ICAR-CIRB
NEWSLETTER
JANUARY - JUNE 2024

ICAR-CIRB

भाकृअनुप - केन्द्रीय भैंस अनुसंधान संस्थान, हिसार
ICAR-Central Institute for Research on Buffaloes, Hisar

(ISO 9001:2015 certified institution for "Improved Buffalo Germplasm Production")

IN THIS ISSUE

From The Director's Desk

The buffalo, domesticated around 5,000 years ago in the Indus Valley, holds immense significance in India's agricultural heritage and economy. Widely distributed across Asia and introduced to many other continents, the buffalo is a versatile animal, valued for its role in agriculture as a draught animal and its production of meat, milk, and other products. Buffalo milk, known for its richness, is the base for creams, butter, yoghurt, and iconic cheeses like mozzarella. Today, buffaloes are raised in over 44 countries across Asia, Africa, Latin America, and Europe, playing a vital role in rural livelihoods and poverty alleviation.

In India, the demand for buffalo products has surged, driving up dairy prices and prompting private sector investments in commercial buffalo farming. This has resulted in advancements in dairy management, including improved genetics through artificial insemination, better veterinary care, and enhanced extension services. At the forefront of these developments, the ICAR-Central Institute for Research on Buffaloes (CIRB) continues to lead in the areas of buffalo nutrition, reproduction, biotechnologies, and genetic improvement. The institute has been pivotal in supplying progeny-tested bull semen and high genetic merit bulls of the Murrah and Nilli-Ravi breeds to developmental agencies and farmers, contributing significantly to buffalo improvement across the country.

This newsletter captures the achievements and progress of CIRB from January to June 2024. Our scientists, technical staff, and administrative teams have worked tirelessly to advance the institute's mission. Their commitment, coupled with the support from the Indian Council of Agricultural Research (ICAR), has enabled us to make substantial strides in buffalo research and development. We are especially grateful to Dr. Himanshu Pathak, Secretary of the Department of Agricultural Research and Education and Director General of ICAR, and Dr. Raghavendra Bhatta, Deputy Director General (Animal Sciences), for their invaluable guidance and encouragement.

We hope this newsletter provides an insightful overview of our ongoing efforts to advance buffalo research and development for the benefit of the farming community and the nation.

Dr. TK Datta
Director, ICAR-CIRB

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Research Insights

Somatic cell banking

M Punetha, D Kumar and PS Yadav

Understanding and sustaining biological and genetic diversity is a social, cultural, scientific and economic imperative that is a key to adaptation and survival in a human-dominated environment. It is apparent that the earth's biodiversity (its wealth of diverse species) is under assault by habitat degradation and loss, overexploitation, pollution, emerging diseases, and climate change. Besides putting the existence of species at risk, these hazards lead to small, fragmented animal populations that reduce resiliency and adaptability to change, often through the loss of genes that control integrity and fitness. Once a genetic resource disappears, it cannot be recovered.

With the growing global population, improving the efficiency and sustainability of food animal production is crucial. There is an urgent need to improve the efficiency and sustainability of producing animals for food in the face of the ever-increasing world population. Improved understanding of mechanisms and challenges of reproductive technologies are vital for improving the viability of the livestock industry. Hence, one solution to preserve animal species is by freezing. Cryopreservation has emerged as the most efficient and compatible method for freezing animal genetic resources. Current viable methods for preserving biodiversity include the cryopreservation of somatic cells, cryopreservation of whole ovaries and testes, and freezing of embryos, oocytes, and semen. The cryopreservation of gametes is restricted to only a few species, each requiring a specific approach. In addition, fibroblasts have emerged as a valuable resource for cloning techniques aimed at preserving and proliferating valuable genotypes of elite seed stock. These cells are easily cultured from various species and tissues and display a spindle-shaped morphology with an oval, flat nucleus. Fibroblast can survive harsh environments, where most cells cannot which points to their intrinsic survival mechanisms and plasticity. Due to their high proliferation potential and capacity for differentiation, fibroblasts are widely used in somatic cell nuclear transfer (SCNT), the generation of induced pluripotent stem cells (iPSCs), genome editing, tissue engineering, and wound healing. As a result, cryopreservation of fibroblasts has become a viable option for long-term storage, and therefore somatic cell cryobanks now exist for various buffalo breeds across India at ICAR-CIRB, Hisar (Fig. 1). Establishment of these biobanks at ICAR-CIRB is an attempt to save them from extinction or to recreate them after extinction.

Fig.1. Isolation and culture of fibroblast cells from different breed of buffalo

Establishment of Centre of Excellence for buffalo OPU-IVF by ICAR-CIRB

A Jerome, RK Sharma, D Kumar, M Punetha, Rupali and R Kumar

In recent years, several stimulation protocols have been developed and commercial media are available for in vitro production of embryos. Thus, despite the limited success reported previously, ovum-pick up and in-vitro embryo production (OPU-IVEP) needs to be explored in this species for enhancing the reproductive efficiency of females, reducing generation intervals, and accelerating genetic improvement progress. OPU-IVEP has the specific advantage

that oocytes are to be repeatedly collected (7 to 10 day interval) from live animals with known pedigree superior germplasm. Considering the potential application of OPU-IVEP in buffalo, comprehensive research on the aspect of donor response as well the donor fertility along with overall net calf production following OPU sessions needs to be established.

Due the scarce results of in vivo embryo recovery in superovulated buffaloes, the association of OPU with IVEP represents an alternative method of exploiting and multiplying genetic for superior. Historically, OPU-IVEP in buffaloes produced lower outcomes than in bovines. However, a series of recent studies have demonstrated the commercial potential of these techniques in the buffalo species. Two main biological problems seem to be related to the low efficiency of the OPU-IVEP technique in buffaloes: low number of follicles on the ovary that results in low oocyte recovery per OPU and poor oocyte quality retrieved. Considering this, the project is designed to address the standardization the use of OPU-IVEP in production of superior buffalo germplasm. In this context, ICAR-CIRB shall establish a Centre of Excellence on Buffalo OPU-IVF funded by DADF, GoI under Rashtriya Gokul Mission (RGM) to the tune of 11.55 crores.

Feed aflatoxins: Issues and concerns with safe food production

S Thakur, RK Singh and A Dey

Aflatoxin is a category of mycotoxin produced by the fungal species *Aspergillus flavus* mainly, besides *Aspergillus parasiticus*, *Aspergillus pseudocaelatus*, *Aspergillus pseudonomius* and *Aspergillus nomius*. The hot-humid tropical climatic conditions predispose certain crops to mould growth, especially maize, peanuts, cottonseed and dairy products. Aflatoxin contamination of animal feeds causes huge economic loss to the feed-food industry throughout the world. Aflatoxin-B_1 is the most hazardous toxin and can be transferred from the feed to the milk of ruminant animals as aflatoxin-M_1 and ultimately poses a significant human health hazard owing to its hepatotoxic, immunosuppressive and carcinogenic effects. In India, the Bureau of Indian Standards (BIS) has set a maximum permissible level of 20 ppb (aflatoxin-B_1) in all animal feeds; however, the Food Safety and Standards Authority of India (FSSAI) recommends a permissible limit of 0.5 ppb in human foods. Aflatoxins can be transferred (0.8 - 6.5%) from the feed to the milk of animals as aflatoxin-M_1 and ultimately pose a significant human health hazard. Not only in milk, but the presence of aflatoxin in other dairy products, eggs and edible animal products also pushed the formulation of regulations to minimize the exposure of aflatoxin to food animals. Pre- and post-harvest prevention of aflatoxin production in agricultural products is necessary with improvement in management protocols for reducing the susceptibility of mould growth. Proper storage conditions, avoiding mechanical and insect damage, maintaining temperature, aeration and moisture are important for reducing aflatoxin contamination of feeds. Various acids, viz. sorbic acid and propionic acid, are used commercially at adequate levels to reduce aflatoxin contaminations in products. Gamma-irradiation, chemical degradation, microbial inactivation and reduction of toxin bioavailability by selective chemisorption with clays are few techniques to reduce the aflatoxin levels in animal feeds. Provision of good quality protein balanced diet with supplementation of N-acetylcysteine, choline, methionine and vitamin E is advantageous for reducing the severity of aflatoxicosis. Sustainable preventive strategies for pre-and post-harvest management of food-feed crops need to be taken up to reduce aflatoxin exposure to animals for the production of safe foods of animal origin.

Why genetic selection of sires is important in Murrah Buffaloes?

S Chhotaray and S Kumar

Murrah buffaloes are one of the most sought-after buffalo breeds, known for their superior milk production and adaptability to diverse environmental conditions. Ensuring genetic improvement through the careful selection of sires (male buffaloes) is essential for enhancing productivity and maintaining the quality of this valuable breed. Genetic sire selection is a method that enables the identification of bulls with the best traits, ensuring that future generations inherit desirable characteristics such as higher milk yield, better fertility, and disease resistance. The breeding value of an animal is a measure of its genetic potential to pass on specific traits to its offspring. Calculated using data from the animal itself, its ancestors, and its progeny, breeding values play a key role in the genetic selection process. By choosing sires with high breeding values, farmers can ensure that the offspring will have the best possible traits for dairy productivity, health, and longevity. For example, selecting bulls with superior breeding values for milk production has led to significant improvements in milk yield among Murrah buffaloes. These bulls are evaluated based on various

performance tests and genetic analyses to predict their ability to transmit advantageous traits. ICAR-CIRB has improved the milk production in Murrah buffaloes of its herd by 84.36% since 1991-92 to till date through systematic genetic selection program and scientific breeding practices.

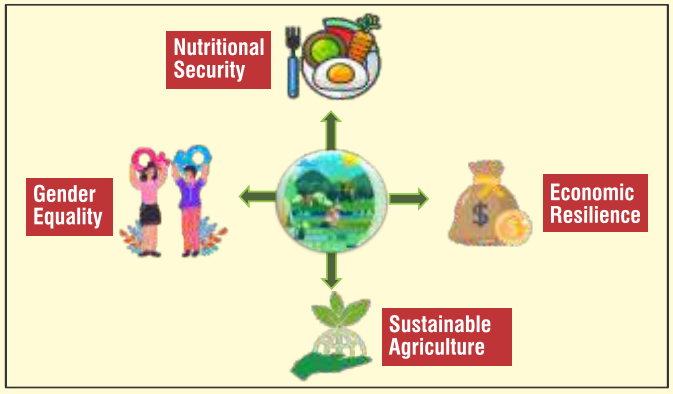
Murrah buffaloes are known for their distinct physical features and productive traits. Murrah buffaloes have native breeding tract in Rohtak, Hisar and Jind of Haryana, Nabha and Patiala districts of Punjab and Western Uttar Pradesh and NCR of Delhi. Physical characteristic appearance of Murrah buffaloes include jet-black body colour with tightly curled short and spiral horns, and tight skin. Buffaloes are kept in mixed type of housing system. Murrah is one of the predominant dairy buffalo breeds that is widely used all over India for grading up nondescript buffaloes, and is referred to as improver breed of buffaloes. Murrah buffaloes are known for its high milk yield, the buffaloes producing more than 4000kg in standard lactation is not uncommon. However, the average lactation performance varies from 1800 to 2300 kg/lactation. The buffalo milk is known for the superior milk fat and it ranges from 7 to 9%. Males are used both for breeding as well as draught purpose. This breed has even formed an important place in the livestock industry of many developing countries like Bulgaria, Philippines, Malaysia, Vietnam, Brazil and Sri Lanka. This breed has spread to almost all parts of the world and is being bred either in pure form or is being used for grading up local buffaloes. It has been exported to many developing countries and is bred there.

Model villages reimagined: Integrating Gandhian principles with contemporary rural development and livestock management

S Aiswarya, M Gururaj, N Saxena, SK Phulia, RK Sharma, S Kumar, V Mudgal, ML Sharma, A Bhaladhare, MH Jan, N Paul, A Habbu, SK Kakraliya and V Kumar

The concept of a model village embodies a vision of holistic rural development, empowering communities to achieve self-reliance, sustainability, and inclusivity. This vision is rooted in Mahatma Gandhi's philosophy of self-sufficient village economies, where agriculture, handicrafts, and cottage industries form the economic foundation, enabling communities to be self-reliant. Gandhi's emphasis on sustainable agriculture and community-based development continues to influence India's rural development policies. In contemporary times, the Indian government has undertaken several initiatives to operationalize this concept, notably through the Sansad Adarsh Gram Yojana (SAGY), launched in 2014. SAGY aims to transform selected villages into model communities by integrating infrastructure development, social harmony, and economic sustainability, with a focus on diversifying agriculture and promoting livestock farming. Livestock, crucial for providing employment and income in regions with scarce or overexploited land, complements traditional crop cultivation and builds resilience against agricultural uncertainties.

ICAR-CIRB has launched a project entitled 'Development of Buffalo-Centric Sustainable Agricultural Hub' under the Scheduled Cast Sub-Plan (SCSP), adopting the villages of Nangla in Hisar, Haryana, and Kheri Gujjran in Nabha, Punjab. The project aims to assess the livelihood vulnerability of dairy farmers, develop and validate sustainable livelihood strategies through need based scientific interventions, and evaluate their impact on buffalo farming communities. Key interventions include the dissemination of superior buffalo germplasm, climate-smart husbandry practices, tailored feeding strategies, area-specific mineral mixtures, round-the-year fodder production, clean milk practices, advanced health management etc. The project aims to establish a replicable model for sustainable rural development by fostering entrepreneurial opportunities and creating resilient buffalo farming systems. This livestock-based approach to model villages can drive economic resilience, enhance food and nutritional security, and promote sustainable agricultural practices, thereby advancing the vision of inclusive rural transformation rooted in Gandhian ideals.



Major Components of Model Village

Buffalo Health & Welfare

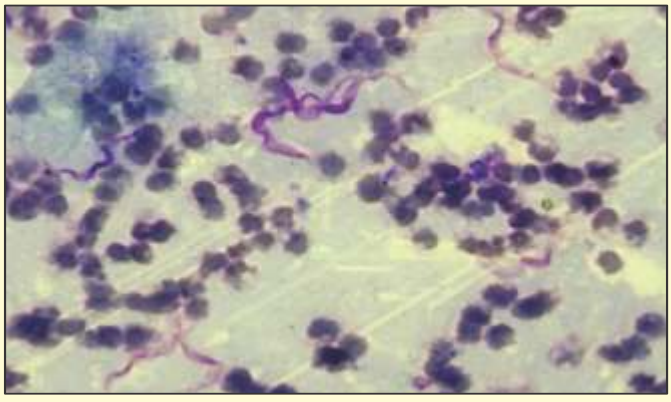
Trypanosomiasis in Nili-Ravi buffalo

A Habbu, FC Tuteja, N Paul and MH Jan

Trypanosomiasis, a significant parasitic disease, is caused by the hemoflagellate Trypanosome species and is widely prevalent across the tropics and subtropics. In India, this disease affects both domestic and wild animals, with outbreaks particularly severe in cattle and buffaloes. Mortality rates can range from 20% to as high as 90% during epizootics. Transmission is heavily influenced by seasonal changes, with rainy and post-rainy periods being the most conducive for the development of tabanid flies, which mechanically transmit the disease. However, cases are reported year-round, with the prevalence of Surra, a form of trypanosomiasis, recorded at 7.92% in Punjab, India. Sub-clinical cases are more common in buffaloes than in cattle.

In India, two species of trypanosomes infect domestic animals: *Trypanosoma evansi* and *Trypanosoma theileri*. Of these, *T. evansi* is particularly pathogenic in most domestic animals. In Nili-Ravi buffaloes at the sub-campus, the clinical signs mostly observed were pyrexia, anemia, wasting, corneal opacity (Fig.1), and neurological symptoms such as head-pressing, nystagmus, and hind-limb weakness. The anemia seen in trypanosomiasis arises from oxidative damage to red blood cells and increased erythrophagocytosis, while parasitemia determines the length of fever episodes. Additionally, *T. evansi* can breach the blood-brain barrier, leading to severe neurological issues. Diagnosis is typically made through blood smear analysis stained with Leishman's stain (Fig 2), which reveals the presence of haemoflagellates. Treatment involves administering Triquin, a combination of Quinapyramine sulphate and chloride, along with supportive therapies like ascorbic acid, B-complex vitamins, and NSAIDs. The prognosis varies based on the animal's immune status, with younger, geriatric, and pregnant animals more vulnerable to severe disease outcomes.Trypanosomiasis remains a major challenge in livestock management in India, demanding effective vector control, timely diagnosis, and appropriate treatment to minimize economic losses and animal suffering.

Corneal opacity in a calf affected with Trypanosomiasis


T.evansi haemoflagelletes in thin blood smear

Steroidal hormones in urine: Window to bovine reproductive diagnostics

R Choudhary, S Sangwan, I Bala, E Hooda, P Sharan, N Verma, S Balhara, S Yadav and AK Balhara

Urine is an excellent medium for hormone analysis due to its non-invasive collection method and the presence of hormone metabolites. Unlike blood sampling, which can be stressful for animals, urine collection is easier and less intrusive, making it suitable for regular monitoring. Steroid hormones, derived from cholesterol, include estrogens, androgens, and progestogens. These hormones are integral to various physiological processes, including reproduction. In buffaloes, as in other animals, these hormones regulate the estrous cycle, pregnancy, and overall reproductive health.

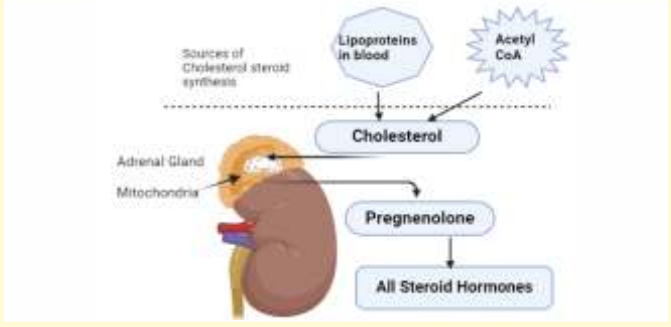


Fig.1 Steroid Hormone Synthesis

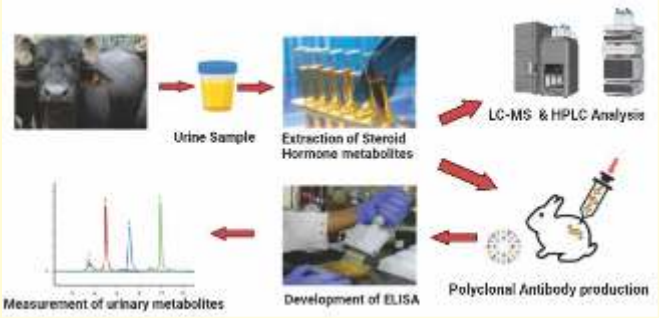


Fig. 2 Qualitative and quantitative assessment of hormones in urine

Key Steroid Hormones in Buffalo Reproductive Health

1. **Estrogens**: These hormones, including estrone and estradiol, are crucial for the development and regulation of the female reproductive system and secondary sexual characteristics.
2. **Androgens**: Testosterone and its derivatives play a significant role in male reproductive health, influencing sperm production and libido.
3. **Progestogens**: Progesterone is essential for regulating the estrous cycle and maintaining pregnancy.

Diagnostic Applications

1. **Estrous Cycle Monitoring:** Urinary hormone analysis can help track the estrous cycle in buffaloes by measuring levels of estrone and progesterone. This is particularly useful for optimizing breeding programs.
2. **Pregnancy Detection:** Hormones such as progesterone can be monitored to confirm and assess the health of a pregnancy in buffaloes.
3. **Reproductive Disorders:** Conditions like ovarian cysts and anestrus can be diagnosed by analysing hormone levels in urine.
4. **Artificial Insemination (AI) Programs :** Monitoring hormone levels can help determine the optimal time for AI, improving the success rates of breeding programs.

Crucial roles of Cu, Zn & Mn in female reproduction

MH Jan, N Paul, AS Habbu, A Bhaladhare and FC Tuteja

Introduction

There is ample evidence showing that minerals are important for reproductive function in female animals. The hypothalamo–pituitary–gonadal axis is one of the vital bodily systems that governs production and release of gonadal steroid hormones, which regulate species-specific patterns of sexual development and behaviour. Minerals, in general, and micromineral especially, Cu, Zn and Mn (trace elements), in particular influence the reproductive process by their action on hypothalamo-pituitary-gonadal axis. Disturbances in one or more minerals lead to a cascade of events that alter the hormonal milieu along this axis and ultimately lead to a disturbance in reproductive functions.

Copper (Cu)

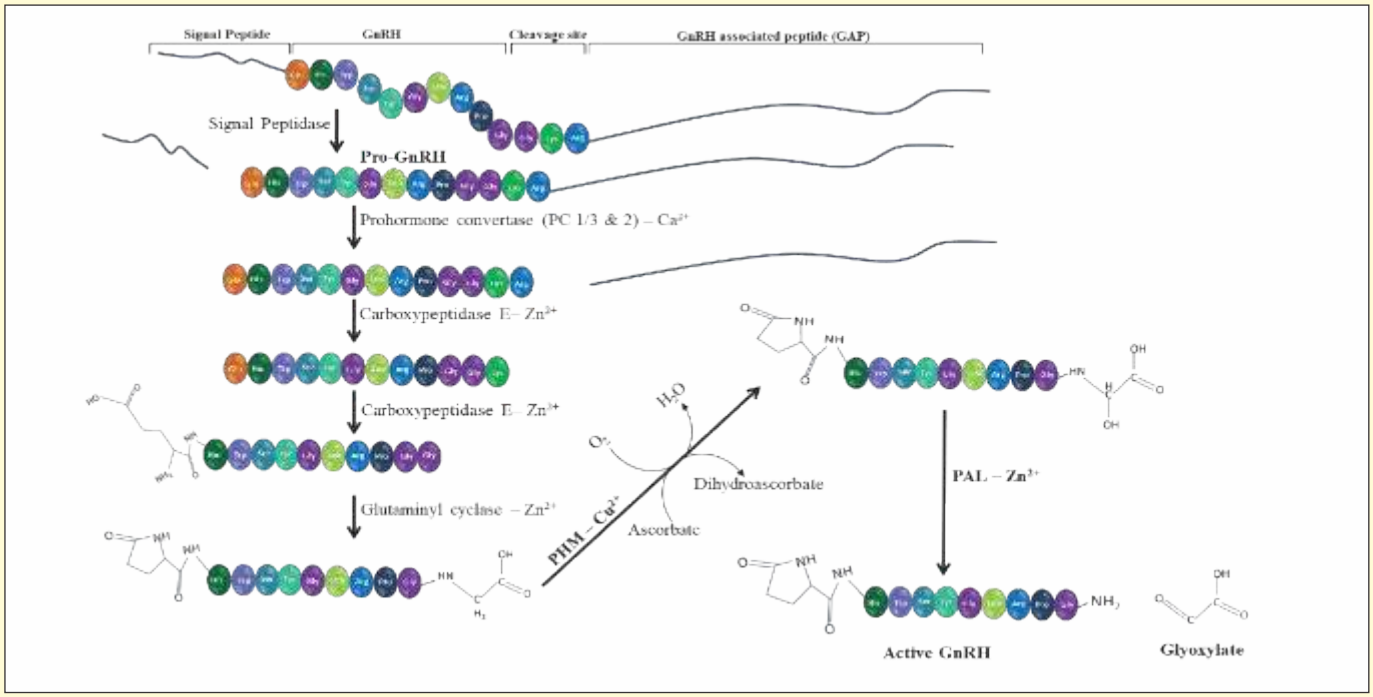
Copper deficiency plays critical roles in reproductive physiology and immune function. It is essential for the activity of superoxide dismutase (SOD1), and its deficiency has been linked to defects in ovarian folliculogenesis and luteal function, reducing progesterone production and fertility in mice. Animal studies have demonstrated a strong correlation between Cu deficiency and decreased fertility, with Cu supplementation improving reproductive outcomes. In humans, lower placental Cu levels have been associated with higher birth weights and the development of preeclampsia. Copper affects the reproductive axis at multiple levels, including the hypothalamus, pituitary, and ovary, influencing the secretion and activity of GnRH, FSH, LH, and estrogen. Inadequate Cu levels may disrupt follicular growth and function due to its role in lysyl oxidase, an enzyme essential for stabilizing the extracellular matrix. Notably, elevated Cu levels in follicular fluid have been implicated in polycystic ovary syndrome. Furthermore, Cu influences the activity of fallopian tube musculature, potentially impairing ovum transport in Cu-deficient infertile women.

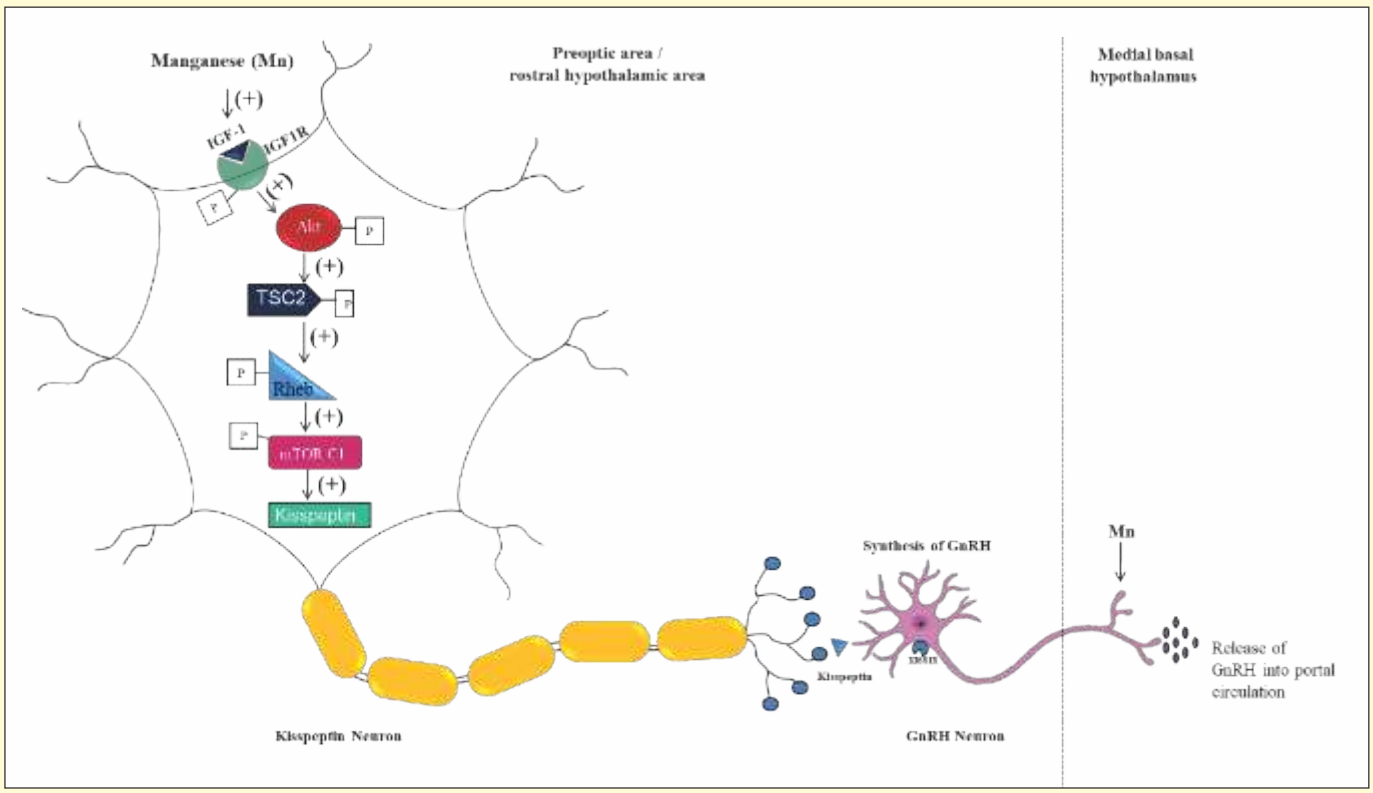
Zinc (Zn)

Zinc is crucial for various reproductive processes, including female germ cell growth, fertility, and pregnancy. Zn deficiency in humans is associated with severe reproductive impairments, increasing the risk of miscarriage, fetal growth restriction, neural development issues, and placental dysfunction. Low plasma Zn levels have been linked to complications such as prolonged labor, hypertension, postpartum hemorrhage, and congenital malformations. In animal models, Zn deficiency leads to irregular estrous cycles, reduced mating frequency, and impaired fertility. Supplementation improves reproductive outcomes, such as calving rates. Zn plays a significant role in regulating gonadotropic hormone release, prolactin secretion, and the hypothalamic-pituitary-gonadal axis. Zn is also essential in oocyte maturation, meiosis regulation, and egg activation, highlighted by the "zinc spark" phenomenon at fertilization, which is critical for early embryonic development.

Manganese (Mn)

Manganese is an essential trace mineral involved in normal reproductive function and fetal development. Mn deficiency is associated with reproductive impairments, including anovulation, delayed puberty, and reduced conception rates in animals. Mn plays a role in the endocrine regulation of reproductive hormones, particularly in the hypothalamus and ovaries. Chronic Mn administration in animals has been shown to increase LH, FSH, and estradiol levels, possibly through its action on the hypothalamus and kisspeptin signaling pathways. Mn is also a key component of mitochondrial superoxide dismutase (SOD2), which is involved in ovarian steroidogenesis and corpus luteum function. Deficiency in Mn may affect cholesterol synthesis, leading to altered estrogen and progesterone production, and its role in SOD2 suggests involvement in corpus luteum regression during the menstrual cycle.



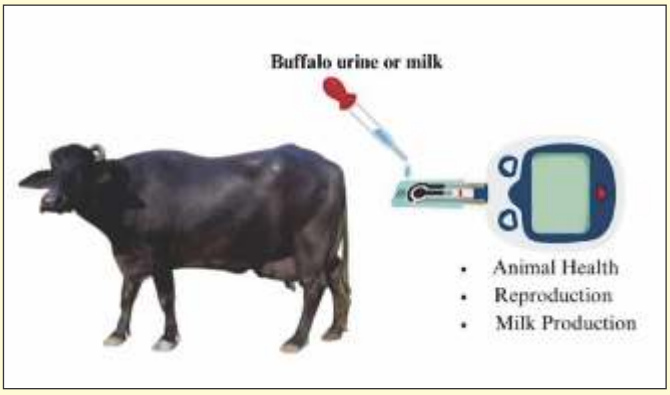


Technology intervention

Smart Buffalo Farming (SBF): Advancing reproduction, health monitoring, and sustainability with electrochemical biosensors

I Bala, S Sangwan, E Hooda, P Sharan, R Choudhary, N Verma, S Balhara, S Yadav and AK Balhara

Biosensors have revolutionized the way we manage biological data in agriculture, traditionally aiding resource-efficient crop management by measuring soil moisture, nutrient levels, and pH. Now, this cutting-edge technology is being adapted for animal farming, with profound implications for buffalo production systems. By integrating electrochemical sensors into buffalo husbandry, farmers can continuously and non-invasively monitor key physiological and reproductive biomarkers, such as hormones and proteins found in blood, urine, and milk. This enables precise, real-time tracking of buffalo health and reproductive status, transforming the management of dairy, meat, and breeding operations.



Buffalo-specific application of biosensors

In buffalo production systems, biosensors offer unparalleled opportunities to optimize animal health, productivity, and welfare. For instance, these sensors can measure a range of physiological markers critical to buffalo well-being, such as pH levels, electrolytes, ketone bodies, and lactate. Continuous, real-time monitoring enables early detection of health issues like metabolic disorders or mastitis, allowing for timely intervention and reducing the severity of diseases and potential spread. In the case of dairy buffalo, early mastitis detection through non-invasive biosensors ensures rapid treatment, minimizing milk loss and economic damage, while improving animal welfare by reducing stress and discomfort from invasive procedures.

These sensors also play a crucial role in reproductive management by tracking hormone levels that indicate estrus, pregnancy, or other reproductive phases. Accurate detection of these biomarkers can enhance breeding programs by optimizing insemination timing, leading to improved reproductive efficiency. This is particularly valuable in buffaloes, where reproductive challenges are common, and small improvements can yield significant gains in productivity and genetic advancement.

Economic and welfare benefits

The proactive nature of biosensor technology not only improves buffalo health and productivity but also lowers operational costs. Early detection and timely treatment reduce veterinary expenses, medication use, and productivity losses. Moreover, non-invasive monitoring aligns with ethical farming practices, improving animal welfare by minimizing stress and discomfort. This approach leads to healthier, more productive buffalo herds, contributing to more sustainable and efficient farming operations.

Future prospects: IoT and AI in buffalo farming

As biosensor technology advances, its integration with IoT (Internet of Things) devices and AI (Artificial Intelligence) analytics is set to further enhance buffalo farming systems. The fusion of these technologies will enable more precise, data-driven decisions in areas like health management, reproduction, and nutrition. IoT-connected sensors can relay real-time data from buffalo farms to cloud-based platforms, where AI algorithms can analyze the data and provide actionable insights to farmers. This will lead to more accurate predictions of buffalo health trends, improved breeding outcomes, and optimized resource use, paving the way for a smarter, more sustainable buffalo production system.

Unlocking 'Smart Buffalo Farming' (SBF) : through machine and deep learning

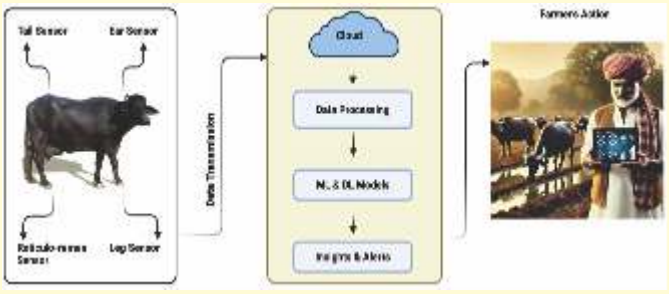
P Sharan, S Sangwan, E Hooda, I Bala, N Verma, S Balhara, S Yadav and AK Balhara

As buffalo farming enters the digital era, integrating machine learning (ML) and deep learning (DL) with IoT-based sensors and cloud computing offers transformative potential for productivity and animal health monitoring. Wearable and environmental sensors collect high-frequency data on buffalo body temperature, milk yield, movement, heart rate, and somatic cell count, which is transmitted to the cloud for storage and real-time analysis. ML and DL algorithms

process this data to detect health anomalies, such as increases in somatic cell counts indicative of infection, facilitating timely interventions and reducing reliance on reactive treatments.

ML models analyze historical and real-time patterns, identifying precursors to diseases like mastitis by detecting subtle shifts in buffalo activity or milk output before clinical symptoms emerge. Concurrently, DL models handle complex inputs, including image data and sensor-based metabolic markers, to identify stress or early illness signs. This data-driven approach supports precision farming by optimizing feed, enhancing reproductive success, and advancing herd management.

These technologies enable a proactive, sustainable, and efficient framework for buffalo farming, bridging traditional practices with data-centric decision-making.



Infrared Thermography: A non-invasive tool for monitoring respiration rate in animals

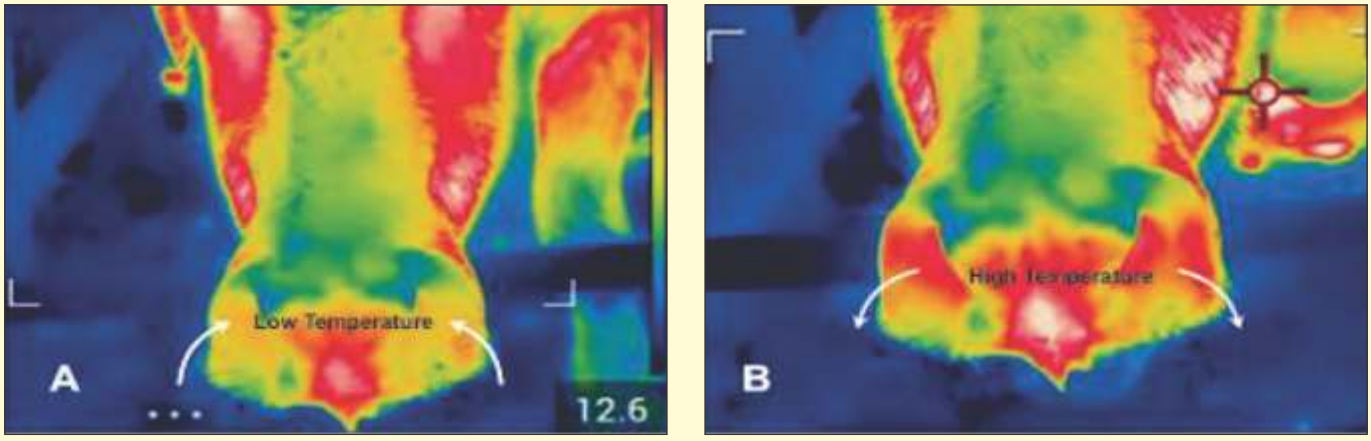
S Balhara, E Hooda, K Kumar and AK Balhara

Respiration is the process by which animals obtain oxygen and expel carbon dioxide, crucial for maintaining physiological balance. It involves pulmonary ventilation, gas exchange, transport of gases to tissues, and regulation of ventilation. Under normal conditions, inspiration (air intake) requires more effort than expiration (air release). Respiratory rates can be influenced by various factors, such as diseases, stress, environmental temperature, or humidity, especially in heat-stressed animals.

Traditional methods for measuring respiration, such as observing rib movements or using stethoscopes, can be labour-intensive and may affect animal behaviour, leading to inaccurate readings. In contrast, infrared thermography (IRT) offers a non-invasive solution. By detecting temperature changes at the nostrils, IRT can capture the cooling effect of inhalation and warming during exhalation. This thermal fluctuation can be recorded as a thermogram, allowing accurate calculation of respiration rate without direct contact with the animal. Through infrared thermography, it is easy to notice or estimate the respiration rate by alteration in temperature due to movement of air through the nostril during respiratory cycle. During inspirations, air from environment enters into nostrils; when cool air inhaled by calf from the environment it gives indications of cooling of the nostrils and thermogram of nostrils gives darker appearance. During expiration, warm air is exhaled from the body into the environment, this air causing warming of the nostrils and thermogram of nostrils gives brighter appearance. On the basis of infrared recording respiration rate can be calculated easily using following formula:

$$\text{Respiration rate (breaths/minute)} = \frac{60}{x} * y$$

where 60 - seconds in a minute; x - time taken to complete specified breaths, y - number of specified breaths



Radiometric images showing inhalation (A) and exhalation (B) through the nostrils

Factors such as sunlight, environmental conditions, and dust on the nostrils need to be controlled for accurate IRT readings. With proper validation, infrared thermography has the potential to become a reliable tool for monitoring animal health and welfare, offering a stress-free and effective method for long-term respiratory assessment.

साइलेज: भैंस पालन में साल भर हरा चारा सुनिश्चित करने की कुंजी

सुनेश बल्हारा , यशपाल, सुशील कुमार फुलिया और अशोक बल्हारा

भारत में भैंस पालन के लिए हरे चारे की लगातार उपलब्धता एक महत्वपूर्ण चुनौती है, विशेष रूप से सूखे और गर्मियों के मौसम में जब चारे की कमी हो जाती है। ऐसे में *साइलेज* एक बेहतरीन समाधान के रूप में उभरा है, जो न केवल साल भर पौष्टिक हरा चारा उपलब्ध कराता है, बल्कि पशुओं की उत्पादकता और स्वास्थ्य को भी बढ़ाता है।

साइलेज क्या है ?

साइलेज एक संरक्षित हरा चारा होता है जिसे खेत में उगाए गए चारे को नियंत्रित रूप से सड़ाकर तैयार किया जाता है। यह प्रक्रिया *फेरमेंटेशन* पर आधारित होती है, जिसमें चारे को ऑक्सीजन से दूर रखकर उसे संरक्षित किया जाता है। यह तरीका चारे में मौजूद पोषक तत्वों को लंबे समय तक सुरक्षित रखता है, जिससे भैंसों को हर मौसम में पौष्टिक आहार मिल सके।

साइलेज बनाने के लाभ

1. **साल भर चारा उपलब्धता:** साइलेज बनाने से किसान साल भर हरा चारा प्रदान कर सकते हैं, जिससे मौसमी चारा संकट से निपटने में मदद मिलती है।
2. **पोषण की गुणवत्ता बनाए रखना:** साइलेज बनाने की प्रक्रिया चारे में मौजूद पोषक तत्वों को सुरक्षित रखती है, जिससे भैंसों को उच्च गुणवत्ता वाला आहार मिलता है, जो दूध उत्पादन और पशु स्वास्थ्य के लिए लाभदायक है।
3. **कम भूमि आवश्यकता:** साइलेज तैयार करने के लिए हरे चारे को कम जगह में स्टोर किया जा सकता है, जिससे बड़े पैमाने पर जमीन की जरूरत नहीं होती।
4. **व्यवसाय के अवसर:** साइलेज उत्पादन एक उभरता हुआ व्यवसाय है, जिसमें किसान न केवल अपने पशुओं के लिए चारा बना सकते हैं, बल्कि इसे बाजार में बेचकर अतिरिक्त आय भी अर्जित कर सकते हैं।

सामान्यत : इस्तेमाल होने वाली फसलें

भारत में साइलेज बनाने के लिए जिन फसलों का उपयोग किया जाता है, उनमें प्रमुख हैं:

- **मक्का (कॉर्न):** मक्का सबसे आम फसल है जिसका इस्तेमाल साइलेज बनाने के लिए किया जाता है। इसमें उच्च ऊर्जा और कार्बोहाइड्रेट की मात्रा होती है, जो पशुओं के लिए फायदेमंद है।
- **ज्वार (सोरघम):** ज्वार भी एक महत्वपूर्ण फसल है जिसका उपयोग साइलेज बनाने में होता है, खासकर उन क्षेत्रों में जहां पानी की कमी होती है।
- **नेपियर घास (नैपीयर ग्रास):** नेपियर घास साइलेज के लिए आदर्श फसल है क्योंकि इसमें प्रोटीन की मात्रा अधिक होती है और यह जल्दी बढ़ती है।
- **बाजरा (पर्ल मिलेट):** बाजरा एक और आम फसल है जिसका उपयोग साइलेज में किया जाता है, विशेष रूप से शुष्क और अर्ध-शुष्क क्षेत्रों में।

साइलेज बनाने की प्रक्रिया

साइलेज बनाने के लिए किसान को पहले चारे को कटाई करनी होती है जब उसमें उचित मात्रा में नमी हो (आमतौर पर 60-70%)। फिर इसे छोटे-छोटे टुकड़ों में काटकर, एक साइलो (भंडारण टैंक) या गड्ढे में डालकर दबाया जाता है। साइलो को अच्छी तरह से बंद कर दिया जाता है ताकि उसमें हवा न जा सके। 40-50 दिनों के भीतर साइलेज तैयार हो जाता है और यह लगभग एक साल तक सुरक्षित रहता है।

व्यापार के अवसर

साइलेज उत्पादन और बिक्री एक उभरता हुआ व्यवसाय है। किसान अपने अतिरिक्त हरे चारे को साइलेज में बदलकर अन्य पशुपालकों को बेच सकते हैं। इसके अलावा, साइलेज की बढ़ती मांग को देखते हुए, कई व्यावसायिक इकाइयाँ साइलेज बनाने और पैक करने का कार्य भी शुरू कर रही हैं। इस क्षेत्र में निवेश करके किसान अपने राजस्व में वृद्धि कर सकते हैं और अन्य पशुपालकों को भी इसका लाभ दे सकते हैं।

Sectorial Growth

Application of the Sustainable Livelihood Framework (SLF) in livestock management

S Aiswarya, M Gururaj, N Saxena and V Kumar

The Sustainable Livelihood Framework (SLF) is a structured approach designed to analyze and enhance the livelihoods of individuals, particularly in rural settings. It focuses on understanding how various factors contribute to individuals' and communities' ability to sustain and improve their well-being over time. The SLF originated in the early 1990s, primarily developed by the UK Department for International Development (DFID), evolved from critiques of top-down development approaches that neglected local knowledge and resources, aiming instead to provide a more inclusive and comprehensive method for assessing and supporting livelihoods.

In the context of livestock, the SLF offers a valuable perspective for understanding how different forms of capital influence livestock-based livelihoods. The SLF helps in evaluating key indicators that affect livestock management and outcomes. Different livelihood capitals in the context of livestock includes:

1. **Natural capital**, for instance, includes the physical environment and resources necessary for livestock farming, such as land, water, and pasture, along with environmental factors like soil quality and climate conditions that impact livestock health and productivity.
2. **Physical capital** refers to the infrastructure and tools needed for effective livestock management, including facilities like barns, feed storage, veterinary services, and transportation systems.
3. **Human capital** encompasses the skills, knowledge, and labour available for livestock management. This includes training and education on best practices, disease management, and breeding techniques, all of which are crucial for improving productivity and sustainability.
4. **Social capital** involves the networks, relationships, and social structures that support livestock farming. Community groups, cooperatives, and social networks play an essential role in providing support through resource sharing, knowledge exchange, and market access.
5. **Finally, financial capital** includes the financial resources available for investing in livestock and related activities. Access to credit, savings, and insurance can significantly impact the ability to purchase inputs, manage risks, and invest in improvements.

The SLF offers a holistic and integrated approach to understanding and improving livelihoods by focusing on the various forms of capital and their interactions. It identifies key areas where interventions can have a significant impact, whether through enhancing infrastructure, improving skills, or strengthening social networks. This framework supports the development of targeted strategies to address specific challenges faced by livestock farmers, contributing to more sustainable and equitable development outcomes.

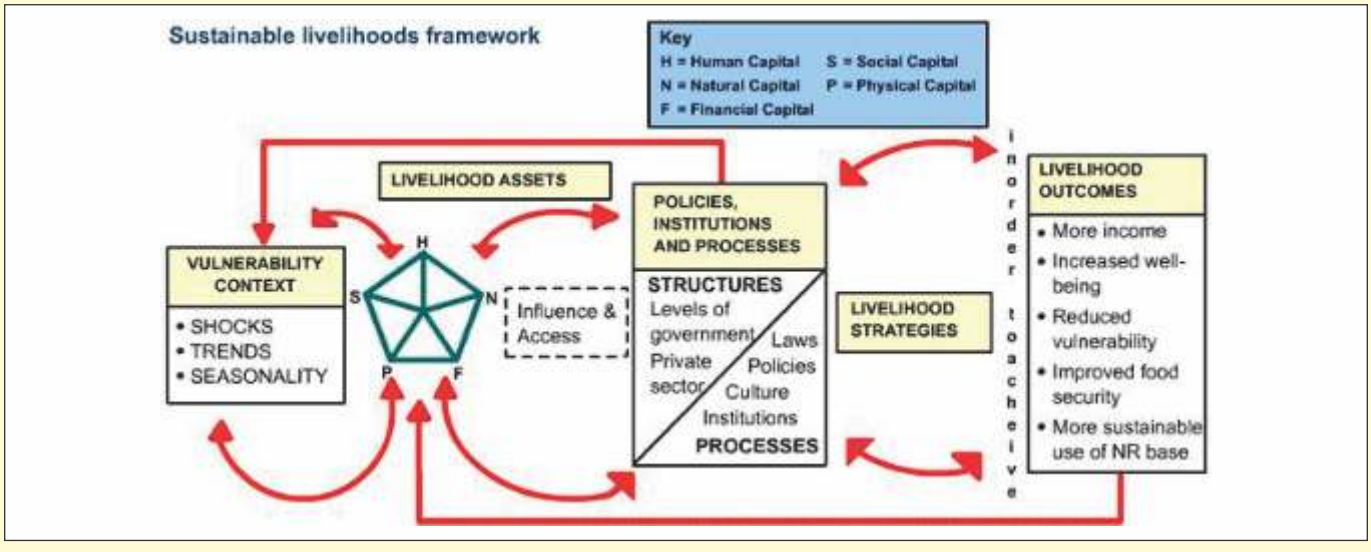


Figure: Sustainable Livelihood Framework Given by DFID, 1990

Strengthening women's role in dairy farming: Challenges and policy pathways

M Gururaj, S Aiswarya, N Saxena, ML Sharma and V Kumar

Feminization in dairy farming refers to the growing participation of women in dairy-related activities, a trend evident worldwide and particularly significant in India. Globally, women are responsible for about 43% of the agricultural labour force, with a substantial presence in dairy farming. In India, the feminization of dairy farming is particularly pronounced where women manage around 60-70% of dairy activities, demonstrating their significant contribution to the dairy operations such as milking, feeding, and caring for livestock, as well as in processing and marketing dairy products. This high level of participation emphasizes the importance of women in sustaining local and national food systems, especially in rural areas where dairy farming is a primary livelihood source.

Despite their crucial role, women in dairy farming face several challenges that hinder their productivity and well-being. Limited access to resources such as land, technology, and financial services is a significant barrier. Women often lack ownership rights to land, which affects their ability to invest in and expand their dairy operations. Additionally, they frequently have limited access to modern dairy technologies and training, which impedes their ability to improve productivity and income. Financial barriers, including limited access to credit and insurance, further exacerbate these challenges, making it difficult for women to invest in better equipment or expand their businesses. Addressing the feminization of dairy farming and strengthening women's involvement in agriculture requires strategic policy measures. Implementing Direct Benefit Transfer (DBT) programs ensures that financial aid reaches women directly, thus facilitating their access to essential resources.

The introduction of 'joint pattas' for both cultivable and homestead land is vital for granting women secure land ownership, which supports their active participation in dairy farming. Integrating crop-livestock systems and

providing timely credit through mechanisms like the Kisan Credit Card will create a more conducive environment for women to engage in agricultural activities effectively. Gender mainstreaming is also essential; initiatives such as forming Self-Help Groups (SHGs) and reserving a certain percentage of funds for women in various schemes and development programs will help address gender-specific needs. Additionally, increasing budgetary allocations for women farmers is crucial to meet their evolving requirements. Utilizing mass media and Information and Communication Technology (ICT) can enhance women's access to information and knowledge, significantly improving their involvement in dairy farming. Furthermore, incorporating ergonomic principles in research and technology development, specifically designed to address women's unique challenges, will improve their work efficiency and overall productivity. For instance, ICAR-CIRB has trained approximately 750 women farmers in scientific buffalo husbandry practices, illustrating a targeted capacity-building aimed at enhancing technical skills and productivity among women in the dairy sector. These comprehensive measures aim to create an inclusive and supportive framework, thereby empowering women in dairy farming and contributing to the sustainable growth of the agricultural sector.

Production Performance

Animal farm

Institute maintains a high pedigree herd of over 500 Murrah and Nili-Ravi buffaloes at Hisar and Nabha, respectively. During the period (January to June, 2024), a total of 179643.0 kg of milk was produced with a wet average of 9.89 kg per buffalo per day and herd average of 7.02 kg per buffalo per day from Murrah at Hisar. Similarly, at Nabha campus, a total of 159285.10 kg of milk produced from Nili-Ravi breed with 8.39 and 5.61 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, in which about 50% is arable and under fodder cultivation. During 2023-24, a total 480 acres was under fodder production. During the period, a total of 1392.8 quintals of grains were produced in which 1133.30, 190 and 69.50 quintals of wheat, barley and oat, respectively were produced. In the same period, a total of 1217.40 quintals of wheat straw was also produced. During the January to June, 2024, at Hisar a total of 18947.15 quintals of green fodder were produced.

Breeds in focus

Manda buffalo: Grey treasure of the Eastern Ghats

S Aiswarya, M Gururaj and AK Balhara

The Manda buffalo, native to the hilly areas of Odisha, especially in the districts of Koraput, Malkangiri and Nawarangapur, is a hardy breed known for its adaptability to the demanding environments of the Eastern Ghats and the Koraput plateau. These buffaloes are mainly bred for their dual utility as draught animals and for milk production. This breed has been registered as the 19th recognised buffalo breed with the accession number: INDIA_BUFFALO_1500 _MANDA_01019.

The Manda buffalo is characterised by its unique body colour, which is predominantly ash grey and grey, often interspersed with copper-coloured hairs. The lower part of the legs is usually lighter, providing a striking contrast to the overall colouring. Their horns are another notable feature: they are broad and protrude slightly to the side. They are curved backwards and inwards, forming a characteristic semi-circular shape.

In terms of milk production, Manda buffaloes produce between 1.2 and 3.7 kg of milk per day. The milk of this breed is characterised by a high fat content of 8.4% on average, which increases its value on the local dairy markets. Manda buffaloes are mainly kept in extensive husbandry systems so that they can thrive in their natural habitat

Purnathadi Buffalo: A unique breed of Vidarbha

S Aiswarya, M Gururaj and AK Balhara

The Purnathadi buffalo, a strain of Nagpuri buffaloes from Maharashtra's Vidarbha region, stands out for its distinct brown coat, locally known as the 'Bhuri buffalo.' Recognized as the 20th registered buffalo breed with the accession number: INDIA_BUFFALO_1100_PURNATHADI_01020, this medium-sized breed is known for its high reproductive efficiency, significant milk fat content, and adaptability to harsh climates.

Found along the Purna river in Akola, Amravati, and Buldhana districts, Purnathadi buffaloes thrive in extreme temperatures, with their light coat helping them endure intense heat. Calves are often born with a whitish coat that darkens with age.

Physically, these buffaloes feature a compact, round udder, long upward-curving horns, and a docile nature, making them easy to manage. Their milk production ranges from 4 to 7 kg per day, with an average lactation yield of around 900 kg. Milk composition is impressive, with 8.18% fat, 4.26% lactose, 3.68% protein, and 8.86% solid-not-fat (SNF), making Purnathadi buffaloes an attractive option for dairy farmers in the region.

Events at CIRB

Vice President of India visited ICAR-CIRB,Hisar

Hon'ble Vice President of India, Sh. Jagdeep Dhankar Ji, and Dr. (Smt.) Sudesh Dhankar visited ICAR-CIRB, Hisar, on 26th December and addressed the farmers, scientists, students, and staff of the institute. Sh. Bandaru Dattatraya Ji, Governor of Haryana, Sh. Kailash Chaudhary Ji , Minister of State for Agriculture, and Dr. Kamal Gupta, Minister of Urban Development & Housing, were also present on the occasion. The dignitaries were welcomed by Dr. T.K. Datta, Director, ICAR-CIRB. Honourable VPI acknowledged the contributions of the farmers of the country in transforming India from being a food-deficit nation to a self- sufficient, food-secure country. He also acknowledged and appreciated ICAR's unwavering commitment to technological development and cutting-edge research delivered to the farming community. In his address, the Vice President also extended a warm invitation to the farmers from the FPT (Field Progeny Testing) villages of ICAR-CIRB, who visited his office in the month of January,2024 to discuss the specific challenges they face.

Farmers from ICAR-CIRB's FPT villages visited VP's office

VP's Visit to ICAR-CIRB

ICAR-CIRB Journal club lecture series

The ICAR-CIRB Journal club offered a diverse array of topics accessible to a wide audience. These lectures served as a gateway to the latest advancements in science and humanity, catering to the interests and needs of various stakeholders. Each session provided a platform for engaging discussions and knowledge exchange, fostering a vibrant intellectual community. With topics ranging from cutting edge scientific research to broader societal issues, the club ensured that its deliberations remained relevant and enriching for all participants. Around five lectures were held from January to June, covering topics such as prebiotics for GI health, communication styles, challenges in farmers' technology adoption, responsible antibiotic use, and the role of animal sciences in healthcare research.

Journal club lecture by Dr Prabodha Swain

Journal club lecture by Dr. SVN Rao

Celebrations/Meetings at CIRB

Republic day celebration at the institute (26 January 2024)

BMGF team meeting with Director General, ICAR at New Delhi (23 January 2024)

40th Foundation day celebration (01 February 2024)

RAC meeting held under the chairmanship of Dr. P Biswas (22-23 February 2024)

IRC meeting held under chairmanship of Director, ICAR-CIRB (29-30 May 2024)

National workshop on AI & sensors for efficient livestock farming was organised at institute (10 June 2024)

International yoga day celebration at the institute (21 June 2024)

Hindi workshop was organised at the institute (19 March & 30 June 2024)

CIRB among the Farmers

CIRB conducts various extension activities, including trainings, Kisan Gosthis, frontline demonstrations, calf rallies, exposure visits, and exhibitions, with a focus on improving the socio-economic status of resource-poor farmers through initiatives such as the SCSP scheme, TSP scheme, MGMG program, and the Aspirational District Program. Over this period, a total of 10 training sessions on buffalo husbandry, entrepreneurship, and milk processing were organized, ranging from two-day to week-long durations, with 324 participants, of which 63% were men and 37% were women. Additionally, four Kisan Gosthis were held, engaging 312 farmers as part of the Foundation Day celebration and TSP scheme. Three frontline demonstrations took place on mastitis detection, pregnancy diagnosis, and milk processing, benefiting 105 farmers. A calf rally was organized as part of the Foundation Day celebrations in the FPT village. Moreover, an exposure visit was conducted for 35 farmers from Badi Sadri, Chittorgarh, Rajasthan.

Kisan gosthi was organised on the occasion of 40th foundation day (01 February 2024)

Industry-interface meet was held on the occasion of 40th foundation day (01 February 2024)

Demonstrations on mastitis detection and pregnancy diagnosis was conducted during TSP farmers exposure visit at CIRB

Exposure visit for Chittorgarh, Rajasthan farmers was organised under TSP scheme (01-02 March, 2024)

ICAR-CIRB & LUVAS organised a collaborative training on value addition in milk for dairy farmers (04-06 March 2024)

Kisan gosthi & frontline demonstration was held at Kewalpur (V), Chittorgarh (D), Rajasthan under TSP scheme (12 March 2024)

भाकृअनुप ICAR

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