वार्षिक प्रतिवेदन
ANNUAL REPORT
2022

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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www.cirb.icar.gov.in

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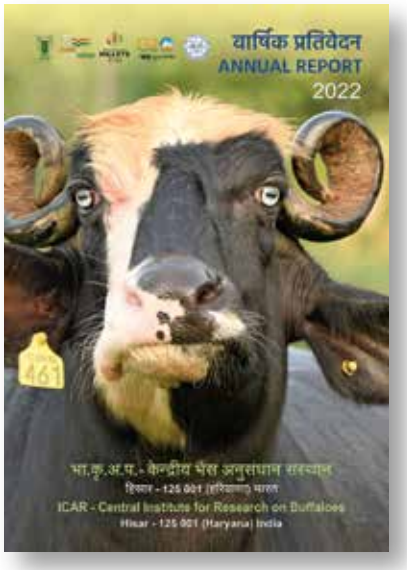

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ICAR - Central Institute for Research on Buffaloes
Hisar-125001 (Haryana) INDIA

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Contents

From Director's Desk

Dairy farming constitutes a vital component in the agrarian economy of India due to its rich and vibrant tradition over many centuries. Dairying alone employs more than 80 million households in the country. India is the world's largest milk producer with 221.06 million tonnes with a global share of about 24% and the milk production in the country has increased at a Compound Annual Growth Rate (CAGR) of about 6.2% which is at maximum during the last 10 years. The commendable growth rate in the dairy sector played a crucial role to achieve the remarkable milestone of reaching record-breaking milk production in the country in recent years. The share of buffalo in total milk production in India is about 45% followed by crossbred and indigenous cows. Buffalo milk contribution has increased to 95.39 million tonnes with 46.28 million milch buffaloes in 2020-21 from 74.71 million tonnes with 39.72 million milch buffaloes in 2014-15. It is well documented that buffaloes are efficient milk producers and most preferred animal over cattle in many parts of the country owing to its superior quality of milk, disease resistance, longer productive life and higher milk productivity. India holds the world's largest buffalo population with 109.85 million headcounts constituting 20.45% to the livestock population. However, 54.60% of the buffaloes in India are of descript types the remaining are non-descript; it requires urgent attention to further characterise the whole population and strategize their improvement plan. India is endowed with the world's best superior germplasm of buffaloes with 20 registered buffalo breeds in the country including Murrah, Mehsana, Surti, Jaffarabadi, Bhadawari, Banni, Pandharpuri, and Nili-Ravi etc. The Food and Agriculture Organization termed Asian buffaloes as the "Black Gold of Asia" due to its superior quality. Despite significant merits, however, buffaloes often encounter problems like poor reproductive efficiency and relatively high methane production due to their rumen ecosystem. Research at ICAR-CIRB continuously emphasizes on essential dimensions like genetic improvement of prominent breeds of buffalo, dissemination of high genetic merit germplasm to farmers, use of advanced reproduction biotechnologies for faster multiplication of superior germplasm, developing improved feeding modules for efficient production while reducing the methane emission and capacity enhancement of buffalo farmers, young entrepreneurs and researchers. The Institute also collaborates with the Asian Buffalo Association and other federations formed to foster International scientific exchanges between major buffalo keeping countries and communities. I am immensely pleased to put forth the "Annual Report - 2022" to our readers, which chronicles the achievements of ICAR-CIRB during 2022. I would like to extend my sincere appreciation to Secretary DARE and DG, ICAR, for his continuous encouragement and astute guidance. The continued cooperation and guidance received from DDG (AS) ICAR, and ADG (AP&B) ICAR in all the activities of the Institute is also thankfully acknowledged. I sincerely hope that the Annual Report 2022 of ICAR-CIRB would serve as a valuable source of information to all the custodians of buffalo in the country. Suggestions for improvement are always welcome.

Dr TK Datta
Director

प्रस्तावना

कई शताब्दियों से चली आ रही अपनी समृद्ध और जीवंत परंपरा के कारण डेयरी फार्मिंग भारत की कृषि अर्थव्यवस्था में एक महत्वपूर्ण घटक है। अकेले डेयरी उद्योग से देश के 80 मिलियन से अधिक परिवारों को रोजगार मिलता है। भारत लगभग 24% की वैश्विक हिस्सेदारी के साथ 221.06 मिलियन टन के साथ दुनिया का सबसे बड़ा दूध उत्पादक है और देश में दूध उत्पादन लगभग 6.2% की वार्षिक वृद्धि दर (सीएजीआर) से बढ़ा है जो पिछले 10 वर्षों के दौरान अधिकतम है। डेयरी क्षेत्र में सराहनीय विकास दर ने हाल के वर्षों में देश में रिकॉर्ड तोड़ दूध उत्पादन तक पहुंचने की उल्लेखनीय उपलब्धि हासिल करने में महत्वपूर्ण भूमिका निभाई है। भारत में कुल दूध उत्पादन में भैंस की हिस्सेदारी लगभग 45% है, इसके बाद संकर और देशी गायों का नंबर आता है। भैंस के दूध का योगदान 2014-15 में 39.72 मिलियन दुधारू भैंसों के साथ 74.71 मिलियन टन से बढ़कर 2020-21 में 46.28 मिलियन दुधारू भैंसों के साथ 95.39 मिलियन टन हो गया है। यह अच्छी तरह से प्रलेखित है कि मवेशियों की तुलना में भैंसें अपने दूध की बेहतर गुणवत्ता, रोग प्रतिरोधक क्षमता, लंबे उत्पादक जीवन और उच्च दूध उत्पादकता के कारण देश के कई हिस्सों में सबसे पसंदीदा जानवर हैं। भारत में 109.85 मिलियन भैंसों की संख्या के साथ दुनिया की सबसे बड़ी भैंस आबादी है, जो देश के पशुधन आबादी का 20.45% है। हालाँकि, भारत में 54.60% भैंसें वर्णनात्मक प्रकार की हैं, शेष गैर-वर्णनात्मक हैं; संपूर्ण जनसंख्या को और अधिक विशिष्ट बनाने और उनकी सुधार योजना की रणनीति बनाने पर तत्काल ध्यान देने की आवश्यकता है। भारत दुनिया में भैंसों के सर्वोत्तम श्रेष्ठ जर्मप्लाज्म से संपन्न है, जिसमें मुर्रा, मेहसाणा, सुरती, जाफराबादी, भदावरी, बन्नी, पंढरपुरी, और नीली-रवी आदि सहित 20 पंजीकृत भैंस की नस्लें शामिल हैं। खाद्य एवं कृषि संगठन ने एशियाई भैंसों को उनकी बेहतर गुणवत्ता के कारण "एशिया का काला सोना" कहा है। हालांकि, महत्वपूर्ण खूबियों के बावजूद, भैंसों को अक्सर अपने रुमेन पारिस्थितिकी तंत्र के कारण खराब प्रजनन

क्षमता और अपेक्षाकृत उच्च मीथेन उत्पादन जैसी समस्याओं का सामना करना पड़ता है। आईसीएआर-सीआईआरबी में अनुसंधान लगातार भैंस की प्रमुख नस्लों के आनुवंशिक सुधार, किसानों के लिए उच्च आनुवंशिक योग्यता वाले जर्मप्लाज्म का प्रसार, बेहतर जर्मप्लाज्म के तेजी से गुणन के लिए उन्नत प्रजनन जैव प्रौद्योगिकी का उपयोग, मीथेन उत्सर्जन को कम करते हुए कुशल उत्पादन के लिए बेहतर फीडिंग मॉड्यूल विकसित करने जैसे आवश्यक आयामों पर जोर देता है। संस्थान एशियन बफ़ेलो एसोसिएशन और प्रमुख भैंस पालने वाले देशों और समुदायों के बीच अंतर्राष्ट्रीय वैज्ञानिक आदान-प्रदान को बढ़ावा देने के लिए गठित अन्य संघों के साथ भी सहयोग करता है। मुझे अपने पाठकों के सामने "वार्षिक रिपोर्ट - 2022" प्रस्तुत करते हुए बेहद खुशी हो रही है, जो 2022 के दौरान आईसीएआर-सीआईआरबी की उपलब्धियों का विवरण देती है। मैं सचिव डेयर और महानिदेशक, आईसीएआर को उनके निरंतर प्रोत्साहन के लिए अपनी हार्दिक सराहना देना चाहता हूं। संस्थान की सभी गतिविधियों में उप- महानिदेशक (पशु विज्ञान) आई.सी.ए.आर., और ए.डी.जी. (एपी एंड बी) आईसीएआर से प्राप्त उचित मार्गदर्शन और निरंतर सहयोग के लिए मैं उनका धन्यवाद करता हूँ। मुझे पूरी उम्मीद है कि आईसीएआर-सीआईआरबी की वार्षिक रिपोर्ट 2022 देश में भैंस के सभी संरक्षकों के लिए जानकारी के एक मूल्यवान स्रोत के रूप में काम करेगी। सुधार के लिए सुझावों का सदैव स्वागत है।

डॉ. तीर्थ कुमार दत्ता
निदेशक

Executive Summary 2022

The ICAR- Central Institute for Research on Buffaloes (ICAR- CIRB) is a leading research institution in the country that focuses on the management and health of the buffalo population as well as the research and development needs of the industry. The institute was established on February 1, 1985 by acquiring the Progeny Testing Bull Farm from Haryana Government at Hisar. In order to fulfil its mandate, the institute has made significant progress. After receiving the Nili-Ravi Buffalo Farm from the Punjab State Government, the institute opened a sub-campus in December 1987 at Bir Dosanjh, Nabha, District Patiala (Punjab). The institute gained preeminence in the "**buffalo world**" shortly after hosting 2nd World Buffalo Congress (1988), 4th and 9th Asian Buffalo Congress (2003 and 2018, respectively).

Organizational Structure

Among more than hundred ICAR institutions located all over the country, the institute is one of the 19 Animal Science institutes. The Director, who oversees administrative tasks as well as research and outreach activities, is in charge of the institute. A Research Advisory Committee (RAC) made up of notable scientists decide the research guidelines based on mandate, objectives and perspective plan of the institute. The Institute management Committee (IMC), which is chaired by the Director, makes key administrative and managerial decisions on financing status, actions taken in response to QRT and RAC recommendations, approval of higher budget projects, etc. The Institute Research Committee (IRC), presided over by the Director, evaluates the status of the many research projects being carried out by the scientists in addition to approving new projects 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 Technologies (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 in charges 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 Senior Administrative Officer (SAO), while Senior Finance & Accounts Officer (SFAO) accomplishes the Audit & Accounts section. The institute presently has the strength of 24 scientists, 27 technicals, 15 administrative staff and 106 skilled supporting staff.

Budget Outlay

The financial outlay of the institute in terms of sanctioned budget and actual expenditure during the year 2022-23 was equal and remained 3271.98 lakh including TSP, NEH and SCSP funds. CIRB also received funds of Rs. 623.47 lakh and 392.36, respectively from plan schemes and externally funded schemes, out of which, Rs. 605.55 and 61.79 lakh were expensed. The revenue receipts of the institute were Rs. 2978.43 lakh during 2022.

Salient Achievements

- ICAR- CIRB is an ISO 9001: 2015 certified institution for improved buffalo germplasm production.
- Achieved highest ever wet average (kg/d) of 10.06 (n= 127) and herd average (kg/d) of 7.09 (n=180) in Murrah buffalo. In Nili-Ravi buffalo average (kg/d) of 8.28 (n= 107) and herd average (kg/d) of 5.64 (n=159) was achieved.
- Achieved lowest ever AFC (37.41 months, n= 68 and 43.51 months, n= 40) and calving interval (440 days, n= 98 and 438 days, n= 86) for Murrah and Nili-Ravi, respectively.
- First time in the history of CIRB, 16 Murrah buffaloes crossed 4000 kg in a single lactation. Buffalo no 5179 was recorded 5170 kg in 305 days at 2nd lactation.
- Recorded highest ever single day milk yield (> 20 kg) for 14 Murrah buffaloes with average 305 days milk yield of total Murrah herd, 2846 kg.
- Veer-Gaurav, a male buffalo calf was born through OPU-IVEP technique using semen of cloned bull (Hisar-Gaurav).
- Telomere length and blood biochemical parameters (AST, ALT, alkaline phosphatase, serum creatinine and creatine kinase, creatine phosphokinase, TLC, DLC) of seven cloned buffaloes were evaluated during the year and found similar with the age matched controls.
- Assamese clone 'Sach-Gaurav' semen parameters evaluated for ejaculated volume, sperm concentration and mass sperm motility and other *in vitro* tests which found similar to non-cloned bulls.
- The semen parameters of multiple clones and re-clone was evaluated and approx. 18211 total semen dose of cloned bulls were cryopreserved.
- 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.

- Three sperm doses i.e. 20, 16 and 12 million/ straw showed no significant difference in sperm kinetics, membrane integrity, mitochondrial membrane potential, superoxide status as well as field conception rates in buffaloes.
- Easy and straightforward protocol was developed and optimized for gene editing in buffalo embryos that could serve as a useful method for studying the functional genomics.
- First comprehensive web genomic resource of buffalo (BuffGR) was developed.
- Three hundred somatic cell lines were established and cryopreserved from different buffalo breeds (Murrah, Nili- Ravi, Bhadawari) of both sexes and were shared with ICAR-NBAGR.
- DNA repository of about 205 buffaloes has been established at the institute for genome analysis.
- The *in vitro* protein degradability (%) of guar korma was found to be 83.67 ± 2.24, whereas various degradability fractions, effective and potential degradability were calculated using nylon bag technique with bag removal at different time intervals. Effective rumen degradability of CP (%) at passage rate 2, 5, and 8%/h was estimated to be 87.34±0.48, 74.76±0.85, and 65.43±1.00, respectively.
- Supplementation of phytogenic feed additive blend [@ 54.6 g/h/d (*Cinnamomum verm*: *Sapindus mukorossi*: *Ficus bengalensis,* 15:5:1] consisting of active phytochemicals containing essential oils, saponins and tannins to fistulated buffalo steers along with basal ration demonstrated reduced ($p<0.05$) methane concentration (%) in exhaled air, without affecting other rumen fermentation parameters. Rumen fluid fatty acid profile (mg/ 100g of FAME) revealed enhanced *t- vaccenic* acid, a precursor of human health promoting conjugated linoleic acid without affecting major fatty acids concentrations.
- Out of 549 bacterial isolates from mastitis milk of buffaloes (*n*, animal level = 472) between 2019 and 2022, a total of 43 *E. coli* strains were isolated with an overall prevalence of 9.11 % at animal level. The highest antibiotic resistance was against ceftriaxone 18 (41.86%), followed by amoxycillin/sulbactam 8 (18.60%) and enrofloxacin 7 (16.27%). Additionally, all were sensitive to gentamicin 43 (100%) followed by cefoperazone/sulbactam 34 (79.06%).
- Institute trained 603 dairy farmers on scientific buffalo husbandry practices by transfer of technology unit during the year 2022.
- Under Network Project on Buffalo Improvement (NPBI) more than 987 elite breedable Murrah buffaloes are maintained at five different centres in addition to three field units for progeny testing of bulls. During the year, use of 20th set of bulls (14) was completed for test mating.
- 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.
- During the year, 3.03 lakhs and 0.23 lakhs doses of semen were produced, and 1.97 lakhs and 0.23 lakhs doses of semen were disseminated for Murrah and other breeds (Nili-Ravi, Jaffrabadi, Surti and Bhadawari), respectively under NPBI.
- Besides Murrah breed, Nili-Ravi, Jaffarabadi 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.
- Semen freezing lab received Grade B by Central Monitoring Unit, Government of India which facilitates the sale and supply of semen from high genetic merit buffalo bulls.

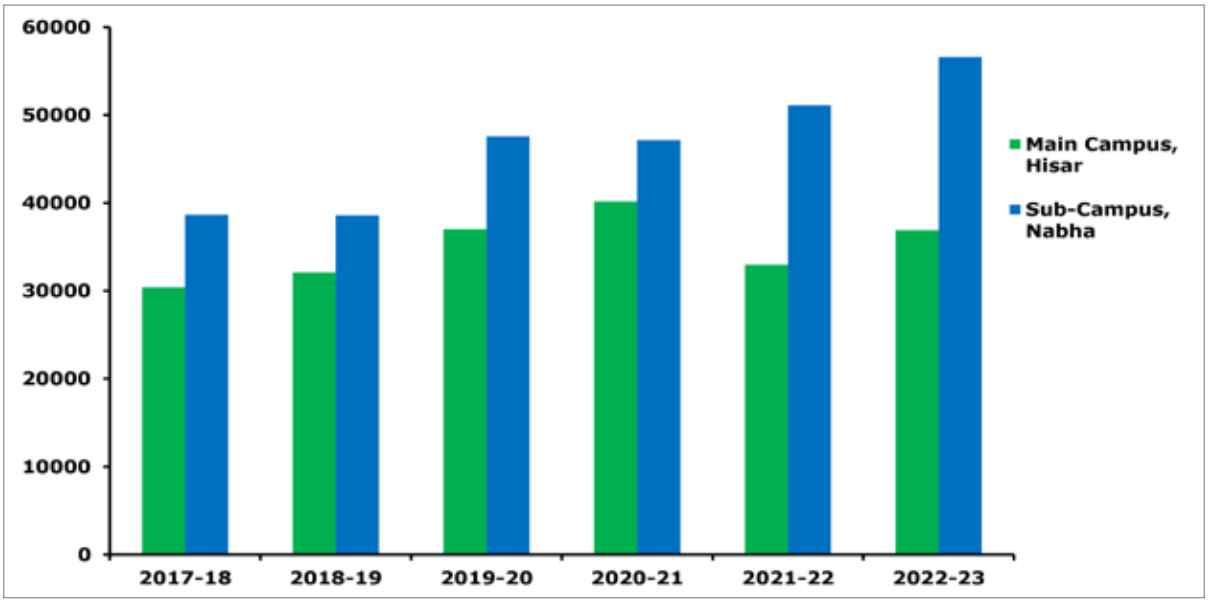
Buffalo production improvements

Criteria	Status	
	Murrah breed at main Campus Hisar	Nili Ravi breed at Sub- Campus Nabha
Total number of animals (as on 31.12.2021)	577	523
Age at First Calving (Months)	37.41	43.51
Calf Mortality (%)	2.75	4.14
Dairy buffaloes herd performance		
Overall annual wet average (Kg)	10.06	8.28
Overall total lactation milk yield (Kg)	2920	2651
Overall SLMY (Kg)	2846	2571
Service Period (days)	131	132
Calving Interval (days)	440	438
Conception rate (%)	51.12	41.65
Male germplasm		
Progeny tested bulls produced	42 (1-16th set)	10 (1-5th)
Semen doses produced	220366	4666
Frozen semen supplied	140962	3526
Revenue geration (Rs. Lakhs)	25.36	0.57
Bulls disseminated in field	545*	137#

** Last twelve years #Since 2006-07*

Agriculture farm production (Qtls)

Fodder	Main Campus Hisar	Sub Campus Nabha
Dry	858.00	2852.00
Green	36895.53	56594.50
Grains	793.10	4077.65



Green Fodder Production (Qtls) at Main Campus and Sub-campus, Nabha

Green Fodder Production (Qtls) at ICAR-CIRB

Revenue Receipt and Target (2022-23)

Rs. in Lakhs

Sr. No.	Major/Minor/Detailed Head of Accounts	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
1	Sale of Farm Produce						
	(i) Sale of Milk	261.62	277.21	336.20	370.31	371.56	386.12
	(ii) Sale of Wheat Busa/Mustard Bhusa/Green Fodder	17.81	1.26	5.05	10.22	0.26	6.31
	(iii) Sale of grain/wheat/paddy	25.61	55.00	4.83	7.92	3.41	4.89
	(iv) Sale of Semen	21.30	28.46	27.54	23.83	30.95	20.29
	(v) Sale of Mineral Mixture	4.87	1.26	0.77	0.45	0.77	0.93
	(vi) Sale proceed of dry trees	6.00	1.75	0.00	10.15	1.60	10.43
	(vii) Sale of Books	0.00	0.06	0.66	0.03	0.15	0.02
	(viii) Sale of Technology/Royalty	0.00	0.00	0.76	0.19	0.17	0.07
2	Sale proceeds of	0.00	0.00	0.00	0.00	0.00	0.00
	(i) Land & Building	0.00	0.00	0.00	0.00	0.00	0.00
	(ii)Machine Tools & Plants Equipments/Vehicle etc.	1.29	0.00	0.00	0.00	8.81	0.00
	(iii) Sale proceeds of Livestock.	91.09	59.59	84.13	89.47	110.24	127.26
3	Rents (licence fee)	3.98	4.68	4.70	5.93	5.88	5.84
4	Application fees from Candidates Tuition Fees, diploma Charges etc.	0.00	0.00	0.00	0.00	0.00	0.30
5	Application fees from Candidates in connection with recruitment	0.26	0.01	0.00	0.00	0.00	0.00
6	Receipts from Service rendered by Instt./ receipt from students	3.72	3.44	2.97	0.00	0.58	0.67
7	Misc Receipt	0.00	0.00	0.00	0.00	0.00	0.00
	(i) Sale of Tender form	2.92	1.69	0.79	0.73	0.87	0.00
	(ii) Guest house charges	2.10	2.62	3.77	1.28	3.18	4.62
	Total:	**442.57**	**437.04**	**472.16**	**520.50**	**538.42**	**567.73**
	Target	341.20	409.43	397.78	397.78	445.000	435.33

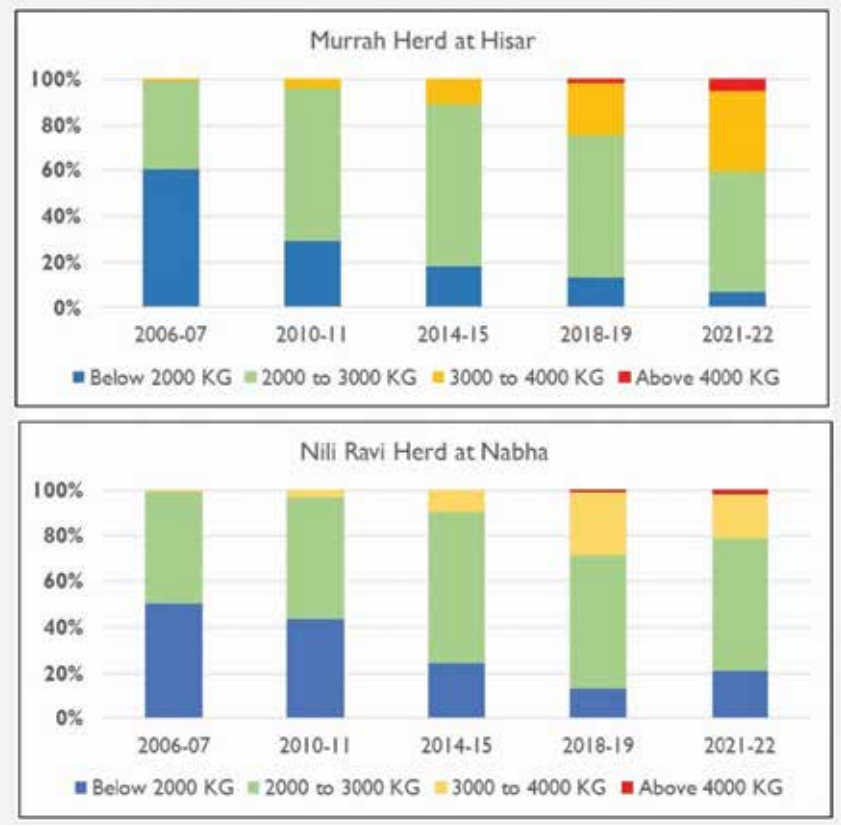
Financial Outlay, INR in Lakh (2022-23)

Name of Institute/Project	Sanctioned Budget	Expenditure
CIRB Main	3246.98	3218.03
CIRB SCSP	18.00	18.00
CIRB TSP	2.00	2.00
CIRB NEH	5.00	5.00
Total	3271.98	3243.03
Plan Schemes		
Network Project on Buffalo Improvement	320.00	320.00
Network Project on Buffalo Improvement, SCSP	13.00	12.96
AICRP on Nutritional and Physiology (Dr R.K Sharma, PS&PI)	6.00	5.51
NAIF Project (Dr Sandeep Khurana, PS&PI)	8.56	8.56
NASF Project (Dr P.S Yadav, PS&PI)	211.61	195.11
NASF Project (Dr Dharmendra Kumar, SS&PI)	21.95	21.95

Name of Institute/Project	Sanctioned Budget	Expenditure
CABin Project (Dr Varij Nayan, SS & PI)	20.00	20.00
FFP (Dr Sarita Yadav, SS & PI)	14.35	13.64
CRP Project (Dr.Meeti, Sci. & PI)	8.00	7.83
Total	**623.47**	**605.55**
Externally funded Schemes (other than ICAR)	Sanctioned Budget 2022-23	Expenditure 2022-23
DBT Project (Dr.Pradeep, Sci. & PI)	16.59	11.78
BMGF Project (Dr.Varij Nayan,Sci & PI)	32.40	19.60
DBT Project (Dr.P.S Yadav,PS & PI)	14.27	13.67
SERB Project (Dr. Meeti Punetha, Sci. & PI)	14.32	13.16
DAHD Project (Dr. R.K Sharma, PS & PI)	263.79	3.57
NLM Project (Dr. Ashok Kumar Balhara, Sr.Sci & PI)	29.85	0.00
NLM Project (Dr. Sunesh Balhara, Sci & PI)	21.15	0.00
Total	**392.36**	**61.79**

Staff Position

Category	Sanctioned Strength	Filled	Vacant
Scientific	44	24	20
Technical	42	27	15
Administrative	25	15	10
Skilled Supporting	124	106	18



Genetic improvement & Trend of milk production (percent of adult female buffaloes)

कार्यकारी सारांश 2022

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 सौ से अधिक 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 24 वैज्ञानिक, 27 तकनीशियन, 15 प्रशासनिक कर्मचारी और 106 कुशल सहायक कर्मचारी हैं।

बजट परिव्यय

वर्ष 2022-23 के दौरान स्वीकृत बजट और वास्तविक व्यय के संदर्भ में संस्थान का वित्तीय परिव्यय समान था और TSP, NEH और SCSP निधियों सहित 3271.98 लाख रूपये बना रहा। सीआईआरबी ने परियोजना योजनाओं और बाह्य वित्तपोषित योजनाओं से क्रमश: 623.47 लाख रुपये और 392.36 रुपये की धनराशि भी प्राप्त की, जिसमें से रु.605.55.38 और 61.79 लाख रुपये खर्च किए गए। संस्थान की राजस्व प्राप्तियाँ रु. 2022 के दौरान 2978.43 लाख।

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 10.06 किलो/दिन(n = 127) का अब तक का उच्चतम वेट औसत और 7.09 किलो/दिन (n = 180) का हर्ड औसत प्राप्त किया। नील-रवि भैंस में 8.28 किलो/दिन (n = 107) का वेट औसत और 5.64 किलो/दिन (n = 159) का हर्ड औसत हासिल किया गया।
- मुर्रा और नीली-रवि के लिए अब तक का सबसे कम AFC क्रमशः (37.41 महीने, n = 68 और 43.51 महीने, n = 40) और बछड़ा अंतराल (440 दिन, n = 98 और 438.00 दिन, n = 86) प्राप्त किया।
- CIRB के इतिहास में पहली बार, 16 मुर्राह भैंसों ने एक बार के दुग्धकाल में 4000 किग्रा का उत्पादन पार कर लिया। भैंस संख्या 5179 का 5वें दुग्धकाल के समय 305 दिनों में 5170 किलोग्राम उत्पादन दर्ज किया गया।
- कुल मुर्राह झुंड की औसत 305 दिनों की दूध उत्पादन, 2846 किग्रा के साथ 14 मुर्रा भैंसों का अब तक की सर्वाधिक एकल दिन दूध उपज (> 20 किग्रा) दर्ज की गई।
- क्लोन बैल (हिसार-गौरव) के वीर्य का उपयोग करके ओपीयू-आईवीईपी तकनीक के माध्यम से नर भैंस के बछड़े वीर-गौरव का जन्म हुआ।
- साथ 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।
- असमिया क्लोन 'सच-गौरव' वीर्य मापदंडों का मूल्यांकन स्खलन की मात्रा, शुक्राणु एकाग्रता और बड़े पैमाने पर शुक्राणु गतिशीलता और अन्य इन विट्रो परीक्षणों के लिए किया गया जो गौरव-क्लोन किए गए बछड़े के समान पाए गए
- कई क्लोनों और पुनः क्लोनों के वीर्य मापदंडों का मूल्यांकन किया गया और लगभग। क्लोन किए गए सांडों की कुल 18211 वीर्य खुराक को क्रायोप्रिजर्व किया 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।

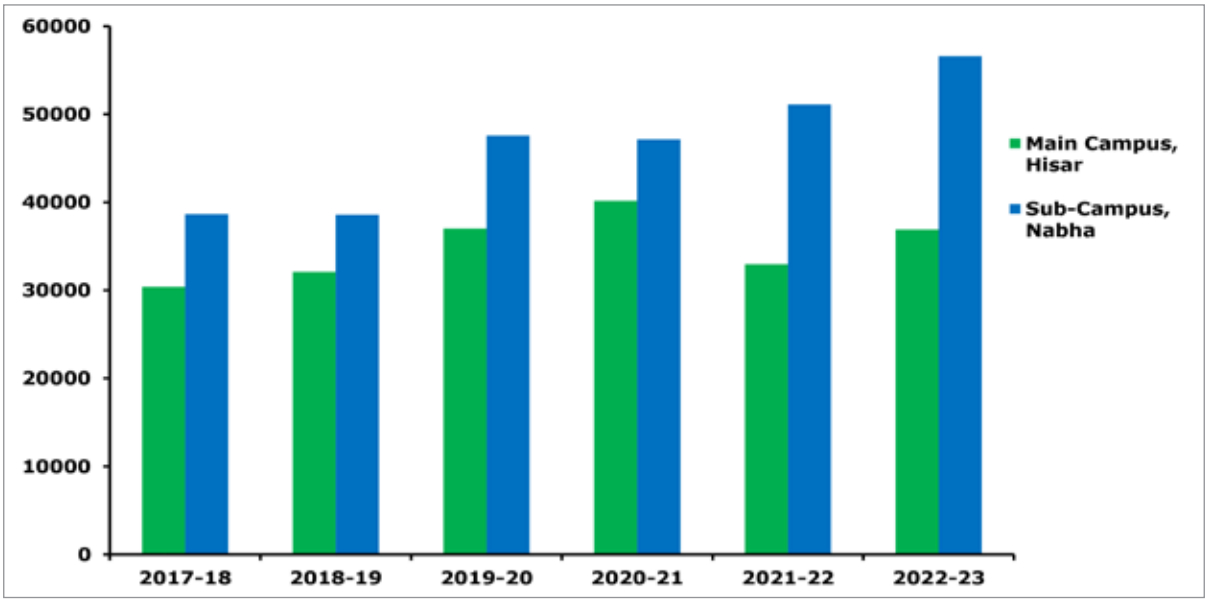
- भैंस के शुक्राणु व्यवहार्यता पर वीर्य का पतला होने (20 और 16 मिलियन 12/स्ट्रॉ) का प्रभाव तथा कार्यात्मक मापदंडों जैसे शुक्राणु पोस्ट-थॉ गतिशीलता, प्लाज्मा झिल्ली अखंडता, थर्मल प्रतिरोध, गतिज मापदंडों का अध्ययन किया गया।
- भैंस के भ्रूण में जीन संपादन के लिए आसान और सीधा प्रोटोकॉल विकसित और अनुकूलित किया गया था जो कार्यात्मक जीनोमिक्स के अध्ययन के लिए एक उपयोगी विधि के रूप में काम कर सकता है।
- भैंस का पहला व्यापक वेब जीनोमिक संसाधन (बफजीआर) विकसित किया गया
- तीन सौ दैहिक कोशिका रेखाएं स्थापित की गईं और दोनों लिंगों की विभिन्न भैंस नस्लों (मुर्रा, नीली- रवि, भदावरी) से क्रायोप्रिजर्व किया गया और आईसीएआर-एनबीएजीआर के साथ साझा किया गया।
- जीनोम विश्लेषण के लिए संस्थान में लगभग 205 भैंसों का डीएनए भंडार
- ग्वार कोरमा की इन विट्रो प्रोटीन डिग्रेडेबिलिटी (%) 83.67 ± 2.24 पाई गई, जबकि विभिन्न डिग्रेडेबिलिटी अंशों, प्रभावी और संभावित डिग्रेडेबिलिटी की गणना अलग-अलग समय अंतराल पर बैग हटाने के साथ नायलॉन बैग तकनीक का उपयोग करके की गई थी। मार्ग दर 2, 5, और 8%/घंटा पर सीपी (%) की प्रभावी रुमेन गिरावट क्रमशः 87.34±0.48, 74.76±0.85, और 65.43±1.00 होने का अनुमान लगाया गया था।
- फाइटोजेनिक फ़ीड एडिटिव मिश्रण का पूरक [@ 54.6 ग्राम/घंटा/दिन (सिनामोमम वर्म: सैपिंडस मुकोरोसी: फाइकस बेंगालेंसिस, 15:5:1] जिसमें बेसल राशन के साथ-साथ फिस्टुलेटेड भैंस स्टीयर के लिए आवश्यक तेल, सैपोनिन और टैनिन युक्त सक्रिय फाइटोकेमिकल्स शामिल हैं। अन्य रुमेन किण्वन मापदंडों को प्रभावित किए बिना, साँस छोड़ने वाली हवा में कम (पी <0.05) मीथेन सांद्रता (%) का प्रदर्शन किया। रुमेन द्रव फैटी एसिड प्रोफ़ाइल (मिलीग्राम / 100 ग्राम फेम) ने बढ़े हुए टी-वैसेनिक एसिड का खुलासा किया, जो संयुग्मित लिनोलिक को बढ़ावा देने वाले मानव स्वास्थ्य का अग्रदूत है। प्रमुख फैटी एसिड सांद्रता को प्रभावित किए बिना एसिड।
- 2019 और 2022 के बीच भैंसों के मास्टिटिस दूध (एन, पशु स्तर = 472) से 549 बैक्टीरियल आइसोलेट्स में से, कुल 43 ई. कोली उपभेदों को पशु स्तर पर 9.11% के समग्र प्रसार के साथ अलग किया गया था। सबसे अधिक एंटीबायोटिक प्रतिरोध सेफ्टिऑक्सोन 18 (41.86%) के खिलाफ था, इसके बाद एमोक्सिसिलिन/सल्बैक्टम 8 (18.60%) और एनरोफ्लोक्सासिन 7 (16.27%) था। इसके अतिरिक्त, सभी जेंटामाइसिन 43 (100%) और उसके बाद सेफोपेराज़ोन/सल्बैक्टम 34 (79.06%) के प्रति संवेदनशील थे।
- संस्थान ने वर्ष 2022 के दौरान प्रौद्योगिकी इकाई के हस्तांतरण द्वारा वैज्ञानिक भैंस पालन प्रथाओं पर 603 डेयरी किसानों को प्रशिक्षित किया।
- नेटवर्क प्रोजेक्ट ऑन बफेलो इम्प्रूवमेंट (एनपीबीआई) के तहत 987 से अधिक विशिष्ट प्रजनन योग्य मुर्रा भैंसों को सांडों की संतान परीक्षण के लिए तीन क्षेत्रीय इकाइयों के अलावा पांच अलग-अलग केंद्रों पर रखा जाता है। वर्ष के दौरान, परीक्षण संभोग के लिए बैलों के 20वें सेट (14) का उपयोग पूरा किया गया।
- वर्ष 1991 में संतान परीक्षण कार्यक्रम की शुरुआत के बाद से, उपयोग किए गए और मूल्यांकन किए गए 188 परीक्षण बैलों में से 39 संतान परीक्षण किए गए मुर्रा बैल का उत्पादन किया गया था।
- वर्ष के दौरान एनपीबीआई के तहत मुर्रा और अन्य नस्लों (नीली-रावी, जाफराबादी, सुरती और भदावरी) के लिए क्रमशः 3.03 लाख और 0.23 लाख वीर्य की खुराक का उत्पादन किया गया। और इनमे से 1.97 लाख और 0.23 लाख खुराकें प्रसारित की गईं
- संबंधित केंद्रों पर मुर्रा नस्ल के अलावा, नीली-रावी, जाफराबादी और सुरती नस्ल की भैंसों का भी बैल उत्पादन के लिए विशिष्ट झुंड बनाए रखने के साथ-साथ संतान परीक्षण पर ध्यान केंद्रित किया जा रहा है।
- आईजीएफआरआई में भदावरी नस्ल, एनपीबीआई का झांसी केंद्र संरक्षण और सुधार इकाई के रूप में कार्य कर रहा है।
- वीर्य फ्रीजिंग लैब को केंद्रीय निगरानी इकाई, भारत सरकार द्वारा ग्रेड बी प्राप्त हुआ जो उच्च आनुवंशिक योग्यता वाले भैंस बैल से वीर्य की बिक्री और आपूर्ति की सुविधा प्रदान करता है।

भैंस के उत्पादन में विकास

मानदंड	स्थिति	
	मुर्रा नस्ल, मुख्य परिसर हिसार	नीली- रावि नस्ल, उप परिसर नाभा
पशुओं की कुल संख्या (31.12.2022 को)	577	523
प्रथम ब्यांत उम्र	37.41	43.51
मृत्यु दर (%)	2.75	4.14
डेयरी भैसों का प्रदर्शन		
कुल मिलाकर वार्षिक औसत	10.06	8.28
कुल मिलाकर दुग्ध उपज	2920	2651
कुल मिलाकर एसएलएमवाई	2846	2571
सर्विस अवधि	131	132
ब्यांत अंतराल	440	438
गर्भाधान की दर	51.12	41.65
नर जर्मप्लास्म		
प्रोजेनी टेस्टेड सांडों का उत्पादन	42 (1-16th set)	10 (1-5th)
हिमीकृत वीर्य टीके उत्पादित	220366	4666
हिमीकृत वीर्य आपूर्ति	140962	3526
राजस्व उत्पत्ति (रुपये, लाख में)	25.36	0.57
क्षेत्र में बैल प्रसार	545*	137#

कृषि फार्म उत्पादन

चारा	हिसार, मुख्य परिसर	नाभा, उप परिसर
गेहूं का भूसा	858	2852
हरा	36895.53	56594.5
अनाज	793.10	4077.65



मुख्य परिसर और उप-परिसर, नाभा में हरा चारा उत्पादन (क्यूटीएलएस)।

राजस्व प्राप्ति (भारतीय रुपये में सभी आंकड़े)

प्रमुख / लघु / खातों का विस्तृत विवरण	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
फार्म उत्पादों की बिक्री						
(i) दूध की बिक्री	261.62	277.21	336.20	370.31	371.56	386.12
(ii) गेहूं भूसा / सरसों भुसा / हरा चारा की बिक्री	17.81	1.26	5.05	10.22	0.26	6.31
(iii) अनाज / गेहूं / धान की बिक्री	25.61	55.00	4.83	7.92	3.41	4.89
(iv) वीर्य की बिक्री	21.30	28.46	27.54	23.83	30.95	20.29
(v) खनिज मिश्रण की बिक्री	4.87	1.26	0.77	0.45	0.77	0.93
(vi) सूखे पेड़ों की बिक्री प्रक्रिया	6.00	1.75	0.00	10.15	1.60	10.43
(vii) पुस्तकों की बिक्री	0.00	0.06	0.66	0.03	0.15	0.02
(viii) प्रौद्योगिकी / रॉयल्टी की बिक्री	0.00	0.00	0.76	0.19	0.17	0.07
बिक्री आय	0.00	0.00	0.00	0.00	0.00	0.00
(i) भूमि और भवन	0.00	0.00	0.00	0.00	0.00	0.00
(ii) मशीन टूल्स और प्लांट उपकरण / वाहन आदि	1.29	0.00	0.00	0.00	8.81	0.00
(iii) पशुधन की बिक्री आय	91.09	59.59	84.13	89.47	110.24	127.26
किराए (लाइसेंस शुल्क)	3.98	4.68	4.70	5.93	5.88	5.84
अभ्यर्थी ट्यूशन फीस, डिप्लोमा शुल्क आदि से आवेदन शुल्क	0.00	0.00	0.00	0.00	0.00	0.30
भर्ती के संबंध में उम्मीदवारों से आवेदन शुल्क	0.26	0.01	0.00	0.00	0.00	0.00
संस्थान द्वारा प्रदान की गई सेवा से प्राप्त रसीदें / छात्रों से रसीद योजना से प्राप्तियां	3.72	3.44	2.97	0.00	0.58	0.67
विविध प्राप्ति	0.00	0.00	0.00	0.00	0.00	0.00
(i) निविदा प्रपत्र की बिक्री	2.92	1.69	0.79	0.73	0.87	0.00
(ii) अतिथि गृह शुल्क	2.10	2.62	3.77	1.28	3.18	4.62
कुल:	**442.57**	**437.04**	**472.16**	**520.50**	**538.42**	**567.73**
टारगेट	**341.20**	**409.43**	**397.78**	**397.78**	**445.000**	**435.33**

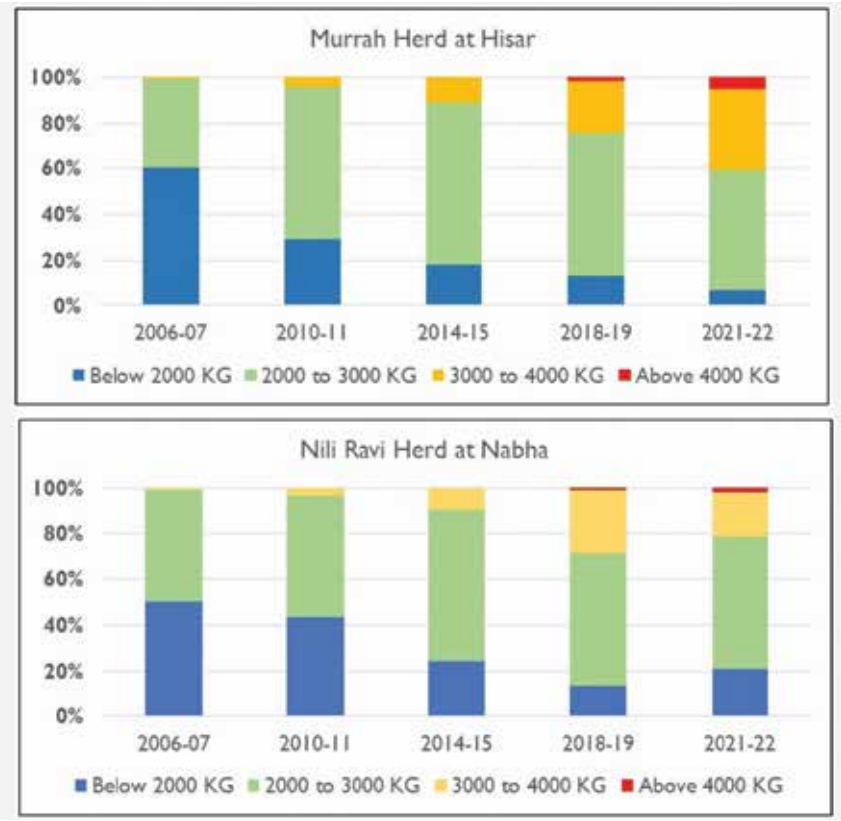
वित्तीय परिव्यय (लाख रुपये में)

संस्थान/परियोजना का नाम	स्वीकृत बजट २०२२-२०२३	व्यय २०२२-२०२३
सीआईआरबी मुख्य	3246.98	3218.03
सीआईआरबी टी एस पी	2.00	2.00
सीआईआरबी एन ई एच	5.00	5.00
सीआईआरबी एस सी एस पी	18.00	18.00
कुल	**3271.98**	**3243.03**
प्लान योजनाएं		
भैंस सुधार पर नेटवर्क परियोजना	320.00	320.00
भैंस सुधार पर नेटवर्क परियोजना, एस सी एस पी	13.00	12.96
पोषण और शरीर क्रिया विज्ञान पर ए आई सी आर पी (डॉ. आर.के. शर्मा, पीएस और पी आई)	6.00	5.51
एन ए आई एफ परियोजना (डॉ. संदीप खुराना, पीएस और पी आई)	8.56	8.56
एन ए एस एफ क्लोनिंग प्रोजेक्ट (डॉ. पी.एस. यादव, पीएस और पी आई)	211.61	195.11
एन ए एस एफ डी एम एम प्रोजेक्ट (डॉ. धर्मेंद्र कुमार, वरिष्ठ वैज्ञानिक और पी आई)	21.95	21.95
केबिन परियोजना (डॉ. वारिज नयन, वरिष्ठ वैज्ञानिक और पी आई)	20.00	20.00

संस्थान/परियोजना का नाम	स्वीकृत बजट २०२२-२०२३	व्यय २०२२-२०२३
एफ एफ पी परियोजना (डॉ. सरिता यादव, वरिष्ठ वैज्ञानिक और पी आई)	14.35	13.64
सी आर पी परियोजना (डॉ. मीती पुनेठा, वैज्ञानिक और पी आई)	8.00	7.83
कुल	**623.47**	**605.55**
बाह्य वित्तपोषित योजनाएँ		
डी बी टी परियोजना (डॉ. प्रदीप कुमार, वरिष्ठ वैज्ञानिक और पी आई)	16.59	11.78
एनएलएम परियोजना (डॉ. अशोक बल्हारा, वरिष्ठ वैज्ञानिक और पी आई)	29.85	0.00
एनएलएम परियोजना (डॉ. सुनेश बल्हारा, वरिष्ठ वैज्ञानिक और पी आई)	21.15	0.00
बी एम जी एफ परियोजना (डॉ. वारिज नयन, वरिष्ठ वैज्ञानिक और पी आई)	32.40	19.60
डीएएचडी परियोजना (डॉ. आर.के. शर्मा, पीएस और पी आई)	263.79	3.57
डी बी टी परियोजना (डॉ. पी.एस. यादव, पीएस और पी आई)	14.27	13.67
एसईआरबी परियोजना (डॉ. मीती पुनेठा, वैज्ञानिक और पी आई)	14.32	13.16
कुल	**392.36**	**61.79**

स्टाफ की स्थिति

श्रेणी	स्वीकृत	कार्यरत	रिक्त
वैज्ञानिक	44	24	20
तकनीकी	42	27	15
प्रशासनिक	25	15	10
कुल सहायक कर्मचारी	124	106	18



आनुवंशिक सुधार एवं दूध उत्पादन की प्रवृत्ति (व्यस्क मादा भैंसों का प्रतिशत)


CIRB
5814
CIRB
5820

INTRODUCTION

Institute at a glance

The ICAR- Central Institute for Research on Buffaloes (CIRB) was established on February 1, 1985 by acquiring the Progeny Testing Bull Farm from Haryana Government at Hisar. The Institute is dedicated to address the developmental needs of this virtuous species through interventions derived from research. 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).

Institute has developed considerable expertise over the last three decades in improving buffalo's genetic performance and fertility management with the application of reproductive biotechnologies, and efficient nutrient utilization and enteric methane mitigation technologies. Information generated at the institute and the services offered to stakeholders have contributed to the growth of buffalo industry as a whole and well-being of millions of milk producers. Under the Network Project on Buffalo Improvement, the ICAR-CIRB coordinated establishment of pedigreed nucleus breeding herds of six important buffalo breeds in their respective home tracts in collaboration with other ICAR institutes and the state agricultural universities. 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.

I. 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.

II. Division of Animal Nutrition and Feed Technologies

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 Biome, 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.

III. 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 and molecular biology, 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. During the year 2022, Semen freezing lab received Grade B by Central Monitoring Unit, Government of India which facilitates the sale and supply of semen from high genetic merit buffalo bulls.

Animal Farms

Highly pedigreed herds of over 550 Murrah buffaloes and an equal number 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 10.06 kg/day and 2846 kg in 2022. 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 37.41 months).

Elite buffaloes at CIRB, Hisar

Buffalo No.	D.O.B.	Highest 305d or less MY (kg) /lactation no.	Best Peak Yield (kg)	Sire No.	Set No.
5179	24/03/17	5170/2	26.8	3591 PT (CIRB)	11
4316	31/03/11	4875/6	23.9	R-11 (Field)	12
5081	27/08/16	4507/3	22.5	4354 PT (CIRB)	15
5151	07/01/17	4444/2	21.0	4592 (CIRB)	16
4692	28/01/14	4431/5	20.0	1994 PT (GADVASU)	9
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
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
E182	19/05/17	4149/2	20.5	NK	--
4251	29/10/10	4138/3	22.0	2133 PT (GADVASU)	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 2022 the production performance of Nili-Ravi herd at Sub-Campus, Nabha has recorded as - wet average 8.28 kg/day, 305 days or less milk yield 2571 kg. Age at first calving 43.51 months and service period 132 days, were recorded during the period.

ICAR-CIRB Buffalo Herd status (2022)

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													
1.	Calves below 3 months	39		24	103	65	-	3	03	3	01	26	14
2.	Calves 3-12 months	35		34			-	1	01	1	01	69	50
3.	Heifers a) 1-2 years b) Above 2.0 years	 77 82		66 113			- -	0 0	01 0	2 18	0 12	 80 76	 55 110
4.	Buffaloes in Milk	137		111			-	1	03	31	20	145	100
5.	Buffaloes Dry	47		46			-	1	02	16	37	47	46
	Sub Total	417		394	103	65	-	6	10	71	71	443	378
Male													
1.	Calves below 3 months	30		22	68	80	-	3	03	4	05	28	31
2.	3-12 months	45		38			-	3	0	10	10	39	38
3.	1) 1-2 years 2) > 2 years	 36 18		 29 34			-	 0 0	 0 0	 49 12	 34 09	 26 29	 42 25
4.	Breeding bulls	12		06			-	0	0	5	04	12	08
5.	Bullocks	0		0			-	0	0	0	0	0	-
6.	Teasers	0		01			-	0	0	0	0	0	01
	Sub Total	149		130	68	80	-	6	03	77	62	134	145
	Grand Total	566		524	171	145	-	12	13	148	133	577	523

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 (2022)

Month	Male (number)		Female(number)		Abortions & Still Birth(number)		Overall(number)	
	M	NR	M	NR	M	NR	M	NR
January	8	10	7	10	--	03	15	20
February	4	07	7	04	2	01	13	11
March	2	02	2	05	1	--	5	07
April	4	03	7	03	1	--	12	06
May	3	01	4	0	2	04	9	01
June	4	0	10	01	1	02	15	01
July	8	02	11	01	1	03	20	03
August	8	10	12	15	2	02	22	25
September	10	12	15	12	2	--	27	24
October	8	11	8	04	--	--	16	15
November	11	16	11	07	1	--	23	23
December	9	06	8	03	--	--	17	09
Overall	79	80	102	65	13	15	194	145

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) = 55:45

ICAR-CIRB Disposal of animals (2022)

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	-	01					3		3	03	6	04
6-12 months	-	01					1		1	01	2	02
Heifers												
1-2.5 yrs	-	12			0		2		0	01	2	13
> 2.5 yrs	-	--			12		6		0		18	
Buffaloes												
Dry	4	37	3		7		2		1	02	17	39
Milch	6	20	8		11		6		1	03	32	23
Sub Total	10	71	11		30		20		6	10	77	81
Male												
< 6 months	4	05							3	03	7	08
6-12 months	10	10							3		13	10
>1 yr	53	43			5				0		58	43
Breeding bulls	2	04			3				0		5	04
Bullock +Teaser	-								0			
Sub total	69	62	0		8		0		6	03	83	65
G. Total	79	133	11		38		20		12	13	160	146

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

ICAR-CIRB Month wise mortality of animals (2022)

Month	Deatails	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. of animals	24	26	29	26	27	13	157	66	178	272	415	403	15	23	26	24	28	19	81	33	154	41	569	140
	No. of Died	--		--		--		--		1		1		--		--		--		--		--		1	
Feb	No. of animals	24	27	32	21	25	19	159	62	185	278	423	407	15	25	29	17	31	27	84	34	159	43	582	146
	No. of Died	--		--		--		--		--		--		1	01	1		--		--		--		2	
	No. of animals	16	19	33	24	34	26	126	64	223	251	433	384	13	17	24	22	28	22	78	14	142	27	576	102
	No. of Died	--		--		--		--		--		--		--		1		--		--		1		1	
Apr	No. of animals	15	12	23	26	45	13	71	65	254	253	408	387	10	11	14	22	28	30	86	15	138	27	546	105
	No. of Died	--		--		--		--		--		--		--		--		--		--		--		--	
May	No. of animals	16	07	23	26	44	33	74	64	223	255	405	385	14	06	14	24	38	32	85	17	147	27	552	106
	No. of Died	--	01	--	01	--		--		--		--	02	--		--		--		--		--		--	
Jun	No. of animals	13	03	24	19	42	44	80	65	230	255	409	386	9	04	14	17	41	37	86	21	150	27	559	106
	No. of Died	--		--		--		--		--		--		01		--		--		--		01		01	
Jul	No. of animals	21	02	15	11	53	51	79	63	252	260	420	387	10	03	13	11	37	44	92	55	152	28	572	108
	No. of Died	--		--		--		--		--		--		--		--		--		--		--		--	
Aug	No. of animals	25	17	16	07	48	47	79	59	263	270	431	400	15	12	9	06	37	41	93	31	154	28	585	118
	No. of Died	--		--		--		--		01	02	01	02	--		--		--		--		--		1	
Sep	No. of animals	30	28	13	03	46	42	78	51	273	284	440	408	20	22	8	04	35	39	96	31	159	32	599	128
	No. of Died	01		--		--		--	01	--	03	01	04	01	02	--		--		--		01		02	02
Oct	No. of animals	37	31	21	02	39	36	80	52	282	257	459	378	25	27	10	03	27	30	101	32	163	28	622	120
	No. of Died	01		--		--		--		--		01		--		--		--		--		--		01	
Nov	No. of animals	33	23	24	17	39	33	77	50	253	262	426	385	24	34	14	11	23	27	98	36	159	28	585	136
	No. of Died	--		--		--		--		--		--		--		--		--		--		--		--	
Dec	No. of animals	33	14	31	28	37	22	78	55	258	269	437	388	28	31	18	19	25	19	92	42	163	30	600	142
	No. of Died	01		--		--		--		01		02		--	01	--		01		--		01		03	01

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

ICAR-CIRB Buffalo conception rate (2022)

No. of AIs	Ist						IInd						IIIrd						IVth & above						Overall					
Criteria	Insemination		Conception		Concept. rate		Insemination		Conception		Concept. rate		Insemination		Conception		Concept. rate		Insemination		Conception		Concept. rate		Insemination		Conception		Concept. rate	
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	80	47	39	21	48.75	44.68	33	35	15	15	45.45	42.86	14	16	7	06	50	37.5	16	31	10	09	62.5	25.81	143	129	71	50	49.65	38.76
Adult	109	129	57	56	52.29	43.41	69	76	35	33	50.72	43.42	38	34	22	13	57.89	38.24	44	33	21	15	47.73	45.45	260	272	135	117	51.92	43.01
Overall	189	176	96	77	50.79	43.75	102	111	50	47	49.02	43.24	52	50	29	19	55.77	38.00	60	64	31	24	51.67	37.50	403	401	206	167	51.12	41.65

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

ICAR-CIRB Buffalo herds production status (2022)

ICAR-CIRB Bull-wise conception rate (2022)

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.	2674	03	19th	5th	16	09	7	2	43.75	22.22
2.	5427	27	20th	5th	27	95	16	42	59.26	44.21
3.	3591	551	11th	9th	19	12	7	05	36.84	35.71
4.	6007	561	15th	9th	24	133	16	58	66.67	43.61
5.	7649	556	20th	9th	43	07	17	01	39.53	14.29
6.	4354	705	15th	9th	29	19	19	09	65.52	47.31
7.	7584	710	20th	9th	35	91	17	40	48.57	43.96
8.	3004	579	20th	9th	15	19	3	05	20.00	26.32
9.	5500	674	20th	9th	11	16	9	06	81.82	31.25
10.	5588		20th		12		8		66.67	
11.	4592		16th		5		2		40.00	
12.	5505		20th		11		6		54.55	
13.	2459		15th		5		2		40.00	
14.	5511		20th		20		7		35.00	
15.	5481		20th		10		9		90.00	
16.	6044		14th		3		0		0.00	
17.	2831		20th		6		4		66.67	
18.	5320		19th		20		8		40.00	
19.	5333		19th		24		13		54.17	
20.	5374		19th		18		8		44.44	
21.	2759		19th		6		2		33.33	
22.	HAU12		19th		6		3		50.00	
23.	5232		19th		13		10		76.92	
24.	2269		13th		2		1		50.00	
25.	7604		19th		6		4		66.67	
26.	2737		19th		17		8		47.06	

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

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	58	46	2524	2435	302	306	2429	2350	12.33	12.28
2nd	41	22	3243	2785	302	296	3166	2661	16.70	15.49
3rd	24	16	2952	2808	279	282	2915	2790	16.68	15.97
4th	11	14	3710	2631	316	287	3616	2604	19.44	14.84
5th and above	17	17	2940	2930	293	305	2900	2819	16.06	15.82
Overall	151	115	2920	2651	298	299	2846	2571	15.14	12.28

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

ICAR-CIRB Buffaloes reproduction performance (2022)

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 $\bar{X}$ SE	73 37.41 ± 0.68	54 43.51 ±0.42										
Av. Service Period (Days)	N $\bar{X}$ SE			47 146.94 ±10.23	29 167 ±15.59	34 123.62 ±12.31	11 131 ±24.95	14 96.14 ±19.33	22 113 ±13.03	19 132.05 ±18.52	25 110 ±14.66	114 131.26 ± 6.89	87 132 ±8.41
Av. Dry Period (Days)	N $\bar{X}$ SE			47 143.94 ± 8.90	29 173 ±10.01	34 123.65 ± 8.50	11 148 ±20.08	14 116.86 ±17.92	22 144 ±11.42	19 122.89 ±12.27	25 137 ±11.31	114 131.05 ± 5.40	87 152 ±6.15
Av. Calving Interval (Days)	N $\bar{X}$ SE			47 454.74 ±10.43	29 472 ±15.48	34 431.88 ±12.57	11 436 ±24.41	14 403.71 ±19.47	22 419 ±13.01	19 443.16 ±18.52	25 417 ±14.37	114 439.73 ± 6.99	87 438 ±8.30

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

ICAR-CIRB Month wise milk sold (2022)

Month	Total Milk Produced (kg)	
	M	NR
Jan, 2022	35831.00	35326.9
Feb, 2022	32846.50	33520.3
Mar, 2022	34930.00	34370.8
Apr, 2022	29932.50	30465.30
May, 2022	28747.50	27206.90
Jun, 2022	27024.00	22036.10
Jul, 2022	28785.50	20652.20
Aug, 2022	28483.00	17855.0
Sep, 2022	31456.50	22819.40
Oct, 2022	33895.00	24925.90
Nov, 2022	32358.50	25470.00
Dec, 2022	38279.50	30804.50
Total	382569.50	325453.30

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

ICAR-CIRB Buffalo herd production performance (2022)

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	134	111	47	49	181	160	74	69	10.24	10.29	7.59	7.14
Feb	136	119	49	50	185	169	74	71	10.27	9.99	7.57	7.06
Mar	139	121	50	42	189	163	74	75	9.71	9.13	7.16	7.0
Apr	123	117	49	37	172	154	72	76	9.87	8.65	7.07	6.61
May	115	111	52	47	167	158	69	70	9.82	7.91	6.77	5.56
Jun	114	98	55	61	169	159	68	61	9.60	7.57	6.50	4.62
July	113	88	62	71	175	159	65	55	10.03	7.65	6.50	4.21
Aug	119	85	65	71	184	156	65	54	9.50	6.83	6.15	3.71
Sept	129	105	62	58	191	163	68	65	9.83	7.20	6.63	4.66
Oct	130	108	53	52	183	160	71	67	10.57	7.66	7.53	5.16
Nov	131	111	49	39	180	150	73	74	10.40	7.66	7.57	5.68
Dec	140	113	48	43	188	156	74	72	10.90	8.78	8.09	6.35
Overall	127	107	53	52	180	159	71	67	10.06	8.28	7.09	5.64

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

ICAR-CIRB Buffalo herd production performance since 1992-93

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	64.83	72	8.04	8.51	5.21	6.22
2016-17	110	102	57	53	167	155	65.82	65	8.08	7.96	5.32	5.23
2017-18	115	97	54	45	169	142	67.78	68	8.71	8.52	5.90	5.84
2018-19	101	109	54	38	155	147	65.08	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
2022	127	107	53	52	180	159	71	67	10.06	8.28	7.09	5.64

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)

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
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)
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 (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)
2022	2920 (151)	2651 (115)	298 (151)	299 (115)	2846 (151)	2571 (115)

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 the year 2022, the total green and dry fodder production during the year was 36896 and 858 quintals, respectively, while grain production was 793 quintals. At Sub-Campus Nabha, the total green and dry fodder production during the year was 56595 and 2852 quintals, respectively, while grain production was 4078 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 650 tonnes of concentrate feed for feeding to farm animals. In addition, approx. 17 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 attached 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 (10 Q/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 100 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 throughout 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, now green fodder and grains are being produced. A step wise plan has been made to reduce soil salinity and improvement of fertility.

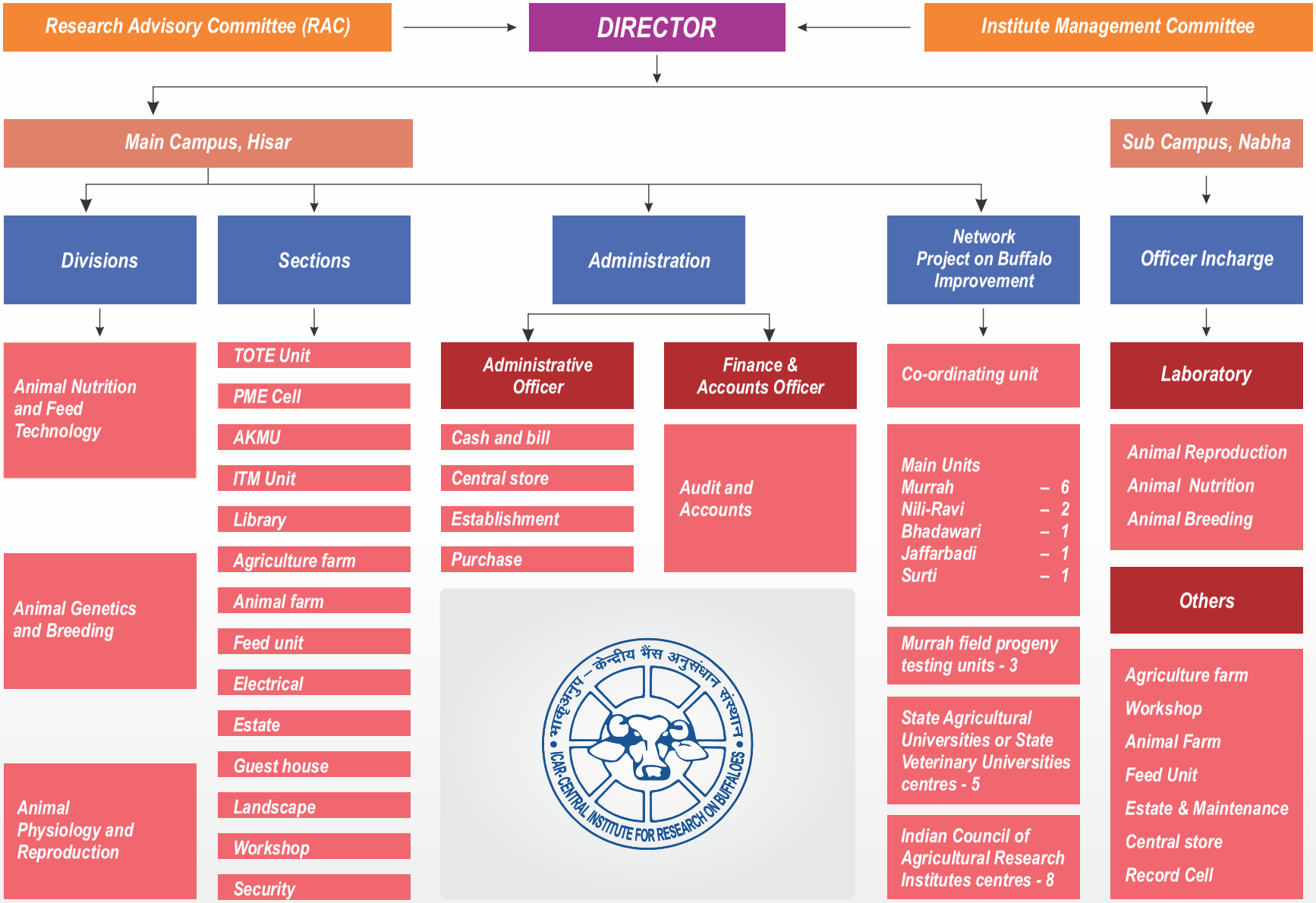
National and International Collaborations

Over the years, the institute has established collaborations with various national and international institutions. Projects were undertaken with various externally funded agencies at this institute sponsored by DBT, DST, USAID, NAIP, NASF, DADF, Network / All India Coordinated projects and other external agencies. 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 postgraduate research in the field of buffalo husbandry, nutrition, physiology and reproduction. 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.

Priority setting, monitoring and evaluation of research activities of Institute

The institute receives advice on research and management through Quinquennial Review Team (QRT), Research Advisory Committee (RAC), Institute Research Committee (IRC) 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 (ITMU) and Agriculture Knowledge Management Unit (AKMU) cater to different responsibilities for smooth functioning of research activities.

ICAR-Central Institute for Research on Buffaloes



RESEARCH ACHIEVEMENTS

Genetics and Breed Improvement

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 superior 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. 987 breedable buffaloes are being maintained at institutional Murrah centres for production of high genetic merit male and female calves to be used for production of future sires.

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. 661 (Nili-Ravi-318, Jaffarabadi-201, Surti-79 and Bhadawari-63) 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			
I	ICAR-CIRB, Hisar	Murrah	1993
II	ICAR-NDRI, Karnal	Murrah	1993
III	ICAR-IVRI, Izatnagar	Murrah	1993
IV	ICAR- IGFRI, Jhansi	Bhadawari	2001
V	ICAR-CIRB, Sub - Campus Nabha	Nili-Ravi	2001
VI	ICAR Research Complex, ER Patna	Murrah	2014
Animal Science/Agricultural Universities			
I	GADVASU, Ludhiana	Murrah	1993
II	LUVAS, Hisar	Murrah	1993
III	JAU, Junagarh	Jaffarabadi	2001
IV	RAJVASU, Vallabhnagar	Surti	2001
V	GADVASU, Ludhiana	Nili-Ravi	2018
Field Units			
I	ICAR-CIRB, Hisar	Murrah	2001
II	ICAR-NDRI, Karnal	Murrah	2001
III	GADVASU, Ludhiana	Murrah	2001

Progeny test evaluation of 16th set (Murrah) used during January 2016 to July 2017

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)
M-29	CIRB	16-10-05	4 P	P274	4600	60	2570.51	3191	2578.94	I	3.82
1053	LUVAS	17-12-13	683	M-29	3559	46	2561.37	3421	2567.15	II	3.35
2383	GADVASU	13-10-10	2489 P	3267PT/XI	4636	78	2553.09	3101	2546.77	III	2.53
4889	CIRB	23-10-04	S-802	FT 245	4120	73	2535.38	3445	2532.68	IV	1.96
4592	CIRB	28-06-13	4353 P	Khali	3528	61	2511.76	3430	2518.33	V	1.38
1064	LUVAS	19-02-14	613	BI 330	3579	8	2499.18	3057	2482.85	VI	-0.05
6753	NDRI	13-07-13	470 P	858/XIII	3389	16	2442.56	2931	2471.15	VII	-0.52
6379	NDRI	17-10-11	402 P	4915PT/VII	3505	39	2468.03	3550	2469.65	VIII	-0.58
2467	GADVASU	01-04-12	2279 P	R-10/XII	3574	77	2444.15	3231	2456.79	IX	-1.10
4623	CIRB	01-09-13	4261 P	1875PT/ VIII	3506	8	2362.54	3272	2451.66	X	-1.30
6646	NDRI	17-02-13	6627 P	NK	3533	40	2441.11	3013	2451.06	XI	-1.33
1027	LUVAS	28-09-13	603	PC 461	3763	47	2433.51	2895	2448.85	XII	-1.41
2501	GADVASU	10-10-12	1794 P	1875PT/ VIII	3053	88	2440.47	2994	2440.90	XIII	-1.73
4705	CIRB	22-07-12	83 P	B 902	3990	78	2453.05	3152	2439.16	XIV	-1.80
6409	NDRI	09-01-12	490 P	4371PT/V	4090	43	2389.38	3265	2403.92	XV	-3.22

NK: Not Known

Average Breeding Value: 2483.99 kg (N=762)

Bull no. M-29 (CIRB), 1053 (LUVAS) and 2383 (GADVASU) ranked 1st, 2nd and 3rd, respectively declared as proven bulls for nominated mating during January 2022 to June 2023.

Breeding bulls of 20th set for test mating

Test mating of 14 Murrah bulls of 20th set initiated in January 2022 and completed on 30th June 2023 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
19	LUVAS	29/10/18	777	2594/Set 17	3695/21.6	3
1454	LUVAS	19/06/18	976	183PT/Set 12	3355/17.4	4
2793	GADVASU	06/07/18	2788	2467/Set 16	3339/21.5	2
2831	GADVASU	11/10/18	2897	Virat/Field	4814/28.7	4
2838	GADVASU	02/11/18	2502	1354PT/Set 3	3340/22.7	3
2850	GADVASU	25/01/19	2973	2594/Set 17	3683/20.6	2
3004	GADVASU	13/10/16	Laado	Rustam/Field	4716/26.2	
5427	CIRB	10/11/18	3633	R-24/Field	3371/15.3	4
5481	CIRB	29/03/19	4621	4733/Set 17	3332/16.6	3
5500	CIRB	15/07/19	4934	1148/Set 17	3271/16.5	3
5505	CIRB	22/07/19	4251	1148/Set 17	4138/22.0	3
5511	NDRI	27/07/19	4800	6942/Set 17	3356/17.4	2
7584	NDRI	30/03/18	6147	6253/Non-Set	3600/16.5	2
7649	NDRI	15/10/18	6735	2558/Set 17	3203/13.5	1

19th Annual Review Meet of Network Project on Buffalo Improvement (NPBI) was held on 28th July, 2022 through Zoom online mode at ICAR-CIRB, Hisar. In this meeting progress of project for the last two

years (2020-21 and 2021-22) was reviewed. During the period, the herd average standard lactation milk yield has increased from 1820 kg in 1993 to 2625 kg (~44%). daughter performance in term of first lactation milk yield of Murrah buffalo increase from 1716 kg in set I to 2547 kg in set XV. In year 2021-22 CIRB disseminated record number of semen doses (1,63,081) for breed improvement. After induction of FPT in 2001 the no. of daughters recording increased drastically from 143 (set VII) to 834 (set XV). As a whole NPBI contributed in breed improvement programme by the production of 39 (CIRB-12, NDRI-10, GADVASU-14 & LUVAS-3) progeny tested Murrah buffalo bulls out of total 15 sets of test bulls during the period.

Genetic Improvement of Murrah Buffalo

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

A total of 181 (79 male and 102 female) calves of high genetic merit were born at CIRB during the year 2022. The test mating (316 inseminations) of 19th and 20th set was carried out during the year resulting in 159 pregnancies. Nominated mating (82 inseminations) using 6 progeny tested bulls of 11th, 13th, 14th and 15th sets were also carried out resulting in 45 pregnancies. The wet average (10.06 kg), herd average (7.09 Kg), 305 days lactation milk yield (2846 kg), total lactation milk yield (2920 kg), peak yield (15.14 kg), were achieved in CIRB Murrah herd during the year. A total of 71% animals were found in milk and average dry period of 131 days was recorded in institute Murrah herd. Average lactation length was 298 days was recorded during the year. The reproductive traits viz., service period, calving interval and AFC were 131 days, 440 days and 37.41 months, respectively during the year. A total of 49 breeding bulls were sold to various agencies including various semen freezing stations in the year 2022. Due to better health management calf mortality (0-3 months) was restricted to 2.75% and overall mortality of buffaloes was 2.04% only in CIRB Murrah herd. Total milk production of 382569.50 kg was recorded during the year 2022. 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 was initiated from January 2022.

Field Progeny Testing of Bulls (FPT) – CIRB Hisar

A Bharadwaj, 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 2022 to December 2022, 3609 artificial inseminations were performed using test bulls of 19th and 20th set of test bulls. The conception rate in the field was worked out to be 55.03%. In this period 1986 pregnancies were confirmed and 1451 calving (males 751, females 701) were recorded. Besides, 224 daughters (18 of 16th, 192 of 17th and 14 of 18th set) with an average age at first calving of 41.14 months were also calved, out of which 188 completed the lactation and rest were sold before completion of lactation. The milk production records of 195 daughters in the field sired by 16th set of bulls were used for sire evaluation. The physical identification using ear tagging has been done in all female progenies born in the field. As on 31st December 2022, 1229 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 145 (80 male and 65 female) calves of high genetic merit were born this year. The test and nominated matings (401 inseminations) using PT bulls, bulls of 9th sets were carried out resulting in 167 pregnancies. The overall conception rate during this period was 41.65%. The overall mortality of 1.94% and calf mortality of 4.14% were recorded during year 2022. During this period, 46 daughters completed 1st lactation. The overall wet average (8.28kg), herd average (5.64 kg), 305 days lactation milk yield (2571 kg), total lactation yield (2651 kg), peak yield (14.24 kg), percentage of animals in milk (67%) and lactation length (294 days) were achieved in Nili-Ravi herd. Improvement in reproductive traits viz., service period (132 days), AFC (43.51 months) calving interval (438 days) and dry period (152 days) were achieved during year 2022. The total milk produced during this year was 3,25,453.3 kg. A total of 4666 doses were produced at Sub-Campus Nabha, out of which 842 doses were used for insemination, 3116 doses were sold for insemination of buffaloes in field, and 410 doses were transferred to GADVASU Ludhiana for insemination and pedigree testing. Total of 133 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

2564 milk samples from 645* milch buffaloes were tested (CMT) as per details

S. No.	Place of sampling	Total no. of animals tested*	Total no. 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
2.	Vill. Chindar, Fatehbad	129	8	5	2	1	2
3.	Vill. Dhandoor, Hisar	29	6	1	2	3	2
4.	Vill Kaimri, Hisar	48	6	1	2	3	2
5	Vill Daya, Hisar	23	3	-	1	1	2
6.	Vill. Neoli Kalan, Hisar	46	8	2	7	6	4
7.	Vill. Daya, Hisar	31	7	2	6	5	3
8.	Vill. Sarangpur, Fatehbad	53	3	1	-	1	2
9.	Vill. Arya Nagar	38	4	1	-	2	2
		645	93	32	45	37	34

- 645 milch buffaloes without clinical mastitis were tested for mastitis and 93 (14.4 %) were found positive for subclinical mastitis by CMT.
- Milk samples from CMT positive quarters subjected to bacteriological analysis resulted in isolation of *Staphylococcus aureus* (16), *Staphylococcus* spp. (8), *Streptococcus* spp. (21), *Enterococcus faecalis* (6), *Klebsiella* sp. (1), *E. coli* (6), *Kocuria rosea* (5), *Kocuria kristinae* (4), *Kocuria varians* (3), *Rothia mucilaginosa* (1), *Enterobacter cloaceae* (3) and *Sphingomonas paucimobilis* (1). Some of these bacteria are unusual and of zoonotic potential.
- All the isolates were tested against 28 antimicrobial agents. A large proportion of isolates were MDR having average MAR values from 0.31 to 0.37. Amikacin, Ciprofloxacin, Gentamicin and ofloxacin should be preferred antibiotics against *S. aureus;* amikacin, gentamicin, and azithromycin against *Streptococcus* spp. and

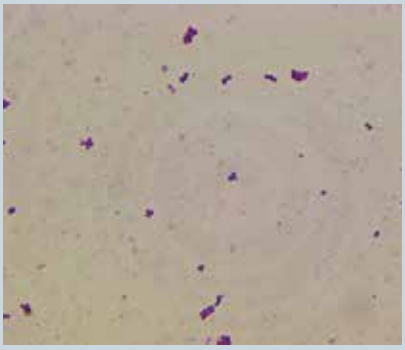
amikacin, ampicillin, azithromycin, gentamicin and kanamycin against *Kocuria* spp. being most effective.

- Average SCC/ ml in CMT positive quarters was 3,95,702 and in CMT negative quarters was 73,949. Average SCC/ ml in CMT positive animals was 2,40,667 and in CMT negative quarters was 70,121.

SCC/ ml	Quarter wise	Animal wise
CMT positive	3,95, 702	240, 667
CMT negative	73,949	70121

- *Staphylococcus areus, Streptococcus spp. and Kocuria spp.* are predominant pathogenic bacteria responsible for sub clinical mastitis. These bacteria have been molecularly confirmed. *Staphylococcus aureus*, *Enterococcus faecalis*, *Kocuria* spp., *Enterococcus faecalis*, *Rothia mucilaginosa*, *Enterobacter cloaceae* and *Sphingomonas paucimobilis* are having varying zoonotic potential. Information regarding causes of sub clinical mastitis and ameliorative measures will help in reducing the sub clinical mastitis and improving the economics of buffalo production.

Kocuria rosea colonies (Nutrient agar plate)



Kocuria rosea (1000X magnification)

Development of Soft Computing Tool for Dairy Buffalo Selection

Sunesh Balhara, AK Balhara, SK Phulia and Naresh Kumar

The extension of the research findings to benefit dairy farmers involved a multi-step process. The initial ANN model, crafted using the Weka tool, was transposed into a Python software program. This transition allowed for wider accessibility and practical implementation. By leveraging the capabilities of deep learning libraries such as TensorFlow, Keras, or PyTorch, the model was reconstructed using predetermined weight and bias values. These libraries offer a comprehensive suite of functions to define, train, and execute complex neural network models.

In this translation, each output used in the Weka ANN model was treated independently, thus enhancing the granularity of predictions. To ensure the model's effectiveness across various scenarios, appropriate constraints were introduced to maintain input values within specific ranges. These constraints played a crucial role in keeping input data compatible with the normalized range of the dataset. This approach facilitated consistency in predictions and reliable outcomes.

Ultimately, this endeavor enabled the integration of advanced predictive capabilities with the practical needs of dairy farmers. By combining the strengths of Weka's initial model with Python's robust programming and deep learning libraries, a comprehensive software solution was realized, helped to provide actionable insights and informed decision-making for dairy farming practices.

Improvement of Reproductive Efficiency and Assisted Reproductive Technologies

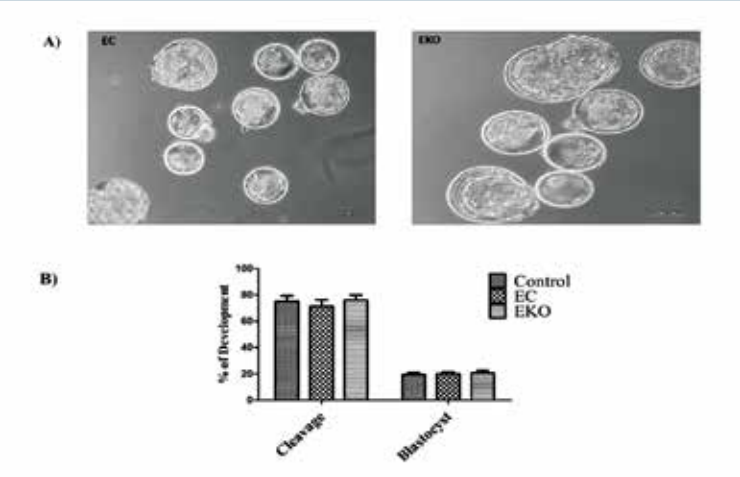
The ability of animals to reproduce efficiently is an integral component of animal production system. Animal Physiology and reproduction division is primarily involved in conducting research studies on multiplication of elite bulls using cloning technique, in vitro fertilization, developing technology 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

Deciphering the functional role of OCT4 during buffalo embryogenesis using CRISPR/Cas9

Meeti Punetha, P S Yadav, Dharmendra Kumar, Gururaj Makarabbi

CRISPR has now been used widely to edit genome reliably and efficiently at the embryonic level with ribonucleoprotein (RNP) using electroporation as a superior method for its delivery. Genetic mosaicism is commonly observed following microinjection as the zygotes continues to develop throughout

the injection process and Cas9 cleave genes at different stages of embryonic development, leading to mosaicism of the introduced mutations. In the present study, we have developed an efficient method called CRISPR-RNP electroporation of zygote (CRISPR-EZ) to reduce mosaicism rate and increase biallelic mutation in buffalo. The study uncovers that electroporation performed at 20V/mm pulse in zygote 10h post insemination (hpi) resulted in increased membrane permeability, higher editing efficiency without affecting embryonic developmental potential. Using the above parameters, we targeted buffalo POU5F1 gene, which resulted in nonsense mediated mRNA decay leading to the complete knockout (KO) of the POU5F1 gene. Upon KO, we did not find any differences in embryonic developmental competence i.e on cleavage and blastocyst rate between control, POU5F1-KO and electroporated control embryos. To elucidate the effect of POU5F1-KO on other pluripotent genes we determined the relative expression of SOX2, Nanog and GATA2 in control (POU5F1 intact) and POU5F1-KO confirmed blastocyst. POU5F1-KO significantly ($P<0.05$) altered the expression of SOX2, Nanog and GATA2 in blastocyst stage embryos. Direct



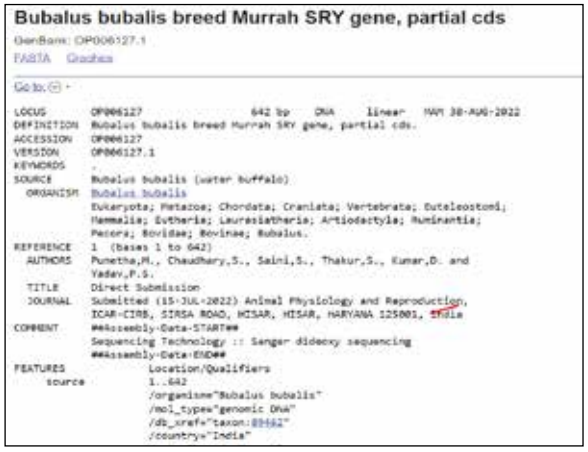
Embryo development following electroporation of CRISPR/Cas9 targeting the POU5F1 was determined at the cleavage (D2) and blastocyst stages (D7) of oocytes fertilized with frozen-thawed bull semen. A) Representative images of blastocyst stage embryos of electroporated control (EC) and POU5F1-mutated (EKO). B) Cleavage and blastocyst rate on control (no electroporation) and after electroporation of buffalo zygotes with Cas9 (EC) and RNP targeting POU5F1 (EKO).

electroporation of CRISPR-RNP component to earlier stage of zygote was efficient in creating mutations in POU5F1 gene. We developed easy and straightforward protocol for gene editing that could be serves as a useful method for studying the functional genomics of the buffalo embryos.

Generation of predetermined sex buffalo embryos using CRISPR mediated gene editing (SERB funded)

Meeti Punetha

For the generation of SRY mutated zygotes, SRY targeted guides were designed. For designing this guide, firstly SRY gene was amplified in male fibroblast cells and sequencing was done. The sequence was


Bubalus bubalis breed Murrah SRY gene, partial cds

GenBank: OP006127.1

FASTA Graphics

Go to: ⓒ

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DEFINITION  Bubalus bubalis breed Murrah SRY gene, partial cds.
ACCESSION   OP006127
VERSION     OP006127.1
KEYWORDS    .
SOURCE      Bubalus bubalis (water buffalo)
  ORGANISM  Bubalus bubalis
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            Mammalia; Eutheria; Laurasiatheria; Artiodactyla; Ruminantia;
            Pecora; Bovidae; Bovinae; Bubalus.
REFERENCE   1  (bases 1 to 642)
  AUTHORS   Punetha,M., Chaudhary,S., Saini,S., Thakur,S., Kumar,D. and
            Yadav,P.S.
  TITLE     Direct Submission
  JOURNAL   Submitted (15-JUL-2022) Animal Physiology and Reproduction,
            ICAR-CIRB, SIRSA ROAD, HISAR, HISAR, HARYANA 125001, India
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```

submitted in online repositories. The sequence was analyzed and was used to design SRY targeting guides. These guides were transfected to buffalo fibroblast cells via nucleofection SRY guide and Cas9 was transfected to male fibroblast cells using Nucleofection to check the functionality of guides.

The validation of SRY knock out and functionality of guides were determined was done by T7/E1 assay. Once it was confirmed that guides were working, we delivered the CRISPR components into one stage zygotes through electroporation also known as CRISPR-EZ (CRISPR RNP Electroporation of Zygotes) to increase biallelic mutation in buffalo. Buffalo zygotes were obtained using established protocols in the laboratory. Buffalo zygotes were electroporated with 0, 15, 20V/mm in optiMEM medium with SRY targeted SgRNA and Cas9 Protein using BTX electroporator.

Consortium Research Platform on Agro-Biodiversity

Meeti Punetha, P S Yadav, Dharmendra Kumar

Skin-tissue from Murrah (n=4), Bhadawari (n=4), Nili-Ravi (n=2) were collected from the underneath part of the tail, just above the anal region. Collected tissue was cultured for primary culture and maintained for subsequent culture. Characterization was performed for fibroblasts using specific antibodies through immunostaining. Fibroblast cells at different passage were cryopreserved using a slow-freezing method. Total of 275 cryovials of fibroblasts were shared with NBAGR.

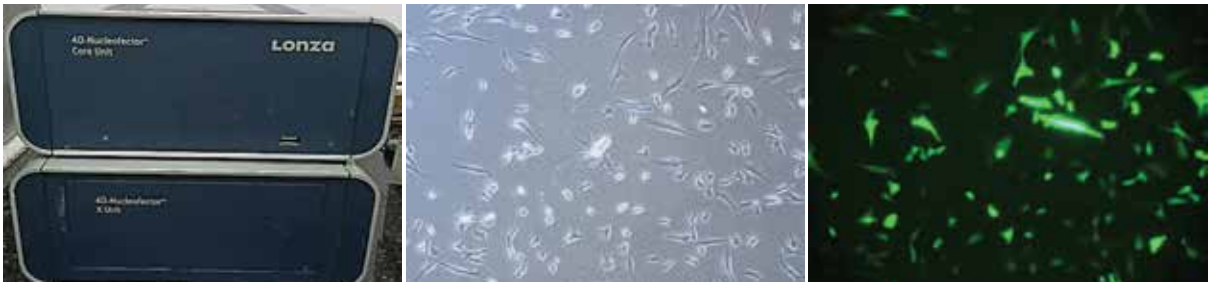
Production of Double Muscled-Mass Farm Animal using CRISPR (NASF Funded)

Dharmendra Kumar, Meeti Punetha, P S Yadav, R K Sharma, Rajesh Kumar

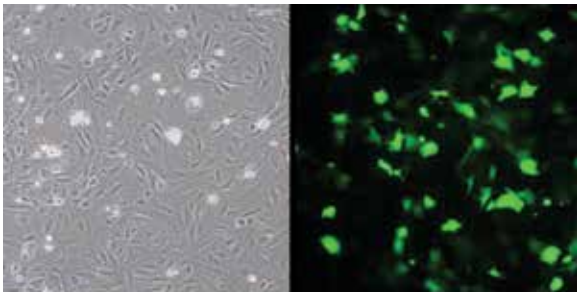
For the production of MSTN edited buffalo we adopted two approaches i.e a) Production of MSTN edited embryo using SCNT b) Delivery of MSTN ribonucleoprotein complex in single stage zygote using electroporation.

a) **Production of MSTN edited embryo using SCNT**

For this, MSTN targeted guides were transfected to buffalo fibroblast cells via nucleofection.

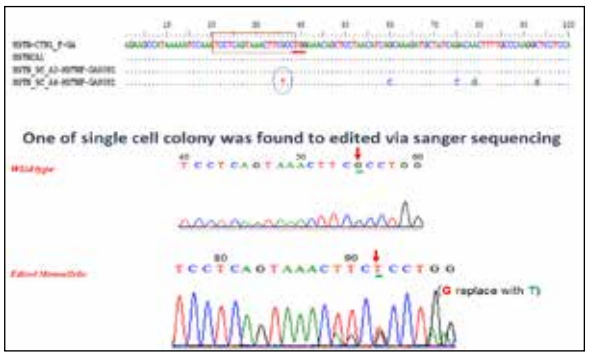


SRY guide and Cas9 was transfected to male fibroblast cells using Nucleofection to check the functionality of guides



Nucleofection of MSTN targeted guide and cas9 to fibroblast cell using Lonza nucleofector

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. Characterization of the Myostatin targeted alleles via PCR screening and sequencing was done and one MSTN mutated colony was found via sequencing.



Validation of MSTN mutation in single cell fibroblast cell using Clustal-W analysis

To check whether the mutation of MSTN gene was biallelic or monoallelic, we did the genotype confirmation and found that the MSTN knockout colonies have monoallelic mutation. The MSTN knock out colonies were propagated and cryopreserved.

b) **Delivery of MSTN ribonucleoprotein complex in single stage zygote using electroporation**

Buffalo zygotes were obtained using established protocols in the laboratory. Buffalo zygotes were electroporated with 0, 15, 20V/mm in optiMEM medium with MSTN targeted SgRNA and Cas9 Protein using BTX electroporator and then cleavage and blastocyst rate were compared. A representative subset of blastocyst was sanger sequenced and analyzed by decomposition analysis to determine the distribution of editing events; remaining blastocyst were transferred to the synchronised recipients. Using electroporation of CRISPR guide, we could successfully edit buffalo embryos, including indel (insertion/deletion) mutations, point mutations, large deletions, and small insertions.

The MSTN monoallelic mutated colony was thawed and used for production of mutated embryos via HMC. A total of 96 reconstruct were culture and out of that 78 (81%) were found cleaved. A total of 18 (23%) blastocysts were generated and out of that 8 were transferred in 3 synchronized female but no pregnancy was established. In the second approach, buffalo zygotes were electroporated using 15hpi, 15V, 5P, 3 ms parameters standardized under project. We successfully edited buffalo embryos which were transferred to the recipients and resulted into 3 pregnancies and continuue.

Establishment of DNA bank of Murrah and Nili-Ravi buffalo herd

Dharmendra Kumar, Sanjay Kumar, Meeti Punetha, Rajesh Kumar, M H Jan

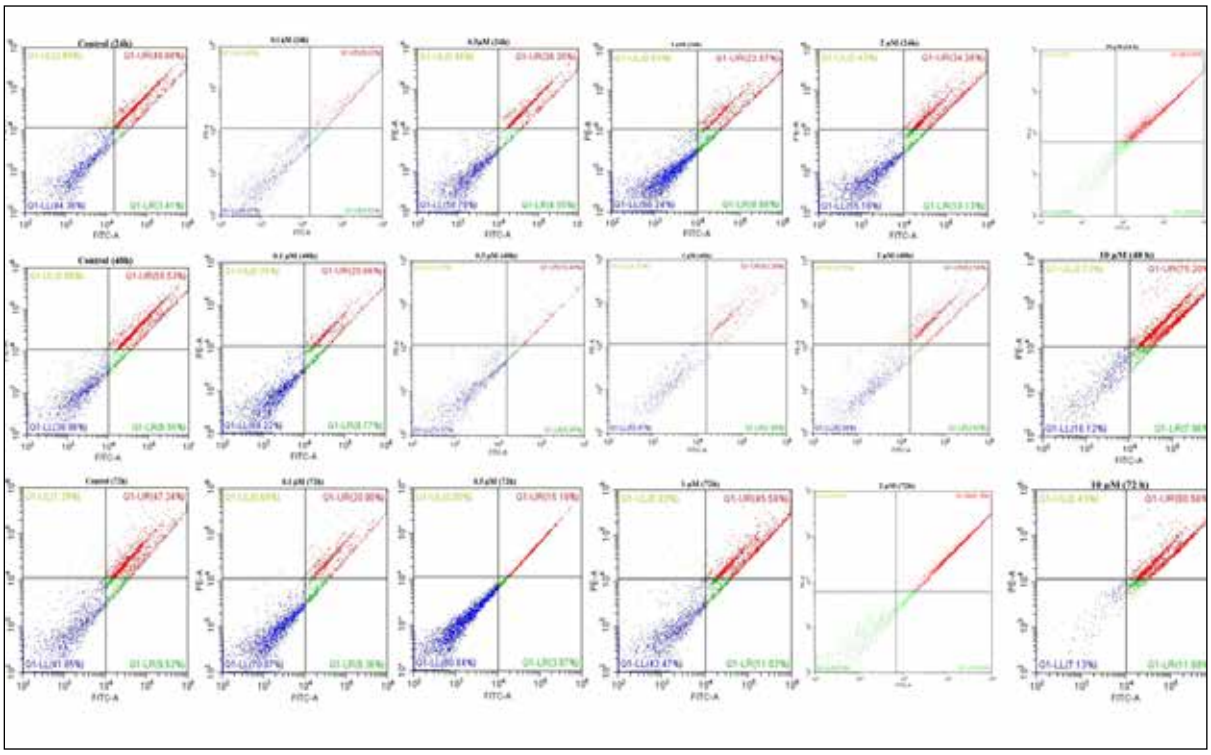
A total of 388 buffaloes DNA has been isolated and stored at -80°C in duplicate. Out of that 128 blood samples were collected from Nili-Ravi and DNA were extracted. Final DNA was eluted in 200µl volume of nuclease free water having average concentration of 41.64g/µl. These 200µl was divided into two storage vials having volume of 100 µl and stored separately in two storage boxes in -80°C with proper label. Details of the isolated samples given below:

Sr. No.	Breed Name	Total number of animals from DNA isolated	Average Concentration (ng/µl)	Average Purity (260/280)
1	Murrah	245	42.71	1.81±0.5
2	Nili-Ravi	128	37.30	1.83±0.5
3	Clones	11	53.64	1.74±0.5
4	Bhadawari	4	32.92	1.78±0.5
Total		388	41.64	1.80±0.5

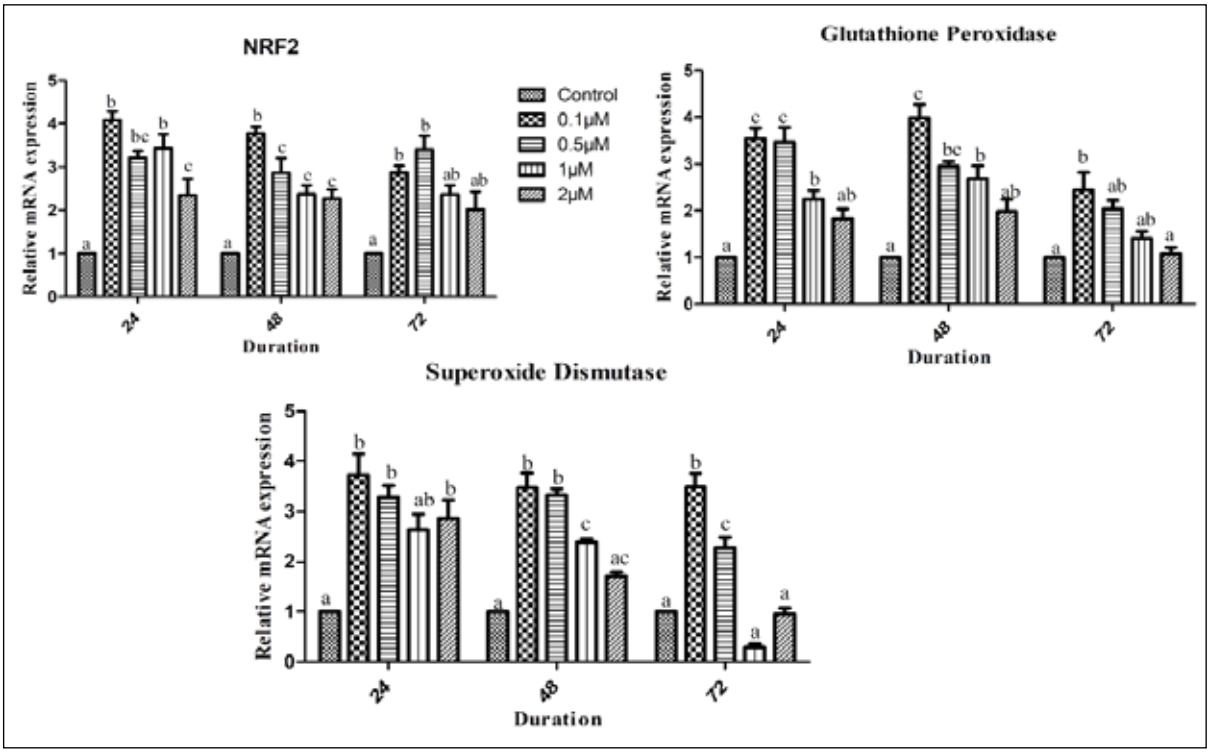
Evaluation of semen characteristics and fertility parameters of cloned bulls and performance of clone's progenies-Phase-II

Prem Singh Yadav, Dharmendra Kumar, Meeti Punetha, R K Sharma, Pradeep Kumar, Rajesh Kumar

A total of 1016 embryos were reconstructed and out of them 154 blastocysts were generated using established HMC method in the laboratory. Out of that 59 embryos were transferred in synchronized female animals (n=27) and Two animal are maintaining their pregnancy. For improving cloning efficiency, MitoQ antioxidant was supplemented during the culture of donor cells and cloned zygote and found significant



Effect of MitoQ on fibroblast viability evaluated through flow cytometry at different time of in vitro culture.



Effect of MitoQ on mRNA expression of antioxidant genes

improvement in the cells viability and embryo production by reducing ROS production and apoptosis.

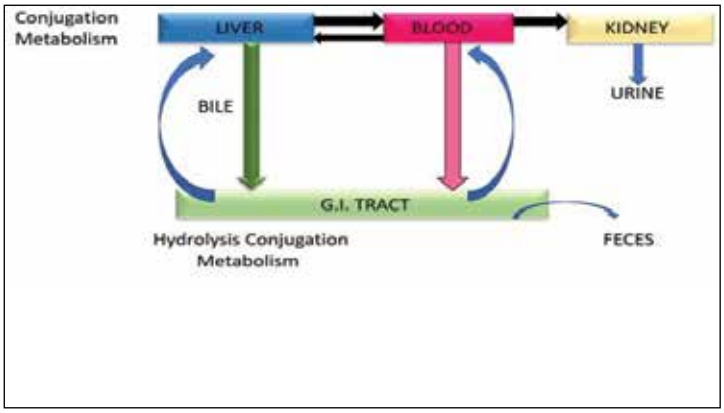
Further we evaluated the semen attributes and fertility potential of the earlier produced cloned buffalo bulls and compared with semen attributes of breeding bulls and found comparable results. Whole genome sequencing was carried out for six cloned buffalo samples using Nanopore PromethION sequencing to perform methylation and variants analysis. The sequencing coverage obtained for raw Nanopore data was around 16.6X to 25.8X where ~43 to 67 GB of long reads data was generated across six samples. Around 60% of the predicted CpG methylation sites were mapped to gene regions in the reference genome. The percentage of annotated Non-synonymous SNPs reported across 6 samples was around 1.6% to 2.9% of the total SNPs predicted. The structural variants predicted was in the range of 1,30,926 to 1,58,440 across all samples. Chromosome wise CpG methylation distribution was also evaluated. Around 45% of the predicted structural variants were mapped for gene region annotation excluding the break end/translocation events. Further analysis of data is under process. > 2500 AIs performed using cloned bulls semen in flied condition and their conception rate is 41%.

Assessing Pregnanediol glucuronide (PDG) for reproductive success in buffaloes

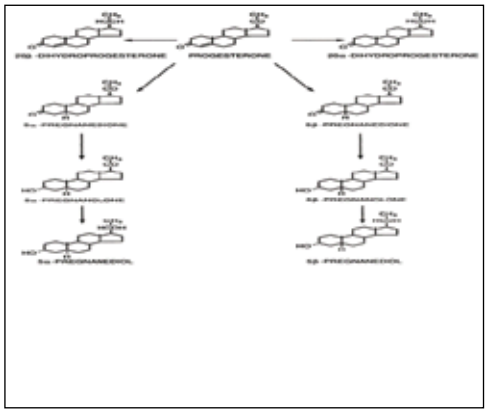
Renu Chaudhary, Suman, SK Phulia, RK Sharma, Sajjan Singh and AK Balhara

Excretion of steroid hormones in urine and faeces present a good opportunity for study of ovarian functions. From diagnostic point of view, urine is an ideal choice of sample - secreted in large amounts, non – invasive collection, good keeping qualities and in numerous chemicals in raw form. Progesterone, primary pregestational hormone produced by corpus luteum of non-pregnant, cyclic animal and by corpus luteum and placenta of some species during pregnancy has a half-life of 5 min in circulation. Progesterone metabolism occurs mainly in liver, enzymes located in brain, skin, and various extra-hepatic tissues in body, it is metabolised to 35 different unconjugated metabolites. Pregnanediol glucuronide (PDG) is a common urinary metabolite of progesterone in wide range of species while in buffalo and cattle it is considered a major metabolite of the parent steroid P4. As P4 level determination in urine is not reliable, alternatively employing its metabolite assessment was a challenge for lack of reliable assay system.

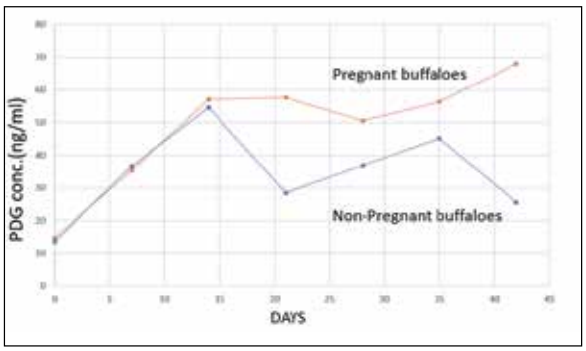
To explore different aspects of progesterone biology in buffaloes, approximately 50- 100 ml of normal micturated urine sample was collected, from 40 adult breeding buffalos on day 0,7,14,21,28,35 and 42 post insemination. Competitive ELISA on these samples revealed that the progesterone metabolite PDG in urine can be detected during estrus and early pregnancy, but detectable levels fall gradually in non-pregnant buffaloes from day 14 post estrus indicating luteal regression. However, the concentrations significantly increased in the pregnant buffaloes accounting for the presence of persistent corpus luteum. Further investigations are required to establish PDG as a diagnostic biomarker for reproductive events in buffaloes.



General pathway of metabolism in animals



Progesterone metabolites in mammalian urine



Variations in PDG concentration (ng/ml) in pregnant and non-pregnant buffaloes

Mastitis detection using Infrared thermography (IRT)

AK Balhara, SK Phulia, Sarita Yadav, AK Boora and FC Tuteja

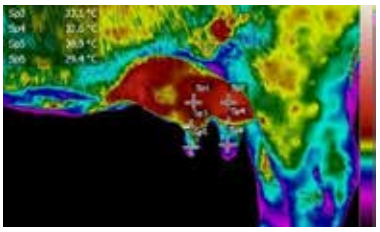
Earliest detection of mastitis is key to minimize losses due mastitis. Infrared thermography (IRT) is one such technology that has recently got attention of researchers for different application. It has been proposed as a diagnostic tool for assessment of normal and physiological as well as pathological status of animal. It is a modern, non-invasive, non-contact technique which does not require sedation and avoids travelling stress for animal. Thermal imaging is very sensitive in detecting temperature differences of less than 0.05^{0}C which is 40 times more sensitive than the human hand. It shows the animal's physiological state by graphically mapping skin surface temperature in response to changes in blood flow and allows early detection of lesions before they are clinically visible.

Although, thermal camera remains expensive and lack specificity regarding the etiology, thermography provides valuable facts for the presence of pathology. Living tissues transfer more heat related with blood stream than do dead tissues. Inflammation due to vascularization or blood stream, pain (hypersensitivity), swelling, and hyperthermia are major signs in the early stage of infection. Skin surface temperature replicates the underlying flow and tissue metabolism, under the control of the autonomic nervous system in mammary gland. Thus, mapping skin surface temperature using IRT may evaluate udder health status.

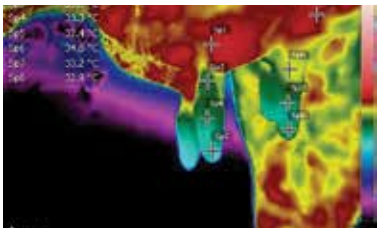
Interpreting udder skin surface temperature (USST) wr.t. udder health:

In studies conducted at the Central Institute for Research on Buffaloes, the USST for all quarters and teats of subclinical mastitis effected animals will be higher than normal animals. A comparative picture of IRT in relation to different udder health conditions is given below:

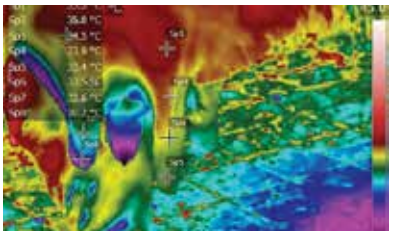
Average Udder Skin Surface Temperature (USST; ^{o}C) (based on experiments carried out at CIRB Hisar; Temperature measured at base of quarter)	Preliminary Interpretation on basis of IRT	CMT Score	Somatic Cell Count (SSC)
< 33.5	Healthy Quarter	N(Negative)	0-200,000
33.5-34.0	Subclinical Mastitis	T (Trace)	200,000-400,000
34.1 -34.8	Subclinical Mastitis	1	400,000-1,200,000
34.8-35.5	Serious Mastitis Infection	2	1,200,000-5,000,000
>35.6	Serious Mastitis Infection	3	Over 5,000,000



Thermogram of animal normal healthy with full udder (just before milking)
Note: Milk synthesizing tissue in udder is most vascular area and therefore highest temperature on udder. Teat base should have lowest skin surface temperature. All teats will similar colour pattern and low temperature as compared to udder.



Thermogram of animal with complete milking
Note: After complete milking, the healthy teats will have low temperature and udder also falls by 1-2^{o}C. All teats will similar colour pattern and low temperature as compared to udder.



Thermogram of animal with incomplete milking
Note: Incomplete milking will have irregular colour patterns over teats. Teats in completely milked quarters will have low temperature as compared to partially milked quarters.

Molecular markers for improving reproduction of cattle and buffaloes

Varij Nayan, Rajesh Kumar, A Bharadwaj, RK Sharma, AK Balhara, TK Datta

Serum amino acids are differentially present in the buffalo estrous cycle

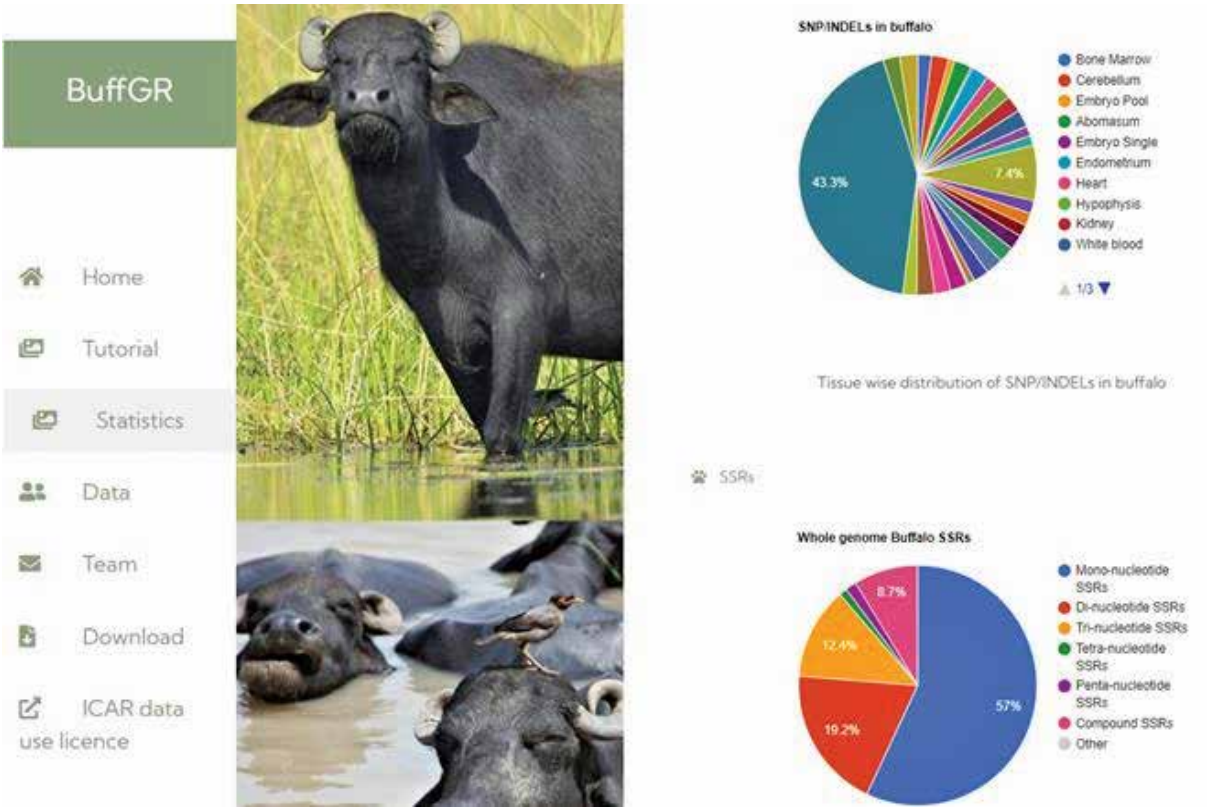
Buffalo heifers (n=40) of Central Institute for research on buffaloes, Hisar, Haryana, were selected during the winter season with heat symptoms such as restlessness, swelling of vulval lips, and cervical secretions were chosen. These were studied further as follows. The heifers chosen were restrained in a trevis and later the vulval lips were washed and disinfected with aseptic measures. Later, a transrectal probe (7.5M Hz frequency make Hitachi) was introduced into the rectum and gently moved on the surface of the uterus for ovary and follicle examination. Heifers with follicle sizes of more than 12mm were confirmed as estrus animals and studied the impressions of the ovary to determine the follicular length. Saliva deposited on the lower lip was collected in a micro-centrifuge tube with a sterile Pasteur pipette before animals were fed. Every morning at 6:30 a.m., saliva was collected. A total of 40 saliva samples, were collected once a day on average. Saliva was delivered to the lab on the ice during the oestrus period and centrifuged for 10 minutes at 4 degrees Celsius at 3000 X g to extract any feed, soil, or cells. The supernatant was relocated to a different container. Using 20 µl of cell and dirt-free saliva, a smear was made on a clean glass slide (8). This was allowed for 5-10 minutes to air before being examined under an inverted microscope (Olympus, Magnus INVI, Japan) for salivary crystallization or fern pattern. Later they were photographed. 10 ml of blood was collected from selected and screened buffalo heifers that are showing estrus symptoms, in clot activators by puncturing the left jugular vein under aseptic conditions. Blood collected was kept for 4 hours at room temperature for extraction of serum. Following the extraction, serum was centrifuged at 2000 g for 8 minutes followed by aliquoting in 2ml falcon tubes for further processing for LC/MS. The current study has revealed role of aminoacid regulation of the estrous cycle directly or indirectly. Alanine, arginine, serine, histidine, tryptophan, isoleucine were significantly different from estrus to diestrus at confidence level ($P<0.001$). Cystine and glutathione levels were significantly different between the two stages at confidence level ($P<0.05$). In contrast, other amino acids were not significantly different among the two stages. It infers that these amino acids have a notable role in the regulation of the estrous cycle.

Network Project on Agricultural Bioinformatics and Computational Biology (ICAR)

Varij Nayan, MH Iquebal, A Bharadwaj, SK Phulia, Rajesh Kumar, Ratna Prabha

Snapshot of BuffGR (comprehensive web genomic resource of buffalo)

BuffGR is a first comprehensive web genomic resource of buffalo that catalogues 6028881 SNPs and 613403 InDels extracted from the set of 31 buffalo tissues while collectively a total of 7727122 SNPs and 634124 InDels were distributed in Murrah, Bangladesh, Jaffarabadi and Egyptian breeds with reference to Mediterranean breed. It also houses 4504691 SSR markers from all the breeds along with 1458 circRNAs, 37712 lncRNAs and 938 miRNAs. This comprehensive web-resource can widely used by the buffalo community across the globe in studies involving marker trait association, genetic diversity, as biomarker in adultery and breed traceability, in various diseases and other stress conditions. This resource can also be useful in buffalo improvement programs and disease/breed management.



Reproductive Performance of Murrah Buffaloes in Relation to Milk Production

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

Parameters	Findings
Effect of AFC on Reproduction (First lactation)	Highest for AFC 42-48 months - SP 168.3 d and CI 478.8 d
Effect of Parity on SLMY, TLMY and PY	Maximum in 4th lactation; n=480
Effect of parity on Reproduction (SP, CI, DP)	>8th lactation (only 87 records)
Peak Milk Yield vs First Service Interval	Low (46.3 ± 1.8 d) in low yielder (>8 kg/d) Medium (73.5 ± 3.8 d) in med. yielder (>14kg/d) High (83.5 ± 9.1 d) in the high yielder (>17kg/d)
Effect of season of calving on First Service Interval	Higher (86.1±8.0) in unfavourable (Feb.-June) season calves Lower (71.8±2.9) in favorable (July to Jan) season calves
Unnoticed Pregnancy losses	Early embryonic mortalities (<60 days): 15% Average (overall) over whole gestation: 9%
Number of AIs per conception	>3500 kg : 2.9±0.4 3000-3500 kg: 2.5±0.3 2500-3000 kg: 2.0±0.3 2000-2500 kg: 1.5±0.2
Effect of THI on Production and Reproduction	68-72
Incidence of Mastitis	Highest during June-Sept (THI >72); Repeated Mastitis occurrence in > 50% animals indicating poor management/antibiotic resistance Higher incidence with Parity, lactation length and milk yield
Thermal imaging for mastitis detection	Indicative of early onset (sensitive to capture temp change of 0.5°C), incomplete milking, injuries, fibrosis etc.
Correcting fertility	CIDR without PMSG are not effective in acyclic buffaloes

Use of OPU-IVEP in production of superior buffalo germplasm

Jerome A, RK Sharma, PS Yadav, D Kumar, M Punetha, Rajesh Kumar, Rupali Rautela

Ovum pick up-invitro embryo production (OPU-IVEP), in recent times has proven to be alternative method for propagate and disseminate superior germplasm, along with established techniques such as superovulation and embryo transfer. But, factors which needs to be addressed for success of OPU-IVEP technology includes selection of donors, development/ refinement of culture conditions of oocytes and embryos. OPU-IVEP can bring enhancement of female genetic pool which shall be future bull mothers. OPU-IVEP Technology, is an advanced reproductive technology for multiplication of superior female germplasm at much faster rate. Using MOET technology one can get 10-20 calf from a superior female animal in a year. Recently, ICAR-CIRB took a project OPU-IVEP and was successfully in producing male buffalo calf out of semen of cloned bull and elite female. OPU-IVEP trials in buffalo carried out resulted oocyte recovery rate (55-65 %) with cleavage rate (25-52%) and blastocyst rate (25-30%). Use of OPU-IVEP technique resulted in birth of male calf (Veer Gaurav) using semen of cloned Bull (Hisar Gaurav). This has opened avenues to work on the OPU-IVEP technology. The inclusion of OPU-IVEP technology shall further enhance the genic pool of bull mothers for future generations. Trials are ongoing to further streamline the process of OPU-IVEP technology in buffaloes.

Investigating molecular basis of seasonal variation on seminal attributes for identification of probable biomarkers of semen quality in buffaloes

Pradeep Kumar, Dharmendra Kumar, Jerome A

The study was designed to study the effect of season and cryopreservation affect sperm kinematics and functional properties in buffalo bulls. Regarding sperm kinematics and motility parameters, it was observed that with respect to cryopreservation stages, total, progressive and rapid motility was higher in fresh stage as compared to frozen stage of cryopreservation. Similarly, all kinematic parameters *viz*. average path velocity, straight liner velocity, curvilinear velocity, beats cross frequency, lateral head displacement, linearity and straightness were higher ($p < 0.05$) at fresh stage as compared to frozen stage. With respect to season, kinematic parameters i.e., VSL, BCF, ALH, TM, PM and RM were higher during winter. Likewise, stage of cryopreservation had significant effect on sperm kinematics *viz*. VAP, VSL, VCL, BCF, ALH, TM, PM, RM, STR and LIN. From this study it was evident that, stage of cryopreservation showed significant effect on mitochondrial superoxide positive status, mitochondrial membrane potential, acrosome status and intra-cellular calcium status.

Hisar Gaurav

OPU-IVF Calf (Veer Guarav)

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 are being estimated. Also, the sperm mitochondrial membrane potential as well as mitochondrial superoxide status was documented. Based on the results, conception rate for the 3 doses are in progress. For deduction of field conception rate 20 million/straw (2285 doses), 16 million/straw (2285 doses) and 12 million/ straw (2285 doses) were disseminated for field insemination. The conception rate of 20 million/ straw, 16 million/straw and 12 million/ straw were 59.92 % (308/514), 59.88 % (306/511) and 57.84% (284/491), respectively.

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

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)

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

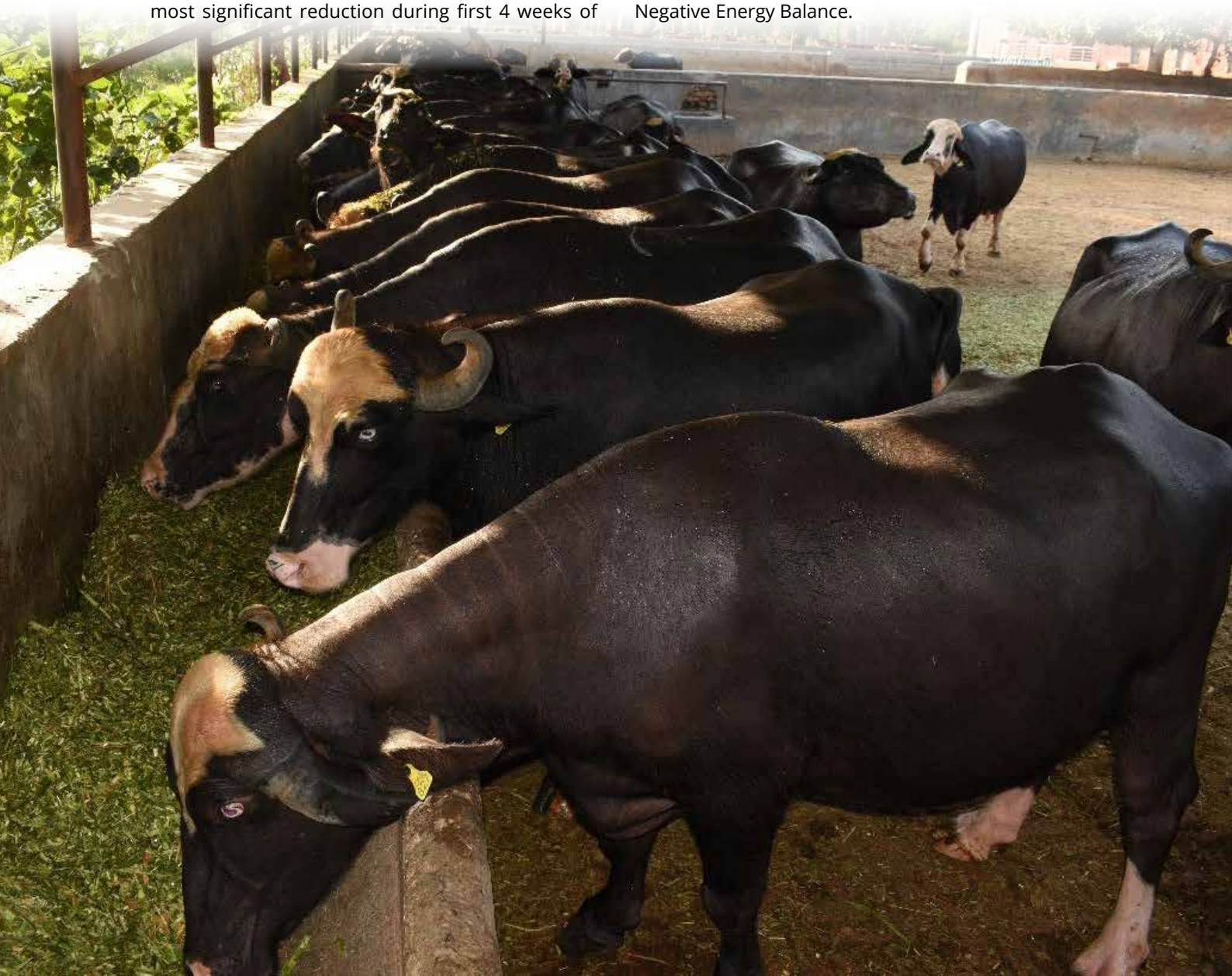
Sperm variables	Mean of sperm variables (Mean ±SEM)				Sig
	TEYC	CIRB Extender	Sericin	Vit E	
VCL(µm/sec)	154.26±4.27	155.03±4.27	156.58±4.76	158.16±3.68	NS
VAP (µm/sec)	92.93±3.24	94.29±2.82	94.01±3.19	96.32±2.47	NS
VSL (µm/sec)	79.40±3.23	80.32±3.08	79.44±3.27	81.91±2.82	NS
ALH (µm)	6.68±0.17	6.70±0.20	6.83±0.21	6.76±0.18	NS
BCF (Hz)	30.73±0.50	30.37±0.52	30.37±0.49	30.54±0.41	NS
LIN (%)	52.61±1.43	53.04±1.41	51.95±1.50	52.71±1.44	NS
STR (%)	83.20±0.85	83.39±1.08	82.54±0.98	82.82±0.93	NS
WOB (%)	61.37±1.13	61.96±0.99	61.22±1.16	61.89±1.10	NS
TM (%)	44.00±2.16 b	56.31±2.12a	49.70±2.02b	47.22±1.86b	**
PM(%)	34.07±2.06b	43.76±2.25a	37.88±1.93b	37.23±1.83b	**
RM (%)	34.70±2.11b	44.85±2.15a	38.89±1.97 b	38.13±1.80b	**

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, Sericin and Vit E extenders.

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

M.H. Jan, FC Tuteja, RK Sharma, SK Phulia

The experiment was conducted in primiparous (1st parity) and multiparous (2nd to 4th parity) buffaloes which were further divided into two groups according to standard lactation milk yield and peak yield viz., a) SLMY ≥2500 kg and/or peak yield ≥ 15 kg, and b) SLMY <2500 kg and/or peak yield <15 kg. Under this project, it was observed that buffaloes loose body weight temporarily post-calving with the most significant reduction during first 4 weeks of parturition, followed by a gain in body weight from 7th week onwards. The negative impact of high milk production on reproductive performance was significant in primiparous, but not in pluriparous animals. Furthermore, animals in first parity with SLMY more than 2500 kg and PY ≥ 15.0 kg had longer post partum breeding interval, longer service period, and took more number of services per conception as compared to primiparpous buffaloes with SLMY less than 2500 kg or <15.0 kg. The proposed correction Plans include: a. Periodic monitoring of body weight and body condition score of heifers during peripartum period to be made routine; b. Special focus will be provided to first calvers through supplemental feeding during peripartum period to prevent sudden drop in body weight by mitigating Negative Energy Balance.

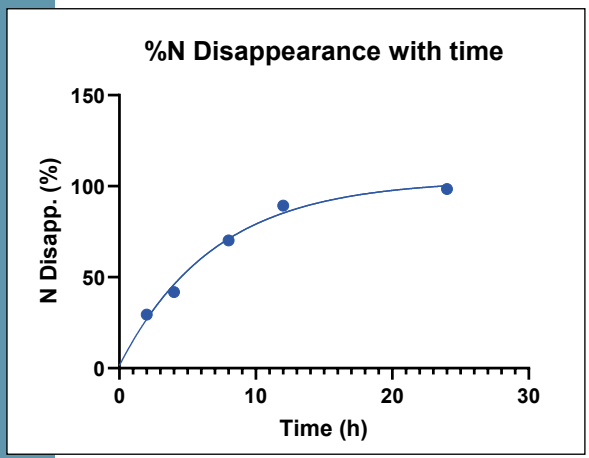


Feed Resource Utilization and Improvement

Quantifying Rumen Undegradable Protein: Validating *in vitro* Ruminal Crude Protein Degradation of Guar Korma in Murrah buffaloes through *in situ* technique

Avijit Dey, Puran Chand Lailer

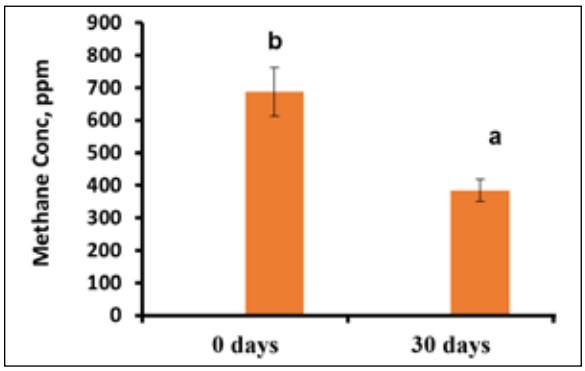
Animal feed protein supplements are in general a limited and expensive commodity that pose a challenge for cost-effective feeding management of animals. Therefore, the importance of feed protein evaluation cannot be undermined, of which estimation of ruminal protein degradation is an essential part. To precisely meet animal's requirements and assess effective utilization of nitrogen in livestock, quantification of ruminal crude protein degradation is of high interest. This study aimed to estimate ruminal crude protein degradation by a new modified *in vitro* technique and validating the technique with *in situ* degradation studies of guar korma with the purpose to establish simple and inexpensive *in vitro* technique of quantifying protein ingredients in ruminants' ration for economic feed formulation. Using modified *in vitro* gas production technique, *in vitro* protein degradability (%) of guar korma was found to be 83.67 ± 2.24, whereas various degradability fractions, effective and potential degradability were calculated using nylon bag technique with bag removal at different time intervals. Effective rumen degradability of CP (%) at passage rate 2, 5, and 8%/h was estimated to be 87.34±0.48, 74.76±0.85, and 65.43±1.00, respectively.



Phytogenic feed additive blend Improves rumen function: reduces enteric methane production and enhances ruminal t-vaccenic acid production

Avijit Dey, Puran Chand Lailer

Phyto-chemicals are commonly derived from herbs and spices having a wide range of anti-microbial activities. The diverse properties and activities of phyto-chemicals have increased their importance on being used as animal feed additives to modify the rumen microbial ecosystem for improving rumen function and feed efficiency. Therefore, the objective of the present study was to investigate the modulation of methanogenesis and rumen fermentation profile of feeds supplemented with phytogenic feed additives blend, with the aim to develop an alternate phytobiotics based feed additive for ruminants. An experiment conducted to examine the effects of supplementing phytogenic feed additives blend consisting of active phytochemicals [@ 54.6 g/h/d (*Cinnamomum verm*: *Sapindus mukorossi*: *Ficus bengalensis,* 15:5:1] on *in vivo* methane production, feed fermentation and ruminal fatty acids composition in fistulated buffalo steers. The supplementation was done along with basal ration for 30 days and various parameters were investigated at the beginning and termination of the study. Methane concentration (%) in exhaled air was reduced ($p<0.05$) after supplementation, without affecting other rumen fermentation parameters. Rumen fluid fatty acid profile (mg/ 100g of FAME) revealed enhanced *t- vaccenic* acid, a precursor of conjugated linoleic acid without affecting major fatty acids concentrations. The study revealed that phytogenic feed additive blend containing active phytochemicals could be an alternate to be used as feed additive to reduce enteric methane production and enhance human health promoting conjugated linoleic acid (CLA) content in animal products.

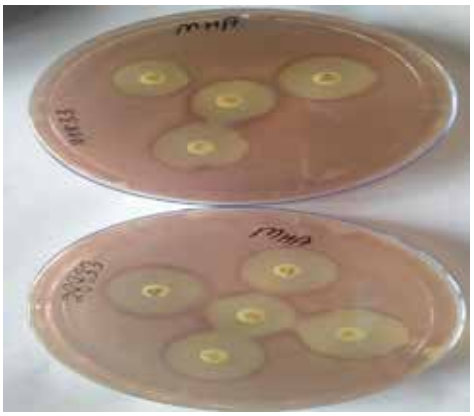


Comparative methane concentrations in exhaled air (ppm) during the beginning and the end of experiment

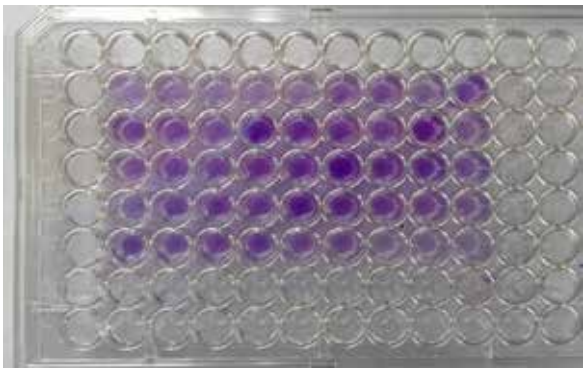
Evaluation of potential plant-based agents for anti-biofilm and antimicrobial activities against major mastitis pathogens of buffaloes

Sarita Yadav, Ashok Boora, Sunesh Balhara and Sandip Khurana

This study aimed to determine the prevalence, antibiotic resistance pattern, extended-spectrum beta-lactamase production and biofilm forming ability of isolated *Escherichia coli* (*E. coli*) strains from buffaloes mastitis milk. Out of 549 bacterial isolates from mastitis milk of buffaloes (*n*, animal level = 472) between 2019 and 2022, a total of 43 *E. coli* strains were isolated with an overall prevalence of 9.11 % at animal level. Prevalence of *E coli* was high in unorganized buffalo herd (11.36%) from villages of Farmer FIRST project (ICAR-FFP) compared with organized buffalo farms (6.73%). The highest resistance was against Ceftriaxone 18 (41.86%), followed by Amoxycillin/Sulbactam 8 (18.60%) and Enrofloxacin 7 (16.27%). Additionally, all were sensitive to gentamycin 43 (100%) followed by Cefoperazone/Sulbactam 34 (79.06). Cephalosporins are frequently used antibiotics to treat bovine mastitis. However, their therapeutic effectiveness is being compromised by bacterial resistant to β-lactams. In the study, a total of 32 (6.78% %) extended-spectrum β-lactamase (ESBL) producing *E coli* were isolated from mastitic buffalo milk (n=43/472). In total, 17 (39.5%) isolates were biofilm producers by microtitre-plate method. There was statistically nonsignificant relationship between biofilm production and antibiotic resistance as well as between ESBL production and biofilm formation in *E coli* strains (p value >0.05). The study demonstrated a high occurrence of ESBL and biofilm producing *E. coli* in buffalo mastitis milk, implementing a significant challenge to treat mastitis in buffaloes, necessitates judicious use of antimicrobials and to explore potential therapeutic agents as substitutes for antibiotics to treat bovine mastitis effectively.



Phenotypic detection of extended-spectrum-β-lactamase (ESBL) on Mueller–Hinton agar plates



Phenotypic characterization of biofilm formation by the 96 well plate microtiter plate method

Allium sativum (garlic) essential oils modulate rumen functions of Murrah buffalo for *in-vitro* fatty acid bio-hydrogenation and methane production

Avijit Dey, Ram Kumar Singh, Shubham Thakur, Puran Chand Lailer

The potential for plant-origin essential oils to modulate rumen functions for reducing bio-hydrogenation of fatty acids and methane production has been a significant area of research in recent times. This study investigated the effects supplementation of garlic (*Allium sativum*) essential oils on *in vitro* bio-hydrogenation of fatty acids, methanogenesis and fermentation characteristics of total mixed ration in buffalo with the aim of enhancing conjugated linoleic acid (CLA) content in animal products as well as reducing environmental pollution. *Allium sativum* (AS) essential oils were examined at four levels [0 (Control), 33.33 µl (AS-1), 83.33 µl (AS-2) and 166.66 µl (AS-3) per litre of buffered rumen fluid] in a radio-frequency based automatic gas production system (ANKOM-RF). Oats hay and concentrate mixture (1:1) was used as a substrate (500± 5 mg) and incubated with 60 mL of buffered rumen fluid in 250 mL ANKOM bottles fitted with automatic gas recording system at 39 °C for 24 h, following standard *in vitro* gas production protocols. The results demonstrated a reduction ($p < 0.01$) in lipid bio-hydrogenation, measured by lowered saturated fatty acids and enhanced unsaturated fatty acids on the supplementation of AS essential oils, irrespective of the dose levels. Moreover, the increased ($p < 0.01$) production of *trans* vaccenic (*trans* C18:1) acid (TVA) following graded dose supplementations of the AS essential oils increased the production of

conjugated linoleic acids (CLA) in animal products. Although, reduced methane production ($p < 0.01$) was evidenced, the decrease in total gas production and feed digestibility (TDDM) demonstrated the strong antimicrobial properties of AS at all dose levels. The study reveals that the *Allium sativam* (Garlic) essential oils have the potential to be an agent for the reduction of the rumen biohydrogenation of fatty acids and methanogenesis.

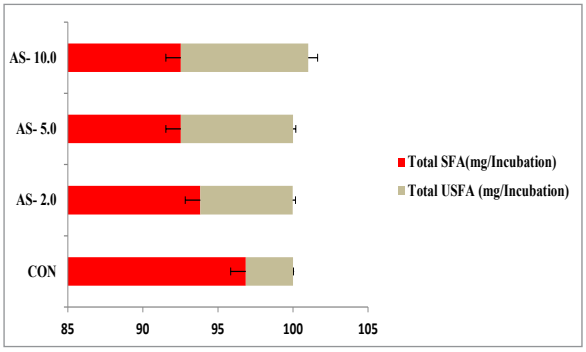
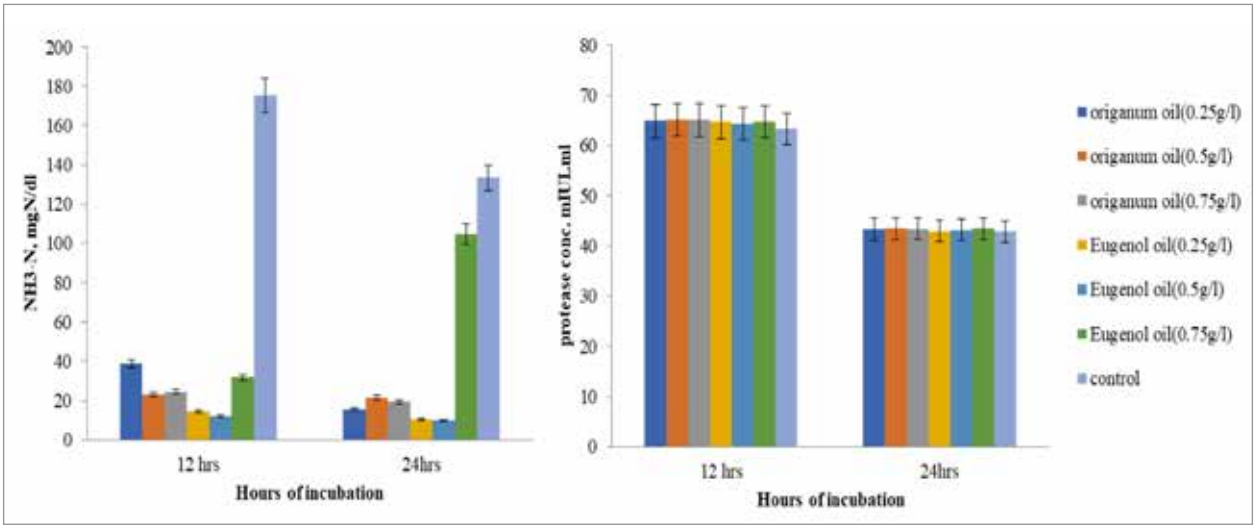


Fig. Effects of the graded levels of AS supplementation with mixed feed on rumen biohydrogenation of fatty acids (SFA, Saturated Fatty Acids; USFA, Un Saturated Fatty Acids)

Potential of various plant bioactive compounds in inhibiting ruminal hyper-ammonia producing bacteria (HAB) in buffalo (*Bubalus bubalis*)

Avijit Dey, Y Mery Chanu, SS Paul, A Jerome

The aim of this study was to evaluate effectiveness of some of the plant bioactive compounds in inhibiting ammonia production from amino acids or proteins by a consortium of enriched hyper ammonia producing bacteria (HAB) from rumen of buffalo. A series of *in-vitro* experiments were conducted where enrichment culture of HAB of buffalo rumen contents were incubated with different types of feed additives such as essential oils and plant extracts, each at graded dose levels and suppression of ammonia production was used as indicator of inhibition of deaminase activity of HAB. The dosing of HAB enrichment culture with garlic oil, thymol and origanum oil resulted in significant reduction in ammonia production at 12h and 24h of incubation in all the treatment groups as compared to control. Addition of saponin from quillaza bark, garlic oil, thymol, *Cannabis sativa*, *Psidium guajava* and extract of *Allium schoenoprasum* to the enrichment culture of HAB showed no significant difference in protease concentration, however, origanum oil reduced protease activity as compared to control. The study demonstrated that the plant bioactive compounds are effective in reducing ruminal ammonia and protease production by inhibiting hyper ammonia producing bacteria (HABs). However, the effectiveness varies with the type of metabolites and their dose levels. Out of all the additive examined, origanum oil was most effective in reducing ruminal ammonia production, envisaging better possibility to use as additive for effective protein utilization by animals.



Transfer of Technology

Economic analysis of milk supply chain in buffalo production system

Gururaj M, P C Lailer, Navneet Saxena, F C Tuteja, Meeti Punetha

Present study was conducted in Haryana and Punjab being breeding tract of Murrah and Nili-Ravi buffalo, respectively. A total of 120 Nili-Ravi buffalo farmers from Sangrur and Firozpur districts of Punjab and 120 Murrah buffalo farmers from Karnal & Hisar districts of Haryana were interviewed personally and collected required data. Selected dairy farmers were post-stratified into Group-I (farmer having 1-2 milch buffaloes), Group-II (3-4 milch buffaloes) and Group-III (5 & more milch buffaloes). Among Murrah buffalo farmers about 46.67% of farmers belongs to Group-I followed by Group-II (33.33%) and Group-III (20.00%). Whereas in case of Nili-Ravi farmers about 51.67% belongs to Group-I followed by 40.83% and 7.50% falls under Group-II and Group-III, respectively. The average milk production among Murrah buffalo farmers was 22.75 kg per day and in which 23.84% of milk used in household consumption (as milk & milk product) and remaining 76.16% is marketed surplus milk, in their counterpart Nili-Ravi buffalo farmers the per day milk production is 22.50 kg and in which about 24.26% of the milk used for household consumption in the form of raw milk & milk product and remaining is surplus milk sold to non-producers. About 68 per cent of Murrah buffalo farmers prefer un-organized milk marketing channels for dispose of the surplus milk and remaining 32% prefer organized milk marketing channels. However, in case of Nili-Ravi farmers about 71% of the surplus milk marketed through organized milk marketing channels followed by unorganized milk marketing channels. Regular market and timely payment against milk supply are the main reasons for choosing the organized milk marketing channel in the study area. However, door step milk collection and advance payment to purchase inputs

attracts dairy farmers to opt for un-organized milk marketing channels.

Binary logistic regression revealed that more number Nili-Ravi milch buffaloes with younger age of the respondents influence to take part in organized milk marketing channels. Further, results of the economics of milk production revealed that average net income per Murrah buffalo was estimated to be Rs. 22524.84 per annum with Break-Even Milk production of 969.89 kg per annum, whereas, in case of Nili-Ravi buffalo it was estimated to be Rs. 25784.80 per annum with Break-Even point of milk production 1146.72 kg. The average net income per Murrah buffalo farm was estimated to be Rs. 155363.63 and in which 59.26% of income comes from milk production. Whereas, the net income from Nili-Ravi milk production per farm was estimated to be Rs. 155479.50 and in which 69.37% of income comes from milk production and remaining from family labour involved in the dairying. The average employment generation was estimated to be 210.57 man-days and 191.36 man-days per annum in case Murrah & Nili-Ravi buffalo milk production, respectively. Lower price for milk, increase in feed cost, non-availability of labor for the dairying are major constraints faced by the Murrah buffalo farmers in the study area. Lack of availability of superior germplasm/bulls for breeding, low price for milk and non-availability of timely veterinary services are the major constraints faced by the Nili-Ravi buffalo farmers. Study concludes that creation of FPOs with value addition to the milk may attract more number of dairy farmers to participation in organized milk channels in Haryana to reap the economies of scale. Need of hour is that create awareness among dairy farmers regarding Nili-Ravi buffaloes in the Punjab through convergence mode by involving research institute, universities, NGOs and state animal husbandry department and encourage & motivate dairy farmers to keep Nili-Ravi buffaloes in its breeding tract because Nili-Ravi buffalo milk production is a profitable enterprise.

Enhancing economy of livestock farmers through AI using cloned buffalo bull semen

P S Yadav, Hema Tripathi, Sajjan Singh, N Saxena, Dharmendra Kumar, Pradeep Kumar, Jerome A, Gururaj M

The project is implemented in the Nuh, aspirational district of Haryana. The main objectives of the project

is to perform artificial insemination using superior cloned / breeding buffalo bull's semen in selected area for improvement of buffalo productivity, Record the AI, conception rate, calving and performance of progenies and to organize trainings on scientific buffalo husbandry for socio-economic upliftment of rural farmers. As on 31 December, 2022 a total of 1768 AIs were performed. Among the beneficiary farmers about 82.58% belongs to Other Backward Classes (OBCs) followed by general (11.41%) and schedule tribes (3.08%) & schedule caste (2.94%). In the study area, about 93.26% of AIs were performed in graded Murrah followed by pure Murrah (4.43%), non-descript (1.25%) and other descript type buffaloes (1.06%). It implies that dairy farmers keep superior quality buffalo breed for the milk production. The inter-parity of buffaloes reveals that dairy farmers prefer to keep buffaloes up to sixth lactation. In the study area, about 25.46 per cent of AIs were performed in third lactation buffaloes followed by heifers (21.3%), second lactation (19.78%), fourth lactation (15.21%), first lactation (9.91%) fifth lactation (5.15%) and sixth lactation (3.18%). The maximum buffaloes are in third lactation may be due to buffaloes produce highest milk in this parity in the study area. During the period about 15 various activities viz. training program (04) (improved buffalo husbandry practices), demonstrations (05) and awareness programs (06) were organized. A total of 415 dairy farmers (men & women) were participated in the different programs and in which about 37.62% participants are agricultural women. The training program has positive influence on the dairy farmers' knowledge regarding breeding, feeding, health and clean milk production in buffaloes. The preparation of balanced feed for buffaloes, heat detection in the buffaloes, benefits of cloned buffalo semen are most popular events among the dairy farmers in the study area.

Dairy farmer's perceptions and profitability of rearing superior breeds of buffalo in Punjab

N Saxena, Gururaj M, F C Tuteja, Sanjit Maiti, Biswjith Sen, Mukesh Bhakat, T K Datta

The present study is planned to conduct in four districts of Punjab namely Amritsar, Taran Tarn, Firozpur and Gurdaspur, because Nili-Ravi breeding tract falls in this area. The present study was planned to study the farmer's perceptions towards superior buffalo breeds available in the Punjab and its influence/impact on the selection of the breed. Also, to analyse the profitability of the different superior buffalo breeds available in the Punjab and to study the constraints faced by the dairy farmers in keeping the preferred buffalo breed. During the period (September to December, 2022) the structured questionnaire was developed for primary data collection. The sampling plan and sample size was decided and the primary data collection is in progress.

Economic impact of Field Progeny Testing (FPT) program on Income of Murrah Buffalo farmers

Sanjay Kumar, Gururaj M, A Bharadwaj

The present study was planned to assess the impact of Field Progeny Testing (FPT) program on income of Murrah buffalo farmers in CIRB adopted villages in Haryana. Under the study the following objectives were framed to analyze the cost and benefits accrued in the FPT program of Murrah buffaloes and to assess the economic impact of FPT program on participating buffalo farmers income.

For the study, both primary and secondary data will be collected and analyzed for meaningful results. Secondary data on expenditure incurred on salaries of staff (scientists, young professionals, AI workers etc.), cost of semen purchase, extension activities organized (melas, calf rallies etc.), transportation cost and miscellaneous cost will be considered. The data on benefits accrued from the program like number of AIs (Change in adoption rate), conception rate, increase in milk yield, reduction in AFC and others will be included. Primary data will be collected from two groups of the farmers the one who is using ICAR-CIRB bull semen for AI (called as treatment group) and other group of farmers who is not using the ICAR-CIRB bull semen for insemination (called as control group). The selection of the control group will be based on the similar socio-economic status as well as same infrastructure facilities for dairy development. The data related to milk yield, AFC, growth rate, veterinary expenditure, feed efficiency ratio etc. will be collected from the both groups of the farmers who are having buffalo in first lactation. During the period, structured questionnaire was developed and tested for primary data collection. The primary data from control group (Non-FPT) villages was collected. A total of 50 dairy farmers were interviewed and collected required information.

Diversified Farming through Livestock and agriculture

Lumpy skin disease: Detection of antibodies in buffaloes

Ashok Boora and Sarita Yadav

Lumpy skin disease virus (LSDV) is enveloped, has 151-kbp double-stranded DNA genome from family *Poxviridae* (genus *Capripoxvirus*). The study highlights detection of antibodies against LSDV in buffaloes showing LSD characteristic mild skin nodular lesions from field outbreaks in villages of Rajasthan under ICAR-Farmer FIRST Project during 2022. Skin lesion samples were collected from buffaloes (n=6) during LSD suspected outbreaks in three villages (Chhani Bari, Jhansal/Moda Khera and Biran Utarada) of Bhadra tehsil, Hanumangarh district, Rajasthan under ICAR-Farmer FIRST Project during 2022. Apparently healthy buffaloes were not showing any specific clinical signs other than deep seated mild nodules 25 -50 mm size suspected of LSD.LSDV DNA was detected in in none of the samples from buffaloes (n=6) by capripoxvirus-specific PCR targeting LSDV074 gene. Virus neutralization assay was determined by ICAR-NCVTC, Hisar for these buffalo sera samples in 96 well tissue culture plates using MDBK cell line as per standard protocol. Buffaloes with mild clinical presentation in current study showed an antibody titre of 1:16 to 1:64 by Virus neutralization assay. There is no information available regarding seroprevalence against LSD in buffalo from India, therefore, it is imperative to further investigate the susceptibility of buffalo to LSDV infection. Though, buffalo is a susceptible host, only mild deep seated skin nodules suspected for LSD were reported from buffaloes under field condition in this study.

Mild nodules on skin of buffaloes

Technologies Developed and their Transfer to End Users

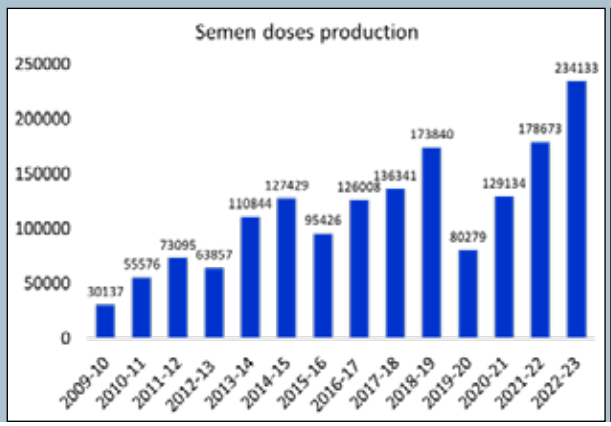
The institute has developed several technologies since its inception that were transferred to the farmers to increase the production and reproductive efficiency of their buffaloes. Many of the farmers trained in this institute are achieving ~60 % conception rates with the frozen semen from this institute. 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

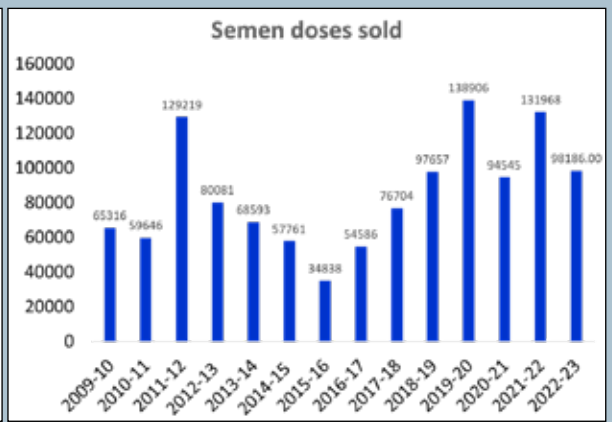
Institute maintains a high pedigreed herd of Murrah and Nili-Ravi buffaloes. The institute has been undertaking breed improvement programme through selective breeding since its inception. The genetic potential of bulls is evaluated through progeny testing. More than four lakh doses of frozen semen from test bulls and over sixty thousand doses from progeny tested bulls are available for Murrah breed improvement. High genetic merit Murrah and Nili Ravi bulls of 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 indicated in the figure.

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 are being sold to farmers/stakeholders/researchers to disseminate quality buffalo germplasm for improvement in the production of country buffaloes. Detail of the semen sold year wise depicted in the figure given below:



Number of frozen semen doses produced (2009-2022)



Number of frozen semen doses sold (2009-2022)

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 decades and details presented in the figure. The revenue generated through sale of semen during the year 2022 was 19.348 lakhs.

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 granted for this 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.

Reduced Buffalo Sperm Dosage for Artificial Insemination

This technology involved use of dilution (@12, 16 & 20 million sperm/straw) for field artificial insemination. In this technology the dilution buffalo on buffalo sperm showed no detrimental effect on sperm structural and functional parameters. Moreover, there was no difference in the field conception rate for the 3 doses. Reduction of sperm dosage per insemination pave way for efficient utilization of resources by increase cost benefit ratio with enhanced production of semen doses for wider dissemination of superior buffalo germplasm to the stakeholders to increase productivity.

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 post- insemination. 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.

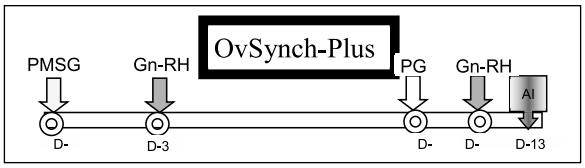
Identification of molecular markers for MAS

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.

Use of OPU-IVEP in production of superior buffalo germplasm

Use of Ovum pick up-invitro embryo production (OPU-IVEP), in recent times has proven to be alternative method for propagate and disseminate superior germplasm, along with established techniques such as superovulation and embryo transfer. OPU-IVEP Technology, is an advanced reproductive technology for multiplication of superior female germplasm at much faster rate.

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.

Repository of somatic cells

Three hundred somatic cell lines were established and cryopreserved from different buffalo breeds (Murrah, Nili- Ravi, Bhadawari) of both sexes. 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 were shared with ICAR-NBAGR, Karnal and these cell lines are also available for researchers on written consent.

DNA bank

DNA repository of about 205 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.

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.

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 field condition. 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.


Short Course Training
on
Advancement in animal cloning and
genome editing technology for desire and faster
multiplication of superior germplasm
केन्द्रीय भैंस अनुसंधान संस्थान, हिसार
Central Institute for Research on Buffaloes, Hisar

RESEARCH PROJECTS AT CIRB

S.No.	Title	PI	Co-PIs	Duration
1	Development and supplementation of nano-minerals in buffalo	V Mudgal	N Saxena SS Dahiya	Sep 2017 - Dec 2022
2	Evaluation of Quality Protein Maize in the ration of Buffaloes.	V Mudgal	Navneet Saxena, SS Dahiya, Shankar Lal (ICAR-IIMR)	Sept 2020 - March 2022
3	Molecular analysis of methanogenic archaeal diversity in rumen of Murrah buffaloes fed different diets	S Yadav	PC Lailer, Ashok Boora, A. Dey, SS Paul, SK Khurana	Dec 2019 - Dec 2022
4	Effect of Feeding Sugar Beet Pulp, and Guar Korma on Rumen Function, Methanogenesis, Nutrient Utilization and Milk Production in Buffaloes.	Avijit Dey	PC Lailer, A Bharadwaj, TK Datta	March 22 - April 2024
5	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
6	Genetic improvement of Nili Ravi buffaloes (Network project, CIRB Sub-Campus Nabha Centre)	FC Tuteja	MH Jan, R Mehta	Jul 2001 - Contd
7	Performance evaluation and improvement of Bhadawari buffaloes (IGFRI centre)	BP Kushwaha	IGFRI: Sultan Singh, Deepak Upadhyay	Apr 2001 - Contd.
8	Progeny testing of bulls under field conditions (FPT) (CIRB Hisar)	A Bharadwaj	VB Dixit, Sanjay Kumar	Apr 2001 - Contd
9	Development of Soft Computing Tool for Dairy Buffalo Selection	S Balhara	AK Balhara, SK Phulia, Naresh Kumar	Apr 2021- Mar 2023
10	Environmental Mastitis in Buffaloes: Challenges and Management	Ashok Boora	Sarita Yadav, AK Balhara, MH Jan, FC Tuteja	May 2021- May 2023
11	Role of bacterial pathogens in subclinical mastitis in buffaloes	SK Khurana	Sanjay Kumar	Apr 2021 - Mar 2023
12	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
13	National Agricultural Innovation Fund (Institute Technology Management Unit (ITMU)	SK Khurana	-	Apr 2008-Contd.
14	Diversified farming through livestock and agriculture –Farmer First Programme	A Boora	S Yadav, 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)	2016 - 2023
15	Economic analysis of milk supply chain in buffalo production system	Gururaj Makarabbi	VB Dixit, N Saxena, PC Lailer, Meeti Punetha, FC Tuteja	Feb 2021-Jan 2023

S.No.	Title	PI	Co-PIs	Duration
16	Evaluation of potential plant-based agents for anti-biofilm and antimicrobial activities against major mastitis pathogens of buffaloes	Sarita Yadav	Ashok Boora, Sandip Kumar Khurana, Sunesh	Oct 2022-Oct 2024
17	Economic Impact of Field Progeny Testing (FPT) Program on the Income of Murrah Buffalo Farmers	Sanjay Kumar	Gururaj Makarabbi, Anurag Bharadwaj	May, 2022 - April, 2024
18	Production Systems, Agribusiness and Institutions: Component I - Impact Assessment of Agricultural Technologies, Sub-group: Livestock & Poultry	PS Birthal, ICAR-NIAP, New Delhi	Prem Chand, D. Bardhan CIRB: Gururaj M	2022 - 2026
19	Dairy farmer's perception towards buffalo breeds and its impact on selection and profitability in Punjab	Navneet Saxena	Gururaj M, TK Datta, FC Tuteja, Sanjit Maiti, Biswajit Sen	Sept 2022 - Aug 2024
20	Buffalo sperm dosages in relation to its functional parameters and field fertility outcome	Sajjan Singh	P Kumar, Jerome A RK Sharma, Gururaj M	Mar 2018-Apr 2022
21	Reproductive performance of Murrah buffaloes in relation to milk production	SK Phulia	RK Sharma, AK Balhara, A Bhardawaj, Sunesh Balhara	Feb 2020 - Jan 2023
22	Establishment of DNA bank of Murrah and Nili-Ravi buffalo herd	D Kumar	Sanjay Kumar, Meeti Punetha	Jan 2022 - Dec 2022
23	Testing and validation of pregnancy diagnosis kit (PregD) in Mithun	AK Balhara	SK Phulia, RK Sharma	Nov 2020 - Oct 2022
24	Molecular markers for improving reproduction of cattle and buffaloes (BMGF)- CIRB Centre (Lead Centre- NDRI, Karnal)	V Nayan NDRI: Rakesh Kumar	TK Datta, Anurag Bharadwaj, RK Sharma, AK Balhara, Rajesh Kumar	Aug 2018 - July 2023
25	Production of multiple copies of elite buffalo bulls using animal cloning technology (NASF Project) – Lead Centre	PS Yadav	D Kumar, RK Sharma, P Kumar, Rajesh Kumar	Apr 2018-Mar 2022
26	Production of double-muscled mass farm animals through CRISPR (NASF Project)	D Kumar	Meeti Punetha, PS Yadav, RK Sharma Rajesh	Jan 2021- Dec 2023
27	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
28	Network Project on "Agricultural Bioinformatics and Computational Biology" (CABin scheme network project): Immunoreagent design, drug discovery and –omics approaches for buffalo production and reproduction	CIRB: Varij Nayan; IASRI: Mir Asif Iquebal	CIRB: Anurag Bharadwaj, S.K. Phulia, Rajesh Kumar; IASRI: Ratna Prabha	July 2020 - June 2025
29	Investigating molecular basis of seasonal variation on seminal attributes for identification of probable biomarkers of semen quality in buffaloes (DBT project)	Pradeep Kumar (Lead centre-NDRI, Karnal)	D Kumar, Jerome A	Sept 2020 - Aug 2023
30	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
31	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
32	Viral diseases affecting reproductive and productive performance of buffaloes	Sarita Yadav	Ashok Boora	Feb 2021 - Jan 2022

S.No.	Title	PI	Co-PIs	Duration
33	Metabolomic profiling of spent media of embryo culture using mass spectral analysis	Navneet Saxena	PS Yadav, D Kumar, Meeti Punetha, Naresh Selokar (NDRI)	Feb 2021 - Jan 2022
34	Consortium Research Platform on Agro-Biodiversity (NBAGR funded)	Meeti Punetha	D Kumar, PS Yadav	Feb, 2022-Jan 2024
35	Use of OPU-IVEP in production of superior buffalo germplasm	Jerome A	RK Sharma, PS Yadav, D Kumar, M Punetha, Rajesh	Jan 2022 - Dec 2022
36	Enhancing economy of livestock farmers through AI using cloned buffalo bull semen (DBT Project)	PS Yadav	Sajjan Singh, Navneet Saxena, Hema Tripathi, Dharmendra Kumar, Pradeep Kumar, Jerome A, Gururaj M	Jan 2022 - Jan 2024
37	Evaluation of semen characteristics and fertility parameters of cloned bulls and performance of cloned progenies (Phase-II) (NASF Project)	PS Yadav	D Kumar, RK Sharma, Pradeep Kumar, Meeti Punetha, Rajesh Kumar	June 2022 - April 2025
38	Generation of predetermined sex buffalo embryos using CRISPR mediated gene editing technology	Meeti Punetha	-	Feb 2022 - Jan 2024
39	Strengthening of semen station at ICAR-CIRB, Hisar	RK Sharma	SK Phulia, Pradeep Kumar, Jerome A	2022-2025
40	Sequestrating X- and Y-sperm using receptor-ligand based approach in buffalo	Pradeep Kumar	TK Datta, Sajjan Singh, RK Sharma, Jerome A, D Kumar, Meeti Punetha	Oct 2022 - Sept 2025

Important Committees

Quinquennial Review Committee (QRT)

During 2022, the Quinquennial Review Team planned for visit to NPBI Centres through virtual meeting on 25 July 2022. Following this, the QRT team visited the NPBI center at IGFRI, Jhansi and got appraised on various constraints in terms of research, infrastructure, farm operations under network project during 25 to 27 August 2022. During 08 & 09 September 2022, QRT team visited NPBI Center of RCER, Patna to monitor undergoing research and farm operations under the network project.

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

Research Advisory Committee (RAC)

The RAC meeting held on June 1-2, 2022 at 10:00 AM. Dr. T.K. Datta, Director, CIRB welcomed Hon'ble Chairman and members of RAC and other invitees to the XXV meeting of RAC. The Chairman of RAC, while welcoming all RAC members and other CIRB scientists, thanked the Director for facilitating holistic support for hybrid mode 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 Research Committee (IRC)

IRC meeting of the institute was conducted under the chairmanship of Dr. T.K Datta. Director ICAR-C1RB during 29th & 30th September 2022 at CIRB, Hisar as per meeting schedule. A follow up meeting to discuss few projects was conducted on 13th October, 2022. Total of 39 projects from different divisions were discussed.

Chairman

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

Member Secretary

Dr. S.K. Khurana, In Charge, PME cell

INTELLECTUAL PROPERTY INDIA
PATENTS | DESIGNS | TRADE MARKS
GEOGRAPHICAL INDICATIONS

सत्यमेव जयते

भारत सरकार
GOVERNMENT OF INDIA
पेटेंट कार्यालय
THE PATENT OFFICE
पेटेंट प्रमाणपत्र
PATENT CERTIFICATE
(Rule 74 Of The Patents Rules)

क्रमांक : 011143289
SL No :

PATENTS

It is hereby certified that a patent has been granted to the patentee for an invention entitled "COMPOSITE FEED ADDITIVE FOR REDUCING METHANE EMISSION AND IMPROVING FIBRE UTILIZATION IN RUMINANTS" as disclosed in the above mentioned application for the term of 20 years from the 22nd day of December 2017 in accordance with the provisions of the Patents Act,1970.

पेटेंट कार्यालय THE PATENT OFFICE GOVT.OF INDIA भारत सरकार

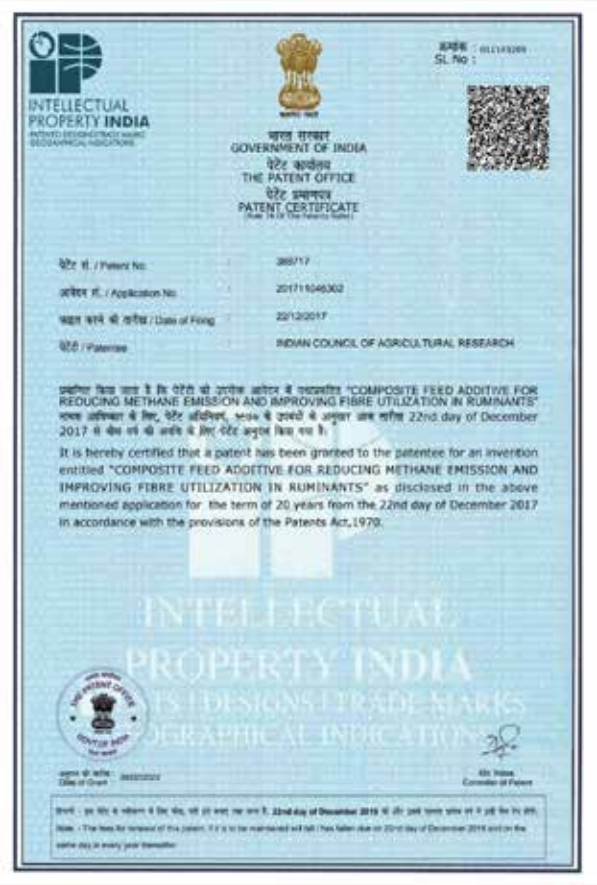
अनुदान की तारीख :
Date of Grant : 08/02/2022

पेटेंट नियंत्रक
Controller of Patent

टिप्पणी - इस पेटेंट के नवीकरण के लिए फीस, यदि इसे बनाए रखा जाना है, **22nd day of December 2019** को और उसके पश्चात प्रत्येक वर्ष मे उसी दिन देय होगी।

Note. - The fees for renewal of this patent, if it is to be maintained will fall / has fallen due on 22nd day of December 2019 and on the same day in every year thereafter.

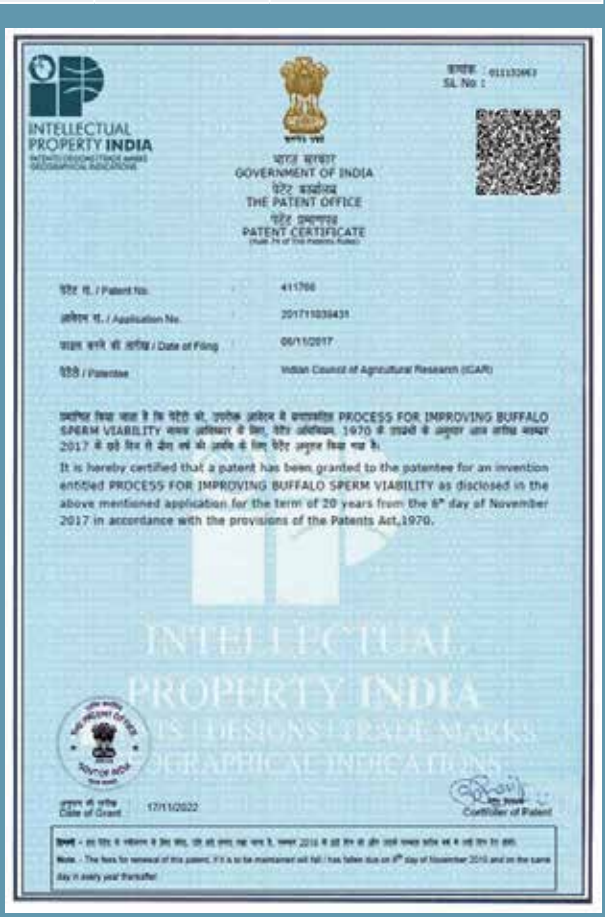
Application/ Patent/ Registration No.	Name of Innovation / Technology	Date of Grant/ Filing	Inventors
Granted			
2940/DEL/2013	An in vitro method for detection of post partum anestrus condition in buffaloes	Granted on 05.02.2019	Rajesh Kumar, AK Balhara, M Gupta, SK Phulia, RK Sharma, Inderjeet Singh
1840/DEL/2013	BUFCOL-A complete diet for enhanced survivability and growth of neonatal buffalo calves	Granted on 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	Granted on 09.04.2021	Varij Nayan, Sunnel Kumar Onteru, Dheer Singh
201711046302	Composite feed additive for reducing methane emission and improving fibre utilization in ruminants	Granted on 08.02.2022	Avijit Dey, SS Paul, SS Dahiya, AK Balhara, Jerome A, BS Punia and YM Chanu
408952	Mangifera indica flower panicles' extract stabilized gold nanoparticles and method for making the same.	Granted on 12.10.2022	Varij Nayan, SK Onteru, Deer Singh
201711039431	Process for improving buffalo sperm viability	Granted on 17.11.2022	Ravindra Kumar, Jerome A, Pradeep Kumar, Monika Saini, Dharmendra Kumar, RK Sharma, Inderjeet Singh
Filed			
1451/DEL/2015	Kalrump Scale - A device to measure Buffalo rump angularity for identification of dairy characters	07.01.2017	SN Kala
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


INTELLECTUAL PROPERTY INDIA

GOVERNMENT OF INDIA
THE PATENT OFFICE
PATENT CERTIFICATE

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

It is hereby certified that a patent has been granted to the patentee for an invention entitled "COMPOSITE FEED ADDITIVE FOR REDUCING METHANE EMISSION AND IMPROVING FIBRE UTILIZATION IN RUMINANTS" as disclosed in the above mentioned application for the term of 20 years from the 22nd day of December 2017 in accordance with the provisions of the Patents Act,1970.


INTELLECTUAL PROPERTY INDIA

GOVERNMENT OF INDIA
THE PATENT OFFICE
PATENT CERTIFICATE

It is hereby certified that a patent has been granted to the patentee for an invention entitled PROCESS FOR IMPROVING BUFFALO SPERM VIABILITY as disclosed in the above mentioned application for the term of 20 years from the 6th day of November 2017 in accordance with the provisions of the Patents Act,1970.

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 programmes are 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 2022, HRD unit of ICAR-CIRB has facilitated the training of **4 Scientists, 5 Technical officers and 1 Administrative staff along with 4 Skilled Supporting Staff** of the institute.

SNo	Name of Employee & Designation	Details of Training	Place and Period of Training
Scientists			
1	Dr. Avijit Dey, Principal Scientist	Online Competency Enhancement programme for Effective Implementation of Training Functions by HRD Nodal officer of ICAR	21-23 Feb. 2022
2	Dr. Gururaj M, Scientist	Online Training on Advanced Statistical Techniques for data analysis using R at ICAR-Indian Institute of Rice Research, Hyderabad	03 - 15 Jan 2022
		Prominent Statistical Tools for Data Science in Agriculture using R and Python	09 - 29 Nov. 2022, ICAR-IASRI, New Delhi
3	Dr. R.K. Sharma, Principal Scientist	Training program on Ovum Pick UP – Embryo Transfer	11 & 12 Sept 2022, ULDB Kalsi, Uttarakand
4	Dr. Varij Nayan, Senior Scientist	Hands on training on Advanced Biotechnological Approaches to augment productivity in Poultry for Ensuring Food and National Security	20 -24 September 2022, ICAR-DPR, Hyderabad
Technical Officer			
1	Dr. ML Sharma, CTO	Workshop for Technical Personnel of ICAR Institutes	01-03 Dec. 2022, ICAR-NDRI, Karnal
2	Sh. Rajesh Prakash, CTO		
3	Sh. Nishan Singh, TO	To improve skills and efficiency of technical and skilled supporting staff	01-03 Aug 2022, ICAR-CIRB, Sub-Campus Nabha
4	Sh. Santokh Singh, TO		
5	Sh. Dalbara Singh, TO		
Administrative Staff			
1	Sh. Jaspal Singh, LDC	To improve skills and efficiency of technical and skilled supporting staff	01-03 Aug 2022, ICAR-CIRB, Sub-Campus Nabha
Skilled Support Staff			
1	Sh. Chotu Ram	To improve skills and efficiency of technical and skilled supporting staff	01-03 Aug 2022, ICAR-CIRB, Sub-Campus Nabha
2	Sh. Kuldeep Singh		
3	Sh. Gurnam Singh		
4	Sh. Ram Kewal		

PUBLICATIONS

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Article

Impact of Dietary Phytogenic Composite Feed Additives on Immune Response, Antioxidant Status, Methane Production, Growth Performance and Nutrient Utilization of Buffalo (*Bubalus bubalis*) Calves

Krishan Kumar, Avijit Dey, Manoj Kumar Rose and Satbir Singh Dahiya

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Books/ Manual/ Compendium

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Book chapter

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Lead / Invited Articles

- Dey A. (2022). Enteric Methane production from Buffaloes and its abatement. Expert Lecture in "Industry Expert Faculty Meet". Oct 11, 2022. Institutional Development Plan, GADVASU, Ludhiana.
- Dey A. (2022). Ration Balancing for Enhanced Buffalo Production. Expert Lecture in "Industry Expert Faculty Meet". Oct 11, 2022. Institutional Development Plan, GADVASU, Ludhiana.
- Gulati BR, Pathak A, Maan S, Mor S, Kumar D, Soman R, Punia S, Chaudhary D, Khurana SK. (2022). Whole genome sequence reveals equine

rotavirus A of bat origin from India. Compendium XXXIV Annual convention of Indian Association of Veterinary Microbiologists, Immunologists and Specialists in Infectious Diseases "Current Trends in Immunodiagnostics & Vaccinology for Health of Livestock and Poultry" COVS, LUVAS, Hisar.

- Khurana SK, Tanvi (2022) The Antibiotic Resistance and its "One Health" perspective. Compendium XXXIV Annual Convention of indian association of veterinary microbiologists, immunologists and specialists in infectious diseases "Current Trends in Immunodiagnostics & Vaccinology for Health of Livestock and Poultry" COVS, LUVAS, Hisar May 27-28, 2022.
- Khurana SK. (2022). An Overview of Milk Borne Zoonotic Diseases. 21 Days National Training Course on "Advances in Veterinary Research for Sustainable Development of Livestock Sector" jointly organized by ICAR-Indian Veterinary Research Institute (IVRI) Regional Station, Palampur, H.P. and National Agriculture Development Cooperative Ltd (NADCL) Baramulla, UT of J & K.
- Pradeep Kumar, Dharmendra Kumar and Jerome A (2022) Future technologies for sperm cryopreservation ISSARCON 2022 National symposium on Optimizing animal reproduction through recent technique of biotechnology, nutraceutical and alternative medicine organized by Indian society of study of animal reproduction (ISSAR) at Jabalpur. 16-19 November 2022.
- PS Yadav (2022) Animal cloning application and status in India. Four-week certificate course in online mode entitled "Enhancing livestock production and food safety through one health approach" Centre of Excellence for Advanced Research on Food Safety, Mumbai Veterinary College, Parel, Mumbai
- Yadav PS, D Kumar (2022) Animal cloning scope and awareness. Coordinated. 5th Annual Conference of National Academy Veterinary Nutrition and Animal Welfare (NAVNAW) and National Symposium on Coordinated Nutrition, Health and Extension Approach for Sustainable Livestock Production, 21-22 September 2022 Veterinary College Jabalpur, MP

Technical/Popular articles/Bulletin

- Dey, A, Datta TK. 2022. काला सोना- भैंस की भारतीय अर्थव्यवस्था में महत्त्व. Kheti, ICAR, May 2022, pp. 4-6.
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- Kumar D, Kumar P, Punetha M, Sharma M. (2022). Mitochondria targeted antioxidants can improve in vitro embryo production in buffalo. Journal of Embryology & Stem Cell Research, 6(1): 000160.
- Sunesh, Sarita, Balhara A. (2022). Application of Infrared Thermography Technique in Animal Production. Vigyan Varta 3(1): 71-73.
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- Vohra V, Chhotaray S, Bharadwaj A, Gowane G, Kumar Sanjay, Chander Ram, Datta, TK. (2022). Technical Manual on Standard Procedure for Sire Evaluation in Buffaloes, ICAR-NDRI Karnal. Published by Project Coordinator, NPBI ICAR-CIRB Hisar.

AWARDS AND RECOGNITIONS

Most calves cloned from a single bull

The Central Institute for Research on Buffaloes (CIRB) in Hisar, Haryana, achieved the production of seven clone calves from a single superior breeding bull, named M-29, between October 2019 and January 2020.

Vatsala

CERTIFIED AUTHENTIC
BY THE HOLOGRAM

Vatsala Kaul Banerjee
Editor, *Limca Book of Records*

Date of Issue: December 2022
(LBR 2023)

Award/ Recognitions	Name of scientist
Treasurer, Indian Society for Buffalo Development (ISBD)	Dharmendra Kumar
General Secretary, Staff Club, ICAR-CIRB	
Editorial Board Member, Current Stem Cell Research and Therapy Journal	
Vice President, Indian Society for Buffalo Development (ISBD)	PS Yadav
Cultural Secretary, Staff club, ICAR-CIRB, Hisar	Meeti Punetha
Early Career Reviewer - Endocrinology	Jerome A
Early Career Reviewer - Journal of Biological Chemistry	
Review Editor : Frontiers in Veterinary Science & Frontiers in Physiology	
Rapporteur at ISSARCON 2022, CVSc, Jabalpur, Madhya Pradesh	
Member of National Academy of Veterinary Sciences (India) by National Academy of Veterinary Sciences (India) (NAVS)	Pradeep Kumar
Associate Fellowship of National Academy of Dairy Sciences (India) [since 29th October, 2022]	Varij Nayan
Key note speaker and session chair in the National Conference on Natural Sciences: Exploration through Innovations (NCNSEI) (27-28 May, 2022) Organized by Maharaja Agrasen University, Baddi, Solan, H.P.	
Journal Editor, Journal of Advanced Veterinary and Animal Research (eISSN 2311-7710); Journal of Applied Biology and Biotechnology (ISSN: 2455-7005)	
Co-Opted member/External Member for PhD viva voce Examination and Examinership for Phd thesis evaluation for IARI	
Reviewer Excellence Award by Indian Journal of Animal Research	
Best oral presentation in the Annual convention & National e-conference on Emerging trends in agricultural & biological sciences (ETABS 2022), January 14-15, 2022	
Three Best Poster awards in the National Conference on Natural Sciences: Exploration through Innovations (NCNSEI).	
Editor, Animal Reproduction Update	Dharmendra Kumar, Pradeep Kumar
Best Paper Presentation Award for the research paper entitled "Effect of Composite Feed Additive supplementation on milk production, methane emission and immunity status of Murrah Buffaloes (Bubalus bubalis)' in 19th Biennial International Conference of Animal Nutrition Society of India, Nov 16-18, 2022. GADVASU, Ludhiana.	Attri, K, Dey A, Dahiya SS
Young Scientist Award from XXXVII Annual Convention of ISSAR and National Symposium on Optimizing Animal Reproduction Through Recent Techniques of Biotechnology, Nutraceuticals and Alternative Medicine at Jabalpur, 16-18 November, 2022.	Sujata Jinagal*, Maninder Sharma, Sheetal Saini, Suman Chaudhary, Meeti Punetha, Dharmendra Kumar, Prem Singh Yadav
Best Paper award in 'XIX SOCDAB National Symposium on Contemporary Technology for Animal Genetic Resources Management' from SOCDAB at ICAR-NBAGR, Karnal, 21-22 September, 2022.	Bajwa KK, Punetha M, Bansal S, Kumar D, Yadav PS, Selokar NL
Work buffalo cloning technology recognised in 'Limca Book of Records' as 'Most calves cloned from a single bull in December, 2022.	Yadav PS, Kumar D, Selokar NL, Sharma RK, Kumar P, Kumar R
Team Award by Indian Society for Buffalo Development on Preg D: Pregnancy diagnostic research	Ashok Kumar Balhara, Suman, Archana sarngi, Mayukh Ghosh, Rajesh Kumar, Sunesh Balhara, S K Phulia, RK Sharma, AK Mohanty, Inderjeet Singh

International Fellowship

Dharmendra Kumar availed DAAD Fellowship for Research Stays for University Academics and Scientists, 2022 award at Institute of Farm Animal Genetics, 31535, Neustadt, Germany during 1st May to 31st July 2022.


23 दिसम्बर
किसान दिवस
Former FIRST

EVENTS


हिसार (हरियाणा)
हिन्दी सप्ताह
केन्द्रीय भैंस अनुसंधान संस्थान, हिसार
Central Institute for Research on Buffaloes, Hisar

Training & Capacity building

Name	Sponsored by	Duration	Course Coordinator (s)
Technological Intervention for Improving Productivity and Profitability in Buffalo Husbandry	ICAR-CIRB, Hisar & MANAGE, Hyderabad Collaborative online training program	18-20 October, 2022	Jerome A, Avijit Dey, Meeti Punetha, Gururaj M
Short Course Training on 'Advancement in animal cloning and genome editing technology for desire and faster multiplication of superior germplasm'	Agricultural Education Division, ICAR, New Delhi	5-14 December, 2022	Dharmendra Kumar, Meeti Punetha, Pradeep Kumar

Participation in conferences/ workshops/meetings

Event	Date	Venue	Participants
National Symposium on 'Optimizing Animal Reproduction through Recent Techniques of Biotechnology, Nutraceuticals and Alternative Medicine'	16-18 November, 2022	NDVSU, Jabalpur	Dharmendra Kumar, Pradeep Kumar, Jerome A
International Conference on Reproductive Healthcare & 32nd Annual Meeting of the Indian Society for the Study of Reproduction and Fertility	11-13 February, 2022	Online	Dharmendra Kumar, Jerome A
5th Annual Convention and National Conference of National Academy of Veterinary Nutrition and Animal Welfare on "Coordinated Nutrition, Health and Extension Approach For Sustainable Livestock Production" under the aegis of "Nanaji Deshmukh Veterinary Science University" Jabalpur. Lead Paper on "Animal cloning: problems and prospects"	21-22 September, 2022	NDVSU, Jabalpur	PS Yadav
Four-week certificate course in online mode entitled "Enhancing livestock production and food safety through one health approach" Centre of Excellence for Advanced Research on Food Safety, Mumbai Veterinary College, Parel, Mumbai	20 September – 18 October 2022	Veterinary college Parel Mumbai	
CIRB-MANAGE collaborative training "Technological Interventions for Improving Productivity and Profitability in Buffalo Husbandry"	18-20 October, 2022	Online Training Program of MANAGE, Hyderabad & ICAR-CIRB	
Attended Training program on OPU-IVF with International Expert Dr Andre (USA)	11-22 September, 2022	Uttarakhand Livestock Development Board Dehradun.	RK Sharma
Annual Review Meet of AICRP at ICAR- NIANP	24 June, 2022	Bengaluru	
Annual Review Meet of NPBI on	28 July, 2022	ICAR-CIRB Hisar	
Attended NABL Assessor's Training Course [Level II] at Gurugram	14-16 March, 2022	New Delhi	Jerome A
International Online Workshop on 'Sustainable Livestock Production under Impending Climate Change' organized under Australia-India Council Project between ICAR-IVRI and University of Melbourne	21-22 December, 2022	Online workshop	
Brainstorming meeting on Network Project for Buffalo Improvement (NPBI)	25 April, 2022	ICAR-CIRB, Hisar	Sanjay Kumar, A Bharadwaj
19th Annual Review Meet of Network Project on Buffalo Improvement, through	28 July, 2022	Zoom online mode at ICAR-CIRB, Hisar	
Meeting of Project coordinator, NPBI and Members QRT with NPBI team members	09 September, 2022	RCER, Patna	TK Datta, Sanjay Kumar
Show of Buffalo bull in Mega Krishi Mela at during	11-13 November, 2022	Morena (MP)	TK Datta, Sajjan Singh, Sanjay Kumar
Online meeting of "FAD 5 Sectional Committee on Feeds" organized by	28 October, 2022.	BIS, New Delhi	A Dey
Industry Expert Faculty Meet" under Institutional Development Plan	11 October, 2022	GADVASU, Ludhiana	

Event	Date	Venue	Participants
Participated and presented in the Annual convention & National e-conference on Emerging trends in agricultural & biological sciences (ETABS 2022)	14-15 January, 2022		Varij Nayan
Participated in the National Conference on Natural Sciences: Exploration through Innovations (NCNSEI) Organized by Maharaja Agrasen University	27-28 May, 2022	Baddi, Solan, H.P.	
Participated and presented in the technical review meeting workshop/meeting of Network Project on Agricultural Bioinformatics and Computational Biology"	21 November, 2022	New Delhi	
Participated and presented in Bill and Melinda Gates Foundation (BMGF) Annual Review Committee Meeting	20 August, 2022		
Participated in the VII Convocation of NADS(I) & National Dialogue on "Innovations in Reshaping the Indian Dairying" organized by Department of Livestock Products Technology, College of Veterinary Science and Animal Husbandry,		U.P Pandit Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwavidyalaya (DUVASU, Mathura)	

Farmers trainings organized

S. No.	Name of the training	Date	No. of participants	Coordinators
1	Training on Introduction to Nili-Ravi buffalo and its management at Nabha	03-10 January, 2022	30	Dr. Mustafa Jan and Dr. F C Tuteja
2	Training on scientific buffalo husbandry practices and skill development	07-08 March, 2022	15	Dr. RK Sharma, DR. SK Phulia and Dr. Jerome A
3	Training on skill improvement among Inseminators	14-17 March, 2022	20	Dr. SK Phulia and Dr. Ashok Balhara
4	Training on scientific management of Nili-Ravi buffaloes	15-22 March, 2022	30	Dr. F C Tuteja and Dr. M H Jan
5	Improved buffalo husbandry practices at ICAR-CIRB, Hisar	19-25 March, 2022	29	Dr. Sajjan Singh, Dr Ram Singh, Dr. D Kumar and Dr. ML Sharma
6	Scientific buffalo husbandry practices Shahapur, Hisar	22-24 March, 2022	35	ICAR-CIRB & LUVAS
7	Improved buffalo husbandry practices from at Tauru, Nuh district Haryana	28-30 March, 2022	40	Dr. Gururaj M, Dr. Dharmendra Kumar and Dr. Pradeep Kumar
8	Improved buffalo husbandry practices Khedi Sherkhan, Kaithal	25-27 March, 2022	35	ICAR-CIRB & LUVAS
9	Improved buffalo husbandry practices at Thuva, Jind	28-30 March, 2022	35	ICAR-CIRB & LUVAS
10	Improved buffalo husbandry practices	05-07 May, 2022	46	Dr. Gururaj M, Dr. N Saxena and Dr. P S Yadav
11	Scientific buffalo husbandry practices	21-27 May, 2022	50	Dr. Meeti Punetha, Dr. Vishal Mudgal, Dr. Gururaj M and Dr. M L Sharma
12	Improved buffalo husbandry practices	16-22 July, 2022	47	Dr. N Saxena, Dr. Gururaj M and Dr. M L Sharma
13	Scientific buffalo husbandry practices	17-23 September, 2022	27	Dr. N Saxena, Dr. Pradeep Kumar, Dr. Gururaj M and Dr. M L Sharma
14	Improved buffalo husbandry practices (Nabha)	27 September-03 October 2022	30	Dr. Mustaf and Dr. F C Tuteja
15	Technological Intervention for Improving Productivity and Profitability in Buffalo Husbandry (Online mode)	18-20 October, 2022	50	Dr. TK Datta, Dr. S Phanda, Dr. A Dey, Dr. Jerome A, Dr. Meeti Punetha, Dr. Gururaj M and Dr. Sushirekha Das
16	Improved buffalo husbandry practices	05-07 December, 2022	67	Dr. Dharmendra Kumar, Dr. Jerome A and Dr. Gururaj M
17	Scientific buffalo husbandry practices	21-27 December, 2022	17	Dr. Avijit Dey, Dr. Jerome and Dr. M L Sharma

Kisan Gosthis

S. No.	Title	Venue	Date	No. of participants	Coordinators
1	38th Foundation Day and Kisan Gosthi	Committee Hall, ICAR-CIRB, Hisar	01 February, 2022	250	Dr. Gururaj M, Dr. Meeti Punetha and Dr. N Saxena
2	Kisan Gosthi, Front-line Demonstrations,	Kewelpura, Badisadari, Chittorgarh, Rajasthan	21 March, 2022	130	Dr. SK Phulia, Dr. Ashok Balhara
3	पशु स्वास्थ्य जांच उपचार शिबिर एवं किसान गोष्ठी	Abu Road, Sirohi District Rajasthan	23 March, 2022	60	Dr. SK Phulia, Dr. Ashok Balhara
4	AI with Elite Semen Doses,	Salumber, Udaipur, Rajasthan	24 March, 2022	100	Dr. SK Phulia, Dr. Ashok Balhara
5	Kisan gosthi	ToT Unit, ICAR-CIRB, Hisar	06 October, 2022	60	Dr M L Sharma and Dr. N Saxena

Participation in mela

S. No.	Mela details	Date	Venue	Coordinators
1	Participated in Haryana state level pashu mela	25-27 February, 2022	Bhiwani, Haryana	Dr. Navneet Saxena, Dr. Sanjay Kumar, Dr. Pradeep Kumar, Dr. Sajjan Singh, Dr. S K Phulia, Dr. Dharmendra Kumar, Dr. Vishal Mudgal, Dr. Gururaj M, Dr. M L Sharma, Sh. Ramesh and Sh. G D Tiwari
2	Pashu Palan Mela at GADVASU, Ludhiana	22-24 September, 2022	Ludhiana, Pujab	Dr. SK Phulia and Dr. Gururaj M
3	Kisan mela at Morena district Madhya Pradesh	10-12 November, 2022	Morena, Madhya Pradesh	Dr. Sanjay, Dr. Sajjan Singh, Sh. Krishan Kumar, Dr. ML Sharma

Special events organized during "Azadi ka Amrut Mahotsav"

S. No.	Event Details	Date	No. of participants
1	Celebration of World Hindi Diwas	10 January, 2022	19
2	Celebration of Republic Day	26 January, 2022	120
3	Lecture on 'High Throughput Semen Analysis: Focus on Flow Cytometry'	03 March, 2022	40
4	पोषक अनाजो, मिलेट, मोटे अनाजो की पौष्टिकता से भरपूर के महत्व	28 April, 2022	100


38 वां स्थापना दिवस एवं किसान गोष्ठी
38th Foundation Day and Kisan Gosthi
(ऑनलाइन माध्यम से)

Distinguished visitors at ICAR-CIRB

Sh. Manohar Lal Khattar, Hon'ble Chief Minister of Haryana (March 26, 2022)
Sh. Ranbir Singh Gangwa, Deputy Speaker of Haryana
Dr. Kamal Gupta, Minister, Govt. of Haryana
Sh. Vinod Bhyana, Member of Legislative Assembly
Sh. Gautam Sardana, Mayor Hisar
Dr. AK Srivastava, Vice-Chancellor, DUVASU, Mathura, Uttar Pradesh

Academic and Research Collaborations

University/Institute/Organisation entering in MoU	Scope of Collaboration	Year of Signing MoU with ICAR - CIRB Hisar
Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana (Punjab)	Academics and Research	2012
Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar (Haryana)	Academics and Research	2014
Nanaji Deshmukh Veterinary Science University, Jabalpur (M.P.)	PG Research	2018
Bihar Animal Sciences University, Patna (Bihar)	Academics and Research	2018
Rajasthan University of Veterinary and Animal Sciences, Bikaner (Rajasthan)	Academics and Research (UG teaching and PG research)	2019
Hitech Sach Dairy, Sirsa (Haryana)	Biotechnological research - buffalo cloning	2019
Punjab National Bank Farmers Training Centre, Sacha Kheda (Jind)	Training & extension	2019
Lovely Professional University, G.T. Road, Phagwara, Punjab	Academics and Research	2022


भाकृअनुप-केन्द्रीय भैंस अनुसंधान संस्थान, हिसार
जश्न-ए-आज़ादी
स्वतन्त्रता दिवस समारोह
Independence Day Celebration
15 अगस्त 2022
आज़ादी का अमृत महोत्सव

STUDENT RESEARCH AT CIRB

Completed Research (in 2022)

SNo.	Name of the scholar	Degree	Subject/ Discipline	University	Year	Advisor Major/ Co-Major	Title of the thesis
1.	Krishan Kumar	Ph.D.	Vety. Physiology	LUVAS, Hisar	2019-22	Dr. Ashok K Balhara	Comparative studies on urinary metabolites and scrotal thermal signatures in normal and cloned Murrah buffalo bulls
2.	Kamlesh K. Bajwa	Ph.D.	Animal Biotechnology	NDRI, Karnal	2019-22	Dr. Naresh Selokar	CRISPR-based manipulation of the CD18 in cultured fibroblast cells of buffalo (Bubalis bubalis)
3.	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.
4.	Satish Kumar	Ph.D.	Veterinary Gynaecology and Obstetrics	RAJUVAS, Bikaner	2021-22	Dr. R.K. Sharma	Studies on semen production variables and cryopreservation using buffalo specific semen extender in Murrah bulls
5.	Kanchan Arya	Ph.D.	Veterinary Medicine	LUVAS Hisar	2022 till date	Dr Sarita Yadav	Clinico-epidemiological and therapeutic studies on hepatic lipidosis in dairy buffaloes
6.	Shipra Chauhan	M.Sc.	Animal Biochemistry	NDRI, Karnal	2021-22	Dr. Varij Nayan	In silico identification and characterization of buffalo TLR4 and HSP70 Epitope peptides

Ongoing Research (2022)

SNo.	Name of the scholar	Degree	Subject/ Discipline	University	Year	Advisor Major/ Co-Major	Title of the thesis
1.	Komal	Ph.D.	Animal Genetics & Breeding	LUVAS, Hisar	2022 till date	Dr. Sanjay Kumar	Genetic evaluation of Fertility, Production performance and Longevity traits in Murrah buffaloes
2.	Amandeep	Ph.D.	Livestock Production & Management	LUVAS, Hisar	2022 till date	Dr Sarita Yadav	Potential of IRT as a tool of screening of mastitis in dairy animals
3.	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
4.	Akanksha Gupta	Ph.D.	Animal Physiology	NDRI, Karnal	2021 - till date	Dr. P.S.Yadav	Studies on hair cortisol, testosterone and fertility biomarkers in buffalo bulls
5.	Swati Thakur	Ph.D.	Animal Physiology	LUVAS Hisar	2021 - till date	Dr. P.S.Yadav	To study the role of major histocompatibility class (MHC) I in buffalo cloned embryos to enhance success rate of pregnancies
6.	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
7.	Amit Kumar	Ph.D.	Animal Biochemistry	NDRI, Karnal	2022 - till date	Dr. Varij Nayan	Title of the thesis yet to be decided
8.	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
9.	Rashmi	M.V.Sc.	Veterinary Gynaecology & Obstetrics	LUVAS, Hisar	2022 - till date	Dr. Pradeep Kumar	Studies on X and Y sperm separation using TLR7/8 agonist Resiquimod (R848) in buffalo
10.	Krishan Ahuja	M.Sc.	Agricultural Economics	NDRI, Karnal	2022 - till date	Dr. Gururaj M	Economic Analysis of buffalo population dynamics and breed preference in Punjab
11.	Nidhi Kumari	M.Sc.	Animal Biotechnology	NDRI, Karnal	2022 - till date	Dr. Dharmendra Kumar	Effect of melatonin on in vitro maturation of buffalo oocytes and subsequent development of cloned embryos
12.	Nisha	M.Sc.	Animal Biochemistry	NDRI, Karnal	2022 - till date	Dr. Varij Nayan	In silico identification and characterization of epitope-based peptides for buffalo SERPINB1 and ENO3

SNo.	Name of the scholar	Degree	Subject/ Discipline	University	Year	Advisor Major/ Co-Major	Title of the thesis
13.	Renu Choudhary	M.V.Sc	Animal Biochemistry	LUVAS Hisar	2021-22	Dr. Ashok Balhara	Studies on urinary and blood pregnediol glucoronide and p-parcresol levels in female buffaloes
14.	Usha Yadav	M.V.Sc.	Veterinary Gynaecology & Obstetrics	LUVAS Hisar	2021-23	Dr. Pradeep Kumar	Influence of antibiotic substitutes on bacterial load and semen quality of buffalo bulls
15.	Krishna Nand Bansal	M.V.Sc	Veterinary Gynaecology & Obstetrics	LUVAS Hisar	2021-23	Dr. Pradeep Kumar	Estimation of lower threshold of sperm concentration and evaluation of semen quality parameters
16.	Sujata	M.V.Sc	Veterinary Gynaecology & Obstetrics	LUVAS Hisar	2021-23 date	Dr. Dharmendra Kumar	Effect of lipopolysaccharide on in vitro developmental competence of buffalo oocytes

PERSONNEL

General Administration

SNo.	Name	Designation
1.	Dr. Tirtha Kumar Datta	Director
2.	Sh. Raj Kumar	Sr. Administrative Officer
3.	Smt. ShammiTyagi	Sr. Finance & Account Officer
4.	Sh. Rajesh Kumar	AAO
5.	Sh. GirdhariLal	AAO
6.	Sh. Viksit Kumar	AAO
7.	Sh. Abdul Mazid	AAO
8.	Sh. Ashok Kumar	Assistant
9.	Smt. Indira Devi	Assistant
10.	Sh. Satbir Singh	Assistant
11.	Sh. Dharam Pal	UDC
12.	Sh. Sunil Kumar	UDC
13.	Sh. Mahabir Singh	UDC
14.	Smt. Savita	LDC
15.	Sh. Rajbir Singh	LDC
16.	Sh. Radhey Krishan	LDC
Sub Campus, Nabha		
1.	Dr. F C Tuteja	Sr. Scientist & Officer In-charge
2.	Dr. Mustafa Hasan Jan	Scientist
3.	Sh. Jagdish Prasad	Chief Tech. Officer
4.	Sh. Rajiv Mehta	Chief Tech. Officer
5.	Sh. RS Pippal	Chief Tech. Officer
6.	Dr. AK Saini	Senior Tech. Officer
7.	Sh. Daljit Singh	Tech. Officer
8.	Sh. Mohan Singh	Tech. Officer
9.	Sh. Tejinder Singh	UDC
10.	Sh. Jaspal Singh	LDC
Transfer of Technology (TOT)		
1.	Dr. Navneet Saxena	Principal Scientist & Incharge
2.	Dr. Gururaj M	Scientist
3.	Dr. ML Sharma	Chief Tech. Officer
Priority Setting, Monitoring and Evaluation (PME) Cell		
1.	Dr. SK Khurana	Principal Scientist
2.	Dr. FC Tuteja	Senior Scientist
3.	Dr. AK Balhara	Senior Scientist
4.	Dr. Dharmendra Kumar	Senior Scientist
5.	Dr. Jerome A	Senior Scientist
6.	Sh. Raj Kumar	Asst. Chief Tech. Officer
AKMU		
1.	Smt. Sunesh Balhara	Scientist & In-charge
2.	Sh. Raj Kumar	Asst. Chief Tech. Officer

HRD Cell		
1.	Dr. Avijit Dey	Principal Scientist, Nodal Officer
2.	Dr. Jerome A	Senior Scientist, Co-Nodal Officer
Public Relations Officer (PRO)		
1.	Dr. Sajjan Singh	Principal Scientist
Academic Coordinator		
1.	Dr. Sanjay Kumar	Senior Scientist
2.	Dr. Ashok Kumar Balhara	Senior Scientist
Estate Section and Electrical Section		
1.	Dr. S.K. Phulia	Principal Scientist
2.	Sh. B. P. Singh	CTO & I/c Estate Section
3.	Sh. Rajesh Prakash	CTO & I/c Electric Section
4.	Sh. Anil Kumar	Technician
Workshop Section		
1.	Dr. Sanjay	Senior Scientist
2.	Sh. Bhim Singh	Tech. Officer
3.	Sh. Satpal	Tech. Officer
Landscape Section		
1.	Sh. AKS Tomar	CTO
Network Project on Buffalo Improvement (NPBI)		
1.	Dr. Tirtha Kumar Datta	Director
2.	Dr. A. Bharadwaj	Principal Scientist & Incharge
3.	Dr. B.P. Kushwaha	Principal Scientist (at IGFRI, Jhansi)
4.	Dr. Sanjay Kumar	Senior Scientist
5.	Sh. Ram Chander	Technical Officer
Animal Nutrition & Feed Technology		
1.	Dr. P.C. Lailer	Principal Scientist & Head
2.	Dr. Navneet Saxena	Principal Scientist
3.	Dr. Avijit Dey	Principal Scientist
4.	Dr. Vishal Mudgal	Principal Scientist
5.	Dr. SaritaYadav	Senior Scientist
6.	Sh. Krishana Kumar	Chief Technical Officer
Animal Physiology & Reproduction		
1.	Dr. Sajjan Singh	Principal Scientist & Head
2.	Dr. Prem Singh Yadav	Principal Scientist
3.	Dr. Rakesh Kumar Sharma	Principal Scientist
4.	Dr. Sushil Kumar Phulia	Principal Scientist
5.	Dr. Varij Nayan	Senior Scientist
6.	Dr. Ashok Kumar Balhara	Senior Scientist
7.	Dr. Dharmendra Kumar	Senior Scientist
8.	Dr. Jerome A	Senior Scientist
9.	Dr. Pradeep Kumar	Senior Scientist
10.	Dr. Meeti Punetha	Scientist
Animal Genetics & Breeding		
1.	Dr. Anurag Bharadwaj	Principal Scientist & Head
2.	Dr. Sandip Kumar Khurana	Principal Scientist
3.	Dr. B.P. Kushwaha	Principal Scientist (at IGFRI, Jhansi)

4.	Dr. Sanjay Kumar	Senior Scientist
5.	Dr. Ashok Kumar	Senior Scientist
6.	Smt. Sunesh Balhara	Scientist
7.	Sh. AKS Tomer	Chief Technical Officer
8.	Sh. Ram Chander	Technical Officer
Public Information		
1.	Dr. R. K. Sharma	CPIO, Hisar
2.	Dr. Mustafa Hussan Jan.	CPIO, Nabha
3.	Sh. Rajesh Kumar	Nodal Officer
Vigilance Officer		
1.	Dr. Navneet Saxena	Principal Scientist & Vigilance Officer
Animal Farm Section		
1.	Dr. Anurag Bharadwaj	Overall In-charge
2.	Sh. AKS Tomer	In-charge Animal farm
3.	Dr. Sanjay	In-Charge Animal Health
4.	Dr. Madhu Singh	STO
5.	Dr. Rupali Rautela	STO
6.	Dr. Rajesh	TO
7.	Sh. Joginder Singh	Technician
Agriculture Farm Section		
1.	Dr. PC Lailer	Overall In-charge
2.	Sh. Surender Singh	Incharge
3.	Sh. Baljeet Singh	Technical Officer
4.	Sh. Jagdeep	Technician
Results- Framework Documents (RFD) Cell		
1.	Dr. Jerome A	Senior Scientist
Library		
1.	Smt. Sunesh Balhara	Scientist
2.	Sh. Raj Kumar	In-charge & ACTO
Hindi Section		
1.	Dr. Sajjan Singh	Principal Scientist
2.	Sh. Krishna Kumar	Chief Technical Officer
SSS, CIRB Main Campus, Hisar		

	Pooran	Ram Kumar	Randhir Singh	Satpal Singh	Ashok Kumar
	Jai Prakash	Gopi Ram	Ram Kesh	Smt. Santro	Om Parkash
	Yam Bahadur	Siri Ram	Subhash	Balwant Singh	Shri Mange Ram
	Chander	Pahlad	Rambir Singh	Surjeet Singh	Baljeet Singh
	Raj Kumar	Ashok Kumar	Jagdeep	Dalbara	Ranbir Singh
	Rajender	Sarla Rani	Jitender Kumar	HiraLal	Ram Pal
	HariKishan	Jai Kumar	Om Prakash	Suraj Pal	Raj Mal
	Nakchhed	Radhey Shyam	Hawa Singh	Rameshwar	Smt. Anita
	Ramesh Chand	Mahabir Singh	Satish Kumar	Jagdish	
	Satbir Singh	Satyawan	Balwant Singh		
	Dilbag Singh	Joginder Singh	Om Prakash		
	Rati Ram	Sadhu Ram	Jarnail Singh		
	Devi Dayal	Prem Singh	Ram Sawroop		
	Reshma	Ramesh	Bhadur		

Sub- Campus, Nabha					
	Shyamdev	Ram Anuj	Rajender	Mohinder Singh	Ved Raj
	Raju	Bhim Singh	Balwant Singh	Jaswinder Singh	Ram Singh
	Brij Mohan	Hansraj	Gurnaam Singh	Nachater Singh	Ram Preet
	Rulda Singh	Ram Kewal	Ram Suraj	GirdhariLal	Krishan Singh
	Jaswant Singh	ShriNath	Rajesh Kumar	Ashwani Kumar	Nazar Singh
	Mukhtaryar Singh	Deshraj	Baljeet Singh	Kulwant Singh	Ram Jeon
	Chotu Ram	Kuldeep Singh	Tara Singh	Vinod Kumar	Karnail Singh
				Ram Kumar	Mohinder Singh
				Bhagwant Rai	Mewa Singh
				Smt. GurmeetKaur	Ganga Singh
				Jaswinder Singh	Karnail Singh
				Malkiat Singh	Gurdeep Singh
				Radhey Sham	Lakhbir Singh
				Pritam Singh	Smt. Harmeet Kaur
				Goli Ram	Ramu
				Avtar Singh	

Joining

Dr. Madhu Singh, STO joined on 20.06.2022

Dr. Rupali Rautela, STO joined on 06.07.2022

Dr. Aishwarya Habbu, STO Sub-Campus Nabha joined on 30.06.2022

Dr. Nilendu Paul, STO Sub-Campus Nabha joined on 29.06.2022

Promotions

Dr. Pradeep Kumar, Scientist promoted to the post of Sr. Scientist (RGP 8000/-) w.e.f 17.05.2019

Dr. Jerome A, Scientist promoted to the post of Sr. Scientist (RGP 8000/-) w.e.f 23.08.2019

Dr. Ashok Kumar, Scientist promoted to the post of Sr. Scientist (RGP 8000/-) w.e.f 21.04.2019

Mrs. Sunesh Balhara, Scientist promoted to the post of Scientist (RGP 8000/-) w.e.f 5.11.2020

Dr. Dharmendra Kumar, Senior Scientist promoted to the post of Sr. Scientist (RGP 9000/-) w.e.f 21.04.2021

Dr. Ashok Kumar Balhara, Senior Scientist promoted to the post of Sr. Scientist (RGP 9000/-) w.e.f 08.01.2020

Dr. Sarita Yadav, Senior Scientist promoted to the post of Sr. Scientist (RGP 9000/-) w.e.f 07.01.2021

Dr. Varij Nayan, Senior Scientist promoted to the post of Sr. Scientist (RGP 9000/-) w.e.f 17.11.2019

Sh. AKS Tomer, ACTO promoted to the post of Chief Technical Officer w.e.f 01.01.2022

Sh. Krishna Kumar, ACTO promoted to the post of Chief Technical Officer w.e.f 31.03.2022

Sh. Satbir Singh CLTS regularized to the post of SSS w.e.f 12.01.2022

Sh. Satbir Singh, UDC promoted to the post of Assistant w.e.f 28.03.2022

Dr. Rajesh Kumar, STA promoted to the post of Technical Officer(T-5) w.e.f 24.11.2021

Regularized

Sh. Satbir Singh, CLTS regularized to the post of SSS w.e.f 12.01.2022.

Smt. Anita Rani, CLTS regularized to the post of SSS w.e.f 21.02.2022.

Sh. Jagdish, CLTS regularized to the post of SSS w.e.f 02.03.2022.

Retirement

Dr. Inderjeet Singh Principal Scientist retired on 30.11.2022

Sh. Jagdish S/o Sh. Hem Raj SSS retired on 28.2.2022

Sh. Jagdish Chander SSS retired on 31.03.2022

Sh. Satbir Singh SSS retired on 31.03.2022

Sh. Tara Chand SSS retired on 30.06.2022

Smt. Lal Dei, SSS retired on 30.06.2022

Smt. Ram Dulari, SSS retired on 30.06.2022

Sh. Kuldeep STA retired on 31.7.2022

Sh. Mehar Chand, SSS retired on 31.08.2022

Sh. Dinesh Chander, SSS retired on 31.10.2022

Sh. Bheera SSS retired on 30.11.2022

Sh. Ved Parkash SSS retired on 30.11.2022

Sh. Suraj Pal SSS retired on 31.12.2022

Transferred

Dr. Ram Singh, Principal Scientist transferred on 03.08.2022 to NDRI, Karnal

Sh. Jitender Kumar STO transferred on 60.06.2022 Meerut (UP)

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