ICAR-CIRB

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ICAR-CIRB NEWSLETTER

JANUARY - JUNE 2025

IN THIS ISSUE

From The Director's Desk

Buffalo husbandry stands at the heart of India's dairy and rural economy, anchoring nutritional security, climate resilience, and livelihoods for millions of smallholders across diverse agro-ecologies. From high-butterfat milk that strengthens household nutrition to resilient draft, manure, and market linkages, buffaloes uniquely convert crop residues into quality milk while supporting circular, low-waste farming systems. As India advances toward sustainable growth, buffaloes remain the most efficient, farmer-preferred dairy option, prized for feed flexibility, heat tolerance, and robust productivity under smallholder conditions.

This issue of ICAR-CIRB Newsletter highlights current frontiers shaping buffalo futures: climate-smart feeding to unlock lignocellulosic residues and curb methane intensity; genomics and genetic resource conservation to safeguard breed diversity; welfare-centric husbandry that promotes natural behaviours linked to productivity; and precision health, metabolomics, and reproductive innovations to reduce disease and improve fertility outcomes. Equally critical are last-mile solutions-year-round fodder calendars, high-yield perennial forages, and cost-effective feed alternatives such as beet pulp and turnip-that stabilize milk yields and farmer income throughout seasons. Institution-led capacity building, andragogy-based trainings, and farmer producer organizations are closing knowledge–practice gaps, improving adoption of scientific practices, and expanding equitable market access-especially for women farmers-thereby deepening the buffalo value chain. These efforts align with ICAR's broader objectives: increasing farmer incomes through science-led innovation, conserving national genetic wealth, enhancing climate resilience, and strengthening safe, quality milk systems for national nutrition.

With deep respect and gratitude, heartfelt thanks are extended to Dr. M. L. Jat, Secretary, DARE and Director General, ICAR, and to Dr. Raghavendra Bhatta, Deputy Director General (Animal Sciences), for their unwavering guidance, encouragement, and support to the buffalo farming. Sincere appreciation is also conveyed to the entire CIRB scientific team whose dedicated work continues to deliver field-ready solutions and real benefits to farming communities. This newsletter is intended as a practical platform to share progress, connect farmers with scientists and development partners, and spark wider adoption of best practices that strengthen buffalo farming. I extend sincere thanks to contributors, and the editorial board for their meticulous effort in curating, refining, and presenting this issue.

Dr. Yash Pal
Director, ICAR-CIRB

Azadi Ka Amrit Mahotsav

International Year of Cooperatives 2025
Cooperatives Build a Better World

Published by :

Dr. Yash Pal
Director, ICAR-CIRB
Hisar - 125001

Research Insights

Production of nutritional smart ruminants for better digestion of lignin with less emission of carbon footprint

D Kumar, M Punetha, P Kumar and S Chhotaray

Ruminants such as cows, buffaloes, goats, and sheep are central to India's rural economy, providing milk, meat, manure, and livelihoods to millions of smallholder farmers. India is the world's largest milk producer, and nearly three-quarters of its milk comes from small farms that feed animals mainly on crop residues like straw and husk. This system is resourceful but faces a key challenge: crop residues are rich in lignin, which makes plant cell walls tough and woody. Because ruminants lack enzymes to break down lignin, much of the feed is not digested efficiently. As a result, animals must eat more to meet energy needs, and the undigested portion ferments in the stomach, producing large amounts of methane- a greenhouse gas far more potent than carbon dioxide. Globally, livestock contributes a significant share of agricultural greenhouse gas emissions, and in India, where many animals are fed low-quality residues, the problem is amplified. This creates a dual burden: farmers spend more on supplementary feed, while the environment suffers from higher methane emissions and the burning of unused straw in fields.

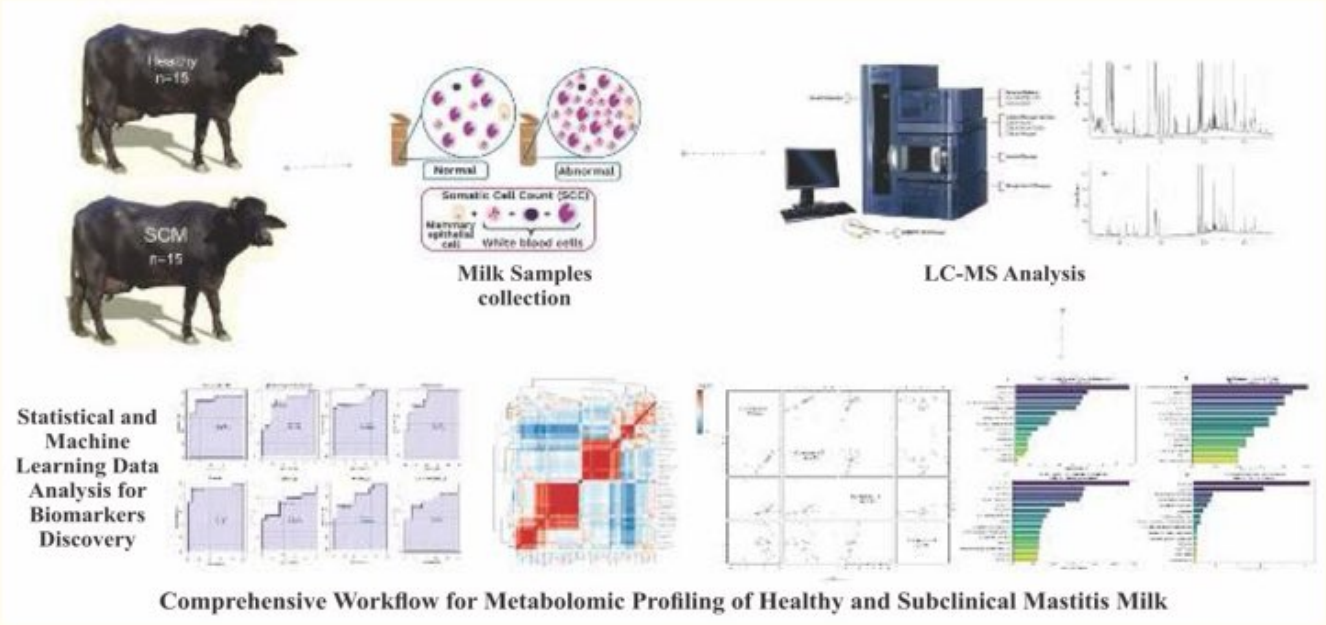
At CIRB, work is underway to overcome this bottleneck by helping ruminants better utilize crop residues. The approach is to use a special enzyme, ligninase, naturally found in some fungi and capable of breaking down lignin. If animals can produce this enzyme in their saliva, the tough fibers in crop residues can begin to break down during chewing. This would expose the nutrients-cellulose and hemicellulose - that stomach microbes can then ferment more efficiently. As a result, animals can extract more energy from the same feed, stay healthier, and produce more milk without costly supplements. It would also put crop leftovers to productive use, reducing field burning, air pollution, and carbon dioxide release. By turning straw into valuable animal feed, this approach can help close the loop between crop production and livestock farming, supporting both farmers and the environment. The work at CIRB is part of a larger effort to make animal farming more nutrition-smart and sustainable. By combining advanced science with practical farming needs, the goal is to reduce the livestock sector's carbon footprint while improving farmers' livelihoods, lowering feeding costs, and reducing reliance on high-quality grains for fodder so that more cereals remain available for human consumption.

Schematic representation of lignin digestion in ruminants

Metabolomic profiling of buffalo milk for subclinical mastitis detection using UPLC-Q-TOF MSE Analysis

P Sharan, E Hooda, S Yadav, S Balhara, Nishu, N Verma, A Kiran, P Sarangi and A K Balhara

UPLC-Q-TOF MSE analysis enabled comprehensive metabolomic profiling of buffalo milk samples to distinguish between healthy and subclinical mastitis (SCM) conditions. Comparative ionization evaluation revealed superior performance of the positive ionization mode, which initially identified 178 metabolites, retaining 115 (64.4%) after quality control. Although the positive mode showed higher metabolite coverage, no statistically significant differences were detected between healthy and SCM samples. Consequently, subsequent biomarker discovery was conducted exclusively using data from the negative ionization mode, which yielded 48 reproducible metabolites (67.6% retention rate).



Comprehensive Workflow for Metabolomic Profiling of Healthy and Subclinical Mastitis Milk

Univariate statistical analysis of these metabolites identified significant differences in abundance between healthy and SCM samples. Out of 48 metabolites, 21 exhibited fold changes greater than 2 or less than 0.5, with 12 statistically significant after false discovery rate correction. Key deregulated metabolites included D-Glucose, 4-Pyridoxic acid, and Riboflavin (Vitamin B2), each showing strong discriminatory potential. Notably, 43.75% of the metabolite panel reflected meaningful alterations, indicating marked metabolic disruption linked to SCM pathology.

Empirical Bayes Analysis of Microarrays (EBAM) strengthened these findings by identifying 22 significantly altered metabolites, demonstrating high statistical confidence (local FDR < 0.05). D-Lactose, Pantothenic acid, and Riboflavin were ranked highest by statistical confidence and discriminatory power, confirming the biological significance of carbohydrate and vitamin metabolism disturbances.

Multivariate statistical modelling, including PCA, PLS-DA, and OPLS-DA, revealed progressively enhanced discrimination between healthy and SCM groups. The OPLS-DA model achieved robust classification with R2Y = 0.417 and Q2 = 0.353, validated by permutation testing ($p < 0.0005$). Key contributors identified through high VIP scores (>1.2) were D-Glucose, 4-Pyridoxic acid, Riboflavin, and Pantothenic acid, underscoring their diagnostic relevance.

To validate these biomarkers further, supervised machine learning models-Logistic Regression, SVM, Random Forest, and XGBoost-were implemented. XGBoost outperformed other models with an accuracy of 83.3%, recall of 80%, and ROC-AUC of 0.922, confirming robust predictive utility.

Consensus analysis across multiple statistical and computational approaches converged on eight high-confidence biomarkers-D-Lactose, D-Glucose, Pantothenic acid, Riboflavin, 4-Pyridoxic acid, DL-2-hydroxystearic acid, Arg-Gly-Asp, and 3-(2,5-dimethoxyphenyl) propanoic acid-representing strong candidates for accurate SCM detection in buffalo populations.

Conservation of India's buffalo genetic resources through somatic cell cryopreservation

M Punetha, D Kumar and M Gururaj

Buffaloes are a cornerstone of India's livestock sector, providing milk, meat, and draught power to millions of farmers. Despite their importance, many buffalo breeds remain underrepresented in genetic repositories, and some face genetic erosion due to shrinking populations and indiscriminate crossbreeding. Conserving these breeds is essential to maintain genetic diversity, adaptability, and sustainable production systems. A promising strategy is cryopreservation of somatic cells, enabling long-term storage of buffalo genetic material. Unlike semen or embryos, which are limited by sex, fertility, or availability, somatic cells support applications such as genome characterization, functional genomics, and advanced reproductive technologies.

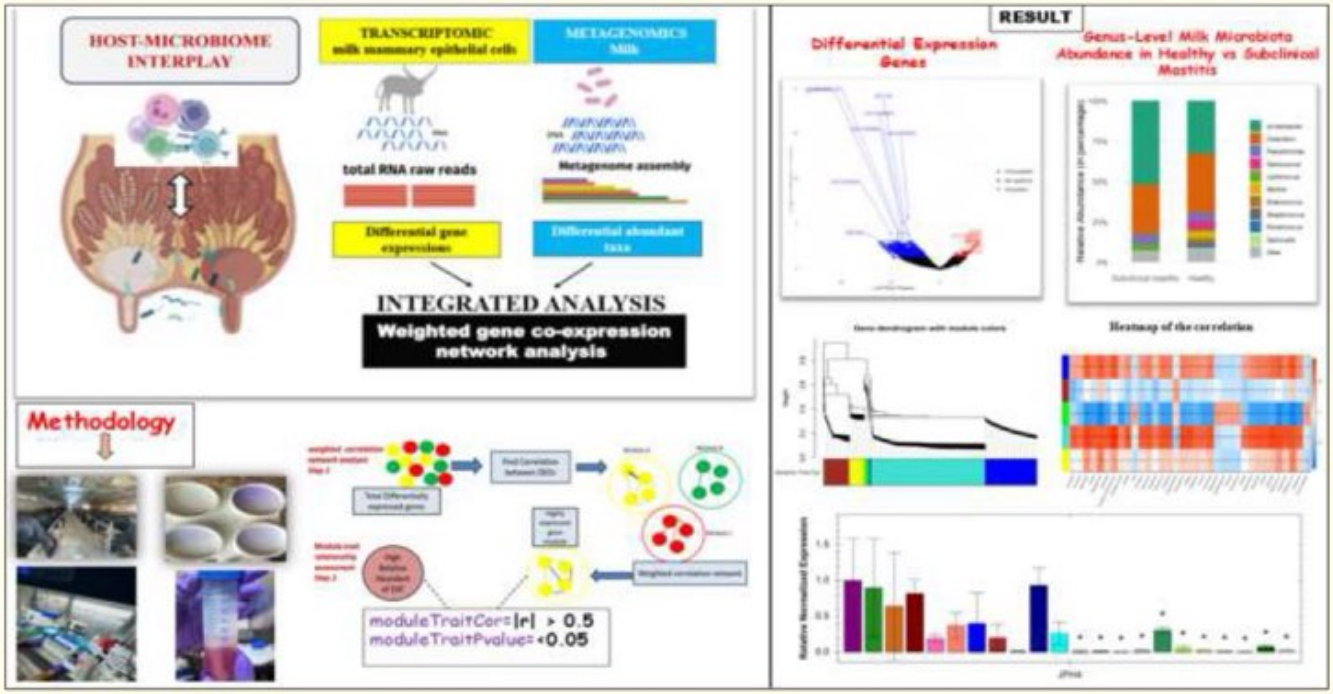
CIRB is optimizing cryopreservation protocols to enhance post-thaw cell viability and functionality, ensuring preserved cells remain suitable for future breeding and research. CIRB's conservation efforts span breeds across India, including Luit, Chilika, Chhattisgari, Bargur, Toda, Banni, Mehsana, Murrah, Nili-Ravi, Bhadawari, Surti, and Dharwadi from regions such as Assam, Odisha, Karnataka, Tamil Nadu, Uttar Pradesh, Haryana, Punjab, and Gujarat. By preserving somatic cells and other genetic material from these diverse breeds, CIRB is safeguarding India's buffalo diversity to retain unique traits, adaptability, and productivity for future generations. This comprehensive effort supports sustainable livestock farming, protects endangered breeds, and provides a valuable resource for research and climate-resilient dairy production.

State-wise Conservation of Buffalo Breeds in India

Multi-omics analysis for delineating host immune response genes for subclinical mastitis in Murrah buffaloes

H Valmiki, S Chhotaray, S Kumar, D Sharma, and P Chayal

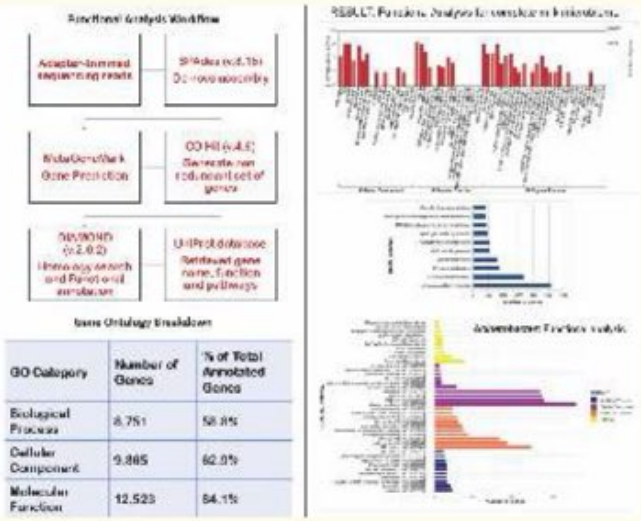
Subclinical mastitis (SCM) is more widespread than clinical mastitis, with a prevalence of 14.63% compared to 5.18% for clinical cases. Mutual interaction between the host and its associated microbiota (Host-microbe interplay) plays an important role in developing such diseases. We employed a multi-omics analysis of the transcriptome (differentially expressed gene analysis) of host and the metagenome of milk microbiota using an integrated bioinformatics approach. Weighted Gene Co-Expression Network Analysis (WGCNA) was applied as a powerful tool for genetic research. The WGCNA grouped differentially expressed host genes into five core modules, two of which were correlated strongly with microbial taxa linked to mastitis. Among the top hub genes identified, Junctophilin-4 (*JPH4*) was identified as a key immune-related gene. qPCR validation further confirmed that *JPH4* was significantly downregulated in SCM samples, supporting its potential role as a candidate gene for disease susceptibility.



Microbial functional dynamics of Murrah buffalo milk in mastitis pathogenesis

D Sharma, S Chhotaray, S Kumar, P Chayal, and H Valmiki

Shotgun metagenomic sequencing is a valuable tool for addressing challenges in microbiome research by enabling direct sequencing of DNA from milk samples. High-quality reads were assembled using SPAdes, and gene prediction was done with MetaGeneMark, yielding 58,837 predicted genes. After redundancy reduction via CD-HIT, a non-redundant gene catalogue was annotated with DIAMOND. A total of 14,887 genes were assigned to Gene Ontology terms, indicating active metabolic processes. KEGG analysis showed enrichment in amino acid, carbohydrate, lipid, and energy metabolism pathways. Notably, genes involved in peptidoglycan biosynthesis (e.g., *murA*, *mraY*, *ftsI*, *murE*, *murF*, *glmU*) were enriched in mastitis samples, particularly in those dominated by *Acinetobacter* spp., suggesting enhanced bacterial cell wall remodelling and persistence during infection. This finding aligns with previous reports linking peptidoglycan-derived fragments to the activation of host NOD1/NOD2 and TLR2 receptors, leading to NF–κB–mediated pro-inflammatory responses.



GO Category	Number of Genes	% of Total Annotated Genes
Biological Process	8,751	58.8%
Cellular Component	9,885	66.4%
Molecular Function	12,523	84.1%

Promoting natural behaviour in buffaloes: A vital step in buffalo farming

AS Habbu, MH Jan and V Mudgal

Animal welfare, as defined by the World Organisation for Animal Health (WOAH), refers to the physical and mental state of an animal in relation to the conditions in which it lives and dies. In dairy farming, especially in intensive systems, welfare is often limited to physical health – disease prevention, absence of injuries, and good management practices such as deworming, vaccination, and regular hygiene. However, mental well-being is equally important and is best reflected through animal behaviour. Encouraging natural behaviours such as grazing, ruminating, wallowing, and social interaction helps improve both welfare and productivity.

Buffaloes need adequate space to graze, access to green and dry roughage for cud chewing, and opportunities to interact with their herd. Group housing supports social bonding and reduces stress, while provision for wallowing or water baths helps maintain body temperature and comfort in hot conditions, leading to better milk yield. Allowing limited maternal contact after calving enhances calf survival and maternal satisfaction. Ensuring freedom of movement and natural reproductive behaviour further supports health and fertility. Promoting these natural behaviours - grazing, resting, wallowing, social interaction, maternal care, and mobility - ensures the holistic welfare of buffaloes and contributes to long-term productivity and sustainability.

Calves kept in age-wise groups

Buffaloes have a strong maternal instinct

Genome editing: A breakthrough for improving buffalo meat production

D Kumar, M Punetha, RK Sharma, P Kumar and S Chhotaray

Genome editing is expanding rapidly and dynamically, and it is among the most promising fields in the life sciences. Genome editing involves making targeted modifications-insertions, deletions, or replacements-at specific sites in the genome, its contexts (such as epigenetic marks), or its outputs (such as transcripts) using nucleases, often called molecular scissors. Beyond its unprecedented role in basic research, genome editing is a powerful tool for studying gene function and physiological processes, and it has emerged as a promising approach for enhancing livestock productivity and conserving biodiversity. The most common genome editing methods use sequence-specific programmable nucleases: protein-guided Zinc Finger Nucleases (ZFNs), Transcription Activator-Like Effector Nucleases (TALENs), and the RNA-guided CRISPR/Cas9 system. Among current technologies, the rapidly advancing class of RNA-guided endonucleases, notably Cas9 from the microbial adaptive immune system CRISPR (clustered regularly interspaced short palindromic repeats), has become especially prominent due to its simplicity and adaptability.

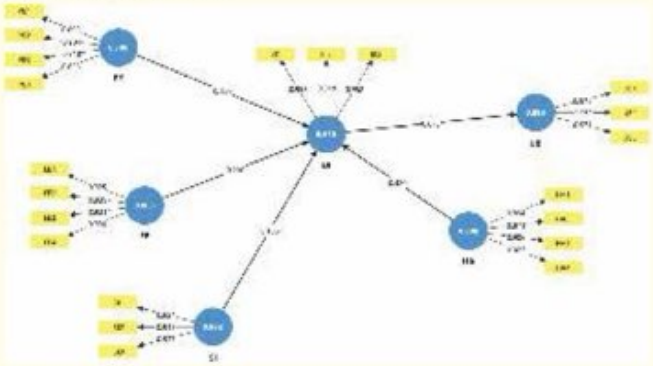
Unlike conventional selective breeding, which requires generations, genome editing can directly target genes controlling traits such as muscle growth, fat deposition, feed efficiency, and disease resistance. For example, editing the myostatin (MSTN) gene, which naturally limits muscle growth, has produced cattle, pigs, and sheep with increased muscle mass, often described as the "double-muscle" trait. Applying this technology in buffaloes could yield faster growth, more lean meat, and improved returns for farmers in India, and research organizations such as the CIRB and other national institutes are exploring genome editing to address key challenges in buffalo production. Scientists are examining MSTN and other genes related to meat quality and fat metabolism to ensure that gains in yield do not compromise animal health or adaptability. Genome-edited buffaloes could convert feed into muscle more efficiently, lowering the environmental footprint of meat production while supporting farm incomes.

What drives buffalo farmers to adopt scientific husbandry practices? insights from an extended UTAUT model

S Aiswarya, M Gururaj and N Saxena

Scientific buffalo husbandry practices are crucial for improving productivity, animal welfare, and environmental sustainability, yet adoption among smallholder farmers remains suboptimal. This study developed and validated a behavioural model to explain the adoption of scientific husbandry practices among buffalo farmers using the extended Unified Theory of Acceptance and Use of Technology (UTAUT). Data were collected from 530 buffalo farmers across major buffalo-rearing regions in India. The model included habit (HA), performance expectancy (PE), effort expectancy (EE), and social influence (SI) as exogenous constructs influencing behavioural intention (BI) and use behaviour (UB). Partial Least Squares Structural Equation Modelling (PLS-SEM) was used to test the hypothesised relationships. The model showed strong explanatory power, identifying habit ($\beta = 0.420$, $p < 0.001$) as the strongest predictor of behavioural intention, followed by effort expectancy ($\beta = 0.206$, $p = 0.008$) and performance expectancy ($\beta = 0.156$, $p = 0.027$), while social influence ($\beta = 0.136$, $p = 0.133$) was not statistically significant. These results indicate that adoption is primarily driven by habitual engagement, perceived ease of implementation, and perceived usefulness, rather than external social pressures.

The model offers an empirical basis for designing context-specific extension strategies that prioritise habit formation and convenience to enhance adoption. The study advances understanding of the behavioural mechanisms underlying livestock technology uptake and presents a validated framework for integrating behavioural science with livestock extension. The extended UTAUT-based model can serve as a practical tool for policymakers and extension professionals to accelerate sustainable adoption of scientific buffalo husbandry practices.



PLS-SEM model

Model Components:

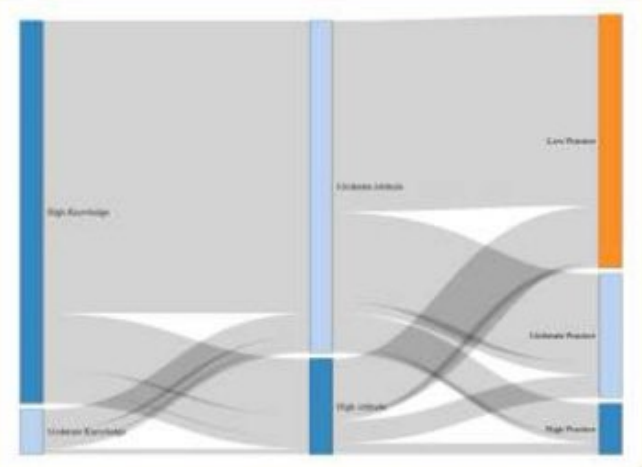
- Latent variables (circles) with composite reliability (ρ_a) values
- Manifest variables (rectangles) with standardized factor loadings
- Path coefficients (β) for structural relationships between constructs

The Knowledge–practice paradox in buffalo husbandry: Empirical insights and policy directions

M Gururaj, S Aiswarya and N Saxena

Buffalo husbandry remains vital to India's dairy sector, yet persistent adoption gaps limit productivity gains. This study assessed the Knowledge, Attitude, and Practice (KAP) levels of 380 buffalo farmers across major milk-producing regions of India to identify behavioural and structural barriers to scientific practice adoption. Knowledge was high in key domains namely – heat detection (79.4%), mastitis identification (77.4%), and balanced feeding (77.9%)-yet practice levels were much lower (32.9–44.7%). The widest knowledge–practice gap was in silage-making (71.5% awareness vs. 32.9% adoption; a 38.6%). Cluster analysis identified five segments: smallholders (36.8%) practiced only 25% of techniques despite moderate knowledge, whereas commercial farmers (7.9%) achieved 90.5% adoption. Chi-square analysis showed education (OR = 3.4, $p < 0.001$) and herd size (OR = 2.4, $p < 0.01$) as significant predictors of KAP scores, and logistic regression indicated income strongly influenced practice (OR = 4.3). To close these gaps, the study proposes three strategies: targeted, skill-based training for smallholders through collective platforms; subsidized input packages (feed, mineral mixtures) integrated with mobile advisory services; and market-linked incentives for quality milk to reward scientific compliance.

The findings highlight the limits of one-size-fits-all extension and call for differentiated, data-driven interventions addressing structural constraints (credit, veterinary access) and attitudinal barriers (silage skepticism, vaccine hesitancy). Policy priorities should include strengthening last-mile extension, expanding cooperative linkages, and leveraging digital platforms to scale farmer-responsive solutions for sustainable buffalo husbandry.



Knowledge-Attitude-Practice (KAP) Transition Pathways in Buffalo Husbandry

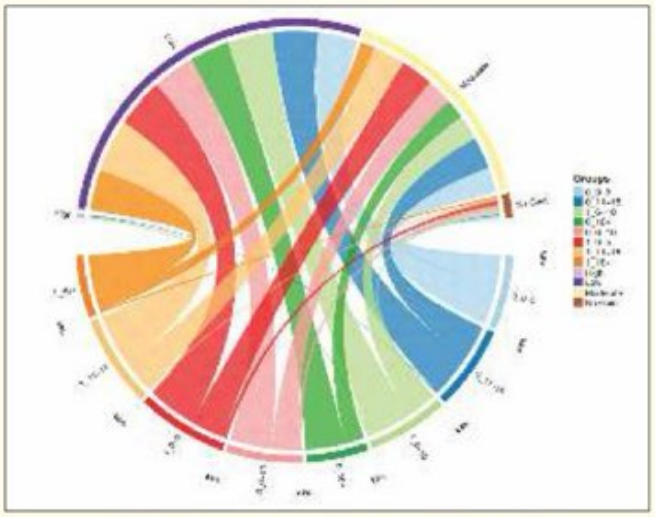
How effective are farmer trainings in scientific buffalo husbandry? evidence from an andragogy-based quasi-experimental study

M Gururaj, Aiswarya S and N Saxena

Scientific buffalo husbandry practices are central to improving milk productivity, animal welfare, and rural livelihoods in India. Despite the growth of capacity-building initiatives, empirical evidence quantifying their learning effectiveness among smallholder farmers remains limited. Grounded in adult learning theory (Andragogy), this study evaluated the cognitive impact of scientific buffalo husbandry training conducted at the CIRB. A quasi-experimental one-group pre-test–post-test design was used with 518 trained farmers. A validated 15-item knowledge test assessed learning across five domains: breeding, feeding and nutrition, animal health, milk quality, and milk marketing.

The intervention led to a significant increase in farmers' knowledge, confirmed by absolute and normalized learning gain indices. Among the domains, feeding and nutrition showed the highest gain, followed by milk marketing and breeding. Multiple linear regression identified gender, livestock holding, and prior experience as significant predictors of knowledge improvement, while age and baseline knowledge were negatively associated with learning

gain. Disaggregated profiling indicated that younger, moderately experienced female farmers managing medium-to-large herds showed the greatest improvement. The findings highlight that learning outcomes from farmer trainings vary across socio-demographic and experiential characteristics. The study supports the relevance of adult learning principles in structuring agricultural capacity-building programs and emphasizes the need for learner-sensitive, domain-specific training models tailored to diverse farmer profiles. Integrating systematic monitoring, feedback, and post-training evaluation can improve the translation of knowledge into practice, raising adoption rates and the overall impact of scientific buffalo husbandry on sustainable rural development.



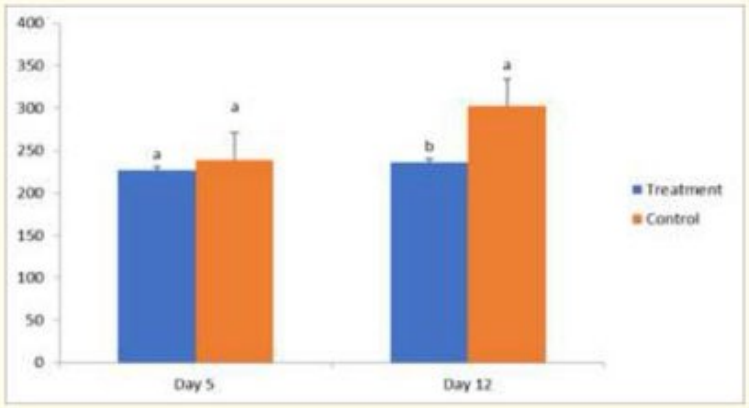
Chord diagram depicting cognitive gain distribution by gender and experience.

Technology Intervention

Effects of exogenous supplementation of progesterone on conception rates in lactating Murrah buffaloes

R Kumar, JB Phogat, RK Sharma, SK Phulia and A Jerome

This study evaluated the effect of exogenous progesterone given as an intramuscular injection at the time of artificial insemination (AI) on ovulation timing and conception rate in lactating Murrah buffaloes. Thirty buffaloes in heat, showing clear vaginal discharge, good uterine tone, and a large follicle (>12 mm), were selected and randomly divided into two groups: Treatment and Control. Ultrasound was performed every six hours after AI until ovulation.



Size of corpus luteum (CL area in mm2) on days 5 and 12 of the estrous cycle in treatment and control groups. a, b—different superscripts indicate significant differences

A higher proportion of buffaloes in the control group (82.4%) ovulated within 24 hours post-AI compared to only 15.4% in the treatment group. In contrast, more buffaloes in the treatment group (53.8%) ovulated after 24 hours, and 30.8% remained anovulatory up to 96 hours, compared to 5.9% in controls. The corpus luteum size did not differ significantly between groups (226.5 ± 17.4 mm^2 in treatment vs. 238.9 ± 7.9 mm^2 in control). Conception rate was higher in the control group (52.9%) than the treatment group (38.5%). These results indicate that progesterone injection at the time of insemination delayed ovulation and lowered conception rate, suggesting no beneficial effect of its use for improving fertility in buffaloes.

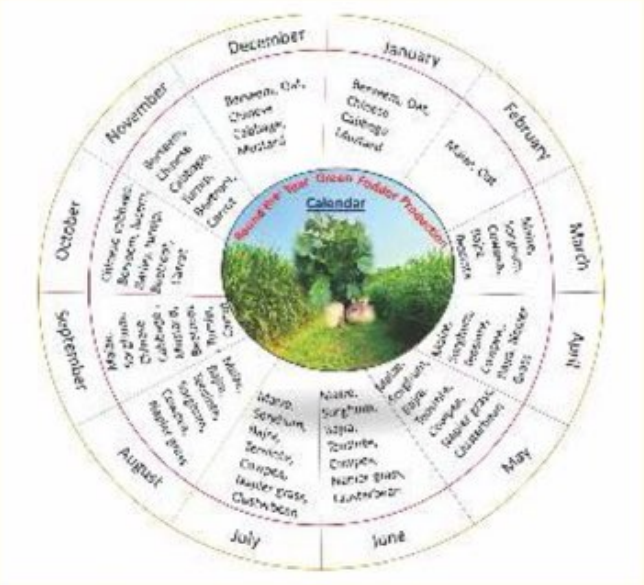
Feed and Fodder Production

Calendar for year-round green fodder production for buffaloes in Northern, Western, and Central India

SK Kakraliya

Buffaloes are a key part of India's dairy economy, providing milk, draught power, and supporting rural livelihoods. Seasonal shortages of green fodder often lead to nutritional stress and lower milk yields. A cropping calendar for Northern, Western, and Central India offers a systematic plan for sowing and harvesting fodder crops in line with local seasons, ensuring a steady supply of nutritious forage throughout the year. This approach reduces dependence on crop residues and costly purchased feed, improving animal health and productivity.

Table below lists major fodder crops such as berseem, maize, sorghum, and perennial grasses, along with their best growing periods and nutritional value. These crops provide balanced protein, fiber, and energy needed for milk production and reproduction. Using the fodder calendar with crop-specific guidance helps bridge seasonal feed gaps, supports consistent milk yields, improves fertility, and increases farm income sustainably.



Month-wise cropping calendar for year-round green fodder production in Northern, Western, and Central zones of India

Round-the-year fodder production cropping systems and their yield potential

Crop sequence	Green fodder yield (tonnes/ha/year)
Napier x Bajra hybrid + Cowpea - Berseem	260
Maize + Cowpea – MP Chari + Cowpea – Berseem + Japanese rape	197
MP Chari + Cowpea – Berseem + Japanese rape	184
Cowpea – MP Chari + Cowpea – Berseem + Japanese rape	176
Napier x Bajra hybrid + Cowpea – Berseem – Cowpea	255

Recommended intensive fodder production systems for Northern, Western, and Central India

North Zone:

- Maize + Cowpea – Sorghum + Cowpea (two cuts) – Berseem + Mustard
- Sudan grass + Cowpea – Maize + Cowpea – Turnip – Oats (two cuts)
- Hybrid Napier or Setaria inter-planted with Cowpea in summer and Berseem in winter (9-10 cuts/year)
- Teosinte + Cowpea (two cuts) – Carrot – Oats + Mustard/Senji (two cuts)

Western and Central Zone:

- Bajra + Guar (Clusterbean) (two cuts) – Annual Lucerne (6 cuts)
- MP Chari + Cowpea (2 cuts) – Maize + Cowpea - Teosinte + Cowpea (2 cuts)
- Hybrid Napier or Guinea or Setaria grass inter-planted with Cowpea in summer + Berseem in winter (8-9 cuts/year)

Efficient fodder production with napier–bajra

NK Pandey, S Aiswarya, M Gururaj and N Saxena

Napier Bajra Hybrid (*Pennisetum glaucum* × *Pennisetum purpureum*) is a perennial, high-yielding fodder grass developed by crossing pearl millet with Napier grass. It grows fast, regenerates well, and produces thick stems with broad leaves. With 8–10% crude protein and 28–30% fibre, it is highly palatable and nutritious, suitable for green fodder, hay, or silage. Superior to maize and sorghum in productivity, it can yield 1200–1400 quintals of green fodder per hectare annually and remain productive for 5–6 years.

The crop is propagated from rooted slips or stem cuttings as seeds are not viable. It should be planted during February–August under irrigation or at monsoon onset in rainfed areas, using 100 × 50 cm spacing. Prepare the land with one deep ploughing, followed by 2–3 harrowings, and apply 18–22 t/ha FYM a month before planting along with recommended NPK fertilizers. Irrigation is needed after planting, again in 10 days, and every 10–12 days in summer, with additional irrigation after each cutting. Control of weeds through hand weeding or spraying Atrazine is suggested. Harvest the first crop at 55–60 days after planting and then every 30–35 days, cutting 12–15 cm above ground for regrowth. Regular irrigation and nutrient management ensure continuous, high-quality fodder supply year-round.

Vegetative growth

Ready for harvesting

Crop harvesting

Turnip and beetroot: Alternative dietary sources for buffaloes

SK Kakraliya and FC Tuteja

Turnips (*Brassica rapa*) and beetroot-based feeds, particularly beet pulp, offer cost-effective, energy-rich alternatives that enhance productivity and feed efficiency. These root crops supply easily fermentable energy and complement conventional roughages and crop residues.

Turnip is a high-energy forage rich in sugars and protein, suitable for stall-fed or semi-intensive systems. The leaves and stems contain 20–25% crude protein with good digestibility, while the roots provide about 10–14% protein and up to 85% digestible dry matter. Feeding turnips improves weight gain, rumen fermentation, and milk energy balance in lactating buffaloes. However, excessive intake may lead to metabolic stress due to glucosinolates and nitrates; thus, turnips should be mixed with dry fodder and supported by mineral supplementation.

Beet pulp, a by-product of the sugar industry, is rich in fermentable fiber and provides about 1,800 kcal/kg of energy with 72% total digestible nutrients. It supports higher milk yield and milk fat while reducing the risk of ketosis and acidosis. For meat buffaloes, beet pulp can replace 5–15% of dietary dry matter to promote steady growth and carcass quality.

Overall, turnip and beetroot-based feeds are sustainable, locally available options that reduce feed costs, improve productivity, and strengthen the resilience of buffalo farming systems when incorporated carefully into balanced rations.

Turnip crop at full vegetative stage

Sectorial News

Empowering dairy farmers through buffalo-based Farmer Producer Organizations (FPOs) in India

Aiswarya S, M Gururaj, NK Pandey and N Saxena

Buffalo-based Farmer Producer Organizations (FPOs) have emerged as a transformative model for enhancing the livelihoods of small and marginal livestock rearers in India. Although the country remains the world's leading milk producer, buffalo rearers continue to face persistent challenges including high feed costs, limited access to quality breeding and veterinary services, weak market linkages, and inadequate infrastructure for milk collection, chilling, and value addition. These systemic gaps often constrain productivity and lead to income instability among rural households. By fostering collective action, buffalo-centric FPOs empower farmers to pool resources, lower input costs, and negotiate more effectively with markets and service providers. They also facilitate the establishment of essential infrastructure—such as bulk milk coolers, milk testing laboratories, and processing units for ghee, paneer, and khoa—thereby improving milk quality, reducing spoilage, and ensuring better price realization.

Crucially, these organizations serve as vehicles for gender empowerment, as women constitute a significant proportion of buffalo rearers and actively participate in management and leadership roles within FPOs. Institutional support from the Government of India, under the Ministry of Agriculture & Farmers Welfare and NABARD, has further accelerated the promotion of such organizations. Agencies including the Small Farmers' Agribusiness Consortium (SFAC), the National Cooperative Development Corporation (NCDC), and several NGOs extend financial, technical, and capacity-building assistance, while partnerships with private sector stakeholders strengthen value chains and market integration. The growth of buffalo-based FPOs thus represents a strategic and inclusive approach toward building a resilient, equitable, and sustainable dairy ecosystem—one that acknowledges the buffalo's central contribution to India's rural economy and nutritional security.

Production Performance

Production performance

Animal farm

Institute maintains a high pedigree herd of approximately 500 Murrah and Nili-Ravi buffaloes at Hisar and Nabha, respectively. During the period (January to June, 2025), a total of 188551.0 kg of milk was produced with a wet average of 9.30 kg per buffalo per day and herd average of 7.03 kg per buffalo per day from Murrah at Hisar. Similarly, at Nabha campus, a total of 180584.60 kg of milk produced from Nili-Ravi breed with 8.34 and 6.04 kg per buffalo per day of wet and herd average of milk, respectively.

Agricultural farm

Institute at main campus Hisar has a total of approximately 780 acres of land, of which about 50% is arable and under fodder cultivation. During the period a total 480 acres was under fodder production. A total of 2005.30 quintals of grains were produced in which 1686.20, 293.05 and 26.05 quintals of wheat, barley and oat, respectively were produced. In the same period, a total of 1197.85 quintals of wheat straw was also produced. During the January to June, 2025, at Hisar a total of 19936.50 quintals of green fodder were produced. Similarly at Sub campus, Nabha has produced a total of 4753.75 quintals of grains, in which 3346.29, 1384.64, 19.62 and 3.20 quintals of wheat, barley, oats and mustard respectively were produced.

Breeds in Focus

Kalahandi Buffalo: Odisha's blackish-grey jewel of rural livelihoods

S Aiswarya, M Gururaj and S Chhottaray

The Kalahandi buffalo, locally called "Deshi," is an indigenous breed of Odisha reared for milk, draught work, and manure. It is mainly found in Kalahandi and adjoining Rayagada districts, especially in Bhawanipatna, Junagarh, Dharmagarh, Kodsara, and Golamunda blocks. During the day, animals graze freely in forests, hillocks, and fields and return in the evening for milking. They are mostly blackish-grey, sometimes lighter, with black muzzle, eyelids, tail, and hooves. The breed has a convex head, small hump, rounded udder, and a long tail with coarse hairs. Horns curve backward and inward in a half-circle, about 50 cm long. Average adult measurements are 125.9 cm height and 377.6 kg weight in males, and 123.8 cm height and 350.9 kg weight in females; calves weigh around 22–23 kg at birth.

The age at first calving is about 50 months, with a calving interval of around 17 months. Milk yield ranges from 680 to 912 kg per lactation, with 7.8–8.2% fat content. The Kalahandi buffalo is hardy and well adapted to local conditions but is declining due to lower productivity and competition from Murrah and crossbreeds. The population increased from about 80,000 in 2009 to over 115,000 in 2013. Conservation and selective breeding are needed to sustain this valuable native breed that supports smallholder farmers in its home region.

Kalahandi Female Buffalo

Kalahandi Buffalo Bull

VKSA Kharif - 2025

ICAR-CIRB participated in Viksit Krishi Sankalp Abhiyaan – Kharif 2025 in Haryana and Punjab

The Viksit Krishi Sankalp Abhiyaan (VKSA)–Kharif 2025, launched by the Hon'ble Union Minister of Agriculture in collaboration with ICAR, was held from May 29 to June 12, 2025, to strengthen farmer–scientist interactions and promote scientific agricultural and livestock practices. ICAR-CIRB, Hisar, organized outreach programmes in Hisar, Fatehabad, and Sirsa districts, covering three villages each day with multidisciplinary teams of experts from livestock, agriculture, fisheries, and horticulture, along with IFFCO representatives. Activities included sessions on clean milk production, colostrum feeding, balanced diet, reproductive health, vaccination, pest management, crop diversification, and the use of quality farm inputs. A live drone demonstration showcased precision in fertilizer and pesticide application. The campaign concluded with a Kisan Gosthi in CIRB's adopted village Nangla, where farmers' queries were addressed and essential materials such as mineral mixtures and mosquito nets were distributed.

Major problems raised by the buffalo farmers were

- Repeat Breeding
- Anoestrus
- Dystocia
- Ecto and End parasitic infections
- Milk fever
- Mastitis
- Low milk production
- Higher feed cost
- Non-availability of quality semen
- Poor quality semen

Farmers-scientist interaction during VKSA

Kisan Gosthi was organised in the adopted village under SCSP Nangla, Fatehbad as a part of VKSA

Farmers-scientist interaction during VKSA

Participation in Kissan Mela in Rohtak as a part of VKSA

Under the same Abhiyaan (May 29–June 12, 2025), ICAR-CIRB Sub-Campus, Nabha, organized awareness and training programmes in 28 villages of Nabha, Patiala, benefiting over 1,100 farmers. The activities, led by institute scientists with support from allied departments focused on livestock management, natural farming, and sustainable crop production. The initiative aimed to bring modern agricultural technologies and government scheme awareness directly to farmers, promote efficient use of soil, water, and nutrients, and strengthen research–farmer linkages for climate-resilient and sustainable agriculture in Haryana and Punjab.

Events at CIRB

Republic day celebration at institute (26 January 2025)

41 Foundation day celebration (1 February 2025)

Plantation by Chief Guest Dr. Sanjay Kumar on the occasion of foundation day (1 February 2025)

Calf rally participants felicitated on the occasion of foundation day (1 February 2025)

Exposure visit of government school students (12 March 2025)

Exposure visit of farmers of ICAR-CSWRI Avikanagar visited under TSP, SCSP and Sheep Mega Project (1 January 2025)

Annual review meeting of BMGF funded project "Climate smart buffalo farming using digital support systems" (21 March 2025)

World health day celebration at Nangla Fatehabad (7 April 2025)

Superannuation at CIRB

S.No.	Name of Employee	Date of Retirement
	Scientific Staff	
1	Dr. T.K Datta (Director)	21.01.2025 (FN) Voluntary
2	Dr. Prem Singh Yadav (Principal Scientist)	30.04.2025
	Technical Staff	
3	Sh. Mohan Singh (T.O.)	31.03.2025
	Skilled Supporting Staff (SSS)	
4	Sh. Rajmal	31.01.2025
5	Sh. Nakched	28.02.2025 (Expired on 15.01.2025)
6	Sh. Ramesh Chander	28.02.2025

7	Sh. Yam Bahadur	31.03.2025
8	Smt. Reshma	31.03.2025
9	Sh. Mahabir	31.05.2025
10	Smt. Santro	30.06.2025
11	Sh. Tara Singh	28.02.2025
12	Sh. Jaswant Singh	31.03.2025
13	Sh. Sham Dev	30.04.2025
14	Sh. Raju	31.05.2025
15	Sh. Gurnam Singh	30.06.2025
16	Sh. Bhim Singh	30.06.2025
17	Sh. Shrinath	30.06.2025
18	Sh. Ram Preet	30.06.2025
19	Sh. Ram Jeon	30.06.2025
20	Sh. Avtar Singh	30.06.2025
21	Sh. Radhe Sham	30.06.2025

CIRB among Farmers

CIRB organizes extension activities primarily under the SCSP and TSP schemes, as well as through institute-funded initiatives and the AICRP, to enhance the socio-economic status of resource-poor farmers. During January–June, the institute conducted 37 training programmes on scientific buffalo husbandry practices and skill development in collaboration with SNAITTE, LUVAS, CoDST College, and PNB Saccha Khera. A total of 705 farmers participated, of whom approximately 97.17% were women. The institute also actively participated in various Pashu and Kisan Melas and other outreach events to demonstrate and disseminate technologies developed at CIRB. In addition, significant days such as International Women's Day, World Health Day, and several Kisan Gosthis were organized both at the institute and in the adopted villages. Farmers were provided with various inputs, including mineral mixtures, dewormers, milk churning machines, and paneer-making making machines.

ICAR-CIRB & SNAITTE organised skill development collaborative trainings on January - March, 2025

ICAR-CIRB & CoDST,LUVAS organised a collaborative training on milk value addition on January - February 2025

Farmers from Hanumangarh, Rajasthan visited ICAR-CIRB under State Department of Agriculture, on 7 February, 2025

Kisan Gosthi was organised under TSP at Mudarla, Deldar, Sirohi, Rajasthan on 14th February,2025

Kisan Gosthi was organised under TSP
at Kalyanpura, Badi Sadri, Chittorgarh, Rajasthan
on 15th February,2025

Training on Scientific Buffalo Husbandry Practices
in the adopted village under SCSP Nangla,
Fatehabad, Haryana on 19-21 Feburary,2025

ICAR-CIRB particpated in ICAR-NDRI mela held on
27 February - 1 March,2025

ICAR-CIRB celebrated International Women's Day
on 8th March, 2025

Training on Scientific Animal Husbandry Practices on
17-19 March,2025 under SCSP at ICAR-CIRB

Training on Scientific Buffalo Husbandry Practices on
5-11 June, 2025 at ICAR-CIRB

भाकृअनुप
ICAR

ICAR - Central Institute for Research on Buffaloes

Sirsa Road, Hisar – 125 001 (Haryana) India

01662-281601, 281602 director.cirb@icar.org.in

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