



Compendium of Abstracts

International Conference

on

“Precision Animal Breeding through Genomics, Artificial Intelligence and Machine Learning”

November 13-14, 2025

Biswa Bangla Convention Centre, New Town, Kolkata



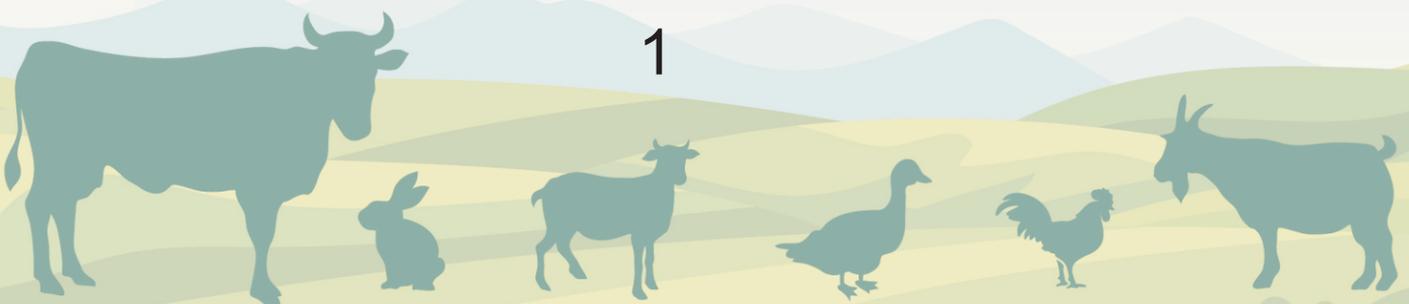
Organized by

**Department of Animal Genetics & Breeding
West Bengal University of Animal and Fishery Sciences
37 & 68, K.B. Sarani, Kolkata-700 037 INDIA**

Under the Aegis of

Indian Society of Animal Genetics and Breeding (ISAGB)

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Gates Foundation works to create a world where every person has the opportunity to live a healthy, productive life.

Our Approach

The foundation's mission remains rooted in the idea that where you are born should not limit your chances in life. We work towards a future where progress is possible—by creating market incentives for life-saving products, spurring innovation where resources are limited, strengthening collaboration across sectors, and generating high-quality data and evidence to drive impact.

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No man, child, or baby dies of a preventable cause.

The next generation grows up in a world without deadly infectious diseases

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Investments in agriculture are the best weapons against hunger and poverty, and they have made life better for billions of people.

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- **Crops R&D** - Harnessing science, AI, and breeding innovations to develop climate-resilient, nutrient-rich varieties.
- **Livestock & Aquaculture** - Improving productivity, animal health, and nutrition through better genetics, vaccines, and market access.
- **Agriculture Delivery Systems** - Strengthening soil, seed, extension, and market systems to ensure farmers have access to quality inputs and services.
- **Adaptive & Equitable Food Systems** - Promoting gender equity, climate adaptation, and nutrition through inclusive programs.

Compendium Development and Publication

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Chief Patron, ISAGBCON 2025**

**Advisor: Prof. Nilotpal Ghosh, Dean, F/o- VAS &
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राज्यपाल, पश्चिम बंगाल
Governor of West Bengal
राज्यपाल, पश्चिमबङ्ग

MESSAGE

It is heartening to know that an International Conference ISAGBICON-2025 on “Precision Animal Breeding through Artificial Intelligence and Machine Learning” and XIX Annual Convention of the Indian Society of Animal Genetics and Breeding (ISAGB) is being organised by the West Bengal University of Animal and Fishery sciences in collaboration with Indian Society of Animal Genetics and Breeding (ISAGB) in Kolkata during November 13-14, 2025.

The livestock sector is a crucial component in India’s agrarian economy and rural livelihoods. Through the National Livestock Mission, the Government of India has given immense boost to the livestock sector across the country. The Mission focuses on generating employment, promoting entrepreneurship opportunities in the livestock, poultry, sheep, goat, and piggery sectors, and increasing per-animal productivity through breed development, and feed and fodder development. Other key initiatives include the Rashtriya Gokul Mission for indigenous bovine breeds and the Animal Husbandry Infrastructure Development Fund for large-scale infrastructure projects and support investment in infrastructure for dairy and meat processing, animal feed plants, breed improvement, and waste management.

I am confident that the stakeholders of the livestock sector will make the most of these initiatives and schemes of the Government.

While the Government has created a support and infrastructure base the educational and research institutions must come forward and contribute their part in ‘Lab to Field’ initiative. In this direction, the integration of Artificial Intelligence and Machine Learning into animal breeding that has the potential to revolutionize traditional livestock management by enabling data-driven decision-making, enhancing genetic selection and promoting sustainable production systems must be encouraged.



राज्यपाल, पश्चिम बंगाल
Governor of West Bengal
राज्यपाल, पश्चिमबङ्ग

It is befitting and also heartening to note that the Conference is being held in West Bengal, that has been in the vanguard of scientific and intellectual advancements. I am sure the experts assembled here will deliberate and exchange notes on the latest cutting-edge technologies and techniques in this very crucial sector. I am confident that at the end of the day meaningful collaborations and innovative solutions will emerge that will give further impetus and direction in the advancement of precision animal breeding in India and overseas.

I extend my best wishes to the organisers, participants and delegates for the successful conduct of the conference and hope that it will generate impactful outcomes for the livestock sector and rural development.

Dr. C. V. Ananda Bose

09.11.2025

শ্রী স্বপন দেবনাথ

ভারপ্রাপ্ত মন্ত্রী
প্রাণী সম্পদ বিকাশ বিভাগ
পশ্চিমবঙ্গ সরকার



Sri Swapan Debnath

Minister-in-Charge
Animal Resources Development Department
Government of West Bengal

No. 489/MIC/ARD/25

Dated 29th October, 2025.

MESSAGE

I am delighted to know that Department of Animal Genetics & Breeding, WBUA&FS is going to organize the XIX Annual Convention of ISAGB and International Conference on “Precision Animal Breeding through Genomics, Artificial Intelligence, and Machine Learning” in collaboration with the Indian Society of Animal Genetics & Breeding (ISAGB) on and from 13th to 14th November 2025, at the Biswa Bangla Convention Centre, Kolkata.

Livestock farming has always been an integral part of rural livelihood and nutritional security in India, particularly in West Bengal, where smallholders and marginal farmers form the backbone of animal husbandry activities. The emergence of Artificial Intelligence (AI) and Machine Learning (ML) offers unprecedented opportunities to revolutionize traditional breeding and management systems through data-driven decision-making, genomic prediction, and precision farming approaches.

The theme of this conference is highly relevant and timely, as it aligns with our collective goal of achieving sustainable livestock development through scientific innovation and technological integration.

My heartfelt greetings to the organizers and wish a grand success of the XIX Annual Convention of ISAGB & the Conference.

(Swapan Debnath)

Sri Swapan Debnath
Minister-in-Charge
Animal Resources Development Department
Government of West Bengal

Dr. Tirtha Kumar Datta
Vice Chancellor
WBUA&FS

প্রদীপ কুমার মজুমদার
ভারপ্রাপ্ত মন্ত্রী
পঞ্চগায়েত ও গ্রামোন্নয়ন দপ্তর এবং
সমবায় দপ্তর
পশ্চিমবঙ্গ সরকার



Pradip K Mazumdar
MINISTER-IN-CHARGE
Department of Panchayats &
Rural Development and
Department of Co-operation
Govt. of West Bengal



06/11/2025

MESSAGE

I am pleased to convey my warm greetings and best wishes to all participants, organizers, and distinguished guests attending the XIX Annual Convention of the Indian Society of Animal Genetics and Breeding (ISAGB) and the International Conference ISAGBCON-2025 on "Precision Animal Breeding through Genomics, Artificial Intelligence and Machine Learning," being hosted by the West Bengal University of Animal and Fishery Sciences in Kolkata on 13th and 14th November, 2025.

Livestock rearing forms a crucial component of the rural economy, contributing significantly to income generation, employment, and nutritional security of millions of households across India. In West Bengal, where the Panchayats and Rural Development Department work closely with local self-governments to uplift rural communities, the adoption of scientific tools such as Genomics, Artificial Intelligence (AI) and Machine Learning (ML) can bring about a paradigm shift in productivity and profitability.

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These technologies can help optimize:

- Improved prediction of breeding outcomes.
- Shorter breeding cycles through early selection.
- Genomic insights into disease resistance and stress tolerance.
- Optimized resource use and reduced environmental footprint.
- Better productivity and reduced losses from disease or inefficiency.

Thus, these can improve the entire breeding programs, improve animal health and management, and thereby strengthen the rural economy. However, the use of these technologies be fraught with challenges, viz.

- Need for large, standardized datasets.
- High investment in genomic testing and computing.
- Need for interdisciplinary expertise combining genetics, data science, and animal husbandry.

The Panchayats and Rural Development Department recognize the importance of such innovations in strengthening grassroots institutions and ensuring inclusive growth.

The conference theme is both timely and forward-looking, underscoring the need to integrate digital innovations with traditional livestock practices to promote sustainable rural development.

I am confident that the deliberations during this international event will lead to actionable strategies that empower farmers, enhance capacity building, and foster inclusive growth in the livestock sector.

I congratulate the organizers for their commendable initiative in bringing together scientists, policymakers, and stakeholders on a global platform and extend my best wishes for the success of the conference and its lasting contribution to rural prosperity through precision animal breeding.



Pradip K Mazumdar

Shri Tirtha Kumar Datta
Vice Chancellor
West Bengal University of Animal & Fishery Sciences
68, Kshudiram Bose Sarani,
Kolkata - 700037



सत्यमेव जयते

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अध्यक्ष

Dr. Sanjay Kumar FNA, FNASc, FNAASc, FCISI

Chairman

Date: 28/10/2025



MESSAGE

I am pleased to learn that the Indian Society of Animal Genetics and Breeding (ISAGB), in collaboration with the West Bengal University of Animal and Fishery Sciences, is organizing the XIX Annual Convention of ISAGB and the International Conference ISAGBCON-2025 on "Precision Animal Breeding through Genomics, Artificial Intelligence and Machine Learning," to be held on November 13-14, 2025, in Kolkata.

The theme of this conference aligns with India's national vision of developing resilient, productive, and sustainable livestock and poultry systems that support rural livelihoods and nutritional security. With one of the world's largest livestock populations and a rapidly expanding poultry sector, the need for scientific innovation in breeding is both timely and crucial.

Precision breeding, powered by genomics, AI, and machine learning, offers immense potential to enhance genetic gains, improve disease resistance, and boost production efficiency. As the apex body for recruiting and nurturing agricultural scientists, the ASRB recognizes the importance of such interdisciplinary efforts that blend technology, innovation, and national priorities.

I am confident that ISAGBCON-2025 will stimulate valuable dialogue, collaboration, and innovation, strengthening India's animal breeding research and its contribution to sustainable agriculture. My best wishes to the organizers for the grand success of this important conference.

(Sanjay Kumar)



डा. राघवेंद्र भट्टा
उप महानिदेशक (पशु विज्ञान)
Dr. Raghavendra Bhatta
Deputy Director General (Animal Science)
M. V. Sc. Ph.D., Postdoctorate (Japan, USA)

भारतीय कृषि अनुसंधान परिषद

कृषि भवन, डॉ० राजेन्द्र प्रसाद रोड, नई दिल्ली-110001
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No. AS/PS/DDG(AS)/Message/2025
Dated 6th November, 2025

MESSAGE

I am delighted to learn that the International Conference on 'Precision Animal Breeding through Genomics, Artificial Intelligence, and Machine Learning' is being organized by the West Bengal University of Animal and Fishery Sciences, in collaboration with the Indian Society of Animal Genetics and Breeding (ISAGB), in Kolkata during November 13–14, 2025.

India's livestock and poultry sectors form a vital pillar of the nation's agricultural economy, contributing significantly to food security, rural livelihoods, and income generation. With one of the world's largest livestock populations and a rapidly expanding poultry industry, our country stands at the crossroads of immense opportunity and multifaceted challenges. To meet the growing demand for animal protein and ensure sustainable growth, it is essential to embrace cutting-edge breeding technologies that enhance genetic potential, improve disease resistance, and optimize production efficiency.

The Indian Council of Agricultural Research (ICAR) remains steadfast in its commitment to fostering innovation, capacity building, and interdisciplinary collaboration across the animal sciences. This conference represents a timely and visionary initiative that brings together leading experts in animal genetics, data analytics, and biotechnology to explore the transformative potential of precision breeding. The integration of genomics with artificial intelligence and machine learning is revolutionizing livestock and poultry development—enabling targeted genetic selection, accelerating breeding cycles, and promoting climate-resilient production systems.

I sincerely commend the organizers for their dedication and efforts in convening this international event. May this conference serve as a catalyst for transformative research, knowledge exchange, and global cooperation in the field of precision animal breeding.

I extend my best wishes for a highly successful and impactful conference.


(Raghavendra Bhatta)



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Dr. Tirtha Kumar Datta
Vice Chancellor

No. : VCS/WBUAFS/.....M-5/1266

Date4th November, 2025



Message

It is with immense pride and pleasure that I welcome all distinguished delegates, scientists, academicians, and industry professionals to the XIX Annual Convention of the Indian Society of Animal Genetics and Breeding (ISAGB) and the International Conference ISAGBCON-2025 on "Precision Animal Breeding through Genomics, Artificial Intelligence and Machine Learning," being organized by the West Bengal University of Animal and Fishery Sciences on 13th and 14th November, 2025 in Kolkata.

This conference marks a significant milestone in our collective pursuit of excellence in animal science and offers a timely opportunity to spotlight the evolving landscape of animal husbandry in West Bengal. The state has long been recognized for its rich diversity in livestock and poultry resources, and its deep-rooted contributions to rural livelihoods, nutritional security, and agricultural sustainability. With growing demand for high-quality animal protein and increasing challenges posed by climate change and disease, West Bengal's animal husbandry sector stands at the cusp of transformation.

The convergence of genomics, artificial intelligence, and machine learning is redefining livestock breeding ushering in an era of precision, efficiency, and resilience. These technologies offer transformative solutions to enhance genetic gain, improve productivity, and support sustainable development across species and production systems. For West Bengal, this means unlocking new potential in indigenous breeds, strengthening disease resistance, and empowering farmers with data-driven tools for better decision-making.

As a leading institution committed to advancing veterinary and animal sciences, our university is honoured to host this prestigious international event. We believe that fostering interdisciplinary collaboration and global dialogue is essential to drive innovation and translate research into real-world impact. The ISAGBCON-2025 provides a vital platform for sharing knowledge, forging partnerships, and inspiring the next generation of scientists and practitioners.

I extend my heartfelt appreciation to the Indian Society of Animal Genetics and Breeding for their continued leadership and to all contributors for making this event possible. May the deliberations and outcomes of this conference pave the way for a smarter, more resilient animal husbandry sector in West Bengal and across the nation.

With best wishes for a successful and enriching convention.


(Tirtha Kumar Datta)



Indian Society of Animal Genetics and Breeding

M 31, First Floor, Sector-41, South City-1, Gurugram-122001 (Haryana)

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Dr. Manoj M., Assistant Professor, Kerala Veterinary and Animal Science University, Mannuthy

Dr. B.P. Mishra President

Date: 31/10/2025



MESSAGE

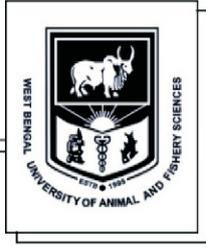
It is with great pleasure and pride that I extend my warm greetings to all delegating researchers, academicians, and industry professionals participating in the Annual Convention of the Indian Society for Animal Genetics and Breed (ISAGB) and the International Conference ISAGBICON 2025 on —Precision Animal Breeding through Genomics, Artificial Intelligence and Machine Learning, to be hosted by the West Bengal University of Animal and Fishery Sciences in Kolkata on 13th–14th November, 2025.

This conference marks a significant milestone in our collective pursuit of excellence in animal genetics and breeding. The convergence of genomics with artificial intelligence and machine learning is revolutionizing the way we understand and improve livestock populations. These technologies offer unprecedented precision in genetic evaluation, selection, and management, ushering in a new era of data-driven, sustainable animal agriculture.

The society has always championed innovation, collaboration, and scientific rigour. Through this international platform, we aim to foster dialogue among global experts, share cutting edge research, and inspire actionable strategies that can transform breeding programs across species and geographies. The insights generated here will not only advance academic knowledge but also empower practitioners and policymakers to address the pressing challenges of food security, climate resilience, and animal welfare.

I congratulate the organizing committee for their tireless efforts in curating this timely and impactful event. I am confident that this ISAGBICON 2025 will serve as a catalyst for future-ready breeding systems and strengthen our commitment to scientific progress and societal benefit.

President



WEST BENGAL UNIVERSITY OF ANIMAL AND FISHERY SCIENCES

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Prof. Partha Das, Ph.D.
Registrar (Actg.)

No. WBUAFS/Edn./M-5/765/2025

Date: 31.10.2025

MESSAGE



It is with great pleasure that I extend my warm greetings to all delegates, researchers, academicians, and professionals participating in the XIX Annual Convention of the Indian Society for Animal Genetics and Breeding (ISAGB) and the International Conference ISAGBCON 2025 on “Precision Animal Breeding through Genomics, Artificial Intelligence and Machine Learning,” being hosted by the West Bengal University of Animal and Fishery Sciences on 13th and 14th November, 2025 in Kolkata.

This prestigious event reflects the university’s commitment to advancing scientific inquiry and fostering innovation in the field of animal breeding. The integration of genomics with artificial intelligence and machine learning is revolutionizing livestock research and development—offering new dimensions of precision, efficiency, and sustainability. These technologies hold immense promise for enhancing genetic potential, improving productivity, and addressing the evolving challenges of food security and climate resilience.

As Registrar, I am proud to witness our institution serve as a platform for global collaboration and knowledge exchange. The presence of eminent scientists, thought leaders, and young researchers at this ISAGBCON 2025 will undoubtedly enrich the academic discourse and inspire future-ready solutions for the livestock sector.

I congratulate the Indian Society for Animal Genetics and Breeding and the organizing committee for their tireless efforts in bringing this international conference to fruition. I wish all participants a fruitful and intellectually stimulating experience.


(PARTHA DAS)

To
The Organising Secretary
ISAGBCON 2025,
Department of Animal Genetics and Breeding
Faculty of Veterinary and Animal Sciences,
West Bengal University of Animal & Fishery Sciences,



**Directorate of Research, Extension and Farms
West Bengal University of Animal and Fishery Sciences
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Prof. Subhasis Batabyal,
Director of Research, Extension & Farms (Actg.)

Ref. No.: WBUAFS /DREF / _____/2025

Date: 31.10.2025



Message

*It gives me immense pleasure to welcome all delegates and participants to the **XIX Annual Convention of the Indian Society for Animal Genetics and Breeding (ISAGB) and the International Conference, ISAGBCON 2025, on “Precision Animal Breeding through Genomics, Artificial Intelligence and Machine Learning.”***

This conference reflects a shared vision to harness science, technology, and innovation for the betterment of society. The fusion of knowledge and digital intelligence is opening new horizons in livestock development, empowering farmers and researchers alike to shape a sustainable and resilient future.

As Director of Research, Extension & Farms, I take pride in our University's role in fostering collaboration, creativity, and global partnership. I congratulate the ISAGB and the Organizing Committee for their dedicated efforts.

May ISAGBCON 2025 ignite ideas that inspire lasting progress in animal science and human welfare.

(Prof. Subhasis Batabyal)

Director of Research, Extension & Farms
West Bengal University of Animal and Fishery Sciences

West Bengal University of Animal & Fishery Sciences

FACULTY OF VETERINARY & ANIMAL SCIENCES

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Prof. (Dr.) Nilotpal Ghosh

Ph.D., FNAVS(I), FNAPM, FNAVNAW, FAAAA

DEAN



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Memo No: WBUAFS/VAS/2025/ M-1212

Dated: 31.10.2025



Message

It is a matter of great pleasure to welcome all distinguished delegates, scientists, academicians, industry professionals, and young researchers to the **XIX Annual Convention of the Indian Society of Animal Genetics and Breeding (ISAGB) and the International Conference on “Precision Animal Breeding through Genomics, Artificial Intelligence and Machine Learning”**, being organized by the Department of Animal Genetics and Breeding, Faculty of Veterinary & Animal Sciences under the West Bengal University of Animal and Fishery Sciences at Biswa Bangla Convention Centre, Newtown, Kolkata.

The Faculty of Veterinary and Animal Sciences at WBUAFS carries forward the glorious legacy of over a century of veterinary education and research in this historic city. With a steadfast commitment to excellence, the faculty continues to nurture innovation and scientific inquiry that contribute to the sustainable growth of the livestock sector and the well-being of our farming community.

In today's dynamic era, the convergence of genomics, artificial intelligence, and machine learning offers unprecedented opportunities to revolutionize animal breeding practices. This conference provides an excellent platform for scientists, academicians, and professionals from India and abroad to deliberate on recent advances, exchange ideas, and foster collaborations aimed at achieving precision and sustainability in animal production systems.

I convey my sincere appreciation to the esteemed leadership of the Indian Society of Animal Genetics and Breeding for entrusting us with the privilege of hosting this prestigious convention and international conference at our university. I also extend my heartfelt wishes to the organizing committee and all participants for a highly engaging and productive deliberation that will lead to meaningful outcomes and strengthen our collective efforts toward advancing the field of animal genetics and breeding.

Best wishes for the grand success of the conference.

(Prof. Nilotpal Ghosh)
Dean



Dr. Uttam Sarkar

Assistant Professor & Organizing Secretary, ISAGBCON-2025



MESSAGE

It is with immense pleasure and a deep sense of responsibility that I welcome all esteemed delegates, researchers, academicians, and industry professionals to the XIX Annual Convention of the Indian Society of Animal Genetics and Breeding (ISAGB) and the International Conference ISAGBCON-2025 on “Precision Animal Breeding through Genomics, Artificial Intelligence and Machine Learning,” being hosted by the West Bengal University of Animal and Fishery Sciences on 13th and 14th November, 2025 in Kolkata.

This conference is a testament to our collective commitment to advancing the frontiers of animal science through the integration of cutting-edge technologies. The convergence of genomics, artificial intelligence, and machine learning is reshaping the landscape of animal breeding—offering transformative solutions for genetic improvement, disease resistance, and sustainable livestock production. The ISAGBCON-2025 aims to provide a vibrant platform for scientific exchange, interdisciplinary collaboration, and the dissemination of innovative research that can drive real-world impact.

As Organizing Secretary, I am honoured to be part of this landmark event and grateful for the enthusiastic participation of experts from across the country and around the world. I extend my sincere thanks to the Indian Society of Animal Genetics and Breeding, our university leadership, and the dedicated organizing team for their unwavering support and tireless efforts in making this conference a reality.

I am confident that the deliberations and interactions during this ISAGBCON-2025 will inspire new ideas, forge lasting partnerships, and contribute meaningfully to the development of precision breeding strategies that benefit both science and society.

Wishing everyone a successful, enriching, and memorable conference experience.

Uttam Sarkar

[Dr. Uttam Sarkar]

With best compliments from:



भारतीय कृषि अनुसंधान परिषद
INDIAN COUNCIL OF AGRICULTURAL RESEARCH
Ministry of Agriculture and Farmers Welfare



International Conference on "Precision Animal Breeding through Genomics, Artificial Intelligence and Machine Learning"



ISAGB Central Committee

- Chief Patron** : Dr. V. K. Taneja , Former DDG (AS), ICAR and Former Vice Chancellor, GADVASU, Ludhiana
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Programme Schedule

ISAGBCON-2025 WBUAFS, Kolkata

13-14 November, 2025

Biswa Bangla Convention Centre (BBCC), New Town, Kolkata-700 156

Day 0: 12-11-2025 (Wednesday)	
13:30-14:00 PM	Registration
14:00-17:00PM	Pre-Conference Workshop & High Tea
Day 1: 13-11-2025 (Thursday)	
9:00-10:00 AM	Registration Venue: BBCC, Main Entry Gate Level 2 (second floor)
10:00 AM-12:00 Noon	Inaugural Session followed by Keynote Addresses Venue: Auditorium Hall No. 7 Level 1 (first floor)
12:00-12:10 Noon	High Tea Break 2 Venue: Food Area Hall No. 2 Level 2 (second floor)
12:10-1:00 PM (13-11-2025)	Plenary Session I Venue: BBCC, Auditorium Hall No. 7 Level 1 (first floor) 1. Speaker: Dr. Subir S. Majumder, Director General, Gujarat Biotechnology University, & Former Director, NIAB, Hyderabad ▪ Lecture: Generation of a High Density SNP Chip using Indigenous Cattle, the First Step for Genomic Selection Chairpersons: 1. Prof. Purnendu Biswas, Former Vice Chancellor, WBUAFS, Kolkata 2. Dr. Mihir Sarkar, Director, ICAR -NRCY, Dirang, Arunachal Pradesh Rapporteur: 1. Dr. Santanu Banik, Head, ICAR-NDRI (ERS), Kalyani, WB
1:00-2:00 PM	Lunch Break Venue: Food Area Hall No. 2 Level 2 (second floor)
2:00-3:30 PM (13-11-2025)	Technical Session I: Next Generation Breeding: Integrating Genomics & Phenomics Venue: BBCC, Auditorium Hall No. 7 Level 1 (first floor)



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	<p>Chairpersons:</p> <ol style="list-style-type: none">1. Dr. B. P. Mishra, Former Director, ICAR -NBAGR, Karnal, Haryana2. Dr. U. Rajkumar, PS, ICAR-DPR, Hyderabad3. Dr. Subodh Kumar, PS & Head, DAG, ICAR-IVRI, Izatnagar <p>Rapporteurs:</p> <ol style="list-style-type: none">1. Dr. Arnab Sen, PS & Station In-Charge, ICAR-IVRI-ERS, Kolkata2. Dr. Ayan Mukherjee, Asst. Prof., Animal Biotech., WBUAFS
	<p>Lead Papers</p> <ol style="list-style-type: none">1. Speaker: Dr. Mintu Nath, Senior Lecturer, University of Aberden, U.K.<ul style="list-style-type: none">▪ Lecture: From Association to Causation: Integrating Mendelian Randomisation Tool for Enhanced Genomic Prediction in Livestock2. Speaker: Dr. Alfred De Vries, SPO, Bill & Melinda Gates Foundation, USA<ul style="list-style-type: none">▪ Lecture: Optimized Breeding Tools for Herd Productivity Gains under Challenging Conditions3. Speaker: Dr. Gopal Gowane, PS, ICAR-NDRI, Karnal<ul style="list-style-type: none">▪ Lecture: Future-Ready Genomic Evaluation Strategies for Indigenous and Crossbred Cattle in Smallholder Systems4. Speaker: Dr. Nilesh Nayee, DGM, Animal Breeding - Field Projects, NDDB<ul style="list-style-type: none">▪ Lecture: Fast Tracking Genetic Progress in Bovines using Genomics and ARTs
	<p>Best Abstracts</p> <ol style="list-style-type: none">1. Speaker: Dr. Rani Alex, PS, AGB, ICAR-NDRI, Karnal<ul style="list-style-type: none">▪ Lecture: Implementation of Genomic Selection in Indigenous Sahiwal Cattle at ICAR-NDRI2. Speaker: Prof. Ashis Kumar Ghosh, AGB, GBPUA&T, Pantnagar<ul style="list-style-type: none">▪ Lecture: Expression Profile of Bola DRB 3.2 Gene in Crossbred Cattle
2:00-3:30 PM (13-11-2025)	<p>Poster Session I: Genetic Architecture and Quantitative Foundations of Animal Breeding</p> <p>Venue: BBCC, Auditorium Pre -Conference Area-G Level 2 (2nd floor)</p> <p>Chairpersons:</p> <ol style="list-style-type: none">1. Prof. P. K. Senapati, Former Dean, F/o -VAS, WBUAFS2. Dr. T. K. Ghosal, Head, ICAR-CIFE, Kolkata3. Dr. Ajoy Mandal, PS, AGB, ICAR -NDRI (ERS), Kalyani, WB



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3:30-5:00 PM (13-11-2025)	Technical Session II : Tools for Accelerated Genetic Improvement: Applications in Plants, Animals and Aquatic systems Venue: BBCC, Auditorium Hall No. 7 Level 1 (first floor)
	Chairpersons: 1. Dr. Vineet Bhasin, Former PS (AG&B), ICAR Head Qtrs., New Delhi 2. Dr. Tarun Kumar Bhattacharya, Director, ICAR -NRCE, Hisar 3. Dr. Pushpendra Kumar, PS, DAG, ICAR-IVRI, Izatnagar 4. Dr. Vikas Vohra, PS & Head, AGB, ICAR-NDRI, Karnal
	Rapporteurs: 1. Dr. Amit Kumar, PS, DAG, ICAR-IVRI, Izatnagar 2. Dr. Aruna Pal, Assoc. Prof., LFC, WBUAFS
	Lead Papers
	1. Speaker: Dr. Srinivas Jahageerda, PS, Fish Genetics and Biotechnology, ICAR - CIFE, Mumbai ▪ Lecture: From Fish to Farm: Genetic Tools in Aquaculture and Their Relevance to Livestock and Plant Breeding 2. Speaker: Dr. Kutubuddin Ali Molla ▪ Lecture: Precision Genome Editing at Scale: Next Generation Tools for Accelerated Improvement in Crops, Livestock, and Aquaculture 3. Speaker: Dr. Mahesh R. Neupane, Animal Scientist, Animal Genomics and Improvement Laboratory, USDA ▪ Lecture: A Case Study on Digital Transformation in Conventional Cattle Breeding 4. Speaker: Dr. Periasamy Kathiravan, PS, ICAR-NRCM, Medziphema & Former Livestock Geneticist, IAEA, Vienna ▪ Lecture: From Ear Tags to Genomics: ICT Innovation for Accelerated Livestock Improvement in Developing Countries.
Best Abstracts	
1. Speaker: Dr. Ravi Kr Gandham, Head, Animal Biotech., ICAR-NBAGR, Karnal ▪ Lecture: Cattle Genome : Insights into Indian Zebu 2. Speaker: Dr. Asit Jain, Associate Professor, AGB, NDVSU, Jabalpur ▪ Lecture: Cathepsins Inhibition by E-64 during Oocyte Maturation Enhances Developmental Competence of Buffalo Embryos via Apoptosis Suppression	



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3:30-5:00 PM (13-11-2025)	Poster Session II : Next Generation Breeding: Integrating Genomics & Phenomics Venue: BBCC, Pre-Conference Area-G Level 2 (2 nd floor)
	Chairpersons: 1. Dr. A. K. Pandey, PS, DAG, ICAR -IVRI, Izatnagar 2. Dr. Monika Sodhi, PS, Animal Biotech., ICAR-NBAGR, Karnal 3. Dr. Jamuna Valsalan, Asst. Commissioner, MFAHD, GoI, New Delhi
6:30-8:30 PM	Cultural Programme & Dinner
Day 2: 14-11-2025 (Friday)	
8:00-9:00 AM	Breakfast Venue: Food Area Hall No. 2 Level 2 (second floor)
9:00-10:00 AM (14-11-2025)	Plenary Session II Venue: BBCC, Auditorium Hall No. 7 Level 1 (first floor) 1. Speaker: Dr. Mehar Singh Khatkar, Senior Researcher, School of Animal and Veterinary Science, Adelaide University, Adelaide, Australia ▪ Lecture: Beyond Genomics: Phenomics and Artificial Intelligence to Transform Economic Trait Evaluation in Livestock
	Chairpersons: 1. Dr. S. M. Deb. Former Director, NRCY, ICAR -Emeritus Professor, WBUAFS 2. Dr. Yash Pal, Director, ICAR -CIRB, Hisar 3. Dr. Manish Kumar Chatli, Director, ICAR-CIRG, Makhdoom Rapporteurs: 1. Dr. K. N. Raja, SS, AGB, ICAR -NBAGR, Karnal 2. Dr. Asit Jain, Associate Professor, AGB, NDVSU, Jabalpur
10:00 AM-12:00 Noon (14-11-2025)	Technical Session III : Exploring IoT and Artificial Intelligence in Animal Food System Venue: BBCC, Auditorium Hall No. 7 Level 1 (first floor)
	Chairpersons: 1. Dr. N. H. Mohan, Director, ICAR-NBAGR, Karnal 2. Dr. P. K. Rout, PS (AG&B), ICAR Head Qtrs., New Delhi 3. Dr. S. K. Chaturvedi, Former PS, ICAR-CIRC, Meerut Rapporteurs: 1. Dr. S. K. Niranjana, PS, AGB, ICAR-NBAGR, Karnal 2. Dr. Tapas Biswas, SS, IVRI -ERS, Kolkata



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	Lead Papers <ol style="list-style-type: none">1. Speaker: Dr. Suresh Raja Neethirajan, Professor & University Research Chair, Dalhousie University, Canada<ul style="list-style-type: none">▪ Lecture: Welfare by Design: Harnessing AI and IoT for Compassionate and Climate-Ready Livestock Systems2. Speaker: Dr. T. K. Mohanty, PS, LPM, ICAR -NDRI, Karnal<ul style="list-style-type: none">▪ Lecture: Precision Livestock Farming using Sensors and Artificial Intelligence: Optimizing Resources and Productivity3. Speaker: Dr. Soumen Mandal, PS, Human Centered Robotics and Cybernetics Group, CSIR-CMERI, Durgapur<ul style="list-style-type: none">▪ Lecture: Leveraging AI-IoT Powered Wearables for Small Cattle Holder Systems.4. Speaker: Dr. Srinivas Kiran Ambatipudi, Professor, Dept. of Biosciences and Bioengineering, IIT Roorkee<ul style="list-style-type: none">▪ Lecture: Smart Wearable Sensor System for Monitoring Buffalo Health.
	Best Abstracts <ol style="list-style-type: none">1. Dr. Vikas Diwakar, AGB, NDRI, Karnal<ul style="list-style-type: none">▪ Lecture: Comparative Analysis of Artificial Intelligence Based Prediction Algorithms for Breeding Value Estimate in Murrah Buffalo2. Dr. B. N. Shahi, Professor, AGB, GBUA&T, Pantnagar<ul style="list-style-type: none">▪ Lecture: Comparative Evaluation of Machine Learning Models for Prediction of First Lactation 305-Day Milk Yield in Crossbred Cattle
10:00 AM-12:00 Noon (14-11-2025)	Poster Session III : Biological Systems, Reproductive and adaptive genomics Venue: BBCC, Pre-Conference Area-G Level 2 (2 nd floor) Chairpersons: <ol style="list-style-type: none">1. Dr. Sujoy Dhara, Head, ICAR-CIRB, Hisar2. Dr. Soumen Naskar, PS, AGB, ICAR-IIAB, Garkhatanga, Ranchi3. Dr. Indrajit Ganguly, PS, AGB, ICAR-NBAGR, Karnal
12:00 Noon-1:00 PM (14-11-2025)	Technical Session IV : ISAGB Young Scientist Presentation Award Venue: BBCC, Auditorium Hall No. 7 Level 1 (first floor) Chairpersons: <ol style="list-style-type: none">1. Dr. Bhushan Tyagi, Joint Commissioner (RGM), Dept. of AHD, New Delhi2. Dr. Sanjeev Kumar, Former Director (A) & PS, AGB, CARI, Izatnagar3. Dr. Umesh Singh, PS, ICAR-CIRC, Meerut



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1:00-2:00 PM (14-11-2025)	Round Table Meet of stakeholders on Industry-Academician Interface Venue: BBCC, Auditorium Hall No. 7 Level 1 (first floor)	General Body Meeting of the ISAGB Venue: BBCC, Glassroom Level 0
Industry Meet	Coordinator: Dr. Partha Sengupta, Asst. Director, PBGSBS Chairpersons: 1. Dr. V. K. Saxena, Former ADG (AP&B), ICAR, New Delhi 2. Dr. A. K. Thiruvankadan, Professor, TANUVAS, Chennai 3. Dr. G. S. Konar, CEO, PBGSBS Rapporteurs: 1. Dr. H. K. Narula, Former PS, ICAR Head Qtrs. 2. Dr. Manik Pakhira, Professor, Avian Sci, WBUAFS	
2:00-3:00 PM	Lunch Break Venue: Food Area Hall No. 2 Level 2 (second floor)	
3:00-4:00 PM	Award Ceremony Venue: BBCC, Auditorium Hall No. 7 Level 1 (first floor)	
4:00-5:00 PM	Valedictory Session Venue: BBCC, Auditorium Hall No. 7 Level 1 (first floor)	
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OS-01

**IMPLEMENTATION OF GENOMIC SELECTION IN INDIGENOUS SAHIWAL
CATTLE AT ICAR-NDRI**

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ABSTRACT

Pioneering studies were conducted to implement genomic selection at ICAR-NDRI herd through evaluation and selection of indigenous Sahiwal bulls based on their genomic estimated breeding values (GEBVs) for the 305 days' milk yield. Genomic selection was implemented using single-step Genomic Best Linear Unbiased Prediction (ssGBLUP) method, and a genomic evaluation pipeline for dairy animals was established using ssGBLUP. First lactation milk records and pedigree data of 1435 animals spanning over the period of 1957 to 2024 from the Sahiwal herd of ICAR-NDRI, Karnal, were used. Genotype of 503 Sahiwal animals was generated using BovineSNP50 v3 BeadChip (Illumina). Out of the total SNPs genotyped from the chip only 41.37% SNPs were used to estimate the genetic parameters. Genotypic call rates less than 90%, animals with a call rate lower than 0.90, minor allele frequency, MAF (< 5%) was taken to avoid uninformative SNPs. GEBVs were estimated for 45 pedigreed Sahiwal Bulls and the top 3 breeding bulls had percentage superiority (GEBVs) of 21% to 22% over the rest of bulls. It was realized that the ssGBLUP methodology integrates pedigree, genomic, and phenotypic information into a unified genetic evaluation framework, effectively addressing inconsistencies in recorded pedigree data, including errors or cases of misidentified parentage. Thus, for a typical animal breeding program, with resource constraints and incomplete pedigree, the use of the ssGBLUP model is recommended for routine genomic evaluation and selection of potential candidates for successful implementation of a genomic selection program.

Keywords: GEBVs, genomic evaluation, heritability, ssGBLUP.



OS-02

EXPRESSION PROFILE OF BOLA DRB 3.2 GENE IN CROSSBRED CATTLE

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ABSTRACT

The bovine leukocyte antigen (BoLA-DRB3) gene encodes cell surface glycoprotein that initiates immune response by presenting processed antigenic peptides to CD4 T helper cells. DRB3 is the most polymorphic bovine MHC class II gene which encodes the peptide-binding groove. DRB3 gene has been extensively evaluated as a candidate marker for association with various bovine diseases and immunological traits. The present study was undertaken on 200 crossbred cattle maintained at Instructional Dairy Farm (IDF), G.B.P.U.A. & T., Pantnagar, Uttarakhand to investigate the expression profile of BoLA DRB 3.2 gene. Six alleles were identified and amino acid sequences were obtained. Comparing variability of different amino acid sequences, it was observed that the functional mutation in allele E was maximum followed by B, F, A, C and D allele. Proteins coded by B and F alleles were unstable. The functional domain was identified with the help of InterProScan a protein domain identifier. The domain ID of the identified protein was PD000328, which was a class II MHC glycoprotein transmembrane class antigen precursor signal beta chain. Using Swiss Model Workspace, the modelling of identified hypothetical protein structures encoded by six different alleles was done and three-dimensional model of the proteins was visualized by Rasmol software. The physico-chemical properties of the proteins coded by DRB3.2 gene were accessed using ProtParam bioinformatics tools. Occurrence of glutamic acid was maximum in the amino acid composition of the protein irrespective of the alleles. MHC II binding prediction was done by taking human as a model for identification of epitope regions in protein coded by DRB3.2 alleles in crossbred cattle using IEDB analysis. The antigen binding sites for each allele were successfully identified. The higher consensus percentile rank indicated the better antigen binding site.

Keywords: Antigen binding, BoLA DRB3 gene, Crossbred cattle



International Conference on "Precision Animal Breeding through Genomics, Artificial Intelligence and Machine Learning"



OS-03

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ABSTRACT

India's diverse zebu cattle exemplify adaptation and breed differentiation. We developed the 788K IndiGau SNP array on sequencing 40 breeds of Indigenous cattle. Genotyping 2,169 animals from 40 breeds was conducted to map genetic diversity (F_{st} , ROH, FROH), population structure (Phylogeny, admixture, and N_e), and key phenotypic traits (GWAS for milk - dual and draft; GWAS for height; GWAS for adaptation - coat colour, climatic zone comparison, comparison of breeds of extreme climates and Conserved regions of low diversity (CRsLD)). The array exhibited a minor allele frequency (MAF) of 0.27 in Indian cattle, compared to 0.17 for the BovineHD 770K chip, demonstrating its superior informativeness for indigenous populations. The genomic data revealed a strong north-south ancestry split and a recent decline in effective population size. Breeds such as Vechur, Siri, and Umblachery showed breed-specific signatures of positive selection, while other breeds exhibited CRsLD regions harbouring genes linked to characteristic phenotypes. A concentrated selective sweep on chromosome 6 was identified in dairy breeds, encompassing LEF1, OSTC, COL25A1, and ETNPPL. Dwarf stature was associated with loci on chromosomes 19 (ALOX12, MINK1) and 13, whereas climate-related signals involved stress-response and pigmentation genes on chromosomes 13, 18, and 22. Positive selection was inferred using iHS scores, their empirical distributions, haplogroup frequency patterns, and Tajima's D. By integrating PCA-assisted XGBoost, we achieved highly accurate breed classification on an independent cohort. This study represents the first comprehensive genomic comparison of 40 Indian Zebu breeds, utilizing the world's largest SNP chip - IndiGau.

Keywords: IndiGau, High density, Adaptability, Machine learning

OS-04

**CATHEPSINS INHIBITION BY E-64 DURING OOCYTE MATURATION
ENHANCES DEVELOPMENTAL COMPETENCE OF BUFFALO EMBRYOS VIA
APOPTOSIS SUPPRESSION**

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ABSTRACT

Cumulus cells (CCs) are essential for follicular growth, influencing both oocyte quality and embryo developmental competence. This study investigated whether inhibiting CC apoptosis could improve buffalo embryo development. The expression profiles of cathepsins (Cath B, K, S, Z) and apoptosis-related genes, pro-apoptotic (BID, BAX, CYC-C, Caspase-3) and anti-apoptotic (BCL2, XIAP), were quantified by qRT-PCR in in-vitro-produced embryos (2-cell to expanded blastocyst) derived from superior (A-grade) and inferior (B-grade) cumulus-oocyte complexes (COCs), with or without cysteine protease inhibitor E-64 supplementation during in vitro maturation (IVM). Cath B protein localization was assessed via immunocytochemistry, and DNA fragmentation by TUNEL assay. After 24 hours IVM and 14 hours IVF, embryos were cultured for seven days. In both A- and B-grade embryos, cathepsins and pro-apoptotic transcripts remained stable at the 2–4 cell stages but raise sharply at the 8-cell stage, coinciding with a reduction in anti-apoptotic gene expression. E-64 supplementation significantly down regulated Cath B, Z, BID, BAX, CYC-C, and Caspase-3 expression, particularly before major embryonic genome activation (8-cell stage), while modestly increasing BCL2 and XIAP transcripts. Cath B protein intensity was higher ($P < 0.05$) in embryos from B-grade oocytes, with E-64 treatment reducing levels consistent with mRNA data. TUNEL assays showed a higher incidence of apoptosis in embryos from inferior COCs, whereas E-64 reduced TUNEL-positive cells across developmental stages. Supplementation with 10 μ M E-64 increased blastocyst yield from superior-quality oocytes and improved blastocyst quality from both grades. In conclusion, E-64-mediated cathepsins inhibition during IVM reduces mitochondria-dependent apoptosis, thereby enhancing developmental competence in buffalo embryos. Targeted regulation of proteolytic and apoptotic pathways during oocyte maturation may improve embryo survival and quality, offering potential advantages for assisted reproductive technologies in buffalo.

Keywords: Cathepsin B; E-64; Apoptosis; Buffalo, Embryo



OS-05

**COMPARATIVE ANALYSIS OF ARTIFICIAL INTELLIGENCE BASED
PREDICTION ALGORITHMS FOR BREEDING VALUE ESTIMATE IN MURRAH
BUFFALO**

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ABSTRACT

Accurate estimation of breeding values is a critical criterion for selecting superior animals, leading to improved productivity and profitability. With the growing volume of data generated on farms, evaluating the potential of Machine learning (ML) for early genetic predictions becomes increasingly important. ML, a branch of AI, focuses on non-parametric methods for making precise and reliable predictions. Considering this, the study was undertaken to evaluate algorithms, namely, Random Forest (RF), Extreme Grading-Boosting (XGB), and Artificial Neural Network (ANN). Forty-two (42) years of milk yield records of Murrah buffalo herd from NDRI, Karnal were used for estimation of breeding values using Best Linear Unbiased Prediction (BLUP). These BLUP estimated breeding values were further used to train the ML algorithms including in 90:10. Also, the ML algorithms were also trained on monthly milk yield of each animal up to 5 months. The ML algorithms were then evaluated for their ability to predict breeding values based on cumulative monthly milk yield up to 5 months and for 305 days' milk yield records. The correlation coefficients between true and predicted breeding values up to 5 months' monthly milk yield varied from 60 to 75%. Similarly, the coefficient of determination (R^2) varied from 35 to 55%. XG-Boost exhibited superior predictive performance and adaptability under real-time data simulation conditions, indicating its potential for early and dynamic estimation of breeding values in Murrah Buffalo for developing a support system for making breeding decisions.

Keywords: Artificial Intelligence, ML algorithms, Murrah, XG-Boost

OS-06

**COMPARATIVE EVALUATION OF MACHINE LEARNING MODELS FOR
PREDICTION OF FIRST LACTATION 305-DAY MILK YIELD IN CROSSBRED
CATTLE**

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ABSTRACT

Accurate prediction of milk yield is critical for enhancing dairy herd management, breeding strategies, and overall farm profitability. The present study aimed to predict the first lactation 305-day milk yield (FL305DMY) of crossbred cattle using different machine learning algorithms. Data spanning over 29 years (1990–2019) were collected from 567 daughters of 57 sires maintained at the Instructional Dairy Farm, G.B. Pant University of Agriculture and Technology, Pantnagar. Traits considered included 30, 60, and 90 days milk yield, first lactation peak yield (FLPY), first calving interval (FCI), first service period (FSP), days to attend peak yield (DPY), first dry period (FDP), and age at first calving (AFC). Feature selection revealed that 30-days, 60-days, and 90 days milk yields along with FLPY, having correlation values above 0.5 with FL305DMY, were the most significant predictors. Five machine learning models Multiple Linear Regression (MLR), Random Forest (RF), Gradient Boosting Regression (GBR), Extreme Gradient Boosting (XGboost), and Light Gradient Boosting Machine (LightGBM) were used to evaluate the data. The dataset was partitioned into training (80%) and testing (20%) subsets, and model performance was assessed using coefficient of determination (R^2) and root mean square error (RMSE). Results indicated that MLR performed the weakest ($R^2 = 0.55$, RMSE = 478.82 for testing). In contrast, RF outperformed all models, achieving the highest predictive accuracy ($R^2 = 0.85$, RMSE = 267.13 for testing). LightGBM and GBR demonstrated satisfactory prediction ability, whereas XGboost showed moderate performance. Overall, the Random Forest model was identified as the most robust and reliable approach for predicting FL305DMY in crossbred cattle. The findings underscore the potential of advanced machine learning models in dairy herd improvement programs, enabling early selection and management decisions. Future research may improve prediction accuracy by incorporating additional correlated traits and expanding dataset size.

Keywords: Crossbred cattle, milk yield prediction, machine learning models



*Poster
Session-I*



Genetic Architecture and Quantitative Foundations of Animal Breeding

P1-01

CHARACTERIZATION OF MAYURBHANJ GOATS OF ODISHA: A COMPARATIVE STUDY WITH THE GANJAM BREED

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ABSTRACT

The present study aimed to characterize the morphometric and qualitative traits of Mayurbhanj and Keonjhar goats and compare them with Ganjam goats to determine whether Mayurbhanj and Keonjhar goats represent a distinct genetic group. A total of 406 goats, comprising 196 Ganjam and 210 Mayurbhanj animals, were sampled from six locations—Karanjia, Raruan, Sukruli, and Bahalda (Mayurbhanj), and Banspal and Ghatagaon (Keonjhar)—covering both sexes. Data on body weight, body length, chest girth, wither height, and ear length were recorded at birth, 3 months, and 12 months, along with qualitative traits such as head profile, ear orientation, coat color, and horn characteristics. Reproductive parameters including age at sexual maturity, age at first kidding, and kidding interval were also documented. Statistical analyses using least squares models accounted for the effects of sex and location. Highly significant ($P < 0.05$) differences were observed between breeds for most morphometric traits. Ganjam goats were consistently larger at all ages, with mean body weights of 2.53 kg at birth and 18.94 kg at 12 months, compared with 1.70 kg and 12.34 kg in Mayurbhanj goats, respectively. Males were superior to females across both breeds, indicating marked sexual dimorphism. Correlation analysis showed strong positive relationships ($r > 0.80$) among body weight, length, height, and chest girth, particularly in Ganjam goats, while Mayurbhanj goats exhibited tighter inter-trait associations suggesting coordinated growth. Qualitative features revealed distinct phenotypic patterns. Mayurbhanj and Keonjhar goats typically had convex head profiles, medium horizontal ears, dark tan coats with black muzzles, and uniform horn shape, while Ganjam goats displayed more variation in head, ear, and horn types. Despite smaller body size, Mayurbhanj and Keonjhar goats exhibited early maturity, shorter kidding intervals, and good prolificacy, underscoring their adaptability and potential recognition as a distinct, locally adapted genetic resource.

Keywords: Mayurbhanj goats, morphometric characterization, comparative analysis



P1-02

**MORPHOMETRIC VARIATION AND PRINCIPAL COMPONENT ANALYSIS OF
LOCAL BUFFALOES IN THE SOUTHERN REGION OF CHHATTISGARH, INDIA**

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ABSTRACT

Morphometric characterization is essential for understanding structural variability and guiding selective breeding in indigenous buffalo populations. This study analyzed eight morphometric traits—chest girth (CG), body length (BL), height at withers (HW), horn length (HL), face length (FL), tail length (TL), dorsal body height (DBH), and ear length (EL)—in 446 local buffaloes of the southern region of Chhattisgarh using principal component analysis (PCA). Descriptive statistics revealed moderate variation in TL (76.48 ± 9.51 cm), CG (177.23 ± 20.34 cm), BL (132.90 ± 8.97 cm), HW (120.26 ± 6.98 cm), HL (39.95 ± 12.35 cm), FL (41.92 ± 6.06 cm), DBH (20.28 ± 3.04 cm), and EL (22.03 ± 3.87 cm), indicating substantial phenotypic diversity. The Kaiser-Meyer-Olkin measure (0.551) and Bartlett's test of sphericity ($\chi^2 = 757.69$, $p < 0.001$) confirmed the suitability of the dataset for PCA. Three principal components with eigenvalues >1 explained 63.43% of the total variance. Varimax rotation revealed Factor 1 representing body frame and thoracic robustness (TL, CG, HL), Factor 2 representing vertical growth and limb development (HW, DBH, FL), and Factor 3 representing cranial and body length proportions (BL, FL). Ear length contributed minimally to overall variation. The results indicate that structural robustness, vertical development, and body proportion are the primary axes of morphological variability in local buffaloes of the southern region of Chhattisgarh. These findings can inform selective breeding strategies, emphasizing animals with strong body frames, upright growth, and proportional cranial-trunk structures to enhance draft performance, grazing efficiency, and functional adaptability.

Keywords: Principle component analysis, local buffalo, breed characterization, selective breeding