Fulfilling Nation's

DAIRY DREAMS

1923 से नवोन्मेषी डेरी तकनीकियों के
विकास के साथ देश की सेवा में समर्पित

2024

वार्षिक प्रतिवेदन

ANNUAL REPORT

ICAR-NATIONAL DAIRY RESEARCH INSTITUTE
(Deemed to be University) Karnal-132001 India

भाकृअनुप-राष्ट्रीय डेरी अनुसंधान संस्थान
(मानद् विश्वविद्यालय) करनाल- 132001 भारत

VISION

Ensure availability of quality milk and milk products at affordable cost, livelihood security to the producer and profitability to the dairy sector through adoption of appropriate technologies and human resource development.

MISSION

To serve the cause of dairying by developing quality human resource and suitable technologies related to the production, processing and marketing of milk and milk products, and their dissemination for the benefit of dairy industry, farming community and the Nation.

GOAL

Provide R&D support towards generation and dissemination of knowledge towards improved national milch herd for milk production enhancement, greater productivity of dairy industry and management aspects of the dairy profession leading to the social, economic and environmental benefits to the Nation as well as contributing towards manpower development programmes.

MANDATE

- Research in the Areas of Dairy Production, Processing and Marketing.
- Human Resource Development in Dairy Sector.
- Dissemination of Innovative Dairy Technologies.

वार्षिक रिपोर्ट – 2024

ANNUAL REPORT - 2024

भाकृअनुप–राष्ट्रीय डेरी अनुसंधान संस्थान

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(Deemed to be University) Karnal - 132001 India -

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103rd
स्थापना दिवस
अभियान
एक पेड़
एनडीआरआई
के नाम

MILESTONES

1923 Established as Imperial Institute of Animal Husbandry and Dairying in Bangalore.

1936 Renamed as "Imperial Dairy Institute".

1955 Established as National Dairy Research Institute (NDRI) at Karnal with Southern Regional Station of the Institute at Bangalore.

1957 B.Sc. Dairying commenced at NDRI, Karnal.

1961 B.Sc. Dairying bifurcated into two branches, namely B.Sc. (Dairy Technology) and B.Sc. (Dairy Husbandry); M.Sc. Dairying courses commenced at Karnal.

1962 Western Regional Station established at Bombay.

1964 Eastern Regional Station established at Kalyani (W.B.).

1966 Institute brought under the aegis of ICAR.

1975 Operational Research Project initiated.

1976 Department of Human Nutrition and Dietetics established at NDRI, Karnal.

1979 M.Sc., Ph.D. Programme in Dairy Engineering commenced at Karnal.

1980 Karan Swiss cattle breed developed.

1982 Karan Fries cattle breed developed.

1984 Western Regional Station at Bombay was closed in 1984.

1985 "Farm Advisory Bureau" and "Industrial Consultancy Cell" set up.

NDRI recognized as Centre of Excellence in Animal Biotechnology.

1987 Embryo Biotechnology Centre established.

1989 Institute was granted "Deemed to be University" status.

National Library of Dairy Science established M.Sc. in Biotechnology started.

1990 Birth of Pratham, first IVF buffalo calf of the world.

1991 20 bedded Hospital Complex set up and made functional.

1994 The Institute got recognition as Centre of Advanced Studies in Dairy Technology and Dairy Cattle Breeding.

1995 1st Convocation of ICAR-NDRI was held. Sh. Balram Jhakhar, then Union Minister of Agriculture and Farmers Welfare was Chief Guest

1996 A two-year National Dairy Diploma (NDD) course introduced at Southern Regional Station of NDRI at Bangalore.

The ICAR award (1993-94) for outstanding KVK conferred on the KVK located at NDRI.

1997 A state-of-the-art Auditorium having seating capacity of 950 and 2 conference rooms and 2 meeting rooms made functional.

A commercial Model Dairy Plant with a capacity of over one lakh litres/ day commissioned for providing practical training to the students of NDRI University and to serve as an interface between Institute and Industry.

1998 A Modern Cafeteria with a seating capacity of 150 constructed in front of the Institute Hostels.

1999 Total No. of 9 NATP Projects with financial outlay of 266.25 lakhs initiated.

2000 A Guest House with two suites named as "Kamdhenu" was constructed at SRS, Bangalore.

Web-site of NDRI was created and launched by the Hon'ble Union Minister for Agriculture on 23rd December 2000.

2001 Foundation stone of the Agricultural Technology Information Centre laid on 1st August, 2001 under NATP project at NDRI, Karnal.

2002 International Students' Hostel equipped with modern facilities and amenities constructed at NDRI, Karnal.

Feed Quality Control was setup.

2003 State-of-the-art milking parlour system introduced in cattle section.

2004 First IVF goat kid born at NDRI.

ATIC centre made functional at NDRI.

2006 New Animal Biotechnology Centre commissioned.

2007 Creation of Video Conferencing Lab and Mini Auditorium.

2009 World First Cloned Buffalo Calf and second cloned calf "Garima" produced by hand-guided cloning technique at NDRI.

DST supported Technology Business Incubator (TBI) facility made functional.

New Course Curricula for B.Tech. in Dairy Technology and Masters and Doctoral Programmes introduced.

Reforms in examination system, grading system and comprehensive exam for Ph.D. programme introduced.

A new extension programme "Dairy Education at Farmers' Door" started.

2010 8th Convocation of NDRI, Deemed University held in presence of Dr. A. P. J. Abdul Kalam, Former President of India.

2011 M.Sc. in Forage Production Introduced at NDRI, Karnal. NDRI recognized as Centre of Advanced Faculty Training (CAFT) in the Disciplines of Dairy Production and Dairy Processing.

2012 Sahiwal Calf "Holi" through Ovum Pick up (OPU-IVF) technique born on March 7, 2012.

National Referral Center for Milk Quality and Safety (NRCMQS) established Business Planning and Development (BPD) Unit established.

2013 First female calf named 'Mahima' was born to a cloned buffalo on January 25 , 2013.

A male cloned buffalo calf named 'Swarn' was born on March 18, 2013. Donor somatic cell used was isolated from the seminal plasma of an elite bull.

A Diploma in Dairy Technology started at Southern Regional Station, Bangalore.

2014 NDRI bagged the Sardar Patel Outstanding ICAR Institution Award presented by Hon'ble Prime Minister of India, Sh. Narendra Modi Ji.

NDRI produced a clone of endangered wild buffalo of Chhattisgarh named "Deepasha" on December 12, 2014."Farmers' Farm School" started.

NDRI got ISO 9001: 2008 certification.

NDRI implemented MIS/FMS to carryout administrative and financial activity of the Institute.

2016 Two service centres established at Lalukheri, Muzzafarnagar (UP) and Piprakothi East Champaran (Bihar).

2017 Additional KVK established at Eastern Campus, Kalyani.

One month Foundation Course for newly admitted students of 2017-18 batch introduced.

Automation of the 'Academic Management System' implemented.

2018 A mega world-bank funded Institutional Development Plan (IDP) of National Agricultural Higher Education Project initiated.

National Referral Center for Milk Quality and Safety (NRCMQS) granted accreditation by NABL as per ISO 17025:2005.

Set up Atal Incubation Centre at Southern Campus of NDRI, Bengaluru under Section 8 of Companies Act, 2013.

2019 Three cloned calves produced using donor cells of elite bulls.

2020 Twenty three Faculty members and fifty five students successfully completed their International training in 25 Overseas Universities located in 8 different countries under NAHEP.

National Referral Center for Milk Quality and Safety (NRCMQS) granted accreditation by NABL as per ISO 17025:2017.

2022 ICAR - NDRI ranked first among all Agricultural Universities and four Deemed Universities of ICAR consecutively for five times (2016-2017, 2017-2018, 2018-2019, 2019-2020 and 2020-2021).

Service center of ICAR-NDRI established at Goras, Sheopur, Madhya Pradesh.

Centenary year celebrations of the Institute inaugurated.

2023 Ganga was born on March 16, 2023 and birth weight was 32Kgs.

19th Convocation of the ICAR- National Dairy Research Institute was held in the august presence of Hon'ble President of India Smt. Droupadi Murmu ji.

2024 ICAR-NDRI ranked second as per NIRF under 'Agriculture and Allied Sectors' category by the Ministry of Education, Government of India.

B.Tech. (Dairy Technology) programme started at SRS, Bengaluru.

Started two new UG programme B.Tech. (Biotechnology) and B.Tech. (Food Technology) at NDRI, Karnal.

Live birth of buffalo calf with β-lactoglobulin knockout gene using gene edited technology.

प्रस्तावना

PREFACE

मुझे बहुत खुशी है कि मैं आईसीएआर–एनडीआरआई वार्षिक रिपोर्ट– 2024 प्रस्तुत कर रहा हूँ। यह रिपोर्ट संस्थान के मुख्य अधिदेशों– अनुसंधान, शिक्षा, विस्तार और डेरी क्षेत्र में नवाचार में महत्वपूर्ण मील के पत्थर और उपलब्धियों को दर्शाती है। यह भारत में डेरी विज्ञान को आगे बढ़ाने में इस प्रमुख संस्थान के कामकाज और योगदान का व्यापक अवलोकन प्रस्तुत करती है।

मुझे यह बताते हुए प्रसन्नता हो रही है कि 2024 में आईसीएआर–एनडीआरआई ने भारत सरकार के शिक्षा मंत्रालय द्वारा ''कृषि और संबद्ध क्षेत्र'' श्रेणी के तहत राष्ट्रीय संस्थागत रैंकिंग फ्रेमवर्क (एनआईआरएफ) में दूसरा स्थान हासिल किया। यह उल्लेखनीय उपलब्धि हमारे संकाय, शोधकर्ताओं और छात्रों के समर्पण और उत्कृष्टता का प्रमाण है।

इस वर्ष संस्थान द्वारा कई ऐतिहासिक उपलब्धियाँ देखी गईं। विशेष रूप से, बीटा–लैक्टोग्लोबुलिन (बीएलजी) जीन नॉकआउट के साथ भैंस के बछड़े का सफल जन्म जीनोम एडिटिंग अनुसंधान में एक सफलता थी। CRISPR/Cas9 तकनीक का लाभ उठाते हुए, हमारे वैज्ञानिकों ने बीटा–लैक्टोग्लोबुलिन–मुक्त दूध बनाने में सक्षम डेरी पशु विकसित किए हैं – डेरी एलर्जी वाले उपभोक्ताओं के लिए हाइपोएलर्जेनिक दूध बनाने की दिशा में यह एक बड़ा कदम है। यह नवाचार डेरी उपभोग में समावेशिता बढ़ाने की अपार संभावनाएं रखता है।

It is with great pleasure that I present the *ICAR-NDRI Annual Report- 2024*. This report captures the significant milestones and achievements of the Institute across its core mandates-research, education, extension, and innovation in the dairy sector. It offers a comprehensive overview of the functioning and contributions of this premier institution in advancing dairy science in India.

I am delighted to share that in 2024, ICAR-NDRI secured second position in the *National Institutional Ranking Framework (NIRF)* under the 'Agriculture and Allied Sectors' category by the Ministry of Education, Government of India. This remarkable achievement is a testament to the dedication and excellence of our faculty, researchers, and students.

The year witnessed several landmark accomplishments. Notably, the successful birth of a buffalo calf with β-lactoglobulin (BLG) gene knockout marked a breakthrough in genome editing research. Leveraging CRISPR/Cas9 technology, our scientists have developed dairy animals capable of producing β-lactoglobulin-free milk-a major step toward creating hypoallergenic milk for consumers with dairy allergies. This innovation holds immense promise for enhancing inclusivity in dairy consumption.

एक अन्य उपलब्धि में, OPU-IVF तकनीक का उपयोग कर क्लोन गाय 'गंगा' में सफलतापूर्वक गर्भावस्था स्थापित की गई, जिससे उन्नत प्रजनन जैव प्रौद्योगिकी में हमारी अग्रणी स्थिति की पुष्टि हुई। पहली बार, नस्ल शुद्धता और जलवायु लचीलेपन पर अध्ययन का समर्थन करने के लिए संस्थान में सभी साहीवाल गायों की जीनोटाइपिंग की गई।

डेरी विज्ञान में मेटाबोलोमिक्स की बढ़ती प्रासंगिकता को पहचानते हुए, आईसीएआर–एनडीआरआई ने गायों की विभिन्न नस्लों (साहीवाल, थारपारकर, गिर, करण फ्राइज), भैंसों (मुर्राह) और बकरियों (बीतल, बरबरी, जमुनापारी) में दूध के मेटाबोलाइट्स को प्रोफाइल करने के लिए परियोजनाएं शुरू कीं। प्रारंभिक परिणाम दूध की संरचना पर मौसमी विविधताओं के प्रभाव को रेखांकित करते हैं और नस्ल–विशिष्ट मेटाबोलाइट पैटर्न को प्रकट करते हैं जो दही और पनीर जैसे डेरी उत्पाद की गुणवत्ता को अनुकूलित करने के लिए महत्वपूर्ण है।

आईसीएआर–एनडीआरआई ने लद्दाख के ठंडे–शुष्क वातावरण में व्यापक शोध भी किया, जिसका उद्देश्य भोजन, चारा, पोषण और आजीविका सुरक्षा को बढ़ाने के लिए जलवायु–लचीले कृषि–आधारित प्रणालियों को विकसित करना था। विज्ञान और प्रौद्योगिकी विभाग (डीएसटी) द्वारा समर्थित, यह पहल जलवायु परिवर्तन के प्रभावों, पशुधन उत्पादकता और विस्तारित शेल्फ–लाइफ और मूल्यवर्धित डेरी उत्पादों के लिए तकनीकी हस्तक्षेप को संबोधित करती है। किसानों और हितधारकों के बीच क्षमता निर्माण के प्रयास इस मिशन के लिए मुख्य बने हुए हैं।

इसके अलावा, उच्च तापमान और लंबे समय तक बढ़ते डिग्री दिनों के तहत लद्दाख में मक्का की सफल खेती और साइलेज तैयार करने से क्षेत्र में फीड अंतराल को पाटने में मदद मिली है – जलवायु परिवर्तनशीलता के लिए अनुकूली समाधान प्रदर्शित करते हुए।

वर्ष 2024 तक, संस्थान 81 बाह्य वित्तपोषित परियोजनाओं को कार्यान्वित कर रहा है, जिसमें वर्ष के दौरान स्वीकृत 25 नई परियोजनाएँ शामिल हैं, जिनका कुल व्यय ₹1895.76 लाख है। यह मजबूत अनुसंधान गति को दर्शाता है।

विद्वतापूर्ण आउटपुट के संदर्भ में, संकाय ने 339 शोध लेख प्रकाशित किए, जिसमें उच्चतम (नास) रेटिंग 14.9 थी। उल्लेखनीय है कि 40 प्रकाशनों की नास रेटिंग 10 से ऊपर थी, और औसत शोध आउटपुट प्रति वैज्ञानिक 2.45 प्रकाशन था।

नवाचार के मोर्चे पर, दूध की गुणवत्ता के आकलन के लिए नौ नई तकनीकों को एक प्रमुख डेरी उद्यम को लाइसेंस दिया गया। संस्थान ने 13 नए पेटेंट भी दायर किए और उसे 7 पेटेंट प्रदान किए गए। आईसीएआर–एनडीआरआई

In another achievement, pregnancy was successfully established in cloned cow *Ganga* using OPU-IVF technology, reaffirming our leadership in advanced reproductive biotechnologies. For the first time, genotyping of all *Sahiwal* cows at the Institute was carried out to support studies on breed purity and climate resilience.

Recognizing the growing relevance of metabolomics in dairy science, ICAR-NDRI initiated projects to profile milk metabolites across various breeds of cows (Sahiwal, Tharparkar, Gir, Karan Fries), buffaloes (Murrah), and goats (Beetal, Barbari, Jamunapari). Initial results underscore the impact of seasonal variations on milk composition and reveal breed-specific metabolite patterns-important for optimizing dairy product quality such as yogurt and cheese.

ICAR-NDRI also undertook comprehensive research in Ladakh's cold-arid environment, aimed at developing climate-resilient agri-based systems for enhancing food, feed, nutritional, and livelihood security. Supported by the Department of Science and Technology (DST), this initiative addresses climate change impacts, livestock productivity, and technological interventions for extended shelf-life and value-added dairy products. Capacity-building efforts among farmers and stakeholders remain central to this mission.

Further, successful cultivation of maize and silage preparation in Ladakh under high-temperature and prolonged growing degree days has helped bridge feed gaps in the region-demonstrating adaptive solutions to climate variability.

As of 2024, the Institute is implementing 81 externally funded projects, amounting to ₹ 10483.74 lakhs. This also included 25 new projects sanctioned during the year with a total outlay of ₹1895.76 lakhs, reflecting strong research momentum.

In terms of scholarly output, the faculty published 339 research articles, with a highest NAAS rating of 14.9. Notably, 40 publications had NAAS ratings above 10, and the average research output stood at 2.45 publications per scientist.

On the innovation front, nine new technologies for milk quality assessment were licensed to a leading dairy enterprise. The Institute also filed 13 new patents, and 7 patents were granted. Application for the registration of *Karan Fries*, as synthetic breed

में पहले विकसित सिंथेटिक नस्ल के रूप में करण फ्राइज के पंजीकरण के लिए आवेदन इसके ट्रेडमार्क पंजीकरण के साथ दायर किया गया है।

मुझे यह जानकर गर्व हुआ है कि 2024 में कृषि अनुसंधान सेवा परीक्षा में 31 एनडीआरआई छात्र उत्तीर्ण हुए हैं, जिनमें पशुधन उत्पादन प्रबंधन से 7, कृषि विस्तार शिक्षा से 5 और पशु पोषण से 5 शामिल हैं जो संस्थान की अकादमिक ताकत को रेखांकित करता है।

संस्थान ने राष्ट्रीय डेरी मेला–2024 का सफलतापूर्वक आयोजन किया, जिसमें रिकॉर्ड 43,500 आगंतुक आए, जिसमें हमारे संस्थान और अन्य सहयोगी आईसीएआर संस्थानों द्वारा विकसित की गई किसानों के अनुकूल की तकनीकों का प्रदर्शन किया गया, जो डेरी क्षेत्र का समग्र विकास है। जनजातीय उप–योजना (टीएसपी), उत्तर पूर्वी क्षेत्र (एनईआर) और अनुसूचित जाति उप–योजना (एससीएसपी) के तहत विशेष कार्यक्रमों ने पशुधन पालन और डेरी में वैज्ञानिक हस्तक्षेप के माध्यम से आदिवासी समुदायों, अनुसूचित जातियों और पूर्वोत्तर क्षेत्र के किसानों के सामाजिक–आर्थिक उत्थान का समर्थन करना जारी रखा। वर्ष 2024 में, संस्थान ने कुल 3,470 विस्तार गतिविधियों का आयोजन किया, जिससे 301,460 डेरी हितधारकों को लाभ हुआ।

संस्थान डेरी अनुसंधान, शिक्षा और विस्तार में वैश्विक नेता बनने के अपने दृष्टिकोण में दृढ़ है, जो किसानों और डेरी क्षेत्र की भलाई में योगदान देता है।

मुझे विश्वास है कि आईसीएआर–एनडीआरआई वार्षिक रिपोर्ट 2024 देश भर के शोधकर्ताओं, शिक्षकों, नीति निर्माताओं और डेरी विकास पेशेवरों के लिए एक मूल्यवान संसाधन के रूप में काम करेगी।

developed earlier at ICAR-NDRI has been filed alongside its trademark registration.

I am proud to note that 31 NDRI students qualified in the Agricultural Research Service examination in 2024, including 7 from Livestock Production Management, 5 from Agricultural Extension Education, and 5 from Animal Nutrition-underscoring the Institute's academic strength.

The Institute successfully organized National Dairy Mela–2024, which drew a record 43,500 visitors, showcasing farmers' friendly technologies developed by our Institute and other sister ICAR Institutes holistic growth of dairy sector. Special programmes under the Tribal Sub-Plan (TSP), North Eastern Region (NER), and Scheduled Caste Sub-Plan (SCSP) continued to support socio-economic upliftment of tribal communities, Scheduled Castes, and farmers belonging to North Eastern Region through scientific interventions in livestock rearing and dairying. In 2024, the Institute conducted a total of 3,470 extension activities, benefiting 301,460 dairy stakeholders.

These achievements are the result of the unwavering dedication, teamwork, and commitment of the NDRI fraternity. The Institute remains resolute in its vision of becoming a global leader in dairy research, education, and extension, contributing to the well-being of farmers and the dairy sector at large.

I trust that the *ICAR-NDRI Annual Report 2024* will serve as a valuable resource for researchers, educators, policymakers, and dairy development professionals across the country.

(धीर सिंह)
निदेशक, भाकृअनुप–एनडीआरआई

(Dheer Singh)
Director, ICAR-NDRI


20वाँ दीक्षाँत समारोह
भाकृअनुप–राष्ट्रीय डेरी अनुसंधान संस्थान, करनाल - 132001 (हरियाणा)
ICAR
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कार्यकारी सारांश

भाकृअनुप–राष्ट्रीय डेरी अनुसंधान संस्थान, करनाल देश का एक प्रमुख अनुसंधान संगठन है जो देश में डेरी विकास कार्यक्रमों के लिए अनुसंधान एवं विकास तथा मानव संसाधन विकास के लिए समर्थन प्रदान करने के लिए समर्पित है। सन 1923 में बैंगलोर में स्थापित इस संस्थान का मुख्यालय 1955 में करनाल में वर्तमान स्थान पर स्थानांतरित कर दिया गया था। इसके दो क्षेत्रीय स्टेशन हैं, एक बेंगलुरु में और दूसरा कल्याणी में, जो कृषि–जलवायु परिस्थितियों के अनुकूल क्षेत्र–विशिष्ट संबंधी सहायता प्रदान करते हैं। भाकृअनुप–एनडीआरआई को 1989 से अपने शैक्षणिक कार्यक्रमों को लागू करने के लिए एक डीम्ड विश्वविद्यालय होने का गौरव प्राप्त है। संस्थान को 4 डीम्ड विश्वविद्यालयों सहित भारत के सभी कृषि विश्वविद्यालयों की श्रेणी में वर्ष 2016–17, 2017–18, 2018–19, 2019–20, 2020–21 और 2021–22 में लगातार पांच बार प्रथम स्थान प्रदान किया गया। वर्ष 2024 में, आईसीएआर–एनडीआरआई ने भारत सरकार के उच्च शिक्षा मंत्रालय के राष्ट्रीय संस्थागत रैंकिंग फ्रेमवर्क (एनआईआरएफ) –2024 में 'कृषि और संबद्ध श्रेणी' में दूसरा स्थान प्राप्त किया।

संगठनात्मक संरचना

आईसीएआर की डीम्ड यूनिवर्सिटी प्रणाली के प्रशासनिक पैटर्न के अनुरूप, संस्थान विभिन्न नीतिधनिर्णय लेने वाले निकायों, जैसे प्रबंध मण्डल, अनुसंधान सलाहकार समिति, विद्वत परिषद, कार्यकारी परिषद और विस्तार परिषद के माध्यम से प्रबंधित किया जाता है। निदेशक मुख्य कार्यकारी अधिकारी होते हैं, जिन्हें अनुसंधान, शैक्षणिक और विस्तार कार्यों के प्रबंधन के लिए संयुक्त निदेशकों द्वारा सहायता प्रदान की जाती है। संस्थान में अनुसंधान एवं विकास की गतिविधियों के तीन प्रमुख क्षेत्र हैं, जैसे i) डेरी उत्पादन, ii) डेरी प्रसंस्करण और iii) डेरी विस्तार/प्रबंधन। सभी अनुसंधान एवं विकास गतिविधियों का प्रबंधन तेरह अनुसंधान प्रभागों/अनुभागों के माध्यम से किया जाता है, अर्थात् पशु आनुवंशिकी और प्रजनन, पशुधन उत्पादन और प्रबंधन, पशु पोषण, चारा अनुसंधान और प्रबंधन, पशु शरीरक्रिया विज्ञान, पशु जैव रसायन, पशु जैव प्रौद्योगिकी, डेरी प्रौद्योगिकी, डेरी इंजीनियरिंग, डेरी रसायन विज्ञान, डेरी सूक्ष्म जीवाणु प्रभाग, डेरी विस्तार और डेरी अर्थशास्त्र, सांख्यिकी और प्रबंधन। संस्थान में कृषि प्रौद्योगिकी सूचना केंद्र (एटिक), कृषि विज्ञान केंद्र और डेरी प्रशिक्षण केंद्र, कृत्रिम प्रजनन अनुसंधान केंद्र, केवीके, पिपराकोठी, पूर्वी चंपारण, मोतिहारी, बिहार में कृषि और डेरी विकास केंद्र और मुजफ्फरनगर, यूपी में लालूखेड़ी में मॉडल डेरी केंद्र भी हैं।

EXECUTIVE SUMMARY

ICAR-National Dairy Research Institute, Karnal is a premier research organization of the nation dedicated to provide Research and Development (R&D) and Human Resource Development (HRD) support towards dairy development programmes in the country. Established in 1923 at Bangalore, the headquarters of the Institute was moved to the present location at Karnal in 1955. It has two regional stations, one at Bengaluru and the other at Kalyani for providing region-specific support suited to their agro-climatic conditions. ICAR NDRI has the distinction of being a Deemed University for implementing its academic programmes since 1989. The Institute has been ranked first among all Agricultural Universities of India including 4 Deemed Universities, consecutively for the five times in the year 2016-17, 2017-18, 2018-19, 2019-20, 2020-21 and 2021-22. In the year 2024, ICAR-NDRI has secured the second rank in the National Institutional Ranking Framework (NIRF)-2024 in 'Agriculture and Allied Category" of the Union Ministry of Higher Education, Govt. of India.

ORGANISATIONAL STRUCTURE

In consonance with the administrative pattern of the Deemed University System of the ICAR, the Institute is managed through various policy/ decision making bodies, viz. Board of Management, Research Advisory Committee, Academic Council, Executive Council and Extension Council. The Director is the Chief Executive Officer assisted by the Joint Directors for managing research, academic and extension functions. The Institute has three major areas of R & D activities viz. i) Dairy Production, ii) Dairy Processing and iii) Dairy Extension/ Management. All the R & D activities are managed through thirteen Research Divisions/ Sections, namely, Animal Genetics & Breeding, Livestock Production and Management, Animal Nutrition, Forage Research and Management, Animal Physiology, Animal Biochemistry, Animal Biotechnology, Dairy Technology, Dairy Engineering, Dairy Chemistry, Dairy Microbiology, Dairy Extension and Dairy Economics, Statistics and Management. The Institute also has an Agricultural Technology Information Centre (ATIC), Krishi Vigyan Kendra and Dairy Training Centre, Artificial Breeding Research Centre, Krishi and Dairy Vikas Kendra at KVK, Piprakothi, East Champaran, Motihari, Bihar and

संस्थान में पशुधन अनुसंधान केंद्र, चारा अनुसंधान और प्रबंधन केंद्र, कृत्रिम प्रजनन अनुसंधान केंद्र, पशु स्वास्थ्य परिसर, छोटे पशुओं के लिए गृह, मॉडल डेरी संयंत्र, प्रौद्योगिकी व्यवसाय इनक्यूबेटर, कृषि–व्यवसाय इनक्यूबेशन केंद्र, दूध की गुणवत्ता और सुरक्षा के लिए राष्ट्रीय रेफरल प्रयोगशाला, प्रायोगिक डेरी संयंत्र, परामर्श इकाई, पुस्तकालय और राष्ट्रीय जैव सूचना विज्ञान केंद्र, कंप्यूटर केंद्र, संपदा अनुभाग तथा अनुरक्षण अभियांत्रिकी अनुभाग। प्रशासनिक कार्य–स्थापना, भंडार तथा सुरक्षा का नियंत्रण संयुक्त निदेशक (प्रशासन और वरिष्ठ कुलसचिव) के द्वारा किया जाता है जबकि वित्त अनुभाग नियंत्रक (वित्त) के नियंत्रणाधीन होता है। 31.12.2024 तक संस्थान में वर्तमान में 138 वैज्ञानिक, 163 तकनीशियन, 101 प्रशासनिक कर्मचारी और 199 कुशल सहायक कर्मचारी कार्यरत हैं।

बजट परिव्यय

वर्ष 2024–25 के दौरान वास्तविक परिव्यय के संदर्भ में संस्थान का वित्तीय व्यय 27116.10 लाख रुपये था और वर्ष 2024–25 के लिए स्वीकृत बजट 27116.50 लाख रुपये था। इन आंकड़ों में क्षेत्रीय परिसरों के सुदृढ़ीकरण के लिए वित्तीय व्यय भी शामिल है। 2024–25 के दौरान क्षेत्रीय परिसरों सहित संस्थान की राजस्व प्राप्तियां 1278.79 लाख रुपये थीं।

अनुसंधान

प्रयोगशाला से खेत तक (विस्तार कार्यकलाप)

- वर्ष 2024 के दौरान संस्थान ने कुल 3,470 विस्तार गतिविधियाँ आयोजित कीं, जिनसे 301,460 डेरी हितधारकों को लाभ मिला। इन गतिविधियों में 20 प्रदर्शनियाँ, 209 प्रशिक्षण सत्र, डेरी हितधारकों के लिए 13 कौशल विकास कार्यक्रम, 03 बड़ा डेरी मेला, 37 पशु स्वास्थ्य शिविर, 349 एक्सपोजर भ्रमण, 2,179 सलाहकार सेवाएँ और 182 फ्रंट लाइन प्रदर्शन आदि शामिल हैं।
- अनुमान है कि भारत का दूध उत्पादन में 2047 तक में उल्लेखनीय वृद्धि होगी और दुधारू पशुओं के नियंत्रित संख्या वृद्धि के बावजूद औसत दैनिक दूध उत्पादन प्रति पशु 2019–20 में 5.4 किलोग्राम था से बढ़कर 2047–48 तक 8.32 किलोग्राम होने की उम्मीद है। यह आनुवंशिक सुधार, बेहतर रोग नियंत्रण और फीड प्रबंधन के कारण संभव होगा। 2047 तक, कुल दूध उत्पादन 432.28 से बढ़कर 685.52 मिलियन टन तक पहुँच सकता है।
- समय–समय पर विश्लेषण से पता चलता है कि दूध की कीमतें फ्लश और लीन सीजन में स्थिर रहती हैं, जिसमें क्षेत्रीय स्तर पर बहुत कम अंतर होता है। दूध की कीमतों का CAGR अलग–अलग होता है जिसमें नागालैंड में सबसे अधिक (9.5% प्रति वर्ष) और महाराष्ट्र में सबसे कम (3.4%) वृद्धि होती है।

Model Dairy Centre at Lalukheri in Muzzafarnagar, U.P. The Institute has infrastructure consisting of central facilities such as Livestock Research Centre, Forage Research and Management Centre, Artificial Breeding Research Center, Animal Health Complex, Small Animal House, Model Dairy Plant, Technology Business Incubator, Agri-business Incubation Centre, National Referral Laboratory for Milk Quality and Safety, Experimental Dairy Plant, Consultancy Unit, Library and National Bio-informatic Centre, Computer Centre, Estate Section and Maintenance Engineering Section. The administrative functions viz. purchase, stores and security are under the administrative control of the Joint Director (Admn. & Sr. Registrar), whereas finance Division is under the Administrative Control of Comptroller (Finance). As on December 31, 2024, the Institute presently has strength of 138 scientists, 163 technicians, 101 administrative staff and 199 skilled supporting staff.

BUDGET OUTLAY

The financial outlays of the Institute in terms of actual expenditure during the year 2024-25 was Rs. 27116.10 lakhs and budget sanctioned for the year 2024-25 was Rs. 27116.50 lakhs. These figures also include the financial outlays for the strengthening of Regional Campuses. The revenue receipts of the Institute including regional campuses were Rs. 1278.79 lakhs during 2024-25.

RESEARCH

Lab to Land (Extension Activities)

- During the year- 2024, the institute conducted a total of 3,470 number of extension activities, benefitting 3,01,460 dairy stakeholders. These activities included 20 exhibitions, 209 training sessions, 13 skill development programmes for dairy stakeholders, 03 large dairy melas, 37 animal health camps, 349 exposure visits, 2,179 advisory services and 182 front line demonstration etc.
- The projection indicates that India's milk production will rise significantly by 2047, driven by improved milk yield and controlled population growth of milch animals. Average daily milk yield per animal is expected to increase from 5.4 kg in 2019-20 to 8.32 kg by 2047-48, aided by genetic improvements, better disease control, and feed management. By 2047, total milk production could reach 432.28 to 685.52 million tonnes, depending on population growth assumptions.

- दूध खराब होने की संभावना और सीमित क्रॉस–हॉलिंग जैसे कारक क्षेत्रीय मूल्य विभाजन में योगदान करते हैं। इसके अतिरिक्त, दूध की कीमतें चावल और गेहूं जैसी अन्य खाद्य वस्तुओं के साथ सकारात्मक रूप से सह–संबंधित होती हैं जो अंतर–जिंस मूल्य निर्भरता का सुझाव देती हैं। शीत श्रृंखला लॉजिस्टिक्स में सुधार और बाजार कनेक्टिविटी को बढ़ाने के उद्देश्य से नीतिगत उपाय दीर्घकालिक मूल्य स्थिरता के लिए महत्वपूर्ण हैं।
- मादा भैंस में मदकाल का पता लगाने के लिए सैलाइवा स्कोप के साथ किसानों की संतुष्टि का मूल्यांकन किया गया जिससे पता चला कि 79.45% डेयरी किसान संतुलित से लेकर अत्यधिक संतुष्ट थे। ग्यारह वर्षों में अतिव्यस्त अंगीकरण दर 94% तक पहुंचने का अनुमान है।
- सिंधु–गंगा मैदानों के डेयरी क्षेत्र में जलवायु जोखिम वाले हॉटस्पॉट की पहचान की गई, जिसमें 46 जिले जोखिम वाले हैं जिनकी संख्या संभावित रूप से वर्ष 2050 तक 56–57 जिलों तक बढ़ सकती है और इससे 16.67–16.90 लाख हेक्टेयर (आईजीपी का 3.78–3. 83%) प्रभावित होगा।
- महिला डेयरी पालकों के साथ ताप दबाव, सूखा, शीत दबाव तथा बाढ़ के लिए एक जलवायु अनुकूलन योजना तैयार की गई। इसको लागू करके ताप दबाव से होने वाले दुग्ध उत्पादन नुकसान को 90% से अधिक तक वसूलध्पुनरू प्राप्त किया जा सका।
- यह पाया गया कि तमिल नाडु राज्य में प्रति दिन कुल दुग्ध उत्पादन के 1.26% का उपभोग कार्यपरक डेयरी खाद्य (FDP) के तौर पर किया गया था जो कि दुग्ध समतुल्य के संदर्भ में प्रसंस्कृत दुग्ध का 3.78% है।
- भारतीय डेयरी निर्यात में एशियाई देशों की हिस्सेदारी प्रमुख (64%) है और वर्ष 2000 से 2023 के दौरान इसमें उत्तरी अमेरिका की हिस्सेदारी में गिरावट आई है।
- गुजरात राज्य के सभी क्षेत्रों में संकर नस्ल वाले गोपशु लाभकारी थे जिनका औसत लाभ प्रति दिन प्रति पशु 5. 45 रूपये था। सौराष्ट्र क्षेत्र के पास गिर गोपशु कहीं अधिक लाभकारी थे जिनसे मिलने वाला औसत लाभ प्रति दिन प्रति पशु 8/- रूपये था।
- जैव–उर्वरक आधारित चारा फसल प्रौद्योगिकियों के प्रसार के लिए संरचित मल्टीमीडिया उपकरण विकसित किए गए जिनकी प्रभावशीलता और प्रयोज्यता पर किसानों से प्राप्त सकारात्मक प्रतिक्रिया से पुष्टि हुई।
- एनडीआरआई–कृषि विज्ञान केन्द्र द्वारा किए गए तकनीकी हस्तक्षेपों में फार्म उत्पादकता और सामाजिक–आर्थिक परिस्थितियों में उल्लेखनीय सुधार देखने को मिला। सामाजिक–आर्थिक प्रभाव विश्लेषण से

- The temporal analysis shows that milk prices remain stable across flush and lean seasons, with insignificant regional variations. The CAGR of milk prices varies, with Nagaland exhibiting the highest growth (9.5% per annum) and Maharashtra the lowest (3.4%).
- The perishability of milk and limited cross-hauling contribute to regional price segmentation. Additionally, milk prices positively correlate with other food commodities like rice and wheat, suggesting inter-commodity price dependency. Policy measures aimed at improving cold-chain logistics and enhancing market connectivity are crucial for long-term price stability.
- Farmers' satisfaction with Salivascope for estrus detection in buffaloes was assessed, revealing that 79.45% of the dairy farmers were moderately to highly satisfied. The peak adoption rate is projected to reach 94% in 11 years.
- Climate risk hotspots in the Indo-Gangetic Plain's dairy sector were identified, with 46 districts at risk, potentially expanding to 56-57 districts by 2050, affecting 16.67-16.90 lakh hectares (3.78-3.83% of IGP).
- A climate adaptation plan for heat stress, drought, cold stress, and floods was developed with women dairy farmers. Implementing it could recover over 90% of milk production losses from heat stress
- It was found that 1.26 % of the total milk production was consumed as functional dairy food (FDP) per day in Tamil Nadu, which is 3.78 % of processed milk in milk equivalent terms.
- Asian countries account for the major share (64%) in Indian dairy exports and the share of North America has declined over the years during 2000 to 2023.
- Crossbred cattle were profitable across all zones in Gujarat with the average returns of ₹ 5.45/animal/day. The Gir cattle was more profitable near Saurashtra region with the average returns of ₹ 8/ animal/day.
- Developed structured multimedia tools to disseminate bio- fertilizer-based fodder crop technologies, validated by positive farmer feedback on effectiveness and applicability.
- The impact assessment of NDRI-KVK interventions demonstrates significant improvements in farm productivity and socio-

पता चलता है कि क्लस्टर अग्रिम पंक्ति प्रदर्शन (CFLD) से जहां कृषि आय में प्रति फार्म रूपये 1527/– तक की बढ़ोतरी हुई वहीं डेयरी पालन पर प्रदान किए गए प्रशिक्षण से डेयरी से अर्जित होने वाली आय में प्रति फार्म रूपये 6325/– तक की वृद्धि हुई। बढ़ी हुई आय से परिवार का खाद्य खर्च बढ़ा और ग्रामीण आजीविका को लाभ पहुंचा। परिणाम यह संकेत करते हैं कि तकनीकी हस्तक्षेप किए गए खेतों में उच्चतर उपज हासिल की गई जो कि गेहूं और सरसों के मामले में क्रमशरू 12.02% तक एवं 10.50% तक की उपज बढ़ोतरी थी।

- संस्थान द्वारा करनाल शहर के आसपास अंगीकृत किए गए गांवों में कुल 2362 डेयरी पशुओं का उपचार करते हुए 55 पशु स्वास्थ्य कैम्प लगाए गए। संस्थान ने गोपशु के साथ साथ भैंस में उच्च वंशावली वाले सांड़ों के वीर्य के साथ कृत्रिम गर्भाधान में सहयोग दिया। परिपक्वता आयु में कमी लाने और नवजात जनने के बीच वाली समयावधि के अन्तराल को कम करने के लिए बांझपन एवं पशु–चिकित्सा सहायता अभियान आयोजित किए। इसके अलावा, करनाल जिले में मुर्राह भैंस के खेत संतति परीक्षण कार्यक्रम के अंतर्गत गांवों में "calf rally" का आयोजन किया गया।
- गांव स्तर पर कुल 57 किसान संगोष्ठी आयोजित की गईं ताकि डेयरी हितधारकों के बीच वैज्ञानिक डेयरी पालन की नवीनतम प्रौद्योगिकियों के बारे में जागरूकता का सृजन किया जा सके। डेयरी पालन के विभिन्न पहलुओं पर कुल 5719 किसान लाभान्वित हुए।
- कुल पांच महिला सशक्तिकरण प्रशिक्षण एवं अभियान आयोजित किए गए जिनका उद्देश्य महिलाओं के बीच डेयरी पालन के क्षेत्र में जागरूकता का सृजन करना और मूल्य वर्धित उत्पादों पर कौशल प्रदान करना था ताकि कृषिरत महिलाएं डेयरी पालन से कहीं अधिक आय सृजित कर सकें और अपने परिवार में स्वस्थ वातावरण बनाये रख सकें । इन गतिविधियों में कुल 115 कृषिरत महिलाओं ने भाग लिया।
- मेरा गांव–मेरा गौरव (MGMG) कार्यक्रम के अंतर्गत 143 खेत गतिविधियां चलाईं गईं जिससे कुल 2580 किसानों को लाभ पहुंचा।
- कृषि विज्ञान केन्द्र, एनडीआरआई, करनाल ने डेयरी और कृषि के सम्बद्ध क्षेत्रों यथा फसल उत्पादन, बागवानी, मधुमक्खी पालन, मात्स्यिकी तथा गृह विज्ञान के विभिन्न पहलुओं पर देश के विभिन्न राज्यों के कुल 1653 किसानों, कृषिरत महिलाओं, ग्रामीण युवाओं और उद्यमियों के लाभ हेतु कुल 66 प्रशिक्षण कार्यक्रम (ऑन–कैम्पस एवं ऑफ–कैम्पस दोनों) आयोजित किए।
- एसआरएस–एनडीआरआई, बेंगलुरू द्वारा वैज्ञानिक

economic conditions. The socio-economic impact analysis reveals that Cluster Front Line Demonstration (CFLD) increased agricultural income by ₹ 1,527/farm, while dairy training led to a ₹ 6,325/farm rise in dairy earnings. Increased income improved household food expenditure, benefiting rural livelihoods. Results indicate higher yields in intervention farms, with wheat and mustard yields are increasing by 12.02% and 10.50%, respectively.

- Institute organized 55 animal health camps, treating 2,362 dairy animals in adopted villages around Karnal. They also supported AI with semen of high-pedigree bulls in cattle as well as buffaloes. Infertility and veterinary aid campaigns were conducted to reduce maturity age and inter-calving intervals. Further, "calf rally" was organized in the villages under field progeny testing program of Murrah buffaloes in Karnal district.
- Fifty-seven (57) Kisan Sanghoshties were organized at village level for creating awareness about the latest technologies of scientific dairy farming among dairy stakeholders. A total of 5719 farmers were benefitted on different aspects of dairying.
- Five Women empowerment trainings and campaigns were organized with the objective to create awareness in the field of dairying and to impart skill on value added dairy products, so that farm women could generate more income from dairying and maintain healthy atmosphere in their respective family. A total of 115 farm women participated in these activities.
- 143 field activities were carried out benefited 2,580 farmers under Mera Gaon Mera Gaurav (MGMG) program.
- KVK, NDRI organized 66 training programmes (both on and off campus), for the benefit of 1653 farmers, farm women, rural youth and entrepreneurs from various states of the country on different aspects of dairying and allied fields of agriculture such as crop production, horticulture, bee keeping, and fisheries apart home science.
- SRS-NDRI, Bengaluru conducted 08 numbers of training programmes on scientific dairy farming and its allied fields attended by 524 farmers. KVK (Addl.) Nadia located at ERS-NDRI conducted 82 training programmes on various aspects of scientific dairy farming for 3166 farmers and

डेयरी पालन एवं इसके सम्बद्ध क्षेत्रों में कुल आठ प्रशिक्षण कार्यक्रम आयोजित किए गए जिनमें कुल 524 किसानों ने भाग लिया। ईआरएस–एनडीआरआई में स्थित कृषि विज्ञान केन्द्र नाडिया, पश्चिम बंगाल ने वैज्ञानिक डेयरी पालन के विभिन्न पहलुओं पर 82 प्रशिक्षण कार्यक्रम आयोजित किए जिनमें कुल 3166 किसानों व कृषिरत महिलाओं, ग्रामीण युवाओं और प्रसार कार्मिकों ने भाग लेकर लाभ उठाया।

- आदिवासी उपयोजना (टीएसपी) के तहत 407 किसानों को बकरियां, चूजे, बत्तखें वितरित की गईं। 997 किसानों को उनके पशुधनध्मुर्गी पक्षियों की पोषण स्थिति बनाए रखने के लिए कुल 347.25 क्विंटल चारा वितरित किया गया। बड़ी संख्या में आदिवासी किसानों को उनके पशुओं को खिलाने के लिए खनिज मिश्रण (2988 किलोग्राम) वितरित किया गया। विभिन्न नकदी फसलों पर 886 आदिवासी किसानों के लिए उनके खेतों में कुल 12 फील्ड लेवल प्रदर्शन (एफएलडी) आयोजित किए गए।

डेरी उत्पादन

- β–लैक्टोग्लोबुलिन (BLG) जीन नॉकआउट के साथ भैंस कटड़े / कटड़ी का सजीव जन्म हासिल किया गया।
- क्लोन्ड गाय, गंगा में ओपीयू–आईवीएफ तकनीक के माध्यम से सफलतापूर्वक गर्भावस्था स्थापित की गई।
- NANOG–जीन सम्पादित भैंस कोशिकाओं के विकास के लिए जीन सम्पादित प्रौद्योगिकी को सटीक बनाया गया।
- डेयरी गोपशुओं में नस्ल शुद्धता तथा जलवायु अनुकूलता का अध्ययन करने के लिए पहली बार साहीवाल नस्ल की सभी गायों के जीनप्ररूप उत्पन्न किए गए।
- HepG2 कोशिकाओं में हेमे ऑक्सीगिनेज 1 (HMOX1) जीन के प्रकटन का उपयोग करते हुए लैड तथा कैडमियम की विषाक्तता का पता लगाने के लिए एक RT-LAMP आमाप विकसित किया गया।
- नर उर्वरता के संबंध में साहीवाल सांड़ों में शुक्राणु प्लाज्मा मेम्ब्रेन की लिपिड प्रोफाइल को स्थापित किया गया।
- गोजातीय पशुओं में शुक्राणु के कार्य में सुधार के लिए शुक्राणुओं तक बाह्य कोशिकीय पुटिका (EV) प्रोटीन पहुंचाने के लिए नैनो–लिपोसोम्स का घरेलू संश्लेषण विकसित किया गया।
- मिसेनकाइमल स्टेम कोशिकाओं का उपयोग गोपशु एवं भैंस के घावों का उपचार करने में किया गया।
- उपलब्ध कराये गए एक गोजातीय वीर्य नमूने में X–शुक्राणु को समृद्ध करने के लिए एंटीबॉडी संयुग्मित चुंबकीय नैनो कणों पर आधारित तकनीक विकसित की गई। *in-vitro* आईवीएफ परीक्षणों में, इस पद्धति ने

farm women, rural youths and extension functionaries.

- **Under tribal sub-plan (TSP),** goats, chicks, ducklings were distributed to 407 farmers. Total 347.25 quintals feed was distributed among 997 farmers to maintain the nutritional status of their livestock/poultry birds. Mineral mixture (2988 kg) was distributed to large number of tribal farmers for feeding to their livestock. Total 12 Field Level Demonstrations (FLDs) were organized for 886 tribal farmers in their fields on different cash crops.

Dairy Production

- Live birth of buffalo calf with β-lactoglobulin (BLG) gene knock out has been achieved.
- Successful pregnancy of cloned cow, Ganga, was established through OPU-IVF technology.
- Gene editing technology was perfected for development of NANOG-gene edited buffalo cells.
- First time the genotype of all Sahiwal cows was generated to study breed purity and climate resilience in dairy cattle.
- An RT-LAMP assay was developed for lead and cadmium toxicity detection using the gene expression of the Heme Oxygenase 1 (HMOX1) gene in HepG2 cells.
- Lipid profile of sperm plasma membrane in Sahiwal bulls was established in relation to male fertility.
- In-house synthesis of nanoliposomes was developed for delivery of extracellular vesicles (EV) proteins to spermatozoa for improvement of sperm function in bovines.
- Mesenchymal stem cells were used to treat cattle and buffaloes' wounds.
- An antibody conjugated magnetic nanoparticles - based technology was developed for enriching X-spermatozoa in a given bovine semen sample. In *in-vitro* IVF trials, this method skewed sex ratio towards females (3 females: 1 male) in cattle.
- An X-specific ligand was identified for enrichment of X-chromosome-bearing sperm that resulted in the production of 75% female-biased embryos in IVF trials.
- A sperm RNA sequencing based bull fertility assessment kit (BullFertiKit) and an App (BullFertiApp) for fertility prediction in bulls were developed.

गोपशुओं में लिंग अनुपात को महिलाओं (3 मादा : 1 नर) की ओर झुका दिया।

- X–गुणसूत्र धारण करने वाले शुक्राणु को समृद्ध करने के लिए एक X–विशिष्ट लिगैण्ड की पहचान की गई जिसके परिणामस्वरूप आईवीएफ परीक्षणों में 75% मादा भ्रूण का उत्पादन हुआ।
- शुक्राणु आरएनए (RNA) अनुक्रमण आधारित सांड उर्वरता मूल्यांकन किट (BullFertiKit) तथा सांड़ों में उर्वरता पूर्वानुमान के लिए एक ऐप (BullFertiApp) विकसित किया गया।
- लद्दाखी यॉक के पीयूष/खीस (कोलोस्ट्रम) से लैक्टोफेरिन का शुद्धिकरण करने के लिए एक सरल विधि विकसित की गई। पीयूष/खीस (कोलोस्ट्रम) में प्रमुख प्रोटीनों की पहचान करने के लिए शून्य दिवस की अवस्था में लद्दाखी यॉक के पीयूष/खीस (कोलोस्ट्रम) के शॉटगन प्रोटियोमिक्स का उपयोग किया गया।
- आबादी सरंचना विश्लेषण से पता चला कि करन फ्राइज गोपशुओं को विदेशी (होलस्टीन फ्रीजियन) के लिए 61.7% और जेबू (थारपारकर) आनुवंशिकी के लिए 38.3% की आनुवंशिक विरासत के साथ स्थिर किया गया है।
- इस वर्ष 2,747 किलोग्राम की औसत कुल दुग्धस्रवण दुग्ध उपज (TLMY) के साथ भैंस सुधार पर नेटवर्क परियोजना के अंतर्गत कुल 43 श्रेष्ठ दुधारू भैंस उत्पन्न की गईं।
- खेत परिस्थितियों के अंतर्गत मुर्राह भैंस में कुल 5,108 कृत्रिम गर्भाधान किए गए जिसके परिणामस्वरूप 46. 38% की समग्र गर्भाधान दर हासिल हुई। किसानों के यहां पाले जा रहे पशु झुण्डों में कुल 1625 मुर्राह भैंस के श्रेष्ठ नवजात कटडों/कटडियों (943 नर तथा 682 मादा) ने जन्म लिया।
- साहीवाल गोपशुओं में, वर्तमान सेट में गर्भाधान दर 42% (सेट –I) से बढ़कर 48.66% हो गई। प्रथम दुग्धस्रवण 305 दिवसीय दुग्ध उपज में दुग्ध उत्पादन प्रदर्शन में वृद्धिशील रूझान देखने को मिला। प्रारंभ से लेकर अब तक कुल 230 श्रेष्ठ गाय उत्पन्न की गईं जिनमें से 102 गायों का जनन अखिल भारतीय समन्वित अनुसंधान परियोजना को प्रारंभ करने के उपरांत हुआ और वर्तमान में, झुण्ड़ में कुल 35 श्रेष्ठ गायें विद्यमान हैं।
- संकर नस्ल के गोपशुओं में उत्पादकता को बढ़ाने के लिए जीनोमिक चयन को लागू करने के संबंध में केरल पशुधन विकास बोर्ड (KLDB) को तकनीकी इनपुट दिया जा रहा है।
- ई. कोलाई में भैंस रिकॉम्बीनेन्ट लिंग निर्धारण रीजन Y(SRY) प्रोटीन को सफलतापूर्वक उत्पन्न किया गया।

- A simple method was developed for the purification of lactoferrin from Ladakhi Yak colostrum. Shotgun proteomics of 0-day Ladakhi yak colostrum was used to identify key proteins in colostrum.
- Population structure analysis revealed that the Karan Fries cattle is stabilized with the genetic inheritance of 61.7% for exotic (Holstein Friesian) and 38.3% for zebu (Tharparkar) genetics.
- A total of 43 elite milch buffaloes were produced under Network Project on Buffalo Improvement during this year with an average total lactation milk yield (TLMY) of 2,747 kg.
- A total of 5,108 artificial inseminations were performed in Murrah buffaloes under field conditions, resulting in an overall conception rate of 46.38%. A total of 1,625 Murrah buffalo elite calves (943 males and 682 females) were born in farmer's herds.
- In Sahiwal cattle, the conception rate increased from 42% (set –I) to 48.66% in the current set. The milk production performance showed increasing trend in first lactation 305-day milk yield. A total of 239 elite cows were produced since beginning out of which 103 were produced after introduction of AICRP and at present 35 elite cows are present in the herd.
- Technical input with regards to implementation of genomic selection is being given to the Kerala Livestock Development Board (KLDB) for enhancing productivity in crossbred cattle.
- Buffalo recombinant sex-determining region Y (SRY) protein was successfully produced in *E. coli*.
- Progesterone encapsulated nanofiber based intravaginal sponges was developed for estrus induction in dairy cattle.
- Association between mitochondrial alterations and retained placenta in crossbred cattle have been studied.
- Probiotic mix culture for boosting calf health developed.
- An herbal feed supplement was developed for enhancing milk yield and overall health of the dairy animals.
- A herbal teat spray formulation for combating subclinical mastitis and process for preparation thereof was developed.

- डेयरी गोपशुओं में मदकाल उत्प्रेरण के लिए प्रोजिस्टेरॉन सम्पुटित नैनो रेशा आधारित इन्ट्रावैजाइनल स्पोन्ज्स का विकास किया गया।
- संकर नस्ल के गोपशुओं में माइटोकॉन्ड्रियल परिवर्तन और बरकरार गर्भनाल (प्लेसेंटा) के बीच संबंध का अध्ययन किया गया ।
- नवजात बछड़े/बछड़ी के स्वास्थ्य के लिए प्रोबायोटिक मिश्रण संवर्धन तैयार किया गया।
- डेयरी पशुओं में दुग्ध उपज को बढ़ाने और उनके समग्र स्वास्थ्य में सुधार लाने के लिए एक हर्बल आहार अनुपूरक अथवा सप्लीमेन्ट विकसित किया गया।
- उप–क्लीनिकल थनैला रोग का मुकाबला करने के लिए एक हर्बल टीट स्प्रे फार्मुलेशन और उसे तैयार करने की प्रक्रिया विकसित की गई।
- लद्दाख क्षेत्र में कम उत्पादन वाले मौसम के लिए चारा संसाधनों की पहचान की गई है और इसके संरक्षण के लिए कार्यप्रणाली विकसित की गई है।
- गेहूँ के भूसे/पुआल को 50% तक लेमनग्रास और पामारोजा घास के अवशेषों से प्रतिस्थापित किया जा सकता है जिससे दूध देने वाली साहीवाल नस्ल की गायों की पाचनशक्ति, आंतों में मीथेन उत्सर्जन और उत्पादन प्रदर्शन पर कोई प्रभाव नहीं पड़ेगा।
- जाइलन के निष्कर्षण और जाइलो–ऑलिगोसैकराइड के उत्पादन द्वारा श्रीअन्न पुआल का मूल्यांकन किया गया।
- मीथेन आकलन और आहार मूल्यांकन के लिए रुमेन जैसी स्थितियों का अनुकरण करने के लिए एक नया सतत रुमेन बायो–रिएक्टर विकसित किया गया।
- मीथेन उत्सर्जन (ग्राम/दिवस) में सजीव खमीर के साथ 36.6% और पोस्ट–बायोटिक पूरकता के साथ 30% की उल्लेखनीय कमी ($p<0.05$) आई।
- फसल उत्पादन के लिए उपचारित सीवेज जल के उपयोग के लिए एक कार्यप्रणाली को मानकीकृत किया गया।
- पशु आहार के लिए मोरिंगा–नेपियर चारा गुटिका विकसित की गईं।
- रिमोट सेन्सिंग प्रौद्योगिकी के माध्यम से मध्य प्रदेश और पश्चिम बंगाल में चारा उत्पादन के लिए क्षेत्रों का अनुमान लगाया गया।
- गाय के गोबर के सम्पुटीकरण प्रक्रिया मापदंडों को अनुकूलित किया गया और थर्मो–ग्रैविमेट्रिक विश्लेषण ने दहन विशेषता सूचकांक का अनुमान लगाया, जो दहन उद्देश्यों के लिए ऊर्जा भंडारण क्षमता को दर्शाता है।
- ब्लैक बंगाल हिरण के वीर्य का हिम परिरक्षण करने के लिए वीर्य विस्तारक में माइटोकॉण्ड्रिया लक्षित

- Fodder resources for lean season in Ladakh region have been identified and methodology has been developed for its conservation.
- Wheat straw could be replaced by lemongrass and palmarosa grass residues up to 50%, without affecting the apparent digestibility, enteric methane emissions and production performance of lactating Sahiwal cows.
- Valorisation of millet straws was achieved by extraction of xylan and production of xylo-oligosaccharides.
- A novel Continuous Rumen Bioreactor was developed to simulate rumen-like conditions for methane estimation and feed evaluation.
- Methane emissions (g/day) were significantly reduced ($p<0.05$) by 36.6% with live yeast and by 30% with postbiotic supplementation.
- A methodology was standardized for treated sewage water application for crop production.
- Moringa-Napier fodder pellets were developed for animal feeding.
- Through remote sensing technology, areas for fodder production in Madhya Pradesh and West Bengal were estimated.
- The pelletizing process parameters of cow dung were optimized and thermogravimetric analysis estimated the combustion characteristics index indicating the energy storage potential for combustion purposes.
- Supplementation of mitochondria targeted antioxidants MitoTempo @ 50 and 100 µM and Mitoquinine @ 200 nM to the semen extenders for cryopreservation of Black Bengal buck semen found to significantly ($p< 0.05$) improve the post thaw *in vitro* sperm recovery.
- Successful deployment of sensor-based neck collars developed earlier to generate the data pertaining to rumination time, eating time and activity trend of animals for monitoring the health status and heat detection of cattle.

Dairy Processing

- Simulated digested casein has considerably higher inhibition of enzymes (DPP-IV, α-glucosidase and ACE) than undigested casein irrespective of the milk obtained from cow, goat or donkey.
- Colostrum whey protein and proline-rich peptides (PRPs) exhibited anti-oxidative,

प्रति–ऑक्सीकारकों मिटोटेम्पो (MitoTempo) / 50 एवं 100 µM तथा माइटोक्वीनाइन (Mitoquinine) / 200 दड की आपूर्ति करने पर जमने के उपरान्त स्वरू पात्रे शुक्राणु वसूली में उल्लेखनीय ($p< 0.05$) सुधार पाया गया।

- गोपशुओं की स्वास्थ्य स्थिति की निगरानी करने और गर्मी का पता लगाने के लिए जुगाली करते समय, खाने के समय और पशुओं की गतिविधि प्रवृत्ति से संबंधित डेटा उत्पन्न करने के लिए पहले से विकसित सेंसर–आधारित गर्दन कॉलर की तैनाती सफलतापूर्वक की गई।

डेरी प्रसंस्करण

- गाय, बकरी अथवा गधी किसी से भी हासिल किए गए दूध के अपचित कैजीन की तुलना में सिमुलेटिड पचाये गये कैजीन में एंजायमों (DPP-IV, α-ग्लूकोसिडेज तथा ACE) का उल्लेखनीय रूप से कहीं अधिक अवरोधन पाया गया।
- पीयूष / खीस अथवा कोलोस्ट्रम छाछ प्रोटीन तथा प्रोलिन समृद्ध पेप्टाइड्स (PRPs) में प्रति–ऑक्सीकारक, मधुमेह रोधी, मोटापा रोधी, उच्च रक्तचाप रोधी और प्रतिरक्षा–नियंत्रण क्षमता पाई गई और विदेशी तथा संकर नस्ल के मुकाबले स्वदेशी नस्ल के पीयूष / खीस अथवा कोलोस्ट्रम छाछ प्रोटीन तथा प्रोलिन समृद्ध पेप्टाइड्स (PRPs) में जैव–कार्यशील गुण कहीं बेहतर पाए गए।
- चूहों को पीयूष / खीस अथवा कोलोस्ट्रम, कोलोस्ट्रम छाछ प्रोटीन और कोलोस्ट्रीनिन खिलाने से मेटाबॉलिक सिण्ड्रोम (MS) के कारण उत्पन्न परेशानियों को दूर करने में मदद मिली और यह पाया गया कि मेटाबॉलिक सिण्ड्रोम (MS)का मुकाबला करने में हॉलस्टिन फ्रीजियन की तुलना में साहीवाल नस्ल कहीं बेहतर थी।
- कच्चे दूध की सूक्ष्मजीवीय गुणवत्ता का पता लगाने के लिए कलरीमीट्रिक पेपर स्ट्रिप सेंसर विकसित किया गया।
- लिस्टेरिया मोनोसाइटोजीन्स का पता लगाने के लिए In IA तथा In IB प्रोटीनों के विरूद्ध एंटीबॉडीज का उपयोग करके पार्श्वीय प्रवाह उपकरण (लेटरल फ्लो डिवाइस) (LFD) विकसित किया गया ।
- 1 सवह CFU/mL की संवेदनशीलता के साथ 58±2 घंटे के भीतर शिगेला प्रजाति का पता लगाने के लिए एक चयनित माध्यम एवं विधि का विकास किया गया।
- साहीवाल, थारपारकर तथा करन फ्राइज गोपशुओं के दुग्ध मेटाबोलाइट प्रोफाइल्स में मौसमी भिन्नताओं का अध्ययन किया गया।
- मेटाबोलोमिक्स युक्ति का उपयोग करते हुए बारबरी तथा जमुनापारी नस्ल की बकरियों के दूध में संरचनागत परिवर्तनशीलता को स्पष्ट किया गया।

antidiabetic, anti-obesity, antihypertensive and immunomodulatory potential and biofunctional attributes of colostrum whey protein and PRPs of indigenous breeds were better than crossbred.

- Feeding of colostrum, colostrum whey protein and colostrinin to rats helped in amelioration of complications induced due to metabolic syndrome (MS) and it was found that Sahiwal was better than Holstein Friesian in combating MS.
- Colorimetric paper strip sensor for the detection of microbial quality of raw milk.
- Lateral flow device (LFD) developed using antibodies against In IA and In IB proteins for the detection of *Listeria monocytogenes*.
- A selective medium and method were developed for the detection of *Shigella* species within 58±2 h, with a sensitivity of 1 log CFU/mL.
- Seasonal variations in milk metabolite profiles of Sahiwal, Tharparkar, and Karan Fries Cattle studied
- Compositional variability in the milk of *Barbari* and *Jamunapari* goats using metabolomics approach has been elucidated.
- The role of taurine in she-buffalo reproduction was studied.
- Technology on production of stable direct vat set liquid starter culture blend for fermented milk developed.
- Peptides from fermented camel milk exhibited high α-glucosidase inhibitory activity and potent DPP-IV inhibitory activity.
- Green synthesized magnesium oxide nanoparticles (GMgO NPs) reduced *Listeria* biofilm formation on stainless steel surfaces.
- Bioactive proteins and peptides formulation from whey colostrum of Sahiwal showed anti-diarrhoeagenic activity against *E. coli* MTCC 723 in weaning mice model.
- Fermented colostrum whey derived lactoferrin and peptides demonstrated antifungal activity against various mucormycosis-causing strains.
- An enterocin-rich (bacteriocin) whey powder was developed for effectively displacing gastrointestinal pathogens such as *Escherichia coli* and *Salmonella* in a cell line model.
- A spray dried process was developed for the production of probiotic DVS starters of lead binder *Lactiplantibacillus planatarum* HD51 for preparation of fermented dairy products.

- भैंस प्रजनन में टॉरिन की भूमिका का अध्ययन किया गया ।
- किण्वित दूध के लिए स्थिर प्रत्यक्ष वैट सेट तरल स्टार्टर कल्चर मिश्रण के उत्पादन पर प्रौद्योगिकी विकसित की गई।
- ऊंटनी के किण्वित दूध से पेप्टाइड्स में उच्च α–ग्लूकोसिडेज निरोधक गतिविधि और सक्षम DPP-IV निरोधक गतिविधि प्रदर्शित हुई।
- हरित संश्लेषित मैग्नीशियम ऑक्साइड नैनो पार्टिकल्स (GMgO NPs) से स्टेनलेस स्टील सतह पर लिस्टेरिया बायोफिल्म गठन कम हुआ।
- साहीवाल नस्ल की गायों के छाछ पीयूस/खीस अथवा कोलोस्ट्रम से जैव–सक्रिय प्रोटीन तथा पेप्टाइड्स फार्मुलेशन में वीनिंग चूहा मॉडल में ई कोलाई MTCC 723 के विरूद्ध दस्त–रोधी गतिविधि देखने को मिली।
- किण्वित पीयूस/खीस अथवा कोलोस्ट्रम छाछ से उत्पन्न लैक्टोफेरिन तथा पेप्टाइड्स में विभिन्न म्यूकरमाइकोसिस पैदा करने वाले स्ट्रेन के विरूद्ध कवक–रोधी गतिविधि प्रदर्शित हुई।
- एक सेल लाइन मॉडल में एशेरिकिया कोली और साल्मोनेला जैसे जठरांत्र संबंधी रोगजनकों को प्रभावी ढंग से विस्थापित करने के लिए एंटरोसिन युक्त (बैक्टीरियोसिन) छाछ पाउडर विकसित किया गया ।
- किण्वित डेयरी उत्पादों को तैयार करने के लिए लैड बाइन्डर लैक्टीप्लाण्टीबैसिलस प्लाण्टेरम HD51 के प्रोबायोटिक क्टै स्टार्टर के उत्पादन हेतु एक स्प्रे शुष्क प्रक्रिया विकसित की गई।
- मानव, पशु तथा पर्यावरण से एशेरिकिया कोली में सूक्ष्मजीव रोधी प्रतिरोधिता (AMR) जीन तथा सम्बद्ध मोबाइल/चलायमान आनुवंशिक अवयवों की पहचान की गई।
- घी के स्वाद को बढ़ाने के लिए एक तरल स्टार्टर एवं फ्रीज शुष्कित संवर्धन मिश्रण बनाया गया।
- छाछ आधारित मीडिया का उपयोग करते हुए लिमोसिलेक्टोबैसिलस रयूटेरी द्वारा विटामिन B12 उत्पादन के लिए एक जैव–प्रक्रिया विकसित की गई।
- रागी–दुग्ध आधारित कम्पोजिट किण्वित पेय तैयार किया गया।
- अठारह घंटे में दूध में साल्मोनेला का पता लगाने के लिए दो चरणीय एंजाइम आमाप विकसित किया गया जबकि इसकी तुलना में IS 5887 पार्ट 3 : 2021 द्वारा इस कार्य में 5–7 दिनों का प्रोटोकॉल था।
- पनीर छाछ–खुबानी को इस्तेमाल कर के वाइन बनाने की प्रौद्योगिकी विकसित की गई है।
- बकरी के दूध पर आधारित चेडर चीज बनाने के लिए नई प्रसंस्करण तकनीक विकसित की गई ।

- Antimicrobial resistance (AMR) genes and associated mobile genetic elements were identified in *Escherichia coli* from human, animal and environment.
- A liquid starter and freeze-dried culture blend were formulated for improving the flavour of ghee.
- A bioprocess developed for vitamin B_{12} production by *Limosilactobacillus reuteri* using whey-based media.
- A finger millet-milk based composite fermented beverage was developed.
- Two-stage enzyme assay developed for detection of *Salmonella* in milk in 18 h as compared to 5-7 days protocol by IS 5887 Part 3: 2021.
- Technology for Paneer whey-apricot wine has been developed.
- Technology for Goat milk based cheddar cheese by employing novel processing techniques is developed.
- Various milk metabolites associated with yoghurt and cheese texture have been identified.
- Sorghum-milk composite protein isolate was found to exhibit better physico-chemical and functional properties as compared to the sorghum protein concentrate.
- *Lactiplantibacillus plantarum* CRD7 and CRD11 were encapsulated using electrospinning and spray drying methods.
- Gold nanoparticle based competitive lateral flow immunoassay developed for the detection of 5-hydroxyflunixin in milk.
- Technology of spray-dried low lactose milk powder developed.
- Process developed for low lactose *khoa* manufacturing using multi-enzyme approach.
- Process developed for preparation of spray dried galactooligosaccharides rich paneer whey powder.
- Studies revealed 33.9% variability between the metabolites of Tharparkar (TP) and Karan-Fries (KF) cows' milks.
- Possibility of Raman spectroscopy as a rapid, sensitive, and robust tool for ascertaining ghee quality was explored.
- Industry friendly encapsulation process developed for DPP-IV inhibitory peptides rich protein

- योगर्ट और चीज की बनावट से जुड़े विभिन्न दुग्ध मेटाबोलाइट्स की पहचान की गई है।
- ग्वार अथवा सोरघम प्रोटीन सान्द्र की तुलना में ग्वार–दुग्ध कम्पोजिट प्रोटीन पृथक्क में कहीं बेहतर भौतिक–रासायनिक तथा कार्यपरक विशेषताएं देखने को मिलीं।
- इलेक्ट्रो–स्पिनिंग तथा स्प्रे शुष्कन विधियों का उपयोग करते हुए लैक्टीप्लाण्टीबैसिलस प्लाण्टेरम CRD7 तथा CRD11 को एन्कैपसूलेट किया गया।
- दूध में 5–हाइड्रॉक्सीफ्लुनिक्सिन का पता लगाने के लिए गोल्ड नैनो–पार्टिकल आधारित प्रतिस्पर्धी पार्श्व प्रवाह प्रतिरक्षा आमाप विकसित किया गया ।
- स्प्रे–शुष्कित कम लैक्टोज वाले दुग्ध पाउडर की तकनीक विकसित की गई है।
- बहु एंजाइम युक्ति का उपयोग करके कम लैक्टोज मात्रा वाला खोया तैयार करने हेतु प्रक्रिया विकसित की गई।
- स्प्रे शुष्कित गैलेक्टोओलिगो सैकेराइड्स से समृद्ध पनीर छाछ पाउडर तैयार करने के लिए प्रक्रिया विकसित की गई।
- अध्ययनों से थारपारकर (TP) तथा करन फ्राइज (KF) नस्ल के गाय दुग्ध में मेटाबोलाइट्स के मध्य 33.9% भिन्नता का पता चला।
- घी की गुणवत्ता को सुनिश्चित करने के लिए एक त्वरित, संवेदनशील तथा मजबूत टूल्स के तौर पर रमन स्पेक्ट्रोस्कोपी की संभावना तलाशी गई।
- स्प्रे शुष्कन के माध्यम से DPP-IV निरोधक पेप्टाइड्स समृद्ध प्रोटीन हाइड्रोलाइसेट्स के लिए उद्योग मित्रवत सम्पुटीकरण प्रक्रिया विकसित की गई।
- बकरी दुग्ध कैजीन के लिए अधिकतम DPP-IV निरोध गतिविधि हासिल करने हेतु एक एंजाइम हाइड्रोलाइसिस प्रक्रिया को अनुकूल बनाया गया।
- किण्वित डेयरी उत्पाद के लिए एक स्वचालित तापीय भण्डारण माड्यूल विकसित किया गया।
- एक प्रयोगशाला स्केल मैग्नेटिक उत्प्रेरण आधारित दुग्ध हीटिंग प्रणाली (5 लिटर) विकसित की गई।
- रसगुल्ला पकाने के लिए तापीय द्रव आधारित लघु स्तरीय मशीनीकृत प्रक्रिया इकाई विकसित की गई।
- लघु स्तर पर पनीर तैयार करने के लिए इनलाइन दुग्ध जमावट सह कोगुलम प्रेसिंग इकाई विकसित की गई।

बौद्धिक संपदा अधिकार

- कुल 13 नये पेटेंट आवेदन दायर किये गये।
- 07 पेटेंट प्रदान किए गए।
- 03 कॉपीराइट आवेदन दायर किये गये।

hydrolysates through spray drying.

- An enzymatic hydrolysis process was optimized to yield maximum DPP-IV inhibition activity for goat milk caseins.
- Developed an automatic thermal storage module for fermented dairy product.
- A laboratory scale magnetic induction-based milk heating system (5 Litre) was developed.
- Thermic fluid-based small scale mechanized process unit for *rasogolla* cooking was developed.
- Inline milk coagulation-cum-coagulum pressing unit for *paneer* manufacturing at small scale developed.

Intellectual Property Rights

- 13 new patent applications were filed by ICAR-NDRI.
- 07 patents were granted to ICAR-NDRI.
- 03 copyright applications were filed by ICAR-NDRI.
- ICAR-NDRI has made attempt to register two synthetic breeds of cattle, Karan Fries and Karan Swiss under Indian Trademark Act.
- 09 technologies were commercialized to Hatsun Agro Product Ltd., Chennai by ICAR-NDRI.
- 07 new technologies were developed by ICAR-NDRI which are ready for commercialization.

Education

- Faculty of the Institute have organized 01 CAFT and 02 "Winter School" sponsored by ICAR and 01 high end workshops (Karyashala) sponsored by DST for enhancing specialized research skills for the research scholars of other universities.

A group of students visiting dairy industry

- ICAR- NDRI, Karnal and its Regional Stations organized **43** number of seminars/workshops/ symposia/ trainings etc.

- मवेशियों की दो सिंथेटिक नस्लों, करण फ्राइज और करण स्विस को भारतीय ट्रेडमार्क अधिनियम के तहत पंजीकृत करने का प्रयास किया है।
- 09 प्रौद्योगिकियों का हटसन एग्रो प्रोडक्ट लिमिटेड, चेन्नई के साथ व्यावसायीकरण किया गया।
- 07 नई प्रौद्योगिकियां विकसित की गईं जो व्यावसायीकरण के लिए तैयार हैं।

शिक्षा

- संस्थान के संकाय ने आईसीएआर द्वारा प्रायोजित 01 सीएएफटी और 02 'विन्टर स्कूल' तथा अन्य विश्वविद्यालयों के अनुसंधान स्कॉलरों के अनुसंधान कौशल को बढ़ाने के लिए डीएसटी द्वारा प्रायोजित 01 उच्च स्तरीय कार्यशाला आयोजित की ।
- आईसीएआर–एनडीआरआई, करनाल और इसके क्षेत्रीय स्टेशनों द्वारा 43 सेमिनार/कार्यशालाएं/संगोष्ठियाँ/प्रशिक्षण आदि आयोजित की गयीं।

आधारभूत संरचना

- एनडीआरआई, करनाल में पशु पोषण प्रभाग के अनुसंधान परीक्षण की आवश्यकता हेतु लगभग 250 वर्ग मीटर क्षेत्र के एक प्रायोगिक शेड का निर्माण।
- प्रशासनिक ब्लॉक, प्रदर्शनी इकाई इमारत क्रेश (शिशुशाला) सहित, स्टाफ क्लब, छोटे पशुओं का घर, पशु इलाज के लिए कमरा, कल्कि अतिथि गृह, फार्म अनुभाग की पार्किंग शेड, कैफिटीरीअ और इंडोर स्पोर्ट्स कॉम्प्लेक्स बिल्डिंग का मरम्मत कर उन्हें पेन्ट किया गया।
- आउटडोर और इनडोर खेलों को आसान बनाने के लिए खेल के मैदान में अतिरिक्त पोल/फ्लड लाइटें लगाई गई हैं।
- कैफेटेरिया, अतिथि गृह और प्रशासनिक भवन में सौर ऊर्जा लगायी गई हैं ।
- खेलों के लिए बुनियादी सुविधाएं जैसे – खेल मैदान में शेड, कबड्डी मैट, बैडमिंटन कोर्ट मैट, स्टोर रूम, एलईडी लाइट्स (500 W और 300W), आदि लगाए गए।

Infrastructure

- Construction of an Experimental Shed of approx. 250 sqm. area for the research trials need for Animal Nutrition Division at LRC, ICAR- NDRI, Karnal.
- Administration Block building, Exhibition Unit building including Creche, Staff club, Small Animal house, Animal Treatment Hall, Kalki Guest home, parking Shed of farm section, Cafeteria and Indoor sports complex building were repaired and painted.
- 296 Seats (Desk-cum-seat bench) were fixed in the new examination hall building for conducting exams and classes
- Additional poles/ flood lights have been installed in the playground and also sports ground to ease playing of outdoor and indoor games.
- Solar lights have been fixed in the cafeteria, guest house and Admin Building.
- Infrastructure/facilities related to sports and games such as namely construction of shed in sports ground, kabaddi mats, badminton court mats, store room, LED lights (500 W and 300 W), etc. have been procured and installed.

NDRI students embrace the serene campus atmosphere

1. INTRODUCTION

ICAR-National Dairy Research Institute (NDRI) at Karnal, Haryana is one of the premier Institutes in dairy sector. The Institute has contributed tremendously to the growth of the Indian dairy industry and played a crucial role in India's emergence as leading milk producing country in the world with its research in frontier areas of dairy science. Over 100-year-old, NDRI's lineage goes back to the Imperial Institute for Animal Husbandry & Dairying, which was set up in Bangalore in 1923 as a Centre for dairy education. It was shifted to its present site at Karnal in 1955 and renamed as National Dairy Research Institute. The infrastructure of Imperial institute was retained as Southern Regional Station of NDRI and later in 1964, Eastern Regional Station was set up at Kalyani in West Bengal. Although Western Regional Station of NDRI was established at Bombay (now Mumbai) in 1962, it was closed in 1984 because of administrative and strategic reasons related to the NDRI's evolving focus and need for better centralization of its operations. NDRI was brought under the aegis of Indian Council of Agricultural Research (ICAR) in the year 1970. The Institute has the distinction of being a Deemed to be University for implementing its academic programmes since, 1989. NDRI secured First Rank among all Agricultural Universities in India consecutively for five years in the ranking of these Universities by ICAR from 2016-2021. The Institute has been accredited by National Agricultural Education Accreditation Board, ICAR up to 2026. In the year 2024, ICAR-NDRI has secured the second rank in the National Institutional Ranking Framework (NIRF)-2024 in 'Agriculture and Allied Category" of the Union Ministry of Higher Education, Govt. of India. The Institute is also ISO 9001:2015 certified. This unique campus has residential buildings, various well equipped research laboratories as well as green spaces with perennial plants and gardens. Well-equipped sports facilities and attractive leisure time opportunities are offered to the students and employees of the Institute.

Southern Campus, Bengaluru

The foundation stone of the edifice of NDRI was laid at Bengaluru on July 1, 1923. It was the forerunner institution in starting dairy education programmes to meet the manpower requirements of the Nation's dairy industry. After shifting of the Institute Head Quarters to Karnal in 1955, the establishment at Bengaluru continued as the Southern Regional Station of NDRI. This Centre was the first to initiate training in artificial insemination in cattle in the country and has the honour of imparting training to Mahatma Gandhi and Pandit Madan Mohan Malviya. The station has been catering to the research, training and extension needs of the dairy farmers and dairy industry of the southern region of the Nation.

Eastern Campus, Kalyani

The Eastern Regional Station of the Institute was established at the Central Dairy in Kolkata in 1964 and was shifted in 1966 to Kalyani (Nadia district), about 50 km north of Kolkata. The main objective of establishing the Eastern Regional Station was to identify the major constraints of dairy production in eastern and northeastern India and to offer solutions through research and extension activities to these problems.

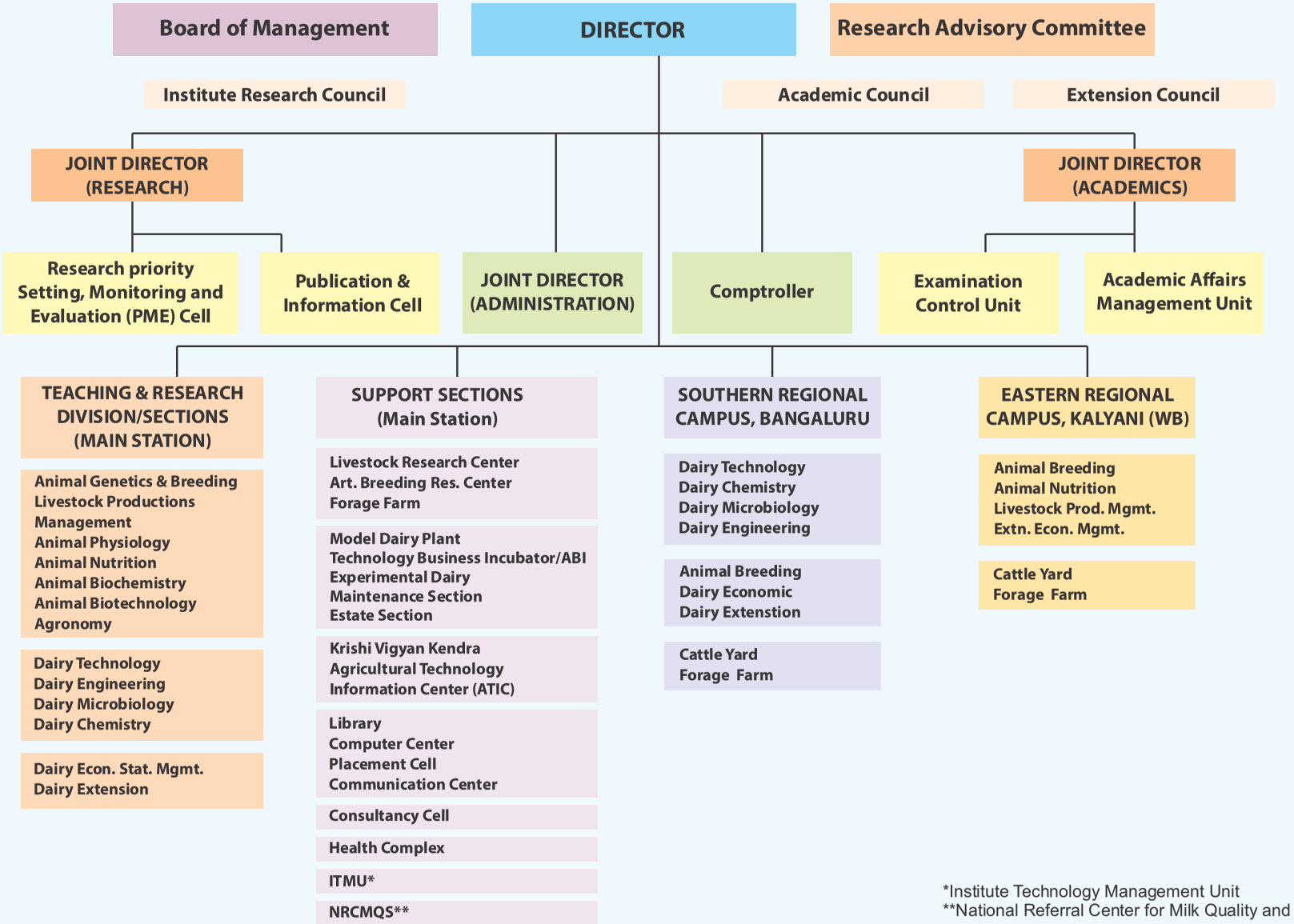
Krishi and Dairy Vikas Kendra, Piprakothi-Motihari

ICAR-NDRI established Krishi and Dairy Vikas Kendra (KDVK) at KVK, Piprakothi, East Charparan (Bihar) in the premises of Dr. Rajendra Prasad Central Agriculture University, Pusa. The Centre was inaugurated by Hon'ble Union Agriculture and Farmers Welfare Minister, Sh. Radha Mohan Singh on July 10, 2016.

Model Dairy Centre, Lalukheri - Muzzafarnagar

The Centre was initiated at Lalukheri in Muzzafarnagar, Uttar Pradesh under the project approved by ICAR, New Delhi vide letter No. 2-2/02-ASR-III dated 25.09.2002. The basic facilities have been created for empowering youth and women involved in dairy sector.

Organizational Structure of NDRI



*Institute Technology Management Unit
**National Referral Center for Milk Quality and Safety

2. ORGANISATIONAL SETUP -

The organisational structure of NDRI follows the Deemed University pattern of the ICAR. The policy-making functions of research, education and extension activities are managed through six main bodies.

- **Board of Management**
- **Research Advisory Committee**
- **Academic Council**
- **Institute Research Council**
- **Extension Council**

The highest policy-making body is the Board of Management (BOM). The Director, NDRI, is the Chairman of this Board. The Research Advisory Committee (RAC) is responsible for the all-round progress in research at the Institute and its application. The Academic Council is responsible for all issues relating to education and training. The Academic Council, in turn, is supported by (i) Standing Committees, (ii) the Post Graduate Faculty, and (iii) the Board of Studies in the respective disciplines. The Extension Council is responsible for guiding extension programs. The Institute Research Committee (IRC) is responsible for prioritization, monitoring and evaluation of research conducted in the Institute. The research, education and extension activities of the Institute are managed by the Director and the Joint Directors through scientific, technical, administrative and supporting staff. The Director is the overall Administrative Head of the Institute and its Regional Stations. The Joint Directors in addition to extending support to the Director in the area of research, academics and administration are responsible to co-ordinate research and educational activities of various Divisions and Regional Stations, respectively. Each of the Regional Stations is administered through the Head located at the station. The scientific and teaching work at the main campus and its regional campuses is conducted in 15 subject-matter disciplines.

BOARD OF MANAGEMENT

Chairman	Dr. Dheer Singh, Director & Vice Chancellor, ICAR-NDRI, Karnal
	Members
Dr. Rajan Sharma	Joint Director (Research), ICAR-National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana
Dr. A. K. Singh	Joint Director (Academics), ICAR-National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana
Dr. Triveni Dutt	Director, ICAR-Indian Veterinary Research Institute (ICAR-IVRI), Izatnagar, Uttar Pradesh
Dr. Anupam Mishra	Vice-Chancellor, Central Agricultural University (CAU), Imphal, Manipur
Dr. Inderjeet Singh	Vice-Chancellor, Guru Angad Dev Veterinary & Animal Sciences University (GADVASU), Ludhiana, Punjab
Dr. Umesh Rai	Vice Chancellor, Jammu University, Jammu
Dr. A. K. Puniya	Principal Scientist, Dairy Microbiology Division, ICAR-National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana
Dr. A. K. Dang	Head, Animal Physiology Division, ICAR-National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana
Dr. P. Barnwal	Head, Dairy Engineering Division, ICAR-National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana
Dr. Suneel Kumar Onteru	Head, Animal Biochemistry Division, ICAR-National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana
Dr. Shilpa Vij	Academic Coordinator & Head, Dairy Microbiology Division,ICAR-NDRI, Karnal, Haryana
Dr. Gopal Sankhala	Head, Extension Division, ICAR-National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana.
Dr. Manmohan Singh Chauhan	Vice Chancellor, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand
Dr. Ashok Kumar	Assistant Director General (Animal Health), Indian Council of Agricultural Research, Krishi Bhavan,New Delhi

Dr. A.K. Singh	Director, Indian Agricultural Research Institute, Pusa Campus, New Delhi
Dr. Abhijit Mitra	The Animal Husbandry Commissioner , Govt. of India, Department of Animal Husbandry & Dairying, Krishi Bhawan, New Delhi
Sh. D. D. Verma	Sr. Comptroller, Indian Agricultural Research Institute, Pusa Campus, New Delhi
Commissioner	Rohtak Division, Rohtak
Sh. Teg Singh Rana	Village & Post Office – Arainpura, H.No. 645, Block-Gharounda, Dist. Karnal
Sh. Sugriv Singh Chauhan	Gram-Manouna, Post-Pinahat, Block-Pinahat, Tehsil-Bah, 152, Parshavnath, Panchvati, Fatehabad Road, Agra
	Member Secretary
Sh. B. D. Phansal	Joint Director (Admn.) & Senior Registrar, ICAR-National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana

RESEARCH ADVISORY COMMITTEE -

Chairman	**Dr. Nagendra Sharma, Ex-Vice Chancellor, SKUAST Jammu and Ex Director, NDRI Karnal, Haryana & CIRG Makhdoom, Uttar Pradesh**
	Members
Dr. Dheer Singh	Director & Vice Chancellor, ICAR-NDRI, Karnal
Dr. Raghvendra Bhatta	Deputy Director General (Animal Science), Indian Council of Agricultural Research, New Delhi
Dr. C.G. Joshi	Director, Gujarat Biotechnology Research Centre, Gandhinagar, Gujarat
Dr. C. Anandharamakrishnan	Director, CSIR-National Institute for Interdisciplinary Science and Technology (NIIST), Council of Scientific & Industrial Research (CSIR), Thiruvananthapuram Kerala
Dr. V.K. Saxena	Director (Research), Bihar Animal Sciences University (BASU), Patna, Bihar
Dr. Pratap Singh Birthal	Director, (ICAR - National Institute of Agricultural Economics and Policy Research (ICAR-NIAP), New Delhi
Dr. Kusumakar Sharma	Ex-ADG (HRM), Education Division, Krishi Anusandhan Bhawan-II, New Delhi; H.No. D-5073, ATS Greens Paradise Sector-Chi-IV, Greater Noida
Sh. S.S. Mann	Founder, Mann Ventures Faridabad (Haryana) (Dairy Industry Partner)
	Member Secretary
Dr. Rajan Sharma	Joint Director (Research), ICAR-National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana.

ACADEMIC COUNCIL

Chairman	**Dr. Dheer Singh, Director & Vice Chancellor, ICAR-NDRI, Karnal**
Vice Chairman	Dr. A.K. Singh, Joint Director (Academic)
Member	Dr. Rajan Sharma, Joint Director (Research)
	Members
Dr. Triveni Dutt, Director & Vice Chancellor, Indian Veterinary Research Institute, Izatnagar, Uttar Pradesh	Dr. R. C. Agrawal, Deputy Director General (Education), ICAR
Dr. Kusumakar Sharma, Former ADG (HRD), 05073, ATS Greens Paradiso, Sector Chi 04. Greater Noida, Uttar Pradesh	Dr. Naveen Prakash Singh, Member (Official), CACP, 382 B, Krishi Bhawan, New Delhi -
Prof. Bechan Lal, Vice Chancellor, Cluster University of Jammu	Sh. B. D. Phansal, Joint Director (Admn.) & Senior Registrar, - ICAR-NDRI, Karnal
Dr. Vivek Sharma, Head, Dairy Chemistry Division	Dr. Suneel Onteru, Head Animal Biochemistry Division
Dr. A.K. Dang, Head Animal Physiology Division	Dr. Deep Narayan Yadav, Head Dairy Technology Division
Dr. Subhashis Mandal, Head Dairy Economics Statistics & Management Division	Dr. Gopal Sankhla, Head, Dairy Extension Division
Dr. Shilpa Vij, Head, Dairy Microbiology Division	Dr. P. Barnwal, Head Dairy Engineering Division -
Dr. Jai Kaushik, Head, Animal Biotechnology Division	Dr. A. K. Samanta, Head Animal Nutrition Division -
Dr. Vikas Vohra, Head, Animal Genetics & Breeding Division	Dr. Pawan Singh, Head, Livestock Production & Management -
Dr. Arindham Dhali, Head, Southern Regional Station of NDRI, Bangalore	Dr. Santanu Banik, Head, Eastern Regional Station of NDRI, - Kalyani -
Dr. A.K. Dixit, Controller of Examination	Dr. Anurag Saxena, Incharge, Forage Research &

	Management Centre
Dr. Anjali Aggarwal, Academic Coordinator	Dr. B.S. Meena, Principal Scientist, Dairy extension
Dr. Suman Kapila, Principal Scientist, Animal Biochemistry Division	Dr. Gopal Gowane, Senior Scientist, Animal Genetics & Breeding Division
Ms. Ojal Singh, Master Topper	Ms. Sravani, PhD Topper

EXTENSION COUNCIL -

Chairman	Dr. Dheer Singh, Director & Vice Chancellor, ICAR-NDRI, Karnal
Members	
Dr. A. K. Singh, Joint Director (Academic), ICAR-National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana	Dr. Rajan Sharma, Joint Director (Research), ICAR-National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana
DDG (Agril. Extn.), ICAR, New Delhi or his nominee	Dr. S.S. Lathwal, PS, LPM Division, ICAR-National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana
Director General, Dept of Animal Husbandry & Dairying (Govt of Haryana) Pashudhan Bhawan, Sce-2, Panchkula or his nominee	Dr. S. Mondal, Head, DES&M Division, ICAR-National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana
Agriculture Commissioner, Govt. of India or his nominee	Dr. Pawan Singh, Head, LPM Division ICAR-National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana
Director (FI), Directorate of Extension, New Delhi	Dr. A. K. Mishra, PS, LPM Division ICAR-National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana
Dr. Vivek Sharma PS, Dairy Chemistry Division, ICAR-National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana	Dr. D. N. Yadav, Head, Dairy Technology Division, ICAR-National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana
Dr. J, K. Kaushik, Head, Animal Biotechnology Division, ICAR-National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana	Dr. Suneel Onteru, Head, Animal Biochemistry Division, ICAR-National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana
Dr. A. K. Dang, Head, Animal Physiology, ICAR- National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana	Dr. S. Banik, Head, ERS of ICAR-National Dairy Research Institute (ICAR-NDRI), Kalyani, Nadia, West Bengal
Member Secretary	
Dr. Gopal Sankhala, Head, Dairy Extension Division, ICAR-National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana	

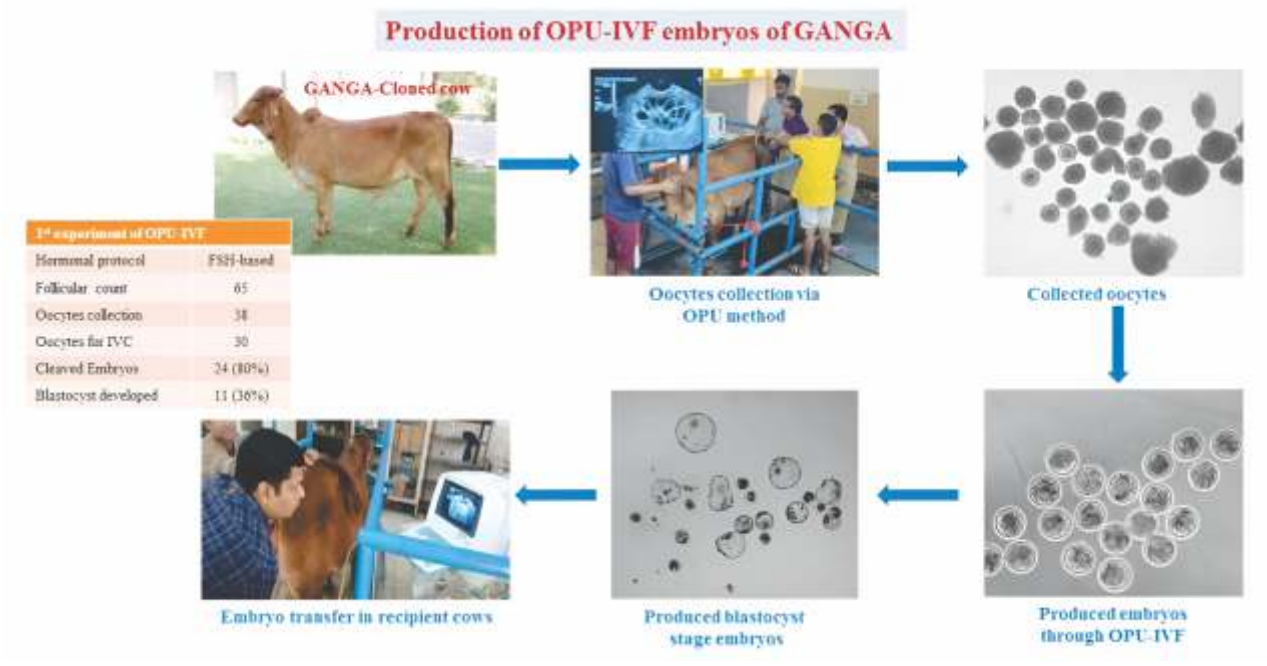
48th Board of Management Meeting on March 14, 2024

3. RESEARCH ACHIEVEMENTS

BIOTECHNOLOGICAL INTERVENTIONS FOR HIGHER PRODUCTIVITY

Utilization of cloned cattle 'GANGA' for *in-vitro* production of OPU-IVF embryos

Animal cloning, combined with reproductive biotechnologies like ovum pick-up and *in vitro* fertilization (OPU-IVF), accelerates the multiplication of superior genetic traits in bovines. 'GANGA,' India's first cloned cattle, produced in 2023 at NDRI, Karnal, was used to assess OPU-IVF feasibility. This study demonstrated the application of cloned donors for *in vitro* embryo production (IVEP). Immature oocytes were retrieved transvaginally following FSH administration. High-quality oocytes were matured *in vitro* using TCM-199 medium with FBS, FSH, and β-estradiol. After fertilization and culture, 50 oocytes yielded 12 blastocysts. Five high-quality blastocysts were transferred into synchronized recipients, while the rest were cryopreserved. Pregnancy diagnosis on day 30 post-embryo transfer confirmed one pregnancy, proving the effectiveness of cloning in IVEP. This study underscored the potential of integrating cloning and OPU-IVF to enhance reproductive efficiency in elite cattle. Further trials aim to establish more pregnancies, marking a major step in applying advanced biotechnologies to livestock breeding.

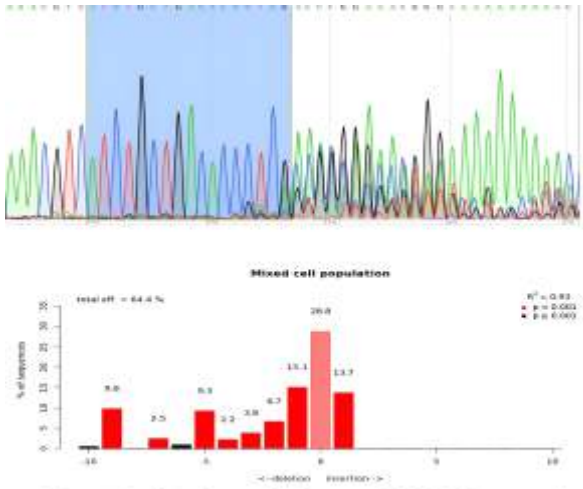


India's first cloned cow, Ganga, utilized in OPU-IVF embryo production

Establishment of NANOG-gene knock-out buffalo cells

NANOG is a reprogramming gene crucial for maintaining pluripotency in early embryonic development. To understand NANOG's role in buffalo embryonic development, CRISPR-Cas9

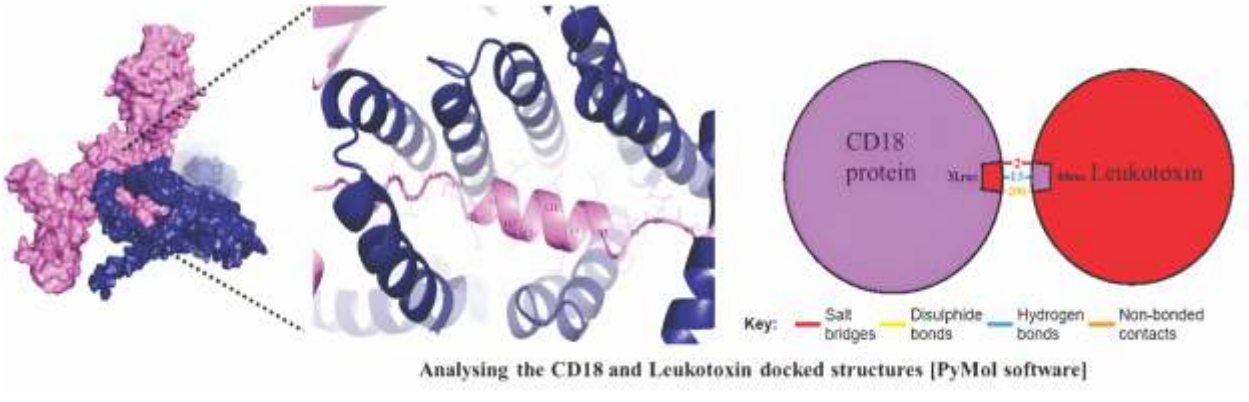
ribonucleoprotein (RNP) was employed to knockout this gene in buffalo fibroblast cells. Three sgRNAs were designed targeting exon 1 of NANOG. Following transfection, targeted regions were PCR-amplified and analyzed *via* Sanger sequencing. TIDE and ICE analyses revealed editing efficiencies of 64% and 61% respectively, with ICE showing a 51% knockout score. Seven single-cell clones were established and screened. Results demonstrated four clones with biallelic deletion and two with monoallelic deletion, confirming successful NANOG knockout. These knockout cells will facilitate future cloned embryo production to elucidate NANOG's functional contributions to buffalo embryonic development.



Pipeline for establishment of NANOG-gene edited buffalo cells. Chromatogram of transfected cells; TIDE analysis of transfected mix cells target gene analysis

In silico study of *Mannheimia haemolytica* leukotoxin and CD18 receptor affinity dynamics across different buffalo breeds

Mannheimia haemolytica, a Gram-negative bacterium, causes bovine respiratory disease (BRD) through its leukotoxin (Lkt A) interaction with CD18 protein on ruminant leukocytes. This computational study analyzed leukotoxin-CD18 interactions across buffalo breeds including Murrah, Mediterranean, African, Carabau, and Chinese buffalo using molecular docking. Results revealed varying binding affinities, with Mediterranean and Indian buffalo exhibiting highest binding capacity to Lkt A, followed by African, Chinese, and Carabau breeds. Critical residues in CD18 signal peptide (positions 3, 5, 7, 22, and 23) were identified as essential for strong leukotoxin binding. Findings suggested the signal peptide's vital role in CD18-leukotoxin interaction and its potential as a genome editing target for developing BRD-resistant buffalo breeds. This *in silico* analysis provided foundation for future genetic resistance research strategies agains BRD.

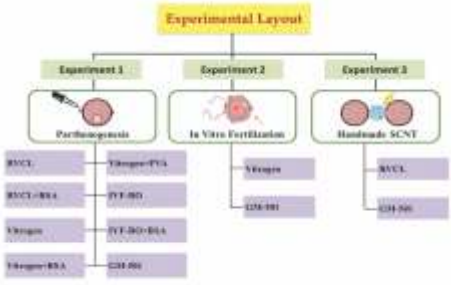


Binding of Mannheimia haemolytica Leukotoxin with buffalo CD18 receptor revealed by molecular docking

Evaluation of commercial single-step embryo culture media for *in vitro* production of parthenogenetic, *in vitro* fertilized, and cloned buffalo embryos

This study evaluated four commercial embryo culture media (Vitrogen, IVF-BO, GM-501, and RVCL) for supporting parthenogenetic, *in vitro* fertilized (IVF), and somatic cell nuclear transfer (SCNT) buffalo embryo development. For zona-free parthenogenetic embryos, all media supported similar early development, though Vitrogen caused dish surface adhesion. In IVF experiments, Vitrogen and GM-501 showed similar developmental rates, but Vitrogen produced blastocysts with higher total cell numbers (184.75 ± 7.94 cells) compared to GM-501 (159.25 ± 7.33 cells). For zona-free SCNT embryos, RVCL and GM-501 yielded comparable cleavage rates, blastocqyst rates, and cell numbers. Results indicate

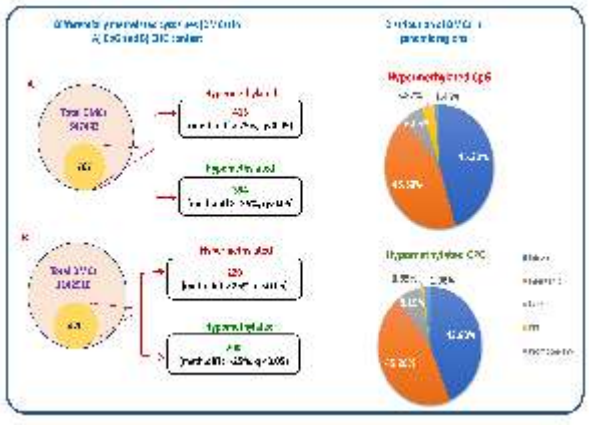
Vitrogen is optimal for IVF and zona-included embryo production, while GM-501 suits zona-free SCNT embryos. These findings indicated the path for selecting appropriate media based on specific embryo production types to achieve optimal reproductive outcomes in buffalo.



Experimental layout of the study, in which different media were used to produce buffalo embryos

Global DNA methylation profile of spermatozoa of cloned buffalo bulls

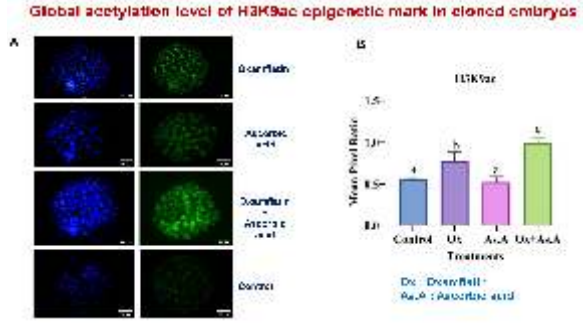
This study compared global DNA methylation patterns and fertility potential of spermatozoa from cloned bulls (MU-6708, MU-6923) versus their donor bulls (MU-5926, MU-4393). Computer-assisted sperm analysis revealed no significant differences in motility, velocity, or linearity between groups. DNA methylation analysis identified 347,442 differentially methylated cytosines in CpG and 1,142,510 in CHG contexts, with 767 DMCs detected in CpG regions (413 hypermethylated, 354 hypomethylated), primarily in intronic and intergenic regions. IVF rates were comparable, showing ~70.6% cleavage and ~14% blastocyst rates for both groups. Gene expression analysis of blastocysts revealed no significant differences in pluripotency, apoptosis, cell cycle, or epigenetic regulation. Results demonstrate that cloned bulls exhibit semen quality, DNA methylation patterns, and fertility potential similar to donors. Importantly, SCNT-induced methylation aberrations weren't inherited by cloned bull spermatozoa, suggesting minimal risk of epigenetic abnormalities transmission to progeny.



Differentially methylayted cytosines in spermatozoa

Epigenetic modifiers enhance the cloned embryo production rate and their quality

This study evaluated epigenetic modifiers-oxamflatin (histone deacetylase inhibitor) and ascorbic acid (DNA methyltransferase inhibitor)-on cloned embryo production using elite bull (MU-2565) donor cells via handmade cloning. Four treatment groups were tested: oxamflatin (1 µM), ascorbic acid (50 µM), combined treatment, and control. The combined treatment significantly improved embryo quality, increasing cleavage (92.1%) and blastocyst rates (46.3%), reducing apoptosis (2.03%), and enhancing global H3K9ac acetylation. RNA sequencing yielded high-quality data with 85-87% reads aligning to the *Bubalus bubalis* genome. Differential expression analysis revealed 10,500+ transcripts per treatment, with the combined treatment upregulating genes involved in placental development, apoptosis regulation, embryo implantation, and steroidogenesis. Key affected pathways included transcription factors, G-protein signaling, PI3K-Akt, and calcium signaling. Combining oxamflatin and ascorbic acid enhanced high-quality cloned buffalo embryo production, offering promising cloning efficiency improvements.

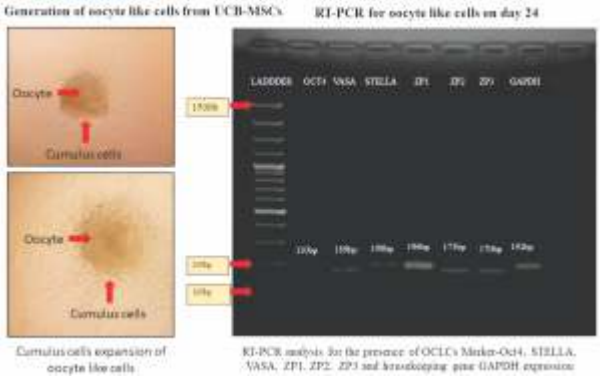


Global acetylation level of H3K9ac epigenetic mark in cloned embryos

Generation of oocyte-like cells from umbilical cord blood-mesenchymal stem cells in cattle

This research aimed to produce oocyte-like cells (OLCs) from umbilical cord blood-mesenchymal

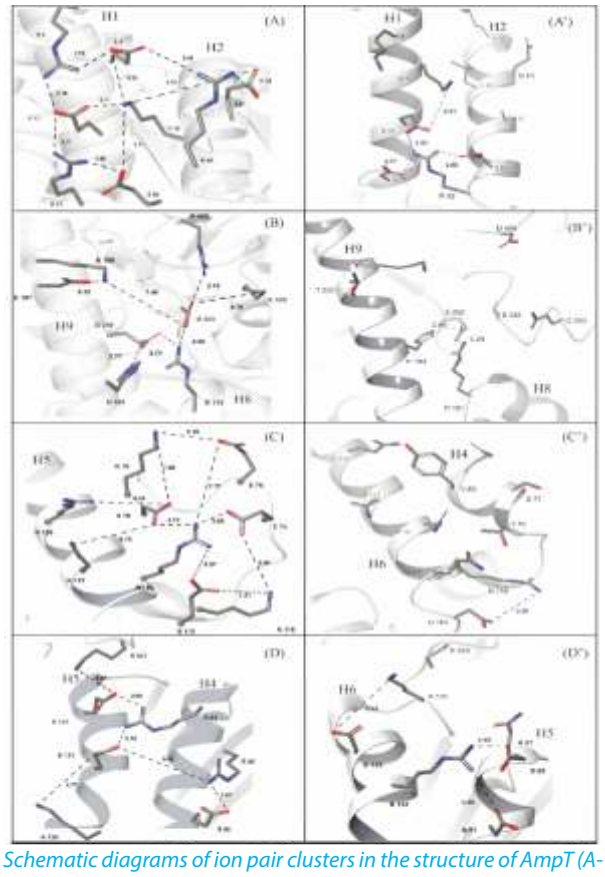
stem cells (UCB-MSCs). Umbilical cord blood was collected from calf umbilical cord, and an in-house protocol generated MSCs. Quality confirmation utilized RT-PCR, alkaline phosphatase assays, MSC-specific genes, immunostaining, and differentiation into osteocytes, chondrocytes, and adipocytes. Confirmed MSCs displayed spindle-shaped morphology, adherence, and expressed surface markers CD73, CD90, and CD105. MSCs were differentiated into primordial germ cell-like cells (PGCLCs) using specialized medium containing DMEM/F12, FBS, FSH, LH, β-estradiol, and antibiotics. PGCLCs were confirmed on day 14 via RT-PCR for Oct4, VASA, STELLA, and DAZL genes. OLCs were confirmed on day 24 through ZP2 immunostaining and RT-PCR for ZP1, ZP2, and ZP3 genes. Results demonstrated successful UCB-MSC differentiation into OLCs, showcasing untapped potential for dairy animal applications.



Generation of oocytes from umbilical cord blood-mesenchymal stem cells (UCG-MSCs) and characterization with molecular marker genes

Protein engineering to enhance stability of leucyl aminopeptidase (PepL) of *Lacticaeibacillus casei*

This research aimed to improve stability of PepL, an industrially relevant aminopeptidase from *Lacticaseibacillus casei*. Through comparative analysis utilizing thermophilic homolog (AmpT) and strategic protein engineering, more stable PepL variants were successfully developed. Engineered mutations demonstrated enhanced thermal stability with increased melting temperature (Tm) and activation energy of denaturation (Ea). Circular dichroism spectroscopy confirmed enhanced mutant stability. Molecular dynamics simulations revealed improvements stemmed from increased inter-residue interactions and reduced structural flexibility compared to wild-type enzyme. Protein refolding conditions were optimized using various stabilizers, with L-arginine, glycerol, and sucrose combination significantly improving refolding efficiency by preventing non-native aggregation. The optimized refolding protocols facilitate industrial enzyme production for biotechnological applications. These results indicated fundamental understanding of protein stability determinants while providing practical solutions for industrial enzyme applications.

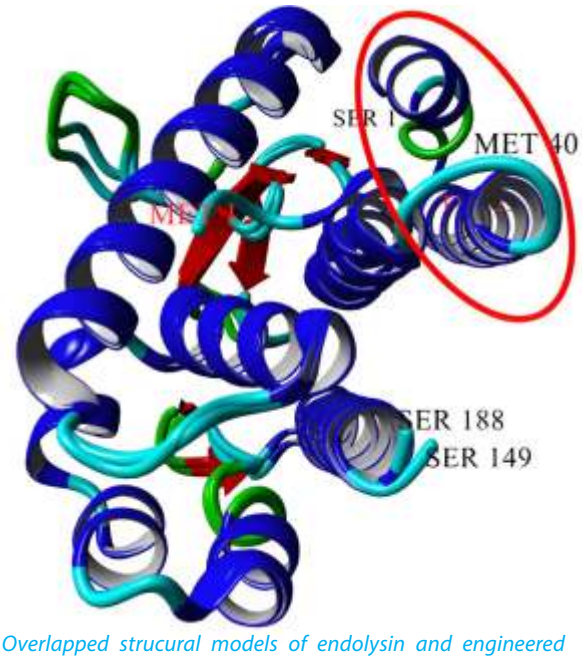


Schematic diagrams of ion pair clusters in the structure of AmpT (A-D) and PepL (A'-D'). The backbone chain has been represented as cartoon, the positively charged atoms are shown in blue and negative ones are in red. The line shown with dashes indicates the ionic interaction. The diagram highlights the difference in the abundance of charged residues and the network of interactions between the two structures. H1, H2…. indicate the helix number, while the numbers along the dash line indicate the ionic bond length in angstrom in the corresponding structures

Production of engineered phage endolysin for improved bactericidal activity against *Escherichia coli*

Our previous study successfully expressed phage endolysin in biologically active form. The wild-type endolysin showed low activity against various MDR isolates of *E. coli* and one reference ATCC strain. Low activity is a known problem for endolysins when acting externally on Gram-negative organisms due

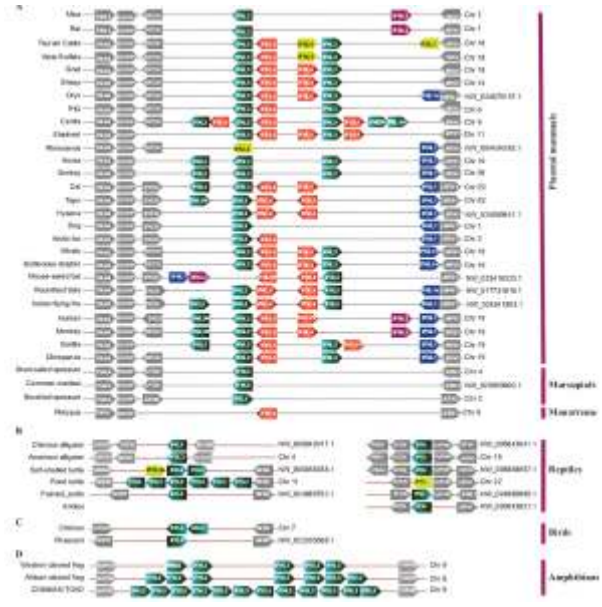
to the impervious outer membrane layer composed of LPS. Therefore, we engineered the endolysin to enhance its inherent bactericidal activity against *E. coli* when applied externally. Results showed that protein engineering enhanced endolysin activity by decreasing *E. coli* count by almost 4-5 log (CFU). However, it was observed that the engineered protein degraded over incubation at 4°C. Further protein engineering work to improve endolysin stability and activity is being carried out to produce a stable endolysin with high catalytic efficiency.



Overlapped strucural models of endolysin and engineered endolysin. A membrane permeabilizing peptide (shown in the ellipse) was tagged with the endolysin to create the engineered endolysin with improved antimicrobial activity

Interferon III genes analyzed in mammals

Ruminants exhibit expansion of innate immune genes, particularly interferons (IFNs), clustered in specific chromosomal locations. IFNs are classified into Type I, II, and III, with Type I and III driving innate immunity, Type II linking innate and adaptive immunity, and Type III acting as epithelial cell gatekeepers. Type I IFNs locate on chromosome 2 (sheep), 3 (buffalo), and 8 (cattle/goats). Type II IFNs are on chromosome 3 (sheep), 4 (buffalo), and 5 (cattle/goats). Type III IFN genes (IFNL1, IFNL3, IFNL4) are on chromosome 18 (cattle/buffalo/goats) and 14 (sheep). Cattle and buffalo possess two copies of IFN-λ3 and IFN-λ4. Gene duplication caused copy number variation, with cattle and buffalo having ~24 IFNW copies and 11 IFNB copies, unlike non-ruminants with single IFNB copy. In ruminants, IFN-λ1 is pseudogene and IFN-λ2 is absent, differing from humans and other livestock species.

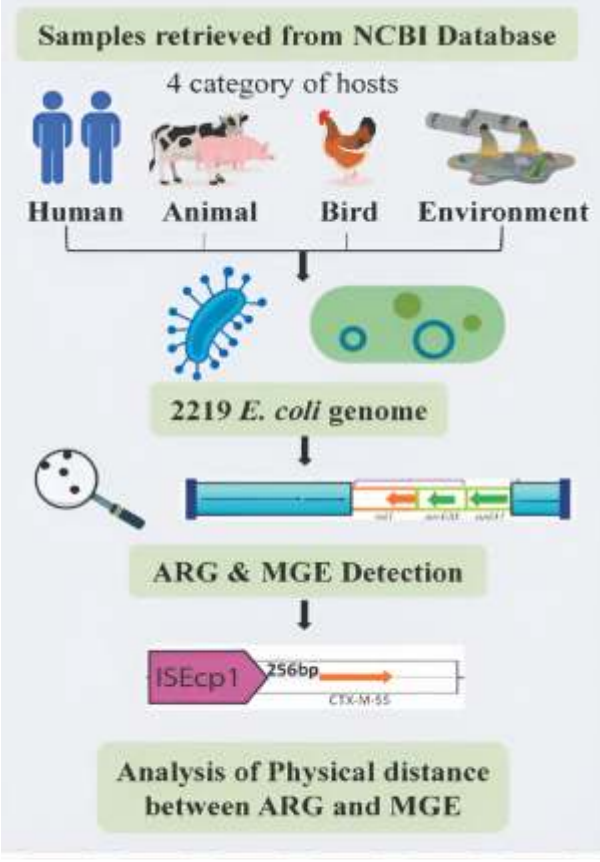


Synteny of type III IFN gene in tetrapod species. The transcription direction of the gene is shown by pointed arrows. The pseudogene is represented as Ψ and partial gene as P. The chromosome number of the respective species is presented at the right end of synteny and the common specie name on the left. This synteny does not include intron-less IFN-λ1 in mammal. (A) Synteny of IFN-λ in mammals (placental mammals, marsupials, and monotremes). (B) Synteny of IFN-λ in reptiles. (C) Synteny of IFN-λ in birds. (D) Synteny of IFN-λ in amphibians (please provide high resolution picture separately in jpg format)

Antimicrobial resistance genes and associated mobile genetic elements in *Escherichia coli* from human, animal and environment - an *in silico* investigation

The global rise of antimicrobial resistance (AMR) threatens human health, with environments facilitating antimicrobial resistance gene (ARG) transmission between humans and animals. Mobile genetic elements (MGEs), including plasmids, insertion sequences (ISs), and transposons, facilitate ARG dissemination. This study analyzed 2,199 *Escherichia coli* whole genome sequences from human, animal, bird, and environmental sources worldwide to assess ARG prevalence and genetic context. Highest ARG numbers were observed in UK and USA, primarily in human hosts, while IS-associated ARGs were most prevalent in birds. ARGs like *aph(6)-Id*, *aph(3)-Ib*, *blaCTX-M*, and *blaNDM* were widespread across hosts. *Tn2* was the most prevalent transposon, largely carried by IncFIB plasmids. IS26 and ISVsa3 carried diverse ARGs, mainly linked to aminoglycoside and β-lactam

resistance. Fixed IS-ARG associations were identified, with strong associations between *blaNDM* and *blaCTX-M* variants suggesting enhanced transmission potential. This study underscores MGEs' role in ARG dissemination and highlights need for predictive mitigation strategies.



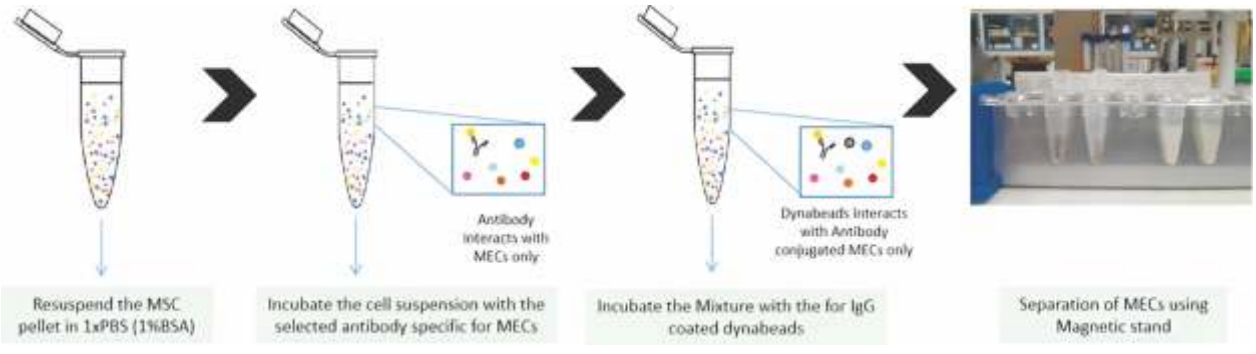
Flow chart of the antimicrobial resistance gene *(ARG) and* mobile genetic elements *MGE detected in E. coli from different sources*

Mammary epithelial cell enrichment using antibody-based approaches in milk samples from Sahiwal cattle

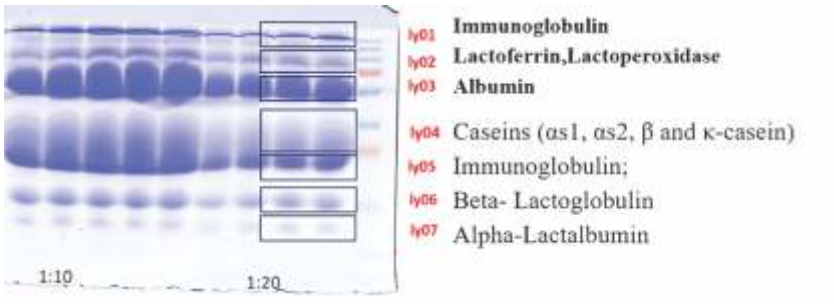
Milk samples from Sahiwal cattle were classified as high-yielding (15–16 L/milking) and low-yielding (<8 L/milking), collected during peak lactation (days 30–90). Animals were selected based on milk yield, parity, and health status. Somatic cell counts and milk composition analysis assessed overall quality. Mammary epithelial cells (MECs) were initially separated from milk somatic cells, followed by enrichment using various cytokeratin antibodies: Anti-Cytokeratin AE1/AE3, Cytokeratin 18, Cytokeratin Pan Type I/II Cocktail, Cytokeratin-8/18 Monoclonal (C-51), and Monoclonal Anti-Cytokeratin Peptide-18. Flow cytometry and fluorescence microscopy assessed antibody specificity. Cytokeratin-8/18 and anti-Cytokeratin Peptide-18 monoclonal antibodies were selected as most promising for MEC enrichment. Flow cytometry showed anti-Cytokeratin Peptide-18 interacted with 3.8-4% of cells, equivalent to mammary epithelial cell proportion. MECs enrichment using antibody-Dynabeads and fluorescence-activated cell sorting (FACS) is being further optimized.

Shotgun proteomics to annotate the major milk proteins in Ladakhi Yak

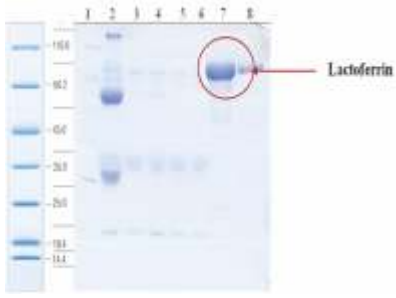
To identify the major milk proteins present in colostrum of Ladakhi yak, SDS-PAGE gel bands identification was done for 0-day colostrum using LC-MS/MS. Selecting 7 major bands on gel, LC-MS/MS analysis was performed after in-gel digestion using trypsin. Based on data analysis, lactoferrin, lactoperoxidase; albumin; caseins (αs_1, αs_2, β and κ-casein); immunoglobulin; β-lactoglobulin and α-lactalbumin were identified respectively on the basis of maximum number of spectra shared and molecular weight of those proteins having maximum spectral count in 0-day colostrum of Ladakhi yak.



Overview of the protocol for antibody based MEC enrichment using epithelial cell specific antibodies



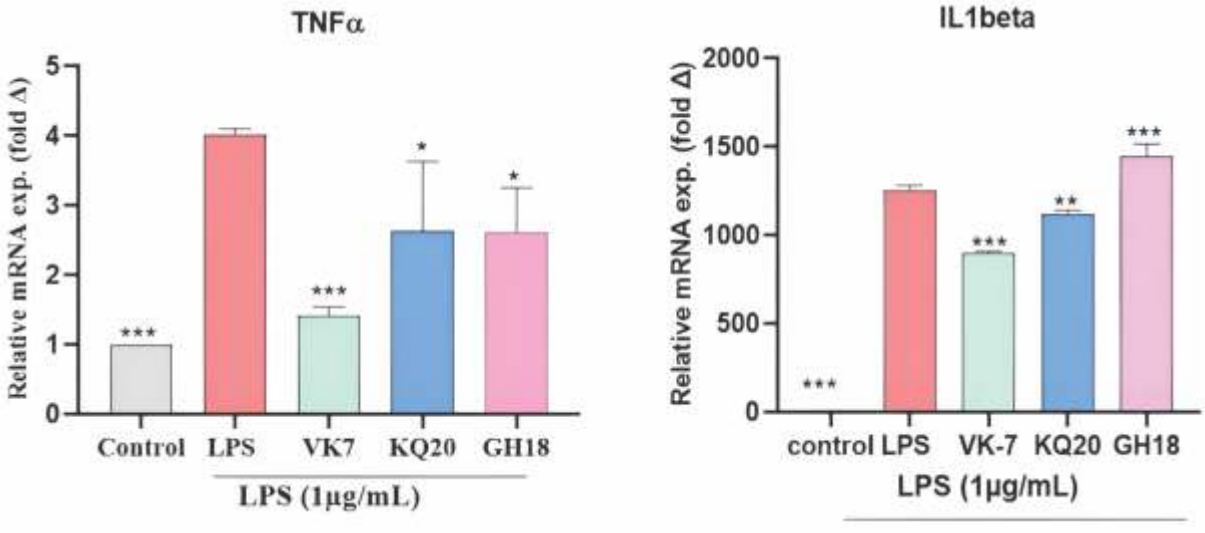
SDS-PAGE showing the 0-day colostrum protein of Ladakhi Yak, depicting the bands used for identification and profiling



Purified single band of protein from Ladakhi Yak colostrum was confirmed as lactoferrin by using LC-MS/MS

Yak colostrum-derived peptides demonstrated anti-inflammatory properties in ipopolysaccharide (LPS) induced RAW264.7 cells

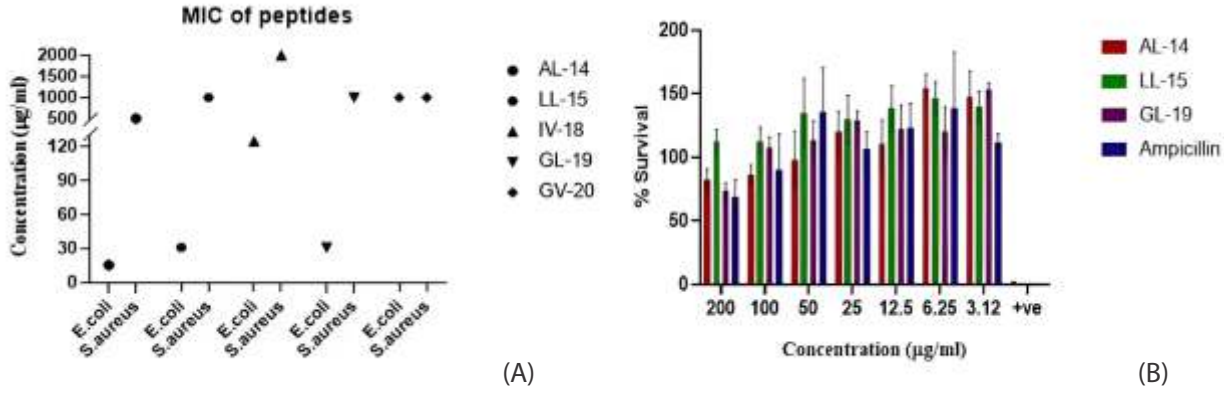
The low molecular weight endogenous peptides (EPs) were extracted from yak colostrum. Using bioinformatics tools, high scoring immunomodulatory peptides were predicted followd by their synthesis and evaluation for the immunomodulatory activity using *in vitro* cell line and biochemical assays. Cytotoxic effect of the synthesized sequences were determined on the RAW264.7 cell lines by MTT cell viability test. Anti-inflammatory potential of synthesized peptides was evaluated using LPS induced RAW264.7 cell lines and measuring the mRNA expression of inflammatory cytokines. Peptide VK-7 and KQ20 significantly mitigated the lipopolysaccharide (LPS) induced inflammation in the cell lines. Figure shows the anti-inflammatory activity of three synthesized peptides.



Transcipt level expression analysis of pro-inflammatory cytokines TNF-α and IL1β using qRT-PCR before and after peptides treatment

Antimicrobial activity of buffalo urine-derived synthetic antimicrobial peptides against disease causing bacterial pathogens

Potential antimicrobial peptides were synthesized after screening from the peptide profile obtained by MS. Minimum inhibitory concentration (MIC) of these peptides were checked against Gram-negative *Escherichia coli* and Gram-positive *Staphylococcus aureus* by following standard broth microdilution method. It was observed that peptides were effective against *E. coli* at a very low concentration, whereas MICs were comparatively higher for *S. aureus*. Peptides with lower MIC were checked for their safety on mammalian cells. Buffalo mammary epithelium cells (BuMEC) were treated with different concentration of peptides to analyse cell viability. Cytotoxicity assay was performed using MTT assay, more than 70% of the cells were found to be viable upon treatment with peptides. Peptide sequences were predicted to possess alpha helical structure.

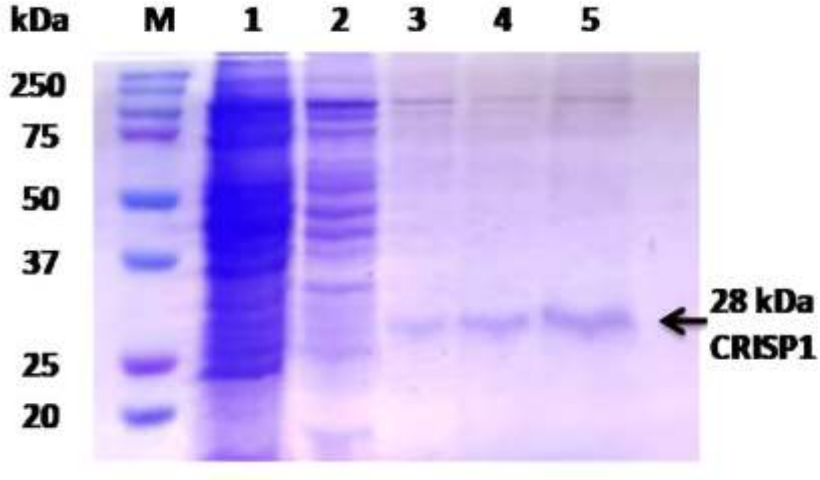


(A) (B)

Minimum inhibitory concentration (MIC) of peptides. The figure (A) indicates that MIC is lower for E. coli than that of S. aureus for all the AMPs except GV-20 for which MIC is equal for both gram positive and Gram-negative bacteria. Figure (B) shows Cytotoxicity assay of peptides on BuMEC. The AMPs are safe for use in the mammalian cells

Cloning of buffalo CRISP-1 gene into pHis-TEV vector and production of bioactive recombinant protein

The pET22b-CRISP1 plasmid that successfully expressed the recombinant protein previously, however failed to express the protein later on. Hence, cloning of the gene was carried out in to a different vector (pHis-TEV; BioBharti Life Sci); and the protein was successfully expressed by using *E. coli* BL21(DE3)-pLyss strain in inclusion bodies following overnight induction with 1 mM IPTG at 18 - 20 °C. The recombinant protein was then purified to almost homogeneity by optimizing protocol of Ni-NTA agarose chromatography. Slow dialysis of the protein in presence of proline, arginine, reduced and oxidized glutathione could successfully refold the protein in to soluble form which exhibited sperm-quiescent activity on buffalo sperm. The CRISP-1 protein at 20µg/mL could reduce sperm progressive motility by about 40% (67 vs. 40%) within 5 min of incubation.



SDS-PAGE analysis of Ni-NTA affinity chromatography purification of recombinant CRISP-1 protein. M: Protein mol weight marker, 1: unbound fraction; 2: 10 mM imidazole wash; 3, 4 & 5: 20, 40 and 80 mM imidazole elutes in 20mM Tris, 8M urea buffer (pH 8)

Effect of Zn and Se nanoparticles on *in-vitro* maturation and expression of IGF family, apoptosis and anti-oxidant related genes in buffalo oocytes

This study evaluated green synthesized zinc nanoparticles on in *vitro maturation* (IVM) and gene expression in buffalo oocytes. Zinc (Zn) nanoparticles were synthesized using *Bos indicus* urine and characterized via TEM, EDX, UV-VIS, XRD, and FTIR. Expression of BAX, BCl2, IGF-I, IGF-II, SOD1, and GPX4 genes was analyzed. The pure, spherical Zn nanoparticles (16 nm), used at 1 µg/ml, downregulated BAX while upregulating BCl2, IGF-I, IGF-II, SOD2, and GPX4, significantly improving oocyte maturation rates. These findings highlighted the potential of Zn nanoparticles in buffalo reproductive biotechnology.

GENETIC IMPROVEMENT OF DAIRY ANIMALS

Genetic improvement Program on Murrah Buffalo (NDRI herd)

The herd comprised 386 buffaloes including 208 breedable females and 54 breeding bulls, achieving 50.18% conception rate. Murrah buffaloes demonstrated strong performance with average age at first calving (AFC) of 43.97 months, service period 143.05 days, dry period 107.1 days, and calving interval 444.1 days. Mortality in 0-3 months was low at 8.25%. Average total lactation milk yield (TLMY) was 2,746.6 kg over 354 days, with standard lactation yield (SLMY) of 2,553.4 kg and peak yield of 13.8 kg. Milk composition included 8.31% fat, 10.13% SNF, 18.45% total solids, 3.56% protein, and 5.77% lactose. Breeding utilized elite bulls from 20th and 21st progeny testing program (PTP) sets. Ten elite buffaloes were identified through nominated mating, averaging 3,113.2 kg best lactation yield—21.92% above herd average. The herd produced 217,409.5 kg total milk and 23,740 frozen semen doses, supplying 8,750 doses to various centers.

Field Progeny Testing Program (Murrah Buffalo)

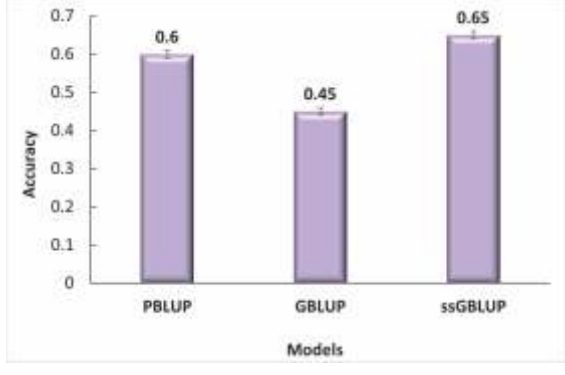
As many as six breeding Murrah bulls from the 20th set and 15 from the 21st set were used for AI. A total of 5,108 AIs were performed in Murrah buffaloes under field conditions, resulting in an overall conception rate of 46.38%. A total of 1,625 Murrah buffalo elite calves (943 males and 682 females) were born in farmers' herds. Performance data on milk recording of 108 daughters born to test bulls of NDRI were recorded for bull evaluation under field conditions. The number of daughters recorded during the period were 25.58% more compared to the previous year. FPT programmed efforts have led to 26,591 calvings, with 12,091 elite female buffalo calves born at farmers herd under the adopted villages of NDRI.

AICRP Indigenous Breed Programme (Sahiwal)

The female herd strength was 350 including 185 breedable females. The average age at first calving was (1261.5 ± 18.49 days), FLMY (1796.32 ± 86.29, 1922.16 ± 30.48 kg), first lactation total milk yield (1922.16 ± 30.48 kg), total Lactation milk yield (2393.24 ± 97.40 kg) peak yield (12.11 ± 0.43 kg) lactation length (253.74 ± 9.11 days) dry period (112.33 ± 12.35 days) and calving interval (392.22 ± 14.23days) and service period (123.41 ± 5.56 days) was observed with wet average (7.3 kg) and dry average (4.2 kg) in the year 2024. The overall conception rate was 48.66%. The highest peak yield recorded in this year was 21.5 kg in the herd. EPD % of the selected males was 5.89% and average of Dam's best Lactation Yield ranges from 3572 to 3710 kg. Based on progeny performance and 4 were declared as proven bulls. Based on EPA, a total of 31 out of 171 Sahiwal females were identified as elite cows. During the period (Jan-Dec, 2024), 12927doses of frozen semen from 10 bulls of Set-V were produced.

Optimization of genomic evaluation models for crossbred cattle in smallholder production systems

Genomic selection reduces generation intervals and improves prediction accuracy in dairy cattle breeding. However, implementation in smallholder systems faces challenges due to low genetic connectedness and management diversity. This study optimized genomic evaluation models and predicted genomic breeding values for crossbred cattle in South India's smallholder dairy system. Data included 305-day first lactation milk yield records from 17,650 crossbred cattle (1984–2021) and



Average estimated accuracy for genomic prediction of breeding values obtained by REML based models for 305-DMY in crossbred cattle

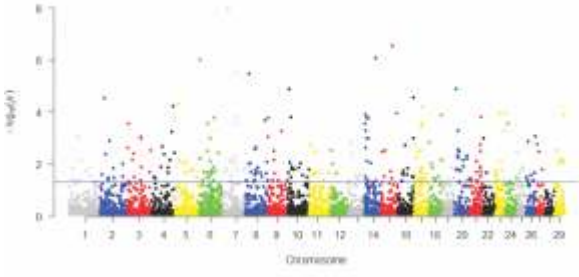
genotypes from 1,004 bulls and 1,568 cows. Non-genetic factors like geography, season, and age at first calving were significant variation sources. Least squares mean for milk yield was 2875 ± 123.54 kg. Variance components were estimated using REML, GREML, ssGREML, and Bayesian methods. Heritability estimates ranged from 0.25 ± 0.08 to 0.40 ± 0.03. Prediction accuracy was highest for ssGBLUP (0.65 ± 0.001) compared to PBLUP (0.60 ± 0.001) and GBLUP (0.45 ± 0.002). ssGBLUP provided more accurate, less biased genomic estimated breeding values, making it recommended for genomic evaluation in crossbred cattle under smallholder dairy systems.

Genetic selection for milk traits using genomic approach in Sahiwal cattle

The population structure and demographic parameters generated in Sahiwal cattle. For the whole and reference population, the ratio (fe/fa) of the effective number of founders (fe) and ancestors (fa) were 1.67 and 1.90, respectively. There was decline in the average generation interval from 8.2 years in whole pedigree to 6.6 years in reference population. The average relatedness and inbreeding coefficient were 5.92% and 2.69%, respectively, for the whole population and 6.98% and 3.85% for the reference cohort while 0.9% genomic inbreeding was found in the reference population. The average effective population size for the maximum, equivalent, complete generation/s and genomic based was 145.51, 50.36, 32.31 and 97, respectively. Half of genetic diversity in the herd was explained by nine ancestors, resulting in low effective population size. The population lost 4.4% genetic diversity and encountered bottleneck and genetic drift over time.

Unravelling the genomic diversity and identifying putative SNPs for milk quality and production in Belahi and HF crossbred population in Haryana state

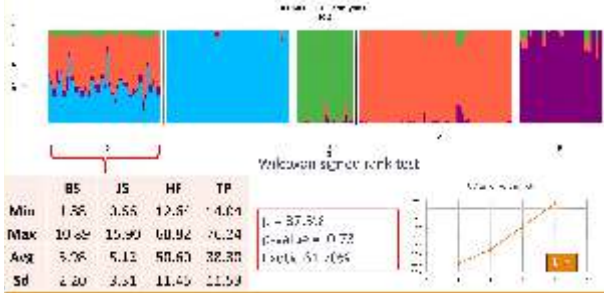
Indigenous cattle in India demonstrate resilience to diseases, parasites, and heat stress. Belahi, a newly registered breed from Shivalik foothills, was selected for adaptability to nomadic grazing, disease resistance, and milk production. This study identified selection signatures in Belahi cattle through genome-wide SNP analysis. Three intra-population statistics—Tajima's D, iHS, and nucleotide diversity—were combined into DCMS (De-correlated Composite of Multiple Signals), along with Runs of Homozygosity (ROH) analysis. Results identified 290 SNPs from DCMS and 8 overlapping ROH regions under selection. DCMS analysis revealed 822 protein-coding genes and 173 significant QTLs, while ROH analysis identified 339 genes and 392 QTLs, with 15 common genes. Hub genes like IL2, IL21 (immune response) and DNAJB13 (protein-folding chaperone) were associated with disease resistance and stress adaptation. QTL analysis highlighted associations with tick resistance, bovine respiratory disease, tuberculosis susceptibility, and pigmentation traits. These findings underscore Belahi's potential for conservation and improvement in disease resilience and environmental adaptability.



Manhattan plot of the genomic regions selected by DCMS method as being under putative selection. The blue line represents the significant threshold level at a FDR of 5% (q value < 0.05).

To elucidate the genomic architecture and breed composition of Karan Fries (KF) cattle using high density SNP array

This was the first genomic study on KF cattle, utilizing HD SNP genotype data. KF cattle was found to be stabilized through the population structure analysis. Global ancestry estimation and Admixture analysis of KF animals alongside parental breeds (HF, Jersey, Tharparkar) indicated a stabilized exotic (HF) and zebu (TP) genetic inheritance of 61.7% and 38.3%, respectively. Observed and expected heterozygosity estimates of KF cattle are moderate and similar in



Population structure of Karan Fries cattle *using admixture analysis*

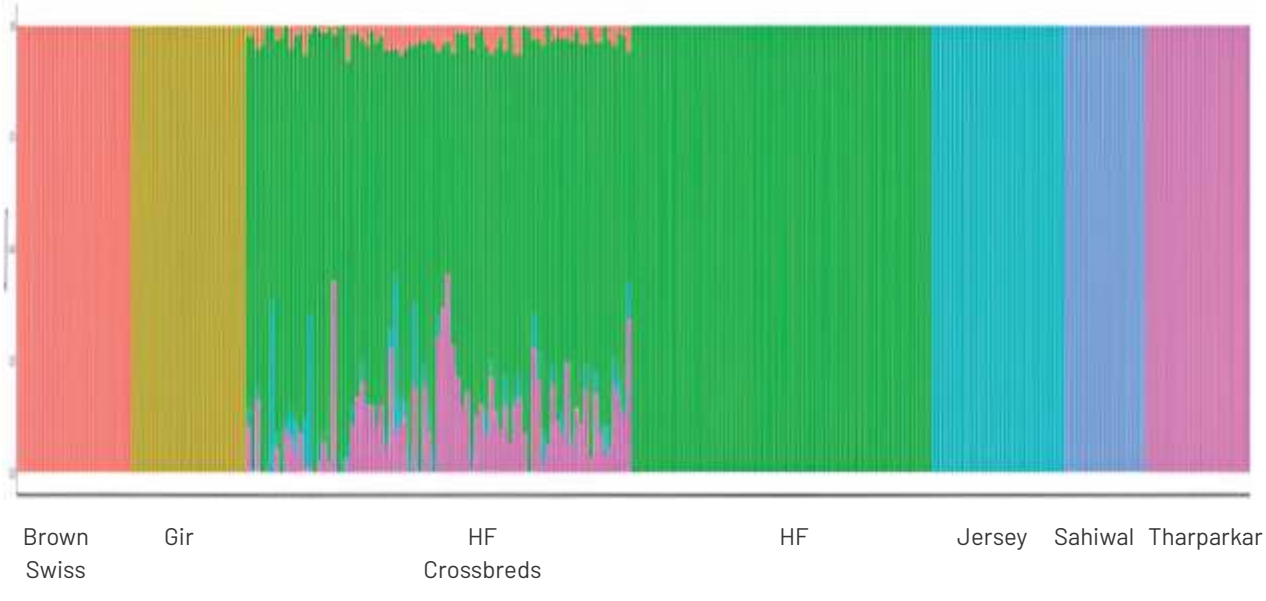
magnitude (H_o= 0.34±0.05; H_e = 0.36±0.06). Average LD between SNPs was r^2 = 0.13. LD decay (r^2 = 0.2) was observed at 40 kb inter-marker distance, in KF cattle. Pedigree-based N_e of KF was 78, whereas LD-based methods 219 (GONE), respectively. Overall, these genomic studies indicated that Karan Fries cattle have established a unique genetic identity as a distinct breed of cattle.

Exploring genetic diversity and population structure of field crossbred cattle using genome-wide SNP markers in Indian conditions

In India, crossbred cattle contribute over 30% of milk production despite comprising less than 26% of total cattle population. Recommended exotic inheritance in crossbreds is 50–62.5% for optimal performance, but indiscriminate crossbreeding often exceeds this. This study estimated diversity indices and breed composition using SNP markers from 81 crossbred animals in Haryana, genotyped with Illumina Bovine SNP 50K V3. Results showed observed and expected heterozygosity of 0.352, effective population size of 60, and linkage disequilibrium with $r^2 > 0.2$ between SNPs at 10–25 kb. Inbreeding coefficient (FGRM) was near zero, while FROH revealed ancient inbreeding. Genetic differentiation indicated closeness to Holstein Friesian (HF). Admixture analysis estimated HF inheritance at 52–99%, exceeding recommended levels. Findings highlighted significant genetic variability in crossbreds but demonstrate that exotic inheritance surpasses optimal ranges. This study indicated crucial insights into crossbred cattle genetic structure, supporting breeding programs for productive animals adapted to Indian conditions.

Mitochondrial DNA Variability and Its Correlation with Milk Production Traits in Indigenous Cattle Breeds

This study examined mtDNA's role in milk traits of Sahiwal, Gir, and Tharparkar cattle. Over 30 days, 101 cattle at ICAR-NDRI were classified into High, Medium, and Low ECM groups. mtDNA copy numbers varied: Sahiwal (0.672–820.30), Gir (0.54–46.90), Tharparkar (3.51–39.76). While no overall correlation existed between ECM and mtDNA, breed-specific trends emerged. Gir cattle showed positive correlations, while Tharparkar had positive correlations with fat/protein but negative with yield. These findings suggested mtDNA influences lactation differently by breed. Further mitochondrial genome sequencing is needed to understand genetic contributions to milk production in indigenous cattle.

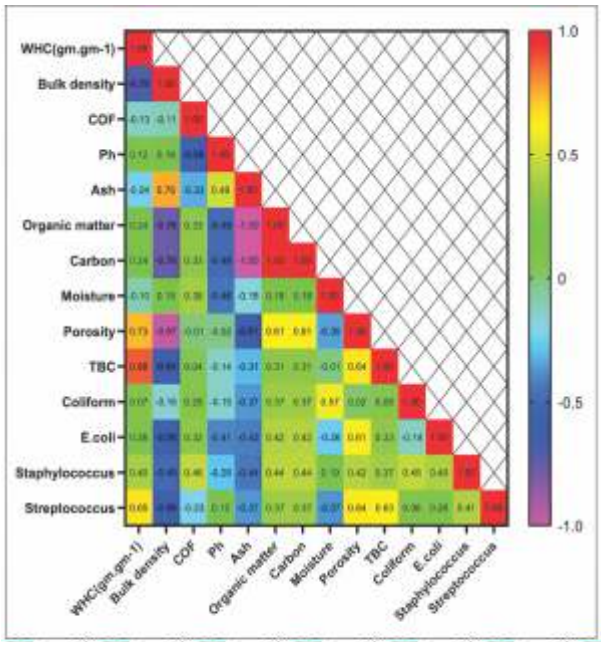


Clustering of Holstein Friesian Crossbreds along with the reference breeds

INNOVATIVE APPROACHES IN MANAGEMENT OF DAIRY ANIMALS

Transforming waste into resource: a comparative in-vitro analysis of recycled manure solids vs. conventional bedding materials

This study compared physicochemical and biological properties of recycled manure solids (RMS) with conventional bedding materials. RMS exhibited highest moisture content, while sawdust showed highest water-holding capacity and coefficient of friction. Ragi straw demonstrated highest porosity, and paddy husk had highest bulk density. Particle size analysis revealed 42% of RMS particles exceeded 1 mm. Sand showcased highest pH and ash content but lowest organic matter content. RMS exhibited highest total nitrogen, while sawdust recorded highest carbon content, C:N ratio, and organic matter. Paddy husk displayed lowest total bacterial, *Staphylococcus* spp., and *Streptococcus* spp. counts, while RMS registered highest counts for *E. coli*, *Staphylococcus* spp., and *Streptococcus* spp. Considering the elevated bacterial load in RMS, incorporating an appropriate conditioner is suggested to effectively manage this load.



Heatmap correlation matrix between various physico-chemical properties and bacterial load Nano Zn-Curcumin conjugate supplementation reduce udder inflammation and infections in subclinical mastitis affected dairy cows

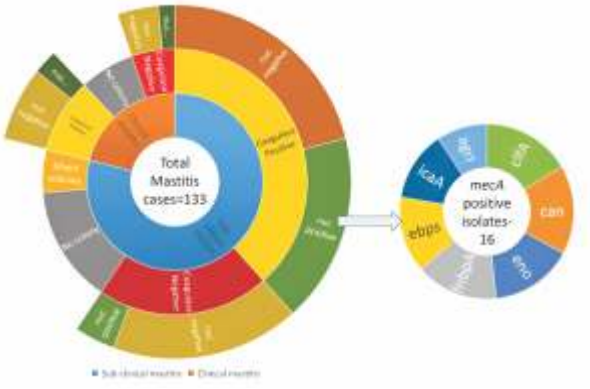
Extraction, phytochemical screening and functional evaluation of *Curcuma longa* rhizome, *Aloe vera* leaf and Ashwagandha roots alcoholic extracts and their bioactive compounds

Alcoholic extracts from *Curcuma longa* rhizome, *Aloe vera* leaf, and *Withania somnifera* roots confirmed alkaloids, phenols, flavonoids, saponins, terpenoids, tannins, and cardiac glycosides presence. HPTLC analysis validated curcumin in turmeric, aloin in *Aloe vera*, and *Withaferin A* in Ashwagandha. Turmeric exhibited significantly higher total phenol content (TPC) and total flavonoid content (TFC) compared to *Aloe vera* and Ashwagandha extracts. Curcumin had higher TPC and TFC than aloin, while withaferin A contained no detectable phenols or flavonoids. Bioactive compounds demonstrated higher TPC and TFC than crude extracts. *In vitro* evaluations revealed turmeric extract had highest antioxidant activity, with curcumin showing superior anti-inflammatory activity compared to aloin and withaferin A. Combined extracts demonstrated synergistic antioxidant and anti-inflammatory effects in vitro. However, intra-mammary infusion of bioactive compound formulations in cows with subclinical mastitis failed to reduce milk somatic cell count, California Mastitis Test (CMT) scores, or inflammation/ antioxidant-related gene expression.

Isolation and antibiogram characterization of methicillin-resistant *Staphylococcus aureus* in clinical and subclinical mastitis in Dairy Cows

Antibiogram characterization of Methicillin-Resistant *Staphylococcus aureus* in clinical and subclinical mastitis in dairy cows (n=133) in north Bengaluru's rural region revealed the infection caused by MRSA in 48.8% of the samples confirmed by *nuc* and *mecA* genes. The majority of MRSA cases (87.5%) were linked to subclinical mastitis, highlighting its asymptomatic prevalence. Molecular characterization identified virulence genes essential for adhesion and biofilm formation, including cna and clfA (100%), fnbpA (93.75%), and icaA (81.25%). The presence of these genes highlightsed MRSA's pathogenicity and its potential

for persistent infections. Antimicrobial susceptibility testing revealed high sensitivity to chloramphenicol (93.75%), trimethoprim-sulfamethoxazole (87.5%) and linezolid (87.5%), while resistance was notable against cefoxitin (75%) and penicillin (68.75%).



Graphical representation of prevalence of S. aureus in mastitis milk samples of Bengaluru's rural region

Development of methodology for the estimation of social hierarchy of buffaloes

A new methodology termed "Elimination method" was developed for estimating social hierarchy of lactating buffaloes based on provoking maximum agonistic interactions when exposed to limited resources. All lactating buffaloes (N=63) were exposed to limited manger space during concentrate mixture feeding, and their agonistic interactions were recorded (Opportunity I). Buffaloes participating in agonistic interactions were separated (eliminated) from the group, and remaining buffaloes were re-exposed to concentrate mixture at limited manger space (Opportunity II). Non-participating buffaloes were given Opportunity III. Socio-matric matrices of all agonistic interactions during Opportunities I, II, and III were prepared, and Dominance Values of each buffalo were calculated based on wins and losses during interactions using Beilharz and Mylrea (1963) methodology. Social order was established by arranging dominance values in descending order. Reliability was tested using Spearman's Rank correlation among dominance values after conducting five trials at weekly intervals. The Elimination method demonstrated high reliability (r=0.99) for determining buffalo social hierarchy. Based on dominance values, buffaloes were classified into five categories: dominant (>90; 12.6%), subdominant (56-90; 14.2%), subordinate (41-55; 31.7%), submissive (26-40; 31.7%), and marginal (0-25; 7.9%), revealing that most buffaloes fell into subordinate and submissive categories.

Agonistic interactions of buffaloes for the possession of feeding space at manger

Effect of physical enrichment on behaviour and performance of stall-fed Barbari goats

This study examined physical enrichment effects on behaviour and performance of pre- and post-partum Barbari goats and their kids under stall-fed conditions. Goats were divided into three groups: control (C), T1 (bedding enrichment), and T2 (bedding, grooming mat, hanging fodder, and climbing platform). Pre-partum, T1 and T2 goats showed lower standing durations, aggression, and restlessness, with increased lying and rumination ($p<0.05$). During parturition, no significant differences were observed. Post-partum, T1 and T2 goats spent more time caring for kids, whose standing and suckling latencies were shorter ($p<0.05$). T2 goats exhibited more feeding, grooming, and play behaviors while showing fewer abnormal behaviors. T2 had highest milk yield ($p<0.05$), with no differences in milk composition or body condition. T2 kids had higher weight gain and lower abnormal behavior frequencies ($p<0.05$). Plasma cortisol levels differed significantly ($p<0.05$).

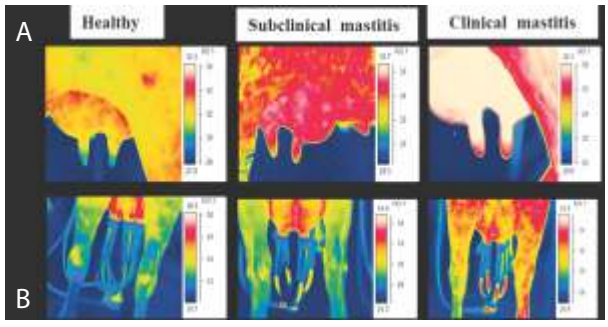
Physical enrichment improved comfort, behavior, milk production, and growth, making it beneficial for goat welfare and productivity under stall-fed conditions.

Automated individual identification of dairy animals using computer vision and deep learning approach

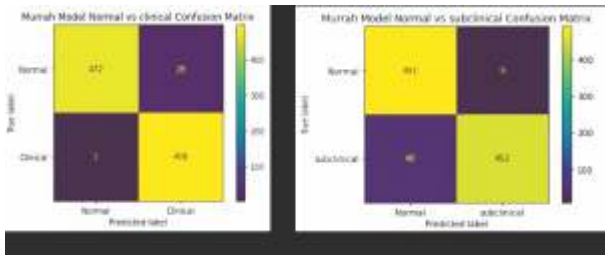
Quality muzzle images were collected from Sahiwal cows (n=349) to create a large database of 5235 images using mobile phones. Images were collected under natural conditions during daytime inside and outside sheds to create a robust dataset. After image acquisition, annotation was performed using 'label studio' software to mark muzzles in images. For detection and localization of muzzles, transfer learning-based YOLOv5 Model was used, with precision found maximum at confidence threshold of 0.68 during training. Model output was cropped muzzle images with known bounding box coordinates, which were used for a second model (ResNet50) for individual muzzle or cow ID identification. An android app interface was developed for mobile and computer use. The YOLO and ResNet50-based cow identification system achieved overall accuracy of 81.6%. This prototype demonstrated effective automated cow identification using muzzle pattern recognition technology for practical livestock management applications.

Early detection and prevention of mastitis in dairy animals using infrared thermography and advanced deep learning models

Mastitis is a major health challenge affecting dairy animals, impacting milk yield and quality. This study aimed to enhance early detection and prevention across diverse dairy species, including Sahiwal, Gir, HF crossbreds, Tharparkar cows, Murrah buffaloes, and crossbred goats. Seasonal thermographic assessments of 140–160 quarters per species revealed temperature variations linked to infection. A 30-day tracking experiment identified subclinical infections 8–10 days before clinical signs. Pre-milking, milking, and post-milking thermograms showed significant temperature shifts, aiding disease progression analysis. Short milking tube thermograms effectively assessed mastitis across seasons. Lower mastitis incidence was observed with best-fitting teat liners, highlighting the need for breed-specific designs to enhance machine milking efficiency. Sequential CNN models trained on thermographic data accurately distinguished healthy, subclinical, and clinical mastitis-affected udders, achieving 87–96% testing accuracy across species. This study underscored the potential of infrared thermography and AI as a non-invasive, high-accuracy diagnostic tool for mastitis detection.



Thermograms of (A) Udder and (B) Short-milking-tube of healthy quarters, subclinical and clinical mastitis-affected quarters in Murrah buffaloes



The Confusion matrix with four quadrants for different Sequential CNN models for clinical and sub-clinical mastitis prediction in Murrah buffaloes

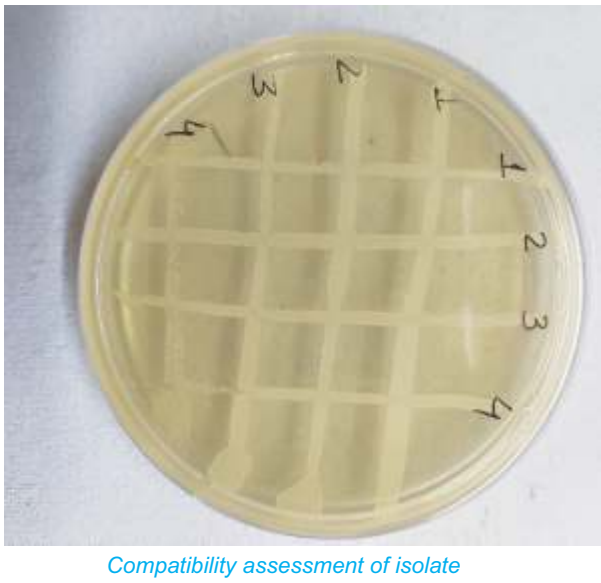
Livestock Production disease detection for early management

Infrared thermography may aid in detecting subclinical hypocalcemia (SCH) on the third day postpartum, though a larger sample size is needed for accurate prediction on the day of calving. SCH could not be reliably identified using activity parameters alone, highlighting the need for additional markers like rumination behavior. A negative correlation between ketosis and activity was observed, requiring further validation. Cows with metabolic disorders were more prone to reproductive tract diseases and delayed ovarian cyclicity but showed no impact on uterine involution. Activity meters effectively detected first postpartum estrus with 70% accuracy. The transition period in dairy cows poses metabolic and physiological challenges, predisposing them to

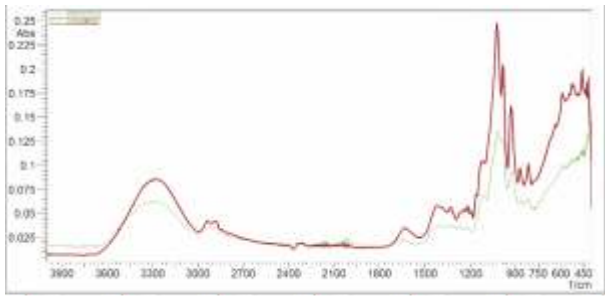
postpartum diseases and reduced reproductive efficiency. Sahiwal and Karan Fries cows supplemented with rumen-protected choline (RPC), negative DCAD, and dry cow therapy (DCT) had significantly lower incidences of postpartum diseases. Treated cows exhibited reduced NEFA and BHBA ($P<0.05$) and increased glucose, triglyceride, VLDL, calcium, and phosphorus levels. Milk somatic cell scores (SCS) were significantly lower ($P<0.05$). Reproductive metrics, including days to first service and services per conception, improved, while body weight and condition remained unchanged. This study indicated the efficacy of combined supplementation in enhancing health, productivity, and profitability in dairy farming.

Evaluation of synbiotic and postbiotic for controlling subclinical mastitis and enhancing milk quality in dairy cows

This study evaluated synbiotic and postbiotic formulations for managing subclinical mastitis and improving milk quality in dairy cows. Four probiotic strains: *Lactobacillus helveticus*, *Lactocaseibacillus rhamnosus*, *Weissella confusa*, and *Pediococcus acidilactici* were confirmed as pure and compatible. Inulin extracted from chicory root had 97.55% purity and was comparable to commercial inulin based on TLC and FT-IR analyses. A medium with 2% glucose and 1% inulin optimized microbial growth and acidification, finalizing the synbiotic formulation. The postbiotic formulation was characterized, identifying 109 metabolites including SCFAs, organic acids, and amino acids. A 21-day *in vivo* trial on indigenous cows with subclinical mastitis showed significant reduction in somatic cell count up to 62% in treated groups, with highest effect in the postbiotic group. However, milk yield, composition, and blood antioxidants remained unchanged. Metabolomics revealed shifts in milk profiles in treated groups. Both synbiotic and postbiotic formulations effectively controlled subclinical mastitis without adverse effects on milk quality or animal health.



Compatibility assessment of isolate


FTIR analysis graph of inulin extracted from chicory root powder

Umbilical cord blood-derived mesenchymal stem cells used as a regenerative medicine to cure severe hoof-wounds of dairy cows

Hoof wounds are serious problems in dairy animals, reducing milk production, fertility performance, and reproductive efficiency. This study investigated umbilical cord blood-derived mesenchymal stem cells (UCB-MSCs) as regenerative therapy for wound healing. UCB-MSCs were isolated aseptically during cow delivery at the Instutute, cultured in CO_2 incubator, and cryopreserved in liquid nitrogen. MSCs were characterized using molecular markers for adipocyte, chondrocyte, neurocyte, and osteocyte lineages. Allogeneic UCB-MSCs (5×10^6 cells) were administered via local injection near wounds and intravenous injection in 40 hoof-wounded dairy cows. All cows were cured within one


The UCB-derived Mesenchymal stem cells were injected and cured the severely wounded cow leg completely

month. Blood parameters showed significant improvements post-treatment: WBC increased from 6.88 to 7.9, RBC from 5.24 to 6.73, PLT from 333 to 586, and HGB from 5.45 to 8.03. Results demonstrated UCB-MSCs' potential for treating wounded hooves in dairy cows.

Exploring the dimensionality of genomic information for numerically small breeds in loose structured dairy cattle breeding system

Effective population size (Ne) and independent chromosome segments (Me) influence genomic prediction accuracy. Ne determines evolutionary potential, while Me represents inherited unbroken genomic segments. This study identified optimal Me estimation methods for small populations and assessed genomic relationship dimensionality in numerically small breeds. Simulations used Ne values of 25, 50, 100, 200, and 500, with real genotypic data from Belahi (n=98), Karan Fries (n=67), and Holstein Friesian crossbred (n=81). The common approximation Me = 4×Ne×L proved inaccurate for small sample sizes, as founder genomes equaled actual genotyped samples, limiting Me estimation. An alternative empirical approach using genomic relationship matrix (GRM) provided better Me estimation. A relationship Me = 12 + 2.37×Ne was established for populations with 30 chromosomes. Results showed numerically small breeds have reduced genomic dimensionality, challenging conventional Me estimation methods. These findings support refining Me estimation techniques for small cattle populations.

Performances of Deoni cattle under semi-intensive management system

This study analyzed 890 records of Deoni cows maintained at LRC, ICAR-NDRI, SRS from 2002–2023 to evaluate milk yield performance and genetic parameters. The least squares mean milk yield across parities was 736.76 ± 12.31 kg (first), 845.76 ± 16.72 kg (second), 826.29 ± 18.41 kg (third), and 868.08 ± 22.93 kg (fourth), showing progressive improvement in later lactations. Lactation length significantly influenced milk yield, particularly in the second parity. Genetic analysis estimated heritability (0.193) and repeatability (0.315) for milk yield. Breeding values were estimated using BLUP (Harvey, 1990), ranking bulls from 760.87 to 1232.32 and top-yielding cows from 1525.6 to 1664.10 kg. The top three cows had breeding values of 145.26, 135.17, and 133.84, respectively. The results suggested genetic merit and improved management enhance Deoni productivity. Culling based on first lactation is not recommended due to increasing yield across parities.

Milk cortisol as a dual-purpose biomarker for mammary health and environmental stress detection in indigenous dairy animals

This study established milk cortisol as a key biomarker for monitoring mammary health and environmental stress in indigenous dairy animals. Milk cortisol levels were estimated and correlated with somatic cell counts, acute phase proteins, and infrared thermography findings in cows, buffaloes, and goats. Milk cortisol levels increased significantly ($P<0.05$) in subclinical mastitis cases in cows and buffaloes, demonstrating its utility for mammary health assessment. Additionally, seasonal evaluation revealed that milk cortisol, along with Hsp90, responded significantly ($p<0.05$) to temperature-humidity index variations, establishing it as a reliable heat stress biomarker. Using combined infrared thermography of udder skin temperature and milk somatic cell count, subclinical mastitis diagnosis was achieved accurately. The study demonstrated that milk cortisol serves as a non-invasive, comprehensive biomarker for both mammary pathology and environmental stress, enabling development of predictive models and effective mitigation strategies for high-yielding dairy animals across different physiological and environmental challenges.

Effect of alpha lipoic acid supplementation on oxidative stress and productive performance of lactating cows during summer

Alpha Lipoic acid (ALA) supplementation lowered physiological responses and increased hemoglobin and PCV content in Sahiwal and Karan Fries cows during hot dry and hot humid seasons. Milk yield was significantly higher ($p<0.01$) in treatment group of KF cows during spring during first week of experiment and withdrawal period. Blood urea nitrogen and cortisol levels were higher ($p<0.05$) in control group throughout experimental period during heat stress in KF cows. Blood glucose and insulin levels remained lower in treatment group

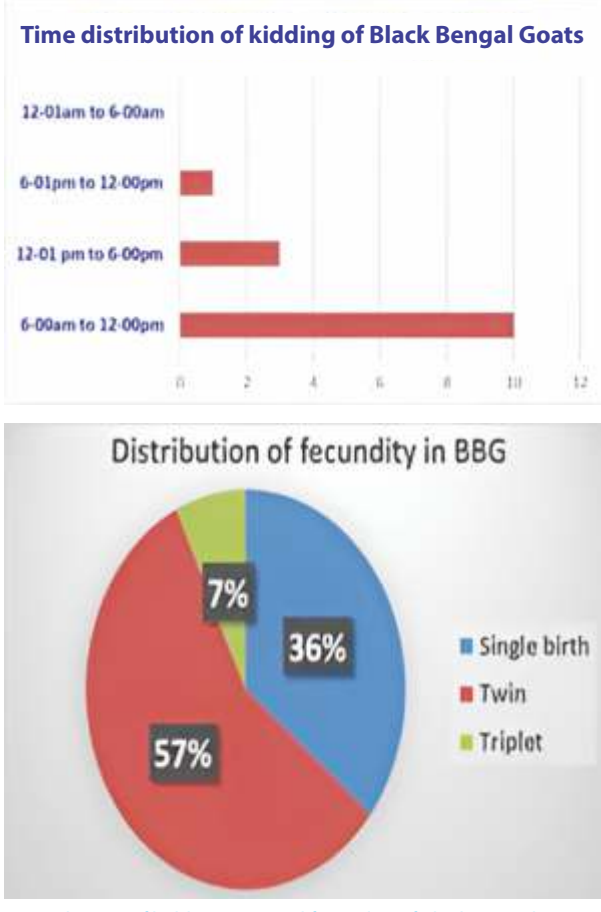
than control group in both breeds during different seasons. GSH levels were higher ($p<0.05$) in treatment groups of KF cows during spring season and in Sahiwal during hot dry season. The mRNA expression of heat shock protein genes (HSF-1, HSP-70, HSP-90, HSP-110) was significantly higher ($p<0.01$) in control group compared to treatment group in both breeds during both seasons. The mRNA expression of pro-inflammatory cytokines (IL-1B, IL-2, TNF-alpha) was higher ($p<0.01$) in control group of both breeds during hot dry season and in KF cows during hot humid season.

Impact of cumin and prill fat supplementation on growth performance and stress markers of crossbred female kids during different seasons

This study evaluated effects of cumin, prill fat, and their combination on physiological, biochemical, and growth parameters in crossbred goat kids across different seasons. Rectal temperature and respiration rate were significantly ($P<0.05$) lower in treatment groups than controls, with highest values during hot-humid season. Ear pinna and dorsal surface temperatures followed similar trends. Blood hemoglobin, packed cell volume, and plasma glucose levels were significantly ($P<0.05$) higher in treatment groups. Plasma cortisol levels were lower ($P<0.05$), while TSH and growth hormone levels were higher ($P<0.05$) in treated animals. Morphological traits including heart girth, body length, and wither height were significantly ($P<0.05$) improved in prill fat and combination groups. Average daily gain and dry matter intake were significantly ($P<0.05$) higher in treatment groups, though lowest during hot-humid season. While combination group showed highest weight gain, its cost-effectiveness was lower than individual supplementation. Overall, supplementation reduced stress markers and enhanced growth, with prill fat and cumin emerging as cost-effective strategies for improving goat productivity.

Kidding and placental characteristics of Black Bengal Goat

Black Bengal goats kidding behavior and placental characteristics were investigated. The maximum kidding occurrence was observed between 6-00am to 12 pm, followed by 12 pm to 6 pm. Night kidding percentage was very less. Average birth weight of kids was 1.26 kg. Male kids had 32% higher birth weight as compared to female kids. Mean weight of does at kidding was 20.4 kg. Male kids had 32% higher birth weight as compared to female kids. Mean weight of does at kidding was 20.4 kg. Mean duration of kidding was 159 minutes and expulsion of placenta time was 235.14 minutes. Mean weight of placenta was 404 g. The average number of cotyledons within the placenta was 66.42 with a range of 58 to 77. The mean length, breadth and depth of placental cotyledons were 18.24, 12.12 and 1.6 mm, respectively. There exist significant variations ($P<0.001$) in placental traits among the goats. Individual variation in placental attributes is one of the characteristics feature of placental morphology of Black Bengal goats.



Distribution of kidding time and fecundity of Black Bengal Goats

Facial Image-Based Biometric Recognition for Unique Animal Identification using Machine Learning (Artificial Intelligence)

The project focuses on developing a facial image-based biometric recognition system for unique identification of cattle using machine learning techniques. A total of 36 animals from different age

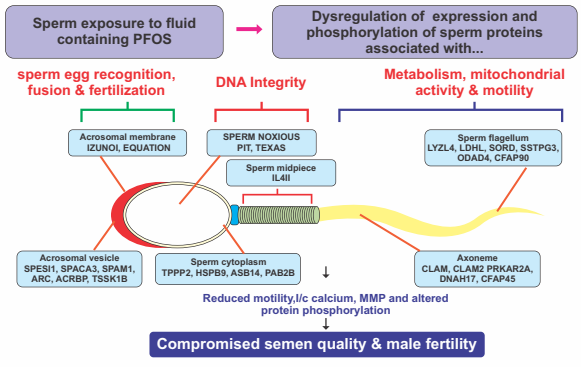
groups (ranging from below 1 month to over 2 years) were selected, and facial images were collected monthly using DSLR and mobile cameras. To ensure practical applicability, unrestricted facial images were captured, with at least 50 images per animal. A total of five image sets (approximately 18,000 images) were collected. In the initial phase, 4,500 images were cropped into four formats—original, with ear, only face, and frontal face—and divided into training (70%) and test (30%) datasets. These were processed using the HOG-SVM (Histogram of Oriented Gradients-Support Vector Machine) model for feature-based machine learning. The frontal face image yielded the highest identification accuracy at 99%. This perusal of the analysis confirms the feasibility of facial image-based biometric recognition for cattle. Ongoing analysis aims to determine the age at which facial features become stable for reliable identification.

Architecture of face-based identification system

ANIMAL REPRODUCTION AND FERTILITY -

Perfluoroalkyl and poly-fluoroalkyl substances induces alterations in phosphorylation of proteins and fertility-related functional attributes in spermatozoa

Perfluoroalkyl and poly-fluoroalkyl substances (PFAS) are emerging environmental risk factors for male infertility. This study investigated perfluorooctane sulfonate (PFOS) effects on sperm function, proteome, and phosphoproteome. Sperm were exposed to 10 µM (average exposure) and 100 µM (high exposure) PFOS, analyzing protein expression, phosphorylation, and fertility functions. Results showed 10 µM PFOS altered proteins linked to spermatogenesis and chromatin condensation, while 100 µM PFOS affected sperm motility and fertility-related proteins. Analysis identified 299 phosphopeptides from 116 proteins, with 45 showing differential phosphorylation between control and PFOS-treated groups. Dysregulated phosphorylation of capacitation, acrosome reaction, and fertilization-related proteins was observed. PRM1, ACRBP, TSSK1B, and CFAP45 were affected at both proteomic and phosphoproteomic levels. Flow cytometry confirmed dose-dependent reductions in sperm motility, viability, calcium levels, and membrane potential, along with increased mitochondrial ROS. This study suggested how PFOS exposure impairs sperm function by altering phosphorylation of key proteins, affecting fertility potential and providing insights for mitigating environmental infertility risks.



The alterations induced by perfluorooctane sulfonate *(PFOS) in sperm proteins, phosphoproteins and sperm functional parameters*

Lectin functionalised iron magnetic nanoparticle-based sperm selection: a potential technique to improve bull sperm quality

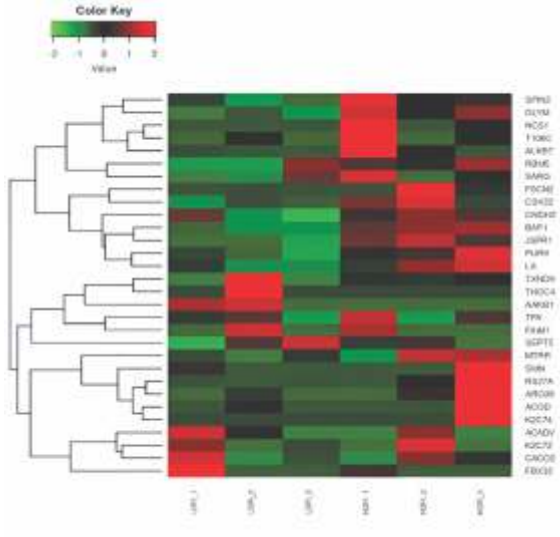
Premature acrosome reaction contributes to low fertility in cryopreserved semen. This study attempted to improve cryopreserved semen quality by selectively removing acrosome reacted spermatozoa using FITC-PNA conjugated iron magnetic nanoparticles (MNPs). Iron MNPs were prepared using co-precipitation method and dextran-coated MNPs were conjugated with FITC-PNA. Among different doses, 0.6 mg FITC-PNA conjugated iron MNPs significantly ($p<0.05$) removed higher acrosomal reacted spermatozoa. Cryopreserved Holstein Friesian bull semen was thawed, washed using Sperm-TALP, and washed spermatozoa (2×10^6) were exposed to 0.6mg FITC-PNA conjugated iron MNPs for 10 minutes at 37°C. Flow cytometric assessment revealed nano purification significantly ($p<0.05$) improved sperm quality. The proportion of viable non-apoptotic spermatozoa with intact acrosome and low intracellular calcium levels were significantly

A) Control semen B) Supernatant fraction of semen (nano purified) showing very few acrosomes reacted spermatozoa C) Particle fraction showing higher proportion of acrosome reacted spermatozoa bound to nanoparticles. FITC-PNA +PI fluorescent stains were used to assess the acrosome reaction status of spermatozoa

($p<0.05$) enriched in nano purified semen. Nano purification did not affect sperm mitochondrial membrane potential and ROS production. FITC-PNA coated iron magnetic nanoparticles effectively removed acrosome reacted spermatozoa and significantly improved sperm functional attributes.

Sperm proteomic landscape is altered in breeding bulls with greater sperm DNA fragmentation index

Although sperm DNA damage is associated with infertility, molecular details of how damaged sperm DNA affects fertility remain unclear. This study aimed to identify sperm proteomic alterations in bulls with high sperm DNA Fragmentation Index (DFI%). Holstein-Frisian crossbred breeding bull semen underwent Sperm Chromatin Structure Assay. Based on DFI%, bulls were classified into high-DFI (HDFI) or low-DFI (LDFI) groups for high throughput proteomic analysis. Liquid chromatography and mass spectrometry identified 4567 total proteins in bull spermatozoa. Results showed 2660 proteins common to both groups, while 1193 and 714 proteins were unique to HDFI and LDFI groups, respectively. In HDFI group, 265 proteins were up-regulated and 262 down-regulated. Proteins involved in capacitation (heparin binding, ERK1/ERK2 cascade, PI3K-Akt signaling, Jak-STAT signaling), spermatogenesis (TLR signaling, gamete generation), and DNA repair mechanisms were significantly altered in bulls with high DFI%, providing insights into molecular mechanisms underlying sperm DNA damage and fertility.



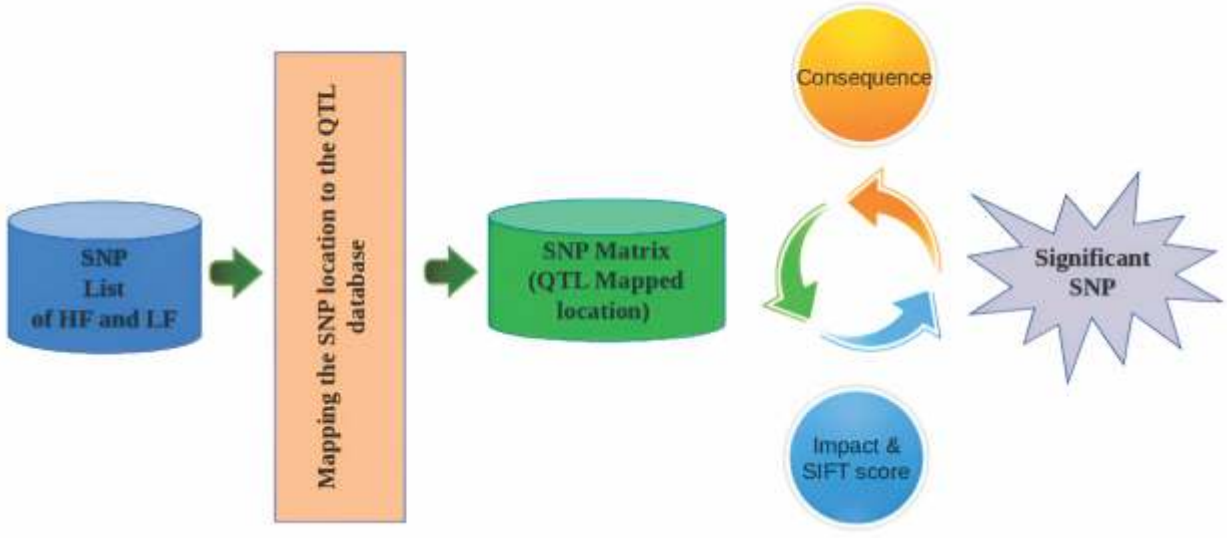
Heat map analysis of top 30 differentially expressed sperm proteins between HDFI- and LDFI- bulls

Effect of different concentrations of hydrogen peroxide on indigenous bull sperm motility

Spermatozoa are susceptible to oxidative stress due to varying polyunsaturated fatty acids (PUFAs) levels in plasma membrane, affecting sperm functions essential for fertilization. Hydrogen peroxide (H_2O_2), produced by dead or immature spermatozoa, is a major oxidative stress cause. This study induced oxidative stress in Deoni bull spermatozoa using different H_2O_2 concentrations (10 µM, 25 µM, and 50 µM) at various time intervals (0, 30, and 60 minutes). Sperm motility was assessed at 30 and 60 minutes. At 30 minutes, control group sperm motility was 60.8 ± 1.3%, while 25 µM and 50 µM concentrations significantly decreased motility to 45.8 ± 1.5% and 27.7 ± 2.2%, respectively. After 60 minutes incubation with 25 µM and 50 µM, spermatozoa exhibited motility percentages of 26.5 ± 1.9% and 14.0 ± 1.1%, respectively. Results demonstrated that sperm motility decreased significantly ($P<0.01$) with greater H_2O_2 concentrations and longer incubation times, confirming oxidative stress's detrimental effects.

Crossbred bull fertility prediction using a transcriptome based SNP methodology

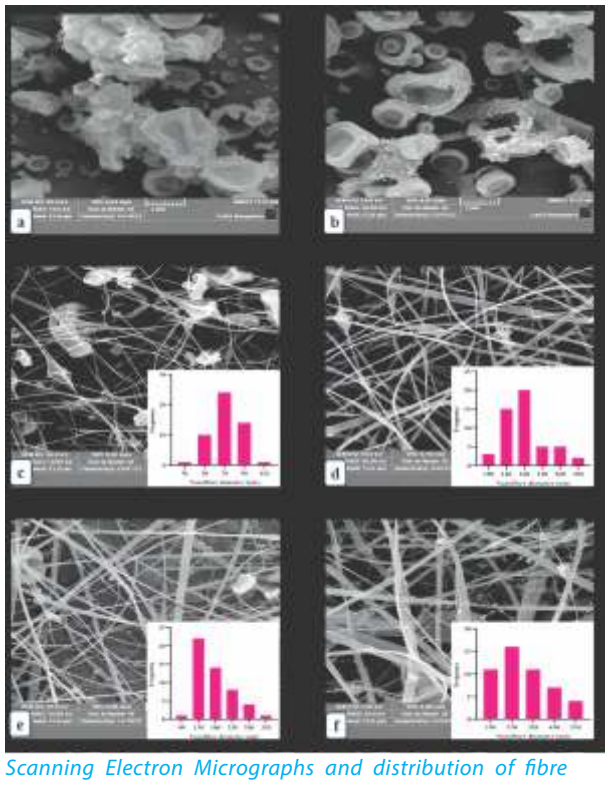
High-throughput data sequencing generates extensive datasets from studies focusing on epigenetics, genomic variations, genome-wide associations, and differential gene expression related to bull fertility, though effective prediction remains challenging. This study examined RNA-Seq variations, particularly coding region alterations, mapping them to fertility-related genes and proximity regions. Transcriptome analysis was conducted on sperm samples from 12 bulls, with six exhibiting high fertility and six showing low fertility based on conception rates. Bioinformatics tools aligned data, identified genetic variants, and subsequently mapped them to known fertility quantitative trait loci (QTL). After filtering for fertility-specific single nucleotide polymorphisms (SNPs) with missense mutations, six significant biomarkers were identified. This demonstrates the efficacy of this innovative approach for screening genetic variants, ultimately leading to successful identification of fertility markers within bovine spermatozoa for improved breeding programs.



Methodology for screening through a vast array of SNPs and pinpointing the ones that hold significance to bull fertility

Development and characterization of progesterone-loaded nanofiber for controlled breeding in dairy cattle

Progesterone plays a crucial role in pregnancy regulation and fertility, but its hydrophobic nature and need for prolonged therapy limit therapeutic potential. This study explored polymeric nanofibers as drug carriers to enhance progesterone delivery. Biodegradable polymers, cellulose acetate (CA) and polycaprolactone (PCL), were used at different concentrations for progesterone encapsulation. Drug entrapment efficiency (DEE) and loading capacity were significantly influenced ($p<0.05$) by polymer concentration, with CA-based nanofibers demonstrating higher DEE than PCL-based nanofibers. However, PCL nanofibers showed better cell viability than blank PCL fibers. Progesterone release was significantly prolonged ($p<0.05$) in nanofiber formulations compared to free progesterone, ensuring sustained drug release profiles. Cell viability assays in BHK cell lines indicated no significant differences between polymer concentrations, but nanofiber concentration influenced viability ($p=0.07$). Optimized CA and PCL nanofibers effectively prolonged progesterone release without adversely affecting cell viability. Further *in vivo* studies in cattle are necessary to develop cost-effective, controlled drug-release intravaginal sponges as alternatives to CIDR 1.38 g for estrus induction.



Scanning Electron Micrographs and distribution of fibre diameter of cellulose acetate nanofibers with and without progesterone. Images from a to f showing nanofibre formation with different per cent of CA and P_4.

Letrozole: a non-steroidal aromatase inhibitor on ovarian function and controlled breeding in cattle and buffaloes

This study found dominant and preovulatory follicles were significantly larger ($p<0.05$) in the Letrozole treatment group compared to control groups (BVS and BVS+P+G). On day 7, preovulatory follicles measured 14.65 ± 0.62 mm in Letrozole group versus 11.18 ± 0.98 mm and 8.97±1.22 mm in

BVS and BVS+P+G groups, respectively, possibly due to enhanced sensitivity to gonadotrophic hormones. Corpus luteum diameter was significantly larger ($p<0.05$) in Letrozole group from day 7-19 post-ovulation, with maximum diameter of 2.30 ± 0.13 cm on day 13 compared to ~1.9 cm in controls. Ovulation rates were 100% (6/6) for Letrozole versus 50% (3/6) and 66.66% (4/6) for control groups. Conception rates were 50% (3/6) for Letrozole compared to 16.66% (1/6) and 33.33% (2/6) for controls. Letrozole-impregnated sponges caused estradiol decline during treatment followed by preovulatory rise on days 7-8, maintaining normal progesterone levels. Preliminary HF crossbred observations showed similar pregnancy rates between Letrozole and CIDR treatments.

Effect of Letrozole on follicular growth and application intra vaginal sponges for in vivo trials in HF crossbred cows maintained at LRC, SRS-ICAR-NDRI

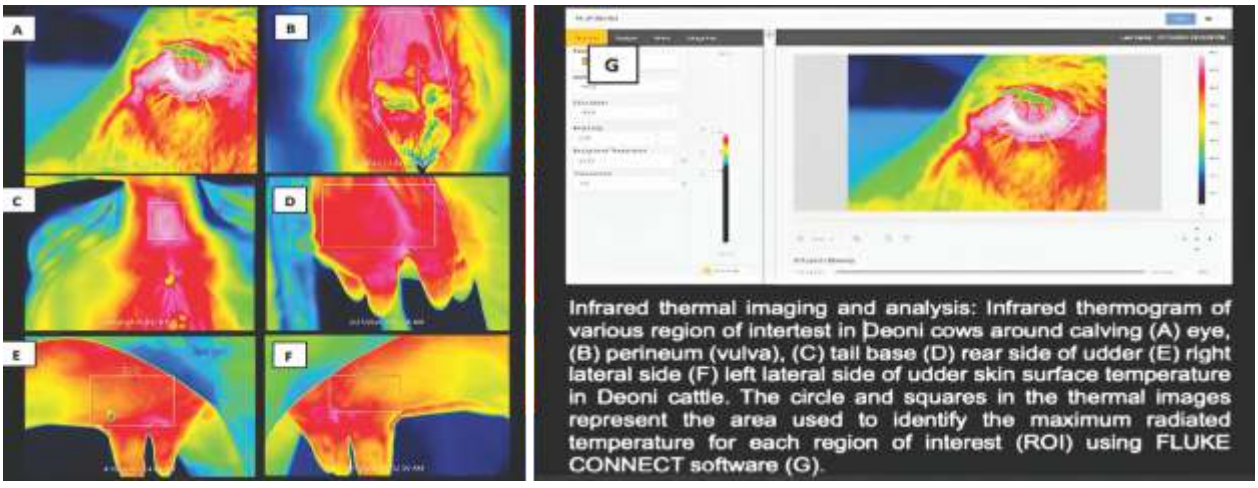
Production disease detection for early management

Infrared thermography may aid in detecting subclinical hypocalcemia (SCH) on the third day postpartum, though a larger sample size is needed for accurate prediction on the day of calving. SCH could not be reliably identified using activity parameters alone, highlighting the need for additional markers like rumination behavior. A negative correlation between ketosis and activity was observed, requiring further validation. Cows with metabolic disorders were more prone to reproductive tract diseases and delayed ovarian cyclicity but showed no impact on uterine involution. Activity meters effectively detected first postpartum estrus with 70% accuracy. The transition period in dairy cows poses metabolic and physiological challenges, predisposing them to postpartum diseases and reduced reproductive efficiency. Sahiwal and Karan Fries cows supplemented with rumen-protected choline (RPC), negative DCAD, and dry cow therapy (DCT) had significantly lower incidences of postpartum diseases. Treated cows exhibited reduced NEFA and BHBA ($P<0.05$) and increased glucose, triglyceride, VLDL, calcium, and phosphorus levels. Milk somatic cell scores (SCS) were significantly lower ($P<0.05$). Reproductive metrics, including days to first service and services per conception, improved, while body weight and condition remained unchanged. This study highlighted the efficacy of combined supplementation in enhancing health, productivity, and profitability in dairy farming.

Thermal signatures as a potential non-invasive indicator of onset of calving process in cattle

Calving is a key performance indicator for sustainable and profitable dairy herd maintenance. Predicting calving onset facilitates timely management, reducing risks and enhancing calf survival and herd profitability. Infrared Thermography (IRT) represents a potential non-invasive technique for monitoring temperature changes associated with the calving process in cattle. This study aimed to determine infrared thermographic profiles of select regions associated with calving in Deoni and HF crossbred cattle and investigate thermal indicators' potential for calving prediction. Results established infrared temperature profiles of eye, perineal region, tail base, and udder skin surface associated with calving process. Ventral tail-base, vulval skin, and most importantly udder skin surface temperature could serve as potential non-invasive indicators for calving

prediction within 6-12 h prior to actual calving in both HF crossbred and Deoni (*Bos indicus*) cows, providing valuable tools for improved postpartum health management of both dam and neonate.



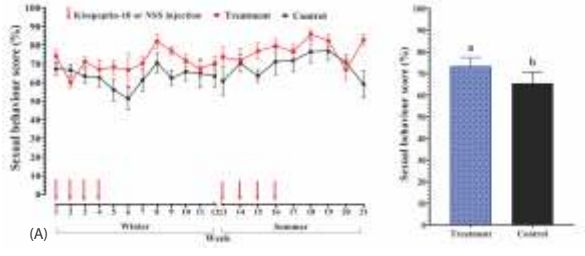
Infrared thermal images of various regions of interest associated with calving process in cattle

Bovine specific Kisspeptin-10 improved the sperm quality parameters in Black Bengal buck semen during refrigeration upto 48h and post-cryopreservation

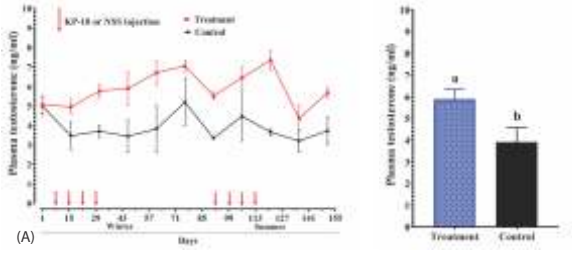
This study investigated kisspeptin-10 (KP-10) supplementation's impact on buck semen preservation at refrigeration (4°C) and ultra-low temperature (-196°C). Semen samples were collected using AV method, pooled, and diluted with Tris extender. Extended semen was divided into five aliquots with varying KP-10 concentrations: 0 (control), 5 (T1), 10 (T2), 20 (T3), and 40 µM (T4). Samples were evaluated at refrigerated temperatures (0, 6, 24, and 48 hours) and after freeze-thawing for progressive motility, viability, functional membrane integrity, acrosome integrity, and MDA levels. Results showed KP-10 supplementation, particularly at 20 µM, significantly improved (P<0.05) all sperm quality parameters and reduced lipid peroxidation levels at both storage temperatures. The study concluded that 20µM KP-10 supplementation in buck semen extender enhances sperm quality and reduces ROS production, proving beneficial for maintaining sperm quality even after post-cryopreservation.

Exogenous Kisspeptin: potent regulator of libido and sexual behaviour in black bengal buck

This study explored exogenous kisspeptin effects on sexual behavior in Black Bengal bucks. Twelve adult breeding bucks were divided into treatment (n=6) and control (n=6) groups. Treatment group received KP-10 @2.5 µg/kg body weight intravenously, while controls received equal volume NSS for four consecutive weeks during winter and summer seasons to determine seasonal variation in libido and sexual behavior during semen collection. Exogenous KP-10 significantly lowered (p<0.05) reaction time in treatment group (31.35 ± 3.88 sec) compared to control group (36.12 ± 5.08 sec). Sexual aggression, tactile stimulation, libido, mating ability, and sexual behavior scores were significantly higher (p<0.05) in treatment group than controls during both seasons. KP-10 injection significantly increased (p<0.05) plasma testosterone concentrations (5.88 ±



Effect of exogenous KP-10 on sexual behavior score during treatment, post-treatment peiod in winter & summer season (A)and entire experimental period (B) in Black Bengal Buck

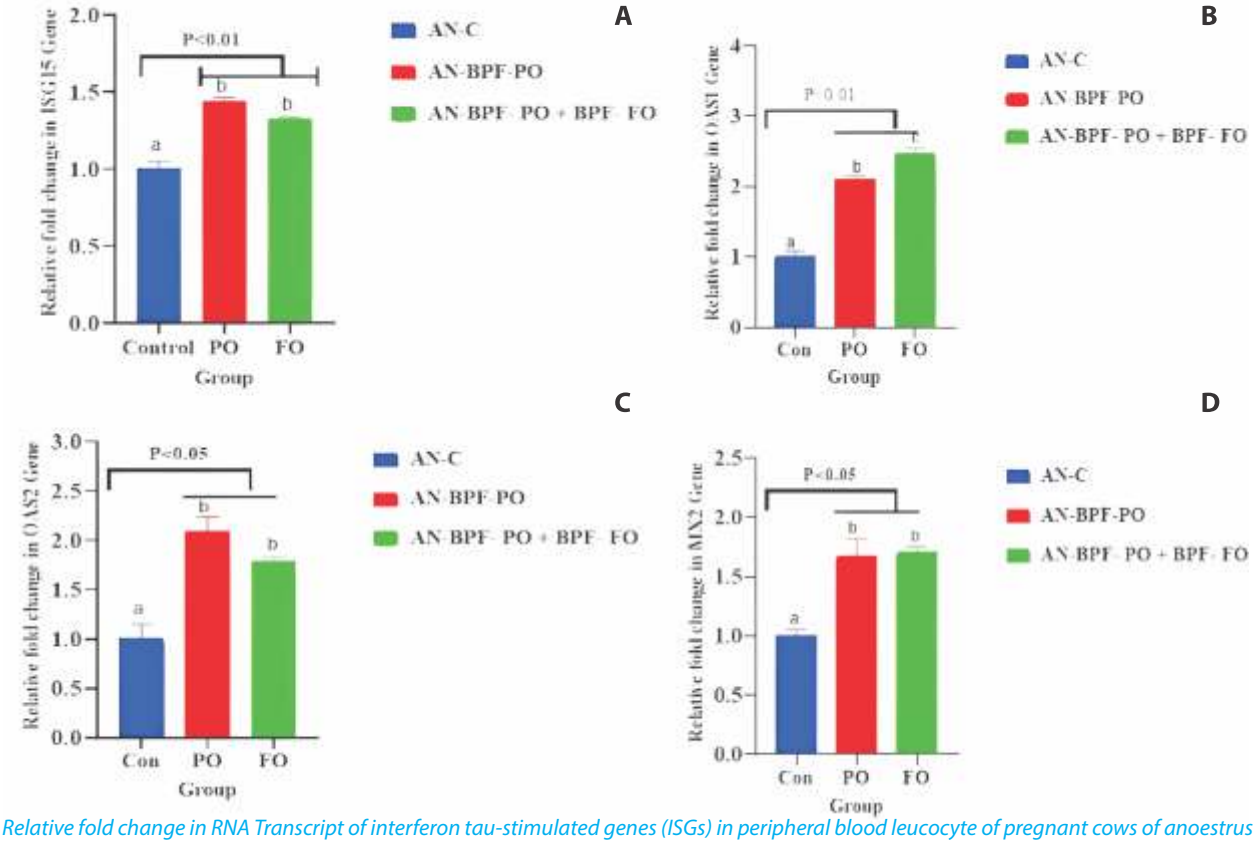


Effect of exogenous KP-10 on plasma testosterone concentration during treatment, post-treatment peiod in winter & summer season (A), and entire experimental period (B) in Black Bengal Buck

0.45 ng/ml vs 3.91 ± 0.67 ng/ml) in treated animals. Results indicated exogenous kisspeptin controls libido and sexual behavior in male bucks through modulating endogenous testosterone levels.

Reproductive management in dairy cows: bypass fat supplementation in reproductive advancement of anoestrus dairy cows

Negative energy balance during early lactation causes reproductive failure in cows. This study investigated palm and fish oil-based bypass fat supplementation effects on reproductive performance in 24 anoestrus cows divided into three groups: Control (C), Bypass Fat of Palm Oil (BPF-PO), and Bypass Fat of Palm and Fish Oil (BPF-PO + FO). Control cows were fed per farm practices, BPF-PO received palm oil-based bypass fat (100g + 10g/kg milk), while BPF-PO + FO received additional fish oil-based bypass fat (300g twice weekly) for 90 days. BPF-PO + FO group showed significantly ($P<0.05$) shorter time to cyclicity than Control and BPF-PO groups. Pregnancy rates were 37.50%, 75.00%, and 75.00% in Control, BPF-PO, and BPF-PO + FO groups, respectively, with conception rates of 27.27%, 54.55%, and 54.55%. NEFA levels were significantly lower in BPF-PO group. Gene expression analysis showed significant upregulation of ISG15, OAS1, OAS2, and MX2 transcripts in pregnant cows, highlighting reproductive benefits of bypass fat supplementation.



Relative fold change in RNA Transcript of interferon tau-stimulated genes (ISGs) in peripheral blood leucocyte of pregnant cows of anoestrus group. A. ISG15, B. OAS1, C. OAS2 D. MX2

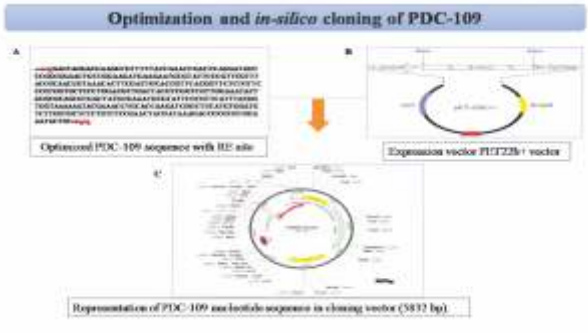
Exploring molecular basis of seasonal variation of seminal attributes and identification of potential biomarkers for selection of buffalo bulls with quality semen

Semen samples of 26 buffalo bulls were analyzed for initial semen quality parameters viz-ejaculate volume, sperm concentration, mass activity, individual sperm motility, viability, acrosome integrity etc. Based on the semen quality changes across the seasons, hot-summer was observed to be having most pronounced impact on semen quality in buffalo bulls, mainly affecting the HOST, acrosomal integrity and viability of sperm cells. Based on the changes in semen quality during different seasons, the bulls were categorized as seasonally affected (SA) and not-affected (SNA) groups, reflected in their % ROS and % apoptosis of sperm cells also. Serum samples collected during hot-humid season showed lower ($P<0.05$) value for

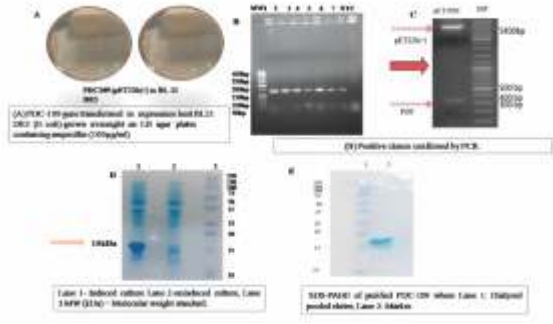
triglycerides (mg/dl), cholesterol (mg/dl), High density lipoprotein (mg/dl) and low density lipoprotein (mg/dl) followed by hot-dry and winter seasons. Sperm cells fatty acid profiling revealed higher number and better concentration during spring and hot-humid seasons compared to hot-dry and winter seasons.

Development of sandwich ELISA for quantification of PDC-109 protein in seminal plasma of bulls as a negative marker of fertility

PDC109 is an important seminal plasma protein regulating various sperm functions including motility, oviductal reservoir formation, cholesterol efflux, capacitation, and acrosome reaction. However, its high concentration significantly compromises sperm functions, making it a negative marker of bull fertility. Threshold concentrations at which PDC109 shows negative effects on semen quality across different breeds remained unknown. Therefore, recombinant PDC-109 protein was produced using gene cloning and expression methods. Subsequently, rPDC-109 was used for raising hyperimmune sera in rabbits and mice. A sandwich ELISA format was developed for quantifying PDC-109 in semen samples of Sahiwal and KF breeds, with semen quality parameters analyzed and correlated with PDC-109 concentrations. PDC-109 concentrations in seminal plasma differed significantly between poor and good freezable quality in both Sahiwal (9.01 ± 0.98; 6.24 ± 0.74 mg/ml) and KF (9.84 ± 1.28; 3.05 ± 0.22 mg/ml) bulls. Ejaculate quality can be differentiated as poor or good based on PDC-109 concentration with 91% and 97% accuracy in Sahiwal and KF bulls, respectively.



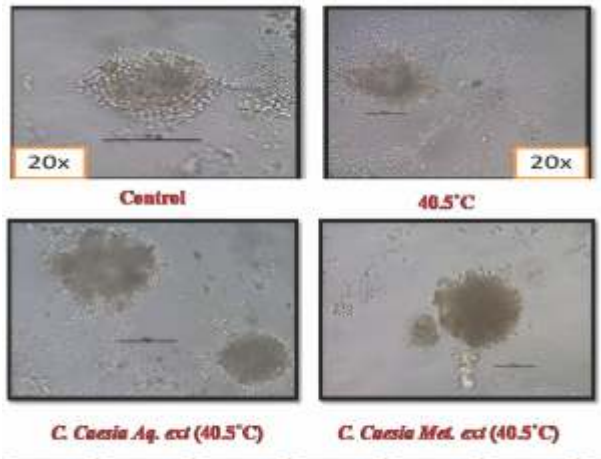
In silico cloning of PDC 109



Transformation of PDC109 gene construct and expression of PDC-109 in E. coli (BL-21 DE3) expression system

Effect of *Curcuma caesia* rhizome extract on buffalo granulosa cell functions in control and heat stress condition using 3-D granulosa cell culture model

This study investigated *Curcuma caesia* plant extract effects on heat stress-induced dysfunction in buffalo granulosa cells (GCs). Heat stress during low-breeding summer season impairs GCs, leading to poor follicular development and reproductive inefficiency. A 3D GCs culture model was developed using hanging drop method with cells isolated from small follicles (2-4 mm) of buffalo ovaries. GCs were seeded at 2-4×10^5 cells/mL in DMEM/Ham's F-12 medium and treated with aqueous (0.78 mg/mL) and methanolic (0.195 mg/mL) extracts of *Curcuma caesia*, then subjected to heat stress (40.5°C, 72 h). Heat stress reduced GC proliferation and function, decreasing PCNA, FSHR, CYP19, and RUNX expression while increasing HSP70 and BAX stress markers. *Curcuma caesia* treatment improved GC phenotype, maintaining spheroid integrity and compactness. Pre-treatment significantly ($p<0.05$) upregulated beneficial markers, reduced stress

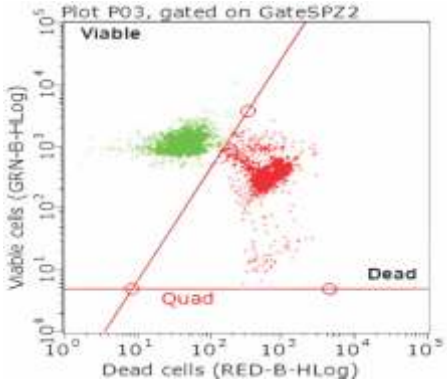


Effect of Curcuma caesia on growth of Granulosa cells cultured under control and heat stress conditions using a 3D-Granulosa cell culture model

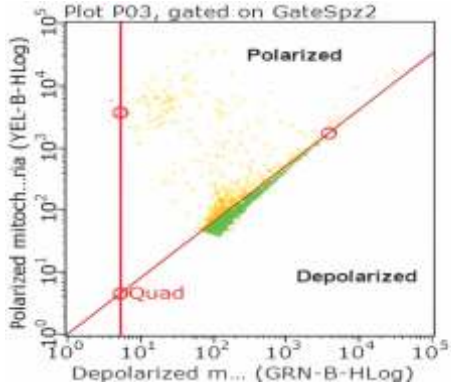
indicators, and enhanced SOD2 antioxidant activity. Findings suggested *Curcuma caesia* extract which could ameliorate heat stress effects, offering potential therapeutic strategy to enhance ovarian function in buffaloes during heat-stressed conditions.

Effect of quercetin supplementation in semen extender to curtail oxidative stress and augment post thaw sperm quality of Black Bengal goat

Cryopreservation of goat semen faces challenges, particularly oxidative damage, due to limited ejaculate volume and high sperm concentration. This study evaluated quercetin (QUE) as an antioxidant supplement in cryopreserving Black Bengal buck semen. Semen from six bucks (36 ejaculates) was collected and supplemented with varying QUE concentrations. The effects on oxidative-antioxidant status, sperm functionality, apoptosis, and CatSper channel gene expression were analyzed. Pro-apoptotic genes (BAD, BAX) showed altered expression, while anti-apoptotic genes (BCl2, BCl2L1) were significantly upregulated in the treatment group. Caspase 3, 8, 9, and 10 expression differed significantly between groups. FAS and FASL gene expression also varied notably. CatSper 1, 2, 3, and 4 genes were significantly upregulated in the treatment group, indicating improved calcium regulation. QUE supplementation enhanced sperm function, mitigated oxidative damage, and improved antioxidant status in Black Bengal buck semen. The modulation of apoptotic and CatSper genes showed its potential role in improving semen preservation outcomes.



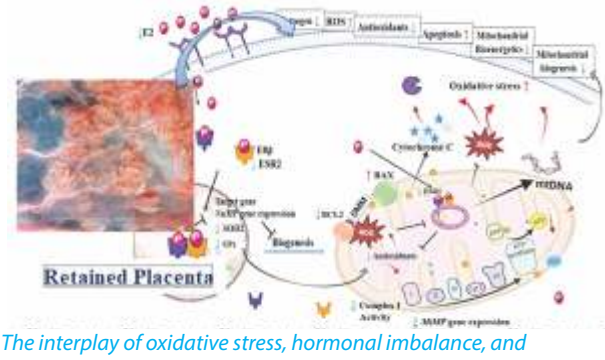
Dot plot gating of spermatozoa indicating effect of Quercetin on sperm viability of black Bengal buck semen



Dot plot gating of spermatozoa indicating effect of Quercetin on sperm mitochondrial membrane potential of Black Bengal Buck semen

Mitochondrial-mediated oxidative stress, apoptosis, and hormonal dysregulation in bovine retained placenta

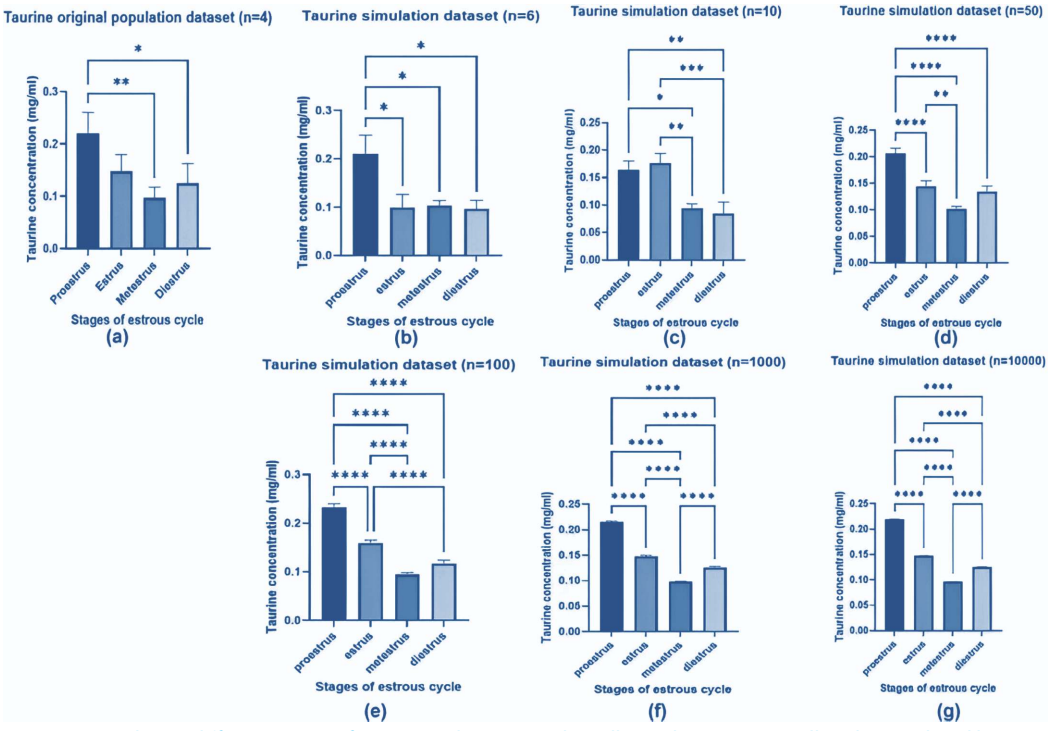
Retention of placenta (RP) is linked to oxidative stress, hormonal imbalances, and mitochondrial dysfunction. This study investigated mitochondrial-mediated processes in placental tissues from normal and RP-affected cows. RP tissues showed elevated ROS levels, reduced hormones, and altered gene expression impacting mitochondrial function. Antioxidant enzyme genes were dysregulated, pro-apoptotic genes upregulated, and BCL2 downregulated, indicating increased apoptosis. Mitochondrial oxidative phosphorylation genes were significantly reduced, except CYC1, which was upregulated. Mitochondrial genome analysis identified fewer SNPs in RP (20) than normal placenta (35). Nuclear-encoded mitochondrial protein genes were downregulated in RP. Negative correlation between BCL2 and CYC1 suggested mitochondrial dysfunction contributes to RP. These findings underscore dmitochondrial disturbances, energy deficits, and hormonal dysregulation in RP pathogenesis. Identifying mitochondrial biomarkers may enable early diagnosis and targeted interventions.



The interplay of oxidative stress, hormonal imbalance, and mitochondrial dysfunction in retained placenta (RP)

Higher serum taurine concentration may help in detecting proestrus stage of buffalo estrous cycle

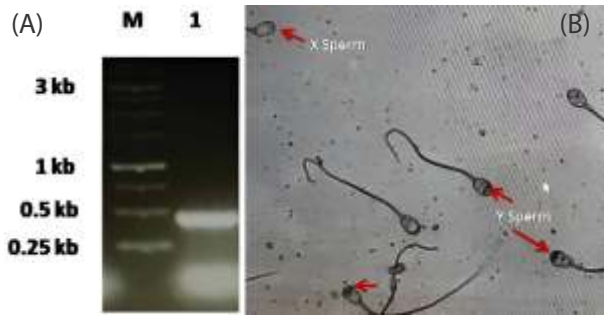
Taurine, a non-protein amino acid that helps in reproductive hormone secretion, was studied for its serum dynamics during buffalo estrous cycle. Blood samples were collected from healthy cyclic buffaloes (n=4) at estrus, proestrus, metestrus, and diestrus stages, with cycle days determined by ultrasonography and behavioral observation. Taurine was estimated using TLC method. Although taurine was consistently present at all stages, highest concentration was observed at proestrus (0.20 ± 0.03 mg/mL) compared to metestrus (0.10 ± 0.05 mg/mL) and diestrus (0.13 ± 0.03 mg/mL). Findings were validated in simulated population datasets of 6 to 10,000 animals. ROC curve analysis indicated taurine's efficiency in distinguishing proestrus from metestrus and diestrus stages at cutoff value <0.1643 mg/mL with 60% sensitivity and specificity. The study concluded that serum taurine concentration could help detect proestrus stage of buffalo estrous cycle.



Taurine concentration during different stages of estrous cycle in original small population (a) as well as the simulated large population (b–g) (Joshi et al., 2024. Reproduction in Domestic Animals, 59, 4: e14560)

Expression of recombinant buffalo SRY protein in *E. coli* and labeling of SRY protein on buffalo spermatozoa using polyclonal antibody against the recombinant protein

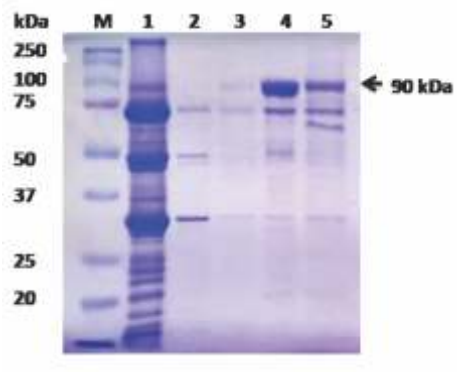
A 448 bp length buffalo SRY cDNA fragment was cloned in to pHis-TEV (BioBharti Life Sci.) expression vector. The 20 kDa recombinant SRY protein was successfully expressed in E. coli BL21 (DE3)-pLyss strain and the protein was purified by Ni-NTA affinity chromatography. Gel pieces of the protein band were cut, crushed and injected sub-cutaneously into a female rabbit after mixing with Freund's adjuvant. After 3 weekly boosters sera was separated and immunohistochemistry was performed. A prominent reaction was seen at the apical part of sperm head in about 50% of the mixed sperm population.



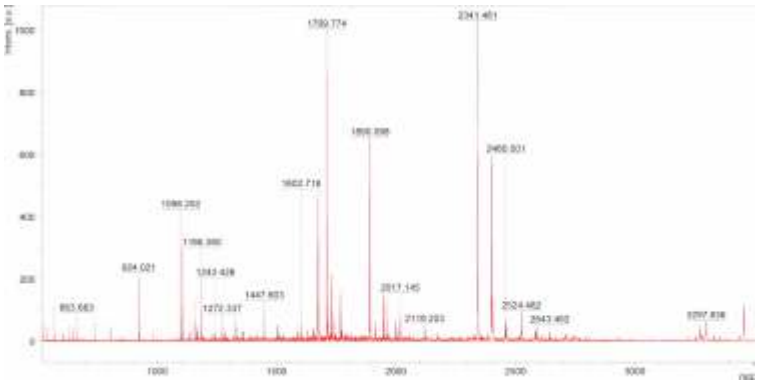
A: Buffalo SRY PCR amplicon (448 bp); B: Immunohistochemistry analysis of buffalo sperm; Y sperm: A prominent reaction at apical part of sperm head; X sperm: no reaction at sperm head

Identification of 90 kDa sperm-quiescent protein of buffalo cauda epididymal plasma

The 90 kDa sperm-quiescent protein of buffalo cauda epididymal plasma was purified by a combination of Hydroxyapatite gel adsorption chromatography followed by DEAE-sepharose anion exchange chromatography. The purified protein band was cut from SDS-PAGE gel and subjected to MS-MS analysis. The MASCOT search of the peptides identified buffalo lactotransferrin having highest number of peptides match and score.



SDS-PAGE analysis of DEAE anion exchange chromatography fractions. M: Protein marker; 1: Unbound fraction, 2: 10 mM potassium phosphate buffer wash; 3, 4, 5: 25, 50 and 100 mM potassium phosphate buffer, pH 7.5 elutes of DEAE sepharose anion exchange chromatography analysis of buffalo CEP



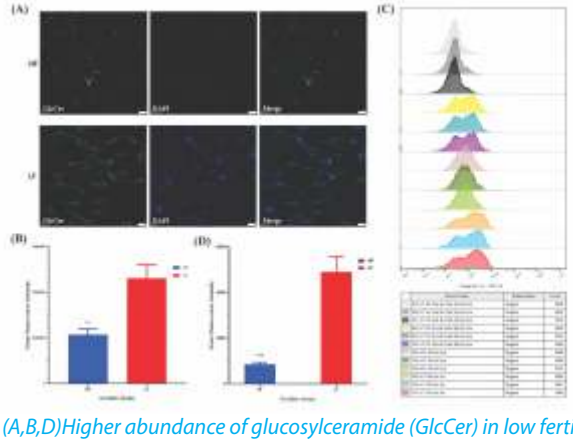
MS-MS spectra of 90kDa sperm-quiescent protein of buffalo cauda epididymis

Table: MASCOT search results (top 5 hits): -

SN	Accession	Mass	Score	Description
1	O77698|TRFL_BUBBU	79733	29	Lactotransferrin OS=Bubalus bubalis OX=89462 GN=LTF PE=1 SV=1
2	P85049|PAG70_BUBBU	1691	25	Pregnancy-associated glycoprotein 70 (Fragment) OS=Bubalus bubalis OX=89462 PE=1 SV=1
3	Q9TSN6|LALBA_BUBBU	16720	25	Alpha-lactalbumin OS=Bubalus bubalis OX=89462 GN=LALBA PE=1 SV=2
4	Q9TSI0|CASB_BUBBU	25147	21	Beta-casein OS=Bubalus bubalis OX=89462 GN=CSN2 PE=2 SV=1
5	Q2PE76|IL12B_BUBCA	37569	18	Interleukin-12 subunit beta OS=Bubalus carabanensis OX=3119969 GN=IL12B PE=2 SV=1

Development of lipid profile of sperm plasma membrane in Sahiwal bulls in relation to male fertility

Lipids and signaling raft molecules are crucial plasma membrane constituents of bull spermatozoa, with lipid class abundance determining fertilization outcomes. This study profiled differential lipid classes in high (HF) and low fertile (LF) Sahiwal bull spermatozoa using LC-MS/MS. Plasma membrane extraction involved solvent extraction, ice-cold Douce homogenizer, and ultracentrifugation, followed by LC-MS/MS lipid mapping. Results showed 565 lipids up-regulated in HF spermatozoa and 1124 down-regulated, predominantly phospholipids with phosphoglycerolipids as sub-classes. Differential localization of glucosylceramide (GlcCer) was confirmed via immunocytochemistry, revealing increased GlcCer levels in LF sperm. Functional evaluation involved blocking sperm

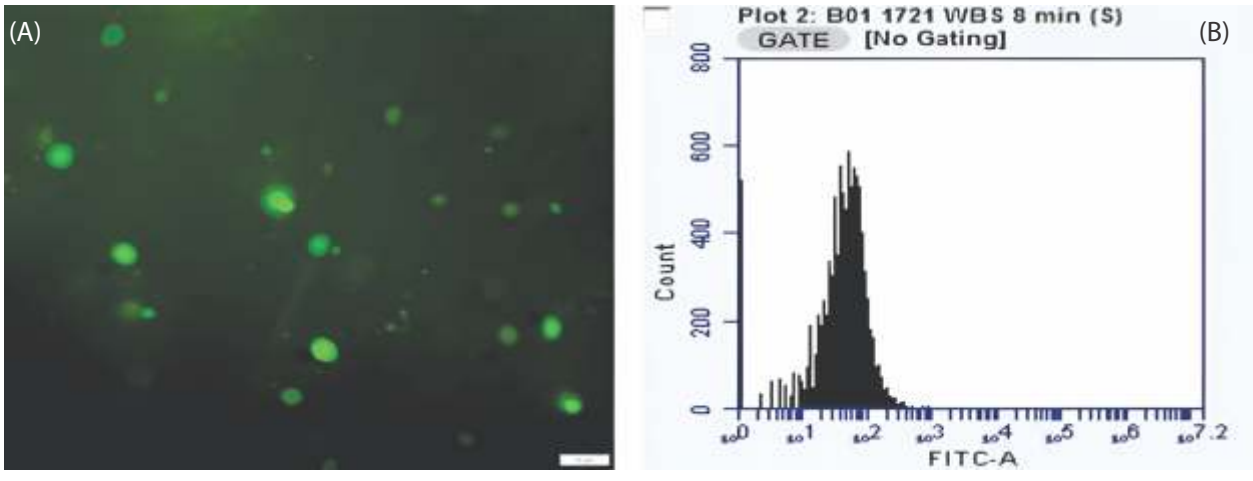


(A,B,D)Higher abundance of glucosylceramide (GlcCer) in low fertile cattle sperm, (C) Flow cytometry analysis of GlcCer in spermatozoa

surface GlcCer using anti-glycolipid antibody in LF spermatozoa, resulting in significantly improved total motility, progressive motility, wobbliness, and progressive wobbliness compared to controls. These findings highlighted GlcCer's role in sperm function and fertility potential.

Synthesis and characterization of nanoliposomes for adsorption of extracellular vesicles protein with spermatozoa

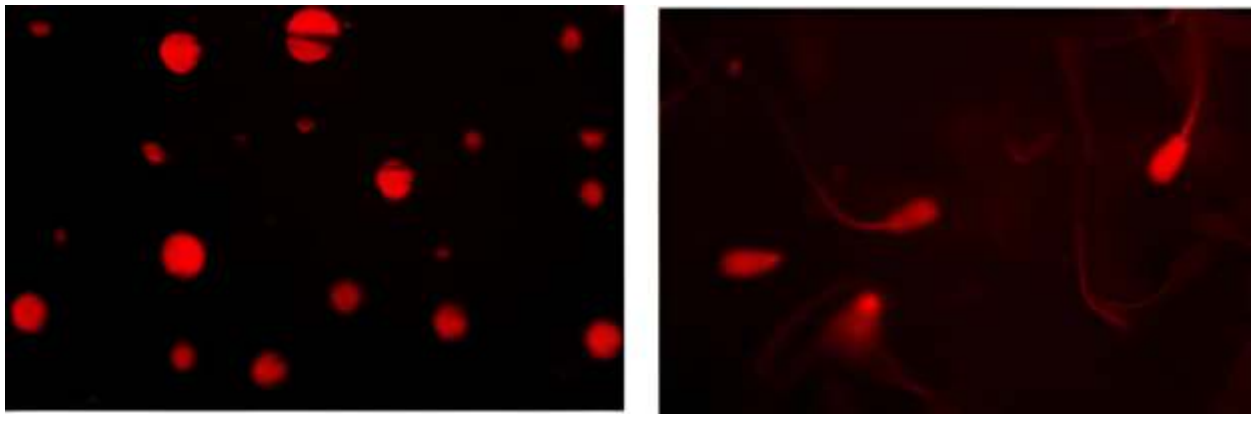
Seminal plasma consists of millions of extracellular vesicles (EVs) which carry protein repertoires related to bull fertility. To deliver the EVs based fertility proteins, nanoliposomes were prepared using active method of water bath sonication. The synthesis of nano liposomes was optimized using different ratio of lipids classes. Liposomes obtained by thin-film hydration and microfluidic techniques were characterized for their dimension, polydispersity index (PDI) and Z-potential using dynamic light scattering. Morphological characterization and encapsulation efficiency (EE%) were performed using a fluorescent dye (PKH67 and E-flur670) through fluorescence microscopy and flow cytometry. The nanoliposomes was synthesized using dipalmitoylphosphatidylcholine: cholesterol: 1,2-dioleoyl-3-trimethylammonium propane (DPPC:Chol:DOTAP) lipids formulation in a specific ratio resulted into a superior quality of nanoliposomes with average size (150 nm), zeta potential (+ 22mV), suitable for encapsulation of negatively charged proteins.



(A)Liposomes spherical shape and oval shape morphology stained with fluorescent dye PKH under fluorescence microscopy using with oil immersion at 60X. (B) The liposome particles were counted using flow cytometer

Uptake of EVs protein by spermatozoa delivered through nanoliposomes for enhancing sperm functions

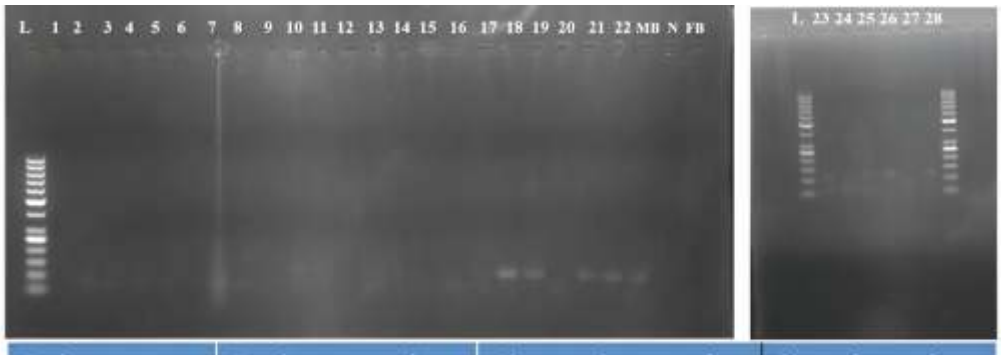
This study explored nanoliposomes for enhancing protein adsorption onto spermatozoa, specifically focusing on extracellular vesicle protein osteopontin uptake. Using freeze-thaw cycle encapsulation, high osteopontin loading efficiency was achieved. Double-dye labeling (PKH67 for nanoliposomes, E-fluor670 for osteopontin) confirmed encapsulation under fluorescence microscopy. Dynamic light scattering indicated particle size increase due to protein encapsulation. Spectrophotometry confirmed 0.36 mg/ml osteopontin encapsulation, with 73-75% release in PBS over four hours. Osteopontin-loaded nanoliposomes successfully fused with spermatozoa, verified by fluorescence imaging and flow cytometry. Functional analysis of low-fertility Sahiwal spermatozoa showed no adverse effects on membrane integrity or viability. However, a significant acrosome reaction increase was observed, indicating enhanced sperm functionality. This study demonstrated that nanoliposomes could efficiently deliver functional proteins to spermatozoa, offering a novel approach for improving sperm performance in breeding programs.



Encapsulation of Osteopontin by nanoliposome and uptake of encapsulated Osteopontin by cattle spermatozoa

Ligand based enrichment of X chromosome bearing sperm in bovine

Toll-like receptor-7 (TLR7), a promising candidate was identified for its use as a unique sperm surface biomarker through bioinformatics analysis. A specific ligand (Ligand A) for the TLR7 receptor was identified by utilizing homology modeling and molecular simulations using YASARA software. Molecular docking studies, conducted with AutoDock and PyRx that confirmed the binding interactions between the selected protein and its ligand. To evaluate the biological effect of this ligand and its interaction with the TLR7 receptor, we treated Sahiwal semen samples with five different concentrations of Ligand A. Sperm-specific enrichment of X in lower layer and Y chromosomes bearing sperm in the upper layer in the ligand A treatment. The treated sperm samples were analyzed using real-time PCR. The X enriched sperm with 0.03 µM Ligand maintained the sperm quality and was used in in vitro fertilization (IVF). The embryo sexing via single-embryo PCR data revealed that 21 out of 28 embryos (75%) were female-specific. The preliminary leads suggested that this approach had significant potential in the development of sexed semen. The work is in progress to refine the enrichment of X-sperm using ligand A, with a focus on generating more IVF embryos with increased female sex.



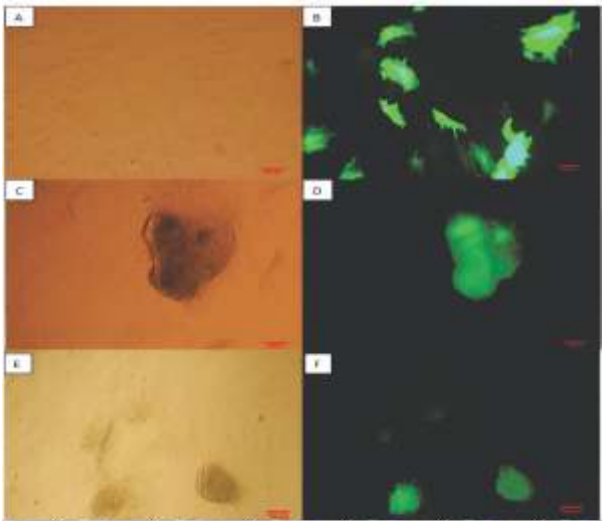
Embryo type	Total embryo produced	Phenotypic sex after PCR	% of embryo produced
IVF embryos produced using Ligand A treated semen sample	28	7 Male (XY)	25
		21 Female (XX)	75

Semen sample was treated with 0.03 µM Ligand A and lower layer was separated as X sperms and were used for In vitro fertilization to generate embryos. Single embryo PCR was done using HSFY primer for gender determination and 75% female embryos were obtained

Recombinant expression of pregnancy associated glycoproteins (PAGs) in uterine endometrial cells

Pregnancy-Associated Glycoproteins (PAGs) are aspartic proteinases expressed in ruminant trophoblast placenta. In *Bos taurus*, this multigenic family consists of approximately 22 members

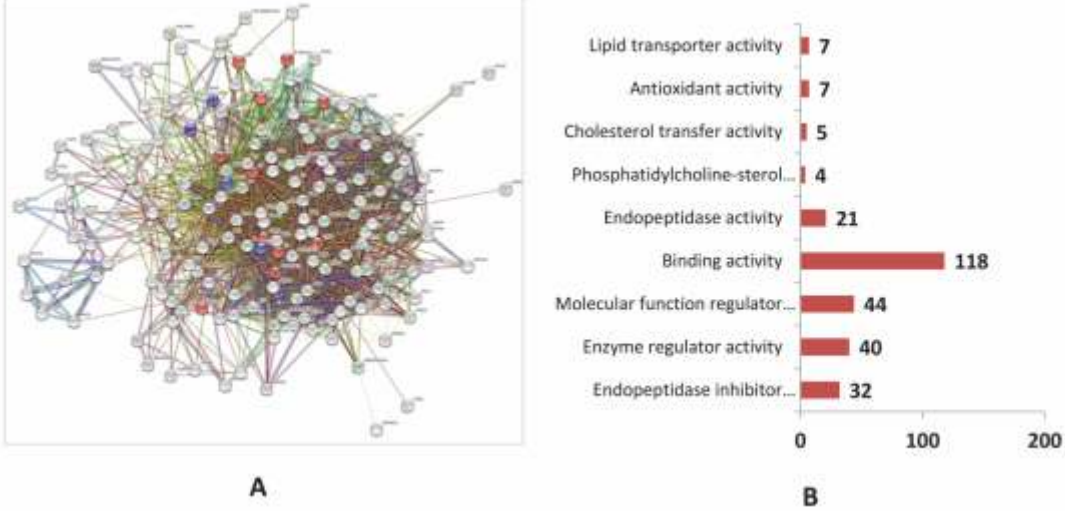
classified into ancient and modern phylogenetic groups. Ancient PAGs are synthesized throughout trophoblastic layer, while modern PAGs are produced by binucleate cells of cotyledons. This study investigated PAGs' functional role using *pAcGFP1-n1* vectors to express PAG1, PAG2, PAG7, and PAG18 isoforms in buffalo uterine endometrial cells (UECs). Stromal cells (passage 3) were transfected via lipofection, with GFP expression observed under fluorescence microscopy. Cells transfected with PAG isoforms exhibited GFP accumulation in cell clusters, contrasting with dispersed patterns in vector-only transfected cells. The study suggested that PAGs could influence cell adhesion and modulate tissue architecture during pregnancy. Further studies are being carried for analyzing PAG-mediated proteomic changes and their potential role in maternal-fetal interactions, providing insights into pregnancy maintenance mechanisms in ruminants.



GFP fluorescence images. (A, C and E) bright field image of endometrial fibroblast cell; (B) Cells transfected with pAcGFP1-n1; (D) cells transfected with pAcGFP1-n1+PAG2; (F) Cells transfected with pAcGFP1-n1+PAG18

Identification of candidate biomarker proteins associated with parturition in cows

Accurate prediction of calving onset in dairy cows is crucial for providing appropriate care and managerial interventions. Timely identification of imminent parturition allows necessary preparations, reducing risks associated with difficult calving and enhancing farm efficiency. Comparative proteome analysis was conducted in blood serum using label-free quantitation and LC-MS/MS analysis to identify candidate proteins associated with parturition. Analysis identified 480, 499, 466, and 485 proteins on day of calving, day -1, -3, and -5 before calving, respectively. Among them, 400 proteins were identified as differentially expressed proteins (DEPs). Significantly upregulated proteins included HP-25 homolog 2, haptoglobin, filamin A, serum amyloid A protein, flavin reductase, fibrinogen-like protein 1, and fibrinogen beta chain. Important downregulated proteins were coagulation factor XIII A chain, alpha-2-antiplasmin, corticosteroid-binding globulin, amine oxidase, and alpha-amylase isozyme 2A. Bioinformatics analysis revealed enrichment of biological processes including stress response, immune system response, wound healing regulation, blood coagulation regulation, and acute inflammatory response, providing potential biomarkers for calving prediction.



A. Protein-protein interaction network (P< 1.0e-16); B. Involvement of DEPs in different Molecular function

FEED, FODDER AND ANIMAL PRODUCTIVITY -

Evaluating variations of feeding behaviour and their associations with production and reproduction performance of Jersey crossbred cattle

Sensor-based data using Allflex collar nodes were collected from 50 Jersey crossbred cows at ERS-NDRI for eating and rumination time over one year. Records included 8963 observations for daily average rumination and eating time through sensor-based collars. Data were standardized to exclude missing records and classified by physiological status, collection month, and animal parity. Manual recording from CCTV camera images validated sensor-based data on 24-hour basis. Least-squares analysis of variance studied environmental factor effects on rumination and eating time. Average daily rumination and feeding time of Jersey crossbred cattle was 511.26 ± 0.94 and 305.92 ± 1.05 minutes, respectively. Month of recording and animal status showed significant ($P<0.01$) effects on average daily rumination and feeding time. Similarly, lactation order ($P<0.01$) affected average daily rumination and feeding time of Jersey crossbred cows.

Nutritional evaluation of top feeds of Leh-Ladakh

This study evaluated the nutritional potential of indigenous fodder trees in Ladakh to address winter feed scarcity for livestock. Commonly used top feeds; Seabuckthorn (*Hippophae rhamnoides*), Himalayan Elm (*Ulmus wallichiana*), Willow (*Salix alba*), and Poplar (*Populus balsamifera*) were collected and analyzed for chemical composition and fibre fractions. An *in vitro* experiment was conducted to assess rumen fermentation patterns using different substrate proportions of alfalfa, barley straw and concentrate, supplemented with tree leaf powders at varying levels (0%, 2.5%, 5%). The results revealed that Seabuckthorn had the highest crude protein content (18.16%) while Himalayan Elm was richest in calcium. Each fodder type demonstrated unique nutritional benefits, indicating their potential as supplementary feed sources for ruminants in Ladakh.

Effect of feeding top feed based total mixed ration on performance of Barbari kids

The study evaluated the impact of Total Mixed Ration (TMR) with 2.5% Poplar leaf on nutrient utilization and growth in Barbari kids. Twenty post-weaned kids were divided into control and treatment groups (n=10 each) and fed for 60 days. Dry matter intake was significantly higher in the treatment group (367.58 g/d) than in the control (337.85 g/d, $p<0.05$). Average daily gain (58.61 g/d) and body weight gain in the fourth fortnight (13.30 g) were also greater in the treatment group ($p<0.05$). Digestibility of DM, OM, CP, and NDF significantly improved ($p<0.05$), along with higher nitrogen utilization ($p<0.05$). Plasma glucose, total protein, albumin, PCV and leukocyte count remained similar ($p>0.05$). However, total immunoglobulin levels were significantly higher in the treatment group (35.03 mg/ml, $p<0.05$). Haemoglobin (9.90 mg/dl) and RBC count (11.12 mg/dl) were also significantly elevated ($p<0.05$). These findings highlighted the benefits of incorporating Poplar at 2.5% in TMR for improved growth and haematological parameters in Barbari kids.

Nutrient evaluation of Chaya and Moringa based pellets and its effect on performance of Barbari goats

This study evaluated optimal inclusion levels of Chaya and Moringa-based pellets in Total Mixed Ration (TMR) for Barbari goats through *in-vitro* fermentation kinetics and feeding trials. Chaya-based, Moringa-based, and combined Chaya-Moringa pellets had DM contents of 91.26%, 89.58%, and 90.60%, respectively. Crude protein content was highest in Chaya-based pellets (25.83%), while Moringa-based pellets showed highest hemicellulose content (27.10%). *In-vitro* studies tested TMR with different pellet inclusion levels (0-8%). Gas production increased significantly ($p<0.05$) in all pellet groups, with highest increase (16.15%) in combined pellet group. Methane reduction was highest in Moringa-based (19.75%) and combined pellets (12.86%). A feeding trial with

24 mid-lactation Barbari goats compared control and combined pellet-supplemented groups over 90 days. The supplemented group showed significantly higher DM intake, digestibility, erythrocyte count, antioxidant markers, immune response, milk yield, fat and protein content with increased oleic acid and unsaturated fatty acids ($p<0.05$). The study concluded 8% inclusion of Chaya-Moringa pellets enhances nutrient utilization, milk quality, and sustainability in goat production.

Effect of polyherbal supplementation several parameters of crossbred goat kids

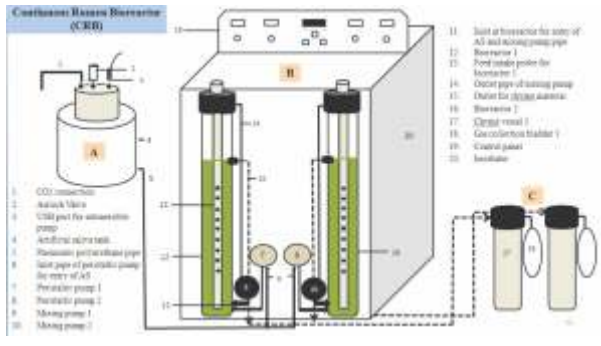
This study evaluated polyherbal supplementation effects on growth, feed intake, economics, and health in crossbred goat kids. Twenty-four kids were divided into four groups (T_0, T_1, T_2, T_3) and fed total mixed ration with polyherbal supplementation at 0%, 1.5%, 3.0%, and 4.5% of dry matter intake (DMI). The mixture contained *Withania somnifera*, *Trigonella foenum-graecum*, *Emblica officinalis*, *Ocimum sanctum*, and *Curcuma longa* in equal proportions. DMI was significantly higher ($p<0.05$) in T_1 (704.01 g/d) compared to T_0 (671.30 g/d) and T_3 (666.67 g/d). Average daily gain was highest in T_1 (96.92 g/d) and T2 (95.43 g/d). Economic analysis showed highest benefit-cost ratio in T_1 (1.66). Faecal egg count was lower ($p<0.05$) in T_2 (252.17) compared to T0 (363.98). Plasma AST was lower in T_2 (76.92 U/L) and T_1 (81.98 U/L). Delayed-Type Hypersensitivity response was highest in T_2 (8.34 mm). Polyherbal supplementation at 1.5% and 3.0% DMI improved growth, reduced parasite load, enhanced liver function, and boosted immunity, with 1.5% level providing best economic returns for sustainable goat production.

Elucidating the role of spray-dried encapsulated autochthonous probiotics on gut health and productivity in calves

The supplementation of autochthonous probiotic to neonatal calves resulted in to higher net gain in body weight (kg), average daily gain (g/d) and dry matter intake compared to non-supplemented groups. The fecal score, pH and ammonia was reduced ($p<0.05$), whereas, fecal lactate was increased in probiotic supplemented groups as compared to antibiotic supplemented and control groups. Fecal short chain fatty acids were increased in probiotic supplemented calves with a concomitant reduction in ammonia concentration. Health positive bacteria *Lactobacillus* and *Bifidobacteria* were ($P<0.001$) increased and health negative bacteria *E. coli* and *Clostridium* were ($P<0.001$) decreased in probiotic supplemented groups as compared to other groups. Superoxide dismutase (SOD, U/mL) activity was significantly increased ($P<0.001$) in the probiotic supplemented groups whereas no significant effect was observed in the GPx and CAT activity. The immunological indices including humoral immunity, cell mediated immunity and lymphocyte proliferation assay was significantly increased as a result of probiotic administration.

A novel continuous rumen bioreactor to simulate rumen-like conditions for methane estimation and feed evaluation

A bioreactor system was designed to mimic rumen conditions incorporating an incubator, artificial saliva delivery unit, chyme unit and sampling ports. The temperature was maintained at 39.5 ± 0.5°C using a thermostat-controlled system. The bioreactor replicated rumen motility with centrifugal and diaphragm pumps operating at two



Design of a bioreactor developed for rumen studies

Model of bioreactor depicting rumen function analysis

Different parts of the bioreactor designed for rumen studies

cycles per minute, ensuring optimal substrate exposure and fermentation efficiency. Performance trials conducted over 40 days demonstrated high reproducibility of results. The gas collection system effectively prevented leakage and ensured accurate estimation of methane emission.

Impact of ramie and mango seed kernel on digestive physiology of rumen and enteric methane emission in Sahiwal heifers under heat stress:

This study investigated the effects of ramie grass and mango seed kernel on rumen digestive physiology and enteric methane emissions in Sahiwal heifers during different seasons (hot dry, hot humid and thermoneutral conditions). The control groups were fed a basal diet whereas the treatment group were fed with 50% seasonal roughage and 50% ramie fodder and also supplemented with 3% mango seed kernel of dry matter intake. Blood and rumen liquor samples were collected for further analyses. Enteric methane emission from both groups were recorded in all seasons. Data entry of methane emissions has been done. At the end of the experiment (in thermoneutral season) digestion trial was conducted for 7 days. In digestion trial feed offered, residual feed and fecal sample from each animal were weighed and incubated. All samples (offered feed, residual feed and fecal samples) were further processed for dry matter, Ash, Ether extract, Crude Protein, NDF and ADF in duplicates.

Status of aflatoxins in feedstuffs and milk in Karnal district of Haryana

Aflatoxins, secondary metabolites of *Aspergillus flavus* and *Aspergillus parasiticus*, pose serious health risks. AFB1, a Group 1 carcinogen, is metabolized in the liver to aflatoxin M1 (AFM1), a Group 2B carcinogen. This study monitored AFB1 in feed ingredients and AFM1 in raw milk at farmers' doorsteps. Fifty samples each of feed ingredients and fresh milk were collected from four villages in Karnal, Haryana, during winter. ELISA analysis showed AFB1 levels in cereal products ranged from 18.75 ppb (channa churi) to 40.42 ppb (maize grains). Groundnut cake had the highest AFB1 (80.5 ppb), while deoiled rice bran contained 64.59 ppb and cottonseed cake had 67.05 ppb. Commercial cattle feed contained 41.61 ppb, while homemade mixtures had 22.24 ppb. Fresh fodder samples were aflatoxin-free. Raw milk samples had average AFM1 concentration of 0.230 ppb (range: 0.050–0.650 ppb). Some feeds exceeded permissible AFB1 limits, emphasizing the need for proper feed processing and toxin binders to ensure safe dairy production.

Effect of varying levels of aflatoxin B_1 and its ameliorant in diet on nutrient utilisation in lactating crossbred cows

Twenty-five lactating Karan Fries cows from ICAR-NDRI, Karnal, were divided into five groups (T1–T5) based on milk yield, body weight, parity, and lactation stage (30–50 days). A 150-day feeding trial was conducted, meeting ICAR (2013) nutrient requirements. Diets included a 40:60 concentrate-to-fodder ratio (DM basis). AFB1 was produced using *Aspergillus parasiticus* (MCC 41) and incorporated into diets. T1 (control) received 15 ppb AFB1; T2 and T3 had additional 20 ppb and 40 ppb AFB1, respectively. T4 and T5 received Mannano-oligosaccharide (MOS: 15–20 g/animal/day) alongside T2 and T3 diets. Dry matter and organic matter digestibility (%) were significantly lower ($P<0.05$) in T3 (60.59% and 63.82%) compared to other groups (T1–T5: 61.65%–67.14%). No significant effects were observed on nitrogen balance across groups. Supplementing MOS (15–20 g/day) in diets improved dry matter and organic matter digestibility in lactating crossbred cows across all the groups, indicating its potential as an effective ameliorant.

Supplementary effects of nano-Cu on nutrient digestibility and nitrogen balance in Alpine × Beetal male kids

The present study was undertaken to investigate the effect of different levels and forms (Inorganic and nano) of copper (Cu) supplementation in diet on feed intake, nutrient utilisation. For this, Alpine×Beetal male kids (30 No.) were divided into five different groups (G1, G2, G3, G4 and G5), wherein, G1 was the control group and offered only a basal diet; G2 was supplemented with 10 ppm copper sulfate, G3, G4 and G5 groups were supplemented with 1 ppm, 5 ppm and 10 ppm nano-Cu respectively. At the end of the feeding trial, metabolic trial was conducted to study nutrient utilization. Results indicated that in groups fed with $CuSO_4$, nano-Cu (5 ppm) and nano-Cu (10 ppm), the digestibility of OM, CP, EE and NDF was higher ($P<0.05$). The Cu-supplemented groups G2, G4 and

G5 demonstrated better N absorption and N balance suggesting that nano-Cu at at levels of 5 and 10 ppm increased nitrogen consumption which was comparable to 10 ppm supplementation through CuSo4. Therefore, the effects of supplementary Cu via $CuSO_4$ @ 10 ppm vis-à-vis 5.0 ppm through nano Cu on feed intake and nutrient utilisation were similar.

Prediction of nutritive value of vegetable protein sources for ruminants using near-infrared spectroscopy

Thirty samples each of soybean meal (SBM), mustard oil cake (MOC), and cottonseed cake (CSC) were collected from Haryana and Punjab, India, and analyzed for proximate principles, fiber content, and in vitro rumen fermentation parameters. Samples were scanned using NIRS, and calibration models were developed via partial least-squares regression (PLSR) using wet chemistry data (SPSS v27). Accuracy was assessed with FOSS Calibrator™ software. Among oilseed cakes, SBM had the highest CP (44.69%) and TOMD (82.08%), while CSC had the lowest CP (24.16%) and TOMD (62.39%). ME values were 10.76, 10.04, and 8.78 MJ/kg DM for SBM, MOC, and CSC, respectively. SBM showed the highest predictability (R^2 >0.90) for moisture, CP, and EE, with NDF, ADF, TDMD and TOMD showing R^2 >0.80. MOC had R^2 >0.80 for TOMD, while CSC had high accuracy (R^2 >0.90) for IVGP, CP, and total ash. Despite some variability, NIRS proved effective for rapid feed assessment, especially for SBM. However, including more samples could improve prediction accuracy for all parameters.

Effect of glycerol and non-edible oil cakes on growth performance of Sahiwal calves

The particular investigation encompassed to find feed intake, digestibility and blood biochemical profile in Sahiwal calves fed glycerol and /or non-edible oil cakes viz., karanja, mahua, neem and simrouba (1:1:1:1). Sixteen Sahiwal caves were grouped into four groups viz., Control group fed as per the requirement consisting roughage and concentrate; Treatment group 1: Control Diet + 1% NEOC; Treatment group 2 Control diet+ 10 % glycerol and Treatment group 3: Control diet+ 1% NEOC Meals+10% glycerol for 60 days. Nutrient intake and digestibility were similar between the groups. Blood profile and metabolites were not affected in Sahiwal calves. The average DMI was 4.61 to 4.75 (kg/day). The digestibility of nutrients (DM, CP, NDF and ADF) was similar among all the groups. Blood metabolites and CBC were not affected with treatment diet. However, faecal egg count was 137.19 in control and reduced to 123.52 in treatment groups. It was concluded that, as the proportion of non-edible oil cake was increased, the gas fermentation and kinetics was reduced due to rate of PSMs.

Assessing lemongrass and palmrosa grass residues on enteric methane emissions and production performance of lactating Sahiwal cows

Sustainable livestock production requires evaluating alternative feed resources to address food security, climate change, and greenhouse gas emissions. Medicinal and aromatic plants (MAPs) like lemongrass (*Cymbopogon flexuosus*) and palmarosa grass (*Cymbopogon martinii*) produce de-oiled biomass after essential oil extraction, which is often discarded despite its high organic matter content. This study assessed the effect of replacing 50% of wheat straw with lemongrass (LGR) and palmarosa grass residues (PGR) on enteric methane emissions, nutrient intake, digestibility, and production performance in lactating Sahiwal cows. Fifteen cows were divided into three groups (CON, LGR, PGR) and fed for 100 days. The control diet included concentrate, green maize, and wheat straw, while LGR and PGR groups had 50% wheat straw replaced with residues. Nutrient intake, digestibility, enteric methane emissions and plasma parameters (glucose, ALT, AST, total protein) showed no significant differences among groups. Milk yield, composition, and fatty acid profile remained unaffected. Results suggested that lemongrass and palmarosa residues ccould replace 50% of wheat straw without impacting digestibility, methane emissions, or production performance in lactating Sahiwal cows, offering a sustainable feed alternative.

Effect of sewage water on berseem-maize cropping system under different nutrient management practices

An experiment on irrigation with treated sewage water (TSW) and different fertilizer levels showed significant improvements in berseem growth

parameters including plant height, trifoliate leaves, biomass and root traits across four cuts. TSW irrigation resulted in higher green fodder yields (16.57–17.60 t/ha) and dry fodder yields (2.06–2.35 t/ha), along with enhanced crude protein, total ash, and nutrient uptake (N, P, K, and micronutrients) compared to tube well water. However, TSW was statistically comparable to mixed water irrigation. Among fertilizer treatments, 75% recommended dose of fertilizer (RDF) significantly improved green (18.00–19.28 t/ha) and dry fodder yields (2.23–2.53 t/ha), performing on par with 100% RDF. The combination of TSW irrigation and 100% RDF yielded the highest fodder production and nutrient uptake. Additionally, 75% RDF enhanced crude protein, ether extract and total ash while reducing fiber fractions (NDF, ADF, ADL) across all cuts, matching 100% RDF. Overall, TSW irrigation combined with 75% RDF offers an effective and sustainable approach to improving berseem yield and quality, reducing reliance on freshwater and fertilizers.

Evaluation of tillage practices and nano-urea on yield and quality of fodder oats maize cropping sequence

The study on tillage practices and nitrogen management showed that Zero Tillage (ZT) significantly improved growth, yield (green and dry fodder), nutrient uptake (N, P, K), and resource efficiency (AEN, PFP, PE) in oats across two years. ZT also enhanced water use efficiency (WUE), energy productivity, net energy gain, and economic returns (gross/net return, B-C ratio), outperformed Conventional Tillage (CT). However, in maize, Permanent Raised Bed (PB) tillage yielded the highest growth and yield parameters. Nitrogen management results showed that 100% recommended dose of nitrogen (RDN) significantly improved growth, yield, and nutrient uptake in oats. Treatments with 50% basal N + ¼ top dressing + urea or nano-urea spray performed similarly to 100% RDN, maintaining crude protein, ether extract, and ash content while reducing fiber fractions (NDF, ADF, ADL). In maize, 100% RDN and 50% basal N + ¼ top dressing + urea spray produced comparable results, while 50% basal N + nano-urea spray achieved the highest PFPN and PE. For optimal productivity and sustainability, ZT with 100% RDN is recommended for fodder oats, while PB tillage with 100% RDN is ideal for maize in the fodder oats-maize cropping system.

Development and characterization of moringa-napier pellets

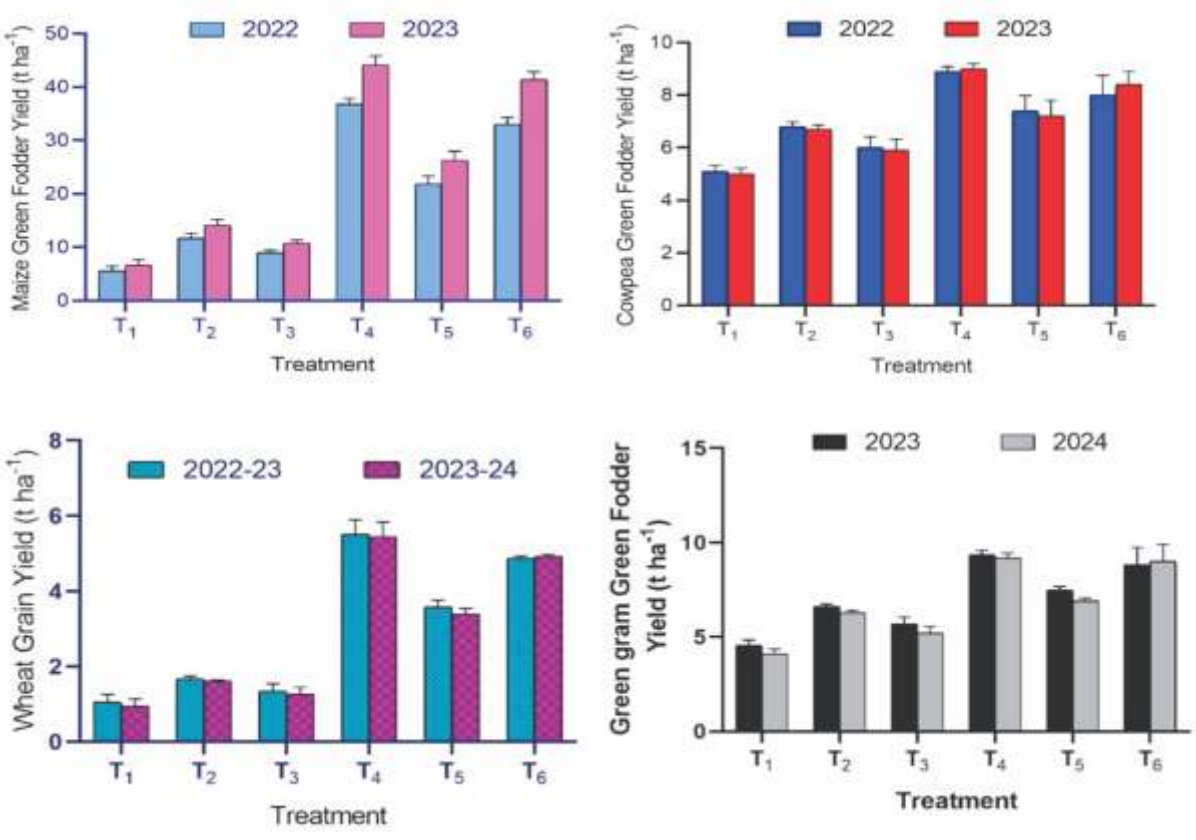
The study aimed to develop and characterize fodder pellets for livestock feeding during lean seasons or periods of scarcity. Pelleting was feasible within a moisture range of 12-18%. The optimal moisture levels for pellet production were 10-12% for Moringa and 16-18% for Napier Bajra Hybrid (NBH). Proximate analysis revealed a reduction in crude fibre (CF), Neutral Detergent Fiber (NDF), Acid Detergent Fiber (ADF), and Ether Extract (EE) after pelleting, which enhanced forage quality. The *in Vitro* Gas Production Technique (IVGPT) showed that the treatment combining 60% NBH, 40% Moringa, and molasses resulted in higher net gas production indicating superior digestibility compared to other treatments. Additionally, the tannin and oxalate content in the pellets remained within permissible limits. The findings demonstrated that forage pelleting was found effective conservation method that improves forage quality, digestibility, and durability.

NBH 80%+Moringa 20% NBH 70%+Moringa 30% NBH 60%+Moringa 40%

Pellets of Moringa and Napier for animal feed

Development of integrated organic nutrient management practices for fodder-food-based cropping systems

Organic treatment PGPR + 100% RDN through FYM combined with Panchagavya spray at 25, 35, and 45 days after sowing (DAS), significantly enhanced the yields of all crops in maize + cowpea – wheat – green gram cropping system. Further, it also significantly improved soil nutrient availability, with 196.6 kg ha ^{1} nitrogen (N), 28.0 kg ha ^{1} phosphorus (P), and 208.2 kg ha ^{1} potassium (K) over all other treatments. However, highest yields recorded with recommended dose of fertilizers.



Effect of Integrated integrated organic nutrient management practices on yield of different crops on fodder-food based cropping system (T_1: Absolute Control, T_2: PGPR, T_3: Panchagavya Spray @ 25, 35 and 45 DAS, T_4: 100 RDF, T_5: PGPR+50% RDN through FYM+Panchagavya spray@ 25, 35 and 45 DAS, T_6: PGPR+100% RDN through FYM+Panchagavya spray@ 25, 35 and 45 DAS)

Fenugreek seeds and areca nut powder on rumen fermentation and enteric methane emission

This study evaluated the effects of areca nut powder (A), fenugreek seed powder (F), and their 1:1 combination (F+A) were mixed at concentrations of 0%, 2%, and 4% with a substrate of 60% roughage and 40% concentrate under in vitro condition. Results showed significant reductions in total gas and methane production across treatments. Total gas production decreased reduced ($P<0.05$) with all treatments; reductions were most pronounced in the F+A combination. Methane (CH4) emission reduced significantly, with the most significant decrease observed in the F+A treatment (23.85% to 20.90%).

Formulation of a novel feed supplement to promote early rumen development for improving animal productivity

Calf feeding and management for optimal growth, the milk yield of dairy cows is affected by their growth and health in the suckling period. Early rumen development is important since promoting early rumen development has a significant impact on later growth and production performances. Butyric acid is a proven inducer of rumen epithelial growth resulting in early rumen development, and hence its supplementation is useful by inducing early consumption of forage and better utilization. Tributyrin is a derivative of butyric acid, and compared with butyric acid and its salts, tributyrin is more stable and less odorous, and has more

favorable pharmacokinetics. Therefore, attempts were made to improve productivity of young growing pre-weaner calves by dietary supplementation of tributyrin. To observe the growth performances and body immune response under intensive feeding (76 days), eighteen pre-weaner Jersey male crossbred calves (14 days age) were divided into three groups (calf starter-G1: Control, calf starter + 1%tributyrin-G2 and @ 2% G3). Calf starter was offeredby 90 days to calves (1 to 76 days of experiment). In first 30 days experimental feeding tributyrin supplementation had no effect on daily dry matter intake, spirotrich protozoa established earlier in comparison to holotrich protozoa. The ciliate protozoal population were B type.

Effect of feeding slow-release nitrogen compound on rumen fermentation, nutrient utilization and growth performances in growing cattle

Urea is used as protein replacement in ruminant diets due to low cost compared to oil cakes, but has limitations in ruminant nutrition. This study evaluated a new slow-release nitrogen compound (mPro) on rumen fermentation and enzyme activities in growing crossbred calves. Eighteen male crossbred Jersey calves (4-6 months) were divided into three groups and maintained on roughage and concentrate-based ration for 140 days. Three iso-nitrogenous concentrate mixtures were used: C1 (without urea), C2 (1% mPro), and C3 (1.2% mPro). Daily intake of nutrients including DM, OM, CP, EE, T-CHO, NDF, ADF, and cellulose were similar among groups. Digestibility coefficients of most nutrients did not differ significantly, however CP and EE digestibility along with ADG and FCE were significantly higher in G3 than G1 and G2 groups. The slow-release nitrogen compound (mPro) could be a viable non-protein nitrogen source for ruminant animal feeding.

Environmental contamination of arsenic: pathway analysis through water-soil-feed-livestock and potential human health risk

This study evaluated arsenic concentrations in environmental components and health risks in arsenic-contaminated Nadia district, West Bengal, India. A survey of 182 cattle and 255 goats from 40 farms revealed high arsenic exposure through water, food and feed sources. Arsenic levels were highest in roughages (483.18 µg/kg DM), tree leaves (391.53 µg/kg DM), and concentrate feed (186.66 µg/kg DM). Pond water (106.11 µg/L) had higher arsenic than shallow tube wells (47.96 µg/L) and deep tube wells (10.64–10.04 µg/L). Goats accumulated 73.46% more arsenic per kg body weight than cattle. Though no visible symptoms were noted, arsenic levels in hair and feces were elevated. Cattle showed higher arsenic in feces (410.4 µg/kg DM) and hair (1917.7 µg/kg DM) than goats. Milk arsenic remained below 10 µg/kg. Cancer risk value (4.96×10^{3}) exceeded safety threshold, with non-cancer hazard index of 11.01 for adults. Farmers should use protein-rich, low-fiber feed and deep aquifer water.

Utilization of conch shell (*Turbinellapyrum*) powder as a potential marine biological source of calcium and some trace minerals for growing crossbred calves

This study evaluated the effects of conch shell powder (*Turbinella pyrum*) as a marine organic calcium (Ca) source, either fresh (FCSP) or calcined (CSCP), on intake, growth, and blood biochemistry in growing Jersey crossbred calves. Over 90 days, 15 female calves (70.68 ± 2.90 kg, 197.73 ± 12.40 days) were divided into three groups: control (T0), fresh conch shell powder (T1), and calcined conch shell powder (T2). All calves received a total mixed ration (TMR) with dicalcium phosphate (DCP) in T0 while T1 and T2 were supplemented with FCSP and CSCP, respectively. CSCP had 11.66% more Ca ($p < 0.01$) and higher Mg, Co, Mn, and Fe but lower Cu and Zn than FCSP. The Ca/P ratio (~2.1) was optimal in all diets. Calves in T1 and T2 had significantly higher dry matter (DM) and crude protein (CP) intake than T0 ($p < 0.001$) but body weight gain and feed conversion ratio remained unaffected. Blood glucose, urea, ALP, AST, ALT, Ca and P levels were similar across groups. Digestibility of Ca and P was significantly higher in T1 and T2 ($p = 0.01$). These findings suggested that conch shell powder, either fresh or calcined, could be a viable local Ca source for livestock.

NOVEL APPROACHES IN VALUE ADDITION AND FUNCTIONAL FOODS

Development of finger-millet-based composite fermented beverage

A finger-millet-based composite fermented beverage was prepared using 2% finger-millet flour (sourced from Karnal) mixed with cow milk. The mixture was heated to 95°C for 5 minutes and cooled to 37°C. Conditions including finger-millet concentration, inoculum level, incubation time, and temperature were optimized. Freshly grown *Lacticaseibacillus rhamnosus* RL-4, selected for its phytase (25 mm), proteolytic, and antimicrobial activities, was inoculated at 2% and incubated at 37°C for 12 h. Based on pH, acidity, and lactic acid bacteria count, the optimized formulation consisted of 2% finger-millet flour, 2% inoculum, and 12-hour incubation at 37°C. The final product exhibited a pH of 4.2 and titratable acidity of 0.86% lactic acid.

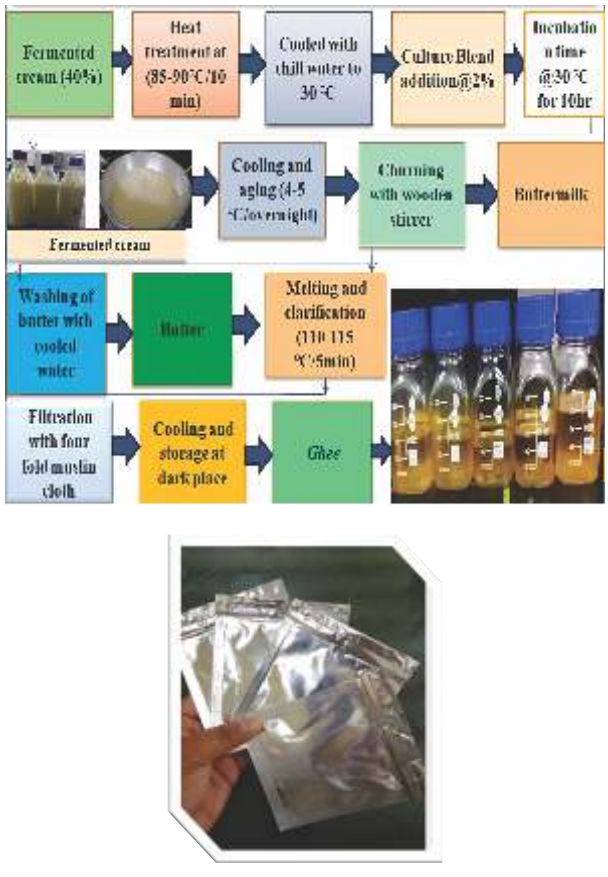
Finger-millet-milk-based composite fermented beverage

Development of bioprocess for enhanced vitamin B_{12} production using whey medium

Vitamin B_{12} is traditionally produced through aerobic or anaerobic fermentation using *Pseudomonas denitrificans* and *Propionibacterium freudenreichii* subsp. *shermanii*. However, these methods are expensive, complex, time-consuming, and raise safety concerns linked to *Pseudomonas denitrificans*. To overcome these limitations, a simple, cost-effective, and safe bioprocess was developed using *Limosilactobacillus reuteri* NCDC 958. Vitamin B_{12} production in optimized media formulation was 25-fold higher than un-supplemented medium. This bioprocess offers a safe, cost-effective method for vitamin B_{12} production while making sustainable use of whey, a dairy by-product. It also enables the development of vitamin B_{12}-rich whey beverages, which could serve as a nutritious solution to address vitamin B_{12} deficiency.

Development of mesophilic direct-vat-set starter culture blend to improve flavour profiles in ripened cow cream ghee

To enhance ghee's flavour, a mesophilic liquid direct-vat-set (DVS) starter culture blend was developed using fast-acidifying, flavour-producing strains. From 31 Lactococcus/Leuconostoc strains, four (NCDC912, 284, 621, 636) were selected based on acidification and diacetyl production, along with positive (NCDC193) and negative (NCDC314) controls. The compatibility of these strains was confirmed through co-culture, streak, and agar slab assays. The optimal blend, consisting of NCDC912 and NCDC621 in a 1.5:0.5 v/v ratio, was selected for further investigation. Molecular identification confirmed the distinctiveness of the strains within the blend. Culture formulation (0.05%, 1% w/v) showed good shelf stability under



Process for enhancing the flavour profile of ghee using mesophilicliquid DVS Starter Culture Blend

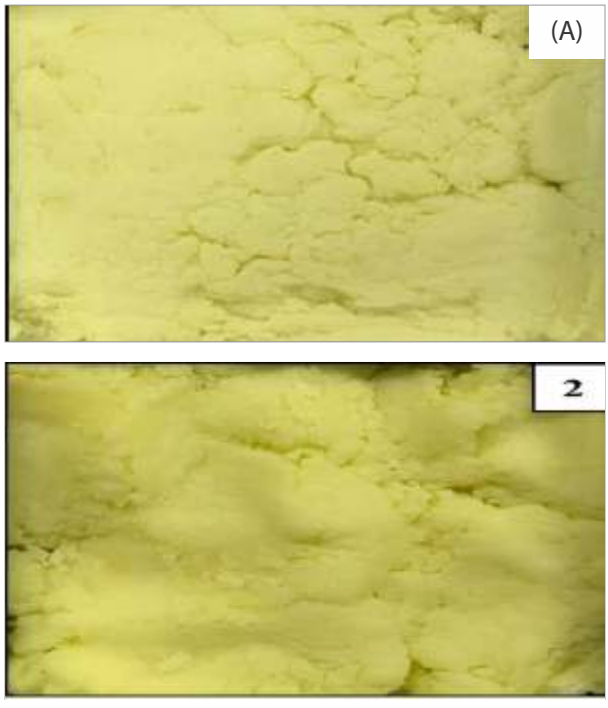
refrigeration. When used in ghee production, the culture reduced ripening time and significantly improved fatty acid and volatile flavour profile.

Development of *in-situ* produced active Vitamin B_{12} rich ready to use therapeutic dairy food and evaluation of its bioavailability and safety

Vitamin B_{12} is vital for nerve health, red blood cell formation, DNA synthesis, and brain function. As it is found only in animal-derived foods, B12 deficiency is common in predominantly vegetarian populations like India. A fermentation matrix using millet malt, legume powder, and milk solids—rich in cobalt, niacin, and riboflavin—was developed to enhance B_{12} biosynthesis. Using Taguchi design, fermentation parameters (inoculation level, lactate concentration, and incubation time) were optimized. The resulting dried fermented base had 25 µg B_{12}/100 g. An I-optimal mixture design was used to formulate a B_{12}-rich nutrimix, which recorded an overall acceptability score of 8.10 ± 0.09, wettability of 1.42 ± 0.08 min, dispersibility of 77.55 ± 0.23%, and insolubility index of 6.31 ± 0.17 mL. The nutrimix contained 72.96% carbohydrates, 18.3% protein, 2.2% fat, and 12.5 µg B_{12}/100 g. The developed nutrimix with a serving size of 20 g contains 2.5 µg B12 which meets approximately 100% RDA for B_{12}.

Production of low lactose *Khoa* using multi-enzyme approach

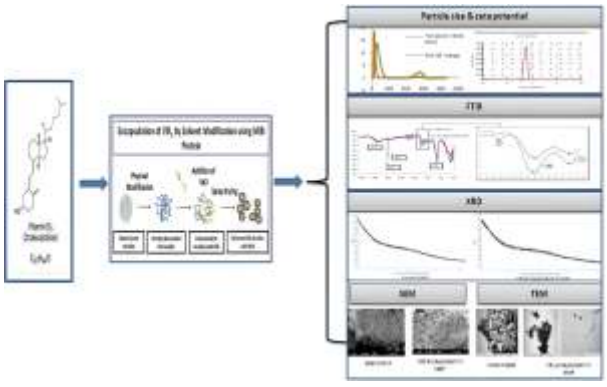
Lactose-hydrolyzed milk was explored for the preparation of heat-desiccated dairy products like *khoa*. Three different methods were employed to produce lactose-free *khoa*. In the first method, a single enzyme (β-galactosidase) was used to hydrolyze lactose before *khoa* preparation. In the second method, the same enzyme was used along with maltodextrin supplementation. Among different concentrations tested, 3% maltodextrin was found optimal, as *khoa* prepared with 1% and 2% showed significantly higher Browning Index (BI). In the third method, a multi-enzyme system comprising β-galactosidase, glucose oxidase, and catalase was used. The Browning Index (BI) of the samples followed the trend: single enzyme (AP1) > single enzyme with 3% maltodextrin (AP2) > multi-enzyme (AP3) > control (buffalo milk *khoa*). Sensory evaluation revealed that the control *khoa* received the highest score, followed by AP3, AP2, and AP1. All *khoa* samples met the FSSAI standards for total solids (TS), fat, ash, and acidity (as % lactic acid).



A Control khoa, B. Low lactose khoa (Multi enzyme approach)

Characterization of vitamin D_3 encapsulated preparation

Vitamin D_3 (VD_3) loaded in conc skim milk following ethanol treatment and subjected to spray drying. The resulted powder preparation showed encapsulation efficiency 92.5%, and an average particle size of 232 nm, with no significant differences in zeta potential compared to the control. The IR spectra of VD_3 encapsulated in skim milk powder showed increased peak intensities at 1645 cm^{-1} (Amide I) and 1545 cm^{-1} (Amide II), along with a new peak at 1745 cm^{-1} for ester C=O stretching. Clusters of peaks at 2852 and 2922 cm^{-1} indicated C-H stretching vibrations from water and fat reorganization during encapsulation. XRD patterns showed decreased peak intensity and broadening, suggesting VD_3 is in an amorphous state within the milk powder matrix. SEM and TEM images revealed particle aggregation and increased nanoparticle size, indicating structural changes due to ethanol treatment and temperature, affecting shape and surface characteristics.



Process of encapsulation of vitamin D_3 and its properties

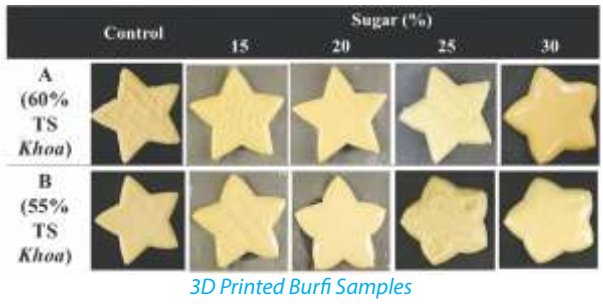
Development of spray dried probiotic direct vat set starters of *Lactiplantibacillus plantarum* strain(s)

Spray-dried probiotic direct vat set (DVS) starters were developed using *Lactiplantibacillus plantarum* and *Streptococcus thermophilus* for use in fermented dairy products. A protective medium was optimized to ensure heat tolerance during drying. The resulting DVS starter showed good functional, sensory, and probiotic properties, remaining stable for two months under refrigeration. These starters were further used to develop a synbiotic Dahi with improved curd-setting time, texture, and probiotic count. The product had a shelf life of 28 days at 4°C. Thus, multi-strain probiotic DVS starters with improved techno-functional attributes could be efficiently developed through spray drying for the production of synbiotic fermented dairy products as potential bio-therapeutic delivery systems.

Spray-dried probiotic direct vat set (DVS) starters and their application in the preparation of synbiotic dahi

Development of technology for 3D printing of traditional dairy products

The 3D printing formulations of burfi were prepared with varying total solids (50, 55 and 65%) of *khoa* and *sugar* concentrations (15, 20, 25 and 30%). Rheological analysis of printing formulations viz., shear-stress behaviour, apparent viscosity (η), yield stress (τ_0), and storage modulus (G') along with printability assessment of 3D constructs were conducted to optimize the printing formulation. It was observed that the increase in sugar content in formulations with reducing milk solids content resulted in the sagging of the printed constructs. In assessing the quality of the 3D printed constructs, the formulation containing *khoa* 60% solids and sugar 15% obtained the highest visual assessment score (4.9), with extrusion rate of 0.63g/ min and dimension accuracy factor of 97.5%.



3D Printed Burfi Samples

Proline rich polypeptide (PRP) supplemented long-life flavoured milk

Proline-rich peptides (PRP), bioactive peptides rich in proline (1–10 kDa), known for their immunomodulatory properties are derived from the colostrum of milch animals. To address the rising demand for immunity-boosting foods, PRP-supplemented long-life flavoured milk was developed. PRP was isolated from 12-hour postpartum Sahiwal cow colostrum and added (250 mg/100 mL) to cardamom-flavored sterilized milk (121°C/20 min). The product showed acceptable sensory quality and stability for one month at room temperature (30°C).Animal studies indicated that PRP long-life milk feeding to immunocompromised mice (@25 mg PRP/day) improved their health status by enhancing their immunoprotective properties viz. enhanced the level of anti-inflammatory cytokines (IL-10) and immunoglobulin (IgA & IgG) levels, increased phagocytic activity and lymphocyte proliferation activity and reduced the level of pro-inflammatory cytokines (TNF-α, IFN-γ).

Proline rich polypeptide (PRP) supplemented long-life milk

Optimization of formulation for preparation of foxtail millet payasam mix using natural sugar alternatives

Instant foxtail millet payasam mixes were developed using dry crystallization to enhance accessibility and appeal by incorporating natural sugars-jaggery powder (JP) and coconut sugar (CS). Two variants were formulated: JP-FPM with 40–60% JP and refined sugar (RS), and CS-FPM with 40–80% CS and 60–20% RS. Impact of varying proportions of natural sugars and refined sugars was evaluated on the physico-chemical, sensory, textural and rheological attributes of the payasam mixes, while the millet and milk solids levels were kept constant. Upon optimization desirability of 0.87 for JP-FPM with 31.5% each of JP and RS, and 0.88 for CS-FPM with 43% CS and 20% RS was found. More than 95% of consumers rated the developed samples as excellent and very good. The dry mixes consistently maintained acceptable sensory scores and microbiological parameters were within the permissible limits throughout storage (90 days) at 25°C.

Jaggery incorporated foxtail millet payasam mix

Immobilization of β-galactosidase on activated bentonite clay nanoparticles and galacto oligosaccharides production from paneer whey

The β-galactosidase immobilized on glutaraldehyde functionalized clay nanoparticles and production of GOS from paneer whey. The nano-immobilized enzyme showed significantly higher stability than free enzyme at extreme pH (4.0, 6.5, 7.2 and 8.0) and temperature conditions (30, 40, 50 and 60 °C). During storage study, the immobilized enzyme retained (97.41 %) significantly ($P<0.05$) higher initial enzyme activity than free enzyme (94.83 %) after stored for 90 days at 4°C. The nano-immobilized enzyme produced 1.41 times higher GOS than free enzyme in paneer whey. During reusability study, the GOS production decreased by 71 % after 4 cycles.

Encapsulation of piperine using β-cyclodextrin based metal organic frameworks and incorporation in flavoured milk

The β-cyclodextrin based metal-organic frameworks (β-CD-MOFs) used as carrier for piperine encapsulation and incorporated in flavoured milk. The encapsulated piperine maintained good stability at various pH, processing temperature and ionic conditions. During in-*vitro* digestion, the antioxidant activity of encapsulated piperine was decreased from 92.92 ± 0.37% at oral phase to 86.66 ± .57% at gastric phase and 85.33 ± 0.76% at intestinal phase. Encapsulated piperine was incorporated in flavoured milk at the concentration of 10, 12.5, and 15 mg/ml and achieved antioxidant activities of 87.11 ± 0.32 91.86 ± 0.68 and 94.45 ± 0.78%, respectively. Sensory evaluation revealed that even lower piperine concentration (10 mg/ml) showed remarkable spiciness and pungency.

Utilization of paneer whey for production of bioactive lactose-derived oligosaccharides

Paneer whey was concentrated and hydrolysed using commercial β-galactosidase enzymes. Trials were conducted to prepare freeze-dried GOS rich paneer whey powder with the addition of drying aids, including maltodextrin, gum arabic, xanthan gum, and tricalcium phosphate. However, the obtained freeze-dried powder became highly hygroscopic, sticky, and cakey within 24 hours of storage. So, instead of freeze drying, GOS rich

hydrolyzed concentrated paneer whey (HCPW) syrup was characterized. GOS rich HCPW was packed in Polyethylene Terephthalate (PET) bottles, were analysed over a 60 days' storage period at 7 ± 2°C. The GOS and HMF concentration in GOS-rich HCPW were 24.34% initial lactose and 6.94 µM/L, respectively, and did not change significantly upon storage. Additionally, the 18 experimental runs were performed for optimizing the levels of spray drying condition by using Taguchi method. The optimized spray dried GOS rich paneer whey powder had 55.43% encapsulation efficiency and good solubility and dispensability (93.03%).

A: Spray dried galactooligosaccharides rich paneer whey powder; B: Galactooligosaccharides rich paneer whey added snack bar

Comparative evaluation of shelf-stability of *Lacticaseibacillus rhamnosus* CRD11 encapsulated by electrospinning and spray drying

L. plantarum CRD7 and CRD11 were encapsulated using electrospinning and spray drying methods. Trehalose was used as a thermal protectant, while isomalto-oligosaccharides (IMO) and pullulan functioned as prebiotic and wall material, respectively. Encapsulates were examined using SEM and also analyzed using FTIR to ascertain the integrity of both electrospun and spray-dried fibres during storage. *L. plantarum* encapsulated through electrospinning and stored at -20°C maintained the viability of 9.09 $\log_{10}$CFU/g and 5.42 $\log_{10}$CFU/g at 25°C at the end of 120days. Spray-dried encapsulates retained 7.72 $\log_{10}$CFU/g at -20°C and 5.07 $\log_{10}$CFU/g at 25°C during the same period. FESEM analysis revealed substantial degradation of the microstructure in spray-dried fibres, displaying cracks and rough surfaces, while electrospun fibres maintained relatively better structural integrity. Similarly, encapsulates stored at -20°C retained better structural integrity, showing reduced degradation.

Preparation of binder-blended cattle dung pellets for utilization as a biofuel

Cattle dung pellets were prepared for use as a biofuel, utilizing cattle dung, sawdust, and bentonite clay. The optimal composition obtained was 75% cattle dung, 17% sawdust, and 8% bentonite clay based on pellet characteristics. Similarly, the pelletizing process parameterswere optimized using Response Surface Methodology as 0–0.5 mm cattle dung particle size, 0–0.5 mm sawdust particle size and 17% (w.b.) moisture content. The pellets prepared under these optimized conditions exhibited good combustion properties, with a flaming time of 171.67±25.54 s, a glowing time of 464±36.51 s and an ignition temperature of 281.24°C. Thermogravimetric analysis estimated the combustion characteristics index as 5.41×10^{-8} min^{-2} K^{-3}, suggestive of the energy storage potential for combustion purposes.

Densification of cattle dung-based composite torrefied biomass for bioenergy

A prototype reactor for thermochemical conversion of biomass (capacity: 20 L) was designed and fabricated. It comprised of torrefaction chamber, central perforated pipe, reactor lid, condenser unit, provision to create vacuum and flush N_2 gas to sweep gases, accessories to measure and monitor pressure in headspace of reaction vessel, temperature sensors with thermostatic control, etc. Feasibility trials on conversion of cow dung into torrefied biomass revealed 64% reduction in volatile matter as compared to dried cattle dung. Ultimate analysis showed 44.45% increase in carbon content in torrefied cattle dung as compared to normal dried form.

Reactor Prototype for Thermochemical Conversion

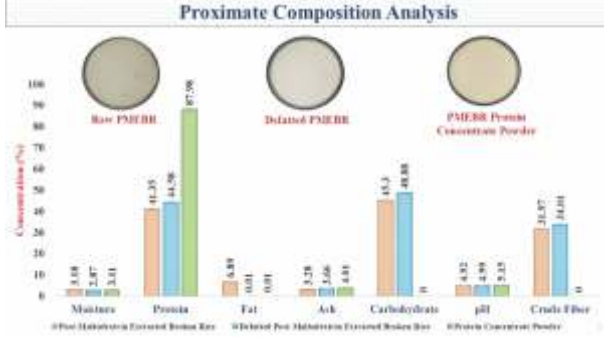
Apricot Kernal Protein-based Biodegradable Packaging Film

Apricot protein kernel-based biodegradable films were developed using apricot kernel protein isolate containing 90% protein (dry matter basis). Films were developed by adopting the casting method, wherein the protein was dissolved in water, followed by the addition of a plasticizer, casting, and drying, after which the film was peeled off. To optimize the levels of protein and plasticizer, various combinations were explored. Protein concentrations ranged from 6% to 10%, with three different plasticizers: glycerol, sorbitol, and polyethylene glycol (PEG). Biodegradable film could be successfully developed with glycerol and sorbitol. The mechanical properties including thickness, tensile strength, and percentage elongation of all the films were determined. Among the glycerol and sorbitol-containing films, there was an increase in the tensile strength and percentage elongation with an increase in the protein and plasticizer levels. The selected films were subjected to thermoforming to produe thermoformed container for usage as sustainable inserts in a cardboard box for packaging of dairy products.

Apricot kernel film and thermoformed inserts for sustainable packaging of dairy products

Development of green packaging materials from agro-co-product proteins for dairy products

The by-products of rice milling are notable for their protein levels, featuring 15-18% in rice bran and around 6% in broken rice. Rice bran proteins consist of 27% alkali-soluble proteins, whereas broken rice proteins contain 82%. Traditional alkali extraction–acid precipitation methods often yield low protein recovery. This study explored ways to improve protein yield and purity from PMEBR using dilute acid pre-soaking, microwave, and enzymatic treatments (phytase and xylanase). Results showed that high pH (13), combined with stronger acid (2N HCl) and alkali (3N NaOH), significantly enhanced extraction efficiency. Optimizing these conditions improved both yield and purity, making the process commercially attractive. The isolated proteins also hold potential for use in biodegradable films and food or dairy applications, adding value to rice



Proximate analysis of post-maltodextrin extracted broken rice and protein concentrate

milling by-products through sustainable utilization.The results indicated that modifying extraction conditions could significantly enhance protein recovery from PMEBR, likely increasing their market value.

Paneer Whey-Apricot-based Wine

A novel fermented beverage was successfully developed using apricot pulp and paneer whey, offering sustainable use of dairy by-products. Paneer whey was pre-treated by defatting and deproteinizing to obtain clear whey. Paneer whey-apricot wine preparation involved defatting and deproteinizing whey, cooling and filtering, adjusting pH, adding sugar, inoculating with yeasts, fermenting at 28°C for 7 days, using clarifying agent, centrifuging, filling in glass bottles, in-bottle pasteurization, and storing at 5°C. Pectinase treatment effects on apricot pulp were studied for juice yield, TSS, total solids, titratable acidity, and pH. Whey treatment improved final wine clarity, making it more appealing. Ethanol tolerance tests showed yeast co-cultures survived up to 10% ethanol concentration. Physico-chemical analysis of paneer whey-apricot wine was compared with market apricot wine control sample. The developed paneer whey-apricot wine was comparable to market apricot wine, demonstrating successful utilization of dairy by-products for beverage production.

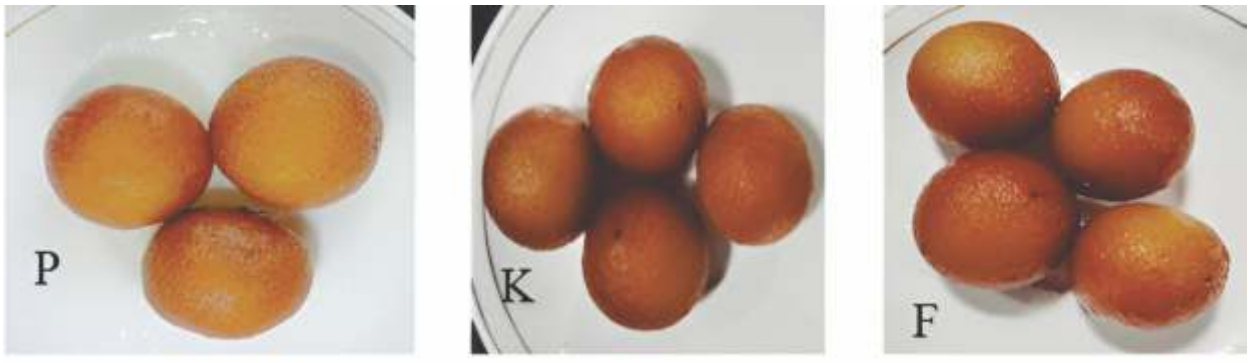
Production of Paneer Whey-Apricot-based Wine

Research Advisory committee meeting held on March 21, 2024

DEVELOPMENT AND VALIDATION OF HEALTH PROMOTING DAIRY FOODS

Preparation of gluten-free version of gulab jamun using millets

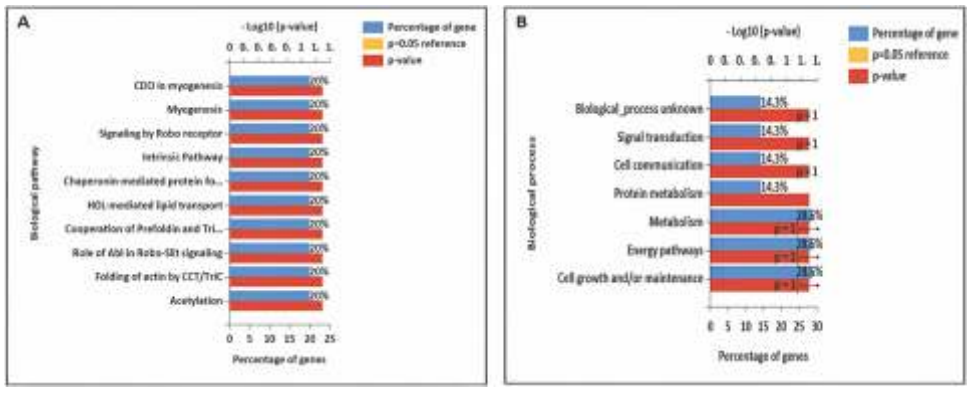
This study aimed to develop gluten-free Gulab Jamun using pearl, kodo, and foxtail millets in paste and flour forms to replace maida, which can be harmful for those with celiac disease. Gulab jamun prepared using paste form of millet had lower phytic acid content and higher overall sensory acceptability. Optimized gulab jamun formulations with 30% kodo millet and 35% foxtail millet (paste form) showed better sensory scores than their flour form of millets, though it was still lower than the control. Kodo millet added gulab jamun had highest protein (8.26 ± 0.09%), ash (1.98 ± 0.05%), and carbohydrate (45.13 ± .31%) content, while the control sample exhibited highest moisture (33.81 ± 0.17%). Fat content across all the samples was not significantly different ($p<0.05$), ranging from 2.51 to 12.86 %. Similar trends were observed in foxtail millet and pearl millet samples.



Millet added gulab jamun samples. P- Pearl millet added sample; K- Kodo millet added sample; F- Foxtail millet added sample

Buffalo milk extracellular vesicles' proteome reveals their possible role in muscle development

Buffalo milk is not only a rich source of nutrients but also of extracellular secretory vesicles (mEVs). mEVs are involved in cell-to-cell communication and may serve as therapeutic or drug delivery agents. mEVs were isolated from milk of three healthy buffaloes, and LC-MS identified 331 common proteins. Bioinformatics analysis revealed roles in metabolism, immunity, and cell cycle regulation, with functions including transporter, catalytic, and GTPase activity. Further, 114 proteins appeared to be newly identified in the buffalo mEVs by a comparative analysis with the previously available bovine mEVs proteome. The biological pathways associated with these 114 proteins highlighted their major role in muscle development, indicating that buffalo mEVs would be helpful for consumers to enhance their muscle development. Overall, these findings shed light on possible market avenues of buffalo milk towards pharmaceutical or nutraceutical industries.



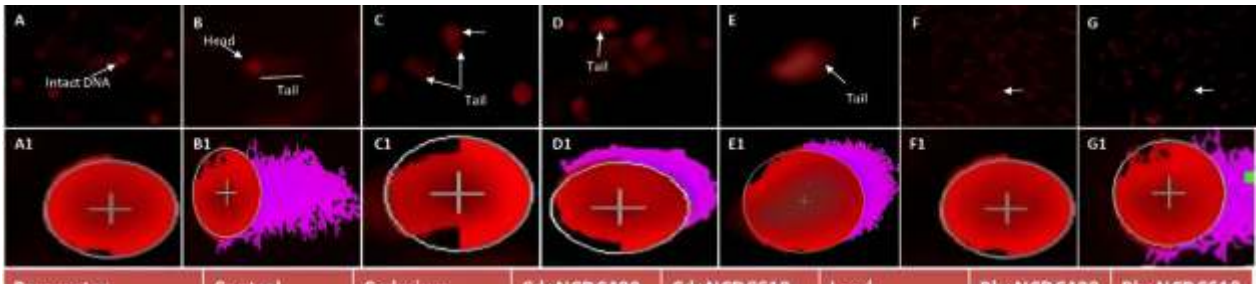
Functional annotation for newly identified buffalo milk extracellular vesicle proteins

Anti-oxidative potential of surface components extracted from probiotic lactobacill

Exo-polysaccharide (EPS) extracted from probiotic *L. fermentum* (LF) MTCC 5898 and surface proteins from *L. rhamnosus* (LR) MTCC 5897 were evaluated for toxicity, junctional integrity and anti-oxidative potential of intestinal epithelial cells against H_2O_2 induced stress *in vitro*. Both extracellular components derived from respective bacteria did not show any toxicity (1-1000 µg/ml) to intestinal epithelial cells by neutral red assay. On the other hand, surface proteins extracted from *L. rhamnosus* did not show protective effect on epithelial barrier integrity in comparison to EPS extracted from *L. fermentum* by trans-epithelial electric resistance (TEER). Significant protective effect of EPS and surface proteins (1-500 µg/ml) derived from respective bacterial strains against H_2O_2 induced stress was also observed on intestinal epithelial cells which was measured by increased cell survival and decreased activities of anti-oxidative enzymes (catalase, superoxide dismutase and glutathione peroxidase).

Probiotics as an innovative approach for bioremediation of heavy metal to alleviate male infertility

Probiotics, especially Lactobacillus strains like *L. fermentum* NCDC-400 and *L. rhamnosus* NCDC-610, showed promise for bioremediation of heavy metals such as cadmium and lead, which negatively impact male fertility. These strains bind metals via negatively charged groups on their cell walls. In male Wistar rats, we evaluated testosterone, liver enzymes (SGOT, SGPT), antioxidant enzymes (SOD, catalase, GPx), sperm parameters, and histopathological changes in the testis and intestine. It was also assessed expression of steroidogenesis and inflammatory genes. Probiotic treatment restored hormone levels, enzyme activity, and gene expression, while reducing tissue metal accumulation. The probiotics also demonstrated positive effects on gonadotropin levels and sperm parameters. The research suggest *L. fermentum* NCDC-400 and *L. rhamnosus* NCDC-610 effectively mitigate heavy metal-induced reproductive toxicity through metal



Parameter	Control	Cadmium	Cd+NCDC400	Cd+NCDC610	Lead	Pb+NCDC400	Pb+NCDC610
Head Length (µm)	232.92 ± 5.409	130.12 ± 13.34**	203.21 ± 11.94	199.33 ± 10.99*	160.23 ± 12.45***	212.01 ± 5.25	200.25 ± 13.35*
Tail Length (µm)	7.286 ± 0.91	12.21 ± 1.86	8.031 ± 0.96	9.54 ± 0.67	11.06 ± 0.89	8.61 ± 1.54	9.80 ± 1.70
Comet Length (µm)	235.6 ± 7.21	135.01 ±15.39***	196.31 ± 6.45*	210.01 ± 13.12*	145.01 ± 11.9**	218.0 ±17.98**	192.0± 4.70*
% DNA in Head	90.75.6 ± 3.83	66.62 ± 6.75	77.97 ± 3.42	80.52 ± 2.64	69.12 ± 9.38	74.48 ± 4.91	66.45 ± 4.91
% DNA in Tail	2.46 ± 0.41	7.41 ± 0.73***	2.75 ± 0.45	4.90 ± 0.46	6.42± 0.76**	2.57 ± 0.92	5.78 ± 0.65
Tail Moment	0.36± 0.07	0.83± 0.04	0.44± 0.09	0.51± 0.03	0.77± 0.08	0.32± 0.11	0.56± 0.20

Evaluation of Cadmium and Lead toxicity on Sperm DNA Damage analyzed by Comet Assay: Fluorescent microphotograph of rat sperm after Cadmium and Lead treatment determined by single cell gel electrophoresis (Comet Assay) with Ethidium Bromide (EtBr) staining. Representative of (A-A1) Intact DNA of control group, (B-B1) Cadmium treatment group, (C-C1) Cd+NCDC-400(T), (D-D1) Cd+NCDC-610(T), (E-E1) Lead treatment group, (F-F1) Pb+NCDC-400(T), and (G-G1) Pb+NCDC-610(T) showing DNA damage on sperm head and tail.

binding, antioxidant, anti-inflammatory, and androgenic actions, offering a novel therapeutic approach for managing male infertility caused by environmental contaminants.

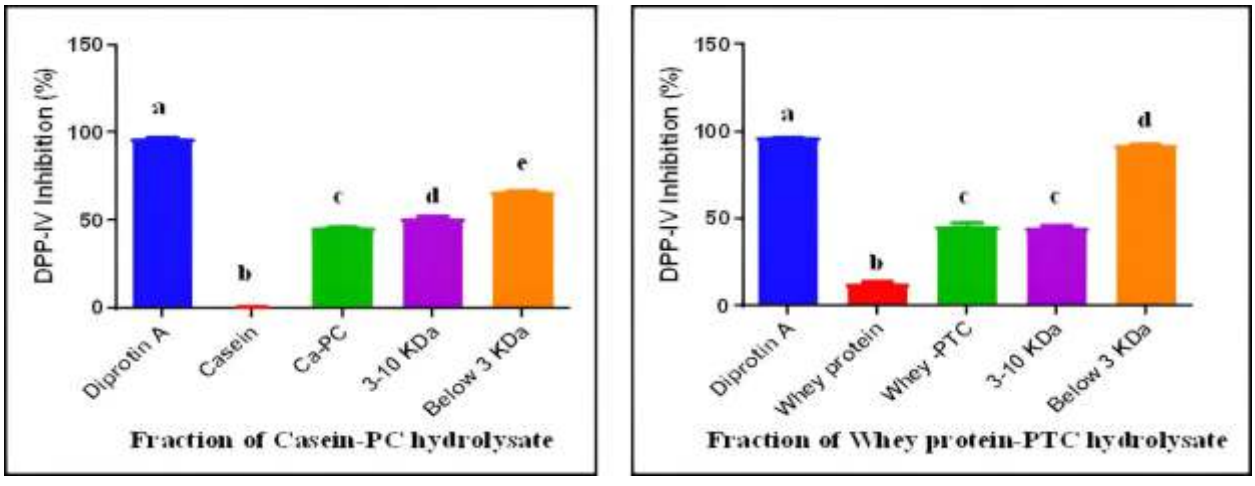
Role of whey protein and proline-rich peptides from colostrum in combating metabolic syndrome

Whey protein and proline-rich peptides (PRPs) from colostrum of five cattle breeds (Sahiwal, Gir, Tharparkar, Karan Fries, and Holstein Friesian) were evaluated for anti-diabetic and anti-obesity effects in RIN-5F and 3T3 cells. Indigenous breeds, particularly Sahiwal and Gir, showed better outcomes in terms of insulin and glycerol release,

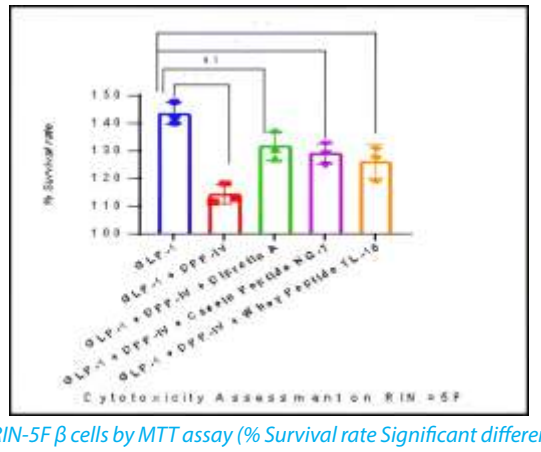
phagocytosis, and reduced lymphocyte proliferation. Colostrum whey protein and colostrinin also demonstrated significant α-glucosidase, DPP4, ACE inhibitory, and antioxidant activities. Based on in vitro results, Sahiwal and Holstein Friesian colostrum were tested in vivo on metabolic syndrome (MS) rats. Rats fed Sahiwal colostrum, whey, and PRPs showed improved insulin, hemoglobin, GLP-1 levels, better lipid, liver, and kidney profiles, and reduced glycated hemoglobin and pro-inflammatory cytokines. Gene expression analysis revealed improved insulin sensitivity and reduced gluconeogenesis. Overall, colostrum components ameliorated MS symptoms, and SW was better than HF in combating MS.

Camel milk casein and whey protein hydrolysates exhibited DPP-IV inhibition potential

Camel milk casein and whey protein hydrolysates showed potential for DPP-IV inhibition, a key therapeutic target in diabetes management. GLP-1, an insulinotropic hormone promoting β-cell proliferation and insulin secretion, is rapidly inactivated by DPP-IV. Peptides NQ-7 and TL-10, derived from camel milk casein (PC) and whey (PTC) hydrolysates, inhibited DPP-IV. GLP-1 alone significantly enhanced β-cell proliferation. While GLP-1 alone enhanced β-cell proliferation, its combination with DPP-IV reduced cell survival. However, co-treatment with GLP-1, DPP-IV, and DPP-IV inhibitors—Diprotein A, NQ-7, or TL-10—significantly increased β-cell proliferation, suggesting restoration of GLP-1 activity. NQ-7 and TL-10 moderately improved proliferation, indicating their potential as natural DPP-IV inhibitors.



DPP-IV inhibition potential of casein protein PC and whey protein PTC hydrolysates and their fractions (3-10 KDa and <3 KDa)

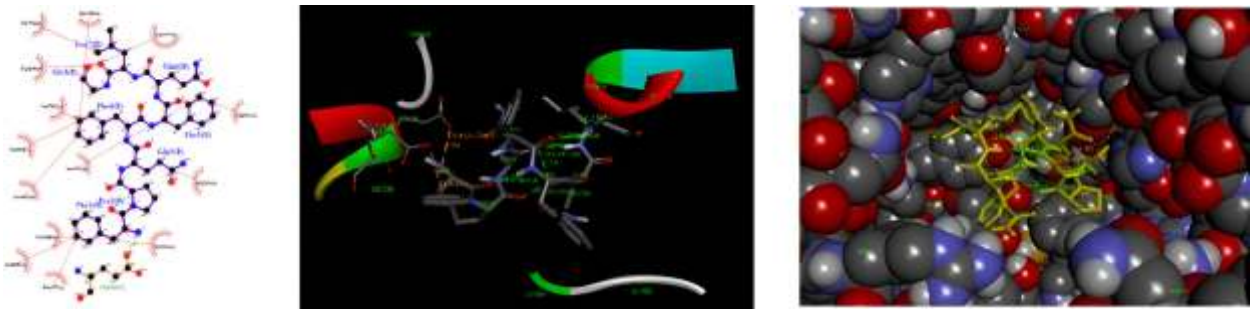


*Cytotoxicity assessment on Pancreatic RIN-5F β cells by MTT assay (% Survival rate Significant difference (***P < 0.001), significant difference (**P < 0.01) significant difference (*P < 0.05), ns-non significant from 100 µm group, using one-way ANOVA. Data expressed as mean ± SEM, n=3*

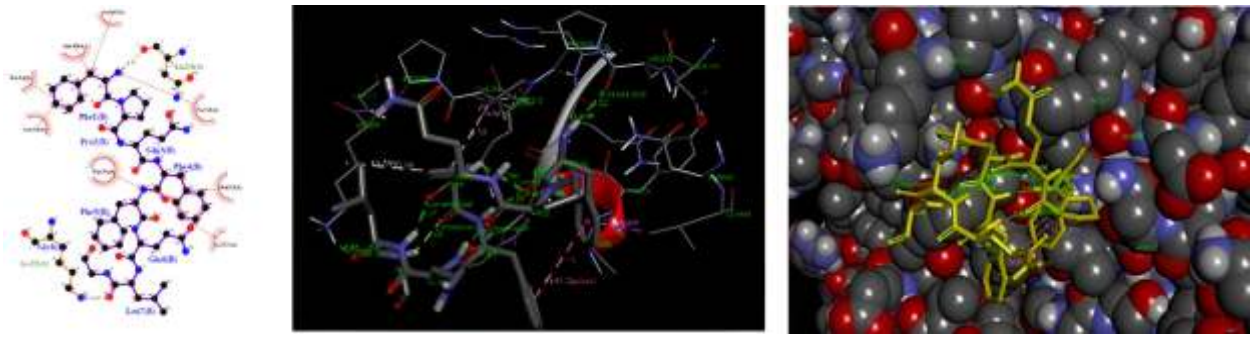
Anti-diabetic potentials of fermented camel milk

The <10 kDa fraction of fermented camel milk displayed high IC_{50} value of α-glucosidase (0.72 ± 0.003 mg/mL) and DPP-IV (0.54 ± 0.01 mg/mL) inhibitory activities. After LC-MS/ MS analysis, 545 peptides have been identified, of which 395 were predicted to exhibit antidiabetic activity. Specific

peptides demonstrated robust DPP-IV and α-glucosidase inhibitory activities, validated through *in silico* studies, with novel sequences confirmed in the BIOPEP-UWM database. Peptides such as FPQFFQLG (α-S1-casein), SSIQFVLIDSCKYL (κ-casein), and FQEPVPDPVR (β-casein) showed high binding affinities to both enzymes (DPP-IV and α-glucosidase), with HADDOCK scores ranging from -93.4 ± 4.9 to -66.1 ± 2.2. These findings highlighted the therapeutic potential of fermented camel milk peptides in managing Type 2 diabetes.



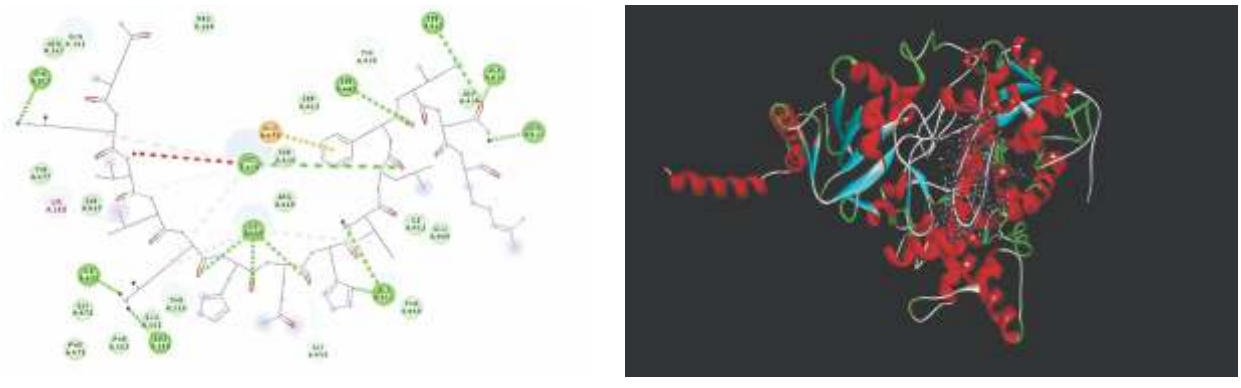
Representation of binding interactions between selected peptide FPQFFQLG and Human Dipeptidyl peptidase-IV enzyme



Representation of binding interactions between FPQFFQLG and Human α-Glucosidase enzyme

Antifungal potential of cow colostrum whey-derived lactoferrin rich fermentate preparations against mucormycosis causing molds

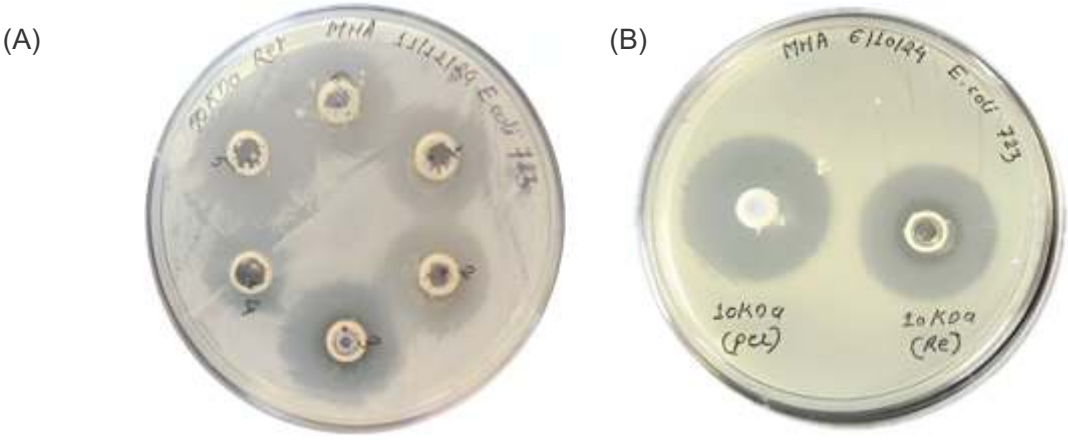
Lactoferrin and fermented whey fractions from cow colostrum showed strong antifungal activity against mucormycosis-causing fungi like *Rhizopus* and *Mucor* species. The most effective were C25-fermented 50 kDa and 10 kDa fractions, with MICs of 25–100 mg/mL. The 10 kDa fraction exhibited the best antihyphal activity (80%) across all cultures and showed no haemolytic activity against sheep blood. LC-MS/MS identified peptides, 152 of which showed significant antifungal potential in silico. Five peptides exhibited a HADDOCK score of -91.3 +/- 9.8 to -81.3 +/- 2.2 and a Z score of -2.3 to -2.6 with Lanosterol 14-alpha demethylase (CYP51). Molecular dynamics simulations confirmed the stability of these peptide-enzyme complexes, supporting their antifungal potential.



Representation of binding interactions between selected peptide 1 and lanosterol 14-alpha-demethylase enzyme

Pre-clinical efficiency, safety and toxicity of colostrum whey protein derived formulation

Diarrhoea is major global health concern. In India, it ranks third among causes of death, accounting for 13% of annual mortality. This study aimed to explore a natural treatment using bioactive proteins and peptides derived from Sahiwal cow colostrum whey. Colostrum was defatted and treated with 2% citric acid to obtain whey, which was then ultrafiltered using 50 kDa and 10 kDa membranes. Before ultrafiltration, it was fermented with *Lactocaseibacillus rhamnosus* C25 for 48h Peptide concentrations in >50 kDa and <10 kDa fractions were 3.45 mg/mL and 5.98 mg/mL. Antimicrobial activity against *E. coli* MTCC 723 was confirmed using well diffusion assay. The >50 kDa fraction showed a 19 mm inhibition zone, while <10 kDa and >10 kDa fractions showed 30 mm and 28 mm zones, respectively. The fractions were lyophilised and were tested for Minimum Inhibitory Concentration (MIC) using resazurin assay. MICs ranged from 0.31–0.15 mg/mL for >50 kDa, and 0.12–0.06 mg/mL for <10 kDa fractions.



Antimicrobial activity of A: >50 KDa whey proteins and B: <10 KDa peptides derived from whey proteins against E.coli MTCC723

Isolation of proline-rich polypeptides from colostrum of select indigenous cattle breed and evaluation of their nutraceutical potential

Exosomes were isolated from skimmed colostrum (1st day), transitional milk (7th day), and matured milk (14th day) of Holstein Friesian, Sahiwal, Tharparkar, and Karan Fries breeds using ultracentrifugation. Particle size ranged from 30–190 nm, with concentrations between 1.5–3.0 × 10^7 particles/mL. Proteomic analysis identified 2,260 distinct proteins across all samples. Heat maps and volcano plots highlighted differential protein expression across breeds and lactation stages. The presence of unique high abundance proteins decreased significantly over the lactation periods for all breeds, suggesting that the diversity of uniquely abundant proteins was found highest at the onset of lactation and diminishes as lactation progresses.

DPP-IV inhibitory (antidiabetic) peptides-rich milk protein hydrolysates: Effect of simulated digestion and safety evaluation

Optimized the encapsulation process for DPP-IV inhibitory peptides rich hydrolysates through spray drying. The optimal combination consists of gum Arabic (GA) and resistant maltodextrin (RMD) as wall material, 10% core protein, 10% feed solids concentration and dried at 70□ outlet temperature. The storage associated changes in the physicochemical, sensory and microbial parameters of optimized product were analysed during the storage period of 120 days on every 15 days interval. The product stored at 25□ and 35□ was stable through the storage period while product stored at 45□ showed significant changes in browning (HMF content) and sensorial properties. The encapsulation efficiency (~65%) of the product wasn't affected by the storage conditions. The encapsulation helps to protect the DPP-IV inhibition activity at absorption site (in small intestine) by ~ 5.8 times. The optimized product received a total sensory score of 88.10 ± 5.20 for 100.

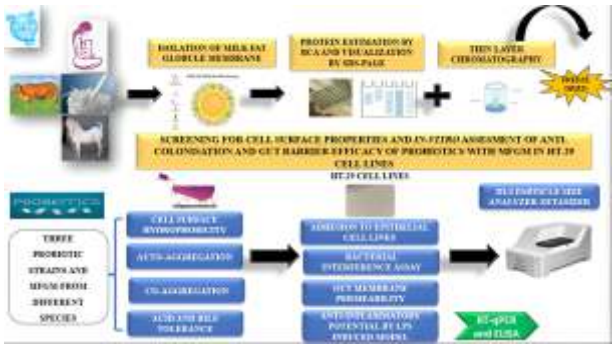
Optimized an enzymatic hydrolysis process to yield maximum DPP-IV inhibition activity for goat milk caseins

The enzymatic hydrolysis process for generating DPP-IV inhibitory peptides from goat milk casein

was optimized using a multi-enzyme approach with plant and microbial enzymes. Hydrolysis time was reduced to 1 hour, achieving a high DPP-IV inhibition with an IC50 of 0.16 ± 0.01 mg/mL and a degree of hydrolysis of 37.28 ± 0.73%. SDS-PAGE and HPLC confirmed the presence of low molecular weight peptides. The hydrolysate also exhibited multifunctional activities, including α-glucosidase inhibition (IC50: 4.31 ± 0.05 mg/mL), ACE inhibition (IC50: 0.26 ± 0.01 mg/mL), ABTS radical scavenging (82.04 ± 0.11 µmol TE/g protein), and DPPH scavenging (23.96 ± 0.09 µmol TE/g protein). Therefore, the developed hydrolysate from goat milk casein has the potential to be offered as a dietary supplement to people suffering from diabetes or prediabetes after validation through suitable in vitro and in vivo models.

Comparative functional analysis of milk fat globule membrane from *Sahiwal* and *Jamunapari breeds* in murine gut model

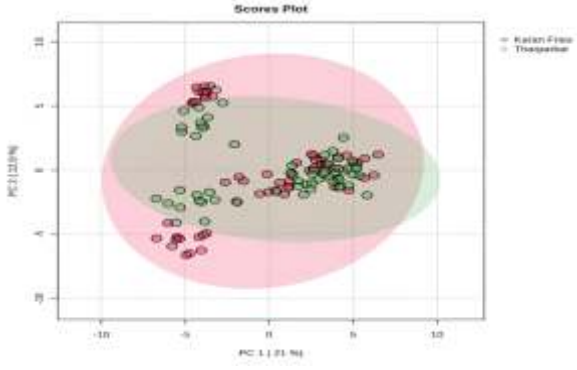
This study compares Milk Fat Globule Membrane (MFGM) from Sahiwal (cow), Jamunapari (goat), and human milk in enhancing probiotic functionality and promoting gut health. Isolated and digested MFGM was tested with Lactobacillus strains to assess probiotic functionality. Human MFGM showed the highest probiotic tolerance, adhesion, and pathogen interaction, followed by goat and cow MFGM. The same pattern was observed in Gut barrier assays which confirmed reduced LPS-induced permeability, while cytokine analysis showed increased IL-10 and TGF-β and decreased pro-inflammatory markers. The characterization results showed clear presence of MFGM components like Butyrophilin, CD36, and Lactadherin in the MFGM samples. Zeta potential and particle size analysis indicated increased bacterial surface charge during MFGM interaction.



Schematic diagram for functional analysis of milk fat globule membrane in murine gut model

Quality of milk from selected indigenous cattle breeds

A total of 60 milk samples were collected from healthy, mid-lactation Tharparkar (TP) and Karan-Fries (KF) cows at the Livestock Research Center, NDRI. Using a GC-MS based method, a total of 203, and 180 milk metabolites were identified in TP, and KF, respectively . Principal Component Analysis indicated a 33.9% variability. Between both breeds, the top 10 differential metabolites identified as malic acid, creatinine, dodecanoic acid, nonadecanoic acid, glycerol monostearate, erythrono-1,4-lactone, heptadecanoic acid, adipic acid, proline, and erythrofuranose.



PCA Plots showing overlapping of metabolites in milk of Tharparkar and Karan Fries

Breed-specific microbial diversity in raw milk

Metagenomic sequencing of the V3-V4 region of the 16S rRNA gene was conducted to analyze microbial diversity in raw milk from Karan Fries, Gir, and Nili-Ravi breeds. In Karan Fries milk, Firmicutes (49%), Actinobacteriota (25%), and Proteobacteria (20%) dominated, with Corynebacterium (23%), Pseudomonas (6%), and Acinetobacter (5%) as major genera. Gir milk showed higher Proteobacteria (47%), followed by Firmicutes (26%) and Actinobacteriota (17%), with Acinetobacter (17%), Pseudomonas (10%), Lactobacillus (8%), Enterobacteriaceae (7%), and Staphylococcus (6%) as key genera. Nili-Ravi milk was rich in Actinobacteriota (40%) and Proteobacteria (39%), with Rothia (18%), Pantoea (11%), Enterococcus (10%), Acinetobacter (8%), and Bacillus and Macrococcus (6% each) being most abundant.

MECHANIZATION AND PROCESS ENGINEERING -

Development of magnetic induction based milk heating system for *paneer*

Laboratory scale magnetic induction-based milk heating unit with 5L capacity was developed. This novel thermal technique's energy requirement to heat 2.5L milk was least as compared to other heating methods like LPG stove, electric heating coil etc. About 25 per cent energy saving was observed compared to LPG stove. The total time to heat the milk was also less in the fabricated unit. Almost zero milk deposit was observed in the unit after heating the milk up to 90°C. Furthermore, no steam/water is required as a heating source in the fabricated unit since the electrical energy is converted to heat energy by eddy currents.

Magnetic Induction based Milk Heating System

Development of inline milk coagulation cum coagulum pressing unit for paneer manufacturing at small scale

The Inline milk coagulation cum coagulum pressing unit (20L milk / batch capacity) was evaluated for its performance. The studies were conducted (20 runs) as per face centered central composite design (FCCD) using Response Surface Methodology (Design expert 13.0.5.0 software) for *paneer* manufacturing. The independent parameters were coagulation temperature (70, 80, and 90°C), pressure (1.5, 3.0 and 4.5 kg/cm^2) and pressing time (9, 12 and 15 min), based on preliminary trials. Dependent variables (responses) were yield (%), moisture content (w.b%), porosity (%) hardness (N), springiness, chewiness, gumminess, cohesiveness and sensory attributes. The optimum conditions were obtained as 2.7 kg/cm^2 pressure, 76.3°C coagulation temperature and 10 min pressing time using numerical optimization. The predicted values were found non-significant with experimental values in student's t-test.

Inline Milk Coagulation cum Coagulum pressing unit

Development of chest freezer attachment for small scale milk cooling application

An attachment unit that is seamlessly compatible with chest freezers is designed and fabricated. The system includes a milk tank, a slurry jacket, a scraper blade, a milk agitator, a drive motor, and a temperature controller. In the subsequent phase, various multi-component blends (MCB) were formulated by varying the ratio of specific components in water. The blends were tested to optimize their slurry and cooling properties. The degree of subcooling and the time required for ice nucleation varied depending on the blend composition and scraper speed, with faster nucleation observed in certain optimized conditions. The cooling rate of milk was highest with blends containing higher additive concentrations under specific conditions. These findings highlight the potential to control and optimize the cooling characteristics by modifying blend compositions and operational parameters.

Monitoring and characterization of yogurt fermentation process on the basis of electrical properties

The yogurt fermentation process was monitored

using pH, titratable acidity, capacitance, and electrical conductivity over time. During the first hour, minimal changes in conductivity and capacitance were observed due to slow fermentation and negligible structural changes. As fermentation progressed, both parameters increased significantly in a linear pattern. Gel strength measurements showed that minimal stress was needed initially, indicating a lack of texture development. After three hours, as yogurt began to set, the required stress increased with fermentation time. Initially, the storage modulus (elastic behavior) was nearly zero, reflecting the milk's viscous nature. However, as texture developed, the storage modulus surpassed the loss modulus, indicating a shift to elastic dominance. Capacitance showed a stronger correlation with textural parameters-firmness, cohesiveness, consistency, and work of cohesion—compared to electrical conductivity, making it a more effective indicator for monitoring yogurt texture during fermentation.

Development and integration of automatic thermal storage module with solar fermentation unit

An automatic thermal storage module was developed and integrated with a solar fermentation unit. Phase change materials (PCMs)—paraffin wax, palm oil, and beeswax—were evaluated for thermal energy storage based on their melting and solidification behavior in various container geometries. Cylindrical containers showed superior performance. The melting temperature and melting time were measured as 59.3 °C and 36 min, 68.1 °C and 48 min., and 43 °C and 20 minutes, respectively for Paraffin wax, Beeswax and Palm Oil in the specific experimental conditions. Notably, palm oil had the lowest melting and solidification points and highest rate of heat release, cooling from 71°C to 38°C in just 20 to 40 minutes, which may limit its effectiveness in providing sustained thermal energy release. Paraffin wax was found to be the most suitable for solar applications, as its melting temperature (59°C) is 10°C to 15°C higher than the working temperature.

Development of a mechanized unit for Pinni manufacturing

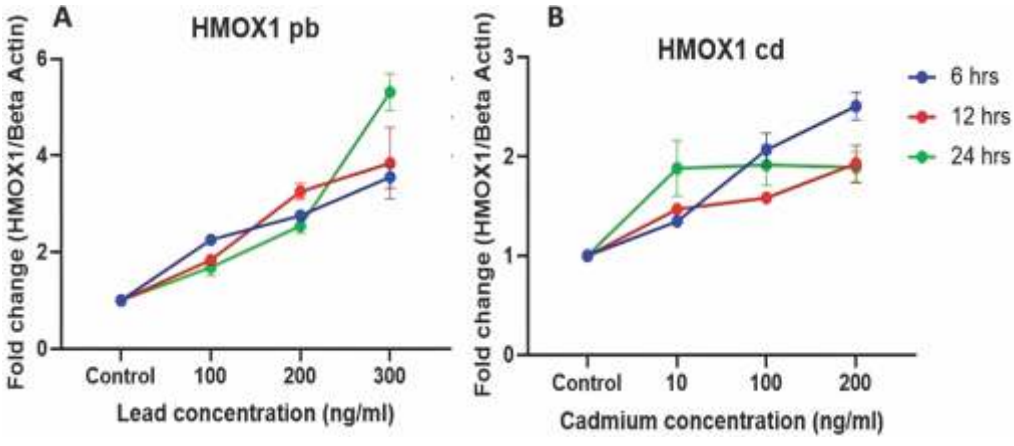
Pinni is a composite dairy product, and its ingredient optimization was conducted using fixed amounts of wheat flour and cardamom powder, while varying ghee, khoa, sugar, and edible gum. The optimized quantities were 89.94 g ghee, 107.52 g khoa, 70.54 g sugar, and 16.77 g edible gum.Engineering properties of *pinni* mix were determined viz. angle of repose, bulk density and tapped density etc. The browning index, geometric mean diameter, hardness etc of *pinni* were also determined. These properties were determined for moulding of *pinni* mix to *pinni*. Process parameters (pneumatic pressure and pressing time) were optimized for moulding of *pinni* mix (with optimized ingredients) to *pinni*. Full factorial design for two independent parameters viz. pneumatic pressure (2 to 4 bar) and pressing time (2 to 10 s) was used for experimental trials. Statistical DMRT (Duncan's multiple-range-test) technique was applied using SPSS software (version 23) to optimize the process parameters.

Participants of the training Emerging engineering and technological interventions in processing and value addition of milk products organized at ICAR-NDRI during January 10-30, 2024 with Officials of ICAR-NDRI

RISK ASSESSMENT AND NEW GENERATION METHODS TO ASSESS THE QUALITY AND SAFETY OF MILK AND MILK PRODUCTS

Developed RT-LAMP assay for lead and cadmium toxicity detection using the HemeOxygenase 1 (HMOX1) gene of HepG2 cells

Lead and cadmium, persistent environmental toxins, pose serious health risks even at low levels. This study was targeted to detect lead and cadmium toxicity using RNA biomarkers from HepG2 cells. Gene expression analysis in HepG2 cells showed significant upregulation of AhR pathway genes, apoptosis-related genes, MAPK1, and HMOX1 after lead and cadmium treatments. In particular, the gene expression of hemeoxygenase 1 (HMOX1) was increased linearly up to fivefold in a dose and time-dependent manner, correlating with elevated bilirubin secretion after 6 hours. Based on this, an RT-LAMP assay targeting HMOX1 was developed for lead and cadmium detection, with results visible via HNB dye color change (violet to blue) in 30 minutes. Standard curves were generated for quantification, and the assay was validated in spiked milk samples, showing 100% sensitivity and specificity above MRL levels in infant foods.



Dose- and time-dependent effect of lead acetate (A) and cadmium chloride (B) on HMOX1 gene expression in HepG2 cells

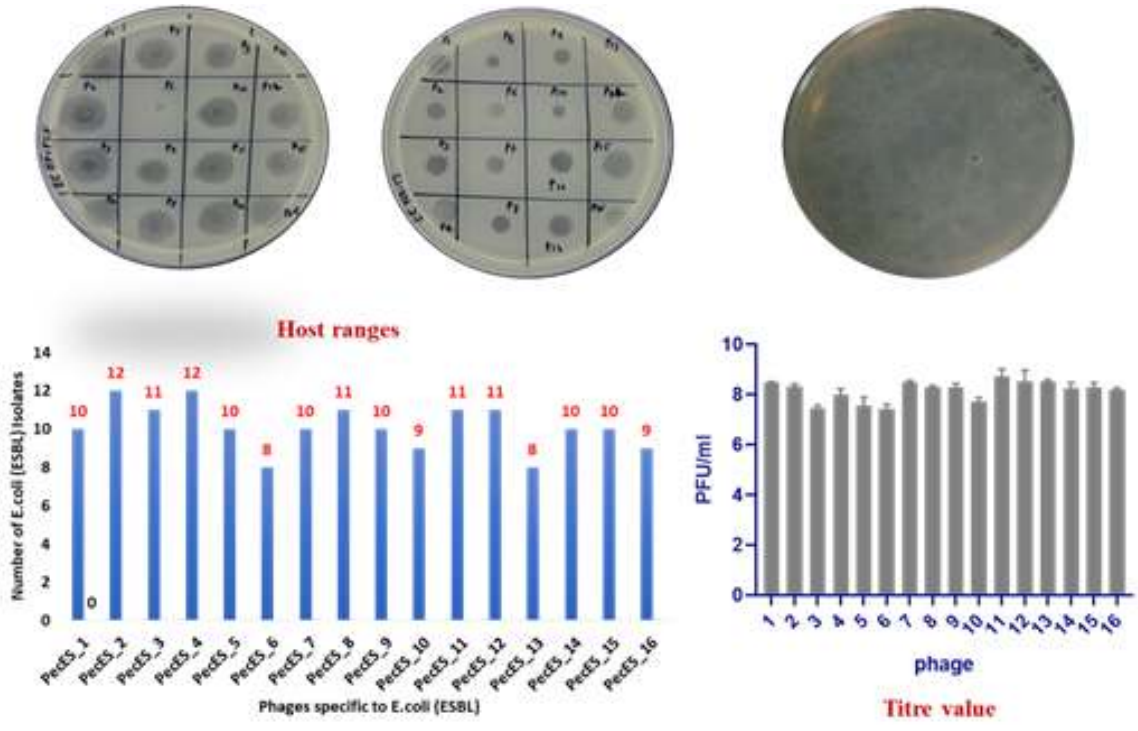
Bioinformatics analyses deciphered critical molecular pathways in cancers caused by aflatoxin B1

Aflatoxin B1 (AFB1), a fungal toxin in food and feed like cereals, nuts, and oilseeds, is among the most potent human carcinogens. However, little is known about the molecular pathways it affects during cancer development. Thus, a bioinformatics analysis was conducted on AFB1-responsive genes involved in five deadliest cancer types including lung, colorectal, liver, stomach, and breast cancers. Genes from the Comparative Toxicogenomics Database were analyzed for each cancer type by statistical overrepresentation test using the PANTHER database. AFB1 predominantly affected the GnRHR, CCKR signaling, and angiogenesis pathways in lung, breast, liver, and stomach cancers, while apoptosis and Wnt signaling were impacted in liver and stomach cancers. Thirteen key genes (e.g., FOS, AKT1) were identified as biomarkers for AFB1-induced cancers as well as for *in vitro* AFB1 toxicological studies using specific cancer cell lines.

Bacteriophage based antimicrobial therapy for the bio-control of multi-drug resistant (MDR) zoonotic bacterial dairy pathogens

This study explores bacteriophage therapy as a promising solution against multidrug-resistant (MDR) E. coli. From 103 environmental samples collected across northern India {Hisar (HR), Karnal (HR), Kurukshetra (HR), Nanota (UP), Gangoh (UP),

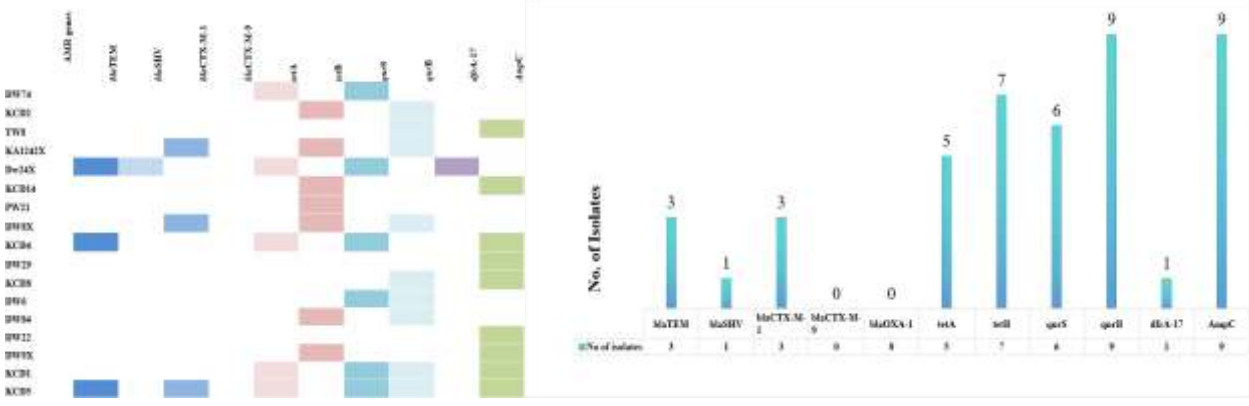
and Delhi}, 26 bacteriophages specific to MDR *E. coli* were isolated. These phages were stable across a wide pH range (3–11) and exhibited strong lytic activity with burst sizes of 154–1,938 virions per infected cell. Specificity testing demonstrated that the phages exhibited no lytic activity against *Listeria monocytogenes*, *Staphylococcus aureus*, *Cronobacter sakazakii*, *Bacillus cereus*, *Rhodococcus equi*, *Shigella flexneri*, and *Salmonella enterica*, confirming their specificity to *E. coli*. Host range analysis revealed that two phages, PecES_2 and PecES_4, exhibited the broadest host range, lysing 12 out of 14 MDR *E. coli* isolates, while one isolate showed the narrowest host range, lysing 8 out of 14 isolates. These findings revealed the potential of bacteriophages as a targeted and effective approach to addressing infections caused by MDR *E. coli*.



Host Ranges and titre value of Bacteriophages Specific to E. coli (ESBL)

Surveillance of antibiotic resistant *Shigella* spp. isolated from dairy farm

This study investigated antibiotic-resistant *Shigella* spp. in a dairy farm using phenotypic (CLSI) and genotypic (PCR) methods. Out of 200 samples, 17 (8.5%) were positive for the *ipaH* gene. Most isolates came from dairy wastewater (52.94%), followed by feces (35.29%) and cattle drinking water (11.76%). Species detected included *S. flexneri* (3.5%), *S. dysenteriae* (2.5%), and *S. sonnei* (2.5%). No *Shigella* was found in milk, milking machine, or handlers'



Prevalent antimicrobial resistant genes in Shigella species isolates from dairy supply chain

swabs. Over 52.9% of *Shigella* isolates from dairy farms showed multidrug resistance, especially to ampicillin (100%), tetracycline (82.4%), amoxicillin-clavulanic acid (64.7%), and cefoxitin (58.8%). PCR screening revealed tetracycline resistance genes (*tetA*, *tetB*) in 70.5% of isolates, quinolone resistance genes (*qnrS*, *qnrB*) in 58.8%, and *AmpC* beta-lactamase genes in 52.9%. ESBL genes (*blaTEM*, *blaCTX-M*) were found in 17.6%, and trimethoprim resistance gene (*dfrA-17*) in 5.8%. These findings revealed the risk of spreading antibiotic-resistant *Shigella* from dairy farm environments to the wider community.

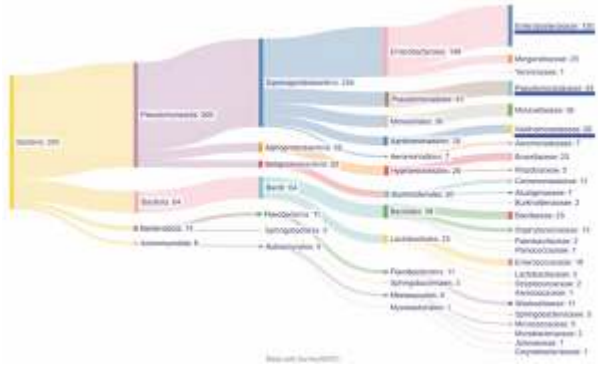
Development of enterocin rich whey powder against gastrointestinal pathogens

This study optimized enterocin production from *Enterococcus faecium* FH99 using paneer whey and and evaluating its potential to reduce gastrointestinal pathogen colonization in HT-29 cells. The whey medium was first optimized for nutritional components using Response Surface Methodology, followed by fine-tuning physical parameters such as incubation time, temperature, and pH. The resulting enterocin-rich whey powder and whole FH99 cells were tested for cytocompatibility using MTT assays, confirming 1% powder and 10^9 CFU/mL cells as safe doses. In bacterial interference assays, post-treatment was most effective, with *E. faecium* FH99 inhibiting *S.* Typhimurium and *E. coli* O157:H7 by 97.8% and 96.29%, respectively, and bacteriocin mix powder achieving 98.3% and 96.8% inhibition, respectively. These findings suggested that the present bacteriocin-based powder can effectively disrupt pathogen adhesion and prevent bacterial colonization in the gut and intervene during pathogen infections.

Development of Enterocin rich whey powder

Genomic based approaches for characterization of the microbial antibiotic resistance and resistome in dairy production system

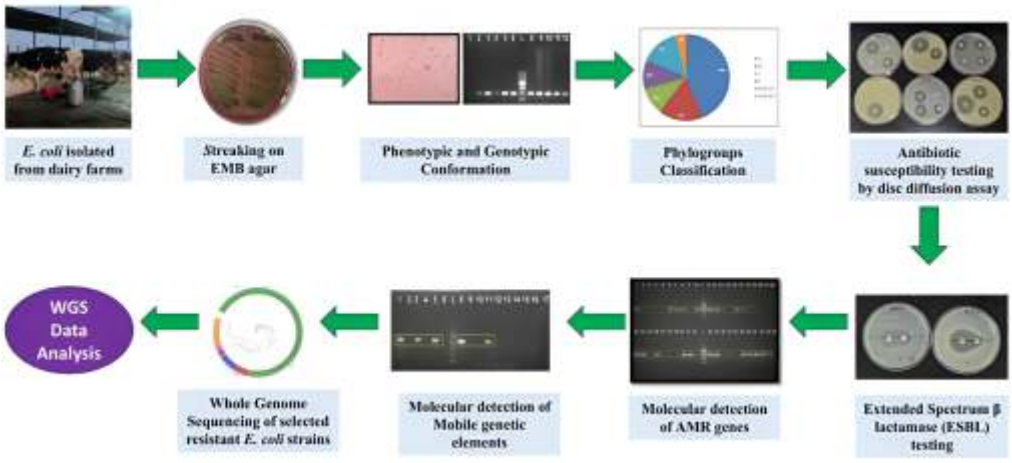
The study provided critical insights into antimicrobial resistance patterns, highlighting the following key findings: a notable dominance of β-lactam resistance was observed, particularly within the Enterobacteriaceae family. The majority of identified antibiotic resistance genes (ARGs) were associated with aminoglycosides, tetracyclines, β-lactams, and macrolides.Wastewater samples were identified as the primary reservoirs of antibiotic-resistant bacteria and ARGs, followed by feces, soil, and milk samples. Within the *Enterobacteriaceae* family, *Escherichia coli* emerged as the most prevalent antibiotic-resistant bacterium, while Shigella exhibited extensive-spectrum resistance.



Phylogenetic grouping of putative antibiotic resistant bacteria isolated from dairy production system

Molecular characterization of *E. coli* strains from dairy farms

Out of 48 *E. coli* isolates from dairy farms, 60.41% were resistant to ampicillin and 54.16% to β-lactams and tetracyclines. About 23% showed multidrug resistance, and 52% were ESBL producers, indicating strong antibiotic resistance. Further genetic analysis



Molecular characterization of E. coli strains from dairy farms

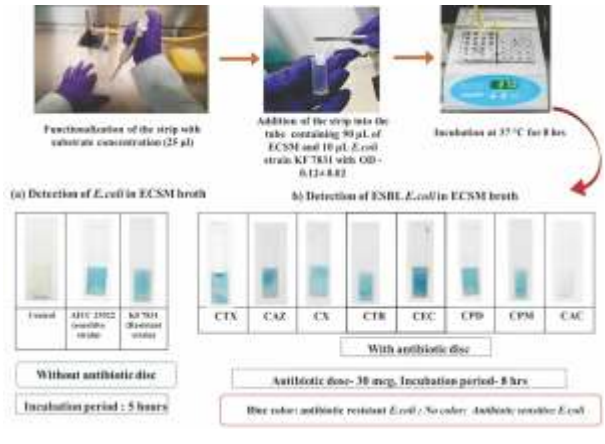
showed the bla$_{CTX-M-1}$ gene to be the most commonly identified β-lactamase gene. Other resistance genes against Tetracyclines, trimethoprim and fluoroquinolones were also detected. Many *E. coli* isolates carried class 1 integrons and mobile genetic elements like IS26 and IncF plasmids, indicating active spread of resistance genes. Additional evidence of complexity in resistance development was given by the transposons identified in many of the isolates, such as Tn3 and Tn1721. Whole genome sequencing of selected multidrug-resistant strains revealed various resistance genes (*floR*, *sul1*, *mph(A)*, *blaCTX-M-65*, *blaCTX-M-15*, *qnrS1*) and several virulence genes (*etsC*, *irp2*, *fyuA*, *shiB*, *hlyA*, *cia*, *iss*, *anr*), suggesting these strains not only resist treatment but also cause serious illness.

A paper strip-based assay for the detection of extended-spectrum beta-lactamase (ESBL) - producing *E. coli*

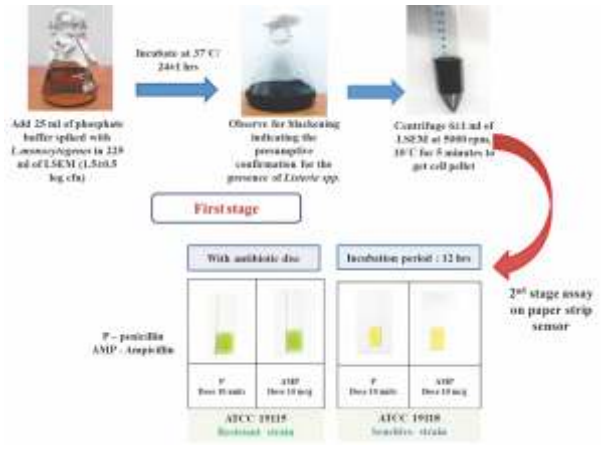
A paper strip-based assay was developed to detect extended-spectrum beta-lactamase (ESBL)-producing *E. coli* isolates from ECSM samples. The assay was tested with multiple *E. coli* strains using ESBL antibiotic discs. *E. coli* ATCC 25922 was sensitive, while strains like KF 7831, CYK 46, K312M, AF1PT, BFLT, DF1LT, CF1FT2, DF1VCI, BF1PA, AF1CCI, BF1CA, DF1VCH, and DF2VT showed resistance. Some strains, including KF 7994, BF1PCF, DF1VCI, and BF1PA, showed intermediate resistance. The detection time was 8 hours.

A paper strip-based assay for the detection of AMR *Listeria monocytogenes*

A paper strip-based assay was developed to detect antimicrobial-resistant *L. monocytogenes* isolates from LSEM samples. It was evaluated with strains ATCC 19115, ATCC 19118, ATCC 15313, MTCC 1143, and BAA 751. The strip identified ATCC 19115 as resistant, while the others were found to be sensitive. The detection time for this assay was 10 hours.



Paper strip based sensors for detection of extended-spectrum beta-lactamase (ESBL) E. coli



Paper strip based sensors for detection of Antimicrobial resistant Listeria monocytogenes

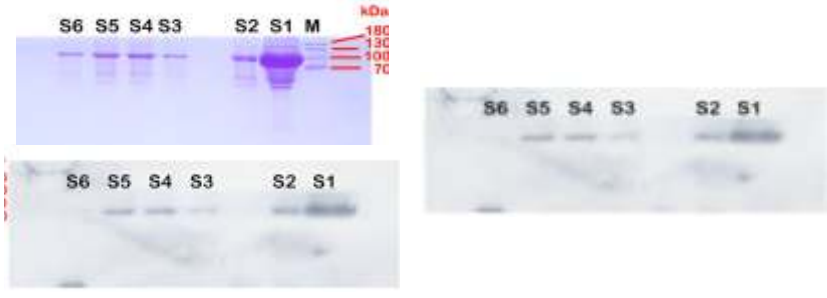
Protein based optical sensors for detection of *Listeria monocytogenes* in milk

To detect *Listeria monocytogenes* in milk, protein- and antibody-based assays were developed. Recombinant Listeria Adhesion Protein (rLAP) was expressed in *E. coli* BL21 (DE3), yielding 2.88 mg/mL protein, confirmed via Western blot. Epitope-based Anti-InlA and Anti-InlB antibodies were generated in rabbits, showing high specificity to *L. monocytogenes* with minimal cross-reactivity. ELISA assays using these antibodies detected 4 $\log_{10}$ CFU/mL of *L. monocytogenes*. A LAP-based sandwich ELISA offered enhanced sensitivity and specificity. Lateral flow assays (LFA) were developed using rLAP and Anti-InlB, detecting 3.26 $\log_{10}$ CFU/mL in broth and 4.3 $\log_{10}$ CFU/mL in milk within 20 minutes. Pre-enrichment in Listeria Selective Enrichment Medium (LSEM) improved sensitivity to 1 $\log_{10}$ CFU/25 mL. The assays were validated per IS 14988:2020 using milk and paneer, with no cross-reactivity to non-*Listeria* organisms. The developed ELISA and LFA provide rapid, sensitive, and cost-effective tools for detecting *L. monocytogenes* in dairy products.

Molecular cloning expression and characterization of *Listeria monocytogenes* born listeria binding protein

The *lap* gene from *L. monocytogenes* was amplified and cloned into the pJET1.2 vector, followed by sub-cloning into the pET28b expression vector. Recombinant LAP (rLAP) was successfully expressed in *E. coli* BL21 (DE3) under optimized conditions (20°C, 0.5 mM IPTG), yielding 2.88 mg/mL of soluble protein. Confirmation was done through colony PCR, restriction digestion, and western blot analysis, which identified a 104 kDa His-tagged protein. In summary, we optimized the protocol for expression of rLAP and successfully produced 2.88 mg/ml rLAP in soluble form. The binding study of purified rLAP for detection of *L. monocytogenes* also carried out by sandwich ELISA assay. It was found that rLAP as a detection biomolecule provide excellent specificity with *L. monocytogenes* no cross reactivity with other tested *Listeria* species and non-*Listeria* species were observed except *L. ivanovii*. Hence this finding represents novel type bio-recognition molecule for detection of *L. monocytogenes*

Blue white screening of transformed Colonies on (+) kanamycin LB Plates. White Colonies were recombinants while blue colonies were Non-recombinants.



Western Blot analysis of rLAP using anti His monoclonal Ab, HRP conjugate showed 104 kDa size proteins

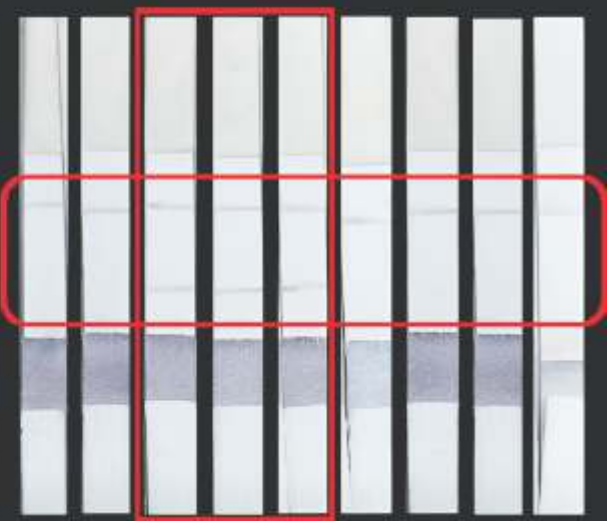
Detection of *Listeria monocytogenes* by lateral flow assay

An epitope peptide (19 amino acids, 2014.05 Da) of *Listeria monocytogenes* surface protein Internalin A (InlA) was predicted and used to generate a specific antibody in rabbits. The purified antibody reacted with *Listeria* spp. and *S. aureus* but not with *E. coli by* dot blot assay. Both indirect and sandwich ELISAs detected *L. monocytogenes* at 4 log CFU/mL. A sandwich-format lateral flow assay (LFA) was developed, optimized for InlA antibody concentration and component assembly. The LFA detected *L. monocytogenes* at 4.04 log CFU/mL in broth and 4.3 log CFU/mL in spiked milk within 15 minutes. After 22 ± 2 hrs of pre-enrichment in *Listeria* Selective Enrichment Medium (LSEM), sensitivity improved to 1 log CFU/25 mL. The assay was validated as per IS 14988 (Part I); 2020 using pasteurized milk, skim milk powder, and paneer. Due to the specificity of InlA and InlB antibodies, the LFA strips showed excellent selectivity for *L. monocytogenes* over other bacteria.

Development and evaluation of lateral flow assay for detection of *Listeria monocytogenes* in milk samples

A protein-based lateral flow assay (LFA) was developed for rapid detection of *Listeria monocytogenes* using recombinant Listeria adhesion protein (rLAP) and gold nanoparticles (GNPs). Designed in a sandwich format, the assay employs a GNP-InlB-antibody conjugate to enhance specificity and concentration through antigen–antibody interaction. It selectively identified virulent *L. monocytogenes* strains (MTCC-1143, ATCC-19118, ATCC-19115) with no cross-reactivity to other *Listeria* species or unrelated Gram-positive and Gram-negative bacteria. The LFA demonstrated a detection limit of 3.34 ± 0.01 log CFU/mL in broth and 3.3 ± 0.02 log CFU/mL in milk, with visible results within 20 ± 2 minutes. After 22 ± 2 h of enrichment in LESM, the strips achieved high sensitivity, detecting *L. monocytogenes* at 2.00 ± 0.01 log CFU/mL in spiked milk samples.

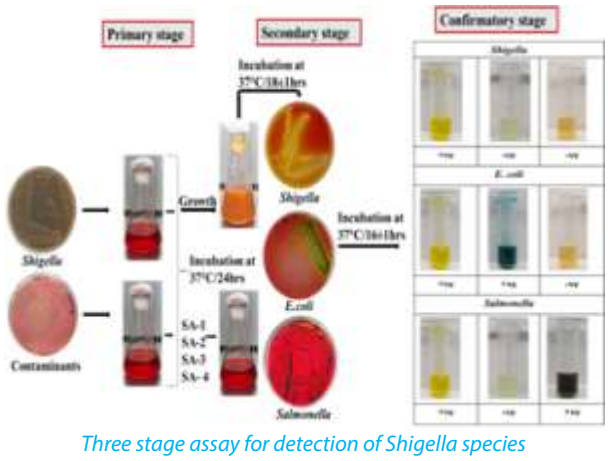
	Bacteria	(Log CFU/ mL)	Results	
			T	C
A	*S. aureus*	4.85±0.25	-ve	+ve
B	*B. cereus*	4.63± 0.50	-ve	+ve
C	*L. monocytogenes* (19115)	3.42± 0.20	+ve	+ve
D	*L. monocytogenes* (19118)	3.25± 0.42	+ve	+ve
E	*L. monocytogenes* (1143)	4.38± 0.28	+ve	+ve
F	*E. coli*	3.26± 0.62	-ve	+ve
G	*L. ivanovii*	3.15± 0.52	-ve	+ve
H	*L. innocua*	3.45± 0.52	-ve	+ve
I	Borate buffer		-ve	+ve



Lateral flow assay for detection of Listeria monocytogenes in milk

Development of technique for detection of *Shigella*

A novel three-stage assay was developed for rapid detection of *Shigella* in milk and dairy products, involving enrichment, differential plating, and confirmation steps. The Shigella Enrichment Medium (ShEM) enables presumptive detection within 24 hours by inhibiting non-target bacteria. Differential plating on an enzyme and indicator-based agar yields colorless colonies in 18 ± 1 hours. Final confirmation uses enzyme-substrate reactions targeting specific enzymes and indicators, producing a yellow color in 16 ± 1 hours. The assay detects *Shigella* with a sensitivity of 1 log CFU/mL and a total time of 58 ± 2 hours. It was validated using spiked milk and water samples and tested on natural samples-raw milk, paneer, khoa, and wastewater. The assay is faster, highly sensitive, selective, user-friendly, and less labor-intensive compared to conventional methods, offering a reliable alternative for *Shigella* detection in dairy and environmental samples.

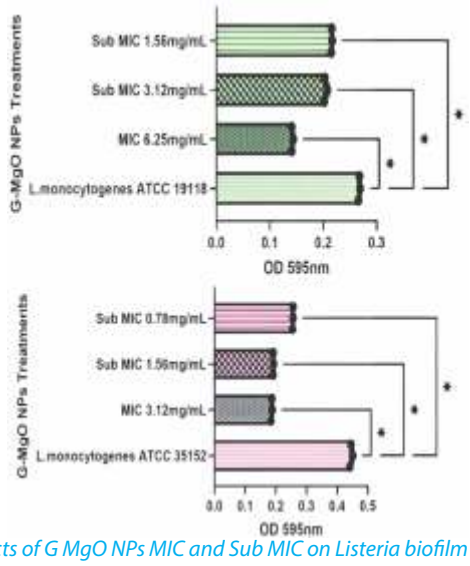


Three stage assay for detection of Shigella species

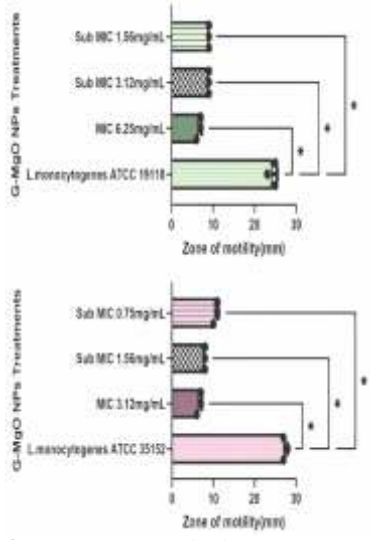
Quenching potential of green nanoparticles to inhibit biofilm formation by *Listeria monocytogenes* on food contact surface

Listeria monocytogenes can survive in food processing environments and form biofilms on surfaces, posing risks to food safety and public

health. This study explored the use of plant-based green-synthesized magnesium oxide nanoparticles (G-MgO NPs) to inhibit Listeria biofilms. The nanoparticles, about 37 nm in size (spherical), were tested using crystal violet assay, motility, and EPS production. At MIC, biofilm formation was significantly reduced after 48 hours, with EPS decreasing by 19% and motility by 50% at 25°C. Gene expression analysis showed downregulation of key virulence (prfA, hly, plcA, plcB) and quorum sensing (agrA, agrC, agrD) genes. This study presents a green approach for low-cost nanoparticle synthesis and their ability to counter Listeria virulence. All the experiments were performed in triplicate. The results are represented as mean ± standard deviation, and differences were considered statistically different at $p < 0.05$.



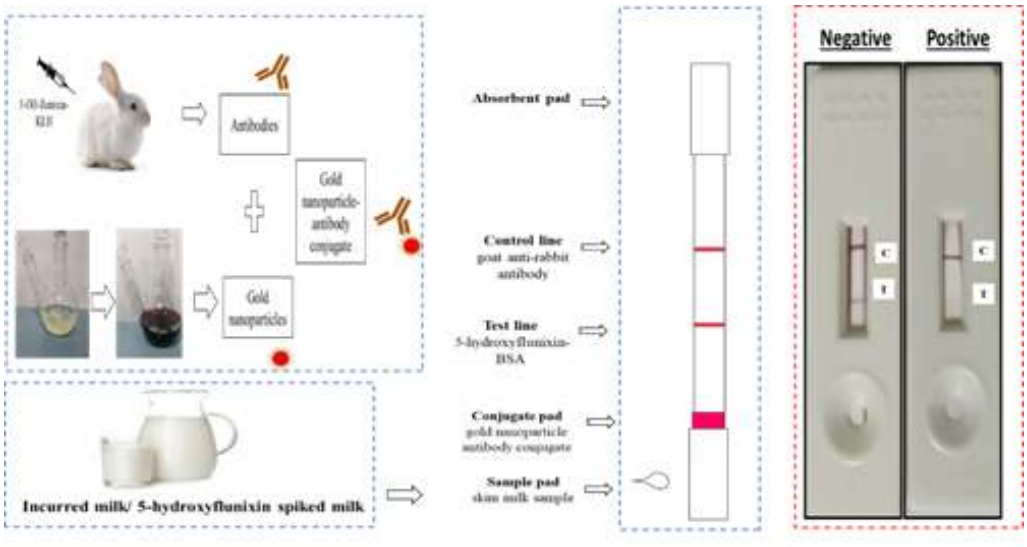
Effects of G MgO NPs MIC and Sub MIC on Listeria biofilm



Effects of G MgO NPs MIC and Sub MIC on isteria motility

Gold nanoparticle based competitive lateral flow immunoassay for the detection of 5-hydroxyflunixin in milk

Flunixin, a non-steroidal anti-inflammatory drug (NSAID), is commonly used to treat mastitis in lactating animals. Its metabolite, 5-hydroxyflunixin (5-OH-FLN), can pass into milk and pose health risks to consumers, potentially affecting the liver, kidneys, blood, and nervous system, and causing allergic reactions. To address this, a gold nanoparticle-based competitive lateral flow immunoassay (LFIA) was developed. The assay uses rabbit-derived antibodies conjugated to gold nanoparticles, a 5-OH-FLN-BSA conjugate on the test line, and goat anti-rabbit antibodies on the control line. The test detects 5-OH-

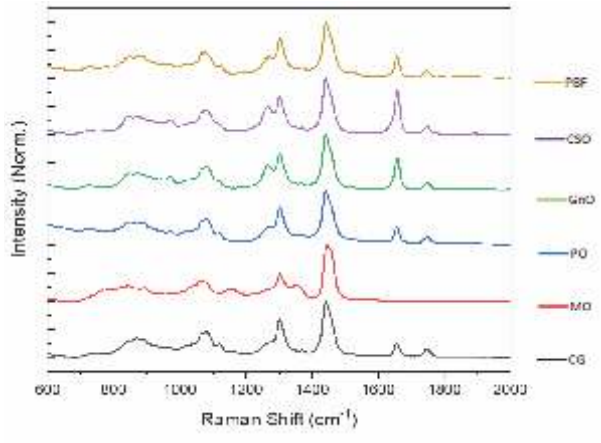


Competitive lateral flow immunoassay for the detection of 5-hydroxyflunixin in milk

FLN in skim milk at levels as low as 4 ng/mL—well below the maximum residue limits set by the EU, Canada, China, and Japan. It works with the naked eye, eliminating the need for costly monoclonal antibodies or instruments. No cross-reactivity was observed with flunixin, meloxicam, nimesulide, cephalexin, tetracycline, oxytetracycline and chlortetracycline. The LFIA strip offers a rapid, affordable, and user-friendly tool for point-of-care milk safety testing.

Detection of adulteration in ghee using Raman Spectroscopy

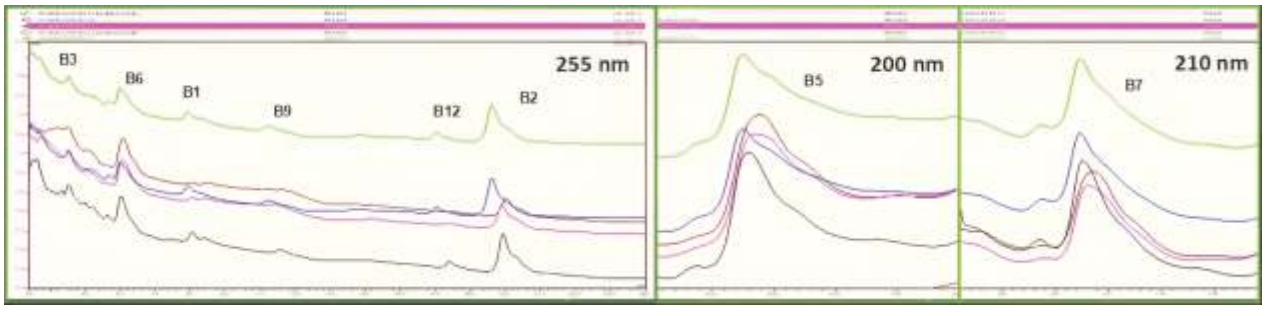
This study employed Raman spectroscopy with chemometric tools to detect adulteration in cow ghee using various oils: mineral oil, palmolein, groundnut oil, cottonseed oil, and lard at 0–100% levels. Raman spectra were captured at 785 nm for 25 seconds and processed using baseline correction, Savitzky-Golay smoothing, and min-max normalization. Specific spectral regions were identified for each adulterant: 733–790 & 1330–1357 cm^{-1} (mineral oil), 1653–1660 cm^{-1} (palmolein), 967–975 & 1250–1279 cm^{-1} (groundnut oil), 965–976 & 1256–1276 cm^{-1} (cottonseed oil), and 1653–1656 cm^{-1} (lard). PCA clearly separated pure from adulterated samples. PLS and PCR models showed high predictive accuracy (R^2: 0.871–0.984) for detecting ghee adulterants. SIMCA classified 100% pure and >86.67% adulterated samples. It could be concluded that Raman spectroscopy was a rapid, sensitive, and effective method for ghee adulteration detection and ensuring product authenticity.



Raman Spectra of cow ghee and adulterated ghee along with PCA graphs

Validation of RP-HPLC method for simultaneous quantification of all B vitamin in milk matrix

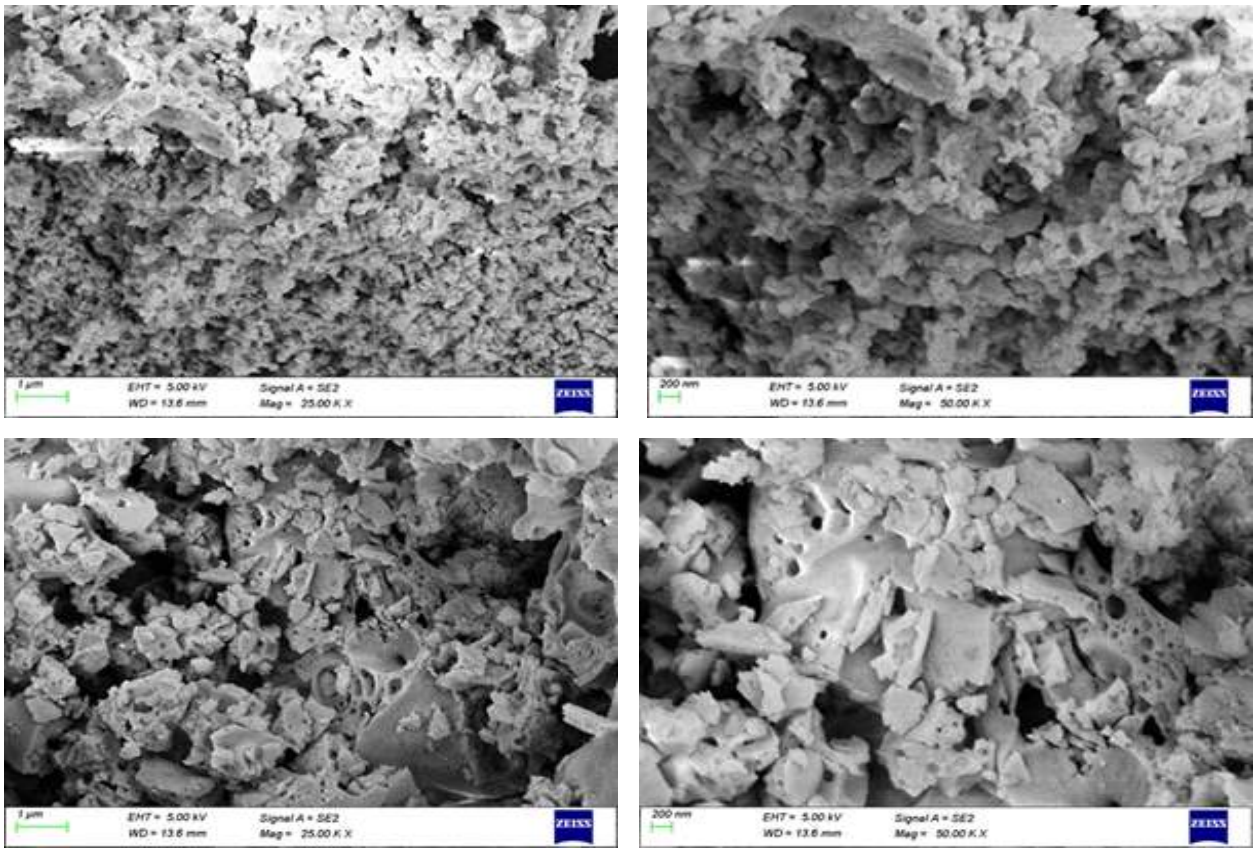
An ion-pair modified reverse-phase HPLC method was developed for the simultaneous quantification of all B-vitamins in milk. The separation was carried out on C18 column using binary gradient elution. Mobile phase A consisted of 65% methanol, and mobile phase B was 0.05 M sodium phosphate monobasic (pH 3.05) containing 0.01 M 1-hexane sulfonic acid sodium salt. The mobile phase starts at 3% A and 97% B, maintaining this ratio until 0.1 minutes. It gradually shifts to 15% A (0.3–2 min), 20% A (5–7 min), 23% A (10 min), 30% A (15 min), 40% A (20 min), and 55% A (30 min), returning to the initial ratio by 33 minutes. The method demonstrated excellent linearity with a correlation coefficient > 0.93 for all B-vitamins. It exhibited good intra- and inter-day repeatability with relative standard deviation < 6%. Recovery rates ranged from 74-109%, with limits of detection between 2.15–24.72 ng/mL and limits of quantification from 6.51–74.93 ng/mL.



HPLC chromatograms for detection all B vitamins in milk using standardized method

Application of Green Synthesized Nanoparticles for Treatment of Dairy wastewater

Leaf extracts of *Carica papaya*, *Cymbopogon citratus*, and *Chrysopogon zizanioides* were used as green reducing agents to synthesize ZnO nanoparticles. TEM images showed mainly quasi-spherical and hexagonal particles, with average sizes of 9.73 nm (*C. papaya*) and 10.41 nm (*C. citratus*). Interplanar distance (d-spacing) of lattice fringes was found to be 0.25 nm for both types. The mean hydrodynamic diameter of ZnO nanoparticles synthesized using *C. papaya* and *C. citratus* leaf extracts were 9.21 and 10.06 nm, respectively. ZnO nanoparticles-coated sand was prepared and characterized using FESEM, AFM, FTIR and XRD. The prepared ZnO nanoparticles-coated sand was used as adsorbent in the fabricated adsorption column for treatment of dairy wastewater. Coating of ZnO nanoparticles on sand had significant effect on percentage COD reduction of treated water as high as 89%. Reusability studies showed that significant difference in COD reduction at 5% level was observed only after eighth cycle of treatment.



SEM micrographs of ZnO nanoparticles synthesized using C. papaya leaf extract at (A) 25 and (B) 50 kX and C. citratus leaf extract at (C) 25 and (D) 50 kX magnifications

Development of a safe alternative to mercury for dairy glassware-butyrometer calibration

The study was undertaken to replace the use of mercury in butyrometer calibration and to develop a suitable method calibration with a safe alternative provided critical insights highlighting the following key findings: To replace the mercury in the butyrometer calibration, 3 possible alternatives were screened. Galinstan alloy was compared with existing standard 'Mercury' and other alternatives such as high-density sucrose solution and Sodium polytungstate solution. Milk, cream, ice-cream, cheese, and butter butyrometers specifications on the physical and structural dimensions were assessed. Elements purity and physico-chemical parameters of the possible alternatives were assessed to establish the calibration performance. This study identified sodium polytungstate as potential alternative and Galinstan treated with reducing agent could be another alternative to mercury for butyrometer calibration.

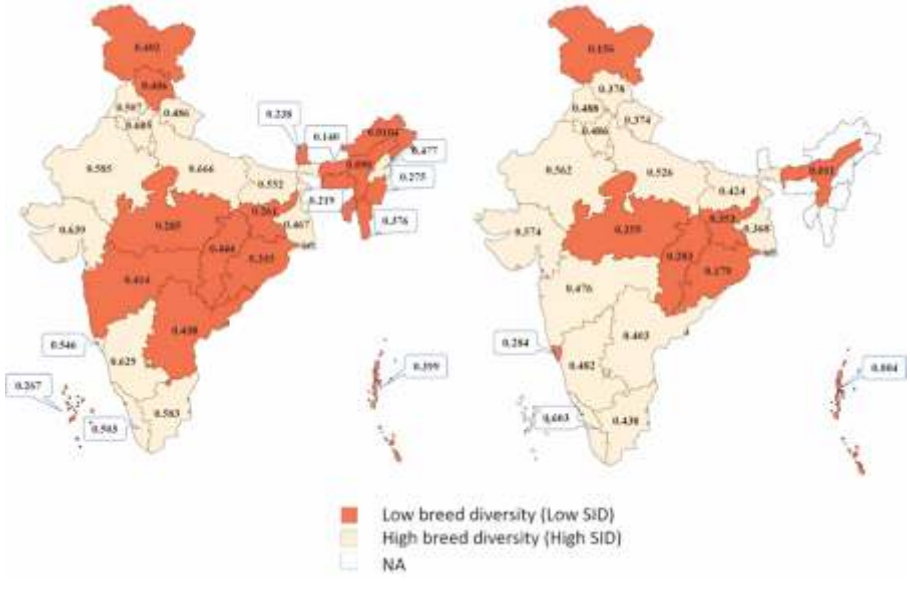
DAIRY DEVELOPMENT: POLICY ANALYSIS, STRENGTHENING DATABASE AND IMPACT ASSESSMENT -

Assessment of performance and potential of Indian dairy exports in Asian countries

India accounts for 8.30% of total dairy exports to Asian market, with South Asia and Gulf countries as major destinations. Overall export growth rate was 12.18%, with processed cheese showing highest growth (41.57%) and whey powder lowest growth (-4.09%). Most stable dairy product was butter oil, while most stable market was Gulf countries. Highest instability was noted for yogurt and West Asia. Moderate increase occurred in both product and geographic diversification. Export diversification positively impacted export growth. Factors like India's GDP, destination countries' GDP and per capita GDP, unit price, immigration, contiguity and colonial ties positively influenced dairy exports, while exchange rates and geographical distance had negative impacts. Butter oil had positive import elasticity in majority destinations. Price competitiveness was crucial for butter and casein. India has highest export potential in Saudi Arabia, Malaysia, Qatar, and UAE. Efforts should focus on increasing market share in East Asia, Central Asia, and West Asia through trade negotiations, product diversification, and quality assurance.

Breed-wise economics of milk production in gujarat-a comparative analysis

Analysis of primary data collected from the Saurashtra region revealed that the profitability of both *Gir* and Crossbred cows was comparable in the region, while *Kankrej* cattle were more profitable in Banaskantha. Larger landholdings and principal source of income being livestock - both are significantly and negatively associated with the choice of *Kankrej* cattle. Based on secondary data, the diversity level in both cattle (Simpson Index=0.457) and buffalo (Simpson Index=0.359) was found to be low. Furthermore, factors such as pasture and fallow land, rainfall and temperature were found to affect breed diversity for cattle and buffalo. The impact of artificial insemination (AI) was found to be insignificant for cattle but positively significant for buffalo.



Simpson index of diversification for cattle

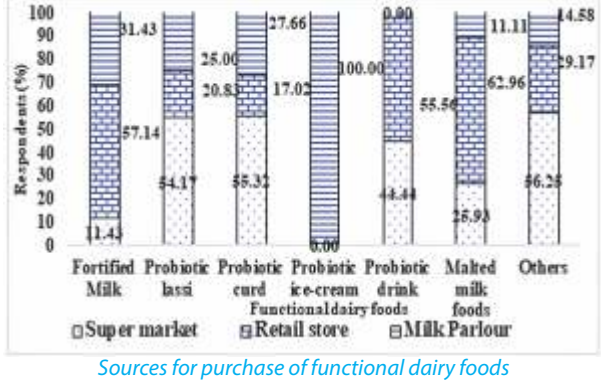
Simpson index of diversification for buffalo

Levels and trends in income from dairy of agricultural households in major dairy states of India

Analysis of secondary data revealed that dairy income has over 80% share in total income earned from farming of animals in Haryana, Punjab, Rajasthan, UP, Bihar, Himachal Pradesh, Gujarat, and Madhya Pradesh. Analysis of income from the dairy enterprise across NSS state-regions highlighted the regions that lag behind, namely, the Northern region of Chhattisgarh; Cachar plains in Assam, Southern plains in WB; Inland eastern of Maharashtra; and Inland north western of Telangana. Dairy income earned across various social groups in all the states of India brought out disparities, in terms of scheduled groups earning less than the state average dairy income in some states, namely, Himachal Pradesh; Rajasthan; Punjab, UP; Uttarakhand; Haryana, and West Bengal. Dairy income share was found highest (in the total income earned from farming of animals) for small farmers in Bihar; Chhattisgarh; Maharashtra; Karnataka; and Tamil Nadu.

Consumer Behaviour and demand-supply analysis of dairy based functional foods in Tamil Nadu

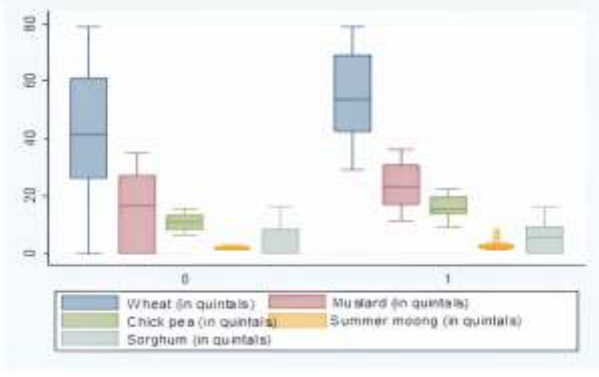
Through primary survey conducted in Chennai and Salem it was observed that a significant portion (84 %) of respondents were aware of functional dairy foods when explained about them. Television advertisements were their primary source of information, followed by digital platforms such as social media and the internet. It was found that 1.26% of the total milk production in Tamil Nadu is consumed as functional dairy foods daily, which accounts for 3.78% of processed milk in milk equivalent terms. Significant expenditure elasticities were found for fortified milk (0.059), probiotic drinks (0.025), and malted milk foods (0.108). The demand analysis revealed that the demand for functional dairy foods is relatively inelastic.



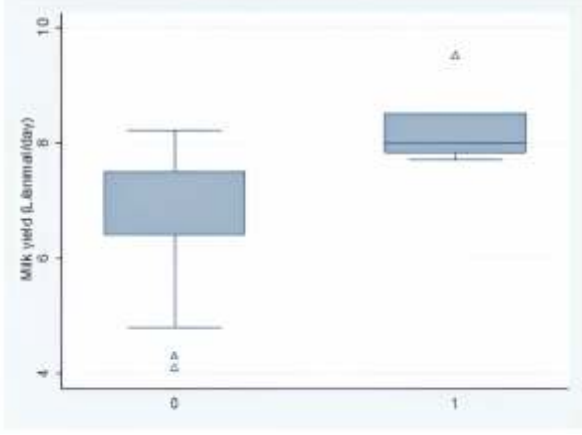
Sources for purchase of functional dairy foods

Impact assessment of selected interventions of NDRI-KVK

The impact assessment of NDRI-KVK interventions demonstrates significant improvements in farm productivity and socio-economic conditions. The study evaluated Cluster Front Line Demonstration (CFLD) in pulses and oilseeds, Crop Residue Management (CRM), and training in animal husbandry and dairying. Results indicate higher yields in intervention farms, with wheat and mustard yields are increasing by 12.02% and 10.50%, respectively. Dairy productivity also improved, with an 8.56% rise in milk production per animal. These improvements suggest better resource management and efficiency. The technical efficiency gains underscore the success of interventions in closing yield gaps.



Yield difference in demonstration vis-à-vis control farm (Crop)

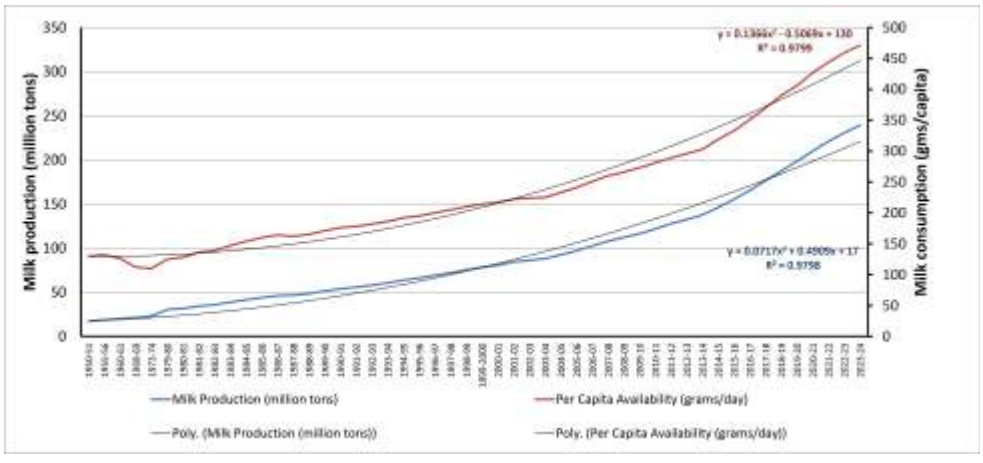


Yield difference in intervention vis-à-vis control farm (Dairy)

The socio-economic impact analysis reveals that CFLD increased agricultural income by ₹1,526.75/farm, while dairy training led to a ₹ 6,324.92/farm rise in dairy earnings. Increased income improved household food expenditure, benefiting rural livelihoods. However, adoption constraints include financial limitations, extension challenges, and social barriers. While financial and extension service constraints were significant, social constraints had a lesser impact. Addressing these challenges through targeted policies and enhanced support can ensure broader adoption and long-term sustainability, reinforcing the role of KVK interventions in rural development and agricultural progress.

Enhancing dairy production during Amrit Kal

The projection indicated that India's milk production will rise significantly by 2047, driven by improved milk yield and controlled population growth of milch animals. Average daily milk yield per animal is expected to increase from 5.4 kg in 2019-20 to 8.32 kg by 2047-48, aided by genetic improvements, better disease control, and feed management. By 2047, total milk production could reach 432.28 to 685.52 million tonnes, depending on population growth assumptions.

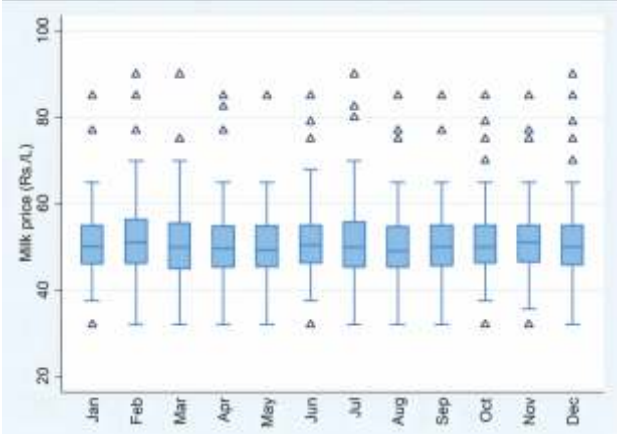


Growth in milk production and consumption of India after independence

Enhancing milk production requires advanced technologies and strategic interventions, including increasing artificial insemination adoption to 150 million doses per year by 2047, promoting improved feed like Anionic Mineral Mixture to boost milk yield by 14% with necessary subsidies, and expanding the use of sexed semen technology for better herd quality. Genetic improvement through superior breeds demands region-specific breeding policies, while effective disease control is crucial due to climate-related risks, requiring a One Health approach. Increasing livestock R&D investment, given its high returns, and establishing a national dairy database for policy formulation are essential for ensuring efficiency and sustainability. -

Multimarket price determination of milk in India

It was observed that milk prices remain stable across flush and lean seasons, with insignificant regional variations. The CAGR of milk prices varies, with Nagaland exhibiting the highest growth (9.5% per annum) and Maharashtra the lowest (3.4%).



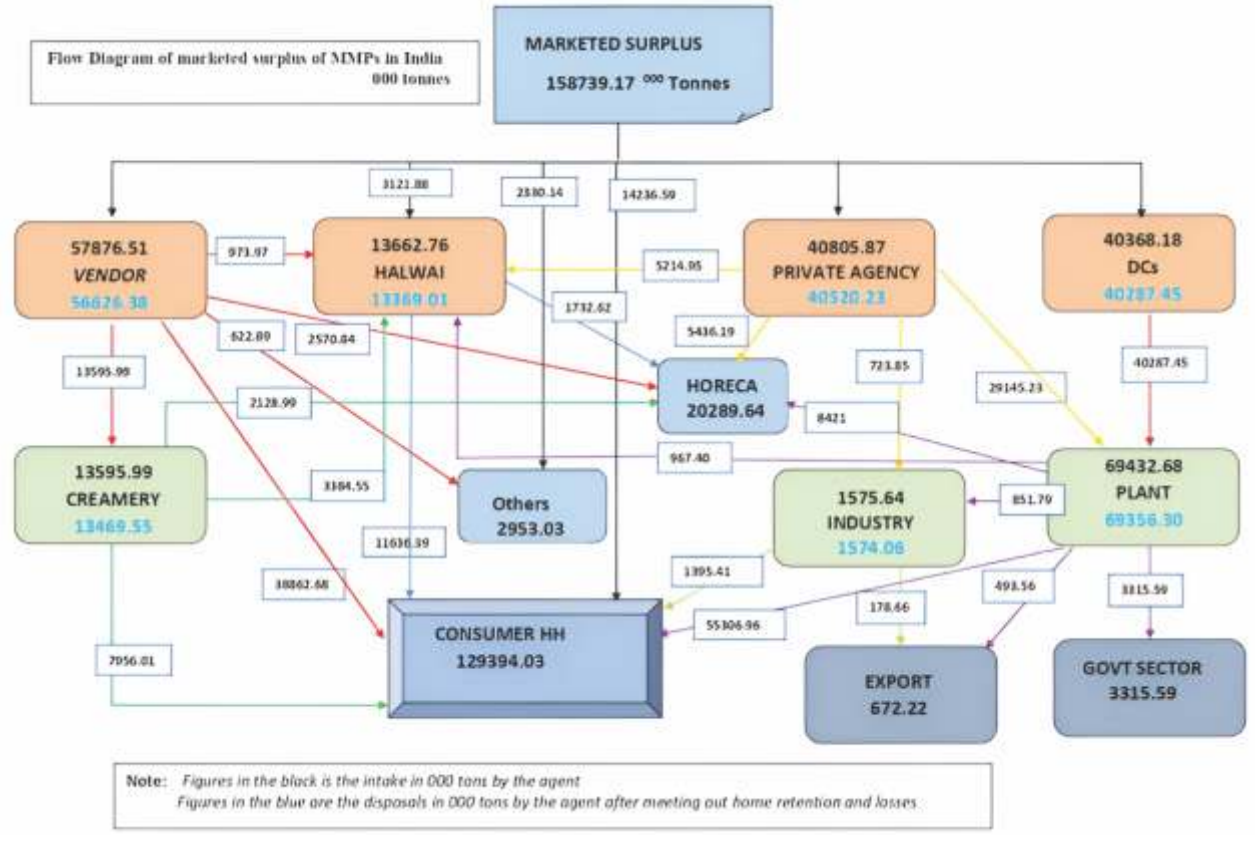
Temporal variations of milk price in India (2010-2023)

Market integration tests reveal that most milk markets are not co-integrated in the long run, except for Bhopal and Mumbai, likely due to perishability and strong cooperative control. The perishability of milk and limited cross-hauling contribute to regional price segmentation. Additionally, milk prices positively correlate with other food commodities like rice and wheat, suggesting inter-commodity price dependency.

Vector Error Correction Model results show that short-run price shocks in Chennai and Guwahati tend to return to equilibrium. The research highlights barriers such as cooperative dominance and weak cold-chain infrastructure, which hinder market efficiency. Policy measures aimed at improving cold-chain logistics and enhancing market connectivity are crucial for long-term price stability. Strengthening integration between regions and addressing entry barriers could enhance price transmission and stabilize milk markets, ensuring fair pricing for producers and consumers alike.

Milk production and utilization in india: a comprehensive analysis

The study "*Estimation of Production and Utilization Pattern of Milk and Milk Products in India*" analyzed India's dairy sector through a nationwide survey covering 79 districts and seven metro cities across 24 states. India's total milk production was estimated at 209.96 million tonnes (2020-21), with 75.60% marketed surplus and 24.40% retained for home consumption (22.30%) and losses (2.10%). Farmer-producers contributed 88.98% of production, while commercial dairy farms accounted for 11.02%. Milk vendors handled 36.46% of marketed surplus, followed by private agencies (25.71%) and cooperatives (25.43%). Traditional processing units processed 17.17% of marketed surplus into ghee, paneer, and curd, while 43.74% was processed by milk plants. Consumer households absorbed 81.51% of final marketed surplus, HORECA utilized 12.78%, government sector 2.09%, and exports 0.42%. Supply chain inefficiencies caused 2.54% spoilage and wastage. The study emphasizes need for improved cold-chain logistics, technology-driven processing, and enhanced market linkages to minimize losses and maximize dairy sector efficiency.

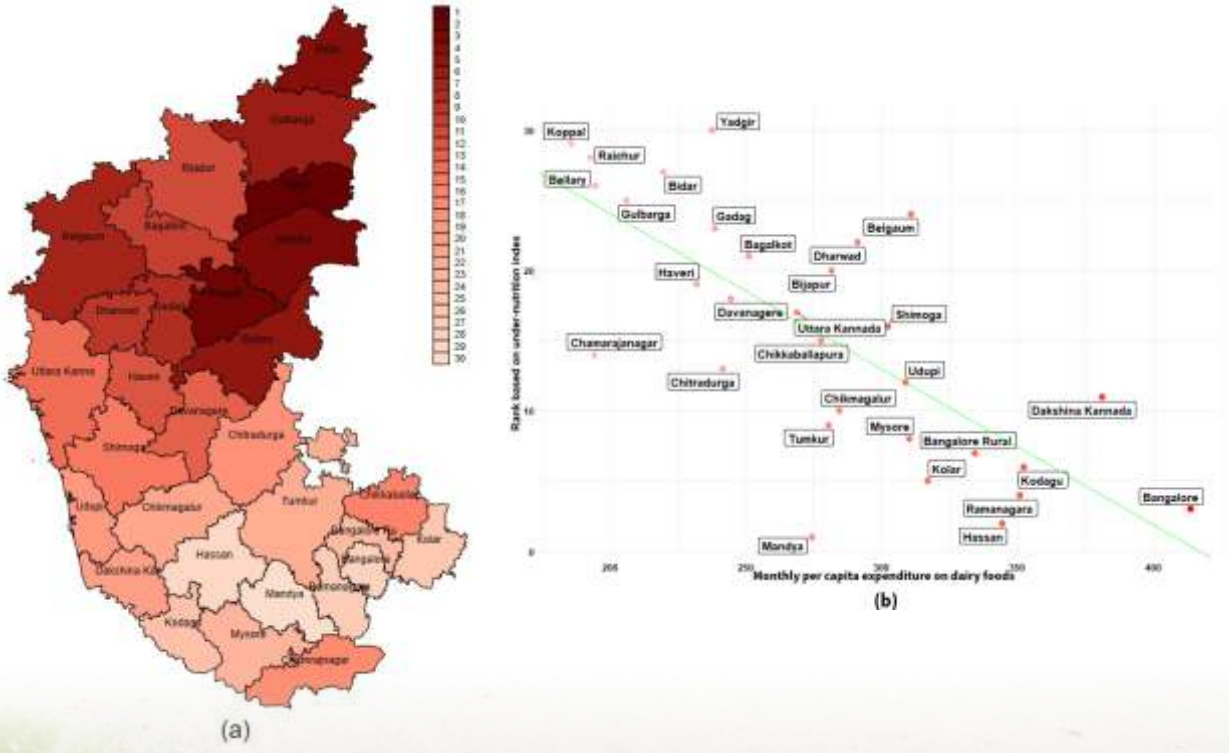


Flow Diagram of marketed surplus of MMPs in India- 000 tons

Implications of dairy foods consumption on undernutrition in Karnataka

This study analyzed dairy food consumption patterns and under-nutrition implications in Karnataka at district level using 2022 household consumption expenditure survey and 2019-21 National Family Health Survey data. Under-nutrition index was constructed integrating five key

indicators (wasted, stunted, underweight children under 5 years, thin women and anaemic women aged 15-49 years) through principal component analysis. Consumption expenditure served as proxy for total consumption, with strong correlation (0.88) between calorie intake from dairy foods and expenditure among 12,380 sample households. Scatter plot analysis revealed Mandya, Hassan, and Bengaluru districts had higher dairy consumption and better nutritional health scores, while Yadgir, Koppal, and Raichur lagged behind. Bivariate copula analysis using Frank and Student's t-copulas showed strong negative dependence between dairy consumption and under-nutrition index. This implies districts with higher dairy consumption experience lower under-nutrition levels, highlighting dairy consumption's critical role in improving nutritional outcomes and food security in Karnataka.



District level under nutrition ranking and its association with monthly per capita expenditure on dairy foods in Karnataka

Dr. Dheer Singh, Director & Vice Chancellor along with Dr. M S Chauhan, Vice-Chancellor of GBPUAT among Ladakhi farmers

EXTENSION APPROACHES FOR SOCIO-ECONOMIC UPLIFTMENT THROUGH DAIRYING

Impact of temperature humidity index-based climate services for murrah buffaloes of india on operational decision-making and economic outcome of the farm

Climate change affects productive and reproductive functions of Murrah buffaloes, India's major milch breed. Weekly Temperature Humidity Index-based climate services were prepared and disseminated to farmers in experimental villages of Haryana through WhatsApp, Text SMS, and Mobile Application. Difference-in-Difference quasi-experimental design studied impact on operational decision-making and economic outcomes. Climate services positively affected farmer adoption of oil cakes, minerals, and feed additives in animal diet. Treatment effects were significant on oilcake quantity (0.39, 0.45, 0.51 kg/animal/day), concentrates during summer (0.48, 0.56, 0.59 kg/animal/day) and winter (0.35, 0.40, 0.42 kg/animal/day), and mineral mixture (9.47, 12.34, 13.08 gm/animal/day) across Text SMS, WhatsApp, and MobileApp groups respectively. Treatment effect on summer milk yield was significant (0.38, 0.44, 0.50 L/animal) respectively. Overall benefit-to-cost ratio was 1:1.8. Climate services were proved to be an effective adaptive mechanism for helping vulnerable dairy farming adapt to current and future climate challenges.

Farmers' participatory assessment of "Salivascope for estrus detection" method in buffalo

An exclusive index with seven components (profitability, risk, simplicity, relative cost, sustainability, farmers' safety, and compatibility with the existing system) was developed to appraise farmers' satisfaction towards the Salivascope method for estrus detection in buffalo. Farmers' satisfaction towards Salivascope for estrus detection in buffaloes was assessed and it was found that 79.45 percent of the farmers were moderately to highly satisfied. Relatively lower cost was the main driver for high level of satisfaction. Farmers were having a favorable attitude towards Salivascope for estrus detection in buffaloes. Farmers' inquisitiveness towards new scientific methodology was the significant determinant of the favorable attitude. In case of adoption of the Salivascope by the dairy farmers, it was clearly predicted that the peak adoption rate of Salivascope will be 94% after a period of 11 years. Capacity building of the dairy farmers towards the use of Salivascope will accelerate its adoption.

Demonstration of Salivascope at the farmer's doorstep

Assessment of granular risks and adaptation options for dairy animals in south Asia

Climatic hazards analysis for dairy bovines in South Asia revealed greatest rise predicted for 2050 in extreme rainfall days and heat stress (THI) as major hazards for cattle and buffalo production. Cold stress is predicted to decrease due to global warming effects. Regional appraisal showed THI threshold days will increase in Indo-Gangetic Plain region, while hot day intensity will be higher in Western India and eastern Pakistan by 2050. A total of 50.30% buffalo population was under high to very high hazard and 26.3% under high to very high risk. For cattle, 29.20% population was under high to very high hazards, while 34% was under high to very high risk. Suitable adaptation options were identified at granular level for most bovine populations across South Asia.

Socio-climatic risk hotspots for smallholder dairy production system of the Indo-Gangetic Plains of India

The socio-climatic risk of the dairy production system of the 171 districts of the Indo-Gangetic

plain region were analyzed using IPCC protocol and mapped hotspots through spatial analysis in two time frame scenarios viz. historical (1971-2021) and future (2022-2050). Future risk and hotspot analysis was carried out based on two emission scenarios i.e. SSP2-4.5 and SSP5-8.5. It was found that only 1 percent of the area of IGP i.e. 4.4 lakh hectares was in the very high risk category in 2021 which may be further expanded to 6.85 percent to 15.31 percent in 2050 with an additional area of 25.76 lakh hectares to 63.09 lakh hectares based on SSP2-4.5 and SSP5-8.5 scenario, respectively. Accordingly, the dairy production system of the 46 districts of the IGP was in the hotspot region in 2021 which may be further extended to 56 to 57 districts in 2050 with an additional land area of 16.67 to 16.90 lakh hectares. Thus, region-specific climate adaptation planning for dairy farming could be formulated for the hotspot region to sustain the increasing trend of milk production in the Indo-Gangetic Plain region.

Development of climate adaptation decision models for the agricultural commodities of West Bengal

In West Bengal, where agriculture and dairy farming sustain a large portion of the population, small and marginal farmers (96%) face increasing difficulties due to shifting climatic conditions. Major crops like paddy, maize, and potato, along with milk production, were highly sensitive to climate variations. A study conducted in climate risk hotspot districts (South 24 Parganas, Darjeeling, Jalpaiguri) based on the climate sensitivity analysis using panel data from 1991 to 2020 across 18 districts. Findings revealed that higher maximum temperatures positively influenced crop yields, while minimum temperatures negatively impacted rice and maize. Rainfall had minimal or negative effects on maize and potato, with rice being unaffected. A Climate Risk Index based on IPCC's framework classified South 24 Parganas as the most vulnerable district, with most farmers in high to very high-risk zones. Jalpaiguri had the lowest risk levels, while Darjeeling fell in between. To address these challenges, six heuristic-based climate adaptation decision models were developed for rice, maize, potato, and milk, helping farmers optimize resources and enhance productivity. The study's findings support climate adaptation planning to improve resilience in West Bengal's agricultural sector.

Sensitivity and risk characterization of the smallholder dairy farmers to climate change in Bihar

The study investigates the impact of climate change on Bihar's dairy sector, a crucial livelihood source for smallholder farmers. Bihar's vulnerability to climate risks is heightened by widespread poverty, small landholdings, and frequent climatic hazards. Panel data regression analysis revealed that climatic factors, such as maximum temperature (-0.232), minimum temperature (0.254), and temperature-humidity index (0.068), significantly influenced milk production, accounting for 19.96% of its variability. The Dairy-centric Climatic Risk Index (DCRI), aligned with IPCC's AR5 framework, identified key risk factors, including heatwaves, droughts, and livestock composition. Bhagalpur emerged as the most at-risk district, followed by Buxar, Bhojpur, and Sitamarhi. Using the Analytical Hierarchy Process (AHP), adaptation strategies were evaluated, with housing management practices, such as "use of fans," and health measures, like "deworming livestock," ranked as the most effective. The findings underline the urgency of tailored, location-specific adaptation strategies to mitigate climate risks and safeguard Bihar's dairy sector.

Livelihood augmentation of scheduled caste households in arid region of Rajasthan: An appraisal of NDRI interventions

Rajasthan comprises 61% of India's arid zone, where extreme weather and natural disasters worsen challenges for Scheduled Caste farmers. ICAR-National Dairy Research Institute introduced crop and dairy interventions to improve Scheduled Caste household livelihoods through economic stability, poverty alleviation, social empowerment, and sustainable development. A research study assessed intervention effectiveness among 240 respondents from Hanumangarh and Bikaner districts. Findings showed advisory services were most beneficial, with 75% complete satisfaction. Propensity Score Matching revealed significant productivity improvements among beneficiaries, with highest gains in wheat and 19.81% increase in milk production. Beneficiaries experienced 23.85% rise in gross annual income. AHP analysis identified breeding as biggest dairy constraint, especially heat detection, while marketing was lesser concern. In

crop production, unpredictable rainfall and high irrigation costs were primary challenges. The study highlights NDRI's significant impact and emphasizes need for continued advisory support, breeding assistance, and irrigation investment for marginalized communities.

Capacity building of resource poor farmers in paddy-wheat cum dairy production system through farmer first programme under irrigated agro-eco region of Haryana

The Farmer FIRST Programme achieved notable progress across agriculture, livestock management, horticulture, enterprise development, and capacity building. In crop production, integrated pest management in paddy yielded 54-55 q/ha, while nutrient and weed management in wheat achieved 61-62 q/ha. High-yielding varieties PB-1885, PB-1692, DBW-370, DBW-371, DBW-372 demonstrated excellent productivity. Mustard varieties Radhika and PM-32 supported diversification with yields of 13.88 and 14.37 q/ha respectively. In livestock management, 150 cattle and buffaloes received infertility treatments, while 2,027 dairy animals received parasite control, increasing daily milk yield by 200-300 ml per animal. Nutritional supplements led to 14% milk yield increase and 50% conception rate. Saliva Scope technology achieved 66% farmer satisfaction and 94% projected adoption. Horticulture included planting Mango, Lemon, and Guava with 42.65%-61.45% survival rates. VIREN DAIRY processed 450 litres milk daily, generating ₹95,000 monthly. Integrated Farming System increased net returns by 21.49%. Capacity-building benefited 1,100+ farmers through training, extension programs, and animal health camps, strengthening farm productivity and sustainability.

Demonstration of wheat variety (DBW-370)

Empowering farmers through selective interventions in salt affected agro-ecosystems of Ghaghar plains

The mineral mixture supplementation @50-60g/day/animal to buffaloes improved the conception rate and milk yield significantly (P<0.05) over the farmers practice. Bypass fat supplementation 100g/day/animal, enhanced the milk yield by 12.34 % with a BC ratio of 5.87. Buffaloes supplemented with anionic mixture @100g/day/animal prior to 21 days of parturition, improved the disease resistance, no case of milk fever, 95 % of buffaloes expel the placenta in time and milk yield was 10.72 % higher compared to control. Tractor operated feed mill was introduced for preparation of concentrate mixture at the farmers door and farmers are utilizing the service for getting prepared concentrate mixture of good quality for their dairy animals.

Enriching knowledge-integrating technology and institutions for holistic village development in horticulture-based farming system

Under Farmer FIRST Collaborative Project of IIHR-SRS-NDRI, an on-campus training programme on 'Good Dairy Management Practices and Value Addition' was organized at SRS-NDRI on March 20, 2024. Subject matter specialists sensitized trainee farmers on balanced feeding of dairy cattle, cattle health, quality raw milk production, profitable dairy farming, and preparation of value-added dairy products, followed by interactive sessions. Sixty farmers, farm-women, and farm youth from project villages Yeremgere, Hosadurga, and Vasappanadoddi of Kanakapura Taluk, Ramanagara District participated. A dairy animal health and infertility camp was organized in Hosadurga and Vasappana Doddi villages on July 16, 2024. Fifty crossbred HF cattle and 35 sheep were treated. Interactive sessions identified mineral deficiency, mastitis, and anoestrus as major problems. Corrective measures including mineral mixture supplements, deworming, and curative medicines were distributed to beneficiary farm families of the adopted villages.

Dairy startups in Karnataka state: an ecosystem analysis

The study *"Dairy Startups in Karnataka State: An Ecosystem Analysis"* involved 52 dairy startups and

key stakeholders including 15 incubators/ accelerators, 12 mentors, and 10 investors. Findings revealed majority startups were in early development phases: 34.62% ideation, 28.85% validation, 15.38% early traction, and 21.15% scaling stages. Only 34.62% received incubator/accelerator support, while 57.69% lacked formal startup training. Funding sources included institutional support from incubators/accelerators (40.38%) and government grants (38.46%), with non-institutional funding from bootstrapping (62.26%) and family/friends (26.42%). Using Analytical Hierarchy Process, stakeholder priority matrix revealed 'Finance' ranked highest (0.30), followed by 'Support', 'Policy', 'Market', 'Media', and 'Human Capital'. The ecosystem was considered 'moderately effective' by 38.46% entrepreneurs. Key challenges included limited scalable technologies, lack of agricultural knowledge among founders, and insufficient mentoring. Stakeholders emphasized need for value chain-based technological support, institutional networking, and Center of Excellence creation for enhanced capacity-building.

A study on consumption pattern of dairy foods among farm families in aspirational district of Andhra Pradesh

Dairying holds significant socio-economic importance in rural areas, ensuring livelihood and nutritional security. Despite substantial milk production, undernutrition persists in Aspirational Districts. A study in Visakhapatnam, Andhra Pradesh, assessed dairy consumption patterns among 284 farm families using proportionate random sampling. Findings showed majority households had moderate (38.38%) to low (32.02%) knowledge about dairy nutritional benefits. Respondents were more informed about general health benefits than specific nutritional aspects. Most households (52.11%) consumed up to 1 liter milk daily despite average family size of five. Average per capita milk availability was 223.61 ml, with actual consumption below recommended levels. Monthly per capita dairy spending was ₹345.79, about 29.64% of total food expenses. The study highlights need for targeted awareness and nutrition programs to balance income generation with improved health outcomes through adequate milk consumption in Aspirational Districts.

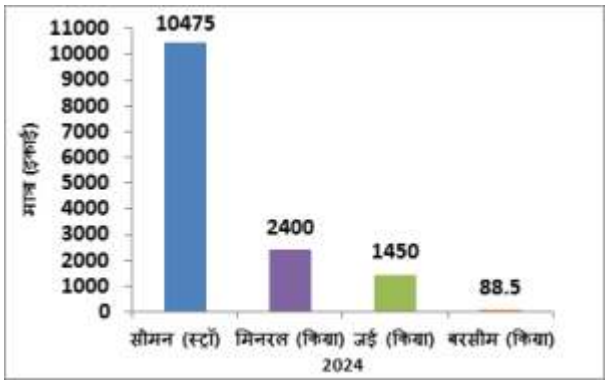
Assessment of the socio-spatial dynamics for bio-fertilizer adoption within dairy based farming systems

A structured interview schedule collected primary data from 191 farmers using bio-fertilizers in three agro-climatic zones: New Alluvial, Red and Lateritic Soil, and Coastal Saline Soil. Gender distribution varied significantly across zones, with 56% female and 44% male in New Alluvial Zone, 79% female and 21% male in Red and Lateritic Soil Zone, and 60% female and 40% male in Coastal Saline Soil Zone ($\chi^2 = 8.20$, $P = 0.02$). Caste-wise analysis revealed predominance of Scheduled Tribes (82%) in New Alluvial Zone, whereas Scheduled Castes were high adopters in Red and Lateritic Soil (72%) and Coastal Saline (74%) zones ($\chi^2 = 128.21$, $P < 0.01$). Socio-economic parameters showed significant inter-zonal variation. Coastal Saline Soil Zone had highest mean income (₹124,302.33) ($F = 10.27$, $P < 0.001$), while New Alluvial Zone had largest mean herd size of 9.52 animals per household ($F = 12.61$, $P < 0.01$). Mean age across zones showed no significant variations ($F = 0.84$, $P = 0.43$). Workshops evaluated farmer awareness and information networks using Gephi software to identify key knowledge dissemination channels.

Kisan Seva Kendra, ICAR-NDRI, Karnal, at Lalukheri (Muzaffarnagar, UP)

A service center of ICAR-NDRI at village Lalukheri, district Muzaffarnagar (UP) provides input services to farmers for genetic improvement of dairy animals for higher milk production and fertility. The center distributes quality seeds of different fodder and grain crops, mineral mixture, and frozen semen doses of buffalo, Sahiwal, crossbred, and Tharparkar breeds to farmers from surrounding villages. Kisan Gosthis were organized regularly at the center and surrounding villages, where farmers were educated about various animal husbandry practices including breed improvement importance, mineral mixture role in improving fertility, balanced ration preparation using domestic ingredients, and artificial insemination benefits using elite breeding bull semen from renowned institutions. Demand for fodder crop seeds, mineral mixture, and frozen semen doses has increased among farmers. Many good quality calves have been born through high genetic merit bull semen provided by Lalukheri

center. Significant improvement in milk production and fertility of dairy animals had been observed in surrounding villages through center-provided inputs.



Inputs supplied through Kisan Seva Kender, ICAR-NDRI, Karnal at Lalukheri (Muzaffarnagar, UP) during 2024

Establishment of artificial insemination network for improving milk production potential of dairy animals in district Muzaffarnagar (UP)

The Ministry of Fisheries, Animal Husbandry and Dairying has sanctioned Rs. 8.5 crores to NDRI to expand the present services of the centre in 100 villages of district Muzaffarnagar. Under the project, the farmers are being provided artificial insemination services at their door steps and kisan gosthies are being conducted in adopted villages to create awareness among the farmers for use of quality bull semen for AI in their dairy animals and use of scientific cow and buffalo rearing for maximum return. The frozen semen doses of Murrah buffalo bulls is being procured from the well known stations having superior quality Murrah buffalo bulls in the country. The cow bull's semen doses are being procured from NDRI, Karnal for improving milk production potential of local dairy animals. This year 15 Kisan gosthies were organized for making the farmers aware about the scientific rearing of dairy animals. During 2024 ~20000 artificial inseminations have been made in cows and buffaloes in 100 adopted villages under the project with ~ 44% conception rate.

Awareness of farmers on scientific management practices of gir indigenous cattle and productivity enhancement in Goras region (MP)

Primary and secondary data collection revealed that all farmers in the study area rear Gir cattle under fully grazing system with sub-standard housing and open paddock management. Limited green fodder availability, absence of concentrate feeding, natural breeding practices, and neglected vaccination were

A kisan gosthi at village Jaggahedi

Semen doses supplied to AI worker

A Kisan gosthi conducted at village Kutbi

Training of the AI worker

observed. Calving interval was 391±46 days with service period of 155±37 days. About 78.50% households had low socio-economic status. Major constraints included repeat breeding, unavailability of high pedigree semen, stray bulls, fodder shortage, imbalanced feeding, calf mortality, parasite infestation, unhygienic milk production, and limited scientific knowledge. Interventions included supply of high pedigree Gir semen, reproduction management, perennial grass introduction, vaccination camps, animal health camps, parasite control, and calf management. Awareness programs on artificial insemination were organized in 14 villages. Over 1236 artificial inseminations were conducted using quality pedigreed Gir semen. Five training programs were conducted for 50 farmers on scientific dairy farming practices.

Glimpses of RGM programme at Sheopur, Goras (MP)

Establishment of field-based conservation unit of Lakhimi Cattle of Assam

This project aimed to identify Lakhimi cattle rearers in Assam and educate them on breed conservation and improvement. Field visits assessed the breeding tract, identifying animals with true-to-breed characteristics. Over 100 farmers from Morigaon and Kamrup districts, each owning at least four animals, were selected for data recording. Awareness programs and input distribution camps were organized with KVKs and ICAR-ATARI, Guwahati. Analysis revealed most farmers are marginal, owning 2–3 bighas land and averaging 6.5 animals. Breeding relies primarily on natural mating with limited systematic breeding knowledge. Farmers practice semi-intensive grazing with occasional rice bran and salt supplementation. Average milk yield is 2.84 liters daily with 7.23-month lactation periods. FMD and LSD vaccinations are administered, generating approximately Rs. 3,000 monthly from milk sales. Challenges include flood management and limited veterinary access. This initiative emphasizes Lakhimi cattle conservation while supporting marginal farmers through education and documentation, promoting sustainable dairy development and ensuring breed preservation and genetic improvement.

Field visit of Lakhmi Cattle rearers and input distribution programme at Assam

4. RESEARCH PRIORITIZATION, MONITORING AND EVALUATION -

The objective of Research Prioritization, Monitoring and Evaluation (PME) Cell is to put in place a robust mechanism for managing research functions and for developing and strengthening the research ecosystem. The essential elements of such an ecosystem, viz., generation of knowledge and facilitation of research, innovation and technology development for industrial & societal benefits, are addressed by human resource, intellectual capital, governance and financial resources, information management system, research promotion & guidance, Integrity and ethics, capacity building and research monitoring. The PME creates a conducive environment for enhanced research productivity, encourages collaboration across industry, government, community based organizations, and agencies at the local, national, and international levels and to facilitate research through mobilization of resources and funding. PME Cell at ICAR-NDRI coordinates and manages research activities and facilitates the decision support system with the following terms of reference:

- To co-ordinate and synthesize the given recommendations of QRT, RAC, IRC and Vision document of Institute and ICAR.
- To recommend research priorities of the institution for short-listing researchable problems at Institute level.
- To co-ordinate and arrange for annual monitoring of each on-going project and evaluation of completed projects through internal and external experts.
- To co-ordinate and arrange for technology validation and impact assessment of successful technologies through internal and external experts.
- Regularly sensitizing and capacity building of research managers and scientists through training programmes.
- Maintaining a database on all publications, technologies developed, IPRs, consultancy projects undertaken in the past and on-going projects.

Research Advisory Committee (RAC)

The new Research Advisory Committee (RAC) for ICAR-NDRI, Karnal was constituted as per the provisions of 'functions' of RAC provided under clause 71C of the ICAR Society rules, which includes, among other functions: (i) to suggest research programs in national and global context of research in thrust areas, and (ii) to review the research achievements of the Institute and deliberate as per the program developed by the institute and the provision 71F of the ICAR Society rules. The meeting of RAC of ICAR-NDRI was conducted on March, 21-22, 2024 under the Chairmanship of Dr. Nagendra Sharma, Former- Vice Chancellor, SKUAST, Jammu and Former- Director, ICAR-NDRI, Karnal & CIRG, Makhdoom, Mathura.

Institute Research Committee (IRC)

The IRC meetings to evaluate the outcome of the completed research projects and to consider new research projects proposals were held on April 22, 23, 24 and 29; May 01 and 27, 2024 for ICAR-NDRI, Karnal and its Regional Stations. The mid-term review of IRC projects of ICAR-NDRI was taken up on October 3 and 4, 2024 at SRS, Bengaluru, and October 7, 9, 11 and 26, 2024 at ICAR-NDRI, Karnal

Institute Research Committee meeting in progress

and October 14, 2024 at ERS, Kalyani. The virtual meetings were conducted under the Chairmanship of Director and convened by Joint Director (Research), ICAR-NDRI, Karnal.

Screening and Evaluation of Concept Proposals of Externally Funded / Contract / Consultancy Projects

The meetings of the PME Unit were convened for thorough deliberations on the functions envisaged under the purview of PME Cell with the overall objective of facilitating the decision support system of ICAR-NDRI, Karnal. PME also screened and evaluated Externally Funded / Contract / Consultancy research proposals received from time to time. A total of 60 Externally Funded / Contract / Consultancy research proposals were screened for submission to external funding agencies. Out of which 25 number of externally funded projects were sanctioned amounting to Rupees 18.96 Crores from various funding agencies. NDRI has been successful in getting external funding from almost all leading national funding agencies i.e. Department of Biotechnology (DBT),National Agricultural Science (NASF),Department of Science and Technology (DST),Haryana State Council for Science and Technology (HSCST), National Bank for Agriculture and Rural Development (NABARD),Ministry of Environment and Forests (MoE&F), Food Safety and Standards Authority of India (FSSAI), Indian Council of Medical Research (ICMR),Indian Council of Agricultural Research (ICAR), Indian Tobacco Company (ITC) Ltd.(Corporate Social Responsibility Fund),etc.

PME also coordinated with scientists of the divisions and regional stations and facilitated submission of research proposals after proper documentation. The cell also handled all the correspondence and maintained liaison with SMD, ICAR for smooth implementation of research and training proposals.

Formulation of Guidelines

In order to provide robust mechanism for developing and strengthening the research ecosystem, PME Unit formulated guidelines related to submission of Project Proposals for In- house/ External Funding / Consultancy / Contract Research. PME Cell also prepared guidelines for smooth function of the Unit by way of defining roles to be performed by the members of the ITMU.

MoUs Signed and Implemented

PME Unit provided all the logistic support for scrutinizing / finalizing the following MoUs signed between ICAR-NDRI and Other State Agricultural Universities and Central Universities.

1. MoU signed with Central Institute of Medicinal and Aromatic Plants, Lucknow on June 12, 2024.
2. MoU signed with Dau Shri Vasudev Chandrakar Kamdhenu Vishwavidyalya, Durg, Chhattisgarh on July 01, 2024.
3. Dalhousie University Institution, Halifax, Nova Scotia, Canada on July 01, 2024.
4. MoU signed with M/S Smillet, Housing Board Colony, Karnal (Private Ltd) on July 12, 2024.
5. MoU -signed with National Institute of Food Technology, Entrepreneurship And Management , Thanjavur (NIFTEM-T), Tamil Nadu on August 08, 2024.
6. MoU signed with M/S Saksham Dairy, Gharaunda, Karnal (Private Ltd) on August 13, 2024.
7. MoU signed with M/S Aavas Dairy, Ernakulam, Kerala (Private Ltd.) on August 13, 2024.

Technical Screening Committee Meetings

Technical Screening Committee constituted under the Chairmanship of Joint Director (Res.) evaluated the manuscripts for publication in the form of books, technical bulletins, manuals etc. Based on the recommendations of the committee, the manuscripts were also sent to outside experts for evaluation. The same were again evaluated in light of the comments received from experts and the contents of the publications got modified and subsequently got published as Institute publications. During the period under report, the following manuscripts were screened, evaluated and allotted publication numbers of ICAR-NDRI:

- Technologies available at NDRI for commercialization- 2024
- Dairy Smarika in Hindi
- Dudh mai dehik koshikao ki sankhya kam karne aur uchch gunvatta wala dudh prapt karne ke liye prathaon ka pakage (Hindi)

- All institute publications which were assigned ISBN number

Research Documentation and Publication

The PME Cell of the Institute is responsible for documentation and dissemination of research output through Annual Reports, Half Yearly Reports, Quarterly Reports, Monthly Reports, Technical Reports / Bulletins, etc. During the period under report, the following publications were prepared, edited and published through this cell:

- Annual Report -2023.
- ICAR-NDRI News Letter-a quarterly newsletter in English.
- Director's Report for the 20th Convocation.
- Research Projects (2023).
- Institute Research Committee (IRC) Proceedings (2 No) under the identified research programmes of the Institute.
- Research achievements of ICAR-NDRI for inclusion in ICAR / DARE Annual Report 2024-2025.

XIII Plan EFC Memo Document (2021-26)

- Formulation of EFC plan document under the theme: "Dairy Production &Technology Development" amounting to ₹ 468.824 Crores comprising Sub-scheme ICAR-NDRI, Karnal: ICAR-CIRB, Hisar ; ICAR-CIRB, Network Project on Buffalo Improvement, Hisar ; ICAR-CIRC, Meerut; ICAR-CIRC, All India Co-ordinated Research Project, Meerut, ICAR-NRC on Camel, Bikaner and submitted for consideration and final approval. The same was approved vide letter bearing F.No. AS s/26/2020 - IA-1-(Pt-I), Govt. of India, Ministry of Agriculture & Farmers welfare, Department of Agricultural Research & Education, New Delhi dated November 01, 2024.
- Prepared replies of comments received on EFC document from various appraisal agencies and Ministries including Niti Aayog etc.
- Prepared Action Taken Report on actionable points for Animal Science Division on suggestions made by the Hon'ble Agriculture Minister & MoS (A &FW) during the presentations on SFC / EFC of SMD. The provision of budget (Rs. 3.84 Crores) earmarked for promotion of research and technologies on adulterants and contaminants checking in milk products at National Referral Centre for quality and safety at NDRI, Karnal
- Prepared information regarding justification of continuation / extension of on-going schemes proposed under EFC document of the Institute for the period (2021-26) alongwith significant achievements of XIII Plan and year-wise outputs / deliverables of XIV Plan.

Half Yearly/ Quarterly/ Weekly/ Monthly Reports

- PME unit consolidated the half yearly/ Quarterly/ Weekly/ Monthly Reports of the Institute in the prescribed formats and submitted to the Council. Likewise, quarterly reports were consolidated in terms of financial and physical targets of TSP activities being carried out at Eastern Campus, Kalyani.
- Quarterly, Half Yearly and Annual progress report were consolidated with respect to implementation of Tribal Sub Plan (TSP), North-Eastern Hill (NEH) Region and SCSP schemes being carried out at Eastern Regional Station, Kalyani.

Assessment / Retention Cases of Scientists

The PME Unit also processed the documents for the assessment of 20 scientists and the retention cases of 19 scientists at ICAR-NDRI, Karnal. Assessment meetings were held in April, 12; June 04, August 08, September 27, 2024, while the meeting for retention cases took place on December 12, 2024.

Action Taken Reports (ATRs) and Information Collation

This Unit also prepared the following Action Taken Reports on recommendations emerged during the following meetings and submitted the same to the Animal Science Division of ICAR, New Delhi.

- The proceedings of the review meeting of the ICAR Institutes under Agriculture Engineering Division of the ICAR.
- SOC meetings
- Observation(s)/suggestion(s) with respect to Department of Agriculture Research and Education (DARE) in prescribed format pertaining to ICAR-NDRI for uploading on eSamikSha portal
- The proceedings of Annual conference of VCs/Directors held on February 26-27, 2024

- The proceedings of 96th foundation and technology held on July 15-16, 2024
- The minutes of 94 Annual General meeting of ICAR Society held in 2024
- Actionable points pertaining to NDRI, Karnal made to review the meetings of ICAR Institutes held on August 05, 2024.
- e-Samiksha observation(s)/suggestion(s) made in cabinet meetings
- Scaling up and promotion vaccine/health management protocols and reproductive technologies developed by the ICAR Institutes emerged during the meeting of the committee constituted under the Co-Chairmanship of Secretary (A & FW) and Secretary (DARE) & DG, ICAR to discuss the agenda topics/issues submitted by various divisions of the Council
- Minutes of the meeting held under the Chairmanship of Additional Secretary, DARE & Secretary, ICAR to review the preparedness for ICAR Foundation Day celebrated on June 16, 2024.

Besides, PME Cell also collated information towards agenda and nine action taken reports on the recommendations of ICAR- Regional Committees No. I, II, V, VI, VII and VIII held from time to time. The Unit also collated information sought by the Council from time to time on the Institute activities, achievements, technologies, training programmes, initiatives undertaken for the growth of dairy sector for realizing various components of white revolution scheme for next 5 years, GB meetings as well as for third party evaluation at SMD level. PME Cell also prepared the information on formulation of vision and strategy to the agriculture sector in view of vision of India@2047.

Research Papers

Research papers submitted by the scientists were processed by the unit for publication in various journals of National and International repute. In addition, a large number of abstracts of papers were also processed for presentation at various Seminars / Symposia / Workshops / Conferences etc.

Information for Parliamentary Standing Committees and Parliament Questions

- PME cell consolidated information for Parliamentary Standing Committee on Agriculture on the performance review of NDRI; ATRs on the recommendations / observations contained in the 39th Report based on comprehensive agricultural research based on "Geographical Conditions and Impact of Climatic Changes to Ensure the Food Security in the Country" of Parliamentary Standing Committee on Agriculture.
- Prepared information on studies carried out by the Institute regarding change in milk production pattern of indigenous breeds of cattle in the country to the Parliamentary Standing Committee on Agriculture, Animal Husbandry and food processing branch
- During the period under report, a total number of 41 parliament questions (Lok Sabha & Rajya Sabha) were attended.

Promotion of National and International Linkages

The unit also acted as a catalyst to promote and strengthen linkages with other Institutions of national and international repute. Visits of international delegations and distinguished visitors at the national level were coordinated and through scientific interactions / deliberations, agenda for mutual collaboration was chalked out with a view to arrive at MoUs for promotion of research and educational endeavours.

Dr. Kusumakar Sharma (RAC member) interacting with scientists of ICAR-NDRI

Research Projects 2024 (In-House on going) -

Sl. No.	Project No.	Title	PI
1.	A-82	Explore the use of mesenchymal stem cells for early maturity of cattle and buffalo heifers	D. Malakar
2.	A-83	Enhancing economy of livestock farmers of SC community through artificial insemination using cloned buffalo bull semen	Manoj Kumar Singh
3.	A-84	Exploring the potential of OPU-IVF in buffaloes	Naresh Selokar
4.	A-86	Genetic selection for milk traits using genomic approach in Sahiwal cattle	Anupama Mukherjee
5.	A-87	Optimization of strategies for genomic selection suitable for crossbred cattle for enhancing milk production	Rani Alex
6.	A-88	Exploring the prevention of wounds of cattle using umbilical cord blood-derived mesenchymal stem cells	D. Malakar
7.	A-89	Evaluation of genetic merit in Deoni cattle using emerging machine learning algorithms	D. N. Das
8.	A-90	Genomic selection strategies for identification of climatic resilience dairy cattle for increasing productivity.	T.V. Raja
9.	A-91	Estimation of Genomic Heterosis and Genome-wide Association for milk production traits in developing improved KF Cattle	Sabyasachi Mukherjee
10.	A-92	Early identification and selection of superior dairy animals through genomic evaluation	Vikas Vohra
11.	A-93	Development of glycan-lectin based colorimetric assay to assess the fertilizing potential of buffalo spermatozoa	Rakesh Kumar
12.	A-94	Development of an automated blastocyst grading system using artificial intelligence in cattle and buffalo	Bharati Pandey
13.	A-95	Production of gene edited buffalo fibroblast cells for expression of the human lysozyme	Satish Kumar
14.	A-96	Sex-sorting of bovine semen by selectively killing of Y-sperm to accelerate production of female calves.	Rajani Kr. Paul
15.	A-97	Validation of Progesterone loaded nanofibre based polyurethane sponge system for estrus synchronization in dairy cattle	Vedamurthy G V
16.	A-98	Establishment of field-based conservation unit of Lakhimi Cattle of Assam	Santanu Banik
17.	B-58	Enhancement of socio-economic condition of scheduled caste farmers through livestock based integrated farming in eastern India. (SCSP)	Ajoy Mandal
18.	B-61	Augmentation of ovarian, testicular function and fertility in buffaloes during low-breeding summer season by dietary supplementation and hormonal intervention	Rubina K. Baithalu
19.	B-67	Determination of Sample Size and Covariance Structure for Animal Studies involving Linear Mixed-Effects Models	M. Sivaram
20.	B-68	Automated individual identification of dairy animals using computer vision and deep learning approach	Indu Devi
21.	B-69	Social dominance in buffaloes and its implications for their performance and welfare	M. L. Kamboj
22.	B-70	Letrozole: a non-steroidal aromatase inhibitor on ovarian function and controlled breeding in cattle and buffaloes	S. Jeyakumar
23.	B-71	Effect of vaccination stress relieving feed supplements on semen quality of buffalo bulls.	Nishant Kumar
24.	B-72	Development and validation of immuno-biosensing assay for estrus identification in buffaloes	Rubina K. Baithalu
25.	B-73	Milk production prediction in India under changing climate scenarios with machine learning algorithms.	A.K. Sharma
26.	B-74	Development of an isothermal bovine semen straw thawing device	Ankit Deep
27.	B-75	Facial Image-Based Biometric Recognition for Unique Animal Identification using Machine Learning	Santanu Banik
28.	B-76	Elucidating the role of placental characteristics on birth related traits, reproductive efficiency and mother-kid bonding in Black Bengal goats (BBG).	Dilip Kumar Mandal
29.	B-77	Enhancing the fertilizability of Bengal buck semen through optimization of sperm dose and amelioration of oxidative stress with membrane targeting antioxidants.	M. Karunakaran

Sl. No.	Project No.	Title	PI
30.	C-68	Effect of sewage water on berseem-maize cropping system under different nutrient management practices	Hardev Ram
31.	C-69	Development of organic nutrient management practices on fodder–food based cropping systems	Sanjeev Kumar
32.	C-70	Effect of residue management on soil microbial activities under salt affected soils in rice-wheat system	Rakesh Kumar
33.	C-71	Designing and development of continuous bioreactor for in vitro rumen studies	Raman Malik
34.	C-72	Potential of selected methane inhibitors under in vitro model and towards carbon neutrality in livestock sector	Goutam Mondal
35.	C-73	Prediction of nutritive value of feedstuffs using near-infrared Spectroscopy (NIRS).	Chander Datt
36.	C-74	Development of silage inoculants possessing probiotic potential for enhancing nutrient utilisation from crop residues and agro-industrial waste.	Nitin Tyagi
37.	C-75	Exploring lemon grass and palmarosa grass residue on rumen fermentation and production performance in dairy animals	Goutam Mondal
38.	C-76	Reduction of Aflatoxin M1 (AFM1) in Milk Using Aflatoxin Detoxifying Agents in Dairy Animals.	Ram Singh
39.	C-77	Development and Characterization of Moringa-Napier Pellets.	Rajesh Kumar Meena
40.	C-78	A Machine Learning Approach to Assess Gait Kinematics for Prediction of Lameness in Crossbred Cattle	Mukund A. Kataktalware
41.	C-79	Effect of environmental and feeding stress on the total discomfort of dairy animals and their performance	Bandla Srinivas
42.	C-80	Formulation of a novel feed supplement to promote early rumen development for improving animal productivity.	A. Santra
43.	C-81	Validation of Nutrient Enriched Rice Straw technology in an organized Dairy Farm	A. Chatterjee
44.	C-82	Evaluating genetic variations of feeding behaviours and their associations with production and reproduction performance of Jersey crossbred cattle	Ajoy Mandal
45.	C-83	Therapeutic management of calf diarrhea with probiotics and herbal anti-diarrheal compounds	Saroj Rai
46.	D-62	Profiling of milk constituents from indigenous breeds of cattle and buffalo	Rajesh Kumar
47.	D-63	Utilization of paneer whey towards sustainable production of bioactive lactose-derived oligosaccharides	Priyanka Singh Rao
48.	D-64	Development of spray dried probiotic direct vat set starters of Lactiplantibacillus plantarum strain(s)	Chand Ram
49.	D-65	Characterization and bioprocess optimization for enhanced Vitamin B12 production by Limosilactobacillus reuteri NCDC 958	Manorama Kumari
50.	D-66	Characterization of Urolithin A (UroA) producing probiotic strains as a functional health ingredient.	Diwas Pradhan
51.	D-67	Development of Autochthonous Dahi and Yoghurt Starter Culture Blends to Strengthen NCDC Repository.	Pradip Behare
52.	D-68	Profiling of bovine and non-bovine milk constituents and determining their therapeutic potential to enhance market profitability.	Rajan Sharma
53.	E-56	Metabolomics-assisted elucidation of compositional and technological variations in milk of Beetal, Barbari and Jamunapari goats	Heena Sharma
54.	E-61	Improvement in functionality of buffalo milk protein concentrate (BMPC80)	Ganga Sahay Meena
55.	E-63	Monitoring and characterization of yogurt fermentation process on the basis of electrical properties	Khushbu Kumari
56.	E-64	Development of nutri-cereals based ready to reconstitute payasam mixes	Menon Rekha Ravindra
57.	E-65	Densification of cattle dung-based composite torrefied biomass for bioenergy	Vairat Amita Dinkar
58.	E-66	Development of Technology for 3-D Printing of Traditional Indian Milk Products.	Kaushik Khamrui

Sl. No.	Project No.	Title	PI
59.	E-67	Development of Milk and Plant proteins based egg white analogues	Deep Narayan Yadav
60.	E-68	Development of Green Packaging Materials from Agro-Co-Product Proteins for Dairy Products.	Narender Raju Panjagari
61.	E-69	Development and integration of automatic thermal storage module with solar fermentation unit	Chitranayak
62.	E-70	Scale-up and validation of magnetic induction heating unit for milk	Hima John
63.	E-71	Development of a mechanized unit for Pinni manufacturing	Barnwal
64.	E-72	Characterization of ghee prepared using Bilona Process.	Vivek Sharma
65.	E-73	Physico-chemical characterization and storage stability of khoa prepared from low lactose milk with reduced maillard browning	Sumit Arora
66.	E-74	Adsorption and microbial purification of GOSs derived from paneer whey and its utilization in select dairy products	Manoj Kumar C.T.
67.	E-75	Valorization of industrially produced ghee residue through extraction of phospholipids and production of phospholipid rich powder	Monika Sharma
68.	F-33	Development of analytical strategy for estimation of endogenous water-soluble vitamins in milk.	Richa Singh
69.	F-36	Detection of adulteration in milk and ghee using Raman Spectroscopy coupled with chemometrics	Rajan Sharma
70.	F-37	Determining a safe alternative to Mercury for Dairy Glassware-Butyrometer Calibration	Laxmana Naik, N.
71.	F-38	Dung-mining for understanding the linkage of microbial assemblage to milk productivity in dairy animals	Anil Kumar Puniya
72.	F-39	Development of Engineered Endolysins as a Novel Therapeutic Agent for Multi-drug Resistant E. coli Infections in Dairy Animals	Jai K Kaushik
73.	F-40	Deoni cow urine-based formulation for wound healing in animals	Mamta Chauhan
74.	F-41	A Rapid Test Kit for Detecting Bovine Ketosis at Point of Care	Dr. Mohan Mandal
75.	G-79	Livelihood augmentation of resource poor scheduled caste farm households in western dry region of Rajasthan	Gopal Sankhala
76.	G-80	Empowerment of tribal farmers through dairy interventions in Rajasthan	B.S. Meena
77.	G-81	An appraisal of natural farming practices in different climatic cone of north India	Raj Kumar
78.	G-82	Farmers' Participatory Assessment of "Salivascope for Estrus Detection " Method in Buffalo	Sanjit Maiti
79.	G-83	Assessment of competitiveness and performance of Indian dairy export	Gunjan Bhandari
80.	G-84	Impact assessment of selected interventions of NDRI-KVK	Anil Kumar Dixit
81.	G-85	Consumer Behaviour and Demand–Supply Analysis of Dairy Based Functional Foods in India	Ajmer Singh
82.	G-86	Levels and trends in income from dairy of agricultural households in major dairy states of India	Udita Chaudhary
83.	G-87	Multimarket price determination of milk in India	Biswajit Sen
84.	G-88	Women-Centric Vulnerability Mapping and Participatory Adaptation Planning to Climate Change for Dairy Farmers in Haryana	Sanchita Garai
85.	G-89	Understanding the inclination of dairy entrepreneurs towards choosing dairying and related businesses as a means of employment in Haryana: A comprehensive study	Raj Kumar
86.	G-90	Estimation of lifetime economics of Deoni cattle in organized and unorganized farms	Shivaswamy GP
87.	G-91	Developing Dairy Development Index of India –Framework and Determinants	Subhasis Mandal
88.	G-92	Assessment of the Socio-spatial Dynamics for Bio-Fertilizer Adoption within Dairy based Farming Systems	Asif Mohammad

New Externally Projects Sanctioned-2024

In the year 2024, following 25 projects had been sanctioned to the faculty of ICAR-NDRI with total financial layout of ₹1895.76 lakhs.

Sl. No.	Title of the Project	PI	Co-PI	Funding Agency	Duration	Total Cost ₹ (in Lakh)
1.	Development of novel strategy for the detection and tackling of antimicrobial resistant (AMR) Mastitis pathogens in dairy animals and environment using nanotechnology	Raghu H.V.	Shilpa Vij	NASF	2024- 2027	82.25300
2.	*In vitro* production of oocyte- and spermatozoa-like cells from pluripotent stem cells of farm animals	M.K Singh	Naresh L. Selokar	NASF	2024- 2027	88.86000
3.	Preparation of greenhouse inventory from Indian Livestock for first BTR, fourth BUR and fourth NC from livestock sector	Goutam Mondal	Nitin Tyagi Sanjit Maiti	MOEF& CC,GOI	2024- 2027	70.15168
4.	DPP-IV inhibitory (antidiabetic) peptides-rich milk protein hydrolysates: Effect of simulated digestion and safety evaluation	Sathish Kumar M.H Suman Kapila	Devaraja H C, Manoj Kumar Priyanka Rao, Rajeev Kapila	DST	2024-2027	94.63
5.	Network Project on Animal Genetic Resources (AnGR)	Santanu Banik	-	ICAR-NBAGR	2024-2025	10.00
6.	Agricultural waste management using vermicomposting and microbial-based residues decomposers	Rajesh Kumar Meena	Hardev Ram, Anurag Saxena, Pankaj Kumar Saraswat	Swachhta Action Plan (SAP) under ICAR	2024-2026	8.50
7.	AICRP on Mechanization of animal agriculture production And post-production Mechanization augmentated With innovation technologies For sustainable agriculture Development	P Barnwal	Indu Devi	ICAR	2024-2026	11.70
8.	Application of mesenchymal stem cells for the treatment of metritis to control repeat breeding in cattle and buffaloes for improvement of the live stock	Dhruba Malakar	Satish Kumar	DST-Haryana	2024-2026	30.00
9.	Development of probiotic for mulations containing lactiplantibacillus plantarum LP91 (MTCC-5690) and its pre-clinical safety & efficacy study for human use	Rashmi M.H	Diwas Pradhan P. Heartwin	ICMR	2024-2026	205.47
10.	Effect of processing on the levels of afflatoxin M1 in selected dairy products	Raghu H. V	Kamal Gandhi, A.K Puniya, Writdhama Prasad	FSSAI	2024-2026	86.20
11.	Knowledge partnership to understand the Pashusakhi model, Co-development and supporting in creation of Entrepreneurship.	M Karunakaran	Mohan Mandal, Ajoy Mondal, C Bhakat	ITC(CSR)	2024-2025	9.765
12.	Production of broiler livestock and poultry using CRISPR technology	Naresh Selokar	M K Singh, Bharti Pandey Dheer Singh	ICAR	2024-2026	329.00
13.	Exploring CRISPR/ Cas9-based genome editing for skewed sexed embryo production in buffalo-NDRI	M.K. Singh	Naresh Selokar, Dheer Singh	ICAR	2024-2026	136.00

Sl. No.	Title of the Project	PI	Co-PI	Funding Agency	Duration	Total Cost ₹ (in Lakh)
14.	Preclinical Efficacy safety and toxity of colostrum whey protein derived formulations ('Propep') in animals mode; (DHR) and its preclinical safety and efficacy study for human use	Shilpa Vij	A. K. Puniya Vikas Dighe	ICMR-DHR	2024-2026	179.86
15.	Bacteriophage and Metal based Antimicrobial Therapy for the Bio-Control of Multi-Drug Resistant (MDR) Zoonotic Bacterial Dairy Pathogens	Raghu H.V	A K Puniya, Shilpa Vij, S De, Kamal Gandhi	ICMR	2024-2027	85.00
16.	Biosynthesis and downstream processing of lacto bionic acid from paneer whey using lactose oxidizing bacteria.	Yogesh Khetra	G S Meena, Rashmi H M, Sumit Arora	DBT	2024-2027	38.20
17.	Development and functional characterization of spray-dried lactose-free milk powder using high molecular weight polysaccharide as adjunct	Richa Singh	Sumit Arora	DST	2024-2027	27.96
18.	Development of fertility signatures for identifications of repeat breeding cows by exploring crosstalk mechanism in SNP-miRNA-mRNA networks	Rani Alex	G R Gowane, Vikas Vohra	HSCSIT	2024-2027	40.00
19.	Livelihood improvement of rural farmers through augmentation of fertility in dairy cows with assured female calf approach in Chakdaha & Haringhata blocks of Nadia district, West Bengal	M Karunakaran	Asif Mohammad, Mohan Mandal, Ajoy Mondal, C Bhakat	NABARD	2024-2027	20.09
20.	Comprehensive characterization of badri cow milk bioactivities and its dairy products (yogurt & Paneer) across seasons	Rashmi H M	Suneel Onteru	DBT	2024-2027	17.95
21.	All India Network Programme (AINP) on antimicrobial resistance (AMR) in Fishery & animal sciences (INFAAR)	Raghu H.V	Diwas Pradhan	ICAR-NBFGR	2024-2026	17.25
22.	Application of aptamer, microfluidics and protein targeted approaches for sex specific spermatozoa enriched in bovine and technology development there of	Mohan Mondal	M Karunakaran, Ajoy Mondal, S.K. Das	DBT	2024-2026	102.74
23.	Application of aptamer, microfluidics and protein targeted approaches for sex specific spermatozoa enriched in bovine and technology development there of	Sudarshan Kumar	Jai Kaushik Satish Kumar T.K. Mohanty Rubina Baithalu	DBT	2024-26	94.96
24.	Management of subclinical mastitis through NIFs indigenous approach at lower gangetic region	Champak Bhakat	-	NIF	2024-2026	14.22
25.	Designing, synthesis & functional evaluation of therapeutic potential of bovine specific novel kisspeptin-10 analogues for reproduction augmentation in livestock species	Mohan Mondal	M Karunakaran	DST-SERB	2024-2027	95.00
Total						**1895.76**

5. EXTRA-MURAL FUNDING AND COLLABORATIONS

As on 31.12.2024, the following 81externally funded projects having financial layout of Amount ₹10483.74 lakhs are in progress at ICAR-NDRI, Karnal.

Sl.No.	Title of the Project	Name of PI/ CCPI	Name of Associates	Funding Agency	Duration	Cost ₹(Lakh)
International Projects						
1)	Molecular markers for improving reproduction of cattle and buffaloes (MMIRCB).	Rakesh Kumar	Dheer Singh, Suneel Onteru, Rubina K. Baithalu, A.K. Mohanty, S. Kumar, T.K. Mohanty, J.K. Kaushik and M. Bhakat	Bill & Melinda Gates Foundation, USA	2018-2024	648.38
2)	Molecular markers for improving reproduction of cattle and buffaloes.	A. Kumaresan	A. Manimaran and K.P. Ramesha	Bill & Melinda Gates Foundation, USA	2018- 2024	127.13
National Projects						
3)	Network programme on veterinary type culture (VTC)-Rumen Microbes.	Sachin Kumar	Nitin Tyagi	ICAR	2009-2026	13.80
4)	Indigenous breed program (Sahiwal Cattle).	Anupma Mukherjee	Vikas Vohra, T. K. Mohanty, S.S. Lathwal and M. Bhakat	ICAR	2015-2026	8.35
5)	Capacity building of resource for farmers in paddy-wheat cum dairy production system through Farmer First Programme.	Gopal Sankhala	A. S. Meena, H. R. Meena, S. S. Lathwal, Rakesh Kumar, Ajmer Singh, A. K. Singh, V. K. Pandita (IARI), Nitin Tyagi, Sanket Borad, Heena Sharma and Sachin, Omvir Singh (CTO)	ICAR	2016-2025	33.62
6)	Enriching knowledge-integrating technology and institutions for holistic village development in horticulture based farming system.	B. Balakrishna, IIHR, Bengaluru	M.C.A. Devi and S. Subhash	ICAR	2016-2025	31.80
7)	Incentivizing research in agriculture: Project-V: Semen sexing in cattle.	Sudarshan Kumar	-	ICAR	2021-2026	239.50
8)	Network project on buffalo Improvement-Institute herd	Vikas Vohra	Pawan Singh, G.R.Gowane, T.K. Mohanty and Mukesh Bhakat	CIRB-ICAR	2017-2026	15.60
9)	Network project on buffalo Improvement-Field Unit	Vikas Vohra	G. R. Gowane, Sabyasachi Mukherjee and S. K. Rathi	CIRB-ICAR	2017-2026	30.70
10)	National Innovations in climate resilient Agriculture (NICRA)	Ashutosh	Mahendra Singh, S.S. Lathwal, Nishant Kumar, Nitin Tyagi, Ashwani Roy, Anjali Aggarwal, M.K.Singh, Sunita Meena, Rani Alex, B. S. Meena, Ritu Chakravarty, Richa Singh, Sachin Kumar, Madhu Mohini and Biswa Bhaskar	CRIDA (ICAR)	2017-2025	91.50
11)	Monitoring of drug residues and other environmental pollutants-outreach project of ICAR	Raghu H.V.	-	ICAR	2017-2022	19.87
12)	Improving the livelihood through dairy farming in North Eastern region of India.	T. K. Dutta	M. K. Ghosh, S. K. Das, A. Santra, C. Bhakat, A. Mandal, A. Chatterjee, D. K. Mandal, Mohan Mondal, M. Karunakaran, A. Mohammad, S. Rai, R. Behera, Chander Dutt,	ICAR	2017-2026	20.00
13)	Incentivizing research in agriculture Project-V : Semen sexing in cattle	T. K. Mohanty PI of Component -A	Mukesh Bhagat, A. Kumaresan, Pawan Singh and Rubina K. Baithalu	ICAR	2017-2026	549.84

Sl.No.	Title of the Project	Name of PI/ CCPI	Name of Associates	Funding Agency	Duration	Cost ₹ (Lakh)
14)	Empowering farmers through selective interventions in salt affected agroecosystems of Ghaghar Plains(Farmers' FIRST Programme	Sohanvir Singh CCPI	K. Ponnusamy	ICAR	2018- 2024	169.80
15)	Scheme on Dairy Microbes under Network Mode. (ICAR-Network Project)	P.V. Behare	A.K. Puniya	ICAR Network Project	2019-2024	95.00
16)	Upliftment of socio-economic condition of tribal people through integrated livestock farming in north eastern hill region/eastern part of India	T. K. Dutta	M. K. Ghosh, S. K. Das, A. Santra, C. Bhakat, A. Mondal, A. Chatterjee, D. K. Mondal, Mohan Mondal, M. Karunakaran, Asif Mohammad, S. Rai and R. Behera.	ICAR	2020-2026	50.00
17)	Exploring molecular basis of seasonal variation of seminal attributes and identification of potential biomarkers for selection of buffalo bulls with quality semen	Pawan Singh	Ranjit Singh Kataria-NBAGR, Karnal and Pardeep Kumar-CIRB, Hisar	DBT	2020- 2024	193.00
18)	Establishment of AI network in Muzaffarnagar	Pawan Singh	B. S. Meena, Sohanvir Singh, Nishant Kumar and Indu Devi	DADF	2022- 2025	859.10
19)	Characterizing milk colostrum of Ladakhi cows and yak for identification of biomolecules with therapeutic potential	Sudarshan Kumar	Jai Kumar Kaushik	SERB-DST	2020 -2024	349.42
20)	Water budgeting and improving water productivity livestock based farming	Ashutosh	Mahendra Singh, Sunita Meena and Satish Kumar (CTO)	ICAR	2020-2025	90.00
21)	Generation of milk somatic cell reference values and intelligent and predictive modelling for monitoring mammry profile and milk quality of indigenous dairy animals	A.K. Dang,	Gourav Kr. Deshwal and Adesh Kumar. Sharma	DBT	2021-2024	73.06
22)	Development of quantitative molecular assays for rapid enumeration of viable probiotics from probiotic food products	Rashmi HM	Diwas Pradhan	ICMR	2021 -2024	43.90
23)	Protein based optical sensors for detection of listeria monocytogenes in milk	Raghu H.V.	Rashmi H.M. and Naresh Kumar	ICMR	2021-2024	43.30
24)	ICAR Network programme on precision agriculture	T. K. Mohanty	A.K. Mishra, S.S.Lathwal and Mukesh Bhakat	ICAR-NEPPA	2021-2026	332.00
25)	Dairy entrepreneurship development among rural youth and women in aspirational districts of Karnataka State	S. Subash	K.P. Ramesha, S. Jeyakumar, H.C. Devaraja	RKVY	2021-2024	232.00
26)	Evaluation of bio functional attributes of extracellular components derived from probiotic lactobacilli as post-biotics	Rajeev Kapila	Suman Kapila	SERB	2022-2025	40.00
27)	Unique innate-immunity genomic signatures identification in Sahiwal Gir, Tharparkar, Kangeyamm Karan Fries and Holstein Friesian cattle using immune informatics	Suneel Kumar Onteru	Ragothaman M.Yennamalli, Sastra Deemed to be University, Thanjavur	NASF	2022-2025	95.40
28)	Enhancing post thaw quality of cryopreserved buffalo semen by using sperm-quiescent proteins of cauda epididymal plasma	R.K. Paul	-	SERB-DST	2022 -2024	13.60000

Sl.No.	Title of the Project	Name of PI/ CCPI	Name of Associates	Funding Agency	Duration	Cost ₹ (Lakh)
29)	Antimicrobial resistance surveillance in view of one health concept	rerna Aggarwal (PProf. & Head) Department of Microbiology KCGMCH Karnal	Anupam Berwal and Sachinandan De	ICMR New Delhi	2022-2024	57.34
30)	Evaluation of semen characteri-stics and fertility parameters of cloned bulls and performance of clones progenies –Phase II	Prem Singh Yadav, ICAR-CIRB, Hisar	M.K. Singh	NASF	2022-2025	450.58
31)	Genome editing for improved lactation traits in Indian Buffalo	Naresh Selokar Bhanu	Chi-Hun Park and Ravikant Reddy Ponnuru	Bill & Melinda Gates Foundation (BMGF)	2022 -2027	98.53
32)	Unravelling the genomic diversity and identifying Putative SNPs for Milk quality and production in Belahi and crossbred population in Haryana State.	G.R. Gowane	Vikas Vohra, Rani Alex	DST (HSCSI&T)	2022 -2025	40.00
33)	Utilization of paddy straw as complete fodder block by treating with Gomutra (Indigenous cow urine)	Ajay Vir Singh Sirohi	Sanjeev Kumar Verma, Naimi Chand, Ahmad Fahim, CCPI: Nitin Tyagi CC CoPI: Sachin Kumar	DST-SEED-SUTRA	2022 -2024	70.68
34)	Development of Nano-Micro matrices for the delivery of bio-actives, micro-nutrients and therapeutics	Rajesh Kumar	Naveen K Navani, IIT Roorkee Rajendran D., ICAR-NIANP, Bengalur P.Senthil Kumar, TANUVAS, Orathanad and P. Heartwin Amaladhas	NASF-ICAR	2022-2025	401.63
35)	Electronic platform to monitor cattle health	S. M. Deb	Ajoy Mandal, Chamapak bhakat and M.Karunakaran and milk quality	MEIT	2022-2024	60.88
36)	Characterization of native livestock and poultry population of West Bengal State.	Ajoy Mandal	S.M. Deb M. Karunakaran and Mohan Mandal	ICAR	2022-2027	27.50
37)	Development of climate resilient and sustainable agri based systems for better food, feed, nutritional and livelihood security potions to farming community of cold arid region– Ladakh	Anurag Saxena	Sanjeev Kumar, Hardev Ram, A.K. Mishra, Ashutosh, P. Narender Raju, Richa Singh	DST	2022-2025	272.00
38)	Isolation of pro-rich poly peptides from colostrum of select indigenous cattle breed and evaluation of their nutraceutical potential.	Shaik Abdul Husain	Sathish Kumar, M.H.	NASF	2022-2025	100.55
39)	Delineating the drug delivery potential of milk exosomes to combat intracellular pathogenic niche causing bovine mastitis	Dheer Singh	Suneel Kumar Onteru	DBT	2023 -2026	98.72520
40)	Evaluation of the impact of mitochondrial changes on milk production traits of indigenous cattle	Sadeesh E.M.	-	SERB-DST	2023 -2025	29.53800
41)	Controlled Release of Olfactory Cues for Management of Lesser Grain Weevil, Sitophilus Oryzaea Stored Product Pest of Rice	Gautam Kaul	Rajani Paul	DBT	2023-2026	86.42800
42)	Overexpression of recombinant LA isomerise/ desaturase on the surface of probiotic LAB for enhanced *in situ* production of CLA as acids in GI of the host	Anita Kumari Garsa	Mentor: J. K. Kaushik	DST under Women Scientist Scheme (WOS-A)	2023-2026	31.28

Sl.No.	Title of the Project	Name of PI/ CCPI	Name of Associates	Funding Agency	Duration	Cost ₹ (Lakh)
43)	Establishment of Centre of Excellence with OPU-IVF Technology	M .K. Singh	Naresh Selokar, Rubina Baithalu, Subhash Chand and Ranjit Verma	MOFAHD	2023-2028	1185.25
44)	Production of cloned indigenous cattle using simplified handmade cloning method	Naresh L Selokar	M. K. Singh and Ranjeet Verma	ICAR	2023 -2026	35.00
45)	Indian dromedary camel genome diversity analysis and development of customized low density SNP chip for camel.	Ved Prakash (NRCC, Bikaner)	G.R. Gowane and Basanti Jyotsana	NRCC Bikaner as part of coordinated research project IAEA Vienna	2023 -2028	0.00
46)	Valorization of pearl millet straw for production of gut health caring nutraceuticals: Global Centre of Excellence on Millets (Shri Anna)-Sub-Component	Sachin Kumar	Sumit Arora, Shaik Abdul Hussain and Nitin Tyagi	ICAR-IIMR, Hyderabad	2023-2026	50.00
47)	Identification of heat stress-specific biomarkers to develop a biosensor for formulating mitigation strategies in high yielding dairy animals	A.K. Dang	-	DBT	2023 - 2026	49.10480
48)	Building resilience model for the vulnerable hotspots to climate change in smallholder dairy production system of Indo-Gangetic Plain Region of India using GIS and fuzzy cognitive mapping approach	Sanjit Maiti	Rupak Goswami Howrah, Bishwa Bhaskar Choudhary Jhansi and Anirban Mukherjee,Patna	NASF	2023-2026	54.94741
49)	The South Asia Agriculture Adaptation Atlas: Interconnections between climate risk, practices, technologies and policies	Sanjit Maiti	-	MOA&FW New Delhi (Collaborations) ICAR-CRIDA Hyderabad in collaboration with BISA	2023-2026	28.86580
50)	Affordable sustainable and nutritionally balanced milk millet protein ingredients	Yogesh Khetra	S.A. Husain, G.S. Meena, Sumit Arora	DST	2023-2026	29.69327
51)	Sensor based oestrus identification and health monitoring device in dairy animals	T. K. Mohanty	Mukesh Bhakat and Rubina Kumari Baithalu	DST (Collaborative project with IIT Delhi)	2023 -2026	34.04592
52)	In-situ production of active vitamin B12 rich ready to use therapeutic composite dairy food and evaluation of its bioavailability and safety	Devraja H.C., SRS	Monika Sharma, Rashmi H.M. and Goutam Kaul	ICMR	2023-2026	44.89
53)	Novel Nano purification technology for enrichment of super sperm population to improve fertility and skew sex ratio towards female in dairy animals.	A. Kumaresan	-	Funded under National Fellow ICAR	2023 - 2027	376.59880
54)	AICRP on Mechanization of animal Agriculture Production and Post-Production Mechanization Augmented with innovation Technologies for sustainable agriculture Development	P. Barnwal	Indu Devi	ICAR	2024-2026	11.70
55)	In vitro production of oocyte - and spermatozoa-like cells from pluripotent stem cells of farm animals	M.K Singh	Naresh L. Selokar	NASF	2024- 2027	88.86000

Sl.No.	Title of the Project	Name of PI/ CCPI	Name of Associates	Funding Agency	Duration	Cost ₹ (Lakh)
56)	Harnessing Ruminant Immunity for Practical Application (National Professor Scheme)	Sachinandan De	-	-	2024-2028	0
57)	Exploring the role of non-coding RNAs in regulating the epigenomics of lactation in low yielding cows	Sudarshan Kumar	Jai Kaushik	DBT	2023 -2026	87.13166
58)	Production of broiler livestock and poultry using CRISPR technology	Naresh Selokar	M. K. Singh, S. S. Lathwal, Bharati Pandey and Dheer Singh	ICAR	2024-2026	329.00
59)	Exploring CRISPR/Cas9-based genome editing for skewed sexed embryo production in buffalo-NDRI	M. K. Singh	Naresh Selokar and Dheer Singh	ICAR	2024-2026	136.00
60)	Development of fertility signatures for identifications of repeat breeding cows by exploring crosstalk mechanism in SNP-miRNA-mRNA networks	Rani Alex	G. R. Gowane and Vikas Vohra	HSCSIT	2024-	40.00000
61)	Preparation of greenhouse inventory from Indian Livestock for first BTR, fourth BUR and fourth NC from livestock sector	Goutam Mondal	Nitin Tyagi and Sanjit Maiti	MOEF&CC,GOI	2024- 2027	70.15168
62)	Development and functional characterization of spray-dried lactose-free milk powder using high molecular weight polysaccharide as adjunct	Richa Singh	Sumit Arora	DST under SYST	2024-2027	27.96200
63)	Development of novel strategy for the detection and tackling of antimicrobial resistant(AMR) Mastitis pathogens in dairy animals and environment using nanotechnology	Raghu H.V.	Shilpa Vij	NASF	2024- 2027	82.25300
64)	Bacteriophage and Metal based Antimicrobial Therapy for the Bio-Control of Multi-Drug Resistant (MDR) Zoonotic Bacterial Dairy Pathogens	Raghu H.V.	A K Puniya, Shilpa Vij, S De and Kamal Gandhi	ICMR	2024-2027	85.00
65)	DPP-IV inhibitory (antidiabetic) peptides-rich milk protein hydrolysates: Effect of simulated digestion and safety evaluation	Sathish Kumar M.H. and Suman Kapila	Devaraja H. C., Manoj Kumar C. T., Priyanka Singh Rao and Rajeev Kapila	DST	2024-2025	94.63108
66)	Network Project on characterization and documentation of Animal Genetic Resources (AnGR) of ICAR-NBAGR	Ajoy Mandal	M. Karunakaran ,M. Mandal , Champak Bhakat ,S Banik	ICAR	2021-2026	10.00
67)	Agricultural waste management using vermicomposting and microbial-based residues decomposers	Rajesh Kumar Meena	Hardev Ram, Anurag Saxena and Pankaj Kumar Saraswat	SAP (Swachta Action Plan) ICAR	2024-2026	8.50
68)	Biosynthesis and downstream processing of lacto bionic acid from paneer whey using lactose oxidizing bacteria.	Yogesh Khetra	G. S. Meena, Rashmi H. M. and Sumit Arora	DBT	2024-2027	38.20

Sl.No.	Title of the Project	Name of PI/ CCPI	Name of Associates	Funding Agency	Duration	Cost ₹ (Lakh)
69)	Livelihood improvement of rural farmers through augmentation of fertility in dairy cows with assured female calf approach in Chakdaha and Haringhata blocks of Nadia district, West Bengal	M Karunakaran	Asif Mohammad, Mohan Mandal, Ajoy Mondal and C Bhakat	NABARD	2024-2027	20.09
70)	Knowledge partnership to understand the Pashusakhi model, Co-development and supporting in creation of Entrepreneurship	M Karunakaran	Mohan Mandal, Ajoy Mondal and C. Bhakat	ITC (CSR)	2024-2025	9.765
71)	Application of mesenchymal stem cells for the treatment of metritis to control repeat breeding in cattle and buffaloes for improvement of the livestock	Dhruba Malakar	Satish Kumar	DST Haryana	2024-2026	30.00
72)	All India Network Programme (AINP) on antimicrobial resistance (AMR) in Fishery & animal sciences (INFAAR)	Raghu H.V	Diwas Pradhan	ICAR-NBFGR	2023-2026	17.72
73)	Effect of processing on the levels of aflatoxin M1 in selected dairy products	Raghu H. V. and Writdhama Prasad	Kamal Gandhi, A.K. Puniya	FSSAI	2024-2026	86.20
74)	Pre-Clinical efficacy, safety and toxicity of colostrum whey protein derived formulations ('ProPep') in animal model	Shilpa Vij	A. K. Puniya and Vikas Dighe	ICMR	2024-2026	179.86
75)	Development of probiotic formulation containing Lactiplantibacillus plantarum Lp91 (MTCC 5690) and its pre-clinical safety & efficacy study for human use	Rashmi M.H	Diwas Pradhan and P Heartwin	ICMR	2024-2026	205.47
76)	Awareness of Farmers on Scientific Management Practices of Gir Indigenous Cattle and Productivity Enhancement in Goras Region (MP)	S. S. Lathwal	B. S. Meena, Arun Kumar Misra, Nishant Kumar, Gopal R. Gowane and Indu Devi	DADF	2023 -2028	276.65
77)	Comprehensive characterization of Badri cow milk bioactivities and its dairy products(yogurt and paneer) across seasons	Rashmi H M	Suneel Onteru	DBT	2024-2027	17.95
78)	Application of aptamer, microfluidics and protein targeted approaches for sex specific spermatozoa enriched in bovine and technology development thereof	Mohan Mondal (ERS)	M. Karunakaran, Ajoy Mondal and S. K.Das	DBT	2024-2026	102.74
79)	Application of aptamer, microfluidics and protein targeted approaches for sex specific spermatozoa enriched in bovine and technology development thereof	Sudarshan Kumar	Jai Kaushik, Satish Kumar, T.K. Mohanty and Rubina Baithalu	DBT	2024-2026	94.96
80)	Management of subclinical mastitis through NIFs indigenous approach at lower gangetic region	Champak Bhakat (ERS)	NIF	18 months	14.22	
81)	Designing, synthesis & functional evaluation of therapeutic potential of bovine specific novel kisspeptin-10 analogues for reproduction augmentation in livestock species	Mohan Mondal	M. Karunakaran	DST-SERB	2024-2027	95.00
	Total					**10483.74**

6. INTELLECTUAL PROPERTY MANAGEMENT

Institute Technology Management Unit (ITMU) -

Institute Technology Management Unit at NDRI is managed by Institute Technology Management Committee (ITMC). ITMC is the highest body which takes important decisions for the intellectual property management at NDRI viz., filing of patents, Copyrights, approval of the technology for commercialization, pricing of the technologies ready for commercialization etc. ITMC is chaired by the Director.

In 2024, upto September 23, the following ITMC was in place -

1.	Dr. Dheer Singh, Director and Vice-Chancellor	Chairman
2.	Dr. Rajan Sharma, Joint Director (Research) & Member Secretary, IRC	Member
3.	Dr. Deep Narayan Yadav, Head, DT Division	Member
4.	Dr. Sachinanadan De, Principal Scientist, ABTC Division & Technical Expert	Member
5.	Dr. Chand Ram, Principal Scientist DM Division & Technical Expert	Member
6.	Dr. A.K. Puniya, Principal Scientist DM Division & Representative of PME Cell	Member
7.	Ms. Shikha Singh, Managing Associate, New Delhi & External IPR Expert	Member
8.	Dr. P.N. Raju, Senior Scientist & Office-in-charge, ITMU	Member-Secretary

After this, ITMC was reconstituted and since September 24, 2024 following ITMC is in place -

1.	Dr. Dheer Singh, Director	Chairman
2.	Dr. Rajan Sharma, Joint Director (Research) & Member Secretary, IRC	Member
3.	Dr. Deep Narayan Yadav, Head, DT Division	Member
4.	Dr. Sachinanadan De, Principal Scientist, ABTC Division & Technical Expert	Member
5.	Dr. Chand Ram, Principal Scientist DM Division & Technical Expert	Member
6.	Dr. A.K. Puniya, Principal Scientist DM Division & Representative of PME Cell	Member
7.	Ms. Shikha Singh, Managing Associate, New Delhi & External IPR Expert	Member
8.	Dr. Pradip V. Behare, Senior Scientist & Office-in-charge, ITMU	Member-Secretary

ITMC Meetings Organized

1. 60th ITMC Meeting was held on January 02, 2024
2. 61st ITMC Meeting was held on May 16, 2024
3. 62nd ITMC Meeting was held on July 18, 2024
4. 63rd ITMC Meeting was held on August 03, 2024
5. 64th ITMC Meeting was held on October 28, 2024

In all these meetings, pricing of technologies and examination of patent applications for their novelty and commercial applicability before filing patent applications, copyright applications, trademark applications were taken-up. The details are as follows:

Technologies Developed

During the period, 07 technologies were approved by ITMC for its inclusion in Technology Booklet of NDRI. These technologies are ready for commercialization. The details are:

S. No.	Name of technology	Approved on	Inventors
1	Innovative Technology for Producing Antimicrobial Coagulant Formulation to Prolong the Shelf-Life of Paneer	60th ITMC on 02-01-2024	Pradip V. Behare, Rallapalli Vembar Rajanikar, Sudhir Kumar Tomar, Diwas Pradhan, Rajan Sharma, Sanket Borad
2	Technology on production of stable direct Vat Set liquid starter culture blend for fermented milk	61st ITMC on 16-05-2024	Pradip V. Behare, Mr. Reshab Majumdar, Diwas Pradhan, P. Narender Raju
3	Fast-acidifying streptococcus thermophilus NCDC 960 strain for production of fermented milk	61st ITMC on 16-05-2024	Pradip V. Behare, Manorama, Anil Kumar Puniya, Shaik Abdul Hussain
4	Spray-dried low lactose milk powder	62nd ITMC on 18-07-2024	Sumit Arora, Richa Singh, Vivek Sharma, Payal Singh, Priyanka Singh Rao, A.K. Singh
5	Probiotic mix culture for boosting calf health	63rd ITMC on 03-08-2024	Sachin Kumar, AK Samanta, Nitin Tyagi, Pradip Behare, Heartwin, A Pushapdass, Balaga Sravani, Rakesh Chouraddi

S. No.	Name of technology	Approved on	Inventors
6	Cloning of bulls for the industry	63rd ITMC on 03-08-2024	Naresh Selokar, and Manoj Kumar Singh
7	Colorimetric paper strip sensor for the detection of total bacterial count in milk	64th ITMC on 28-10-2024	Raghu H V., Shreya Saha, Mohit Singh, Maharshi Prajapathi, Naresh Kumar

Technologies Commercialized -

A total of 09 technologies were transferred to Hatsun Agro Product Ltd. through 01 License agreement thereby earning a total of Rs. 32.30 Lakhs for the institute through technology licensing fee. The license aggrement was signed on Januray 04, 2024 at ICAR-NDRI, Karnal. The list of technologies licensed are given below:

S. No.	Name of technology	Inventor(s)	Price Fix (In Rupees)	Buyer
1	A new rapid test for detection of detergent in milk	Rajan Sharma,Y.S. Rajput and Amit Kumar Barui	7.50 Lakhs + Tax	Hatsun Agro Product Ltd., Chennai
2	A new strip based test for detection of neutralizers in milk	Rajan Sharma, riyae Brath Gautam, P Y.S. Rajput and Bimlesh Mann	2.50 Lakhs + Tax	-do-
3	A new strip based test for detection of urea in milk	Rajan Sharma, Priyae Brath Gautam, Y.S. Rajput and Bimlesh Mann	10.00 Lakhs + Tax	-do-
4	Strip based test for detection of glucose in milk	Rajan Sharma, Y.S. Rajput, Bimlesh Mann and Panchal Bhaveshkumar R	2.50 Lakhs + Tax	-do-
5	Strip based test for detection of hydrogen peroxide in milk	Rajan Sharma, Y.S. Rajput, Bimlesh Mann and Priyae Brath Gautam	2.50 Lakhs + Tax	-do-
6	Strip based test for detection of maltodextrin in milk	Rajan Sharma, Y.S. Rajput, Bimlesh Mann and Panchal Bhaveshkumar R	5.00 Lakhs + Tax	-do-
7	A strip based test for detection of sucrose in milk	Rajan Sharma, Priyae Brath Gautam, Y.S. Rajput and Bimlesh Mann	2.50 Lakhs + Tax	-do-
8	Strip for detection of sodium chloride in milk	Rajan Sharma, Y.S. Rajput and Bimlesh Mann	2.50 Lakhs + Tax	-do-
9	Paper based strip for the rapid detection of formalin in milk	Kamal Gandhi, Farhin Sayyad, Rajan Sharma, Priyae Brath Gautam and Harshitha CG	3.00 Lakhs + Tax	-do-
10	Cloning of bulls for the industry	63rd ITMC on 03-08-2024 Naresh Selokar and Manoj Kumar Singh		-do-
11	Colorimetric paper strip sensor for the 64th ITMC	Raghu H V., Shreya Saha, Mohit Singh, Maharshi		
12	Strip for detection of sodium chloride in milk	Rajan Sharma, Y.S. Rajput and Bimlesh Mann	2.50 Lakhs + Tax	-do-
13	Paper based strip for the rapid detection of formalin in milk	Kamal Gandhi, Farhin Sayyad, Rajan Sharma, Priyae Brath Gautam and Harshitha CG	3.00 Lakhs + Tax	-do-

Scan Me!

Read This book of Technology

Transfer of 09 Technologies collectively titled as "Rapid Test for detection in Milk Technologies" to Hatsun Agro Product Ltd., Chennai on January 04, 2024

Patent Filed

During the period 13 patent applications were filed at Indian patent office. The details are:

S. No	Title of Patent	Inventors	Date of Filing	Patent Application No.
1.	Method of preparing processed cheese from ultrafiltration retentate of cow milk	Yogesh khetra, Suresh C.T., Ganga Sahay Meena, Lata Sabhikhi, Sumit Arora and Sangita Ganguly	March 21, 2024	202411021939
2.	A recombinant polynucleotide comprising goat beta casein gene, method of producing and use thereof	D. Malakar and Abhishek Thakur	March 23, 2024	202411022771
3.	A shelf-stable direct vat set liquid starter culture and a method of preparation thereof	Pradip Behare, Mr. Reshab Majumder, Diwas Pradhan and P.N. Raju	March 27, 2024	202411024415
4.	A process of producing khoa powder substitute using sweet cream butter milk and ghee-residue	G.S. Meena, Adittya Dutta, Yogesh Khetra, Ashish Kumar Singh and Sumit Arora	May 2, 2024	202411034793
5.	Instant desi Chhach powder & Process of Preparing the same	G.S. Meena, Mr. Subhadeep Manik, Ashish Kumar Singh and Yogesh Khetra	July 3, 2024	202411050894
6.	Assay for detection of bovine pregnancy associated glycoprotein isoform BuPAG-2	A.K. Mohanty , Sudarshan Kumar, Sushil Kumar, T.K. Mohanty, Rubina Kumari Baithalu, Munna Yadav and Shweta Yadav	July 30, 2024	202411057694
7.	Mouse monoclonal antibodies against bovine pregnancy associated glycoprotein	A.K. Mohanty, Sudarshan Kumar, Sushil Kumar, T.K. Mohanty, Rubina Kumari Baithalu, Munna Yadav and Shweta Yadav	July 30, 2024	202411057692
8.	Device for monitoring Udder health condition of dairy animals by detecting mastitis, and method thereof	Ajoy Mandal, Muthu Karunakaran and Champak Bhakat, ERS, Kalyani, Nadia	September 4, 2024	202431066949
9.	Epitop peptide pridicted INL A and INL B antibody based lateral flow assay strips for detection	Raghu H.V., Mariya Divanshi A S, Jitesh Tarak, and Sachinandan De	October 22, 2024	202411080111

S. No	Title of Patent	Inventors	Date of Filing	Patent Application No.
10.	Two stage assay for rapid detection of *Salmmonella* in foods and water	Raghu HV, Ajit A, Ms. Pushpa Devi, Rashmi H.M. and A.K. Puniya	October 22, 2024	202411080112
11.	Whey-Apricot wine and its production process thereof	P. Narender Raju, Harsh Jindal, Sangita Ganguly and Anurag Saxena	November 5, 2024	202411084435
12.	An apparatus for real-time monitoring of rumen fermentation	Raman Malik and Harneet Kour	November 21, 2024	202411090649
13.	A teat spray formulation for combating subclinical mastitis and process for preparation thereof	Sachin kumar, Nitin tyagi, Ashis kumar samanta, Ashish kumar singh, Pradip Vishnu behare, Nutan Chauhan and Ojal singh	November 28, 2024	202411093245

Copyright Filed

During the period 03 Copyright applications were filed by ICAR-NDRI. Details are as follows:

Sl. No.	Copyright Title	Author and Co-Author	Dairy No.	Date_of_filing
1.	Catalogue of National Collection of Dairy Cultures	Pradip Vishnu Behare, Yogita Sharma and Shilpa Vij	34218/2024-CO/L	October 30, 2024
2.	A Monograph on Performance Evaluation of Dairy Bovines	Vikas Vohra, Supriya Chhotaray, Rajesh Gahlyan, Anupama Mukherjee, Archana Verma and Dheer Singh	38809/2024-CO/L	December 10, 2024
3.	Karan Fries Cattle: 'The Pride of NDRI' Development Report, Planning and Research	Sabyasachi Mukherjee, Anupama Mukherjee, Vikas Vohra, Shivam Bhardwaj and Archana Verma	40145/2024-CO/L	December 20, 2024

Trademark Filed

During the period, NDRI has filed trademark application to register two synthetic breeds of cattle, Karan Fries and Karan Swiss developed earlier at ICAR-NDRI. Details are as follows:

Sr. No.	Title	Class in Trademark Application	Indian Trademark Application No.	Filed on
1.	Karan Fries	31 (Live animals)	6513556	05-07-2024
2.	Karan Swiss		6513557	05-07-2024
3.	Karan Fries	44 (Veterinary services)	6513558	05-07-2024
4.	Karan Swiss		6513559	05-07-2024

Other Activity

Institute celebrated World Intellectual Property Day by organizing a workshop on "Pre-requisites for sustainable innovations in dairy and animal science" on April 26, 2024. At this workshop, Ms. Shikha Singh and Mr. Avi Garg, Managing Associates at M/s LexOrbis conducted sessions on the drafting procedures of patents, copyrights, and industrial designs. More than 150 persons attended this event from NDRI and other Institutes.

Patent Workshop Organised by Institute Technology Management Unit, ICAR-NDRI on the occasion of World Intellectual Property Day on April 26, 2024

ICAR-NDRI Technologies certified by ICAR

In the year 2024, following 17 technologies/ methodologies have been certified by ICAR on the occasion of 96th ICAR Foundation Day.

Sr. No.	Name of Technology/Methodology Certified by ICAR in 2024	Inventors
1.	Milk Protein-enriched Bajra Snacks	Ashish Kumar Singh, P.N. Raju, Sanket Borad and R.R.B. Singh
2.	Misti doi/dahi with fast acidifying high sugar tolerating lactic culture(s)	Surajit Mandal, Sudhir Kumar Tomar and Pradip V. Behare
3.	Native vitamin B12 producing *Lactobacillus reuteri* NCDC 958/VTCC 610B for production of vitamin B12 bio-fortified soy curd.	S. K. Tomar, Manorama Kumari, Harshil Kumar Patel and Pradip V. Behare
4.	Technology of low-fat Shrikhand by using exopolysaccharides (EPS) producing lactic cultures"	Pradip V. Behare, Harisha M. R. S. K. Tomar and Sanket Borad
5.	A new strip based test for detection of neutralizers in milk	Rajan Sharma, Priyae Brath Gautam, Y.S. Rajput and Bimlesh Mann
6.	A new strip based test for detection of urea in milk	Rajan Sharma, Priyae Brath Gautam, Y.S. Rajput and Bimlesh Mann
7.	Strip based test for detection of hydrogen peroxide in milk	Rajan Sharma, Y.S. Rajput, Bimlesh Mann and Priyae Brath Gautam
8.	Strip based test for detection of maltodextrin in milk	Rajan Sharma, Y.S. Rajput, Bimlesh Mann and Panchal Bhavesh kumar R
9.	Indigenous probiotics *L rhamnosus* NCDC 610	Sudhir Kumar Tomar, Pradip V. Behare, Sandip Basu and Ashish Kumar Singh
10.	Exopolysachharides producing lactic culture for preparation of low fat lassi	Pradip V. Behare, Sudhir Kumar Tomar and Surajit Mandal
11.	Exopolysachharides producing lactic culture for preparation of low fat dahi	Pradip V. Behare, Surajit Mandal and Sudhir Kumar Tomar
12.	Bio-process for direct vat set (DVS) misti dahi culture	Surajit Mandal, Sankara Rao N., Siddivinayaka, Sudhir Kumar Tomar and Pradip V. Behare
13.	Technology of sour dahi using prolific acidifying lactic cultures	Pradip V. Behare, Sudhir Kumar Tomar and Surajit Mandal
14.	Fast acidifying yoghurt culture for Greek style yoghurt	Surajit Mandal, Sudhir Kumar Tomar, Pradip V. Behare, Jyoti and Ravi S. Wankhede
15.	NDRI Climate Services Mobile App	Sanjit Maiti, Manjunath KV, Sanchita Garai, Goutam Mondal, Anjali Aggarwal, Mukesh Bhakat, Raj Kumar and K. S. Kadian
16.	Climate Resilience Index for Murrah Buffalo Production System	Sanjit Maiti, Ruchi Singh, S. K. Jha, Sanchita Garai, Anjali Aggarwal, Mukesh Bhakat, A. K. Dixit
17.	Cropping system for round the year fodder production in the Indo-Gangetic Plains of India	Rajesh Kumar Meena, Rakesh Kumar, Hardev Ram, Magan Singh & Anurag Saxena

MoU exchange ceremony between ICAR-NDRI, Karnal and Garden City University (GCU), Bengaluru on February 9, 2024

7. ENTREPRENEURSHIP DEVELOPMENT, BUSINESS INCUBATION ACTIVITIES AND CONSULTANCY SERVICES

Consultancy Processing Unit

The consultancy processing unit facilitates and coordinates the professional service functions of the institute by offering different services to organization, individuals, industries and entrepreneur. The services include contract research, consultancy services, contract service and training programmes. Contract research comprises all research activities undertaken through specific contractual agreements with external agencies for the purpose. Consultancy shall mean professional services rendered to external agencies in terms of scientific, technical, engineering or other professional advice/assistance based on the expert knowledge and skill available at the institute. Contract services would mean services rendered to the external organizations/ clients/ customers, or assistance of minor nature based on available knowledge, expertise, skills and facilities of the institute.

Project Name	Firm Name	Name of consultant
A validation of fatscan milk analyzer Equipment for rapid assessment of The composition of milk	M/s everest instruments pvt. Ltd. corporate house no. Block-A, times Corporate park, thaltej–shilaj road, Ahmedabad, gujarat-380059	Dr. Rajesh Kumar Bajaj, P.S., Dairy Chemistry Division
In-vitro anti-bacterial efficacy evaluation of dairy sanitizers and detergents	M/S Narsipur Chemical Pvt. Ltd., C-238, MIDC, Turbhe, Navi Mombai-400705	Dr. Raghu H.V., Senior Scientist, Dairy Microbiology Division
Homogenization and pasteurization of protein rich dairy drink	M/S Innobev Solution Private Ltd., Gurugram-12201	Dr. Yogesh Khetra, Senior Scientist, Dairy Technology Division

Contract Research

Institute is engaged in active collaboration with industry, government agencies and other stakeholders for executing the research projects funded by them.

Consultancy Projects

Institute offers both general and advisory consultancy to individuals or organization on various aspects of dairy production, processing and management. The details of consultancy projects are given below:

Contract Services

Training Programmes

A total of 4 officials from dairy firms and 131 number of students belonging to different Universities and Educational Organization were imparted training for the period (1 to 6) month duration in various divisions and sections of the Institute and the Institute earned revenue Rs. 18,53,780.

Institute assisted stakeholders through offering the services of analysis, supply of testing kits, cultures and other services. Through contract services Institute offered 43 services of analysis, 6 supplies of kit and culture to different organization, individuals and industries.

Agri-Business Incubator/ Technology Business Incubation

During the period, 03 Entrepreneurship Development Programmes were conducted for 16 entrepreneurs and the details are as follows:

Programme	Date	No. of Participants	Coordinators
Cheese: Production & Quality Evaluation	July 17–21, 2024	03	Dr. Yogesh Khetra (Senior Scientist), Dr. Sangita Ganguly (Scientist) Dairy Technology Division
Milk and Milk Products Processing	October 14–19, 2024	08	Dr. G.S. Meena (Senior Scientist), Dr. Heena Sharma (Senior Scientist) Dairy Technology Division
Commercial Dairy Farming	October 21–26, 2024	05	Dr. Sachin Kumar (Scientist) Animal Nutrition Division

Group photo with trainees during Commercial Dairy Farming Training (21-26 October 2024)

Group photo with trainees during Milk and Milk Products Processing Training (14-19 October, 2024)

Incubation Support Provided

- Incubation support MoU was signed with M/s. SMILLET, Karnal, Haryana for the product "Milk-Millet Cookies" for a period of six months from 12th July to 11th Jan 2025.

M/s. SMILLET launched it's product "Milk-Millet Cookies" during National Milk Day i.e. November 26, 2024 at ICAR-NDRI, Karnal

- Incubation support MoU was signed with M/s. Saksham Dairy, Gharaunda, Haryana for the product "Paneer & Dahi" for a period of six months from August 13, 2024 to February 12, 2025.
- Incubation support MoU was signed with M/s. Labrose Ayurveda (OPC) Pvt. Ltd., Haryana for the product "Paneer, Yoghurt & Dahi" for a period of six months from September 5, 2024 to March 4, 2025.

Entrepreneurs manufacturing products in the facility of ABI, ICAR-NDRI

- Incubation support MoU was signed with M/s. Aavas Dairy, Kerala for the product "Mozzarella Cheese, Processed Cheese & Yoghurt" for a period of six months from September 24, 2024 to March 23, 2025.

Innovation and Creativity Contest

An Innovation and Creativity Contest was organized on March 1, 2024 by ABI, ICAI-NDRI as a part of Academic Fortnight. The purpose of this event was to inculcate creative thinking and promote innovative mindset among the students. Applications were invited from UG, PG and PhD students of ICAR-NDRI in two different categories viz. Business idea and Research idea. Several ideas were received in the broad categories form students viz. Innovative value-added products, Artificial Intelligence in Dairying, Marketing & branding, Sustainable packaging solutions, real-time monitoring of milk quality, Diagnostic tools/Kits for animal health, Application of IoT in animal production, Climate resilient agriculture and animal husbandry and Waste management for circular economy. A total of 34 ideas were presented by student teams and prizes were awarded to three best ideas from each category.

Idea Pitching Competition

An E-cell was established for the students of ICAR-NDRI for inculcating and promoting entrepreneurial

Students Presenting their innovative ideas during Innovation and Creativity Contest – 2024 organized by ABI, ICAR-NDRI, Karnal on March 1, 2024.

mind set among the students. The E-cell is fully operated by the students themselves and technical & logistical support is provided by ABI project of ICAR-NDRI. An innovative idea contest namely "Ideas Den: An Idea Pitching Competition" was organized on September 28, 2024 at ICAR-NDRI, Karnal, Haryana. A total of 25 participants have presented their ideas and prizes were distributed for top three best ideas.

Entrepreneurship Development, Business Incubation Activities and Consultancy Services(22)

ICAR-NDRI students presenting their innovative ideas during Idea Pitching Competition -2024

A view of students' training

8. DAIRY EDUCATION

ICAR-National Dairy Research Institute is the premier Institution of International repute in Human Resource Development for the growing dairy industry in India. ICAR-NDRI which has been conferred deemed to be university status vide Govt. of India, Ministry of Human Resource Development, Department of Education, and Notification No. F. 9-15/85-U.3 dated 28.3.1989, is well equipped and staffed to meet emerging needs of the 21st Century of the Dairy Industry. The University offers academic programmes at Under-graduate, Post-graduate and Doctoral levels in the field of Dairy Science and Technology. The following courses were offered by NDRI Deemed University during the academic session 2023-24. The courses have been so designed as to provide broad base as well as specialized training on different aspects of dairying.

B.Tech. (Dairy Technology)

This four-year degree programme offers intensive training in processing and quality control of milk and milk products; and engineering aspects of milk processing plants.

B.Tech.(Food Technology)

This is a new four-year degree programme which has been started from the current academic session (2024-25). There are 20 seats and primary responsibility to run this programme is with Dairy Technology Division.

B.Tech.(Biotechnology)

This is a new four-year degree programme which has been started from the current academic session (2024-25). There are 20 seats and primary responsibility to run this programme is with Animal Biotechnology Division.

Master's and Doctoral Degree Programmes

The Institute offers Master's degree programme in the following disciplines:

1 Dairy Microbiology
2 Dairy Chemistry
3 Dairy Technology
4 Dairy Engineering
5 Animal Biochemistry
6 Animal Biotechnology
7 Animal Genetics and Breeding
8 Livestock Production and Management
9 Animal Nutrition
10 Animal Physiology
11 Agricultural Economics
12 Agricultural Extension Education
13 Agronomy
14 Animal Reproduction Gynaecology and Obstetrics

The Institute offers Doctoral degree programme in the all the above disciplines.

Scholarship and Fellowships

Masters in Dairying and Ph.D. students are awarded Institute scholarship at the following rates in accordance with the prescribed rules and regulations of ICAR.

Institute Scholarships

1.	Master's degree	:	Rs. 7560/- P.M. for two years plus Rs. 6000/- per annum as contingency
2.	Ph.D.	:	Rs.25,000/- P.M. for first two years, Rs.28000/- during third year and Rs. 10,000/- per annum as contingency.
3.	Ph.D. (In-service)	:	Rs. 3000/- P.M. for three years and Rs. 10000/- per annum as contingency

ICAR Junior Research Fellowship -

1.	Master's	:	Rs. 12,640/- P.M. (For Veterinarians) for two years and Rs. 6000/- per annum as contingency
2.	Ph.D.		Rs.31,000/- P.M. for first two years, Rs.35000/- during third year and Rs. 10,000/- per annum as contingency.

National Talent Scholarship

The National Talent Scholarship (NTS) @ Rs.3000/- per month is awarded by ICAR on merit provided that the university/institute is located outside the state of his/her domicile.

Career Guidance, Training and Placement Cell

The placement Cell provides career guidance, training and placement services for the passing out students in various disciplines of the Deemed University. B.Tech. (Dairy Technology) and Master in Dairying students were provided employment in reputed organizations through campus interviews. Passed out students of NDRI are getting employment in Dairy/ Food Industry (Govt./ Cooperative/Multinationals). Salary ranges from Rs. 30,000 to 60,000/- per month. In addition to placement, someof students also opt for higher studies in India and abroad. The major functions of the Cell are as follows:

- To counsel the undergraduate and post graduate students in career planning.
- To compile a directory of corporate and academic bodies at the National and International level engaged in the area of Dairying and Food Processing.
- To prepare a compendium of resume of the final year students for facilitating placement/ screening with prospective employers.
- To evolve mechanism for placement of Graduate/ Postgraduate students from various disciplines by arranging campus interviews.
- To arrange seminars/workshops/presentations to maintain closer liaison between student community and industry.

Counselling for Admissions

Online Counselling for admission to UG/PG programmes was held by the Education Division of ICAR New Delhi.

Admissions

Admission for the academic session 2024-25 for B.Tech. (Dairy Technology), B.Tech (Food Technology), B. Tech (Biotechnology), M.Sc./M.V.Sc./M.Tech. and Ph.D. programmes were made.

S. No.	Courses/Programmes	No. of students admitted	Male	Female
1.	B.Tech. (Dairy Technology)	55	31	24
2.	B.Tech. (Food Technology)	18	7	11
3.	B.Tech. (Biotechnology)	18	8	10
4.	Masters' programme	138	75+1*	62
5.	Ph.D. Programme	87	44	43
	Total	**316**	**166**	**150**

*One Foreign student from Vietnam has joined.

Meetings

- 53rd & 54th meetings of Academic Council were held on 13.03.2024 and 22.04.2023.

Celebration of Academic Fortnight

Date	Events
March 1 , 2024	Innovation &Creativity Contest in Dairying, Animal Sciences and Allied Disciplines
March 6, 2024	Presentation of Best Thesis (Master's Programme for 2021-22 and 2021-22 for Processing, Production and Social Science groups
March 7, 2024	Presentation for Best Division forProcessing, Production and Social Science Divisions
March 8, 2024	Dr. K.K. Iya Memorial Oration by Dr. Abhijit Mitra, Animal Husbandry Commissioner, Government of India
March 9, 2024	Presentation of Best Thesis (Doctoral Programme for 2021-22 and 2021-22 for Processing, Production and Social Science groups
March 10, 2024	Celebration of World Women Day in Adopted Village
March 11, 2024	Dr. N.N. Dastur Memorial Oration by Dr. R. C. Agrawal, Deputy Director General (Agricultural Education), Indian Council of Agricultural Research (ICAR), New Delhi
March 13, 2024	• Dr. D. Sundaresan Memorial Oration by Dr. Meenesh Shah, Chairman, National Dairy Development Board, Anand • 54th Meeting of Academic Council
March 14, 2024	BOM Meeting & Rehearsal of Convocation
March 15, 2024	20th Convocation of ICAR-National Dairy Research Institute, Karnal

Twentieth Convocation of the ICAR-National Dairy Research Institute

The 20th Convocation ceremony of the National Dairy Research Institute (NDRI) was held on March 15, 2024 at the Dr. D. Sundanaresan Auditorium. The occasion was graced by Padma Bhushan awardee and former Director General of the Indian Council of Agricultural Research (ICAR), Dr. R. S. Paroda, along with Dr. Dheer Singh, Director and Vice-Chancellor of ICAR-NDRI Karnal. Dr. Paroda conferred degrees to a distinguished cohort of 278 students, which included 49 BTech graduates, 127 master's degree recipients, and 102 researchers.

Dr. R.C. Aggarwal, DDG (Education) along with Dr. Dheer Singh, Director & V.C., ICAR-NDRI, during Dr. N.N. Dastur Mermorial Oration

Degrees awarded to the students during the 20th Convocation of ICAR-NDRI

Degree Awarded	Total	Boys	Girls
Ph.D.	102	62	40
Master	127	64	63
B.Tech.	49	37	12
Total	**278**	**163**	**115**

Medals awarded to the students during the 20th Convocation of ICAR-NDRI

Medals	Total	Boys	Girls
Gold	3	-	3
Silver	3	2	1
Bronze	3	2	1

Award of Ph.D. Degree to the Foreign Student -

Name of degree	Name of student	Regn. No.	Discipline	Date of completion
Ph.D.	Iayee Soe	19-P-GO-08	VGO	26-10-2023

In addition to the above, the best thesis award to the Master & Ph.D. students

Master's Programme2022-23

Group	Name of the student	Name of the Guide	Discipline
Production	Mr. Dibyasha Kar	Dr. Indrajit Ganguli	Animal Genetics & Breeding
Processing	Mr. Manan Preet Singh	Dr. Ashish Kumar Singh	Dairy Technology
Social Science & Management	Ms. Sheetal Berry	Dr. K.S. Kadian	Agricultural Extension Education

Doctoral Programme 2022-23 -

Group	Name of the student	Name of the Guide	Discipline
Production	Dr. Gayathri S. Lal	Dr. Mukesh Bhakat	Livestock Production & Management
Processing	Mr. Basavaprabhu H. N.	Dr. Pradeep V. Behre	Dairy Microbiology
Social Science & Management	Mr. Manjunath K. V.	Dr. Sanjit Maiti	Agricultural Extension Education

Best Division Award -

Heads of all the divisions and regional stations presented the achievements in research, academics, extensions and other institutional activities on Dairy Technology of the Institute was adjudged as Best Division for the year 2022-23.

Three Memorial Oration Award

- Dr. Abhijit Mitra, Animal Husbandry Commissioner, Govt. of India for Dr.K.K.Iya Memorial Oration Award

- Dr. R.C. Agrawal, Dy. Director General (AE), ICAR, New Delhi, for Dr. N.N. Dastur Memorial Oration Award
- Dr. Meenesh Shah, Chairman, National Dairy Development Board Anandfor Dr. D. Sundaresan Memorial Oration Award.

The awards carry a cash award of Rs.20, 000/-, Shawl, Certificate and a Citation.

The award of Honoris Causa of ICAR-National Dairy Research Institute (Deemed University), Karnal during the 20th Convocation was bestowed to following eminent personalities in Animal and Dairy Sciences.

1. Dr. Kamal Malla Bujarbaruah, FormerVice Chancellor, Assam Agricultural University, Jorhat & Former, Deputy Director General (Animal Science), ICAR, New Delhi

2. Dr. D.V.R. Prakasha Rao, President National Academy of Veterinary Sciences &Chairman and Managing Director, Prakash Foods and Feed Mills (P) Ltd., Chennai

Diploma & Certificate Courses designed for UG- In-house Student -

Sr. No.	Name of the Course	Name of Division
1.	Bioinformatics (Basic & Advanced)	ABT, ABC& AG&B Division
2.	Dairy Operation Management	DT, DE Division & MDP
3.	Quality Assurance and Dairy Food Safety	DM and DC Division
4.	Assisted Reproduction Technologies	ABT Division
5.	Commercial Dairy Farming	LPM and other production Division
6.	Milk and Milk Production Processing	DT Division
7.	Artificial Intelligence and Machine Learning with Application to Dairy Industry	DES&M Division
8.	Animal Breeding Techniques	AG & B Division

Key Initiative of ICAR-NDRI NEP-2020

- New UG Degree Programme, Diploma & Certificate courses have been started at NDRI, Karnal
- UG Programme: B.Tech. (Food Technology) and B.Tech. (Biotechnology)
- As per NEP-2020, criteria for admitting students from the diverse field is initiated. Students from Biological science (PCB) subjects at Senior Secondary level were admitted in B. Tech. (DT), B. Tech. (Food Technology)besides students from PCM group. Likewise, at Post Graduate level students having bachelor degree in Agriculture were permitted in Biochemistry.
- B. Tech. (Biotechnology) and B. Tech. (Food Technology) have been commenced from the academic session 2024-25.
- Global Collaboration & Student Exchange.
- Teaching & Learning Infrastructure Development.
- Created 17 classrooms: equipped with interactive panel along with dedicated internet connectivity for harnessing the expertise of faculty located in other ICAR institutes.
- One Virtual class room with provision of video recording of lectures is developed under the NAHEP to implement Blended Learning Programme (BLP).
- One language lab for improving the English and foreign language is functional.

Implementation of 6th Dean committee Report

Sixth Dean Committee report has been implemented at ICAR-NDRI.

- Multiple Entry and Exit has been introduced.
- B. Tech (Dairy Technology) with 20 seats has been started at Southern Regional Station, Bangalore.
- A course entitled "Deeksharambh" (0+2) (Non-gradial) was offered at the start of first semester for a duration of two weeks.
- Courses such as, First Aid, Yoga Practices, Meditation, NCC and NSS have also been included in addition to Physical Education for students for better social awareness and health of the future generation.

- Examination and Evaluation system has been restructured as per 6th Dean committee report.

Deeksharambh: Induction-cum-Foundation Course

ICAR-NDRI, Karnal organized first "Deeksharambh: Induction-cum-Foundation Course" for the newly admitted students of B.Tech. (Dairy Technology, Food Technology, and Biotechnology), M.Tech., and M.Sc. programs from November 6-22, 2024. Out of total 91 students admitted in Under Graduate Programme, 50 students were admitted in B.Tech. (Dairy Technology), 18 students each in B.Tech. (Food Technology) and in B. Tech. (Biotechnology). B.Tech. (DT) programme with 20 seats has been initiated at SRS of NDRI, Bangalore. The students admitted in B. Tech. programms marks the first batch to follow the recommendations of the 6th Dean's Committee report which is essentially based on National Education Policy-2020 guidelines. In Master's programme 78 students have been admitted in processing and social science disciplines. The Deeksharambh course aimed to provide insights into academic and research opportunities, institutional policies, and personal well-being to facilitate a smooth transition through their academic journeys. The inauguration ceremony was presided over by Dr. Dheer Singh, Director and Vice Chancellor of ICAR-National Dairy Research Institute, Karnal. Newly admitted students from the SRS Bengaluru campus also participated virtually. The purpose of "Deeksharambh" was to help new students acquaint and feel comfortable in the new environment, inculcate in them the ethics and culture of the institution, assistance in developing stronger bonds with fellow students, faculty and other staff members, and prepare them for future journey.

A view of Deeksharambh: Induction-cum-Foundation Course

- Courses such as, First Aid, Yoga Practices, Meditation, NCC and NSS have also been included in addition to Physical Education for students for better social awareness and health of the future generation.
- Examination and Evaluation system has been restructured as per 6th Dean committee report.

Institutional Development Plan Project(NAHEP)

Institutional Development Plan (IDP) titled "Incentivizing Dairy Education through Innovative Learning Approaches" a sub-component 1Aof National Agricultural Higher Education Project (NAHEP) has been successfully conducted during the extended period i.e. May-August, 2024 with a sanctioned budget of Rs. 50 lakhs. In this project a total of 15 workshops/training programs were organized on several aspects viz. professional skill development, leadership qualities, pedagogical skills, advances in dairying, creative and innovative thinkingto enhance the technical and soft skill sets of the students and faculty. Entrepreneurial skill development trainings were also conducted for the students to promote entrepreneurial mind set among the students so that they can become job givers rather job seekers.

Doctoral Programme 2022-23

S.No.	Activity Type	Title	Duration
1.	Brainstorming session	Restructuring the Academic & Research Agenda for Dairy Engineering	May 18, 2024
2.		Animal Cloning and Genome editing technology	July 19, 2024
3.	Capacity building	Bovine & Non-Bovine Milk and Human Health	June 01, 2024
4.	programmes	Application of Artificial Intelligence and IoT enabled Sensor	July 24, 2024

S.No.	Activity Type	Title	Duration
		Technologies for Precision Dairy Farming	
5.		Recent Advance in CASA and Flow Cytometry for Bovine Semen Education	July 29, 2024
6.		Application of Artificial Intelligence and Machine Learning in Dairy and Food Industry	July 31, 2024
7.	Skill Development Training	FoSTaC Advance Manufacturing Training for UG (B.Tech. Dairy Technology) students	June 26, 2024
8.	Student/Faculty well-being Programmes	Yoga session was organized on International Yoga Day	June 21, 2024
9.	Workshop	Digital Marketing and Personal Branding	July 27, 2024
10.		Impact of a Dietary iso-peptide: Modulating Taste Sensations and Alleviating Vascular Information	June 10-11, 2024
11.		Food Safety Issues and Challenges in Dairy Industry	July 31, 2024
12.	Industrial Training Programmes	"Dairy Plant Management" training at Mansinh Institute of Technology-NDDB, Mehsana, Gujarat for B.Tech. (Dairy Technology) 2nd year students	May 28 - June 11, 2024
13.		"Dairy Plant Management" training at Mansinh Institute of Technology-NDDB, Mehsana, Gujarat for B.Tech. (Dairy Technology) 3rd year students	July 5 - 19, 2024
14.	Entrepreneurial trainings	"Entrepreneurial Skill Development" training programme at ICAR-NAARM, Hyderabad	June 05 - July 02, 2024
15.	Massive Online Open Courses (MOOCs)	Developed MOOCs on the subject "Fat rich dairy products". A total of 17 modules were developed with the support of CAR-NAARM, Hyderabad	July-August, 2024

Glimpses of Activities conducted under IDP-NAHEP Project

A National Workshop on "Application of Artificial Intelligence and IoT-enabled Sensor Technologies for Precision Dairy Farming" was organized on July 24, 2024 at ICAR-NDRI, Karnal. The workshop was attended by 98 participants, including faculty and students.

A National Workshop on "Application of Artificial Intelligence and Machine Learning in the Dairy & Food Industry" was organized on July 31, 2024 at ICAR-NDRI, Karnal. A total of 265 participants including students and faculty attended the workshop.

A national brainstorming workshop on "Animal Cloning & Genome Editing Technology" was held on July 19, 2024. A total of 41 participants attended the event.






A customized training programme on "Dairy Plant Management" was organized at Mansinh Institute of Training (MIT) of NDDB, Mehsana, Gujarat B.Tech. (Dairy Technology) students. A total of 37 B.Tech. (Dairy Technology) 2nd year students and 31 B.Tech. (Dairy Technology) 3rd year students have undergone the training during 28th May to 11th June 2024 and 5th to 19th July 2024, respectively.

Entrepreneurial Skill Development training programme was organized at ICAR-NAARM, Hyderabad from 5th June to 2nd July 2024 B.Tech. (Dairy Technology) students.

Chief Guest Dr. R.S. Paroda Former DG ICAR and other dignitaries' distribution of degree certificates during the 20th Convocation at ICAR-NDRI, Karnal on March 15, 2024

9. TECHNOLOGY DISSEMINATION AND EXTENSION PROGRAMMES

DAIRY EXTENSION DIVISION

Dairy Mela and Agri Exhibition at Chaibasa, Jharkhand

A three-day Dairy Mela and Agricultural Exhibition was organized on March 9–11, 2024, at Khuntakatti Maidan, Chaibasa, West Singhbhum, Jharkhand by ICAR–National Dairy Research Institute (NDRI), Karnal, Haryana. The event was inaugurated by then Hon'ble Union Minister of Agriculture and Farmers Welfare, Shri Arjun Munda, in the presence of Dr. Dheer Singh, Director, ICAR-NDRI.He emphasized the need for developing improved cattle breeds to enhance milk production in Jharkhand and urged young farmers to adopt dairy entrepreneurship and become employment generators.

Over 50 exhibition stalls showcased advanced technologies, livestock breeds, and services by research institutes and government departments, including horticulture, animal husbandry, sericulture, irrigation, and NABARD. The event also featured a dairy animal beauty contest, health camps, farmer-scientist interactions, and seminars. More than 3,000 stakeholders participated, including tribal farmers, who were awarded for showcasing their agricultural produce under the Scheduled Tribe Sub-Plan initiative.

Then Hon'ble Union Minister of Agriculture and Farmers Welfare, Shri Arjun Munda with Director, ICAR-NDRI, Karnal along with other officials

Kisan Sangosthis on Goat Farming in Hanumangarh and Bikaner districts of Rajasthan

A series of Kisan Sangosthis on scientific methods of goat farming and management were organized in collaboration with Krishi Vigyan Kendra (KVK), Nohar and other institutions in different places of Rajasthan. The first Sangosthi was held on September 18, 2024, in Ramsara village, Hanumangarh, the second on September 19, 2024, at the CAZRI Regional Station, Bikaner campus, and the third in Bherupawa village, Bikaner by ICAR-NDRI, Karnal to support Scheduled Caste farmers to improve breeding practices and livelihood enhancement. During the programs, 52 bucks, 2 goats, and one male Murrah buffalo were distributed to Scheduled Caste farmers, and blankets were provided to 55 elderly women farmers as a gesture of encouragement. Around 180 farmers participated across the Sangosthis. Experts from NDRI, Karnal, CAZRI Regional Station, Bikaner, KVK, Nohar, and various line departments delivered lectures on deworming and vaccination protocols for dairy animals, managing infertility in goats, breeding techniques to improve livestock productivity, and government schemes and services available for livestock farmers, especially those belonging to Scheduled Castes family. They also discussed year-round green fodder production, high-yielding crops suitable for Rajasthan's climate, tree-based forage systems for arid regions, and the benefits of the National Livestock Mission. These Sangosthis aimed to enhance farmers' knowledge and skills, promote government initiatives, and ensure sustainable livelihoods through improved livestock practices and support.

Field/Farm Technician (FFT) Laboratory

The Field/Farm Technician (FFT) Laboratory of Dairy Extension Division provides a base for extension

Women farmers being educated by Extension Scientist

work in the adopted villages around Karnal and keeps the records of all extension activities of the Division. The FFT Laboratory is operated through Stockman Centres. The Stockmen are the grass-root level workers through whom a live contact between scientists and farmers is established.

In order to upgrade the existing breeds of dairy animals, cross-breeding was continued in cows and selective breeding in local buffaloes through A.I. using high pedigree bulls. To reduce age at maturity and to minimize inter-calving interval, infertility and veterinary aid campaigns were conducted in adopted villages.

Kisan Sangosthi

Twenty one Kisan Sangosthies were organized at village level on clean milk production practices in rural areas, Management of animals during heat and cold stress condition, Preparation of value added milk products, Correct time of breeding of cow and buffaloes, Preventive measure of contagious disease, Awareness on endo & ecto-parasite infestation, Management of round the year green fodder production and fodder conservation practices at farmers' level.

Question/Answer sessions were also arranged, in these sessions which provided excellent opportunities to the farmers and explained the solutions to their day to day problems and also collected the feedback on the extension programmes.

Dairy Education at Farmers Door (DEFD)

The extension education programme "Dairy Education at- Farmers' Door" was initiated to strengthen the effective dissemination of dairy production and processing technologies among farming community. Under this programme, a team of NDRI scientists including subject matter specialists from production, processing and management group organize Dairy Education at Farmers' Door in various villages on 2nd Saturday of every Month. Scientists also obtained the feedback from the participating farmers. At the outset, arrangement for discussion with a group of farmers was made at the local common entrance of the village and discussion on farmers' problems related to scientific dairy farming, crop husbandry practices and to give veterinary advice to the farmers. The farming community expressed happiness on this new extension initiative of the Institute where the NDRI scientists devote their holiday for dairy farmers. Various queries were raised by the farmers related to different aspect of animal husbandry and dairying. A total of 6861 dairy stakeholders were benefited.

Establishment of Climate Resilient Dairy Farm School

Two climate resilient dairy farm schools were established and continuing in the Gudha and Phurlak villages of Karnal district. Twenty smallholder dairy farmers of the Gudha village participated in this school. Whereas, climate resilient dairy farm school of Furlak village was exclusively for women dairy farmers and 20 women dairy farmers are enrolled in this school. The curriculum consists of seven blocks for this school has also been developed.

Educational Visit and Tour

A total of 24305 visitors (students & Faculty) of 349 colleges/Institutions/Universities have visited the institute which were coordinated by the division. The groups have been sensitized about the different research, teaching and extension achievements and facilities available in the Institute.

Advisory Services

Division is providing the regular advisory services through postal, e-mail, phone to individual farmers / NGO's / relevant departments all over the country in response to their particular / general queries regarding latest technologies of the institute and modern dairy farming practices. Advisories were mainly on reproductive management, feeding and disease management. Weekly climate advisories were also given to the dairy farmers to cope with the heat stress during summer season.

H. Technological interventions/demonstration at farmers' field

i. Natural resource management

Technology	Results of demonstration	No of Demo.	Area Covered (Ha)	No of Farmers involved
Integrated Pest Management in Paddy	IPM in Paddy: By effectively controlling pests and diseases in the paddy crop using IPM techniques, an average yield of 54-55 quintals per hectare (q/ha) was recorded.	50	20.24	50
Integrated Nutrient Management in Wheat	INM in Wheat: Utilizing various sources for nutrient management in wheat cultivation resulted in higher productivity compared to conventional methods. On farmers' fields, an average yields of 61-62 q/ha was recorded.	60	24.29	60
Integrated Weed Management in Wheat	Through integrated weed management practices in wheat, including control measures for Phalaris minor and other weeds, an average yield of 61.5-62.5 q/ha was achieved.	50	20.24	50

Integrated pest management in paddy

Integrated nutrient management in wheat

Demonstration of Paddy Variety PB-1692

Demonstration of Wheat Variety DBW-371

Demonstration of OVM Powder for infertility problems in dairy animals

Ecto parasitic control programme

ii.Varietal trial of paddy, wheat and mustard crop for higher productivity -

Technology	Results of demonstration	No of Demo.	Area Covered (Ha)	No of Farmers involved
Varietal trial of paddy	The average yield and net return of paddy varieties were as follows: PB-1885 yielded 47.77 quintals per hectare (q/ha) with a net return of Rs. 1,31,902.94 per hectare, while PB-1692 yielded 54.21 q/ha with a net return of Rs. 91,030.88 per hectare.	193	78.13	193
Varietal trial of wheat	The average yield and net return of wheat varieties are as follows: DBW-370 yielded 61.87 quintals per hectare (q/ha) with a net return of Rs. 1,21,073.90 per hectare, DBW-371 yielded 62.99 q/ha with a net return of Rs. 1,23,036.90 per hectare, and DBW-372 yielded 61.94 q/ha with a net return of Rs. 1,22,589.20 per hectare.	50	10.12	50
	Intervention of Wheat variety (DBW-371) was demonstrated in 2024-25.	35	14.17	35
Crop diversification through Mustard	For crop diversification, Demonstrations were conducted on mustard varieties Radhika and PM-32. The average yield for Radhika was recorded at 13.88 quintals per hectare (q/ha), while PM-32 yielded14.37 q/ha. The net returns from these varieties were Rs. 45,698.80 per hectare for Radhika and Rs. 51,089.50 per hectare for PM-32.	50	20.24	50
	Intervention of Mustard variety (Radhika) was demonstrated in 2024-25.	35	14.17	35

iii.Livestock & Fodder Production

Technology/ problems identified	Results of demonstration	No of Demo.	Number of Animals	No of Farmers involved
Infertility problems in dairy animals	OVM Powder was provided to 150 dairy animals, including high-aged heifers and animals with a history of repeated insemination failures. Among these, 120 exhibited signs of heat following supplementation. Remarkably, a 50% conception rate was achieved after insemination across varied reproductive conditions.	150	150	150
Control of ecto & endo parasitic infestation among dairy animals.	Implementation of continuous ecto-endo parasite control measures effectively managed parasites in the adopted villages, leading to improved health in all dairy animals. This resulted in a notable increase of 200-300 ml of milk per animal per day in milch animals, along with a significant improvement in their body condition score after the intervention.	2027	2027	710
Supplementation of Liv-52 Bolus, a liver protector and booster	Supplementation of Liv-52 Bolus in 100 animals under this intervention resulted in an average 14% increase in milk yield, improved overall health, better digestion, and a reduction in liver-related problems among the treated animals.	100	100	100
Tympany / Bloat, 102 animals like cow, buffalo, goats and sheep was treated.	Supplementation with Him Bloat to animals for tympany (bloat), which occurs when an animal consumes excessive feed or foreign material, leading to the accumulation of gases in the rumen. Him Bloat has recovery up to 80% in cases of tympany (bloat) by alleviating bloating, reducing gas buildup, and improving overall rumen health.	102	102	92

Technology/ problems identified	Results of demonstration	No of Demo.	Number of Animals	No of Farmers involved
Salivascope methods for esturs detection method in buffalo	Silent heat was identified as the most significant reproductive disorder in buffaloes, emphasizing the need for better estrus detection technologies. A Satisfaction Index was developed, capturing their subjective evaluations of the technology's effectiveness and usability, which showed that 66.00 per cent of respondents expressed satisfaction with the technology, with relative cost being the most highly rated factor in its acceptance. The ADOPT software predicted 94.00 per cent peak adoption of the Saliva scope within 11 years.	10	300	300

Shri Shivraj Singh Chouhan, Hon'ble Union Minister for Agriculture and Farmers Welfare & Rural Development laying foundation stone for boy's hostel on December 11, 2024

SOUTHERN REGIONAL STATION, BENGALURU –

Advisory services

Advisory services were rendered to 575 clientele comprising progressive farmers and prospective dairy entrepreneurs, during personal visits and through digital media, phone and mail enquiries. The profile of the advisory services comprised, technical advice on scientific dairy farming, management of indigenous dairy cattle, improved / hydroponic green fodder production, balanced cattle feed, dry fodder enrichment, dairy animal disease management, quality milk production, mastitis management, preparation of milk & milk products, dairy start-ups, training programmes in dairy farming and dairy products preparation, dairy animal health care, scientific feeding of dairy cattle, feed formulations, dairy farming business modules, indigenous dairy cows for dairy farming, milk products for dairy business and improved fodder varieties.

Visitors

During the period under report, the visit profile to the institute comprised, 2497 visitors in 59 batches comprising, 480 students in 13 batches, 1967 farmers in 44 batches, nineteen extension officials and 31 trainee officers of CAG. The visitors were updated about the ongoing research, educational, extension activities of the institute in dairy production and processing aspects, as per their needs, followed by visit to the livestock research centre and experimental dairy plant.

Visit of students and trainees to campus and LRC at SRS-ICAR-NDRI, Bangalore

Exposure Training Programme

- An Exposure cum One Day Training programme was organised for 172 farmer trainees in 9 batches comprising farmers, farmwomen and farm youth from eight districts of Tamil Nadu State, Sivagangai, Tiruvannamalai, Thirupathur, Ramanathapuram, Tiruvallur, Cuddalore, Thiruvarur and Nagapattinam, under 'Support to State Extension Programmes for Extension Reforms' (SSEPERS) under Agricultural Technology Management Agency (ATMA) scheme.
- An Exposure cum One Day Training programme was organised for 174 farmer trainees in 5 batches comprising farmers, farmwomen and farm youth from Central training Institute, Karnataka Milk Federation, Bengaluru. The farmers from Bengaluru rural and urban districts,

Visit of farmers under ATMA programme

Kolar, Chikkaballapura, and Tumkur districts attended the one-day exposure training programme at SRS-NDRI.

- The farmer trainees were sensitised about quality milk production, importance of green fodder production, clean milk production, dairy animal health care through lecture presentations in local language by faculties. Interactive sessions were organised with subject matter specialists for discussion on various issues related to dairying faced by the farmers at field level. Visits to Livestock Research Centre and Experimental Dairy Plant were organized for the benefit of farmer trainees.

Exhibition Participation

- Participated in the National Horticultural Fair 2024, held from March 5-7, 2024 (3 days) at IIHR, Hesaraghatta, Bengaluru, organized by ICAR-IIHR, in collaboration with the Society for Promotion of Horticulture (SPH) and BESST-HORT, a Technology Business Incubator of ICAR-IIHR. A total 1500 farmers, entrepreneurs, research scholars and students from the State and neighbouring States.
- Participated in the Krishi Mela 2024, held during November 14-17, 2024 (4 days) at GKVK Campus, UAS, Bengaluru.

Participation in exhibition, krishi mela and national fair

- **Progressive Farmer's Summit:** Participated in Progressive Farmer's Summit organized by KMF on November 26, 2024 at Dr. Babu Rajendra Prasad Convention Hall, GKVK, Bengaluru.

Training to field veterinarians of KMF on Balanced feeding strategies for dairy animal

Animal health camp organised under TSP

Under TSP program, animal health cum infertility camp was organized in collaboration with KOCHIMUL and State DAH&VS, under TSP program at Pingyanalli village of Chikkaballapur District of Karnataka State. A total of 81 dairy animals were attended in the animal health camp which included 54 HF cross-bred animals, 6 buffaloes, 12 heifers and 9 calves, for the problems of infertility issues, mineral deficiency, mastitis, wounds & worms. Corrective measures comprised distribution of inputs, mineral mixture supplements, preventive and curative medicines for infertility, mastitis and wounds, dewormers for the healthcare of the dairy cattle, to benefit beneficiary farm families of the adopted village. During the programme, farmers

Dairy animal health camp organised under TSP

interaction meeting with the experts was also organized to sensitize the farmers about improved dairy management practices.

Outreach activities

Under the Tribal Sub-Plan (TSP), during the period various technical inputs were distributed to 100 beneficiary-Scheduled Tribe farmers in the adopted villages of Chintamani Taluk of Chikkaballapur District, Karnataka State, procured under TSP funds. Farmers were provided with critical inputs like, improved hybrid fodder crop seeds viz., Sorghum CoFs-31 for increasing the area under fodder crops leading to improved animal productivity and teat dip cups and solutions promoting clean milk production practices at farm level. Further, extension literature related to improved dairy farming practices were also distributed for the benefit of the farmers. On farm training and demonstration on 'improved fodder production practices' was conducted at farmers field followed by Farmers interaction meeting on May 12, 2024 at Pingyanahally village of Chikkaballapur District.

Farmer training and demonstration on clean milk production in adopted villages under TSP programme

Training program organized under TSP

The Farmers Training programme on 'Scientific Dairying and Milk Processing' was organized on March 18, 2024 at SRS of ICAR-NDRI, under TSP Program. The one day on-campus training programme was well attended by 96 target beneficiaries belonging to ST community from the adopted villages of Chikkaballapur District of Karnataka State. The faculties of SRS, NDRI trained the dairy farmers on various aspects of scientific dairy farming practices including scientific breeding & reproduction management, balanced feeding, silage making, green fodder cultivation practices and health management besides value addition to milk and milk products and also about quality milk production practices to be adopted at farm level. During the program farmers were provided with the critical inputs like, CoFS-31 Fodder Seeds, Mineral Mixtures and Teat tip cups & Solutions were distributed for the beneficiary farmers. Further, the farmers were taken around the Livestock Research Center to apprise them about the improved practices and also to witness the demonstration of machine milking and clean milk production practices.

Distribution of critical inputs to framers under TSP

Farmer FIRST Project

Under Farmer FIRST Collaborative Project of IIHR-SRS-NDRI, On-Campus Training Programme on 'Good Dairy Management Practices and Value Addition' was organised at SRS-NDRI on March 20, 2024, for the benefit of the beneficiary farm families. The trainee farmers were sensitised by the subject matter specialists on focus areas of: Good Management Practices for Balanced Feeding of Dairy Cattle, Dairy Cattle Health, Quality Raw Milk Production at Farm Level and Profitable Dairy Farming and Preparation of Value added Dairy Products at Farm Level followed by interactive sessions with experts. The training programme was well-participated by 60 farmers, farm-women and farm youth beneficiaries from the project villages, Yeremgere, Hosadurga, and Vasappanadoddi of Kanakapura Taluk of Ramanagara District. A Dairy Animal Health & Infertility Camp and Farmers' Interactive Session, was organised in two project villages, Hosadurga and Vasappana Doddi in Kanakapura Hobli of Ramnagara Taluk on July 16, 2024, for the health care of the dairy cattle, for the benefit of the target beneficiary of the farm families. The animals attended in the health camp included,

50 Crossbred HF Dairy Cattle and 35 Sheep, with participation profile of 46 beneficiaries, comprising 36 famers and 10 farm women. The problem profile included, mineral deficiency, mastitis, anoestrus and other related problems. Corrective measures comprised mineral mixture supplements, deworming and curative medicines for the healthcare of the dairy cattle, to benefit beneficiary farm families of the two adopted villages. An interactive session was organised with the farmer beneficiaries to identify the present problems and needs, for further need-based interventions.

On-Campus Training Programme on 'Good Dairy Management Practices and Value Addition' for Farmers and Farm women, Animal health camp and input distribution to the dairy farmers under Farmer FIRST Project

On-Farm training programme

An On-Farm Training Programme was organised under TSP Funds, at Husenpura Village, Chintamani Taluk, Chikkaballapura District of Karnataka District, in coordination with KOCHIMUL (Kolar-Chikkaballapura Milk Union) of Karnataka Milk Federation. The training programme on 'Green Fodder Cultivation' and Farmers' Interaction Meeting was well attended by 70 Farmers Beneficiaries.

On-Farm Outreach programs

Training program organized under SCSP

Under the SCSP program, the Farmers Training program on 'Scientific Dairying and Value Addition to Milk' was organized at SRS of ICAR-NDRI. The on-campus training program was attended by 335 dairy farmers belonging to the SC community from Karnataka and Tamil Nadu States. The faculties of SRS, NDRI trained the dairy farmers on various aspects of scientific dairy farming practices including scientific breeding & reproduction management, balanced feeding, silage making, green fodder cultivation practices and health management besides value addition to milk and milk products and also about quality milk production practices to be adopted at farm level.

On campus training programme organised under SCSP

Orientation program for field extension functionaries

The subject matter specialist from SRS-NDRI delivered the lecture on 'Nutritional management strategies for quality milk production' for the benefit of around 80 field extension functionaries of Kolar District of Karnataka State in the Orientation program organized by KOCHIMUL for the benefit of field extension officers of KMF held on March 15, 2024.

Dairy education at farmers' door

The Dairy Education at Farmer's Door was organized in the selected clusters of villages of Ramanagara and Kolar Districts of Karnataka State. During the period under report organized visits were made by the multidisciplinary team to the selected villages. Necessary technical advice was rendered on scientific dairy farming, green fodder production, clean milk production and animal health care to the farmers and farm women at their doorsteps. The interactive sessions with farm families, to identify the problems and issues to be addressed which included, poor milk quality, mineral deficiency, malnutrition, reproductive disorders, repeat breeding and mastitis. Based on the observed and expressed problems, suitable strategies as institute interventions are being formulated for systematic addressing and solving the problems for the benefit of the farm families.

EASTERN REGIONAL STATION, KALYANI –

Outreach activities carried out under TSP

The ICAR-National Dairy Research Institute, Eastern Regional Station (ERS), Kalyani, has implemented various initiatives to support the tribal farming community in West Bengal, focusing on sustainable agriculture, animal husbandry, and livelihood improvement through the Tribal Sub-Plan (TSP) and collaborative programmes.

- On August 13, 2024, a Scientists-Farmers Interaction Session and Animal Health Care Camp were conducted in the Shiber Bandh area of Sonamukhi, Bankura district, in collaboration with KVK, Bankura. This event aimed to promote knowledge exchange and support the local tribal farming community. The session facilitated discussions among scientists, Block Livestock Development Officers (BLDO), and KVK officials, addressing critical issues in animal husbandry and sustainable farming practices. Additionally, an animal health camp provided essential veterinary services, improving livestock health and welfare. The programme included an 'Animal Husbandry Input Distribution Camp' at the KVK-Bankura campus, where 40 bags of animal feed, mineral mixtures, and various utensils were distributed to tribal farmers, enhancing the nutritional status of their livestock.
- On August 23, 2024, an input distribution camp was organized at the ERS, Kalyani, focusing on Front Line Demonstration (FLD) for sorghum fodder crop and black gram cultivation. Essential agricultural inputs, including seeds, fertilizers, and insecticides, were distributed to 102 tribal farmers, aiming to enhance crop productivity and sustainability. A follow-up event on August 29 provided 40 female goats, goat feed, and aluminum tumblers to 40 tribal farmers, promoting integrated farming practices and improved livestock management.
- A significant programme took place on September 6, 2024, where 225 tribal farmers from various regions participated in a one-day programme focused on developing scientific backyard poultry through Direct Benefit Transfers (DBTs). The event included the distribution of 2,700 chicks (20 per farmer), 3,275 kg of feed, and essential equipment to promote backyard poultry farming. Additionally, 1,500 kg of goat feed and 2,900 kg of pig feed were provided to enhance the production potential of their animals.
- On September 12, 2024, a scientist-farmer meeting was organized at KVK-Bankura to promote scientific duck husbandry among tribal farmers. The programme distributed 2,000 ducklings, 2,500 kg of duck feed, and necessary equipment to 100 participating farmers, empowering the community with knowledge and resources for sustainable duck rearing.
- The ERS, Kalyani, hosted a programme on October 14, 2024, focusing on the livelihood improvement of tribal farmers through livestock interventions. The event featured a Scientists-Farmers Interaction session with 106 beneficiary farmers, followed by the distribution of 2,000 chicks, 2,500 kg of poultry feed, 300 kg of pig feed, and aluminum utensils. These efforts aimed to support the vulnerable farming community by creating nutritional and economic security.
- On November 5, 2024, an input distribution camp was organized under the TSP, providing agricultural inputs to 96 farmers cultivating mustard, 15 growing maize, and 50 producing oats. This initiative showcased the programme's extensive reach and commitment to enhancing agricultural productivity and fostering sustainable livelihoods among tribal communities. Overall, these initiatives reflect ICAR-NDRI ERS's dedication to empowering tribal farmers, improving their livelihoods, and promoting sustainable agricultural practices in West Bengal.

Organization of Kissan Mela-2024 at ERS, Kalyani campus under TSP

On March 2, 2024 the Eastern Regional Station (ERS) of ICAR-National Dairy Research Institute (ICAR-NDRI) organized a Kisan Mela under the Tribal Sub-

Empowering Tribal Livelihoods: A Transformative Drive through Poultry Bird Distribution

Supporting livelihood of tribal farmers at Bankura KVK

Plan Project (TSP). This initiative aimed to empower tribal communities in agriculture and allied sectors. Approximately 500 participants, dominated by tribal farmers, engaged in the mela, fostering knowledge exchange and collaboration. The event featured 12 exhibition stalls showcasing innovative agricultural technologies, drawing participation from diverse stakeholders including representatives from ICAR institutes, Farmer Producer Organizations (FPOs), and *Krishi Vigyan Kendras* (KVKs). Notably, indigenous breeds of animals were highlighted, emphasizing the importance of preserving tribal heritage in agriculture. A key aspect of the Mela was the farmers-scientists interaction session, providing a platform for dialogue on sustainable farming practices and technological interventions tailored to tribal contexts. Additionally, essential inputs such as mineral mixtures, veterinary medicines, steel buckets, and aluminum tumblers were distributed among 333 tribal farmers present at the event, aiming to enhance their agricultural productivity and livelihoods. Overall, the Kissan Mela organized under the TSP by ICAR-NDRI-ERS exemplified a concerted effort towards promoting inclusive and sustainable agricultural development among tribal communities, fostering empowerment and resilience in tribal agriculture.

Outreach activities carried out under NEH project

The ICAR-National Dairy Research Institute, Eastern Regional Station (ERS), Kalyani, Nadia, West Bengal, organized a series of impactful programmes aimed at enhancing the livelihoods of farmers in the North Eastern Hill (NEH) region through livestock interventions. These initiatives included scientist-farmer interaction meets, training sessions, input distribution activities, and awareness programmes, conducted in collaboration with local *Krishi Vigyan Kendras* (KVKs) in Assam and Tripura.

- The first programme took place on February 21-22, 2024, in Dhubri, Assam. The objective was to uplift the socio-economic conditions of farmers through livestock improvement. During this programme, various animal husbandry inputs, including 20 goats, 5,000 chicks, 25 piglets, and substantial quantities of feed and supplements

Director of ICAR–NDRI addresses farmers at Kisan Mela, ERS Campus- Sheds Light on Innovations in Livestock and Rural Development

Catalyzing Change Across Districts: Reaching Tribal Farmers of Birbhum, Burdwan, and Nadia with Livelihood-Strengthening Inputs -

were distributed benefiting a total of 200 farmers.

- On March 13-14, 2024, a similar programme was conducted in Bagma, Udaipur, Gomati district, Tripura. This programme aimed to improve farmers' socio-economic conditions through enhanced livestock practices. Inputs such as 21 goats, 720 chicks, 830 ducklings, and a variety of feeds were distributed, reaching 200 farmers in the region.
- A significant event on September 6, 2024, at KVK Morigaon, Assam, focused on the conservation of the indigenous Lakhimi cattle breed. The session, attended by scientists from ICAR-NDRI and ICAR-ATARI, emphasized sustainable livestock practices. Livestock inputs, including silage, cattle feed, and veterinary supplies, were distributed to support local dairy activities, fostering the conservation of this valuable breed.
- On September 26, 2024, ERS Kalyani organized an interaction programme for pig and poultry farmers in Nagaland, collaborating with ICAR-RC-NEH Region. This initiative targeted 20 pig farmers and 51 poultry rearers, providing insights into scientific animal husbandry practices. Beneficiaries received piglets and feed, and follow-up visits were conducted to assess livestock health and rearing practices.
- Subsequent programmes continued to support NEH farmers, with another event in Dhubri, Assam, on October 1, 2024, where additional livestock inputs were distributed.
- The final outreach programme on December 17, 2024, at KVK Kamrup, Assam, reached 60 farmers. This event highlighted the importance of indigenous breeds like Lakhimi cattle and featured input distribution aimed at improving livestock management and productivity.

Overall, these initiatives fostered collaboration between scientific institutions and the farming community, promoting sustainable practices that are expected to lead to higher economic gains for resource-poor farmers in the NEH region.

Essential animal husbandry inputs distributed to Assam farmers to enhance livestock-based livelihoods

Outreach Initiatives at Namsai KVK Bring Tangible Benefits to Farmers of Arunachal Pradesh -

Outreach activities carried out under SCSP

The ICAR-National Dairy Research Institute, Eastern Regional Station (ERS), Kalyani, has implemented a series of initiatives under the Scheduled Caste Sub Plan (SCSP) aimed at enhancing the livelihoods and agricultural practices of Scheduled Caste (SC) farmers in West Bengal. These interventions, which span veterinary care, resource distribution, and training programmes, underscore the institute's commitment to supporting marginalized communities in the region.

- On June 25, 2024, a veterinary camp was organized in Muratipur village, Nadia district, where a dedicated team from ICAR-NDRI ERS provided critical treatment and vaccinations for a variety of livestock, including 53 cattle, 27 calves, 61 goats, and 211 poultry birds. This initiative benefited 39 SC farmers, significantly improving the health and productivity of their livestock. Additionally, poultry feed was distributed to further support the farmers' efforts in maintaining healthy poultry populations, emphasizing the role of veterinary care and resource support in sustainable agricultural practices.

- On August 2, 2024, an SCSP programme was conducted in Hingalganj block, North 24 Parganas district, where 78 SC farmers received vital resources, including 78 kilograms of mineral mixtures and essential veterinary medicines. Educational extension literature was also distributed, aimed at enhancing livestock health and agricultural productivity while equipping farmers with knowledge of modern and sustainable farming practices. The anticipated outcome is an improved socio-economic status for the participating farmers.
- On August 3, 2024, another targeted intervention took place in the Gosaba block, benefiting 36 SC farmers. This event mirrored the previous initiative, focusing on livestock health through the distribution of 36 kilograms of mineral mixture and veterinary medicines, along with educational materials. A field visit provided practical exposure to advanced livestock management techniques, fostering sustainable development within the farming community.
- On October 21, 2024, a training programme and workshop on "Scientific Goat Husbandry" were organized at the ERS campus, attended by 22 farmers from the Bolpur region. The workshop combined theoretical lectures with practical experiences, including a farm tour to showcase best practices in goat husbandry. This comprehensive educational experience empowered farmers with the necessary skills to enhance their goat-rearing practices and overall livelihoods.
- Another significant event occurred on November 5, 2024, when a workshop on 'Scientific Animal Husbandry' was held, coupled with an input distribution camp that benefited 25 SC farmers from North 24 Parganas district. Participants received knowledge on scientific practices along with goat feed and male goats, bolstering their farming activities and enhancing livestock management.
- On November 6, 2024, an interaction cum input distribution programme focused on poultry-based livelihoods was hosted at ERS Kalyani. This event provided essential inputs, such as chicks and drinkers, to 80 SC farmers, empowering them to initiate or enhance poultry rearing practices. The programme facilitated a meaningful exchange of knowledge between scientists and farmers, reinforcing best practices in poultry management and promoting the SCSP's mission to uplift marginalized farming communities.

Overall, these initiatives reflect ICAR-NDRI ERS's proactive approach to fostering sustainable agricultural practices, improving livestock management, and enhancing the livelihoods of Scheduled Caste farmers in West Bengal.

Reaching the Margins: ERS initiatives benefit scheduled caste farmers in the Sunderbans

Capacity Development activities

i.Training programme organized for tribal farmers

Date	Topic	Participants
07-02-2024 to 09-02-2024	Scientific Animal Husbandry practices and clean milk production	30
06-03-2024 to 08-03-2024	Health Management of Livestock	28
02-07-2024 to 04-07-2024	scientific Animal husbandry for Tribal unemployed youth	20
09-07-2024 to 11-07-2024	Scientific Animal husbandry for Tribal unemployed youth	30

ii.Training programme organized for farmers from NEH region

Date	Topic	Participants
12-03-2024 to 16-03-2024	Scientific Animal husbandry for NEH Farmers from Tripura State	15

iii. Training programme cum sensitization programme organized for Scheduled Caste Farmers -

Date	Topic	Participants
07-03-2024	Scientific Animal husbandry for Scheduled Caste livestock farmers from 24pgs district of West Bengal	24
11-03-2024	Scientific Animal husbandry for Scheduled Caste Women livestock farmers from 24pgs district of West Bengal	50
23-07-2024 to 25-07-2024	Scientific Animal husbandry for Scheduled Caste Women from Birbhum district of West Bengal	20
07-08-2024	One Day Training Programme Cum Interaction on Scientific Animal Husbandry	85
21-10-2024	Sensitization workshop on scientific goat farming	22
5-11-2024	Training Cum Sensitization programme on Scientific Goat Husbandry	29
12-12-2024	Collaborative Training cum input distribution programme	115

iv. Training programme organized by the funding support from ITC -

Date	Topic	Participants
25-11-2024 to 29-11-2024	Kid Nursery & Scientific Goat Farming Practices	22

F. Veterinary health and infertility camps organized under NABARD programme -

Sl. No.	Date	VillageName	No. of Farmers	Cows screened & vaccinated	Goats vaccinated	Deworming doses	Mineral mixture issued
1	26-06-2024	Sonakhali, Haringhata	50	47	110	157	50 kg. 5 liter of Vitamin supplement
2	26-07-2024	Nimtala Uttar Brahmapur Haringhata	40	57	166	223	40 kg. 5 liter of Vitamin supplement
3	13-09-2024	Rautari, Shimurali, Chakdaha	39	-	-	80	39 kg. 5 liter of Vitamin supplement
4	12-11-2024	Narapatipara, Simurali, Chakdaha	70	112	104	216	80 kg. 5 liter of Vitamin supplement
5	At weekly interval	Muratipur, Kalyani	220	618	-	618	-

Participation in Agricultural Fairs

Participation in Regional Agricultural Fair-2024 at Khunti district of Jharkhand

The Eastern Regional Station (ERS) of ICAR-National Dairy Research Institute (ICAR-NDRI) actively participated in the Regional Agricultural Fair for the Eastern Region-2024, held at the KVK Khunti campus in Jharkhand during February 3-5, 2024. Notably, the stall attracted significant attention, receiving visits from esteemed dignitaries including the Union Minister of Agriculture and Farmers Welfare, as well as the Director General of ICAR. Additionally, during the fair, 100 quintals of goat feed, 400 packets of mineral mixture and veterinary medicines, as well as 400 steel buckets and aluminum tumblers (watering and feeding devices for livestock) were distributed among the tribal farmers, further contributing to their livelihood.

Participation in agricultural fair organized at Chaibasa, Jharkhand

The ERS of ICAR-NDRI played a pivotal role in the successful organization of the Kisan Mela (March 9-11, 2024) held in Chaibasa, Jharkhand, actively participating and offering valuable assistance. A dedicated exhibition stall was set up by the institute, attracting notable attention, including a visit from the esteemed Union Minister of Agriculture and Farmers Welfare. During the mela, the institute demonstrated its commitment to support tribal farmers by distributing essential resources directly benefiting their agricultural endeavors. A significant contribution was made with the distribution of 2000 packets of mineral mixture and veterinary medicines, crucial for the health and well-being of

A Moment of Honor: Cabinet Minister, Agriculture & Farmers Welfare, engages with ERS Stall at Khunti Agri-Exhibition -

ERS Expert showcases innovative technologies at dairy mela, Chaibasa, Jharkhand -

livestock owned by tribal farmers in the state of Jharkhand. By actively engaging in the organization of the Kisan Mela and providing tangible support to tribal farmers through resource distribution, the institute reaffirmed its dedication to promoting agricultural development and welfare within the local resource-poor tribal community.

Showcasing Innovations in Dairy Science: ERS-ICAR-NDRI's Participation in National Events

The Eastern Regional Station (ERS) of ICAR-National Dairy Research Institute (NDRI), Kalyani, showcased its innovative technologies at two significant events. During the National Conference organized at ICAR-RC for NEH Region, Nagaland Centre, Medziphema, the institute set up an exhibition stall that engaged diverse stakeholders, highlighting technologies with potential applications in the north-eastern region during November 29-30, 2024. Additionally, ERS actively participated in the APC Roy Science Fair at WBUAFS, Kolkata, from December 26-29, 2024.

Dignitaries Visit ERS exhibition stall at Kolkata, showcasing innovations in agricultural and livestock technologies

KRISHI VIGYAN KENDRA, ICAR-NDRI, KARNAL

On Farm Testing (OFT) for Technology assessment

OFT 1: Assessment of Efficacy of Flaxseed and Azolla feeding on Productivity Lactating Goat

Title	Assessment of efficacy of Flaxseed and Azolla feeding on Productivity Lactating Goat
Problem	Low productivity of goat at field condition
Technology Selected	Feeding of Flaxseed Feeding of Azolla
	Use 1 month before kidding and after 3 month kidding
Source of Technology	ICAR- NDRI, 2021
Thematic area	Nutrition Management
Performance of the Technology	Azolla is a low cost fodder Flax seed improves the milk quality (Fat % increase)

Parameters/ Performances	Demo.Flax Seed	Demo. Azolla	Farmers Practice
Average Yield (l/animal)	1.45	1.32	1.18
% increase in yield	22.8	18.64	
Gross Cost (Rs/day/animal)	50	32.5	36.0
Gross Return (Rs/day/animal)	145	132	118
Net Return (Rs/day/animal)	95	99.5	82
Cost saving	14	-3.5	0
BCR (over feed cost)	2.9	4.06	3.27

OFT2: Assessment of Mastitis Management Technologies in Milch Animals

Thematic Area	Health Management
Problem	Economic loss due to incidence of sub-clinical and clinical mastitis, Loss of milk due to mastitis and sub-clinical loss.
Source of Technology (ICAR- NDRI, 2017):	Postpartum Feeding of Vitamin E @ 1500 IU/day/Animal orally and teat dip with KMnO4 solution (1%) after milking.

Parameters/ Performances	Demo. Vita-E	Farmers Practice
Average incidence of SCM at 0 days	66.67	67.85
Average incidence of SCM at 60 days	44.45	63.89
CMT Score at 0 days	1.17	1.28
CMT Score at 60 days	0.50	1.29
Average SCC/ml milk at 0 days	14.83	13.25
Average SCC/ml milk at 60 days	7.50	14.30
% decrease in SCM	33.34	5.85
Gross Cost (Rs/day/animal)	187.5 (7.5)	180.0
Gross Return over (Rs/day/)	382.5	369.0
Net Return (Rs/day/animal)	205.5	189
B:C based on milk	2.04:1	2.05: 1.0

Demonstration of Mastitis management at the farmer's doorstep

OFT3: Assessment of Management Intervention on Repeat Breeding in Crossbreed Cattle

Thematic Area	Health Management
Problem	Economic loss due to prolong service and dry period. -
Source of Technology (ICAR- CIRB, 2018):	Mineral mixture feeding @50gm per animal per day for 30 days orally

Parameters/ Performances	Demonstration unit	Farmers Practice
Conception rate	20% (2/10)	10% (1/10)

OFT4: Assessment of Efficacy of Nano Urea in Wheat Crop

Thematic area	Resource conservation technology
Solved the problem	Excessive and unbalanced use of fertilizer
Description of Technology	Use of nano urea liquid Variety: DBW-222 Sowing: Zero Tillage/Happy Seeder
Technology source and year	IFFCO- Nano Biotechnology Lab, Gujarat, 2019
Technical/ Technology treatment	TO1 – Two sprays of Nano Urea 500 ml/acre at the stage of tillering and setting. TO2 – 50 percent recommended Nitrogen + two sprays of Nano Urea 500 ml/acre at the stage of budding and setting. TO3 – 75 percent recommended Nitrogen + two sprays of Nano Urea 500 ml/acre at budding and setting stage. TO4 – Farmer Practice (Recommended Fertilizer Use)
Evaluate/refine	Evaluation
Number of tests	3
Area (in hectares)/unit/	Total area – 0.50 ha
Farming conditions	Irrigated, rice-wheat cropping system, soil type- sandy loam
Evaluation parameters	Growth and yield @ different stages Average yield (Q/ha) B:C ratio

Technical/ Technology treatment	Plant height at harvest (cm)	Total number of buds at the time of harvesting (square meter)	Earring length (cm)	Number of grains one ear
TO1 – Two sprays of Nano Urea @ 500 ml/acre at tillering and setting stage.	79.11	294.79	7.63	19.39
TO2 – 50% recommended Nitrogen + two sprays of Nano Urea @ 500 ml/acre at tillering and tillering stage.	81.97	338.04	8.92	23.41
TO3 – 75% recommended Nitrogen + two sprays of Nano Urea @ 500 ml/acre at tillering and tillering stage.	87.26	347.91	9.35	25.83
TO4 – Farmer Practice (Recommended Fertilizer Use)	85.08	343.07	9.26	25.58

Front Line Demonstration

FLD 1: Assessment of Efficacy of Poly Herbal Feeding in Dairy Animals

Sr No	Observation Parameters	Farmers' practice	Feeding of Polyherbal Mixture
1.	Average milk yield (kg)	10.5	13.4
2.	Increase milk yield (%)	-	27.6
3.	Average fat (%)	3.8	4.1
4.	Average SNF (%)	8.4	8.6
5.	Av. feed cost/animal/day (Rs)	190.34	211.34
6.	Total feed cost in 90 days	17130.6	19044.0
7.	Total milk yield in 90 days	945.0	1206.0
8.	Difference in milk yield	-	261
9.	Income from milk (Rs)	34492.5	45707.4
10.	Increase income (%)	-	32.51
11.	B:C Ratio	1:1.98	1:2.4

Extension activities being carried out in the field

FLD 2: Popularization of Nutri-garden at Domestic Level

Sl No	Name of the Village	Name of the Vegetables	No of Demonstration	Area under kitchen gardening(m2)	Yield (kg/unit)	Per capita consumption (g/d)B:C ratio
1.	Ghogdi Pur and Badota	Spinach, Coriander Radish, Tomato, Cauliflower, Brinjal, Carrot and Methi	3	300	119.3	3372.765

Demonstration of nurti-garden at the farmer's doorstep

FLD 3: Popularization of Oat green fodder var. OL-10 for Dairy Animals

Crop / Enterprise	Technology demonstrated	Demonstration Yield (Qt/Ha)			Yield of local Check	Increase in yield	Avg. Cost of Cultivn. (Rs/Ha)	Avg. Gross Return (Rs/Ha)	Avg. Net Return	B:C Ratio (Rs/Ha)
		H	L	A	Qt/Ha)	%				
Fodder Oat	Var. OL-10	680	540	610	549	11.12	35790	61000	25210	1.7:1

Demonstration of fodder oat variety OL -10

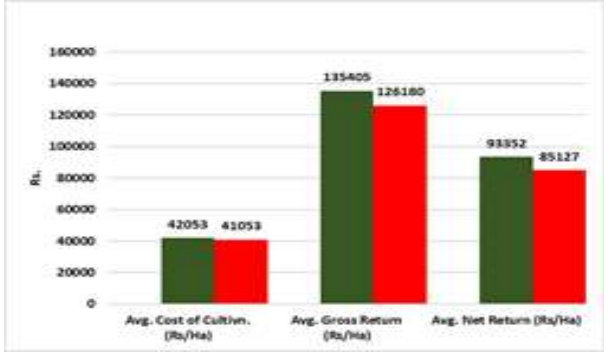
FLD 3: Popularization of berseem variety for Dairy Animals -

Crop / Enterprise	Technology demonstrated	Demonstration Yield (Qt/Ha)			Yield of local Check	Increase in yield	Avg. Cost of Cultivn. (Rs/Ha)	Avg. Gross Return (Rs/Ha)	Avg. Net Return	B:C Ratio (Rs/Ha)
		H	L	A	Qt/Ha)	%				
Fodder Berseem	Var. BL-44	1075	825	950	870	8.5	64285	114000	49715	1.77:1

Demonstration of Berseem variety BL-44

FLD 5: Demonstration of Maize var. J-1007 for Fodder Production at Farmers Field -

Crop / Enterprise	Technology demonstrated	Demonstration Yield (Qt/Ha)			Yield of local Check	Increase in yield	Avg. Cost of Cultivn. (Rs/Ha)	Avg. Gross Return (Rs/Ha)	Avg. Net Return	B:C Ratio (Rs/Ha)
		H	L	A	Qt/Ha)	%				
Fodder Maize	Var. J-1007	472.2	430.8	451.35	420.6	7.31	42053	135405	93352	1.98:1



Demonstration of maize fodder variety J-1007

FLD 6: Frontline Demonstrations on Direct Seeded Rice (DSR)

Particulars		Direct Seeded Rice (DSR)
Area	Ha	3
Demonstration	No:	1 at KVK
Farmers	No:	2 at villages
Technology/Variety		Arize Swift gold
Maximum yield		66
Minimum Yield		45
Yield (Kg/Ha)	Demo	63.5
	Local	65.2
Gross Return (Rs/Ha)	Demo	120650
	Local	123880
Net Return (Rs/Ha)	Demo	44830
	Local	47380
BC ratio	Demo	1.69
	Local	1.61

Feedback: Farmers appreciated the technology adoption for Direct Seeded Rice (DSR) compared with puddled transplanted rice (PTR) practices. We present the impact of DSR technology adoption on paddy yield, income generation, and cost incurred on various farm operations.

Demonstration of direct seeded rice

Cluster front line demonstrations on oilseeds, pulses, cereals and fodder

CFLD 1: Mustard

Crop	Thematic area	Variety	Season and year	Area (ha) Proposed	Actual	No. of farmers/demonstration SC/ST	Others	Total
Mustard	Crop diversification	Radhika (DRMR -2017-15)	Rabi-2022-23	50	50	24	101	125

Sowing date: October 15, 2024 to November 5, 2024
Source of technology: DRMR, Bhartpur

1. Crop Sequence: -Rice-Mustard
Sorghum-Mustard

2. Situation: Irrigated

3. Soil Type: Loam and Sandy Loam

Organic Matter- 0.36 to 0.69 %

Nitrogen- 115 to 193 kg/ha

Phosphorus- 9 to 46 kg/ha

Potassium – 126 to 456 kg/ha

4. Weed Flora: *Chenopodium album, Chenopodium murale, Asphodelus tenuifolius*

***5.* Diseases:** Alternaria Blight (*Alternaria brassicae*), White Rust (*Albugo candida*)

6. Insect: Aphid (*Lipaphis erysimi*)

Particulars		Mustard (2023-24)
Area	Ha	45.12
Demonstrations	No	111
Farmers	No	111
Technology/ Variety		DRMR 2017-15 (Radhika)
Maximum Yield	Q/ha	28.5
Minimum Yield	Q/ha	7.38
Yield (Q/ha)	Demo	18.3
	Local	15.25
Gross Return (Rs/ha)	Demo	103169
	Local	86163
Net Return (Rs/ha)	Demo	74834
	Local	58823
B: C Ratio	Demo	3.64
Local	3.15	

Feedback: Farmers appreciated the Mustard variety Radhika with excellent yield performance, BC ratio and negligible attack of alternaria blight and white rust disease.

Training programmes achievements of KVK

On-Campus and OFF-Campus

KVK provides strong training support to disseminate need-based and skill-oriented technology for various target groups for achieving a production breakthrough in Dairying, Agriculture and allied subjects. Need-based short and long-term (on and off-campus) trainings on various disciplines, viz. Dairy Production, Dairy Processing,

Agriculture, Horticulture, Vermi-culture, Bee-keeping, Fish Farming and Home Science are being organized for farmers, farm-women, rural youth, in-service personnel and rural leaders. The training programmes organized and achievements made by KVK during January 2024 to December 2024 have been summarized in the following table.

Training Achievements (January to December 2024)

Title of the course	On-Campus	Off-Campus	Total	No of Participants
Scientific Dairy Farming (Sponsored)	5	0	5	130
Scientific Dairy Farming and Dairy Processing	11	12	23	518
Crop residue management	2	10	12	205
Fisheries production & management	1	3	4	53
Home Science	2	3	5	123
Natural farming & Horticulture production	4	6	10	378
Vermi-compost Production	2	3	5	210
Rural Youth (Bee keeping)	2	-	2	63
Total	**29**	**37**	**66**	**1653**

Important Celebrations

- A workshop on DSR (Direct Seeded Rice) was organized by KVK, ICAR-NDRI in collaboration with Bayer India at N.N Dastur auditorium on 30.04.24. This program was also telecasted through virtual mode. The program was organized under the guidance and leadership of Dr Dheer Singh, Director, ICAR-NDRI. Dr U.S Gautam (D.D.G, Agri Extn) was the chief guest of this event. Eminent dignitaries from Bayer India also took part in this program. -

Workshop on direct seeded rice held at ICAR-NDRI on April 30, 2024

Release of 17th installment of PM - Kisan Samman Nidhi

- KVK organized World Environment Day 2024 on June 05, 2024 at KVK campus. This year's campaign is celebrated under the theme our land our future #Generation Restoration. It highlights the need to take concrete action to achieve transformative change to tackle the climate crisis. Tree plantation campaign was also organized on this event. A total of 65 people participated in this programme.
- PM-Kisan 17th instalment release was virtually telecasted at Dr S Sundaresan auditorium, ICAR-NDRI on June 18th 2024. Hon'ble CM Haryana, Sh Nayab Singh was the chief guest of this event. 1080 participants including farmers and farmwomen attended the program. Certificates were distributed to 'Krishi Sakhi' during this event.

Extension Education programme/Activities

Sl. No.	Activity	Total No.	Sl. No.	Activity	Total No.
1	Field day	2	8	Radio talks /TV talks	2
2	Kisan Ghosthi	5	9	Literature/ articles	1
3	Exhibition	10	10	Scientists visit to farmers field	26
4	Film Show	0	11	Farmers visit to KVK	7245
5	Method Demonstrations	14	12	Scientist farmers interactions	38
6	Group meetings	23	13	Soil/Water samples analysed	10
7	Newspaper coverage	85	Total		7461

Seed and other bio-products produced at KVK -

This KVK is maintaining live demonstration units in fish farming, bee keeping, vermi-culture, horticulture and crop production for imparting practical training for skill development, demonstration of technologies and production of quality seed material of latest varieties for sale to farmers. The products from these units particularly seed are being sold through ATIC to farmers. The performance of instructional farm (Crops production) including seed production during the year 2024 is given in the following table.

Seed produced and sold at crops production unit during the year 2024

Crop	Variety	Area(acre)	Total seed produced (Q)	Sale (₹)
Rice (Grain)	PR-114 NF	1	4.25	29,006
	Taraori Basmati	1	5.75	33,206
	Paddy under size	-	25 .00	31,500
	PB-1847	1	160.00	4,80,000
	PB-1509	10	93 .80	6,75,360
Wheat (Seed)	DBW-372	10	168.00	7,56,000
	WH -371	10	174.00	7,83,000
Wheat (Grain) NF	NF	1	8.50	29,750
Oats (Seed)		1	2.00	10,000
Mustard (Grain)	Radhika	1	4.5	25,425
Barseem (Seed)	BL-42	7	12.77	4,45,950
Total				**33,99,997**

Income Augmentation Activities (Revolving Fund):2024

Sr. No	Source	Total Income (₹)
1	Seed and crop Production	33,99,997
2	Auction of Amla and Lemon	1,00,000
3	Fish Unit	1,47,950
4	Vermicompost	18,750
5	Kisan Bhavan	4,95,920
6	Training programme	49,500
7	Bee Keeping	48,800
8	Fodder Supply to LRC (3484 Qtl)	13,93,190
	Total revenue in 2024 (Rs)	**56,54,077**

ICAR-KVK (ADDITIONAL), NADIA, NDRI-ERS, KALYANI

Training programme:

A total of 82 on campus training programmes were conducted for the farmers and farm women. In addition to these, 9 for rural youth, 3 for extension personals and 5 skill development training were conducted.

Training for Farmers and Farm Women

Sr. No	Training Topic	Training	Male	Female	Total
1	Disease management for livestock farming	6	181	85	266
2	Scientific Goat farming	3	46	77	123
3	Weed management	2	57	16	73
4	Scientific cultivation practices of different crops	1	6	2	8
5	Scientific fodder cultivation	10	224	136	360
6	Water management	4	91	87	178
7	Soil health management	1	40	23	63
8	Scientific dairy farming	8	178	194	372
9	Scientific Piggery farming	1	17	13	30
10	Scientific Bee farming	1	12	9	21
11	Scientific cultivation practices of different crops	1	31	54	85
12	Training on Cultivation Technique of Tropical Fruits (Banana, Mango, Guava)	1	23	17	40
13	Protective of Cut Flowers Verbena & Orchids	1	25	10	35
14	Training on Scientific Fodder Farming	1	28	22	50
15	Training on Scientific Dairy Farming & Vaccination Camp	1	37	7	44
16	Training on Scientific Plantation Crop Management (Arecanut, Coconuts)	1	27	14	41
17	Training on Exotic Vegetable Cultivation	1	16	24	40
18	Oyster mushroom cultivation	2	10	47	57
19	Scientific Bee-Keeping	2	14	23	37
20	Cultivation of Tuber Crops (Sweet Potato)	1	25	11	36
21	Training on Rejuvenation of old fruits orchards through Purning & Training	1	15	25	40
22	Training Programme on Scientific Cultivation of Black Gram	1	55	33	88
23	Technique of Fertilizer Application for Enhancing NUE in Kharif Rice	1	16	19	35
24	Training on Nano Urea Use in Kharif Rice Cultivation in Nadia Dist.	1	15	5	20
25	Scientific Goat Farming	1	0	20	20
26	Elephant foot yam Cultivation	1	16	20	36
27	Training Program on Scientific Lentil Cultivation	1	35	7	42
28	Training programme on Jal Shakti Abhiyan	1	22	18	40
29	Plant propagation methods	1	17	14	31
30	Natural Farming	1	20	17	37
31	Scientific lentil cultivation	1	35	2	37
32	Cutivation of tuber crops	1	26	1	27
33	Scientific cultivation of bio-fortified rice	1	15	15	30
34	Organic inputs and mushroom	1		100	100
35	Dairy Management for livelihood security	2	20	24	44
36	Feed management for augmenting economic returns	01	16	15	31
37	Scientific Goat farming	02	30	25	55
38	Off–Season cultivation techniques of solanaceae and cucurbit vegetables	02	16	19	35
39	Scientific cultivation practices high value (Exotic vegetables)	01	25	15	40
40	Protective cultivation of cut flowers (Gerbera and orchids)	01	20	19	39
41	Rejuvenation of old fruit Orchards through training and pruning	01	25	10	35

Sr. No	Training Topic	Training	Male	Female	Total
42	Scientific Cultivation Tropical fruits (Banana, Mongo, Guava, Citrus fruits, pine apple, papaya, dragon Fruits)	02	40	35	75
43	Scientific management of coconut and Areca nut cultivation	01	19	22	41
44	Scientific management of tropical tuber crop cultivation	02	18	14	32
45	Scientific cultivation of Black Gram	1	55	33	88
46	Techniques of Fertilizer Application for Enhancing NUE in Kharif Rice	1	12	23	35
47	Natural Farming for Production of High-quality Food and Preserving Soil Quality	1	28	6	34
48	Green fodder production throughout the year	01	20	20	40
Total		**82**	**1719**	**1447**	**3166**

Training for Rural Youth -

Sr No	Training Topic	Training	Male	Female	Total
1.	Scientific dairy farming for rural youth	05	33	32	65
2.	Scientific Goat farming for rural youth	01	25	0	25
3.	Scientific technique of tropical mushroom production	02	20	20	40
4.	Scientific Practices in commercial apiary	01	22	14	36
Total		**9**	**100**	**66**	**166**

Training for Extension Personals

Sr No	Training Topic	Training	Male	Female	Total
1.	Nutrient management for Extension Personnel	2	17	107	124
2.	Pest management for Extension Personnel	1	17	35	52
Total		**3**	**34**	**142**	**176**

Skill development training programme -

Topic	Date	Duration	Male	Female	Total
Skill development training RPL program for Organic Growers	22-07-2024 to 24-07-2024	3 days	18	22	40
Skill training on "Integrated management of Horticultural Crops"	19-08-2024 to 23-08-2024	5 days	30	32	62
Skill training programme on "Scientific Management of Goat" (112 participants)	6-09-2024 to 10-09-2024	5 days	0	112	112
Skill training programme on "Advanced goat husbandry: Best practices and Innovations"	4-10-2024 to 8-10-2024	5 days	0	146	146
Skill training programme on "Identification and management of insect pests and diseases of major crops in Nadia"	25-10-2024 to 29-10-2024	5 days	65	40	105
Total			**113**	**352**	**465**

One day training programme -

Topic	Venue	Date	Total
Scientific Banana cultivation	Choto kulia	18-07-2024	42
Improved Jute Retting Technology for Quality Fiber Production	Jaikrishnapur	05-08-2024	50
Scientific cultivation of Black gram	Anandanagar	07-08-2024	53
Improved Jute Retting Technology for Quality Fiber Production	Choto kulia	-do-	70
Scientific cultivation of Black gram	Choto kulia	-do-	70
Importance of Bio-fortified and climate crop varieties	KVK Campus	11-08-2024	51
Scientific aquaculture & IFS	Moshra	30-08-2024	50
Farmers Scientist interaction for promoting scientific vegetables productions	Arpara	04-09-2024	75
Farmers-Scientists Meet to Strengthen the Scientific Practices of Cultivation	Raotara	18-09-2024	52
Farmers Scientist interaction for promoting scientific vegetables productions	Kandakhola	19-09-2024	51
Livestock Farmers Scientist interaction for promoting Scientific AH	Phulia	30-09-2024	50
Live webcast release of 18th instalment of PM-Kisan by Hon'ble Prime Minister	KVK Campus	05-10-2024	55

Topic	Venue	Date	Total
Farmers Scientist interaction for promoting scientific practices associated with crops and dairy animals	KVK, ERS campus	14-10-2024	100
Training cum inputs distribution under cluster frontline demonstration (CFLD) programme on Oilseed (Mustard)	Bahadurpur	17-10-2024	200
Kisan Gosthi	Palashipara	21-10-2024	51
Awareness workshop for farmers on PM KUSUM (Component A)	KVK Campus	18-11-2024	30
Training cum inputs distribution under cluster frontline demonstration (CFLD) programme on chickpea	Krishnanagar I, Krishnanagar II	02-12-2024	60
Field visit cum Inputs distribution of paddy seeds	Bahadurpur, Krishnanagar I, Krishnanagar II, Nakasipara and Chakdah	04-12-2024	25
Training cum inputs distribution under cluster frontline demonstration (CFLD) programme on Lentil	Krishnanagar I, Krishnanagar II	December 6, 2024	200
Krishi Choupal	KVK Campus	07-12-2024	42
Field visit cum Inputs distribution of mustard seeds	Bahadurpur	09-12-2024	200
Preliminary survey for the project "Mainstreaming Non-Productive Cattle: Inclusive Development and Sustainable Integration into Rural Economies"	Krishnanagar I	18-12-2024	23
Participatory Rural Appraisal (PRA)	Gobindapur	20-12-2024	35
Participatory Rural Appraisal (PRA)	Bidyanandapur	26-12- 2024	40
Total			**1675**

Different extension Activities:

A total of 8 different extension activities were conducted during the period under KVK (Nadia) additional, ERS-NDRI, Kalyani. The details are given as follows:

Sr No	Title of the Activities	Activity	Male	Female	Total
1.	Field Day	39	40	60	110
2.	Farmers training	24	99	80	179
3.	Awareness week	04	100	50	150
4.	Special Day Celebrations	05	200	150	350
5.	Live telecast of Ministerial programme	03	180	160	340
6.	Kisan Gosthi	08	80	120	200
7.	Advisory services	23	22	10	32
8.	Mobile /social media Advisory services	250	220	230	450
	Total	**356**	**941**	**860**	**1811**

On Farm Testing (OFT) for Technology assessment

Following 06 different OFTs were conducted during this reporting period.

Sr No	Title of the OFTs	Trials	Male	Female	Total
1.	Cultivation of fodder sorghum for augmenting milk production	27	35	7	42
	Effect of Bio-fertilizers and bio-pesticides on yield potentiality of Maize	15	12	03	15
2.	Varietal evaluation of tomato for late season's cultivation under Nadia districts.	20	25	15	40
3.	Varietal evaluation of Chilies for tolerance of CHL.CV (Chili leaf curl virus)	25	25	15	40
4.	Effect of planting time for early flowering of comm ercial chrysanthemum varieties under Nadia agro-climatic condition	2	5	10	15
5.	Evaluation of six new onion varieties from DOGR, Pune	6	15	0	15
6.	Sustainable management of root knot nematode (RKN) in pointed gourd under organic or small farming systems	10	12	3	15
	Total	**105**	**129**	**53**	**182**

Front Line Demonstration (FLD)

Following 23 different FLDs were conducted during this reporting period.

Sr No	Title of the FLDs	Demonstrations	Male	Female	Total
1.	Cultivation of maize fodder crop through improved package of practice (J-1006)	10	65	45	110
2.	Frontline demonstration on green gram (Virat –IPM -205-7)	5	33	17	50
3.	Frontline demonstration on Black Gram (PU 31)	20	207	111	318
4.	Oilseed production mustard	5	30	50	80
5.	Frontline demonstration Bottle gourd Arka Shreyas	5	5	7	12
7.	Frontline demonstration Bio-fortified sweet potato Cv.Bhu-krishna	10	70	77	147
8.	Popularization of nano urea use in kharif rice cultivation	5	30	19	49
9.	Popularization of HYV Rice variety through improved package of practices	10	130	22	152
10.	Promotion of summer green gram (Pusa-1431) cultivation through improved package of practices	5	10	2	12
11.	Promotion of Tissue culture Banana	10	12	8	20
12.	Popularization of HYV super fine rice (NLR 34449, NLR 33389, RNR 15048 and MTU 1064) varieties through improved package of practices	06	05	01	06
13.	Popularization of Mustard (B-9 and NRC 105) through improved package of practices	06	100	100	200
14.	Method demonstration on pheromone traps in vegetable crops	20	40	25	65
15.	Popularization of goat feeder	02	01	01	02
16.	Method demonstration on sticky traps in vegetable crops	20	40	25	65
17.	Popularization of lentil variety (Pusa Ageti) through improved package of practices	03	80	70	150
18.	Popularization of chickpea variety (Bidisha) through improved package of practices	02	100	50	150
19.	Popularization of Berseem variety (BL 42) through improved package of practices	10	40	35	65
20.	Popularization of tuberose variety (Bidhan Singdha) through improved package of practices	02	05	0	05
21.	Popularization of ridge gourd variety (Arka Vikram) through improved package of practices	01	05	0	05
22.	Popularization of duck (Khaki Campbell)	04	03	01	04
23.	Popularization of goat (Black Bengal) for breeding programme	2	1	1	2
	Total	**178**	**1061**	**698**	**1749**

Extension Activities: A total of 12 different extension activities were conducted during this reporting period under KVK (Nadia) additional, ERS- NDRI, Kalyani:

SN	Title of the Activities	Activity	Male	Female	Total
1	Parthenium Awareness Week	1	83	86	169
2	Jal Shakti Abhiyan	10	150	165	315
3	Mahila Kisan Diwas	1		24	24
4	Swachatta Campaign	1	22	21	41
5	International Women Day	1		65	65
6	Kisan Mela, Kisan Bhagiroti Prathamikta Hamari	1	102	69	171
7	Animal Vaccination Camp	2	63	70	133
8	Balanced Use of Fertilizer cum Agro-forestry	1	32	28	60
9	Natural Farming Awareness programme	1	20	26	46
10	DFI & ICAR Foundation Day	1	52	48	102
11	PM Kisan Samman Sammelan	1	43	40	83
12	Field Day on Elephant Foot Yam	1	25	26	51
	Total	**22**	**592**	**668**	**1260**

Special Events:

- Celebration of "19th Parthenium Awareness Week" carried during August 16-22, 2024, organized by Krishi Vigyan Kendra (KVK), Nadia (Addl.), ERS of ICAR-National Dairy Research Institute, Kalyani.
- Industrial visit to Gontra S.K.U.S Limited (seed processing plant) at Chakdah along with RAWE students on November 6, 2024.
- Exposure cum industrial visit to Haringhata milk processing unit with RAWE students.
- Visit to P. G. Eggplant (Poultry unit) at Santipur on November 11, 2024 with RAWE students.
- On December 4, 2024, a Kisan Mela was organized at Ghoralia Rina Palace, Santipur, by Nadia Organic FPOs with the theme "Chemical-Free Food." The event, attended by 117 farmers and farm women from various blocks of Nadia district, featured an exhibition stall by KVK staff showcasing organic farming technologies.
- On December 5, 2024, World Soil Day was celebrated at the ICAR-KVK, Nadia-II campus with the theme "Caring for Soil - Measure, Monitor, and Manage."
- On December 11, 2024, Dr Gutha Venkata Ramesh attended a training-cum-workshop on "Drone Technology and its Applications" was organized by ICAR-CIFRI, Barrackpore, in collaboration with ICAR-IARI, New Delhi.
- Celebration of "Vigilance Awareness Week" carried during October 28 to November 3, 2024 organized by Krishi Vigyan Kendra (KVK), Nadia (Addl.), ERS of ICAR-National Dairy Research Institute, Kalyani.
- Field day programme on Rice (Variety: MTU 1156) at Choto kulia on October 17, 2024.

Inputs & planting materials: As per need of farmers following inputs were distributed during this reporting period.

SrNo	Inputs	Quantity Distributed	Male	Female	Total
1	Nano Urea (500 ml)	24 bottles	25	24	49
2	Seeds of fodder maize	80 kg.	22	21	43
3	Seeds of Sorghum	80 kg.	25	26	51
4	Seeds of Green gram	150 kg.	40	45	85
5	Seeds of Black gram	180 kg.	55	33	88
6	Elephant Foot Yam rhizomes	10 Quintal	12	12	24
7	Cuttings of Sweet Potato	10000 nos.	36	25	61
8	Chilli saplings	3500 nos.	40	45	85
9	Brinjal saplings	1500 nos.	55	33	88
10	Tomato saplings	4000 nos.	36	36	72
11	Nano Urea &Nano DAP (500 ml)	48 bottles	50	48	98
12	Black Gram Seeds	1400 kg.	150	20	170
13	Papaya, Guava, Drumstick, Jackfruit saplings	10000 nos.	140	145	285
14	Banana sucker	60 nos.	0	60	60
15	HYV rice seeds (MTU 1156)	3000 kg.	130	22	152
16	Vegetable seeds	200 pack	25	26	51
17	Micronutrients (Boron & zinc)	62 nos.	35	27	62
18	Pesticides	62 nos.	35	27	62
19	Herbicides	3 nos.	35	27	62
20	Liquid micronutrient (sagarika)	70 nos.	0	100	100
21	Sprayer	7 nos.	7	0	7
22	Paddy	120 kg.	05	01	06
23	Tuberose bulbs	20 kg.	05	0	05
24	Chick pea	150 kg.	100	50	150
25	Ridge gourd seeds	15 packets	05	0	05
26	Lentil	200 kg.	80	70	150
27	Berseem seeds	70 kg.	40	35	75

SrNo	Inputs	Quantity Distributed	Male	Female	Total
28	Mustard seeds	250 kg.	100	100	200
29	Liquid Fertilizers	10 bottles	08	02	10
30	Pesticides	50 packets	30	20	50
31	Sprayer	03	03	0	03
32	Ducks	300	03	01	04
33	Goat	20	01	01	02
34	Goat feeder	2	01	01	02
35	Maize seeds (J-1006)	150 kg.	25	22	47
36	SSH (Sugargaze) seeds	200 kg.	50	52	102
37	Sorghum (PC-23) cuttings	5000 Nos.	3	4	7
38	Rice Beans(B-1,B-2,B-3) seeds	60 kg.	20	19	39
39	Hybrid Napier-Co-4 seeds	15 kg.	7	8	6
40	Black Gram- P.U-31 seed	200 kg.	70	80	150
41	Oats-Kent seeds	40 kg.	25	09	34
42	Berseem-Mescavi seeds	10 kg.	5	4	9
43	Bottle gourd seeds	500 gm.	7	5	12
44	Onion seeds and seedlings	6 kg.	15	0	15
	Total		**1539**	**1281**	**2811**

Training on scientific management of goat


Farmer scientist interaction programme

Distribution of chickpea

Livestock farmer scientist interaction programme

Training on scientific aquiculture


QRT team visit and input distribution to farmers

Agricultural Technology Information Centre (ATIC), ICAR-NDRI, Karnal -

Agricultural Technology Information Centre at NDRI Karnal became operational in November 2004. This centre is engaged in disseminating information on dairying and allied agricultural fields. Besides NDRI, relevant information available from other research stations of ICAR and state institutions located at Karnal are utilized by this centre for the farmers and other stakeholder visiting this centre. A large number of entrepreneurs, practicing farmers, extension workers and students are availing the facilities of ATIC together latest information related to dairying and allied fields.

Dissemination of technological information

Presently, ATIC NDRI is involved in dissemination of latest know-how among the end users—farmers—in a form that is accessible and without any distortion. Effective information delivery should be streamlined and ideally made available at a single point, saving farmers time and effort in accessing relevant data and guidance through personal interaction with visiting farmers, providing material inputs like improved varieties of crops, wheat grain, vermi-compost, toll free telephone number (1800-180-1199) and through whatsApp Group etc. A total number of 10366 farmers benefited.

The Director of the institute with visitors at Agricultural Technology Information Centre (ATIC), ICAR-NDRI, Karnal

Services rendered in Agricultural Technology and Technology Products

Sr. No	Detail of services	No. of Services	No. of Persons
1.	Dairy/Agriculture related information through Video show and Lecture	75	3507
2.	Personal Discussion with Subject-Matter-Specialist on Dairy Farming	63	2306
3.	Information through Dairy/Agriculture Literature	103	103
4.	Information on Agriculture (Seed/Fertilizer/Compost etc)	1286	1510
5.	Information through telephone (Toll-free) on Agriculture & Dairying etc.	410	410
6.	Information through e-mail on Agriculture & Dairying etc.	25	25
7.	Information through Whatsapp group on Agriculture & Dairying etc.	167	2505
	Total	**2129**	**10366**

Capacity building programme: 75 Video shows and lectures given to 3507 visitors, trainees and farmers.

Total Sale

Sr. No.	Item	Amount (₹)
1	Books (NDRI Publications)	60,076
2	Agriculture Inputs (seeds, fertilizers etc) obtained from KVK NDRI, Farm Production Section NDRI	34,62,492
	Total	**35,22,568**

10. WOMEN EMPOWERMENT AND MAINSTREAMING OF GENDER ISSUES

Women-centric Vulnerability Mapping and Participatory Adaptation Planning to Climate Change for Dairy Farmers in Haryana

The study was conducted to assess the impacts of climate hazards on dairy animals and the adaptation strategies perceived by women dairy farmers in Haryana. Adaptation pathways were designed to address heat stress, drought, cold stress, and floods. Elevated temperatures emerged as the most significant perceived impact of climate change. The farmers demonstrated moderate to high awareness of climate change effects, with 40% possessing average knowledge of climate-resilient dairy practices, while nearly half expressed unfavourable attitudes toward them. PICSA identified fifteen, thirteen and seven adaptation strategies for heat stress, drought, and other hazards, respectively. Implementing these plans could recover over 90% of milk production loss and enhance reproductive performance by 44.19% during heat stress, restore 77.49% of fodder production during drought, and recover 15.20% of milk loss during cold stress. Additionally, 48.75% of livestock loss and 46.99% of economic losses from floods could be mitigated.

Woman scientist of NDRI interacting with women farmers

Dairy Entrepreneurship Development among Rural Youth and Women in Aspirational Districts of Karnataka State

Various technological interventions on 'scientific dairy farming' were implemented through on-farm and on-campus training and capacity-building programs in the study area i.e. Raichur and Yadgir, aspirational districts of Karnataka state. The selected 550 farmer-beneficiaries from the two districts were sensitized about balanced feeding and improved fodder crop inputs were distributed among the beneficiaries to augment green fodder production in the study area. To provide the training to the selected beneficiaries, the training infrastructure in both the KVKs and at the station is being strengthened through establishing new facilities for effective training and demonstration and the civil work is being carried out for establishment of 'Dairy Entrepreneurship and Skill Development Center' to provide capacity building support to the farmers, entrepreneurs, field extension functionaries and other stakeholders.

Role Potential of Youth in Dairying in Aspirational Districts of Andhra Pradesh: A Gender Perspective

The study titled *"Role Potential of Youth in Dairying in Aspirational Districts of Andhra Pradesh – A Gender Perspective"* was undertaken to assess the extent of women youth participation in dairying, the factors influencing their role potential, and the involvement of key stakeholders in supporting an ideal dairy ecosystem. Conducted in the aspirational districts of Vizianagaram and Visakhapatnam, the study involved 180 women youth respondents and 30 relevant stakeholders, selected using random sampling. Data was gathered through personal interviews. The findings indicated that women youth actively participated in feeding (49%), house management (45.64%), processing and marketing (45%), but had limited involvement in economic decisions (9.11%). High engagement was observed in calf management (67.75%) and animal healthcare (61.82%). Overall, 30% of respondents showed high role potential, while 43.33% exhibited moderate potential. Key factors influencing role potential included education, dairying experience, participation in extension activities, and exposure to social media. Stakeholders such as the Department of Animal Husbandry, Rythu Bharosa Kendras,

private dairies, KVKs, and credit institutions played vital roles by offering services like breeding, input support, healthcare, finance, advisory, and marketing. Major constraints included time limitations due to multiple responsibilities, high input costs, inadequate subsidized feed, low milk prices, and insufficient stakeholder support. The study underscores the entrepreneurial potential of women youth in dairying, highlighting the need for targeted support and interventions.

Women Empowerment Lab in Dairy Extension Division

Women empowerment lab was established in Dairy Extension division in 2013 for capacity building of different self-help groups of NDRI, DRDA and NGOs. This lab was established with the objective to create awareness and impart skills in the field of dairy processing and fruit and vegetable preservation and also mobilize these groups to take up vocation in these areas. For this lab., all items of Dairy Processing Unit viz. Eco Milk Testing Machine, Refractometer, pH Meter, Moisture Balance were procured. Regular women empowerment trainings and campaigns through this Women Empowerment laboratory were organized to create awareness among rural farm women in the field of dairying and home science and also impart skill in these areas so that farm women could generate more income from dairying and maintain healthy atmosphere in their respective family.

On Campus Women Empowerment Training Programme-cum-Demonstrations

SN	Training name	Date	Participants
1	Training-cum-demonstration programme on homemade value-added milk products for trainees	January 4, 2024	12 women
2	Homemade value-added milk product for farm women	July 16, 2024	10 women
3	Training programme on value added milk products for farm women from Budhanpur village under SCSP project	December 3,2024	33 women
4	Training programme on value added milk products for farm women from Nagla Roran village under SCSP project	December 6,2024	40 women

Training programme at the Women Empowerment Laboratory in Dairy Extension Division

Climate Resilient Dairy Farm school for women dairy farmers at Furlak village

An exclusively Climate Resilient Dairy Farm School was established for the women dairy farmers of the Furlak Village. Total 20 smallholder women farmers enrolled in this farm school. School started in August 2024 and continued till December 2024 with the weekly classes on every Thursday from 12 Noon to 2.00 PM.

Training programmes organized for women dairy farmers

- One day training programme on "Scientific Dairy Farming and Value Addition to Milk" was organized at SRS-ICAR-NDRI, Bangalore for 130

Women scientist of NDRI taking class for female farmers in Climate Resilient Dairy Farm School

women dairy farmers of Tamil Nadu on October 17, 2024 under SCSP fund. The major topics covered under the this training programme were calf management, disease management, feeding management and traditional dairy products.

- During the period of January to March, 2024, KVK organized 19 exposure visits for 628 participants and conducted seven on-campus training sessions focusing on scaling up nature farming, benefiting 229 farm women.
- A training program was conducted during February 7-9, 2024, to enhance the skills and knowledge of tribal farmers in animal husbandry and livestock management, focusing on 'Scientific Animal Husbandry Practices and Clean Milk Production.' The program attracted 30 farmwomen. It covered a comprehensive range of topics such as modern techniques for animal management, hygiene practices in milk production, and methods for ensuring the quality and safety of dairy products.

Farm women training in progress

11. HONOURS AND AWARDS

Institute Awards -

- The ICAR-National Dairy Research Institute (NDRI) secured the second rank in the National Institutional Ranking Framework (NIRF)-2024 in 'Agriculture and Allied Category" of the Union Ministry of Higher Education. Dr. Dheer Singh, Director and Vice-Chancellor of the institute, received the award for the ranking from Union Minister for Education Shri Dharmendra Pradhan during the award ceremony for the India Rankings 2024 in New Delhi on 12th August, 2024.

Dr. Dheer Singh, Director and Vice-Chancellor, ICAR-NDRI, Karnal receiving the award for second rank award in the NIRF-2024 at New Delhi on August 12, 2024

- ICAR-NDRI technology titled "A *new strip based test for detection of urea in milk*" has been awarded one of the best technologies amongst 05 technologies of Animal Science Division. Dr. Rajan Sharma, Joint Director (Research) received the certificate from Shri Shivraj Singh Chouhan, Honourable Union Minister of Agriculture & Farmers Welfare & President of the ICAR Society on July 16, 2025 on the occasion of 96th ICAR Foundation Day at New Delhi.

Dr. Rajan Sharma, Joint Director (Research) receiving certificate of best technology on July 16, 2024 on the occasion of 96th ICAR Foundation Day at New Delhi

- ICAR-National Dairy Research Institute (NDRI) Library received the award for *"Best e-Resource Sharing"* through the CeRA@J-Gate (Consortium of e-Resources in Agriculture) platform among deemed universities, state agricultural universities, and central agricultural universities for 2023 on September 2, 2024, during the CeRA Workshop for the Northern Region held at SKUAST in Srinagar, Kashmir.

Vice-Chancellor of SKUAST-Kashmir, presenting award to officials of ICAR-NDRI on September 2, 2024

Fellowship

- Ajoy Mandal awarded Fellow of Indian Society of Animal Genetics and Breeding for the year 2024.
- Bindeshwari Pratap Singh, Chief Technical Officer (Library) received the award for the Fellow of the Association of Agricultural Librarians and Documentalists of India (AALDI) for the years 2023 and 2024.

Bindeshwari Pratap Singh, CTO (Library) received the award for the Fellow of the Association of Agricultural Librarians and Documentalists of India (AALDI) for the years 2023 and 2024 from the dignitaries on November 23, 2024

- D. Malakar was conferred on as an Honorary Fellow of the Association of Biotechnology and Pharmacy-2024 from Mangalayatan University, Aligarh, UP.
- Goutam Mondal conferred with Fellow of Animal Nutrition Association (FANA), ICAR-IVRI, Bareilly, Izatnagar, UP, India.
- Richa Singh received Associate Fellowship Award from National Academy of Dairy Science, India (NADSI), during the 8th Convocation of NADSI, held on April 9, 2024 at Pt. Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwavidyalaya Evam Go-Anusandhan Sansthan, (DUVASU), Mathura. U.P.
- Laxmana Naik N. received Associate Fellowship Award from National Academy of Dairy Science, India (NADSI), during the 8th Convocation of NADSI, held on April 9, 2024 at Pt. Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwavidyalaya Evam Go-Anusandhan Sansthan, (DUVASU), Mathura. U.P.
- Magan Singh Received Fellow Award (2022-23) of Indian Association of Hill Farming (IAHF) on November 29, 2024 at ICAR-RC-NEHR, Nagaland Centre, Jharnapani, Medziphema, Nagaland.
- Pradip Vishnu Behare, Senior Scientist received NASI- Membership 2024 (Biological Sciences, Biochemistry, Biophysics, and Biotechnology) in 2024 from The National Academy of Sciences in its 94th Annual Session on December 1, 2024.

Dr. Pradip Vishnu Behare received NASI-Membership 2024 at Bhopal on December 1, 2024

- Priyanka Singh Rao was conferred with Associate Fellowship Award during 8th Convocation of NADSI from April 9, 2024 at U.P. Pt. Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwavidyalaya Evam Go-Anusandhan Sansthan, (DUVASU), Mathura.
- Sohan Vir Singh was selected as a Fellow by Society of Animal Physiologist of India on November 27, 2024 during 32nd Annual Conference of SAPI & International Symposium on "Advances in Physiological Research in Omics Era for sustainable Animal Production and Livelihood Security under Changing Climate Scenario" organized by ICAR-CIRC, Meerut in collaboration with Society of Animal Physiologist of India during November 27-29, 2024.
- Vikas Vohra was conferred with ISAGB Fellow Award 2024 from Indian Society for Animal Genetics & Breeding, during the 18th Annual Convention of ISAGB held at BASU, Patna.

Best Paper Award

- Ajoy Mandal awarded First Best Paper Award for the article "Application of Smart Technologies in Livestock Management" published in Indian Dairyman, 2022 by the Indian Dairy Association during the 50th Dairy Industry Conference held at Hyderabad on dated March 4-6, 2024.
- Fanny Josan, Sonam Yadav, Seema Karanwal, Vikrant Gaur, Aditya Patel, Prasanna Pal, Mukesh Bhakat, Tirtha Kumar Datta, Rakesh Kumar received the 2nd Best Paper Award for the research paper entitled "Distinctive abundance of lipid molecules in spermatozoa from contrasting

fertility cattle bulls affect fertilization potential through capacitation" in the XXXII Annual Conference of SAPI & International Symposium on "Advances in physiological research in omics era for sustainable animal Production and livelihood security under the changing climatic scenarios" organised by ICAR-CIRC, Meerut, UP & SAPI during November 27-29, 2024.

- M. R. Meena, P. Govindraj and R.K. Meena received Best Research Paper award by the society for Sugarcane Research and Development (SSRD), SBI, Coimbatore, TN for the article entitled "Genetic variability for fodder quality traits among high biomass energy cane feedstock under rainfed condition".
- Manisha Yadav, Nishant Kumar and Ashutosh received 2nd best paper award for the research paper entitled "Effect of Dietary Curcumin supplementation on Physiological attributes of Crossbred Bulls during Induced Heat Stress" in the 24th Indian Veterinary Congress & 31st Annual Conference of IAAVR & National Symposium on "Livestock Health and Poultry: A Paradigm Change to Maximize Productivity for Sustainable Farmers' Livelihood" organized by College of Veterinary & Animal Sciences, LUVAS, Hisar (Haryana) during February 7-8, 2024.
- Sanchi Kamal, Nishant Kumar, T.K. Mohanty and D. K. Yadav received Best Paper Award for the research paper entitled "Effect of bull urine exposure in augmenting early resumption of ovarian cyclicity in postpartum Sahiwal cows" in 24th Indian Veterinary Congress & 31st Annual Conference of IAAVR & National Symposium on "Livestock Health and Poultry: A Paradigm Change to Maximize Productivity for Sustainable Farmers' Livelihood" organized by College of Veterinary & Animal Sciences, LUVAS, Hisar (Haryana) during February 7-8, 2024.
- Sanjeev Kumar received Best Paper Award 2024 for the research paper entitled "Organic Carbon Management for Soil Health in Fodder Based Systems" published in Agri Journal World Volume 04 issue 02 published by Leaves and Dew Publication.
- V. V. Vinay, S. Kumar, N. Tyagi and A. K. Samanta received Best Paper Award during 2024 for the research paper entitled "Impact of electro hydrodynamically micro encapsulated probiotics vs in-feed antibiotics on nutrient utilization, faecal microbiota and rumen fermentation profile of indigenous cattle calves" published in the proceedings of the 20th Biennial Animal Nutrition Society of India Conference, January 23-25, 2024, Chennai, India.
- V. V.Vinay, S. Kumar, S. Balaga, Rashmi H.M. and B. L. Jangir received Best Paper Award 2024 for the research paper entitled "Oral delivery of electro dynamically encapsulated *Lactiplantibacillus plantarum* CRD7 modulates gut health, antioxidant activity and cytokines-related inflammation and immunity in mice" published in the proceedings of the 20th Biennial Animal Nutrition Society of India Conference, January 23-25, 2024, Chennai, India.
- Vjay Shende, Aakash Wani, Writdhama Prasad, Kaushik Khamrui and Shaik Abdul Hussain received Dr C.M. Singh Best research article award for the research paper entitled "Effect of glucan addition on complexed zinc concentration and physico-chemical attributes of buffalo milk paneer whey" during 2nd National Conference On Enhancing Farmer's Income by Livestock, Poultry and Aqua Farming through Sustainable and Eco-Friendly Smart Technologies and Practices, held at BASU, Patna during February 28-29, 2024.
- Richa Singh and Rajan Sharma Received Best Research Paper Award in the category of "Commecial Aspects of Dairying" for the year 2022 by the Indian Dairy Association (IDA) for the article entitled "Geographical Indication for Traditional Indian Dairy Products- A Perspective" in Indian Dairyman. 74 (9), 88-95 during the 50th Dairy Industry Conference held during March 4-6, 2024 at Hyderabad.

Best Oral Presentation Award

- A. Raj, R.K. Baithalu, M. Pandey S.P. Pannu, M. Akram, R. Sharma and T.K. Mohanty received second best oral presentation award in National symposium of Indian Society for Buffalo Development (ISBD) on "Innovative approaches for boosting buffalo productivity" held at CoVS&AH, Kamdhenu University from December 16-18, 2024.
- A. S. Rajput, M. Bhakat, T. K. Mohanty, G. Mondal, A.

A. Mir and M. S. Rajput received Best Presentation Oral presentation Award for the research paper entitled "Assessment of Transient stress in FMD vaccination using Infrared thermography (IRT) in dairy animals" in the 30th Annual convention and national conference on 'Optimization of livestock farming for sustainable development in the era of climate change' held during February 22-24, 2024 at Madras Veterinary College, Chennai.

- A. Ukey, S. V. Singh, T. Satpute, P. Singh, R. Sharma and Afreed Muhhamad, N.V. received Third Prize in Oral presentation for the research paper entitled "Assessment Of Seasonal Impacts And Temperature Humidity Index On Blood Biochemical Parameters And Semen Quality In Murrah Bulls" in the National Symposium of Indian Society for Buffalo Development on "Innovative Approaches for Boosting Buffalo Productivity" (December 16-18, 2024) organized by College of Veterinary Science & Animal Husbandry, Kamdhenu University, Anand – 388001.
- Anjali M. K., Mohit Singh Shah, G. Bharath, Raghu H.V. received Best Paper Presentation award for the research paper entitled "Development of Rapid conducting polymer based colorimetric sensor for detecting total bacterial count and *E. coli* in milk" in the 15th National Women's Science Congress held at Karnataka Samskrit University, Bengaluru held during December 6-8, 2024.
- Anu, J., Sanchita Garai, and Sanjit Maiti received Best Presentation award for oral presentation on "Assessment of adaptive capacity to climate change in low elevation coastal zones of Kerala" in the 6th International conference on "Cutting Edge Solutions in Science- Agriculture, Technology, Engineering and humanities" conducted by the Society for community mobilization for sustainable development (MOBILISATION), New Delhi in collaboration with Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan from August 24-26, 2024.
- Chandrasekhar B, A Monica Rose, Akash Shriram, Hemlatha Singh, Ganga Gulati, Rushikesh Deshmukh, Ravikanth V, Diwas Pradhan, Raghu H V and Rashmi H M received Best Presentation Award for the oral presentation on "Insights into the resistome profile of raw milk from Haryana" at Fifth Science Conclave-cum-National Biomedical Research Competition (NBRCOM) 2024, under the aegis of Society of Young Biomedical Scientists, India, which was jointly organized by AIIMS, New Delhi and SCMM, JNU, New Delhi at JLN Auditorium, AIIMS, New Delhi from December 1-3, 2024.
- Gayathri S. L., M. Bhakat, and T. K. Mohanty received 3rd Best Oral Presentation Award for the research paper entitled "Assessment of moringa-based herbal post-teat dip solution via goat trial" in the International conference of the Indian Society for Sheep and Goat Production and Utilization (ISSGPUCON 2024) on "Recent trends and future perspectives to improve the performance, health and welfare of small ruminants under changing climate scenario" held at Rajiv Gandhi Institute of Veterinary Education and Research (RIVER), Kurumbapet, Puducherry during April 24-26, 2024.
- Gayathri S. L., M. Bhakat, and T. K. Mohanty received First Best Oral Presentation Award for the research paper "Seasonal assessment of mastitis using thermal image analysis in Goats" in the International conference of the Indian Society for Sheep and Goat Production and Utilization (ISSGPUCON 2024) on "Recent trends and future perspectives to improve the performance, health and welfare of small ruminants under changing climate scenario" held at Rajiv Gandhi Institute of Veterinary Education and Research (RIVER), Kurumbapet, Puducherry during April 24-26, 2024.
- Hency Rose, Heena Sharma, A. K. Singh, Yogesh Khetra, Fathima Shahna and D. N. Yadav received Best Oral Presentation award for the research paper entitled "Effect of admixture of goat and cow milk on the physic-chemical properties of feta" in 8th National Youth Convention on 'New perspectives for sustainable Agriculture& Livelihood Security' held at BHU, Varanasi during August 22-23, 2024
- Indu Devi received Best Oral Presentation award for the research paper entitled "Development of a deep learning aided computer vision system for automated measurement of linear traits in Sahiwal cow" in 11th National Seminar on 'Indian Dairy & Food Industry in Viksit Bharat: Developments and Innovations' during September 27–28, 2024, at ICAR-NDRI Karnal.

- Indu Devi received Best Oral Presentation award on "Development of a deep learning aided computer vision system for automated measurement of linear traits in Sahiwal cow" in the International symposium "Advances in Physiological Research in omics era for sustainable animal production and livelihood security under the changing climate scenario" from November 27–29, 2024, at ICAR-CIRC, Meerut– 250001, UP (India).
- Indu Devi received Second Best Oral presentation award for the research paper entitled "Development of a deep learning and computer vision – based model for automated appraisal of linear traits in Sahiwal cows" in the National Conference on 'Optimization of livestock farming for sustainable development in the era of climate change & 30th annual convention of ISAPM 2024' during February 22-24, 2024 at Madras Veterinary College, Chennai – 600 007, Tamilnadu, India.
- Manisha Sethi, Tushar Kumar Mohanty, Nadeem Shah, Mukesh Bhakat, Dilip Kukar Swain, Dileep Kumar Yadav, Nishant Kumar and Rubina Kumari Baithalu recieved Best Oral Paper Presentation Award at 32" Annual Conference of SAPI &International Symposium on "Advances in Physiological Research in Omics Era for Sustainable Animal Production and Livelihood Security under the Changing Climatic Scenario" organized by ICAR-CIRC, Meerut (UP) during November 27-29, 2024.
- Mir Muneeb Rafiq, Surender Singh Lathwal, Pawan Singh, Indu Devi, Atul S Rajput, Manoj Sharma, Nadeem Shah and Hitesh K Bagri received Second Best Oral Presentation award for the research paper entitled 'Effect of age on sperm kinematics, viability and mitochondrial membrane potential in Murrah Buffalo' in the National Conference on 'Optimization of livestock farming for sustainable development in the era of climate change & 30th annual convention of ISAPM 2024' during February 22-24, 2024 at Madras Veterinary College, Chennai – 600 007, Tamilnadu, India.
- P. Pavan, Sanchita Garai, A. Veldandi, S. Zade, Amitava Panja, N. Padaliya and Sanjit Maiti received Best Oral Presentation Award for the research paper entitled "Approaches for evaluating climate change adaptation: Methodological insights and tools" in the National Seminar on "Agricultural Extension cum Alumni Meet", held at Banaras Hindu University, Varanasi, Uttar Pradesh, India from 15th to 17th November 2024.
- R. Arunkumar, T. K. Mohanty, A. Kumaresan, R. K. Baithalu, M. Bhakat, and V. K. Gupta received First Oral Presentation award for the research paper entitled "Impact of FMD vaccination on bull seminal plasma fertility-related proteins" the in National Conference on "Challenges in Animal Health and Production admist Climate change: Innovative, Sustainable solutions and their Translation"-VIBCON2024, Madras Veterinary College, Chennai during September 26-28, 2024.
- R. Arunkumar, T. K. Mohanty, R. K. Baithalu, M. Bhakat and Selvaraj Kumaresan received Second Prize Oral Presentation award for the research paper entitled "Optimizing mitigation strategies for reducing the impact of Foot and Mouth Disease Vaccination induced stress on semen production performance" in the 30th Annual Convention ISAPM and National Conference on "Optimization of Livestock Farming for Sustainable Development in the Era of Climate Change", held during February 22-24, 2024 at Madras Veterinary College, TANUVAS, Chennai
- Rubina K. Baithalu received best oral presentation award in International Symposium and XXXII Annual Conference of SAPI on "Advances in Physiological Research in Omics Era for Sustainable Animal Production and Livelihood Security under the changing climate scenario" held at ICAR-CIRC, Meerut, India from November 27-29, 2024.
- Sanchita Garai, A. K. Reddy, Sanjit Maiti, Amitava Panja and Gopal Sankhala received Second Best Oral Presentation award for the research paper entitled "Improving adaptive capacity of women dairy farmers: the impact of climate resilient dairy farming practices in Haryana" in the 3rd International conference ICNSFS-2024 during November 6-8, 2024 at ICAR-ICWA, Odisha.
- Sanjit Maiti, Manjunath KV, Sanchita Garai, Goutam Mondal, Anjali Aggarwal, and Gopal Sankhala received Second Best Oral Presentation Award for

the research paper entitled "Building Climate Resilient: Impact of the NDRI Climate Service Model" in the International Conference on Impact of Climate Change on Biodiversity- A Global Perspective held at Madras Veterinary College, TANUVAS, Chennai on July 11-13, 2024 organized by Madras Veterinary College, Tamil Nadu Veterinary and Animal Science University, Chennai.

- Sushil Kumar Yadav, T.K. Dutta, A. Chatterjee, Sneha Dutta, and Vibhor Agarwal received 2nd Best Paper Award (Oral Presentation) for the research paper entitled "Assessment of Arsenic Contamination Chain and Cancer risk in human residing near in Murshidabad of West Bengal" at the 20th Biennial International Conference of Animal Nutrition Society of India (January 23-25, 2024) held at Madras Veterinary College, Chennai.
- T. Satpute T, P. Singh, A. Ukey, K. R. Sriranga, and S. V. Singh received First Prize in Oral presentation for the research paper entitled "Effect Of Supplementary Feeding on Testicular Thermo-regulation of Murrah Buffalo Bulls and its Relation with Semen Quality" in National Symposium of Indian Society for Buffalo Development on "Innovative Approaches for Boosting Buffalo Productivity" (December 16-18, 2024) organized by College of Veterinary Science & Animal Husbandry, Kamdhenu University, Anand – 388001.

Best Poster Award

- Amitava Panja, Sanchita Garai, Sanjit Maiti, S. Sahani, S. Zade, and A. Veldandi received Best Poster Presentation award on "Exploring the viability of land shaping technology as an adaptive mechanism in saline coastal regions of West Bengal" in the International salinity conference on "Rejuvenating salt affected ecologies for land degradation neutrality under changing climate" conducted by ICAR-CSSRI, Karnal from February 14-16, 2024.
- Anu, J., Sanchita Garai, Sanjit Maiti and S. Zade received Best Poster Presentation award on "Assessment of Adaptive Capacity and Exposure to Climate Change of Dairy Farmers in the coastal low-lying region of Kerala" in the 11th National Seminar on "Transformative Agriculture and Sustainable Development: Rethinking Agriculture for a changing world" conducted by Kumaon University Nainital, Uttarakhand from March 5-7, 2024.
- Arijit Ray, Chitranayak, Kiran Goyat, P.S. Minz, J.K. Dabas, Hima John & Khusbhu Kumari received 1st Best poster presentation award for poster presentation on "Solar powered hybrid automatic yogurt processing system" in International Conference on Emerging Technologies in Food Processing, (ETFP-2024), organized at Ghani Khan Choudhury Institute of Engineering and Technology, Narayanpur, Malda, West Bengal.
- Arijit Ray, Chitranayak, Rishi Shringi, Khushbu Kumari, P.S. Minz, J. K. Dabas received 1st Best poster presentation award for poster presentation on "Unnat engineering taknik va swachalan prasansakan dwara dahi banana ka set up" in "Hindi Shodh-Patra Pradarshan Pratiyogita, ICAR-NDRI, Karnal on September 23, 2024.
- Arthiya, K. awarded First prize in poster presentation entitled "CRISPR/Cas9 mediated editing of COX-2 gene to discern its role in prostaglandin production in buffaloes (Bubalus bubalis) in XXI SOCDAB National Symposium during February 15-16, 2024 at NTR Veterinary College, Gannavaram, Andhra Pradesh
- Ashritha B. received Best poster Award for the poster entitled "Fortification of milk-derived DPP-IV inhibitory peptides into snack bar and it's in vivo effect on alleviating hyperglycaemia" in the National Seminar on 'Innovative Strategies for Global Nutrition Security: Focus on Fortification' at College of Agriculture, Kerala Agricultural University, Vellayani, during October 16-17, 2024.
- Chitranayak, P.S. Minz, A.K. Singh, J.K. Dabas, Arijit Ray, Nisha Bose received Second Best Poster presentation award for poster presentation on 'Solar-Powered Automation for Curd Fermentation: A Hybrid Approach' in 11th National Seminar by NGA on "Indian Dairy & Food Industry in Viksit Bharat: Developments and Innovation" during September 27-28, 2024 at ICAR-NDRI, Karnal.
- D. Rajendran, Shobha, M, Emerald FME, Selvaraju, S. and Gopi, M. received best poster award for the research paper entitled "Synthesis and Characterization of Conjugated Zn-Phyto-Chemical Nanoparticles" in the 20th Biennial

International Conference of Animal Nutrition Society of India on "Sustainable Animal Nutrition for Global Health and Production: Innovations and Directions" Organized by Madras Veterinary College, TANUVAS, Chennai, January 23-25, 2024.

- Divyanshu Lakhanpal, T.K. Mohanty, Ramaswamy Arunkumar, Dipti Nain, Mukesh Bhakat and Rubina Kumari Baithalu received First Best Poster Presentation Award in the Andrology, Semenology and Artificial Insemination Session(Poster Presentation) for the paper entitled, "Evaluation of testicular blood perfusion and its association with temperature gradient and semen quality in dairy bull during summer", in the 39th Annual Convention of the Indian Society for study of Animal Reproduction(ISSAR), and National Symposium on "Challenges in Enhancing Reproductive Efficiency of Livestock: An Indian Perspective" organised by Dept. VGO, College of Veterinary Science, GADVASU, Ludhiana (Punjab), November 29, 2024 to December 1, 2024.
- Heena Sharma, Ashish Kumar Singh, Saipriya Kanchanpally, Lakshmipriya P R and Richa Singh received 2nd Best Poster Presentation Award for paper entitled 'Exploration of breed-specific candidate metabolites in Barbari and Jamunapari goat milk using gas chromatography-mass spectrometry based metabolomics approach in National Symposium on 'Animal Production Systems and its role in sustainable use of AnGR' heald at NTR college of Veterinary Science, Gannavaram, Andhra Pradesh during February 15-16, 2024.
- Hency Rose, Heena Sharma, A. K. Singh, D. N. Yadav, Yogesh Khetra, Kanchanpally Saipriya and Poornima received Best Poster Presentation Award for the paper entitled "Evaluation of physico-chemical composition and proteolyctic changes during ripening of feta cheese prepared using Barbari goat milk" at International Conference on "Recent Trends and Future Prespective to improve the eprformace, health and welfare of small ruminants under changing climate scenario" held at RIVER, Puducherry, during April 24-26, 2024.
- Hima John, P. Barnwal, Khushbu Kumari, & Banashree N. received Third Best Poster presentation award for poster presentation on 'Magnetic induction: a sustainable milk heating solution' in the attended 11th National Seminar on "Indian Dairy & Food Industry in Viksit Bharat: Developments and Innovation" during September 27-28, 2024 at ICAR-NDRI, Karnal.
- Kaviya P, Rajesh Kumar Bajaj, Parvesh, Abdul Hussain Shaik, Poojitha, G., Aiswarya V.G. and Rajan Sharma received 1st Best Poster Award for the research paper entitled "Evaluation of nanoencapsulated curcumin for preparation of functional yoghurt" at 11th National Seminar on "Indian Dairy & Food Industry in Viksit Bharat: Development & Innovation held at ICAR-National Dairy Research Institute, Karnal, Haryana during September 27-28, 2024.
- Saipriya Kanchanpally, Heena Sharma, Ashish Kumar Singh, D. N. Yadav, Richa Singh, G. S. Meena, Diwas Pradhan, Sachin Kumar and Anusha Kishore received Second Best Poster Presentation Award for the paper entitled "Elucidation of difference in metabolite profile and physic-chemical characteritics of Barbaria dn Beetal goat milk" at International Conference on "Recent Trends and Future Prespective to improve the eprformace, health and welfare of small ruminants under changing climate scenario" held at RIVER, Puducherry, during April 24-26, 2024
- Sheetal Berry, K. S. Kadian, S. Maiti, A. Ray received 3rd position in Poster Presentation on Building Climate Resilience through Adaptive Mechanisms Adopted by the Livestock Rearers of Uttarakhand. 8th National Youth Convention on New Perspectives for Sustainable Agriculture & Livelihood Security (NYC-NPSALS) at Institute of Agricultural
- Sonia Mor, Swarnalata, Surendra Nath and Laxmana Naik N awarded 2nd place in the poster presentation for poster entitled "Fortification of milk with encapsulated milk derived peptides" held at 50th Dairy Industry Conference, during March 4-6, 2024 at Hyderabad, Telangana.
- Diksha, Rajan Sharma, Kamal Gandhi, and Sonu K Shivanna (2024). Detection of Vegetable Oil Adulterants in Cow Ghee Using Raman Spectroscopy in Combination with Multivariate Analysis. 11th National Seminar organized by NDRI Graduate Association & ICAR-National

Dairy Research Institute, Karnal held on September 27-28, 2024 at ICAR-NDRI, Karnal, India.

Professional Society Award

- Afreed Muhammed NV awarded Best MVSc thesis award by Animal Physiologists Association during 4th Annual convention of Animal Physiologists Association and National Conference held during March 1-2, 2024 at ICAR-Central Sheep and Wool Research Institute, Avikanagar (Rajasthan).
- Kishan Fatania conferred with Young Scientist Award to for his research work on "Buffalo bull fertility prediction using functional sperm populations" on October 25, 2024 by SVSBT during the XI Annual conference of SVSBT held at Tirupati.
- Magan Singh was conferred Tenth Dr. Gopal Pandey Memorial Award by the Society of Biological Sciences and Rural Development, Prayagraj (U.P.) on July 27, 2024 during 10th Dr. Gopal Pandey Memorial Lecture Function.
- Monika Sharma was conferred with the Young Scientist Award by the Pragati International Scientific Research Foundation (PISRF) for her contribution to the field of Food Science and Technology during the International Conference on "Climate Smart Nutri-Sensitive Integrated Farming System for Gender Equitable Sustainable Agriculture: Prospects and Challenges: ICNSFS" organized from November 6-8, 2024.
- Nilendu Paul received Dr. T. C. Anand Kumar Young Scientist Award to for his research work on "Transcriptomic profiling of buffalo spermatozoa in relation to field fertility" on February 25, 2024 during the 34th Annual Meeting of the Indian Society for the Study of Reproduction and Fertility-2024 held at Hyderabad.
- Pawan Singh awarded with distinguished Extension Worker Award- 2024 by the Indian Society for Buffalo Development in its National Symposium on "Innovative Approaches for Boosting Buffalo Productivity" (December 16-18, 2024) organized at College of Veterinary Science & Animal Husbandry, Kamdhenu University, Anand.
- Ragulraj, S., M. Bhakat, T. K. Mohanty, S. Maiti, A. Fernandes, P.B. Nandhini, C. Sahu, G. S. Patil and R. Vikram received Shri. A. Lakshman Rao Award for fresh M.V.Sc. Research paper entitled "Infrared thermal image analysis for estrus identification in Murrah buffaloes" in the 30th Annual convention and national conference on "Optimization of livestock farming for sustainable development in the era of climate change" held during February 22-24, 2024 at Madras Veterinary College, Chennai.
- Ravi Prakash who completed his Ph D (Dairy Engineering) from the Southern Regional Station of ICAR – NDRI under the supervision of Dr Menon Rekha Ravindra, was selected for the IAUA Award for Outstanding Ph.D. Thesis Research for the year 2023 in the category Dairy and Fisheries Sciences. The award was presented during IAUA Vice Chancellors' Convention held on March 17, 2024 at GADVASU, Ludhiana.
- Sakshi Payasi conferred with Young Scientist Award to for her research work on "Thermal signatures of udder skin surface: a potential non-invasive tool to predict parturition in cows" on October 25, 2024 by SVSBT during the XI Annual conference of SVSBT held at Tirupati.

Other Individual Award and Recognition

- Anil Kumar Puniya, Principal Scientist, Dairy Microbiology Division was awarded Scientific High Level Visiting Fellowships (SSHN) 2024 by Institute of French in India (IFI) and French Embassy in India at UMR Herbivores Centre, Clermont Auvergne, France during October 14-27, 2024.
- A. Kumaresan is ranked among the world's top 2 percent scientists list published by the Stanford University, USA consecutively for last four years (2024, 2023, 2022 & 2021)
- Vaibhav Bharat Rokade received a bursary of £1000 from the UK Food Safety Research Network (FSRN) and Microbiology Society UK for attending the 21st International Symposium on Problems of *Listeria* and Listeriosis (ISOPOL), hosted by Quadram Institute at the University of East Anglia, Norwich, United Kingdom, during September 10-13, 2024. Symposium and presented a poster on "The Influence of

Biomimetic Synthesized Magnesium Oxide Nanoparticle on *Listeria monocytogenes* Virulence and Biofilm forming properties".

- A. K. Puniya was nominated as the Member, 'National Advisory Committee', Ministry of Fisheries, Animal Husbandry & Dairying. New Delhi
- A.K. Puniya was nominated as the Member, Scientific Panel on Milk & Milk Products: Food Safety & Standards Authority of India, Ministry of Health & Family Welfare, Government of India, New Delhi
- A.K. Puniya was nominated as the Member, Sectoral Expert Committee on Biomanufacturing; Subsector: Functional Foods, Department of Biotechnology (DBT), Ministry of Science & Technology, New Delhi
- A.K. Puniya was nominated as the Principal Member, FAD 31 (Food & Agriculture Division), Sectional Committee, Bureau of Indian Standards, New Delhi
- P. Barnwal acted as Chairman, BIS of Dairy Equipment Sectional Committee, FAD 33.
- Chitranayak acted as BIS Member of Dairy Equipment Sectional Committee, FAD 33.
- P. S. Minz acted as BIS Member of Dairy Equipment Sectional Committee, FAD 33.
- Ankit Deep was invited member of FAD 33 / Panel-1 & 2, BIS, New Delhi.
- Chitranayak received third prize for "INDIA-General knowledge test" ICAR- NDRI Raj Bhasha at ICAR-NDRI, Karnal on September 30, 2024.
- D. Malakar was awarded Dr. A.P.J. Abdul Kalam Memorial NABS Life Time Achievement Award in September, 2024 from NABS University of Madras, Chennai, Tamil Nadu.
- Helna Pious received appreciation and cash award in a competition conducted by Bureau of Indian Standards (BIS) on "Standardization Contest - Shaping Tomorrow's Sustainability Standards".
- Manisha Sethi awarded received Savitribai Phule Excellence Award 2024 for in National Level Essay Writing Competition held on the Birth Anniversary of SAVITRIBAI PHULE, "First Female Teacher of India" on 3rd January and Presented on the Indian Republic Day, January 26, 2024.
- Manjunath KV was awarded the prestigious MANAGE Best PhD Thesis Award. This award was presented on the 37th Foundation Day celebration of National Institute of Agricultural Extension Management (MANAGE), Hyderabad, an autonomous institute under the Ministry of Agriculture and Farmers' Welfare, Govt. of India.
- Mohan Mandal nominated as a member of the Indian Expert Panel for Joint Indo-UK Panel to review proposals under Indo-UK joint calls on Farm Animal Disease & Health (FADH) of DBT, GOI for three-year term
- Narender Raju Panjagari, Senior Scientist, Dairy Technology received International Travel Grant for attending the 17th International Hydrocolloids Conference held at the Riddet Institute, Massey University, New Zealand during November 12-15, 2024 and presenting an oral paper by the Anusandhan National Research Foundation (former SERB), DST, Govt. of India.
- R. K. Meena received Best Agronomist award conferred by Agri meet foundation and CCSHAU, Hisar during International conference on "Recent Advances in Agriculture for Aatmanirbhar Bharat" during April 19-21, 2024
- Raghu H.V. received certificate of appreciation in recognition for his contribution as an Eminent speaker at India Food Summit and wards 2024 held at Dwarka, New Delhi during December 5-6, 2024 organized by Synnex.
- Raghu H. V was nominated and received a certificate of appreciation for exceptional contribution as a Jury in Smart India Hackathlon (SIH), 2024 held at IES, Bhopal, Madhya Pradesh during December 11-15, 2024 organized by AICTE-MIC Innovation cell, Ministry of Education, Govt. of India.
- Santanu Banik was nominated as the Member, General Body, Paschim Banga Go-Sampad Bikash Sanstha, West Bengal.
- Santanu Banik was selected as the Member, National Advisory Committee for Animal Husbandry and Dairying sector for Piggery by Ministry of Fisheries, Animal Husbandry and Dairying, Department of Animal Husbandry and Dairying, GoI.

12. PUBLICATIONS

Animal Biotechnology			
Sl.No. -	Research Papers	Impact Factor	NAAS Rating
1 -	Rana, C., Vikas, V., Awasthi, S., Gautam, D., Vats, A., Rajput, S., Behera, M., Ludri, A., Berwal, A., Singh, D. & De, S. (2024). Antimicrobial resistance genes and associated mobile genetic elements in *Escherichia coli* from human, animal and environment. *Chemosphere*, *369*, 143808.	8.1	14.1
2 -	Das, D., Kumar, S., & Kaushik, J. K. (2024). Networks of ion-pairs are responsible for the large differences in the thermal stability of two structurally similar aminopeptidases. *International Journal of Biological Macromolecules*, *281*, 136465.	7.7	13.7
3 -	Behera, M., Singh, G., Vats, A., Parmanand, Roshan, M., Gautam, D., Rana, C., Kesharwani, R. K., De, S., & Ghorai, S. M. (2024). Expression and characterization of novel chimeric endolysin CHAPk-SH3bk against biofilm-forming methicillin-resistant Staphylococcus aureus. *International Journal of Biological Macromolecules*, *254*(Pt 2), 127969. -	7.7	13.7
4 -	Rajput, S., Gautam, D., Vats, A., Roshan, M., Goyal, P., Rana, C., Payal, S.M., Ludri, A. & De, S. (2024). Aquaporin (AQP) gene family in Buffalo and Goat: Molecular characterization and their expression analysis. *International Journal of Biological Macromolecules*, *280*, 136145.	7.7	13.7
5 -	Karanwal, S., Pal, A., Josan, F., Patel, A., Chera, J. S., Yadav, S., Gaur V., Verma P., Badrhan S., Chauhan V., Bhakat M., Datta, T.K. & Kumar, R. (2024). Higher abundance of DLD protein in buffalo bull spermatozoa causes elevated ROS production leading to early sperm capacitation and reduction in fertilizing ability. *Journal of Animal Science and Biotechnology*, *15*(1), 126.	6.3	12.3
6 -	Chauhan, V., Kashyap, P., Chera, J.S., Pal, A., Patel, A., Karanwal, S., Badrhan, S., Josan, F., Solanki, S., Bhakat, M. & Datta, T.K. (2024). Differential abundance of microRNAs in seminal plasma extracellular vesicles (EVs) in Sahiwal cattle bull related to male fertility. *Frontiers in Cell and Developmental Biology*, *12*, 1473825.	4.6	10.6
7 -	Badrhan, S., Karanwal, S., Pal, A., Chera, J. S., Chauhan, V., Patel, A., Bhakat, M., & Kumar, R. (2024). Differential protein repertoires related to sperm function identified in extracellular vesicles (EVs) in seminal plasma of distinct fertility buffalo (Bubalus bubalis) bulls. *Frontiers in Cell and Developmental Biology*, *12*, 1400323.	4.6	10.6
8 -	Kaushik, J. K., Krishnan, V., & von Ossowski, I. (2024). Functional insights into the probiotic mechanisms of surface protein action. *Frontiers in Microbiology*, *14*, 1355529.	4.0	10.0
9 -	Panchal, P., Rani, R., Kumar, R., Malik, S., Mukesh, M., Kaushik, J. K., Sodhi, M., Mohanty, A.K. & Kumar, S. (2024). Optimizing workflow efficiency for analyzing low molecular weight endogenous peptides in colostrum. *RSC Advances*, *14*(40), 29189-29200.	3.9	9.9
10 -	Tara, A., Singh, P., Gautam, D., Tripathi, G., Uppal, C., Malhotra, S., De, S., Singh, M.K., Telugu, B.P. and Selokar, N.L. (2024). CRISPR-mediated editing of β-lactoglobulin (BLG) gene in buffalo. *Scientific Reports*, 14(1),14822.	3.8	9.8
11 -	Choudhary, M., Kumar, S., Onte, S., Meena, V. K., Malakar, D., Garg, K., Kumar, S., Rajawat, M.V., Awasthi, M.K., Giri, B.S., Jaiswal, D.K. & Kochewad, S. A. (2024). Optimizing crop quality and yield: Assessing the impact of integrated potassium management on Chinese cabbage (*Brassica rapa* L. subsp. *chinensis*). *Heliyon*, *10*(17).	3.4	9.4
12 -	Batra, V., Dagar, K., Diwakar, M. P., Kumaresan, A., Kumar, R., & Datta, T. K. (2024). The proteomic landscape of sperm surface deciphers its maturational and functional aspects in buffalo. *Frontiers in Physiology*, *15*, 1413817.	3.3	9.2
13 -	Ahuja, K., Batra, V., Kumar, R., & Datta, T. K. (2024). Transient suppression of Wnt signaling in poor-quality buffalo oocytes improves their developmental competence. *Frontiers in Veterinary Science*, *10*, 1324647.	2.6	8.6
14 -	Yadav, P., Kumar, D., Saini, M., Sharma, R., Dua, S., Selokar, N. L., Bansal, S., Punetha, M., Gupta, A., Kumar, R., & Kumar, P. (2023). Evaluation of postnatal growth, hematology, telomere length and semen attributes of multiple clones and re-clone of superior buffalo breeding bulls. *Theriogenology*, 213, 24–33.	2.4	8.4

Animal Biotechnology			
Sl.No. -	Research Papers	Impact Factor	NAAS Rating
15 -	Roshan, M., Singh, I., Vats, A., Behera, M., Singh, D. P., Gautam, D., Rajput, S., Tarak, J., Packirisamy, G. & De, S. (2024). Antimicrobial and antibiofilm effect of cannabinoids from Cannabis sativa against methicillin-resistant Staphylococcus aureus (MRSA) causing bovine mastitis. *International Microbiology*, *27*(6), 1839-1852.	2.3	8.3
16 -	Jamwal, S., Tyagi, N., Kumar, J., Kaushik, J. K., Kumar, S., & Mohanty, A. K. (2024). Simple method for isolation and culture of primary buffalo (Bubalus bubalis) endometrial epithelial cells (pBuEECs) and its characterization using high throughput proteomics approach. *Animal Reproduction Science*, *263*, 107449.	2.2	8.2
17 -	Gautam, D., Sindhu, A., Vats, A., Rajput, S., Rana, C., & De, S. (2024). Evolutionary insights of interferon lambda genes in tetrapods. *Journal of Evolutionary Biology*, *37*(9), 1101-1112.	2.4	8.1
18 -	Kumar, D., Tiwari, M., Goel, P., Singh, M. K., Selokar, N. L., & Palta, P. (2024). Comparative transcriptome profile of embryos at different developmental stages derived from somatic cell nuclear transfer (SCNT) and in-vitro fertilization (IVF) in riverine buffalo (*Bubalus bubalis*). *Veterinary Research Communications*, *48*(4), 2457-2475.	1.8	7.8
19 -	Ritika, R., Saini, S., Shavi, S., Ramesh, P. N., Selokar, N. L., Ludri, A., & Singh, M. K. (2024). Curcumin enhances developmental competence and ameliorates heat stress in in vitro buffalo (*Bubalus bubalis*) embryos. *Veterinary World*, 17(11), 2433.	1.7	7.7
20 -	Singh, S. K., Kumar, R., Mathur, M., Kamboj, H., Kaushik, J. K., Mohanty, A. K., & Kumar, S. (2024). Exploring aptamers for targeted enrichment of X sperm in bovine: unraveling selective potential. *Animal Biotechnology*, *35*(1), 2323592.	1.9	7.7
21 -	Shukla, S., Deshpande, A. D., & De, S. (2024). Cellular distribution of AQP1, AQP2, and AQP3 in ureter and urinary bladder of goats in different seasons. *Small Ruminant Research*, *236*, 107308.	1.6	7.6
22 -	Jain, T., Jain, A., Goswami, S. L., Roy, B., De, S., Kumar, R., & Datta, T. K. (2024). Association of growth differentiation factor 9 expression with nuclear receptor and basic helix-loop-helix transcription factors in buffalo oocytes during in vitro maturation. *Zygote*, *32*(6), 429-436.	1.5	7.5
23 -	Jain, T., Jain, A., Goswami, S. L., Roy, B., De, S., Kumar, R., & Datta, T. K. (2024). Association of growth differentiation factor 9 expression with nuclear receptor and basic helix-loop-helix transcription factors in buffalo oocytes during in vitro maturation. *Zygote*, *32*(6), 429-436.	1.5	7.5
24 -	Gautam, D., Sindhu, A., Vats, A., Rajput, S., Roshan, M., Pal, H., & De, S. (2024). Characterization and expression profiling of buffalo IFN-lambda family. *Veterinary Immunology and Immunopathology*, *272*, 110770.	1.4	7.4
25 -	Francis, F., Parkunan, T., & DE, S. (2024). Effect of season on hematological, physio-biochemical and electrolyte profiles of indigenous goat breeds. *Biological Rhythm Research*, *55*(11-12), 520-534.	1.0	7.0
26 -	Tripathi, G., Gupta, S., Rinka, K., Gupta, T., Selokar, N. L., & Singh, M. K. (2024). Exogenous miR-29b reduces DNA methylation and apoptosis in transgenic cells. *Indian Journal of Animal Research*, 5248: 1-7.	-	6.4
27 -	Jamwal, S., Jena, M. K., Tyagi, N., Kancharla, S., Kolli, P., Mandadapu, G., Kumar, S. & Mohanty, A. K. (2023). Proteomic approaches to unravel the molecular dynamics of early pregnancy - in farm animals: an in-depth review. *Journal of Developmental Biology*, *12*(1), 2. -	2.2	-
28 -	Mohapatra, S. S., Mukherjee, J., Das, P. K., Ghosh, P. R., Das, K., De, S., & Banerjee, D. (2024). Expression profile of RFRP-3 gene in hypothalamic tissue and its relationship with reproductive hormones across phases of the estrous cycle in female rats. *Discover Animals*, *1*(1), 34.	-	-
29 -	Anand, V., Jaswal, S., Jena, M. K., Kumar, S., Kaushik, J. K., & Mohanty, A. K. (2024). Novel Interacting Partners of MGP-40, a Chitinase-Like Protein in Buffalo Mammary Epithelial Cells. *Cell Biochemistry and Biophysics*, *83*(2), 2127-2137.	-	-

Animal Genetics & Breeding			
Sl.No. -	ResearchPapers	ImpactFactor	NAASRating
1 -	Akinsola, O. M., Musa, A. A., Muansangi, L., Singh, S. P., Mukherjee, S., & Mukherjee, A. (2024). Genomic insights into adaptation and inbreeding among Sub-Saharan African cattle from pastoral and agropastoral systems. *Frontiers in Genetics*, *15*, 1430291.	2.8	9.7
2 -	Mukherjee, A., Cai, Z., & Mukherjee, S. (2024). Application of genomics in livestock populations under selection or conservation. *Frontiers in Genetics*, *15*, 1363839.	2.8	9.7

Animal Genetics & Breeding			
Sl.No. -	Research Papers	Impact Factor	NAAS Rating
3 -	Uttam, V., Vohra, V., Chhotaray, S., Santhosh, A., Diwakar, V., Patel, V., & Gahlyan, R. K. (2024). Exome-wide comparative analyses revealed differentiating genomic regions for performance traits in Indian native buffaloes. *Animal Biotechnology*, *35*(1), 2277376.	3.7	9.7
4 -	Gahlyan, R. K., Vohra, V., Chhotaray, S., & Kataria, R. S. (2024). Diversity assessment of a lesser known buffalo population from Central India and its comparative evaluation reveals presence of sufficient genetic variation and absence of selection. *Animal Biotechnology*, *35* (1), 2305550.	3.7	9.7
5 -	Dutta, G., Alex, R., Singh, A., Gowane, G. R., Vohra, V., De, S., Verma, A. & Ludri, A. (2024). Functional transcriptome analysis revealed upregulation of MAPK-SMAD signalling pathways in chronic heat stress in crossbred cattle. *International Journal of Biometeorology*, *68* (7), 1371-1385.	3.0	9.0
6 -	Singh, A., Verma, A., Dutta, G., Gowane, G. R., Ludri, A., & Alex, R. (2024). Functional transcriptome analysis revealed major changes in pathways affecting systems biology of Tharparkar cattle under seasonal heat stress. *3 Biotech*, *14* (7), 177.	2.6	8.6
7 -	Illa, S. K., Mumtaz, S., Nath, S., Mukherjee, S., & Mukherjee, A. (2024). Characterization of runs of Homozygosity revealed genomic inbreeding and patterns of selection in indigenous sahiwal cattle. *Journal of Applied Genetics*, *65* (1), 167-180.	2.0	8.4
8 -	Bhardwaj, S., Togla, O., Mumtaz, S., Yadav, N., Tiwari, J., Muansangi, L., Illa, S.K., Wani, Y.M., Mukherjee, S. & Mukherjee, A. (2023). Comparative assessment of the effective population size and linkage disequilibrium of Karan Fries cattle revealed viable population dynamics. *Animal Bioscience*, *37*(5), 795.	2.4	8.4
9 -	Upadhyay, A., Alex, R., Dige, M. S., Sahoo, S., Khan, K. D., Das, P., Vohra, V. & Gowane, G. R. (2024). Modelling the lactation curve in Alpine× Beetal crossbred dairy goats using random regression models fitted with Legendre polynomial and B-spline functions. *Journal of Animal Breeding and Genetics*, *141*(4), 365-378.	1.9	7.9
10 -	Sahoo, S., Alex, R., Vohra, V., Mukherjee, S., & Gowane, G. R. (2024). Assessing genetic parameters for first parity reproductive traits for early selection in Saanen×Beetal goats of India. *Reproduction in Domestic Animals*, *59*(7), e14669.	1.65	7.6
11 -	Rahim, A., Chaudhary, R., Rajaravindra, K. S., Pourouchottamane, R., Gowane, G. R., & Kumar, A. (2024). Elucidating population structure and genetic diversity of Intercross sheep through pedigree analysis. *Small Ruminant Research*, *237*, 107309.	1.6	7.6
12 -	Naik, S.P., Nandedkar, P.V., Gurao, A., Rout, P.K., Singh, M.K., Ali, S.S., Suryawanshi, P.R., Ghorpade, P.B., Chitkara, M., Kataria, R. and Gowane, G.R., Genetic Diversity and Evolutionary Significance of Cahi-Drb1 Gene in Indian Goat. *Small Ruminant Research*, *240*, 107365.	1.6	7.6
13 -	Upadhyay, A., Alex, R., Dige, M. S., Sahoo, S., Khan, K. D., Das, P., Vohra, V. & Gowane, G. R. (2024). Optimizing the genetic evaluation criteria for the small herd of Saanen x Beetal crossbred dairy goats of Indian sub-tropic. *Small Ruminant Research*, *241*, 107402.	1.6	7.6
14 -	Rahim, A., Rajaravindra, K. S., Chaudhary, R., Chaturvedi, O. H. & Gowane, G. R. (2024). Evaluating animal models comprising additive genetic and maternal effects on growth traits in German Angora rabbit. *World Rabbit Science*, *32*(3), 161-174.	0.8	6.8
15 -	Singh, R., Gurao, A., Mishra, S. K., Niranjan, S. K., Vohra, V., Mukesh, M., Rajesh, C. & Kataria, R. S. (2024). Molecular characterization of the coding region and 5'UTR of HSP70 gene in Indian riverine buffalo breeds. *Indian Journal of Animal Research*, *58*(2), 196-199. -	0.8	6.8
16 -	Sharma, N., Revanasiddu, D., Kumar, S., Gowane, G. R., Gupta, I. D., & Verma, A. (2024). Factor analysis for udder and teat type traits in Sahiwal and Karan Fries cows. *The Indian Journal of Animal Sciences*, *94*(2), 173-178.	0.35	6.2
17 -	Rahim, A. R., Chaudhary, R., Rajaravindra, K. S., Chaturvedi, O. H. & Gowane, G. R. (2024). Estimation of (co)variance components for body weight traits in intercross synthetic sheep. *Indian Journal of Animal Sciences* 94 (8): 717–724.	0.35	6.2
18 -	Singh, D., Shunthwal, J., Gowane, G. R. & Khanna, S. (2024). Gender Differences in Moral Distress and Ethical Conflict: A Survey of Indian Veterinary Practitioners. *Agricultural Science Digest*. 44(3): 571-579.	-	5.52
19 -	Khanna, S., Potliya, S., Ganguly, A., Singh, H., Maharana, B. R., Singh, D., & Gowane, G. R. (2024). An assessment of Indian Livestock Owners' selective management practices for risk amelioration of obstructive urolithiasis in water buffalo male calves. *Asian Journal of Dairy and Food Research*, *43*(2), 373-380.	0.51	5.44

Animal Genetics & Breeding			
Sl.No. -	**Research Papers**	**Impact Factor**	**NAAS Rating**
20 -	Kale, D. S., Singh, J., Sathe, Y. B., Wankhade, A., Dudule, P. D., Patil, D. V., & Gowane, G. R. (2024). Association of prolactin gene polymorphism with milk production traits in Gaolao cattle. *Journal of the Indonesian Tropical Animal Agriculture*, *49*(3).	-	-
21 -	Das, R., Vohra, V., & Chhotaray, S. (2024). Delineating marker genotypes for higher reproduction performance to aid in selection of Murrah bulls. *The Indian Journal of Animal Genetics and Breeding*, 21-23.	-	-

Animal Biochemistry			
Sl.No. -	**Research Papers**	**Impact Factor**	**NAAS Rating**
1 -	Joshi, M., Sharma, S., Onteru, S. K., & Singh, D. (2024). Comprehensive proteomic analysis of buffalo milk extracellular vesicles. *International Journal of Biological Macromolecules*, *282*, 136735.	7.7	13.7
2	Sharma, S., Kapri, A., Joshi, M., Onteru, S. K., & Singh, D. (2024). Development of RT-LAMP assay for detection of lead and cadmium toxicity using HepG2 cells. *Environmental Science and Pollution Research*, 1-16.	5.8	11.8
3	Sadera, G., Jaglan, A., Kapila, S., Kumar, A., de Zaldivar, BS. & T Requena, T. (2024). Protective effects of probiotic supplemented vegetable jams in *E. coli* induced diarrhoeal mice model. *Food Bioscience* 62, 105301.	4.8	10.8
4 -	Kumar, J., Onteru, S. K., & Singh, D. (2024). Deciphering the Drug Delivery Potential of Milk ExosomeNanovesicles for Aminobenzylpenicillin Therapeutic Efficacy against Contagious Staphylococcus Aureus in Bovine Mastitis. *Advanced Biology*, *8*(6), 2300519.	3.2	9.2
5 -	Sadeesh, E.M., Malik, A., Lahamge, M.S., & Singh, P. (2024). Differential expression of nuclear-derived mitochondrial succinate dehydrogenase genes in metabolically active buffalo tissues. *Molecular Biology Reports*, 51(1), 1071.	2.6	8.6
6 -	Ampadi, A.N., Sadeesh, E.M., & Lahamge, M.S. (2024). Mitochondrial DNA D-loop SNPs unveil molecular signatures of milk production variation in Murrah buffalo. *Molecular Biology Reports*, 51(1), 902.	2.6	8.6
7 -	Sadeesh, E.M., & Malik, A. (2024). Deciphering tissue-specific expression profiles of mitochondrial genome-encoded tRNAs and rRNAs through ranscriptomics profiling in buffalo. *Molecular Biology Reports*, 51(1), 876.	2.6	8.6
8 -	Verma, S. K., Kumar, L. K., Thumar, M., Kumar, T. V. C., Vedamurthy, V. G., Singh, D., & Onteru, S. K. (2024). A synonymous single nucleotide polymorphism (g. 36417726C> A) in the Lama2 gene influencing fat deposition is associated with post-partum anestrus interval in Murrah buffalo. *Gene*, *896*, 148032. -	2.6	8.6
9 -	Kapri, A., Singh, D., & Onteru, S. K. (2024). Deciphering Aflatoxin B1 affected critical molecular pathways governing cancer: A bioinformatics study using CTD and PANTHER databases. *Mycotoxin Research*, 1-19.	2.6	8.6
10 -	Sadeesh, E.M., Lahamge, M.S., Malik, A., & Ampadi, AN. (2024). Differential expression of nuclear-encoded mitochondrial protein genes of ATP synthase across different tissues of female buffalo. *Molecular Biotechnology*, 67(2), 705–722.	2.4	8.4
11 -	Sadeesh, E.M., Lahamge, M.S., Malik, A., & Ampadi, AN. (2024). Nuclear genome-encoded mitochondrial OXPHOS complex I genes in female buffalo show tissue-specific differences. *Molecular Biotechnology*, 67:2411–2427.	2.4	8.4
12 -	Devi, U and Kapila, S. (2024). Metabolic Syndrome: A Comprehensive Review on Understanding Pathophysiology, Clinical Implications and Different Management Strategies. *Journal of Metabolic Syndrome*. 13:350.	2.14	8.14
13 -	Kumar, V., Joshi, M., Vats, A., Kumar, L. K., Verma, S. K., Neeraj, Baithalu, R.K., Veerappa, V.G., Singh, D. & Onteru, S. K. (2024). Mucin and salt combination simulate typical fern-like pattern of buffalo saliva smear at estrus. *Microscopy Research and Technique*, *87*(8), 1753-1765.	1.6	7.6
14 -	Mohapatra, S.K., Panda, B.S.K., Deepika, S., Chaudhary, D., Kapila, R. & Dang, A.K. (2024). Pregnancy associated cytokines for successful pregnancy establishment in bovines. Sustainable Agriculture Reviews, 62: 131-154.	-	-

Animal Physiology			
Sl.No. -	Research Papers	Impact Factor	NAAS Rating
1 -	Satheesan, L., Kittur, P. M., Alhussien, M. N., Lal, G. S., Kamboj, A. & Dang, A. K. (2024). Reliability of udder infrared thermography as a non-invasive technology for early detection of sub-clinical mastitis in Sahiwal (*Bos indicus*) cows under semi-intensive production system. *Journal of Thermal Biology*, 121, 103838.	2.9	8.7
2 -	Kittur, P. M., Satheesan, L., Madhusoodan, A. P., Sriranga, K. R., Kumar, D., Kamboj, A., & Dang, A. K. (2024). Correlation of udder thermogram and somatic cell counts as a tool for detection of subclinical mastitis in buffaloes. *Veterinary Research Communications*, *48*(4), 2721-2729.	2.89	8.2
3 -	Satheesan, L., Kittur, P. M., Alhussien, M. N., Karanwal, S., AP, M., Alex, R., Kamboj, A. & Dang, A. K. (2024). Comparative Profiling of Milk Somatic Cells Proteomes Revealed Key Players in Mammary Immune Mechanisms During Mastitis in Tropical Sahiwal (*Bos indicus*) Cows. *PROTEOMICS–Clinical Applications*, *18*(6), e202400054.	2.1	8.0
4 -	Satheesan, L., Kamboj, A. & *Dang, A. K.* (2024). Assessment of Mammary Stress in Early Lactating Crossbred (Alpine X Beetal) Does During Heat Stress in Conjunction with Milk Somatic Cells and Non-Invasive Indicators. *Small Ruminant Research*, 107375.	1.83	7.8
5 -	Singh, S. V., Kumar, G. & Rajkumar. (2024). Anionic Mixture supplementation and their impact on hemato-biochemical parameters and post partum performance of buffaloes under field conditions: Impact of anionic mixture supplementation on hemato-biochemical parameters and post partum performance of buffaloes. *Indian Journal of Dairy Science,77*(3):258-266.	1.83	7.8
6 -	Yadav, D. K., Somagond, Y. M., Das, P., Lathwal, S. S., Kamboj, A., Alhussien, M., & Dang, A. K. (2024). Injection of antioxidant trace minerals/vitamins into peripartum crossbred cows improves the nutritional and immunological properties of colostrum/milk and the health of their calves under heat stress conditions. *Tropical Animal Health and Production, 56*, 225.	1.7	-
7 -	Kumar, Y., Singh, S. V., Prakash V., Saraswat, P.K. & Sheoran, P. (2024). Micro-level evaluation of agromet advisory services (AAS) interventions to address climate variability induced in dairy sector. *Journal of AgriSearch.* 11 (3): 204-211.	-	-
8 -	Kumar, P. & Singh, S. (2024). Effect of melatonin implantation on reproductive performance in post-partum Murrah buffaloes (Bubalusbubalis) during summer season. *Journal of Experimental Zoology India*, *27*(1).	-	-

Livestock Production and Management			
Sl.No. -	Research Papers	Impact Factor	NAAS Rating
1 -	Ram, S., Malik, V. K., Gupta, V., Narwal, S., Sirohi, M., Ankush, Pandey, V., Gupta, O.P., Misra, A.K. & Singh, G. (2024). Impact of foliar application of iron and zinc fertilizers on grain iron, zinc, and protein contents in bread wheat (*Triticum aestivum* L.). *Frontiers in Nutrition*, *11*, 1378937. -	-	10.0
2 -	Gayathri, S. L., Bhakat, M., & Mohanty, T. K. (2024). Advancing mastitis assessment in dairy bovines via short milking tube thermography: A seasonal perspective. *International Journal of Biometeorology*, *68*(11), 2253-2265.	3.0	9.0
3 -	Vasisth, R., Gurao, A., Chitkara, M., Kumar, G., Sriranga, K. R., Mukesh, M., Dige, M.S., Singh, P., Aggarwal, R.A.K. & Kataria, R. S. (2024). Selection of reference genes for normalizing gene expression data across seasons in spermatozoa of water buffalo (Bubalus bubalis). *International Journal of Biometeorology*, *68*(7), 1397-1409.	3.78	9.0
4 -	Gayathri, S. L., Bhakat, M., & Mohanty, T. K. (2024). Seasonal assessment of mastitis using thermogram analysis in Murrah buffaloes. *Journal of Thermal Biology*, *121*, 103842.	-	8.9
5 -	Kumar, G., Gurao, A., Vasisth, R., Chitkara, M., Singh, R., Sriranga, K. R., Dige, M.S., Mukesh, M., Singh, P. & Kataria, R. S. (2024). Genome-wide 5 -C-phosphate-G-3 methylation patterns reveal the effect of heat stress on the altered semen quality in Bubalus bubalis. *Gene*, *906*, 148233.	2.6	8.6
6 -	Singh, N.P and Kamboj, M.L. (2024). Does calf-mother contact during heat stress period affect physiology and performance in buffaloes? *Animal Bioscience*, 37(6): 1121-1129.	-	8.4
7 -	Gayathri, S. L., Bhakat, M., & Mohanty, T. K. (2024). Early Detection of Sub-clinical Mastitis in Murrah Buffaloes through Udder Thermogram Analysis during the Natural Progression of Infection. *The Veterinary Journal*, *306*, 106176.	2.3	8.3

Livestock Production and Management			
Sl.No. -	Research Papers	Impact Factor	NAAS Rating
8 -	Kumar, A., Prasad, J. K., Kumar, N., Anand, M., Verma, S., Dhariya, R., Kumar, A. & Gattani, A. (2024). Quercetin in semen extender curtails reactive oxygen and nitrogen species and improves functional attributes of cryopreserved buck semen. *Cryobiology*, *116*, 104931.	-	8.3
9 -	Gayathri, S.L., Bhakat, M., Mohanty, T.K. (2024). Short milking tube thermogram analysis: an indicator of mastitis in Murrah buffaloes. *Tropical Animal Health and Production*, 56(1): 5.	1.7	7.7
10 -	Kaur, H., Chitkara, M., Mathai, E., Gurao, A., Vasisth, R., Dige, M. S., Mukesh, M., Sriranga, K.R., Singh, P. & Kataria, R. S. (2024). Polymorphism detection and characterization of sperm cells chromatin remodeling associated genes in Murrah buffalo. *Tropical Animal Health and Production*, *56*(8), 318.	1.7	7.7
11 -	Warhade, R., Devi, I., Singh, N., Arya, S., K. Dudi, Lathwal, S.S., Tomar, D.S. (2024). Attention module incorporated transfer learning empowered deep learning-based models for classification of phenotypically similar tropical cattle breeds (*Bos indicus*). *Tropical Animal Health and Production,* 56:192.	1.7	7.7
12 -	Tiwari, S., Lathwal, S. S., Devi, I., & Tomar, D. S. (2024). Effect of post-milking teat dipping on milk quality and udder health of crossbred cows. *Journal of Dairy Research*, *91*(3), 315-318.	1.6	7.6
13 -	Gayathri, S.L. Bhakat, M., Mohanty, T.K. Chaturvedi, K.K. Kumar, R.R., Gupta, A. and Kumar, S. (2024). Udder thermogram-based deep learning approach for mastitis detection in Murrah buffaloes. *Computers and Electronics in Agriculture* 220, 108906.	-	7.0
14	H.P. Yadav, T.K. Mohanty, R.K. Dewry, S.A. Lone, S. Nath, M. Bhakat, R.K. Baithalu, S. Tiwari, D.K. Swain, P. Kumar, A.K. Mohanty and T.K. Datta. 2024. Reduced sperm number of murrah (Bubalus bubalis) bull semen in French mini-straw affects kinetic and functional competence after cryopreservation. *Cryoletters,* 45(1): 36-40. -	-	7.0
15 -	Bhakat, R.K. Baithalu, S. Tiwari, D.K. Swain, P. Kumar, A.K. Mohanty and T.K. Datta. 2024. Reduced sperm number of murrah (Bubalus bubalis) bull semen in French mini-straw affects kinetic and functional competence after cryopreservation. *Cryoletters,* 45(1): 36-40.	-	7.0
16 -	Kumar, D., Mehta, J. S., Jerome, A., Kumar, P., Bhardwaj, S., Patil, C. S., Bala, R., Verma, N., Virmani, M., Sharma, R.K. & Singh, P. (2024). Cryopreservation alters buffalo sperm kinematics and mitochondrial parameters, acrosome and intra-cellular calcium status. *Cryoletters*, *45*(4), 257-268.	-	7.0
17 -	Kumar, D., Mehta, J. S., Andonissamy, J., Kumar, P., Kumar, D., Bhardwaj, S., Patil, C.S., Bala, R., Verma, N., Nain, S. & Singh, P. (2024). Effect of season, age and period on semen quality traits in buffalo bulls. *Acta Agriculturae Scandinavica, Section A-Animal Science*, *73*(3-4), 172-178.	-	6.8
18 -	Chandra, S., Kamboj, M.L., Singh, M., & Kumar, C. (2024). Productive and Reproductive Performance of Indigenous Milch Cows under Different Herd Structure of Gaushalas. *Indian Journal of Animal Research*, 5127:1-4.	-	6.4
19 -	Chopra, D., Sahu, S., Misra, A.K., Chharang, D. (2024). Behavioural changes of Murrah buffalo calves under various upbringing systems. *Indian Journal of Animal Sciences,* 94 (4): 381–385.	-	6.2
20 -	Gayathri, S.L. Bhakat, M., Mohanty, T.K (2024) Seasonal mastitis assessment in Holstein Friesian Crossbred cows using infrared thermography, *Italian Journal of Animal Science*, 23:1, 1574-1591.	-	6.2
21 -	Lal, G. S., Bhakat, M., Mohanty, T. K., & Sinha, C. (2024). A study on the assessment of milking machine teat cup liner size fitting in indigenous dairy animals. *Indian Journal of Dairy Science*, *77*(6).	-	6.2
22 -	Kumar, A., Lathwal, S.S., Devi, I., Tomar, D.S., Singh, P., Mamta, Singh, Y. (2024). Assessment of body conformation traits and their relationship with production performance of Sahiwal cows. *Indian Journal of Dairy Sciences*. 77 (5): 455–460.	-	6.2
23 -	Singh, N.P., Kamboj, M.L., Nishant Kumar, Sunil Dutt. 2024. Influence of calf-mother interaction on performance and behaviour of Murrah buffalo calves during heat stress. *Indian Journal of Dairy Science*. 77(4).	-	6.2
24 -	Sethi, M., Shah, N. Mohanty, T. K Bhakat, M. Yadav, D. K. Kumar, P., and Kumar N. (2024). Effect of Modified Freezing Diluent on Post Thaw Sperm Characteristics of Poor Freezable Sahiwal Bull. *Indian Journal of Veterinary Sciences & Biotechnology, 20 (3), 2024*	-	6.2
25 -	Elizabeth, J., Ponnusamy, K. and Kamboj, M.L. (2024) Efficiency of farm diversification in Haryana. *Journal of Community Mobilization*, 19(spl): 66-73.	-	5.02
26 -	Pandey, H., Kumar, N., Kumar, D., & Lathwal, S. S. (2024). Luteinizing Hormone Release in Kisspeptin treated Prepubertal Murrah Buffaloes. *Indian Journal of Animal Reproduction*, *45*(1).	-	4.13
27 -	Choudhary, S. Kamboj, M.L., Pawan Singh and Lathwal. S.S (2024). Behavioral time allocation in suckled buffaloes: Analysis of pre- and post-estrus periods. *Indian Journal of Animal Production Management* 40 (Special Issue): 50-57.	-	3.38

Livestock Production and Management			
Sl.No. -	Research Papers	Impact Factor	NAAS Rating
28 -	Kamboj, M. L., & Choudhary, S. Calf-Cow and Cow-Bull Stimulus; Effect on the Performance, Behaviour and Welfare of Indigenous Cattle and Buffaloes. *Behaviour and Welfare of Native Livestock Species*, *100*(3000.00), 32.	-	3.38
29 -	Kansal, K. and Misra, A.K. (2024). An insight into the challenges to welfare of small ruminants in India and their mitigation strategies. *Indian Journal of Animal production and Management*, 40: 95-106.	-	3.38
30 -	Sastry, N.S.R. and Kamboj, M.L. (2024). Research on behaviour of indigenous farm animals as a sine qua non for improving their productivity and welfare. *Indian Journal of Animal Production Management,* 40 (Special Issue): 1-11.	-	3.38
31 -	Sethi, M., & Kumar, N. Sexual Behaviour in Native Cattle and Buffalo Bulls and its Consequences for Welfare and Quality Semen Production. *Behaviour and Welfare of Native Livestock Species*, *100*(3000.00), 42.	-	3.38
32 -	Thakur, Ankaj, Kamboj, M.L., Vanita, B., Raza, M. and Dogra, P.K. (2024). Behaviour of migratory Gaddi Goats, their welfare issues and mitigation measures. *Indian Journal of Animal Production Management*, 40 (Special Issue): 107-115.	-	3.38
33 -	Tiwari, S., Lathwal, S.S., Devi, I., Tomar, D.S. (2024). Seasonal Prevalence of Major Mastitis Pathogens Isolated from Crossbred Cow Milk Samples in Sub-tropical India. *Indian Journal of Animal Production Management*, 40(3), 146-149.	-	3.38
34 -	Devi, I., Singh, N., Dudi, K., Ranjan, R., Lathwal, S.S., Tomar, D.S., Nagar, H. (2024). Deep learning aided computer vision system for automated linear type trait evaluation in dairy cows. *Smart Agricultural Technology* 8: 100509.	6.3	-
35 -	Gayathri, S.L. Bhakat, M., Mohanty, T.K (2024). Thermographic assessment of mastitis progression in sahiwal cattle: Insights into the patterns in the natural course of infection. *Microbial Pathogenesis* 196: 106964.	3.3	-
36 -	Gayathri, S.L. Bhakat, M., Mohanty, T.K (2024). Seasonal assessment of mastitis using thermogram analysis in Sahiwal cows. *Research in Veterinary Science,* 166: 105083.	-	-
37 -	Kalwani, D.S., Parsana, Y. and Misra, A.K. (2024). Finding the impact of WB 02 straw based diet on milk composition of Murrah Buffaloes. *International Journal of Veterinary Sciences and Animal Husbandry,* 9 (2): 307-309.	-	-
38 -	Kamboj, M. L., Kumar, N., Kumar, S., & Didel, S. Human-Animal Relationship: How Does it Affect Animal Performance and Welfare?. *Behaviour and Welfare of Native Livestock Species*, *100*(3000.00), 140.	-	-
39 -	Kumar, V., Joshi, M., Vats, A., Kumar, L.K., Verma, S.K., Neeraj, Baithalu, R.K., Veerappa, V.G. Singh, D., and Onteru, S.K. (2024). Mucin and salt combination simulate typical fern-like pattern of buffalo saliva smear at estrus. *Microscopy Research and Technique*, 87:1753–1765.	-	-
40 -	Rajput, A.S., Rafiq, M. M., Chouksey, S., Bhakat, M., and Mohanty, T.K. (2024). Infrared thermography an alternate supportive tool for Estrus detection in dairy animals: A review, *International Journal of Veterinary Sciences and Animal Husbandry* 2024; SP-9(1): 462-468.	-	-
41 -	Singh, N., Devi, I., Dudi, K., & Chouriya, A. (2024). Development of Attention-Enabled Multi-Scale Pyramid Network-Based Models for Body Part Segmentation of Dairy Cows. *Journal of Biosystems Engineering*, *49*(2), 186-201.	-	-
42 -	Singh, N.P. and Kamboj, M.L. 2024. Influence of Maternal Contact on Hormonal, Growth, and Behavioral Responses of Murrah Buffalo Calves in winter. *International Journal of Environment and Climate Change,* 13(11): 1635-1645.	-	-

Animal Nutrition			
Sl.No. -	Research Papers	Impact Factor	NAAS Rating
1 -	Varada, V.V., Kumar, S., Balaga, S., Thanippilly, A.J., Pushpadass, H.A., Rashmi, H.M., Jangir, B.L., Tyagi, N. and Samanta, A.K. (2024). Oral delivery of electrohydrodynamically encapsulated *Lactiplantibacillus plantarum* CRD7 modulates gut health, antioxidant activity, and cytokines-related inflammation and immunity in mice. *Food & Function*, *15*(21), 10761-10781.	5.1	11.1
2 -	Kumar, S., Pattanaik, A.K., Jadhav, S.E. and Jangir, BL. (2023). *Lactobacillus johnsonii* CPN23 vis-à-vis *Lactobacillus acidophilus* NCDC15 improves gut health, intestinal morphometry, and histology in weaned Wister rat. *Probiotics and Antimicrobial Proteins*, 16 (2): 474-489.	4.4	10.4
3 -	Gohar, V., Srivastava, R., Mishra, D., Chauhan, N., Kumar, S., Behare, P. V., and Tyagi, N. (2024). Xylanase and lactic acid bacteria mediated bioconversion of rice straw co-ensiled with pea waste and wet brewers' grains as potential livestock feed. *Biomass Conversion and Biorefinery*, 15(1), 671-686.	3.8	9.8

Animal Nutrition			
Sl.No. -	**Research Papers**	**Impact Factor**	**NAAS Rating**
4 -	Chauhan, N., Kumari, N., Mani, V., Pradhan, D., Gowane, G. R., Kumar, S., and Tyagi, N. (2024). Effects of *Lactiplantibacillus plantarum, Limosilactobacillus fermentum*, and propionic acid on the fermentation process of sugarcane tops silages along with variations in ph, yeast and mould count after aerobic exposure. *Waste and Biomass Valorization*, 15(4), 2215-2230.	2.6	9.2
5 -	Dahiphale, G.B., Das, A., Reddy, P.B., Kumar, S., Tyagi, N. and Tyagi, A.K. (2024). Beneficial effects of dietary supplementation of tropical seaweeds on rumen fermentation, antioxidant status, immunity and milk yield of lactating Murrah buffaloes. *Journal of Applied Phycology*, *36*(6), 3697-3715.	2.8	8.8
6 -	Chauhan, N., Kumar, S., Chauhan, T., & Samanta, A. K. (2024). Screening of lactic acid bacteria from the milk of Sahiwal cows and characterization of their probiotic potential for preventing bovine mastitis. *International Microbiology*, 1-26.	2.3	8.3
7 -	Naveen, P., Kour, H., Malik, R., Naliyapara, H., Gabbur, A., Rana, P. and Goyal, A. (2024). Influence of different taste feed additives on feed intake and growth performance in growing goats. *Flavour and Fragrance Journal*, 40, 1-5.	2.1	8.0
8 -	Datt, C., Chauhan, P., Thakuria, A., & Malik, R. (2024). Influence of Supplementary Nickel on Minerals Balance, Hematobiochemical Parameters, Antioxidant Activity, Plasma Minerals and Hormones Status in Murrah Buffalo Calves. *Agricultural Research*, 1-10.	-	7.0
9 -	Goyal, S., Sankhala, G., Datt, C., Meena B.S., Mondal, G., Maiti, S., Sendhil, R. and Rai, C. K. (2024). Impact of cation-based mineral supplement characteristics on dairy farmer's adoption: Insights from a field trial. *Indian Journal Animal Sciences*, 94 (8), 707-711.	0.2	6.2
10 -	Tamilselvan, G. and Tyagi, N. (2024). Life Cycle Assessment as an evaluation tool-A critical review on carbon footprint in dairy sector: Carbon footprint of milk. *Letters In Animal Biology*, 4(1), 10-16.	-	6.0
11 -	Saini A.K. and Singh, R. (2024). Managemental response of different housing and feeding systems on feed conversion efficiency (fce), physiological reactions and blood parameters in Murrah buffalo heifers. *International Journal of Education and Management Studies*, 14 (2), 240-244.	-	4.43

Agronomy			
Sl.No. -	**Research Papers**	**Impact Factor**	**NAAS Rating**
1 -	Garg, K., Dhar, S., Kumar, S., Azman, E. A., Sharma, V. K., Meena, R. P., Mohammad, H., Awasthi, M.K., Kumar, S., Onte, S. and Kumar, D., Giri, B.S. and Rajawat, M. V. S. (2024). Enhancing agricultural output: Investigating the impact of advanced organic formulations on crop productivity, nutrient use efficiency, and profitability in a multi-crop system. *Journal of Environmental Management*, 366, 121759.	8.9	14.9
2 -	Garg, K., Dhar, S., Sharma, V. K., Azman, E. A., Meena, R. P., Hashim, M., Kumar, D., Ali, G., Karunakaran, V., Kumar, Y., Athnere, S. & Kumar, S. (2024). Optimizing agricultural sustainability: enriched organic formulations for growth, yield, and soil quality in a multi-crop system. *Frontiers in Plant Science*, *15*, 1398083.	5.6	11.6
3 -	Garg, K., Dhar, S., Azman, E.A., Sharma, V.K., Meena, R.P., Hashim, M., Rajawat, M.V.S., Ali, G., Hindoriya, P.S., Kumar, Y., Athnere, S., Kumar, S., Om, H., Tuti, M.D., Kumar, B. and Kumar, S. (2024). Exploring the potential of enhanced organic formulations for boosting crop productivity, nutrient utilization efficiency, and profitability in baby corn-kabuli gram-vegetable cowpea cropping system. *Frontiers in Sustainable Food Systems* 8:1380279. -	4.5	10.5
4 -	Choudhary, M., Garg, K., Reddy, M.B., Meena, B.L., Mondal, B., Tuti, M.D., Kumar, S., Awasthi, M.K., Giri, B.S., Kumar, S., Rajawat, M.V.S. (2024). Unlocking growth potential: Synergistic potassium fertilization for enhanced yield, nutrient uptake, and energy fractions in Chinese cabbage. *Heliyon* 10(7).	4.0	10.0
5 -	Kushwah, M., Meena, B.L., Choudhary, M., Karunakaran, V., Kanwat, M., Rajawat, M.V.S., Tuti, M.D., Hashim, M., Chandrashekhar, S., Meena, V.K. and Kumar, S. (2024). Enhancing yield, mineral composition, and energy fractions through intercropping and nutrient management in oats and berseem. *Journal of the Saudi Society of Agricultural Sciences, 23*(7), 508-520.	4.0	10.0
6 -	Hindoriya P. S. Kumar R. Meena R. K. Ram H. Kumar A. Kashyap S. and Bhattacharjee S. (2024). The Impact of Integrated Nutrient Management on Trifolium alexandrinum Varietal Performance in the Indo-Gangetic Plains: A Comparative Yield and Economic Analysis. *Agronomy* 14(2), 339.	3.3	9.3

Agronomy			
Sl.No. -	Research Papers	Impact Factor	NAAS Rating
7 -	Kashyap S. Kumar R. Ram H. Kumar A. Basak, N. Sheoran, P. and Min D. (2023). Quantitative and qualitative response of fodder maize to use of bulk and nano-fertilizers in north western plains of India. *Agronomy* 13(7), 1889.	3.3	9.3
8 -	Bisworanjita B., Kumar, R., Kumar, A., Meena, R.K., Ram, H., Rai, A.K., Kashyap, S., Bhattacharjee, S., Das, R., Baral, K., Padhan, S.R., Rana, B. and Birbal (2024). Enhancing growth, yield and nutrient quality of fodder maize through foliar application of ortho-Silicic Acid. *Silicon* 16(2), 559-571.	2.8	8.8
9 -	Kumar, S., Singh, M., Kumar, S., and Rajeev. (2024). Changes in root nodules dynamics under mixed cropping with varying nutrient management of berseem crop and succeeding fodder cowpea. *Journal of Plant Nutrition*, 1–22.	2.28	8.28
10 -	Meena, R.K., Singh, Y.V., Shivay, Y.S., Kumar, D., Kumar, R., Ram, H. and Ram, M. (2023). Rice performance as influenced by crop establishment methods, green organic mulches and rates of nitrogen fertilization along with liquid Azotobacter chroococcum. *Journal of Plant Nutrition*, 46(3):401-422.	1.6	7.6
11 -	Yadav M. R. Singh M. Kumar R. Kumar D. Ram H. Meena R. K. and Makarana G. (2023). Productivity, quality, and land use efficiency of cereal-legume forages under monocropping and intercropping systems with integrated use of organic and inorganic nutrient sources. *Journal of Plant Nutrition* 46: 2231-2245.	1.6	7.6
12 -	Yadav M. R. Singh M. Kumar R. Kumar D. Ram H. Meena R. K. and Makarana G. (2023). Productivity, quality, and land use efficiency of cereal-legume forages under monocropping and intercropping systems with integrated use of organic and inorganic nutrient sources. *Journal of Plant Nutrition* 46: 2231-2245.	1.6	7.6
13 -	Youdol, T., Mishra, A. K., Raghuwanshi, M. S., Ram, H., Bhattacharjee, S., Apurva, A., & Saxena, A. (2024). Availability and seasonal dynamics of feed sources for Ladakhi cattle breed in the cold arid region of Ladakh and future scope under increasing growing degree days. *Biological Rhythm Research*, *55*(5-6), 310-323.	1.0	7.0
14 -	Biswal, B., Kashyap, S., Bhattacharjee, S., Kumar, R., Kumar, D., Ram, H., Meena, R.K., Birbal, Das, R. and Saxena, A. (2023). Scope of Horse Gram and Bambara Groundnut as Source of Food and Feed Legume: A Review. *Legume Research* 46(2): 127-133.	-	6.8
15 -	Hashim, M., Singh, K.K., Singh, R., Kumar, N., Deo, M.M., Chaudhary, S.K., Kumar, S., and Meena, V.K. (2024). Improving Productivity and Profitability of Chickpea (Cicer arietinum L.) Through Front Line Demonstrations in Bihar, India. *Legume Research- An international Journal,* 1:8.	0.8	6.8
16 -	Meena, R.K., Hindoriya, P.S., Kumar, R., Ram, H., Singh, M. and Kumar, D. (2023). Quality, productivity and profitability of diversified fodder-based cropping systems for year-round fodder production in Indo-Gangetic plains of India. *Range Management and Agroforestry*, 44(1): 152-159.	0.8	6.8
17 -	Singh, K., Ram, H., Kumar, R., Meena, R.K., Saxena, A. and Kumar, R. (2023). Yield and Seed Quality of Summer Green Gram as Influenced by Weed Management under Zero Tillage. *Legume Research*. 46(1): 69-74.	0.8	6.8
18 -	Kumar, R., Ram, H., Kumar, R., Meena, R.K., Meena, B.L., Manisha and Kumar, D. (2023). Proximate Composition and Fibre Fraction of Pearl Millet Fodder as Influenced by Different Nutrient Management Practices. *Indian Journal of Animal Research.* 57(3): 334-339.	-	6.4
19 -	Praveen, B.R., Singh, M., Chethan babu R.T., Kumar S., Naragund, R., Sachin, K.S., Pyati, P.S., Kumar, R., and Teli, K.G. (2024). Biostimulants based nutrient management on growth and yield of spring maize (*Zea mays*) under legume based cropping sequence. *Indian Journal of Agricultural Sciences* 94 (12): 1305–1310.	-	6.3
20 -	Mahanta, R., Meena, R., Kumar, R., Ram, H., Singh, M., Bhakar, A., Kumar, D. and Bhattacharjee, S., (2023). Proximate principles and dry matter digestibility of fodder maize and sugargraze in response to potassium management. *The Indian Journal of Animal Sciences*, 93(04): 384-388.	-	6.2
21 -	Glotra, A., Singh, M., Kumar, S., Jat, S.L., Kumar, S. (2023). Effect of nutrient management on the land equivalent ratio, yield of various quality parameters, economics of oats and Chinese cabbage in intercropping. *Agricultural Science Digest*, 5720:1-5.	-	5.52
22 -	Babu, R. T., Mavarkar, N. S., Praveen, B. R., Singh, M., & Dileep, R. (2023). Effect of water-soluble fertilizers and pgpr on soil microbial population, nodule count and economics of black gram. *Indian Journal of Ecology*, *50*(1), 95-98.	-	5.38
23 -	Pravalika, K.M., Yogananda, S.B., Fathima, P.S., Ananthakumar, M.A. and Kumar, S. (2024). Response of chia (*Salvia hispanica* L.) to spacing and organic nutrient levels under Southern dry zone of Karnataka. *International Journal of Research in Agronomy,* 7: 101-105. -	-	5.2

Agronomy			
Sl.No. -	**Research Papers**	**Impact Factor**	**NAAS Rating**
24 -	Singh, M., Das, A., Kumar, S., & Glotra, A. (2024). Quality and Yield Enhancement in Fodder Berseem through Zinc and Iron Fertilization. *Indian Journal of Animal Nutrition*, *41*(3), 432-438.	-	5.19
25 -	Singh, M., Meena, R. K., Mondal, G., Saxena, A., & Chauhan, N. (2024). Agronomic Biofortification of Fodder Crops to Enhance Livestock Nutrition: A Review. *Indian Journal of Animal Nutrition*, *41*(3), 370-384.	-	5.19
26 -	Singh, D. K., Chandra, S., Bhatnagar, A., Patel, S., Yaying, M., & Singh, M. (2024). Productivity and profitability of traditional scented rice (Oryza sativa l.) varieties under organic cultivation in north-west plains of India. *Journal of Cereal Research*, *16*(3).	-	5.05
27 -	Maneesha, Singh, M., Supriya, Praveen B.R., Chetan Babu R.T., Kumar, S., & Gunashekhar H. (2024). Performance of zinc and iron ferti-fortification on growth and yield of berseem. *Forage Research,* 50: 50-56. -	-	4.76
28 -	Singh, M., Kumar, R., Saxena, A., R.T., Chetan Babu, & Meena, R. K. (2024). Seaweed as Bio-Stimulant for advancing Crop Sustainability: A Review. *Journal of Indian Fisheries Association* 50 (4): 40-52.	-	3.92
29 -	Bagrecha, S., Meena, R.K., Saxena, A., Ram, H., Nithinkumar, K., Saikia, N., Fiskey V. V., Manjunath S.M. (2024). Dried Sewage Waste in Agriculture: Opportunities and Concerns from a Practical Viewpoint. *Indian Journal of Natural Sciences*, 15(86): 80433-80440.	-	-

Dairy Microbiology			
Sl.No. -	**Research Papers**	**Impact Factor**	**NAAS Rating**
1 -	Kumari, M., Dasriya, V. L., Ali, S. A., and Behare, P. V. (2024). Evaluation of antioxidant and anti-inflammatory properties of *Lacticaseibacillus rhamnosus* Ram12-derived exopolysaccharides in a D-galactose-induced liver injury mouse model. *International Journal of Biological Macromolecules*, 281(1):136241.	7.7	14.2
2 -	Chaudhary, V., Katyal, P., Kaur, J., Bhatia, S., Singh, S., Puniya, A. K., Raposo, A., Yoo, S., Han, H., Alturki, H. A., & Kumar, A. (2024). Bioactive activity and safety analysis of *Monascus* red biopigment. *Food Bioscience, 57*, 103523.	5.2	11.2
3 -	Vinchurkar, R. V., Parveen, H., Amarlapudi, M. R., Mallappa, R. H. & Pradhan, D. (2024). Phenotypic and genotypic characterization of antimicrobial resistance in Enterococcus species from dairy niches. *Food Bioscience*, *62*, 105186.	4.8	10.8
4 -	Nataraj, B. H., Ranveer, S. A., Jeevan, K., Nagpal, R. & Behare, P. V. (2024). Immune and microbiome modulatory effects of *Limosilactobacillus fermentum* NCDC 400 in an immuno-compromised mouse model. *Microbial Pathogenesis*, 196, 106927.	3.3	9.8
5 -	Basavaprabhu, H. N., Jeevan K, Dang, A. K., Nagpal, R., Ali, S. A. & Behare, P. V. (2024). Pre-clinical Safety and Toxicity Assessment of *Limosilactobacillus fermentum* NCDC 400 in Murine Model. *Microbial Pathogenesis.* 189:106589.	3.3	9.8
6 -	Modasiya, I., Mori, P., Maniya, H., Chauhan, M., Grover, C. R., Kumar, V., & Sarkar, A. K. (2024). In Vitro Screening of Bacterial Isolates From Dairy Products for Probiotic Properties and Other Health-Promoting Attributes. *Food Science & Nutrition*, *12*(12), 10756-10769.	3.553	9.553
7 -	Tigga, A., Mallappa, R. H., Muniyappa, S. K., Kadyan, S., Pradhan, D., Niharika, E. S. & Grover, S. (2024). 16S metagenomics and metabolomics unveil the microbial compositions and metabolite profiles in Dahi, a traditional Indian fermented milk product prepared by the backslopping method. *Journal of Food Science and Technology*, 1-14. -	2.6	8.6
8 -	Iram, D., Sansi, M. S., Meena, S., Puniya, A. K. & Vij, S. (2023). In vitro antimicrobial and synergistic effect of fermented Indian zebu (Sahiwal) cow colostrum whey derived peptides with *Lactobacillus rhamnosus* against pathogenic bacteria. *Journal of Food Science and Technology*, *60*(10), 2568-2580.	2.6	8.6
9 -	Pal, U., Pal, S. & Vij, S. (2023). *Kluyveromyces marxianus* MTCC 1389 Augments Multi-stress Tolerance After Adaptation to Ethanol Stress. *Indian Journal of Microbiology*, *63*(4), 483-493.	2.1	8.1
10 -	Iram, D., Sansi, M. S., Puniya, A. K., Gandhi, K., Meena, S., & Vij, S. (2024). Phenotypic and molecular characterization of clinically isolated antibiotics-resistant S. aureus (MRSA), E. coli (ESBL) and Acinetobacter 1379 bacterial strains. *Brazilian Journal of Microbiology*, *55*(3), 2293-2312.	2.1	8.1
11 -	Kumar, N., Talwar, N., Sharma, R., Raghu, H. V., Goel, P., & Singh, N. A. (2024). Comparative study of QuEChERS methods for monitoring pesticides in milk using GC-MS/MS. *Current Science (00113891)*, *127*(5).	1.1	7.1

Dairy Microbiology

Sl.No. -	Research Papers	Impact Factor	NAAS Rating
12 -	Iram, D., Sansi, M. S., Puniya, A. K., Meena, S. & Vij, S. (2023). Draft genome sequence of methicillin-resistant Staphylococcus aureus strain D1418m22 isolated from human wound pus. *Microbiology Resource Announcements*, *12*(11), e00409-23.	0.7	6.7
13 -	Majumder, R., Himanshu. Kumari, M., Hussain, S. A. and Behare, P. V. (2024). Screening of sugar tolerant fast-growing lactic acid bacteria for preparation of Misti dahi. *Indian Journal of Dairy Science,* 77(1): 1-9.	-	5.24
14 -	Kumar, N., Dua, K., Goel, P., Sandhu, P., Jaswal, A., Shekhawat, A., Kalyan, P., Kaur, G. & Vishweswaraiah, R. (2024). Prevalence of mastitis, antibiotic residues, and antibiotic resistant pathogens in dairy animals: Prevalence of mastitis in dairy animals. *Indian Journal of Dairy Science*, 77(2).	-	5.24

Dairy Chemistry

Sl.No. -	Research Papers	Impact Factor	NAAS Rating
1 -	Sen, C., Arora, S., Singh, R., Sharma, V., Meena, G. S., & Singh, A. K. (2024). Reduction of maillard browning in spray dried low-lactose milk powders due to protein polysaccharide interactions. *Food Research International*, *183*, 114175.	7.0	13.0
2 -	Singh P., Arora S., Kathuria D., Singh R., Rao P. S. & Sharma V. (2024). Developing low lactose milk powder: A multi- enzyme approach to reduce Maillard browning. *Innovative Food Science and Emerging technologies***.** 98: 103849.	6.3	12.3
3 -	Saji, R., Gandhi, K., Sharma, R. & Raghu, H.V. (2024). Detection of meloxicam residues in milk using ATR-FTIR spectroscopy coupled with chemometrics. *Food Control, 163*, 110491.	5.6	11.6
4 -	Ramani, A., Seth, R., Gandhi, K., Sharma, R. & Saji, R. (2024). Development and validation of a HPLC-UV method for the quantification of major phospholipids in milk. *Journal of Food Composition and Analysis, 134*, 106552.	4.0	10.0
5 -	Gautam, P. B., Sharma, R., Atbhaiya, Y., Gandhi, K. & Mann, B. (2024). Thermosonication: A technique to inactivate the plasmin system in milk. *International Dairy Journal*, 105997.	3.1	9.1
6 -	Deshmukh, U., Arora, S., Kathuria, D., Singh, A. K., Sharma, V., & Singh, R. (2024). Influence of calcium depletion and addition on heat stability, buffering capacity, partitioning of minerals and iron binding properties of buffalo milk. *International Dairy Journal*, *149*, 105828.	3.1	9.1
7 -	Kumar, R.N., Mounika, P., Rao, P. S., Singh, R., Arora, S. & Sharma, V. (2024). Development of a thin layer chromatography-based method to detect sorbitol presence in milk and its applicability in formalin preserved milk samples. *Journal of Food Science and Technology*, *61(5)*, 870-878.	2.6	9.1
8 -	Saji, R., Gandhi, K., Sharma, R., Bajaj, R., Mann, B. & Ramani, A. (2024). Detection of flunixin residues in milk using ATR-FTIR spectroscopy coupled with chemometrics. *Journal of Food Measurement and Characterization*, 1-11.	3.4	8.9
9 -	Sayyad, F., Gandhi, K., Sharma, R., Amrutha, T.M., Gautam, Priyae B. & Harshitha, C.G. (2024). Development and validation of paper-based strip method for the detection of formalin in milk. *Journal of Food Science and Technology*, *61*(12), 2367-2376.	3.7	8.6
10 -	Harshitha, C.G., Singh, R., Sharma, R. & Gandhi, K. (2024). Fate of aflatoxin M1 in milk during various processing treatments. *International Journal of Dairy Technology, 77*(4), 1250-1255.	3.7	8.6
11 -	Sandhu, R., Mann, B., Sharma, R., & Bajaj, R. K. (2024). Identification and Molecular Docking of ACE Inhibitory Peptides Derived from Sodium Substituted Cheddar Cheese. *International Journal of Peptide Research and Therapeutics*, *30*(6), 59.	2.0	8.0
12 -	Sonvanshi, V., Gandhi, K., Ramani, A., Sharma, R., & Seth, R. (2024). ATR-FTIR coupled with chemometric techniques to detect vanaspati ghee (hydrogenated vegetable oil) adulteration in milk fat. *Results in Chemistry*, *7*, 101343.	0.9	6.2
13 -	Taherabbas S., Ramani A., Seth R., Gandhi K., Sharma R. & Mann B. (2024). Physico-chemical characteristics of butter prepared from the milk of selected indigenous and crossbred cows. *Indian Journal of Dairy Science*, 77(6), 1-7.	0.9	6.2

Dairy Technology

Sl.No. -	Research Papers	Impact Factor	NAAS Rating
1 -	Rehman, H., Saipriya, K., Singh, A. K., Singh, R., Meena, G. S., Khetra, Y. & Sharma, H. (2024). A metabolomics approach to establish the relationship between the techno-functional properties and metabolome of Indian goat yoghurt. *Foods*, 13(6), 913.	3.7	10.7
2 -	Thomas, E., Panjagari, N. R., Ganguly, S., Deepika, S., Kapila, S. & Singh, A. K. (2024). Development and Validation of Flaxseed Lignan-Enriched Set-Type Fermented Milk to Manage Postmenopausal Osteoporosis. *Fermentation*, 10, 72.	3.3	9.3
3 -	Roy, S., Hussain, S. A., Prasad, W. G. & Khetra, Y. (2024). Effect of kappa-carrageenan inclusion in the stabilizer blend on rheology, texture, and physical properties of high protein ice cream. *International Dairy Journal*, 159: 106052.	3.1	9.1
4 -	Sharma, H., Simngh, A.K., Rao, P.S., Deshwal, G.K., Singh, R. and Kumar, D.M. (2024). A study on incorporation of giloy (Tinospora cordifolia) for the development of shelf-stable goat milk based functional beverage. *Journal of Food Science and Technology*. 61 (3): 503-515.	2.4	8.4
5 -	Karpurapu, U., Panjagari, N. R., Raman, R. K., Singh, A. K., Sharma, L. C., Ganguly, S., Sharma, R. & Sharma, V. (2024). Headspace volatile markers of Sandesh, a chhana-based delicacy stored at elevated temperatures: Headspace volatile markers of Sandesh stored at elevated temperatures. *Indian Journal of Dairy Science*, 77(2): 97-109.	0.2	6.2
6 -	Thomas, E., Ritika & Panjagari, N.R. (2024). Effect of Njavara rice bran on physico-chemical, sensory, and textural properties of sweetened yoghurt. *Indian Journal of Dairy Science*, 77(6): 506-514.	0.2	6.2
7 -	Pratiksha N, Khamrui, K. and Prasad, W. (2024). Physicochemical, microbial, and sensory properties of 'in-package' fermented lassi. *Indian Journal of Animal Health*, (2024), 63(2)-Special Issue: 221- 225.	-	5.59

Dairy Engineering

Sl.No. -	Research Papers	Impact Factor	NAAS Rating
1 -	Kumari, K., Chakraborty, S. K., Kishore, A. & Chitranayak. (2024). Development of a parallel plate capacitive sensor-based system for assessing the quality of Paneer (Indian cottage cheese). *Journal of Food Process Engineering*. 47 (1), e14515.	3.0	9.0
2 -	John, H., Giri, S. K., Subeesh, A., Chandra, P. & Pandiselvam, R. (2024). Optimization of Process Parameters for the Production of Soy Protein by Ultrafiltration Using ANN. *Journal of Food Processing and Preservation*. 2024 (1), 5535413.	2.5	8.5
3 -	Sharanabasava, Chitranayak, Abhinash, P., Rafiq, S.M., Minz, P.S., John, H., Ramniwas, S., Obaid, S.A., Ansari, M.J., Mugabi, R. & Nayik, G.A. (2024). Innovative approaches to controlled yogurt fermentation using integrated solar PCM systems, *CyTA-Journal of Food*, 22:1, 2362690.	2.1	8.1
4 -	Ray, A., Minz, P. S. & Sinha, C. (2024). Framework for Accurate Estimation of Freezing Time and Convective Heat Transfer Coefficient for Freezing of Food product in Domestic Refrigerator: A Numerical and Simulation Modeling approach. *Multiscale and Multidisciplinary Modeling, Experiments and Design*. 7, 5481–5498.	1.9	7.9
5 -	Naskar, B., John, H., Barnwal, P., Puniya, A. K., Sharma, R & Juneja, A. K. (2024). Influence of Magnetic Induction Power on Physico-Chemical and Microbial Quality of Milk. *Journal of Scientific & Industrial Research*. 83, 343-349.	0.6	6.6
6 -	Lal G.S., Bhakat, M., Mohanty, T. K. & Sinha, C. (2024). A study on the assessment of milking machine teat cup liner size fitting in indigenous dairy animals. *Indian Journal of Dairy Science*, 77(6), 534-541.	0.2	6.2
7 -	Sain, M., Minz, P. S., Ray, A. & Shaikh, A. (2024). Exploring the impact of varying fat content on milk properties during ohmic heating: A PCA study of viscosity changes alongside pH fluctuations. *Asian Journal of Dairy and Food Research. 43*(2), 196-203.	-	5.44
8	Rohit, H K., Chitranayak, Minz, P. S., Dabas, J. K. & Ray, A. (2024). Characterization of multi-component antifreeze liquids for sub-zero cooling applications: Antifreeze liquids for sub-zero cooling applications. *Journal of AgriSearch,* 15(2). 180-185. -	-	4.95
9 -	John, H., Sain, M., Mansuri, S. M., Ray, A., Banasree, N. & Sinha, L. K. (2024). Optimization and comparison of drying methods of ultrafiltered soy protein solution using response surface methodology. *Annals of Arid Zone*. 63(4), 61-70.	-	4.86

Dairy Engineering			
Sl.No. -	Research Papers	Impact Factor	NAAS Rating
10 -	Vekariya, Y. K., Deep, A., Kathiriya, M., Rajashekhar, T. (2024). Impact of Raw Milk Quality on Dairy Products & Payment Systems. *Asian Research Journal of Agriculture.* 17 (2), 116-122.	-	4.86
11 -	Vekariya, Y. K., Deep, A., Kathiriya, M., Rajashekhar, T. (2024). Performance Evaluation of On-farm Raw Milk Cooling System. *Asian Journal of Current Research.* 9 (2), 81-90.	-	4.86
12 -	Vekariya, Y. K., Deep, A., Kathiriya, M., Rajashekhar, T., Rathwa, R. (2024). Impact of Heat Treatment on Consistency Coefficient of Dairy Cream. *Advances in Research on Teaching,* 25(3), 91-96.	-	4.76

Dairy Economics, Statistics & Management			
Sl.No. -	Research Papers	Impact Factor	NAAS Rating
1 -	Maniruzzaman, M., Sarangi, S.K., Mainuddin, M., Biswas, J.C., Bell, R.W., Hossain, M.B., Paul, P.L.C., Kabir, M.J., Digar, S., Mandal, S., Maji, B., Burman, D., Mandal, U.K and Mahanta, K.K. (2024). A novel system for boosting land productivity and income of smallholder farmers by intercropping vegetables in waterlogged paddy fields in the coastal zone of the Ganges Delta, *Land Use Policy,* 139, 107066,. -	6.0	12.0
2 -	Dixit, A. K., Sirohi, S., Ravishankar, K. M., Cariappa, A. A., Kumar, S., Bhandari, G., Sharma, A.K. & Thakur, A. (2024). Understating emerging value chains and business performance: evidence from dairy industry in India. *Journal of Agribusiness in Developing and Emerging Economies*, 14(3), 607-621. -	2.4	8.4
3 -	Mondal, I., Bhandari, G., Sen, B. & Chaudhary, U. (2024). Level of Awareness and Willingness to Pay for Safe Milk: A Study of Urban Consumers in North India. *Agricultural Research*, 1-7.	1.4	7.4
4 -	Velmurugan, A., Swarnam, T.P., Burman, D., Mandal, S., Subramani, T. (2024), Climate smart land management methods for enhancing the adaptive capacity of food production system in the tropical region, *Current Science*, 126(6):676-685.	1.0	7.0
5 -	Haritha, K., Bhandari, Gunjan & Sendhil, R. (2024). Effect of COVID-19 Pandemic on the Economics of Milk Production in Kerala. *Indian Journal of Economics and Development*, 20(1): 11-19.	0.2	6.2
6 -	Patowary, S., Malhotra, R. and Chaudhary, U. (2024). Resource Use Efficiency in Milk Production in Different Dairy-Integrated Farming Systems in Terai Region of West Bengal. *Indian Journal of Dairy Science*. 77(6): 554-559.	0.2	6.2
7 -	Konda, R. R., Kundu, A. S. & Chaudhary, U. Economic analysis of costs and returns of milk production in Andhra Pradesh. *Indian Journal of Dairy Science*, 77(4).	0.2	6.2
8 -	Konda, R. R., Kundu, A. S. & Chaudhary, U. Economic analysis of costs and returns of milk production in Andhra Pradesh. *Indian Journal of Dairy Science*, 77(4).	0.2	6.2
9 -	Barman, S., Malhotra, R., Chaudhary, U., Sen, B. and Mondal, I. (2024). A Comparative Economic Analysis of the Identified Integrated Farming Systems in the Coastal West Bengal. *Journal of the Indian Society of Coastal Agricultural Research*, 42(2).	-	5.45
10 -	Sarangi, S.K., Mainuddin, M., Bell, R.W., Digar, S., Mahanta, K.K., Burman, D., Mandal, U.K. and Mandal, S. (2024). Low-cost pitcher irrigation system with paddy straw mulching for growing vegetables in coastal saline soils, *Journal of Indian Society of Coastal Agricultural Research,* 41(2):165-174.	-	5.45
11 -	Das, A., Shivaswamy, G.P., Bhandari, G., Subash, S., Devi, M.C.A., Dixit, A.K. and Sivaram, M. (2024). Economic Effect of COVID-19 Pandemic on Member and Nonmember Farmers of Dairy Cooperative Societies in West Bengal State, India. *Asian Journal of Dairy and Food Research,* 10.	-	5.44
12 -	Mohapatra, S., Malhotra, R., Dixit, A.K., Choudhary, U. & Bhandari, Gunjan (2024). Modelling food loss and waste management strategies in the agri-food supply chains in India using analytical hierarchy process. *Agricultural Economics Research Review*. 36: 19-31.	-	5.44
13 -	Dhasarathan M., Mandal S., Sen B., and Singh A., (2024). Consumption of functional dairy foods in northern Tamil Nadu: Pattern and Key drivers. *Agricultural Economics Research review*, 37(2), 213-226.	-	5.15
14 -	Brahma, S., Sen, B., Chaudhary, U., Maiti, S., Ganguly, S. and Verma, A. (2024). Multivariate Analysis of Consumption Pattern of Milk and Milk Products vis-à-vis Food Items Across Different Income Groups in Kamrup District of Assam. *Biological Forum – An International Journal*, 16(11): 75-80.	-	4.96

Dairy Economics, Statistics & Management			
Sl.No. -	**Research Papers**	**Impact Factor**	**NAAS Rating**
15 -	Ray, P. & Singh, A. (2023). Dynamics of Dairy Farming in North-East India: Fostering Growth in the Land of Diversity. *Asian Journal of Agricultural Extension, Economics & Sociology*, 41(10), 856-862.	-	4.73
16 -	Brahma, S., Sen, B., Chaudhary, U., Maiti, S., Ganguly, S. and Verma, A. (2024). "Consumption of Milk and Other Dairy Products As Influenced by Dietary Habits of Vegetarians and Non-Vegetarians in Kamrup District of Assam, India: A Study". *Asian Journal of Agricultural Extension, Economics & Sociology,* 42 (12):114-24.	-	4.73
17 -	Dhasarathan, M., Singh, A., Sen, B. (2024). Beyond Borders: Unravelling the Business Landscape of India and China from 2019 to 2023. *Journal of Investment, Banking and Finance*, 2(1), 01-12.	-	-
18 -	Kumar, A., Sen, B. and Saroj, S. (2024). Impact of dairy cooperatives on milk productivity: Evidence from rural Bihar. *Economic and Political Weekly,* 59(13).	-	-

Dairy Extension			
Sl.No. -	**Research Papers**	**Impact Factor**	**NAAS Rating**
1 -	Manjunath, K. V., Maiti, S., Garai, S., Reddy, D. A., Bhakat, M., Aggarwal, A., & Mondal, G. (2024). Impact of temperature humidity index-based climate services for Murrah buffaloes of India on operational decision-making and economic outcome of the farm. *Climate Services, 36*, 100522.	4.0	10.0
2 -	Maiti, S., Garai, S., Bhakat, M., & Kadian, K. S. (2024). Vulnerability to climate change among the Changpa pastoral nomads of Leh-Ladakh. *Range Management and Agroforestry, 45*(1), 184–187.	0.8	6.8
3 -	Meena, D.C., Meena, B.S., Garai, S., and Sankhala, G. (2024) Participatory validation of the ethno-veterinary practices followed by the livestock farmers in the vicinity of Ranthambore Tiger Reserve, India. *Indian Journal of Traditional Knowledge*, 23(11), 1085-1093.	0.7	6.7
4 -	Abrar, P. N. F., Maiti, S., Jha, S. K., Garai, S., Bhakat, M., Dixit, A. K., Roy, S. K., Kademani, S. B., Ranjan, A., Kujur, S., Quader, S. W., Madhulatha, C., Priyanka, B. N., Gosh, B., & Barman, B. (2024). Farmers' satisfaction with climate-resilient agriculture technologies in the coastal low-lying region of Kerala. *AMA, Agricultural Mechanization in Asia, Africa and Latin America, 55*(9), 18701-18707.	0.4	6.4
5 -	Manjunath, K. V., Maiti, S., Garai, S., Reddy, D. A. K., Sahani, S., Panja, A., & Jha, S. K. (2024). Impact of climate services on the operational decision and economic outcome of wheat (*Triticum aestivum*) and rice (*Oryza sativa*) cultivation in Haryana. *Indian Journal of Agricultural Sciences, 94*(3-S1), 116–123.	0.3	6.3
6 -	Haldar, A., Maiti, S., Goswami, R., Mandal, S. N., Shee, A., Goswami, B., Mahato, D., Ghorai, D., Pal, K., Khan, M., Samanta, M. K., Das, M. K., Gupta, M. D., Dey, M., Barma, P., Chatterjee, P., Mukherjee, R. D., Roy, R., Das, S., Ghosh, S., Das, U., Roy, K., Das, A., Mukherjee, S., Roy, S. K., & Dey, P. (2024). Driving factors for developing integrated farming: Multi-criteria decision-making analysis. *Indian Journal of Agricultural Sciences, 94*(3-S1), 49–55.	0.3	6.3
7 -	Reddy, D. A., Garai, S., Maiti, S., & Manjunath, K. V. (2024). Analysing the impact of climate change on dairy farming as perceived by the women farmers: Application of analytical hierarchy process. *Indian Journal of Animal Sciences, 94*(8), 712–716.	0.2	6.2
8 -	Goyal, S., Sankhala, G., Datt, C., Meena, B. S., Mondal, G., Maiti, S., Sendhil, R., & Rai, C. K. (2024). Impact of cation-based mineral supplement characteristics on dairy farmer's adoption: Insights from a field trial. *Indian Journal of Animal Sciences, 94*(8), 707–711.	0.2	6.2
9 -	Das, A., Raju, R., Malhotra, R., Singh, A., Maiti, S., Kumar, R., & Patnaik, N. M. (2024). Economics of livestock-based farming systems in saline and normal areas of West Bengal: A comparative analysis. *Indian Journal of Dairy Science, 77*(2), 162-170.	0.2	6.2
10 -	Manjunath, K. V., Reddy, D. A. K., Garai, S., Meena, H. R., Kumar, R., Bhakat, M., Mondal, G., Aggarwal, A., & Maiti, S. (2024). Impact of climate services on the operational decision of Murrah buffalo farmers in Haryana. *Indian Journal of Dairy Science, 77*(2), 179-184.	0.2	6.2
11 -	Pabba, A. S. and Ponnusamy, K. (2024) Evolving strategies for improving the performance of farmer producer companies through field studies. *Indian Journal of Animal Sciences*, 94(8): 725-730.	0.2	6.2
12 -	Bijla, S., Birthal, P. S., Malhotra, R., Dixit, A. K., Sankhala, G., Singh, P., & Maiti, S. (2023). Livestock and transitional poverty in rural India. *Agricultural Economics Research Review, 36*(2), 155-168.	-	5.15

Dairy Extension			
Sl.No. -	Research Papers	Impact Factor	NAAS Rating
13 -	Manjunath, K., Maiti, S., Garai, S., Reddy, D.A., Meena, H., Bhakat, M., & Mondal, G. (2024). Perceived effects of climate change on crop-livestock farming system in the murrah buffalo breeding tracts of Haryana. *Journal of Community Mobilization and Sustainable Development*, 19 (spl), 225-232.	-	5.02
14 -	Ali, W., Garai, S., Maiti, S., Lepcha, C. Y., Meena, D. C., & Roy, S. (2024). Attitude and knowledge of Belahi cattle rearers for improved dairy farming practices in Haryana. *Indian Journal of Extension Education, 60*(4), 131-135.	-	5.02
15 -	Manjusree, R. V., Maiti, S., Garai, S., Manjunath, K. V., Jha, S. K., & Kadian, K. S. (2023). Farmers' feedback associated with accessibility and usability of agromet advisory services disseminated in Thiruvananthapuram district. *Journal of Community Mobilization and Sustainable Development, 18*(4), 1229-1233.	-	5.02
16 -	Niranjan, D. A., Jha, S. K., Dominic, D. M., Maiti, S., & Kadian, K. S. (2023). Constraints associated with geographical indication usage: Experts and producers' perspective. *Indian Journal of Extension Education, 59*(2), 128-131.	-	5.02
17 -	Yadav, P., Maiti, S., Jha, S. K., Meena, H. R., Bhakat, M., & Dixit, A. K. (2024). The discrepancy between climate change perception and adoption levels: Limit the use of climate-smart technology in agriculture. *Journal of Community Mobilization and Sustainable Development, 19*(3), 562-568.	-	5.02
18 -	Madhavan, M. M., Sankhala, G., Maiti, S., Smitha, S., & Chandrakumar, A. (2024). Risk perception and perceived effects on environment vis-à-vis dairy animal waste management in NCR, India. *Indian Journal of Extension Education, 60*(2), 61-65.	-	5.02
19 -	Saurav, S. K., Chandran, V., Chakravarty, R., Ponnusamy, K., Meena, B.S., Malhotra, R. and Bhakat, M. (2024) Perceived constraints and benefits of dairy farming practices in northern Bihar: A garrett ranking analysis, *Journal of Community Mobilization and Sustainable Development,* 12(2): 287-293.	-	5.02
20 -	Jose, E., Ponnusamy, K., Kamboj, M.L. (2024) Efficiency of farm diversification in Haryana, *Journal of Community Mobilization and Sustainable Development,* 19(spl): 66-73.	-	5.02
21 -	Saurav, S.K., Chakravarty, R., Chandran, V., Sinha, S., Ponnusamy, K., Meena, B.S. (2024) Assessment of the productive and reproductive performance of cattle and buffalo in northern Bihar: A quantitative analysis. *Journal of Community Mobilization and Sustainable Development,* 19(spl): 32-39.	-	5.02
22 -	Reddy, D. A., Garai, S., Veldandi, A., Maiti, S., & Meena, B. S. (2024). Exploring the determinants of higher level of adoption of climate-resilient dairy farming practices. *Indian Research Journal of Extension Education, 24*(3), 111-119.	-	4.99

Southern Research Station, Bengaluru			
Sl.No. -	Research Papers	Impact Factor	NAAS Rating
1 -	Ohja, A., Seethu, B.G., Heartwin A. Pushpadass, Magdaline Eljeeva Emerald Franklin, Chand Ram Grover, Sachin Kumar, and Arindam Dhali. (2024). Encapsulation of Lactiplantibacillus plantarum CRD7 in sub-micron pullulan fibres by spray drying: Maximizing viability with prebiotic and thermal protectants." *International Journal of Biological Macromolecules* 269, 132068.	7.7	13.7
2 -	Prakash, R., Menon R. R., Battula, S.N. & Sivaram, M. (2024) Chilling of the agitated milk using nano-enhanced phase change materials, Journal of Food Engineering, 366, 111852.	5.3	11.0
3 -	Raghavendra, K. J., Kumara, T. M., Gowda, C., Kandpal, A., Bhat, S., Amrutha, T., Shivaswamy, G. P., Nithyashree, M. L. & Ravisankar, N. A. (2024). A meta-analysis on economic performance of organic vis-à-vis conventional farming in India. *Clean Technologies and Environmental Policy*, 1-12.	4.2	10.2
4 -	Khatri, N., Raghavendra, K. J., Prusty, A.K., Ansari, A., Kumar, S., Singh, R., Shamim, M., Punia, P., Kashyap, P., Shivaswamy, G. P. & Dutta, D. (2024). Unravelling determinants of integrated farming Systems adoption for sustainable livelihood and dietary diversity. *Frontiers in Nutrition*, 11, 1264658.	4.0	10.0
5 -	Meena, P., Kataktalware, M.A., Praveen, S., Patoliya, P., Ravindra, M.R., Jeyakumar, S., Sivaram, M., Chauhan, M., Ramesha, K.P., Devi, L.G. and Dhali, A., (2024). Sustainable transformation of recycled manure solids: effects of lime and neem oil-based bedding conditioners on physicochemical and microbial properties. *Biomass Conversion and Biorefinery*, 1-14.	4.0	10.0

Southern Research Station, Bengaluru			
Sl.No. -	Research Papers	Impact Factor	NAAS Rating
6 -	Nataraj, B.H., Nayakvadi, S., Dhali, A., Shome, R., Prakash, K. and Revanasiddappa, S.T., 2024. Evaluation of virulence determinants and cell surface properties associated with biofilm formation in methicillin-resistant Staphylococcus aureus (MRSA) and extended spectrum beta-lactamase (ESBL) Escherichia coli from livestock and poultry origin. *Microbial Pathogenesis*, *195*, p.106905.	3.3	9.8
7 -	Nataraj, B.H., Ramesh, C. and Mallappa, R.H., 2024. Probiotic and postbiotic interference exhibit anti-adhesion effects against clinical methicillin-resistant Staphylococcus aureus (MRSA) and impede MRSA-induced intestinal epithelial hyper-permeability in HT-29 cell line. *Microbial Pathogenesis*, 107215.	3.3	9.8
8 -	Nataraj, B.H., Ranveer, S.A., Jeevan, K., Nagpal, R. and Behare, P.V., 2024. Immune and microbiome modulatory effects of Limosilactobacillus fermentum NCDC 400 in an immunocompromised mouse model. *Microbial Pathogenesis*, *196*, 106927.	3.3	9.8
9 -	Kumar, C.M., Supreetha, S. Kumar M.H.S., Rao, P.S. & Rao, K.J. (2024). Assessing the production of galactooligosaccharides in batch and continuous mode by using β-galactosidase immobilised on mesoporous silicon dioxide nanoparticles. International Journal of Food Science & Technology, 59(2), 939-949.	3.3	9.3
10 -	Batra, V., Dagar, K., Diwakar, M. P., Kumaresan, A., Kumar, R. & Datta, T. K. (2024). The proteomic landscape of sperm surface deciphers its maturational and functional aspects in buffalo. *Frontiers in Physiology*, 15, 1413817.	3.2	9.2
11 -	Kumar, K. N., Veerappa, V. G., Kumaresan, A., Lavanya, M., King, J. E. S., Sulochana, M., Patil S. & Jeyakumar, S. (2024). Localization and expression analysis of sperm-specific glyceraldehyde 3-phosphate dehydrogenase in bull spermatozoa with contrasting sperm motility. Andrology. https://doi.org/10.1111/andr.13810. -	3.2	9.2
12 -	Kumar, C.M., Supreetha, S. Kumar M.H.S., Naik L.N. & Rao, K.J. (2024). Preparation of nano-immobilised β-galactosidase using mesoporous silicon dioxide nanoparticles and its efficiency in production of galactooligosaccharides. International Dairy Journal, 150, 105847.	3.1	9.1
13 -	Kumaresan, A., Yadav, P., Sinha, M.K., Nag, P., John Peter, E.S.K., Mishra, J.S. and Kumar, S. (2024). Male infertility and Perfluoroalkyl and poly-fluoroalkyl substances: Evidence for alterations in phosphorylation of proteins and fertility-related functional attributes in bull spermatozoa. *Biology of Reproduction*, *111*(3), 723-739.	3.1	9.1
14 -	Shivanna, S. K, Naik, L. N & Rao, P. S. (2024). Enhancing nutritional, textural, and bio-functional properties of yoghurt through fortification with Moringa oleifera: a comprehensive investigation. *Journal of Food Measurement and Characterization*, *18*(10), 8289-8304.	2.9	8.9
15 -	Shivanna, S. K, Laxmana Naik & Rao, P. S. (2024). Impact of drying techniques on the composition, physicochemical attributes, antioxidant capacity, antidiabetic potential, and ACE inhibition properties of Moringa oleifera pod pulp powder. *South African Journal of Botany*, *165*, 405-416.	2.7	8.7
16 -	Patoliya, P., Kataktalware, M. A., Raval, K., Devi G, L., Sivaram, M., Praveen, S., Meena, P., Jeyakumar, S., Mech, A. & Ramesha, K. P. (2024). Assessing lameness prevalence and associated risk factors in crossbred dairy cows across diverse management environments. *BMC Veterinary Research*, 20(1), 1-12.	2.6	8.6
17 -	Rajunaik, B., Franklin, M. E. E., Seethu, B. G., Pushpadass, H. A., Battula, S. N., & Naik, N. L. (2024). Fabrication and characterization of electrospun catechins-loaded nanofibres for fortification of milk. *Journal of Food Science and Technology*, *61*(4), 798-811.	2.6	8.6
18 -	Tigga, A., Mallappa, R. H., Muniyappa, S. K., Kadyan, S., Pradhan, D., Niharika, E. S., & Grover, S. (2024). 16S metagenomics and metabolomics unveil the microbial compositions and metabolite profiles in Dahi, a traditional Indian fermented milk product prepared by the backslopping method. *Journal of Food Science and Technology*, 1–14.	2.6	8.6
19 -	Datir, R. P., Menon Rekha Ravindra, M. Manjunatha, Monika Sharma (2024) Optimizing quality and mixing performance of processed cheese spread using a mechanical universal disperser International Journal Dairy Technology, 77 (1) 224-233.	2.5	8.5
20 -	Sonarthi, H., Kumar MH, S., Rajani, C. S., Sharma, A., Kumaresan, A. &Sabikhi, L. (2024). Production of DPP-IV inhibitory peptides-rich beta casein hydrolysates from milk of Gir (*Bos indicus*) cow and their evaluation for potential antidiabetic effect through in vitro assay. *International Journal of Dairy Technology*, *77*(1), 94-104.	2.5	8.5

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Sl.No. -	Research Papers	Impact Factor	NAAS Rating
21 -	Raval, K., Kumaresan, A., Sinha, M.K., Elango, K., King, J.P.E.S., Nag, P., Paul, N., Thalluri, T.R. and Patil, S. (2024). Sperm proteomic landscape is altered in breeding bulls with greater sperm DNA fragmentation index. *Theriogenology*. 216: 82-92.	2.4	8.4
22 -	Shaji, A., Kumaresan, A., Sinha, M.K., Nag, P., Patil, S., Jeyakumar, S., Gowdar Veerappa, V., Manimaran, A. and Ramesha, K. (2024). Identification of potential differences in salivary proteomic profiles between estrus and diestrus stage of estrous cycle in dairy cows. *Systems Biology in Reproductive Medicine*, 70(1), 204-217.	2.1	8.1
23 -	Ali, M., Gautam, D., Deepika, S., Meena, A. S., Chera, J. & De, S. (2022). The genetic variations in CSN2 gene of Indian sheep breeds affect its protein stability and function. *Small Ruminant Research*, 207, 106612.	1.893	7.89
24 -	Birwal Preeti, Menon Rekha Ravindra, M Sivaram, Deshmukh P Gajanan, Azad Mandeep Singh (2024). Effect of pulsed electric field treated on quality of curd. Food Science and Technology International, 30 (8), 731-740.	1.8	7.8
25 -	Praveen, S., Kataktalware, M.A., Lavanya, M., Abhijeet, S., Chinnusamy, D., Jeyakumar, S., Ravindra, M.R., Devi, G.L. and Ramesha, K.P. (2024). Enhancing hoof health and locomotion in crossbred dairy cows: impact of recycled manure solids bedding on lameness incidence and gait kinematics. *Tropical Animal Health and Production*, *56*(7), 242.	1.7	7.7
26 -	Paul, N., Kumaresan, A., Talluri, T.R., Raval, K., Elango, K., Pradeep Nag, B.S., Duraisamy, R. and Manimaran, A., (2024). Lectin Functionalised Iron Magnetic Nanoparticle-Based Sperm Selection: A Potential Technique to Improve Bull Sperm Quality In Vitro. *Reproduction in Domestic Animals*, 59(10), 14733.	1.8	7.6
27 -	Patoliya, P., Kataktalware, M., Sivaram, M., Jeyakumar, S., Mech, A., Manimaran, A. & RAMESHA, K. (2024). Meta-analysis of prevalence and associated risk factors for lameness in dairy cattle across tropical Asian nations. *Animal Production Science,* 64(3):23335.	1.4	7.4
28 -	Talluri, T. R., Kumaresan, A., Paul, N., Elango, K., Raval, K., Nag, P., Legha, RA & Pal, Y. (2024). Heterologous Seminal Plasma Reduces the Intracellular Calcium and Sperm Viability of Cryopreserved Stallion Spermatozoa. *Biopreservation and Biobanking* 22(1): 82-87.	1.2	7.2
29 -	Kumar, P., Kataktalware, M. A., Jeyakumar, S., Kumaresan, A., Das, D. N., Devi, G. L. & Ramesha, K. P. (2024). Seasonal variation in sexual behaviour of Deoni (*Bos indicus*) bulls. *Indian Journal of Animal Research*, 58(6), 1073-1076.	0.5	6.5
30 -	Nath, S., Nitai Das, D., Kumar Illa, S., Kumar Nagaleekar, A. & Revanasiddu, D. (2024). Identification of single nucleotide variations in the AGPAT6 gene and its association with milk production traits in Murrah buffalo. *Veterinarski Arhiv*, 94(6), 449-462.	0.5	6.5
31 -	Krishnegowda, R., Sharma, M., Menon R. R. & Jose, N. (2024). Development of process protocol to enhance the phospholipid content of ghee residue. Indian Journal of Dairy Science,77(6).	0.2	6.2
32 -	Munshi, S. A., Das, A., Shivaswamy, G. P., Devi, M. C. A., Subash, S., Jeyakumar, S. & Sivaram, M. (2024). Socio-economic impact of COVID-19 pandemic on dairy farm households in West Bengal state. *Indian Journal of Animal Sciences*, 94, 130041. -	0.2	6.2
33 -	Heartwin, A. S., Franklin, M. E. E., Kanagaraj, M., Sakthivel, J., Kataktalware, M. A., Muniandy, S., & Kerekoppa, R. P. (2024). Development of convolutional neural network models for evaluation of body condition scores of Holstein Friesian crossbred cows. *Indian Journal of Dairy Science, 77*(3), 1–7.	0.2	6.2
34 -	Nath, S., Das, D. N., Illa, S. K., Mundhe, U. T., Divya, P., Kumar, M., & Chandra, S. (2024). Genetic variations in the MAPK15 gene and their relationship with milk production characteristics in Murrah buffalo. *Exploratory Animal Medical Research, 14*(2): 316-324.	0.1	6.1
35 -	Das, A., Shivaswamy, G.P., Bhandari, G., Subash, S., Devi, M.C.A., Dixit, A.K. & Sivaram, M. (2024). Economic Effect of COVID-19 Pandemic on Member and Non-member farmers of Dairy Cooperative Societies in West Bengal State, India. *Asian Journal of Dairy and Food Research*, 2146.	-	5.44
36 -	Reddy, G., Subash, S. & Devi, M C. A. (2024). Challenges Hindering Agri-Startups in Telangana: Tackling Key Constraints. *Gujarat Journal of Extension Education*. 38(2): 189-194.	-	5.30
37 -	Sinha, M.K., Kumaresan A., Patil, S. and Aranganathan, V. (2024). Crossbred Bull Fertility Prediction Using a Transcriptome based SNP Methodology. *Indian Journal of Veterinary Sciences & Biotechnology*, 20(1), 97-101.	-	5.25

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Sl.No. -	Research Papers	Impact Factor	NAAS Rating
38 -	Gadapa, S., Battula, S. N., Pushpadass, H. A., Naik, L. N., & Emerald, M. E. Optimization of Green Tea Catechin Loaded Niosomes by Thin Film Hydration Technique using Food Grade Surfactants. *Journal of Scientific Research and Reports.* 30(10):177-187.	-	5.17
39 -	Kumar, H. V., Anuja, A. R., Shivaswamy, G. P., Lama, A., Rajesh, T. & Singh, K. N., (2024). Determinants of Formal Agricultural Credit Flow to Districts in India: An Econometric Analysis. *Journal of Scientific Research and Reports*, 30, 22688.	-	5.17
40 -	Sharanabasava, S., Menon, R. R., Nagaratna, Praveen Kumar Y. S., Mahesh, G., Manjunatha, M. & Shivanand. (2024). Exploring Thermal Dynamics of Gulabjamun Balls under - Hypobaric Conditions. European Journal of Nutrition & Food Safety, 16 (2), 102 -108. -	-	5.14
41 -	Aneesha, K., Subash, S., Devi, M. C. A. & Sivaram, M. (2024). Profile characteristics of agri-startups in Andhra Pradesh State. *Journal of Community Mobilization and Sustainable Development*. 19(Special Issue), March 2024, 154-161.	-	5.02
42 -	Pavithra, V, Subash, Somasekaran & Devi, M C. A (2024). Exploring Agri-Startups in Bengaluru: Sector Insights and Entrepreneurial Profiles. *Gujarat Journal of Extension Education*. 38, 163-170.	-	5.02
43 -	Thakor, H. P., Verma, A., Elango, K., Vedamurthy, G. V., Manimaran, A., Jeyakumar, S., & Kumaresan, A. (2024). Effect of different concentrations of hydrogen peroxide on indigenous bull sperm motility. *International Journal of Veterinary Sciences and Animal Husbandry,* 9(2): 881-884.	-	4.61
44 -	Praveen, S., Kataktalware, M. A., Meena, P., Lavanya, M., Patoliya, P., Jeyakumar, S., Ravindra MR, Chauhan M, Ramesha KP, Devi GL, Kastelic J.P. & Dhali, A. (2024). A combination of calcium hydroxide and sodium hydrosulphate controls pathogens causing environmental mastitis in recycled manure solids. Bioresources and Bioprocessing, 11(1), 95.	4.3	-
45 -	Mukheshkumar, G. H., Heartwin A. Pushpadass, F. Magdaline Eljeeva Emerald, Saurabh Shankar Patel, and K. Manimala. (2024). Heat Transfer Characteristics of Cryogenically Frozen Kulfi (A Dairy Dessert). *Journal of Agricultural Engineering (India)* 61(5).	2.4	-
46 -	Pasagadi, A. S., Franklin M.E.E., Pandiyaraj, K.N. Ramalakshmi A. and Heartwin A. P. (2024). Atmospheric cold plasma treatment of whey: Insights into microbiological quality and structural characteristics of whey proteins. *IEEE Transactions of Plasma Science*, 52(7):2570-2578.	1.3	-
47 -	Kumar, A., Sathish Kumar, M.H., Champalli, S.R., Sabikhi, L. and Harshita, S. (2024). Inhibition of dipeptidyl peptidase-IV by hydrolysates of beta-lactoglobulin isolated from Gir cow milk. *Food Chemistry Advances,* 5, 100842.	-	-
48 -	Ramya H R, M.C.A. Devi & S. Subash (2024). Stakeholder Linkages Analysis in Integrated Farming System for Technology Reach in Select Agro-Climatic Zones of Karnataka. Indian Research Journal of Extension Education, 24(4), 73-83.	-	-
49 -	Rani, R., Sabikhi, L., & MH, S. K. (2024). Storage stability, nutritional profiling and consumer acceptability of a milk-sorghum-based breakfast smoothie. *Sustainable Food Technology*, *2*(3), 729-740.	-	-
50 -	Veeresh, H. B., and Srinivas Bandla. (2024). PUFA supplements to improve diarrhoea, faecal consistency, and disease resilience in neonatal and preweaning calves. *Journal of Research in Veterinary Sciences,* 2(1), 1-1.	-	-

Eastern Regional Station, Kalyani			
Sl.No. -	Research Papers	Impact Factor	NAAS Rating
1 -	Yadav, S.K., Dutta, T.K., Chatterjee, A., Dutta S, Mohammad A & Das A.K. (2024). Environmental contamination of arsenic: pathway analysis through water-soil-feed-livestock in Nadia District (India) and potential human health risk. *Environmental Science and Pollution Research* 31, 57832–57855.	5.8	11.8
2 -	Bhagat, J., Dutta, T. K., Chatterjee, A., Yadav, S. K., Mohammad, A., & Rai, S. (2024). Conch shell (*Turbinella pyrum*) powder: A potential marine biological source of calcium and some trace minerals for growing crossbred calves. *Biological Trace Element Research, 202*, 5465–5478.	3.9	9.9
3 -	Lalhriatpuii, M., Chatterjee, A., Das, A. K., Dutta, T. K., & Patra, A. K. (2024). Influence of dietary supplementation of inorganic and organic chromium on body conformation, carcass traits, and nutrient composition in muscle and internal organs of Black Bengal goats. *Biological Trace Element Research, 202*, 2062–2074.	3.9	9.9

Eastern Regional Station, Kalyani			
Sl.No. -	Research Papers	Impact Factor	NAAS Rating
4 -	Lalhriatpuii, M., Chatterjee, A., Dutta, T. K., Mohammad, A., & Patra, A. K. (2024). The effects of dietary inorganic and organic chromium supplementation on blood metabolites, hormones, and mineral composition of blood and internal organs in Black Bengal goats. *Biological Trace Element Research, 202*, 2547–2563.	3.9	9.9
5 -	Gayari I, Rahman M, Lalhmingmawii S and Mandal A. (2024). Elucidating the effect of heat stress on milk production and composition in Jersey crossbred cows using test day records integrated with NASA POWER satellite data. *International Journal of Biometeorology*, 68: 2641-2651.	3.0	9.2
6 -	Roy, I., Rahman, M., Karunakaran, M., Gayari, I., Baneh, H. and Mandal, A. (2024). Genetic relationships between reproductive and production traits in Jersey crossbred cattle. *Gene*, 894:147982.	2.6	8.6
7 -	Mandal, A., Gayari, I., Baneh, H. and Notter, D. R. (2024). Genetic analysis of body weight and growth curve parameters in Muzaffarnagari sheep of India. *Journal of Animal Breeding and Genetics*, 141:425–439.	1.9	7.9
8 -	Dutta, T.K., Tripathi, P., Chatterjee, A., Mohammad, A. and Das, A.K., (2024). Effect of feeding Bengal gram residual forage-based pelleted total mixed ration on growth performance, nutrient availability, carcass traits and composition in finisher Barbari kids. *Tropical Animal Health and Production*, 56: 124.	1.7	7.7
9 -	Vangchhia N, Gayari I, Rahman M, Lalhmingmawii S, Bhakat C, Baneh H, Mandal A. (2024). Direct and maternal genetic parameters for growth traits in Jersey crossbred cattle. *The Journal of Agricultural Science*, 162, 173–180.	1.7	7.7
10 -	Vangchhia N, Gayari I, Roy, I., Lalhmingmawii S, Baneh H and Mandal A. (2024). Bayesian approach to estimate variance components and genetic parameters of average daily gains and Kleiber ratios in crossbred cattle. *Tropical Animal Health and Production*, 56:302.	1.7	7.7
11 -	Mandal, D. K., Kumar, M. & Tyagi, S. (2024). Evaluation of predictive ability of linear type gonadal traits on reproductive capacity of breeding dairy bulls. *Reproduction in Domestic Animals*, 59(6): e14641.	1.6	7.6
12 -	Das, A., Mandal, D.K., Debbarma, A., Karunakaran, M., Dutta, T.K., Santra, A. and Singh, B. (2024). Effect of thermo-insulated kid barrel on behavioral, physiological responses, and morphometric growth performance of winter-born Black Bengal goat kids during pre- and post-weaning periods. *Journal of Applied Animal Welfare Science*, 1–20.	1.4	7.4
13 -	Das, A., Mandal, D.K., Debbarma, A., Karunakaran, M., Dutta, T.K., Santra, A. and Singh, B. (2024). Effect of thermo-insulated kid barrel on behavioral, physiological responses, and morphometric growth performance of winter-born Black Bengal goat kids during pre- and post-weaning periods. *Journal of Applied Animal Welfare Science*, 1–20.	1.4	7.4
14 -	Bera, S., Pramanik, A., Menda, R., Shah, V., Prasad, S., Santra, A., Rai, S. and Das, S.K. (2024). Effect of Different Growth Factors on in vitro Developmental Competence and Quality of Cattle Oocytes. *Indian Journal of Animal Research*, 5269: 1-5.	0.5	6.50
15 -	Santra, A., Jamadar, P., Taku, T., Tripura, S., Mandal, D. K. and Das, S. K. (2024). *Ficus hookeri* tree leaves as herbal feed additives to enhance ruminal fermentation and reduced protozoal population in growing crossbred cattle. *Indian Journal of Animal Sciences,* 94 (4): 355–361.	-	6.40
16 -	Tripathi, P., Tripathi, M.K., Dutta, T.K., Kumar, R., Yadav, S.K. & Chaudhary, U.B., 2024b. Nutritional evaluation of cowpea, mung bean and cluster bean fodders in Barbari male adult goats. *The Indian Journal of Animal Sciences*, 94, 987–994.	-	6.32
17 -	Prajapati, B. K., Singh, K. P., Rout, P. K., Roy, R., Roy, I.and Mandal, A. (2024). Elucidating the associations of polymorphism of growth hormone gene with milk production traits in Jamunapari goats of India. *Indian Journal of Dairy Sciences*, 77(4): 387-391.	0.2	6.20
18 -	Debbarma A, Mandal D K, Das A, Tripura S, Sarkar D and Swain S K. (2024). Evaluation of Rearing System on Body Condition Score and Mortality Rate of Black Bengal Goats. *Journal of Scientific Research and Reports,* 30(5): 889-893.	-	5.71
19 -	Lalmuansangi, Behera, R., Roy, I., Lalhmingmawii, S., Rahman, M. and Mandal, A. (2024). Climate Resilient Livestock Production in the Coastal Ecosystem of India. *Journal of the Indian Society of Coastal Agricultural Research*, 42(2):141495.	-	5.45
20 -	Rajendar, M., Shah, V., Bera, S., & Das, S. K. (2024). Oocyte isolation techniques from the ovary samples of slaughtered animals: A review. *International Journal of Advanced Biochemistry Research, 8*(6), 340–344.	-	5.29

Eastern Regional Station, Kalyani			
Sl.No. -	Research Papers	Impact Factor	NAAS Rating
20 -	Sheikh, S. A., Rai, S., Das, A., Rava, P. C., BedSingh, Jogi, J., & Yadav, A. K. (2024). Reduction in microbial load from the preputial cavity of Black Bengal bucks after washing with potassium permanganate solution. *International Journal of Advanced Biochemistry Research, 8*(7), 35.	-	5.29
22 -	Vijay, L., Mohammad, A., Chatterjee, A., Lepcha, C. Y. & Girish, C. E. (2024). Exploring the adaptation strategies to meteorological disasters followed by dairy farmers of Indian Sundarbans. *International Journal of Environment and Climate Change*, 14(8), 383–389.	-	5.16
23 -	Das A, Mandal D K, Debbarma A and Singh B. (2024). Effect of thermo-insulated kid hutch on huddling behaviour, health and faecal worm in Black Bengal kids born during winter. *Indian Journal of Small Ruminants* 30 (1): 57-62.	-	5.11
24 -	Barman, B., Mohammad, A., Kisku, U., Girish, C. E. & Sruthi, C. O. (2024). Exploring the factors influencing occupational choices of rural Rajbanshi youth from dairy farm families. *Journal of Community Mobilization and Sustainable Development*, 19(spl), 74–79.	-	5.02
25 -	Barman, B., Mohammad, A., Kisku, U. and Lepcha, C. Y. (2024). Exploring Dairy Farming Practices and Perceived Constraints: A Study of Rajbanshi Farmers in Coochbehar. *Indian Research Journal of Extension Education*, 24(1), 44-52.	-	4.99
26 -	Barman, B., Mohammad, A., Girish, C. E., Kisku, U., Lepcha, C. Y. & Shruthi, C. O. (2024). Breeding and healthcare practices followed by the rajbanshi dairy farmers in coochbehar district of West Bengal. *Environment and Ecology*, 42(1), 130–134.	-	4.87
27 -	Gayari, I., Lalhmingmawii, S. and Mandal, A. (2024). Heat stress on dairy cattle: Insights into its impact on animal productivity. *The Indian Journal of Animal Genetics and Breeding*, 43 (1, 2), 118-124.	-	2.00
28 -	Sani, M. ., Bora, B., Mezhatsu, V., Ozukum, S. ., Refinetti, R. ., Baruah, K. . & Mondal, M. 2024. Circadian-Time Dependence of Plasma Non-Esterified Fatty Acid, Glucose, and α-Amino Nitrogen Variations in Mithun (*Bos Frontalis*) Cows. *Nigerian Journal of Animal Production*, 740–743.	-	-

Review Articles -

1) Biswal, P., Lathwal, S. S., Baithalu, R. K., & Bisht, D. (2024). Oxidative stress indicators during peripartum uterine infection of buffaloes: A review. *Buffalo Bulletin, 43*(4).

2) Datt, C., Dutt, S., Choudhary, S., Didel, S., Singh, P., & Gaikwad, S. (2024). Harnessing natural ingestive behaviours of dairy animals for improving their productivity and welfare. *Indian Journal of Animal Production and Management, 40*, 68–75.

3) Devi, I., Tomar, D. S., Dudi, K., Lathwal, S. S., & Singh, P. (2024). Bovine milk vs plant-based beverages: Nutrient composition and fortification. *Current Science, 126*(7), 765–773.

4) Gupta, M., Vaidya, M., Kumar, S., Singh, G., Osei-Amponsah, R., & Chauhan, S. S. (2024). Heat stress: A major threat to ruminant reproduction and mitigating strategies. *International Journal of Biometeorology. (NAAS: 9.00)*

5) Kishore, A., S, M. A., Kumar, P., Singh, A., Kumari, K., & Kumar, N. (2024). Innovative packaging strategies for freshness and safety of food products: A review. *Packaging Technology and Science, 37*(5), 399–427. *(NAAS: 8.6)*

6) Nair, P. M., Sivaprasad, M. S., Rahman, A. T. F., Chaudhary, P., Arulkumar, S., Mani, V., & Mondal, G. (2024). Major metabolic diseases in dairy animals, nutritional aspects and treatment–A review. *Indian Journal of Animal Health, 63*(2), 194–206.

7) Pandey, D., Kamboj, M. L., & Mukherjee, S. (2024). Deciphering genetic determinants of behavioral traits in indigenous cattle: A review. *Indian Journal of Animal Production Management, 40*(Special Issue), 86–94. *(NAAS: 3.38)*

8) Pandey, D., Kamboj, M. L., & Mukherjee, S. (2024). Unravelling maternal behaviour in cattle for improved farming practices: A review. *Indian Journal of Animal Production Management, 40*(Special Issue), 76–81. *(NAAS: 3.38)*

9) Panja, A., Garai, S., Maiti, S., et al. (2024). Climate adaptation in agricultural sector of coastal India: A comprehensive exploration of adaptation strategies. *Mitigation and Adaptation Strategies for Global Change, 29*, 92.

10) Ramani, A., Taherabbas, S., Saji, R., Bumbadiya, M., Gandhi, K., & Seth, R. (2024). Nanotechnology: An emerging trend in the dairy industry-Applications and future challenges. *Food and Humanity*.

11) Rout, P., Sharma, V., & Arora, S. (2024). Stereospecific distribution pattern of fatty acids in triglycerides: A comparative review of human, bovine, bubaline, caprine, and equine milk fat. *Indian Journal of Dairy Science, 77*(4), 291–302.

12) Sain, M., Minz, P. S., John, H., & Singh, A. (2024). Effect of ohmic heating on food products: An in-depth review approach associated with quality attributes. *Journal of Food Processing and Preservation, 2025937. (NAAS: 8.5)*

13) Saji, R., Ramani, A., Gandhi, K., Seth, R., & Sharma, R. (2024). Application of FTIR spectroscopy in dairy products: A systematic review. *Food and Humanity*.

14) Sethi, M., Mohanty, T. K., Shah, N., Bhakat, M., Kumar, N., & Baithalu, R. K. (2024). Understanding the crucial role of seminal plasma exosomes in bull fertility: A review. *Reproduction in Domestic Animals, 59*, e70000.

15) Singh, O., Sahu, N., Tyagi, A. K., & Kumar, S. (2024). Application of nutrigenomics and metagenomics in livestock. *The Indian Journal of Animal Genetics and Breeding*.

16) Singh, S. V., & Ukey, A. (2024). Climate change trends and their impacts on bovine productivity: Precision livestock farming for sustainable development goals and one health. *Indian Journal of Animal Health, 62*(2, Special Issue), 20–30. *(NAAS: 5.59)*

17) Singh, S. V., Ukey, A., & Vaidya, M. (2024). Indicators of ecosystem services under livestock-based farming systems. *Journal of Agricultural Physics, 24*(Special Issue), S70–S81.

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Training Compendium

1) Chitranayak, Minz, P. S., Kumari, K., John, H., Priyanka & Kumar, S. (2024) Advances in instruments, sensors and automation for dairy and food processing, In: Training manual entitled "Hands on Training programme in Dairy Engineering" (Eds. Deep, A., Kumari, K., Barnwal, P. and Chitranayak), 56-67.

2) Chitranayak, Minz, P. S., Kumari, K., John, H., Deep, A. & Priyanka (2024) Application of Microwave processing for dairy and food products, In: Training manual entitled "Hands on Training programme in Dairy Engineering" (Eds. Deep, A., Kumari, K., Barnwal, P. and Chitranayak), 68-74.

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7) Dhali, A. Sathish Kumar M. H. and Rao P.S. (2024). Hands-on-training on production and characterization of milk-derived bioactive compounds using advanced instruments. ISBN: 978-81-970997-6-2

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Policy/Technical/Working Papers

1) Mandal, S., Kumar, S., Singh, J., Jain, R. & Kandpal, A. (2024). Economic Impact of Salt-Tolerant Mustard Varieties. Policy Brief, ICAR – National Institute of Agricultural Economics and Policy Research. New Delhi. ISBN/ISSN: ICAR-NIAP Policy Brief 56.

Institute Publications/ Technical Bulletin / Training Manuals/ Compendia

1) Aggarwal, A., Maiti, S., & Garai, S. (2024). *Heat stress on dairy animals: Impact, measurement index and coping mechanism*. ICAR-National Dairy Research Institute, Karnal, Haryana, India. ISBN: 978-81-970997-5-5. Total pages: 32.

3) Deep, A., Barnwal, P., & John, H. (2024). *Training manual on "Hands-on Training Programme in Dairy Engineering"*. ICAR-National Dairy Research Institute, Karnal, Haryana, India.

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5) Kumaresan, A., Manimaran, A., & Vedamurthy, G. V. (2024). *Training manual on application of flow cytometry in semen analysis conducted during 18–20 November, 2024 at SRS, ICAR-NDRI*. ICAR-National Dairy Research Institute, Southern Regional Station, Bengaluru, Karnataka, India.

6) Mandal, D. K., Dutta, T. K., Banik, S., Rai, S., Santra, A., Chatterjee, A., Karunakaran, M., & Das, S. K. (2024). *Technical Folder on Duck Farming: A Profitable Business for Farmers* ICAR-National Dairy Research Institute, Karnal, Haryana-132001, India. Pages: 1–4.

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13. TRAINING AND CAPACITY BUILDING

Human Resource Management (HRM) unit has been established at ICAR-NDRI for effective coordination and implementation of training programmes in accordance with the Govt. of India National Training Policy 2012 based on the tenet competency-based training for all. The training plan of ICAR-NDRI addressed the gap between the existing and the required competencies and provides opportunities to the employees to develop their competencies.

(A) Deputations Abroad

S. No.	Name & Designation	Title	Duration
1.	Dr. Anupama Mukherjee	International training on "Livestock Genetic Improvement Programme" at International Livestock Research Institute, Nairobi, Kenya	February 19-24, 2024
2.	Dr. Gopal R. Gowane	Sabbatical leave to work as Post Doc with Dr. Ignacy Mitszal on genomic selection aspect (Methods) at University of Georgia (GA) Athens, (USA)	March 25, 2025 to September 30, 2024
3.	Dr. Narender Raju Panjagari	Attended the 17th International Hydrocolloids Conference and present an oral paper at The Riddet Institute, Massey University, New Zealand	November 12- 15, 2024

(B) Trainings/ Conferences

Scientific Staff

The following faculty members of ICAR-NDRI various conferences/seminars/Training and other events across the country.

S. No.	Employee Name and Designation	Title	Duration
1.	Dr. T.K. Dutta, Principal Scientist	86th Foundation Day, Farmers' Day and Seminar at ICAR-National Institute of Natural Fibre Engineering Technology, Tallygunj, Kolkata	January 4, 2024
2.	Dr. S. Banik, Principal Scientist; Dr. A. Mandal, Principal Scientist	ational Symposium on "Role of Anti-Microbial Resistance (AMR) in N Veterinary & Animal Sciences with a special reference to Poultry industry" at WBUAFS, Kolkata	January 10-11, 2024
3.	Dr. Sachin Kumar, Scientist Dr. A. Manimaran, Principal Scientist	Animal Nutrition Conference "Sustainable Animal Nutrition for global health and production: Innovations and Directions" at Tamil Nadu Veterinary and Animal Sciences University, Chennai	January 23-25, 2024
4.	Dr. Diwas Pardhan, Scientist	To present an oral talk at the International Conference on advances in Biological Sciences for Sustainable Development at Central University of Jammu & Kashmir	February 1-2, 2024
5.	Dr. Nishant Kumar, Sr. Scientist	24th - Indian Veterinary Congress & 31st Annual Conference of IAAVR and National at LUVAS, Hisar	February 7-8, 2024
6.	Dr. Sohan Vir Singh, Principal Scientist	Presented the lead lecture during International conference on "Climate change and Agro ecosystem: threats, opportunities and solution" Banaras Hindu University, Varanasi (U.P.)	February 8-10, 2024
7.	Dr. Sohan Vir Singh, Principal Scientist Dr. Sanjit Maiti, Sr. Scientist Dr. Sanchita Garai, Sr. Scientist Dr. Subhasis Mandal, Principal Scientist	Conference entitled "International Salinity Conference on "Rejuvenating salt affected Ecologies for land degradation neutrality under changing climate" at CSSRI, Karnal	February 14-16, 2024

S. No.	Employee Name and Designation	Title	Duration
8.	Dr. Anupama Mukherjee, Principal Scientist Dr. Vikas Vohra, Principal Scientist	National Symposium and XXI Annual Convention of Society at Gannavaram (AP)	February 15-16, 2024
9.	Dr. Nitin Tyagi, Principal Scientist	New Horizons of Animal Nutrition Research: Combating the Challenges of Productivity, Health and Welfare of Animals at DUVASU, Mathura	February 16-18, 2024
10.	Dr. T. K. Mohanty, Principal Scientist	Indo Canadian Bi-National Agri Cluster Workshop-2024 at Tamil Nadu Agricultural University, Coimbatore	February 22-23, 2024
11.	Dr. A. Manimaran, Principal Scientist Dr. Indu Devi, Scientist	National Conference & 30th annual convention of Indian Society of Animal Production and Management 2024 at Madras Veterinary College Chennai, Tamil Nadu	February 22-24, 2024
12.	Dr. Rajani Kumar Paul, Sr. Scientist	4th Annual Convention of Animal Physiologists Association and National through Online Mode at CSWRI, Avika Nagar	March 1-2, 2024
13.	Dr. A. Mandal, Principal Scientist, Dr. Sohan Vir Singh, Principal Scientist Dr. P.N. Raju, Sr. Scientist Dr. Naresh Selokar, Scientist	Attended the 50th Dairy Industry Conference at HITEX Exhibition Centre Hyderabad	March 4-6, 2024
14.	Sh. Biswajit Sen, Scientist	Winter School Training on " Quantitative Techniques for Agricultural Policy Analysis" at ICAR-NIAP, New Delhi	March 8-28, 2024
15.	Dr. Rajiv Kapila, Principal Scientist	Workshop to present the progress of work under SERB funded project entitled at BHU, Varanasi	March 14-15, 2024
16.	Dr. A. Chatterjee, Principal Scientist	Inter-country Knowledge Sharing Webinar on the "Biosafety targets"	March 22, 2024
17.	Dr. T.K. Dutta, Principal Scientist	Foundation Day Programme of KVK-Addl, ERS of ICAR-NDRI, Kalyani chaired by Dr. Himanshu Pathak, DG, ICAR and Secretary DARE, GoI	March 31, 2024
18.	Dr. T.K. Dutta, Principal Scientist	Online Seminar on "Viksit Bharat" chaired by Dr. Himansu Pathak, DG, ICAR and Secretary, DARE, GoI	April 16, 2024
19.	Dr. Sumit Arora, Principal Scientist	To deliver lectures in the one day workshop entitled "Recent Advances in tools and techniques for food quality and safety" ONLINE at University of Horticultural Sciences Bagalkot.	April 16, 2024
20.	Dr. Rajan Sharma, Principal Scientist Dr. Raghu H.V., Sr. Scientist	Conference "The FIRST IDF Regional Dairy Conference Asia Pacific 2024" at Kochi, Kerala	June 26-28, 2024
21.	Dr. M. Karunakaran, Principal Scientist	National Steering Committee (NSC) of "National programme on Electronics and ICT Applications in Agriculture and Environment (AgriEnIcs)", at ICAR-NDRI-ERS, Kalyani	June 12, 2024
22.	Dr. Basavaprabhu H.N., Scientist, Dairy Microbiology SRS, Bangalore	National training programme under IDP-NAHEP Project at IIT, BHU, Varanasi	July 1-15, 2024
23.	Dr. Shaik Abdul Hussain, Scientist	Training program on "Building Successful Incubation Ecosystem" at ICAR-NAARM Hyderabad	July 3-5, 2024
24.	Dr. Rashmi H.M., Sr. Scientist	National Training programme at National Centre for Biological Sciences, Tata Institute of Fundamental Research, GKVK, Bellary Road, Bengaluru	July 4, 2024 to August 2, 2024
25.	Dr. Sonu K.S., Scientist	National Training programme at IIT Madras, Chennai	July 4, 2024 to August 2, 2024
26.	Dr. M. Karunakaran, Principal Scientist	Meeting of Regional Advisory Group -NABARD, West Bengal, held at NABARD Bhawan, Kolkata	July 10, 2024
27.	Dr. Rajan Sharma, Principal Scientist	ICAR Foundation Day & Technology Meet, New Delhi	July 15-16, 2024
28.	Dr. S. Subhash, Sr. Scientist	Attended the workshop and participate in 'Dairy Entrepreneurship Curriculum Workshop' at Coimbatore	July 16-17, 2024

S. No.	Employee Name and Designation	Title	Duration
29.	Dr. Bharati Pandey, Scientist	National training programme at Department of Computer Science at Delhi University, Delhi	July 30, 2024 to August 19, 2024 -
30.	Dr. Sumit Arora, Principal Scientist Dr. Vivek Sharma, Principal Scientist; Dr. A. Santra, Principal Scientist	Workshop on Application of artificial intelligence and machine learning in dairy and food industry under IDP-NAHEP NDRI, Karnal -	July 31, 2024 -
31.	Dr. A. K. Dixit, Principal Scientist Dr. Udita Chaudhary, Sr. Scientist Dr. Gunjan Bhandari, Scientist	32nd International Conference of Agricultural Economists (ICAE) at NASC complex, New Delhi -	August 2-7, 2024 -
32.	Dr. P. Barnwal, Principal Scientist Dr. A. K. Sharma, Principal Scientist Er. Ankit Deep, Scientist	Training Programme on Python Organized by ICAR-IASRI, New Delhi through (online mode.)	August 2-8, 2024 -
33.	Dr. Sonu, Scientist	Training programme on Laboratory Quality Management System and International Audit in accordance with IS/ISO/IEC17025-2017 at NITS, Noida, UP	August 9, 2024
34.	Dr. A. Kumaresan, National Fellow	XXIX Annual Convention of ISVIB and National Conference of Madras Veterinary College, Chennai	August 7-9, 2024 -
35.	Dr. Bharati Pandey, Scientist	Attended the 8th National Youth Convention and also present the research work of her SERB project at Banaras Hindu University (BHU), Varanasi, Uttar Pradesh	August 22-23, 2024 -
36.	Dr. S. Banik, Principal Scientist	XXVII Meeting of ICAR Regional Committee No. II at ICAR-NRRI, Cuttack.	August 23, 2024 -
37.	Dr. Rajan Sharma, Principal Scientist	Executive Development Programme (EDP) on 'Leadership Excellence' for RMPs of ICAR at ICAR-NAARM, Hyderabad	August 26-31, 2024 -
38.	Dr. Sachin, Scientist	Training programme on "Multivariate Analysis Using R" at ICAR-NAARM, Hyderabad	August 26-30, 2024 -
39.	Dr. M. Mondal, Sr. Scientist	Online international e-training program on "The Physiology of Reproductive Success in Veterinary field: latest insight and innovations - ", by Department of Veterinary Physiology, College of Veterinary and Animal Sciences, Kishanganj under the acgis of Bihar Animal Sciences University, Patna	September 2 and - 11, 2024 -
40.	Dr. S.De, Principal Scientist	Annual Conference of the Society of one health Biochemist and Nutritional Symposium on "Biochemistry of One Health" at Nagpur Veterinary college Nagpur	September 4-5, 2024 -
41.	Dr. S. K. Das, Principal Scientist	Regional Science Congress organised by Jawahar Navodaya Vidyalaya, Kalyani and delivered presentation on 'Horizon of Biotechnology and its Multi-dimensional Aspects'	September 13, - 2024 -
42.	Dr. Subhasis Mandal, Principal Scientist	To deliver a talk on "Management of coastal salinity for transforming agri-food systems in Ganges delta – turning grassroots experiences into policy" at NDDB, Anand	September 18-20, - 2024
43.	Dr. D.K. Mandal, Principal Scientist; Dr. A. Chatterjee, Principal Scientist; Dr. A. Santra, Principal Scientist; Dr. S. K. Das, Principal Scientist	Webinar on "Internet of Things in Precision Farming"	September 26, 2024
44.	Dr. A. Chatterjee, Principal Scientist	Informational webinar on 'Risk Assessment and Risk Management: Looking Ahead to CP-MOP 11' held on 27th September 2024	September 27, 2024

S. No.	Employee Name and Designation	Title	Duration
45.	Dr. Vivek Sharma, Principal Scientist , Sumit Arora Principal Scientist; Dr. Manoj Kumar Singh, Sr. Scientist Dr. Naresh Lalaji Selokar, Sr. Scientist; Dr. Richa Singh, Senior Scientist, Dr. Kamal Gandhi, Scientist	11th National Seminar on " Indian Dairy & Food Industry in Viksit Bharat: Development & Innovation ICAR- NDRI, Karnal	September 27- 28, 2024
46.	Dr. Rajan Sharma, Principal Scientist	37th Foundation Day of ICAR-National Research Centre on Mithun & Regional Workshop on "Development of Dairy sector in Northeast - India with special reference to Mithun (Bos frontalis)" Nagaland	October 15, 2024 -
47.	Dr. Sumit Arora, Principal Scientist	Training Workshop on "Enhancing Academic Excellence of Agricultural Higher Education Institutions through NIRF Ranking and NAAC Accreditation" at ICAR-NAARM, Hyderabad	October 16-18, 2024 -
48.	Dr. Sachin Kumar, Scientist	39th Indian Poultry Science Association Conference (IPSACON-2024) and National Symposium under the aegis of IPSA, Bareilly at Department of Poultry Science, MAFSU-Nagpur Veterinary College, Nagpur	October 16-18, 2024 -
49.	Dr. Hardev Ram, Sr. Scientist	National conference at Chandra Shekhar Azad University of Agriculture & Technology, Kanpur	October 18-20, 2024 -
50.	Dr. P.N. Raju, Sr. Scientist	National Conference on "Biotechnological Innovations to augment health and productivity of livestock and poultry for sustainable livelihood" and XI Annual at College of Veterinary Science, Sri Venkateswara Veterinary University Proddatur (AP)	October 23-25, 2024 -
51.	Dr. Yogesh Khetra, Sr. Scientist	International Conference-2024 on : Emerging Paradigm Shifts in Food & Dairy Processing at Banaras Hindu University	October 25-26, 2024 -
52.	Dr. Sanchita Garai, Sr. Scientist	International Conference on "Climate-Smart Nutri-Sensitive Integrated Farming System for Gender-equitable at ICAR-CIWA, Bhubaneswar, Odisha	November 6-8, 2024 -
53.	Dr. Nitin Tyagi, Principal Scientist	Stakeholders Consultation Workshop on Innovative Approaches to Crop Residue Management, jointly organized by FAO and the ICAR-CSSRI, Karnal	November 9, 2024 -
54.	Dr. Sadeesh E.M., Sr. Scientist	International Conference on Progress in Mitochondrial Research and Therapy at SDM University, Dharwad, Karnataka	November 11-12, - 2024
55.	Dr. Udita Chaudhary, Sr. Scientist	To present the paper and attend the 84th Agricultural Economics Conference at Karaikal, Pondicherry	November 11-13, 2024 -
56.	Dr. Sudarshan Kumar, Sr. Scientist	Conference on "New Vistas in Harnessing Genetic Resources for sustainable Animal Production" & XVIII Animal Convention of Indian Society of Animal Genetics & Breeding at IIT Bombay	November 12, 2024
57.	Dr. A. Mandal, Principal Scientist	Brainstorming meet on "Automation in agriculture using sensor-based networks" at CDAC, Kolkata	November 13, 2024 -
58.	Dr. D. Malakar, Principal Scientist	International Conference on Reproductive Sciences and Molecular Medicine at University of Delhi	November 15-17, 2024 -
59.	Dr. Rajan Sharma, Principal Scientist	National Seminar on 'Policy and Strategies for the Indian Goat Sector in Amrit Kaal' Agra.	November 19, 2024 -
60.	Dr. Santanu Banik, Principal Scientist Dr. Vikas Vohra, Principal Scientist Dr. G. R. Gowane, Principal Scientist; Dr. A. Mandal, Principal Scientist; Dr. S. Banik, Principal Scientist	Conference on "New Vistas in Harnessing Genetic Resources for sustainable Animal Production" & XVIII Animal Convention of Indian Society of Animal Genetics & Breeding at Bihar Veterinary College, BASU, Patna -	November 21-22, 2024 -

S. No.	Employee Name and Designation	Title	Duration
61.	Dr. Sohan Vir Singh	Presented the lead lecture during XXXII Annual Conference of Society of Animal Physiologists of India &International Symposium ICAR-CIRC, Meerut	November 27- 29, 2024
62.	Dr. Jai Kumar Kaushik, Principal Scientist Dr. Nishant Kumar, Sr. Scientist Dr. Sudarshan Kumar, Sr. Scientist Dr. Rubina K. Baithalu, Sr. Scientist Dr. Rani Alex, Sr. Scientist Dr. Indu Devi, Scientist; Dr. M. Mondal, Sr. Scientist	Attended XXXII Annual Conference of Society of Animal Physiologist of India (SAPI) & International symposium on Advances in Physiological Research in Omics Era for sustainable Animal Production and Livelihood Security under the changing climatic scenario" at Central Institute for Research on Cattle in Meerut Cantt. (UP)	November 27-29, 2024
63.	Dr. A. Mandal, Principal Scientist	Online 3-day collaborative training programme on "Characterization, Documentation and Sustainable Utilization of Indigenous Livestock and Poultry Genetic Resources" -	November 27-29, 2024 -
64.	Dr. D.K. Mandal, Principal Scientist; Dr. C. Bhakat, Principal Scientist; Dr. A. Santra, Principal Scientist; Dr. S. K. Das, Principal Scientist	Presentation on line given by Dr. Pallavi Dubey, Iowa State Univ., USA on the topic: Cattle Manure to Sustainable Aviation Fuel - A Techno Economic Analysis and Life Cycle Assessment -	November 28, 2024 -
65.	Dr. S. Banik, Principal Scientist; Dr. Magan Singh, Sr. Scientist; Dr. A. Mohammad, Sr. Scientist	National Conference on "Hill Agro-Ecosystem: Challenges and Opportunities for Achieving Sustainable Development Goals" at ICAR-Research Complex for NEH Region, Nagaland Centre, Jharnapani -	November 29-30, 2024 -
66.	Dr. Pradip Behare, Scientist	Presented a poster in the 94 Annual Session and Symposium on "Accelerated R&D towards a Developed India" organized by the National Academy of Sciences, India (NASI) at IISER Bhopal -	December 1-3, 2024 -
67.	Dr. Sanjeev Kumar, Scientist	Global Research Initiatives for Sustainable Agriculture and Allied Sciences (GRISAAS -2024) conference at SKNAU, Jai Pur	December 10-12, 2024 -
68.	Dr. Subhasis Mandal, Principal Scientist Dr. Sanjit Maiti, Sr. Scientist	Presented Research Paper during 32nd Annual Conference of Agricultural Economics and Research Association (AERA), India at Indira Gandhi Krishi Viswavidyalaya (IGKV), Raipur, Chhattisgarh -	December 11-13, 2024 -
69.	Dr. Pawan Singh, Principal Scientist Dr. Vikas Vohra, Principal Scientist Dr. Nitin Tyagi, Principal Scientist	National Symposium on "Innovative approaches for Boosting Buffalo productivity" at Department of Animal Genetics and Breeding, College of Veterinary Science & A. H., Kamdhenu University, Anand (Gujarat) -	December 16-18, 2024 -
70.	Dr. Bharati Pandey, Scientist and Dr. Indu Devi, Scientist	National Conference at National Agriculture Science Complex (NASC), New Delhi	December 17-18, 2024 -
71.	Dr. M. Mondal, Sr. Scientist	National Conference on "Digital Agriculture: Empowering Indian Farming," jointly organized by NAAS, ICAR, and ICRISAT at A.P. Shinde Symposium Hall, NASC, New Delhi [ONLINE]	December 17-18, 2024
72.	Dr. Subhasis Mandal, Principal Scientist	Workshop on data validation of livestock production in India at Hotel Jaypee Siddharth, Rajendra Place, New Delhi	December 20, 2024 -
73.	Dr. Rajni Kumar Paul, Scientist	8th Annual Convention of Society of Veterinary Biochemists and Biotechnologists of India and National Symposium on "Unlocking and Potential of Veterinary Biochemistry and Biotechnology for Food and Nutrition Security" (SVBBICON-2024) at DUVASU Mathura	December 20-21, 2024 -
74.	Dr. Saroj Rai, Principal Scientist	Advance Training Course on Sample size determination & Power Analysis in Health Research	December 28-30, 2024 -

Technical Staff -

S. No.	Employee Name and Designation	Title	Duration
1	Dr. Santosh Kumar, ACTO	Winter School on Animal Nutrition Strategies for Efficient and Carbon Neutral Livesetock Production at Animal Nutrition Division, ICAR-NDRI, Karnal	January 18, February 7, 2024
2	Dr. Ranjeet Verma, STO Dr. Subhash Chand, CTO	Basics of Echocardiography and Doppler Ultrasonography in Animals at ICAR-IVRI, Izatnagar, UP	February 5-10, 2024
4	Dr. Santosh Kumar, ACTO	Advanced Agricultural Technologies for Self-Reliant Farmers and Developed India at Dr. Rajendra Prasad Central Agricultural University Pusa Samstipur, Bihar	February 11, 2024
5	Sh. Narendra Singh, STO	J-Gate @CeRA SKUAST-Kashmir at Indian Council of Agricultural Research, New Delhi	September 2, 2024
6	Sh. Gurpartap Singh, STO Sh. Ajeet Rundla, STO Ms. Diksha Bhardwaj, STO Sh. Himanshu Nitant, STA Sh. Vijay Kumar, STA Sh. Navneet, STA Sh. Manoj Kumar, STA Sh. Deepak Golan, TA Sh. Ravi Kant, CTO Sh. Rohitashav Meena, TA Sh. Rajender Kumar, TA	Indian Dairy & Food Industry In Viksit Bharat: Development and Innovation at ICAR-NDRI, Karnal	September 27-28, 2024
17	Sh. Bindewshwari Pratap Singh, CTO	Technological Transofrmations in Agircultural Library and Information Systems and Services in the AI Era at University Library Karnataka Veterinary, Animal and Fisheries Sciences University, Bidar, Karnataka	November 22-23, 2024
18	Sh. Arun Kumar T V, STA	Global Research Initiatives Agricultural and Allied Sciences at SKNAU RARI, Durgapura, Jaipur, Rajasthan	December 10-12, 2024
19	Sh. Aditya Tandon, Technician	Laboratory Animal Handling and Experimentation at Department of Molecular and Cellular Medicine, ILBS, Delhi	December 17-20, 2024

Administrative Staff

S. No.	Name & Designation	Training Programme	Duration
1	Sh. Chiranjee Lal, AAO, E-II (T) Section, ICAR-NDRI, Karnal	Training Programme on "Administrative and Financial Management ICAR-NAARM, Hyderabad. (in-person mode)"	November 25-29, 2024

Training Programme organized -

In the Year 2024, faculty of the ICAR-NDRI also organized following training programmes for the students & faculty of other institutes. Many of these training programmes were sponsored.

S. No.	Scientist	Title	Sponsoring agency	Duration
1.	Dr. Nitin Tyagi, Principal Scientist and Dr. Rubina Baithalu, Sr. Scientist	Entrepreneurship Development Program on "Commercial Dairy Farming"	ABI project of ICAR-NDRI	January 6-11, 2024
2.	Dr. Sanjeev Kumar, Sr. Scientist	15 days short course training (online) on Climate Smart Practices in Agriculture and Allied Sciences for Sustainable Development	Astha Foundation, Meerut	March 15-30, 2024
3.	Dr. Sanjeev Kumar, Sr. Scientist	15 days short course training (online) Climate Change Scenario: Impact on Agriculture and Allied Sciences	Astha Foundation, Meerut	March 16-30, 2024
4.	Dr. Richa Singh, Sr. Scientist; Dr. Vivek Sharma, Principal Scientist	Hands-on training for fatty acid and triglyceride analysis of ghee	Everest Instruments Pvt. Ltd. Ahmedabad	April 19-20, 2024

S. No.	Scientist	Title	Sponsoring agency	Duration
5.	Dr Sadeesh E.M. Sr. Scientist	Summer Internship Training Program for students, focusing on Mitochondrial Research Techniques. The program covered key techniques, including the Isolation of Mitochondria from Tissues, Mitochondrial DNA Extraction, PCR Amplification, and Genetic Analysis of Mitochondrial DNA	Students from the following institutions participated in the program: Kurukshetra University, Kurukshetra, Haryana Chandigarh University, Punjab	May 27, to July 7, 2024
6.	Dr. Suneel Kumar Onteru	Summer Internship Training Program for students on the topics "Targeted delivery and analysis of anti-cancerous drugs (in vitro) and encapsulated miRNA (in vivo) using bovine milk exosomes"	Students from Kurukshetra University participated in this program	June 3, 2024 to July 14, 2024
7.	Dr Rajani Kr Paul, Sr. Scientist	Summer internship training on " Gene cloning, protein expression and purification" for 4-6 weeks duration	Ms Radhika Ms Parul Dagar Mr Kritik Balayen Kurukshetra University	May 28 to July 12, 2024 June 3 to July 16, 2024 July 15 to August 14, 2024
8.	Dr. P. Barnwal, Head of Division; Dr. Ankit Deep, Scientist	One month training to students	Hands on training programme in Dairy Engineering" for undergraduate students from Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh and Mehr Chand Mahajan DAV College for Women, Chandigarh	June 3 to July 2, 2024
9.	Dr. Shaik Abdul Hussain, Sr. Scientist	One month training to student	Ms. Palak Aggarwal and Ms. Tamanna, student of M.Sc. Home Science (Food Nutrition & Dietetic), Kurukshetra University, Kurukshetra.	June 3 to July 3, 2024
10.	Dr. Shaik Abdul Hussain, Sr. Scientist	One month training to student	Ms. Kavyashree, student of B.Tech Food Technology, Shoolini University, Solan (H.P).	June 10 to July 10, 2024
11.	Dr. Yogesh Khetra	Training on Cheese Technology	Dairy Technology Division, ICAR-NDRI Karnal	June 17-21, 2024
12.	Dr. P. Barnwal, Head of Division; Dr. Ankit Deep, Scientist	One month training to students	Hands-on Training Program in Dairy Engineering (Five undergraduate students from Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh; Mehr Chand Mahajan DAV College for Women, Chandigarh and NIMS University, Jaipur)	July 1-31, 2024
13.	Dr. Yogesh Khetra, Sr. Scientist and Dr. Sangita Ganguly, Scientist	Entrepreneurship Development Program on "Cheese: Production & Quality Evaluation"	ABI project of ICAR-NDRI	July 17-21, 2024
14.	Dr. Naresh L. Selokar Dr. Manoj Kumar Singh.	National Brainstorming Workshop on "Animal Cloning & Genome Editing Technology"	ICAR-NDRI, Karnal	July 19, 2024
15.	Dr. Bharati Pandey, Scientist	SERB Sponsored High-End Workshop (Karyashala) on "Harnessing the Power of Multi-omics Big Data in Animal Science for Precision Agriculture."	ICAR-NDRI, Karnal	July 15-28, 2024

S. No.	Scientist	Title	Sponsoring agency	Duration
16.	Dr. Rajesh Bajaj, Principal Scientist; Dr. Richa Singh, Sr. Scientist, Dr. Raghu H.V. , Sr. Scientist; Dr. Kamal Gandhi, - Scientist	Training on "Chemical and Microbiological Quality and Safety Monitoring in Dairy Industry"	Officials of Hatsun Agro Products Ltd, Chennai	July 23 to August 01, 2024
17.	Dr. Writdhama Prasad and Dr. Kaushik Khamrui	National workshop on Application of artificial intelligence and machine learning in dairy and food industry	ICAR-NDRI, Karnal	July 31, 2024
18.	Dr. Sanjeev Kumar, Sr. Scientist	21 Days Summer School in Online Mode on Emerging Challenges and Opportunities in Biotic and Abiotic Stress Management - (ECOBASM-2024)	Astha Foundation, Meerut	August 10-30, 2024
19.	Dr. Yogesh Khetra	FOSTAC training program on manufacturing	For B. Tech. Dairy Technology students	September 7, 2024
20.	Dr. G.S. Meena, Scientist and Dr. Heena Sharma, Sr. Scientist	Entrepreneurship Development Program on "Milk and Milk Products Processing"	ABI project of ICAR-NDRI	October 14-19, 2024
21.	Dr. Sachin Kumar, Scientist	Entrepreneurship Development Program on "Commercial Dairy Farming"	ABI project of ICAR-NDRI	October 21-26, 2024
22.	Dr. Bharati Pandey, Scientist	SERB sponsored One-day Workshop titled "Applications of Big Data in Animal Science: Advances and Insights" -	ICAR-NDRI, Karnal	October 25, 2024
23.	Dr. Anupama Mukherjee, Principal Scientist	Dr. Akinsola Oludayo Michael, Animal Geneticist, Jos, Nigeria	Trained (PDF) at AGB Division, NDRI under C V Raman Fellowship sponsored by DST, Govt of India & FCCI for a period of six month	October 26, 2023 to April 26, 2024

Innovative idea contest

An Ecell, NDRI was established for the students of ICAR-NDRI for inculcating and promoting entrepreneurial mindset among the students. The Ecell is full operated by the students themselves and technical and logistical support is provided by ABI project of ICAR-NDRI. An innovative idea contest namely "Ideas den: An idea pitching competition" was organized on September 28, 2024 at ICAR-NDRI, Karnal, Haryana. A total of 25 participants have presented their ideas and prizes were distributed for top three best ideas.

Students participating in "Idea pitching competition" organized on September 28, 2024 at ICAR-NDRI, Karnal, Haryana

Glimpse of FosSTaC Training program (June 26, 2024)

14. MAJOR EVENTS

Date	Title of the Event
January 10-30, 2024	ICAR- sponsored National Training Programme on "Emerging engineering and technological interventions in processing and value addition of milk products" -
January 18 to February 7, 2024	ICAR- sponsored winter school on "Animal Nutrition Strategies for efficient and carbon - neutral livestock production" -
February 9, 2024	A Memorandum of Understanding (MoU) was signed between "ICAR- National Dairy - Research Institute (NDRI), Karnal and Garden City University (GCU), Bengaluru" in a ceremony held at GCU campus, Bengaluru -
February 16-25, 2024	SERB sponsored High end workshop on "Biotechnological techniques in animal nutrition for enhancing livestock productivity" -
February 26 to March 6, 2024	SERB Sponsored Karyashala program "Hands-on-training on production and characterization of milk derived bioactive compounds using advanced instruments" -
March 9-11, 2024	National Dairy Mela-2024 at Chaibasa, Jharkhand -
March 14, 2024	48th meeting of Board of Management
March 15, 2024	20th Convocation of the ICAR-NDRI -
April 22-24 & 29 and May 1, 2024	Institute Research Committee (IRC) Meetings for evaluation of completed research projects - and discussion of new research project proposals (in-house projects as well as externally funded projects) -
May 8-17, 2024	A "High-End Workshop (Karyashala) on Advanced Biosafety Practices for Handling and Detection of Foodborne Pathogens" sponsored by Anusandhan National Research Foundation under the Accelerate Vigyan Scheme -
May 18, 2024	A Brainstorming Session on "Restructuring the Academic & Research Agenda" -
June 1, 2024	Celebrated World Milk Day by organizing a seminar on "Bovine and Non-Bovine Milk and Human Health" to highlight the significance of milk and dairy products for human health -
June 3, 2024	French delegation Dr. Didier Raboisson, Attaché for Scientific and Academic Cooperation, Dr. Meenakshi Singh, Scientific Coordinator and Mr. Aymmeric Voquang, Project Manager from Embassy of France, New Delhi visited ICAR-NDRI, Karnal.
June 3, 2024	Renovated Creche facility was inaugurated at the premises of ICAR-NDRI, Karnal -
June 10, 2024	World Bank officials Mr. Bekzod Shamsiev and Dr. Gerry Boyle visited ICAR-NDRI, Karnal -
June 18, 2024	The Hon'ble Prime Minister Shri Narendra Modi released the 17th instalment of PM Kisan by transferring Rs. 20,000 crore directly into the accounts of 9.25 crore beneficiaries under the PM Kisan Samman Nidhi Yojana from Varanasi. The virtual event was attended by Haryana Chief Minister Shri Nayab Singh Saini as the Chief Guest at ICAR-NDRI, Karnal -
June 26, 2024	FoSTaC Training on "Advanced Manufacturing & Covid" -
June 26 to July 25, 2024	SERB sponsored one-month Training programme "ABHYAAS (VRITIKA component)" on the topic entitled "Development of Nutri-cereals incorporated probiotic convenience foods and beverages" -
June 26 to July 25, 2024	SERB DST sponsored training programme under ABHYAAS (VRITIKA component) entitled "Quality attributes of lactic fermented spray dried milk prepared using paneer whey" -
July 15-28, 2024	Training program on "Harnessing Multi-Omics Big Data in Animal Science for Precision Agriculture" (Karyashala) under Accelerate Vigyan Scheme and sponsored by the Anusandhan National Research Foundation (ANRF) -
July 17-21, 2024	Entrepreneurship Development Program on "Cheese: Production & Quality Evaluation" was organized under ABI
July 29, 2024	A National workshop on "Recent advances in Computer-Assisted Sperm Analysis (CASA) and flow cytometry for bovine semen evaluation" -
July 31, 2024	National Workshop on "Application of Artificial Intelligence and Machine Learning in Dairy and Food Industry" -
August 10-11, 2024	Two day workshop and Kisan Gosthi on "Climate Resilient Agriculture for Cold Arid Ladakh" at High Mountain Arid Agriculture Research Institute, University of Ladakh -
August 11, 2024	An online program titled "109 Bio-fortified and Climate-adapted varieties developed by ICAR dedicated to the Nation by the Hon'ble Prime Minister" was held at KVK, NDRI Karnal and Eastern Regional Station, Kalyani -

Date	Title of the Event
August 15, 2024	A virtual telecast of the "Nationwide Launch of the National Pest Surveillance System (NPSS)" by the Honorable Agriculture Minister took place
August 16-22, 2024	Celebration of "19th Parthenium Awareness Week"
August 20, 2024	49th Extension Council Meeting of ICAR-NDRI, Karnal
August 25-31, 2024	The NDRI Student Council's seven-day sports festival "Capacity-2024"
August 29, 2024	Celebration of "Ek Ped Maa Ke Naam" (PLANT4MOTHER)
September 9, 2024	Seminar on "Dried Distilleries Grains with Solubles" (DDGS): Feed of the Future. For India, By India"
September 10-19, 2024	Hands-on training "Production of Functional Starter Culture and Fermented Dairy Products" under ICAR's Developmental Action Plan for Scheduled Caste
September 17 to October 2, 2024	Swachhata Hi Seva Campaign-2024
October 8, 2024	Exposure Training on "Present Status and Mechanization Gap in Dairy Farming in India" for PIs, Co-PIs and Scientists from nine AICRP-MAH centers
October 14-19, 2024	Entrepreneurship Development Program on "Milk and Milk Products Processing" was organized under ABI
October 25, 2024	A workshop entitled, "Natural behaviors in relation to production and welfare of native farm animals" on animal behavior and welfare
October 28 to November 3, 2024	Observance of "Vigilance Awareness Week"
November 6-22, 2024	First "Deeksharambh: Induction-cum-Foundation Course" for newly admitted B.Tech., M.Tech. and M.Sc. students
November 26, 2024	Celebration of National Milk Day
December 2-6, 2024	A training programme on "Preparation of Ice Cream and Frozen Desserts" in the dairy Processing section to train entrepreneurs regarding different aspects of ice cream manufacture
December 4, 2024	A Kisan Mela at Ghoralia Rina Palace, Santipur by Nadia Organic FPOs with the theme "Chemical-Free Food"
December 5, 2024	World Soil Day at the ICAR-KVK, Nadia-II campus with the theme "Caring for Soil - Measure, Monitor and Manage"


Brainstorming Session on Restructuring the Academic & Research Agenda (May 18, 2024)


Visit of French delegation Dr. Didier Raboisson, Dr. Meenakshi Singh, and Mr. Aymmeric Voquang, from French Embassy in India on June 3, 2024

Visit of Dr. R. B. Singh Former Chairman, ASRB at NDRI on May 28, 2024

Staff of NDRI taking pledge for cleaning of premises under Swachh Bharat Abhiyan program on December 16, 2024

Visit of World Bank officials Mr. Bekzod Shamsiev and Dr. Gerry Boyle on June 10, 2024

Hon'ble Chief Minister viewing the live telecast of Release of Installements of PM Kisan and distributing the certificates

Dr. Dheer Singh, Director and Vice Chancellor NDRI, Karnal addressing the participants of brainstorming session on Present Status and Mechanization Gap in Dairy Farming in India on October 8, 2024

Glimpses of the seminar on "Dried Distilleries Grains with Solubles" (DDGS) organized on September 9, 2024

OTHER SIGNIFICANT ACTIVITIES OF STAFF AND STUDENTS

Celebration of Republic Day and Independence Day

ICAR-NDRI, Karnal, celebrated the 75th Republic Day and the 78th Independence Day with joy and enthusiasm. The events saw active participation from all staff, family members, and students. Dr. Dheer Singh, Director of ICAR-NDRI, Karnal, highlighted the glorious heritage of our country and reminded everyone of their duties and responsibilities as citizens. The celebrations included an NCC parade during the flag hoisting, as well as various sports activities and cultural events.

Celebration of Republic Day 2024

Celebration of Independence day 2024

Cultural Celebrations at ICAR-NDRI

Celebration of World Milk Day

ICAR-NDRI celebrated World Milk Day 2024 on June 01 by organizing a seminar on “Bovine and Non-Bovine Milk and Human Health” to highlight the significance of milk and dairy products for human health. This year's theme was "The vital role dairy plays in delivering quality nutrition to nourish the world”.

Celebration of National Milk Day

ICAR-NDRI, Karnal celebrated National Milk Day on November 26, 2024. The event featured Padma Shri Awardee Kanwal Singh Chauhan as the guest of honor, with Dr G. S. Rajorhia from the National Dairy Development Board serving as the chief guest. The celebration also showcased an innovation in dairy products, with the launch of millet milk protein-based cookies by "Smillets," a startup nurtured at NDRI's Agri-Business Incubator.

Dr Dheer Singh, Director and Vice Chancellor, ICAR-NDRI and other dignitaries during the celebration of National Milk Day on November 26, 2024

Celebration of World Environment Day & Tree Plantation Drive

ICAR-NDRI celebrated World Environment Day on June 5, 2024. The event included a cycle rally involving faculty and students and a tree plantation. In NDRI a special drive was organized for the tree plantation.

Dr Dheer Singh, Director and Vice Chancellor, ICAR-NDRI and faculty during the celebration of Environment Day on June 05, 2024

Organization of Sports Tournament

The NDRI Student Council's seven-day sports festival, "Capacity-2024," concluded at ICAR-NDRI, Karnal, on August 31, 2024. Organized during August 25-31, the event emphasized sports' role in character development. Around 200 students participated in the event.

Glimpses of Sports Meet (August 25-31, 2024)

Celebration of International Day of Yoga

ICAR- National Dairy Research Institute, Karnal celebrated the 10th International Yoga Day on 21st June 2024. This event was organized at Kalki Bhawan Indoor Sports Complex of the institute from 6:00 AM onwards. The employees and their family members, students of the institute, trainees and members of Yoga club actively participated in this event. The Yoga experts assisted the Yoga Session as per the Protocol and Guidelines of Ayush Department.

Celebration of International Yoga Day (June 21, 2024) at ICAR-NDRI

"Dheeksharambh" Induction-cum-Foundation Course

In an inspiring kick-off to the academic year 2024, ICAR-NDRI organized a special "Dheeksharambh" Induction-cum-Foundation Course' for newly admitted B.Tech., M.Tech., and M.Sc. students from November 6-22, 2024. The institute invited Dr Nivedita Shreyans, a renowned educationist, Director of Youth Programs at Heartfulness Institute, Hyderabad, to speak on the vital theme of "Wellbeing and Happiness."

Dr Dheer Singh, Director and Vice Chancellor, ICAR- NDRI and other officials along with newly admitted students

15. DISTINGUISHED VISITORS

Date	Name and Designation of the Visitor
January 04, 2024	Mr. Shanmuga Priyan, Chief Operating Officer (COO) & Mr. Anil Kumar, Quality Head (Quality Assurance) from Hatsun Agro Products Ltd., Chennai
February 14-29, 2024	Dr. Roopesh M. Syamaladevi, Associate Professor, Faculty of Agricultural, Life and Environmental Science, Agriculture, Food and Nutrition Science Department, University of Alberta, Edmonton, Canada
March 8, 2024	Dr. K.K. Iya Memorial Oration by Dr. Abhijit Mitra, Animal Husbandry Commissioner, Govt. of India
March 11, 2024 Delhi	Dr. N.N. Dastur Memorial Oration by Dr. R.C. Agrawal, Dy. Director General (AE), ICAR, New
March 13, 2024	Dr. D.D. Sundarensan Memorial Oration by Dr. Meenesh Shah, Chairman, National Dairy Development Board, Anand, Gujarat
March 14-15, 2024	Dr. R. S. Paroda, Former DG, ICAR Dr. Raghvendra Bhatta, DDG (AS), ICAR Dr. R. C. Agrawal, DDG (Agriculture) Education, ICAR Dr. K. M. Bujarbaruah, Former DDG (Animal Sciences), ICAR Dr. D. V. K. Prakasha Rao, Chairman & Managing Director, Prakash Foods and Feed Mills Private Limited, Chennai Dr. M. S. Chauhan, Vice-Chancellor, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand
March 31, 2024	Dr. Himanshu Pathak, Secretary DARE & DG, ICAR inaugurated New Agricultural Facilities at KVK (Additional), Nadia
May 28, 2024	Dr. R. B. Singh Former Chairman, ASRB; former Director & Vice-Chancellor, Indian Agricultural Research Institute, New Delhi; former Chancellor, Central Agricultural University, Imphal
June 3, 2024	Following officials from French Embassy, New Delhi Dr. Didier Raboisson, Attaché for Scientific & Academic Cooperation Dr. Meenakshi Singh, Scientific Coordinator Mr. Aymeric Vo Quang, Project Manager
June 10, 2024	Following officials from world bank Dr. Bekzod Shamsiev, Task Team Leader (TTL), NAHEP Dr. Gerry Boyle, World Bank Consultant (NAHEP)
June 10-11, 2024	Dr. Kaustav Majumder, Associate Professor, University of Nebraska, Lincoln, USA
June 18, 2024	Shri Nayab Singh Saini, Honorable Chief Minister , Haryana
November 16, 2024	Dr. Shiv Prasad Kimothi, Member, Agricultural Scientists Recruitment Board (ASRB), New Delhi Dr. Arthbandhu Sahoo, Director, ICAR-NIANP, Bengaluru Dr. Baldev Raj Gulati, Director, ICAR-NIVEDI, Bengaluru
November 17, 2024	Mr. Acharya Devvart, Hon'ble Governor of Gujarat
November 20, 2024	Mr. Gabriel D. Wangsu, Hon'ble Minister (Agriculture, Horticulture, Animal Husbandry, Veterinary, Fisheries, Food and Civil Supply, Legal Metrology and Consumer Affairs) Govt. of Arunachal Pradesh
November 26, 2024	Padma Shri Sh. Kanwal Singh Chauhan, Member, Governing Body, ICAR Dr. G.S. Rajorhia, Member, Board of Directors, NDDB & Former President, IDA Mr. Sarabjot Singh - Olympic bronze medalist Ms. Rahi Sarnobat - Arjuna Awardee Mr. Samaresh Jung - Arjuna Awardee
November 28, 2024	Dr. Vivek Pathania, Chief General Manager NABARD along with 16 District Development Officers of Himachal Pradesh
December 02, 2024	Ms. Nivedita Tiwary, Chief General Manager along with District Development Officers of Haryana
December 11, 2024	Shri Shivraj Singh Chauhan, Cabinet Minister of Agriculture and Farmer's Welfare, Govt. of India

Dr. R. S. Paroda, Former DG, ICAR during 20th convocation of ICAR-NDRI

Dr. R. C. Agrawal, DDG (Agriculture Education), ICAR delivering Dr. N.N. Dastur Memorial Oration

Dr. Dheer Singh Director, ICAR-NDRI welcoming Mr. Gabriel D. Wangsu Hon'ble Minister Govt. of Arunachal Pradesh at ICAR-NDRI Karnal

Mr. Gabriel D. Wangsu Hon'ble Minister Govt. of Arunachal Pradesh along with his delegation visited Artificial Breeding Research Centre of ICAR-NDRI

Shri Shivraj Singh Chauhan, Cabinet Minister of Agriculture and Farmer's Welfare, Govt. of India interacting with farmers, scientists and students during his visit to NDRI on December 11, 2024

Dr. Dheer Singh, Director & Vice-Chancellor welcoming Mr. Sarabjot Singh, Olympic Bronze Medallist on the occasion of National Milk Day on November 26, 2024

NABARD delegation visiting NDRI led by Dr. Vivek Pathania, Chief General Manager, NABARD on November 28, 2024

16. MAIN CAMPUS, ICAR-NDRI, KARNAL -

Research Divisions

Animal Genetics & Breeding

The Division of Animal Genetics and Breeding was established in the 1960s in the Main Campus of ICAR-NDRI, Karnal. This Division is the part of the chequered history of dairy cattle crossbreeding in India for increasing the milk production at the national level which was started in the early 1970s, and as a result of which, India became a milk-sufficient state from the milk-deficient one. Development of two high-yielding dairy cattle crossbreds-Karan Fries and Karan Swiss was the signature of this glorious achievement. An application has been filed for registration of Karan Fries cattle during 2025.

Division has been actively involved in conducting research in the areas of animal genetics and breeding including cytogenetics and molecular genetics. The research thrust areas of the division are genetic improvement of indigenous and crossbred cattle and Murrah buffaloes by progeny testing of breeding males, faster multiplication of indigenous cattle, development of sustainable breeding plans, part and complete characterization of genes and their association with production/reproduction traits, disease resistance, screening of young breeding males for genetic disorders and assessment of reproductive efficiency of cattle and buffaloes.

The division also fulfills the mandate of extension in the area of Animal Genetics and Breeding through training programs in KVK, TBI and Dairy Extension Division, Consultancy services to farmers and various dairy stakeholders, supplies superior germplasm in the form of frozen semen and surplus breeding males to farmers, livestock developmental agencies, state governments and other stake holders involved in dairy development in the country.

The organizational structure for research consists of Animal Breeding Lab., Biometrical Genetics Lab., Buffalo Breeding Lab., Molecular Genetics Lab., DNA Bank for cattle and buffaloes, Livestock Record Cell and besides this, breeding herds of cattle (Karan Fries, Sahiwal, Tharparkar & Gir) and Murrah buffaloes is also the integral part of the research component of Animal Genetics and Breeding Division. The Divisional Library has 436 books, 253 M.Sc./ M.V.Sc. and 152 Ph.D. theses.

Livestock Production & Management

The Livestock Production & Management (LPM) section came into being in June, 2009 after being carved out of Dairy Cattle Breeding Division of the Institute. Separate faculty of LPM along with board of studies was in existence since 1976 and post graduate and doctorate degree programmes in LPM were continuing. The faculty of LPM is engaged in conducting research in the frontline areas of all applied aspects of dairy animal production and has been successful in evolving many transferable technologies and development of package of practice on the routine care and management of dairy animals. The faculty of LPM is engaged in teaching both at UG and PG levels. The LPM faculty is also shouldering the responsibility of the routine management of the Livestock Research Centre and breeding bulls maintained at the Artificial Breeding Research Center of Institute besides supporting the training and extension activities of the institute.

The mandate of the division includes: (i) To maintain elite germplasm repository of dairy animals of the identified breeds, ii) Development of state-of-art dairy animal management facilities and infrastructure for high yielding dairy animals, (iii) To carry out research, in collaboration with different divisions, in the upstream areas of dairy animal production, (iv) To standardize the package of management practices and to demonstrate the state of the art dairy animal production system to clients and (v) To provide consultancy to the needy farmers and entrepreneurs for establishment of

commercial dairy farms.

The organizational structure for research consists of Sensor and Animal behaviour lab, Molecular Reproduction lab, ABRC, Andrology and semen preservation lab, milk analysis lab, ARGO lab in LRC and Livestock research center.

Animal Biotechnology

Biotechnology was initiated at NDRI, Karnal during mid-eighties under a UNDP 'Centre of Excellence on Biotechnology' programme. The urgent need for application of recent biotechnological advances in reproduction and production of superior females of dairy breeds of ruminants for improving animal productivity in our country formed the basis for the establishment of a state-of-the-art Embryo Biotechnology Centre (EBC) with financial support from the Department of Biotechnology. Biotechnology was further strengthened by establishment of Livestock Genome Lab and Molecular Biology Unit. Animal Biotechnology Division was reorganized in June 1999 by consolidating all the infrastructure facilities created under various programmes on biotechnology. Besides research on areas relevant to biotechnology in dairy production and processing, the division also offers B.Tech./ M.Sc./ M.V.Sc./ M.Tech and Ph.D. (Animal Biotechnology) programmes. The main focus has been given on following objectives: (i) To undertake biotechnology oriented basic and applied research programmes for improving animal productivity and for developing innovative dairy processes for producing superior quality, safe and wholesome dairy products.

Animal Biotechnology Division, NDRI

Animal Physiology

Animal Physiology used to function as a section of the erstwhile Dairy Husbandry Division and subsequently as Dairy Cattle Nutrition and Physiology Division till the end of the 6th Five Year Plan. The discipline of Animal Physiology received the status of an independent division in 1984. The scientists of the division have contributed to the development of infrastructural facilities to initiate research in the area of Embryo Biotechnology centre and now the same has been established as Animal Bio-Technology Centre.

The division has been committed to conduct Research, Teaching, and Extension activities in Environmental and Stress Physiology, Lactation and Immuno Physiology, Growth and Reproductive Physiology, and Endocrinology. The division has developed certain useful technologies like induction of lactation, rBST to augment milk production, milk SCC for udder health and CMP and application of mist and fan to alleviate summer stress, which have been adopted several progressive farmers of the area. A large Animal Treadmill was indigenously developed for the draft evaluation system and work-rest cycle in working bullocks. Somatic Cell Counts as an index of clean milk production and udder health in milch animals have been a major focus for a package of practices. A modern custom-designed shelter with automatic control systems has been installed in Livestock Research Centre to ameliorate the heat stress. Water-saving/ purification demonstration units have been installed at the animal farm and are ready to use by the dairy farmers. Modern state-of-the-art facilities are available at National Innovations on Climate Resilient Agricultural Research Centre (NICRA).

Animal Nutrition

Dairy Cattle Nutrition Division was established in the year 1972, as Dairy Cattle Nutrition and Physiology Division. It was bifurcated into independent division as Dairy Cattle Nutrition and Dairy Cattle Physiology in 1978. Dairy Cattle Nutrition Division was renamed as Animal Nutrition Division in the year 2016. Division undertakes basic and applied research in field of post-graduate programmes of education and participates in the process of extension education through various training programmes and field level technology development and refinement in the discipline of animal nutrition and forage production. Milk replacer and calf starter

based on locally available sources were developed along with their feeding schedule. Work was also done on nutrient requirements of cattle, buffalo and goats. Utilization of Zn and vitamin A and iodine was studied.

Degcure mixture was developed as a cure for degnala disease. Sulphur requirements with NPN compounds were also standardized. Sources of minerals were evaluated for their availability and chelated minerals were prepared and evaluated. Surveys have been carried out to find the prevalence of pesticide and toxic metals as well as essential trace minerals.

With the emergence of one health concept more focus has been diverted into value addition of milk and meat products, probiotics and prebiotics application in animal nutrition, mineral nutrition, and methane emission and its mitigation strategies. This division offers Ph.D. and Masters' Program in Animal Nutrition discipline.

The research laboratories are equipped with modern analytical instruments for chemical and physical analysis. The Division has developed excellent laboratory facilities, which are central facilities for research and education, not only for the Institute but also for various sister organizations seeking such support from time to time. The central facilities include central fine instrumentation laboratory, laboratory for anaerobic rumen microbial work, laboratory for environment related studies including methanogenesis, quality control laboratory, feed processing unit and nutritional biotechnology laboratory. Some of the sophisticated instruments available include atomic absorption spectrophotometer, gas-liquid chromatography, HPLC system, 15N-Analyzer, methane analysis equipment using SF6 technique, spectrophotometer, PCR machine etc. Research on precision nutrition is being undertaken since the past few years.

Forage Research & Management Center

Agronomy Section (Forage Research and Management Centre) was established as sister section of forage production section in 2013 to strengthen the research and teaching and extension activities related to round the year forage production and quality improvement of forages through agronomic manipulations. The mandate of section includes, generating the human resource in Forage Agronomy, developing the agro-techniques for enhancing the fodder productivity and quality through efficient management of resources and to disseminate the knowledge about new agro-techniques for forage crop production and management to the dairy farmers/extension functionaries. The section offers masters and doctoral programmes in agronomy. Section has facilities for quality analysis of forages and about 10-acre land for conducting research experiments of total five scientists and 19 students'trial.

Animal Biochemistry

The Division of Animal Biochemistry came into being in September 1984 with the merger of the discipline of Animal Biochemistry of Dairy Chemistry Division and the Division of Human Nutrition and Dietetics. Research endeavours of the Division are presently directed towards development of probiotic foods, dairy nutraceuticals and their mechanism of action, validation of health benefit claims of Indian dairy products, characterization of genes related to fertility in buffalo, signal transduction mechanism in sperm functions, identification of fertility markers, and bioinformatics researches. The Division is offering Masters and Doctoral degree courses in Animal Biochemistry. The Division has Central Instruments Room that houses expensive equipments and are available to all users. Small Animal House is Central facilities managed by Animal Biochemistry Division. The contributions of the Division have been amply recognized by three Rafi Ahmed Kidwai Memorial Awards, Dr. P. G. Nair Award, two Jawahar Lal Nehru Award, Young Scientist Award, IUIS/FIMSA Travel Bursary Award, Best publication award and several paper presentation awards.

Dairy Chemistry

Dairy Chemistry Division is one of the oldest divisions of ICAR-National Dairy Research Institute established in 1941. Since its inception, the division is working in the area of fundamental and applied research, human resource development for academia and industry, and providing R& D support to Dairy Industry and standard bodies (FFSAI/ BIS/ AGMARK). The mandate of division is to conduct

fundamental and applied research for understanding chemistry of milk and milk products, to impart educational programmes for undergraduate and postgraduate courses and to provide R&D support towards chemical-quality control related problems of the dairy industry. The Division has contributed significant knowledge on the chemistry of milk and milk products. Division's work on development and commercialization of strip based rapid test methods in detecting the adulteration in milk and milk products, technology of low- lactose milk powder, nano- encapsulation of cucrcumin and low cholesterol ghee has won it wide national and international acclaim. Dairy Chemistry division has generated significant quantum of intellectual property (more than 17 in last 5 years) in addition to quality research publications of high impact factor. Our academic program leading to Master of Science/ Technology and Doctor of Philosophy degrees provides a solid background in the chemistry of milk constituents, milk products, or food chemistry and analytical chemistry.

Dairy Technology

The Dairy Technology Division is one of the oldest Divisions of the Institute. The Division contributes significantly to the teaching, research, training and consultancy activities of the Institute. The educational programmes include the flagship programme of B.Tech. (Dairy Technology), B.Tech (Food Technology), Masters and Ph.D. (Dairy Technology) and Masters (Food Technology). The research efforts of the Division faculty are brought to fruition through sponsored as well as in-house projects including dissertations of post graduate students. Basic and applied studies to refine processing and packaging technologies for traditional, composite, western and dried dairy products constitute the major focus of research activities.

The Division has developed strong expertise in the area of membrane processing, biotechnological applications, fermented dairy products, composite dairy and food products and their packaging. It has successfully organized 40 National Training Programs under the ICAR-sponsored Centre for Advanced Faculty Training in Dairy Processing (earlier, Centre for Advanced Studies in Dairy Technology) since 1994, for teaching faculty of State Agricultural Universities and other institutions.

The Division of Dairy Technology has received a number of awards in recognition of the outstanding scientific contributions made by the scientists, students and staff, such as Fellow of the National Academy of Agricultural Sciences (NAAS), Fellow of the Indian Dairy Association (IDA), Best Employee Award from ICAR, Best Teacher Awards, Rafi Ahmed Kidwai Awards, Jawaharlal Nehru Award, DAAD Fellowships, Humboldt Fellowships and several others, including Best Research Paper awards.

Dairy Microbiology

Dairy Microbiology Division is engaged in research, teaching, consultancy, training and technology transfer in specialized field of Dairy Microbiology. Broadly, the research work of the division covers the areas related to starter cultures and fermented milk products; direct vat starters (DVS); indigenous probiotics, their functional efficacy and gut microbiota, prebiotics and synbiotics; bioactive peptides, microbial metabolites and bio-preservatives; biosensors, quality assurance and food safety; rumen micro-organisms etc. The division has played a leading role in establishing National Collection of Dairy Cultures' (NCDC) with current repository of more than 800 cultures and national referral centre for milk quality and safety. The division has recently transferred technologies on two indigenous strains of probiotics, Misti Dahi, rapids kits for antibiotic residues, Listeria monocytogenes and Enterococci to potential stake holders in our country for their industrial application. Few more such products like carbonated lassi, vitamin B12 rich propioni-yoghurt, blueberry fortified probiotic dahi, real time test for detection of E. coli and antibiotic residues in milk have been developed and are under process of validation for their commercialization. The Division offers M. Tech and Ph. D programmes in Dairy Microbiology. The division offers contractual and consultancy / training services such as supply of starter cultures, freeze-drying of cultures, microbiological analysis and setting standards for regulatory compliance of dairy products in the country.

Dairy Engineering

Dairy Engineering Division was established as one of

the major research divisions from the inception of the Institute. It was engaged in the maintenance and operation of tractors & agricultural implements for agricultural operation & road transport duties in year 1960-61. The division also looked after the equipment in the dairy supervised and kept in proper working order the electrical and mechanical apparatus in research divisions. Diploma Course in Dairy Engineering was started for the first time in November, 1962 by Government of India in collaboration with the UNICEF/ FAO. The enrolment for this course was continued up to session 1984-85. In year 1972, Dairy Engineering was one of the disciplines, which were identified for post-graduate research and training/ post-graduate courses/M.Sc. (Dairying). In year 1977-78, Dairy Engineering was one of the disciplines for which students were distributed for PhD degree programmes. The division has research laboratory facilities to cater to the needs of specific areas and programmes such as Process Engineering, Process Equipment Design and Instrumentation, Research & Development Workshop, Equipment testing hall, CAD Lab to support both research and teaching activities. The division has achieved breakthrough in developing a number of process equipment for manufacturing indigenous milk products.

Dairy Economics, Statistics & Management

The Dairy Economics, Statistics & Management (DES&M) Division has a strong historical foundation in advancing research, education, and industry-driven initiatives in dairy economics and management. With a focus on trade, marketing, natural resource management, and policy analysis, the division aims to enhance economic efficiency and sustainability in the dairy sector. It offers academic programs, including B.Tech. (Dairy Technology), M.Sc. (Agricultural Economics), and Ph.D. (Agricultural Economics) supported by dedicated faculties. The division's research has contributed significantly to areas such as dairy export competitiveness, functional dairy food demand, water productivity in dairy farming, integrated farming system profitability and price policy dynamics. Its achievements include externally funded research projects, high-impact publications and faculty and student recognitions at national and international levels.

Students and faculty of DES&M Division

Dairy Extension

Dairy Extension Division was established at NDRI, Karnal in May 1961 to undertake extension activities, besides teaching and research in Extension Education. Research endeavors of the division are in the areas of Information and Communication Technologies, organizational behaviour, information management, participatory technology development. Gender mainstreaming and impact studies of dairy innovations. The faculty has also been engaged in human resource development through post graduate and doctoral programmes of NDRI. The main extension programme of the Institute includes Dairy Mela, training, study visit, demonstrations, field days etc. Research-Extension-Industry-Farmer Interface is also organized by the division to provide an opportunity for the convergence of all stakeholders working together for dairy development. Interface not only helps the dairy organizations to find solutions for today's problems, but also to realize the vision for the future. The division also organizes technology transfer campaigns, infertility and veterinary aid campaigns, kisan sanghosthi and field workshops at the adopted villages regularly. These activities strengthen the linkages with end users, helps in understanding the problems of farmers and better dissemination of technologies as well as easy availability of feedback from the farmers. A new Extension Education Programme "Dairy Education at Farmers' Door" initiated on 9.02.2009 to strengthen the effective dissemination of dairy production and processing technologies among farming community. A new Extension Approach "Farmers Farm School" in village is initiated on 30.08.2014 for updating farmers' knowledge in the field of dairy farming in particular and agriculture in general.

Support Sections

Agricultural Technology Information Centre (ATIC)

Agricultural Technology Information Centre at NDRI Karnal became operational in November 2004. This Centre is engaged in disseminating information on dairying and allied agricultural fields.

Forage Production Section

The Forage Production Section is primarily responsible for ensuring a consistent supply of high-quality green fodder to meet the nutritional requirements of the Institute's herd. This responsibility becomes particularly critical during the lean periods of May–June and November–December, when green fodder is scarcest. To address this challenge, the section prioritizes the cultivation of perennial grasses and high-value dual-purpose crops, which provide a year-round fodder supply with lower maintenance and cost requirements, supporting a sustainable approach.

In addition to meeting the herd's immediate daily fodder needs, specific areas are designated for producing fodder seeds and grain crops. This dual-purpose strategy supports the Institute's technology transfer programs by providing essential resources while contributing to the feed supply. Furthermore, these activities generate revenue, enhancing the financial sustainability of the Institute. By effectively managing forage resources, the section ensures both short-term and long-term goals are met, balancing immediate needs with sustainability and economic viability.

Fodder/Feed Production and Supply

In 2024, the Forage Production Section achieved success in fodder production, total of **237,963 q** of high-quality green fodder, **2,378.2 q** of dry fodder, and **4,454.75 q** of straw. These achievements were the result of cultivating high-yielding fodder crop varieties such as maize, sorghum, Napier grass, and bajra during the *Kharif* season, as well as berseem, oats, mustard, Chinese cabbage, and winter maize during the rabi season.

Over the year, a total of **237,963 q** of fodder was distributed (Table-1), including **227,176 q** of green fodder, **4,454.75 q** of straw and **2,378.2 q** of dry fodder. These resources were allocated to the cattle yard, ABRC, and other sections, ensuring the nutritional requirements of the Institute's livestock were consistently met. The section also produces seeds and grain of fodder crops, focusing on oats, wheat, mustard, and berseem. The total grain yield was 6,902.7 quintals, with an average productivity of 47.4 q/ha for wheat, 2.88 q/ha for Chinese cabbage, and 13.4 q/ha for oats (Table-2).

Table1: Monthly Fodder Supply during the year 2024 to LRC/ AN/ others Sections -

Month	Green Fodder (qt.)	Dry Fodder (qt.)	Total (qt.)
January	23657	-	23657
February	23185	-	23185
March	26198	-	26198
April	22534	44	22578
May	16069	3426	19495
June	17610	838	18448
July	23202	-	23202
August	22220	-	22220
September	18576	-	18576
October	18921	-	18921
November	13522	-	13522
December	7961	-	7961
Total	**233655**	**4308**	**237963**

Table-2: Production and productivity of seed crops under RFS -

Sr. No.	Kind of Seed	Quantity of seed (qt.)	Area (ha)	Average Yield (qt/ha)
1.	Wheat seed	6582.20	138.79	47.43
2.	Mustard C. Cabbage	14.00	4.86	2.88
3.	Oats	306.50	22.85	13.41
	Total	**6902.70**	**166.50**	

The average productivity of rabi season crops was **580.46** quintals per hectare (q/ha), and that of *kharif* season crops was **416.56** q/ha (Table-3).

Table-3. Production and Productivity of Forage Crops in terms of green and dry fodder production

Sl. No.	Crop	Area (ha)	Production (q.)	Average Yield (q/ha)
Rabi Season				
1.	Berseem	35.46	52095.00	1469.05
2.	Berseem+Mustard	51.55	29854.00	579.12
3.	Oats Green	43.74	22482.00	513.95
4.	Oats dry	18.89	659.10	34.87
5.	Mustard C. cabbage	16.61	2523.00	151.89
6.	Mustard+Oats	2.48	267.00	107.66
7.	Napier grass	23.13	6164.00	266.49
8.	Napier mixture	6.38	2805.00	439.65
9.	Napier mixture Dry	4.52	1715.00	379.42
10.	Barley Green	1.82	288.00	158.24
11.	Barley Dry	0.18	4.10	22.77
	Total	**204.76**	**118856.2**	**580.46**
Kharif Season				
1.	Maize	152.42	42175.00	276.70
2.	Sorghum	156.00	49960.00	320.25
3.	Bajra	17.82	7501.00	420.93
4.	Napier Grass	19.46	10956.00	563.00
5.	Napier grass+Sorghum	0.60	106.00	176.66
	Total	**346.3**	**110698.00**	**319.65**
	Grand Total	**551.06**	**229554.2**	**416.56**

Table-4. Calculated cost of fodder supplied to LRC -

Sl. No.	Crop Name	Quantity (q)	Rate (₹/q)	Amount (₹)
1.	Green fodder (Cereal)	145227.00	300/-	43568100.00
2.	Green fodder (Legume)	81949.00	400/-	11993695.00
3.	Dry Fodder	2378.20	500/-	1189100.00
4.	Straw	4454.75	1000/-	4454750.00
	Total	**234008.95**		**61205645.00**

Revolving Fund Scheme on Seed Production -

The primary challenge in increasing fodder crop productivity is the lack of high-quality seeds of improved varieties. To address this, NDRI, Karnal, launched a Revolving Fund Scheme on Seed Production, covering 138.79 hectares (Table-5). The scheme aims to produce and supply improved fodder and grain crop seeds from the Institute's farm to farmers and other agencies. During the reporting period, the scheme successfully produced 6,582.20 quintals of wheat seed and 3,844.70 quintals of straw. The total value of the straw was Rs. 38,44,700 (as detailed in Table-7). Notably, the sale of seeds and other farm outputs under the scheme generated Rs. 2,12,88,566.25 in revenue (Table-8). Beyond improving seed availability, this initiative enhances financial sustainability, reinforcing the positive impact of the Revolving Fund in supporting agricultural activities at NDRI, Karnal.

Table-5. Production and productivity of Grain/seed crops

Sl. No.	Crop	Area (ha)	Average Yield (q/ha)	Total Production (q)
1.	Wheat	138.79	47.43	6582.20
2.	Mustard (C. cabbage)	4.86	2.88	14.00
3.	Oats (Kent)	22.85	13.41	306.50
4.	Berseem (BL-44)	1.62	2.00	3.25
5.	Barley	0.40	22.37	8.95
	Total	**168.52**		**6914.90**

Table-6. Production and productivity of straw

Sl. No.	Crop	Area (ha)	Average Yield (q/ha.)	Production (q)	Remarks
1.	Oats Straw	22.85	26.39	602.95	Supplied to the
2.	Wheat Straw	138.79	27.70	3844.70	LRC, ABRC,
3.	Barley Straw	0.40	17.75	7.10	and other sections
	Total	**162.04**	**27.49**	**4454.75**	

Table-7. Production and Calculated Cost of Dry Straw -

Sl. No.	Kind of Fodder	Production (q)	Rate (₹/q)	Calculated cost (₹)
1.	Wheat Straw	3844.70	1000/-	3844700.00
2.	Oats Straw	602.95	1000/-	602950.00
	Grand Total	**4447.65**		**4447650.00**

Table-8. Revenue Generation by Sale of Seed and Other Items in R.F.S. -

Sl. No.	Kind	Sold (qt.)	Rate per qt.	Amount (₹)	Remarks
1.	Oats seed	342.30	5000/-	1711500.00	Sold to Farmer
2.	Mustard (C. Cabbage)	1.08	12000/-	12960.00	
3.	Napier Root	4075.0	2/- Root	8150.00	
5.	Wheat seed	6582.20	2957.50	19466856.50	Supplied to DWR
6.	Barley	8.95	2405/-	21524.75	-do-
7.	Others (FYM, Fuel wood and Oats)				
	a) FYM	150.50	150/-	22575.00	Sold to Farmer
	b) Oats	9.00	5000/-	45000.00	Supplied to Lalukheri
		Total		**21288566.25**	

The total calculated cost of fodder supplied to LRC is ₹ **61205645.00** and the total revenue generation by sale/supply of seed and other items under RFS is ₹**21288566.25**

Livestock Research Centre

Livestock Farm

The total milk production of the herd during the current year was 741960.8 kg. The production performance of the two crossbred strains developed by the NDRI viz. Karan Swiss and Karan Fries was 11.7 and 9.5 kg per head per day, respectively. The milking average of Sahiwal, Gir and Tharparkar cows were 5.7, 4.2 and 4.5 kg per animal per day. Milking average of Murrah buffaloes was 7.2 kg per animal per day respectively. The best milk production of Karan Fries and Karan Swiss was recorded as 39.5 (KF-7978) and 16.0 kg (KS-4479) while best yield in Sahiwal, Gir and Tharparkar was 17, 15 and 16 kgs respectively. Best yield in Murrah buffalo (MU-7564) was 18.0 kg per day during the current year. For AB and SB goats the best yield stayed at 3.4 and 3.3 kgs respectively.

Month-wise Milking Average (kg.) of Cows, Buffaloes and Goats Maintained at NDRI, Karnal during the year 2024

Months	Cows											Buffaloes		Goats		
	Sahiwal		Tharparkar		Gir		Karan Swiss		Karan Fries			Murrah		Alpine x Beetal	Sannen x Beetal	
	A*	M#	A*	M#	A*	M#	A*	M#	A*	M#	A*	M#	A*	M#	A*	M#
January	69	4.5	16	4.1	15	4.6	01	1.5	54	12.8	92	8.2		19	1.3	091.4
February	65	4.9	15	3.6	15	4.2	01	4.9	53	12.9	94	7.7		18	1.7	091.7
March	69	5.6	16	4.4	20	5.6	01	4.7	54	14.0	87	8.0		17	1.7	091.6
April	77	5.7	24	3.7	21	6.2	01	1.9	55	12.8	89	6.9		13	1.7	081.5
May	75	6.3	24	4.1	23	5.3	01	0.6	55	12.4	80	6.3		15	1.4	091.3
June	81	6.4	20	4.6	23	4.8	01	0.9	55	11.7	76	5.9		14	1.2	081.2
July	89	5.5	21	4.4	25	3.8	01	12.1	58	10.9	73	5.5		13	0.7	060.8

Months	Cows											Buffaloes	Goats		
	Sahiwal		Tharparkar		Gir	Karan	Swiss	Karan	Fries			Murrah	Alpine x Beetal		Sannen x Beetal
August	94	5.0	27	4.3	28	3.2	02	10.5	58	10.3	75	5.4	09	0.7	050.8
September	89	5.5	27	4.6	29	2.8	02	8.9	62	10.0	91	6.8	15	0.6	060.5
October	78	6.5	21	4.3	22	2.7	02	7.8	59	10.7	95	7.7	28	1.5	101.2
November	79	6.2	16	5.7	19	3.7	02	5.6	57	11.5	90	7.9	35	1.5	111.4
December	76	6.7	17	5.5	19	5.7	03	7.1	58	12.2	91	9.0	47	1.5	161.6
Average	79	5.7	20	4.5	22	4.2	01	9.5	57	11.7	86	7.2	20	1.4	091.4

* Av. No of animals in milk per day # Milk Yield Average (kg) per Animal per day

Bovine Strength of Cattle and Buffaloes as on December 31, 2024

Age Group	Cattle						Buffaloes	Experiment	Total
	Sahiwal	Tharparkar	Gir Swiss	Karan Fries	Karan	Total	Murrah	Murrah	Bovines
Male up to 06 months	24	09	10	01	11	55	34	01	90
Female upto 6 months	25	09	07	01	12	54	44	03	101
Heifers	148	51	66	03	73	341	107	50	498
Cows/ Buff	186	56	59	06	100	407	158	09	574
Young Male Stock	25	07	14	-	13	59	13	-	72
Bulls	47	13	26	-	09	95	01	02	98
Teaser Bull	-	-	-	-	-	-	**02**	**-**	**02**
Total	**455**	**145**	**182**	**11**	**218**	**1011**	**359**	**65**	**1435**

Flock Herd Strength of Goats as on December 31, 2024 -

Age Group	Alpine x Beetal	Sannen x Beetal	Total	Barbery	Total
Female					
Kids upto 6 months	40	11	51	-	51
Yearling	34	21	55	06	61
Goats	59	22	81	01	82
Male					
Kids upto 6 months	52	13	65	-	65
Bucks	25	10	35	-	35
Total	**210**	**77**	**287**	**07**	**294**

Sale of Livestock during the year 2024

Mode of Disposal	Cattle	Buffaloes	Goats	Total
On Book Value	-	30769.00	124630.00	155399.00
Public Auction	990200.00	4786000.00	527500.00	6303700.00
Total	990200.00	4816769.00	652130.00	6459099.00

Auction of animals was conducted on March 18-20, 2024 and September 23-25, 2024

Fodder and Concentrate fed to animals during the year 2024

Months	Type of Fodder (Qntls.)				Concentrate (Kgs.)
	Green	Dry/Hay	Silage	G. Total	
January	20709.00	380.00	-	21089.00	108212.00
February	20301.00	178.00	-	20479.00	102137.00
March	23541.00	251.00	-	23792.00	87483.00
April	19964.00	302.00	-	20266.00	84207.00
May	13102.00	3726.00	-	16828.00	100533.00
June	14855.00	1098.00	-	15953.00	96671.00

Months	Type of Fodder (Qntls.)				Concentrate (Kgs.)
	Green	Dry/Hay	Silage	G. Total	
July	20071.00	315.15	-	20386.15	134153.00 (+437.00) Mustard oil
August	19290.00	50.00	-	19340.00	128760.00
September	16439.00	30.00	-	16469.00	125200.00
October	16050.00	20.00	-	16070.00	131978.00
November	11210.00	450.00	-	11660.00	121971.00
December	6508.00	1755.00	125.00	8388.00	149226.00
Total	202040.00	8555.15	125.00	210720.15	1370531.00 (+437.00) Mustard Oil
				Grand Total	**1370968.00**

Total milk production and milk supplied to Experimental Dairy during the year 2024 -

Month	Total Milk Production	To Calves/ Kids	To other Division	Total Disposal Milk	Total Milk Send to Expt. Dairy	Total Milk Received by Expt. Dairy
January	62480.2	9640.2	932.8	10573.0	51874.6	51864.0
February	57836.4	8033.5	710.0	8743.5	48808.9	48808.0
March	67263.5	11201.5	579.0	11780.5	55128.2	55125.0
April	62337.4	11010.2	525.2	11535.4	50668.3	50654.0
May	60829.3	11641.0	566.6	12207.6	48571.5	48536.0
June	56526.9	9853.6	446.1	10299.7	46066.9	46055.0
July	55470.4	10552.9	423.0	10975.9	44335.0	44378.0
August	54394.6	11118.4	357.9	11476.3	42615.1	42620.0
September	60785.7	13556.0	521.1	14077.1	46408.2	46413.0
October	65857.3	15157.9	437.0	15594.9	49887.7	49889.0
November	63823.5	13177.6	714.2	13891.8	49615.9	49623.0
December	74355.6	12595.7	451.7	13047.4	60945.0	60952.0
Total	**741960.8**	**137538.5**	**6664.6**	**144203.1**	**594925.3**	**594917.0**
				Total milk production during the year		**741960.8 kg**
				Average No. of animals in milk per day:		
					Cattle	**179**
					Buffaloes	**86**
					Goats	**29**

Performance of Dairy Animals during the year 2024 -

Particulars	Genetic Groups									
	Sahiwal	Tharparkar	Gir	Karan Swiss	KaranFries	Total cattle	Murrah	AXB Goats	SXB Goats	Total Goats
Average number of animals in milk per day	79	20	22	01	57	179	86	20	09	29
Average number of dry animals per day	102	34	29	02	46	213	58	09	05	14
Milking average (kg) per day	5.7	4.5	4.2	9.5	11.7	7.3	7.2	1.4	1.4	1.4
Overall average (kg) per day	2.5	1.7	1.8	3.2	6.5	3.3	4.3	1.0	0.9	0.9
Best yield (kg) in a day	17.0	15.0	16.0	16.0	39.5		18.0	3.4	3.3	
Animal Number	2534	1362	116	4479	7978		7564	411	308	

Artificial Breeding Research Center (ABRC) -

The Artificial Breeding Research Centre (ABRC) with 158 breeding bulls (Sahiwal-46, Tharparkar-10, Karan-Fries - 23, Karan Swiss -01, Murrah – 75, Gir- 3), is engaged in progeny testing programme for Sahiwal and Murrah bulls. This centre is engaged in advanced research on bull management, Breeding

soundness evaluation standards for the indigenous bull, semen cryobiology, sperm sexing; early bull fertility assessment, amelioration of vaccination stress and dissemination of quality germplasm to the farmers and developmental agencies. The Artificial Insemination Laboratory under ABRC is also developing strategies for fertility improvement in dairy cows and buffaloes through reproduction management, estrous synchronization.

Four Murrah breeding bulls were selected under Network Project on Buffalo Improvement for the 22nd set of progeny testing programme.

Production of superior germplasm

The centre is involved in production and conservation of superior male germplasm of cattle and buffaloes. During the year 2024 a total of 150776 doses of frozen semen were produced.

Month	MU	SW	TP	GIR	KF	KS	Total
January	4040	3720	-	-	280	-	8040
February	2078	4308	1540	-	2024	-	9950
March	4080	6240	280	-	2640	-	13240
April	9224	5680	840	220	3408	-	13972
May	9620	7780	340	-	3140	-	20880
June	2580	1200	-	-	1380	-	5160
July	5390	2620	-	-	1440	-	9450
August	9980	3900	-	-	1260	-	15140
September	5360	3500	-	-	2400	-	11260
October	9980	5364	1840	-	2500	-	19684
November	5660	3300	1700	560	1820	-	13040
December	4940	3760	1140	-	1120	-	10960
Total	**72932**	**51372**	**7680**	**780**	**23412**	**-**	**150776**

Dissemination of superior germplasm

The centre is disseminating superior male germplasm for genetic improvement programme of cattle and buffaloes. During the year ABRC disseminated 134370 ml doses liquid semen of Sahiwal, KF and Murrah bulls to local farmers and also disseminated/ supplied 97515 doses frozen semen of Sahiwal, Tharparkar, KF and Murrah bulls to farmers and various Dairy development organizations/ Institutes/ Gaushalas of 11 states viz., Haryana, Punjab, Uttarakhand, Delhi, U.P,MP Rajasthan, Bihar, Himachal Pradesh, and Maharashtra.

Month-wise dissemination of semen doses 2024

Month	Liquid semen doses (ml) to Farmers	Frozen semen doses to Farmers/ Institutes/ Dairy Development Agencies/ Project students Research
January	9485	4852
February	11230	11576
March	11635	6344
April	8910	8083
May	9210	3622
June	8290	5231
July	10270	6894
August	12600	8234
September	13860	5780
October	13150	11441
November	12900	11485
December	12830	13973
Total	**134370**	**97515**

Bull Strength during the year 2024 -

SN	Breed	January, 2024	December, 2024
1	MU	56	75
2	SW	45	46
3	KF	25	23
4	KS	1	1
5	TP	8	10
6	GIR	3	3
Total	**138**	**158**	

Reproductive status of NDRI Herd for the Year – 2024 -

Particulars	Breed					
	SW	TP	KS	GIR	KF	MU
				Cow/ Buff		
Nos. of Observations	81	29	1	27	36	73
Service Period (days)	132.91	118.06	118	141.0	152.02	137.28
Nos. of Service/Conception	1.50	1.27	1.0	1.62	1.63	1.45
				Heifer		
Nos. of Observations	41	12	4	26	22	26
Av. age at Maturity (Month)	30.68	30.5	28.5	34.30	31.54	28.73
Av. age at Conception (Month)	32.68	32.0	28.5	36.5	33.59	32.65
Nos. of Services/Conception	1.63	1.58	1.0	1.61	1.5	1.69
				Conception Rate (%)		
Conception Rate 1st Service	42.44	54.23	100	56.92	45.55	58.01
Conception Rate 3rd Service	81.39	77.96	100	84.61	67.77	81.67
Overall Conception Rate	**43.62**	**42.85**	**77.77**	**46.92**	**42.37**	**50.00**

Small Animal House

The Small Animal House Facility houses about 1000 mice (Swiss albino and C57 black), 500 rats (Wistar albino) and 25 New Zealand white rabbits. All animals are maintained following strict hygiene and animal ethics guidelines and are provided balanced diet and comfortable microenvironment. Planned breeding of the animals is carried out to cater the experimental needs of the research scholars and faculty of the institute. Other facilities available are centralized air conditioning, autoclave, incinerator, euthanasia chamber, dissection room, and fumigation facility.

Experimental Dairy

Experimental Dairy was setup in 1961 with the objective of providing necessary infrastructure facilities to the scientists for the scaling up of new products/processes developed in the laboratories on pilot scale as well as to provide training facilities to the students in the operation of dairy plant. Apart from above fulfilling above objectives, it also provides training to outside students of various universities/colleges and entrepreneurs from across the country in the dairy field. This self-sustaining Experimental Dairy has been running under Revolving Fund Scheme since 1989-90.

Experimental dairy processes the milk received from NDRI Cattle Yard. During the year 2024, 198585.00 kg Buffalo milk and 576440.00 kg Cow milk was processed. After milk collection, different platform and quality tests are done on daily routine basis after that milk is processed in different sections (Market Milk Section, Powder Section, Paneer and Cheese section) for products preparation. During the year 2024, Flavoured Dairy Drink, Ice Cream, Kalakand, Lassi, Paneer, Cheese Slice, SMP Roller etc. was prepared and sold at NDRI Milk Parlour. The revenue generated from the sale of milk products during the year 2024 was Rs.6,15,66,815.00/-

New Initiatives

During the year 2024, vacuum packaging of paneer was started in order to extend shelf life and maintain the quality of the product. Also, packaging design of pasteurized butter and Pizza cheese were re-designed for quality maintenance, ease of handling and to improve aesthetic value. In order to facilitate

digital/cashless transactions, UPI Payments were also started at milk parlour. Also, a liquid milk packaging machine and R.O. plant was procured and installed in experimental dairy. Cold rooms and milk parlour gate were also renovated.

During the year of 2024, about 1800 school/college students, farmers and officers from different states of India visited the experimental dairy to know about the milk processing.

Students of B.Tech (DT) in Experimental Dairy Plant

View of Milk Parlour at NDRI, Karnal

Computer Centre

The Computer Centre was established in 1982 with the aim to provide scientific data processing facilities to scientists and research scholars of the Institute. Over the years, the Centre has expanded its activities in line with the rapid advancements in ICT field to face the new challenges. The Centre has by now successfully inculcated Computer culture in the Institute by organizing training programmes/ workshops. The activities of Computer Centre are being carried out through three units, namely, Data Processing Unit; Teaching & Training Unit, and Computer maintenance Unit besides AKMU Cell and BTIS Sub Centre. The Centre also includes an ASRB Lab and a PC Lab where more than 130 systems are currently working and well equipped with an i3/i5, heavy duty Line Matrix Printer and software like MATLAB, SYSTAT, etc. NKN Connectivity 1 GBPS link with more than 300 Mbps speed is provided at NDRI offices and library. The network is utilized for various official purposes. Apart from this, the library is providing Internet/ Email Services to students, faculty members and other staff members of the institute. For this purpose there are 40 work-stations available in the library, so that students may have easy access to current information in the area of their interest and communicate with the researchers of their interest immediately. Our Kaveri, Alaknanda, and Narmada hostels are now fully Wi-Fi enabled, allowing students to conduct research-related work from their hostels. This upgrade has significantly enhanced the academic environment by providing seamless internet access for studies, research, and other educational activities. A dedicated mail server with the domain ndri.res.in has been created for the students. This server is maintained by the Computer Centre and it is ensured that all students have reliable and secure email communication for academic and administrative purposes. The servers' maintenance includes regular updates, security checks, and support to ensure uninterrupted service. Server room, web server and mail server for smooth internet functioning of NDRI are also maintained by the Computer Centre.

National Library in Dairying

The Institute Library has an impressive collection of literature on Dairy Science and related subjects. More than 36 scientific periodicals were subscribed to keep track of the current scientific/ technical developments. There are 99,369 volumes which include books, bound journals, theses, standards and annual reports. In addition of that 2023 e-books of different foreign and Indian publishers were made available for perpetual access at NDRI Campus. Library has an excellent computer section having twenty five workstations for students and staff of the institute. Students use these to get current information in the advanced research areas and for communication.

The Library provides Internet, Email, Documentation, Reference, Current Awareness Services, CD- ROM Literature scanning through CD-ROM of CAB Abstract, Food Science Technology Abstract, AGRIS, Derwent Biotechnology Abstract,

Indian Standards and ISO Standards on food products including milk and dairy products on CD-ROM. The Library also provides Photocopying, Document Scanning, Printing and Computerized Issue-Return and reservation facilities.

The Library, NDRI is an active partner CeRA (Consortium for e-Resources in Agriculture) and provides single point search for consortia subscribed, Library subscribed and open access journals to its users under institute's IP addresses.

CeRA Usage Report during the year 2024

1	Total Hits	11041
2	Total Logins/ Sessions	1520
3	Searches	4643
4	Document View	1937
5	Journal Finder	2238
6	Alerts	220
7	Profiles Created	50
8	Others Usage	432

Provides instant Document Delivery Services to users of ICAR sister Institutes, State Agricultural Universities and other participating Institutions on their request.

Document Delivery Request Send Report during the year 2024

Name of Institute/ University	Total Requests Received	Total Requests Fulfilled
Total Document Delivery Request Received and Delivered to ICAR Institutes/ State Agricultural Universities	405	212

The Library is also an active partner of Agricat (a sub-portal under WorldCat). Presently 53,441 catalogue records of Library, NDRI available on Agricat/ WoridCat and all the users worldwide participating institution may access catalogue records of national Dairy Research Institute though URL: http://www.worldcat.org or www.agricat.worldcat.org.

National Library in Dairying, ICAR-NDRI

Presently ~ 7345 digitized records, which includes valuable books, institutional publications, M.Sc. and Ph.D. Dissertations, reports, conference proceedings and ~ reprints etc. on KrishiKosh-Institutional Repository of Indian National Agricultural Research System. In addition of above complete online library catalogue is also available on URL: library.ndri.res.in by using Koha-Library Management System.

Communication Centre

The Communication Centre provides comprehensive photography, videography, and audio-visual support for various events and academic activities. The Photo Lab handled photography for 246 events, including seminars, workshops, VIP visits, and extension programs. It also managed photo printing, cataloguing, scanning, and consultancy services. The Video Lab covered 49 events, supporting research and documentation through audio-video editing, dubbing, and mixing. A notable achievement includes the re-editing of the NDRI song, showcased to national and international visitors. Facilities like Dr. D. Sundresan Auditorium (900 seats), Dr. N. N. Dastur Auditorium (149 seats), and Pinaki Hall support major institute functions and meetings. The Exhibition Unit hosted 14,580 visitors across 243 groups, organizing nine exhibitions across India. A Virtual Classroom supports online education with smart panels. Audio-visual services also extend to various auditoriums, halls, and outdoor venues, including student and institute events, ensuring seamless execution of programs across platforms.

Maintenance Engineering Section

In the year 1979, the Institute took over the maintenance works from CPWD and UHBVNL and created an in-house centralized maintenance facility named as Maintenance Engineering Section to operate the essential services of electric supply, water supply and sewerage water disposal and to provide maintenance services of all kinds to the whole institute. The following works/ functions are included in the mandate of M.E. Section.

The responsibilities involve comprehensive operation and maintenance of essential infrastructure systems at the Institute. This includes water supply via bore wells, sewage disposal through pumps and ETP, and ensuring compliance with environmental norms. Electrical duties cover substation operations, meter reading, billing, and providing uninterrupted power, including generator backup for offices, hostels, and residential areas. Civil, electrical, mechanical, and HVAC maintenance services are provided, along with renovation and repair work. Responsibilities also include preparing estimates for new and repair works, and maintaining plinth area records. Liaison with government agencies like CPWD, CPCB, HSPCB, UHBVN, and CEA ensures project execution and regulatory compliance. Additional duties involve maintaining residential quarters and other facilities, processing house loan advances, managing solar power generation, and maintaining inventory through civil and electrical stores. Alterations in lab infrastructure are made to enhance the research environment. Regular inspection of new buildings and utilities ensures efficient infrastructure management.

Infrastructure Developed

During the reporting period, ICAR-NDRI, Karnal, undertook a series of critical infrastructure enhancement works aimed at improving research, academic, and residential facilities. Key civil and electrical works included the renovation and renovation of the ABRC boundary wall and bull sheds to meet MSP standards, alongside the comprehensive overhaul of the high-tension electrical distribution system. Laboratory infrastructure was significantly upgraded with the renovation of the Feed Quality Control Lab, NCDC Lab, and multiple labs in the ABT and Dairy Chemistry Divisions to support advanced research instrumentation.

Residential and student facilities such as Kalki Bhawan, Alaknanda Hostel, and the Indoor Sports Complex were refurbished. New constructions included vehicle parking sheds, an animal incinerator platform, and profile sheet-roofed structures. Guest house infrastructure was improved through roof re-grading and pathway tiling. Administrative and academic buildings underwent structural and aesthetic enhancements. These initiatives were implemented to support scientific excellence.

Human Health Complex

The Human Health Complex (HHC) of ICAR-NDRI became functional on September 23, 1991, with a 20-bed capacity to cater the healthcare needs of students, staff, retired personnel, and their families. Additionally, HHC provides medical treatment facilities to sister institutes located in Karnal.

At present, HHC has a full-time Medical Consultant and three part-time consultants specializing in Homeopathy, Ayurveda, and Gynecology.

Furthermore, HHC has empaneled five hospitals- Amritdhara, Cygnus, Park, Virk, and Arpana for cashless treatment, along with 13 hospitals for OPD treatment of staff, their dependents, and retired employees.

In 2024, HHC provided medical treatment to 11,500 patients and supplied medicines and laboratory facilities to students, staff, and their dependents, including retired faculty of ICAR-NDRI and its sister institutes in Karnal. Additionally, HHC regularly organizes health awareness programs on diseases such as malaria, tuberculosis, and polio in collaboration with District Hospital Karnal. It also conducted five medical health camps in partnership with Amritdhara, Park and Cygnus hospitals during the ICAR Sports Meet, held during August 25-30, 2024.

Model Dairy Plant

A state-of-the-art commercial Dairy Plant was established in 1996 at N.D.R.I. (National Dairy Research Institute), Karnal through the financial assistance and installed on turnkey basis by the National Dairy Development Board. The Plant has been designed to handle 60,000 liters (Ltrs.) of milk per day initially and is presently handling 1,50,000-1,70,000 liters per day. Model Dairy Plant is presently certified under the Food Safety Management System ISO 22000:2018.

Special Features:

- Model Dairy Plant provides Six Months In-plant training to the students of B.Tech. (DT) of the NDRI Deemed University during the 4th year of the course curriculum.
- The students are provided with complete infrastructure for training, which helps them in gaining sufficient experience in managing the modern commercial Dairy Plant and instills confidence in handling real life problems in production management.
- It also provides infrastructure facilities to the scientists of NDRI for scaling up R&D concepts from laboratory scale to industrial scale under commercial environment.
- Model Dairy Plant (MDP), an Autonomous Unit of ICAR, is independently managed by a committee, whose chairman is the Director of NDRI.

Procurement of Milk

MDP does not have its own infrastructure for milk procurement and is receiving milk on behalf of Mother Dairy Fruit and Vegetable Ltd. from the Milk Producers companies of All over India. The average milk procurement is 1.40 lacs liters per day, which is sufficient to meet day to day demand of different milk variants like Full Cream Milk (Premium), Full Cream Milk, Toned Milk, Double Toned, Super T, Cow Milk being packed at MDP.

Liquid Milk Processing and Packaging

Model Dairy Plant is currently engaged in processing and packaging of milk for Mother Dairy in different variants (Full Cream (Premium), Full Cream, Toned Milk, Double Toned Milk, Super T and Cow Milk). MDP is presently processing and packing 1,60,000 LPD of Poly pack Milk in all the varieties for Mother Dairy Fruit and Vegetable Pvt. Ltd., Delhi. The plant is running in three shifts and the supplies from MDP are dispatched in the evening and morning to Delhi market and nearby cities thereby utilizing the plant to more than its full capacity.

Ghee Manufacturing

MDP manufactures Cow Ghee from Cow Butter purchased from different State Federations and its production is taken as per demand. The average production/sale of ghee is 50-55 metric tons per month. All the Ghee manufactured at MDP is being sold through the MDP Sale Counter.

Cheese and Paneer

MDP is also engaged in training students in manufacturing of Cottage Cheese, Processed Cheese, Paneer on trial basis. The section is operated occasionally for the purpose of taking trials and making the students familiar with the manufacturing details.

Pinni & Besan Burfi Manufacturing

Pinni launched in the thirteenth Convocation of N.D.R.I. Deemed University on 14th February 2015 and developed by the students of batch 2010-14. Multi Grain Pinni launched in Sept 2023. Beasn Pinni and Besan Burfi launched in the month of June, 2024. Total Sale of Pinni and Burfi was 84.0 metric tons from January–December 2024.

Training to the Students

Model Dairy Plant provides In-plant training to the

4th B.Tech. (DT) students of NDRI Deemed University. The students are provided with In-plant Training Manual comprising of unit wise operation covering all the sections of the Dairy Plant. Since its inception in 1996, Model Dairy Plant has provided training to twenty-Nine batches of B.Tech. (DT) students. The student trainees are provided Rs.5000/- per month as stipend for first five meritorious students and Rs.3000/- per month for rest of trainee students from the year 2025. So far, 714 students have been trained at MDP. Students are given hands on experience for plant operations and are trained to manage the shift activities of the plant under the guidance of trained technical staff.

In addition to the above, students are also made to involve in other activities like KAIZENs, Small Group Activities etc. The feedback regarding In-plant Training, from the student's trained at MDP and now working in different capacities with different organizations is quite positive and encouraging.

Highlights of Model Dairy Plant in the year 2024

1. Two Nos. High Speed Packing machine of capacity 12000 pouches purchased for replacement of one old packing machines and one for small size packing.
2. New product Besan Pinni launched.
3. New product Besan burfi launched.
4. Family pack of eilachi kulfi in 10 pieces launched.
5. Underground water tanks of each 5 LL capacity tiling work from bottom and wall side done.
6. High Speed Milk Packing Machine installed.
7. Epoxy flooring in butter cold stores and main lab completed.

Launch of new milk products by the Model Dairy, ICAR-NDRI, Karnal on the occasion of World Milk Day celebration on June 1, 2024

17. REGIONAL CAMPUS

SOUTHERN REGIONAL STATION, BENGALURU

The National Dairy Research Institute (NDRI) was originally established in Bangalore (now Bengaluru) and has since evolved into what is today known as the Southern Regional Station of National Dairy Research Institute. This pioneering institution in dairying has undergone a series of transformations during its remarkable history spanning more than 100 years. It had its origin on July 16, 1923 as the Imperial Institute of Animal Husbandry and Dairying, established as the primary centre for training and research in dairying in the country. A two-year course leading to Indian Dairy Diploma (IDD) was started as back as in 1923 and it is a matter of pride that the Alumni of the Institute served at various capacities for the development of dairy sector in the country. One of the memorable events of the Imperial Institute was the visit of Mahatma Gandhi in 1927 who got acquainted with scientific dairy farming. After independence, Imperial Dairy Research Institute was renamed as Indian Dairy Research Institute. The activities of the institute were further strengthened during 1952-54 by locating a Central Artificial Insemination Centre, Key Village Scheme and Southern Regional Animal Nutritional Research Centre at Bangalore. Following the reorganization of the institute in 1955 when the National Dairy Research Institute was established with its headquarters relocated to Karnal, the Bangalore centre continued its legacy as the Southern Regional Station, maintaining its position as a leading institution in dairy education and research.With a total strength of 25 scientific faculties, the station is engaged in teaching, research, training, and extension in the field of dairy production, dairy engineering, dairy processing& technology, dairy extension, economic and statistics. This natural green campus is endowed with necessary infrastructure in terms of farmland of about 21 ha, dairy herd of about 300 animals comprising Deoni, Malnad Gidda cattle & HF Crossbred cattle, laboratories are supported with basic and modern equipment, experimental dairy plant, library, staff dispensary, and students hostel & guest house facilities. The Station functions with following objectives focused on the regional issues viz. identify the region-specific problems of dairy production, processing and management in southern part of the Nation and offer solutions through research and extension activities on continuing basis, establish centers for technology development, assessment and dissemination and establish centers of advanced studies for R & D and HRD with the Station as the Southern Campus of NDRI Deemed University.

Infrastructure Facilities and glimpses of student activities of Southern Regional Station, Bengaluru -

Livestock research centre

The Livestock Research Centre at SRS, ICAR-NDRI, Bengaluru, maintained a diverse herd in 2024, consisting of Deoni, Malnad Gidda, and HF crossbred cattle. The total milk production was 139,954 kg, with HF crossbred cattle leading the production at 113,149.5 kg, followed by Deoni cattle at 25,140.1 kg, and Malnad Gidda cattle contributing 1,664.1 kg. On average, the herd had 41 milking HF crossbred cows, 18 Deoni cows, and 2 Malnad Gidda cows per month. In terms of fodder production, the LRC achieved a total of 1,685.04 tonnes, including 562.55 tonnes of Paragrass, 794.35 tonnes of Hybrid Napier, 254.82 tonnes of Guinea Grass, 28.10 tonnes of Fodder Maize, 35.32 tonnes of CoFS, and 9.90 tonnes of miscellaneous crops such as Cowpea, Hedge Lucerne, Rhodes Grass, and Sudan Grass.

Lactating Deoni cattle at LRC of the station

Forage section

In 2024, total fodder production was 1,685.04 tonnes, contributing significantly to meeting the nutritional requirements of the dairy herd and supporting various demonstration activities. The production comprised 562.55 tonnes of Paragrass, 794.35 tonnes of Hybrid Napier, and 254.82 tonnes of Guinea Grass, which served as the primary green fodder sources. Additionally, 28.10 tonnes of Fodder Maize and 35.32 tonnes of CoFS (Cereal-based Fodder Sorghum) were harvested to diversify the feed base. The Centre also produced 9.90 tonnes of miscellaneous crops, including Cowpea, Hedge Lucerne, Rhodes Grass, and Sudan Grass, enriching fodder variety and quality.

Experimental plant

Experimental dairy plant has facility to process the milk to pasteurized milk and packaging in LDPE pouches. The capacity of the plant is 500 LPH. In addition it has also the facility to manufacture products like ice cream, cheeses, processed cheese, cheese spread, paneer, butter, ghee, flavoured milk, yoghurt, dahi, traditional Indian sweets like kunda, milk sweet, chhana podo. Dry powder products like cheese puri mix and gulab jamun mix are also being manufactured in this facility. This facility has been used by most of the research students of post-graduation and doctoral degree to complete their research work. This facility has also made available to external user on chargeable basis as and when request received, especially equipment like homogenizer and ice cream freezer.

Milk parlour

Milk parlor is situated at the entrance of SRS, ICAR-NDRI Campus and many customers visit and purchase the products. It operates from morning 6:30 AM to evening 6:30 AM. Raw fresh milk is also offered to sale to customers through this parlor. Value added products like ice creams, Cheddar cheese, processed cheese, cheese spread, paneer, butter, flavoured milk, Greek yoghurt, curd, kunda, milk sweet, chhana podo, cheese puri mix, gulab jamun mix, whey-fruit beverages, mozzarella cheese are being sold through this parlor.

New variant of *Lassi*, made using skimmed milk Dahi was launched on October 3rd 2024 at the Southern Regional Station of ICAR-NDRI, Bengaluru by the honourable Director and Vice Chancellor Dr Dheer

Dr. Dheer Singh, Director and Vice Chancellor of the Institute launching Lassi prepared with skimmed milk Dahi

Singh. The developed product is intended to cater to the need of consumers looking for low fat and low calorie conventional dairy product. The product recorded the fat content of 0.2% only.

Academic cell

B.Tech (Dairy Technology), M.Tech (Dairy Technology and M.Tech (Dairy Engineering) courses were offered during the year 2024 with 15 B.Tech (DT), 7 M.Tech (DT), 5 M.Tech (DE) students respectively. The dissertation works of PG and PhD students in the disciplines of Dairy Technology, Dairy Chemistry, Dairy Engineering, Animal Genetics & Breeding, Animal Nutrition, Veterinary Gynaecology and Obstetrics, Livestock Production Management, Animal Biochemistry Agricultural Economics and Agricultural Extension Education were also being guided by the faculty of SRS. During the year 15 PG students submitted their final thesis for the award of degree. The PG students from other Universities were also mentored to carry out their internship training at this station. Further, the station serves as a Study Centre of the Indira Gandhi National Open University (IGNOU). During the year, a total of 88 students registered for various courses of IGNOU: at this station: Post Graduate Diploma in Food Safety and Quality Management (PGDFSQM) - 18; M.Sc. Food Safety and Quality Management (MSCFSQM)- 60 and B.Sc. Food Safety and Quality Management (BSCFSQM) :10.

Closing ceremony of "DIKSHARAMBH" for the newly admitted B.Tech and M.Tech students of the academic year 2024-2025

Library

The library of this station is stocked with 13420 books, 10946 bound journals, 4382 Thesis and 1295 reprints. Few journals are received on *gratis* basis from different Institutions / Organizations of the Country. The library has LIBSOFT Library automation software through which in house operation and functions are carried out. 10654 bibliographical details about the books have been updated in to the software. Library is equipped with computer system to meet the student's requirements with Wi-Fi connectivity, photocopying facility, newspaper clipping services, reference services and inter library loan facilities to readers. Library is functional from 9.00 a.m. to 05.30 p.m. on all working days. The Library serves as a referral Centre for students and dairy industry professionals of the region.

Library section of the SRS

Computer Section

The Computer Centre at SRS of ICAR-NDRI, Bengaluru was established in 1990 with the aim to provide Scientific data processing facilities to Scientists and Research scholars of the Institute. Over the years, the Centre has expanded its activities in line with the rapid advancements in the ICT field to face the new challenges. The Computer centre at this campus is also responsible for the information security of the Institute through a centralized network-based security system comprising a Sophos firewall and antivirus software. Internet facility is provided by the "National Knowledge Network (NKN)" an initiative of the Govt. of India. As a hub of the NKN, the institute is provided with a 100 mbps link. The network is utilized for various official purposes. Apart from this, the computer cell and library at this station is providing Internet/ Email Services to students, faculty members and other staff members of the institute. Our campus and hostel are now fully Wi-Fi enabled, allowing Researchers and Students to conduct research-related work from the hostel premises. This upgrade

has significantly enhanced the academic environment by providing seamless internet access for studies, research, and other educational activities. The network is maintained by the Computer Centre and it is ensured that all students and staff have reliable and secure email communication for Research, academic and administrative purposes. Further, the Computer Centre also provides the Maintenance of computers, its peripherals including Hardware and software through outsourced agency by regular updates, security checks and support to ensure uninterrupted service for smooth Internet functioning. The computer centre also facilitates the maintenance of CCTV surveillance systems and EPABX at the station.

Atal Incubation Centre

Atal Incubation Centre at SRS is called AIC-SRS-ICAR-NDRI Foundation, Bengaluru. The Atal Incubation Centre was established at SRS, Bengaluru as a Section – 8 company (registered as AIC- SRS-ICAR-NDRI Foundation Bengaluru) in the year 2018 with the financial support of Atal Innovation Mission (AIM), NITI Aayog, New Delhi. Though the AIC was established in 2020, and became functional in 2021. The Inauguration of AIC was done by Dr. Trilochan Mohapatra, the then Director General of ICAR and Secretary of DARE, in the presence of Sri Ramanan, Mission Director of the Atal Innovation Mission, NITI Aayog, and Dr. M.H. Chauhan, Director and Vice Chancellor of ICAR-NDRI, Karnal, and Dr. K.P. Ramesha, the then Head, SRS of ICAR-NDRI, Bengaluru along with other distinguished officials. The AIC is functional and operated by the Board of Directors and External Members with the assistance of Incubation Manager and Office Assistant. A total of three incubates viz. M/S. Amizzo Foods (Kulfi& Ice Cream), M/S. S.R. Establishments (Paneer) and M/S. 2S Dairy Deli Products (OPC) Pvt. Ltd (Cheeses Spreads and Dips) completed their incubation. Currently, on-board incubates are M/S. Polisem Agronomic Pvt Ltd. (Developing extender for easy storage of semen), M/S. BioSouk Life Science (kit for milk & meat freshness detection), M/S. Sanviha Food Tech Solutions (manufacturing fat filled with milk powder), M/S. Oshiravbrih Foods Pvt Ltd. (supply of raw milk, processed milk and value added dairy products) and ALT Basket PVT Ltd. (plant based Oat milk) and M/S. Flix Drop Technologies (Animal health monitoring system).

Central FSSAI Registration

SRS of ICAR-NDRI obtained a "Central FSSAI Registration Certificate" on August 14 2024, vide certificate No.: **21224999000001**, from the office of the "Food Safety Compliance System" (FoSCoS), FSSAI. This certificate is valid till August 13, 2029.

EASTERN REGIONAL STATION, KALYANI -

The Eastern Regional Station of National Dairy Research Institute was established at the Central Dairy in Calcutta in 1964 and was shifted during 1966 to Kalyani, Nadia district; about 50 km north of Calcutta and was located in the Administrative Building of Kalyani University. The Regional Animal Nutrition Research Centre of the ICAR. till then located at Haringhata, West Bengal, was merged with the ERS of NDRI with effect from June 1, 1968. In 1978 the Government of West Bengal granted 100 acres of land at Kalyani where cattle sheds, forage unit, staff quarters etc. were gradually built up. The Station built its own laboratory building and the entire station started functioning within the same campus from May, 1987. The main objective of establishing the Eastern Regional Station of NDRI was to identify the major constraints of dairy production in eastern and north eastern India and to offer solutions through research and extension activities to these problems. It serves as a vital link between the NDRI, Karnal and the far-flung areas of the eastern and north eastern regions of the country for transfer of technology developed at the institute and provides appropriate feedback after trial for perfection. The research work undertaken at this station is mainly strategic and applied in nature and the thrust of research is to improve the socio-economic condition of dairy farmers of this region.

A view of Eastern Regional Station of ICAR-NDRI, Kalyani

The research work during the period of 1964-1972, were mainly related to Animal Nutrition, that during the period of 1972-1976, were related to Animal Nutrition and Dairy Chemistry and Bacteriology, that during the period of 1977-1985, related to Animal Nutrition, Animal Breeding, Soil Science, Dairy Economics and Dairy Extension, that during the period of 1986-1991, were related to Animal Nutrition, Livestock Production and Management, Animal Breeding, Forage Production, Dairy Economics & Statistics and Dairy Extension and that during the period of 1992-1997, were related to Animal Nutrition, Livestock Production and Management, Animal Breeding, Forage Production, Dairy Economics & Statistics and Dairy Extension. Animal Biotechnology Section started functioning during 2005. The Animal Physiology and Reproduction Laboratory were also established in 2013-14. Goat Farm was also established in 2014-15 in a small scale for research, education and training purposes. Krishi Vigyan Kendra-II, Nadia District of West Bengal was sanctioned in 2016-17 for establishment in the Campus of ERS-NDRI, Kalyani. Dr. Himanshu Pathak, Secretary DARE & DG, ICAR, inaugurated new facilities (Administrative and Farmers' hostel facilities) at Krishi Vigyan Kendra (Additional) Nadia, on March 31, 2024.

The Eastern regional station of ICAR-National Dairy Research Institute has infrastructure facilities like Research Laboratories, Cattle Herd, Fodder Farm, Library, Computer Section, Academic Cell, Hostels and Guest House, Estate Section *etc.*

Keeping in view the enormous demand for milk in the eastern region, low milk production potential of the native stock, shortage of feed and fodder resources and diversified agro-climatic and socio-economic conditions; this research station has a great role to play in the field of dairy development in this region.

Forage Farm of ERS-NDRI, Kalyani

Forage Farm section is engaged in cultivation of quality fodder crops in about 27-30 hectares area and manages harvesting and supply of fodder crops either chaffed or unchaffed to the Cattle Yard. Besides cultivation of fodder crops, the Forage Section also has a mini workshop for regular servicing of agricultural machineries including tractors, chaff-cutter etc. There is a small vermi-compost unit used for training and demonstration purpose. There are more than 1000 plants of teak,

Annual Performance of ERS, ICAR-NDRI, Kalyani Herd

Production & Reproductive Performance of Cattle at in continuation ERS- NDRI Herd during 2024: -

Particulars	Jersey Cross	Particulars	Jersey Cross
Herd Strength as on 31-12-2024	229	No. of Inseminated	243
Total Milk Production (Kg)	16541.17	No. of Pregnant	75
Av. no of Cow's in Milk/Day	72	Conception Rate (%)	30.9
Av. no of Cow's In Dry/Day	23	Service Period (Days)	123
Wet Average (Kg)/Day	7.53	Inter Calving Period (Days)	457
Herd Average (Kg)/Day	5.73	Mortality (%)	4.8
Age at First Calving (Month)	36.5		

sheesham, mango, coconut *etc*. growing around the Institute premises. Mango and guava based agro-forestry have been developed in the ERS campus. Every year staff of ERS used to plant several saplings of different useful species in the campus. The Forage Section has necessary facility for covering the theoretical and practical part of training on fodder crop production.

Library

The Library of ERS contains 1818 books, 4078 volumes of bound journals and other periodicals in the field of Dairying. Besides, Annual Reports of different Institutes and proceedings of various workshops and seminars are also available for reference. Presently Indian Journals are subscribed for students and Scientists.

Fodder production and supply to the Institute Farm, ICAR-NDRI-ERS, Kalyani

Sl. No.	Particulars of fodders	Quantity (Qtl.)
1.	Maize+Cowpea/Maize+Guinea	1693.30
2.	Sorghum/Sorghum+Cowpea/Sorghum+Sorghum+Guinea	9686.90
3.	Oats/Oats+Mustard/Oats+Guinea	3308.50
4.	Berseem/Berseem+Mustard	1519.45
5.	Cowpea+Guinea, Bajra	1872.05
6.	Hybrid Napier Grass/Guinea Grass/Para Grass/Hybrid Napier Grass+Guinea	395.70
	Total	**18475.90**

Computer Cell

The computer center facilitates the maintenance of databases and analysis of research data. The institute has high speed Internet connectivity through NKN, which is being used by Masters' and Ph.D. students for academic and research purposes and by other staff for official and administrative activities of the Institute. The computer cell has extended the Internet facility to Hostels, Guest house and different sections like cattle yard, Forage and Estate section of the Institute.

Academic Cell

M.Sc./ M.V. Sc. and Ph. D. students of different disciplenes like Animal Nutrition, Livestock Production & Management, Animal Physiology, Animal Reproduction, Animal Biotechnology, Animal Genetics & Breeding and Dairy Extension are alloted to pusue ther disseration/ research work at Eastern Regional station, Kalyani. During the year 2024, three Master degree students and five Ph.D. students have successfully completed their thesis works and awarded the respective degrees. Presently, 10 Master degree students and 15 Ph.D. students are pursuing their research work. Other than academics, some sports and literary acivities are organized in which students take keen interest.

18. BUDGET AND EXPENDITURE -

Revenue Generation

The financial outlays in terms of actual expenditure for Grants for the year 2024-25 was ₹ **27,116.10** lakhs and the sanctioned budget for Grants in 2024-25 was ₹. **27,116.50** lakhs. These figures include the financial outlays for regional stations also.

Financial Outlays & Expenditure during 2024-24

(₹ in lakhs)

Particulars	RE/ Budget(2024-25)	Expenditure (2024-25)
Grant-in-Aid Capital	398.00	398.00
Grant-in-Aid General	4,558.00	4,557.60
Non Scheme:- GIA-General	0.00	0.00
Total (Capital + General)	4,956.00	4,955.60
Grant-in-Aid Salary	9,570.50	9,570.50
Grant-in-Aid Pension	12,590.00	12,590.00
Total (Salary + Pension)	**22,160.50**	**22,160.50**
Grand Total	**27,116.50**	**27,116.10**

Resource Generation

The revenue receipts of the Institute and the Regional Stations for the year 2024-25 were ₹1,278.79 lakhs. -

Sl. No.	Head of Account	₹ in lakhs
1.	Sale of farm produce	453.96
2.	Sale of Livestock	85.83
3.	License Fee	64.09
4.	Interested earned on loans and Advances	5.08
5.	Leave Salary and Pension Contribution	25.09
6.	Analytical and Testing Fee	4.21
7.	Application fee from candidates	258.23
8.	Interest earned on short term deposits	109.50
9.	Income generated from internal resource generation	22.23
10.	Recoveries of loans and advances	13.88
11.	Miscellaneous Receipts	236.69
	Grand Total	**1,278.79**

Position of Manpower at NDRI, Karnal and its Regional Stations with KVKs as on December 31, 2024

Type of Posts	Sanctioned/Approved Posts	In-Position Posts	Vacant Posts
Director	1	1	0
Joint Director	2	2	0
Scientific	190	135	55
Technical	226	163	63
Administrative (Group: A&B)	48	36	12
Administrative (Group: Non-Gazetted)	91	65	26
Multi Tasking Staff	374	199	175
Total	**932**	**601**	**331**

19. राजभाषा गतिविधियां

भाकृअनुप–राष्ट्रीय डेरी अनुसंधान संस्थान, करनाल की वर्ष 2024 की राजभाशा की विभिन्न गतिविधियां–2024

भारत सरकार की राजभाषा नीति के अनुपालन में राजभाषा हिंदी के प्रचार, प्रसार एवं कार्यान्वयन हेतु संस्थान में वर्ष 1979 में राजभाषा एकक की स्थापना की गई। राजभाषा एकक द्वारा संस्थान के अधिकारियों, वैज्ञानिकों, मंत्रालयिक स्टाफ, तकनीकी स्टाफ आदि को राजभाषा हिंदी में कार्य करने के लिए प्रोत्साहित करते हुए हर संभव प्रयास/सहयोग प्रदान किया जा रहा है। संस्थान के द्वारा वर्ष 2024 में निम्नलिखित गतिविधियों का आयोजन किया गया।

संस्थान राजभाषा कार्यान्वयन समिति की बैठकें

1. डा. धीर सिंह, निदेशक, भाकृअनुप–राष्ट्रीय डेरी अनुसंधान संस्थान, करनाल की अध्यक्षता में संस्थान राजभाषा कार्यान्वयन समिति की 01 जनवरी से 31 मार्च, 2024 तक की 102वीं तिमाही समीक्षा बैठक दिनांक 24.01.2024 को अपराह्न 3.30 बजे से संस्थान के पिनाकी हॉल में आयोजित की गयी। बैठक में संस्थान के 33 पदाधिकारी शामिल हुए और उन्होंने उन सभी बिन्दुओं पर चर्चा की जहां हिन्दी के कार्य में गति लाने की आवश्यकता थी।
2. संस्थान राजभाषा कार्यान्वयन समिति की 01 अप्रैल से 30 जून, 2024 तक की 103वीं तिमाही समीक्षा बैठक डा. धीर सिंह, निदेशक, भाकृअनुप–राष्ट्रीय डेरी अनुसंधान संस्थान, करनाल की अध्यक्षता में दिनांक 06.05.2024 को अपराह्न 3.30 बजे से संस्थान के पिनाकी कक्ष में आयोजित की गयी। बैठक में संस्थान के 33 प्रभागों एवं अनुभागों के अध्यक्ष शामिल हुए। बैठक में राजभाषा हिन्दी के कार्य में गति लाने वाली अनेक बिंदुओं पर चर्चा की गई।
3. डा. धीर सिंह, निदेशक, भाकृअनुप–राष्ट्रीय डेरी अनुसंधान संस्थान, करनाल की अध्यक्षता में संस्थान राजभाषा कार्यान्वयन समिति की 01 जुलाई से 30 सितंबर, 2024 तक की 104वीं तिमाही समीक्षा बैठक दिनांक 08.08.2024 को अपराह्न 3.30 बजे से संस्थान के पिनाकी हॉल में आयोजित की गयी। बैठक में संस्थान के अनेक प्रभागों एवं अनुभागों से 34 पदाधिकारी शामिल हुए एवं उन्होंने बैठक में राजभाशा हिन्दी से संबंधित सभी महत्वपूर्ण बिंदुओं पर चर्चा की जिससे हिन्दी का कार्य आगे बढ़ सके।
4. डा. धीर सिंह, निदेशक, भाकृअनुप–राष्ट्रीय डेरी अनुसंधान संस्थान, करनाल की अध्यक्षता में संस्थान राजभाषा कार्यान्वयन समिति की 01 अक्तूबर से 31 दिसंबर, 2024 तक की 105वीं तिमाही समीक्षा बैठक दिनांक 18.12.2024 को अपराह्न 3.00 बजे से संस्थान के पिनाकी हॉल में आयोजित की गयी। बैठक में संस्थान के 28 पदाधिकारी शामिल हुए। बैठक के दौरान समिति ने उन सभी बिन्दुओं पर चर्चा की जहां हिन्दी के कार्य में गति लाने की आवश्यकता थी।

हिन्दी कार्यशालाएं, संगोष्ठियां एवं प्रशिक्षण

1. संस्थान के डा.एन.एन.दस्तूर सभागार में दिनांक 05.03.2024 को अपराह्न 3.00 बजे से ''अपनी हिन्दी सुधारें एवं हिन्दी की तिमाही रिपोर्ट भरने में आने वाली समस्याओं का निराकरण'' विषय पर आयोजित की गई। एक दिवसीय हिंदी कार्यशाला में संस्थान कार्यालयों के तकनीकी एवं प्रशासनिक श्रेणी के अनेक अधिकारी एवं कर्मचारी सम्मिलित हुए। इस अवसर पर अपने व्याख्यान श्री धीरज शर्मा, संयुक्त निदेशक (राजभाषा) ने तिमाही रिपोर्ट कैसे भरें विषय पर विस्तार से चर्चा की।
2. संस्थान के डा.एन.एन.दस्तूर सभागार में दिनांक 27.06.2024 को अपराह्न 03.00 बजे से ''राजभाशा हिन्दी का सरलता से कार्यालय में प्रयोग'' विषय पर आयोजित की गई एक दिवसीय हिंदी कार्यशाला में संस्थान के प्रशासनिक और तकनीकी श्रेणी के अधिकारी एवं कर्मचारी सम्मिलित हुए।
3. संस्थान के डा. एन.एन.दस्तूर सभागार में दिनांक 18.09.2024 को "राजभाशा हिंदी एवं उसका कार्यान्वयन, शब्द रचना एवं शब्दावली'' विषय पर तिमाही हिन्दी कार्यशाला का आयोजन किया गया जिसमें संस्थान के 110 वैज्ञानिक, अधिकारी एवं कर्मचारी सम्मिलित हुए।
4. संस्थान के श्री धीरज शर्मा, संयुक्त निदेशक (राजभाषा), भाकृअनुप–केन्द्रीय पक्षी अनुसंधान संस्थान, इज्जतनगर, बरेली तथा संस्थान के अधिकारियों एवं कर्मचारियों के लिए संयुक्त रूप से दिनांक 17.12.2024 को अपराह्न 3:30 बजे से हिन्दी कार्यशाला (राजभाषा कार्यान्वयन : नियम एवं अधिनियम विषय पर) व्याख्यान दिया। जिसमें संस्थान के वैज्ञानिक, अधिकारी एवं कर्मचारी एवं नराकास, करनाल के सदस्य कार्यालय के 81 अधिकारी एवं कर्मचारी शामिल हुए।

दिनांक 27.06.2024 को अपराह्न 03.00 बजे कार्यशाला की झलक

हिंदी दिवस समारोह एवं हिंदी पखवाड़ा–2024 एवं वार्शिक पुरस्कार वितरण समारोह

भाकृअनुप–राष्ट्रीय डेरी अनुसंधान संस्थान, करनाल ने दिनांक 18.09.2024 से 04.11.2024 तक की अवधि में हिंदी पखवाड़ा–2024 का आयोजन किया गया। इस महोत्सव के दौरान वैज्ञानिकों, कर्मचारियों तथा विद्यार्थियों के लिए हिंदी निबंध प्रतियोगिता (20.09.2024), हिंदी शोध पत्र/पोस्टर प्रदर्शन प्रतियोगिता (23.09.2024), हिंदी श्रुतलेखन प्रतियोगिता (25.09.2024), हिंदी टंकण प्रतियोगिता (27.09.2024), भारत ज्ञान प्रतियोगिता (30.09.2024) तथा टिप्पण–आलेखन प्रतियोगिता (01.10.2024) का आयोजन किया गया।

हिंदी शोध पत्र/पोस्टर प्रदर्शन प्रतियोगिता (23.09.2024) की झलक

वर्ष 2024 के दौरान संस्थान की राजभाशा संबंधी प्रमुख गतिविधियां :

- संस्थान की हिन्दी की चारों तिमाही बैठकें प्रत्येक तिमाही में एक–एक कर आयोजित की गयीं।
- नराकास, करनाल का सचिवालय होने के कारण नगर राजभाषा कार्यान्वयन समिति की 12 जून, 2024 तथा 18 नवंबर, 2024 में छमाही समीक्षा बैठक आयोजित की गयी।
- नगर राजभाषा कार्यान्वयन समिति की 12 जून, 2024 बैठक में नराकास, करनाल के सभी सदस्यों कार्यालयों द्वारा राजभाषा कार्यान्वयन के क्षेत्र में वर्श 2023–24 में सराहनीय कार्य हेतु प्रदत्त, पत्रिका प्रकाशन हेतु शोध संस्थान श्रेणी, बैंक श्रेणी, केन्द्रीय कार्यालय श्रेणी, निगम श्रेणी को प्रथम, द्वितीय एवं तृतीय पुरस्कार से सम्मनित किया गया।
- संस्थान में वर्ष के दौरान चार हिन्दी कार्यशालाओं का आयोजन किया गया।
- वर्ष 2023–24 के दौरान ''सरकारी कामकाज में मूल हिन्दी टिप्पण/आलेखन योजना'' के अन्तर्गत संस्थान के 12 विजेताओं को नकद पुरस्कार व प्रमाणपत्रों से सम्मानित किया गया।
- संस्थान की ''वैज्ञानिक तथा तकनीकी लेखन प्रोत्साहन योजना'' का नियमित रूप से प्रत्येक वर्ष आयोजन कर विजेताओं को नकद पुरस्कार एवं प्रमाण पत्रों से सम्मानित किया जाता है।
- संस्थान में वैज्ञानिकों व विद्यार्थियों के द्वारा हिन्दी में शोधपत्र व पोस्टर बनाने के लिए उन्हें प्रोत्साहित करने के लिए प्रत्येक वर्ष हिन्दी पखवाड़ा/माह के दौरान ''हिन्दी शोधपत्र व पोस्टर प्रदर्शन ''प्रतियोगिता का आयोजन कर सभी प्रतिभागियों को प्रतिभागिता प्रमाणपत्र व विजेताओं को नकद पुरस्कार एवं प्रशस्ति प्रमाणपत्र से सम्मानित किया जाता है।
- संस्थान के डेरी कैलेण्डर को विगत वर्षों की भाँति कृषकों व पशुपालकों के हित को ध्यान में रखकर उनसे संबंधित उपयोगी जानकारी को संक्षिप्त रूप में केवल हिन्दी में तैयार कर प्रकाशित किया जा रहा है।
- निदेशक महोदय के हस्ताक्षर से संस्थान के सभी प्रभागों एवं अनुभागों में जांच बिन्दु बनाए गए।
- संस्थान की राजभाषा गृह पत्रिका 'दुग्ध गंगा' का प्रकाशन किया गया।
- संस्थान के सभी वैज्ञानिकों, अधिकारियों एवं कर्मचारियों के नाम से निदेशक के हस्ताक्षर उपरांत व्यक्तिशः आदेश जारी किए गए।
- संस्थान के 100 से अधिक शोधकर्ता विद्यार्थियों के थीसिस एब्सट्रेक्ट का हिन्दी अनुवाद किया गया।
- संस्थान के लगभग 60 विद्यार्थियों को सप्ताह में तीन दिन हिन्दी की कक्षा के माध्यम से हिन्दी संबंधी बुनियादी जानकारी प्रदान की गयी।
- राजभाषा अधिनियम 1963 की धारा 3(3) के अंतर्गत आने वाले 400 से अधिक दस्तावेजों को राजभाशा एकक द्वारा द्विभाषी किया गया।
- हिन्दी में प्राप्त सभी पत्रों के उत्तर हिन्दी में दिए गए।

20. SWACHH BHARAT ABHIYAN: CLEAN & GREEN NDRI

ICAR-NDRI is consistently pursuing vigorous initiatives in order to keep its campus clean and green. It always inspires the rural farming community also to maintain hygienic and healthy environment of their locations under the novel programme, Swachchh Bharat Abhiyan (SBA) led by the Union government. This covers organizing cleanliness campaigns, motivational talks, publications, awareness camps, cycle rally, tree plantation etc. in the Institute campus, places of public importance and as well as in the adopted villages of NDRI. The residents of the Institute's campus and the villagers were also engaged as participants to make the planned interventions as effective and successful. All the scientists, students and staff of the Institute contributed to the mammoth sanitation drive to instil a sense of responsibility among people of all walks of life. Further, in order to inculcate the value of maintaining health and hygiene at household- level, especially among the residents of the campus of the Institute, several eco-friendly dustbins and display boards depicting environmental themes were kept at multiple locations inside the premises of the Institute.

Awareness Campaigns

Awareness campaigns become regular activities in the adopted villages of the Institute as well as prominent public places. The team of scientists educated the villagers about the wider adoption of the bio-waste management towards processing of bio-wastes into clean and environment-friendly bio-fuels and organic manures. Further, when scientists, technical officers, staff and students of the Institute visited the nearby villages for programmes like field oriented research programmes (Farmers FIRST, DST, NICRA, DAPSC, ICMR, NIF etc); Dairy Education at Farmers' Doors, Farmers' Farm School and Mera Gaaon Mera Gaurav, they gave full emphasis about significance of Swachchh Bharat Abhiyan, in order to inculcate a sense of responsibility for cleanliness among them.

World Environment Day 2024

World Environment Day was celebrated on June 05, 2024 at NDRI campus. This year's campaign is celebrated under the theme our land our future Generation Restoration. It highlights the need to take concrete action to achieve transformative change to tackle the climate crisis. Tree plantation campaign was also organized on this event. A total of 65 people participated in this programme.

World Environment Day 2024 being celebrated at ICAR-NDRI Karnal on June 5, 2024 -

Celebration of Ek Ped Maa Ke Naam

It was a heartfelt environmental campaign that celebrated both motherhood and nature. The initiative encouraged faculty, students and other staff of the Institute for planting a tree in honour of their mothers, symbolizing love, care, and the nurturing spirit that both trees and mothers embody. Such campaign serves as a beautiful

tribute, creating a living legacy that supports environmental conservation while expressing gratitude. By planting trees, participants contributed to a greener planet, fight climate change, and promote sustainability. This unique celebration blended emotion with action, making it a meaningful way to honour mothers while also taking a step toward preserving our earth for future generations.

Swachhata Hi Seva 2024 (Swabhaav Swachhata - Sanskar Swachhata)

On the occasion of the 10th Anniversary of the Swachh Bharat Mission and the birth anniversary of Mahatma Gandhi, ICAR-NDRI, Karnal organized a series of activities under the banner of "Swachhata Hi Seva 2024", from September 14 to October 02, 2024. The theme of this year's campaign was "Swabhaav Swachhata - Sanskar Swachhata". The campaign formally commenced on September 17, 2024 with the administration of the Swachhata Pledge by the Director, Dr. Dheer Singh, to all scientists, administrative and technical officers, and staff members. He emphasized the importance of developing cleanliness as a habit and integrating it into one's lifestyle and thoughts. Daily activities were conducted during the Pakhwada period, aimed at both physical cleanliness and internal value-based awareness. Key highlights include:

- Cleanliness Drives in office premises and surrounding areas.
- Awareness Campaigns involving students, visitors, and trainees to spread the message of "Swabhaav Swachhata".
- Oath Administration to trainees and guests visiting the Institute.
- A Nukkad Natak (Street Play) was performed by NDRI students focusing on the twin themes of behavioral and cultural cleanliness.
- Engagement of all sections of staff and trainees in promoting and sustaining cleanliness initiatives.
- Stressed that clean habits, pure thoughts, and positive values are integral to building a healthy society.
- Recalled Mahatma Gandhi's vision of cleanliness as a way of life.
- Quoted: *"A healthy mind develops in a healthy body,"* linking cleanliness directly to well-being and national development.

The "Swachhata Hi Seva 2024" campaign at ICAR-NDRI not only reinforced the value of external cleanliness but also emphasized the importance of inner cleanliness of character and behaviour. The commitment of the Institute's community echoed the collective spirit envisioned by Mahatma Gandhi and reinforced by the Prime Minister's call for a clean and self-reliant India.

Swachhta Pakhwada 2024

Swachhta Pakhwada, an initiative under the Swachh Bharat Abhiyan, was organised at ICAR–NDRI, Karnal, in a comprehensive and multi-dimensional campaign over a 16-day from December 16 to 31, 2024. The Institute actively engaged its entire ecosystem—including staff, students, scientists, school children, farmers, and local citizens—in a range of activities promoting cleanliness awareness, waste management, green practices, community outreach, and youth engagement.

Swachhta Pakhwada activity during from December 16 to 31, 2024 -

Sl.No.	Activities	Achievement
1	Institutional Impact	240 staff members took part in the Pledge Ceremony and various drives. Old records were digitized, scrap items removed, and offices thoroughly cleaned. Significant effort was placed on maintaining institutional hygiene.
2	Student and Youth Engagement	Over 300 students participated in competitions and awareness sessions. NCC cadets and school children carried slogans and messages during rallies. Drawing contests enhanced creative learning on the theme of swachhata.
3	Community Involvement	Over 300 villagers, including 75 tribal farmers and farm women, participated. Outreach through Nukkad Natak, Kisan Diwas workshops, and Shramdaan activities fostered ground-level awareness. Local celebrities and retired officials added motivation and visibility.

Sl.No.	Activities	Achievement
4	Environmental Initiatives	Plantation drives added to the green cover of the campus. Discouragement of single-use plastics promoted sustainable habits. 15 rainwater harvesting points and a 4 MLD STP/ETP highlighted institutional readiness for sustainable water usage.
5	Waste Management and Innovation	Demonstrations on vermicomposting showcased how cattle and kitchen waste could be turned into wealth (@ Rs.10/kg). Focus on recycling and reuse emphasized circular economy concepts.
6	Best Practices Identified	Integrated Wastewater Management System. Involvement of multiple stakeholders – from VIPs to farmers. Use of media and rallies for effective message dissemination. Eco-friendly income-generation models like vermicompost sales.

21. PERSONNEL

INSTITUTE STAFF

As on December 31, 2024

Director's Office	
Dheer Singh, PhD	Director & Vice-Chancellor
Santra Devi, BA	Principal Private Secretary
Joint Director (Academics) Office	
A K Singh, PhD	Joint Director (Academic)
Seema Rani, BA, BEd	Private Secretary
Academic Affairs Management Unit	
B D Phansal, MA	Joint Director (Admn) & Senior Registrar
Anjali Aggarwal, PhD	Principal Scientist & Academic Coordinator
Bhagwan Dass, BA	Assistant Administrative Officer
Joint Director (Research) Office	
Rajan Sharma, PhD	Joint Director (Research)
Ranjana, BA	Private Secretary
Research Prioritization, Monitoring and Evaluation Unit	
Rajan Sharma, PhD	Principal Scientist & Chairman
Gopal Ramdas Gowane, PhD	Principal Scientist
Varij Nayan, PhD	Principal Scientist
Biswajit Sen, MSc	Scientist & Officer-in-Charge
Braj Kishor, MA, BLib Sc	Chief Technical Officer
Lakshman, BCom	Technical Officer
Veenu, BSc, MCA	Technical Officer
Consultancy Processing Cell	
Rajan Sharma, PhD	Principal Scientist & Chairman
Biswajit Sen, MSc	Scientist & Officer-in-Charge
Lakshman, BCom	Technical Officer
Information Technology Management Unit	
Pradip V Behare, PhD	Senior Scientist & Officer-in-Charge
Sachin Kumar, PhD	Scientist (SS), Co-PI
Richa Singh, PhD	Scientist (SS), Co-PI
National Referral Centre for Milk Quality & Safety	
Rajan Sharma, PhD	Principal Scientist & CEO
Richa Singh, PhD	Scientist (SS) & Deputy Quality Manager
Rajesh Kumar, PhD	Principal Scientist & Nodal Officer
Sonu KS, PhD	Scientist & Technical Manager
Raghu H V, PhD	Senior Scientist & Technical Manager
Rakesh Kumar, PhD	Assistant Chief Technical Officer
National Collection of Dairy Cultures	
Pradip V Behare, PhD	Senior Scientist & Officer-in-Charge
Yogita Sharma, MSc	Technical Officer
Administrative Wing	
B D Phansal, MA	Joint Director (Admn) & Senior Registrar
Dinesh Nagpal, AMIE (Civil Engineering)	Chief Administrative Officer
Gajanand Yadav, MSc	Senior Administrative Officer
Ravinder, BE (Mechanical)	Senior Administrative Officer

Karambir Malik, MA	Principal Private Secretary
Rajbir, BA	Administrative Officer
Sukhdev Singh, BA	Administrative Officer
S S Meena, BA	Assistant Administrative Officer
Bhagwan Das, BA	Assistant Administrative Officer
Subhash Chand, BA	Assistant Administrative Officer
Ajit Singh, BA	Assistant Administrative Officer
Ram Pal, BA	Assistant Administrative Officer
Gurjeet Singh, BPharma	Assistant Administrative Officer
Subhash Chander, Senior Secondary	Assistant Administrative Officer
Ram Dhari Singh, MA	Assistant Administrative Officer
Chiranjee Lal, MLib Sc	Assistant Administrative Officer
B L Meena, Senior Secondary	Assistant Administrative Officer
Subhash Kumar, BA	Assistant Administrative Officer
Santosh Kumari, BA	Assistant Administrative Officer
Sonika Yadav, MTech	Assistant Administrative Officer
Dharmendra Singh, BSc	Assistant Administrative Officer
Meera Rani, Senior Secondary	Assistant Administrative Officer
Prabhjit Singh, Pre-University	Assistant Administrative Officer
Pradeep Malik, BA	Assistant Administrative Officer
Finance Wing	
Jagdish Chander, Higher Secondary	Senior Finance & Account Officer
Deepak, BTech	Finance & Accounts Officer
Vishal Acharya, BA	Assistant Finance & Accounts Officer
Sunil, BA	Assistant Finance & Accounts Officer
Avnish Kumar, BCom	Private Secretary
Animal Genetics & Breeding Division	
Vikas Vohra, PhD	Principal Scientist & Head
Sabyasachi Mukherjee, PhD	Principal Scientist
Anupama Mukherjee, PhD	Principal Scientist
T V Raja, PhD	Principal Scientist
Gopal Ramdas Gowane, PhD	Senior Scientist
Rani Alex, PhD	Senior Scientist
Satish Kumar Rathee, PhD	Scientist
Uttam Kumar, PhD	Chief Technical Officer
Vinod Kumar, ITI diploma	Technical Officer
Livestock Production & Management Division	
Pawan Singh, PhD	Principal Scientist & Head
Arun Kumar Misra, PhD	Principal Scientist
T K Mohanty, PhD	Principal Scientist
M L Kamboj, PhD	Principal Scientist
S S Lathwal, PhD	Principal Scientist
Ramesh Chandra, PhD	Senior Scientist
Nishant Kumar, PhD	Senior Scientist
Rubina Kumari Baithalu, PhD	Scientist
Indu Devi, PhD	Scientist
Shiv Kumar, MSc	Chief Technical Officer
Kamlesh Kumari, Matric & Stenographer	Assistant
Animal Nutrition Division	
Ashis Kumar Samanta, PhD	Principal Scientist & Head
Raman Malik, PhD	Principal Scientist
Ram Singh, PhD	Principal Scientist

Chander Datt, PhD	Principal Scientist
Nitin Tyagi, PhD	Principal Scientist
Goutam Mondal, PhD	Principal Scientist
Sachin Kumar, PhD	Scientist (SS)
Gyan Singh, MSc	Assistant Chief Technical Officer
Sumit Narayan, MSc	Assistant Chief Technical Officer
Anita Behl, BA	Private Secretary
Animal Physiology Division	
A K Dang, PhD	Principal Scientist & Head
Sohanvir Singh, PhD	Principal Scientist
Anjali Aggarwal, PhD	Principal Scientist
Sahadev Singh, MSc	Chief Technical Officer
Yogender Pratap Singh, BSc	Senior Technical Officer
Narender Kumar, BA	Technical Officer
Dheeraj Kumar, MSc	Technical Officer
Anita Behl, BA	Private Secretary
Animal Biotechnology	
J K Kaushik, PhD	Principal Scientist & Head
S De, PhD	Principal Scientist
D Malakar, PhD	Principal Scientist
Satish Kumar, PhD	Principal Scientist
Rakesh Kumar, PhD	Principal Scientist
M K Singh, PhD	Senior Scientist
Sudarshan Kumar, PhD	Senior Scientist
Naresh Selokar, PhD	Senior Scientist
Bharati Pandey, PhD	Scientist
Animal Biochemistry	
Suneel Kumar Onteru, PhD	Principal Scientist & Head
Gautam Kaul, PhD	Principal Scientist
Dheer Singh, PhD	Principal Scientist
Rajeev Kapila, PhD	Principal Scientist
Suman Kapila, PhD	Principal Scientist
Varij Nayan, PhD	Principal Scientist
Rajani Kumar Paul, PhD	Senior Scientist
Sunita Meena, PhD	Senior Scientist
Sadeesh EM, PhD	Senior Scientist
Ravikant Saini, PhD	Chief Technical Officer
Meenu Rani, MA, PGDCA	Private Secretary
Dairy Technology Division	
Deep Narayan Yadav, PhD	Principal Scientist & Head
Kaushik Khamrui, PhD	Principal Scientist
P Narender Raju, PhD	Senior Scientist
Ganga Sahay Meena, PhD	Senior Scientist
Yogesh Khetra, PhD	Senior Scientist
SA Hussain, PhD	Senior Scientist
Writdhama G Prasad, PhD	Senior Scientist
Ajay Yadav, PhD	Scientist (SS)
Sangita Ganguly, PhD	Scientist (SS)
Heena Sharma, PhD	Scientist (SS)
Gaurav Kumar Deshwal, MTech	Scientist
Varsha Vihan, PhD	Technical Officer
Sunita Chaudhary, BA & Stenography	PPS

Dairy Chemistry Division	
Vivek Sharma, PhD	Principal Scientist & Head
Sumit Arora, PhD	Principal Scientist
Rajan Sharma, PhD	Principal Scientist
Rajesh Kumar Bajaj, PhD	Principal Scientist
Richa Singh, PhD	Senior Scientist
Kamal Gandhi, PhD	Scientist (SS)
Sonu, KS, PhD	Scientist
Lehri Singh, MSc	Chief Technical Officer
Rajni Bala, BA	Private Secretary
Dairy Microbiology Division	
Shilpa Vij, PhD	Principal Scientist & Head
Anil Kumar Puniya, PhD	Principal Scientist
Chand Ram, PhD	Principal Scientist
Pradip V Behare, PhD	Senior Scientist
Raghu HV, PhD	Senior Scientist
Diwas Pradhan, PhD	Senior Scientist
Saurabh Kadyan, MTech	Scientist
Manorama Kumari, PhD	Scientist
Yogita Sharma, MSc	Technical Officer
Soniya Ranveer, PhD	Senior Technical Officer
Meenu Rani, MA, PGDCA	Private Secretary
Dairy Engineering	
P Barnwal, PhD	Principal Scientist & Head
Chitranayak, PhD	Principal Scientist
P S Minz, PhD	Senior Scientist
Ankit Deep, MTech	Scientist (Senior Scale)
Khushbu Kumari, PhD	Scientist (Senior Scale)
Priyanka, PhD	Scientist
Hima John, PhD	Scientist
Sunil Kumar, MTech	Assistant Chief Technical Officer
Ravi Kumar, PhD	Senior Technical Officer
Manju Bala, Dip (Arch)	Senior Technical Officer
Pardeep, MTech	Senior Technical Officer
Dairy Economics, Statistics and Management Division	
S Mandal, PhD	Principal Scientist & Head
A K Sharma, PhD	Principal Scientist
Ajmer Singh, PhD	Principal Scientist
A K Dixit, PhD	Principal Scientist
Udita Chaudhary, PhD	Senior Scientist
Gunjan Bhandari, PhD	Scientist
Biswajit Sen, MSc	Scientist
Ram Bahadur Verma, MSc (Agril Econ)	Technical Officer
Rajpal Sharma, Matriculation	Senior Technician
Santosh, BA	Private Secretary
Dairy Extension Division	
Gopal Sankhala, PhD	Principal Scientist & Head
K S Kadian, PhD	Principal Scientist
K Ponnusamy, PhD	Principal Scientist
B S Meena, PhD	Principal Scientist
Raj Kumar, PhD	Senior Scientist
Sanjit Maiti, PhD	Senior Scientist
Sanchita Garai, PhD	Senior Scientist

Forage Research and Management Centre	
Anurag Saxena, PhD	Principal Scientist & Officer-in-Charge
Magan Singh, PhD	Senior Scientist
Hardev Ram, PhD	Senior Scientist
Sanjeev Kumar, PhD	Senior Scientist
Rajesh Kumar Meena, PhD	Scientist (SS)
Anil Kumar Dagar, MSc	Chief Technical Officer
Kamal Garg, PhD	Senior Technical Officer
Agricultural Technology Information Centre	
B S Meena, PhD	Principal Scientist
Jitender Singh Rana, PhD	Assistant Chief Technical Officer
Krishi Vigyan Kendra/ TTC	
Pankaj Kumar Saraswat, PhD	Principal Scientist & Head
Kulvir Singh, MSc	Chief Technical Officer
Vijendra Kumar Meena, PhD	Chief Technical Officer
Santosh Kumar, PhD	Assistant Chief Technical Officer
Ashwani Kumar, MSc	Assistant Chief Technical Officer
Deepa Kumari, MA	Senior Technical Officer
Pradeep A, MFSc	Subject Matter Specialist
Sonia, PhD	Subject Matter Specialist
Vikas, MTech	Assistant
Livestock Research Centre	
Pawan Singh, PhD	Principal Scientist & Coordinator
Nitin Tyagi, PhD	Principal Scientist & Officer-in-Charge LRC
Gopal R Gowane, PhD	Principal Scientist
Rubina Kumari Baithalu, PhD	Senior Scientist
S Raju, MVSc	Chief Technical Officer
Praveen Kumar, MVSc	Chief Technical Officer
Jitendra Rana	Chief Technical Officer
Pramod Kumar, MSc	Chief Technical Officer
Amar Pal Singh, PhD	Assistant Chief Technical Officer
Hari Kishan Meena, Senior Secondary	Technical Officer
Puneet Pal Singh, MVSc	Technical Officer
Sandeep Khokhar	Technical Officer
Artificial Breeding Research Centre	
Nishant Kumar, PhD	Senior Scientist & Officer-in-Charge
Subhash Chand, BVSc & AH	Chief Technical Officer
Kaushal Kumar, BVSc & AH	Technical Officer
Ghan Shyam Meena, BSc (Ag)	Technical Officer
Ramesh Kumar, Matriculation	Technical Officer
National Library in Dairying	
A K Puniya, PhD	Head, Library Services
B P Singh, MA, MLib, ISc, PGDCA	Chief Technical Officer
Sunil Sharma, MA, PGDCA	Assistant Chief Technical Officer
Narendra Singh, MSc	Senior Technical Officer
Computer Centre	
Udita Chaudhary, PhD	Senior Scientist & Officer-in-Charge
Vivek Kumar, MSc	Senior Technical Officer
Des Raj, Senior Secondary	Technical Officer
Atul Gupta, MTech	Technical Officer
Communication Centre	
B S Meena, PhD	Principal Scientist & Officer-in-Charge
Sourav Singh, Diploma (Instrumentation)	Technical Officer

Paramjeet, Diploma (Elect & Telecom)	Technical Officer
Official Language Unit	
Dhiraj Sharma, MA (English), PGJMC	Joint Director (OL)
Agri-Business Incubator	
S A Hussain, PhD	Senior Scientist & Officer-in-Charge
SINED-Technology Business Incubator	
Kaushik Khamrui, PhD	Principal Scientist & Officer-in-Charge
Guest House	
Chiranjee Lal, MLib Sc	AAO & Officer-in-Charge
Estate Section	
P M Meena, MSc	Chief Technical Officer & Officer-in-Charge
Human Health Complex	
Arun Kumar Misra, PhD	Principal Scientist & Officer-in-Charge
Richa Walia, Nurses Course	Senior Technical Officer
Saroj Kathuria, Sr Sec & Nurses Course	Senior Technical Officer
Saroj Bala, BA, Pharmacy Diploma	Technical Officer
Anuradha, General Nursing Diploma	Technical Officer
Deepak, Matriculation	Technical Officer
Hospitality Cell	
Navdeep Singh, MTech	Technical Officer & Officer-in-Charge
Chiranjee Lal, MLISC	AAO & In-charge, Guest House
Sudesh Kumar, Matric	Technical Officer
Pawan Kumar, ITI	Technical Officer
Umed Singh, Middle	Technical Officer
Atam Parkash, VII	Technical Officer
Vehicle Maintenance Section	
Sanjeev Kumar, MSc	Assistant Chief Technical Officer
Sports Cell	
Pradip Vishnu Behre, PhD	Senior Scientist & Officer-in-Charge
Sandeep Deswal, MPhil	Chief Technical Officer
Maintenance Engineer	
J K Dabas, PhD	Chief Technical Officer & Officer-in-Charge
Sanjeev Kumar, MTech (CS)	Assistant Chief Technical Officer
Mohan Lal Sharma, MTech (Electrical)	Senior Technical Officer
Balbir Singh, ITI Diploma (Electrical)	Technical Officer
Namo Narayan Meena, Diploma (Mech)	Technical Officer
Ravinder Singh, BTech, Diploma (Civil)	Technical Officer
Pradeep Malik, BA	Assistant Administration Officer
Hostel Office	
Arun Kumar Misra, Ph.D.	Principal Scientist & Chief Hostel Warden
M K Singh, PhD	Senior Scientist & Warden, Krishna Hostel
Yogesh Khetra, PhD	Senior Scientist & Warden, Brahmaputra Hostel
Hardev Ram, PhD	Senior Scientist & Warden, Sutlej Hostel
Sachin Kumar, PhD	Senior Scientist & Warden, Narmada Hostel
Sanjit Maiti, PhD	Senior Scientist & Warden, Married Hostel
Sanchita Garai, PhD	Senior Scientist & Warden, Kaveri Hostel
Bharati Pandey, PhD	Scientist & Warden, Kaveri Hostel
Rani Alex, PhD	Senior Scientist & Warden, Alaknanda Hostel
Indu Devi, PhD	Scientist & Warden, Alaknanda Hostel
Sandeep Deswal, MPhil	CTO & Assistant Hostel Warden
Hardev Singh, BSc	Technical Officer
Experimental Dairy	
Deep Narryan Yadav, PhD	Principal Scientist & Officer-in-Charge

Gurpartap Singh, MTech	Senior Technical Officer
Ajeet Rundla, MTech	Senior Technical Officer
Diksha Bhardwaj, MTech	Senior Technical Officer
SRS, Bengaluru	
Arindam Dhali, PhD	Principal Scientist and Head
B Srinivas, PhD	Principal Scientist
K Jayaraj Rao, PhD	Principal Scientist
MC Arunmozhi Devi, PhD	Principal Scientist
DN Das, PhD	Principal Scientist
P Heartwin Amaladhas, PhD	Principal Scientist
S Jeyakumar, PhD	Principal Scientist
MA Kataktalware, PhD	Principal Scientist
Menon Rekha Ravindra, PhD	Principal Scientist
M Sivaram, PhD	Principal Scientist
AKumaresan, PhD	Principal Scientist
FME Emerald, PhD	Principal Scientist
Mamta Chauhan, PhD	Senior Scientist
S Subash, PhD	Senior Scientist
A Manimaran, PhD	Senior Scientist
Devaraja, HC, PhD	Senior Scientist
Sathish Kumar, MH,	Senior Scientist
RashmiHM, PhD	Senior Scientist
Monika Sharma, PhD	Senior Scientist
Laxmana NaikN, PhD	Senior Scientist
Priyanka Singh Rao, PhD	Senior Scientist
Vedamurthy, GV, PhD	Senior Scientist
Manoj Kumar CT, PhD	Scientist
Shivaswamy GP, PhD	Scientist
Amita Dinakar Vairat, PhD	Scientist
Basavaprabhu, HN, PhD	Scientist
VRVSNaik, MBBS, MD	Chief Technical Officer
P Muruganantham, BSc, MLib	Chief Technical Officer
Siddaramanna, PhD	Chief Technical Officer
Janakshi, MSc, MCA	Assistant Chief Technical Officer
K Ningaraju, PhD	Assistant Chief Technical Officer
R Muthuraju, MCA	Assistant Chief Technical Officer
K Rama Krishna Prasad, MSc	Senior Technical Officer
Ahmed Hussain, PhD	Senior Technical Officer
ERS, Kalyani	
S Banik, PhD	Principal Scientist & Head
T K Dutta, PhD	Principal Scientist
S K Das, PhD	Principal Scientist
A Santra, PhD	Principal Scientist
C Bhakat, PhD	Principal Scientist
A Mandal, PhD	Principal Scientist
D K Mondal, PhD	Principal Scientist
A Chatterjee, PhD	Principal Scientist
M Karunakaran, PhD	Principal Scientist
M Mondal, PhD	Senior Scientist
A Mohammad, PhD	Senior Scientist
Sanjay Ray, PhD	Senior Scientist & Head KVK Nadia (Add)
S Rai, PhD	Senior Scientist
Somnath Dutta, MVSc	Chief Technical Officer

PP Chaudhuri, MSc	Assistant Chief Technical Officer
Annu Mann, BTech	Assistant Administrative Officer
Debabrata Basantia, MSc	Subject Matter Specialist
Chinmayee Sahu, PhD	Subject Matter Specialist
GuthaVenkata Ramesh, MSc	Subject Matter Specialist
Veesam Hari Priya, MSc	Subject Matter Specialist

Joining/ Appointments/ Promotions

- Sh. Sunil Kumar, Senior Technical Officer promoted to the post of Assistant Chief Technical Officer w.e.f. 29.06.2018.
- Ms. Saroj Bala, Technical Officer promoted to the post of Senior Technical Officer w.e.f. 29.06.2018.
- Ms. RichaWalia, Technical Officer promoted to the post of Senior Technical Officer w.e.f. 29.06.2018.
- Dr. Sanjeev Kumar, Scientist, (Agronomy), ICAR-NDRI, Karnal promoted as Senior Scientist to the next higher grade in PB-3 of [Rs. 15,600-39,100+RGP of Rs. 8000/- (Revised Research Pay level-12)] w.e.f. 02.07.2021.
- Dr. Selokar Naresh Lalaji, Scientist, (Animal Biotechnology) ICAR-NDRI, Karnal promoted as Senior Scientist to the next higher grade in PB-3 of [Rs. 15,600-39,100+RGP of Rs. 8000/- (Revised Research Pay level-12)] w.e.f. 01.07.2022.
- Dr. Indu Devi, Scientist (Livestock Production & Management), ICAR-NDRI, Karnal Karnal promoted to next higher grade of Scientist in PB-3 [Rs. 15,600-39,100+RGP of Rs. 7000/- (Revised Research Pay level-11)] w.e.f. 02.07.2022.
- Dr. Sanchita Garai, Senior Scientist, (Veterinary Extension Education) ICAR-NDRI, Karnal promoted to the next higher grade in PB-4 [Rs. 37,400-67,000+RGP of Rs. 9000/- (Revised Research Pay level-13A)] w.e.f. 01.09.2022.
- Dr. Saroj Rai, Scientist, (Livestock Production & Management). ICAR-ERS-NDRI, Kalyani promoted as Senior Scientist to the next higher grade in PB-3 of [Rs. 15,600-39,100+RGP of Rs. 8000/- (Revised Research Pay level-12)] w.e.f. 15.09.2022.
- Dr. Ganga Sahay Meena, Senior Scientist, (Dairy Processing) ICAR-NDRI, Karnal promoted to the next higher grade in PB-4 [Rs. 37,400-67,000+RGP of Rs. 9000/- (Revised Research Pay level-13A)] w.e.f. 15.12.2022.
- Dr. Yogesh Khetra, Senior Scientist, (Dairy Processing) ICAR-NDRI, Karnal promoted to the next higher grade in PB-4 [Rs. 37,400-67,000+RGP of Rs. 9000/- (Revised Research Pay level-13A)] w.e.f. 15.12.2022.
- Dr. Diwas Pradhan, Scientist, (Dairy Microbiology) ICAR-NDRI, Karnal promoted as Senior Scientist to the next higher grade in PB-3 of [Rs. 15,600-39,100+RGP of Rs. 8000/- (Revised Research Pay level-12)] w.e.f. 01.01.2023.
- Dr. Laxmana Naik N., Scientist, (Dairy Chemistry) ICAR-SRS-NDRI, Bangalore promoted as Senior Scientist to the next higher grade in PB-3 of [Rs. 15,600-39,100+RGP of Rs. 8000/- (Revised Research Pay level-12)] w.e.f. 01.01.2023.
- Dr. Richa Singh, Scientist, (Dairy Chemistry) ICAR-NDRI, Karnal promoted as Senior Scientist to the next higher grade in PB-3 of [Rs. 15,600-39,100+RGP of Rs. 8000/- (Revised Research Pay level-12)] w.e.f. 01.01.2023.
- Dr. Priyanka Singh Rao, Scientist, (Dairy Chemistry) ICAR-SRS-NDRI, Bangalore promoted as Senior Scientist to the next higher grade in PB-3 of [Rs. 15,600-39,100+RGP of Rs. 8000/- (Revised Research Pay level-12)] w.e.f. 01.01.2023.
- Dr. Gopal Ramdasji Gowane, Senior Scientist (Animal Genetics & Breeding) ICAR-NDRI, Karnal promoted to the post of Principal Scientist in Lavel-14 w.e.f. 08.01.2023.
- Dr. Devaraja H.C., Senior Scientist (Dairy Processing) promoted to the next higher grade of Senior Scientist in PB-4 of [Rs. 37,400-67,000+RGP of Rs. 9000/- (Revised Research Pay level-13A)] w.e.f. 11.05.2023.
- Dr. Sathish Kumar M.H., Senior Scientist (Dairy Processing) promoted to the next higher grade of Senior Scientist in PB-4 of [Rs. 37,400-67,000+RGP of Rs. 9000/- (Revised Research Pay level-13A)] w.e.f. 11.05.2023.
- Ms. Manju Bala, Technical Officer promoted to the post of Senior Technical Officer w.e.f. 10.07.2023.
- Dr. Sunita Meena, Senior Scientist (Animal Biochemistry) ICAR-NDRI, Karnal promotion to the next higher grade of Senior Scientist in PB-4 of [Rs. 37,400-67,000+RGP of Rs. 9000/- (Revised Research Pay level-13A)] w.e.f. 07.08.2023.
- Dr. Pradip Vishnu Behare, Senior Scientist (Dairy Microbiology) ICAR-NDRI, Karnal promoted to the next higher grade of Senior Scientist in PB-4 of [Rs. 37,400-67,000+RGP of Rs. 9000/- (Revised Research Pay level-13A)] w.e.f. 15.09.2023.
- Dr. Hardev Ram, Senior Scientist (Agronomy) ICAR-NDRI, Karnal promotion to the next higher grade of Senior Scientist in PB-4 of [Rs. 37,400-67,000+RGP of Rs. 9000/- (Revised Research Pay level-13A)] w.e.f. 15.09.2023.
- Dr. Monika Sharma, Senior Scientist (Food Science & Technology) promoted to the next higher grade of Senior Scientist in PB-4 of [Rs. 37,400-67,000+RGP of Rs. 9000/- (Revised Research Pay level-13A)] w.e.f. 18.09.2023.
- Sh. Raj Muni, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 06.10.2023.
- Sh. Ram Bahadur, Senior Technical Assistant promoted to the post of Technical Officer w.e.f. 24.10.2023.
- Dr. Raghu H.V., Senior Scientist (Dairy Microbiology) ICAR-NDRI, Karnal Promotion to the next higher grade of Senior Scientist in PB-4 of [Rs. 37,400-67,000+RGP of Rs. 9000/- (Revised Research Pay level-13A)] w.e.f. 15.12.2023.
- Dr. Writdhama G. Prasad, Scientist (Dairy Technology) promoted as Senior Scientist to the next higher grade in PB-3 of Rs. 15,600-39,100+RGP of Rs. 8000/- (Revised Research Pay level-12) w.e.f. 01.01.2024.
- Dr. Sachin Kumar Scientist, (Animal Nutrition) promoted as Senior Scientist to the next higher grade in PB-3 of Rs. 15,600-39,100+RGP of Rs. 8000/- (Revised Research Pay level-12) and re-designation as Senior Scientist w.e.f. 01.01.2024.
- Dr. Vedamurthy G.V., Scientist (Animal Biochemistry) ICAR-SRS of NDRI, Bangalore promoted as Senior Scientist to the next

higher grade in PB-3 of Rs. 15,600-39,100+RGP of Rs. 8000/- (Revised Research Pay level-12) w.e.f. 01.01.2024.

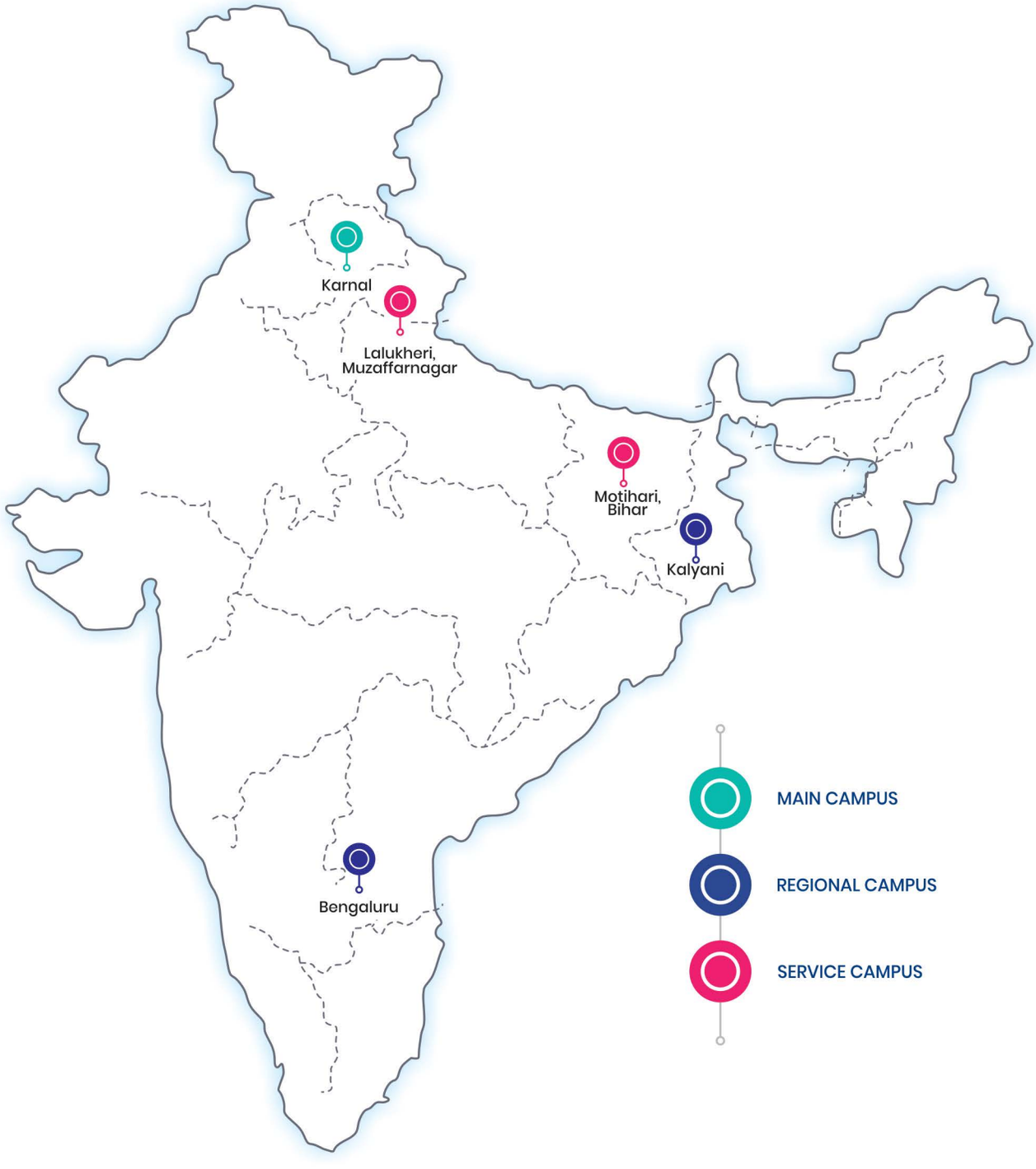
- Sh.Rajesh, UDC promoted to the post of Assistant w.e.f. 01.01.2024.
- Sh. Vedparkash, Multi-Tasking Staff promoted to the post of Technician w.e.f. 12.01.2024.
- Sh. Subhash Chand, Asstt. Chief Technical Officer promoted to the post of Chief Technical Officer w.e.f. 14.01.2024.
- Ms. Pooja Rani, Technician promoted to the post of Senior Technician w.e.f. 16.01.2024.
- Sh. Pradeep Singh Khokher, Technician promoted to the post of Senior Technician w.e.f. 16.01.2024.
- Sh. Ranbir Singh, LDC promoted to the post of UDC w.e.f. 19.01.2024.
- Sh. Amit Chauhan, Technician promoted to the post of Senior Technician w.e.f. 22.01.2024.
- Sh. Sumit Narayan, Senior Technical Officer promoted to the post of Asstt. Chief Technical Officer w.e.f. 12.02.2024.
- Sh. Pardeep, Technical Officer promoted to the post of Senior Technical Officer w.e.f. 27.02.2024.
- Sh. Deepak Golan, Senior Technician promoted to the post of Technical Assistant w.e.f. 28.02.2024.
- Sh. Mohan Lal, Technical Officer promoted to the post of Senior Technical Officer w.e.f. 28.02.2024.
- Sh. Suresh Pal, Multi-Tasking Staff promoted to the post of Technician w.e.f. 29.02.2024.
- Sh. Meet Kumar, Multi-Tasking Staff promoted to the post of Technician w.e.f. 01.03.2024.
- Sh. Dheeraj Kumar, Technical Officer promoted to the post of Senior Technical Officer w.e.f. 06.03.2024.
- Sh. SurajBhan, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 07.03.2024.
- Sh. Sandeep Kumar, Senior Technical Assistant promoted to the post of Technical Officer w.e.f. 13.04.2024.
- Sh. Gaurav Chauhan, Technician joined at ME Section, ICAR-NDRI, Karnal w.e.f. 19.04.2024.
- Dr. Rajani Kumar Paul, Senior Scientist, (Animal Biochemistry) ICAR-NDRI, Karnal promoted to the next higher grade in PB-4 [Rs. 37,400-67,000+RGP of Rs. 9000/- (Revised Research Pay level-13A)] w.e.f. 21.04.2022.
- Sh. Deepak, FAO has joined as FAO, ICAR-NDRI, Karnal on 22.04.2024.
- Sh. Aman Kumar, Technician joined at Forage Production Section, ICAR-NDRI, Karnal w.e.f. 23.04.2024.
- Ms. Meenu, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 26.04.2024.
- Sh. Vikas, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 26.04.2024
- Ms. Sneh, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 26.04.2024
- Sh. Mohan Lal, Senior Technical Assistant promoted to the post of Technical Officer w.e.f. 28.04.2024.
- Sh. Mukesh Kumar, Technician joined at Animal Nutrition Division, ICAR-NDRI, Karnal w.e.f. 29.04.2024.
- Ms. Pinki Devi, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 29.04.2024.
- Sh. Sadeya Naaz, Technician joined at ERS of ICAR-NDRI, Karnal w.e.f. 30.04.2024.
- Sh. Mukul Singh, Technician joined at SRS of ICAR-NDRI, Karnal w.e.f. 30.04.2024.
- Sh. Ankit Kaushik, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 30.04.2024.
- Sh. Sachin, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 30.04.2024.
- Sh. Ishu Dhiman, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 01.05.2024.
- Sh. Rahul Singh Tomar, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 02.05.2024.
- Sh. Manoj saini, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 02.05.2024.
- Sh. Dinesh Kumar, Technician joined at Dairy Technology Division, ICAR-NDRI, Karnal w.e.f. 03.05. 2024.
- Sh. Himanshu Nitant, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 03.05.2024.
- Sh. Manoj Kumar, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 03.05.2024
- Sh. Aditya Tandon, Technician joined at Animal Biochemistry Division, ICAR-NDRI, Karnal w.e.f. 06.05.2024.
- Sh. Ish Kumar, Technician joined at SRS of ICAR-NDRI, Karnal w.e.f. 06.05.2024.
- Sh. Abhishek Kumar, Technician joined at Agricultural Technology Information Centre, ICAR-NDRI, Karnal w.e.f. 07.05.2024.
- Sh. Khurshid Ahmed Jangubhai, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 08.05.2024.
- Sh. Navneet, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 09.05.2024.
- Ms. Deepti Jha, Technician joined at Purchase Section, ICAR-NDRI, Karnal w.e.f. 09.05.2024.
- Sh. Mayank Tripathi, Technician joined at ME Section, ICAR-NDRI, Karnal w.e.f. 10.05.2024.
- Sh. Rahul Kumar Meena, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 10.05.2024.
- Sh. Ravi Kumar, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 13.05.2024.
- Sh. Vijay Kumar, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 14.05.2024.
- Sh. Arun Kumar TV, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 15.05.2024.
- Sh. Ashish Kuma Singh, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 20.05.2024.
- Smt. G.Manjula, Multi-Tasking Staff, SRS of NDRI, Bengaluru promoted to the post of Lower Division Clerk w.e.f 20.05.2024.
- Sh. Munish Leharwan, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 27.05.2024.
- Sh. Alam Singh, Multi-Tasking Staff promoted to the post of Technician w.e.f. 03.06.2024.

- Ms. Sonia, Subject Matter Specialist joined at KVK, ICAR-NDRI, Karnal w.e.f. 13.06.2024.
- Sh. Ajeet Rundla Senior Technical Officer joined at Experimental Dairy, ICAR-NDRI, Karnal w.e.f. 13.06.2024.
- Sh. Pradeep A. Subject Matter Specialist joined at KVK, ICAR-NDRI, Karnal w.e.f. 13.06.2024.
- Sh. Ravi Kumar, Senior Technical Officer joined at Dairy Engineering Division, ICAR-NDRI, Karnal w.e.f. 14.06.2024.
- Diksha Bhardwaj Senior Technical Officer joined at Experimental Dairy, ICAR-NDRI, Karnal w.e.f. 14.06.2024.
- Ranveer Soniya Ashok Senior Technical Officer joined at Dairy Microbiology Division, ICAR-NDRI, Karnal w.e.f. 14.06.2024.
- Sh. Praveen Kumar, Chief Technical Officer granted advance increment w.e.f. 17.06.2023.
- Chinmayee Sahu Subject Matter Specialist joined at ERS of ICAR-NDRI, Karnal w.e.f. 03.07.2024.
- Ms. Varsha Vihan Senior Technical Officer joined at Dairy Technology Division, ICAR-NDRI, Karnal w.e.f. 03.07.2024.
- Gutha Venkata Ramesh Subject Matter Specialist joined at ERS of ICAR-NDRI, Karnal w.e.f. 03.07.2024.
- Sh. Vikram Jeet, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 04.05.2024.
- Sh. Satyajit Chakraborty, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 04.07.2024.
- Sh. Asgar Ali, Technician joined at SRS of ICAR-NDRI, Karnal w.e.f. 05.07.2024.
- Sh. Asif Miyan, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 12.07.2024.
- Sh. Vakil Moun, Technical Assistant promoted to the post of Senior Technical Assistant w.e.f. 18.07.2024.
- Sh. Roop Narain, Multi-Tasking Staff promoted to the post of Technician w.e.f. 12.08.2024.
- Sh. Subhash, LDC, NDRI, Karnal promoted/ appointed to the post of AF&AO at ICAR-RC for NEH, Umiam and relieved on 19.08.2024.
- Sh. Rajesh, Assistant promoted/appointed to the post of AF&AO at ICAR Hqrs, New Delhi and relieved on 21.08.2024.
- Sh. Sunil, LDC, NDRI, Karnal promoted/appointed to the post of AF&AO at ICAR-NDRI, Karnal w.e.f. 22.08.2024.
- Veesam Haripriya, Subject Matter Specialist joined at ERS of ICAR-NDRI, Karnal w.e.f. 27.09.2024.
- Sh. Karan Singh appointed to the post of Assistant and joined at ICAR-NDRI, Karnal w.e.f. 10.10.2024.
- Ms. Rupa appointed to the post of Assistant and joined at ICAR-NDRI, Karnal w.e.f. 22.10.2024.
- Sh. Vikas appointed to the post of Assistant and joined at KVK of ICAR-NDRI, Karnal w.e.f. 11.11.2024.
- Sh. Rohtash, Multi-Tasking Staff promoted to the post of Technician w.e.f. 11.12.2024.
- Sh. Suraj Bhan, UDC, NDRI, Karnal promoted to the post of Assistant w.e.f. 18.12.2024.
- Sh. Mani Ram, Multi-Tasking Staff promoted to the post of Technician w.e.f. 12.12.2024.

Transfer/ Retirement/ Relieving

- Sh. Sube Singh, Technician retired from Council's service on 31.01.2024.
- Sh. Anirban Ghosh, Assistant, ERS, Kalyani retired from Council's service on 31.01.2024.
- Sh. Amitava Ghosh, Chief Technical Officer, retired from Council's service on 31.01.2024.
- Dr. Raman Seth, Principal Scientist retired from Council's services on 29.02.2024.
- Sh. Jagdish Singh, Technical Officer retired from Council's service on 29.02.2024.
- Sh. Bhim Singh, Technician retired from Council's service on 29.02.2024.
- Sh. Raj Kumar Sharma, Senior Technician expired on 01.04.2024.
- Sh. Mukesh Onkar, Technical Assistant relieved from ICAR-NDRI, Karnal on 19.04.2024.
- Sh. Ramesh Kumar, Technician retired from Council's service on 30.04.2024.
- Sh. Ram Kumar, LDC retired from Council's service on 30.04.2024.
- Sh. Rajvir Singh, Security Supervisor retired from Council's service on 30.04.2024.
- Sh. T. Ananda, MTS retired from Council's service on 30.04.2024.
- Sh. Mahender Pal, Technical Officer, retired from Council's service on 31.05.2024.
- Sh. V. Suryanarayana Murthy, MTS retired from Council's service on 31.05.2024.
- Sh. S. Gangaiah, MTS retired from Council's service on 31.05.2024.
- Sh. A. Gangaiah, MTS retired from Council's service on 31.05.2024.
- Sh. Rajasheklaraiah B.K., Chief Technical Officer, retired from Council's service on 31.05.2024.
- Sh. P. G. Satish, Chief Technical Officer retired from Council's service on 31.05.2024.
- Sh. M.S. Nagarajaiah, Assistant Chief Technical Officer retired from Council's service on 30.06.2024.
- Sh. S. Nagaraju, MTS retired from Council's service on 30.06.2024.
- Sh. Rajbir, Technical Officer, retired from Council's service on 31.07.2024.
- Sh. Surender Kumar, Senior Technician retired from Council's service on 31.07.2024.
- Sh. Mukesh Kumar, Technician resigned from Council's service on 31.08.2024.
- Smt. Usha Rani, Assistant retired from Council's service on 31.08.2024.
- Sh. P. Krishnaswamy, MTS retired from Council's service on 31.08.2024.

- Sh. S. Shantha Kumar, MTS retired from Council's service on 31.08.2024.
- Dr. Ashutosh, Principal Scientist, ICAR-NDRI, Karnal has retired (VRS) in the forenoon of 06.09.2024.
- Smt. Savita, Assistant retired from Council's service on 29.09.2024.
- Sh. Gurbaksh Singh, Senior Technician retired from Council's service on 30.09.2024.
- Sh. Ish Kumar, Technician resigned from Council's service on 30.10.2024.
- Sh. Aman Kumar, Technician resigned from Council's service on 05.11.2024.
- Sh. Vinod Kumar, Technical Officer, retired from Council's services on 20.11.2024.
- Sh. Isham Singh, Senior Technician retired from Council's service on 30.11.2024.


Karnal
Lalukheri,
Muzaffarnagar
Motihari,
Bihar
Kalyani
Bengaluru
MAIN CAMPUS
REGIONAL CAMPUS
SERVICE CAMPUS

ICAR-NATIONAL DAIRY RESEARCH INSTITUTE
(Deemed to be University) Karnal-132001 India

भाकृअनुप-राष्ट्रीय डेरी अनुसंधान संस्थान
(मानद् विश्वविद्यालय) करनाल- 132001 भारत