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ANNUAL REPORT
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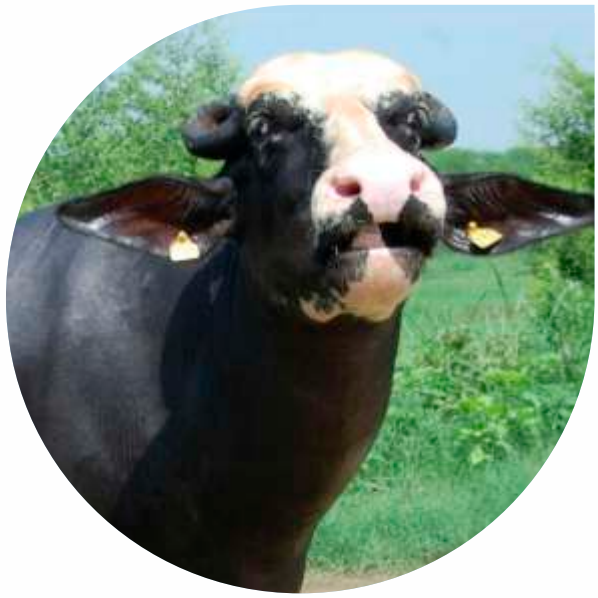

भा.कृ.अ.प.-केन्द्रीय भैंस अनुसंधान संस्थान
हिसार - 125 001 (हरियाणा) भारत

ICAR- Central Institute for Research on Buffaloes
Hisar- 125 001 (Haryana) India

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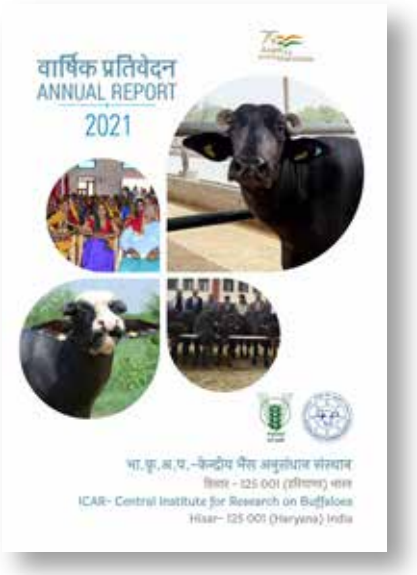

CITATION

CIRB-Annual Report 2021
ICAR - Central Institute for Research on Buffaloes
Hisar-125001 (Haryana) INDIA

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Publication No. : 01/2021

PRINTING

Intech Printers and Publishers
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Karnal - 132001, Haryana
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PREFACE

Dairy farming in India has been an important part of the agricultural scenario for thousands of years. Agriculture diversification through animal husbandry is one of the primary drivers of growth in rural incomes and higher public investment in Livestock Sector is need of the hour for doubling farmers' income. India being a predominantly agrarian economy has about 70 per cent of its population living in villages, where livestock play a crucial role in the socio-economic life. Presently, our country occupies the pride position of being the highest milk producer in the world. This cannot entirely be ascribed to sheer number of livestock heads that we possess, but has to be credited to the gradual increase in productivity of our livestockpaved through science driven development of the sector.

India has been regarded as gold mine of buffalo germplasm as it harbors as many as 20 well-recognized, high producing breeds of this buffalo species. Indian dairy industry is undergoing transformational change and buffalo species is going to contribute to the overall milk production as it alone contributes to 67% of total buffalo milk in the world and around 49% of India's total milk production. Buffalo is a more efficient milk producer than an indigenous cow in India and are preferred over cattle in many parts of the country owing to its superior quality of milk, disease resistance, longer productive life and higher milk productivity. Buffalo farming has become a livelihood and resource generating enterprise for varied strata of our farmers as it plays a major role in alleviation of poverty and the commercial buffalo enterprises now provide employment to rural communities. Buffalo acts as an important asset of rural farmers' property, possession, and profession since it provides the greatest promise for food security and sustainable development. According to Haryana Kisan Aayog dairying provides great opportunity to the youth in agriculture as one person gains full employment by keeping 2-3 milch buffaloes.

ICAR-CIRB has realized and emphasized the important role that buffalo play in overall agricultural production in India, and over the years has supported several projects to improve buffalo's genetic performance and fertility management with the application of reproductive biotechnologies and efficient nutrient utilization technologies. We have also supported the activities of the Asian Buffalo Association other Federation formed to foster scientific exchanges within major buffalo-keeping countries and communities.

In majority of the cases, the true productive potential of individual breeds of buffaloes in their breeding tracts has not been adequately documented. There is an urgent requirement to uniformly describe all the Indian buffalo breeds by utilizing common breed descriptors, by studying their native environment, management practices, qualitative and quantitative aspects of morphological, physiological and functional traits, blood groups and biochemical polymorphisms, cytogenetic parameters, DNA analyses, utility and demographical and geographical distributions. There is ample scope for further development of buffalo in India, which warrants an even more enhanced proactive role from various development agencies both at national and international level.

Director

प्रस्तावना

दुग्ध उत्पादन हजारों वर्षों से कृषि परिदृश्य का एक महत्वपूर्ण हिस्सा रही है। पशुपालन के माध्यम से कृषि विविधीकरण ग्रामीण आय में वृद्धि के प्राथमिक संचालकों में से एक है और किसानों की आय को दोगुना करने के लिए पशुधन क्षेत्र में अधिक सरकारी निवेश समय की आवश्यकता है। भारत मुख्य रूप से कृषि प्रधान अर्थव्यवस्था होने के कारण इसकी लगभग 70 प्रतिशत आबादी गांवों में रहती है, जहां पशुधन सामाजिक-आर्थिक जीवन में महत्वपूर्ण भूमिका निभाते हैं। वर्तमान में हमारा देश विश्व में सर्वाधिक दुग्ध उत्पादक होने का गौरवपूर्ण स्थान रखता इसका कारण हमारे पास मौजूद पशुओं की संख्या को पूरी तरीके से नहीं माना जा सकता है, इसका श्रेय मुख्य रूप से हमारे पशुधन की उत्पादकता में क्रमिक वृद्धि को दिया जाना चाहिए।

भारत को भैंस के जर्मप्लाज्म की सोने की खान माना जाता है क्योंकि यहाँ भैंस प्रजाति की सभी मान्यता प्राप्त, उच्च उत्पादक नस्लों का आश्रयगृह है। भारतीय डेयरी उद्योग परिवर्तनकारी बदलाव के दौर से गुजर रहा है और कुल दुग्ध उत्पादन में भैंस की प्रजाति का मुख्य भूमिका रहेगा क्योंकि यह अकेले दुनिया में कुल भैंस के दूध का 67% और भारत के दूध उत्पादन का लगभग 49% योगदान देता है। भैंस भारत में देशी गाय की तुलना में अधिक कुशल दूध उत्पादक है और दूध की बेहतर गुणवत्ता, रोग प्रतिरोधक क्षमता, लंबे समय तक उत्पादक जीवन और उच्च दूध उत्पादकता के कारण देश के कई हिस्सों में अन्य मवेशियों से अधिक पसंद की जाती है। भैंस पालन हमारे विभिन्न स्तरों के किसानों के लिए आजीविका और संसाधन पैदा करने वाला उद्यम बन गया है क्योंकि यह गरीबी उन्मूलन में एक प्रमुख भूमिका निभाता है और व्यावसायिक भैंस पालन ग्रामीण समुदायों को रोजगार प्रदान करता है। भैंस, ग्रामीण किसानों की आय और एक महत्वपूर्ण पेशा के रूप में कार्य करती है क्योंकि यह खाद्य सुरक्षा और सतत विकास के लिए सबसे बड़ी संभावना प्रदान करता है। हरियाणा किसान आयोग के अनुसार डेयरी युवाओं को कृषि में एक बड़ा अवसर प्रदान करती है क्योंकि एक व्यक्ति को 2-3 दुधारू भैंस रखने से पूर्ण रोजगार प्राप्त होता है।

भा. कृ. अनु. प. - केंद्रीय भैंस अनुसंधान संस्थान ने भारत में समग्र कृषि उत्पादन में भैंस की महत्वपूर्ण भूमिका को महसूस किया है और उस पर जोर दिया है, और वर्षों से प्रजनन जैव प्रौद्योगिकी और कुशल पोषक तत्व उपयोग प्रौद्योगिकियों के उपयोग के साथ भैंस के आनुवंशिक प्रदर्शन और प्रजनन प्रबंधन में सुधार के लिए कई परियोजनाओं का समर्थन किया है। हमने प्रमुख भैंस पालने वाले देशों और समुदायों के बीच वैज्ञानिक आदान-प्रदान को बढ़ावा देने के लिए गठित एशियन बफेलो एसोसिएशन अन्य फेडरेशन की गतिविधियों का भी समर्थन किया है।

अधिकांश मामलों में, उनके प्रजनन क्षेत्रों में भैंसों की अलग-अलग नस्लों की वास्तविक उत्पादक क्षमता को पर्याप्त रूप से प्रलेखित नहीं किया गया है। इसलिए भैंस के सामान्य नस्ल विवरणकों का उपयोग करके, उनके मूल वातावरण, प्रबंधन प्रथाओं, रूपात्मक, शारीरिक और कार्यात्मक लक्षणों के गुणात्मक और मात्रात्मक पहलुओं, रक्त समूहों और जैव रासायनिक बहुरूपताओं, साइटोजेनेटिक मापदंडों, डीएनए का अध्ययन करके सभी भारतीय भैंस नस्लों का समान रूप से वर्णन करने की तत्काल आवश्यकता है। भारत में भैंस के और अधिक विकास के लिए पर्याप्त गुंजाइश है, जिसके लिए राष्ट्रीय और अंतर्राष्ट्रीय दोनों स्तरों पर विभिन्न विकास एजेंसियों से और भी अधिक सक्रिय भूमिका की आवश्यकता है।

निदेशक

Executive Summary

ICAR- Central Institute for Research on Buffaloes is a premier research organization of the nation dedicated to address Research and Developmental needs of buffalo productivity and Human Resource Development (HRD) support towards buffalo management and health in the country. The institute was established on February 1, 1985 by acquiring the Progeny Testing Bull Farm from Haryana Government at Hisar. The institute has come a long way towards addressing its mandated role. A sub-campus of the institute was established in December 1987 at Bir Dosanjh, Nabha, District Patiala (Punjab) with the transfer of Nili- Ravi Buffalo Farm from the Punjab State Government. Soon after its establishment, the institute came to lime-light in the **'buffalo world'** by successfully hosting 2nd World Buffalo Congress (1988), 4th and 9th Asian Buffalo Congress (2003 and 2018, respectively).

Organizational Structure

The institute is one of the 19 Animal Science institutes amongst 111 ICAR institutes spread across the country. The institute is headed by the Director, who is administrative head and managing research and extension functions. He is advised by a Research Advisory Committee (RAC) consisting of eminent scientists to decide the research guidelines based on mandate, objectives and perspective plan of the institute. The institute Management Committee (IMC), headed by the Director, decides on important administrative and management matters which include funding position, action taken on recommendation of QRT and RAC, approval for higher budget works etc. Institute Research Committee (IRC), chaired by the Director, reviews the progress of various research projects being implemented by the scientists, besides assessing the completed projects and approving new research proposals based on mutual discussions amongst the scientists and experts. RAC, IMC and IRC regularly meet and provide guidance for further strengthening research and development activities. Every five years, Quinquennial Review Team (QRT), evaluates the output and outcome of the institute vis-à-vis resources of funds, manpower and facilities available, in order to provide critical appraisal to the council and the ICAR governing body. The research activities of the institute are assigned to three subject matter divisions: Animal Nutrition and Feed Technology (ANFT), Animal Genetics and Breeding (AGB) and Animal Physiology and Reproduction (APR). In addition, a unit for Transfer of Technology (TOT) takes care the extension activities of the institute. Various sections viz. Agriculture farm, Animal farm, Workshop, Estate, Electrical, PME cell, AKMU, Library, Feed Unit, Landscape, Guest House, ITMU are managed by the concerned incharges under the advice of the Director of the institute. The administrative functions viz. purchase, security, cash & bill, establishment and central store are managed by the Administrative Officer (AO), while Finance & Accounts Officer (FAO) accomplishes the Audit & Accounts section. The institute presently has the strength of 25 scientists, 26 Technicians, 16 administrative staff and 64 skilled supporting staff.

Budget Outlay

The financial outlay of the institute in terms of sanctioned budget and actual expenditure during the year 2021-22 was equal and remained 3305.82lakh including TSP, NEH and SCSP funds. CIRB also received funds of Rs. 665.88 lakh and 84.50 respectively from plan schemes and externally funded schemes, out of which, Rs. 657.38 and 33.83 lakh were expensed. The revenue receipts of the institute were Rs. 3165.23 lakh during 2021.

Salient achievements

- ICAR- CIRB is an ISO 9001: 2015 certified institution for improved buffalo germplasm production.
- Achieved highest ever wet average (kg/d) of 10.18 (n= 132) and herd average (kg/d) of 7.50 (n=180) in Murrah buffalo. In Nili-Ravi buffalo wet average (kg/d) of 8.70 (n= 102) and herd average (kg/d) of 6.70 (n=145) were achieved.
- Achieved lowest ever AFC (39.66 months, n= 68 and 43.99 months, n= 40) and calving interval (440.30 days, n= 98 and 420.00 days, n= 86) for Murrah and Nili-Ravi, respectively.

- First time in the history of CIRB, 13 Murrah buffaloes crossed 4000 kg milk yield in a single lactation. Buffalo no 4316 was recorded 4810 kg MY in 305 days lactation length at 5th lactation.
- Recorded highest ever single day milk yield (> 20 kg) for 10 Murrah buffaloes with average 305 days milk yield of total Murrah herd, 2867 kg.
- Telomere length and blood biochemical parameters (AST, ALT, alkaline phosphatase, serum creatinine and creatine kinase, creatine phosphokinase, TLC, DLC) of eight cloned buffaloes were evaluated and found comparable with the age matched controls.
- Cryopreserved semen doses of cloned bulls were used for artificial insemination in farm animals or farmer's animals on prior consent and a total of 62 progenies were produced and they are growing healthy and normal.
- Two male progenies born using semen of cloned bull Hisar-Gaurav donating semen and qualifying minimum standard for semen cryopreservation.
- The effect of dilution (@12 and 16 million spermatozoa/straw) on buffalo sperm viability and functional parameters such as sperm post-thaw motility, plasma membrane integrity, thermal resistance, kinematic parameters were found comparable with the dose of 20 million spermatozoa/ straw studied.
- Induction of ovarian cyclicity (%) in treatment and control groups of buffaloes was done using anti-stress feed supplement alone within 15 days of feeding trial and findings suggested that anti-stress nutritional supplement was beneficial in inducing ovarian cyclicity in 37.5% of buffaloes as compared to only 11.8% control buffaloes.
- Nano Cu and Zn are synthesized in laboratory for supplementation to animals, which have higher bioavailability and low environmental pollution.
- Dietary inclusion of urea-molasses based feed supplement and garlic oil- cinnamon bark-based feed additive in buffalo calves were demonstrated to enhance growth rate (27.66% and 22.21%, respectively) and feed efficiency (10.38%, 10.08%, respectively) by increased nutrient utilization and reducing enteric methane production.
- Supplementation (1% of DM) of essential oil rich eucalyptus *(Eucalyptus citriodora)* leaf-meal to lactating buffaloes, increased milk yield and nutrient digestibility along with enhanced milk quality in terms of higher conjugated linoleic acid (*cis 9, trans 11;* CLA) content in the milk, which has human health benefits and reduction in enteric methane and faecal nitrogen excretion.
- Institute trained 656 dairy farmers on scientific buffalo husbandry practices by transfer of technology unit during Jan.-Dec, 2021. Out of these 159 dairy farmers were trained under the SCSP program.
- Convergence model developed and tested for improvement in buffalo udder health by reducing somatic cells counts.
- Under Network Project on Buffalo Improvement (NPBI) more than 1000 elite breedable Murrah buffaloes are maintained at six different centres in addition to three field units for progeny testing of bulls. During the year, use of 19th set of bulls (12) was completed for test mating and 15th set of test bulls (15) was evaluated on the basis of first lactation record of 834 daughters.
- Since initiation of progeny testing programme in the year 1991, 39 progeny tested Murrah bulls were produced out of 188 test bulls used and evaluated.
- In this period 1792 pregnancies were confirmed at FPT villages of CIRB with the conception rate of 56.64% and 1414 calving (males 687, females 727) were recorded.
- During the year, 2.28 lakh and 0.21 lakh doses of semen were disseminated for Murrah and other breeds (Nili-Ravi, Jaffrabadi, Surti and Bhadawari), respectively under NPBI.
- Nili-Ravi, Jaffrabadi and Surti breeds of buffalo at respective centres are also focusing on progeny testing along with maintaining elite herd for bull production.
- Bhadawari breed at IGFRI, Jhansi centre of NPBI is functioning as conservation and improvement unit.

Buffalo Production Performance

Criteria	Status	
	Murrah breed at Main Campus Hisar	Nili-Ravi breed at Sub-Campus Nabha
Total number of animals (as on 31.12.2021)	566	524
Age at First Calving (Months)	39.66	43.99
Calf Mortality (%)	2.84	3.64
Dairy buffaloes herd performance		
Overall annual wet average (Kg)	10.18	8.70
Overall total lacatation milk yield (Kg)	2977	2585
Overall SLMY (Kg)	2867	2525
Service Period (days)	132	116
Calving Interval (days)	440	420
Conception rate (%)	44.51	48.96
Male germplasm		
Progeny tested bulls produced	39 (1-15th set)	10 (1-5th)
Semen doses produced	194022	21956
Frozen semen supplied	118011	4384
Bulls disseminated in field	480*	133#

** Last ten years #Since 2006-07*

Agriculture farm production (in Quintals)

Fodder	Main Campus Hisar	Sub Campus Nabha
Dry	364	2559
Green	32965	51096
Grains	398	3867

Revenue Receipts (all values in Indian Rs.)

Name of the Institute: CIRB, Hisar	Revenue Receipt (Rs. in Lakhs)							
Major/Minor/Detailed Head of Accounts	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**Grand Total**
Sale of Milk	248.44	217.31	261.62	277.21	336.20	370.31	371.56	**2082.66**
Sale of Wheat Busa/Mustard Bhusa/ Green Fodder	1.90	0.12	17.81	1.26	5.05	10.22	0.26	**36.63**
Sale of grain/wheat/paddy	41.81	33.78	25.61	55.00	4.83	7.92	3.41	**172.37**
Sale of Semen	12.18	19.56	21.30	28.46	27.54	23.83	30.95	**163.82**
Sale of Mineral Mixture	1.88	5.60	4.87	1.26	0.77	0.45	0.77	**15.59**
Sale proceed of dry trees	11.80	9.60	6.00	1.75	0.00	10.15	1.60	**40.90**
Sale of Books	0.06	0.29	0.00	0.06	0.66	0.03	0.15	**1.24**

Name of the Institute: CIRB, Hisar	Revenue Receipt (Rs. in Lakhs)							
Major/Minor/Detailed Head of Accounts	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**Grand Total**
Sale of Technology/Royalty	0.25	2.00	0.00	0.00	0.76	0.19	0.17	**3.36**
Sale proceeds of	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Land & Building	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Machine Tools & Plants Equipments/ Vehicle etc.	0.00	0.00	1.29	0.00	0.00	0.00	8.81	**10.10**
Sale proceeds of Livestock	67.48	53.50	91.09	59.59	84.13	89.47	110.24	**555.49**
Rents (licence fee)	3.37	3.53	3.98	4.68	4.70	5.93	5.88	**32.07**
Application fees from Candidates Tuition Fees, diploma Charges etc.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Application fees from Candidates in connection with recruitment	0.98	0.53	0.26	0.01	0.00	0.00	0.00	**1.77**
Receipts from Scheme	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Receipts from Service rendered by Instt./receipt from students	3.71	3.60	3.72	3.44	2.97	0.00	0.58	**18.02**
Misc Receipt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
Sale of Tender form	2.92	3.37	2.92	1.69	0.79	0.73	0.87	**13.29**
Guest house charges	2.35	2.62	2.10	2.62	3.77	1.28	3.18	**17.92**
Grand Total	**399.11**	**355.42**	**442.57**	**437.04**	**472.16**	**520.50**	**538.42**	**3165.23**

Financial Outlay (Rs in Lakh)

Name of the Insitute/Project	Sanctioned Budget (2021-22)	Expenditure (2021-22)
CIRB Main	3238.82	3238.82
CIRB TSP	2.00	2.00
CIRB NEH	12.00	12.00
CIRB SCSP	53.00	53.00
Total	**3305.82**	**3305.82**

Plan Schemes		
Network Project on Buffalo Improvement	493.15	493.12
Network Project on Buffalo Improvement SCSP	43.00	43.00
AICRP on Nutritional and Physiological (Dr. R.K Sharma,PS & PI)	6.60	6.49
AICRP on Nutritional and Physiological SCSP (Dr. R.K Sharma,PS & PI)	1.65	1.63
NAIF Project (Dr.Sandeep Khurana, PS &PI)	7.00	7.00
NASF Cloning Project (Dr.P.S Yadav,PS & PI)	54.01	50.32

Name of the Insitute/Project	Sanctioned Budget (2021-22)	Expenditure (2021-22)
NASF DMM Project (Dr. Dharmendra, Sci & PI)	25.45	20.84
CABin Project (Dr.Varij Nayan,Sci & PI)	17.00	16.98
FFP Project (Dr.Sarita Yadav, Sci & PI)	15.02	15.01
CRP Project (Dr. Meeti Punetha, Sci & PI)	3.00	2.99
Total	**665.88**	**657.38**

Externally funded Schemes		
DBT Project (Dr.Pradeep, Sci. & PI)	22.00	21.67
DBT Project (Dr. Ashok Balhara, Sr. Sci & PI)	4.79	3.68
BMGF Project (Dr. Varij Nayan, Sci & PI)	27.30	6.65
DBT Project (Dr. P.S. Yadav, PS & PI)	14.53	0.27
SERB Project (Dr. Meeti Punetha, Sci. & PI)	15.88	1.56
Total	**84.50**	**33.83**

Staff Position

Category	Sanctioned Strength	Filled	Vacant
Scientific	44	25	19
Technical	42	26	17
Administrative	24	16	8
Skilled Supporting	65	64	1

कार्यकारी सारांश

आईसीएआर- केंद्रीय भैंस अनुसंधान संस्थान देश का एक प्रमुख शोध संस्थान है जो देश में भैंस उत्पादकता, प्रबंधन और स्वास्थ्य के प्रति और मानव संसाधन विकास (एचआरडी) संबंधी जरूरतों को पूरा करने लिए समर्पित है। हरियाणा सरकार से संतान परीक्षण बुल फार्म को अधिग्रहण कर हिसार में संस्थान की स्थापना 1 फरवरी, 1985 को की गई। संस्थान ने अब तक अपनी अनिवार्य भूमिका को पूरा करने की दिशा में एक लंबा सफर तय किया है। संस्थान का एक उप-परिसर दिसंबर 1987 में बीर दोसांझ, नाभा, जिला पटियाला में पंजाब राज्य सरकार से नीली-रवि भैंस फार्म को हस्तांतरण कर स्थापित किया गया था। अपनी स्थापना के तुरंत बाद, संस्थान द्वितीय विश्व भैंस कांग्रेस (1988), चौथी और नौवीं एशियाई भैंस कांग्रेस (क्रमशः 2003 और 2018) की सफलतापूर्वक मेजबानी करके 'भैंस की दुनिया' में सुर्खियों में आया।

संगठनात्मक संरचना

यह संस्थान देश भर में फैले 111 आईसीएआर संस्थानों के बीच में पशु विज्ञान के 19 संस्थानों में से एक है। संस्थान का नेतृत्व निदेशक करते हैं, जो प्रशासनिक प्रमुख होते हैं तथा अनुसंधान और विस्तार कार्यों का प्रबंधन करते हैं। उन्हें एक अनुसंधान सलाहकार समिति (RAC) जिसमें प्रतिष्ठित वैज्ञानिक शामिल होते हैं, द्वारा संस्थान के जनादेश, उद्देश्यों और परिप्रेक्ष्य योजना के आधार पर अनुसंधान दिशानिर्देश तय करने के लिए सलाह दी जाती है। संस्थान प्रबंधन समिति (IMC), निदेशक की अध्यक्षता में, महत्वपूर्ण प्रशासनिक और प्रबंधन मामलों पर निर्णय लेती है जिसमें वित्त पोषण की स्थिति, QRT और RAC की सिफारिश पर की गई कार्रवाई, उच्च बजट कार्यों के लिए अनुमोदन आदि शामिल हैं। संस्थान अनुसंधान समिति (IRC), निदेशक की अध्यक्षता में, वैज्ञानिकों द्वारा कार्यान्वित की जा रही विभिन्न अनुसंधान परियोजनाओं की प्रगति की समीक्षा करती है, इसके अलावा पूरी की गई परियोजनाओं का आकलन करती है और वैज्ञानिकों और विशेषज्ञों के बीच आपसी चर्चा के आधार पर नए शोध प्रस्तावों को मंजूरी देती है। अनुसंधान और विकास गतिविधियों को और मजबूत करने के लिए मार्गदर्शन हेतु RAC,IMC और IRC की बैठक नियमित रूप से होती है। हर पांच साल में पंचवर्षीय समीक्षा टीम (QRT), परिषद और आईसीएआर के शासी निकाय द्वारा समीक्षा करने के लिए, धन, जनशक्ति और उपलब्ध सुविधाओं के संसाधनों की तुलना में संस्थान के आउटपुट और परिणाम का मूल्यांकन करती है। संस्थान की अनुसंधान गतिविधियों को तीन विषय वस्तु प्रभागों पशु पोषण और फ़ीड प्रौद्योगिकी (ANFT), पशु आनुवंशिकी और प्रजनन (AGB) और पशु शरीर क्रिया विज्ञान और प्रजनन (APR) द्वारा निर्दिष्ट किया जाता है। इसके अलावा, प्रौद्योगिकी हस्तांतरण के लिए एक इकाई (ToT) संस्थान की विस्तार गतिविधियों का ध्यान रखती है। कृषि फार्म, पशु फार्म, कार्यशाला, संपदा, इलेक्ट्रिकल, पीएमई सेल, एकेएमयू, लाइब्रेरी, फीड यूनिट, लैंडस्केप, गेस्ट हाउस, आईटीएमयू जैसे विभिन्न वर्गों का प्रबंधन संस्थान के निदेशक की सलाह के तहत संबंधित प्रभारियों द्वारा किया जाता है। प्रशासनिक कार्यों जैसे खरीद, सुरक्षा, नकदी और बिल, स्थापना और केंद्रीय भंडार का प्रबंधन प्रशासनिक अधिकारी (AO) द्वारा किया जाता है, जबकि वित्त और लेखा अधिकारी (FAO) लेखापरीक्षा और लेखा अनुभाग के काम को पूरा करते हैं। संस्थान में वर्तमान में 25 वैज्ञानिक, 26 तकनीशियन, 16 प्रशासनिक कर्मचारी और 64 कुशल सहायक कर्मचारी हैं।

बजट परिव्यय

वर्ष 2021-22 के दौरान स्वीकृत बजट और वास्तविक व्यय के संदर्भ में संस्थान का वित्तीय परिव्यय समान था और TSP, NEH और SCSP निधियों सहित 3305.82 लाख रूपये बना रहा। सीआईआरबी ने परियोजना योजनाओं और बाह्य वित्तपोषित योजनाओं से क्रमश: 665.88 लाख रुपये और 84.50 रुपये की धनराशि भी प्राप्त की, जिसमें से रु. 657.38 और 33.83 लाख रुपये खर्च किए गए।

प्रमुख उपलब्धियां

- आईसीएआर- सीआईआरबी ने भैंस के जर्मप्लाज्म उत्पादन में सुधार के लिए ISO 9001:2015 प्रमाणित संस्थान का दर्जा बरकरार रखा है।
- मुर्राह भैंस में 10.18 किलो/दिन(n = 132) का अब तक

का उच्चतम वेट औसत और 7.50 किलो/दिन (n = 180) का हर्ड औसत प्राप्त किया। नील-रवि भैंस में 8.70 किलो/दिन (n = 102) का वेट औसत और 6.70 किलो/दिन (n = 145) का हर्ड औसत हासिल किया गया।

- मुर्रा और नीली-रवि के लिए अब तक का सबसे कम AFC क्रमशः (39.66 महीने, n = 68 और 43.99 महीने, n = 40) और बछड़ा अंतराल (440.30 दिन, n = 98 और 420.00 दिन, n = 86) प्राप्त किया।
- CIRB के इतिहास में पहली बार, 13 मुर्राह भैंसों ने एक बार के दुग्धकाल में 4000 किग्रा का उत्पादन पार कर लिया। भैंस संख्या 4316 का 5वें दुग्धकाल के समय 305 दिनों में 4810 किलोग्राम उत्पादन दर्ज किया गया।
- कुल मुर्राह झुंड की औसत 305 दिनों की दूध उत्पादन, 2867 किग्रा के साथ 10 मुर्रा भैंसों का अब तक की सर्वाधिक एकल दिन दूध उपज (> 20 किग्रा) दर्ज की गई।
- आठ क्लोन भैंसों के टेलोमेयर लंबाई और रक्त जैव रासायनिक मापदंडों (एएसटी, एएलटी, क्षारीय फॉस्फेट, सीरम क्रिएटिनिन और क्रिएटिन काईनेज, क्रिएटिन फॉस्फोकाइनेज, टीएलसी, डीएलसी) का मूल्यांकन किया गया और सामान वर्ग के आयु नियंत्रण समूह के साथ समान पाया गया।
- क्लोन किए गए सांडों की क्रायोसंरक्षित वीर्य खुराकों का उपयोग फार्म के पशुओं/ किसानों के पशुओं में कृत्रिम गर्भाधान के लिए पूर्व सहमति पर किया गया था और कुल 62 संततियां पैदा की गईं और वे स्वस्थ और सामान्य बढ़ रही हैं वे स्वस्थ और सामान्य रूप से बढ़ रहे हैं।
- हिसार-गौरव के क्लोन किए गए सांड के वीर्य का उपयोग करके दो पुरुष संतति पैदा हुए जो वीर्य उत्पादन कर रहे हैं और वीर्य क्रायोप्रिजर्वेशन के लिए न्यूनतम मानक को पूरा कर रहे हैं।
- भैंस के शुक्राणु व्यवहार्यता पर वीर्य का पतला होने (12 और 16 मिलियन /स्ट्रॉ) का प्रभाव तथा कार्यात्मक मापदंडों जैसे शुक्राणु पोस्ट-थॉ गतिशीलता, प्लाज्मा झिल्ली अखंडता, थर्मल प्रतिरोध, गतिज मापदंडों का अध्ययन किया गया।
- फीडिंग परीक्षण के 15 दिनों के भीतर अकेले एंटी-स्ट्रेस फीड सप्लीमेंट का उपयोग करके भैंसों के उपचार और नियंत्रण समूहों में डिम्बग्रंथि चक्रीयता (%) का प्रेरण किया गया और निष्कर्षों ने सुझाव दिया कि 37.5% भैंसों में डिम्बग्रंथि चक्रीयता को प्रेरित करने में एंटी-स्ट्रेस पोषण पूरक 11.8% नियंत्रण भैंसों की तुलना में फायदेमंद था।
- पशु अनुपूरण के लिए नैनो Cu और Zn को प्रयोगशाला में संश्लेषित किया गया जिनमें उच्च जैव उपलब्धता और कम पर्यावरण प्रदूषण होता है।
- पोषक तत्वों के उपयोग में वृद्धि और आंत्रिक मीथेन उत्पादन को कम करने के उद्देश्य से भैंस के बछड़ों में यूरिया-शीरा आधारित फीड सप्लीमेंट और लहसुन के तेल-दालचीनी की छाल-आधारित फीड एडिटिव का आहार समावेश विकास दर (क्रमशः 27.66% और 22.21%) और फ़ीड दक्षता (क्रमशः 10.38%, 10.08%) बढ़ाने के लिए प्रदर्शित किया गया।
- आवश्यक तेल से समृद्ध यूकेलिप्टस (यूकेलिप्टस सिट्रियोडोरा) पत्ती-भोजन का पूरक (1% DM) करने से दूध देने वाली भैंस की दूध उपज में वृद्धि और पोषक तत्वों की पाचन क्षमता में वृद्धि के साथ-साथ उच्च संयुग्मित लिनोलिक एसिड (सिस 9, ट्रांस 11; CLA) ज्यादा होने से दूध की गुणवत्ता में वृद्धि होती है, जिससे मानव स्वास्थ्य में लाभ होता है और आंत्रिक मीथेन और मलीय नाइट्रोजन उत्सर्जन में कमी होती है।
- संस्थान ने जनवरी-दिसंबर, 2021 के दौरान प्रौद्योगिकी इकाई के हस्तांतरण द्वारा 656 डेयरी किसानों को वैज्ञानिक भैंस पालन प्रथाओं पर प्रशिक्षित किया। इनमें से 159 डेयरी किसानों को एससीएसपी कार्यक्रम के तहत प्रशिक्षित किया गया।
- दैहिक कोशिकाओं की संख्या को कम करके भैंस के थन स्वास्थ्य में सुधार के लिए कन्वर्जेन्स मॉडल विकसित और परीक्षण किया गया।

भैंस के उत्पादन में विकास

मानदंड	स्थिति	
	मुर्रा नस्ल, मुख्य परिसर हिसार	नीली-रावि नस्ल,उप-परिसर नाभा
पशुओं की कुल संख्या (31.12.2020 को)	566	524
प्रथम ब्यांत उम्र	39.66	43.99
मृत्युदर (%)	2.84	3.64
डेयरी भैसों का प्रदर्शन		
कुल मिलाकर वार्षिक औसत	10.18	8.70
कुल मिलाकर दुग्ध उपज	2977	2585
कुल मिलाकर एसएलएमवाई	2867	2525
सर्विस अवधि	132	116
ब्यांत अंतराल	440	420
गर्भाधान की दर	44.51	48.96
नर जर्मप्लास्म		
प्रोजेनी टेस्टेड सांडों का उत्पादन	39 (1-15th set)	10 (1-5th)
हिमीकृत वीर्य टीके उत्पादित	194022	21956
हिमीकृत वीर्य आपूर्ति	118011	4384
राजस्व उत्पत्ति (रुपये, लाखमें)	27.71	0.57
क्षेत्र में बैल प्रसार	480*	133#

कृषि फार्म उत्पादन (क्विंटल में)

चारा	हिसार, मुख्य परिसर	नाभा, उप-परिसर
गेहूं का भूसा	364	2559
हरा	32965	51096
अनाज	398	3867

राजस्व प्राप्ति (भारतीय रुपये में सभी आंकड़े)

प्रमुख / लघु / खातों का विस्तृत विवरण	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	कुल योग
फार्म उत्पादों की बिक्री	248.44	217.31	261.62	277.21	336.20	370.31	371.56	2082.66
दूध की बिक्री	1.90	0.12	17.81	1.26	5.05	10.22	0.26	36.63
गेहूं भूसा / सरसों भुसा / हरा चारा की बिक्री	41.81	33.78	25.61	55.00	4.83	7.92	3.41	172.37
अनाज / गेहूं / धान की बिक्री	12.18	19.56	21.30	28.46	27.54	23.83	30.95	163.82
वीर्यकीबिक्री	1.88	5.60	4.87	1.26	0.77	0.45	0.77	15.59
खनिज मिश्रण की बिक्री	11.80	9.60	6.00	1.75	0.00	10.15	1.60	40.90

प्रमुख / लघु / खातों का विस्तृत विवरण	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	कुल योग
सूखे पेड़ों की बिक्री प्रक्रिया	0.06	0.29	0.00	0.06	0.66	0.03	0.15	1.24
पुस्तकों की बिक्री	0.25	2.00	0.00	0.00	0.76	0.19	0.17	3.36
प्रौद्योगिकी/ रॉयल्टी की बिक्री	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
बिक्री आय	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
भूमिऔरभवन	0.00	0.00	1.29	0.00	0.00	0.00	8.81	10.10
मशीनटूल्स और प्लांट उपकरण / वाहन आदि	67.48	53.50	91.09	59.59	84.13	89.47	110.24	555.49
पशुधन की बिक्री आय	3.37	3.53	3.98	4.68	4.70	5.93	5.88	32.07
किराए (लाइसेंस शुल्क)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
अभ्यर्थी ट्यूशन फीस, डिप्लोमा शुल्क आदि से आवेदन शुल्क	0.98	0.53	0.26	0.01	0.00	0.00	0.00	1.77
भर्ती के संबंध में उम्मीदवारों से आवेदन शुल्क	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
योजना से प्राप्तियां	3.71	3.60	3.72	3.44	2.97	0.00	0.58	18.02
संस्थान द्वारा प्रदान की गई सेवा से प्राप्त रसीदें / छात्रों से रसीद	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
विविध प्राप्ति	2.92	3.37	2.92	1.69	0.79	0.73	0.87	13.29
निविदा प्रपत्र की बिक्री	2.35	2.62	2.10	2.62	3.77	1.28	3.18	17.92
अतिथि गृह शुल्क	399.11	355.42	442.57	437.04	472.16	520.50	538.42	3165.23
कुल	**248.44**	**217.31**	**261.62**	**277.21**	**336.20**	**370.31**	**371.56**	**2082.66**

वित्तीय परिव्यय (लाख रुपये में)

संस्थान/परियोजना का नाम	स्वीकृत बजट (2021-22)	व्यय (2021-22)
सीआईआरबी मुख्य	3238.82	3238.82
सीआईआरबी टी एस पी	2.00	2.00
सीआईआरबी एन ई एच	12.00	12.00
सीआईआरबी एस सी एस पी	53.00	53.00
कुल	**3305.82**	**3305.82**

प्लान योजनाएं		
भैंस सुधार पर नेटवर्क परियोजना	493.15	493.12
भैंस सुधार पर नेटवर्क परियोजना, एस सी एस पी	43.00	43.00
पोषण और शरीर क्रिया विज्ञान पर ए आई सी आर पी (डॉ. आर.के. शर्मा, पीएस और पी आई)	6.60	6.49

संस्थान/परियोजना का नाम	स्वीकृत बजट (2021-22)	व्यय (2021-22)
पोषण और शरीर क्रिया विज्ञान पर ए आई सी आर पी (डॉ. आर.के. शर्मा, पीएस और पी आई) एस सी एस पी	1.65	1.63
एन ए आई एफ परियोजना (डॉ. संदीप खुराना, पीएस और पी आई)	7.00	7.00
एन ए एस एफ क्लोनिंग प्रोजेक्ट (डॉ. पी.एस. यादव, पीएस और पी आई)	54.01	50.32
एन ए एस एफ डी एम एम प्रोजेक्ट (डॉ. धर्मेंद्र कुमार, वरिष्ठ वैज्ञानिक और पी आई)	25.45	20.84
केबिन परियोजना (डॉ. वारिज नयन, वरिष्ठ वैज्ञानिक और पी आई)	17.00	16.98
एफ एफ पी परियोजना (डॉ. सरिता यादव, वरिष्ठ वैज्ञानिक और पी आई)	15.02	15.01
सी आर पी परियोजना (डॉ. मीती पुनेठा, वैज्ञानिक और पी आई)	3.00	2.99
कुल	**665.88**	**657.38**

बाह्य वित्तपोषित योजनाएँ		
डी बी टी परियोजना (डॉ. प्रदीप कुमार, वरिष्ठ वैज्ञानिक और पी आई)	22.00	21.67
डी बी टी परियोजना (डॉ. अशोक बल्हारा, वरिष्ठ वैज्ञानिक और पी आई)	4.79	3.68
बी एम जी एफ परियोजना (डॉ. वारिज नयन, वरिष्ठ वैज्ञानिक और पी आई)	27.30	6.65
डी बी टी परियोजना (डॉ. पी.एस. यादव, पीएस और पी आई)	14.53	0.27
एसईआरबी परियोजना (डॉ. मीती पुनेठा, वैज्ञानिक और पी आई)	15.88	1.56
कुल	**84.50**	**33.83**

कर्मचारियों की स्थिति

श्रेणी	स्वीकृत	कार्यरत	रिक्त
वैज्ञानिक	44	25	19
तकनीकी	42	26	17
प्रशासनिक	24	16	8
कुल सहायक कर्मचारी	65	64	1

INTRODUCTION

Institute at a glance

On February 1st, 1985, The Central Institute for Research on Buffaloes (CIRB) was established by Haryana Government at Hisar by acquiring the Progeny Testing Bull Farm. The Institute is committed to addressing this noble species developmental needs with interventions based on research. The institute has made significant progress in fulfilling its designated purpose. In December 1987, a sub-campus of the institute was established at Bir Dosanjh, Nabha, District Patiala (Punjab) with the transfer of Nili- Ravi Buffalo Farm from the Punjab State Government. Soon after its establishment, the institute came to lime-light in the **'buffalo world'** by successfully hosting 2nd World Buffalo Congress (1988), 4th and 9th Asian Buffalo Congress (2003 and 2018, respectively).

Applying reproductive biotechnologies and effective nutrient utilisation technologies, the institute has amassed great expertise over the past three decades in enhancing buffalo genetic performance and fertility management. The services provided to stakeholders and the information produced at the institute have helped millions of milk producers and the buffalo sector as a whole. In collaboration with other ICAR institutes and the state agricultural universities, the ICAR-CIRB coordinated the construction of pedigreed nucleus breeding herds of six significant buffalo breeds in each of their home tracts as part of the Network Project on Buffalo Improvement. This has allowed creation of a repository of data and information on various aspects of buffaloes and to undertake focussed technology transfer and extension activities across the country. The Institute has approved cadre strength of 44 scientists in various specialisations, including the sub-campus at Nabha.

Mandate

- Basic and strategic research for enhancing technology development on all aspects of buffalo productivity
- Information repository and dissemination of buffalo products technologies.

The Vision

- To develop and propagate high yielding elite buffalo germplasm for quality milk and meat production while retaining inherent draughtability across different regions of the country.

The Mission

- To improve buffaloes through identification, conservation and propagation of elite germplasm having high efficiency of reproduction and nutrient utilization for sustainable production and commercialization.

The Focus Areas

In view of the institute mandate and existing infrastructure and manpower, five major thrust areas and programs have been identified for research, as per recommendations made by Research Advisory Committee and Institute Research Council:

- Genetic Resource Improvement Program
- Feed Resource Utilization and Improvement Program
- Optimization of Reproductive Efficiency Program.
- Buffalo Management Program
- Extension

Divisions

The institute research activities are managed under three subject specialized divisions with specific objectives and required infrastructure.

Division of Animal Genetics and Breeding

Genetic resources improvement programme is the major programme to undertake studies on genetic improvement of Murrah and Nili-Ravi breeds by implementing efficient breeding plans, envisaged with scientific breeding, using powerful computing systems, maintaining vast pedigree records with necessary technological interventions in the areas of nutrition and reproduction. Genetic improvement is evaluated through associated herd and field progeny testing, performance recording and genetic analysis of data under Network mode. Data resource is generated to develop 'genome-to-phenotype' models for predicting animal's genetic merit. Research focus is on developing methods to measure different conformation and performance traits for selecting high scoring germplasm to line-up the parents of next generation. Sound phonemic and genomic data collection has generated an authentic data resource, to understand the genetics of relevant but complex traits such as milk yield, faster gain in quality meat and reproductive traits. Grading superior buffaloes by digital imaging of animals, linking conformation/ body size indices to productivity, identifying genetic variants through SNP technology elucidating genetic markers are aimed at developing selection tools.

Division of Animal Nutrition and Feed Technology

The nutrition laboratories have the most modern equipment and facilities to undertake research on various aspects related to buffalo nutrition, aimed at developing economic growth and production rations by incorporating agro-industrial by-products. Feed and Forage Quality Control and Processing, Rumen microbiome, Protein Nutrition, Toxicology and Mineral Nutrition laboratories are well-equipped and functional. Major studies include working out nutrient requirements of different categories of buffaloes for milk, meat and growth, with evaluation of different feed and fodder ingredient available in different regions.

Division of Animal Physiology and Reproduction

Facilities have been developed in the division for undertaking studies on semen technology, embryo biotechnology including IVF, embryo transfer and cloning; cell culture, biochemistry, molecular biology, genome editing and endocrinology in order to understand reproductive functions, development and function of the mammary gland, besides other physiological facets which have remained little explored in buffalo.

Semen Freezing Lab

Semen Freezing Lab was established during 2007-08 with most modern facilities for collection, processing, freezing and preservation of semen as per OIE guidelines to fulfil the requirements of the Network Project on Buffalo Improvement and to supply high quality semen in the field. Facilities include CASA, flow cytometry, fluorescent microscope, DIC and Phase contrast microscopes, biofreezer for cryopreservation of Murrah semen. Frozen semen is provided to the developmental agencies, farmers and inseminators engaged in buffalo improvement program. The lab has current stock of more than four lakh doses of frozen semen from nearly 250 Murrah breeding bulls out of which more than sixty-four thousand doses are from progeny tested bulls. Frozen semen doses are also prepared from farmers' champion/ superior bulls, which are available for introduction in organized herds and farmers' animals. Frozen semen production has significantly improved during recent years.

Animal Farms

Highly pedigreed herds of over 566 Murrah buffaloes and 524 of Nili-Ravi buffaloes, including followers, constitute the breeding herds at Hisar and Nabha, respectively. There are covered sheds for indoor housing of adult buffaloes attached with covered calf pens together with open paddocks for loose housing. At Hisar, a mechanized and automated shed for buffalo feeding, cleaning, milking and data recording system has been created, which is being equipped with necessary facilities for automated slurry management and milking. It will have provision for housing of 200 buffaloes, 25 heifers and 10 down calvers besides 25 individual pens for young calves. Sub-Campus. Nabha is equipped with 12 unit cluster automatic milking machine for clean and hygienic milk production.

The production performance viz. wet average and 305 days or less milk yield of Murrah herd has improved from 4.80 kg/day and 1508 kg during 1992-93 to 10.18 kg/day and 2867 kg in 2021. The reproductive performance of the herd also improved as reflected by decline in calving interval (from 502 to 440 days) and age at first calving (50.7 to 39.66 months).

Buffalo No.	D.O.B.	Highest 305d or less MY (kg) /lactation no.	Best Peak Yield (kg)	Sire No.	Set No.
4316	31/03/11	4810/5	23.9	R-11 (Field)	12
4978	25/10/15	4366/2	18.9	1693 PT (LUVAS)	10
4899	01/05/15	4350/3	20.0	6044 PT (NDRI)	14
4767	12/08/14	4308/4	20.6	2369 (GADVASU)	14
5081	27/08/16	4283/2	17.7	4354 PT (CIRB)	15
4817	12/10/14	4250/2	23.5	4100 (CIRB)	14
4613	18/08/13	4180/4	20.2	5943 (NDRI)	13
4605	08/08/13	4177/4	20.4	2269 PT (GADVASU)	13
4251	29/10/10	4138/3	22.0	2133 PT (GADVASU)	11
5179	24/03/17	4073/1	26.8	3591 PT (CIRB)	11
4462	03/06/12	4045/2	23.4	R-10 (Field)	12
5021	17/02/16	4029/2	21.0	4354 PT (CIRB)	15
4458	16/05/12	4028/4	17.0	1796 PT (GADVASU)	7

Similarly, during the year 2021 the production performance of Nili-Ravi herd at Sub-Campus, Nabha has recoreded as - wet average 8.70 kg/day, 305 days or less milk yield 2525 kg. Age at first calving 43.99 months and service period 116 days and conception rate 48.96%, were recoreded during the period.

ICAR-CIRB Buffalo Herd status 2021

S. No.	Category	Addition					Disposal						
		M	NR	M	NR	M	NR	M	NR	M	NR	M	NR
		OB	OB	B	B	P	P	D	D	S	S	CB	CB
Female													
01.	Calves below 3 months	25	21	86		66	-	05	09	-	-	39	24
02.	Calves 3-12 months	51	50				-		02	-		35	34
03.	Heifers a) 1-2 years b) Above 2.0 years	 81 76	65 98				- -		02 01	 03 06	03	 77 82	 66 113
04.	Buffaloes in Milk	132	124				-	1	01	24	22	137	111
05.	Buffaloes Dry	35	35				-		02	18	23	47	46
	Sub Total	**400**	**393**			**66**	**-**	**6**	**17**	**51**	**48**	**417**	**394**
Male													
01.	Calves below 3 months	31	15	68		65	-	1	03	-	-	30	22
02.	3-12 months	43	44				-		04	13	06	45	38
03.	1) 1-2 years 2) > 2 years	36 05	33 35				-	- -		23 14	41 10	36 18	29 34
04.	Breeding bulls	12	06				-	-		6	06	12	06
05.	Bullocks						-	-		-		-	
06.	Teasers		01				-	-		-		-	01
	Sub Total	127	134			65	-	1	07	56	63	149	130
	Grand Total	**527**	**527**			**131**	**-**	**7**	**24**	**107**	**111**	**566**	**524**

M = *Murrah (at Main Campus, Hisar)* **NR** = *Nili Ravi (at Sub Campus, Nabha)*

OB = *Opening Balance* **D** = *Death* **S** = *Sale* **R** = *Received* **B** = *Birth* **P** = *Purchased*

ICAR-CIRB Calving statistics (1st January - 31st December 2021)

Month	Male (number)		Female (number)		Abortions & Still Birth (number)		Overall (number)	
	M	NR	M	NR	M	NR	M	NR
January	4	05	8	03	1	02	13	10
February	8	04	3	02	1	-	12	06
March	2	05	4	03	--	-	6	08
April	5	02	5	03	1	01	11	06
May	4	03	4	01	2	01	10	05
June	6	04	4	01	--	01	10	06
July	7	03	13	06	--	04	20	13
August	7	12	11	10	3	03	21	25
September	11	04	10	10	--	02	21	16
October	8	10	7	10	--	01	15	21
November	4	04	8	04	1	03	13	11
December	3	09	11	13	2	02	16	24
Overall	69	65	88	66	11	22	168	153

M = *Murrah (at Main Campus, Hisar)* **NR**= *Nili Ravi (at Sub Campus, Nabha)*

Sex ratio Murrah *(Male: Female) =44:56 (approx.)* **Sex ratio Nili Ravi** *(Male: Female) = 65:66*

ICAR-CIRB Disposal of animals in 2021

Category	Surplus sold		Udder Health		Repd. problem		Weak & old		Death		Total	
	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR
Female												
< 6 months	-								5	10	05	10
6-12 months	-								-	01	-	01
Heifers												
1-2.5 yrs	-	-			2		1			02	03	02
> 2.5 yrs	-	03			5		1			01	06	04
Buffaloes												
Dry	4	23	3		8		3		-	02	18	25
Milch	3	22	6		12		3		1	01	25	23
Sub Total	**7**	**48**	**9**		**27**		**8**		**6**	**17**	**57**	**65**
Male												
< 6 months	-	-							1	05	01	05
6-12 months	13	06								02	13	08
>1 yr	36	50			1						37	50
Breeding bulls	3	06			3						06	06
Bullock +Teaser	-										-	
Sub total	52	62			4				1	07	57	69
G. Total	**59**	**110**	**9**		**31**		**8**		**7**	**24**	**114**	**134**

M = *Murrah (at Main Campus, Hisar)* **NR**= *Nili Ravi (at Sub Campus, Nabha)*

ICAR-CIRB Month wise mortality of animals in 2021

Mon.	Details	0-3 (female)		3-6		6-12		>1yr		>2yrs		All		0-3 (male)		3-6		6-12		>1yr		All		Total	
		M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR
Jan	No Died	17 --	16 01	13 --	36 -	39 --	16 01	57 --	61 01	261 --	240 -	393 --	369 03	22 --	13 01	27 --	27 01	36 --	18 01	62 --	52 -	147 --	110 03	540 --	479 06
Feb	No Died	18 --	13 -	25 --	29 -	43 --	22 -	86 --	65 01	240 --	241 -	411 --	370 01	22 --	12 -	18 --	21 01	42 --	23 01	62 --	55 -	144 --	111 02	555 --	481 03
Mar	No Died	19 1	06 02	18 --	20 -	40 --	38 -	58 --	60 -	284 --	246 01	419 1	370 03	23 --	13 -	22 --	14 -	33 --	32 -	57 --	55 -	135 --	114 -	554 1	484 03
Apr	No Died	21 --	07 -	19 --	15 -	46 --	43 -	157 --	52 -	165 --	256 -	408 --	373 -	23 --	11 -	19 --	12 -	22 --	37 -	53 --	56 -	117 --	116 -	525 --	489 -
May	No Died	19 --	06 -	23 --	12 -	45 --	46 -	157 --	51 -	167 --	259 -	411 --	374 -	20 --	10 -	21 --	12 -	24 --	41 -	57 --	56 -	112 --	119 -	533 --	493 -
Jun	No Died	13 --	05 -	15 --	07 -	49 --	53 -	151 --	47 -	175 --	262 01	403	374 01	12 1	09 -	22 --	13 -	43 --	43 -	58 --	58 -	145 1	123 -	548 1	497 01
Jul	No Died	13 1	08 -	14 --	08 -	50 --	50 -	151 --	46 -	172 --	267 01	400 1	379 01	16 --	10 -	16 --	11 -	50 --	38 -	69 --	66 -	151 --	125 -	551 1	504 01
Aug	No Died	20 1	16 01	12 --	07 -	49 --	40 -	153 --	52 -	177 --	272 01	411 1	387 02	18 --	19 -	16 --	10 -	47 --	33 -	72 --	75 -	153 --	137 -	564 1	524 02
Sep	No Died	25 --	23 02	13 --	05 -	43 --	26 -	149 --	60 -	191 --	257 -	421 --	371 02	21 --	18 01	13 --	09 -	46 --	22 -	71 --	64 -	151 --	113 01	572 --	484 03
Oct	No Died	31 1	28 01	13 --	06 -	40 --	22 -	147 --	60 -	199 1	264 -	430 2	380 01	27 --	25 -	16 --	10 -	43 --	19 -	75 --	69 -	163 --	123 -	593 2	503 01
Nov	No Died	26 1	22 01	19 --	13 01	35 --	18 -	154 --	62 -	201 --	267 -	435 1	382 02	27 --	17 01	15 --	18 -	35 --	19 -	86 --	72 -	165 --	126 01	600 1	508 03
Dec	No Died	22 --	24 01	24 --	22 -	24 --	12 -	159 --	66 -	180 --	270 -	409 --	394 01	23 --	22 -	21 --	18 -	29 --	20 -	79 --	71 -	152 --	131 -	561 --	525 01

M = *Murrah (at Main Campus, Hisar)* **NR**= *Nili Ravi (at Sub Campus, Nabha)*

ICAR-CIRB Buffalo conception rate in 2021

No. of AIs	Ist						IInd						IIIrd						IVth & above						Overall					
Criteria	I		C		CR		I		C		CR		I		C		CR		I		C		CR		I		C		CR	
Breed	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR
Heifers	61	51	34	16	55.74	31.37	53	42	24	22	45.28	52.38	23	19	11	11	47.83	57.89	22	15	12	8	54.55	53.33	159	127	81	57	50.94	44.88
Adult	159	143	70	75	44.03	52.45	94	61	35	38	37.27	62.30	49	24	21	7	42.86	29.17	67	31	28	12	41.79	38.71	369	259	154	132	41.73	50.97
Overall	220	194	104	91	47.27	46.91	147	103	59	60	40.14	58.25	72	43	32	18	44.44	41.86	89	46	40	20	44.94	43.48	528	386	235	189	44.51	48.96

M = *Murrah (at Main Campus, Hisar)* **NR**= *Nili Ravi (at Sub Campus, Nabha)*

I = No. of animals inseminated; C= No. of animals conceived; CR% = Conception rate (%)

ICAR-CIRB Bull-wise conception rate 2021

Sr. No.	Bull No.		Set No.		Total No. of AI		Total Conceived		CR%	
Breed	M	NR	M	NR	M	NR	M	NR	M	NR
1	1315	411	19th	1st	36	1	24	1	66.67	100.00
2	2674	535	19th	2nd	46	1	21	1	45.65	100.00
3	2737	435	19th	8th	38	26	16	13	42.11	50.00
4	2759	480	19th	8th	42	18	19	9	45.24	50.00
5	5181	543	19th	8th	45	18	23	8	51.11	44.44
6	5232	501	19th	8th	24	21	15	11	62.50	52.38
7	5246	507	19th	8th	34	18	12	9	35.29	50.00
8	5310	511	19th	8th	43	14	21	7	48.84	50.00
9	5320	516	19th	9th	30	3	14	0	46.67	0.00
10	5333	551	19th	9th	28	43	8	22	28.57	51.16
11	5374	556	19th	9th	29	43	12	19	41.38	44.19
12	7604	579	19th	9th	31	67	13	29	41.94	43.28
13	3591	674	11th PT	9th	9	48	4	22	44.44	45.83
14	2269	705	13th PT	9th	15	62	7	36	46.67	58.06
15	2357	710	14th PT	9th	7	3	3	2	42.86	66.67
16	4196		14th PT		48		12		25.00	
17	6044		14th PT		23		11		47.83	

M = *Murrah (at Main Campus, Hisar)* **NR**= *Nili Ravi (at Sub Campus, Nabha)*

ICAR-CIRB Buffalo herds production status 2021

Lact. No	Number		Av. Total Lactation Yield (kg)		Av. Lactation length (days)		305-days yield (kg)		Av. Peak Yield (kg)	
	M	NR	M	NR	M	NR	M	NR	M	NR
1st	66	40	2797	2369	313	308	2664	2252	12.39	11.98
2nd	38	23	2987	2809	297	301	2898	2744	14.72	15.03
3rd	17	26	3375	2683	299	287	3295	2667	16.95	14.70
4th	14	07	3098	2646	291	268	3003	2646	16.22	15.0
5th and above	18	23	3146	2608	299	282	3034	2580	15.63	15.4
Overall	**153**	**119**	**2977**	**2585**	**304**	**294**	**2867**	**2525**	**14.21**	**14.0**

M = *Murrah (at Main Campus, Hisar)* **NR**= *Nili Ravi (at Sub Campus, Nabha)*

ICAR-CIRB Buffaloes reproduction performance 2021

Traits	Value	1		2		3		4		5 & above		Overall	
Breed		M	NR	M	NR	M	NR	M	NR	M	NR	M	NR
Av. Age at First Calving (Months)	N X SE	68 39.66 ± 0.75	40 43.99 0.53										
Av. Service Period (Days)	N X SE			41 160.39 ± 13.46	23 172 17.22	25 95.00 ± 12.13	23 118 10.91	15 130.53 ± 23.30	15 77 4.58	17 118.47 ± 18.36	25 85 8.90	98 131.87 ± 8.39	86 116 7.22
Av. Dry Period (Days)	N X SE			41 139.12 ± 9.07	23 163 10.75	25 109.16 ± 7.75	23 136 16.30	15 128.00 ± 16.86	15 95 8.71	17 132.88 ± 15.30	25 117 8.80	98 128.69 ± 5.73	86 130 6.44
Av. Calving Interval (Days)	N `X SE			41 467.15 ± 13.61	23 478 17.34	25 402.48 ± 12.64	23 421 10.89	15 441.87 ± 23.34	15 380 4.85	17 429.76 ± 18.22	25 390 9.50	98 440.30 ± 8.45	86 420 7.35

M = *Murrah (at Main Campus, Hisar)* **NR**= *Nili Ravi (at Sub Campus, Nabha)*

ICAR-CIRB Month wise milk sold in year 2021

Month	Total Milk Produced (kg)	
	M	NR
Jan, 21	36475.50	36880.30
Feb, 21	33764.50	32442.30
Mar, 21	36576.00	33771.40
Apr, 21	33137.00	29420.3
May, 21	32194.00	24734.8
Jun, 21	31765.50	20457.9
Jul, 21	34330.50	19236.3
Aug, 21	33374.50	20093.7
Sep, 21	34207.50	22481.6
Oct, 21	34897.00	25659.0
Nov, 21	33483.00	28209.60
Dec , 21	35851.50	30516.2

M = *Murrah (at Main Campus, Hisar)* **NR**= *Nili Ravi (at Sub Campus, Nabha*

ICAR-CIRB Buffalo herd production performance 2021

Month	In milk		Dry		Total		% in Milk		Wet Av.(kg)		Herd Av.(kg)	
Breed	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR
Jan	132	114	37	27	169	141	78	81	10.88	10.39	8.48	8.39
Feb	141	118	35	21	176	140	80	85	10.42	9.77	8.37	8.28
Mar	141	122	42	19	183	141	77	87	10.19	8.90	7.91	7.71
Apr	132	119	42	25	174	143	76	83	9.60	8.31	7.25	6.86
May	121	112	45	37	166	149	73	75	9.85	7.71	7.23	5.35
Jun	122	98	48	53	170	151	72	64	10.04	7.04	7.22	4.52

July	124	87	49	65	173	151	72	57	10.30	7.12	7.40	4.09
Aug	128	83	54	69	182	152	70	55	10.11	7.85	7.16	4.29
Sept	137	83	57	58	194	141	71	60	10.27	9.05	7.24	5.42
Oct	140	90	61	49	201	139	70	64	9.86	9.29	6.87	5.98
Nov	134	98	52	43	186	141	72	70	10.26	9.54	7.33	6.67
Dec	135	99	49	47	184	146	73	68	10.38	10.03	7.59	7.0
Overall	132	102	48	43	180	145	73	71	10.18	8.70	7.50	6.70

M = *Murrah (at Main Campus, Hisar)* **NR**= *Nili Ravi (at Sub Campus, Nabha)*

ICAR-CIRB Buffalo herd production performance (Part I)

Year	In milk		Dry		Total		% in Milk		Wet Av (kg)		Herd Av (kg)	
Breed	**M**	**NR**	**M**	**NR**	**M**	**NR**	**M**	**NR**	**M**	**NR**	**M**	**NR**
1992-93	165	98	111	53	276	151	60.60	64	4.80	5.86	2.83	3.42
1993-94	153	81	125	58	178	139	55.00	58	5.65	5.75	3.10	3.39
1994-95	181	92	85	44	266	136	68.10	67	6.09	6.01	4.15	4.18
1995-96	153	86	82	35	235	121	65.19	71	6.43	5.61	4.19	3.99
1996-97	122	81	83	52	205	133	59.56	61	5.62	5.71	3.35	3.49
1997-98	121	113	76	40	197	153	61.38	74	6.12	6.03	3.75	4.45
1998-99	133	104	73	42	206	146	64.52	72	6.77	6.13	4.37	4.26
1999-00	137	85	72	39	209	124	65.48	68	6.85	6.01	4.49	4.23
2000-01	148	96	78	33	226	129	65.39	74	6.68	6.31	4.37	4.69
2001-02	147	86	70	38	217	124	67.70	69	6.59	6.85	4.46	4.82
2002-03	143	106	71	38	214	144	67.00	73	6.27	6.56	4.20	4.83
2003-04	151	106	72	37	223	143	67.69	74	6.49	6.35	4.39	4.70
2004-05	154	100	69	47	224	147	68.97	67	6.39	6.86	4.40	4.65
2005-06	151	114	77	46	238	160	66.37	71	6.57	6.85	4.36	4.84
2006-07	137	119	92	48	229	167	59.81	71	6.45	6.20	3.86	4.40
2007-08	146	102	71	54	217	156	67.32	65	6.64	6.73	4.47	4.46
2008-09	133	122	66	44	199	166	66.00	73	6.50	6.91	4.35	5.03
2009-10	106	110	65	58	171	168	62.00	65	7.01	7.00	4.35	4.66
2010-11	109	98	64	43	173	141	62.97	70	7.45	7.11	4.69	4.93
2011-12	110	84	58	40	168	124	65.38	68	7.83	7.74	5.12	5.30
2012-13	109	90	69	49	178	139	62.24	65	7.74	8.26	4.76	5.34
2013-14	105	94	65	52	170	146	61.78	64	8.01	8.25	4.95	5.32
2014-15	116	99	50	41	166	140	69.97	71	8.25	8.48	5.77	5.98
2015-16	114	110	62	41	176	151	65	72	8.04	8.51	5.21	6.22
2016-17	110	102	57	53	167	155	66	65	8.08	7.96	5.32	5.23
2017-18	115	97	54	45	169	142	67.8	68	8.71	8.52	5.90	5.84
2018-19	101	109	54	38	155	147	65	74	8.92	8.82	5.80	6.54
2019	118	99	49	56	167	155	70	64	9.53	9.09	6.70	5.83
2020	131	102	51	46	182	148	72	69	9.79	8.94	7.02	6.17
2021	132	102	48	43	180	145	73	71	10.18	8.70	7.50	6.70

M = *Murrah (at Main Campus, Hisar)* **NR**= *Nili Ravi (at Sub Campus, Nabha)*

ICAR-CIRB Buffalo herd production performance (Part II)

Year	Av. Total Lact. Milk Yield (kg)		Av. Lact. Length (days)		Av. 305d or less Milk. Yield (kg)	
Breed	**M**	**NR**	**M**	**NR**	**M**	**NR**
1991-92	1761 (154)	2017 (68)	374 (154)	373 (68)	1552 (154)	1813 (68)
1992-93	1804 (137)	1974 (105)	395 (137)	309 (105)	1508 (137)	1921 (105)
1993-94	1980 (148)	1776 (70)	419 (148)	328 (70)	1686 (148)	1744 (70)
1994-95	1930 (206)	2043 (77)	334 (206)	350 (77)	1787 (206)	1944 (77)
1995-96	1936 (147)	2049 (70)	313 (147)	354 (70)	1855 (147)	1894 (70)
1996-97	1879 (173)	2092 (81)	313 (173)	392 (81)	1775 (173)	1807 (81)
1997-98	1784 (123)	2126 (67)	304 (123)	354 (67)	1688 (123)	2056 (67)
1998-99	1762 (153)	2153 (97)	284 (153)	341 (97)	1702 (153)	2056 (97)
1999-00	2138 (141)	1968 (99)	313 (141)	337 (99)	2042 (141)	1874 (99)
2000-01	1997 (173)	1890 (89)	306 (173)	305 (89)	1914 (173)	1812 (89)
2001-02	1954 (152)	1926 (86)	290 (152)	296 (86)	1898 (152)	1885 (86)
2002-03	1987 (148)	2007 (105)	303 (148)	293 (105)	1902 (148)	1941 (105)
2003-04	1910 (148)	1968 (93)	299 (148)	307 (93)	1837 (148)	1895 (93)
2004-05	2017 (167)	1974 (116)	319 (167)	315 (116)	1886 (167)	1848 (116)
2005-06	2047 (149)	2190 (102)	321 (149)	306 (102)	1921 (149)	2090 (102)
2006-07	1995 (170)	1921 (118)	322 (170)	304 (118)	1882 (170)	1795 (118)
2007-08	1954 (169)	1787 (122)	299 (169)	302 (122)	1891 (169)	1629 (122)
2008-09	2076 (138)	2036 (108)	325 (138)	289 (108)	1926 (138)	1929 (108)
2009-10	2285 (102)	1927 (146)	361 (102)	302 (146)	1995 (102)	1822 (146)
2010-11	2471 (113)	2042 (115)	337 (113)	292 (115)	2247 (113)	1972 (115)
2011-12	2598 (116)	2045 (88)	338 (116)	279 (88)	2374 (116)	1998 (88)
2012-13	2478 (110)	2048 (123)	318 (110)	264 (123)	2335 (110)	2017 (123)
2013-14	2394 (98)	2297(109)	333 (98)	285(109)	2291 (98)	2241(109)
2014-15	2502 (110)	2464(115)	313 (110)	303(115)	2355 (110)	2384(115)
2015-16	2483 (152)	2564(110)	322 (152)	305(110)	2336 (152)	2471(110)

Year	Av. Total Lact. Milk Yield (kg)		Av. Lact. Length (days)		Av. 305d or less Milk. Yield (kg)	
Breed	**M**	**NR**	**M**	**NR**	**M**	**NR**
2016-17	2567 (133)	2452(136)	312 (133)	298(136)	2457 (133)	2377(136)
2017-18	2480(140)	2363(110)	295 (140)	282(110)	2424(140)	2321(110)
2018-19	2641 (123)	2797 (111)	305 (123)	311 (111)	2567 (123)	2679 (111)
2019	2673 (88)	2670 (81)	300.06 (88)	301 (81)	2607(88)	2589 (81)
2020	2821 (164)	2645 (141)	306 (164)	303(141)	2704 (164)	2576(141)
2021	2977 (153)	2585(119)	304 (153)	294(119)	2867 (153)	2525(119)

M = *Murrah (at Main Campus, Hisar)* **NR**= *Nili Ravi (at Sub Campus, Nabha); Figures in Parentheses are Number of observation*

Agricultural Farms

The institute at main campus has a total area of 780 acres at Hisar, out of which about 50 per cent land is arable and under fodder cultivation for institute livestock. The sub-campus has 516 acres of highly fertile land, which meets the requirements of green fodder, dry fodder and cereal grains for Nili-Ravi animals herd at Nabha. The institute is self-sufficient in meeting its grain and green fodder requirements for its herds, while majority requirement of dry fodder is also met from its own agricultural farms production. Excess grains are sold to earn extra revenue. During April to December 2019 the total green and dry fodder production during the year was 32965 and 364 quintals, respectively, while grain production was 398 quintals. Showing of paddy plantation in 20 acres and mustard plantation in 42 acres land was done at CIRB, Hisar for land improvement and reclamation of soil. At Sub-Campus Nabha, the total green and dry fodder production during the year was 51096 and 2559 quintals, respectively, while grain production was 3867 quintals. Institute takes guidance from specialized agriculture institutes of ICAR and SAUs for land reclamation, advanced farming techniques and for meeting its requirements of quality seeds of fodder and grain crops.

Feed Units: Feed units, one at each campus, are engaged in preparation of concentrate feed for feeding to farm animals by formulating feed for different categories of animals. Feed unit prepares about 600 tonnes of concentrate feed for feeding to farm animals. In addition, approx. 15 tonnes of area specific mineral mixture is being prepared annually for farm animals as well as for sale to the farmers for its popularization. Feed processing unit and attatched grain / cake store cover an area of about 4500 square feet together with an open drying place of about 1500 sq. ft. This unit is equipped with automatic feed grinder cum mixer of capacity (10Q/hr) with lifts for grinding and mixing of concentrate mixture. Similarly another feed unit with automation is available at sub-campus. These feed units allow the institute to ensure quality of the concentrate fed to the animals as well as experimentation.

Guest house and student hostel: Institute guest house has fourteen well furnished rooms for accommodating 28 guests at a time. It has separate reception with attached well-furnished neat and clean lounge and dining hall to cater to the requirements of visitors as well as get together for institute fraternity. Recently, student hostel added in the institute campus having eight well furnished rooms for accommodating 16 persons at a time.

Farm Machinery and workshop: This section is having nine tractors equipped with agricultural implements such as straw making reaper, zero tillage seed drill machine, chaff cutter, harrow, fodder harvester cum chopper and a laser laveller to improve the farm efficiency. A tractor driven rain gun system for irrigation was also installed. In addition, a TMR (Total mixed ration) machine has also been procured and being used. The workshop section of sub-Campus

Nabha is also equipped with agricultural implements such as nine tractors, straw making reaper, laser laveller, zero tillage seed drill machine, chaff cutter, harrow, fodder harvester cum chopper and six tractor trolleys to improve the farm efficiency.

Electrical section: Electrical section of the institute is responsible for providing round the clock electric supply to the laboratories of institute with zero fault maintenance motto at lowest possible cost. It maintains 11 KV sub-station comprising of 500 KVA transformer, OCB, ACB, LT panels and two DG sets of 250 and 110 Kva capacities for power backup. Section attends day to day electric maintenance related complaints of different labs, guest house and residential units. Repair, servicing and maintenance of more than 90 air conditioners, geysers, electric motors upto 25hp, street lights, different size underground LT cables and HT and LT overhead lines of the agriculture farm of the institute are part of the day to day activity. Operation and maintenance of audio visual equipment of the seminar hall like; power amplifiers, audio mixer, dbx- complete sound management system and LCD projections are taken care of. The institute has shifted to use LED lights for conserving energy. Instituted shifted 100% on LED lights to save electricity.

Estate Section: Estate Section of this institute is responsible for maintenance, modification and repairs works in all the residential, office building, animal sheds and water channels in the agriculture farm. Estate section ensures water supply and sewage disposal to the whole campus. Day to day maintenance activities including cleaning of roads, building and pathways in the campus are also executed through this section.

Landscaping: This section looks after greens at the campus including gardens, roadside maintenance and colony parks. Tree plantation, pruning of trees, removal of fallen dry trees, removal of horticulture wastes, plantation / landscaping at campus, creation & maintenance of nurseries of saplings of trees, shrubs & seedbeds of ground covers & seasonal flowers are the responsibilities of this section. The institute campus bears a neat and green look through plantation of appropriate ornamental plants, trees and agro-forestry trees through out campus for a clean and healthy environment.

Land: At main campus, 30 acres of saline soil was reclaimed by growing paddy followed by barley crops. In this area, crops were taken for the first time since the inception of the institute. Due to encouraging results, it is proposes to grow paddy in another 30 acres of saline soil during next year. About 75 acres of agricultural farm land was levelled with laser leveller. Last year bushes were uprooted from 170 acres of land that was lying unused. This year about 50 acres of this land has been laid out with roads, channel and blocks for use in crop production. The emphasis is on increasing productivity per acre of land with optimum resource use.

At Sub Campus Nabha, 16 acre land was improved by removing dried and uprooted trees and shrubs, 33 acre dhaincha was sown for green manuring that improved physical property of the land, 40 acre land was improved by spreading farm yard manure/ compost. 1300 feet long chain link fences were created to protect farm from stray animals. No paddy straw burning is practised at CIRB farms since last 4 years. During the year, 72 acre and 3 Marla land was transferred to Animal Husbandry Department, Punjab as per approval of the ICAR.

National and International Collaborations

Over the years, the institute has established collaborations with various national and international institutions. Projects were undertaken with Department of Biotechnology on Embryo Transfer Technology; Central Soil Salinity Research Institute, Karnal for reclamation of salinity affected land through subsurface drainage system; CCS Haryana Agricultural University, Hisar for postgraduate research in the field of buffalo husbandry, nutrition, physiology and reproduction, etc. Similar collaboration is continuing with several ICAR institutes, including NDRI, IVRI, IASRI, NBAGR, NIANP, CSWRI, IARI and SAUs like CCS HAU, LUVAS, PAU, GADVASU, RAJUVAS, BASU and some KVKs. For breed improvement activities, Network Project on Buffalo Improvement is being implemented in collaboration with several ICAR institutes and SAUs located in the home tracts of various buffalo breeds. Institute scientists have completed various externally funded projects at this institute and its sub-campus at Nabha sponsored by DBT, DST, USAID, NAIP, NARP, NASF, Network / All India Coordinated projects and other external agencies.

Priority setting, monitoring and evaluation of research activities of Institute

The institute receives advice on research and management through Research Advisory Committee (RAC) and Institute Management Committee (IMC) which consists of different stakeholders including prominent researchers, policy makers and progressive farmers. A number of sections like Priority Setting, Monitoring and Evaluation Cell, RFD Cell, Institute Technology Management Unit and AKMU cater to different responsibilities for smooth functioning of research activities.

RESEARCH ACHIEVEMENTS

Genetics and Breed Improvement

As an important Institution in the buffalo research and extension, ICAR-CIRB is pushing boundaries in the development of science based solutions for sustainable buffalo production systems. The scientific workforce at the institute take part in conducting research, gaining professional experience and disseminating the acquired know-how to farmers, entrepreneurs, students, researchers, academicians, and policy makers. All the research is solution driven - for addressing issues related to buffalo breeding, health, nutrition, reproduction and welfare. The institute embrace scientific thoughts for making buffalo farming sustainable, environment friendly and beneficial for society.

Genetic and Breed Improvement

Buffalo Genetic resources improvement programme is the major agenda undertaken for genetic improvement of Murrah and other buffalo breeds. Continuous efforts have been made to understand, characterize and take forward positives for breed improvement programme. The Division of Animal Genetics and Breeding (AGB) at the institute is the coordinating centre for Network Project on Buffalo Improvement, addressing important breeds and operating through different centres across India. Genetic improvement is targeted by implementing efficient breeding plans, envisaged with scientific breeding, using powerful computing systems maintaining large pedigrees of animals and vigilant technological interventions in the area of nutrition and reproduction. Genetic improvement is evaluated through associated herd and field progeny testing, performance recording and genetic analysis of data. An effective dissemination of high class buffalo germplasm with recording of performance data in fields through Field Progeny Testing Programme is generating data resource to develop 'genome-to-phenotype' models for predicting animal's genetic makeup. Keeping pace with international developments made in the subject as well as looking into national priorities, significant contribution have been made through a number of research projects undertaken in different areas of germplasm conservation, qualitative genetics, population genetics and molecular genetics.

Network Project on Buffalo Improvement

TK Datta, A Bharadwaj, RK Sharma, SK Phulia, Sanjay Kumar, Pradeep Kumar, Dharmendra Kumar, Jerome A

The Network Project on Buffalo Improvement was initiated in 1993 at 5 different Murrah centres and ICAR-Central Institute for Research on Buffalo, Hisar was coordinating centre. The project was started with the aim to produce genetically superior bulls for improvement of buffaloes. This has ensured sustained maintenance and production of improved germplasm on large scale for use in buffalo improvement program and for establishing linkages with institutions. Progeny testing in Murrah Breed is carried out at six participating institutional /SVU centres viz. CIRB Hisar, NDRI Karnal, IVRI Izatnagar, GADVASU Ludhiana, LUVAS Hisar and ICAR Research Complex for Eastern Region Patna. Three field units of Murrah were also initiated in 2001 at CIRB Hisar, NDRI Karnal and GADVASU Ludhiana with the aim to produce more number of daughters per bull for evaluating the breeding bulls with higher accuracy.

Five other breeds and progeny testing units were added in year 2001. Elite herds of Jaffarabadi, Surti, Bhadawari and Nili Ravi breeds of buffaloes are being maintained in their respective breeding tracts. Nili-Ravi and Bhadawari breed centres are functioning as conservation and improvement units and Jaffarabadi and Surti breed centre are concentrating on field progeny testing along with maintaining the elite herd for bull production and testing. A breedable herd of 649 (Nili-Ravi-316, Jaffarabadi-202, Surti-70 and Bhadawari-61) is being maintained at the above four breeds.

PARTICIPATING CENTRES UNDER NPBI

Coordinating Unit, CIRB, Hisar

Sr. No.	Name of Centre	Breed	Year of start
	ICAR Institutes		
1.	ICAR-CIRB, Hisar	Murrah	1993
2.	ICAR-NDRI, Karnal	Murrah	1993
3.	ICAR-IVRI, Izatnagar	Murrah	1993
4.	ICAR-IGFRI, Jhansi	Bhadawari	2001
5.	ICAR-CIRB, Sub - Campus Nabha	Nili-Ravi	2001
6.	ICAR Research Complex, ER Patna	Murrah	2014
	Animal Science/Agricultural Universities		
1.	GADVASU, Ludhiana	Murrah	1993
2.	LUVAS, Hisar	Murrah	1993
3.	JAU, Junagarh	Jaffarabadi	2001
4.	RAJVASU, Vallabhnagar	Surti	2001
5.	GADVASU, Ludhiana	Nili-Ravi	2018
	Field Unit		
1.	ICAR-CIRB, Hisar	Murrah	2001
2.	ICAR-NDRI, Karnal	Murrah	2001
3.	GADVASU, Ludhiana	Murrah	2001

Progeny test evaluation of 15th set (Murrah) used during July 2014 to December 2015

Bull No.	Centre	Date of Birth	Dam No.	Sire No./ Set No.	Dam's Best 305 DLMY (kg) / Lact No.	No of daughters	Average Daughter FLMY	Daughter Max FLMY	Breeding Value	Rank	% superiority (BLUP Model)
4354	CIRB	05/09/11	4353P	NK	3528/4	77	2645	3573	2589	1	1.67
4324	CIRB	19/04/11	4323P	NK	3605/3	60	2564	4004	2546	8	-0.04
4328	CIRB	14/05/11	3147	220/XII	2989/3	65	2600	3635	2584	4	1.48
4363	CIRB	24/09/11	3428	4915PT/VII	3068/2	48	2608	3217	2560	6	0.51
4403	CIRB	04/01/12	3351	R-10/XII	2981/2	39	2576	3540	2552	7	0.22
4438	CIRB	20/03/12	4437P	NK	3222/2	57	2527	3289	2536	9	-0.42
6007	NDRI	15/09/08	5231	5396/X	3260/2	38	2683	3404	2588	2	1.61
6139	NDRI	10/03/09	5650	4506PT/VI	2828/1	54	2515	3811	2531	11	-0.60
6290	NDRI	26/10/10	5517	4915PT/VII	4341/2	40	2418	3069	2489	15	-2.27
6405	NDRI	26/01/12	486	NK	2743/1	55	2501	3740	2533	10	-0.55
2459	GADVASU	22/12/11	2489	1796PT/VII	4636/2	44	2611	3404	2587	3	1.58
2371	GADVASU	30/08/10	1794	1796PT/VII	3053/4	64	2528	3522	2524	12	-0.90
2412	GADVASU	24/04/11	2467	220/ XII	2998/1	61	2476	4406	2511	13	-1.41
2417	GADVASU	10/07/11	2487	2177/XII	3565/3	84	2456	3138	2503	14	-1.72
2429	GADVASU	15/08/11	2138	5710/XII	3435/6	48	2601	3962	2568	5	0.86

NK: Not Known

Average Breeding Value: 2546.73 kg (N=834)

Bull no. 4354 (CIRB), 6007 (NDRI) and 2459 (GADVASU) ranked 1st, 2nd and 3rd, respectively declared as proven bulls for nominated mating during January 2022 to June 2023.

Breeding bulls of 19th set for test mating

Test mating of 12 Murrah bulls of 19th set initiated in July 2020 and completed on 31st December 2021 at associated centres of Murrah main unit and field progeny testing unit for genetic improvement under NPBI.

Bull No.	Centre	D.O.B.	Dam No.	Sire No./ Set No.	Dam's Best Yield / PY (kg)	Parity
1315	LUVAS	18/11/16	708	2045PT/X	3824/18.4	4
2674	GADVASU	01/03/16	2532	2412/XV	3583/23.0	1
2737	GADVASU	04/08/17	2543	2383/XVI	3241/22.8	3
2759	GADVASU	09/11/17	2502	2133PT/XI	3340/20.7	3
5181	CIRB	11/04/17	4340	3591PT/XI	3428/17.9	4
5232	CIRB	06/08/17	4322	1354PT/III	3568/17.0	5
5246	CIRB	20/08/17	4672	4371PT/V	3124/15.7	2
5310	CIRB	23/12/17	4545	6646/XVI	4069/21.0	3
5320	CIRB	15/01/18	4017	1053/XVI	3340/15.2	4
5333	CIRB	02/02/18	3485	1053/XVI	3304/17.6	5
5374	CIRB	12/07/18	4344	1148/XVII	3244/17.4	3
7604	NDRI	18/06/18	6477	7010/XVII	3158/16.0	2

18th Annual Review Meet of Network Project on Buffalo Improvement (NPBI) was held on 19th March, 2021 through Zoom online mode at ICAR-CIRB, Hisar. The meeting was chaired by Dr. VK Saxena, ADG (AP&B), ICAR-New Delhi. Dr. TK Datta, Director, ICAR-CIRB & Project Coordinator, NPBI, Dr. Vineet Bhasin, Principal Scientist (AG&B) ICAR and Dr. MS Tantia, Principal Scientist, ICAR-NBAGR attended the meeting along with other scientists. At the outset, Dr. TK Datta, Director ICAR-CIRB & Project Coordinator, welcomed the chair, participants and other members present in meeting and made the introductory remarks regarding the NPBI. Dr. Vineet Bhasin, elaborated the progress made in buffalo improvement under. Dr. VK Saxena, in his opening remarks, welcomed all the members and other participants and emphasized the contribution of buffaloes in livestock economy and urged to promote the up-gradation of buffalo germplasm through the use of improver breeds of buffalo. The Chairman also emphasized on incorporation of genomic evaluation program in buffaloes. He further added that buffalo meat is also significantly contributing to the beef industry and there is need to develop a breeding strategy in buffalo to have higher average daily weight gain for the purpose of development of broiler buffalo.

Genetic Improvement of Murrah Buffalo

A Bharadwaj, Pradeep Kumar, RK Sharma, SK Phulia, Sanjay Kumar, AKS Tomar

A total of 157 (69 male and 88 female) calves of high genetic merit were born at CIRB during the year 2021. The test mating (426 inseminations) of 19th set was carried out during the year resulting in 198 pregnancies. Nominated mating (102 inseminations) using 5 progeny tested bulls of 11th, 13th, and 14th sets were also carried out resulting in 37 pregnancies. The highest ever wet average (10.18 kg), herd average (7.50 Kg), 305 days lactation milk yield (2867 kg), total lactation milk yield (2977 kg), peak yield (14.21 kg), were achieved in CIRB Murrah herd during the year. A total of 73% animals were found in milk and average dry period of 129 days was recorded in institute

Murrah herd. Average lactation length was 304 days was recorded during the year. The reproductive traits viz., service period, calving interval and AFC were 132 days, 440 days and 39.66 months, respectively during the year.A total of 41 breeding bulls were sold to various agencies including various semen freezing stations in the year 2021. Due to better health management calf mortality (0-3 months) was restricted to 2.84% and overall mortality of buffaloes was 1.24% only in CIRB Murrah herd. Highest ever milk production of 4,10,057 kg was recorded during the year 2021. Five future breeding bulls from CIRB were selected out of total 14 bulls from 4 Murrah centres under 20th set of progeny testing programme, the use of which will be initiated from January 2022.

Field Progeny Testing of Bulls (FPT) – CIRB Hisar

A Bharadwaj, VB Dixit, Sanjay Kumar

Under field progeny testing program (FPT) semen of test bulls is used for artificial insemination in the field, followed by pregnancy diagnosis, calving records and follow up of progenies till the completion of first lactation for milk records on the basis of monthly test day recording. During the period from January 2021 to December 2021, 3164 artificial inseminations were performed using test bulls of 19th set of test bulls. The conception rate in the field was worked out to be 56.64%. In this period 1792 pregnancies were confirmed and 1414 calving (males 687, females 727) were recorded. Besides, 224 daughters (9 of 15th, 128 of 16th and 87 of 17th set) with an average age at first calving of 40.85 months were also calved, out of which 176 completed the lactation and rest were sold before completion of lactation. The milk production records of 213 daughters in the field sired by 15th set of bulls were used for evaluation. The physical identification using ear tagging has been done in all female progenies born in the field. As on 31st December 2021, 1217 female progenies of 16th to 19th set of different age are standing at various field unit centres for future recordings.

Genetic Improvement of Nili-Ravi Buffaloes

FC Tuteja, MH Jan, Rajiv Mehta

The objective of this project is to genetically improve Nili-Ravi Buffaloes through Progeny testing programme.The test mating of 9th set of bulls and, the preliminary selection and breeding soundness examination of 10th set of bulls is underway. The progeny testing of 5th set of bulls is also completed and the top two bulls have been selected for nominated mating. A total of 131 (65 male and 66 female) calves of high genetic merit were born this year. The test and nominated matings (386 inseminations) using PT bulls, bulls of 8th and 9th sets were carried out resulting in 189 pregnancies. The overall conception rate during this period was 48.96%. The overall mortality of 3.64% and calf mortality of 7.19% were recorded during year 2021. During this period, 40 daughters completed 1st lactation. The overall wet average (8.70 kg), herd average (6.70 kg), 305 days lactation milk yield (2525 kg), total lactation yield (2585 kg), peak yield (14.00 kg), percentage of animals in milk (71%) and lactation length (294 days) were achieved in Nili-Ravi herd. Improvement in reproductive traits viz., service period (116 days), AFC (43.99 months) calving interval (420 days) and dry period (130 days) were achieved during year 2021. The total milk produced during

this year was 3,23,903 kg, and 2,67,261 kg was sold.A revenue of ₹1,43,14,987/- was generated through sale of milk and milk products. A total of 21956 doses were produced at Sub-Campus Nabha, out of 1504 which doses were used for insemination and 2880 doses were sold for insemination of buffaloes in field. Total of 110 animals were sold through public auction and on book value to famers, universities and various developmental agencies.

Role of Bacterial Pathogens in Subclinical Mastitis in Buffaloes

SK Khurana, Sanjay Kumar

A total of 2032 milk samples from 512 milch buffaloes were tested (CMT) as per details given in table.

S. No.	Place of sampling	Total number of animals tested	Total number of CMT positive animals	LF positive cases	LH positive cases	RF positive cases	RH positive cases
1.	ICAR-CIRB, Hisar	121	11	1	6	3	3
2.	ICAR-CIRB, Hisar-IInd Sampling	127	37	18	19	12	12
3.	Vill. Chindar, Fatehbad	129	8	5	2	1	2
4.	Vill. Dhandoor, Hisar	8	4	1	1	2	2
5.	Vill Kaimri, Hisar	27	4	-	1	2	2
6.	Vill Daya, Hisar	23	3	-	1	1	2
7.	Vill. Neoli Kalan, Hisar	46	8	2	7	6	4
8.	Vill. Daya, Hisar	31	7	2	6	5	3
Total		512	82	29	43	32	30

512 milch buffaloes without clinical mastitis were tested for mastitis and 30 (16%) were found positive for subclinical mastitis by CMT. Milk samples from CMT positive quarters subjected to bacteriological analysis yielded resulted in isolation of Staphylococcus spp. (18), Streptococcus spp. (21), Klebsiella sp. (1), Gram positive bacteria yet to be identified (8). Further process of identification is underway. Antibiotic sensitivity testing is also being done on identified bacteria. AMR strains are being identified. More samples are being tested. Bacteriologically identified major isolates will be confirmed by molecular methods.

Development of Soft Computing Tool for Dairy Buffalo Selection

Sunesh Balhara, AK Balhara, SK Phulia, Naresh Kumar

Soft computing tools is an application of artificial intelligence (AI) which enables computer programs to learn, explore and predict outcomes automatically without human interference. Machine learning has been used in numerous fields and it is now aggressively serving mobile application development. In the present study, in order to obtain the optimal architecture and parameters for development of ANN prediction models, ANNs were trained by varying features, numbers of hidden layer(s) and neuron(s), training algorithms, learning rates and the threshold for partial derivatives of the error function as stopping criteria. A total of 15 ANN architectures were trained using the same features and various numbers of hidden layer(s) and numbers of neuron(s) in each hidden layer, with the objective to find the optimal number of hidden layer(s) and the corresponding neurons for each hidden layer. A change of numbers of hidden layers and neurons in each hidden layer greatly affected the performance of ANN models. One of the architectures 9-5-3-1 with two hidden layers had the lowest error value. Therefore, the optimal architecture of the ANN model for prediction of milk yield in lactating dairy buffaloes was a feed forward network with 2 hidden layers.

Improvement of Reproductive Efficiency and Assisted Reproductive Technologies

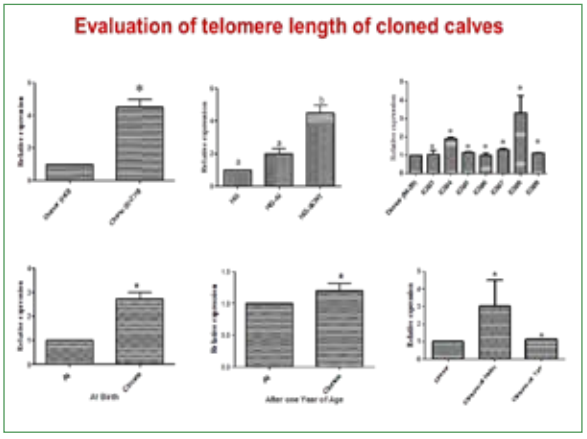
The ability of animals to reproduce efficiently is an integral component of animal production system. Animal Physiology and reproduction division is primarily involve in conducting research studies on multiplication of elite bulls using cloning technique, in vitro fertilization, developing technology for early pregnancy diagnosis and estrus detection, genome editing, semen cryopreservation technology for improved sperm freezability and higher conception rate. The division has also established and cryopreserved primary somatic cell lines from adult elite buffaloes which would be a viable biomaterial for long term maintenance of elite germplasm, which have wide range of applications including cloning even after death of animal, induced pluripotent stem cells production and unlimited DNA/RNA/ protein source for any research purpose. Significant achievements have been made in cloning technology by producing multiple clones of an elite bull and re-cloning the already cloned bull. Cloned bulls have been found have good fertility and reproduce normally similar to non-cloned bulls. Urine based pregnancy diagnostic kit is being tested at farm and field with encouraging results. The division also organizes extension and outreach programs. These programs transfer research-based knowledge that fill the gap between fundamental research and its application to the farmer for managing their animal's reproductive health across the country. Scientists are making efforts to improve the buffalo farming techniques through both basic/discovery and translational/development research.

Production of multiple copies of elite buffalo using cloning technology

PS Yadav, Naresh L. Selokar, Dharmendra Kumar, RK Sharma, Pradeep Kumar, Rajesh Kumar

The objectives of this project are to produce multiple clones of elite animals, improve the cloning efficiency and study the growth of clones, and reproduction of produced clones. During reporting period the effect of nuclear reprogramming on telomere length after SCNT in cloned buffalo and donor was evaluated. For that, telomere lengths of one-day-old new-born cloned buffalo (n=8) calves were measured and compared with their donor bull. Telomere length in normal cloned buffalo calves was significantly ($P<0.05$) increased compared to donor bulls. To further confirm our result the telomere length of the donor bull was compared with its age-matched AI born progeny and SCNT produced cloned calves. The telomere length of the SCNT produced calves was significantly ($P<0.05$) higher than the AI born progeny.

Further, we evaluated the effect of aging in telomere length analysis of donor, SCNT calves and age-matched AI born. To confirm whether telomere length is normally decreased with biological and chronological aging, telomere length of donor bulls with its SCNT produced calves at birth and after one year was measured and compared. The SCNT produced calves telomere length was significantly ($P<0.05$) higher than the donor bull during birth as well as one year of age. Thought, the telomere length of cloned calves decreased with aging but was not significant. Similarly, the SCNT produced calves telomere length was significantly ($P<0.05$) higher than AI born calves (n=8) both at birth and after one year.



Telemore length of clones was normal or even elongated compared to age matched controls

Evaluation of targeted histone modifications in fibroblast cells of cloned buffaloes

Somatic cell nuclear transfer has successfully been achieved in buffalo. However, the overall buffalo cloning efficiency is still low, and this limits the large-scale applications. It is generally believed that low cloning efficiency is mainly due to aberrant epigenetic reprogramming during embryonic development (in-vitro and in-vivo) as well as epigenetic alterations in born-cloned calves. Earlier, several studies have been performed to determine the epigenetic abnormalities in donor cells and cloned embryos; however, there is no report determines the epigenetic status of live cloned buffaloes. To achieve this, skin-derived fibroblast cells were established from eight cloned buffaloes, namely E263, E264, E265, E266, E267, E268, E269, and E270; and non-cloned buffaloes, namely Mu-5609, Mu-5613, and Mu-5618 as controls. We cryopreserved more than 20 cryovials from each animal for future studies. We recorded the cells' outgrowth percentages from the seeded primary explants, population doubling time, flow-cytometry-based cell cycle analysis. We focused on three major epigenetic marks, such as histone H3 lysine 9 (H3K9) acetylation, histone H3 lysine 27 (H3K27) methylation, histone H3 lysine 5 (H3K5) acetylation, which were examined by indirect immunofluorescence microscopy, to examine differences in epigenetic status of cloned vs non-cloned animals. In addition, gene expression analyses of epigenetic-related genes (*DNMT1, DNMT3A, HDAC, CAS3, CAS9, and P53*) were examined and there was no significant changes notice in targeted epigenetic status between fibroblasts of cloned and non-cloned buffaloes.

Progeny of cloned bull

Frozen semen of cloned bulls has been used for artificial insemination at CIRB farm as well as Hiteck Sach dairy farm Sirsa and consenting farmers and more than 60 parentage verified calves has been produced with normal health, indicate fertility and breeding value of cloned bull.

Progenies of Hisar-Gaurav born using fresh semen through artificial insemination

Gestation length of cloned buffalo (Hisar-Gaurav) progenies

We also evaluated the gestation length of animal's pregnant using frozen semen of cloned buffalo and found ranged from 307-316 and average gestation length of buffalo found 312 days which is in normal range for buffaloes.

SNo	Calf no /sex	Dam no	DOB	Sire	Gestational length
1	843F	547	2020	Hisar-Gaurav	315
2	C833F	38	2020	Hisar-Gaurav	315
3	109M	1424	2020	Hisar-Gaurav	313
4	103M	649	2020	Hisar-Gaurav	310
5	102M	650	2020	Hisar-Gaurav	312
6	101M	1204	2020	Hisar-Gaurav	260
7	C843F	547	22 March, 2020	Hisar-Gaurav	305
8	110M	122	23 July, 2020	Hisar-Gaurav	316
9	C868F	916	21 July, 2020	Hisar-Gaurav	312
10	C851	1336	16 June, 2020	Hisar-Gaurav	307
11	104M	136	28 July, 2020	Hisar-Gaurav	313
12	C863	521	23 July, 2020	Hisar-Gaurav	308
13	C575 Heifer	418	2019	Hisar-Gaurav	302
14	C619 Heifer	385	2019	Hisar-Gaurav	307

We recently demonstrated that successful cloning of a superior buffalo bull in which growth, blood hematology, plasma biochemistries, and reproductive organs of the produced cloned bull were found normal. Subsequently, the bull was employed for semen production. Semen parameters such as CASA (Computer Assisted Semen Analysis) variables and in vitro fertilizing ability of sperms of the cloned bull were found similar to non-cloned bulls, including the donor bull. Cloned bull successfully produced freezable quality semen. There was no difference in sperm concentration of ejaculated semen and frozen-thawed semen parameters which include sperm motility, percentage of live and normal morphology sperm, and distance travelled through oestrus mucus. We also performed in vitro and in vivo fertility of 4 cloned bulls and was found equal to non-cloned bulls.We improved cloning efficiency from 1% to 7-9% using different approaches to increase cloned embryo production and efficient management of recipient and born calves.

A total of 9 clones of superior breeding bulls are available at CIRB from superior breeding bulls indicating multiple clones from a superior breeding

bull (seven copies of a superior breeding bull M-29 (Dam's SLMY 4600 Kg) and two copies of bull no 4354 (Dam's SLMY 3605 kg).Semen of the cloned animals cryopreserved and a total of 26228 frozen semen doses prepared. Some of the cryopreserved semen doses were used for artificial insemination in farm animals or farmer's animals on prior consent and a total of 62 progenies were produced and they are growing healthy and normal. Two male progenies born using semen of cloned bull Hisar-Gaurav donating semen and qualifying minimum standard for semen cryopreservation. Three female progenies born using semen of Hisar-Gaurav are now pregnant. Established finite and characterized somatic cell line (n=50) from elite buffaloes of three breed for future use. This bank has somatic cell from superior males/ females and 10 clones.

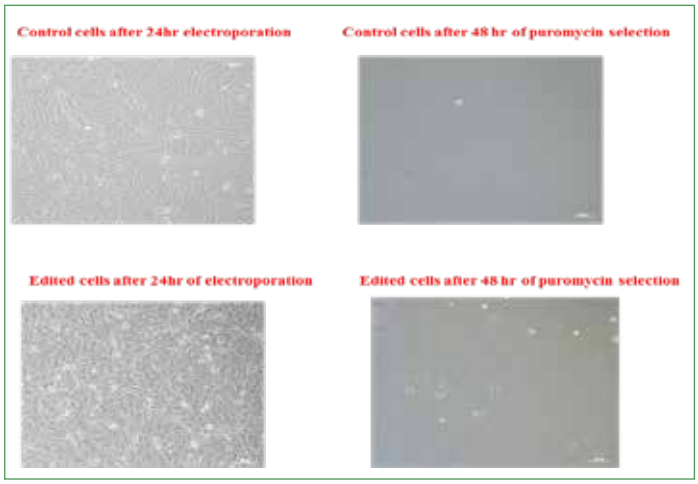
Production of Double Muscled-Mass Farm Animal using CRISPR

Dharmendra Kumar, Prem Singh Yadav, RK Sharma, Meeti Punetha, Rajesh Kumar

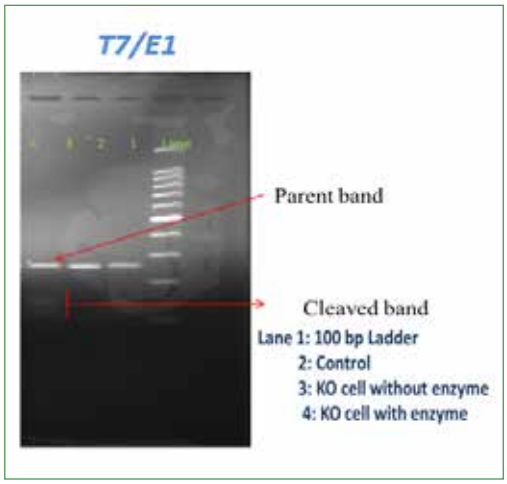
The present project aims to increase the meat production by targeting the myostatin gene which is known to inhibit muscle growth and differentiation. For the ablation of MSTN gene we adopted two approaches i.e a) Delivery of MSTN ligated guides enclosed in PX459 vector transduced to fibroblast cells via electroporation; b) Delivery of MSTN ribonucleoprotein complex in fibroblast cells via lipofectamine.

Delivery of MSTN ligated guides in PX459 vector in fibroblast cells via electroporation

For knocking out MSTN gene, guides targeting exon 1 of the MSTN gene were successfully designed *insilico* and were ordered with required modification to allow for target sequence ligation into BbS1- digested, spCas9 bearing plasmid, including PX459. The guides were successfully ligated, amplified and purified for transfection to fibroblast cells using GeneJet Plasmid Miniprep Kit. Sanger sequencing was done to confirm that these plasmid DNA are carrying the targeted gRNA. The amplified plasmid carrying Cas9 and gRNA were transfected to the fibroblast cell obtained from skin under the tail region. For transfection, conditions were optimized for electroporation and best condition i.e 300V, 1sq P and 20 ms was used for further experiment. After 24 hrs of transfection with plasmid DNA, transfected cells were selected by



Fibroblast cells after Puromycin selection at the dose rate 2µg/ml for 48 hrs

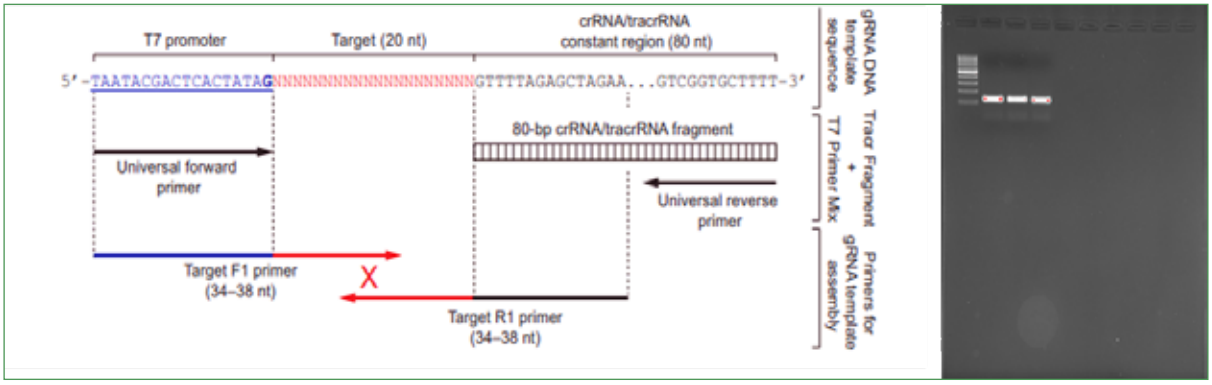


Validation of MSTN gene Knock out via T7/E1 assay in mixed population of buffalo fibroblast cells

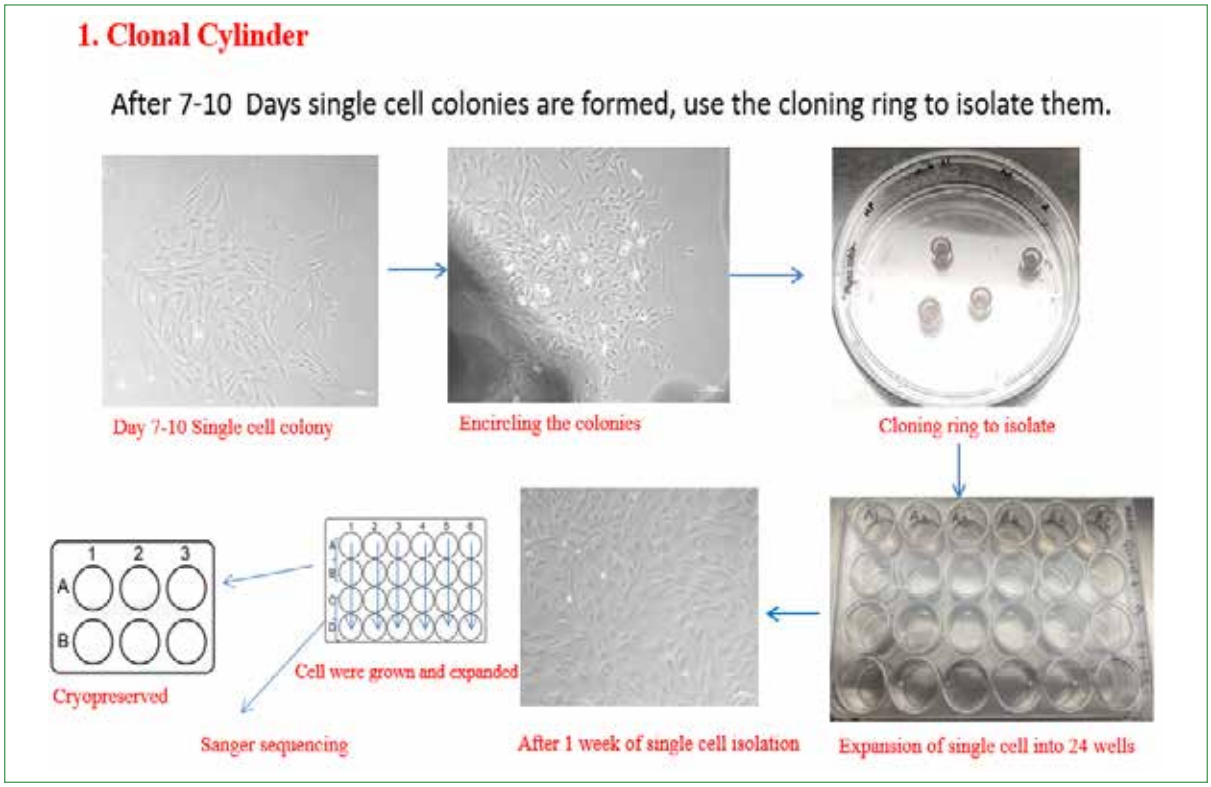
transient antibiotic treatment. The appropriate dose of puromycin i.e 2µg/ml for 48 hrs was determined for the generation of multiple clones of myostatin edited cell lines. After antibiotic selection, half of the cells were kept for validation of MSTN gene knock by T7/E1 assay and rest cells were kept for single cells clone isolation. Result of T7/E1 assay showed the successful knock out of the MSTN gene. Twenty-one single cell clones sent for sequencing shows that all clones were wild type fibroblast cell and there was no knock out colonies obtained which shows the low efficiency of MSTN guides.

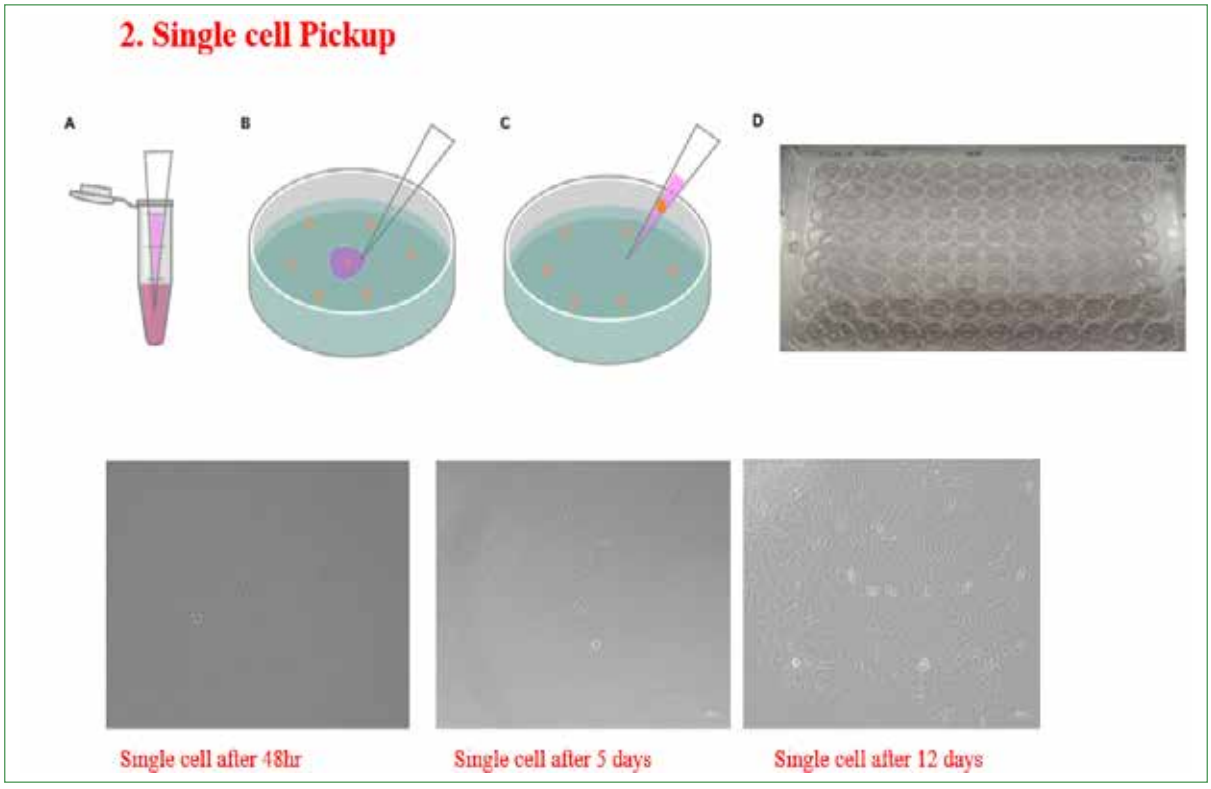
Delivery of MSTN ribonucleoprotein complex in fiXbroblast cells via lipofectamine

Apart from the delivery of DNA format into the cells, we also adopted alternative method to deliver ribonucleoprotein (RNP) consisting of Cas9 protein in complex with a targeting gRNA to fibroblast cell. MSTN targeted guides were transfected to buffalo fibroblast cells via lipofectamine. The validation of MSTN knock out was done by T7/E1 assay and individual cell clonal lines were isolated with the help of clonal cylinders and pick up method. The result shows that the isolation of single clonal cells by clonal cylinder growth was better then pick up method. Characterization of the Myostatin targeted alleles via PCR screening and sequencing was done and we found one MSTN mutated colony via sequencing. To check whether the mutation of MSTN gene was biallelic and monoallelic, we did the genotype confirmation via genotype confirmation kit and found that the MSTN knockout colonies have monoallelic mutation. The MSTN knock out colonies were propagated and cryopreserved for SCNT.

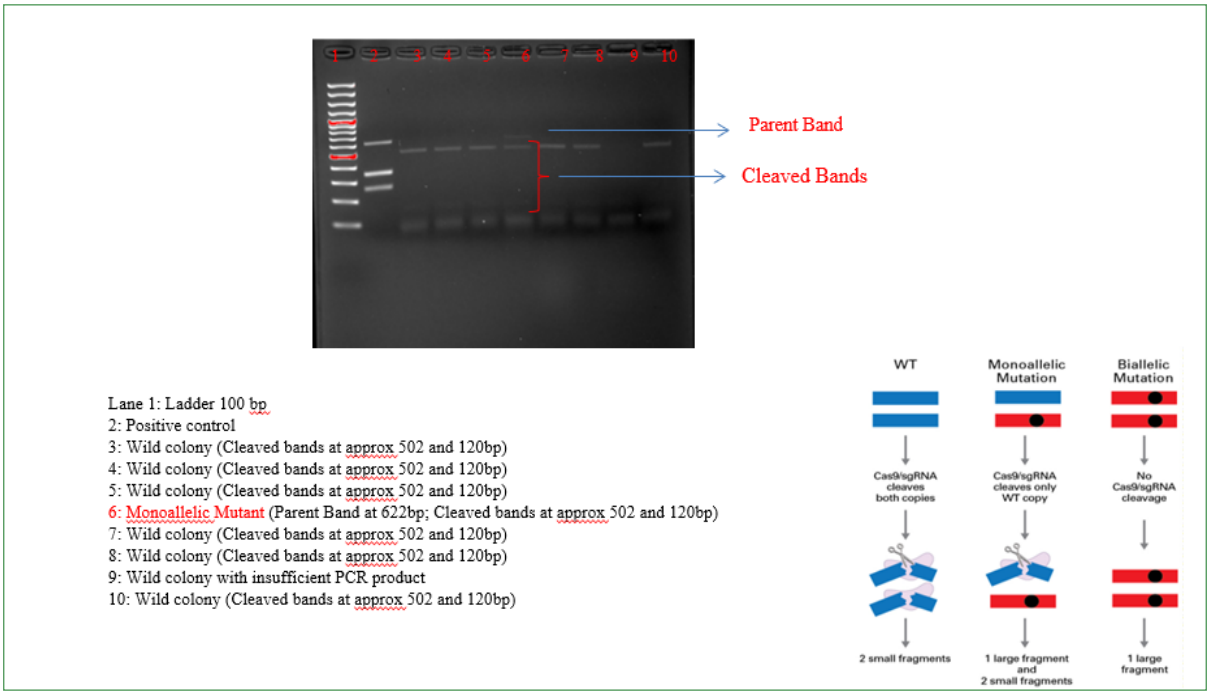


sgRNA synthesis using IVT, and gel picture of ready to transfect MSTN sgRNA targeting Exon 1





Different method from single cell clonal pickup via Clonal Cylinder (A); Single cell Pickup (B)



Genotype confirmation of Single mutated colony of MSTN via Genotype Confirmation Kit showing Monoallelic mutation in one of the colony.

Further, optimization for delivery of CRISPR vector into buffalo somatic cell/zygote is under experimentation for in vitro embryo production and transfer into synchronised female for production of myostatin edited buffalo.

Deciphering the functional role of oct4 during buffalo embryogenesis using CRISPR/cas9

Meeti Punetha, Prem Singh Yadav, Dharmendra Kumar, Naresh L Selokar, Gururaj Makarabbi

OCT4 is a transcription factor with regulatory roles in the development of mammalian embryos, determination of cell lineage and maintenance of pluripotency of germ cells. Low expression of OCT4 suggests inferior quality embryos, reduced blastocysts formation and developmental failures. The present study explores the functional role of OCT4 in embryonic development. Recent advances in genome editing using the CRISPR (clustered regularly interspaced, short palindromic repeat)–Cas (CRISPR-associated protein) system have greatly increased the efficiency of genetic modification. By mutating or silencing genes, genome editing technology has greatly improved the efficiency of producing transgenic organisms, disease models for drug discovery, discovering novel drug targets, and functional validation of a gene. To determine whether CRISPR/Cas9 can be used to understand the transcriptional regulation of early embryo development we aimed to target OCT4. To achieve this OCT4 guide sequences are designed insilico to target the functional domain of OCT4Cas9-gRNA RNP complex were prepared and delivered to single stage zygote through a process known as CRISPR-EZ (CRISPR RNP Electroporation of Zygotes). Electroporation conditions were optimized to target the OCT4 gene in single stage embryos. Validation of OCT4 knock out was performed using a T7E1 assay and Sanger sequencing.

Consortia Research Platform on 'Agrobiodiversity'

Meeti Punetha, Dharmendra Kumar, PS Yadav

Biobanks of cryopreserved somatic cells of buffalo have been utilized to spread desired genotypes and to conserve the animal germplasm of endangered

breeds. For this purpose, skin-tissue were selected and collected from the underneath part of the tail, just above the anal region of different breeds of buffalo. Collected skin tissues were transported in Dulbecco's phosphate-buffered saline fortified with Ca2+ and Mg2+ salts (DPBS+) to the laboratory and washed four to five times with DPBS+. The biopsies were chopped into small pieces (about 1 mm in size per piece) using a sterile surgical blade and washed three times with the Dulbecco's modified Eagle's medium (DMEM) supplemented with 10% fetal bovine serum (FBS). The tissue explants were seeded in 15 µL drops of DMEM supplemented with 20% FBS, 1% (v/v) nonessential amino acids, 1%vitamin mix (Himedia, VA001, Mumbai, India), and 1%antibiotic solution (GIBCO, 15240–062, Grand Island, NY), hereafter called culture medium, in 25 cm2 culture flasks at 38.5C in a 5% CO2 incubator (three to five explants in one flask). After 10–12 hours of seeding, 3 mL of fresh culture medium was added and kept for culturing. Cell outgrowths appeared after 7–10 days of the explant seeding. The growth of cells was observed until they reach 70%–80% confluence, after that, they were trypsinized, subcultured and cryopreserved.

Details of Cryobanking of primary fibroblast-like cells of elite buffaloes.

S. No.	Animal Id	Breed	Sex	Age of animal at time of sample collection (Years)	Cell Type	Passage	No. of Cryovials
1.	4978	Murrah	Male	6	Fibroblast cells	P1 P2	5 20
2.	4316	Murrah	Male	10	Fibroblast cells	P1 P2	5 15
3.	5609	Murrah	Male	1	Fibroblast cells	P1 P2	8 15
4.	5613	Murrah	Male	1	Fibroblast cells	P1 P2	6 15

Buffalo sperm dosage in relation to functional parameters and field fertility outcome

Sajjan Singh, Pradeep Kumar, Jerome A, RK Sharma, Gururaj M

The effect of dilution (@12 and 16 million/straw) buffalo sperm viability and functional parameters were studied. The parameters included sperm post-thaw motility, plasma membrane integrity, thermal resistance, kinematic parameters. Also, the sperm mitochondrial membrane potential as well as mitochondrial superoxide status was documented. These investigations showed no

adverse effect of dilution on sperm structural and functional properties. Understanding the economics of semen harvesting as well as the sperm dosage in relation to efficient energy utilization for germplasm production is important for sustainable and efficient germplasm production. For this study, total of 14 bulls of set 17th and 18th were considered to estimate the cost per dose of semen. The cost and returns of per dose semen production was calculated for three different semen insemination dosage *viz*. semen dose with 20, 16 and 12 million sperm/straw as our previous study reported no significant difference in conception rate under field conditions. In this study, we estimated that the overall net cost [(Fixed cost + variable cost) - (Income)] per dose of semen to be Rs. 11.49, 15.32 and 19.15, respectively for dose with 12, 16 and 20 million sperm/straw. The net profit was observed to be highest in sperm dose with 12 million (9.58 per dose) spermatozoa in comparison with dose with 16 (5.75 per dose) and 20 (1.92 per dose) million spermatozoa. For deduction of field conception rate 20 million/straw (1425 doses), 16 million/straw (1425 doses) and 12 million/ straw (1425 doses) were disseminated for field insemination.

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

Pradeep Kumar,Dharmendra Kumar, Jerome A,

This study was designed to study the effect of season, age and period on semen quality traits in buffalo bulls. Murrah buffalo bulls (n= 45) taken for study aged between 24-75 months. For the present study data collected during the year 2010 to 2021 for seven semen traits viz. ejaculate volume (VOL), sperm concentration (SPC), mass activity (MA), initial motility (BFM), post-thaw motility (PTM), number of sperms per ejaculate (NSP) and number of motile sperm (NMSP) were used. General mixed model was applied to obtain R2 value which was proportion of variation in semen variable. With respect to study period, highest SPC was obtained during 2012 (1283.85±18.76 million/mL); whereas highest BFM (75.42 ± 0.26%) and PTM (53.57± 0.57%) was obtained during 2015 and 2012, respectively. With respect to season, highest VOL (ml) in hot humid (2.94±0.03) and highest SPC (1088.07 ± 11.89 million/mL) during hot-dry seasonwas observed. With respect to age, higher VOL, SPC, NSP and NMSP was obtained in older bulls. Highest correlation was obtained between NSP and NMSP (0.96) with positive correlation seen between VOL with NSP (0.63), NMSP (0.58), likewise SPC with NSP (0.62) and NMSP (0.63). From this study, it was evident that showed that period, season and age had significant effect on key semen quality traits viz. VOL, MA, SPC, BFM, PTM, NSP and NMSP in buffalo bulls.

Molecular markers for improving reproduction of cattle and buffaloes

V Nayan, RK Sharma, A Bharadwaj, KP Singh Ramchander, Rajesh Kumar

Blood miRNAs and transcriptome during estrous cycle of buffalo

Healthy heifers with normal temperature and respiratory rate were selected from the Animal Farm of the Central Institute for Research on Buffalo, Hisar. They were observed for behavioural signs like bellowing and phlegm reaction and signs like swelling of the vulval lips and reddening of the vagina and ropy discharge. Later, estrus was confirmed by ultrasonography. The animals were also examined for salivary fern patterns and blood progesterone hormone levels.

Identification of buffaloes in estrus a) edematous vulval lips, congested vagina, c) per rectal examination: tonocity of uterine horns and cervix. d) standing cervical discharges e-f) ultrasonography

Blood miRNA profile during buffalo estrous cycle

Good quality RNA was extracted by trizol method and RNA quality and quantity was checked before NGS. A total of 94 miRNAs were significantly expressed ($p<0.05$)in estrus. 63 miRNAs were upregulated (log2Fold>0) and 31 miRNAs that were downregulated (Log2Fold < 0)

Blood transcriptome in buffalo estrus and diestrus

In the estrus and diestrus groups, a total of 14101 genes were determined to be expressed. Out of these, a total of 1137 genes were found to be significantly expressed. Filtering genes to ($p<0.05$) resulted in 648 genes that were upregulated and 489 genes that were downregulated. In estrus compared to diestrus, 80 were upregulated and 81 were downregulated (log2 Foldchange2).

Serum Metabolites, Biochemical and Minerals Changes during Estrous Cycle in Water Buffaloes

We tried to find the changes during estrus and diestrus stages of serum metabolites (n=6; pooled to groups of 3 each consisting 2 samples), biochemicals (n=19) and minerals (n=19) in Indian Murrah buffaloes. The level of different metabolites were assessed during estrus as compared to diestrus using a ultra-high-performance liquid chromatography-high resolution mass spectrometry metabolomics approach, and minerals analysis by using Inductively coupled plasma-optical emission spectrometry (ICP-OES). The biochemical changes were also seen. A metabolomic profile was generated by using UHPLC-Q-Orbitrap HRMS which revealed a total of 789 metabolites to be present in the serum sample of buffalo out of which 71 metabolites were having significantly different concentrations during the two stages. The biochemical study presents the higher concentration of bilirubin direct, bilirubin indirect, and aspartate aminotransferase during estrus. Minerals analysis of both groups of animals shows iron and magnesium to be significantly higher in concentration during estrus as compared to diestrus. We tried to find a comprehensive understanding of the changes in metabolites, and biochemical and mineral parameters during the estrous cycle.

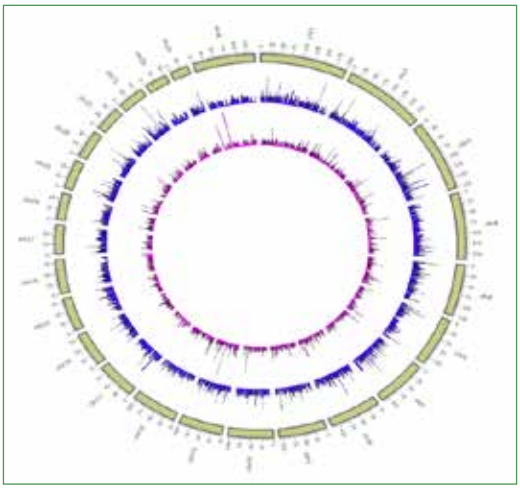
Serum biochemical and minerals profile: A total of 19 healthy heifers were selected for serum biochemical and minerals analysis. In biochemical analysis, no significant difference was observed in most of the parameters namely ALT, Urea, Creatinine, Triglyceride, Cholesterol, Uric acid, albumin, and protein between two groups of animals but estrus and diestrus animals differ significantly in AST, BIT, and BID and the mean serum value for biochemical analysis in the present study was recorded 156.31±4.92 to 144.10±4.43 IU/L, 0.16±0.017 to 0.12±0.008 mg/dl, and 0.12±0.011 to 0.09±0.0041 mg/dl from estrus to diestrus respectively (table) . In minerals analysis, the level of minerals including calcium, copper, iron, potassium, magnesium, manganese, phosphorus, and zinc was measured in serum samples then compared between estrus and diestrus groups. The present study did not show a significant level of difference in calcium, copper, manganese, phosphorus, and zinc. Both groups of animals differ significantly in iron and magnesium and the mean serum value for minerals analysis in the present study was recorded 10.12±0.968 to 7.88±0.365 ppm, and 3.24±0.069 to 2.96±0.061 mg/dl from estrus to diestrus respectively (table).

Network Project on Agricultural Bio-informatics and Computational Biology

V Nayan, SK Phulia, A Bharadwaj, MA Iquebal, D Kumar, Sarika

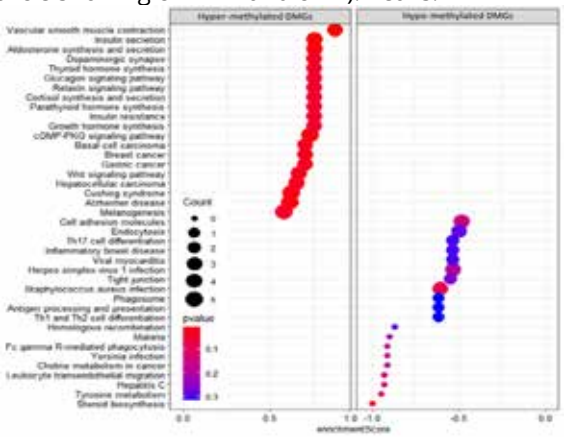
An integrative transcriptomics and DNA methylomics approach to understand the dynamic features of biotic stress responses associated with mastitis in buffaloes

We produced the first genome wise DNA methylation study of peripheral blood lymphocytes to compare SCM infected buffaloes with healthy control buffaloes using MeDIP-Seq. Average methylation in healthy buffaloes was higher than in SCM infected buffaloes. DNA methylation was found the most in intergenic region followed by intronic region in both healthy



control and SCM groups. DNA methylation level was significantly higher in gene body than in up and down stream regions of genes. There was more hypo-methylation while comparing sub-clinical mastitis (SCM) with healthy control group. A sum of 3950 DMRs were identified which were annotated to 370 DMGs. Most of DMGs were enriched in promoter region. Some of DMGs found related to immune system are as follows: Colony stimulating factor 2 receptor beta common subunit (CSF2RB) and granulocyte-macrophage colony-stimulating factor receptor subunit alpha-like (LOC102408349) are cytokines considered essential for the survival, proliferation and differentiation of blood cells such as granulocyte and macrophages. From results of KEGG pathway analysis interestingly it was found that *Staphylococcus aureus* infection pathway was found activated significantly due to hypo-methylation, suggesting possible regulatory role of DMGs in the host response to *S. aureus*-induced mastitis. In this study, DNA methylation was compared with transcriptome data to understand the effect of DNA methylation on gene expression in response to SCM in buffaloes. A total of 4778 significant DEGs were extracted in response to SCM, out of which 67 DMGs were also found differentially expressed suggesting that during SCM, DNA methylation could be one of the epigenetic regulatory mechanism of gene expression. Among these genes, 73% DMGs were negatively correlated with promoter while rest were positively correlated suggesting dynamic regulation due to DNA methylation in response to SCM. Most common class of TEs in differentially methylated regions and TAGs were of SINE family. Large number of TFs in differentially methylated intergenic and introinc regions suggests role of DNA methylation in stability of genome. More hypo-methylated TFs in response to SCM suggested more movement of TEs during the host and pathogen interaction. Similarly, probable differentially methylated TAGs were also found more hypo-methylated in response to SCM.

Extracted Differentially methylated regions: Distribution of methylation counts in extracted DMRs within SCM (inner magenta circle) and control (middle indigo circle) groups in all chromosomes (outer brown circle showing chr1-24 and chrX): Peaks.



GO and KEGG pathway enrichment analysis of DMGs: In KEGG pathway enrichment pathway analysis, 142 pathways were found for 367 DMGs at p-value<0.1, out of which 40 most enriched pathways by hypo and hyper-methylated DMGs (by 20 each) are shown in form of dotplot in the figure.

Development of Buffalo Subclinical Mastitis Methylome-Transcriptome Database (BSCM2TDb)

(http://webtom.cabgrid.res.in/BSCM2TDb/)

Snapshot of BSCM2TDb (Buffalo Subclinical Mastitis Methylome-Transcriptome Database)

Genome Wide Prediction, Mapping and Development of Genomic Resources of Mastitis Associated Genes in Water Buffalo

In this work, we focused on the application of targeted gene panels (TGPs) in screening for candidate gene association analysis, and how this approach overcomes the limitation of genome wide association studies. This work will facilitate the targeted sequencing of buffalo genomic regions with high depth coverage required to mine the extremely rare variants potentially associated with buffalo mastitis. Although the whole genome assembly of water buffalo is available, neither mastitis genes are predicted nor TGP in the form of web-genomic resources are available for future variant mining and association studies. Out of the 129 mastitis associated genes of cattle, 101 were completely mapped on the buffalo genome to make TGP. This further helped in identifying rare variants in water buffalo. Eighty-five genes were validated in the buffalo gene expression atlas, with the RNA-Seq data of 50 tissues. The functions of 97 genes were predicted, revealing 225 pathways. The mastitis proteins were used for protein-protein interaction network analysis to obtain additional cross-talking proteins. A total of 1,306 SNPs and 152 indels were identified from 101 genes. Water Buffalo-MSTdb was developed with 3-tier architecture to retrieve mastitis associated genes having genomic coordinates with chromosomal details for TGP sequencing for mining of minor alleles for further association studies. Lastly, a web-genomic resource was made available to mine variants of targeted gene panels in buffalo for mastitis resistance breeding in an endeavor to ensure improved productivity and the reproductive efficiency of water buffalo.

Development of Water buffalo mastitis database (WBMSTDb)

(https://icar.org.in/sites/default/files/June%202021-%20Monthly%20Summary.pdf; http://webtom.cabgrid.res.in/wbmstdb/index.php)

Snapshot of Water buffalo mastitis database (WBMSTDb)

We present here world's first water buffalo genomic resource for mastitis associated genes to be used as targeted gene panels (TGP). It can be used in dissecting genetics of complex disease by mining of extremely low frequency alleles required in case-control association analysis.

It ensures minor novel alleles are not missed, which are also not present in the prefabricated SNP array/ chip. TGP approach offers multifold advantages like sequencing at much higher depth (500-1000X coverage) than whole genome sequencing/ whole exome sequencing, allowing discovery of extremely rare variants which are potentially most valuable alleles for association studies. It is rapid, cost effective especially in case of association studies where sample size is limited and mining of causative mutations in a single step NGS data generation by direct amplicon sequencing (if TGP <50) or by target enrichment by magnetic beads. Database contains a panel of mastitis associated 101 TGP genes of buffalo which are predicted by successful mapping of 153 mastitis genes and validated on buffalo genome and buffalo specific transcriptome. Database is populated with 1707 mastitis disease associated proteins(DAP) with 6 hub proteins/genes involved in medication of disease which can be used in drug designing and their genes can be used in future SNP discovery. The database also contains 1306 SNPs and 152 were Indels were mined from 101 TGP using RNA-seq data of mammary gland and buffalo WGA. Water Buffalo-MSTdb (WBMSTDb) was developed with 3-tier architecture namely a client, middle and database tier using LAMP (Linux-Apache-MySQL-PHP) technology. Users can retrieve mastitis associated genes having genomic coordinates with chromosomal details for TGP sequencing to mine minor alleles for association studies. This genomic resource can be used in mastitis resistance breeding of water buffalo, to improve its sustainability and profitability by better milk and reproduction efficiency.

AICRP on Nutritional and Physiological interventions for enhancing reproductive performance in animals

RK Sharma, SK Phulia, Vishal Mudgal, Pradeep Kumar, Jerome A

Anti-stress feed supplement in relation to reproductive performance

The experiment was carried out to know whether anti-stress feed supplement can be formulated for improving the pregnancy rate if they are supplemented prior to administration of standard

progesterone implant protocol. For this experiment anovular lactating buffaloes (n=33) of >90 days post-partum were selected from farm animals. During the observation period of one month without any treatment, none of the buffaloes were found in heat on visual observation and as diagnosed by ultrasound examination. Buffaloes were then divided in to treatment (n=16) and control group (n=17). The treatment group buffaloes were given additional antistressor feed supplement under test for a period of 40 days while control group animals were not given this feed supplement. Progesterone implant was inserted 15 days after start of anti-stress feed supplement in control as well as treatment group. An injection of 400 IU PMSG was also administered at the time of CIDR removal and animals were inseminated at 48 and 60 hr after implant removal. Animals were regularly monitored for recurrence of estrus, insemination and pregnancy diagnosis till 90 days of FTAI.

Induction of ovarian cyclicity (%) in treatment and control groups using antistress feed supplement alone within 15 days of feeding trial

Group	N	Buffaloes induced to cyclicity (n)	Induction of cyclicity (%)
Treatment	16	6	37.5%
Control	17	2	11.8 %

Post treatment conception rate at different time period in treatment and control group during summer season

Group	n	Pregnant within 30 days of CIDR removal	Pregnant between 30- 90 days of CIDR removal	Cumulative pregnancy within 90 days of CIDR removal	Acyclic status at Day 30 Post AI
Treatment	16	37.5% (6)	56.2% (9)	93.7% (15)	6.3% (1)
Control	17	64.7 % (11)	17.7% (3)	82.4% (14)	17.6% (3)

Findings suggested that anti-stress nutritional supplement was beneficial in inducing ovarian cyclicity in 37.5% of buffaloes as compared to only 11.8% control buffaloes. It was also helpful in preventing returning of anovular condition after treatment (6.3% vs 17.6%). However, overall conception rate remain similar in treatment and control group.

Comparative efficacy of buffalo specific semen extenders for semen cryopreservation

In this study buffalo specific semen extender developed at ICAR-CIRB, Hisar and at GADVASU, Ludhiana were studied for semen freezability and also compared with routine Tris egg yolk extender. CIRB extender was developed by extracting LDL from egg yolk and supplemented with Tris buffer. The GADVASU extenders are basically TEYC supplemented with sericin (0.25%) or vitamin E (1 mg/ml). Semen samples were collected with artificial vagina technique from minimum six buffalo bulls (n=6). Semen samples of individual bulls (4 replicate of each bull) were diluted with each of four experimental extenders and cryopreserved. After cryopreservation, sperm kinetics and motility parameters were assessed using CASA system. HOST, MitoSOX positive spermatozoa. spermatozoa with high mitochondrial membrane potential (MMP) and percent live sperm with intact acrosome were also studied at different stage of cryopreservation.

Overall data suggested that post thaw motility and other semen parameters were found to be significantly better if semen was frozen in LDL based extender as compared to TEYC, Sericine and Vit E extenders.Anti-stress nutritional supplement

formulated at CIRB was beneficial in inducing ovarian cyclicity in 37.5% of buffaloes as compared to only 11.8% control buffaloes. It was also helpful in preventing returning of anovular condition after treatment (6.3% vs 17.6%). However, overall conception rate remain similar in treatment and control group.LDL based semen extender developed at CIRB was found to be significantly improve the post thaw motility and other semen parameters as compared to TEYC, and TEYC with sericine (0.25%) or with Vit E (1 mg/ml) semen extenders.

Reproductive Performance of Murrah Buffaloes in Relation to Milk Production

SK Phulia, RK Sharma, AK Balhara, A Bharadwaj, and Sunesh

In this project, it was deuced that Overall 12 % Incidence of mastitis in herd over last ten years and same animal repeats more than 50% with more incidence in high THI (hot humid conditions). Cases of mastitis is More pronounced in rear seats and left side of udder and thermal imaging technique may be useful in identifying early mastitis. Post vaccination (FMD and HS) there is milk loss 3-6% up to 5 days but no effect on conception. Trends in unnoticed pregnancy loses is about 8.5% with highest incidence during high THI. It was also observed that herd average, wet average, daily milk production and average monthly milk production starts declining above 70 of THI and

Fertility of Nili-Ravi buffaloes in relation to lactational, metabolic and environmental stressors.

MH Jan, FC Tuteja, RK Sharma, SK Phulia

The objective of this project is to study the effect of lactation and associated metabolic and endocrine disturbance on fertility in buffaloes. Before the actual experiment, the farm records from 2001-02 onwards were compiled. The results revealed a significant improvement in reproductive and productive performance of buffaloes, with the best performance during 2016-2020 period. Buffaloes with higher SLMY and peak yield have reduced reproductive performance i.e., significantly highly service period and calving interval. In addition, heifers with AFC between 42-44 months had better production and reproduction performance during first lactation. The actual ongoing experiment on postpartum buffaloes will reveal the metabolic pathways leading to low reproductive performance in high producing buffaloes.

Feed Resource Utilization and Improvement

Buffalo rearing now a days arrives multiple challenges to enhance productivity to meet the increasing demand of animal products and reduce its impact on the environment with financial feasibility owing to enhanced cost and scarcity of feedstuffs. Nutrition plays a crucial role in the production, reproduction and health of animals. Animal Nutrition and Feed Technology Division is involved in conducting research activities on precision feeding and development of low-cost feed formulations for various categories of buffaloes, galactagogue herbal mixture, development and supplementation of nano-minerals, aflatoxin detoxifying agents to reduce the potential hazards of aflatoxin metabolites in milk, feed and fodder technology, phytogenic feed additives to reduce environmental pollution from buffaloes. The division has been accredited by FAO/IAG for feed quality analysis. The Feed Processing Unit under the division is involved in procurement of feed ingredients and formulation of concentrate mixtures for various categories of buffaloes to enhance the production performance. The year-round fodder production at Agriculture Farm under the supervision of the division supports achieving the target of production and reproduction through supply of good quality green fodders. The division is also engaged with other institutes for collaborative research works on development and validation of fodder varieties, application of agro-industrial by products as animal feed supplement. The division also organizes farmers training for disseminating nutritional technologies to the farmers to improve their feeding practices and enhance income from buffalo rearing. Scientists of the division are engaged in both basic and applied research on advanced animal nutrition studies for enhancing buffalo production and reducing impact on the environment.

Evaluation of feed additives on growth rate, nutrient utilization and methane production in buffalo calves

Avijit Dey, PC Lailer, A Jerome, Putan Singh, AK Verma

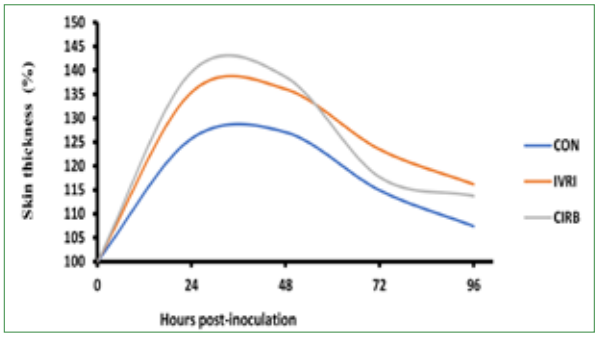
Feed additives in the animal ration have the potential to improve animal performance by improving intake, feed utilization efficiency and rumen function. A molasses-based feed supplement was developed by the Animal Nutrition Division, IVRI, Izatnagar, which was proposed to improve intake and efficiency of animal production. Many feed additives and their combinations have been formulated at CIRB Hisar and found to reduce methane production and improve feed degradability under *in vitro* condition. However, *in vivo* trial was found necessary before their application as feed additives in animal ration. Therefore, the study evaluated the effect of dietary inclusion of both the feed additives, individually on feed intake, growth rate, nutrient digestibility and methane production in buffalo calves. Female buffalo calves (24 in no., 1.5-year-old) divided into 3 groups in completely randomized design and fed a diet containing wheat straw, concentrate mixture and green fodder as per nutritional requirement. The feed additives developed by IVRI and CIRB were mixed with the respective concentrate mixtures at their recommended dose levels. Feed intake and

body weight changes were recorded for a period of 170 days. The improvement ($p<0.05$) in growth rate and nutrient digestibility with reduction ($p<0.05$) in enteric methane production were recorded with supplementation of both the feed additives. The cell mediated immune response (CMI) was enhanced by addition of both the feed additives. Thus, both the supplements demonstrated positive response in growth and feed utilization as well as methane reduction and immune response of buffalo calves.

Effects of supplementing feed additives on the growth rate and feed efficiency In buffalo calves

Attributes	Treatments		
	CONT	IVRI	CIRB
Body weight (kg)			
Initial	183.72	183.82	181.78
Final	247.28	264.96	259.47
Total gain+	63.57	81.15	77.68
ADG (g)	373.92 [a]	477.35 [b]	456.96 [b]
Total dry matter intake (kg/d)	4.59	4.64	4.59
FCR	12.80	9.80	10.12
FE (%)	8.19[a]	10.38[b]	10.09 [b]

CON= Control group; IVRI= Molasses-based feed additive; CIRB= Plant bioactives based feed additive
ADG, Average daily gain; FCR, Feed conversion ratio (kg DMI/ kg gain); FE, Feed efficiency (kg gain/ kg DMI)
[a,b]Mean values bearing different superscript within a row vary significantly ($p<0.05$)



*Cell Mediated Immune (CMI) response of buffalo calves as measured by skin fold thickness (**in vivo** delayed type of hypersensitivity reaction) fed with different feed additives*

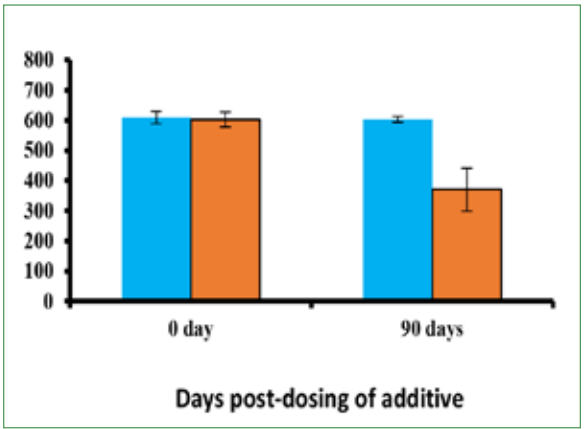
Eucalyptus (*Eucalyptus citriodora*) leaf-meal supplementation improves milk quality and reduces environmental pollution

Avijit Dey, Sandeep Sheoran

Eucalyptus (*Eucalyptus sp.*) leaves are rich source of an array of volatile essential oil compounds and non-volatile phenolic compounds which have antimicrobial properties and are associated with many health benefits. An experiment was conducted to examine the effect of eucalyptus leaf-meal supplementation on milk quality, nitrogen utilization and methane emission of lactating Murrah buffaloes. Sixteen lactating Murrah buffaloes at early stage of lactation with average milk yield of 10-12 kg were

Activities on feeding trial of buffalo calves fed different feed additives
(A-B) = Feed additives in requisite quantities were mixed uniformly with small quantity of feeds
(C-D) = The premix was placed into the manger and mixed with the other portion of feeds thoroughly and fed to buffalo calves
(E) = Digestibility trial to study nutrient utilization
(F) = Skin fold thickness to study immune response

selected and divided into two groups in a completely randomized design. All the experimental animals were fed as per the normal farm practice. Dried eucalyptus leaf meal was added (1% of DMI) with the concentrate mixture of treatment animals (ELM). The results demonstrated an increase ($p<0.05$) in milk yield and nutrient digestibility in leaf meal supplemented animals. There was an increase ($p<0.05$) in quantity of conjugated linoleic acid (*cis 9, trans 11;* CLA) in the milk of supplemented animals, which has human health benefits, with a reduction ($p<0.01$) in enteric methane and faecal nitrogen excretion.



Methane concentration in the eructed air of buffaloes fed eucalyptus leaf meal

Development and supplementation of nano-minerals in buffalo

V Mudgal, N Saxena

The objective of the experiment was to synthesize nano minerals using physical, chemical or biological methods and their evaluation for *in vitro* bioavailability and potential benefit of supplementation on the performance of buffalo calves. Laboratory synthesized nano Cu and Zn are being evaluated in the ration of growing heifers for a period of one year. Blood samples were collected on bimonthly interval starting from day 0 of experiment. Body weight is being recorded on fortnightly basis from day 0 of experiment. Due to smaller size and higher surface area nano minerals are supposed to be of higher bioavailability and thus excretion of minerals will be less per animal per day.

Molecular analysis of methanogenic archaeal diversity in rumen of Murrah buffaloes fed different diets

S Yadav, PC Lailer, A Boora, A Dey, SS Paul, SK Khurana

Understanding of methanogens distribution in Murrah buffalo rumen is required for effective strategy to reduce GHG emission and increasing production efficiency. Composition of archaea in buffalo is largely uncharacterized compared to cattle. 16 S rRNA and mcrA based amplicon sequencing by sanger's method may not represent majority of archaea diversity in rumen. Therefore, NGS need to be done to characterize the archaeal diversity.

Evaluation of Quality Protein Maize in the ration of Buffaloes

V Mudgal, N Saxena

Protein quality had an important role in the dairy animals during early lactation and for assessment of the same 16 Murrah buffaloes at about 45 days in milk were selected and distributed between two groups fed either normal maize (control) or quality protein maize (treatment) grain-based concentrates mixtures for four months. Body weights, total, and fat-corrected milk production, including the composition of milk, remained uninfluenced ($P>0.05$) due to the use of two different maize grains in the diet of lactating buffaloes. It may be concluded that the use of quality protein maize in place of normal maize was unable to influence the production performance of medium-yielding buffaloes.

Transfer of Technology

Economic analysis of milk supply chain in buffalo production system

Gururaj M, PC Lailer, Navneet Saxena, FC Tuteja and Meeti Punetha

The present study was conducted in Punjab and Haryana state being breeding tract of Nili-Ravi and Murrah buffalo breed, respectively. In the present study a mulit-stage random sampling technique was used for selection of the respondents. In first stage, Punjab and Haryana was selected. In second stage, two districts from each state namely Hisar & Karnal and Sangrur & Firozpur from Haryana and Punjab, respectively was selected randomly. In third stage, two blocks from each district was selected randomly. In final stage, a total of 60 dairy farmers from each block were selected randomly. A total of 240 dairy farmers were interviewed personally for primary data collection using semi-structured pre-tested interview schedule. The collected data was analyzed separately for Nili-Ravi (Punjab) and Murrah (Haryana) dairy farmers using suitable statistical technique for meaningful results. A data of 120 Nili-Ravi buffalo owners from the two districts of Punjab was analyzed.

ICAR-CIRB & MANAGE Collabaorative training

The results perusal that there is statistically significant difference in the educational level, number of Nili-Ravi milch buffalo holdings, operational land holdings and area under green fodder production among the Nili-Ravi buffalo owners in Firozpur and Sangrur district. The average production, consumption and

Demonstration on balance feed formulation

Farmers' FIRST training progrmme

marketed surplus of the milk are found to higher for the Firozpur farmers in comparison with their counterpart. Among the selected Nili-Ravi owners, about 70.83 and 29.17 per cent of them preferred organised and unorganised milk marketing channels, respectively for the dispose of the surplus milk. The distance of the society, regular & assured market and help in the avail loan for purchase of animals and inputs are main reasons for opting organised milk marketing channels. Whereas, assured & regular market, advance payment for purchase of inputs and door step milk collection are important factors for choosing un-organised milk marketing channels in the study area. The econometric analysis of binomial logit regression revealed that Nili-Ravi owner with younger age and larger numbers of the Nili-Ravi buffalo holdings prefer organised milk marketing channels to dispose surplus milk rather than un-organised channels.

Mahila Pashu Palak Sammelan

Training on Thermal Imaging

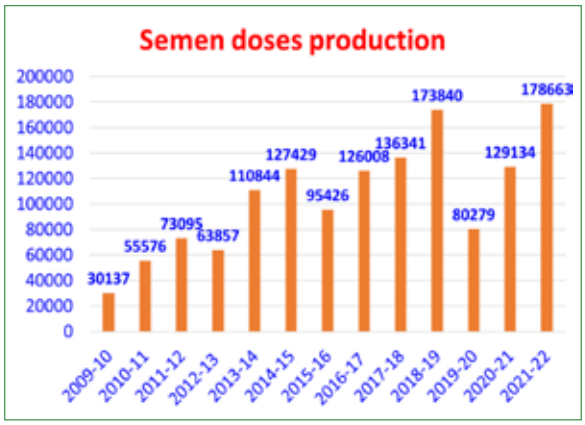
Development of Technologies and their Transfer to End Users

The institute has developed several technologies since its inception that were transferred to the farmers to increase the production and reproductive efficiency of their buffaloes. Many of the farmers trained in this institute are achieving ~60 % conception rates with the frozen semen from this institute. The developed technologies are also transferred through field visits, kiasn melas, radio and TV talks and web portal based extension activities. Books, bulletins and popular articles are regularly written by scientists for dissemination of knowledge of scientific buffalo husbandry to the farmers. Some of the technologies which found acceptance with users are presented below.

Impact of quality semen produced by institute

Institute maintains a high pedigreed herd of Murrah and Nili-Ravi buffaloes. The institute has been undertaking breed improvement programme through selective breeding since its inception. The genetic potential of bulls is evaluated through progeny testing. Due to intense selection pressure, production performance of Murrah and Nili-Ravi herds improved from about 5.86 kg in 1991 to 9.09 kg in Nili Ravi and 4.80 to 9.53 kg in Murrah during 2019.

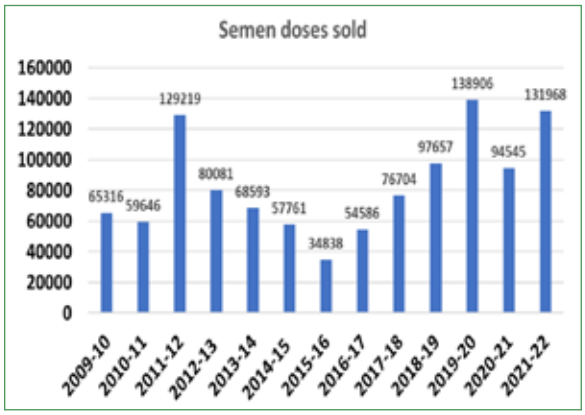
More than four lakh doses of frozen semen from test bulls and over sixty thousand doses from progeny tested bulls are available for Murrah breed improvement. About 444 Murrah and 302 Nili Ravi bulls of high genetic merit have been supplied to various developmental agencies and village panchayats in 12 States for increasing milk production through genetic improvement. Under field progeny testing program in adopted villages, more than one lakh AIs were done so far with frozen semen of test bulls with conception rate of 48%. Year wise frozen semen production from Murrah bulls are indictaed in the figure below.



Number of frozen semen doses produced during last ten years (2009-2021)

Dissemination of quality germplasm (semen) for breed improvement

The quality semen cryopreserved from test bulls and progeny tested bulls having >50% post-thawed motility is used at our farm, Network centres and adopted villages for genetic improvement of the buffalo herd. The surplus quality frozen semen doses is being sold to farmers/stakeholders/researchers



Number of frozen semen doses sold and distributed among network centers during last twelve years (2009-2022)

to dissiminate quality buffalo germplasm for improvement in the production of country buffaloes. Detail of the semen sold year wise depicted in the figure given below.

Revenue generated through sale of semen

The frozen semen collected and cryopreserved at CIRB having huge demand and acceptability among the buffalo farmers due to good quality and farmers friendly environment in the institute. The CIRB earned more than rupees 182 lakhs from sale of frozen semen of Murrah bulls during a decads and details presented in the figure.

Revenue generation (Rs., lakhs) from sale of semen during last twelve years (2009-2021)

Improved protocol for buffalo semen cryopreservation

A simple, reliable and economical method for freezing of buffalo semen has been developed and found to be effective to freeze the static ejaculates successfully, a phenomenon specific to buffaloes which greatly reduces the efficiency of utilization of buffalo semen for artificial insemination. A large proportion of buffalo semen ejaculates collected during summer months are rejected due to the high incidence of post-thaw backward motility of sperm cells. Through thorough investigations about the phenomenon, stage of glycerolization was identified to be the most critical step responsible for backward sperm motility. Glycerolization at room temperature during initial stage of semen dilution reduced/ eliminated the backward motility due to which 20 percent more ejaculates could be preserved annually, thereby enhancing the frozen semen production. Overall semen freezing protocols improved resulting in almost 15% improvement in post-thaw motility and improved frozen semen quality and fertility on artificial insemination.

Further, novel cryopreservation protocol for buffalo sperm was developed by altering the freezing rates in 3-step cryopreservation protocol. Using this protocol, significant improvement in post-thaw sperm motility and kinetics parameters (average path velocity, straightline velocity, sperm elongation, total, progressive & rapid motility), sperm live percent, plasma membrane and acrosome integrity was obtained. Patent has been applied for the technology.

Sericin for improved semen freezing

Sericin is a water-soluble globular protein (a proteinhydrolysate) derived from silkworm Bombyx mori. Supplementation of 0.25-0.5% sericin in semen extender improved frozen-thawed semen quality through protecting sperm from oxidative stress.

Ready to use buffalo semen extender

Egg yolk is most commonly used semen extender for semen cryopreservation. There are some limitations of egg yolk based semen extender like wide variability of egg yolk composition, risk of microbial contamination, presence of high-density lipoproteins, calcium and steroids hormones. To solve the above stated problems, active ingredient of egg yolk was extracted and unwanted substances were removed from the egg yolk. Important additives were added and compared with raw egg yolk based extender and found that customized extender showed better performance in terms of sperm motility and freezability compared to egg yolk based extender. This technology is available at Agrinnovate (www.agrinnovateindia.co.in) for commercialization.

Improved protocol for oocyte vitrification

Supplementation of BSA in place of FCS in maturation media ensures successful vitrification of in vitro matured oocytes. It has positive influence on post-thaw survival and maintenance of developmental competence of in vitro matured buffalo oocytes vis-à-vis FCS.

Area-specific mineral mixture

Surveys of feeding practices carried out in Haryana revealed deficiencies of essential minerals like calcium, phosphorus, zinc and manganese in 70 percent of buffaloes. On the basis of analysis of mineral intake vs requirement an area specific mineral mixture was developed. Seventy per cent of the buffaloes suffering from anaestrus conceived within a period of 2-4 weeks of feeding the area specific mineral mixture. The mineral mixture improves feed intake, milk production and reproductive efficiency. Institute has been preparing and selling mineral mixture to the farmers at no profit no loss basis.

Feeding standards for different categories of buffaloes

Feeding standards have been developed for different categories of buffaloes, viz. growing males, growing heifers, lactating buffaloes and pregnant buffaloes. Nutrient requirement for heat and humidity stress was also estimated and published.

Ultrasonographic fetal sex determination in buffaloes

Ultrasonography guided fetal age and sex determination technology has been standardized. The accurate diagnosis can be made at 55 day of gestation in buffaloes in contrast to 50 days reported in cows.

Method for estimation of gestational age

By ultrasonography fetal age can be accurately assessed that is useful in better management of pregnant buffalo at the time of calving. The length of gestation in buffalo can be estimated by following standard chart that is developed for crown-rump length of buffalo fetus on different days postinsemination. When this plot was used for determining the age of fetus in pregnant buffaloes the exact date of mating/gestation could be predicted.

Ultrasonography for monitoring ovarian activity

The non-invasive technique of ultrasonographic scanning has been standardized for diagnosis of ovarian activity. This technique is very useful for follicular dynamics studies. With the use of this technique, time of ovulation can be predicted very precisely to allow fixed time insemination.

Early pregnancy diagnosis in buffaloes

A protocol has been standardized for establishment of early pregnancy diagnosis in buffaloes. With ultrasonic scanning, pregnancy could be diagnosed as early as 26 days post insemination. The technique can be used to assess date of service in case of unobserved mating.

Identification of molecular markers for MAS

RAPDs, Microsatellites and traits governing specific genes as growth hormone, seminal fluid protein gene specific primers based buffalo genome characterization done for identification of genetic diversity and markers for higher milk production and bull performance. A twenty nucleotide base pair length having di-nucleotide repeats have been identified showing polymorphic expression of milk production in low and high milk producing buffaloes. Study revealed more than 30 percent dissimilarity between high and low yielding buffalo genotypes.

OvSynch plus protocol for estrus induction in buffaloes

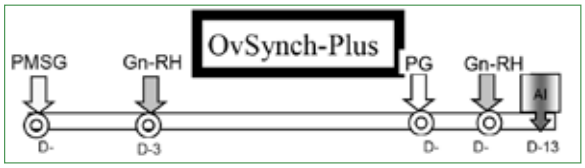
Anestrus, in pubertal heifers and postpartum buffaloes, is the primary cause for low reproductive and productive performance of buffaloes. The

condition is associated with the presence of static ovaries and though follicular development may occur, none of the ovarian follicles becomes mature enough to ovulate. In anestrus animals, doninant follicle (DF) undergoes atresia instead of ovulation. Analysis of ovarian response of anestrus buffaloes to 'Ovsynch' protocol revealed that only the buffaloes with a large DF (>9mm) at the time of first GnRH injection respond well to this treatment. However, such an accurate assessment of follicular size is difficult under field conditions with routine per-rectal palpation. Hence, to ensure consistently similar ovarian follicular picture of all anestrus buffaloes at the time of first GnRH injection, a new protocol was developed and named 'Ovsynch Plus.' In this protocol, an injection of PMSG is administered 72 h prior to the first GnRH injection of Ovsynch treatment, in order to support ovarian follicular development so that at least one large follicle is available after 72 h for responding to the GnRH injection with ovulation/ luteinization. Resulting luteal structure in the ovary is then subjected to luteolysis by PGF given 7 days later. Further administration of GnRH ensures synchronous ovulations of preovulatory follicles to allow fixed time insemination of treated animals.

The major advantage of this protocol is that it induces oestrus in cyclic as well as acyclic animals within a close window. Buffaloes not coming into estrus within the defined period following this protocol also become cyclic and get pregnant within one month of treatment, if initiated during breeding season.

Embryo transfer technology

Efforts have been made in developing and improving the embryo transfer technology for buffaloes which has resulted in the production of 20 calves at this Institute. Technology for large scale production of *in-vitro* matured and *in-vitro* fertilized embryos using slaughter house ovaries has also been developed. The embryo cryoprservation technique has been standardized. This technique has been standardized for *in-vitro* maturation of oocytes obtained from abattoir ovaries followed by their *in-vtiro* fertilization and culture of the resulting embryos to transferable stage. The technique of IVF will be of immense use for faster multiplication of elite germplasm and progeny testing of bulls after collecting oocytes from live animals.



Scrotal circumference for bull selection

Scrotal circumference of Murrah buffalo males is highly correlated with age and body weight and it can, therefore, be used for pre-selection of breeding bulls at an early age. For mature (>600 Kg BW) Murrah buffalo bulls (n=86), mean SC values were 35.23 cm, with S.D. of 3.00. Therefore Murrah bulls having scrotal circumference <29 cm (Mean -2 S.D.) must be excluded from the breeding programme, while males with SC of over 41 cm (Mean +2 S.D.) should qualify as the best semen donors.

Super ovulation with ablation of dominant follicle

Superovulatory treatment in buffaloes starts from day 9-12 of the estrous cycle (Day 0 = Estrus). At this stage ovary invariably has a large dominant follicle (DF) ranging from 12- 15 mm that suppresses the growth of other subordinate follicles. During superovulatory treatment also this DF suppresses other subordinate follicles to grow in response to FSH treatment. This results in less number of preovulatory follicles at the time of insemination leading to less number of ovulations and embryos. Therefore, DF was ablated using ultrasound guided transvaginal follicle ablation technique prior to start of superovulatory treatment. This technique is minimal invasive and has no ill-effect on animal fertility. Ablation of DF results in better superovulatory response and establishment of pregnancies in recipients.

Sexing of IVF produced embryos

Sexing of *in-vitro* produced embryos was successfully done with PCR technique using bovine primers. Micromanipulation of the embryos was done for obtaining biopsy for sexing.

Cloning of breeding bulls for semen production

Using cloning technology, it is possible to make multiple copies of outstanding bulls in the shortest possible time that could mitigate demand of proven semen. The institute produced Hisar-Gaurav, which is cloned of a superior breeding bull, in 2015. This cloned bull has started donating semen at the age of 22 months and qualifies all semen and fertility parameters. Using his semen, 20 progenies were produced that are healthy and normal. In addition to Murrah bull cloning, institute has cloned Assamese breeding bull, which is growing normal and healthy. The semen of this bull has also been collected and cryopreserved successfully with acceptable post-thawed sperm motility. Institute also produced seven cloned calf of M-29, superior bull and one re-clone of Hisar-Gaurav which is first report of its kind.

Frozen repository of somatic cells

40 primary somatic cell lines were established and cryopreserved from adult elite buffaloes, which includes 4 from champion bulls. These primary cell lines were characterized using expression of cytoskeleton markers including vimentin for fibroblast origin type and cytokeratin for epithelial origin type. Cryopreserved cell lines would be a viable biomaterial for long term maintenance of elite germplasm, which have wide range of applications including cloning even after death of animal, induced pluripotent stem cells production and unlimited DNA/RNA/protein source for any research purpose. Frozen somatic cells of four breeding bulls were shared with NDRI for cloning studies. These cell line is available for researchers on written consent.

Induction of lactation

Farmers rear the dairy animals for milk production and livelihood but they are commonly facing the problems of conception failure, long calving interval, anestrous, cystic ovaries, specific abortions and repeat breeding. They can benefit by inducing such animals into lactation by induced lactation therapy. The buffalo is weighed and appropriate dose of hormones, Estradiol- 17b and progesterone @ 0.1 mg/kg body weight/day each, is calculated for seven days therapy, dissolved in absolute ethanol

and stored. On the day of treatment, 1 ml of each hormone solution is administered subcutaneously in the morning and evening at an interval of 12 hours, for seven consecutive days. Thereafter, on day 17,19 and 21 of treatment, 10 ml Largectil injection and on day 16, 18 and 20, injection of 20 mg of Dexamethasone are also given intramuscularly. Between 15th and 21st day of treatment, udder massage is given for fifteen minutes each in the morning and evening daily till the udder is turgid with milk, which is usually around 21st day when milking is started. The milk becomes normal in physical and chemical properties within 10 -15 days of start of milking and the amount of milk yield increases with time. Almost 60-75 percent of the buffalo's milk yield potential can be achieved following induced lactation.

Colostrum feeding for higher growth and calf survival

Higher levels of immunoglobulins absorbed within 16 h of birth, reduce the mortality in calves and result in faster growth rate by 20-22 percent. High titre of circulating immunoglobulins in calves at an early age of 24 h showed the association with weight gain upto the age of 2 years. Status of immunoglobulin levels at such an early age could also predict the health status of calves. A critical level of these blood proteins required for the survival of calves has been assessed.

Antioxidants in survival and growth of neonates

Advanced pregnant (270 to 280 days' gestation), buffaloes are administered two doses of antioxidant micronutrients, consisting of vit A (Palmitate), vit D and vit E (dl- alpha 3 Tocopherol acetate, within 30 days before calving, at 15 days intervals. These buffaloes secreted 25-80% more Ig protein in colostrum than control buffaloes. Calves born to treated buffaloes were also supplemented with mineral mixture @ 5 g/calf/day, colostrum feeding @ 10% of birth weight, concentrate mixture started 10 to 15 days after birth and green folder offered after 3 weeks, in order to achieve high growth rate and survival. Calves born to vitamins administered buffaloes and further supplemented with mineral mixture gained 10 percent higher body weight and 30% better immunity status. Calves bearing higher body weight and better immunity are economically more rewarding for meat and milk industry.

Uromol preparation

Uromol is a compound prepared by heating urea and molasses in the ratio of 1 : 3 and then mixing it with

equal amount of wheat bran/deoiled rice bran. Four kg urea along with 12 kg molasses is slowly heated in a container for 30 minutes. Then equal amount (16 kg) of wheat bran or deoiled rice bran is mixed in it and the mixture is cooled to room temperature. This material contains 36 percent DCP and 72 percent TDN and can replace conventional compound feeds in the ration of buffaloes yielding 8-10 litres milk/day.

Urea molasses mineral blocks (UMMB)

Urea molasses mineral blocks are prepared in the same way as Uromol, except with the addition of mineral mixture, salt and binder. By *ad-lib* feeding these blocks along with other feed ingredients, about 20 percent of the conventional concentrate mixture can be saved. UMMB prepared by the 'cold process' technology has yielded even better results.

Superior isolates of anaerobic fungus

Superior isolates of anaerobic fungus were isolated and evaluated for ability to increase *in vitro* digestibility of straw by buffalo rumen microflora. Such isolates have the potential to be used as feed additives.

Enzyme supplementation

Fibrolytic enzyme supplementation can be used as feed ingredient in the concentrate mixture of calves to increase the growth rate. Further, the cost of enzyme can be reduced by using feed grade enzyme or enzymes used in textile industry (cellulase) and paper industry (Xylanase).

Thermal stress management

Microclimate modifications with supplementation of niacin @ 6 gms/day/animal, yeast @10 gms/day/animal and mustard oil @150 gms/day/animal; enhance milk production of lactating buffaloes by reducing thermal stress.

DNA bank

DNA repository of about 3119 buffaloes has been established at the institute for genome analysis. Phenotypic data on all the animal is being collected which shall be used for establishing linkages with performance traits and identification of molecular markers.

Marker based early detection of post-partum anestrus (PPA) in buffaloes

This technology has been granted patent 'An in vitro method for detection of postpartum anestrus condition in buffaloes' vide application No. 2940/DEL/2013CBR No. 10352 Docket No. 16369, patent granted on 05/02/2019. SNPs at position 251 of 5' untranscribed region of HSP70 gene has been used for assessing genetic predisposition to postpartum anestrus (PPA) condition in buffaloes. This tool can be used for selection of animals for breeding programs.

Mobile based App

The mobile based app on buffalo reproduction, nutrition and health has been developed and put in public to impart knowledge for buffalo owners and also a guide for VLDA and graduating veterinarians. The App provides basic information on different areas of buffalo reproduction, nutrition and healthfor better management of animals by farmers. . The App additionally provides answers on frequently asked questions under each section of buffalo reproduction. The three Apps is presently available in Hindi and English languages. Complete App content has audio backup with download facility.

The app is now placed on Google Play store on following link.

For buffalo reproduction app link : https://play.google.com/store/apps/details?id=com.cirb

For buffalo nutrition app link: https://play.google.com/store/apps/details?id=com.cirb.buffaloposhahar

For buffalo health app link: https://play.google.com/store/apps/details?id=com.cirb.buffhealth

e-Bhains Vigyan Kendra (ई-भैंस विज्ञान केन्द्र)

This portal is hosted at www.ebhainsgyan.cirb.res.in for two ways interaction between scientists and farmers. This interface has designed to substantiate CIRB's efforts towards use of ICT for popularizing

buffalo farming and bridging gaps between end users and scientists. Under this project 'CIRB-Central Institute for Research on Buffaloes' YouTube channel was launched in July 2014. The channel has received overwhelming response from internet users with more than thirty thousand subscribers and more than 80 lakh views. The amateur 'e-lessons' by the Institute scientists themselves explains the processes in very simple and easy to understand language. 91% of the views have been accessed through mobile phones indicating huge penetration of these devices among the buffalo owners. The channel has more than seventy thousand subscribers.

Buffalopedia (http://www.buffalopedia.cirb.res.in)

It is an internet accessible interactive instructional resource available free at the official website of the ICAR-Central Institute for Research on Buffaloes, Hisar (http://www.cirb.res.in). It is aimed at providing concise information on various aspects of buffalo statistics, breeds, health, reproduction, nutrition and management aspects. This web portal allows different stake holders in buffalo farming to use resources in an integrated and interactive learning manner on the internet. It presents facts, figures, demonstrations, examples, graphics and more regarding the concepts, practices and vocabulary used in buffalo husbandry in user-friendly formats. 'Buffalo e-library' is the main repository of information on various facets of buffalo husbandry, covering the broad areas of buffalo breeds, health, reproduction, nutrition, meat production and extension activities. Buffalopedia is CIRB's contribution towards the broader goal of rural upliftment through popularization of buffalo farming in the most scientific manner. It is an effort to address the need of providing comprehensive information on different aspects of buffalo rearing through ICT tools for wider access. Additionally, it will also give a platform for contributions by different stakeholders to the buffalo farming community. This computer application software is a ready to use technology which can be used by all stake holders through internet. The Buffalopedia has already got lakhs of hits since it was made online and has recorded more than 7.3 lakh visits.

Mobile based App 'ODK collect'

This is an android based smart recording tool for capturing animal related data from field and its transfer to CIRB based central bio-repository database. This collection of data will strengthen ongoing FPT Programme. The data can be immediately accessed by ICAR scientists in different locations through linking of all field units. The program has been customized at ILRI with help of CIRB scientists. Twenty netbooks loaded with complete application forms were distributed under CIRB- CGIAR collaborative

project 'Genomic selection in Murrah buffaloes' (2016-18) among the FPT field workers in three Field Units under Network Project on Buffalo Improvement during October 2018.

Modified Artificial Vagina for semen collection from bulls

At the time of semen collection, some bulls take more time to donate the semen meanwhile the temperature of artificial vagina (AV) goes down from the required temperature. In that condition, the semen collector can change the AV to get better quality of semen. Routinely semen is collected in early morning and in winter season if the environmental temperature is very low in the situation AV temperature also fall down rapidly in that condition, it helps to collector in change the AV to get better semen quality. Generally young bulls require low temperature of AV while mature bull requires high temperature of AV to donate good quality of semen. In that condition, semen collector can identify the bulls which one requires high or low temperature of AV. The temperature sensor is fixed in the AV in such a way that it does not hinder the semen collector at the time of semen collection. Further it does not hinder the washing and sterilization process of AV. This technology is available at Agrinnovate (www.agrinnovateindia.co.in) for commercialization. Intitute sold this technology to Chemtron Analytical Instruments Pvt Ltd, New Delhi on non-exclusive licence for production and sale to the users.

Field Microscope (Spermoscope)

High motile sperm in cryopreserved semen is essential for better conception rate in field condition through artificial insemination (AI). But there is no facility available to check the sperm motility of a semen dose that would be used to inseminate particular animals at the time of AI. Hence, keeping these difficulties in mind institute scientists designed a handy and portable microscope namely 'Field Microscope' of 'Spermoscope' especially for the evaluation of sperm motility in fieldcondition.This technology is available at Agrinnovate (www.agrinnovateindia.co.in) for commercialization. Intitute sold this technology to Novel Industries, Ambala Cantt, Haryana on non-exclusive licence for production and sale to the users.

Preg-D: Buffalo Pregnancy Diagnosis Kit (Urine based)

The kit is a urine based novel technique for pregnancy diagnosis in dairy animals. The kit utilizes a simple thermophilic biochemical colour reaction in urine to diagnose pregnancy. It does not require any instrumentation and results can be interpret by naked eye. The kit is a very effective alternate method for identifying non-pregnant animals in the herd. The kit can be used by the farmer himself, so very useful in rural areas where it is very difficult to have a Veterinarian for pregnancy diagnosis.

HUMAN RESOURCE DEVELOPMENT

Human resource development

Nodal Officer: Dr. Avijit Dey, Pr. Scientist

Co-Nodal Officer: Dr. Jerome A, Sr. Scientist

The objectives of human resource development programmesare to develop professional, impartial, effective and efficient DARE/ICAR personnel responsive to the needs of the farmers, citizens and other stakeholders and help in realizing organizational mandate and vision. Considering this, HRM Unit of ICAR has been set up for monitoring and implementation of ICAR HRM Policy for training and capacity building of the staff of ICAR from time to time though HRD unit set up in different ICAR institutes. The role of HRD unit at the institute level is to organize, facilitate and implement training programmes to all the employees of the institute. During the year 2021, HRD unit of ICAR-CIRB has facilitated the training of **3 Scientists, 5 Technical officers and 10 Administrative staff along with 26 Skilled Supporting Staff** of the institute.

SNo.	Employee Category / Name	Details of Training	Place and Period of Training
Scientists			
1	Dr. Sanjay Kumar, Sr. Scientist	Online training Integrating Molecular Biology and Bioinformatics for Clinical Diagnosis	LUVAS, Hisar (10-30 March, 2021)
2	Dr. Jerome A, Sr. Scientist	Online International training on Bayesian method of estimating Genomic breeding value (Online Mode)	BAIF, Pune (23-25 November, 2021)
3	Dr. Meeti Punetha, Scientist	Online Training on Transcriptomic Data Analysis	ICAR-IASRI, New Delhi (28-30 September, 2021)
Technical Officer			
1	Mr. Ram Chander, Technical officer	E-Governance for Technical Staff	ICAR-IASRI, New Delhi (06-10 September, 2021)
		Online Training on Data Visualization in Agribusiness and Agricultural Research	ICAR-NAARM, Hyderabad (22-27 Feb 2021)
2	Sh. Daljit Singh, Technical officer	To improve skills and efficiency of Technical and Skilled Supporting Staff	ICAR-CIRB, Sub-Campus, Nabha (18-20 February, 2021)
3	Sh. Mohan Singh, Technical Officer		
4	Sh. Santokh Singh, Technician		
5	Sh. Dalbara Singh, Technician		
Administrative Staff			
1	Sh. Gandhari Lal, AAO	Accrual Accounting	ICAR-NRRI, Cuttack (26-30 July, 2021)
2	Sh. Ravinder, AAO	Online Training Program cum Interactive session on Government e-Marketplace (GeM)	ICAR Headquarters, New Delhi (27 August, 2021)
3	Smt. Shammi Tyagi, SFAO		
4	Sh. Rajesh, AAO		
5	Sh. Girdhari Lal, AAO		
6	Sh. Ashok, Assistant		

SNo.	Employee Category / Name	Details of Training	Place and Period of Training
7	Smt. Shammi Tyagi, SFAO	Online Virtual Training Programmes on Accrual Accounting	ICAR-National Rice Research Institute, Cuttack, Odisha (12-14 January, 2021)
8	Sh. Ashok, Assistant	Online training GeM Training Session for Ministry of Agriculture	GeM, New Delhi (10 February, 2021)
9	Sh. Sunil, UDC		
10	Smt. Savita, LDC		
Skilled Support Staff			
1	Sh. Pooran	To improve skills and efficiency of Skilled Supporting Staff	ICAR-CIRB, Hisar (06-08 January, 2021)
2	Sh Ram Kumar		
3	Sh. Bheera		
4	Sh. Randhir Singh		
5	Sh. Jai Prakash		
6	Sh. Ram Kesh		
7	Sh. Yam Bahadur		
8	Sh. Siri Ram		
9	Sh. Subhash		
10	Sh. Rambir		
11	Sh. Jagdeep		
12	Sh. Jitender Kumar		
13	Sh. Nakchhed		
14	Sh. Radhey Shyam		
15	Sh. Sham Dev	To improve skills and efficiency of Technical and Skilled Supporting Staff	ICAR-CIRB, Sub-Campus (18-20 February, 2021)
16	Sh.Ram Anuj		
17	Sh.Rajinder Singh		
18	Sh. Raju		
19	Sh. Ram Suraj		
20	Sh. Bhim Singh		
21	Sh. Balwant Singh		
22	Sh. Brij Mohan		
23	Sh. Jaswant Singh		
24	Sh. Rulda Singh		
25	Sh. Des Raj		
26	Sh. Baljit Singh		

Important Committees

Research Advisory Committee (RAC)

The RAC meeting was held on 08th July 2021 at 10:00 AM. Dr. T.K. Datta, Director, CIRB welcomed Hon'ble Chairman and members of RAC and other invitees to the XXIV meeting of RAC. The Chairman of RAC, while welcoming all RAC members and other CIRB scientists, thanked the Director for facilitating holistic support for virtual meeting. Chairman and all the members of RAC in their opening remarks raised the issue of shortage of scientific manpower and allocation of fund to fulfill the mandate of the institute. All the members mentioned that Nili-Ravi breed needs to be popularized considering its potential for milk and meat production. It was suggested that the institute should continue to further strengthen research relating to buffalo cloning technology, breed conservation, nutritional requirements of feeds and fodder, methane mitigation, genomic selection, calf management, improvement of reproductive efficiency and dissemination of improved buffalo management practices to farmers.

Composition of RAC members

Chairman

Dr. U.K. Mishra, Ex-Vice Chancellor, Chhattisgarh Kamdhenu University, Raipur

Members

Dr. Arjava Sharma, Ex-Director, NBAGR

Dr. S.S. Kundu, Ex-Head, DCN, NDRI, Karnal

Dr. N.S.R. Sastry, Ex-Prof. NIRD Hyderabad

Dr. S.V.N. Rao, Ex-Prof. Pondicherry Veterinary College

Dr. V.K. Saxena, ADG (AP&B)

Dr. Madan Lal, Farmers' Representative

Mr. Manish Kumar, Farmers' Representative

Dr. T.K. Datta, Director, CIRB Hisar

Member Secretary

Dr. Avijit Dey, Principal Scientist

Institute Management Committee (IMC)

The 28th meeting of IMC was held on 11th June, 2019 to discuss the action taken report on 27th meeting of IMC, Publication charges, briefing the IMC about Institute research activities and others.

IMC meeting

Chairman

Dr. T.K. Datta, Director, CIRB Hisar

Member Secretary:

Administrative Officer, CIRB, Hisar

Institute Research Committee (IRC)

IRC meeting of the institute was conducted under the chairmanship of Dr. T.K. Datta. Director ICAR-C1RB during December 03 & 04, 2021. A follow up meeting to discuss few projects was conducted on February 03, 2022. Total of 35 projects from different divisions were discussed.

IRC meeting

Chairman

Dr T.K. Datta, Director, CIRB, Hisar

Member secretary

Dr. SK Khurana, In Charge, PME cell

Quinquennial Review Committee (QRT)

QRT team visit (October 07-08, 2021)

The Quinquennial Review team assembled at the institute on October 06, 2021. The very first meeting of QRT was held on 07.10.2021 for preparing the roadmap of the review process. The team members interacted with the scientists, technical officers, administrative and financial staff. QRT team visited the animal farm, modern shed (cloned animal shed), agricultural farm, semen freezing lab and bull shed and feed unit.

Visit to CIRB, Nabha

Chairman and Dr. BK Joshi, member QRT visited the sub-campus Nabha on October 09, 2021. The team interacted with staff of CIRB, Nabha. Later the team visited Nili-Ravi buffalo farm, agricultural farm, semen freezing laboratory and feed unit.

Composition of the QRT team

Chairman

Dr. P. Biswas, Ex-Vice Chancellor WBUAFS, Kolkata

Members

Dr. Kusumakar Sharma, Former ADG, ICAR, New Delhi

Dr. BK Joshi, Ex Director, NBAGR, Karnal

Dr. HK Verma, Former Director Extension, GADVASU, Ludhiana

Dr. Mahesh Chander, Joint Director (Extn), IVRI, Izatnagar

Dr. G.Dhinakar Raj, Professor & Head, TANUVAS

Member secretary

Dr. Navneet Saxena, Principal Scientist, ICAR-CIRB, Hisar

QRT meeting


अनुसूचित जाति उपयोजना
के अन्तर्गत
भैंस पालन एवं डेयरी प्रशिक्षण
17 से 20 मार्च, 2021
भाकृअनुप - केन्द्रीय भैंस अनुसंधान संस्थान, हिसार

PUBLICATIONS

Research Articles

Research Articles

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Sharma RK, SK Phulia, A Jerome, AK Balhara. (2021). Reproductive Inefficiency in Buffalo and Ameliorative Measures. In Skills for Entrepreneurship Development in Buffalo Husbandry'. Published by ICAR-CIRB, Hisar and MANAGE, Hyderabad. pp.19-26.

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Sunesh, Gurpreet, Balhara AK (2021). Bhains palan aur Krishi Shetra me soochna Kranti ka yogdaan. Published by ICAR-CIRB. pp. 97.

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Yadav S, Ashok Boora (2021). The Buffalo: Managing health problems for sustainable production, Souvenir – cum – Comp. National Symposium of ISBD on Scientific Interventions to Address Challenges for Sustainable Buffalo Production. pp. 73-78.

Patents

Application/ Patent/ Registration No.	Name of Innovation / Technology	Date of Grant/ Filing	Inventors
Granted			
2940/DEL/2013	An in vitro method for detection of post partum anestrus condition in buffaloes	05.02.2019	Rajesh Kumar, AK Balhara, M Gupta, SK Phulia, RK Sharma, Inderjeet Singh
1840/DEL/2013	BUFCOL-A complete diet for enhanced survivability and growth of neonatal buffalo calves	21.11.2019	P Sikka, D Lal, S Khanna, RK Sethi
364236	Peptide sequence and polyclonal antibodies for the detection of cow and buffalo luteinizing hormone	09.04.2021	Varij Nayan, Sunnel Kumar Onteru, Dheer Singh
Filed			
1451/DEL/2015	Kalrump Scale - A device to measure Buffalo rump angularity for identification of dairy characters	07.01.2017	SN Kala
201711039431	Process for improving riverine buffalo sperm viability and uses thereof	06.11.2017	Ravindra Kumar, Jerome A, Pradeep Kumar, Monika Saini, Dharmendra Kumar, RK Sharma, Inderjeet Singh
201711046302	Composite feed additive for reducing methane emission and improving fibre utilization in ruminants	22.12.2017	Avijit Dey, SS Paul, SS Dahiya, AK Balhara, Jerome A, BS Punia and YM Chanu
202011013074	Urine based pregnancy detection method for ruminant livestock animals.	25.03.2020	AK Balhara, Suman, Archana, Rajesh Kumar, Mayukh Ghosh, SK Phulia, RK Sharma, P Sikka, Sunesh Balhara, Sudershan Kumar, AK Mohanty, Inderjeet Singh, SS Dahiya

EVENTS

Azadi Ka Amrit Mahostav

Events organised under Azadi Ka Amrit Mahostav during 2021

S. No	Event Details	Date	No. of participants
1.	Farmer's awareness campaign on balanced use of fertilizers / Scientist of CIRB	18 June, 2021	977
2.	Officer-like Qualities and Personality development / Dr. KP Singh, IPS, Former DGP Haryana	01 July, 2021	34
3.	World zoonosis day, [Lecture delivered by Dr. Rajesh Khurana on Milk Borne diseases affecting human beings. Chairman Dr. Yash Pal, Co-chairperson Dr. Sushila Maan, President Dr. TK Datta]	06 July, 2021	50
4.	E-Symposium on 'Sustainable buffalo production through integration of reproduction, nutrition, health and knowledge dissemination' on was organized by Dr. PS Yadav, Dr. Dharmendra Kumar, Dr. Sunesh Balhara, Dr. Meeti Punetha	07 July, 2021	100
5.	Lecture on Large Animal Model: Status of Cloning and Gene Editing" by Prof. Dr. Heiner Niemann Professor, Hannover Medical School, a leading biomedical research institute, Germany	30 July, 2021	246
6.	Lecture on Pregnancy Associated Glycoproteins and their Use as Markers of Pregnancy in Ruminants by Dr. JA Green Associate Professor Division of Animal Science, University of Missouri, USA [Organised by Dr. PS Yadav, Dr. Dharmendra Kumar, Dr. Meeti Punetha]	26 August, 2021	98
7.	International Year of Millets 2023 Campaign on Nutri-Garden and Tree Plantation on to commemorate the 71st birthday of Honourable Prime Minister Sh. Narender Modi Ji. The occasion was graced by the presence of Dr. SL Goswami, EX-Director, NAARM and Vice Chancellor. Plant saplings were distributed among the lady farmers and the male farmers to plant	17 September, 2021	100

Awarenes program on benefits of Millets

S. No	Event Details	Date	No. of participants
8.	Online interface with Farmers/stakeholders for release of 35 new crop varieties By Honorable Prime Minister	28 September, 2021	100
9.	Lecture on Probiotic food for nourishment and health on the occasion of World Food Day by Dr. Anju Kumari, Assistant Director, DHRM, CCSHAU, Hisar	16 October, 2021	35
10.	Sensitization of students on Higher education in Agriculture and Swachhata	28 October, 2021	80
11.	Agriculture and Environment: The citizen Face at Govt. Girls Senior Sec. School, at Nahla Village, Fatehabad	26 November, 2021	100
12.	World Soil Day 2021 by Dr. AK Boora	05 December, 2021	41
13.	Online interface for natural farming presided by Hon. PM Shri Narendra Modi	16 December, 2021	88
14.	Swachhta Pakhwada, 2021	16-31 December, 2021	-
15.	Four Training program on Reproduction in Dairy Species in Collaboration with Haryana Veterinary Training Institute, Hisar for Haryana field veterinary officers on "Reproductive Management in Buffaloes: Therapeutic Interventions for Early Calving"	05 July, 2021 to 09 July, 2021 Batch 856	22
		12 July, 2021 to 16 July, 2021 Batch 857	19
		19 July, 2021 to 23 July, 2021 Batch 858	20
		26 July, 2021 to 30 July, 2021 Batch 859	18

Special events organized

Virtual meeting was organized with Director of Research and other representative of SDAU, Sardar Krushinagar on 22 May, 2021 to discuss the feasibility of initiating a PT plan for Banni Buffaloes.	Dr. Anurag Bharadwaj
Organized four-monthly Review Meeting of Network Project on Buffalo Improvement held on 12 July 2021, through Zoom online mode at ICAR-CIRB, Hisar.	Dr. Anurag Bharadwaj Dr. Sanjay Kumar Dr. Jerome A Dr. Ram Chander
Visited Bhadawari centre at IGFRI Jhansi on 26-27 Nov, 2021 and reviewed the progress of unit at IGFRI and activities in the field at Orchha district.	Dr. Anurag Bharadwaj
Coordinated academic activity of CIRB as academic coordinator.	Dr. Sanjay Kumar
Organised International Year of Millets-2023 campaign on Nutrigarden and tree plantation on 17 september, 2021 at Nyoli kalan, Hisar	Dr. Sunesh Balhara Dr. Sajjan Singh

ICAR-CIRB Journal Club Lecture Series organized (Coordinator: Dr. Varij Nayan)

Lecture # 1: Making of an embryo: All that glitters is not gold! (Speaker: Dr. T.K. Datta, Director, CIRB, Hisar); Link: https://anyflip.com/jnktd/iebt	27 February, 2021
Lecture # 2: Bull fertility prediction: How close we are? (Speaker: Dr. A. Kumaresan, Principal Scientist, ICAR-NDRI, Karnal, SRS Campus, Bengaluru); Link: https://anyflip.com/jnktd/klnh/	12 March, 2021
Lecture #3: Science, technology & innovation: Impact of education skills and work with human interface (Dr. P.S. Yadav, Principal Scientist, ICAR-CIRB, Hisar); Link: https://anyflip.com/jnktd/npkw/	26 March, 2021

Conferences/ workshops/meetings

Lecture # 4: Bhadawari: The buffalo known for high milk fat (Speaker: Dr. B.P. Kushwaha, Principal Scientist, CIRB, Hisar); Link: https://anyflip.com/jnktd/ziyt/	09 April, 2021
Lecture # 5: Data-driven dairy production system: Smart Dairy Farming (Speaker: Dr.T.K.Mohanty, Principal Scientist, ICAR-NDRI, Karnal ;; Link: https://anyflip.com/jnktd/cfrz/	23 April, 2021

Participation in conferences/ workshops/meetings

Event Attended	Name of Scientist
ISSRF International Conference on Challenges and Strategies in Reproductive and Environmental Health with Special Reference to COVID-19 (19-21 February, 2021) New Delhi.	Dr. Jerome A
International E-Symposium 'Harnessing the potentials of genome editing tools to augment the productivity and health of farm animals' organized by ICAR-NDRI, Karnal [19 & 20 July, 2021].	
International Webinar on 'Large Animal Model: Status of Cloning and Gene Editing' organized by ICAR-CIRB, Hisar [30 July, 2021].	Dr. Jerome A Dr. PS Yadav Dr. Dharmendra Kumar Dr. RK Sharma Dr. Meeti Punetha
National Symposium on Physiological Interventions for the augmentation of sustainable animal Production, APACON2021, DUVASU, Mathura [24-25 September, 2021].	Dr. Jerome A Dr. Meeti Punetha
International ISSAR conference 'Novel Knowledge, Innovative practices and Research in Theriogenology' at CVAS, Mannuthy, Kerala [27-29 December, 2021]	Dr. Jerome A
10th Asian Buffalo Congress 'Buffalo production for food security and livelihood' jointly organized by Asian Buffalo Association (ABA) and Agriculture and Forestry University, Rampur, Chitwan, Nepal during October 25-29, 2021	Dr. AK Balhara Dr. Dharmendra Kumar Dr. Gururaj Dr. Avijit Dey Dr. Sanjay Kumar
National Symposium on 'Scientific interventions to address challenges for sustainable buffalo production' jointly organized by ISBD and GADVASU, Ludhiana during December 10-11, 2021	Dr. RK Sharma Dr. AK Balhara Dr. Dharmendra Kumar Dr. Ashok Boora
National e-conference on "Igniting young minds for sustainable growth through entrepreneurship and skill development: A Vets' vision" organised under Institutional Development Plan (IDP) Cell, Guru Angad Dev Veterinary and Animal Sciences University (GADVASU), Ludhiana during March 01-05, 2021	Dr. AK Balhara
E-Symposium on 'Sustainable buffalo production through integration of reproduction, nutrition, health and knowledge dissemination' Online.	Dr. RK Sharma Dr. SK Khurana Dr. Avijit Dey Dr. Dharmendra Kumar Dr. Gururaj Dr. Meeti Punetha
International Webinar on 'Pregnancy associated glycoproteins and their use as markers of pregnancy in ruminants'	Dr. RK Sharma Dr. Dharmendra Kumar Dr. PS Yadav Dr. Meeti Punetha

Visit of Dr. BN Tripathi, DDG (AS) to ICAR-CIRB

Event Attended	Name of Scientist
Presentation on Genome Editing technology on AICTE Training And Learning (ATAL) Academy Online Elementary FDP on "Gene and Genome Technology for Biologists" from 22.11.2021 to 26.11.2021 at Bihar Animal Sciences University.	Dr. Meeti Punetha
Participated and presented in the technical review meeting workshop/meeting chaired by DDG(AS) ICAR of Network Project on " Agricultural Bioinformatics and Computational Biology" under CABin Scheme on November 09, 2021.	Dr. Varij Nayan
Participated in Bill and Melinda Gates Foundation (BMGF) Annual Review Committee Meeting held on 17th July,2021	
Webinar on "Management of peripartum complications in bovines" by Dr. R. Ezakial Napolean, TANUVAS Nanakkal TN on 30.08.2021.	Dr. RK Sharma
Impact of oxidative stress on male and female reproduction' Organized by NDRI on 01.07.21. Speaker Dr. Robert John Aitken, Australia.	
Common Milk born disease affecting human beings' Organized by ICAR-CIRB, Hisar on world zoonosis day on 06.07.21. Speaker Dr. Rajesh Khurana.	
Corona viruses: Burgeoning and enduring threats' organized by ICAR on 14.07.21. Speaker: Dr. BN Tripathi, DDG, Anim. Sci	
'Bovine Endometritis' Organized by IMV on 05.10.21. Speaker: Giovanni Gnemmi, Spain	
'Probiotic food for nourishment and health' organized by CIRB on World Food Day on 16.10.21. Speaker: Dr. Anju Kumari, CCSHAU Hisar.	Dr. RK Sharma
Participated in XV Agricultural Science Congress on Energy and Agriculture; Challenges in 21st Century BHU, Varanasi(Virtual mode) (13-16 November, 2021)	Dr. Gururaj
Attended "Virtual Training on "Implementation and Use of Agricultural Research Management System (ARMS)" on 08 June 2021.	Dr. SK Khurana
Online training programme on "*Training for Technical Committee Members*" organized by BIS, New Delhi from Jan 07-08, 2021.	Dr. Avijit Dey Dr. Vishal Mugdal
"Centennial Symposium of Animal Nutrition Association" organized jointly by Animal Nutrition Association India and Animal Nutrition Division, IVRI, Izatnagar from March 11-12, 2021	Dr. Avijit Dey Dr. Vishal Mugdal
Online International Webinar on "Colonization and establishment of rumen microbiota – opportunities to influence the livestock productivity" organized by Animal Nutrition Division of ICAR-NDRI, Karnal on July 20, 2021.	Dr. Vishal Mugdal
Online meeting on data capture module and demonstration of Sire-Dam Software developed by IASRI, for use in all centers under NPBI on 08 April, 2021	Dr. Anurag Bharadwaj
Online meeting to discuss the feasibility of initiating a Progeny Testing plan for Banni Buffaloes on 22 May, 2021.	Dr. Anurag Bharadwaj Dr. Sanjay Kumar

Event Attended	Name of Scientist
Preliminary selection of 20th Set of Murrah test bulls of CIRB and LUVAS under NPBI on 21 June, 2021.	Dr. Anurag Bharadwaj
4MRM of Network Project on Buffalo Improvement, ICAR-CIRB Hisar on12 July, 2021	
Meeting with VC and Pis of Murrah and Nili-Ravi GADVASU centre under NPBI at Ludhiana on 23 July, 2021.	
Preliminary selection of 20th Set of Murrah test bulls at NDRI under Network Project on Buffalo Improvement on 24 July, 2021.	
9th Meeting of Breed Registration Committee under the Chairmanship of Dr. B.N. Tripathi, Deputy Director General (AS) on 16 August, 2021.	
Online meeting of NPBI (Coordinating Centre, Hisar) for assigning responsibilities in monitoring NPBI Centres on 11 June and 18 November 2021	
Online meeting NPBI for re-induction of Centre on Pandharpuri Buffalo under NPBI at ZARS, Kolhapur.	Dr. Sanjay Kumar
Paper presented on 'Intelligent modelling for prediction of peak milk yield based on linear traits of buffalo using machine algorithms in 10th Asian buffalo congress held during 25th Oct.to 29th ,20021 at Nepal in virtual mode.	Dr. Sunesh Balhara
Paper presented on 'Use of artificial intelligence in peak yield prediction for buffalo selection' in National Symposium on Scientific Interventions to address challenges for sustainable Buffalo Production held during 10-11Dec,2021 at Ludhiana.	

Independence day celebration (15th August)

Constitution day celebration (26th November)

Vigilance awareness week celebration (31st October to 6th November)

Hindi week celebration (14th to 21st September)

World food day celebration (16th October)

Swacchta pakhwada (16th to 31st December)

Plantation drive

CIRB among farmers

Trainings

S. No.	Name of the training	Date	No of participants	Coordinators
1	21 days training program on dairy entrepreneurship development	08 – 28 March, 2021	25	Dr. Sajjan Singh Dr. Gururaj M
2	Improved buffalo husbandry practices	16 – 19 March, 2021	25	Dr. Ram Singh Dr. Gururaj M
3	Scientific Buffalo husbandry practices	21-27 August 2021	48	Dr. VB Dixit Dr. Sarita Yadav Dr. Gururaj M Dr. ML Sharma
4	Improved buffalo husbandry practices	18-24 September, 2021	22	Dr. RK Sharma Dr. SK Khurana Dr. Sunesh Balhara Dr. ML Sharma
5	Scientific Buffalo husbandry practices	21 - 27 October, 2021	20	Dr. PC Lailer Dr. V Nayan Dr. Ashok Kumar Boora Dr. ML Sharma
6	Improved buffalo husbandry practices	20-26 November, 2021	21	Dr. PS Yadav Dr. AK Balhara Dr. Jerome A Dr. ML Sharma
7	Hands on training Infrared Thermal imaging applications in animal health and welfare assessment	13-24 December 2021	15	Dr. AK Balhara
8	SCSP programme on "Scientific buffalo farming"	10-16 December, 2021	30	Dr. Sajjan Singh Dr. A Dey Dr. Sanjay Kumar Dr. Gururaj M
9	Organized Training program on 'Skills for Entrepreneurship Development in Buffalo Husbandry' along with MANAGE, Hyderabad	24-27 August 2021		Dr. TK Datta Dr. Shahaji Phand Dr. A Dey Dr. Jerome A Dr. Meeti Punetha
10	In-House Training Program 'To improve the Skill and Efficiency of Skilled Supporting Staff	06 - 08 January 2021		Dr. A Dey Dr. Jerome A

Kisan Gosthis

S. No.	Kisan gosthi title	Venue	Date	No of participants	Coordinators
1	Foundation cum Kisan Gosthi	CIRB, Hisar	01 February 2021	150	Dr. VB Dixit Dr. PC Lailer Dr. A Bharadwaj Dr. RK Sharma
2.	Fertility camp cum Kisan Gosthi (133 animals were treated in the health camp)	Rajgarh (MGMG village)	20 June, 2021	21	Dr. FC Tuteja Dr. MH Jan

Dairy entrepreneurship training program

S. No.	Kisan gosthi title	Venue	Date	No of participants	Coordinators
3.	Fertility camp cum Kisan Gosthi (133 animals were treated in the health camp)	Rajgarh (MGMG village)	23 June, 2021	26	Dr. FC Tuteja Dr. MH Jan
4.	One Health - Kisan Gosthi - Animal Health camp organised at	Kidoli Parhladpur (Sonepat)	30 August, 2021		Dr. AK Boora
5.	Role of balanced feeding in profitability of the buffalo farming	Badi Nyangal, Rajasthan	30 October, 2021	60	Dr. Vishal Mudgal Dr. N Saxena

Demonstrations

S. No.	Demonstration	Venue	Date	Number of participants	Co-ordinators
1	Preg-D kit	NRC Mithun	22 March, 2021	4	Dr. AK Balhara Dr. SK Phulia
2.	Ration balancing	Badi Nyangal, Rajasthan	30 October, 2021	30	Dr. Navneet Saxena Dr. Vishal Mudgal
2	Mastitis detection	CIRB, Hisar	16 December, 2021	26	Dr. Gururaj M and Dr. Meeti Punetha
3	Balanced feeding	CIRB, Hisar	17 December, 2021	22	Dr. Gururaj M and Dr. Meeti Punetha

Farmers interface meeting organised

S. No	Particular	Venue	Date	Number of participants	Coordinators
1	One health	Chani Badi, Dhani of Moda Kheda, Biran, Rajasthan	14 October, 2021	17	Dr. Ashok Kumar Boora Dr. Sarita Yadav
2.	Kisan diwas: Interaction with Horticulture Farmers	Date palm orchard, Ninan	23 December, 2021	25	Dr. AK Boora
3.	Kisan Sanvad	Nuri farm, Rajasthan	27 December, 2021	36	Dr. Ashok Kumar Boora Dr. Sarita Yadav

Recognition and Awards

Recognition and Awards

Awards/ Recognitions	Name of Scientist
Membership, National Academy of Veterinary Sciences	Dr. Jerome A Dr. Vishal Mugdal
Reviewer Excellent Award – Agricultural Science Digest Journal	Dr. Jerome A
Co-Chaired in Bovine Gynaecology and Obstetrics Session in International Symposium 'Novel Knowledge, Innovative practices and Research in Theriogenology' at CVAS, Mannuthy, Kerala [27-29 Dec. 2021].	
Team Award 2021 for their commendable contribution in buffalo research and development from ISBD on 10th December, 2021.	Dr. PS Yadav Dr. Dharmendra Kumar Dr. RK Sharma Dr. AK Balhara
Listed in India Book of Record 2021 for 'Maximum Buffalo Clones Produced'.	Dr. PS Yadav Dr. Dharmendra Kumar Dr. RK Sharma
Certificate of Appreciation by Director ICAR-CIRB, Hisar for outstanding performance and significant contribution in research in buffalo cloning.	
Associate Fellow of National Academy of Dairy Science, India from January 01, 2021.	Dr. Dharmendra Kumar
Elected as Treasurer, Indian Society for Buffalo Development (ISBD) since 10.12.2021	
General Secretary, Staff Club of CIRB, Hisar w.e.f 15.04.2019- continuing	
Editorial Board Member: Current Stem Cell Research and Therapy Journal w.e.f. 17.09.2020- continuing	
Serving as associate editor of journal 'Animal Reproduction Update' from August 2021.	
Jawaharlal Nehru Award for P.G. Outstanding Doctoral Thesis Research in Agricultural and Allied Sciences (2020) by ICAR on 16-07-2021	Dr. Meeti Punetha
Young Scientist award via Animal Physiologist Association (2021)	
APA Best Thesis by Animal Physiologist Association (2021)	
Cultural Secretary, Staff Club of CIRB, Hisar	
Distinguished Scientist Award" by the Society for Bioinformatics and Biological Sciences (SBBS)	Dr. Varij Nayan
"Certified Publons Academy Mentor" by Publons (Clarivate Analytics)	
Reviewer to "Biosensors and Bioelectronics" (IF: 12.545), "Environmental Science: Nano" (IF: 9.473), "Comparative Biochemistry and Physiology Part C: Toxicology & Pharmacology" (IF: 4.52)	
Reviewer Excellence Award" by Indian Journal of Animal Research	
Editor, Journal of Advanced Veterinary and Animal Research (eISSN 2311-7710); Journal of Applied Biology and Biotechnology (ISSN: 2455-7005); European Scientific Journal (ISSN: 1857-7881)	
Young Researcher Award" by the Institute of Scholars	

Prime minister interaction with farmers

Awards/ Recognitions	Name of Scientist
Team Award-2021 on Pregnancy Diagnosis work by ISBD	Dr. SK Phulia
"SBER Fellow- 2021" for outstanding contribution in the field of animal nutrition and feed technology by 'Society for Biotic and Environmental Research'.	Dr. Avijit Dey
Received Award of 3rd position in the Emerging Scientist Category by the student in the "Centennial Symposium of Animal Nutrition Association" during March 11-12, 2021 for the research paper "Rumen-balanced Feed Additive Reduces Methane production with Enhanced Immunity and Milk Production in Murrah Buffaloes (Bubalus bubalis)" authored by Attri, K., Dey, A. Paul, S.S. and Dahiya, S.S.	
"Best Presentation Award" in the student category in the "National Symposium of ISBD" during Dec 10-11, 2021 for the research paper "Reducing environmental impact of methane production from Murrah buffalo (Bubalus bubalis) and improvement in rumen functions, ruminal biohydrogenation of fatty acids through Garlic (Allium sativum) essential oil supplementation" authored by Singh, R.K., Dey, A., Thakur, S., Singh, M., Lailer, P.C. and Dahiya, S.S. at GADVASU, Ludhiana.	

Distinguished Visitors

Name of Visitor	Organisation	Date
Dr. Priyanka Soni, IAS	Deputy Commissioner, Hisar	27 August, 2021
Mr Sanjiv Kumar, IAS	DARE/ICAR	06 December, 2021
BRG. S.S. Balaje	Commandant EBS, Hisar	24 December, 2021

Visit of DC, Hisar to ICAR-CIRB

Vist of Sh. JP Dalal, MIC, Agri. & A.H, Govt. of Haryana

RESEARCH AT CIRB

Research Projects

Ongoing Projects

Title	PI	Co-PIs	Duration
Animal Nutrition & Feed Technology			
Development and supplementation of nano-minerals in buffalo	V Mudgal	N Saxena, SS Dahiya	Sep. 2017 – Dec. 2022
Molecular analysis of methanogenic archaeal diversity in rumen of Murrah buffaloes fed different diets	S Yadav	SS Dahiya, PC Lailer, A Dey, A Boora, SK Khurana	Dec. 2019 – Dec. 2022
In vitro evaluation of efficacy of certain aflatoxin detoxifying agents	R Singh	--	Jan. 2019 – Dec. 2021
Diversified uses of Azolla (Div. of Microbiology, IARI Project Code: (IARI: CRSCIARISIL2014030262)	IARI: G Abraham P Jaiswal	CIRB: V Mudgal, SS Dahiya	May 2018 – Sept. 2021
Evaluation of Quality Protein Maize in the ration of Buffaloes.	V Mudgal	N Saxena, SS Dahiya	Sept. 2020 – Mar. 2022
Evaluation of feed additives on growth rate, nutrient utilization and methane production in buffalo calves.	A Dey	PC Lailer, Jerome A, SS Dahiya Putan Singh, A K Verma (IVRI)	Jul. 2020 – Aug. 2021
Animal Genetics Breeding/ Production Diseases/ Management/ Extension activities			
Genetic improvement of Murrah buffaloes (Network project CIRB, Hisar Centre)	A Bharadwaj	P Kumar, RK Sharma, SK Phulia, Sanjay Kumar, AKS Tomar	Jul. 1993 – Contd
Genetic improvement of Nili Ravi buffaloes (Network project, CIRB Sub-Campus Nabha Centre)	FC Tuteja	MH Jan, R Mehta	Jul. 2001 – Contd
Performance evaluation and improvement of Bhadawari buffaloes (IGFRI centre)	BP Kushwaha	IGFRI: Sultan Singh, Deepak Upadhyay	Apr. 2001 – Contd.
Progeny testing of bulls under field conditions (FPT) (CIRB Hisar)	A Bharadwaj	VB Dixit, Sanjay Kumar	Apr. 2001 – Contd
Development of Soft Computing Tool for Dairy Buffalo Selection	S Balhara	AK Balhara, SK Phulia, Naresh Kumar	Apr. 2021 – Mar. 2023
Environmental Mastitis in Buffaloes: Challenges and Management	Ashok Boora	Sarita Yadav	May 2021 – May 2023
Role of bacterial pathogens in subclinical mastitis in buffaloes	SK Khurana	Sanjay Kumar	Apr. 2021 – Mar. 2023

Title	PI	Co-PIs	Duration
Development of web tool for real-time field data collection and analysis for improved buffalo productivity and breeding management	Sunesh Balhara	Sanjay Kumar, A Bharadwaj, Vikash Vohra (NDRI), Puneet Malhotra (GADVASU), TK Datta, UB Angadi (IASRI), Mir Asif Iquebal (IASRI), Sarika (IASRI), Dinesh Kumar (IASRI)	Apr. 2021 – Mar. 2023
National Agricultural Innovation Fund (Institute Technology Management Unit (ITMU)	SK Khurana	-	Apr. 2008 – Contd.
Diversified farming through livestock and agriculture –Farmer First Programme	S Yadav	A Boora, PC Lailer, S Singh, Bharat Singh (HAU), Manjeet Singh (IARI), A Kumar (IASRI), Sukanta Dash (IASRI), Mukesh Kumar (CIAH), Ramesh (CIAH), Hanuman Chaudhary (CIAH), JS Gora (CIAH), SR Meena (CIAH)	Feb. 2016 – Mar. 2022
Economic analysis of milk supply chain in buffalo production system	Gururaj Makarabbi	VB Dixit, PC Lailer, Meeti Punetha, FC Tuteja	Feb. 2021 – Jan. 2023
Animal Physiology & Reproduction			
Buffalo sperm dosages in relation to its functional parameters and field fertility outcome	Sajjan Singh	P Kumar, Jerome A, RK Sharma	Mar. 2018 – Apr. 2022
Reproductive performance of Murrah buffaloes in relation to milk production	SK Phulia	RK Sharma, AK Balhara, A Bhardawaj, Sunesh Balhara	Feb. 2020 – Jan. 2023
Development of early pregnancy diagnostic assay through discovery of biomarkers in cattle and buffalo (DBT)	AK Balhara	Varij Nayan, SK Phulia	Jun. 2018 – May 2021
Testing and validation of pregnancy diagnosis kit (PregD) in Mithun	AK Balhara	SK Phulia, RK Sharma	Nov. 2020 – Oct. 2022
Molecular markers for improving reproduction of cattle and buffaloes (BMGF)- CIRB Centre (Lead Centre- NDRI, Karnal)	V Nayan	TK Datta, RK Sharma, A Bharadwaj, Rajesh Kumar	Jul. 2018 – Jul. 2023

Title	PI	Co-PIs	Duration
Production of multiple copies of elite buffalo bulls using animal cloning technology (NASF) – Lead Centre	PS Yadav	D Kumar, RK Sharma, P Kumar, Rajesh Kumar	Apr. 2018 – Mar. 2022
Production of double-muscled mass farm animals through CRISPR (NASF funded)	D Kumar	PS Yadav, RK Sharma, Meeti Punetha, Rajesh	Nov. 2020 – Oct. 2023
Nutritional and physiological interventions for enhancing reproductive performance in animals (AICRP)	RK Sharma	SK Phulia, V Mudgal, Jerome A, P Kumar	Apr. 2020 – Mar. 2025
Network Project on Agricultural Bioinformatics and Computational Biology Under Cabin Scheme Title: Immunoreagent design, drug discovery and -omics approaches for buffalo production and reproduction	Lead Centre CCPI: V Nayan IASRI: MA Iquebal	CIRB: A Bharadwaj (NRCE) SK Phulia, Rajesh Kumar IASRI: Ratna Prabha	Jul. 2020 – Jun. 2025
Investigating molecular basis of seasonal variation on seminal attributes for identification of probable biomarkers of semen quality in buffaloes (DBT funded multi-institutional project)	Pradeep Kumar (Lead centre-NDRI, Karnal)	Dharmendra Kumar, Jerome A	Sept. 2020 – Aug. 2023
Deciphering the functional role of OCT4 during buffalo embryogenesis using CRISPR/Cas9	Meeti Punetha	PS Yadav, Dharmendra Kumar, Naresh L Selokar, Gururaj Makarabbi	Feb. 2021 – Jan. 2023
Fertility of Nili-Ravi buffaloes in relation to lactation, metabolic and environmental stressors.	MH Jan	FC Tuteja, RK Sharma, SK Phulia	Feb. 2021 – Jan. 2023
Viral diseases affecting reproductive and productive performance of buffaloes	Sarita Yadav	Ashok Boora	Feb. 2021 – Jan. 2022
Metabolomic profiling of spent media of embryo culture using mass spectral analysis- Pilot Study	Navneet Saxena	PS Yadav, D Kumar, Meeti Punetha, Naresh Selokar (NDRI)	Feb. 2021 – Jan. 2022
CRP on Agro-bioderversity (NBAGR funded): culture, characterization and cryopreservation of somatic cells of different breeds of buffalo	Meeti Punetha	PS Yadav, D Kumar	Sept. 2021 – Aug. 2026

Students Research at CIRB

Completed Research (in 2021)

Name of the scholar	Degree	Subject/ Discipline	University	Year	Advisor Major/ Co-Major	Title of the thesis
Rajesh Kumar	Ph.D.	Veterinary Gynaecology and Obstetrics	LUVAS, Hisar	2018-22	Dr. RK Sharma	Hormonal interventions for improving post-partum fertility in Murrah Buffaloes
M. Naveen Swaroop	Ph.D.	Animal Biochemistry	NDRI, Karnal	2019-21	Dr. Varij Nayan	Prognostic blood miRNAs and lncRNAs during estrous cycle of buffalo
Pushpanjali Singh	M.Sc.	Animal Biochemistry	NDRI, Karnal	2020-21	Dr. Varij Nayan	Serum metabolites and minerals profile during buffalo estrous cycle
Vineichuno kuotsu	M.Tech.	Animal Biotechnology	NDRI, Karnal	2020-21	Dr. Naresh Selokar	Epigenetic status of skin derived somatic cells of buffalo clones.

Ongoing Research (during 2021)

Name of the scholar	Degree	Subject/ Discipline	University	Year	Advisor Major/ Co-Major	Title of the thesis
Krishan Kumar	Ph.D.	Vety. Physiology	LUVAS, Hisar	2019-till date	Dr. Ashok K Balhara	Comparative studies on urinary metabolites and scrotal thermal signatures in normal and cloned Murrah buffalo bulls
Ram Kumar Singh	Ph.D.	Animal Nutrition	NDRI, Karnal	2018-22	Dr. A Dey	Modulation of buffalo milk conjugated linoleic acid content through dietary supplementation of plant secondary metabolites.
Satish Kumar	Ph.D.	Veterinary Gynaecology and Obstetrics	RAJUVAS, Bikaner	2021-22	Dr. RK Sharma	Studies on semen production variables and cryopreservation using buffalo specific semen extender in Murrah bulls
Kamlesh K. Bajwa	Ph.D.	Animal Biotechnology	NDRI, Karnal	2019 till date	Dr. Naresh Selokar	CRISPR-based manipulation of the CD18 in cultured fibroblast cells of buffalo (Bubalis bubalis)
Devender Kumar	Ph.D.	Veterinary Gynaecology and Obstetrics	RAJUVAS, Bikaner	2021-22	Dr. A Jerome	Seasonal variation in semen functional and biochemical attributes in buffalo bulls
Subham Thakur	Ph.D.	Animal Nutrition	LUVAS, Hisar	2019 till date	Dr. A Dey	Effect of dietary malic acid protected protein supplementation on growth performance, nutrient utilization and methane emission in Murrah buffalo calves

Name of the scholar	Degree	Subject/ Discipline	University	Year	Advisor Major/ Co-Major	Title of the thesis
Akanksha Gupta	Ph.D.	Animal Physiology	NDRI, Karnal	2021-till date	Dr. PS Yadav	Studies on hair cortisol, testosterone and fertility biomarkers in buffalo bulls
Swati Thakur	Ph.D.	Animal Physiology	LUVAS Hisar	2021-till date	Dr. PS Yadav	To study the role of major histocompatibility class (MHC) I in buffalo cloned embryos to enhance success rate of pregnancies
Prashant Kumar	Ph.D.	Animal Biochemistry	NDRI, Karnal	2020-till date	Dr. Varij Nayan	Silver and silica nanoparticles effects on steroidogenic and apoptotic pathway genes expression in cultured buffalo granulosa cells
Maninder Sharma	M.Sc.	Animal Biotechnology	NDRI, Karnal	2021-till date	Dr. Dharmendra Kumar	Role of mitochondria-targeted antioxidant on buffalo oocytes maturation and embryonic development of cloned Embryo
Renu Choudhary	M.V.Sc	Animal Biochemistry	LUVAS Hisar	2021-till date	Ashok Balhara	Studies on urinary and blood pregnediol glucoronide and p-parcresol levels in female buffaloes
Shipra Chauhan	M.Sc.	Animal Biochemistry	NDRI, Karnal	2021-till date	Dr. Varij Nayan	In silico identification and characterization of buffalo TLR4 and HSP70 Epitope peptides
Usha Yadav	M.V.Sc.	Veterinary Gynaecology & Obstetrics	LUVAS Hisar	2021-till date	Dr. Pradeep Kumar	Influence of antibiotic substitutes on bacterial load and semen quality of buffalo bulls
Sujata	M.V.Sc	Veterinary Gynaecology & Obstetrics	LUVAS Hisar	2021-till date	Dr. Dharmendra Kumar	Effect of lipopolysaccharide on in vitro developmental competence of buffalo oocytes
Krishna Nand Bansal	M.V.Sc	Veterinary Gynaecology & Obstetrics	LUVAS Hisar	2021-till date	Dr. Pradeep Kumar	Estimation of lower threshold of sperm concentration and evaluation of semen quality parameters

PERSONNEL

ICAR-CIRB Personnel

General Administration

Dr. Tirtha Kumar Datta	Director
Sh. Ravinder	Administrative Officer
Dr. Sanjay Kumar	Head of Office (w.e.f. 13.10.2021)
Smt. Shammi Tyagi	Fin. & Accounts Officer
Sh. Narender Kumar	Asst Adm. Officer
Sh. Rajesh Kumar	Asst Adm. Officer
Sh. Girdhari Lal	Asst Adm. Officer
Sh. Viksit Kumar	Assistant
Sh. Abdul Majid	Assistant
Sh. Ashok Kumar	Assistant
Smt. Indira Devi	Assistant
Sh. Satbir Singh	Upper Div. Clerk
Sh. Dharam Pal	Upper Div. Clerk
Sh. Sunil Kumar	Upper Div. Clerk
Sh. Mahabir Singh	Upper Div. Clerk
Smt. Savita	Lower Div. Clerk
Sh. Rajbir Singh	Lower Div. Clerk
Sh. Radhey Krishan	Lower Div. Clerk

Sub- Campus, Nabha, Patiala

Dr. F C Tuteja	Sr. Scientist & Officer In-charge
Dr. Mustafa Hasan Jan	Scientist
Sh. Jagdish Prasad	Chief Tech. Officer
Sh. Rajiv Mehta	Chief Tech. Officer
Sh. RS Pippal	Asst. Chief Tech. Officer
Dr. AK Saini	Senior Tech. Officer
Sh. Daljit Singh	Tech. Officer
Sh. Mohan Singh	Tech. Officer
Sh. Tejinder Singh	Upper Div. Clerk
Sh. Jaspal Singh	Lower Div. Clerk

Transfer of Technology and Entrepreneurship (TOTE) Unit

Dr. VB Dixit	Principal Scientist & In-charge
Dr. Navneet Saxena	Principal Scientist
Dr. Gururaj M	Scientist
Dr. ML Sharma	Asst. Chief Tech. Officer

Priority Setting, Monitoring and Evaluation (PME) Cell

Dr. SK Khurana	Principal Scientist
Dr. FC Tuteja	Senior Scientist
Dr. AK Balhara	Senior Scientist
Dr. Dharmendra Kumar	Senior Scientist
Dr. Jerome A.	Scientist
Sh. Raj Kumar	Asst. Chief Tech. Officer

Agricultural Knowledge Management Unit (AKMU)

Smt. Sunesh Balhara	Scientist & In-charge
Sh. Raj Kumar	Asst. Chief Tech. Officer

Human Resource Development (HRD) Cell

Dr. A. Dey	Principal Scientist, Nodal Officer
Dr. Jerome A.	Scientist, Co- Nodal Officer

Public Relations Officer (PRO)

Dr. Sajjan Singh	Principal Scientist

Academic Coordinator

Dr. Sanjay Kumar	Senior Scientist

Estate Section and Electrical Section

Dr. A Bharadwaj	Over all In-charge
Sh. B P Singh	CTO In-charge, Estate
Sh. Rajesh Prakash	ACTO In-charge, Electrical
Sr. Anil Kumar	Technician

Workshop Section

Sh. Surender Singh	Overall In-charge
Sh. Kuldeep Singh	Tech. Officer & In-charge
Sh. Bhim Raj	Tech. Officer
Sh. Sant Lal	Tech. Officer
Sh. Satpal	Tech. Officer
Sh. Ram Kumar	Senior Tech. Assist.

Landscape Section

Sh. AKS Tomar	ACTO & In-charge

Network Project on Buffalo Improvement (NPBI)

Dr. Tirtha Kumar Datta	Project Coordinator (B)
Dr. Dr. A Bharadwaj	Principal Scientist & In-charge
Dr. BP Kushwaha	Principal Scientist (at IGFRI, Jhansi)
Dr. Sanjay Kumar	Sr. Scientist
Sh. Ram Chander	Technical Officer

Animal Nutrition & Feed Technology (ANF&T) Division

Dr. PC Lailer	Principal Scientist & Head
Dr. Navneet Saxena	Principal Scientist
Dr. Ram Singh	Principal Scientist
Dr. Avijit Dey	Principal Scientist
Dr. Vishal Mudgal	Principal Scientist
Dr. Sarita Yadav	Scientist
Sh. Krishan Kumar	Asst. Chief Tech. Officer

Animal Physiology & Reproduction (APR) Division

Dr. RK Sharma	Principal Scientist & Head
Dr. PS Yadav	Principal Scientist
Dr. Sajjan Singh	Principal Scientist
Dr. SK Phulia	Principal Scientist
Dr. Varij Nayan	Senior Scientist
Dr. Ashok Kumar Balhara	Senior Scientist
Dr. Dharmendra Kumar	Senior Scientist
Dr. Jerome A	Scientist
Dr. Pradeep Kumar	Scientist
Dr. Solekar Naresh	Scientist
Lalaji	Scientist
Dr. Meeti Punetha	
Sh. Ashrfi Shah	Technician

Animal Genetics & Breeding (AGB) Division

Dr. Anurag Bharadwaj	Principal Scientist & Head
Dr. SK Khurana	Principal Scientist
Dr. KP Singh	Principal Scientist
Dr. BP Kushwaha	Principal Scientist
Dr. Sanjay Kumar	Senior Scientist
Dr. Ashok Kumar	Scientist
Smt. Sunesh Balhara	Scientist
Sh. AKS Tomer	Asst. Chief Tech. Officer
Sh. Ram Chander	Technical Officer

Public Information (PI)

Dr. RK Sharma	CPIO, Hisar
Dr. Mustafa	CPIO, Nabha
Sh. Ravinder	Transparency Officer
Dr. Sanjay Kumar	Transparency Officer (w.e.f. 13.10.2021)
Sh. Rajesh Kumar	Nodal Officer

Vigilance Officer

Dr. Navneet Saxena	Principal Scientist

Animal Farm Section

Dr. Anurag Bharadwaj	Overall In-charge
Sh. AKS Tomar	In-charge
Dr. Sanjay Kumar	In-charge, Animal Health
Dr. Rajesh Kumar	Senior Technical Asst.

Agriculture Farm Section

Dr. PC Lailer	Overall In-charge
Sh. Surender Singh	In-charge
Shri Baljeet Singh	Technical Officer
Shri Satish	Senior Technician
Shri Jagdeep	Technician

Results-Framework Documents (RFD) Cell

Dr. Jerome A	Scientist

Library

Dr. Sunesh Balhara	Overall In-charge
Sh. Rajkumar	In-charge

Hindi section

Dr. Sajjan Singh	Principal Scientist
Dr. ML Sharma	ACTO
Sh. Dharampal	LDC

Skilled Support Staff

CIRB Main Campus Hisar (Haryana)

Sh. Pooran
Sh. Ram Kumar
Sh. Bheera
Sh. Randhir Singh
Sh. Jai Prakash
Sh. Gopi Ram
Sh. Ram Kesh
Sh. Yam Bahadur
Sh. Siri Ram
Sh. Subhash
Sh. Chander
Sh. Pahlad
Sh. Rambir
Sh. Raj Kumar
Sh. Ashok Kumar
Sh. Jagdeep
Sh. Rajender
Smt. Sarla Rani
Sh. Jitender Kumar
Sh. Hari Kishan
Sh. Satish Kumar
Sh. Satbir Singh
Sh. Satyawan
Sh. Balwant Singh
Sh. Dilbag Singh
Sh. Joginder Singh
Sh. Om Prakash
Sh. Rati Ram
Sh. Sadhu Ram
Sh. Jarinal Singh
Sh. Om Prakash
Sh. Nakchhed
Sh. Ram Kishore
Sh. Jai Kumar
Sh. Radhey Shyam
Sh. Hawa Singh
Sh. Ramesh Chander
Sh. Mahabir Singh

CIRB Sub Campus, Nabha (Punjab)

Sh. Shyam Dev
Sh. Ram Anuj
Sh. Rajinder Singh
Sh. Raju
Sh. Ram Chander
Sh. Bhim Singh
Sh. Balwant Singh
Sh. Brij Mohan
Sh. Hans Raj
Sh. Gurnam Singh
Sh. Rulda Singh
Sh. Balkar Singh
Sh. Ram Kewal
Sh. Ram Suraj
Sh. Jaswant Singh
Sh. Mukhtiar Singh
Sh. Rajesh Kumar
Sh. Shrinath

Retirement

Dr. S.S. Dahiya, Principal Scientist retired on 31.03.2021.

Dr. K.P. Singh, Principal Scientist retired on 31.03.2021.

Sh. Ram Kumar, T-4 (Driver) retired on 31.05.2021.

Sh. Baljeet Singh, T-5 (Technical Officer) retired on 30.09.2021.

Dr. V.B. Dixit, Principal Scientist retired on 30.11.2021.

Sh. Narinder Kumar, AO retired on 30.11.2021.

Sh. Asharfi Shah, T-2 (Sr. Technician) retired on 30.11.2021.


गणतंत्र दिवस समारोह
Republic Day Celebration

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