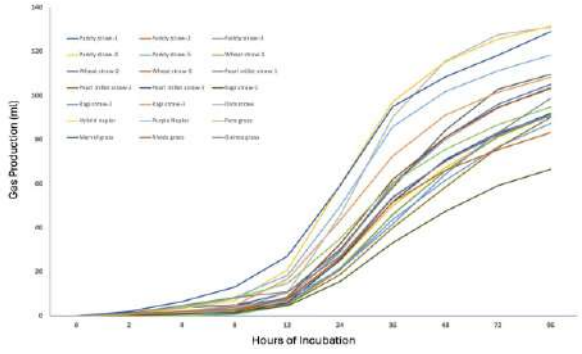


Figure 1: Cumulative gas production from isolated NDF of straw samples at different hours

BGM 2.9 : Evaluation of postbiotic supplementation of chicken origin on intestinal microbiota in poultry

M Gopi, AP Kolte, VB Awachat

- *In ovo* probiotic supplementation did not affect the feed intake but enhanced the body weight gain.
- Post hatch postbiotic supplement in feed has increased the cell mediated immune response.

An experiment was carried out to assess the effect of *in ovo* probiotic and post-hatch postbiotic supplementation on growth performance and gut development in broiler chickens. The probiotic (*L. rhamnosus*; 5×10^7 cfu/100µl) was administered through *in ovo* amnion route on 18th day of incubation and the hatched out chicks were fed with 0.9% v/w postbiotic from day 1-35 of age. No significant differences observed in weekly cumulative body weight gain either due to the main effect of *in ovo* or post hatch supplementation or due to their interaction up to four weeks of age. However, body weight gain of chicks due to the main effect of *in ovo* supplementation (1812 g/b) was higher ($p<0.03$) than without *in ovo* supplementation (1722 g/b) at five weeks of age. However, there was no significant difference observed in cumulative body weight gain due to the main effect of post hatch supplementation or due to interaction (*in ovo* × post hatch). No significant difference was observed in cumulative feed intake of birds during 0-5 weeks of age. The ileal digestibility coefficient of protein, calcium, or phosphorus in birds were not affected either due to main effect of *in ovo* probiotic or post hatch postbiotic supplementation or its interaction (*in ovo* x post hatch supplementation).

The cell mediated immune response and immune organ weights did not differ ($p<0.05$) either due to main effect or interaction (*in ovo* × post hatch supplementation). The main effect revealed higher

($p<0.01$) humoral immunity of birds on post hatch postbiotic supplementation. The interaction effect was also significant ($p<0.05$) with postbiotic supplementation and combination of postbiotic with *in ovo* supplementation being higher than on only *in ovo* supplementation or no supplementation.

BGM 2.10: Understanding the thermophiles in the rumen, their metabolic role and bioprospecting the thermostable biomass degrading enzymes

AP Kolte, PK Malik, G Krishnan

- A new study is initiated to identify and understand role of thermotolerant ruminal microbes.

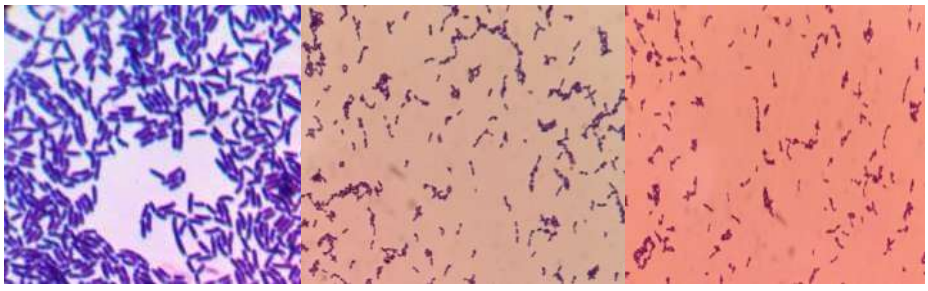
The rumen microbes are well adapted to mesophilic temperatures. *In vitro* incubation studies at higher temperatures reduces the cumulative gas production indicating impaired microbial activity. Similarly, the incubation at lower temperatures, slows fermentation, affects dry matter digestibility, microbial diversity and methanogen functionality. The microbial community in rumen liquor stored at subzero temperatures also changes over the period. However, in anaerobic digesters, the ruminal microflora used as an inoculum showed most of the communities survives the temperatures between 55-60^{0}C. Among the microbial communities, the archaea are known to be thermo-tolerant and a few are extremophiles. With this background, the project is undertaken to identify the thermostable ruminal microbes through meta-transcriptomic approach and characterize the microbial fermentation at higher temperatures. The identification of the thermos-tolerant microbes shall be used for bioprospecting biomass degrading enzymes as well as development of live microbial supplements to improve the rumen function.

ICAR-Network: Veterinary type culture- rumen microbes

D Rajendran, M Gopi

- A total of 67 anaerobic bacterial isolates from gut of different livestock were added to the repository.
- The repository maintains a total of 473 organisms in a lyophilized form.

The National Centre for Veterinary Type Culture (NCVTC) – Rumen Microbes is a multi-institutional collaborative initiative led by the ICAR. The main objectives of the project are to isolate and purify anaerobic gut microbes, investigate their morphological, biochemical, and enzymatic characteristics, and perform molecular identification. Cultures provided by various centers are accessioned after thorough characterization. Isolation of organisms was from rumen liquor of cattle and faecal samples of sheep, which were collected under strict anaerobic conditions. During 2025, ICAR-NIANP has isolated 10 anaerobic organisms namely *Lactiplantibacillus pingfangensis, Bacillus licheniformis TCM1, Bacillus licheniformis BF1, Steptococcus lutetiensis MRS1, Ligilactobacillus murinus, Enterococcus durans, Steptococcus lutetiensis WCA1* and *Limosilactobacillus fermentum* from cattle and *Bacillus tequilensis, Lactiplantibacillus pentosus* from sheep (Fig. 2). During the current year, 67 bacterial cultures were deposited to NCVTC repository by collaborating centres; ICAR-CSWRI (15 isolates from sheep); ICAR-NDRI (13 isolates from goats); ICAR-CIRG (5 isolates from goats, 3 isolates from Antelope and 1 isolate from Sambar deer); ICAR-IVRI (10 isolates from buffalo); ICAR-NRCC (6 isolates from camel) and Gujarat Biotechnology Research Centre (3 isolates from poultry and 1 from goat). Presently, 493 organisms were revived and 473 lyophilized, while parallel stocks were preserved in glycerol at -80°C.



Limosilactobacillus fermentum *Lactiplantibacillus pentosus* *Bacillus tequilensis*

Figure 2: Rumen bacteria (gram positive) isolates obtained from sheep faeces & cattle rumen liquor

Novel Approaches for Assessing and Improving Nutrient Bioavailability, Animal Reproduction and Productivity

APR 3.28: Elucidation of cryo-tolerance and its mechanism in buffalo spermatozoa

B Krishnappa, BK Binsila, A Arangasamy, S Selvaraju, A Prasad

- Sperm quality characteristics were assessed in cryopreserved high and low freezable bull semen samples.
- LC-MS/MS revealed approximately 900 proteins in semen samples from both good and poor freezer sperm.

Post-thaw semen samples of Murrah buffalo bulls maintained at a semen station were used in the study. Bulls (n=12) were classified into high and low freezability groups based on post thaw sperm viability assessed using eosin–nigrosin staining/ CFDA. Mitochondrial membrane potential (MMP) was evaluated using JC-1 staining on flow cytometer. Intracellular reactive oxygen species (ROS) levels were determined using DHR 123 fluorescent probe. Total and progressive sperm motility was assessed using a computer-assisted sperm analysis (CASA) system. Sperm DNA integrity was evaluated by assessing normal condensed and decondensed chromatin using DTT-SDS and PI staining. Plasma membrane integrity was determined by hypo-osmotic swelling test (HOST), and the percentage of hypo-osmotic swelling positive (HPAP) spermatozoa was calculated. All observations were made by counting a minimum of 200 spermatozoa per sample except flow cytometer, and the data were statistically analyzed to compare high and low freezability using t-test.

Significant differences were observed in ROS$^+$, total motility, progressive motility, and HPAP$^+$% between the groups in post thaw samples (Fig. 3a). However, no significant differences were found in MMP$^+$% (Fig. 3b), Normal nuclear morphology%, and decondensation% between the groups. Untargeted proteomic analysis of the frozen sperm samples was performed on LC-MS/MS. About 1400 proteins were identified by LC–MS/MS. Subsequent filtering based on identification confidence and relevance to the study reduced the dataset to 900 proteins, which were used for downstream analysis. Coming to data quality we found 58% unique peptides and about 2-4 peptide spectrum match in 90 percent of proteins (Fig. 3c).

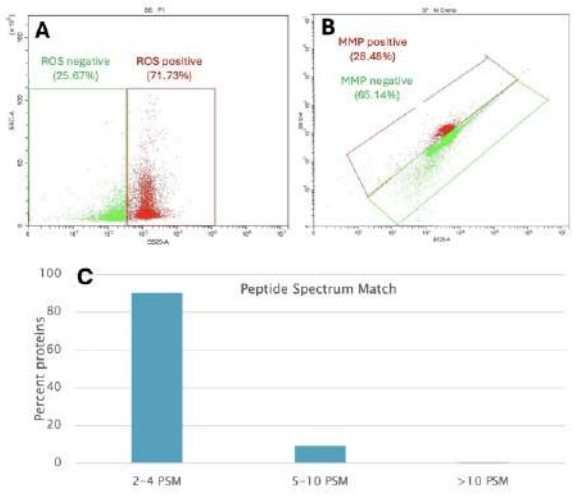


Figure 3: Post thaw sperm analysis (A) Reactive oxygen species (ROS) and (B) Mitochondrial Membrane Potential (MMP) status accessed on flow cytometery. (C) Peptide spectrum match of the proteins detected on LC-MS/MS in the post thaw sperm samples.

APR 3.29: Development of a synthetic semen extender for cryopreservation of buffalo semen

SC Roy, A Dhali

- Post-thaw progressive motility of buffalo spermatozoa was significantly higher (P ≤ 0.05) in metabolite-enriched CRYODIL.
- Preliminary fertility trial data of CRYODIL from Bihar demonstrated promising results.

A novel egg yolk–free, ready-to-use semen extender (CRYODIL) with an extended shelf-life (≥18 months when stored at 4 °C) for the cryopreservation of buffalo semen was developed. CRYODIL, was validated using a large cohort of buffalo bulls maintained at the Nandini Sperm Station (NSS), Hessarghatta, Bengaluru. Post-thaw progressive motility of spermatozoa cryopreserved using CRYODIL was significantly higher (P ≤ 0.05)

compared to that obtained with traditional egg yolk–based extenders (42.17 ± 2.11% vs. 26.30 ± 2.18%; n = 24). Further enhancement in sperm motility was achieved through the incorporation of selected metabolites, leading to the development of a metabolite-enriched CRYODIL formulation.

Third-party evaluation of CRYODIL is currently underway in villages adopted by BAIF, Pune. During the reporting period, approximately 960 semen straws were distributed to artificial insemination centres across Uttar Pradesh, Maharashtra, Telangana, and Jharkhand, and around 130 artificial inseminations have been performed in buffaloes. Pregnancy diagnosis in these animals is in progress. Preliminary fertility data from Bihar indicate promising and satisfactory outcomes.

APR 3.30: Studies on complementary physiological and molecular mechanisms and fine-tuning research tools for holistic poultry production

KVH Sastry, AV Elangovan, IJ Reddy, RK Gorti, CG David, A Mishra, M Bagath, M Gopi

- Manipulating gonadal sex using *In ovo* supplementation of Fadrazole led to embryonic mortality at the early and late stages of incubation.
- A non- invasive molecular method of sex determination was developed by using feather follicles in day old chicks and adult chicken

Male chicks co-hatched along with their sisters are culled in layer industry. Approximately, seven billion male chicks are being killed immediately after birth worldwide. Production of all female chicks could mitigate this anti-welfare practice in poultry production. Sex reversal strategies could help in modulating the sex ratio towards female. A sex revered bird with ZW configuration having capability to produce W bearing spermatozoa will be a game changer. The current aim of the project is to develop sex reversed birds by using chemical and molecular tools through early embryonic (in ovo) manipulation. Fadrazole has been used (in-ovo) to change the sex at embryonic stage and check the phenotypic and genotypic sex of the bird. The protocol using Fadrazole for manipulating the gonadal sex could not produce any live chicks. There is embryonic mortality at the early and late stages of incubation. A non- invasive molecular method of sex determination was developed by using feather follicles in day old chicks and adult chicken (Fig. 4).

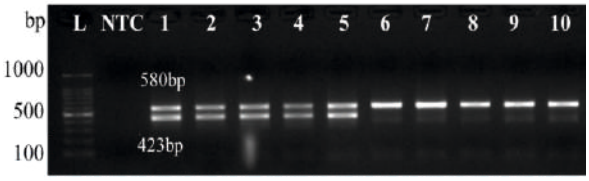


Figure 4: Molecular sexing of chicks by using feather follicles (L – Ladder (100bp) NTC – Non-Template Control, 1-5 –female; 6-10 –males

APR 3.31: Studies on bioavailability of zinc in rats fed with biofortified rice

N Ramachandran, A Dhali, DT Pal, CN Neeraja, M Gopi, D Rajendran, BK Binsila, A Mishra, SC Roy

- Zinc feeding through bio-fortified rice increases zinc bioavailability and antioxidant status in rats without any significant changes in vital organs.

Analysis of plasma and tissue samples from the relative bioavailability trial of bio-fortified rice based semi-purified diet fed group in rats revealed that the Zn content was 21.49, 9.64, 140.64 ppm in liver, muscle, bone samples of negative control diet group (NC), respectively. The respective values were 22.26, 11.86, 147.61 ppm for positive control group (PC), 50.35, 11.64, 131.03 pppm for conventional rice (CR,MTU1010) group, 43.25, 9.85, 119.06 ppm for bio fortified rice (ZnBR, DRR48) group. The iron level in liver, muscle, bone samples of negative control, positive control, conventional rice, bio fortified rice based diet fed group were 127.86, 55.74, 74.09 ppm; 148.41, 25.99, 64.79 ppm; 185.05, 26.91, 192.51 ppm; 167.60, 31.80, 163.86 ppm, respectively. Similarly, the calcium level in liver, muscle, bone samples of negative control, positive control, bio fortified rice based diet fed group were 0.003, 0.011, 43.81%; 0.007, 0.017, 48.80%; 0.007, 0.012, 48.06%; 0.007, 0.019, 41.29%, respectively.

The mean antioxidant enzymes level like SOD, CAT in plasma and liver of rats of different groups (Fig. 5) revealed that the increased bioavailability of Zn from bio-fortified rice increasing the antioxidant enzymes status indicating the beneficial effect of higher bioavailable zinc for the biological functions in the body. The histo-pathological assessment of vital organs did not show any significant changes in the

present study. The analysis of stored samples is in progress for metallothioneins and immunoglobulins.

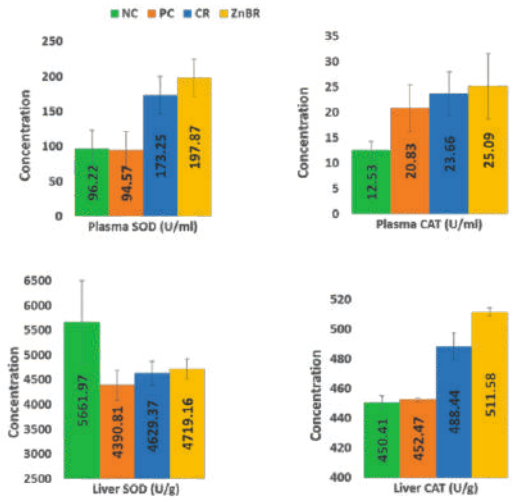


Figure 5: Effect of feeding Zn bio-fortified rice based diet on antioxidant enzyme status in rats

APR 3.32: Elucidating the role of L-arginine amino acid and its transporters on the functioning of the immune system

M Bagath, KVH Sastry, AV Elangovan, CG David, J Ghosh, M Gopi, G Krishnan, VB Awachat

- The L-arginine supplementation resulted in a potential anti-inflammatory and immunomodulatory effect in rats.

A total of ninety Wistar rats (45 males and 45 females) with a mean body weight of 60.83 ± 0.29 g were used in this study. After one week of acclimatization, the animals were randomly assigned into three experimental groups (n = 30 per group). Group I received a control diet containing normal arginine levels, Group II received a diet supplemented with 15% higher arginine, and Group III received a diet supplemented with 30% higher arginine. The experimental diets were administered daily for a period of 45 days. Body weight was recorded weekly. Blood samples were collected at fortnightly intervals for plasma analysis. The spleen, kidney, and liver were harvested on Days 30 and 45 for organ weight measurements and gene expression analysis. Body weight and organ weights were comparable among all treatment groups throughout the experimental period ($p > 0.05$). Similarly, spleen, kidney, and liver weights did not differ significantly ($p > 0.05$) among the treatment groups on Days 30 and 45. However, dietary arginine supplementation at 15% and 30% levels modulated splenic gene expression in Wistar rats, particularly affecting immune-related pathways. The downregulation of CAT1 (Fig. 6) suggests altered arginine transport, while the unchanged expression of CAT4, ARG1, and iNOS indicates that core arginine metabolism remained stable. Notably, the significant reduction in pro-inflammatory cytokines (IL-6 and TGF-) and toll-like receptors (TLR1, TLR4, TLR7, and TLR8) in the supplemented groups reflects a potential anti-inflammatory and immunomodulatory effect of arginine (Fig. 6).

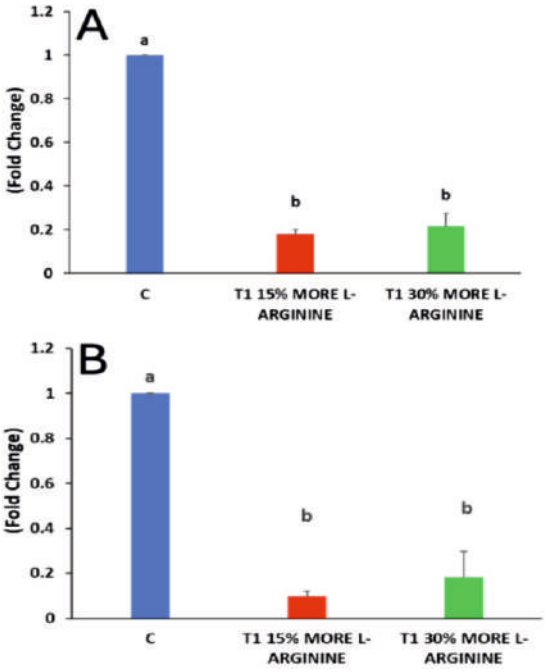


Figure 6: Effect of feeding higher Arginine content at 15% and 30% on the relative splenic CAT1 (A) and IL6 (B) Expression. C– Control; T1 15% Argi- Treatment 1 fed with 15% higher Arginine; T2 30% Argi- Treatment 2 fed with 30% higher Arginine, Values bearing different superscript differ with each other at $p < 0.05$

APR 3.33: Establishment of chicken primordial germ cell (PGC) lines expressing fluorescent protein and evaluation of its colonisation efficiency in chicken and duck gonads

J Ghosh, KVH Sastry, IJ Reddy, S Nandi, A Arangasamy, M Bagath

- Successfully completed isolation, culture, production of transgenic PGC.
- The PGCs were successfully injected into early embryo resulting into their settlement into the gonads of chicken and duck embryos.

The primordial germ cells (PGCs) are the unipotent germ line stem cells that differentiate into sperm and oocytes. It is considered the primary vehicle for genetic manipulation and germplasm conservation due to their small size and round shape. Considering their importance we isolated and cultured these cells harvested from their migrate track of blood circulation, genital ridges, primitive gonads and the early embryonic gonads. The chicken primordial germ cells are cultured in a feeder/feeder-free system. The genetic sex of the isolated PGC was determined indirectly by PCR. The feeder free cultured PGC were labelled using lentiviral pseudoparticle transduction. The lentiviral particles were generated in the HEK293T host cells from commercial lentiviral pLVX-mCherry-N1 (8778bp) vector transfection. We could grow these mCherry labelled PGCs *in vitro* and standardized the protocol for injection in the very early chicken and duck embryo dorsal aorta. Attempts were made to inject the cells keeping the eggs in vertical and horizontal positioning without disturbing the air sac. Out of the two approaches of injection horizontal positioning was found better than vertical positioning in terms of convenience of injection. The injected embryos were sacrificed after 10 days of incubation, gonads isolated and isolated tissues scanned under fluorescence microscope to check the presence of red fluorescence in the gonadal cells (Fig. 7). Similar experiment was conducted in duck embryo. The results indicated the cells are settling into the gonads of chicken and duck embryos. However the injection efficiency to the embryo was very limited and we were not successful in our attempt to hatched chicks after injection. However, the technique needs more perfection with more effort to make it faster aiming to improve the embryo survivability after injection. On a positive note the knowledge on these difficulties and problems would help to improve the technique and closing the gap of deficiencies leading to the future development of chicken transgenesis using this approach. Although direct injection approach has the drawback of random integration of expression constructs in the chicken genome and other inherent disadvantages of the technique. The findings will help future research on targeted and non-targeted genome editing in chicken.

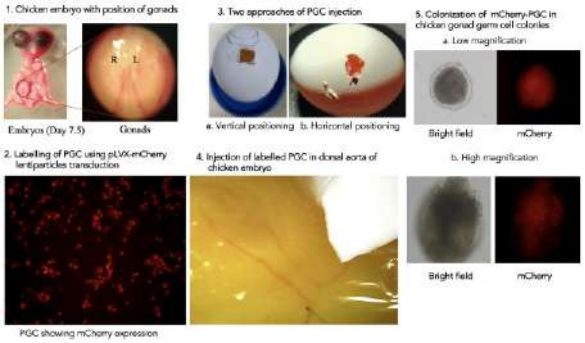


Figure 7: Transferred mCherry PGC successfully to early chicken embryo. (1) Chicken gonads were isolated from the early chicken embryo and gonadal germ cells (PGC) were isolated and cultured in vitro, 2) the gonadal germ cells were labelled using pLVX-mCherry lentiparticles transduction, 3) the mCherry labelled germ cells were injected into the dorsal aorta (4) of the early chicken embryo using vertical (3a) and horizontal (3b) approaches, colonization of the labelled cells were observed in the gonad isolated gem cells (5).

APR 3.34: Bio-manufacturing of organic zinc and selenium in functional food and feed application

DT Pal, SC Roy, AP Kolte, N Ramachandran, BK Binsila, NKS Gowda, A Dhali, G Maya

- Supplementation of the LAB3 isolate in the feed did not affect the feed intake, however resulted into better weight gain in rats

Zinc and selenium are the two most important micronutrients for both animal and human. Several reports indicate the beneficial effects of dietary supplementation of organic zinc and selenium in livestock species. *Lactobacillus* species/strains used in fermented food products can accumulate metal ions with different potential. These microbial species/strains may convert the inorganic Zn and Se to their organic forms which have potential physiological and molecular functions in the body. Under this project, eighty-four isolates were screened for Zn and Se content and were subjected to Se and Zn enrichment. Amongst these, seven isolates showed high selenium enrichment between 10,000 ppm to 28,000 ppm with respect to the biomass yield as analyzed by cluster analysis in JMP. Nineteen LAB isolates enriched with Zn and among these, three isolates exhibited higher Zn accumulation to 263.7 ppm, 363.4 ppm, and 460.5 ppm post-enrichment.

Two Isolates ID LAB-3 & LAB-8 were selected for mass production after calculating the cumulative probiotic potential and Se accumulation ability. An experiment was conducted in rats to assess the effect of dietary supplementation of selenium enriched lactic acid bacteria on bioavailability of selenium and immune function. Weekly body weight of rats was not affected by dietary supplementation Se through LAB isolates (Table 2 & Fig. 8). The analysis of the effects on bio-availability and immune function are in progress.

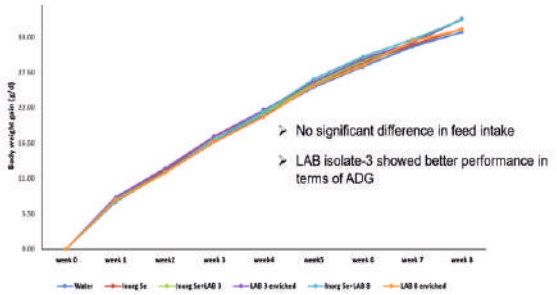


Figure 8: Effect of feeding Se-enriched LAB isolates on feed intake and weekly body weight of rats. The inorganic selenium was supplemented through feed @ 0.2 µg/g

Table 2: Effect of feeding Se-enriched LAB isolates on feed intake and weekly body weight of rats. The inorganic selenium was supplemented through feed @ 0.2 g/g

Parameters	T1 Water	T2 Inorg-Se	T3 Inorg-Se + LAB3	T4 Se-enriched LAB3	T5 Inorg-Se + LAB8	T6 Se-enriched LAB8
Feed Intake (g/d)	20.46	20.19	21.43	22.31	21.41	20.68
Initial body weight (g)	58.92	58.65	58.40	58.92	58.66	59.99
Final body weight (g)	295.70	298.79	309.39	309.86	308.83	300.02
Body weight gain (g)	236.78	240.14	250.99	250.94	250.17	240.03
Average daily gain (g/d)	4.23	4.29	4.48	4.48	4.47	2.29

APR 3.35: Cryopreservation of embryos produced in vitro with oocytes from ovarian preantral follicles of sheep

PSP Gupta, S Nandi, S Mondal

- rhGH supplementation at 2 mIU is optimal for ovine preantral follicle culture to improve the development of preantral follicle and its resultant oocyte

A study was conducted to determine the effect of various doses of recombinant human growth hormone (rhGH) on the development and antrum formation in sheep preantral follicles cultured under *in vitro* conditions. The effect on oocyte growth, oocyte yield and embryo production was also studied. Ovine preantral follicles (N=1382) of 200-350 µm size were isolated from slaughter house derived ovaries by micro dissection method. The preantral follicles were cultured in base medium containing TCM 199, which was added with various supplements i.e. Sodium pyruvate, Hypoxanthine, ITS, Non-essential amino acids, Fetal bovine serum, human Follicle stimulating hormone, Epidermal growth factor, Insulin like growth factor and gentamicin in vitro at 5% Carbon dioxide level and 95% relative humidity at 39^{0}C for 20 days. Leutinizing hormone was also added on day 10 and human chorionic gonadotropin was added on day 18 of the *in vitro* culture. The levels of MDA in the spent media at Day 10 and Day 20 of preantral follicle culture were assessed. The mitochondrial membrane potential of granulosa cells was examined under Flow cytometry by using JC-1 staining. The supplementation of rhGH at the concentration of 2 mIU in ovine preantral follicle culture was effective in improving the follicular growth rate, oocyte yield, antrum formation rate and the survival rate. Since there was no significant improvement with 3, 4 and 5 mIU concentration when compared to that of 2 mIU concentration. The levels of MDA, an end product of lipid peroxidation was decreased and the mitochondrial membrane potential of granulosa cells were increased when rhGH was supplemented which evidences that GH play a role in reducing the reactive oxygen species. There was an up regulation of growth-related gene *GDF9* and steroidogenesis related gene *CYP19A1* whereas down regulation of apoptosis related gene *CASPASE9* was observed. The study indicates that rhGH supplementation at 2 mIU concentration is optimal for ovine preantral follicle culture to improve the development of preantral follicle and its resultant oocyte.

APR 3.36: Studies on complementary physiological systems for healthy broiler production

IJ Reddy, KVH Sastry, AV Elangovan, RK Gorti, J Ghosh, A Mishra, S Mondal, CG David, M Bhagath, VB Awachat

- In ovo Injection of DETA NONOate enhanced resilience against the onset of diet induced Pulmonary Hypertension Syndrome (PHS) in broilers

The present study was aimed to evaluate the effect of *in ovo* treatment of L-thyroxine (T_4), DETA NONOate (DN) separately and their combination (T_4+DN) on development cardio-pulmonary system and angiogenesis in embryo, hatchability and post-hatch performance of broilers in preventing the occurrence of PHS induced by high-energy diet. Injection (*in ovo*) of DETA NONOate improved the vascular development and post-hatch growth with better tolerance to hypoxia due to high-energy diets. Prenatal supplementation of L-Thyroxine especially on 10th day of incubation proved detrimental to hatchability. Prenatal (*in ovo*) treatment of L-Thyroxine and DETA NONOate showed lasting effects on gene expression patterns during embryonic and post embryonic development. Injection (*in ovo*) of DETA NONOate enhanced resilience against the onset of diet (high energy) induced Pulmonary Hypertension Syndrome (PHS) in broilers.

APR 3.37: Isolation, characterization, differentiation of ovarian mesenchymal stem cells and their possible role in ovarian cell functions in sheep

S Nandi, PSP Gupta, S Mondal, J Ghosh, A Arangasamy

- The MSCs were successfully isolated from the ovine ovaries and evaluated for stemness and clonogenicity.
- The coculture of the MSCs or their spent media was evaluated in ovarian follicle culture.

Progress was made in establishing reliable protocols for the isolation, culture, and characterization of mesenchymal stem cells (MSCs). Tissue processing and cell isolation procedures using different enzymatic digestion and *in-vitro* culture conditions were standardized for efficient cell recovery such as medium composition, seeding density, and incubation conditions. The developed protocol allowed the successful expansion of MSCs while maintaining their typical fibroblast-like morphology and high cell viability, uniform spindle-shaped morphology and adherence to plastic culture surfaces. Following successful isolation and culture, the MSCs were characterized for stemness. Cell proliferation studies were performed to monitor the growth kinetics of the cultured MSCs and to determine their expansion capacity under defined culture conditions. The expression of characteristic MSC markers was examined, and the results confirmed the presence of a consistent and well-defined MSC population. Immunocytochemical staining enabled visualization of marker expression at the cellular level, while flow cytometry allowed quantitative assessment of the percentage of cells expressing these markers. The expression patterns of key MSC-associated genes were evaluated, providing evidence of successful isolation and maintenance of mesenchymal stem cells. Apart from chondrogenic, osteogenic and adipogenic differentiation, the induction towards GCs was evidenced by expression of *FOXL2, CYP19A1, FSHR* and downregulation of *NANOG, OCT4.* Moreover induction towards neurons as the expression of *TUJ1, DCX, MAP2 was* upregulated. The slow freezing showed more viability of MSCs compared to vitrification. Co-culture of MSCs with preantral follicles and spent culture medium indicated both promote growth but co-culture provides higher growth rates.

APR 3.38: Parenteral administration of divalent cations for cost effective sex pre-selection in cattle

A Arangasamy, J Ghosh, S Selvaraju, DT Pal, S Nandi

- Divalent cation injection around AI time resulted in skewing the sex ratio in calf born.
- Study in 1000 cows revealed that the treatment resulted in 68% female births

The present study was undertaken with the objective of "Parental administration of divalent cations on skewing of sex ratio in cattle". The Project was

initiated with an injection (single) of divalent cations salts around AI time. Divalent cations salts administration lead to higher conception rate (640/1000: 64 % Vs 330/1000: 33%). We have calculated for 1000 animals from the available records, however actual AI covered number is higher. Sex ratio skewed towards female calf in dairy cattle (68%) compared to (50%) in control groups. This study shows that through parenteral administration of divalent cations, it is possible to improve the conception rate as well as skewing of sex ratio towards female calves.

APR 3.39: Efficiency of synthetic neo-hormone analogues to augment reproduction in sheep

KS Roy, J Ghosh, A Arangasamy

- The 'P2' peptide at a dose of 20 µg/kg body weight has optimized endocrine profiles (viz. LH and Estradiol-17β etc.) and was found suitable for induction of estrous in sheep.

During this period, eight new peptides have been synthesized (P1, P2, P3, P4, P5, P6, P7, P8) and among them, the peptide P2 responded best. As per the technical programme, the dosages of P2 have been standardized and final trials for the dose rate of 20 µg and 25µg/Kg body weight of the animal has repeated to finalize the dose and the dose rate 20 µg/Kg body weight have been tested properly and confirmed (Fig.9). And test trial for induction of estrous with P2 has also been carried out. The hormonal profile of LH and Estradiol have been estimated in blood plasma of 'intensive sampling' through ELISA in treated ewes. The Progesterone ELISA has also been carried out for checking the cyclicity in these animals (from all animals in alternate day sampling).

Figure 9: Lambs born with the estrous induction treatment of P2 during the pilot trial at ICAR-NIANP, Bangalore

APR 3.40: Application of phytogenics to improve immunity in broilers and egg production and quality in laying hens

RU Suganthi, A Sahoo, PK Malik, AP Kolte, M Gopi, VB Awachat, GB Manjunatha Reddy

- Dietary Piper betle leaf essential oil supplementation at 0.05% improved immunity without affecting performance of broilers under LPS induced stress.
- Chitosan coating fortified with 1.0% essential oil effectively reduced both protein and lipid oxidation in chicken meat during refrigeration.

An experiment was conducted to determine the effect of betel leaf essential oil (BLEO) on LPS induced immune stress in broilers involving the following treatments: basal diet; basal diet+ LPS (1 mg/kg bw); basal diet+ BLEO @ 0.05% in diet and basal diet+ LPS+BLEO. LPS challenge and dietary essential oil showed no significant effect on growth performance. At 21 days of age, LPS challenge reduced the weight of immune organs, increased serum proinflammatory

Table 3: Meat lipid peroxidation (MDA, mg/kg meat) of breast meat in different treatments

Treatment	0th day	1st day	4th day	7th day
Effect of LPS injection				
WoLPS	0.314	0.331	0.440	0.638[b]
WLPS	0.342	0.361	0.446	0.697[a]
Significance	0.082	0.061	0.797	0.007
Effect of betel leaf essential oil supplemented diet (BLEO)				
WoBLEO	0.339	0.361[a]	0.467[a]	0.646[b]
WBLEO	0.318	0.331[b]	0.418[b]	0.689[a]
Significance	0.188	0.051	0.038	0.044

cytokines and uric acid while BLEO supplementation showed protection. Immunoglobulins IgY and IgM were increased by both LPS and EO. Breast meat samples collected at the end of 35 days exhibited improved oxidative stability up to 7 days of refrigerated storage (Table 3).

In an another experiment, the effect of chitosan fortified with a specific essential oil coating on biochemical changes and shelf life of chicken meat during refrigerated storage. Chicken breast samples were subjected to the following treatments: Control, Chitosan (CH) coating, CH+0.5% essential oil, CH+1.0% essential oil, and CH+1.5% essential oil coating. At 24 hr postmortem, a progressive decline in glycogen and glycolytic potential was observed. Higher hexokinase activity was observed in CH+EO while pyruvate kinase activity remained unaffected. Chitosan fortified essential oil coating efficiently reduced drip loss, lipid and protein oxidation and maintained colour stability and sensory acceptability during refrigeration.

APR 3.41: Formulation and evaluation of milk replacer for piglets

S Anandan, NM Soren, E Lokesha

- In sows with agalactia, the milk replacer supplementation is effective in rearing the piglets solely on milk replacer developed at ICAR-NIANP

Mismatch in the supply of nutrients through dams milk vis a vis the genetic potential of the newborn can adversely affect the health, growth and survivability. This is more true for polytocous species like pig where large litter size and rapid growth are very conducive for under-nutrition. Supplementary nutrition through milk replacer is one of the strategies to address this issue. Formulated milk replacer was evaluated at two pig farms located at ICAR-National Research Centre on Pig, Guwahati and ICAR-Central Island Agricultural Research Institute, Port Blair.

In first trial Rani crossbred piglets (Hampshire X Ghungroo breed) from two different sows were used in the experiment. Half of the Piglets from each dam were partially weaned from dam during day time and supplemented with milk replacer and were allowed to suckle the dam during the night time. Milk replacer was supplemented for seven weeks and they were weaned at 42 days and the body weight gain during first thirty days of post-weaning was recorded to see any carry over effect. The Body weight gain during pre-weaning and post-weaning did not differ between the control and the milk replacer supplemented piglets and the body weight changes are presented in the graph below. One of the sows had agalactia and the piglets from the agalactia effected sow were completely reared on milk replacer and the body weight gains in the milk replacer supplemented group were comparable to the piglets reared with dam indicating that in cases of agalactia, milk replacer as sole diet can be used to ensure survival and normal body weight gains (Fig. 10C).

Second trial was carried out in indigenous Nicobari piglets. Eight piglets from single litter were divided into two groups - control and treatment group. In treatment group piglets were supplemented milk replacer in addition to suckling while control group piglets were exclusively on suckling dam's milk. The supplementation was carried out for thirty days and piglets were weaned. Body weight and milk replacer consumption were recorded during the pre-weaning phase. Post weaning, the carry over effect of milk replacer supplementation in control and treatment group were recorded for second and third month. Results of the weight gain in control and milk replacer supplemented group during pre-weaning and post-weaning were comparable and is presented in the table 4 and Fig. 10 A and B below.

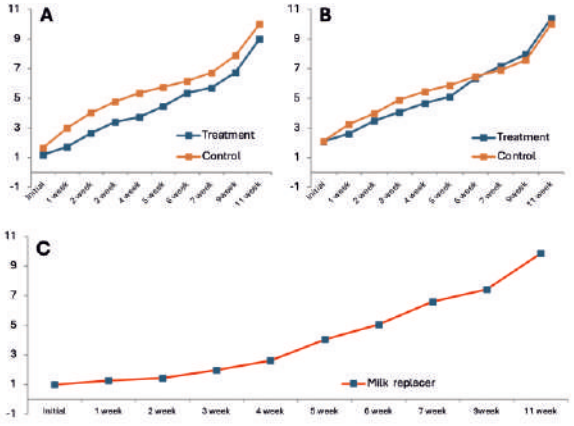


Figure 10: Body weight changes in piglets during pre-weaning (7 weeks) and post weaning (>7 weeks) in piglets fed milk replacer (treatment) and control group. (A) Nicobari piglets from sow1, (B) Nicobari piglets from sow2, (C) Body weight changes (kg) in Rani crossbred piglets reared solely on milk replacer due to agalactia in sow.

Table 4: Body weights of Nicobari piglet supplemented with milk replacer (treatment) versus control during pre-weaning and post weaning period.

	0 day	1st week	2nd week	1 month	2 month	3month
		Pre weaning			Post weaning	
Treatment (kg)	1.41	2.44	3.40	5.43	11.2	18.1
Control (kg)	1.46	2.35	3.03	5.04	10.8	17.5

APR 3.42. Production of female embryos modulating ion channels mediated polarity of oocytes

A Mishra, SC Roy, S Selvaraju, M Bagath

- Fertilization potential of oocytes exposed to Na-K^+ channel manipulator is better than exposed to Ca^{+2} channel manipulator.
- The *in vitro* embryos produced by Na-K^+ channel manipulation of oocytes were biased towards female

Oocyte membrane polarity state determines the binding pattern of sex-specific sperm during fertilization. Depolarized oocyte favours negatively charged-X sperms to fertilize and result in a female embryo. In contrast, the repolarized oocyte is receptive to positively charged Y sperms producing a male embryo. Hence, it is speculated that ion-channels dependent membrane potential (polarity) of the oocytes facilitates the binding of X or Y sperm. Though ion channels are key regulators of oocyte polarity and their fertilization success, the exact mechanism of these interactions is not well understood. The study was initiated to investigate the sex ratio of sheep embryos produced *in vitro* upon manipulation ion channels in oocytes. *In vitro* sheep embryos were produced using Na-K^+ channel manipulator and Ca^{+2} channel manipulator with various concentrations and time of exposure before fertilization. The developmental potential (% of morula and blastocysts) of generated embryos was recorded regularly and viability of embryos were observed by staining. The fertilization potential of oocytes exposed to Na-K^+ channel manipulator is better than exposed to Ca^{+2} channel manipulator. The polarity in oocytes post exposure to ion channel manipulators were observed by estimating the intracellular positive ion concentrations using ICP-OES. The *in vitro* embryos produced by Na-K^+ channel manipulation were biased towards female sex as compared to control.

APR 3.44: Studies on the impact of growth rate on the skeletal muscle physiology and metabolism in broilers

CG David , RK Gorti, KVH Sastry, IJ Reddy, AV Elangovan, M Bagath, M Gopi, VB Awachat, EEF Magdalene

- High energy diet reduces the pH of the pectoral muscle as well as hardness

A broiler trial with Ross strain was conducted by modulating the growth rate using three dietary energy levels (low energy, normal energy and high energy). Dietary energy modulated body weight gain in the order: high energy > Normal energy > low energy. The pectoral muscle pH at 15 minutes post mortem ranged between 6.63 and 6.83 in all the groups which reduced in the order of low energy > normal energy > high energy in pectoral muscle after 24 hours post mortem. The colour of meat did not show significant variation between the groups and was dark (L* = 48-51); redness (a*=4.53-5.3);yellowness (15.35-16.32) in all the three groups The shear-force was comparatively higher in breast muscle of birds fed on low energy ratio indicative of hardness compared to that of those fed on normal and high energy ration. Incidence of deep pectoral muscle was recorded in birds fed on standard ration (Fig. 11).

Figure 11: Deep pectoral muscle myopathy was observed in the birds.

APR 3.45: Physiological, growth, lactation and reproductive traits of a native cattle breed from six months to end of second conception in relation to body condition score

HS Ramesh, PSP Gupta, S Nandi, J Ghosh, S Mondal, M Bagath, VB Awachat

- The study is initiated to characterize the Hallikar breed production parameters with relation to BCS.

The study focuses on understanding the relationship between body condition score (BCS) and key biological traits in a native cattle breed, with special emphasis on growth, reproduction, and lactation. The primary objectives of the project includes: (1) investigating physiological and metabolic parameters during different stages such as growth, puberty, conception, pregnancy, and lactation in relation to BCS of Hallikar (2) examining the expression of candidate genes associated with growth, reproductive performance, and udder development; and (3) assessing the expression of genes linked to milk quality traits during lactation. As part of the progress made so far, a group of Hallikar calves approximately six months of age has been selected from Hallikar breeding centre, Govt. of Karnataka, Kunikenahally, Turuvekere, Tumkur. These calves were categorized into different groups (Eight animals in each group) based on their body condition score, ranging from BCS 1 to 4. Each animal was carefully identified using ear tags, and the corresponding identification numbers were recorded for tracking and future reference. Baseline physiological parameters, including body temperature and respiration rate, were recorded for all selected calves.

APR 3.46: Influence of dietary supplementation of omega-3 fatty acids on endocrine profiles and expression of prostaglandin synthase genes during pregnancy in goats

S Mondal, M Gopi, IJ Reddy, S Nandi, PSP Gupta, HS Ramesh, RU Suganthi

- The study is undertaken to evaluate the effect of omega-3 fatty acid supplementation on reproductive regulation in goats.

Embryonic mortality (EM) is a significant contributor to reproductive inefficiency in goats and other livestock species. It leads to reduced pregnancy rates, slower genetic improvement, and considerable economic losses for farmers. In goats, early embryonic losses are reported to be approximately 18% in cases of twin ovulations and up to 40% in triplet pregnancies. Such losses occur primarily during the early stages of gestation when the embryo is highly dependent on proper hormonal signalling and maternal support for survival. Based on these findings, nutritional modulation of prostaglandin pathways may provide a practical approach to reducing embryonic mortality. Considering these aspects, the present study has been proposed with twin objectives: (i) investigating the changes in biochemical and hormonal profiles during pregnancy in goats, and (ii) evaluating the effect of omega-3 fatty acid supplementation on biochemical parameters, hormonal levels, and the expression of prostaglandin synthase genes involved in reproductive regulation in goats.

APR 3.48: Green synthesis of mineral nano particles as a replacement of antibiotic feed additives in commercial poultry production

D Rajendran, M Gopi, NM Soren, N Ramachandran, A Sahoo

- Green synthesis of mineral nanoparticles for Mn and Fe is in progress using seaweed extracts and soil microbes.

The present study emphasizes green synthesis of nano minerals using biological sources such as seaweeds and microbial systems, which are rich in bioactive compounds including phenolics, flavonoids, and polysaccharides. These green synthesized nano minerals are expected to possess antimicrobial, antioxidant, and anti-inflammatory properties, thereby enhancing immune competence and growth performance in poultry. The project aims to standardize synthesis protocols, characterize nanoparticles using advanced analytical techniques, and evaluate their biological efficacy and safety through *in vitro*, *ex vivo*, and *in vivo* approaches.

Extracts from seaweeds such as *Ulva lactuca*, *Kappaphycus alvarezii*, and *Sargassum polycystum*

were prepared and utilized for nanoparticle synthesis. Manganese nanoparticles were synthesized using seaweed extracts (Fig. 12), while iron nanoparticles were produced through microbial-mediated processes involving soil isolates and ferric precursors (Fig. 13). Preliminary optimization trials using varying extract concentrations (1%, 10%, and 20%) indicated scope for improving yield and stability. Concurrently, microbial isolation and preparation of supernatants for nanoparticle synthesis were undertaken.

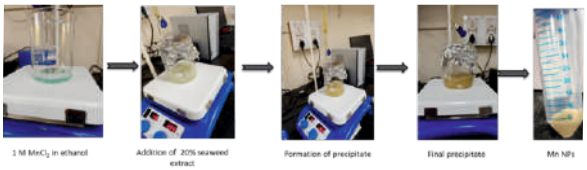


Figure 12: Green synthesis of manganese nanoparticles using seaweed extract

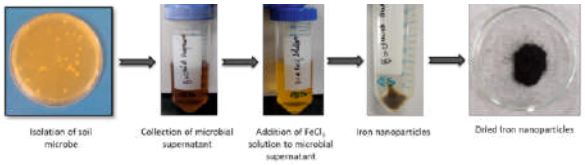


Figure 13: Green synthesis of iron nanoparticles

ICAR-AICRP: Nutritional and physiological interventions for enhancing reproductive performance in animals (NPIERPA)

Coordinator- Artabandhu Sahoo

S Anandan, SC Roy, DT Pal, S Selvaraju, BK Binsila, B Krishnappa

- Mulberry leaves serve as an effective source of protein and magnesium, at 20% replacement level in the total dry matter improves the reproductive performance of sheep

Long term feeding of mulberry leaves feeding at 1/5 level of dry matter intake in sheep from weaning to lambing was carried out and the effect on growth rate, blood biochemical parameters, hormones and reproductive parameters were monitored. Results of the long term feeding on various parameters are summarized in the table 5.

Mulberry feeding at 20% of dry matter intake resulted in comparable body weight gains in control ewes fed traditional fodder (Fig. 14A). Mulberry leaves being rich in protein and magnesium resulted in higher level of blood protein and magnesium in ewes fed mulberry leaves compared to the control ewes (Fig. 14B, C & D)

In an another activity to develop polyclonal antibody against the synthetic peptide of buffalo FSH β-chain and production of recombinant buffalo FSH for detection and quantification of Buffalo FSH, treatment of infertility and IVF, a peptide of 14 amino acids corresponding to antigenic site of FSH β-chain was synthesized and conjugated with KLH (Keyhole Limpet Hemocyanin). The conjugated peptide was injected in a rabbit for development of polyclonal antibody. The antibody will be tested for detection of natural FSH in blood/plasma of buffaloes. Recombinant buffalo FSH β–chain (rbu-FSH) was expressed in E. coli (Fig. 15). Purified protein samples has been sent to IISc for protein identification by MALDI-TOF mass spectrometry.

Attempt is also being made for production of bioactive recombinant buffalo FSH (rbu-FSH) in mammalian expression system e.g. CHO cell line. Plasmid constructs containing gene sequences of FSH (with His-tag) and β-chain (with Flag-tag) were prepared using pcDNA 3.4 vector. Pilot scale expression was carried out of transfected CHO-S cells. Positive signals for the respective recombinant proteins were obtained in Western blot.

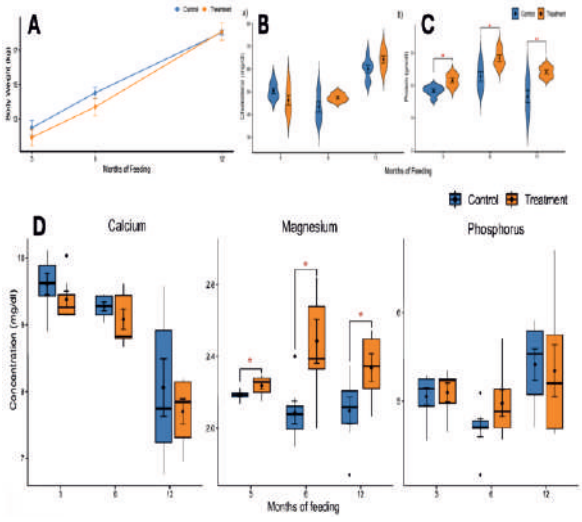


Figure 14: Effect of feeding 20% mulberry leaves over a period of 12 months in sheep. (A) Body weight changes, (B) serum total cholesterol (mg/dl), (C) protein levels (g/dl) and (D) serum levels of calcium, magnesium and phosphorous (mg/dl)

Table 5: Effect of feeding mulberry leaves on reproductive metrics and hormonal levels in ewe lambs

Attributes	Control (n=6)	Treatment (n=6)	P - value
Reproductive performance			
Age at first heat (days)	528.0 ± 51.0	468 ± 33.0	0.2
Cycle length (days)	18.5 ± 0.6	19 ± 0.7	0.3
Pregnancy rate (%)	100	100	
Number of lambs born	6	6	
Age at lambing (days)	719 ± 63	667 ± 35	0.8
Estrous induction (%)			
240 days of feeding	16.66	16.66	
365 days of feeding	100	100	
Reproductive hormonal profileAt estrus			
Estrogen (E2, pg/mL)	400± 88.6	336± 89.2	0.2
At third trimester of pregnancy			
Progesterone (P4, ng/mL)	14.2 ± 2	14.5 ± 03	0.4
Estrogen (E2, pg/mL)	188.0 ± 18	174.0 ± 5.7	0.2
P4/E2	74.5	85.2	

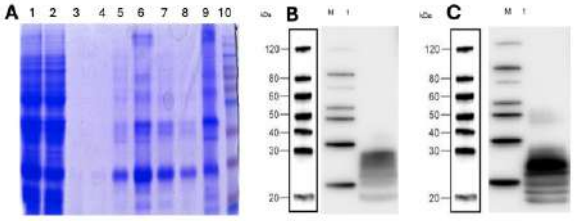


Figure 15: (A) SDS PAGE electrophoresis of bFSH pET28a purification optimization samples. Lane 1-pre bound, Lane 2-post bound, Lane 3-60 mM wash, Lane 4-80 mm wash, Lane 5-100 mM elute, Lane 6-200 mm elute. Lane 7-300 mM elute Lane 8-500 mM elute, Lane 9-Resin and Lane 10-Prestained protein molecular weight marker. (B) Expression of alpha chain of rbuFSH, compound protein with mouse anti-his mAb. (C) Expression of beta chain of rbuFSH with mouse anti-flag mAb.

ICAR-National Fellow: Development of buffalo bull fertility diagnostic chip based on sperm transcripts signatures

S Selvaraju

- Subfertility is primarily driven by disruptions in mitochondrial function, energy buffering, and oxidative balance.
- Sperm proteins are majorly associated with calcium-mediated signaling, energy metabolism, RNA processing and proteasome-mediated degradation.
- MAP1B, C>T and SPATA48 C>G can be used as a potential marker to predict overall semen quality.

Bovine sperm primarily depend on oxidative phosphorylation as their main source of energy for motility and fertilization. Any imbalance in mitochondrial function can severely impair sperm performance. The present study evaluated functional, biochemical, and transcriptomic differences between high-fertile (HF; n = 7) and sub-fertile (SF; n = 7) Murrah buffalo bulls. Flow-cytometric analysis revealed a significantly higher sperm viability ($p<0.01$) and lower intracellular ROS levels ($p<0.01$) in HF bulls, whereas SF bulls exhibited elevated mitochondrial membrane potential (MMP; $p<0.05$) and ROS ($p<0.05$), suggesting mitochondrial dysfunction and oxidative stress. Phosphocreatine (PCr), level was significantly higher in HF bulls ($p<0.001$), in contrast, reduced PCr levels in SF bulls were observed. This leads to excessive ROS generation. Transcriptomic analysis further supported these findings, with significant upregulation (>2-fold, FDR <0.05) of genes involved in creatine metabolism (*CKM, CKMT1A, GAMT, GATM* and *SLC6A8*), antioxidant defense (*SOD1, GPX4, CAT* and *PRDX6*), and mitochondrial energy metabolism (*ATP5F1A* and *NDUFS1*) in HF bulls. The present study demonstrates that buffalo bull sperm function is critically dependent on oxidative phosphorylation and energy homeostasis. Overall, this study highlights that subfertility is primarily driven by disruptions in mitochondrial function, energy buffering, and oxidative balance rather than conventional semen parameters. A multiparametric approach integrating CASA, flow cytometry, biochemical assays (PCr and antioxidants) and transcriptomics provides a robust framework for early

identification of subfertile bulls and improving reproductive efficiency in AI programs.

In this study, RNA-seq derived transcript per million (TPM) values were used in a bioinformatics framework to evaluate the expression of sperm-associated renin–angiotensin system (RAS) genes in Murrah buffaloes(n=21) and their association with semen quality traits. Significant relationships were observed, with *AGT* negatively associated with membrane integrity ($p<0.05$), suggesting that elevated precursor levels may enhance Ang-II mediated pro-oxidant signaling and compromise membrane stability. Conversely, *ACE* and *THOP1* showed positive associations with functional competence ($p<0.01$), indicating a role in regulated peptide processing and calcium-dependent pathways essential for capacitation. *CPA3* was inversely related to sperm nuclear morphology ($p<0.05$), linking altered peptide processing to redox imbalance and chromatin integrity. Overall, these findings highlight that sperm structural and functional stability is dependent on RAS signaling balance rather

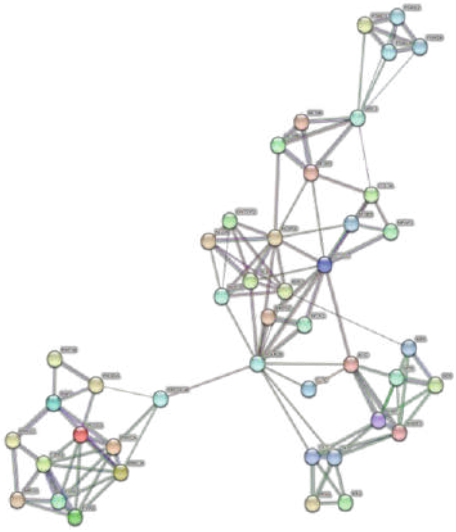


Figure 16: Protein–protein interaction network of high-confidence proteins (STRING score >0.90). The clustered network highlighting functional modules such as calcium signaling, metabolism and protein regulation (synthesis and degradation).

than individual gene expression, providing a pathway-level insight into the role of RAS in buffalo sperm fertility.

Using sperm proteins, high-confidence (score >0.90) protein–protein interaction (PPI) network was constructed employing STRING interactions. These proteins segregate into key biological modules including calcium-mediated signaling, energy metabolism, RNA processing and proteasome-mediated degradation (Fig. 16).

A total of 35 samples were analyzed for identification of single nucleotide polymorphism (SNP). These samples were grouped based on important key reproductive traits such as progressive motility, functional membrane integrity, acrosome integrity and conception rate. Based on the sequence quality, the filtered reads were aligned to the reference genome. The variants were identified using GATK (RNA-seq) pipeline. This approach enabled the reliable detection of SNPs as well as small insertions and deletions (indels) across all samples (Fig. 17). Among the identified variants, particular emphasis was placed on nonsynonymous variants and some of them were selected for further validation using ARMS-PCR. As part of this validation, several SNPs associated with genes related to functional membrane integrity (FMI) and progressive motility were successfully validated, and also studied the network and pathways which highlighting their potential relevance in influencing key reproductive traits.

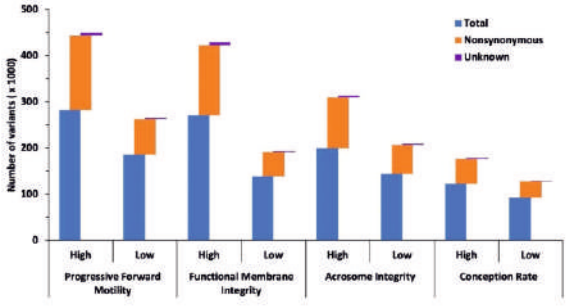


Figure 17: Distribution of total, nonsynonymous, and unknown variants across reproductive phenotypes (PFM, FMI, A+, CR) in high- and low-fertile groups. High-fertile groups generally exhibit higher variant counts across all phenotypes, with nonsynonymous variants contributing a substantial proportion, indicating their potential functional relevance in fertility traits.

Frozen semen samples (4 ejaculates/bull) from buffalo bulls (n=24) were subjected to sperm functional attributes analysis such as sperm kinematics, viability (%), functional membrane integrity (%), acrosome integrity (%), mitochondrial membrane potential (%), normal sperm nuclear morphology (%) and chromatin decondensation ability (%) and positivity for ROS (%). The DNA from the blood and sperm of the same animals were

extracted and genotyping for the selected genes was carried out using tetra-primer amplification refractory mutation system. Based on bioinformatic analysis, three expressed SNPs, *MAP1B* (C>T), *USF3* (T>C), *CALD1* (T>A) and *SPATA48* (C>G) were selected and subjected to validation studies. All these genotypes were in Hardy-Weinberg Equilibrium. In both blood and sperm genotyping, bulls with the *MAP1B* heterozygous (CT) genotype exhibited the lowest rejection percentage as compared to the reference (CC) genotype. The *MAP1B* double mutation (TT) genotype in blood and sperm is significantly ($p<0.05$) associated with reduced sperm functional traits, particularly membrane integrity, motility, viability, and nuclear morphology. *USF3* genotypes analysis in both blood and sperm-derived DNA revealed that bulls with the reference genotype (TT) had significantly ($p<0.05$) higher sperm concentration than heterozygous (TC) or double-mutation (CC) genotypes. *USF3* polymorphism in the reference genotype is significantly ($p<0.05$) higher membrane integrity and viability than the double-mutation genotype. The present study revealed that mutation in *CALD1* did not influence overall semen quality and variations in the genotypes also did not influence the positive predictive ability of sperm functional attributes. The concordance analysis between blood and sperm derived genotypes indicated a substantial agreement (kappa statistic value, 0.65) in supporting the reliability of blood-derived DNA for detection of SNPs associated with sperm function. The *MAP1B* homozygous mutant genotype had the overall poor semen quality ($p = 0.043$) as compared to heterozygous reference genotype. The study revealed that blood DNA can be used for genotyping of sperm expressed SNPs. Mutation in *MAP1B* and *SPATA48* can be used as a potential marker to predict overall semen quality (Fig. 18).

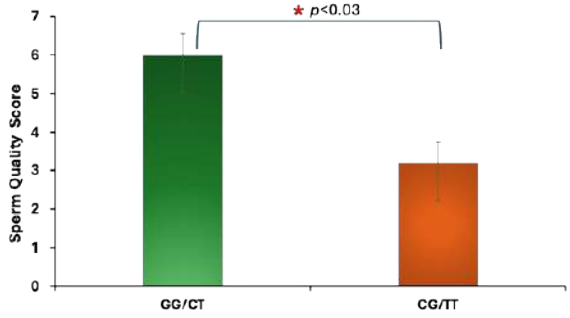


Figure 18: Combination effect of SNPs from MAP1B (CT/TT) and SPATA48 (GG/CG). Presence of both SNPs (GG/CT, beneficial genotype) in bulls leads to improvement in overall sperm quality as compared to other (CG/TT) genotypes.

DST-SERB: Cryopreservation of in vitro propagated sheep spermatogonial stem cells and transplantation efficiency in sheep

BK Binsila, S Selvaraju, A Arangasamy, B Krishnappa, A Dhali, A Mishra, N Ramachandran

- The cryopreservation of the SSCs using isopropyl alcohol-controlled freezing is better for cryo-survival rate.
- L-cysteine (15 mM) and ascorbic acid (250 µM) can be used to improve cryo-survivability of SSCs.
- Apoptotic inhibitor (Y-27632) improved post-thaw viability and post-thaw SSC culture characteristics.

The project attempts to optimize the controlled freezing protocol for spermatogonial stem cells (SSCs) cryotolerance and post-thaw viability. SSCs cryopreservation in 10% DMSO, 80% serum and 10% media exhibited enhanced protective properties in terms of cell viability, colony size, stem cell activity, and proliferative capability. Addition of sheep serum at a concentration of 90% and 80% in the cryomedia improved viable cell recovery to 78.59 ± 3.34 and 79.81 ± 3.35, respectively. Three different protocol with varying cooling rates; isopropyl alcohol based freezing method, slow controlled freezing method/programmable freezing and uncontrolled/rapid freezing method. The isopropyl based slow freezing exhibited significantly higher stemness activity (0.456 ± 0.04) and post thaw viability (79.64 ± 4.1).

To determine optimal antioxidant concentration for sheep SSC cryomedia, SSCs were cryopreserved in varying concentration of antioxidants for 1 month. The effect of antioxidants (6 doses in each antioxidants) such as Ascorbic acid (25 -250µM), -Tocopherol (100 -1500µM), L-Cysteine (0.25- 25mM), and Hypotaurine (1 -50mM) were evaluated in the cryomedia. SSCs cryopreserved with 250 µM ascorbic acid showed significantly fewer ROS-positive cells (39.62 ± 2.43%) compared to the control (69.75 ± 1.41%; $P<0.05$; Fig. 19). Viability and mitochondrial membrane potential have no significant difference with control groups. Post-thaw viability (%) was significantly higher ($p < 0.05$) in cryomedia with L-cysteine at 15 mM (74.03 ± 3.98), 10

mM (72.15 ± 3.15), and 1 mM (72.10 ± 3.37) compared to the control (58.84 ± 1.77). L-cysteine at 15 mM reduced ROS-positive cells (46.46 ± 2.03) and lowered JC-1 monomers (22.09 ± 0.15) versus the control group (65.81 ± 3.69 for ROS and 26.24 ± 0.58 for JC-1, $p < 0.05$). SSCs cryopreserved with varying concentrations (100 µM, 150 µM, 200 µM, 250 µM, 500 µM, 1500 µM) of vitamin E shows no significant improvement in post-thaw viability. Among the four antioxidants studied, L-Cysteine at 15 mM improved post thaw SSC viability and ascorbic acid 250 µM and L-Cysteine (15 mM) decreased ROS production. Hence L-Cysteine and ascorbic acids are recommended for the SSC cryopreservation media. ROCK inhibitor (Y-27632) is recommended in the cryomedia and post thaw culture media for better post thaw viability and SSC culture characteristics as such stemness, proliferation and colony size.

Produced recipients sheep (surrogate sire) for transplantation of SSCs. Spermatogenic cycle was disrupted using 1.5 mg/kg of busulfan injection into the mediastinum testis without affecting integrity of seminiferous tubule. Optimized the location and protocol using ultrasound guided transplantation of SSCs to the sheep testis. Recipients were checked for lack of germ cells in the seminiferous tubule before transplantation. Transplanted cryopreserved SSCs in the sheep and the colonization and progression of spermatogenesis is awaited.

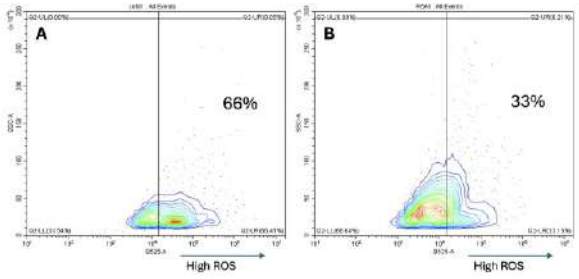


Figure 19: Representative image of the flow cytometry analysis of ROS production in post thaw SSCs using H2DCFDA test (A) Control (B) Cryomedia with L-cysteine

DADF-NLM: Cryopreservation of embryos and semen of sheep and goats for the genetic improvement of non-descript breeds to improve farmers' livelihood

A Mishra, IJ Reddy, A Dhali, A Arangasamy, N Ramachandran

- Cryovials are suitable for sheep and goat semen cryopreservation than regular straw.
- Percoll density-based sheep semen processing method is suitable for the enrichment of motile X-sperm.

The project aims to cryopreservation of embryos and semen of non-descript breeds of sheep and goats. An improved method of sheep and goat semen cryopreservation in cryovials resulted in significantly ($p<0.05$) higher post-thaw functional parameters and subsequent embryo production than the semen cryopreserved in straws with a bio-freezer and LN2 vapour. Higher post-thaw viability of the sperm cryopreserved in cryovials in the vertical position is suggested due to gravity-supported settling of the sperm at the bottom, creating a small air gap, and resulting in less ice crystal formation and subsequent embryo production *in vitro*. Whereas the straws in the horizontal position created a large air gap and faster ice crystal formation, and uneven distribution of temperature along the length of the straw in the vertical position leads to significant ($p<0.05$) sperm damage for subsequent embryo production.

A suitable Percoll density-based sheep semen processing method is standardized for the enrichment of motile X-sperm to increase female embryo production. It has been observed that protein supplementation in cryomedia has improved post-thaw motility, viability and fertility of semen. Semen of Bellary breed shows better post thaw viability and embryo production than Bannur breed of sheep. Cryopreservation of goat semen with egg yolk extender compared with the goat semen without seminal plasma or with sheep seminal plasma is yields better post-thaw quality. Sheep embryo cryopreservation protocol is developed which showed viability of 40%.

DST: Transgenic chicken for expression of leukemia inhibitory factor (LIF): A potential cytokine in stem cell biology and therapy

J Ghosh

- Transgenic poultry birds carrying LIF gene were produced using pLVX-LIF pseudoparticles
- The female birds have shown presence of LIF protein in the egg albumin and the male birds are carrying the LIF gene in the genome.

Commercial layers are highly efficient protein bioreactors due to their protein production efficiency in eggs. They are good transgenic chicken model due to less generation interval. Up-scaling of product does not require much investment in infrastructure and technical manpower as required for any cell-based bioreactors. The human leukemia Inhibitory Factor (hLIF) is a protein has a lot of demand for stem cell culture and therapy. This multi-institutional project envisaged generation of lentiviral construct for the expression of LIF under chicken OVA promoter in pLVX vector backbone and to modify chicken genome for expression of LIF in the egg albumin. However, the transfected PGCs injected early chicken embryo could not successfully generate the transgenic chicken due to poor hatchability of the embryos. PCR assay indicated that the few embryos that survived were not transgenic. An alternate approach using pLVX-LIF pseudoparticles, we produced 14 chicks. The presence of LIF construct was tested in the growing feather follicle isolated DNA of all the birds. Among the tested birds 6 females and 4 males showed the presence of LIF construct in their genome. All the transgenic birds (6 females and 4 males) are grown to sexual maturity. In all the six female egg albumin were positive for the LIF protein in Western blot experiment indicating the expression ability of the construct. Out of 4 positive males, two males are producing sperm whose DNA was positive for the LIF construct. These males are to be tested for the generation ability of hemizygous males and females by back crossing and then homozygous males and females by forward crossing for the ability to generate founder stock (Fig. 20).

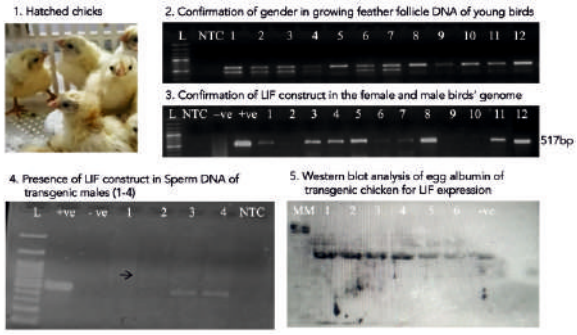


Figure 20: Successful production of LIF transgenic chicken. The chicks (n=14) were produced using an alternative approach of genome modification. Two chicks did not survive the rest were grown to sexual maturity. The genetic sex (2) and the presence of LIF expression construct (3) in all the grown up birds were determined in the growing feather follicle isolated DNA. Testing of sperm DNA of two males shown positive for the construct (4) and the egg albumin of all the female birds' eggs were positive for the presence of LIF protein with different intensities as determined by Western blot experiment (5).

NASF: Metabolomics fingerprinting of body fluids for development of a metabolite-based novel semen extender for enhancing fertility of bull sperm and diagnostic assays for detection of sub-clinical hemoprotozoan diseases in cattle

SC Roy, A Mishra, A Dhali, SH Sontakke

- A novel metabolite-based semen extender, CATTASOL, developed using a combination of 12 validated metabolites, exhibited superior efficacy.
- In a field trial, 83% of Holstein Friesian bulls responded positively to CATTASOL, with a 3.47-120.8% increase in post-thaw motility.

Post-thaw motility and fertility of cryopreserved sperm remain substantially lower than those of fresh semen, with 30–50% of spermatozoa losing viability during the freezing process. Despite decades of refinement in egg yolk–based extenders, conception rates continue to be suboptimal. Semen dilution during processing reduces critical seminal plasma components essential for sperm survival and fertilizing ability. Replacing these components is challenging, as many key metabolites remain unidentified, and the recombinant production of fertility-associated proteins is both costly and impractical. A more feasible strategy is to supplement extenders with naturally occurring, commercially available, low-cost metabolites that enhance fertility. Accordingly, there is an urgent need to develop species-specific semen extenders based on seminal plasma metabolites identified through metabolomics and bioinformatics approaches. In the present study, seminal plasma from Holstein Friesian bulls categorized as high fertile (HF; ≥50% conception), low fertile (LF; ≤40%), good freezer (GF; >70% post-thaw viability), and poor freezer (PF; <40%) was analysed using both untargeted and targeted LC-HRMS metabolomics. Data were processed using MetaboAnalyst 6.0 to identify biomarkers associated with fertility and freezability. Untargeted analysis of HF and LF samples identified seven fertility-related biomarkers, while targeted analysis revealed an additional seven metabolites, primarily involved in phenylalanine, tyrosine, and tryptophan metabolism. In GF and PF groups, untargeted metabolomics identified eleven biomarkers associated with freezability, affecting similar metabolic pathways. Targeted analysis further detected four metabolites

linked to alanine, aspartate, glutamate, and phenylalanine metabolism.

To validate these findings, putative metabolite biomarkers of fertility and freezability were procured commercially and individually incorporated, at physiologically relevant concentrations, into an existing egg yolk–based cattle semen extender. Their effects on the progressive motility of chilled sperm were evaluated. Most metabolites significantly improved post-thaw progressive motility at specific concentrations. Building on these results, a novel metabolite-based semen extender, CATTASOL, has been developed using a combination of 12 validated metabolites. Semen samples processed with CATTASOL exhibited significantly higher progressive motility compared to those extended with conventional egg yolk–based formulations, as assessed by computer-assisted sperm analysis (CASA). The performance of CATTASOL has been successfully validated at the Nandini Sperm Station, Hessarghatta, Bengaluru, where approximately 83% of Holstein Friesian bulls showed a positive response, with improved post-thaw progressive motility. Overall, CATTASOL enhanced post-thaw motility by 3.47–120.8%, depending on the bull, relative to traditional extenders.

These findings suggest that the use of CATTASOL may lead to significant improvements in conception rates following artificial insemination with cryopreserved semen. A provisional patent for the process and product of the CATTASOL semen extender has been filed (Patent Application No. 202611006853, dated 23 January 2026).

ICAR-NPGET: Genome editing in spermatogonial stem cells and transplantation to produce lambs with improved meat production traits (Theme: Production of broiler livestock and poultry using CRISPR technology)

BK Binsila, S Selvaraju, B Krishnappa, AP Kolte, A Dhali, N Selokar

- Produced *MSTN* edited spermatogonial stem cells with 21% indels using CRISPR Cas9 system.
- The *MSTN* edited SSC clonal population are propagated successfully in vitro through single cell propagation.

SSCs were isolated, purified, cultured and cryopreserved from prepubertal sheep testis. Three sgRNA were designed targeting the exon 1 of *MSTN* in *Ovis aries* using the CHOP CHOP and CRISPOR software. The cleavage efficiency of each single-guide RNA (sgRNA) targeting the *MSTN* gene was evaluated using an in vitro cleavage (IVC) assay. For genome editing of SSCs for knock down of *MSTN* gene, the SSC were cultured and electroporation was performed at different parameters pulse voltage, pulse width and pulse number using Neon NXT system. The electroporated SSCs culture had similar morphology as non-electroporated cells. Upon reaching 80% confluency the cells were trypsinized and genomic DNA was extracted from the mixed cell population 72 hours after electroporation. The target site within the *MSTN* gene was successfully amplified by PCR using the extracted gDNA as a template. To isolate clonal populations, single SSCs were picked using an ultrafine glass capillary and cultured individually in 96-well plates. PCR amplification of the *MSTN* target region from several hundred single-cell-derived colonies was also optimized, yielding specific bands corresponding to the expected amplicon size. The presence of indels following transfection was confirmed by T7 Endonuclease I (T7E1) assay and Sanger sequencing of the PCR amplicon. The sequencing data were analysed using bioinformatics tools, (Inference of CRISPR Edits and CLC workbench 21). Out of the 7 electroporation protocols E3 exhibited maximum editing efficiency of 21% indels (Fig. 21).

Figure 21: Sequences present in the edited population and their relative proportions

NASF: Development of nano-micro matrices for the delivery of bioactives, micronutrients and therapeutics

D Rajendran, S Selvaraju, M Gopi

- Synthesized nZnO–Cur as a safer and promising candidate for antimicrobial, antioxidant, and anti-inflammatory applications.
- nZnO–Cur in a poultry feeding @ 100 ppm exhibited improved FCR

Nano zinc oxide (nZnO), nano curcumin (nCur), and their conjugate (nZnO–Cur) were synthesized via chemical reduction and characterized. UV–Vis spectra showed the characteristic peak of nZnO at 370 nm, nCur within 400–600 nm, and additional peaks at 550–650 nm and 300–400 nm for the nZnO–Cur conjugate, confirming conjugation. FTIR and XRD analyses verified functionalization and revealed a wurtzite crystalline phase with structural alterations following curcumin incorporation. SEM–EDS and DLS indicated particle sizes of 88.41/122 nm (nZnO), 53.81/98 nm (nCur), and 43.41/102 nm (nZnO–Cur). Antibacterial assays demonstrated the highest activity for nZnO–Cur, indicating synergism. Antioxidant activity was greater in nCur and nZnO–Cur, while all three nanoparticles inhibited protein denaturation, indicating anti-inflammatory potential. Cytotoxicity revealed nZnO as most toxic, whereas acute oral toxicity studies identified nZnO–Cur as least toxic (LD_{50} = 425.4 mg/kg). Collectively, the data highlight nZnO–Cur as a safer and promising candidate for antimicrobial, antioxidant, and anti-inflammatory applications.

Nano-selenium (Se) and curcumin-conjugated selenium nanoparticles (Se-Cur NPs) were synthesized via ascorbic acid reduction and Tween-20 stabilization. UV–Vis spectroscopy showed a peak at 491 nm for SeNPs and an additional peak at 650 nm for Se-Cur NPs, confirming conjugation. Band gap energy decreased from 2.13 eV to 1.67 eV. XRD confirmed rhombohedral crystallinity, while FTIR verified reduction, stabilization, and curcumin functionalization. Particle size decreased from 71.06 nm to 54.06 nm and zeta potential improved from −33.1 mV to −35.7 mV. EDX and elemental mapping confirmed selenium distribution. In vitro antimicrobial, anti-inflammatory, and antioxidant assays showed no significant activities, consistent with selenium requiring intracellular conversion to seleno-proteins. Acute toxicity testing revealed an LD_{50} of 5064 mg/kg for SeNPs and 939.1 mg/kg for Se-Cur NPs, indicating increased toxicity after conjugation.

In vivo supplementation of curcumin-conjugated ZnO nanoparticles (100 ppm) in broilers significantly improved body weight gain, feed conversion efficiency, and overall health status compared to controls (Fig. 22).

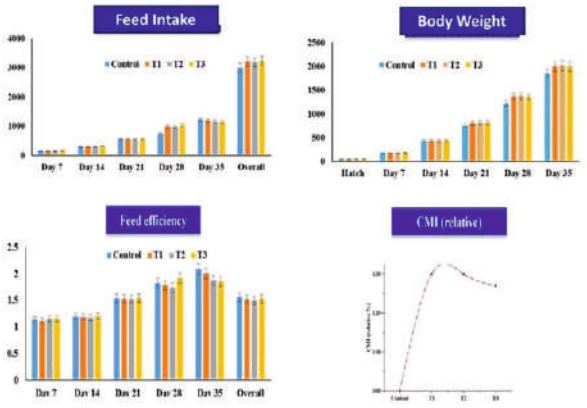


Figure 22: Effect of administration of nano zinc oxide curcumin conjugate as non-antibiotic growth promoter feed additive (feed consumption, body weight gain, feed efficiency & cell mediated immune response) in broiler chickens.

ICAR-NPGET: CRISPR-Cas9 mediated genome editing approach to increase female population *in vitro* and *in vivo*

A Mishra, SC Roy, IJ Reddy, D Nayak

- The electroporation parameters were standardized for transfection of oocytes and embryos to maintain their developmental potential.

The projects aims for the production of higher percentage of female population by forced male to female sex reversal using CRISPR-Cas9 mediated genome editing technology. Sex-specific embryos especially male embryos (presumptive zygotes) were produced by knockout of sexual differentiation gene i.e SRY. Ovine SRY gene specific CrRNA was designed *in silico* by online software CRISPOR. SgRNA incorporated in all-in-one vector with Cas9 and GFP. The presumptive zygote transfected using lipofectamine and electroporation method were developmentally arrested. Later, electroporation was carried out with different combinations of the electroporation parameters to optimize condition for transfection in both oocytes and presumptive zygotes to observe the effect of electric pulse-mediated transfection and observed for further developmental ability. The confirmation and validation of the electroporation mediated transfection of oocytes and

presumptive zygotes was carried out using green fluorescent protein (GFP) expression. The genome editing approach is being used in mice embryos. The mouse embryonic stem cells (ESCs) will be used to create a model for a CRISPR-Cas9 approach and to skew the sex ratio in favor of females by targeting genes within these ESCs that are critical for the development of Y-chromosome-bearing sperm.

DST-SERB-AISTDF: Biotechnological interventions to improve livestock ovarian tissue, follicle and oocyte cryo-survivability for successful embryo production (CRD/2022/000556)

S Nandi

The objective of the project was to develop a suitable cryopreservation technique for bubaline, ovine and porcine ovarian tissue, follicles and oocytes and whole ovaries minimizing the stress related to freezing and to facilitate capacity building and human resource development by providing training activities in the field of oocyte/ follicle/embryo culture and cryopreservation. Established a reproducible and reliable experimental platform for the long-term preservation and in vitro evaluation of ovarian tissues. The standardized cryopreservation procedures, along with optimized culture conditions and the implementation of a scaffold-free 3D culture system, provide a robust framework for studying ovarian tissue physiology and follicular development. The protocols developed through this work ensure consistent experimental outcomes and can be effectively utilized in future reproductive biology and fertility preservation research. PI of the project had visited the Institute of Biology, Vietnam Academy of Science and Technology, Hanoi, Vietnam (15-23 Oct, 2025) under exchange visit program.

Feed Informatics, Feed Quality and Safety and Value Addition

FQS 4.6: Development of sensor based automatic community chaff cutter for dairy farmers

D Rajendran, B Krishnappa, M Gopi, A Sahoo

During the survey under Farmers First Programme, the farmers consistently expressed the need for a safe chaff cutter for efficient fodder utilization. Although, IARI recently introduced sensor-based machine to minimize operational hazards, these developments primarily addressed safety concerns and did not fully overcome practical field challenges. Existing commercial machines continue to face several limitations, including rapid blade dulling, unsafe manual feeding, blockage with wet materials, limited adaptability to diverse crops, gender-skewed usage pattern, dependence on skilled operators, and lack of automation. To address these gaps, a collaborative initiative with ICAR-CIAE was undertaken to design an automated, coin- or card-operated community-based chaff cutter. The project aims to improve safety, efficiency, and accessibility and its effect on fodder value chain to enhance the dairy farmer's livelihood.

The project has progressed significantly toward the development of an innovative, automated, community-based chaff cutter equipped with a long conveyor integrated with a digital weighing system and linked to an automated payment interface. Key features include a blower-type flywheel, high-carbon steel blades, a forward–reverse gear mechanism, and a microcontroller-based control panel with a digital display for seamless operation and communication. With an anticipated capacity of around 3 tons per hour, the system is designed to enhance cutting speed, efficiency, user-friendliness, and wider adaptability across diverse farming conditions.

FQS 4.7: Realtime forecasting of livestock feed resources through automation

G Ravikiran, S Anandan, AV Elangovan, KVH Sastry, K Giridhar

- Developed R programme based, data-driven robust platform for long-term assessment of feed availability-demand balance that supports evidence-based livestock policy and planning.

The project was undertaken to develop a robust, automated computer models for reliable three tier (district, state and country) forecasting of animal feed resources availability. Aim is to fine tuning the existing ARIMA models by using machine learning and artificial intelligence to enhance the accuracy and automate the forecasting.

For feed resource availability estimation, crop-level datasets comprising 27 major crops and 8 land-use categories were compiled. The input data included annual crop production, crop area, rainfall, and rainfall deviation series for the period 1971-2025. Future values of explanatory variables (area, rainfall, rainfall deviation) were also forecasted and used as inputs to generate production projections up to 2047.

The forecasted crop production was then transformed into feed resource availability through a structured conversion module. Crop-wise production was converted into feed components using predefined residue and by-product ratios, including crop residues (straw), grains, bran/chuni, oilcakes, and green fodder fractions. Additional adjustments were incorporated programmatically, including crop-specific residue loss factors (e.g., paddy straw and wheat straw to account for residue burning), deduction of oilcake quantities based on historical export data and projected averages, and inclusion of DDGS contributions for maize and rice in future years. These steps resulted in annual estimates of feed availability across dry, green, and concentrate categories. The physical quantities were subsequently converted into nutritional equivalents using standardized nutritive tables, where feed quantities were multiplied by DM (%), CP (%), DCP (%), and TDN (%) coefficients to obtain year-wise nutrient availability.

For feed requirement estimation, livestock census data were processed category-wise (species, breed type, sex, and age groups). The raw data were transformed from wide to long format and used to construct time-series for each category. Population projections were generated at 5-year intervals up to 2047 and subsequently converted into annual series using block-wise CAGR interpolation, ensuring smooth and consistent temporal transitions between projection points.

Finally, the availability and requirement modules were

integrated programmatically to compute feed balance by subtracting requirement from availability for each component (dry, green, concentrate, DM, CP, TDN). An interactive dashboard was developed using the Shiny framework to filter data by year, crop, and population scenario. The dashboard generates comparative visualizations (bar plots), tabular summaries, and real-time surplus/deficit estimates, enabling intuitive interpretation of feed resource dynamics.

Developed R programme based, data-driven robust platform for long-term assessment of feed availability-demand balance (Fig. 23) that supports evidence-based livestock policy and planning.

Figure 23: Screenshot of the feed resources, demand and availability portal.

ICAR-CRP: Bio-fortification of cereals- evaluation of value addition cereals (VAC) and cereal by-products for animal feeding

SBN Rao, NM Soren, M Chandrasekharaiah

Straw from the Zn-Biofortified rice (DPR Dhan 48) feeding in lactating buffaloes revealed more zinc secretion in milk. A 90 day lactation experiment was carried out at SVVU, Tirupati to compare conventional rice straw vs DRR Dhan 48 developed by Indian Institute of Rice Research (IIRR), Hyderabad. Twelve graded Murrah lactating buffaloes (Av BW-474.85±2.02 kg and 2nd lactation stage) were randomly allotted into two groups based on the body weight and milk yield. Two types of Total mixed rations (TMR) were prepared using ground rice straw and concentrate mixture in 60:40 ratio. The chopped green fodder (Super Napier) was offered to all the experimental animals. No change was observed in the blood parameters such as serum calcium, phosphorus, glucose, triglycerides, blood urea nitrogen, creatinine, SGOT and SGPT. Total secretion of zinc in milk remained same in both groups (Fig. 24). The efficiency of zinc secretion in milk expressed as % intake was more in bio-fortified straw based TMR (5.73 compared to 5.10 in control).

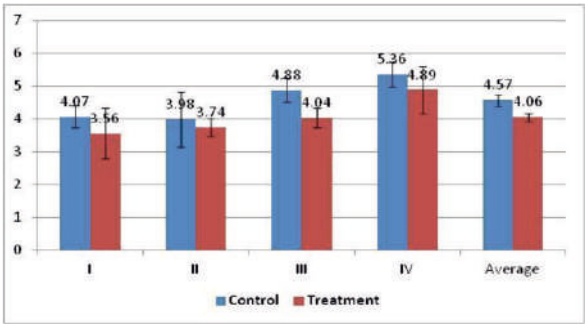


Figure 24: Concentration of zinc in milk (mg/lit) during the last month of experiment. I- 10 week; II- 11 week; III- 12 week; IV- 13 week.

Nutritional evaluation of 24 varieties of Rice grain from IIRR, Hyderabad: Among bio-fortified varieties, the Zn (ppm) was ranging from 16.6 in DRR 48 to 25.75 in in DRR Dhan 63. However, other rice varieties also have good concentration of zinc (12.02 in DRR 72 and 79.66 in DRR 46). The *in vitro* bio-availability of zinc from rice grain was evaluated. Compared to control variety (DRR Dhan 41), all bio-fortified varieties have more bio-available zinc (Fig. 25). The % Bio-availability of Zn was found to be 8.1; 23.2; 21.0 and 42.9% in DRR Dhan45; DRR Dhan48; DRR Dhan49 and DRR Dhan63; , respectively, compared to 4.11 % in DRR Dhan 41.

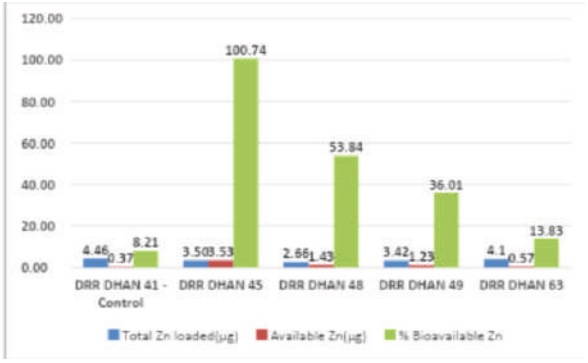


Figure 25: *In vitro* bioavailability of zinc in different bio-fortified rice grain varieties.

Nutritional Evaluation of different improved/ biofortified rice straw varieties: The crude protein % in the straw was ranging from 4.16 in DRR64 and 6.85 in DRR53. Correlations between straw protein with grain protein and straw zinc with grain zinc were negative, indicating grain bio-fortification does not reflect in straw. The ADF in different straw samples ranging from 0.29 in DRR 43 to 0.60 in DRR 50. All the biofortified varieties (DRR 45, 48, 49 and 63) are in intermediary in ranges. Lowest bound N was found in DRR-45 (biofortified variety) and highest in DRR-64. The bio-fortified varieties like DRR45, DRR 49, DRR63

and DRR 48 has IVOMD (%) of 39.5; 40.8; 42.1 and 42.7 respectively. Among the bio-fortified varieties, DRR 63 has better fermentability as indicated by more acetate and total VFA production (µeq/ml) than their counterparts. Other improved varieties like DRR44, DRR43, DRR60, DRR58, DRR 56 also have better fermentability indicated by acetate and total VFA.

ICAR-AICRP: Micro and secondary nutrients and pollutant elements in soils and plants

K Giridhar, DT Pal, S Anandan

- Soil application of one kg of boron per hectare improved green fodder yield of lucerne by over 12% (mean of five cuts), and boron content in fodder by 25 ppm as compared to the control.

Our previous research shown that boron is a beneficial micronutrient for the livestock. Among forage crops, lucerne is very responsive to boron application. The field experiment commenced in the previous year with seven treatments at the fodder farm of ICAR-NIANP was continued to study the effect of correction of boron deficiency in soils on yield as well as quality of lucerne. The available boron in the experimental plot was in deficient category with a mean content of 0.32 ppm. Boron was applied through borax fertilizer to the soil @ 0.75, 1 and 1.25 kg/ha and foliar spray treatments consisted of one and two sprays of 0.1% boron at 30 and 45 days after sowing. A total of five cuts were taken for green fodder from lucerne. Maximum green fodder yield of 103.4 q/ha (mean of 5 cuts) of lucerne was recorded in T4 (soil application of one kg of boron per hectare).

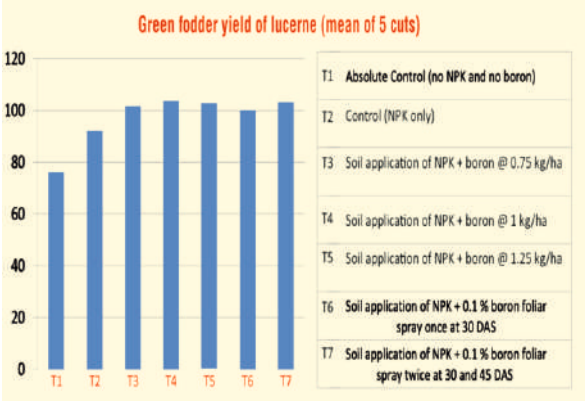


Figure 26: Effect of boron on green fodder yield of lucerne (q/ha)

It was 12.5 % higher as compared to the no boron treatment (T2). The next best treatment was 1.25 kg boron to soil (T5) with a mean green fodder yield of 102.5 q/ha (Fig. 26). All the treatments that had boron application recorded more boron content, ranging from 115 to 135 ppm, as compared to 98.5 ppm in the control. After harvest, lucerne hay was prepared by drying in the shade.

The boron fortified lucerne was fed to growing rabbits to assess the calcium sparing action. Two breeds of rabbits, namely, Soviet Chinchilla and White Giant were selected. Feed pellets were made as per the rabbit experiment treatments. Three lucerne based total mixed diets were formulated having normal calcium in first group and lower calcium (approximately, 80 to 85% of recommended levels) content in second and third groups. In the third group, the rabbits were fed with boron fortified lucerne, while in the second group rabbits were fed with boron unfortified lucerne and lower calcium. This trial is in progress at rabbit farm of ICAR-CSWRI, Mannavanur.

AINP: Livestock and poultry products safety (residue control programme)

SBN Rao, S Jash, M Chandrasekharaiah

- Chicken breast, liver and carabeef samples (156) were analyzed for pesticide residues and no samples were positive for pesticide residue presence.

A total of 156 samples (79 chicken breast meat and 56 chicken liver and 21 Carabeef) were collected from different districts of Karnataka state. The districts surveyed were Belagavi, Bagalkote and Vijayapura for Carabeef; Bangalore Rural, Belagavi, Bellary including Vijayanagara, Chikkabalapur, Chikkamagalur, Dakshin Kannada, Kolar, Mysore for poultry meat and liver samples. Representative samples (One Carabeef and One Chicken meat) were analysed for antibiotics (Nitrofurazone, Nitrofurnatoim, Furaltadone, Furazolidone, Nitrofuran metabolies such as AMOZ, AOZ, AHD, Semicarbazide); Tetracyclines (Chlortetracycline, Oxytetracycline and Tetracycline and Chloramphenicol) and pesticide residues (303 pesticides including isomers) at a NABL accredited laboratory, and all results were negative. All poultry meat samples were analyzed for Chlorpyrifos, Cypermethrin, and Fenvalerate using GC-ECD at NIANP, and the results were negative.

CDB: Value addition of coconut milk through in situ production of monolaurine and its evaluation as health promoting molecule

M Gopi, AP Kolte, A Mech, A Dhali, AK Samanta

- Fermentation of coconut milk with *Lactobacillus plantarum* for 24 hours at 37°C resulted in maximum monolaurin production.
- Fermented coconut milk exhibits potent antibacterial activity against E. coli and Salmonella.

Based on the results of titrimetric method (quantitative), five potential isolates showing higher lipase activity i.e., *Lactobacillus plantarum*, *Lactobacillus fermentum* (HV6B), *Lactobacillus plantarum* (RBPL-2), Lab *Lactobacillus rhamnosus* and *Lactobacillus pentosus* (YD5S) were selected for *In situ* monolaurin production through fermentative action. The asceptically collected coconut milk was fermentated with 1.0% (*v/v*) inoculation of selected five isolates at 37°C for 24 hours. The fatty acid profile of the coconut milk before and after fermentation was studied using the gas chromatography (GC). The coconut milk had about 46.40% lauric acid (Table 6).

Subsequently, FTIR analysis was used to identify monolaurine production (Fig. 27). The FTIR analysis was carried out to select the isolate and for optimizing the duration for higher yield of monolaurine.

Based on the initial FTIR screening, *Lactobacillus fermentum* was selected for the optimization process. As the lipase activity is reversible, longer fermentation could results in formation as well as the reversal of the monolaurin. The results indicated that the peak concentration has been identified at 24 h of fermentation and the concentration reduces at 48 h (Fig. 28). The antibacterial activity of the fermented coconut milk was evaluated against E. coli and Salmonella. The fermented coconut milk exhibited higher antibacterial activity compared to unfermented coconut milk.

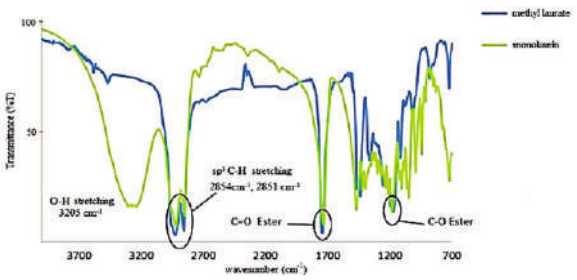


Figure 27: Reference spectra of monolaurine used for the confirmation.

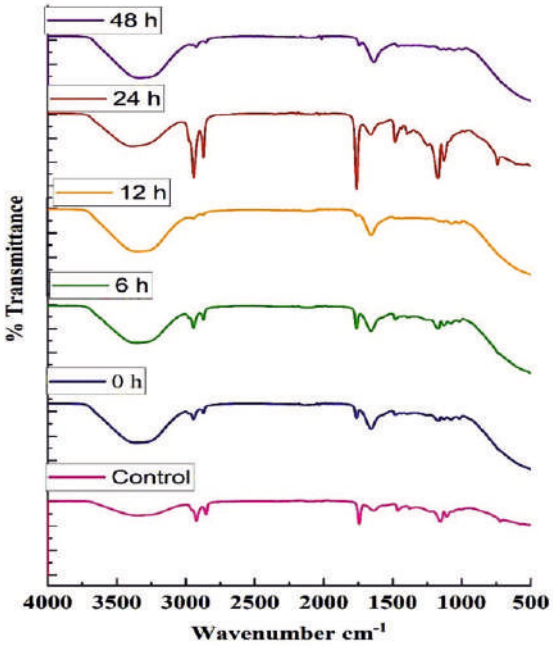


Figure 28: FTIR spectra of L. fermentum 8712 fermented coconut milk at different time intervals

Table 6: Fatty acid profile of coconut milk used for fermentation.

Fatty acids	Concentration (%)
Caprylic acid (Octanoic acid, C8:0)	6.58±0.13
Capric acid (Decanoic acid, C10:0)	4.63±0.07
Lauric acid (C12:0)	46.41±0.49
Myristic acid (C14:0)	23.35±0.10
Palmitic acid (C16:0)	9.28±0.26
Stearic acid (C18:0)	2.19±0.12
Oleic acid (C18:1)	6.09±0.22
Linoleic acid (C18:2)	1.48±0.03

Climate Change Impact on Livestock

CCL 5.3: Comparative analysis of the carbon footprint in semi-intensive vs. intensive dairy farming systems

A Mech, G Letha Devi, NM Soren, M Sivaram, MA Kataktalware, G Maya

- The study highlights enteric methane and feed production are the primary emission hotspots in both semi-intensive and intensive dairy farming systems.
- The intensive farms had higher CF 2.63 kg CO_2eq/kg FPCM compared to 1.76 kg CO_2eq/kg FPCM in semi-intensive farms.

Dairy farming contributes significantly to rural livelihoods and national milk production in India. Simultaneously the sector is also a major source of greenhouse gas (GHG) emissions like methane (CH_4) and nitrous oxide (N_2O) from enteric fermentation and manure management. The emission intensity across production systems is influenced by differences in feed intake, productivity, and herd structure. Hence a comparative assessment was designed to estimate the carbon footprint (CF) of traditional semi-intensive and commercial intensive dairy farms and to identify potential indicators for environmental sustainability of dairy farms. The life cycle assessment was carried out at 45 dairy farms, using a functional unit of kg CO_2 equivalent per kg of fat and protein corrected milk (FPCM). The system boundary extended from input production to the milk selling point. The assessment included major emission sources, like enteric fermentation, manure management, feed-related emissions, and emissions associated with fuel and electricity usage. The environmental sustainability assessment included key indicators as greenhouse gas (GHG) emissions expressed as kg CO_2eq/kg FPCM.

The average herd size was 4.5 animals in semi-intensive farms and 189 animals in intensive farms. Corresponding to these herd sizes, the annual total absolute greenhouse gas (GHG) emissions at the farm level were 11,966 kg CO_2eq per farm per year in semi-intensive systems, compared to 282,767 kg CO_2eq per farm per year in intensive systems. The annual fat- and protein-corrected milk (FPCM) production averaged, 7,683 kg per farm per year in semi-intensive farms whereas intensive farms produced 113,359 kg per farm per year. The semi-intensive farms were small holders and maintained mostly Holstein Friesian cross. In contrast, indigenous breeds such as Malnad Gidda, Gir,

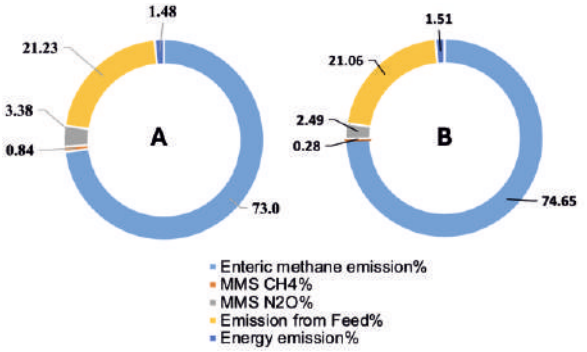


Figure 29: Contribution (%) of different sources to total GHG emissions in semi-intensive dairy farms (A) and intensive dairy farms (B)

Hallikar, Deoni, and Sahiwal coexist with Jersey and HF cross and buffaloes in the intensive commercial farms, reflecting their inclusion within structured production systems. Intensive farms also maintained a more balanced lactating: dry: heifer ratio, whereas semi-intensive farms were predominantly composed of lactating animals with relatively fewer replacement stock. Enteric methane and feed-related emissions were identified as the dominant contributors, accounting for respective 73-75% and 21% of total GHG emissions in both intensive and semi-intensive systems (Fig. 29 & Fig. 30). Manure methane and nitrous oxide emissions varied depending on herd composition and manure handling practices.

In most of the semi-intensive dairy farms CF ranged between 1.5–2.0 kg CO_2eq/kg FPCM with average CF of 1.76 kg CO_2eq/kg FPCM . Whereas, in the intensive dairy farms, the CF was most frequently observed in 2.0–3.0 kg CO_2eq/kg FPCM range with an average CF of 2.63 kg CO_2eq/kg FPCM. Semi-intensive systems demonstrated a lower carbon footprint per kg of FPCM due to moderate input use and reliance on locally available feed resources. In intensive farms, the combined presence of high-producing crossbreds, with presence of indigenous breeds with low milk production, along with higher feed input use, contributed to greater enteric methane emissions and

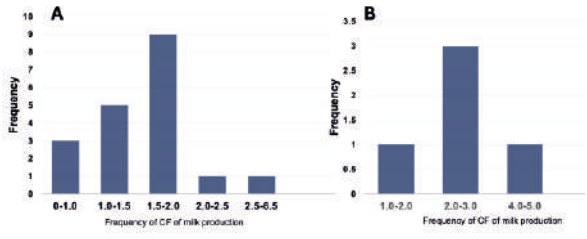


Figure 30: Carbon footprint (CF) kg CO_2eq/kg in semi-intensive dairy farms (A) and intensive dairy farms (B)

overall emission intensity (kg CO_2eq per kg FPCM) compared to semi-intensive systems. The exhibition of higher emission intensity in intensive systems indicated significant scope for mitigation through feed optimization strategies and improved management practices.

ICAR-Outreach: Estimation of methane emission under different feeding systems and development of mitigation strategies

Coordinator: Artabandhu Sahoo

PK Malik, AP Kolte, G Krishnan

- Biochar could not reduce methane production in IVGPT however, sulfur and nitrate could reduce the methane at and more than 3 and 2%, respectively.

Quantifying and mitigating the enteric methane emissions from livestock always remains one of the top most priority of the animal nutritionist. However, most of the approaches tried either could not achieved the desirable reduction in enteric methane emissions or were not economically and practically viable/feasible. Therefore, the ICAR conceptualized the outreach methane project, being implemented with the four distinct objectives of 1) developing a national database on state wise enteric methane emission from Indian livestock, 2) develop mitigation strategies for enteric methane emissions reduction, 3)conduct long term studies with established mitigation approaches and ascertain the effect on enteric methane mitigation, growth, and milk yield and 4) to explore the rumen methanogens plasticity and adaptation during long term evaluation of established methane mitigating phyto-sources. During the reporting period, the effect of graded levels of biochar, nitrate and sulfur supplementation on in vitro methane production was studied. Results from the studies with four variable levels of biochar at 1, 2, 3 and 4% of the diet did not reveal any impact on the total gas and in vitro methane production. Similarly, there was no significant reduction in methane production by supplementing sulfur up to 2% of the diet; however, a significant reduction in methane production was noticed at 3 and 4% levels. The nitrate supplementation at 2% levels and beyond induce a significant reduction in methane production. Comparison of sulfur and nitrate at the similar levels of 2 and 3% in the diet demonstrated the similar reduction in methane production (Fig. 31).

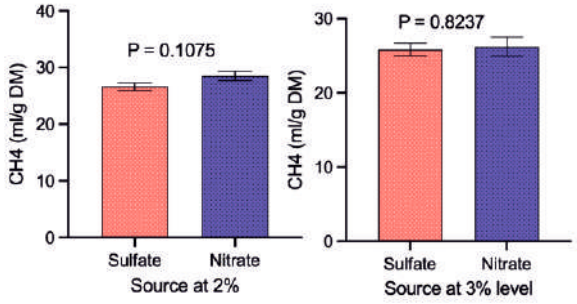


Figure 31: Effect of sulfate and nitrate on methane production at the similar level of 2 & 3%

FAO-IAEA: Utilization of agro-industrial/seaweed wastes as animal feed for reducing GHG emissions, improving nitrogen use efficiency and livestock productivity

PK Malik, R Bhatta, AP Kolte, A Mech

- Enteric methane emission was lower in sheep fed 5% Kappaphycus alvarezii.

The IAEA sponsored project is being undertaken to explore the potential of agro-industrial waste and seaweed for their use as animal feed and optimizing the inclusion level for maximizing productive efficiency including nitrogen and energy while reducing enteric methane emissions. The project is approved to address the objectives of 1) identifying, screening, and dose optimization of selected agro-industrial/seaweed wastes for anti-methanogenic potential, 2) *in vivo* evaluation of the promising agro-industrial/seaweed wastes for reducing GHG emissions, improving nitrogen use efficiency, and livestock production and 3) field evaluation of the selected agro-industrial/seaweed wastes in dairy cattle for the impact on GHG emission, nitrogen use efficiency, and milk production. During the reporting period, an in vivo study was conducted in growing

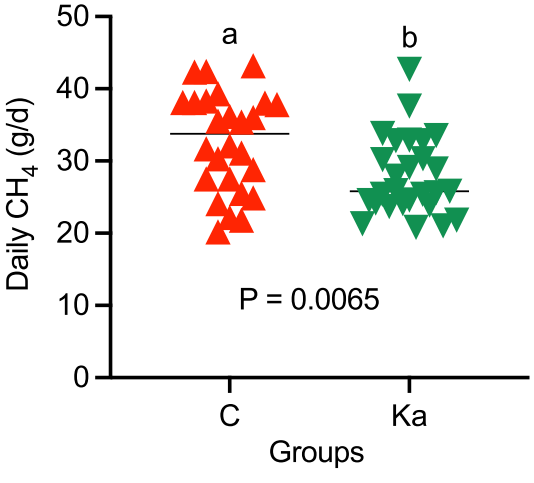


Figure 32: Effect of *Kappaphycus alvarezii* on daily enteric methane emissions in growing sheep

sheep to study the impact of selected seaweed Kappaphycus alvarezii on feed intake, fermentation, nutrient digestibility, growth and rumen metagenome and metatranscriptome. The daily enteric methane emission (g/d) was significantly decreased due to the supplementation of seaweed at 5% levels of the diet (Fig. 32). However, there was no effect on the dry matter intake and growth performance of the sheep. The rumen fluid samples were collected, and the RNA was isolated and sent for the Metatranscriptome sequencing. Methodologies were optimized for quantifying volatilized ammonia from the livestock excreta and two experiments using cattle dung collected through grabbing were conducted and the volatilized ammonia was quantified using the device.

ILRI-ICAR: Assessment of spatio-temporal variation in enteric methane emissions and development of primary based methane emissions inventory

PK Malik, AP Kolte, R Bhatta

- Paddy straw based diets leads to more enteric methane emission compared to sorghum kadbi.

The ILRI-ICAR collaborative project is being undertaken to address the objectives of 1) developing country specific empirical models for assessing enteric methane emission from livestock, 2) to study the seasonal feeding practices in cattle populated states and assessment of the seasonal variation in annual enteric methane emission and 3) to study the seasonal feeding practices in buffalo populated states and assessment of the seasonal variation in annual enteric methane emission. During the reporting period, an animal study was conducted in cattle for the purpose of developing enteric methane emissions factors while fed on paddy straw-based diet. The enteric methane emission was quantified using SF6 tracer technique. Results from the study established that adult cattle emit about 54.9 kg of methane due to the enteric fermentation per year (Fig. 33). The emission factor for paddy straw was compared with the sorghum kadbi emissions ascertained in the preceding year and it was found that the paddy straw based diet led to more methane emissions as compared to the jowar kadbi diet. The comparison of methane emission established in this study with the IPCC default tier II system indicated that the IPCC tier systems overestimated the enteric methane emissions from Indian cattle under natural feedings systems of high fibre diet.

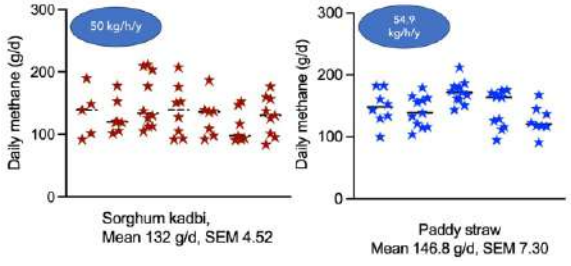


Figure 33: Annual enteric methane emissions in cattle fed on two distinct diets

ICAR-NICRA: Climate change and small ruminant production: Novel approaches to establish climate resilience and for stress amelioration in sheep and goats

V Sejian, C Devaraj, PK Malik, N Ramachandran, A Sahoo

- The ruminal microbiome diversity was affected during heat stress could be restored with the herbal supplementation, and enhanced the fibrolytic microbes.

The protective effects of a herbal supplement was studied on rumen microbial balance and fermentation in Nandidurga goats under heat stress. Microbial analysis revealed that heat stress reduced microbial load and alpha diversity, which were restored in the NDHSS group, indicating the beneficial influence of the herbal supplement. Heat stress disrupted microbial balance by reducing fibrolytic organisms such as *Clostridia* (class level; Fig. 34), *Ruminococcus*, and *Lachnospiraceae* (genus level; Fig. 35), which were partially restored by the herbal supplement, though not sufficiently to reflect on fermentation metabolites. Likewise, heat stress altered protein metabolism–associated taxa including *Bacteroidata* (class) and *Prevotella* and *Prevotellaceae* (genus), with partial recovery under supplementation. Additionally, heat stress increased methanogen abundance in NDHS, while the herbal supplement significantly reduced it in NDHSS. Notably, the herbal supplement enhanced the fibrolytic species *Christensenellaceae R-7* genus in

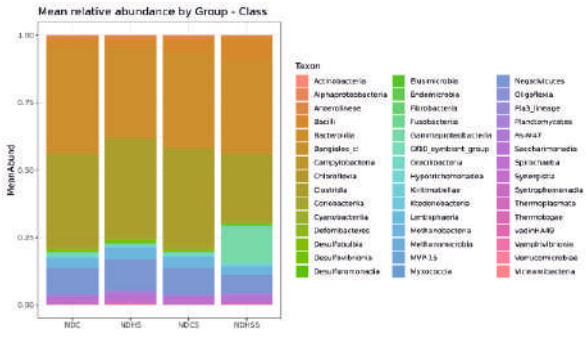


Figure 34: Mean relative abundance of ruminal microbes at class level (all classes) in Nandidurga goats. (NDC: Nandidurga control; NDHS: Nandidurga heat stress; NDCS: Nandidurga control + Herbal supplement; NDHSS: Nandidurga heat stress + Herbal supplement)

NDCS, promoting fibrolytic activity under thermoneutral conditions. Overall, while heat stress adversely affected rumen fermentation, microbial balance, and intestinal morphology, the herbal supplement demonstrated a protective role by improving feed efficiency, restoring microbial richness, mitigating protozoal proliferation, and enhancing goblet cell activity, thereby supporting better rumen health and resilience in Nandidurga goats under thermal stress.

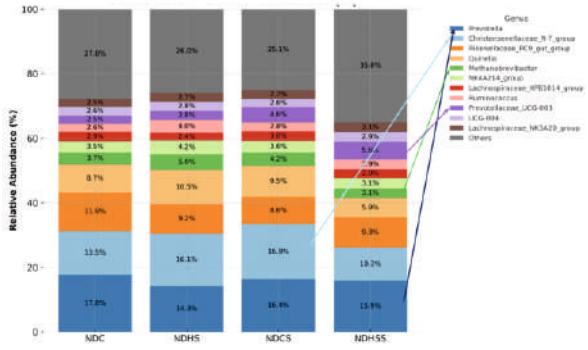


Figure 35: Percent abundance of ruminal microbes at genus level in Nandidurga goats. (NDC: Nandidurga control; NDHS: Nandidurga heat stress; NDCS: Nandidurga control + Herbal supplement; NDHSS: Nandidurga heat stress + Herbal supplement)

The herbal feed additives positively altered the heat stress induced adverse changes on classical heat stress biomarkers such as RR, plasma cortisol, aldosterone, prolactin and *HSF1, HSP27, HSP70, HSP90 & HSP110*. This shows the high potential of herbal feed additives used in this study to ameliorate heat stress in Nandidurga breed. Thus, it could be inferred that even in extremely adapted Nandidurga breed, herbal feed additives may prove beneficial in improving their climate resilience further. Thus, these RR, plasma cortisol, aldosterone, prolactin and *HSF1, HSP27, HSP70, HSP90 & HSP110* variables could be considered markers for reflecting the beneficial effect of herbal feed additives during heat stress exposure in Nandidurga breed (Fig. 36).

Heat stress also significantly reduced *GHR*, *LEP* and *MSTN* expression pattern reflecting the adverse effects of heat stress on growth-signaling pathways. The herbal supplementation increased the expression pattern of these genes suggesting its beneficial effect on molecular mechanisms governing growth. However, the expression pattern of *IGF-1*, *LEPR* and *THRA* was unaltered by both heat stress and herbal supplementation, suggesting that the Nandidurga goats were able to maintain stable growth-signaling pathways without the requirement of herbal product supplementation. Heat stress caused mild to moderate hepatic tissue injury, indicating metabolic strain during thermal exposure.

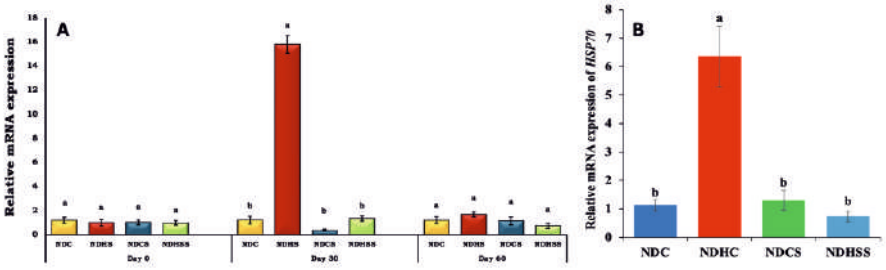


Figure 36: Relative HSP70 mRNA expression in PBMCs (A) and liver (B) in Nandidurga goats. (NDC: Nandidurga control; NDHS: Nandidurga heat stress; NDCS: Nandidurga control + Herbal supplement; NDHSS: Nandidurga heat stress + Herbal supplement). Values bearing different superscripts across the groups differ significantly with each other $p < 0.05$.

Technology Translation to Connect Discovery with Application

TTA 6.6: Economic analysis of green fodder intervention in dairy farming

T Chandrappa, K Giridhar, S Jash

- Adoption of green fodder cultivation by the farmers helped to reduce the per litre milk production cost form Rs 31 to Rs 25.

Field study was conducted to assess the green fodder production and feeding practices in dairy farming and also cost and returns of production of green fodder. Interview questionnaire was developed, validated and collected the primary data from 80 dairy farmers who are cultivating green fodder, using a pre-tested questionnaire through personnel interview method on feeding practices followed in milch cows and also on costs and returns of milk production. The results indicates that before the intervention of fodder cultivation the farmers were feeding milking cow per day on an average 7 kg green fodder, 11 kg dry fodder, 6.49 kg concentrate feed, 2.93 kg wheat bran coarse, 1.49 kg, wheat bran fine 1.63 kg, groundnut cake and 50 grams of mineral mixture. After the intervention of fodder cultivation the farmers are feeding per milking cow per day on an average 25 kgs green fodder, 6 kgs dry fodder, 4.74 kgs concentrate feed, 2.4 kgs wheat bran coarse, 1.52 kgs, wheat bran fine, 1.3 kgs groundnut cake and 50 grams of mineral mixture. Average milk yield has increased from 12.89 liters to 14.42 liters per cow per day. Total feeding cost per milking cow per day has reduced from Rs 407 to Rs 353. Cost per liter of milk produced has been reduced from Rs 31 to Rs 25. Net returns per day per milking cow has increased from Rs 111 to Rs 227.

TTA 6.7: Sustainable livelihood enhancement for scheduled tribe communities through animal husbandry

B Krishnappa, A Arangasamy, T Chandrappa, N Ramachandran, A Mech, C Devaraj, VB Awachat, K Giridhar, S Anandan

- The prevalence of mastitis was assessed using the California Mastitis Test (CMT), revealing a high prevalence in Bramanaradinni village.
- Supplementation of Fertimin Plus to lactating cows resulted in improved milk fat (FCM) in 52% of the cases.

Animal husbandry forms the backbone of livelihood of T. Hosur village, with an average holding of 2.57 large ruminants per farmer, predominantly crossbred

HF cows along with a few buffaloes. Small ruminant rearing is also significant, with around 50 farmers maintaining sheep and goats (6–8 animals per farmer) under stall-fed systems, while a few adopt extensive rearing. Fodder availability is a major constraint, as 37.5% of farmers do not cultivate green fodder and others allocate only small areas (average 9.3 guntas; range 0–40 guntas), mainly under Hybrid Napier and maize. Key reproductive issues such as anoestrus and repeat breeding were reported. Backyard poultry with desi birds is common, indicating diversified livestock-based livelihoods with scope for improvement in fodder production and reproductive management.

During the health camp conducted at Bramanaradinni village, 38 lactating cows were screened, of which 21 (55.26%) were found affected with mastitis, indicating a high prevalence. Subclinical mastitis was observed in 7 animals (18.42%), highlighting the need for early detection and management. Quarter-wise distribution showed higher infections in the hind quarters, particularly the right-hind (12 cases) and left-hind (11 cases), compared to the fore quarters. In the Front Line Demonstartion and On-Farm trial conducted at Bramanaradinni and Thernahalli villages to evaluate the effect of Fertimin Plus supplementation on fat corrected milk (FCM) yield in lactating cows (n=21), an increase in FCM was observed in 11 cases (52.4%). Overall, the results indicate a positive response to supplementation in a majority of the animals.

A series of outreach and development activities were successfully implemented under the DAPST scheme for the ST community, covering multiple villages. A total of 1,296 beneficiaries were reached, including 781 males and 515 females. Key interventions included the distribution of cattle feed, rubber mats, desi birds for backyard poultry farming, CMT kits, first aid kits, fodder seeds, and study kits for school children.

Farmer-scientist interactions and training programmes were organized to improve knowledge on scientific livestock management practices. Health camps and mastitis screening programmes contributed to improved animal health and productivity. Special emphasis was given to supporting women and youth through targeted activities such as student-scientist interactions and educational support.

TTA 6.8: Efficacy of input distribution and their impact on augmenting the livelihood of sc dairy farmers under activity plan for schedule caste.

A Arangasamy, B Krishnappa, T Chandrappa, S Jash, M Bagath, SBN Rao, IJ Reddy, A Sahoo

- Conducted 18 farmers scientist interaction meets, 4 training program, 5 animal health camps and distributed farm inputs to the SC farmers

Development Activity Plan for Schedule Caste (DAPSC) i.e. Scheduled Caste-Sub Plan (SCSP) is an economic empowerment program supported and sponsored by Government of India. This program significantly enhances livestock productivity and income stability. During the reporting period, we have provided input materials for SC farmers such as concentrated cattle feed 57 tons, Fertimin Plus powder 8.3 tons, rubber mats 540, milk cans 843, farmers bags 86, shawls 150, ladies bag 576, bucket, notepad, pen, Veterinary medicine kit 557, first aid kit 577, deworming tab 604, estrus induction tab 531, school bag 473, milking buckets, technical leaflets, feed charts, calendars 150, stationary kits 453 to

Mandya KVK

KGF, Kolar, Karnataka


Gestampalli, AP


Kallakurichi, TN


Bhubaneswar, Odisha

farmers children, reproductive calendars 100 for SC farmer's, required injections and tablets for Cattle reproductive management. Conducted 18 farmers scientist interaction meets, 4 training program, 5 animal health camps etc., to educate the SC dairy farmers to encourage them to adopt the recent advances in the dairy sector. A total of 2620 SC farmers benefitted under the DAPSC scheme from Jan–Dec 2025, we have collected the questionaries from farmers to analyse the impact of distributed feed and mineral supplements on dairy animal's normal physiological system and found that an increase in the milk yield and fat components with respect to the feed distributed, Rubber mats helped by preventing an infections.

ICAR-Farmer FIRST: Improving livelihood security of farmers through technological interventions for sustainable livestock farming

Coordinator: Artabandhu Sahoo
G Letha Devi, DT Pal, K Giridhar, A Arangasamy, A Mech, MA Kataktalware, GB Manjunath Reddy, Atheequalla, Ramamurthy, V Gowda

- Ten technology interventions resulted in 4% area increase in cultivated fodder crops, mastitis incidence dropped by 64% and 16% increase in millk production in the project area.

Farmer FIRST is an effort to go beyond the issues of production and address the complex and diverse realities at field level through enhancing farmer-scientist interaction with multi stake holders participation. The major aim is to enrich farmer-scientist interface for technology development and application through focus on innovations, multi-stake-holders participation, and technological interventions for sustainable livelihoods. The project is being implemented in 5 villages in Doddaballapura taluk of Rural Bangalore, covering 600 farm families.

A total of 10 technology interventions were implemented under 6 modules covering 650 households in a cluster of 5 villages. There was an average 4 times increase in area under fodder crops and a reduction in mastitis incidence by 64%. Area under vegetable crops increase by 3 times. Three SHGs and a custom-hiring center was created in the

village. Average 16% increase in milk production was noticed in the study villages during the period and an average 21% gross income increase across different technology interventions. total of 14 capacity development programs and 5 field days were organized in the year. A Scientist-Farmer-Extension interface meeting was held during 29th Oct 2025.

ICAR-Farmer FIRST: Enriching knowledge, Integrating technology and institutions for holistic village development in horticulture based farming system

D Rajendran, B Krishnappa

- Feeding advisory charts were prepared for fattening lamb production.

The project primarily focused on strengthening small ruminant-based farming systems through input distribution and capacity building. A feeding chart for fattening lambs was developed in 10 different languages, based on survey data collected over the past two years. The preliminary survey revealed that farmers practicing semi-intensive broiler lamb production typically provide about 60% concentrate feed to optimize growth, while those under intensive systems offer up to 70% concentrate feed to achieve target body weights. It was also observed that some progressive farmers feed concentrate up to 4% of the lamb's body weight, achieving an average daily gain (ADG) of around 200 g. The feeding chart has a unique feature that enables calculation of concentrate requirements under both intensive and semi-intensive systems to achieve expected ADGs of 75, 100, 150, and 200 g. The chart is designed in two sheets with a rotating mechanism and masked values, allowing farmers to determine concentrate requirements based on body weights ranging from 30 kg to 50 kg at 5 kg intervals. The reverse side of the chart provides information on the preparation of concentrate mixtures at the farm level, lists various roughages suitable for fattening lambs, and includes general feeding guidelines for optimal growth. The chart is self-explanatory and prepared in local vernacular languages to ensure ease of understanding and adoption by farmers.

DST-SEED-SCSP : Application of horticultural, dairy and small ruminant technologies for technological empowerment to enhance and sustain livelihood security of small and marginal SC farmers in Karnataka

Letha Devi G, S Anandan

Livestock offers employment opportunity in the rural areas, and small ruminants has got the advantage over other livestock through supply of regular income in a short period, and also ensures nutritional security. In the recent times, rearing of small ruminants has been found to be popular in field, as they are sturdy and withstand the vagaries of adverse climate as compared to dairy animals, as most of the areas are under rainfed and small ruminants is best suitable under such agro-climatic zone. Poor participation in official programmes related to agriculture developmental activities due to a lack of exposure and knowledge or poor linkage with related institutions and social groups, lack of motivation to learn due to poor involvement in getting technical guidance and lack of resources for adoption of innovations, including initial investment and lack of family or social support and financial resources to adopt innovations are the major bottlenecks faced by SC communities in rural areas.

Hosadurga and Vasappanadodi villages from Kanakapura taluk, Ramanagara district and Chinnahalli and Chikkatammanahalli villages from Gudibande taluk, Chikkaballapura district were selected. A total of 80 beneficiaries from among Adi Karnataka, Adi Dravida, Lambani were selected from all the villages together. The predominant Livelihoods were found to be farming, dairying, petty business, construction work, daily wage labourers. Baseline data collection was done among the beneficiaries to assess the existing situation. Two awareness campaigns and demonstration of scientific feeding and management practices in sheep were conducted. Inputs such as feed, mineral mixture, lambs and milk replacer were distributed among the beneficiaries.

Chapter - 3

Publications Awards and Honours

Research Papers

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Lead Papers

A Sahoo

Nutrient-gene-host interactions to mitigate the impact of climate change on livestock. Presented at WANACON 2025 "Newer vistas to animal nutrition research, towards climate resilient animal production for livelihood, food and nutritional security organized by MAFSU, Nagpur and Animal Nutrition Association. 20-22 January 2025.

Climate Resilient Technologies and their adoption in livestock farming. Presented at Conference cum workshop on Climate Resilient Livestock Production: Emerging Concepts and Technologies for Sustenance. Organized by ICAR-NIANP, Bangalore, 23-24 November 2025.

AP Kolte

Changing paradigms in rumen microbiology. Presented at WANACON 2025 "Newer vistas to animal nutrition research, towards climate resilient animal production for livelihood, food and nutritional security organized by MAFSU, Nagpur and Animal Nutrition Association. 20-22 January 2025.

D Rajendran

The role of nanotechnology in the development of novel feed additives: Integrating nano minerals for precision livestock feeding. Presented at World Animal Nutrition Conference, organized by Nagpur Veterinary College and Animal Nutrition Association, 20-22 January 2025.

HS Ramesh

Cloning technology: Emerging advances and ongoing challenges. Presented at the 9th annual convention of SVBBI and National symposium on advancing animal health and production through biochemical and biotechnological innovations organized by west Bengal university of animal and fishery sciences, Kolkata, India, 28-29 November 2025.

N Ramachandran

Enhancing small ruminant productivity in India through a precision shelter approach. Presented at ISSGPUCON 2025 on "Transforming small ruminant production: Empowering Precision Farming and Genomic Innovation

for enhanced productivity and sustainable development" organized at ICAR-CIRG Mathura from 5-7 March 2025. In Lead papers and Abstracts compendium (Eds) Dass Gopal, Gururaj K, Singh TP, Chatli MK. ISBN: 978-93-342-3060-4. Pp 135-42.

PK Malik

Mitigation of enteric methane emissions from Indian Livestock. Presented at WANACON 2025 "Newer vistas to animal nutrition research, towards climate resilient animal production for livelihood, food and nutritional security organized by MAFSU, Nagpur and Animal Nutrition Association. 20-22 January 2025.

Approaches for Enteric Methane Mitigation from Indian livestock during Animal Nutrition Conference on Global Resilience in Animal Nutrition: Innovations for Sustainable Future, held at Ayodhya on 19-21 November 2025

Methane Emission from Livestock and its Mitigation: What We Know and What We Need to Know. Presented at ISBD Conference at ICAR-IVRI, Bareilly, 16 December 2025.

Measurement and Mitigation of GHG emissions from livestock' in the CLIMATECON2025 at ICAR-NIANP, Bengaluru on 24 November 2025.

Measurement of livestock GHG emissions and role of nutrition, feed and fodder in their mitigation. Presented at National Conclave at the AAETI, Nimli, 27 October 2025.

V Sejian

Climate resilient goat production: An ideal model for sustainability and economic stability for small holders. Presented at 9th IDF International Symposium on Sheep, Goat, Camel and other Non-Bovine Milk organized by International Dairy Federation (IDF) at NDDB, Anand, 9-11th February, 2026.

Strategies to Ensure Sustainable Small Ruminant Farming System in the Changing Climate Scenario. In Technical session IV: Stress Physiology and Epigenetic Adaptations to Climate Change at 5th Annual conference of Animal Physiology Association & National symposium on "Next Generation Physiological Approaches for Climate-Adaptive Livestock production" organized by Department of Veterinary Physiology and Biochemistry, Veterinary College, Nandinagar, Karnataka veterinary Animal and Fisheries Sciences University, Bidar from 09-10th October 2025.

Goats and Climate Change: A model for resilient animal production systems. In: Conference cum workshop compendium on Climate Resilient Livestock Production: Emerging Concepts and Technologies for Sustenance. Organized by ICAR- NIANP, Bangalore, from 23-24th November 2025.

Invited lectures

A Mech

Life Cycle Assessment for milk production under smallholder farming systems' in three-day training programme on greenhouse gases (GHGs) and their mitigation, organized by SAARC Agriculture Centre, Dhaka, Bangladesh during 22-24 Dec 2025.

M Gopi

Entrepreneurship opportunities in Animal Feed and Nutrition during Skill Development Workshop on Innovative Approaches for Sustainable Livelihood through Skill Development in Animal Feed Production and Vermiculture Technology organized by Alagappa University from 27-29 October 2025.

Feed quality analysis: Establishing feed analytical laboratory. In: Entrepreneurship Development Programme on Poultry Farming: From Basic to Business at ICAR-CARI, Izatnagar, 15-19 December 2025.

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Kolte AP

Introduction to animal metagenomics and applications with special emphasis on 16S rRNA gene amplicon Sequencing. In: ICAR Sponsored Winter School on "Advancements in goat husbandry: Enhancing production efficiency, reproductive performance and health management" organized at CoVS and AH, DUVASU, Mathura, on 2nd February 2026.

V Sejian

Evidence Based Ground Reality Livestock Adaptation Strategies to Puducherry Region. In: Regional Consultation on India's National Adaptation Plan – August 25-26, 2025, Puducherry.

Climate-Smart practices for livestock management, including methane reduction strategies, feed efficiency and water management systems. In: Workshop on Enhancing climate action: Integrating climate smart practices across, Agriculture, water resources, horticulture and livestock sectors organized by Environmental Management and Policy Research Institute, Bangalore between 14-16 October 2025.

Climate resilient livestock production: Emerging concepts and technologies for sustenance. In South Zone SAPI Veterinary Physiology Quiz, Organized by College of Veterinary Science, PVNRTVU, Hyderabad on 12 December 2025.

Compilations

Annual Report 2024, ICAR-NIANP. (English Version) Kolte AP, Krishnan G, Ramachandran N, Mech A and Elangovan AV (Eds). ISBN 978-81-982398-4-6. Pages 110.

Annual Report 2024 ICAR-NIANP. (Hindi Version) Kolte AP, Krishnan G, Ramachandran N, Mech A and Elangovan AV (Eds) ISBN 978-81-995384-3-6. Pages 92.

AICRP Annual Report 2024-25 "Nutritional and physiological interventions for enhancing reproductive

performance in animals". 2025. Krishnappa B, Binsila BK, Selvaraju S, Anandan S, Sahoo A. (Eds.), Published by Director, ICAR-NIANP, Bengaluru.

Annual Report 2024-25 of Outreach Project on "Estimation of methane emission under different feeding systems and development of mitigation strategies". 2025. Kolte AP, Krishnan G and Malik PK. (Eds). Published by Director, ICAR-NIANP, Bengaluru, Pages 1-70.

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Insight to impact: 30 years of research excellence. 2025. Sahoo A, Pal DT, Mishra A, Letha Devi G,. David ICG (Eds). An ICAR-NIANP publication, 1-275 pages.

Hands-on Training Manual "Molecular Biology Techniques" published under ICAR-NPGET project. Binsila B K, Selvaraju S, Krishnappa B, A P Kolte, Artabandhu Sahoo (Eds.). 2025. Published by Director, ICAR-NIANP, Bengaluru. Pages 1-74.

Training Manual "Cell Culture and Biotechniques in Reproductive Biology" ICAR-NPGET sponsored Binsila B K, Selvaraju S, Krishnappa B, A P Kolte, Artabandhu Sahoo (Eds.). 2025. Published by Director, ICAR-NIANP, Bengaluru. Pages 1-140.

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Souvenir. Livestock Nutrition and Health Care Translating to Human Wellbeing. 2025. Rajendran D, Devi LG, David CG, Gopi M, Selvaraju S, Krishnappa B, Jash S, Saha SK, Sahoo A. (Eds.). ICAR-NIANP, Bengaluru, India. pp. 1-135.

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Proceedings of 21 International Conference of Animal Nutrition Society of India-Abstract Papers in "Global Reslience in Animal Nutrition: Innovations for Sustainable Future". 2025. Singh VK, Tewari D, Sachin G, Rao SBN, Chahal U, Katoch S (Eds.) November, 19-21, Ayodhya, India. Pages 1-320.

Books

Climate change and sustainable development. 2025. Jadhav A, Rout P, Mondal S (Eds). CRC Press, USA. ISBN: 9781003492733, 1-272 pages.

Genetic and reproductive approaches for sustainable livestock production. 2025. Mondal S (Eds). Academic Press, Elsevier, USA, ISBN: 9780443248122, pages 1-352.

Climate resilient livestock production: Emerging concepts and technologies for sustenance. 2025. Sejian V, Kolte AP, Mech A, Ramachandran N, Devaraj C, Sahoo A (Eds). An ICAR-NIANP Publication, 1-177 pages.

Sustainable goat production in the changing climate. 2025. Sejian V, Silpa MV, Thirunavukkarasu D (Eds). Elsevier Publisher, Cambridge,UK; ISBN: 9780443135255, 1-402 pages.

Essential protocols in reproductive biology. 2025. Selvaraju S, Binsila BK, Krishnappa B, Arangasamy A. (Eds). An ICAR-NIANP Publication, ISBN: 978-81-969620 -1-138 pages.

Book Chapters

Devaraj C, Shashank CG, Silpa MV, Madhusoodan AP, Sejian V. 2025. Heat stress impacts on growth performance in goats. In: Sustainable Goat Production in the Changing Climate. Sejian V, Silpa MV, Thirunavukkarasu D (Eds.) Elsevier, Cambridge, UK. pp. 41–54. ISBN: 9780443135255.

Kalaignazhal G, Silpa MV, Shashank CG, Devaraj C, Rebez EB, Rajkumar RS, Sejian V. 2025. Impact of climate change on livestock production and mitigation strategies in coastal region. In Advances in Agri-Food Systems. Pathak H, Lakra WS, Gopalakrishnan A, Bansal KC (Eds.). Springer, Singapore. pp. 99–119. ISBN: 978-981-96-0759-4.

Pourouchottamane R, Ramachandran N, Pallavi Chauhan, B. Rai. 2025. General Care, Management, and Record Keeping in Organized Goat Farms. pp112-144. In: Goat Husbandry, ICAR-CIRG Publication. 398 pages.

Prabakar G, Dhinesh Kumar R, Preethi S, Gopi M. 2025. Physiological characteristics of pigs and their welfare needs. Sustainable Swine Farming in India. Singh NJ, Singh G, Swaroop D. and Banik S. (Eds). Choudhary Publishing Media, Ghaziabad (U.P.) pp. 15-25. ISBN 978-81-969936-9-6.

Rebez EB, Sejian V, Silpa MV, Devaraj C, Kalaignazhal G, Shashank CG, Bhatta R. 2025. Transportation of goats during summer season. In: Sustainable Goat Production in the Changing Climate. Sejian V, Silpa MV, Thirunavukkarasu D (Eds.). Elsevier, Cambridge, UK. pp. 21–40. ISBN: 9780443135255.

Rebez EB, Sejian V, Silpa MV, Thirunavukkarasu C, Devaraj C, Kalaignazhal G, Shashank CG, Bhatta R. 2025. Climate resilient technologies for sustainable goat production. In: Sustainable Goat Production in

the Changing Climate. Sejian V, Silpa MV, Thirunavukkarasu D (Eds.). Elsevier, Cambridge, UK. pp. 281–304. ISBN: 9780443135255.

Sejian V, Kalaignazhal G, Rebez EB, Silpa MV, Devaraj C, Ruban W, Shashank CG, Bhatta R. 2025. Heat stress impact on meat characteristics and quality in goats. In: Sustainable Goat Production in the Changing Climate. Sejian V, Silpa MV, Thirunavukkarasu D (Eds.). Elsevier, Cambridge, UK. pp. 71–80. ISBN: 9780443135255.

Sejian V, Silpa MV, Thirunavukkarasu D, Rebez EB, Devaraj C, Sahoo A, Bhatta R. 2025. Adapting goat production to climate change: Conclusions and future researchable priorities. In Sustainable Goat Production in the Changing Climate. Sejian V, Silpa MV, Thirunavukkarasu D (Eds.). Elsevier, Cambridge, UK. pp. 365–377. ISBN: 9780443135255.

Silpa MV, Kalaignazhal G, Rebez EB, Devaraj C, Shashank CG, Bhatta R, Sejian V. 2025. Heat stress mediated changes in the rumen microbiota in goats. In: Sustainable Goat Production in the Changing Climate. Sejian V, Silpa MV, Thirunavukkarasu D (Eds.). Elsevier, Cambridge, UK. pp. 185–190. ISBN: 9780443135255.

Silpa MV, Rebez EB, Kalaignazhal G, Devaraj C, Shashank CG, Bhatta R, Sejian V. 2025. Heat stress associated changes in the whole transcriptomics profile in goats. In: Sustainable Goat Production in the Changing Climate. Sejian V, Silpa MV, Thirunavukkarasu D (Eds.). Elsevier, Cambridge, UK. pp. 177–184. ISBN: 9780443135255.

Popular articles

Gopi M, Elangovan AV. and Sahoo A. 2025. Manipulating gut microbiota through dietary polyphenols: Newer feed additive. Chicken EggsPress, September issue, 01(03): 8-9.

Gowda NKS, Krishnappa B, Letha Devi, Arangasamy A, Chaitra GJ. 2025. Advisory for dairy farmers (Kannada). Technical article. ICAR-National Institute of Animal Nutrition and Physiology, Bengaluru.

Gowda NKS, Krishnappa B. 2025. Advisory for dairy farmers (Kannada). Technical article. ICAR-National Institute of Animal Nutrition and Physiology, Bengaluru.

Gowda NKS, Krishnappa B. 2025. Attention to dairy farmers (Kannada). Technical article. ICAR-National Institute of Animal Nutrition and Physiology, Bengaluru.

Krishnappa B, Gopi M, Binsila BK, Selvaraju S. 2025. Advisory for backyard poultry farming (Kannada). Technical article. ICAR-National Institute of Animal Nutrition and Physiology, Bengaluru.

Krishnappa B, Rajendran D, Supriya, Balakrishna B. 2025. Fodder Tree- Sesbania grandiflora (Kannada). Technical article. ICAR-National Institute of Animal Nutrition and Physiology, Bengaluru.

Awards and Honours

K S Roy

Received First Consolation Prize in Hindi Poem Writing Competition in TOLIC (O-1) 2025 Competition; organized RRSC and coordinated by URSC, Indian Space Research Organization (ISRO), Bengaluru on December'2025.

P K Malik

Dr Tilak Dhiman Best Researcher Award for the year 2025 by the Animal Nutrition Society of India during Binneial International Conference at Ayodhaya during 19-21st November 2025.

Steering Committee Member of the Livestock and Climate Solutions Hub of International Livestock Research Institute (ILRI), CGIAR for the period 2025-2027.

Guest Editor in the Frontiers in Microbiology for the research topic on New Horizons in Gut Microbiome Research for Enhancing Livestock Productivity.

N Ramachandran

Conferred with ISSGPU Fellow 2025 at ISSGPUCON 2025 organized at ICAR-CIRG Mathura from 5-7th March 2025.

Conferred with NAVS Associate Fellow 2025 at NAVS (I) Annual Convention held at BASU Patna Bihar 2025 from 22-23rd December 2025.

Technical committee member of FAD 32-P1 of Bureau of Indian Standards from 2022 for Expert Panel for Review of Standards on Cattle Housing and Transport Panel and revised "Code of practice for Sheep and Goat Housing" and is published in 2025.

Technical committee member of FAD 32-P5 of Bureau of Indian Standards from 2022 for Expert Panel for Review of Standards on Review of Indian Standards on Laboratory Animals and Its Quality Management and revised Code for Breeding, Care, Management and Housing of Laboratory Animals. Part 1 Laboratory Mice and Rats (Second Revision) and is published in 2025..

M Gopi

ANA-Dr. UB Singh Memorial Young Scientist Award during the World Animal Nutrition Conference (WANACON 2025) held at MAFSU, Nagpur during 20-22 January, 2025.

PSP Gupta

Conferred with SAPI Fellow 2025 at SAPICON 25 organized at the RIVER, Pondicherry.

SBN Rao

Chief Editor, Indian Journal of Animal Nutrition.

V Sejian

FAO- Livestock Environmental Assessment and Performance (LEAP) Partnership Technical Advisory

Group member to develop the new LEAP guidelines for "Incorporating livestock greenhouse gas mitigation strategies into national inventories." Rome, Italy.

International Advisory Panel Member for FAO's Livestock Environmental Assessment and Performance Partnership (LEAP), Rome, Italy.

World's top 2 % Scientists list by the Stanford University, USA for the sixth consecutive year since 2020 to 2025 with global ranking for the year 2025 is 96369.

Animal Nutrition Division Award

The Animal Nutrition Division of ICAR-NIANP, Bengaluru has been awarded as **"Best Department of Animal Nutrition"** by Animal Nutrition Society of India (ANSI) in the 21st Biennial International Conference (ASICON 2025) on "Global resilience in animal nutrition: Innovations for sustainable future" during 19th – 21st November 2025 at College of Veterinary Science & Animal Husbandry, AND University of Agriculture & Technology, Kumarganj, Ayodhya, UP.

Patents granted

Malik PK, Kolte AP, Bhatta R. Granted a design patent for 'A Device for Quantifying Greenhouse Gases' on 28th November 2025 (Design patent no. 469025-001).

Anand M, Vaswani S, Malik PK, Chaudhary DK. 2025. Granted a design patent for 'Smart group feeder for goats with feed separation and residual feed recovery system' on 7th August 2025 (Design patent no. 457125-001).

Patents filed

Malik PK, Kolte AP, Bhatta R. 2025. A patent is filed for a device for quantifying greenhouse gases emissions from animal excreta and operation method thereof, patent application no. 202541075655, date of filing 08th August 2025.

Malik PK, Kolte AP, Krishnan G, Anand M, Sahoo A, Bhatta R. 2025. A Device to trap volatilize ammonia from livestock excreta under indian natural storage settings and operation method thereof, patent application no. 202511132666, date of filing 27th December 2025.

Malik PK, Kolte AP, Krishnan G, Anand M, Sahoo A, Bhatta R. 2025. A device to trap volatilize ammonia from livestock excreta under natural storage settings, Design patent application no. 485339-001, date of filing 27th December 2025.

Technology licensing

Harit Dhara - an anti-methanogenic feed supplement was licensed to M/s EVerse.AI Pvt., Ltd, Nagpur on 14th April 2025.

Harit Dhara - an anti-methanogenic feed supplement was licensed to M/s ZeroEarth Pvt. Ltd., Kerala on 04th July 2025.

WastG - a device for quantifying GHG emissions from animal excreta was licensed to M/s Ega Tools & Instruments, Chennai on 17th December 2025.

Tamarin Plus - tamarind seed husk enriched complete feed block for methane amelioration was licensed to M/s Gau Agritech Pvt., Ltd., Bengaluru on 15th August 2025.

Brewery waste for reducing enteric methane emissions from ruminants was licensed to M/s Gau Agritech Pvt., Ltd., Bengaluru on 15th August 2025.

PhytoVridhi developed by ICAR-NIANP licensed to M/s Keshav Merchandise, Krishnagiri, Tamil Nadu on 22nd December 2025.

TransCare for Goat-an anti-transport stress oral powder for goat was licensed to Hornet Biologicals Pvt. Ltd., Bellary, Karnataka on 24th November 2025.

Technology certification by ICAR

National inventory on the state wise enteric methane emissions from Indian livestock developed by R Bhatta, PK Malik, KP Suresh and AP Kolte was granted ICAR Certification on 16th July 2025.

Tamarin Plus: tamarind seed husk enriched complete feed block for methane amelioration, technology developed by R Bhatta, PK Malik and AP Kolte was granted ICAR Certification on 16th July 2025.

Enteric methane emission reduction using silkworm (Bombyx mori) pupae oil, technology developed by PK Malik, AP Kolte and R Bhatta was granted ICAR Certification on 16th July 2025.

Conference Presentation Awards

Conferences	Awards
INFUSE 2025 International Conference on Frontiers of Unified Science and Exploration organized by JAIN (Deemed-to-be University), Bangalore, 17-18 September, 2025.	Best paper award for "Effect of varying concentrations of retinoic acid on in vitro differentiation of sheep spermatogonial stem cells" authored by Tomcy AT, Binsila BK, Krishnappa B, Ramachandran N, Shiyamala E, Sadikh M, Aranganathan V, Kolte AP and Selvaraju S.

Conferences	Awards
VII Annual Conference of International Society of Gene and Cell Therapy on Bio Agricultural Research, organised by ISGCT & ICAR-NIANP, Bengaluru, 12 December 2025.	Best paper award for " Effect of hypoxic conditions on stemness of sheep spermatogonial stem cells" authored by Binsila BK, Tomcy AT, Shiyamala E, Sadikh M, Krishnappa B and Selvaraju S. Best paper award for "Reducing premature capacitation of post-thaw semen to improve *in vitro* embryo production in sheep" authored by Karimpat A. Suchita Atreya S and Mishra A. Best lead speaker award for "Progress and prospects of spermatogonial stem cell technology in Livestock" to Binsila BK. Best oral presentation award for "Omics approach to increase female animal population" to Mishra A.
CLIMATECON2025, Climate Resilient Livestock Production: Emerging Concepts and Technologies for Sustenance, organized by ICAR-NIANP, Bengaluru, 24-25 November 2025.	Best poster presentation award (3rd) for "Mineral analysis of locally available seaweeds for utilization in livestock diet" authored by Akani BT, Arangasamy A, Ige AO, David CG, Adegoke ZA, Soren NM, Pal DT, Gupta PSP and A Sahoo Best poster award for "Effect of breeding and non-breeding seasons on i*n vitro p*roduction of Sheep embryo" authored by Karimpat A, Atreya S and Mishra A.
WANACON 2025 on 'Newer Vistas to Animal Nutrition Research towards climate resilient animal production for livelihood, food and nutritional security' at Nagpur Veterinary College, Nagpur from 20-22 January 2025.	Best poster award for "An i*n-silico* study to decipher the interaction between ovalbumin and phytochemicals" authored by Chanakya S, Suganthi RU, Rangapur AA, Sahoo A and Malik PK. Best Poster Presentation Award for "Development of rapid method for determination of bacterial lipase activity and their peak catalytic activity" authored by Gopi M, Sowmya B, Mech A, Kolte AP, Dhali A and Samanta AK.
VII Annual Convention and National Conference of National Academy of Veterinary Nutrition and Animal Welfare on "Livestock Nutrition and Health Care Translating to Human Wellbeing" conducted at ICAR-NIANP, Bangalore from 16 - 17 October 2025.	Best oral presentation award (1st) for "Effect of Piper betle leaf essential oil on nutrient digestibility, production performance, immunity and antioxidant status in broiler chickens under LPS-induced stress" authored by Rangapur AA, Suganthi RU, Elangovan AV, Awachat VB, Chanakya S, Malik PK, Soren NM, Pal DT and Sahoo A. Best Poster Award (2nd) "I*n ovo* administration of probiotic (*Lactobacillus rhamnosus*) favourably altered the caecal microbiota in broiler chickens" authored by Vishwajeet JS, Gopi M, Kolte AP, Akshay R, Vaibhav AB, Sastry KVH, Sahoo A and Elangovan AV. Best Poster Award (3rd) for "Manipulation of antibacterial activity of postbiotics with the incorporation of prebiotic skeleton and duration of production" authored by Achyuth DS, Sowmya B, Vishwajeet JS, Rakesh M, Kolte AP and Gopi M. Best poster award (2nd) for "Evaluating seasonal dynamics of carbon footprint in semi-intensive sheep production systems in Karnataka" authored by Mech A, Letha Devi G, Malik PK, Sivaram M, Soren NM, Maya G and Dhali A. Best poster award for "Bovine serum albumin vs Fetal bovine serum as protein source in fertilization medium for sheep embryo production *in vitro"* authored by Karimpat A, Atreya S and Mishra A.
SVBBICON-2025 organised at Veterinary College, WBUV&A Univeristy, West Bengal during 28-29 November 2005.	Best oral presentation award for "Effect of AREG, NRG-1, TNF-á and their optimal doses on retrieval of good cultivable oocytes from in vitro cultured preantral follicles in sheep" authored by Ramesh HS, Nandi S, Gupta PSP and Kumar VG. Best oral presentation award for "Resveratrol's effects on fertility and steroidogenic activity in ovine ovarian granulose cells and preantral follicles" authored by Kumar BS, Kumar VG, Singh PK, Ramesh HS and Nandi S.

Conferences	Awards
V Annual Conference of Animal Physiology Association (APACON 2025) & National Symposium on Next-Generation Physiological Approaches for Climate-Adaptive Livestock Production, held at Veterinary College, KVAFSU, Nandinagar, Bidar, October 09-10, 2025.	APA Women Young Scientist award for "Studying the efficacy of herbal feed additives in ameliorating the adverse heat stress impacts in Kenguri sheep" authored by Rebez EB, Devaraj C, Silpa MV, Nikhil KT, Ninan J, Sahoo A, Dunshea FR and Sejian V. Best oral presentation award for "Quercetin supplementation in culture medium reduced oxidative stress and improved sheep embryos production *in vitro"* authored by Karimpat A, Atreya S and Mishra A. APA Women Young Scientist award for "Studying the efficacy of herbal feed additives in ameliorating the adverse heat stress impacts in Kenguri sheep" authored by Rebez EB, Devaraj C, Silpa MV, Nikhil KT, Ninan J, Sahoo A, Dunshea FR and Sejian V. Best oral presentation award for "Quercetin supplementation in culture medium reduced oxidative stress and improved sheep embryos production *in vitro"* authored by Karimpat A, Atreya S and Mishra A. Best poster presentation award for "Comparative study on growth rate of preantral follicles retrieved from fresh ovaries and cryopreserved ovaries" authored by Tagale DK, Ramesh HS and Nandi S. Best oral presentation award (I) for "Influence of heat stress on the quantitative expression patterns of classical genes governing reproductive function in Bidri goats" authored by Imtiyaz T, Ilavarasi G, Thenambigai S, Balamurugan N, Silpa MV, Devaraj C, Sahoo A, Bhatta R and Sejian V. Poster Presentation Award (II) for "Heat stress induced changes on the quantitative expression patterns of classical heat shock protein genes in Bidri goats" authored by Ilavarasi G, Imtiyaz T, Thenambigai S, Balamurugan N, Silpa MV, Devaraj C, Sahoo A, Bhatta R and Sejian V. Best Poster Presentation Award (II) for "Heat stress influence on the expression patterns of different growth governing genes in Bidri goats" authored by Thenambigai S, Tasmiya Imtiyaz T, Balamurugan N, Ilavarasi G, Silpa MV, Devaraj C, Sahoo A, Bhatta R and Sejian V. Best Poster Presentation Award (III) for "Influence of heat stress on the expression pattern of *HSP70* gene in different parts of digestive tract in Bidri goat breed" authored by Balamurugan N, Imtiyaz T, Ilavarasi G, Thenambigai S, Silpa MV, Devaraj C, Sahoo A, Bhatta R and Sejian V.
International Conference on Rainfed Agricultural: Building pathways for resilience and sustainable livelihoods. Organized by ICAR-CRIDA, Hyderabad, Telangana 29-31st January 2025.	Best oral presentation award for "Efficacy of herbal feed additive in mitigating heat stress in bannur sheep under hot-dry tropical conditions" authored by Devaraj C, Sejian V and Sahoo A.

Chapter - 4

Training and Capacity Building

Training/ Workshop/ Meeting Organized

National Brainstorming Workshop on Nanotechnology

The National brainstorming workshop on "Nanotechnology: Animal production and health" was organized at ICAR-NIANP, Bengaluru on 28th January 2025. The workshop provided a common platform for scientists, faculties, research scholars, students, industry experts and other stakeholders for designing the action plan for the applications of nanotechnology in the livestock production. Professor Absar Ahamed, Founder Director, Interdisciplinary Nanotechnology Centre (IDNC), Aligarh Muslim University (AMU) delivered the keynote lecture and the theme lectures were delivered by Dr S Anandan, Professor, NIT, Trichy and Dr D Rajendran, Principal Scientist, ICAR-NIANP, Bengaluru. The panel discussion chaired by Dr Artabandhu Sahoo, Director, ICAR-NIANP, co-chaired by Dr Jitendra Kumar, ADG (NASF), ICAR, New Delhi and Prof Absar Ahmad deliberated the latest research developments, current challenges and future prospects of nanotechnology in agriculture and animal sciences.

National Workshop on Laboratory Animals and Ethics

A one day workshop on "Laboratory animals and ethics in bioscience research" was organized on 27th February 2025. Dr Ramachandra SG, Former Director, ICMR-NARFBR, Hyderabad was chief guest and delivered key note address on "Laboratory animals and ethics in biomedical research" and shared his experiences in laboratory animal research. The special guest, Dr Krishnappa H, President and Managing Director, Advinus Therapeutics delivered theme lecture on "Ethics, welfare and quality laboratory animals" and deliberated the necessity of using quality lab animals for research with welfare measures. About 150 participants attended the workshop. the country attended the programme.

IPR Training for Students

A training programme was organized on "Fundamentals to application: Mastering intellectual property rights for future innovators" from 25th - 26th February 2025 under the Institute Technology Management Unit (ITMU). The training was especially designed for the post-graduate and doctoral degree students of the National Agricultural Research System of the country. A total of 55 participants attended the two days training programme. Different experts educated the participants on various aspects of intellectual property, the requirements and official procedures for filing intellectual property rights and licensing mechanisms for newly invented technologies.

Farmers Off Farm Training

One off farm training programme comprising skill improvement along with distribution of input materials was organized at ICAR-NIANP, Bengaluru on 4th February 2025 for the Scheduled Tribe farmers from Bramanardinni, Chintamani Taluk, Karnataka. A total of 51 farmers, including 16 women farmers participated in the training programme. The program attempted to impart knowledge about scientific feeding practices and reproductive management of dairy animals. The programme also aimed to enhance the knowledge and resources of the Schedule Tribe farmers, empowering them to improve dairy farming practices. The participants were appraised about the importance of balanced feeding, resources of green fodder, feed preparation with locally available feed ingredients and reproductive management. Dr Artabandhu Sahoo, the Director addressed the farmers and distributed various farming inputs, such as feed supplements, First-Aid Kits for animals, fodder seeds, milking buckets and etc.

Farmers-Scientist Interaction Meet

ICAR-NIANP, Bengaluru organized one day Farmers-scientist interaction meet on 6th February 2025 at Thally Block, Krishnagiri District, Tamil Nadu under Development Action Plan for Scheduled Caste (DAPSC). Dr Artabandhu Sahoo, Director ICAR-NIANP inaugurated the program and emphasized the importance of scientific feeding practices of dairy animals. He elucidated the contributions of ICAR-NIANP in nutrition and welfare of livestock in different physiological stages for augmenting productivity. Farmers also visited TVS NGO chilling centre and horticulture farm. A total of 75 dairy farmers belonging to Scheduled caste benefitted in this program.

Dairy Farmers Field Day

The ICAR-NIANP, Bengaluru organized a "Dairy Farmers Field Day" in selected remote villages (Vengasandra, NG Hulkur, Mustoor, Lakshmisagara, Kadiriganakoppa, Pooganahalli, Gennerahalli and Gandodihalli) of Kolar Gold Fields Taluk, Karnataka on 19th February 2025. Dr Artabandhu Sahoo, the Director ICAR-NIANP inaugurated the programme and highlighted the importance of scientific feeding of dairy animals. Mrs Roopakala Shashidhar, MLA of Kolar Gold Fields graced the occasion and commended the activities of NIANP towards the upliftment of socioeconomic status dairy farmers by providing scientific advises and essential material inputs for the better and profitable dairy farming. The institute distributed cattle feed to 150 dairy farmers under Development Action Plan for Scheduled Caste.

Training Programmes under NPGET projects

Advanced biotechniques for improving reproductive and productive efficiency in livestock

The capacity building training programme was organized under the SCSP component of the ICAR funded project "Network programme on application of genome editing technology for improvement in livestock health and production (NPGET)" at ICAR-NIANP, Bengaluru during 03rd -12th February 2025. The training programme was designed to integrate both theoretical and practical aspects of animal biotechnology, with a focus on various tools and biotechnological techniques applied in animal research. A total of twenty participants, including faculty members and postgraduate students from different states across.

Emerging biotechniques for animal science research

This training programme was organized under the SCSP component of the ICAR funded "Network programme on application of genome editing technology for improvement in livestock health and production" at ICAR-NIANP, Bengaluru from 17th to 26th September 2025. The training programme was designed with incorporation of the theoretical and practical aspects of 'Animal Biotechnology', where the participants got exposure to various biotechniques used in livestock research.

Hands on training on molecular techniques

A hands on training programme for skill development was conducted during 27th – 31st October 2025. The five days training programme was carried out under TSP component of ICAR-Network Programme on Genome Editing Technology (NPGET). Dr Binsila BK was the course director and Selvaraju S, Atul P Kolte and Krishnappa B were Course coordinators for the training programme. Dr A Sahoo, the Director, ICAR-NIANP in his inaugural address emphasized the importance for the skill development in the molecular biology and genome editing techniques. Dr NH Mohan, the Director, ICAR-NBAGR, Karnal graced the valedictory function. Eleven participants from five different states completed the Hands-on training on molecular techniques. A training manual on Molecular biology techniques was released during the training programme.

Ten Days Skill Development Programme

A ten days skill development programme on "Cell culture and molecular techniques" from 12th to 21st November 2025 under ICAR-Network Programme on Genome Editing Technology (NPGET) SCSP plan. The programme was inaugurated by Prof Utpal Tatu, Chairman, Department of Biochemistry, Indian Institute Science, Bengaluru. Dr A Sahoo, the Director, ICAR-NIANP emphasized the significance of biotechnological tools and genome editing techniques for augmenting livestock production and reproduction. Dr Binsila BK was course director and Dr S Selvaraju, AP Kolte and Krishnappa B coordinated the programme. A total of eighteen research scholars and faculties from seven different states of the country participated in the training programme. Valedictory Address was delivered by Dr PK Gupta, Principal Scientist, ICAR-NPGET programme Co-ordinator. He stressed on the need and importance of genome editing research in animal health and production.

Short Course on Frontier technologies to improve fertility in livestock

A short course on "Frontier technologies to improve fertility in livestock" was organized from 22nd to 31st December 2025 as a part of ICAR-National Fellow Project entitled "Development of buffalo bull fertility diagnostic chip based on sperm transcripts signatures". The inaugural program was graced by Dr Suresh Honnappagol, Former AH Commissioner, GOI, and VC, KVAFSU emphasized the importance of developing technical skills in higher educational program and appreciated the initiative taken up at NIANP. The short course was aimed at training the young researchers for enhancing their technical skill and competence in the state-of-art reproductive technologies. A total of 15 trainees representing from Rajasthan, UP, Bihar, Karnataka, Tamil Nadu including from abroad, Nigeria attended the training program. A book on "Essential protocols in reproductive biology" was released and distributed to the trainees attending the short course.

Hosting Scholars with External Grant for Conducting Research

Scholar	Title of the Research Project	Grant	Mentor
M Srinivasan	Establishing the functional significance of microbiome and secretome of seminal plasma in predicting buffalo bull semen quality.	DST-SERBNPDFS	Selvaraju
Kalpana Kaushik	Embryo production from the oocyte of encapsulated vitrified preantral follicle in ruminant animal: Genomics and proteomics	DST-WISE-PDF	PSP Gupta

Training Undergone by Staff

Scientist

Particulars	Participants
Traing programme on "Artificial Intelligence in Agriculture", 1-17 February 2025 at ICAR-NAARM, Hyderabad.	Letha Devi G
National training programme on "Genome editing technology in farm animals", 8 - 17 February 2025 at ICAR-NDRI, Karnal, Haryana.	Binsila B Krishnan
MDP training on "Intellectual property valuation and technology management" , 3 - 7 March 2025 at ICAR-NAARM, Hyderabad.	T Chandrapapa
Training programme of Capacity Building Commission's 3-Day on "Karmayogi facilitators training programme" under the Rashtriya Karmayogi Large Scale Jan Seva Programme, 15 – 17 December 2025 at ICAR-NAARM, Hyderabad.	H S Ramesh

Meeting/ Conference/ Symposium Attended by the Director

Particulars	Date
International Conference on Rainfed Agriculture, Organized by Indian Society of Dryland Agriculture, at CRIDA, Hyderabad	30 Jan 2025
"Transforming small ruminant production: empowering precision farming and genomic innovations for enhanced productivity and sustainable development organized by ISSGPU & CIRG, Makhdoom	4-5 March 2025
WANACON-2025 on "Newer vistas to animal nutrition research towards climate resilient animal production for livelihood, food and nutritional security" at MAFSU, Nagpur	20-22 Jan 2025
Awareness camp on mastitis prevention under Farmer FIRST Project at Gangasandra village	14 May 2025
Viksit Krishi Sankalp Abhiyan-2025	29 May 2025
Farmers-Scientist Interaction Meet cum Input Distribution under DAPSC Scheme at Andhra Pradesh	27 Jun 2025
19th Convention on 'Spirituality for Human Existence-Innovating newer avenues' at Mount Abu, Rajasthan	30 Aug 2025
Input distribution cum animal health camp under DAPSC at Doddathandya village	11 Aug 2025
Frontline Demonstration Conducted Under DAPST Scheme at Chikkaballapur	28 Aug 2025
Farmers-Scientist Interaction Meet cum Input Distribution under DAPSC Scheme at Krishnagiri, Tamil Nadu	18 Sep 2025
2nd National Training-cum-Workshop organized by VOTI (Odisha Govt) & CEAH (DAHD) in AFMI-2025" at ICAR-CIWA, Bhubaneswar	22 Sep 2025
Capacity Development Programme on Scientific Dairy Farming for Tribal Farmers at Puttur, Dakshina Kannada	13 Oct 2025
Farmers-Scientist Interaction Meet cum Input Distribution under DAPSC Scheme at CVSc & AH, OUAT Bhubaneshwar Odisha	30 Oct 2025

Particulars	Date
National Conference & 17th Veterinary Science Congress at Wayanad, Kerala	8-9 Nov 2025
ANSICON 2025 "Global resilience in animal nutrition: innovations for a sustainable future" ANDUAT, Kumarganj, Ayodhya	19-21 Nov 2025
Farmers Scientist Interaction Meet cum Input Distribution at Erode TN under DAPSC Scheme at Chennampatti, Erode, Tamil Nadu	4 Dec 2025
Kisan Gosthi cum Input Distribution at remote backward villages of Mysore District Karnataka under DAPSC Scheme at HD Kote, Mysore	10 Dec 2025

Workshop/ Conference/ Seminar/ Symposium/ Krishi Mela/ Expo/ Meeting Attended by Scientists and Technical Officers

Particulars	Participants
Southern Dairy Summit-2025 on "Livestock: An Indian perspective" at NIMHANS Convention Centre, Bengaluru, 9 -11 January 2025	PSP Gupta, SBN Rao, K Giridhar, S Anandan, KS Roy, J Ghosh
World Conference of Animal Nutrition Association (WANACON-2025) on "Newer vistas to animal nutrition research towards climate resilient animal production for livelihood, food and nutritional security" at MAFSU, Nagpur, 20-22 January 2025	PK Malik, D Rajendran, RU Suganthi, NM Soren, AP Kolte, M Gopi
National Brainstorming Workshop on "Nanotechnology: Animal production and health", at ICAR-NIANP, Bengaluru, 28 January 2025	All the Scientists
National Workshop on "Animal ethics and welfare for research" at ICAR-NIANP, Bengaluru, 27 February 2025	All the Scientists
Conference of World Veterinary Poultry Association, India on "Wings of innovation: Flock forward for future poultry production" at Rajiv Gandhi Institute of Veterinary Education and Research, Puducherry, 27-28 February 2025	CG David, D Rajendran
National Conference (ISSGPUCON-2025) on "Transforming small ruminant production: Empowering precision farming and genomic innovation for enhanced productivity and sustainable development", at ICAR-CIRG, Mathura, 5-7 March 2025.	N Ramachandran
National Scientific Convention cum XXII NAVS convocation on "Challenges and priorities for optimal production of livestock, poultry, healthcare and nutrition of pets", at Veterinary College, Hebbal, Bengaluru, 8-9 March 2025.	RU Suganthi
5th Annual Conference of Animal Physiologists Association & National Symposium (APACON 2025) on "Next generation physiological approaches for climate adaptive livestock production" at Veterinary College, KVAFSU, Nandinagar, Bidar, 9–10 October 2025	IJ Reddy, V sejian, A Mishra, G Krishnan, HS Ramesh
Brainstorming session on "Strategies to enhance feed quality and implement sustainable solutions to address nutritional challenges and boost small ruminant productivity in a changing climate" at ICA-CSWRI, Avikanagar, 9 October 2025.	S Anandan

Particulars	Participants
21st Biennial International Conference (ANSICON 2025) on "Global resilience in animal nutrition: Innovations for sustainable future" at College of Veterinary Science & Animal Husbandry, ANDUAT, Kumarganj, UP, 19–21 November 2025.	PK Malik, SBN Rao, D Rajendran, G Krishnan
National Conference-cum-Workshop on "Climate resilient livestock production: Emerging concepts and technologies for sustenance" at ICAR-NIANP, Bengaluru, 23-24 November 2025.	All the Scientists
7th Annual Conference of International Society for Gene and Cell Therapy (ISGCTCON 2025) on "Bio agricultural research" at ICAR-NIANP, Bengaluru, 12 December 2025.	All the Scientists
National Conference on "Buffalo production and health in changing climate: Innovations for a resilient future" at ICAR-IVRI, Barielly, 15–16 December 2025	PK Malik

List of Workshop / Training Conducted for Stakeholders

Particulars	Date	Venue
Workshop on "Dairy animal management and ration balancing"	17 Feb 2025	KMF central training institute, Bengaluru
Awareness camp on "Mastitis prevention" under Farmer FIRST Project	14 May 2025	Gangasandra village
One-day Farmer-Scientist Interaction Meet cum Input Distribution Programme under the Development Action Plan for Scheduled Castes (DAPSC).	27 June 2025	ICAR-NIANP, Bengaluru
Farmers training on "Soil and animal health management" under DST-SCSP project	13 Aug 2025	Gudibande Taluk
A 10 days capacity building training programme on "Emerging biotechniques for animal science research" was organized under the SCSP component of the ICAR funded "NPGET" project.	17 to 26 Sep 2025	ICAR-NIANP, Bengaluru
TSP Training on "Hands-on training in Molecular Biology Techniques" was organized under the SCSP component of the ICAR funded "NPGET"	27 to 31 Oct 2025	ICAR-NIANP, Bengaluru
TCSP Training on "Skill Enhancement in Cell Culture and Molecular Biology" was organized under the SCSP component of the ICAR funded "NPGET".	10 to 19 Nov 2025	ICAR-NIANP, Bengaluru
ICAR-NFP sponsored short course on "Frontier technologies to improve fertility in livestock"	22 to 31 Dec 2025	ICAR-NIANP, Bengaluru

Chapter - 5

Other Activities

Research Advisory Committee Meeting

The 30th meeting of the Research Advisory Committee (RAC) was held at the institute on 24th& 25th March 2025 under the Chairmanship of Dr KT Sampath, Former Director, ICAR-NIANP, Bengaluru. The other members Dr U Krishnamurhy, Former Head, Division of Animal Sciences, KVAFSU, Bidar, Dr BN Saikia, Dean, Veterinary College, AAU, Assam, Dr BP Mishra, Former Director, NBAGR, Karnal, Dr Sushant Rai, M/s Raison Nutrition, Mangalore, Dr AK Tyagi, ADG (AN&P), ICAR, New Delhi and Mr Ramesh Koravi also actively participated in the meeting. Dr Artabandhu Sahoo, the Director, ICAR-NIANP, presented an overview of the institute's activities and accomplishments for the year 2024-25. Following the opening remarks from the chairman and members, the scientists presented the advancements and successes of their research projects.

Mid-term Institute Research Committee Meeting

The mid-term Institute Research Committee meeting was held on 7th January 2025 under the Chairmanship of Dr Artabandhu Sahoo, Director, ICAR-NIANP to review the progress of all the ongoing research projects. Dr DT Pal, Member secretary IRC conducted the IRC meeting and scientists presented the half-yearly progress and achievements of their respective projects.

AICRP Review Meeting

The annual review meeting of AICRP on "Nutritional and physiological interventions for enhancing reproductive performance in animals" was held on 16th April 2025 at ICAR-NIANP, Bengaluru under the chairmanship of Dr Raghavendra Bhatta, DDG (Animal Science), ICAR, New Delhi to review the progress of the research work for the years 2023-24 & 2024-25. Dr Artabandhu Sahoo, Project Coordinator and Director, ICAR-NIANP presented the coordinator's report. Dr Raghavendra Bhatta, released the Annual Reports of AICRP (2023-24 and 2024-25) and AICRP Technical and Technology Document 2014-24. The principal investigators of lead and participating centres presented their progress of the research work with the salient outcomes.

ICAR Outreach Programme Review Meeting

The Annual Review meeting of ICAR-Outreach project on "Estimation of methane emission under different feeding systems and development of mitigation strategies" for the year 2024-25 was held under the chairmanship of Dr Raghavendra Bhatta, Deputy Director General (Animal Science), ICAR, New Delhi on 17th April 2025. Dr Artabandhu Sahoo, Director, ICAR-NIANP and Co-ordinator of ICAR-Outreach project, presented overall progress of the

project. The DDG emphasized significance of "Harit Dhara" initiative, highlighting the need for a nationwide technological approach to reduce enteric methane emissions. Further, DDG appreciated the efforts of lead centre for the commercialization of technologies especially of "Harit Dhara" to the five firms that enabled the reach of the technology to 17 states of the country.

National Conference of NAVN&AW

The ICAR-NIANP, Bengaluru hosted the VII National Conference of the National Academy of Veterinary Nutrition and Animal Welfare (NAVN&AW) during 16th-17th October 2025. The two-day event themed "Livestock nutrition and health care translating to human wellbeing", brought together over 234 delegates from various ICAR institutions, Veterinary Universities, Colleges, Research organizations, farmers and industry personnels across the country. The conference was inaugurated by the

Dr Manmohan Singh IAS, Former Special Chief Secretary, Govt. of Andhra Pradesh and Vice-Chancellor, SVVU, Tirupati in presence of Dr KC Veerana, Vice-Chancellor, KVAFSU, Dr MC Sharma, Former Vice-Chancellor, IVRI, Dr N Ramaswami, IAS, Secretary, Animal Husbandry and Dairy Development Department, Govt. of Maharashtra. Dr NN Pathak, Founder President of the Academy, Dr SP Tiwari, President and Dr Artabandhu Sahoo, Director, ICAR-NIANP had graced the occasion. On the second day Dr R Narendra Babu, I/C Vice-Chancellor, TNVASU and Dr JV Ramana, I/C Vice-Chancellor, SVVU, Tirupati participated in the programme.

CLIMATECON 2025

National Conference-cum-Workshop on "Climate resilient livestock production: Emerging concepts and technologies for sustenance" during 23rd to 24th November 2025 was organized in collaboration with National Innovations on Climate Resilient Agriculture (NICRA). A distinguished scientist, Dr B Venkateshwarlu, Former Director of ICAR-CRIDA

and Former Vice Chancellor of VNMKV, Parbhani graced the inaugural function as the Chief Guest. The conference provided a scientific platform which brought researchers, academicians, policymakers, and industry stakeholders together who deliberated on the challenges posed by climate change to the livestock sector. This platform also paved way for developing interdisciplinary collaboration, thereby contributing to the advancement of sustainable and climate-resilient livestock production systems.

ISGCT Conference

7th Annual Conference of International Society of Gene and Cell Therapy on the theme "Bio agricultural research" was organized on 12th December 2025. The conference was inaugurated by Justice Umesh Kumar Sirohi, Retired Judge, Allahabad High Court, Dr Baldev Raj Gulati, the Director, ICAR-NIVEDI, Dr Artabandhu Sahoo, Director, ICAR-NIANP and Dr Sunita Rana Agarwal, President, Gene Research Foundation, Bengaluru. The conference theme was bio-agritech research, stem cell research and toxicology. The professional experts presented keynote address followed by the invited talks from the outstanding researchers of the country.

World Milk Day 2025

ICAR-NIANP in collaboration with Indian Dairy Association (South Zone) Organized National Symposium on "Dairying for Nutrition and Livelihood Security" to commemorate the celebration of "World Milk Day-2025" on 6th June 2025

Institute Foundation Day Celebrations

31st Foundation day of the Institute was celebrated on 24th November 2025 with great enthusiasm and academic spirit. Dr KML Pathak, Former DDG (AS) and Vice Chancellor DUVASU, Mathura was chief guest for the programme and he has appreciated the

growth and development of institute at national and global scales. On the occasion, Dr Artabandhu Sahoo, Director, ICAR-NIANP highlighted significant achievements of the institute and organized several events such as release of institutional publications, signing of Memorandum of Understanding (MoUs) and honouring outstanding staff members.

Activities under DPASC and DPAST schemes

Launch Workshop of DST-SCSP

A launch workshop of DST- Scheduled Caste Sub-Plan and special competitive studies project was organized on 21st May 2025 at Kasaba Hobli,

Chikkaballapura District, Karnataka. ICAR-NIANP is collaborating with IIHR, NDRI-SRS and NBSS&LUP to improve the livelihood of the rural Scheduled Caste population.

Animal Health Camps

Several animal health camps were organized by ICAR-NIANP, Bengaluru at Scheduled Tribe villages;

Malkanahalli, Bingipura, Anshithalli and Bramanardinn Karnala during the entire year under the Development of Action Plan for Schedule Tribe (DAPST). Dairy farmers were benefited with the health camps and the animals were treated for

different health and reproductive issues. Further, important medicines and mastitis control kits to enhance the clean and hygienic milk production were distributed to the farmers.

Input distribution

Various programmes were organized for farmers under the Developmental Activities Plan for Scheduled Caste and distributed different input materials such as milk can, rubber mat and cattle concentrate feed to the Scheduled Caste farmers. A total of 500 Scheduled Caste farmers were benefited from villages, Anajwadi doddi, tulasi doddi, chokiasandra, Doddathandya, Kanchina doddi, Kanakpura Tk, Maligondanahalli Ramohalli,

Bengaluru south, Kanakpura Tk and Thally block of Tamil Nadu. The activities were coordinated by Dr A Arangasamy, Principal Scientist & Nodal Officer DAPSC.

Under the DAPST programme, Kolar district in Karnataka was selected which has a notable Scheduled Tribe (ST) population, comprising 5.13% of the district's total. Under the Central Government's "Development Action Plan for Scheduled Tribes (DAPST)," ICAR-NIANP adopted two villages, Malkanahalli and Anshithalli in Kolar district. The selected villages, host a milk collection centre and have a substantial population of crossbred dairy cattle. The scheme aimed to enhance the livelihoods of 120 ST beneficiaries through focused support in animal husbandry in these adopted villages. As part of the program, a Farmer-Scientist Interaction and Input Distribution event was conducted, during which key inputs such as cattle feed, mastitis detection kits, fodder seeds, horticulture kits, jute bags, and Fertimin

Plus supplements were distributed. Additionally, two on-campus training programs and a visit to a fodder fair (Fodder Mela) were organized during the reporting period to further build capacity and promote best practices in livestock management. The activities were coordinated by Dr Krishnappa, Nodal Officer, DAPST.

Rashtriya Kisan Divas

On the occasion of Rashtriya Kisan Diwas, one day Farmer-scientist interaction meet was organized under Developmental Action Plan for Schedule Caste/Schedule Tribes (DAPSC/DAPST) Scheme on 23rd December 2025. The programme aimed to bring awareness among farmers on feeding practices and reproductive management of dairy cows and small ruminants. One hundred and one farmers were provided with input materials such as Fertimin Plus and veterinary medicines. Further, six progressive farmers from Karnataka and Tamil Nadu were felicitated for their exemplary contribution to animal husbandry. Dr A Sahoo, Director ICAR-NIANP, inaugurated the programme and interacted with the farmers. The Chief guest, Dr NKS Gowda, Dean,

Veterinary College, Hebbal, Bengaluru and guest of honour Dr A Dhali, SRS NDRI graced the occasion and interacted with the famers, and emphasized the importance of animal husbandry. All the participating farmers also attended the virtual meeting addressed by Shri Shivraj Sigh Chouhan, Hon'ble Minister of Agriculture and Farmers Welfare.

Distinguished Visitors

Additional Secretary DARE

Smt. Alka Arora, Additional Secretary, Department of Agriculture, Research Education & Financial Advisor ICAR, Ministry of Agriculture & Farmers Welfare, Government of India visited ICAR-NIANP on 28th May

2025. She interacted with staff and scientists of the institute and emphasized the need for collaborative research to enhance the socioeconomic status of the farmers.

International Visitors

Dr Excel Rio S Maylem, Senior Science Research Specialist and Head, Department of Reproductive Biotechnology and Physiology, Philippine Carabao Centre National Headquarters, Science City of Munoz, Nueva Ecija, Philippines visited ICAR-NIANP, Bengaluru on during 12th - 19th January 2025. Mr Matt Daniel Benitez Peralta, Science Research Specialist I, Unit Head, Semen Processing, PCC National Bull Farm, Carranglan, Nueva Ecija, Philippines also visited ICAR-NIANP on during 20th January to 8th February 2025. These visits were sponsored under the DST sponsored ASEAN-India Science & Technology Development Fund (India-Philippines-Vietnam).

Technology Commercialization

Non-conventional oil for enteric methane reduction

The ICAR-NIANP, Bengaluru commercialized its technology "non-conventional oil for enteric methane

reduction in ruminants" was commercialized to M/s Gou Agritech Pvt Ltd, Bengaluru on on 13 April 2025 in the presence of Dr Raghavendra Bhatta, Deputy Director General (Animal Science), ICAR, New Delhi and the firm was represented by the Director of the firm, Mr CN Shabarish.

Harit Dhara- An antimethanogenic feed supplement

The ICAR-NIANP, Bengaluru commercialized its technology "Harit Dhara" an anti-methanogenic feed supplement to two firms, eVerse.AI Private limited, Nagpur and M/s Zeroearth Pvt. Ltd., Trivendaram, Kerala on 13 April 2025 and 16 July 2025,

respectively on a non-exclusive basis through Agrinnovate India Limited, New Delhi.

Tamarind seed husk enriched complete feed block and Brewery waste for reducing enteric methane emissions

The ICAR-NIANP, Bengaluru commercialized two technologies "Tamarind Seed Husk Enriched Complete Feed Block" and "Brewery Waste" for reducing enteric methane emissions from ruminants

to M/s Gou Agritech Pvt Ltd, Bengaluru on a non-exclusive basis through AgrInnovate India on 15th August 2025.

WastG – An equipment for quantifying methane and nitrous oxide emissions from animal excreta

The ICAR-NIANP, Bengaluru developed an instrument and named as "WastG" for quantifying methane and nitrous oxide emmmissions from animal excreta. and it was commercialized to M/s Eaga Tools and Instruments, Pvt. Ltd., Chennai, Tamil Nadu on a non-exclusive basis through AgrInnovate India on 17th December 2025 in the august presence of Dr Raghavendra Bhatta, Deputy Director General (Animal Science), ICAR, New Delhi.

PhytoVridhi – phytogenic growth promotor for poultry

The ICAR-NIANP, Bengaluru developed a potential phytogenic growth promoter "PhytoVridhi" as a natural feed additive for poultry production. The technology was commercialized to M/s Keshav Merchandise, Krishnagiri, Tamil Nadu on a non-exclusive basis through AgrInnovate India on 22nd December 2025.

MoU for joint development of Harit Dhara-SITA platform

The collaboration to jointly develop a 'Harit Dhara-SITA' platform for climate-smart dairying through SITA (Sink Traceability Alliance) platform, a digital system designed to ensure transparency and traceability in emission reduction initiatives developed by Zeroearth Pvt. Ltd., Trivendaram, Kerala. The agreement was signed on 14th May 2025 in the presence of Dr Raghavendra Bhatta, Deputy Director General (Animal Science), ICAR, New Delhi.

Activities of Hindi Cell

Hindi Cell of the institute organized four Quarterly Hindi workshops including 'Teaching Official Language Hindi and its Challenges', Dr S Senani, former principal scientist, ICAR-NIANP deliberated significance of teaching Hindi and its challenges on 7th March 2025. Dr Mamta Chauhan, Principal Scientist & In-Charge Official Language, ICAR-NDRI, Bengaluru deliberated about different ways of Hindi writing on 'Simple, effective and professional Hindi writing' on 26th June 2025. In addition To encourage

the use of Hindi in official correspondence. Concurrently, two Hindi workshops on 'Open session on the usage of software for Hindi translation' and 'Moving forward: Literature, sensitivity and inspirations for the new year' were also conducted.

Quarterly meetings of the Official Language Implementation Committee were held on 12th March, 26th June 2025, 29th September and 18th December 2025 to review the progress of implementation of the Official Language in various divisions and sections. The minutes of the meetings were forwarded to the ICAR Headquarters, New Delhi, the Town Official

Language Implementation Committee (TOLIC-O-1), Bengaluru, and the Regional Implementation Office (South) for observation and recommendations.

Rajbhasha Hindi Week was celebrated from 8th to 15th September 2025. Various events were organized on the occasion including singing, poem recitation, slogan writing, quiz, translation, and extempore speech. On 14th September 2025 a drawing competition was organized for the children. The winners of the competitions and the Hindi Incentive Scheme were announced during the closing ceremony held on 20th September 2025. At the programme Col. Manoj K Das, Commanding Officer, 49 Army Veterinary Hospital, ASC Centre and College, Bengaluru was present as Chief Guest and the programme was chaired by Dr. Arthabandhu Sahoo.

Swachh Bharat Abhiyan

Swachhata Hi Seva Campaign 2025 was conducted during 17th September to 2nd October 2025. The Program commenced with administration of 'Swachhata Pledge' to the staff. The fortnight long programme featured: transformation of neglected utility points of neighbourhood - ATM kiosk, milk parlour and a green belt zone of social forestry; engagement with High School students of Karnataka public school, Adugodi through literary activities raising awareness on environment. The programme ended on 2nd October 2025 (Gandhi Jayanti) with Prabhat Pheri (Dawn Procession) to promote

community participation in raising awareness and implementation of 'Clean India Initiative' wherein school-goers displayed hand-made posters with slogan depicting care and concern for the Country.

Swachhta Pakhwada 2025 was observed during 16th – 31st December 2025. The programme 'Swachhta Pledge Day' was started with rendition of National Song "Vande Mataram". Dr Artabandhu Sahoo, administered the pledge for dedicating 'two hours per week to voluntary work for cleanliness'. The fortnight long program stood sentinel through awareness seminar on 'Reduce, Reuse and Recycle', punctual

deliberation of aesthetic office premises, sanitation drive at the milk parlour and children's play park, plantation drive of chrysanthemum saplings, community outreach through playground cleaning of public school, community involvement in de-littering of the neighbourhood, fostering drawing competition of kids, signature campaigns of farmers in Mysore District, recycling of wates and rainwater harvesting, massive community mobilization through talks on discarding single use plastics and securing kitchen wastes, mega plogging event, involvement dignitaries from Karnataka Pollution Control Board deliverance's on deterioration of urban ecology.

International Women's Day Celebrations

"International Women's Day and Farmers-Scientist Interaction meet cum Input Distribution" was organized on 7th March 2025. A total of 73 women dairy farmers belonging to Scheduled caste participated in the programme. The aim of the programme was to educate woman farmers about "Gender equality" and "Scientific feeding practices of dairy animals". Various material inputs such as milk buckets, first aid kits, Fertimin plus-feed supplement, veterinary medicines and technical leaflets to the beneficiaries under Development Action Plan for Scheduled Caste (DAPSC). Mrs Shilparani Vijaykumar, Branch Manager, SBI, Adugodi, Bengaluru appraised the women farmers about the bank schemes for women towards self-financial management.

Staff Welfare Club Activities

Republic Day and Independence Day Celebrations

ICAR-NIANP celebrated the 76 Republic Day on 26 January, 2025. Director hoisted the national flag and delivered the Republic Day speech The 78th Independence Day was celebrated on 15th August 2025. The Director hoisted the national flag and delivered an inspiring speech to mark the occasion. The awardees, promoted staff of the institute and winners of the various sports events organized by the Staff Welfare Club were felicitated on both the occasions.

Farewell to superannuating staff members

The staff welfare club extended best wishes to Mrs S Shashikala, Senior Administrative Officer, as she

superannuated on 31 May 2025. Mrs S Shashikala served in the ICAR system in different categories for 32 years. The staff welfare also club extended best wishes and felicitated Mr D R Govinda, Technical Officer (T-5), Estate and Maintenance on his superannuation (31st December 2025). Mr Govinda has served the institute for over 22 years with a total service period of 28 years ICAR system.

Others

Viksit Krishi Sankalp Abhiyan 2025

Scientists of the Institute has participated in the "Viksit Krishi Sankalp Abhiyan 2025 Pre Kharif", a national campaign launched by the ICAR from 29th May 2025 to 12th June 2025, under the visionary guidance of the Hon'ble Union Minister for Agriculture and Farmers Welfare, Shri Shivaraj Singh Chauhan ji. The Abhiyan aimed to create awareness and mobilise the farming community towards sustainable, technologically advanced, and economically viable agriculture, with a focus on doubling farmers' income, improving soil and livestock health, and integrating innovation in farming practices. The campaign was aligned with the Government of India's larger vision of a Viksit Bharat @2047 - a self-reliant and prosperous India. A total of 30 scientists and technical staff from the institute have joined multi-disciplinary teams from KVKs, state departments and other ICAR institutes, across different districts of Karnataka. A total of 74 farmer-scientist interaction meetings, covering a total of 4100 farmers.

As part of this nationwide initiative, ICAR-NIANP has actively engaged with farmers, stakeholders, and grassroots organisations to disseminate knowledge on scientific feeding and management of livestock to improve productivity and income, nutrient management through locally available feed resources and crop residues, use of bio-technological tools in livestock breeding and disease management, promotion of climate-resilient animal husbandry practices and encouragement of integrated farming systems for holistic rural development. Farmers were also made aware about various government schemes covering livestock sector.

Academic activities

The institute has initiated academic activities by establishing MoU with several State Veterinary and Fisheries Sciences Universities, non-ICAR private and government universities and also offer short-term postgraduate training for students applying from different universities. ICAR-NIANP is recognized as the Bengaluru academic hub of the Indian Veterinary Research Institute for the subjects in Veterinary Physiology and Animal Nutrition. In addition, Rajiv Gandhi Institute of Veterinary Education and Research (RIVER) and Karnataka Veterinary, Animal and Fisheries Science University, Karnataka sends the post graduate students for their research work. We have completed 12 years of successful collaboration with Jain University, Bengaluru for the doctoral registration to the project-employed JRF/SRF/RA/PA/YPs of the institute. This enabled both the candidate and the scientist to enhance the research environment. Recently, MoU with Jain University was extended for another 6 years for the similar activities. To cater to the needs of the teaching activities, the institute has excellent library, smart classroom, students' 24X7 study room, seminar hall and Zoom subscriptions to extended the online classes. The facilities are oriented towards organizing small group theory and practical classes. Further, separate hostel accommodation facilities for boys and girls with a common students' mess.

Glance of postgraduate/doctoral students at ICAR-NIANP, Bengaluru during 2025

Name of the University	Completed	Students on roll	
	MVSc	PhD	MVSc
IVRI Bengaluru Hub	7	6	18
Rajiv Gandhi Institute of Veterinary Education and Research (RIVER), Pondicherry	3	-	-
Karnataka Veterinary Animal and Fisheries Sciences University, Bidar, Karnatak	1	-	5
Central University of South Bihar, Gaya, Bihar-1-Jain University, Bengaluru, Karnataka	11	7	23

Right to Information

During this period (January'2025 to Dec'2025) total twenty one RTI queries/applications received and all are replied as per the provision of RTI Act'2005 and disposed off.

Chapter - 6

Infrastructure and Facilities

Research Laboratories

The Institute has 18 state-of-the-art research laboratories, providing a comprehensive ecosystem for advanced nutritional and physiological studies. Our facilities are categorized into four core functional domains.

I. Nutrition, Feed Quality, and Safety: A significant portion of our infrastructure is dedicated to ensuring the integrity of the livestock feed chain. The Micronutrient Laboratory utilizes high-throughput instrumentation, including ICP, to analyze macro/micro minerals and heavy metals across various matrices, from soil and water to animal products like milk, meat, and eggs. Complementing this, the Toxicology Laboratory provides specialized analysis for toxic elements in biological and environmental samples. Our expertise in feed-related science is further strengthened by the Feed Analysis, Feed Quality and Safety, and Feed Resources and Informatics Laboratories. These units focus on proximate analysis, in vitro digestibility, and the development of "smart" digital tools for farmers. Notably, these laboratories serve as vital analytical hubs for external stakeholders, including milk federations, government agencies, and commercial

feed industries. Furthermore, the Feed Additives and Nutraceuticals Laboratory drives innovation in prebiotics and probiotics, focusing on extracting value from agricultural byproducts to enhance animal health.

II. Microbiology and Metabolic Physiology: Our laboratories dedicated to microbial ecology and metabolism focus on the frontier of sustainability. The Rumen and Gut Microbiology Laboratories specialize in the isolation and characterization of bacteria, protozoa, and methanogens. Parallel to this, the Energy Metabolism Laboratory addresses global climate challenges by quantifying greenhouse gas emissions and developing cost-effective methane mitigation strategies through successful international partnerships with Japan, Germany, Australia, and Kenya.

III. Molecular Biology, Biotechnology, and Omics: The Institute maintains high-end molecular capabilities through its Omics, Animal Biotechnology, and Molecular Biology Laboratories. Utilizing transcriptomics, metagenomics, and proteomics, the Omics Laboratory investigates gut/ruminal microbial community structure and function. Our biotechnology efforts focus on advanced techniques such as the cryopreservation of follicles, in vitro embryo generation, and the identification of biomarkers for environmental stress. Meanwhile, our Molecular Biology Laboratory advances buffalo productivity through the development of pregnancy biomarkers and innovative semen extenders. Additionally, the Radioisotope and Endocrinology Laboratory, an AERB-certified RIA Type II facility, utilizes radioisotopes to study neuroendocrine regulation and animal well-being.

IV. Integrative Physiology and Core Facilities: The Nutrient Kinetics and Integrative Physiology Laboratory explores the cellular mechanisms of

thermo-tolerance and nutrient-gene interactions, including the study of climate-resilient indigenous goat breeds. Finally, all research activities are supported by the Central Instrumentation Facility, which provides essential services in advanced techniques such as near-infrared spectroscopy (NIRS), spectrofluorometry, and flow cytometry.

Centre for Climate Resilient Animal Adaptation Studies

The "Centre for Climate Resilient Animal Adaptation Studies" provides a specialized environment for investigating climate change adaptation, specifically

within small ruminant populations. The infrastructure consists of two climate chambers, thermo-neutral zone and heating/cooling chambers. These chambers are designed for small ruminants and can be expanded to accommodate pigs and poultry. Each chamber can hold up to twelve animals and is provisioned for individual feeding and watering facilities, as well as excreta collection.

This facility is equipped with 24 microclimate-controlled chambers, 12 thermo-neutral zone chambers featuring four temperature regulating sensors (22-28°C) with one relative humidity regulating sensor (55-60%). In addition, 12 heating/cooling chambers with six temperature (5-50°C) regulating sensors and one relative humidity (45-95%) regulating sensor. It also provides

regulations for weather variables such as temperature, relative humidity, and light intensity, the ability to induce accurate thermo-neutral zones for small ruminants, and the capacity to conduct both heat stress and cold stress studies. Moreover, the facility can simulate diverse global weathers, and it ensures that animals experience no socialization and restraining stress, as they can see and communicate with each other and are maintained in individual cabins with free movements. Additionally, automated data loggers provide continuous, 24/7 monitoring of microclimate variables both within and outside the chamber structures, enabling robust, longitudinal studies throughout the year.

Centre for Laboratory Animal Research

The Institute is home to the state-of-the-art Centre for Laboratory Animal Research (CLAR), an 846m² integrated BSL-II facility designed for high-precision research. The Centre provides a sophisticated environment for the breeding and experimental management of rats, mice, rabbits, guinea pigs, and hamsters.

To ensure the highest standards of biosafety and experimental integrity, the facility utilizes a specialized double-corridor system, strictly separating "clean" and "dirty" pathways. The infrastructure includes dedicated animal housing, quarantine suites, a surgical/dissection theatre, and advanced support units for autoclaving and sterile storage. Notably, the facility features specialized rooms for mice and rats equipped with Individually Ventilated Cages (IVC) to maintain optimal, contaminant-free environments.

The Centre's research capabilities extend far beyond basic animal research; it serves as a hub for advanced molecular biology and proteomics. Our laboratories are equipped for complex procedures, including oocyte and embryo culture, genetic manipulation of cellular lineages, and the production of recombinant proteins and antibodies. Through CLAR, the Institute is advancing critical frontiers in nutrient bioavailability, developmental biology, metabolic disease modelling, and the study of gut microflora-immune system interactions. Furthermore, the Centre contributes to the scientific community through specialized training in laboratory animal management and the production of high-quality, in-house antibodies and transgenic strains.

ARIS Cell and ICAR-ASRB Online Examination Centre

The Institute's digital operations are anchored by the Agricultural Research Information Systems (ARIS) Cell, established in 1998. The ARIS Cell serves as the technological backbone of the Institute, overseeing critical IT infrastructure, hardware maintenance, and comprehensive network security. Through a centralized, network-based security architecture, the Cell ensures the integrity of the Institute's digital assets. Leveraging the National Knowledge Network (NKN) initiative by the Government of India, the Institute enjoys high-speed 100 Mbps connectivity,

facilitating seamless global research collaboration. Furthermore, the ARIS Cell manages the Institute's web presence, providing vital updates on recruitments, tenders, and training programs, while hosting specialized scientific platforms such as "Feed Base," "Feed Chart," and the "Indian Livestock Feed Portal."

Complementing this digital ecosystem is the ICAR-ASRB Online Examination Centre. Serving the Karnataka region, this center is a dedicated facility for conducting high-stakes ICAR NET/ARS examinations. The center is equipped with a robust computing infrastructure comprising 100 examination terminals, dual servers, and uninterrupted power via UPS backup. To ensure the highest standards of examination integrity, the entire process is monitored through an advanced IP-based CCTV surveillance system, making it a reliable hub for standardized, transparent, and technology-driven assessment.

Library

The Institute maintains a spacious, well-organized library designed to serve as a premier repository of scientific knowledge for our researchers and the wider academic community. The library's extensive collection is a blend of rich physical archives and cutting-edge digital resources. Our physical holdings include over 3,500 back volumes of prestigious Indian and international scientific journals, 1,338 scientific and administrative reference books, and a specialized collection of 31 Master's and Doctoral theses. In alignment with our commitment to promoting Rajbhasha (Hindi), the library has curated a dedicated collection of 453 Hindi titles.

To ensure our researchers remain at the forefront of global scientific advancements, the library provides seamless access to an expansive digital ecosystem via the Consortium of e-resources in Agriculture (CeRA) and the J-Gate Plus platform. This includes subscriptions to over 2,500 online international journals and 1,174 e-books. Complementing these scholarly resources is a regular subscription to 12 scientific magazines and seven newspapers in English, Hindi, and Kannada.

The library's services extend beyond our internal staff; we proudly offer access to students and researchers from other ICAR institutes and State Agricultural Universities (SAUs). Through modernized computer terminals for literature browsing and comprehensive reprographic services, the library continues to facilitate uninterrupted scientific inquiry. Furthermore, the library has successfully transitioned into a digital-first era, with digitized accessioning and automated circulation systems for all reading materials.

Experimental Livestock Unit

The ELU serves as the cornerstone of the Institute's live-animal research, providing specialized housing for large and small ruminants, as well as poultry. During the reporting period, the unit supported 12 active research projects involving a diverse livestock population, including 23 cattle, 16 buffaloes, 140 sheep/goats, and 750 poultry birds. To ensure institutional sustainability, the unit optimizes resource utilization by processing and distributing surplus farm produce (including meat, eggs, and live animals)

following the completion of experimental cycles. The unit is supported by an integrated small-scale feed processing and storage facility.

Fodder Production Unit

To ensure nutritional security for the experimental livestock, the Fodder Production Unit maintains a robust supply chain of high-quality green fodder. The unit manages extensive cultivation of various forage crops, including Bajra, Maize, Guinea Grass, and Hybrid Napier, alongside the establishment of perennial species like Marbel Grass and Erythrina tree fodder. To mitigate seasonal shortages, the unit produces silage in plastic drums and maintains continuous Azolla cultivation in dedicated ponds as a protein-rich supplement. Beyond internal use, the unit plays a vital role in technology dissemination; through method demonstrations (silage making, grain

sprouting, and Azolla production), the Institute provides high-quality planting materials, such as root slips and seedlings, to local farmers, strengthening the farmer-scientist interface.

Guest House

The Institute has a picturesque guest house within the campus. It is furnished with AC suites and rooms. Television with DTH connection and internet connectivity are available in each room apart from the basic amenities. VIPs, Institute guests and invited guests are accommodated at this guest house. Other facilities at the Guest House includes dining hall with kitchen and food is available for all the residing guests on prior request.

Agricultural Technology Information Centre

The ATIC serves as the Institute's "Single Window" for technology transfer and advisory services. It acts as a critical contact point, facilitating evidence-based decision-making for farmers through customized technical advice on breed selection, nutrition, and management practices. The center utilizes a multi-channel communication strategy, including in-person interactions, telephone consultations, and participation in national agricultural fairs. Notably, during this period, the ATIC produced vital livestock

advisories in both English and Kannada, covering dairy, goat, sheep, and poultry farming to ensure localized impact.

Conference Facilities

The institute has state of the art, fully airconditioned auditorium with a seating capacity of 250. The auditorium is complete with all audio-visual facilities and acoustics for conducting scientific meetings. In addition, the institute also has a committee room, a lecture hall and seminal hall which are fully equipped.

A newly built mini auditorium at the ICAR-NIANP, Bengaluru was inaugurated by Dr Himanshu Pathak, Secretary DARE and Director General ICAR, New Delhi on 30 August 2023. This mini auditorium, with a seating capacity of 100, is fully air-conditioned. It is equipped with cutting-edge audio-visual facilities and acoustics, making it an ideal venue for hosting scientific meetings with fewer than 100 attendees.

Institutional Hospitality & Campus Welfare

Hospitality & Guest Facilities

To accommodate visiting scientists, dignitaries, and institutional guests, the Institute maintains a picturesque, well-appointed Guest House. The facility features premium air-conditioned suites equipped with modern amenities, including DTH and high-speed internet. To ensure a seamless experience for VIPs and institutional delegates, the guest house provides full dining and catering services upon request.

Campus Amenities & Student Welfare

The Institute is committed to the well-being of its staff and students through comprehensive campus amenities. The Farmers' Training cum Students' Hostel provides modern, twin-sharing accommodations, featuring fully furnished rooms

with essential amenities to support postgraduate researchers. A versatile Community Hall serves as a venue for both social events and indoor sports (such as Table Tennis and Badminton). The campus features an expansive 13,000 m² playground and an 1,800 m² children's park. These well-maintained spaces, equipped with cricket pitches and play equipment, promote physical wellness and work-life balance for the entire Institute community.

Chapter - 7

Personnel

List of Employees

Scientific personnel

Name	Designation
Dr Artabandhu Sahoo	Director

Animal Nutrition Division

Name	Designation
Dr AV Elangovan	Acting Head
Dr M Chandrasekharaiah	Principal Scientist
Dr S Anandan	Principal Scientist
Dr NKS Gowda	Principal Scientist (on Deputation)
Dr DT Pal	Principal Scientist
Dr K Giridhar	Principal Scientist
Dr D Rajendran	Principal Scientist
Dr NM Soren	Principal Scientist
Dr (Mrs) G Letha Devi	Principal Scientist
Dr M Bagath	Principal Scientist
Dr AP Kolte	Senior Scientist
Dr M Gopi	Scientist
Dr S Jash	Scientist
Dr T Chandrappa	Scientist
Dr Melody Lalhriatpuii	Scientist (joined on 07.07.2025)

Animal Physiology Division

Name	Designation
Dr Paluru Subramanyam Parameswara Gupta	Head
Dr Ippala Janardhana Reddy	Principal Scientist
Dr S Mondal	Principal Scientist
Dr SC Roy	Principal Scientist
Dr S Nandi	Principal Scientist
Dr J Ghosh	Principal Scientist
Dr ICG David	Principal Scientist
Dr S Selvaraju	Principal Scientist and National Fellow
Dr A Arangasamy	Principal Scientist
Dr A Mishra	Principal Scientist
Dr Ramesh H S	Senior Scientist (joined on 15.05.2025)
Dr B Krishnappa	Senior Scientist
Dr BK Binsila	Senior Scientist

Bioenergetics and Environmental Sciences Division

Name	Designation
Dr PK Malik	Head
Dr SBN Rao	Principal Scientist
Dr KVH Sastry	Principal Scientist
Dr KS Roy	Principal Scientist
Dr G Ravikiran	Principal Scientist
Dr (Mrs) RU Suganthi	Principal Scientist
Dr V Sejian	Principal Scientist
Dr N Ramachandran	Principal Scientist
Dr (Mrs) A Mech	Principal Scientist
Dr G Krishnan	Principal Scientist
Dr C Devaraj	Scientist

Technical Officers / Technicians

Name	Designation
Dr VB Awachat	Chief Technical Officer, T-9 (ELU)
Shri DR Govinda	Technical Officer, T-5 (Estate and Maintenance)
Mrs Maya G	Technical Officer, T-5 (BEES)
Shri Kamalesh KM	Technical Officer, T-5 (Estate and Maintenance)
Mrs Vijayalakshmi YC	Senior Technical Assistant, T-4 (Establishment)
Mrs Bharathi K	Senior Technical Assistant, T-4 (AND)
Shri Shivarama M	Technical Assistant, T-3 (Maintenance)

Administrative Personnel

Name	Designation
Administration	
Mrs S Shashikala	AO (up to 31.05.2025)
Mrs MP Mridula	AAO
Shri R Suresh Babu	AAO
Mrs K Jayalakshmi	Private Secretary
Mrs JV Jyothi	Assistant
Mrs Geetha B	Assistant
Ms Monika MT	Assistant
Ms Gowrabathina Yasaswi	Assistant
Shri N Vinod Kumar	UDC (upto 28.07.2025)
Accounts and Audit	
Mrs Sheeja PP	FAO
Mrs Prema Nagaraju	Assistant
Ms Tejaswani Joshi	Assistant

Supporting Staff

Name	Designation
Shri K Narayana	MTS
Mrs Jhansi Lakshmi	MTS

In Charges of Section/ Unit/ Cell

Section/ Unit/ Cell	In Charge
Priority Setting, Monitoring and Evaluation Cell	Dr DT Pal
Institute Research Council	Dr DT Pal
Official Language Implementation Cell	Dr (Mrs) A Mech
HRD Nodal Officer	Dr S Anandan
ARMS Nodal Officer	Dr M Gopi
Academic Cell	Dr J Ghosh
Library	Dr SC Roy
Institute Technology Management Unit	Dr AP Kolte
Sample Analysis Services Section	Dr NM Soren
Hostel Warden	Dr NM Soren
Publication Cell	Dr AV Elangovan
Consultancy Processing Cell	Dr D Rajendran
Agricultural Technology Information Centre	Dr Letha Devi
ARIS Cell	Dr G Ravikiran
Experimental Livestock Unit	Dr ICG David
Fodder production Unit	Dr K Giridhar
Centre for Laboratory Animal Research	Dr V Sejian
Women's Cell	Dr (Mrs) RU Suganthi
Public Relation Officer	Dr AP Kolte
Public Information Officer	Dr KS Roy
Radiological Safety Officer	Dr IJ Reddy
Institutional Animal Ethics Committee	Dr A Mishra
Citizen's Charter and Grievance Cell	Mrs S Shashikala
Institute Joint Staff Council official / staff	Shri Govinda

Retirement

Name	Position	Date of Superannuation
Mrs S Shashikala	Senior Administrative Officer	31.05.2025
Shri DR Govinda	Technical Officer, T-5	31.12.2025

Promotion

Name	Promoted to the post of	With effect from
Shri Kamalesh KM	Technical Officer (T-5)	29-01-2025

Recruitment/ Appointment/ Joining

Name	Designation	Date of joining
Dr Ramesh H S	Senior Scientist	15-05-2025
Dr Melody Lalhriatpuii	Scientist	07-07-2025

Chapter – 8

List of Research Projects

LIST OF RESEARCH PROJECTS (JAN 2025 - DEC 2025)

Bio-geography of Gut Microbes in Animals

Funding	Project Title	Duration	
		Start	End
Institute	BGM 2.5: In ovo manipulation of gut microbes in broiler chicken	Jun 2020	Mar 2025
Institute	BGM 2.6: Production and evaluation of nutraceutical potential of post and parabiotics in lab animals	Apr 2021	Oct 2025
Institute	BGM 2.7: Effect of graded chlorpyrifos on rumen fermentation, microbial degradation, and bioaccumulation in visceral organs in lactating goats	Aug 2023	Jul 2026
Institute	BGM 2.8: Evaluation of functional characterization of promising rumen microbes for augmenting feed utilization	Aug 2024	Jul 2027
Institute	BGM 2.9: Evaluation of postbiotic supplementation of chicken origin on intestinal microbiota in poultry	Oct 2025	Sep 2027
Institute	BGM 2.10: Understanding the thermophiles in the rumen, their metabolic role and bioprospecting the thermostable biomass degrading enzymes	Aug 2025	Mar 2028
ICAR-Network	Veterinary type culture collection rumen microbes	Oct 2009	Mar 2026

Novel Approaches for Assessing and Improving Nutrient Bio-availability, Animal Reproduction and Productivity

Funding	Project Title	Duration	
		Start	End
Institute	APR 3.19: Studies on metal carnitine chelates for improving bioavailability and tissue utilization of trace minerals and production performance in animals	Apr 2017	Mar 2025
Institute	APR 3.28: Elucidation of cryo-tolerance and its mechanism in buffalo spermatozoa	May 2020	May 2026
Institute	APR 3.29: Development of a synthetic semen extender for cryopreservation of buffalo semen	July 2020	Jun 2026
Institute	APR 3.30: Studies on complementary physiological and molecular mechanisms and fine-tuning research tools for holistic poultry production	Dec 2021	Nov 2026
Institute	APR 3.31: Studies on bioavailability of zinc in rat fed with biofortified rice	Apr 2022	Mar 2026
Institute	APR 3.32: Elucidating the role of L-arginine amino acid and its transporters on the functioning of the immune system	Apr 2022	Mar 2026
Institute	APR 3.33: Establishment of chicken primordial germ cell (PGC) lines expressing fluorescent protein and evaluation of colonisation efficiency of PGC in chicken and duck gonads.	Apr 2022	Mar 2026

Institute	APR 3.34: Bio-manufacturing of organic zinc and selenium for application in functional food and feed animals	Aug 2023	Jul 2026
Institute	APR 3.35: Cryopreservation of embryos produced *in vitro* with oocytes from ovarian preantral follicles of sheep	July 2022	Jun 2026
Institute	APR 3.36: Studies on complementary physiological systems for healthy broiler production	Dec 2023	Nov 2026
Institute	APR 3.37: Isolation, characterization, differentiation of ovarian mesenchymal stem cells and their possible role in ovarian cell functions in sheep	Dec 2023	Nov 2026
Institute	APR 3.38: Parenteral administration of divalent cations for cost effective sex pre-selection in cattle	Dec 2023	Nov 2026
Institute	APR 3.39: Efficiency of synthetic neo-hormones / analogues to augment reproduction in sheep	Dec 2023	Dec 2026
Institute	APR 3.40: Application of phytogenics to improve immunity in broilers and egg production and quality in laying hens	Jul 2024	Jun 2027
Institute	APR 3.41: Formulation and evaluation of milk replacer for piglets	Apr 2024	Mar 2026
Institute	APR 3.42: Production of female embryos modulating ion channels mediated polarity of oocytes	Aug 2024	Jul 2027
Institute	APR 3.44: Studies on the impact of growth rate on the skeletal muscle physiology and metabolism in broilers	Oct 2024	Sep 2026
Institute	APR3.45: Physiological, growth, lactation and reproductive traits of a native cattle breed from six months to end of second conception in relation to body condition score	Sep 2025	Sep 2029
Institute	APR3.46: Influence of dietary supplementation of omega-3 fatty acid on endocrine profiles and expression of prostaglandin synthase genes during pregnancy in goats	Aug 2025	July 2028
Institute	APR 3.47: Evaluation of the leukaemia inhibitory factor (LIF)-transgenic chicken	Aug 2025	July 2028
Institute	APR 3.48: Green synthesis of mineral nano particles as a replacement of antibiotic feed additives in commercial poultry production	Oct 2025	Sep 2028
Inter-Institutional	Studies of Black soldier fly and associated microorganisms for their utilization	Apr 2020	Mar 2025
AICRP	Nutritional and physiological interventions for enhancing reproductive performance in animals	Apr 2020	Mar 2026
ICAR-National Fellow	Development of buffalo bull fertility diagnostic chip based on sperm transcripts signatures	May 2022	May 2027
DST	Transgenic chicken for expression of leukemia inhibitory factor (LIF): A potential cytokine in stem cell biology and therapy	Jan 2022	Jan 2025

NASF	Development of nano-micro matrices for the delivery of bio actives, micronutrients and therapeutics	Jul 2022	Jun 2025
DST	Transgenic chicken for expression of leukemia inhibitory factor (LIF): A potential cytokine in stem cell biology and therapy	Jan 2022	Jan 2025
DST-SERB	Cryopreservation of *in vitro* propagated sheep spermatogonial stem cells and transplantation efficiency in sheep	Aug 2022	Nov 2025
NASF	Metabolomics fingerprinting of body fluids for development of a metabolite-based novel semen extender for enhancing fertility of bull sperm	Aug 2022	Apr 2026
ICAR-NPGET	Genome editing in spermatogonial stem cells and transplantation to produce lambs with improved meat production traits	May 2024	Sep 2026
ICAR-NPGET	CRISPR-Cas9 mediated genome editing approach to increase female population in vitro and *in vivo*	May 2024	March 2026
DADF-NLM	Cryopreservation of embryos and semen of sheep and goats for the genetic improvement of non-descript breeds to improve farmers' livelihood	May 2024	Sep 2026
DST-IJCSP	Development of gamete preservation technology for avian conservation	Jan 2021	Jan 2025
SERB-AISTDF	Biotechnological interventions to improve livestock ovarian tissue, follicle and oocyte cryosurvivability for successful embryo production	Feb 2024	Aug 2026

Feed Informatics, Feed Quality and Safety and Value Addition

Funding	Project Title	Duration	
		Start	End
Institute	FQS 4.5: Assessment and forecasting of feed resources at regional and national level for different production scenarios	Apr 2021	Mar 2025
Institute	FQS 4.6: Development of sensor based automatic community chaff cutter for dairy farmers	Apr 2025	Mar 2027
Institute	FQS 4.7: Real time forecasting of livestock feed resources through automation	Apr 2025	Mar 2028
ICAR-CRP	CRP on biofortification of cereals	Nov 2014	Mar 2027
AICRP	Micro and secondary nutrients and pollutant elements in soil and plants	Jan 2016	Mar 2027
AINP	Livestock and poultry products safety (Residue control program	Mar 2021	Mar 2026
CDB	Value addition of coconut milk through in situ production of monolaurine	Jan 2023	Mar 2026

Climate Change Impact on Livestock

Funding	Project Title	Duration	
		Start	End
Institute	CCL 5.3: Comparative analysis of the carbon footprint in semi-intensive vs. intensive dairy farming system	Aug 2024	Mar 2028
ICAR-Outreach	Estimation of methane emission under different feeding systems and development of mitigation strategies.	Apr 2020	Mar 2026
FAO-IAEA	Utilization of agro-industrial /seaweed wastes as animal feed for reducing GHG emissions, improving nitrogen use efficiency and livestock productivity	Apr 2022	Jun 2027
NICRA	Climate change and small ruminant production: Novel approaches to establish climate resilience and for stress amelioration in sheep and goats	Apr 2021	Mar 2031
ILRI-ICAR	Assessment of spatio-temporal variation in enteric methane emissions and development of primary based methane emissions inventory	Jan 2023	Dec 2026

Technology Translation to Connect Discovery with Application

Funding	Project Title	Duration	
		Start	End
Institute	TTA 6.6: Economic analysis of green fodder intervention in dairy farming	Aug 2024	Jul 2027
Institute	TTA 6.7: Sustainable livelihood enhancement for scheduled tribe communities through animal husbandry	Dec 2024	Nov 2027
Institute	TTA 6.8: Efficacy of input distribution and their impact on augmenting the livelihood of SC dairy farmers under activity plan for schedule caste (DAPSC).	Dec 2024	Nov 2027
ICAR-Farmer First	Improving livelihood security of farmers through technological interventions for sustainable livestock farming	Nov 2016	Mar 2026
ICAR-Farmer First	Enriching knowledge, integrating technology and institutions for holistic village development in horticulture-based farming system	Nov 2016	Mar 2026
DST-SCSP	Application of horticultural, dairy and small ruminant technologies for technological empowerment to enhance and sustain livelihood security of small and marginal SC farmers in Karnataka	Apr 2025	Mar 2028

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ICAR - National Institute of Animal Nutrition and Physiology
Adugodi, Bengaluru – 560 030, Karnataka, India
An ISO 9001:2015 Institute
Tel: +91-80-25711304, 25711303, 25702546; Fax: +91-80-25711420
Email: directornianp@gmail.com, Website: http://www.nianp.res.in