Annual Report

वार्षिक प्रतिवेदन

2020

ICAR-Central Institute for Research on Buffaloes, Hisar

भा.कृ.अनु.प.–केन्द्रीय भैंस अनुसधान संस्थान, हिसार

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PREFACE

Dairying is very intimately interwoven with the Indian agrarian economy and its way of life. Presently, our country occupies the pride position of being the highest milk producer in the world. This cannot entirely be ascribed to sheer number of livestock heads that we possess, but has to be credited to the consistent increase in productivity of our livestock which is being steered by science driven technology innovations. Contribution of buffaloes in the dairy success of India is well documented. In India, buffaloes are preferred over cattle in many parts of the country owning to its superior quality of milk, disease resistance, longer productive life, higher milk productivity and its well adoption under the existing agro-climatic milieu. According to 20th Census, the buffalo population (109.85 million) is about the half as compared to cattle (192.49 million) but share of the buffalo milk production is higher than the indigenous and crossbred cows taken together. Buffaloes contribute about 49 per cent in total milk production with production of 97.21 MT in 2019-20. India endowed with rich bio-diversity of buffalo germplasm in the form of 19 recognized breeds and several non-descript types. Despite availability of diverse germplasm, the majority of Indian buffaloes are however, low producing. At times, milk productivity is marred by suboptimal reproductive efficiency and lack of quality feed resources which constraints to reap the full potential benefits from buffalo farming in the country. Besides, buffaloes are well appreciated for their meat and draught in addition to their milk production. Buffalo meat dominates the exports with a contribution of over 89.08% in total animal products exported from India. Also, buffalo contributes high-value hides, bones, and draught power for agricultural activities.

Recognizing the importance of Buffaloes, the Indian Council of Agricultural Research (ICAR) established the Central Institute for Research on Buffaloes (CIRB) in 1985 to focus primarily on the exclusive physiological features of this species and improving the buffaloes through identification, conservation and propagation elite germplasm having high efficiency of reproduction and nutrient utilization for sustainable production and commercialization. The institute remains committed to provide research-based solutions to the buffalo owners, policy makers, entrepreneurs and development agencies for sustainable, efficient and economically viable buffalo production systems. During the year the institute recorded the highest herd performance in terms of wet average (9.79 kg), TLMY (2821 kg) and SLMY (2704 kg) for Murrah herd since the inception of the institute. The herd performance of Nili- Ravi at CIRB sub campus Nabha, Punjab were herd average (7.53 kg), SLMY (2576 kg) and TLMY (2645 kg).

During the reporting year 2020, the institute has been recognized as important policy input center for dairy development at national and international level. Institute has funding support of Department of Science and Technology (DST), Department of Biotechnology (DBT), National Agriculture Science Fund (NASF), Bill-Melinda Gates Foundation (BMGF) and International Livestock Research Institute (ILRI) to augment research outputs for the nation service.

As research accomplishment; ICAR-CIRB developed and validated novel urine-based pregnancy diagnosis kit 'Preg-D'. The Preg-D kit is the prototype of a urine-based technique to detect pregnancy as early as day-30 post breeding for achieving high lifetime productivity. The institute also established a somatic cells bio-bank where the finite somatic cells line derived from tail-skin biopsies of 26 elite male and female buffaloes of three breed including the cloned animal's somatic cells were stored. Innovative method on supplementation of eucalyptus oil- mulethi root blend to buffalo was demonstrated

to reduce (50%) ruminal ammonia production without affecting beneficial organisms and resulted improvement in protein utilization efficiency. In germplasm improvement, insemination of sperm doses with 20, 16 and 12 million spermatozoa revealed no significant difference in sperm kinetics, membrane integrity, mitochondrial membrane potential, superoxide status as well as field conception rates in buffaloes. Institute is popular among the farmers to disseminate the knowledge on improved buffalo husbandry practices and able to reach thousands of farmers through various trainings, demonstrations, kisan gosthis and outreach programmes under Schedule Caste Sub Plan (SCSP), Tribal Sub Plan (TSP) and Mera Gao Mera Gaurav (MGMG).

I take this opportunity to extend heartily commendations to the CIRB family of scientists, technical manpower, administrative personnel and supportive staff for their untiring efforts in making a very successful year for the institute. The institute acknowledges the leadership of ICAR for encouragement, support, motivation and guidance.

Tirtha Kumar Datta
Director

प्रस्तावना

डेयरी उद्योग भारतीय कृषि अर्थव्यवस्था और इसके जीवन के तरीके के साथ बहुत ही घनिष्ठ रूप से जुड़ा हुआ है। वर्तमान समय में हमारा देश विश्व में सबसे अधिक दुग्ध उत्पादक होने का गौरवपूर्ण स्थान रखता है। यह पूरी तरह से हमारे पास मौजूद पशुधन की संख्या के कारण नहीं हो सकता है, बल्कि इसके लिये हमारे पशुधन की उत्पादकता में निरंतर वृद्धि को श्रेय दिया जाना चाहिए। जिसे विज्ञान संचालित प्रौद्योगिकी नवाचारों द्वारा संचालित किया जा रहा है। भारत की डेयरी सफलता में भैंसों का योगदान अच्छी तरह से प्रलेखित है। भारत में, भैंसों को देश के कई हिस्सों में मवेशियों की तुलना में प्राथमिकता दी जाती है। जो की दूध की उच्च गुणवत्ता, रोग प्रतिरोध, लंबे उत्पादक जीवन, उच्च दूध उत्पादकता और मौजूदा कृषि जलवायु को अच्छी तरह से अपनाने के कारण है। 20 वीं जनगणना के अनुसार, भैंसों की आवादी (109.85 मिलियन) मवेशियों (192.49 मिलियन) की तुलना में लगभग आधी है, लेकिन भैंस के दूध उत्पादन का हिस्सा देशी और क्रॉसब्रेड गायों की तुलना में अधिक है। 2019–20 में 97.21 मीट्रिक टन उत्पादन के साथ भैंस का कुल दूध उत्पादन में लगभग 49 प्रतिशत का योगदान है। भारत 19 मान्यता प्राप्त नस्लों और कई नॉन–डिस्क्रिप्ट प्रकारों के रूप में भैंस के जर्मप्लाज्म की समृद्ध जैव–विविधता से सम्पन्न है। विविध जर्मप्लाज्म की उपलब्धता के बावजूद, अधिकांश भारतीय भैंस कम उत्पादन वाली है। कभी–कभी दूध की उत्पादकता को उप–पशु प्रजनन क्षमता और गुणबत्ता वाले फीड संसाधनों की कमी के कारण नुकसान होता है, जो देश में भैंस की खेती से पूर्ण संभावित लाभों को प्राप्त करने के बाधक होते है। इसके अलावा, भैंसों को उनके दूध उत्पादन के अलावा उनके मांस और मसौदे के लिए भी सराहा जाता है। भारत से निर्यात किए जाने वाले कुल पशु उत्पादों के 89.08% से अधिक के योगदान के साथ भैंस का मांस निर्यात में प्रभुत्व रखता है। इसके अलावा, भैंस कृषि गतिविधियों के लिए उच्च मूल्य की खाल, हड्डियों और मसौदा शक्ति का भी योगदान करती है।

भैंसों के महत्व को पहचानते हुए भारतीय कृषि अनुसंधान परिषद (ICAR) ने 1985 में इस प्रजाति की विशिष्ट शारीरिक विशेषताओं पर मुख्य रूप से ध्यान केंद्रित करने और भैंसों में सुधार करने के लिए प्रजनन और पोषक तत्वों के उपयोग की उच्च दक्षता वाले विशिष्ट जर्मप्लाज्म की पहचान, संरक्षण और प्रसार के माध्यम से स्थायी उत्पादन और व्यावसायीकरण को बढ़ाने के लिए भैंसों पर अनुसंधान के लिए केन्द्रीय भैंस अनुसंधान संस्थान (CIRB) की स्थापना की थी। संस्थान भैंस मालिकों, नीति निर्माताओं, उद्यमियों और विकास एजेंसियों को टिकाऊ, कुशल और आर्थिक रूप से व्यवहार्य भैंस उत्पादन प्रणालियों के लिए अनुसंधान–आधारित समाधान प्रदान करने के लिए प्रतिबद्ध है। इस वर्ष के दौरान संस्थान की स्थापना के बाद से मुर्रा हर्ड के लिए गीले औसत (9.79 किलो), TLMY (2821 किलो) और SLMY (2704 किलो) के संदर्भ में सबसे अधिक हर्ड प्रदर्शन दर्ज किया। सीआईआरबी उप परिसर नाभा, पंजाब में नीली–रवी का झुंड प्रदर्शन औसत (7.53 किग्रा) SLMY (2576 किग्रा) और TLMY (2645 किग्रा) था।

वर्ष 2020 के दौरान संस्थान को राष्ट्रीय और अंतर्राष्ट्रीय स्तर पर डेयरी विकास के लिए महत्वपूर्ण नीति इनपुट केंद्र के रूप में मान्यता दी गई है। संस्थान को राष्ट्र सेवा और अनुसंधान उत्पादन को बढ़ाने के लिए विज्ञान और प्रौद्योगिकी विभाग (DST) जैव प्रौद्योगिकी विभाग (DBT), राष्ट्रीय कृषि विज्ञान कोष (NASF), बिल–मेलिंडा गेट्स फाउंडेशन (BMGF) और अंतर्राष्ट्रीय पशुधन अनुसंधान संस्थान (ILRI) की वित्तीय सहायता प्राप्त है।

अनुसंधान उपलब्धि के रूप में, भा.कृ.अनु.प.–केन्द्रीय भैंस अनुसंधान संस्थान ने नवीन मूत्र–आधारित गर्भावस्था निदान किए 'प्रेग–डी' को विकसित और मान्य किया है। प्रेग–डी किट एक मूत्र आधारित तकनीक का प्रोटोटाइप है जो उच्च जीवनकाल उत्पादकता प्राप्त करने के लिए गर्भावस्था के 30 वें दिन की शुरुआत में ही गर्भावस्था का पता लगाती है। संस्थान ने एक सोमैटिक सेल बायो–बैंक भी स्थापित किया, जहां क्लोन किए गए जानवरों की दैहिक कोशिकाओं सहित तीन नस्लों के 26 कुलीन नर और मादा भैंसों की पूंछ–त्वचा

बायोप्सी से प्राप्त परिमित दैहिक कोशिकाओं की रेखा को संग्रहीत किया गया है। अभिनव विधि द्वारा भैंस को यूकलिप्टस तेल और मुलेठी जड़ का मिश्रण देने से लाभकारी जीवनों को प्रभावित किए बिना (50%) कम रूमिनल अमोनिया उत्पादन प्रदर्शित किया गया और परिणामस्वरूप प्रोटीन उपयोग दक्षता में सुधार हुआ। जर्मप्लाज्म सुधार में, शुक्राणु डोज में 20, 16 और 12 मिलियन शुक्राणुओं के साथ गर्भाधान से शुक्राणु काइनैटिक्स, झिल्ली अखंडता, माइटोकॉन्ड्रियल झिल्ली क्षमता, सुपरऑक्साइड स्थिति के साथ-साथ भैंसों में क्षेत्र गर्भाधान दर में कोई महत्वपूर्ण अंतर नहीं पाया गया। यह संस्थान किसानों के बीच बेहतर भैंस पालन पद्धतियों के बारे में ज्ञान का प्रसार करने और विभिन्न प्रशिक्षणों, प्रदर्शनों, किसान गोष्ठियों और अनुसूचित जाति उप योजना (SCSP), जनजातीय उप योजना (TSP) और मेरा गावों मेरा गौरव (MGMG) के तहत आउटरीच कार्यक्रमों के माध्यम से हजारों किसानों तक पहुंचने में सक्षम है।

मैं इस अवसर पर वैज्ञानिकों, तकनीकी जनशक्ति, प्रशासनिक कर्मियों और सहयोगी कर्मचारियों के इस सीआईआरबी परिवार को संस्थान के लिए एक बहुत ही सफल वर्ष बनाने में उनके अथक प्रयासों के लिए उनकी हार्दिक सराहना करता हूँ। यह संस्थान प्रोत्साहन, समर्थन, प्रेरणा और मार्गदर्शन के लिए आईसीआर के नेतृत्व को स्वीकार करता है।

तीर्थ कुमार दत्ता
निदेशक

EXECUTIVE SUMMARY

ICAR- Central Institute for Research on Buffaloes is a premier research organization of the nation dedicated to address Research and Developmental needs of buffalo productivity and Human Resource Development (HRD) support towards buffalo management and health in the country. The institute was established on February 1, 1985 by acquiring the Progeny Testing Bull Farm from Haryana Government at Hisar. The institute has come a long way towards addressing its mandated role. A sub-campus of the institute was established in December 1987 at Bir Dosanjh, Nabha, District Patiala (Punjab) with the transfer of Nili- Ravi Buffalo Farm from the Punjab State Government.

Organizational Structure

The institute is one of the 19 Animal Science institutes amongst 113 ICAR institutes spread across the country. The institute is headed by the Director, who is administrative head and managing research and extension functions. He is advised by a Research Advisory Committee (RAC) consisting of eminent scientists to decide the research guidelines based on mandate, objectives and perspective plan of the institute. The institute Management Committee (IMC), headed by the Director, decides on important administrative and management matters which include funding position, action taken on recommendation of QRT and RAC, approval for higher budget works etc. Institute Research Committee (IRC), chaired by the Director, reviews the progress of various research projects being implemented by the scientists, besides assessing the completed projects and approving new research proposals based on mutual discussions amongst the scientists and experts. RAC, IMC and IRC regularly meet and provide guidance for further strengthening research and development activities. Every five years, Quinquinal Review Team (QRT), evaluates the output and outcome of the institute vis-à-vis resources of funds, manpower and facilities available, in order to provide critical appraisal to the council and the ICAR governing body. The research activities of the institute are assigned to three subject matter divisions: Animal Nutrition and Feed Technology (ANFT), Animal Genetics and Breeding (AGB) and Animal Physiology and Reproduction (APR). In addition, a unit for Transfer of Technology (TOT) takes care the extension activities of the institute. Various sections viz. Agriculture farm, Animal farm, Workshop, Estate, Electrical, PME cell, AKMU, Library, Feed Unit, Landscape, Guest House, ITMU are managed by the concerned incharges under the advice of the Director of the institute. The administrative functions viz. purchase, security, cash & bill, establishment and central store are managed by the Administrative Officer (AO), while Finance & Accounts Officer (FAO) accomplishes the Audit & Accounts section. The institute presently has the strength of 33 scientists, 28 Technicians, 17 administrative staff and 65 skilled supporting staff.

Budget Outlay

The financial outlay of the institute in terms of sanctioned budget and actual expenditure during the year 2020-21 was equal and remained 3177.22 lakh including TSP, NEH and SCSP funds. CIRB also received funds of Rs. 696.23 and 99.22 lakh, respectively from plan schemes and externally funded schemes, out of which, Rs. 680.43 and 48.37 lakh were expended. The revenue receipts of the institute were Rs. 520.50 lakh during 2020.

Salient achivements

ICAR- CIRB maintained its ISO 9001: 2015 certifiifed institution status for improved buffalo germplasm production.

Achieved highest ever wet average (kg/d) of 9.79 (n= 131) and 8.94 (n= 102) as well as herd average (kg/d) of 7.02 (n=182) and 6.17 (n=148) for Murrah and Nili-Ravi, respectively.

Achieved lowest ever AFC (42.74 months, n= 64 and 44.72 months, n= 44) and calving interval (432.38 days, n= 104 and 446.00 days, n= 146) for Murrah and Nili-Ravi, respectively.

First time in the history of CIRB, 10 Murrah buffaloes crossed 4000kg in a single lactation. Buffalo no 4316 was recorded 4810kg in 305 days at 5th lactation.

Recorded highest ever single day milk yield (> 20 kg) for 6 Murrah buffaloes with average 305 days milk yield of total Murrah herd, 2704 kg.

Telomere length and blood biochemical parameters (AST, ALT, alkaline phosphatase, serum creatinine and creatine kinase, creatine phosphokinase, TLC, DLC) of eight cloned buffaloes was evaluated 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.

Fresh semen of 'Hisar-Gaurav' was used for artificial insemination in 15 oestrous synchronised female buffaloes at the institute's experimental herd and out of that 13 were found pregnant and 11 delivered normal calves.

A novel urine based pregnancy diagnosis method developed and validated. The method involves a thermophilic reaction involving embryonic development indicating metabolites excreted in urine.

Climate Vulnerability Modeling for buffalo farming systems was developed and tested in representative data from six states.

Winter calved buffaloes (60%) resume their ovarian cyclicity early, as compared to summer calved buffaloes (30%) by day 28 postpartum. Furthermore, 40% buffalo remain anovular till day 90 postpartum during summer season as compared to only 10% during winter season.

Progesterone injection should not be administered at the time of insemination in buffaloes as fertility improving drug as it delay the time of ovulation, facilitate follicular cyst formation and reduces conception rate.

Deoxygenation of buffalo semen by Oxyrase has the potential of improving post-thaw sperm quality by overcoming the problem of cryocapacitation and oxidative damage during cryopreservation process.

Three sperm doses i.e. 20, 16 & 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.

Survey of AI practices was carried out and package of practices about knowledge of hygienic AI practices was developed.

ITK bases herbs (Fenugreek seeds, Cumin seeds, Jivanti roots, Satavari roots, Anise seeds and Black cumin) in various combinations were examined for increasing milk production and found no additional benefit to the supplemented animals.

GnRH (Busrelin acetate 10 μg: 2.5 ml I/V) administration on day 21 post calving was found to improve the early resumption of cyclicity during winter calved (83.3%) and summer calved buffaloes (80%) by day 28 postpartum as compared to only 60% and 30% in respective seasons.

Supplementation of eucalyptus oil- mulethi root blend (10.5 mL eucalyptus oil and 7.35 g mulethi root powder/h/d) to buffalo was demonstrated to reduce (50%) ruminal ammonia production by inhibiting hyper ammonia producing microbes without affecting beneficial organisms, resulting 14% increased ADG and 21.4% improvement in protein utilization efficiency.

Comparative evaluation of brown midrib (bmr) sorghum (SPV-2018), normal sorghum (CSV-27) and sweet sorghum (CSH 22SS) revealed lowest ADL (1.27%) with highest hemicellulose (37.72%) contents in bmr sorghum which resulted higher fermentation, feed digestibility, ruminal enzyme production and abundance of total ruminal bacterial population are indicative of higher feeding value.

Designer Azolla prepared to take care of the requirement of trace elements Zn and Cu in buffaloes without adding those elements through mineral mixture.

Institute trained 656 dairy farmers on scientific buffalo husbandry practices by transfer of technology unit during Jan.-Dec, 2020. Out of these 159 dairy farmers were trained under the SCSP program.

Convergence model developed and tested for improvement in buffalo udder health by reducing somatic cells counts.

Under Network Project on Buffalo Improvement (NPBI) more than 1000 elite breedable Murrah buffaloes are maintained at six different centres in addition to three field units for progeny testing of bulls. During the year, use of 19th set of bulls (15) was initiated for test mating and 14th set of test bulls (12) was evaluated on the basis of first lactation record of 439 daughters.

Since initiation of progeny testing programme in the year 1991, 36 progeny tested Murrah bulls were produced out of 188 test bulls used and evaluated.

During the year, 177918 and 35447 doses of semen were disseminated for Murrah and other breeds (Nili-Ravi, Jaffrabadi, Surti and Bhadawari), respectively under NPBI.

Nili-Ravi, Jaffrabadi and Surti breeds of buffalo at respective centres are also focusing on progeny testing along with maintaining elite herd for bull production.

Bhadawari breed at IGFRI, Jhansi centre of NPBI is functioning as conservation and imrpovement unit.

Revenue receipts (all values in Indian Rs.)

Sr. No.	NAME OF THE INSTITUTE : CIRB, HISAR	Revenue Receipt						
	Major/Minor/Detailed Head of Accounts	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**2020-21**
1	(i) Sale of Milk	19837011	24844089	21730861	26162117	27721410	33620226	37031295
	(ii) Sale of Wheat Busa/ Mustard Bhusa/Green Fodder	1470988	189775	12000	1781231	126430	505225	1022157
	(iii) Sale of grain/wheat/paddy	2479538	4181305	3377626	2561279	5500382	483343	792076
	(iv) Sale of Semen	1772124	1218013	1956478	2130286	2846201	2753609	2382868
	(v) Sale of Mineral Mixture	45198	187642	560290	486825	125800	76800	44500
	(vi) Sale proceed of dry trees	2050000	1180000	960000	600306	175000	0	1015000
	(vii) Sale of Books	14857	5925	29203	0	5800	65550	2600
	(viii) Sale of Technology/Royalty	0	25000	200000	0	0	75725	19097
2	**Sale proceeds of**							
	(i) Land & Building	0	0	0	0	0	0	0
	(ii) Machine Tools & Plants Equipments/Vehicle etc.	0	0	0	129000	0	0	0
	(iii) Sale proceeds of Livestock	3919491	6747800	5349700	9109238	5959026	8412500	8947000
3	**Rents (Licence Fee)**	357149	336715	353023	398091	467965	470209	593184
4	**Application fees from Candidates Tuition Fees, diploma charges etc.**	0	0	0	0	0	0	0
5	**Application fees from Candidates in connection with recruitment**	7500	97500	53250	25500	750	0	0
6	**Receipts from Scheme**	0	0	0	0	0	0	0
7	**Receipts from Service rendered by Instt./receipt from students**	264800	370900	360400	371520	343700	296900	0
8	**Misc Receipt**							
	(i) Sale of Tender form	197000	292000	337100	291500	169000	79000	73000
	(ii) Guest house charges	205995	234510	261700	210024	262467	377280	127605
Grand Total		**32621651**	**39911174**	**35541631**	**44256917**	**43703931**	**47216367**	**52050382**

Financial Outlay (Rs. in Lakhs)

Name of the Institute/Project	Sanctioned Budget 2020-21	Expenditure 2020-21
CIRB Main	3113.62	3113.62
CIRB TSP	1.60	1.60
CIRB NEH	20.00	20.00
CIRB SCSP	42.00	42.00
Total	**3177.22**	**3177.22**
Plan Schemes		
Network Project on Buffalo Improvement	502.95	502.86
Network Project on Buffalo Improvement, SCSP	50.00	49.53
AICRP on Nutritional and Physiological (Dr. R.K. Sharma, PS & PI)	8.53	8.43
AICRP on Nutritional and Physiological (Dr. R.K. Sharma, PS & PI) SCSP	1.02	10.01
NAIF Project (Dr. Sandeep Khurana, PS & PI)	7.45	6.83
NASF Project (Dr. P.S. Yadav, PS & PI)	81.22	74.70
NASF Project (Dr. Dharmendra, Sci & PI)	7.61	5.88
CABin Project (Dr. VarijNayan, Sci. & PI)	18.98	18.95
FFP Project (Dr. Sarita Yadav, Sci. & PI)	18.47	12.28
Total	**696.23**	**680.47**

Staff Position

Category	Sanctioned Strength	Filled	Vacant
Scientific	44+1	32+1	12
Technical	42	28	14
Administrative	19	17	02
Skilled Supporting	65	65	00

कार्यकारी सारांश

आईसीएआर- केंद्रीय भैंस अनुसंधान संस्थान देश में भैंस प्रबंधन और स्वास्थ्य के लिए भैंस उत्पादकता और मानव संसाधन विकास (एचआरडी) समर्थन की अनुसंधान और विकास संबंधी जरूरतों को पूरा करने के लिए समर्पित देश का एक प्रमुख अनुसंधान संगठन है। संस्थान की स्थापना 1 फरवरी 1985 को हिसार में हरियाणा सरकार से प्रोजेनी टेस्टिंग बुल फार्म प्राप्त करके की गई थी। संस्थान ने अपनी अनविार्य भूमिका को पूरा करने की दिशा में एक लंबा सफर तय किया है। पंजाब राज्य सरकार से नीली-रवि भैंस फार्म के हस्तांतरण के साथ संस्थान का एक उप-परिसर दिसंबर 1987 में बीर दोसांझ, नाभा, जिला पटियाला (पंजाब) में स्थापित किया गया था। अपनी स्थापना के तुरंत बाद, संस्थान दूसरी विश्व भैंस कांग्रेस (1988), चौथी और 9वीं एशियाई भैंस कांग्रेस (क्रमशः 2003 ओर 2018) की सफलतापूर्वक मेजबानी करके 'भैंस की दुनिया' में सुर्खियों में आया।

संगठनात्मक संरचना

यह संस्थान सीआईएआर के देशभर में फैले 111 संस्थानों में से 19 पशु विज्ञान संस्थानों में से एक है। संस्थान का नेतृत्व निदेशक द्वारा किया जाता है, जो प्रशासनिक प्रमुख होता है और अनुसंधान और विस्तार कार्यों का प्रबंधन करता है। उन्हें एक शोध सलाहकार समिति (RAC) द्वारा सलाह दी जाती है जिसमें संस्थान के जनादेश, उद्देश्यों और परिप्रेक्ष्य योजना के आधार पर अनुसंधान दिशा-निर्देश तय करने के लिए प्रख्यात वैज्ञानिक शामिल हैं। निदेशक की अध्यक्षता में संस्थान प्रबंधन समिति (IMC), 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), की अध्यक्षता में निदेशक, वैज्ञानिकों द्वारा कार्यान्वित की जा रही विभिन्न अनुसंधान परियोजनाओं की प्रगति की समीक्षा करता है, इसके अलावा पूर्ण परियोजनाओं का आंकलन करता है और वैज्ञानिकों और विशेषज्ञों के बीच आपसी चर्चा के आधार पर नए शोध प्रस्तावों को मंजूरी देता है। RAC, IMC और IRC नियमित रूप से मिलते हैं और अनुसंधान और विकास गतिविधियों को और मजबूत करने के लिए मार्गदर्शन प्रदान करते हैं। हर पांच साल में, पंचवर्षीय समीक्षा टीम (QRT), परिषद् और आईसीएआर शासी निकाय को महत्वपूर्ण मूल्यांकन प्रदान करने के लिए, उपलब्ध धन, जनशक्ति और सुविधाओं के संसाधनों के साथ-साथ संस्थान के आउटपुट और परिणाम का मूल्यांकन करती है। संस्थान की अनुसंधान गतिविधियों को तीन विषय प्रभागों को सौंपा गया है: पशु पोषण और फ़ीड प्रौद्योगिकी (एएनएफटी), पशु आनुवंशिकी और प्रजनन (एजीबी) और पशु शरीर क्रिया विज्ञान और प्रजनन (एपीआर)। इसके अलावा, प्रौद्योगिकी हस्तांतरण (टीओटी) के लिए एक इकाई संस्थान की विस्तार गतिविधियों का ध्यान रखती है। विभिन्न खंड अर्थात्। कृषि फार्म, पशु फार्म, वर्कशॉप, एस्टेट, इलेक्ट्रिकल, पीएमई सेल, एकेएमयू, लाइब्रेरी, फीड यूनिट, लैंडस्केप, गेस्ट हाउस, आईटीएमयू का प्रबंधन संस्थान के निदेर्शक की सलाह के तहत संबंधित प्रभारी द्वारा किया जाता है। प्रशासनिक कार्य जैसे। खरीद, सुरक्षा, नकद और बिल, स्थापना और केंद्रीय स्टोर का प्रबंधन प्रशासनिक अधिकारी (AO) द्वारा किया जाता है, जबकि वित्त और लेखा अधिकारी (FAO) लेखा परीक्षा और लेखा अनुभाग को पूरा करता है। संस्थान में वर्तमान में 33 वैज्ञानिक, 28 तकनीशियन, 17 प्रशासनिक कर्मचारी और 65 कुशल सहायक कर्मचारी हैं।

बजट परिव्यय

वर्ष 2020-21 के दौरान स्वीकृत बजट और वास्तविक व्यय के संदर्भ में संस्थान का वित्तीय परिव्यय समान था और TSP, NEH और SCSP फण्ड सहित 3177.22 लाख रहा। सीआईएआरबी को भी रू. 696.23 और 99.22 लाख बाह्य वित्त पोषित योजनाओं से मिले हैं, जिनमें से रू. 680.43 और 48.37 लाख खर्च किए गए। 2020 के दौरान संस्थान की राजस्व प्राप्तियां रू. 520.50 लाख रही हैं।

प्रमुख उपलब्धियां

- आईसीएआर–सीआईआरबी ने भैंस के जर्मप्लाज्म उत्पादन में सुधार के लिए ISO 9001:2015 प्रमाणित संस्थान का दर्जा बरकरार रखा है।
- मुर्राह और नीली–रवि के लिये क्रमश: 9.79 (n=131) और 8.94 (n=102) का अब तक का सबसे अधिक वैट औसत (Kg/d) प्राप्त किया और साथ ही साथ 7.02 (n=182) और 6.17 (n=148) के हर्ड औसत (Kg/d) को प्राप्त किया।
- मुर्राह और नीली–रवि के लिए अब तक का सबसे कम AFC (42.74 महीने, n=64 और 44.72 महीने, n=44) और ब्याने का अंतराल (432.38 दिन, n=104 और 446.00 दिन, n=146) हासिल किया।
- सीआईआरबी के इतिहास में पहली बार, 10 मुर्राह भैंसों ने एक ही स्तनपान में 4000 कि.ग्रा. को पार किया। भैंस संख्या 4316 को 5वें स्तपनान के 305 दिनों में 4810 कि.ग्रा. दर्ज किया गया।
- अब तक की सबसे अधिक एक दिन की दूध उपज दर्ज की गई (>20 कि.ग्रा.) 6 मुर्राह भैंसों के लिए कुल मुर्राह झुंड की औसत 305 दिनों की दुग्ध उपज, 2704 कि.ग्रा. के साथ।
- आठ क्लोन भैंसों के टेलोमेयर की लंबाई और रक्त जैव रासायकिन मापदंडों (AST, ALT, क्षारीय फॉस्फेट, सीरम क्रिएटिनिन और क्रिएटिन काइनेज, क्रिएटिन फॉस्फोकाइनेज, TLC, DLC) का मूल्यांकन किया गया और उन्हें आयु मिलान नियंत्रण के समान पाया गया।
- असमी क्लोन 'सच–गौरव' के वीर्य के मापदंडों का मूल्यांकन स्खलन मात्रा, शुक्राणु एकाग्रता और बड़े पैमाने पर शुक्राणु गतिशीलता और अन्य इन विट्रो परीक्षणों के लिए किया गया जो गैर–क्लोन वाले बैल के समान पाए गए।
- हिसार–गौरव के ताजा वीर्य का उपयोग संस्थान के प्रायोगिक झुंड में 15 एस्ट्रस सिंक्रनाइज़ मादा भैंसों में कृत्रिम गर्भाधान के लिए किया गया था और इसमें से 13 गर्भवती पाई गई और 11 ने सामान्य बछड़ों को जन्म दिया।
- एक नवीन मूत्र आधारित गर्भावस्था निदान पद्धति विकसित और मान्य की गई। इस विधि में एक थर्मोफिलिक प्रतिक्रिया शामिल है जिसमें भ्रूण का विकास शामिल है जो मूत्र में उत्सर्जित चयापचयों को दर्शाता है।
- भैंस पालन प्रणाली के लिए जलवायु संवेदनशीलता मॉडलिंग का विकास और परीक्षण छह राज्यों के प्रतिनिधि डेटा में किया गया था।
- शीतकालीन ब्यांत भैंस (60 प्रतिशत) अपने डिम्बग्रंथि चक्रीयता को जल्दी फिर से शुरू कर देती हैं। गर्मियों में ब्यांत भैंसों (30 प्रतिशत) की तुलना में जबकि गर्मियों में ब्यांत भैंसों में प्रसवोत्तर 28 दिन होते हैं। इसके अलावा, 40 प्रतिशत भैंस गर्मी के मौसम के दौरान 90 दिनों के बाद तक ओव्यूलेशन रहित रहती है, जबकि सर्दियों के मौसम में यह केवल 10 प्रतिशत होती है।
- भैंसों में गर्भाधान के समय प्रोजेस्टेरोन का इंजेक्शन प्रजनन क्षमता में सुधार करने वाली दवा के रूप में नहीं देना चाहिए क्योंकि ओव्यूलेशन के समय में देरी करती है, फोलीकुलर सिस्ट के गठन की सुविधा प्रदान करती है और गर्भाधान की दर को कम करती है।
- ऑक्सीरेज़ द्वारा भैंस के वीर्य के डीऑक्सीजनेशन में क्रायोप्रिजर्वेशन प्रक्रिया के दौरान क्रायोकैपेसिटेशन और ऑक्सीडेटिव क्षति की समस्या पर काबू पाने के द्वारा पोस्ट–थॉ शुक्राणु की गुणवत्ता में सुधार करने की क्षमता है।
- तीन शुक्राणु खुराक अर्थात् 20, 16 और 12 मिलियन/ स्ट्रॉ ने शुक्राणु गतिकी, झिल्ली अखंडता, माइटोकॉन्ड्रियल झिल्ली क्षमता, सुपरऑक्साइड स्थिति के साथ–साथ भैंसों में क्षेत्र गर्भाधान दर में कोई महत्वपूर्ण अंतर नहीं दिखाया।
- ITK आधारित जड़ी बूटियों (मेथी के बीज, जीरा, जिवंती की जड़ें, शतावरी की जड़ें, सौंफ के बीज और काला जीरा) के विभिन्न संयोजनों में दूध उत्पादन बढ़ाने के लिए जांच की गई और पूरक पशुओं को कोई अतिरिक्त लाभ नहीं मिला।

- गर्भाधान के समय प्रोजेस्टेरोन पूरकता से बचना चाहिए क्योंकि यह ओव्यूलेशन के समय में देरी करता है, फोलीकुलर सिस्ट के गठन की सुविधा प्रदान करती है और भैंसों में गर्भाधान दर को कम करता है।
- जन्म के 21वें दिन GnRH (Busrelin acetate 10 mg : 2.5 ml I/V) के क्रियान्वन से चक्रियता की शीघ्र बहाली में सर्दियों के ब्यांत (83.3 प्रतिशत) और गर्मियों में ब्यांत भैंसों (80 प्रतिशत) के दौरान सुधार करने के लिए पाया गया।
- भैंस के लिए नीलगिरी के तुल-मुलेथी रूप मिश्रण (10.5 एमएल नीलगिरी का तेल और 7.35 ग्राम मुलेठी रूप पाउडर/एच/डी) का पूरक लाभकारी जीवों को प्रभावित किए बिना हाइपर अमोनिया उत्पादक रोगाणुओं को रोक कर (50 प्रतिशत) रूमाल अमोनिया उत्पादन को कम करने के लिए प्रदर्शित किया गया था, जिसके परिणामस्वरूप 14 प्रतिशत एडीजी में वृद्धि हुई और प्रोटीन उपयोग दक्षता में 21.4 प्रतिशत सुधार हुआ।
- ब्राउन मिडरिब (BMR) सोरघम (एसपीवी-2018), सामान्य सोरघम (सीएसबी-27) और स्वीट सोरघम (सीएसएच 22 एसएस) के तुलनात्मक मूल्यांकन से BMR सोरघम में उच्चतम हेमिसेलुलोज (37.72 प्रतिशत) सामग्री के साथ सबसे कम एडीएल (1.27 प्रतिशत) का पता चला, जिसके परिणामस्वरूप उच्च किण्वन, फ़ीड पाचनशक्ति, रोमिनल एंजाइम उत्पादन और कुल रूमिनल जीवाणु आबादी की प्रचुरता उच्च खिला मूल्य का संकेत है।
- डिज़ाइनर एजोला को भैंसों में ट्रेस तत्वों Zn और Cu की आवश्यकता का ध्यान रखने के लिए तैयार किया गया खनिज मिश्रण के माध्यम से उन तत्वों को जोड़े बिना।
- संस्थान ने जनवरी-दिसंबर, 2020 के दौरान प्रौद्योगिकी इकाई के हस्तांतरण द्वारा वैज्ञानिक भैंस पालन प्रथाओं पर 447 डेयरी किसानों को प्रशिक्षित किया। इनमें से 124 डेयरी किसानों को एससीएसपी कार्यक्रम के तहत प्रशिक्षित किया गया था।
- दैहिक कोशिकाओं की संख्या को कम करके भैंस के थन के स्वास्थ्य में सुधार के लिए अभिसरण मॉडल को विकसित और उसका परीक्षण किया गया।
- भैंस सुधार पर नेटवर्क परियोजना (एनपीबीआई) के तहत सांडों की प्रोजेनी परीक्षण के लिए तीन फील्ड इकाइयों के अलावा छह अलग-अलग केंद्रों पर 1000 से अधिक कुलीन नस्ल के मुर्राह भैंसों का रख-रखाव किया जाता है। वर्ष के दौरान, परीक्षण संभोग के लिए सांडों के 19वें सेट (15) का उपयोग शुरू किया गया था। और 439 बेटियों के पहले स्तनपान रिकॉर्ड के आधार पर परीक्षण बैल (12) के 14वें सेट का मूल्यांकन किया गया था।
- वर्ष 1991 में संतति परीक्षण कार्यक्रम की शुरूआत के बाद से, इस्तेमाल किए गए और मूल्यांकन किए गए 188 परीक्षण सांडों में से 36 संतति परीक्षण मुर्राह सांडों का उत्पादन किया गया था।
- वर्ष के दौरान एनपीबीआई के तहत मुर्राह और अन्य नस्लों (नीली-रवी, जाफराबादी, सुरती और भदावरी) के लिए वीर्य की खुराक का प्रसार क्रमशः 2020-21, 177918 और 35447 किया गया।
- संबंधित केंद्रों पर नील-रवि, जाफराबादी और सुरती नस्ल की भैंसें भी बैल उत्पादन के लिए कुलीन झुंड बनाए रखने के साथ-साथ प्रोजेनी टेस्टिंग पर भी ध्यान केंद्रित कर रही है।
- एनपीबीआई के आईजीएफआरआई, झांसी केंद्र में भदावरी नस्ल संरक्षण और सुधार इकाई के रूप में कार्यरत है।

राजस्व प्राप्ति (भारतीय रुपये में सभी आंकड़े)

प्रमुख/लघु/खातों का विस्तृत विवरण	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
फार्म उत्पादों की बिक्री							
(i) दूध की बिक्री	19837011	24844089	21730861	26162117	27721410	33620226	37031295
(ii) गेहूं भूसा/सरसों भूसा/ हरा चारा की बिक्री	1470988 2479538	189775 4181305	12000 3377626	1781231 2561279	126430 5500382	505225 483343	1022157 792076
(iii) अनाज/गेहूं/धान की बिक्री							
(iv) वीर्य की बिक्री	1772124	1218013	1956478	2130286	2846201	2753609	2382868
(v) खनिज मिश्रण की बिक्री	45198	187642	560290	486825	125800	76800	44500
(vi) सूखे पेड़ों की बिक्री प्रक्रिया	2050000	1180000	960000	600306	175000	0	1015000
(vii) पुस्तकों की बिक्री	14857	5925	29203	0	5800	65550	2600
(viii) प्रौद्योगिकी/रॉयल्टी की बिक्री	0	25000	200000	0	0	75725	19097
बिक्री आय							
(i) भूमि और भवन	0	0	0	0	0	0	0
(ii) मशीन टूल्स और प्लांट उपकरण/वाहन आदि	0	0	0	129000	0	0	0
(iii) पशुधन की बिक्री आय	3919491	6747800	5349700	9109238	5959026	8412500	8947000
किराए (लाइसेंस शुल्क)	357149	336715	353023	398091	467965	470209	593184
अभ्यर्थी टयूशन फीस, डिप्लोमा शुल्क आदि से आवेदन शुल्क	0	0	0	0	0	0	0
भर्ती के संबंध में उम्मीदवारों से आवेदन शुल्क	7500	97500	53250	25500	750	0	0
योजना से प्राप्तियां	0	0	0	0	0	0	0
संस्थान द्वारा प्रदान की गई सेवा से प्राप्त रसीदें/छात्रों से रसीद	264800	370900	360400	371520	343700	296900	0
विविध प्राप्ति							
(i) निविदा प्रपत्र की बिक्री	197000	292000	337100	291500	169000	79000	73000
(ii) अतिथि गृह शुल्क	205995	234510	261700	210024.53	262467.8	377280	127605
कुल योग	32621651	39911174	35541631	44256917	43703931	47216367	52050382

वित्तीय परिव्यय (लाख रूपये में)

संस्थान का नाम	स्वीकृत बजट 2020-21	व्यय 2020-21
सीआईआरबी मुख्य	3113.62	3113.62
सीआईआरबी टी एस पी	1.60	1.60
सीआईआरबी एन ई एच	20.00	20.00
सीआईआरबी एस सी एस पी	42.00	42.00
कुल	**3177.22**	**3177.22**
योजनाएं		
भैंस सुधार पर नेटवर्क परियोजना	502.95	502.86
भैंस सुधार पर नेटवर्क परियोजना, एस सी एस पी	50.00	49.53
पोषण और शरीर विज्ञान पर ए आई सी आर पी (डॉ. आर.के. शर्मा, पीएस और पी आई)	8.53	8.43
पोषण और शरीर विज्ञान पर ए आई सी आर पी (डॉ. आर.के. शर्मा, पी एस और पी आई) एस सी एस पी	1.02	10.01
एन ए आई एफ परियोजना (डॉ. संदीप खुराना, पी एस और पी आई)	7.45	6.83
एन ए एस एफ परियोजना (डॉ. पी.एस. यादव, पी एस और पी आई)	81.22	74.70
एन ए एस एफ परियोजना (डॉ. धर्मेन्द्र, वैज्ञ और पी आई)	7.61	5.88
केबिन परियोजना (डॉ. वारिजनयन, वैज्ञ. और पी आई)	18.98	18.95
एफ एफ पी परियोजना (डॉ. सरिता यादव, वैज्ञ. और पी आई)	18.47	12.28
कुल	**696.23**	**680.47**

कर्मचारियों की स्थिति

श्रेणी	स्वीकृत संख्या	भरा गया	रिक्त
वैज्ञानिक	44+1	32+1	12
तकनीकी	42	28	14
प्रशासनिक	19	17	02
कुशल सहायक	65	65	00

INTRODUCTION

The 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.

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 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.

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.

Mandate

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

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. 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 phenomic and genomic data collection has generated an authentic data resource, to understand the genetics of relevant but complex traits such as milk yield and reproductive traits.

II. Division of Animal Nutrition and Feed Technology

The nutrition laboratories have the most modern equipment and facilities to undertake research on various aspects related to buffalo nutrition, aimed at developing economic growth and production rations by incorporating agro-industrial by-products. Feed and forage quality control and processing, rumen microbiome, protein nutrition, toxicology and mineral nutrition laboratories are well-equipped with modern research facilities. Major studies include working out nutrient requirements of different categories of buffaloes for milk, meat and growth, evaluation of different feeds and fodders for reducing enteric methane production

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. In recent years production of multiple clones of elite bulls have brought this division and institute in limelight at national and international level. Facilities includes electrofusion machine, Real time PCR, Micromanipulator, blood biochemistry analyser and automatic haematology analyser.

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, DIC, Phase contrast microscopes and 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 production has significantly improved during recent years.

Animal Farms

Highly pedigreed herds of over 500 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. 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 9.79 kg/day and 2704 kg in 2020. The reproductive performance of the herd also improved as reflected by decline in calving interval (from 456 to 432 days) and age at first calving (44 to 42.7 months).

Similarly, the production performance of Nili-Ravi herd at Sub-Campus, Nabha has improved significantly - wet average

(5.86 kg/day in 1992-93 to 9.40 kg/day in year 2020) and 305 days or less milk yield (1921 kg during 1992-93 to 2576 kg in 2020). During the same period, age at first calving declined from 47.3 months during 1992-93 to 44.72 monthsin 2020.

Elite Buffalos at ICAR-CIRB 2020

Buffalo No.	D.O.B.	Highest 305d or less MY (kg) /lactation no.	Highest Peak Yield (kg)	Sire No.	Set No.
4316	31/03/2011	4810/5	23.9	R-11(Field)	12
4817	12/10/2014	4250/2	22.0	4100 (CIRB)	14
4978	25/10/2015	4366/2	18.9	1693 PT (LUVAS)	10
4767	12/08/2014	4268/3	18.3	2369 (GADVASU)	14
4605	08/03/2013	4168/2	20.0	2269 PT (GADVASU)	13
4251	29/10/2010	4138/3	22.0	2133 PT (GADVASU)	11
4545	30/01/2013	4069/3	21.0	4813 PT (NDRI)	8
4462	03/06/2012	4045/2	23.4	R-10 (Field)	12
4613	18/08/2013	4043/3	18.0	5943 (NDRI)	13
4458	16/05/2012	4028/4	17.0	1796 PT (GADVASU)	7

ICAR-CIRB Buffalo Herd status 2020

S. No.	Category	Addition						Disposal							
		M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR
		OB	OB	B	B	T	T	D	D	T	T	S	S	CB	CB
Female															
1	Calves below 3 months	21	16	77	86	-	-	03	09	69	70	01	02	25	21
2	Calves 3-12 months	59	57			69	129	01	08	75	128	01	-	51	50
3	Heifers a) 1-2 years b) Above 2.0 years	 40 107	 64 85	 - -	 - -	 75 34	 69 175	 - -	 02 -	 34 52	 64 156	 - 13	 02 06	 81 76	 65 98
4	Buffaloes in Milk	146	123	-	-	73	154	05	03	40	135	42	15	132	124
5	Buffaloes Dry	42	31	-	-	40	135	02	01	21	109	39	21	35	35
	Sub Total	**415**	**376**	**77**	**86**	**291**	**662**	**11**	**23**	**291**	**662**	**96**	**46**	**400**	**393**
Male															
1	Calves below 3 months	18	23	74	66	-	-	01	03	60	71	-	-	31	15
2	Calves 3-12 months	54	42	-	-	60	136	-	01	61	122	10	09	43	46
3	a) 1-2 years b) > years	26 07	40 21	- -	- -	61 10	57 64	- -	01 -	10 -	33 31	41 14	30 19	36 05	33 35
4	Breeding bulls	08	08	-	-	-	-	-	-	-	-	02	02	12	06
5	Bullocks	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	Teaser	-	01	-	-	-	-	-	-	-	-	-	-	-	01
	Sub Total	**113**	**135**	**74**	**66**	**131**	**257**	**01**	**05**	**131**	**257**	**67**	**60**	**127**	**136**
	Grand Total	**528**	**511**	**151**	**152**	**422**	**919**	**12**	**28**	**422**	**919**	**163**	**106**	**527**	**529**

M = Murrah (at Main Campus, Hisar)
NR = Nili Ravi (at Sub Campus, Nabha)
OB = Opening Balance
D = Death
S = Sale
B = Birth
T = Transfer
CB = Closing Balance

ICAR-CIRB Calving statistics (Jan -Dec 2020)

Month	Male (Number)		Female (Number)		Abortions & Still Birth (Number)		Total Calving (Number)	
	M	NR	M	NR	M	NR	M	NR
January	07	03	05	06	-	01	12	09
February	05	06	04	07	01	-	09	13
March	04	05	05	01	-	01	09	06
April	06	02	08	02	02	01	14	04
May	05	-	02	02	01	-	07	02
June	01	02	04	-	01	-	05	02
July	08	09	08	06	01	02	16	15
August	08	11	11	16	04	-	19	27
September	06	12	07	21	01	-	13	33
October	14	07	12	10	01	-	26	17
November	08	05	10	06	-	-	18	11
December	08	04	05	09	01	-	13	13
Total	**80**	**66**	**81**	**86**	**13**	**5**	**161**	**152**

M = Murrah (at Main Campus, Hisar) **NR**= Nili Ravi (at Sub Campus, Nabha)
Sex ratio Murrah (Male: Female) = 50:50 (approx.) **Sex ratio Nili Ravi** (Male: Female) = 43:57

ICAR-CIRB Disposal of animals 2020

Month	Surplus sold		Udder Health		Repd. Problem		Weak & old		Death		Expt. purpose		Total	
	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR
Female														
< 6 months	1	-	-	-	-	-	-	-	3	-	3	-	7	-
6-12 months	1	-	-	-	-	-	-	-	1	-	-	-	2	-
Heifers														
1-2.5 yrs	-	2	-	-	-	-	-	-	-	2	-	-	-	4
> 2.5 yrs	-	-	-	-	10	-	3	-	-	-	13	-	26	-
Buffaloes														
Dry	18	-	12	-	6	-	6	-	5	-	3	-	50	-
Milch	11	-	7	-	14	-	7	-	2	-	10	-	51	-
Sub Total	31	2	19	-	30	-	16	-	11	2	29	-	136	-
Male														
< 6 months	-	2	-	-	6	-	-	-	-	2	-	-	6	4
6-12 months	-	6	-	-	-	-	-	-	1	-	1	-	2	6
>1 yr	54	-	-	-	2	-	3	-	-	6	-	-	59	6
Breeding bulls	-	-	-	-	2	-	-	-	-	-	-	-	2	-
Bullock +Teaser	-	36	-	-	-	-	-	-	-	36	-	-	-	36
Sub total	54	44	-	-	10	-	3	-	1	46	1	-	69	46
G. Total	**85**	**46**	**19**	-	**40**	-	**19**	-	**12**	**48**	**30**	-	**205**	**50**

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

ICAR-CIRB month wise (Jan - Dec 2020) mortality register

Month	Deatails	0-3 (female)		3-6		6-12		>1yr		>2yrs		All		0-3 (male)		3-6		6-12		>1yr		>2yrs		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	M	NR
Jan.	NA	21	15	39	25	20	32	48	63	287	246	415	381	18	19	28	29	26	16	25	40	16	34	113	138	528	519
	ND	-	-	-	-	-	-	-	-	-	01	-	01	-	-	-	-	-	-	-	-	-	-	-	-	-	01
	Mort. (%)	-	-	-	-	-	-	-	-	-	0.41	-	0.26	-	-	-	-	-	-	-	-	-	-	-	-	-	0.19
Feb.	NA	18	17	37	22	25	39	47	60	292	250	419	388	16	17	33	20	26	31	25	40	16	35	116	143	535	531
	ND	-	-	-	-	-	-	-	-	-	-	-	-	-	01	-	-	-	-	-	-	-	-	-	01	-	01
	Mort. (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	5.88	-	-	-	-	-	-	-	-	-	0.70	-	0.19
Mar.	NA	11	14	34	16	39	43	47	58	294	257	424	388	12	13	34	23	34	34	24	38	16	40	119	148	543	536
	ND	-	-	-	-	-	-	-	-	-	01	-	01	-	-	-	-	-	-	-	-	-	-	-	-	-	01
	Mort. (%)	-	-	-	-	-	-	-	-	-	-	-	0.26	-	-	-	-	-	-	-	-	-	-	-	-	-	0.19
Apr.	NA	13	10	21	15	43	39	62	62	270	264	399	390	16	12	18	19	36	37	36	35	17	45	123	148	522	538
	ND	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
	Mort. (%)	-	-	-	-	-	-	-	-	0.37	-	0.25	-	-	-	-	-	-	-	-	-	-	-	-	-	0.19	-
May	NA	17	05	18	17	48	40	52	61	271	268	406	391	15	07	16	17	42	41	38	37	18	46	129	148	535	539
	ND	-	-	-	-	-	01	-	-	-	-	-	01	-	-	-	-	-	-	-	-	-	-	-	-	-	01
	Mort. (%)	-	-	-	-	-	3.85	-	-	-	-	-	0.26	-	-	-	-	-	-	-	-	-	-	-	-	-	0.19
Jun.	NA	15	04	11	14	58	40	50	64	275	269	409	391	18	04	19	13	41	48	35	35	19	50	132	150	541	541
	ND	1	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mort. (%)	6.66	-	-	-	-	-	-	-	0.36	-	0.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Jul.	NA	13	08	14	10	61	36	57	67	285	271	425	392	16	11	18	12	43	45	38	37	19	53	134	158	559	550
	ND	-	-	-	-	-	04	-	-	-	01	-	05	-	-	-	-	-	01	-	-	-	-	-	01	-	06
	Mort. (%)	-	-	-	-	-	11.11	-	-	-	0.37	-	1.28	-	-	-	-	-	2.22	-	-	-	-	-	0.63	-	1.09
Aug.	NA	13	20	17	05	63	35	57	70	283	274	433	404	18	22	25	07	36	35	40	48	23	54	142	166	575	570
	ND	-	02	-	-	1	-	-	02	1	-	2	04	-	-	-	-	-	-	-	-	-	-	-	-	2	04
	Mort. (%)	-	10.00	-	-	2.86	-	-	2.85	-	-	0.46	0.99	-	-	-	-	-	-	-	-	-	-	-	-	0.34	0.70
Sep.	NA	21	38	13	04	43	26	56	69	262	241	395	368	18	32	18	04	41	25	36	19	23	41	136	121	521	499
	ND	-	01	-	-	-	-	-	-	2	-	2	01	1	-	-	-	-	-	-	-	-	-	1	-	3	01
	Mort. (%)	-	2.63	-	-	-	-	-	-	0.76	-	0.50	2.26	-	-	-	-	-	-	-	-	-	-	0.73	-	0.57	0.20
Oct.	NA	17	40	12	07	44	21	57	69	282	246	412	384	21	30	23	11	44	23	32	23	16	41	136	128	548	512
	ND	1	03	-	-	-	-	-	-	-	01	1	04	-	-	-	-	-	-	-	-	-	-	-	-	1	04
	Mort. (%)	5.88	7.50	-	-	-	-	-	-	-	0.40	0.24	1.04	-	-	-	-	-	-	-	-	-	-	-	-	0.18	0.78
Nov.	NA	14	33	9	18	33	20	67	69	284	250	407	390	19	23	27	22	44	17	46	29	20	41	156	132	563	522
	ND	-	-	-	-	-	-	1	-	-	-	1	-	-	01	-	-	-	-	-	-	-	-	-	-	-	01
	Mort. (%)	-	-	-	-	-	-	1.49	-	-	-	0.24	-	-	0.81	-	-	-	-	-	-	-	-	-	-	0.12	0.19
Dec.	NA	25	21	12	34	39	16	81	65	243	257	400	393	31	15	12	31	31	13	36	33	17	42	127	134	527	527
	ND	1	03	-	02	-	01	1	-	-	-	2	06	-	01	-	-	-	-	-	01	-	-	-	02	2	08
	Mort. (%)	4.00	14.3	-	5.80	-	6.25	1.25	-	-	-	1.00	1.53	-	6.67	-	-	-	-	-	3.03	-	-	-	1.49	0.38	1.52

M = Murrah (at Main Campus, Hisar) **NR**= Nili Ravi (at Sub Campus, Nabha) **NA** = No. of Animals **ND** = No. of Animals Died

ICAR-CIRB Buffalo conception rate (2020)

No. of AIs	Ist						IInd						IIIrd						IVth & above						Overall					
Particulars	I		C		CR		I		C		CR		I		C		CR		I		C		CR		I		C		CR	
Breed	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR	M	NR
Heifers	87	54	40	27	45.98	50.00	49	30	27	15	55.10	50.10	22	10	10	03	45.45	30.00	19	21	9	04	47.37	19.05	177	115	86	49	48.58	42.61
Adult	161	145	94	67	58.34	46.21	87	74	38	38	43.68	51.35	42	32	17	15	40.48	46.88	53	31	21	10	39.62	32.26	343	282	170	130	49.56	46.09
Overall	248	199	134	94	54.69	47.24	136	104	65	53	48.42	50.96	64	42	27	18	42.32	42.86	72	53	30	14	41.95	26.92	520	39	256	179	49.23	45.09

M = Murrah (at Main Campus, Hisar) **NR**= Nili Ravi (at Sub Campus, Nabha)
I = No. of animals inseminated; **C=** No. of animals conceived; **CR% =** Conception rate (%)

ICAR-CIRB Bull-wise conception rate (2020)

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	7227	543	18th	8th	28	64	17	20	60.71	31.25
2	1150	480	18th	8th	26	28	10	13	38.46	46.43
3	7147	487	18th	8th	14	27	8	14	57.14	51.85
4	1219	511	18th	8th	45	45	22	26	48.89	57.78
5	183	435	12th PT	8th	44	54	23	29	52.27	53.70
6	4905	507	18th	8th	16	25	4	11	25.00	44.00
7	4995	501	18th	8th	25	64	9	27	36.00	42.19
8	2676	516	18th	8th	21	45	9	19	42.86	42.22
9	2677	535	18th	2nd	19	03	11	03	57.89	100.00
10	1209	523	18th	2nd	35	02	15	01	42.86	50.00
11	2645	473	18th	1st	25	02	14	01	56.00	50.00
12	7094	916	18th	4th	11	02	3	-	27.27	-
13	2234	411	13th PT	1st	11	02	6	01	54.55	50.00
14	1208	905	18th	4th	40	04	20	03	50.00	75.00
15	7263	674	18th	9th	18	03	9	-	50.00	-
16	2357	525	14th PT	2nd	7	01	4	-	57.14	-
17	5181	674	19th	3nd	33	11	14	06	42.42	54.54
18	5232	702	19th	3nd	35	13	23	05	65.71	38.46
19	6044	-	14th PT	7th	13	02	6	-	46.15	-
20	4196	-	14th PT	-	23	-	12	-	52.17	-
21	5246	-	19th	-	9	-	4	-	44.44	-
22	2269	-	13th PT	-	24	-	13	-	54.17	-

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

ICAR-CIRB Buffalo herd production status (2020)

Lact. No	Number		Av. 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	68	50	2586	2515	312	318	2465	2402	11.51	12.2
2nd	35	38	3049	2710	313	293	2878	2644	14.09	14.1
3rd	38	15	2882	2607	295	295	2781	2574	14.33	13.8
4th	11	14	3394	2966	315	308	3263	2885	16.75	15.3
5th and above	22	24	2826	2647	283	292	2789	2653	15.00	14.4
Overall	**164**	**141**	**2821**	**2645**	**306**	**303**	**2704**	**2576**	**13.36**	**13.6**

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

ICAR-CIRB Buffaloes reproduction performance (2020)

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 Calving (Months)	N X SE	64 42.74 ± 0.79	44 44.72 ±0.53										
Av. Service Period (Days)	N X SE			45 112.87	37 192± 12.65	26 137.54	28 92± 6.39	10 155.30	11 118± 21.00	23 114.26	30 122± 12.50	104 123.42 ±6.76	106 138± 7.38
Av. Dry Period (Days)	N X SE			45 119.67	37 176± 11.00	26 126.58	28 118± 8.35	10 145.10	11 138± 19.42	23 122.91	30 140± 11.16	71 124.56	106 147± 6.15
Av. Calving Interval (Days)	N X SE			45 422.42	37 500± 12.75	26 446.15	28 398± 6.42	10 461.40	11 427± 21.15	23 423.65	30 431± 12.88	104 432.38 ±6.92	106 446± 7.49

M = Murrah (at Main Campus, Hisar) **NR**= Nili Ravi (at Sub Campus, Nabha) 1,2,3,4,5 and above indicates lactation order

ICAR-CIRB Month wise milk production 2020

Month	Total Milk Produced (kg)	
	M	NR
Jan, 20	38783.00	35613.7
Feb, 20	35966.50	33659.9
Mar, 20	35204.00	33586.7
Apr, 20	31716.50	27505.3
May, 20	33531.50	24365.6
Jun, 20	30534.50	19904.3
Jul, 20	28855.00	16083.9
Aug, 20	30097.50	19195.0
Sep, 20	27867.50	26390.20
Oct, 20	31383.50	31794.1
Nov, 20	34015.00	32701.4
Dec , 20	35260.00	36685.4

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

ICAR-CIRB Buffaloes herd production performance 2020

Traits	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	144	122	46	31	190	153	76	80	10.29	9.40	7.82	7.53
Feb	148	122	46	32	194	154	76	79	9.89	9.53	7.53	7.55
Mar	133	117	43	34	176	151	76	77	9.77	9.21	7.44	7.13
Apr	132	106	45	35	177	141	75	75	9.18	8.54	6.87	6.41
May	138	101	44	42	182	143	76	71	9.10	7.56	6.91	5.40
Jun	132	84	53	59	185	143	71	59	9.07	7.82	6.54	4.59
July	124	74	62	71	186	145	67	51	8.88	6.91	5.98	3.55
Aug	124	75	68	75	192	150	65	50	9.45	8.26	6.12	4.16
Sept	112	88	64	60	176	148	64	60	9.98	9.80	6.33	5.90
Oct	116	103	59	42	175	145	66	71	10.38	9.83	6.83	7.02
Nov	133	113	51	36	184	149	72	76	10.67	9.60	7.69	7.29
Dec	132	115	41	38	173	153	76	75	10.71	9.73	8.14	7.26
Overall	**131**	**102**	**51**	**46**	**182**	**148**	**72**	**69**	**9.97**	**8.94**	**7.02**	**6.17**

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

ICAR-CIRB Buffalo herd production performance 1992-2020

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

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

Traits	Av. Lact. Yield (kg)		Av. Lact. Length (days)		Milk yield 305 days or less	
Breed	M	NR	M	NR	M	NR
1992-93	1804 (137)	1974 (105)	395 (137)	309 (105)	1508 (137)	1921 (105)
1993-94	1980 (148)	1776 (70)	419 (148)	328 (70)	1686 (148)	1744 (70)
1994-95	1930 (206)	2043 (77)	334 (206)	350 (77)	1787 (206)	1944 (77)
1995-96	1936 (147)	2049 (70)	313 (147)	354 (70)	1855 (147)	1894 (70)
1996-97	1879 (173)	2092 (81)	313 (173)	392 (81)	1775 (173)	1807 (81)
1997-98	1784 (123)	2126 (67)	304 (123)	354 (67)	1688 (123)	2056 (67)
1998-99	1762 (153)	2153 (97)	284 (153)	341 (97)	1702 (153)	2056 (97)
1999-00	2138 (141)	1968 (99)	313 (141)	337 (99)	2042 (141)	1874 (99)
2000-01	1997 (173)	1890 (89)	306 (173)	305 (89)	1914 (173)	1812 (89)
2001-02	1954 (152)	1926 (86)	290 (152)	296 (86)	1898 (152)	1885 (86)
2002-03	1987 (148)	2007 (105)	303 (148)	293 (105)	1902 (148)	1941 (105)
2003-04	1910 (148)	1968 (93)	299 (148)	307 (93)	1837 (148)	1895 (93)
2004-05	2017 (167)	1974 (116)	319 (167)	315 (116)	1886 (167)	1848 (116)
2005-06	2047 (149)	2190 (102)	321 (149)	306 (102)	1921 (149)	2090 (102)
2006-07	1995 (170)	1921 (118)	322 (170)	304 (118)	1882 (170)	1795 (118)
2007-08	1954 (169)	1787 (122)	299 (169)	302 (122)	1891 (169)	1629 (122)
2008-09	2076 (138)	2036 (108)	325 (138)	289 (108)	1926 (138)	1929 (108)
2009-10	2285 (102)	1927 (146)	361 (102)	302 (146)	1995 (102)	1822 (146)
2010-11	2471 (113)	2042 (115)	337 (113)	292 (115)	2247 (113)	1972 (115)
2011-12	2598 (116)	2045 (88)	338 (116)	279 (88)	2374 (116)	1998 (88)
2012-13	2478 (110)	2048 (123)	318 (110)	264 (123)	2335 (110)	2017 (123)
2013-14	2394 (98)	2297(109)	333 (98)	285(109)	2291 (98)	2241(109)
2014-15	2502 (110)	2464(115)	313 (110)	303(115)	2355 (110)	2384(115)
2015-16	2483 (152)	2564(110)	322 (152)	305(110)	2336 (152)	2471(110)
2016-17	2567 (133)	2452(136)	312 (133)	298(136)	2457 (133)	2377(136)
2017-18	2480(140)	2363(110)	295 (140)	282(110)	2424(140)	2321(110)
2018-19	2641 (123)	2797 (111)	305 (123)	311 (111)	2567 (123)	2679 (111)
2019	2673 (88)	2670 (81)	300.06 (88)	301 (81)	2607 (88)	2589 (81)
2020	2821 (164)	2645 (141)	306 (164)	303 (141)	2704 (164)	2576 (141)

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 revenue. At CIRB Hisar, total green and dry fodder production during the year were 37017 and 907 quintals, respectively, while grain production was 1716. At Sub-Campus Nabha, the total green and dry fodder production during the year was 53352.5 and 3294.5 quintals, respectively, while grain production was 3994.52 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 balanced feed for different categories of animals. Feed unit at each campus prepares about 700 tonnes of concentrate feed annually for feeding to farm animals. In addition, approx. 15 tonnes of area specific mineral mixture is being prepared annually for farm animals as well as for sale to the farmers for its popularization. Feed processing unit and attatched grain / cake store cover an area of about 4500 square feet together with an open drying place of about 1500 sq. ft. This unit is equipped with automatic feed grinder cum mixer of capacity (10.0 Qtls/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 mixture 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. A student hostel has been added in the institute campus having eight well furnished rooms for accommodating 16 persons at a time.

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

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

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

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

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

At Sub Campus Nabha, 16 acre land was improved by removing dried and uprooted trees and shrubs, 33 acre dhaincha was sown for green manuring that improved physical property of the land, 40 acre land was improved by spreading farm yard

manure/compost. 1300 feet long chain link fences were created to protect farm from stray animals. No paddy straw burning is practised at CIRB farms since last 4 years. During the year, 72 acre and 3 Marla land was transferred to Animal Husbandry Department, Punjab as per approval of the ICAR.

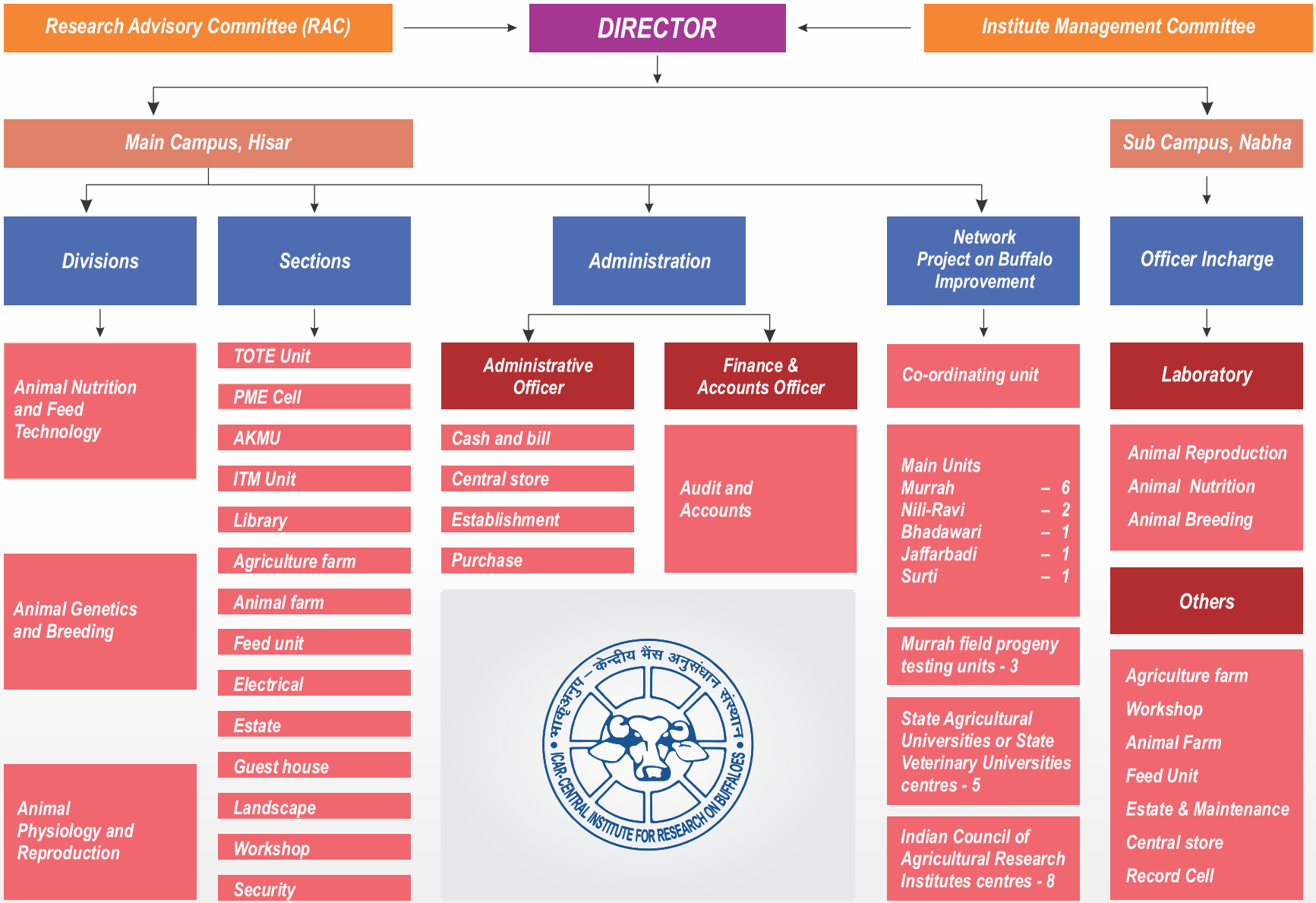
National and International Collaborations

Over the years, the institute has established collaborations with various national and international institutions. Projects were undertaken with Department of Biotechnology on Embryo Transfer Technology; Central Soil Salinity Research Institute, Karnal for reclamation of salinity affected land through subsurface drainage system; CCS Haryana Agricultural University, Hisar for postgraduate research in the field of buffalo husbandry, nutrition, physiology and reproduction, etc. Similar collaboration is continuing with several ICAR institutes, including NDRI, IVRI, IASRI, NBAGR, NIANP, CSWRI, IARI and SAUs like CCS HAU, LUVAS, PAU, GADVASU, BASU and some KVKs. For breed improvement activities, Network Project on Buffalo Improvement is being implemented in collaboration with several ICAR institutes and SAUs located in the home tracts of various buffalo breeds. Institute scientists have completed various externally funded projects at this institute and its sub-campus at Nabha sponsored by DBT, DST, USAID, NAIP, NARP, NASF, Network / All India Coordinated projects and other external agencies. A new collaborative project with ILRI is in operation since 2016 on genomic techniques to profile and improve productivity and resilience in Murrah buffaloes.

Priority setting, monitoring and evaluation (PME) Cell

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

ICAR-Central Institute for Research on Buffaloes



Research Achievements

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

Genetic & Breed Improvement

Continued efforts are required to understand, characterize and take forward positivities for breed improvement programs. The buffaloes are often said to be superior converters of high roughage diets, have excellent adaptability to difficult environmental conditions, produce high quality milk but inefficient breeders. This entails a huge importance to the genetics of various traits in the large and diverse population of buffaloes in the country. The division of Animal Genetics and Breeding (AGB) at the Institute is the coordinating center for the network project on buffalo improvement, addressing five most important milch breeds i.e. Murrah, Nili Ravi, Surti, Bhadawari and Jaffrabadi and operating through centers across India. Keeping pace with International developments made in the subject as well as looking into national priorities, significant contributions have been made through a number of research projects undertaken in different areas of germplasm conservation, quantitative genetics, population genetics and molecular genetics.

Network Project on Buffalo Improvement (NPBI)

The Network Project on Buffalo Improvement was initiated in 1993 with the aim to produce genetically superior bulls for improvement of buffaloes. Thereafter, five other breeds and progeny testing units were added in 2001. Six important breeds are covered under fifteen (ICAR/SAU based) centers. Alongwith improvement, conservation of Bhadawari and Nili Ravi is also taken under this program. Progeny testing was also extended to field in the year 2001, at ICAR-CIRB Hisar, ICAR-NDRI Karnal and GADVASU Ludhiana units for Murrah breed along with Surti, Bhadwari and Jaffarabadi breeds at their respective centres with the aim to produce more number of daughters per bull in order to have more accuracy in bull evaluation.

PARTICIPATING CENTRES UNDER NPBI

Coordinating Unit, CIRB, Hisar

Sr. No.	Name of Centre	Breed	Year of Start
	ICAR INSTITUTE		
I	ICAR-CIRB, Hisar	Murrah	1993
II	ICAR-NDRI, Karnal	Murrah	1993
III	ICAR-IVRI, Izatnagar	Murrah	1993
IV	ICAR Res. Comp. ER Patna	Murrah	2014
V	ICAR-CIRB, Sub- Campus Nabha	Nili-Ravi	2001
VI	ICAR-IGFRI, Jhani	Bhadawari	2001
	Animal Science/ Agricultural University		
I	LUVAS, Hisar	Murrah	1993
II	GADVASU, Ludhiana	Murrah	1993
III	GADVASU, Ludhiana	Nili-Ravi	2018
IV	JAU, Junagarh	Jaffarabadi	2001
V	RAJVASU, LRS Vallabhnagar	Surti	2001
	Field Unit		
I	ICAR-CIRB, Hisar	Murrah	2001
II	ICAR-NDRI, Karnal	Murrah	2001
III	GADVASU, Ludhiana	Murrah	2001

Average Breeding Value: 2419.68 Kg (N=439)

Bull No. 2357 (GADVASU), 6044 (NDRI) and 4196 (CIRB) ranking 1st, 2nd and 3rd, respectively declared as proven bulls for nominated mating during July 2020 to December 2021.

Progeny test evaluation of 14th set bulls (Murrah) used during January 2013 to June 2014

Bull No.	Centre	Date of Birth	Dam No.	Sire No./ Set. No.	Dam's Best 305 DLMY (kg)	Number of Daughters	Daghtr FLMY (kg)	Sire BV	Superiority BV (%) BLUP Model	Rank
4196	**CIRB**	**10-05-10**	**3586**	**1153PT/VI**	**3304**	**21**	**2505**	**2474**	**+2.27**	**III**
4439	CIRB	Purchase	NK	NK	22.0kg PY	39	2353	2363	-2.36	VIII
4093	CIRB	10-09-09	3133	3255/XI	3040	29	2382	2420	-0.50	VII
4100	CIRB	18-09-09	3033	2154/XI	2971	26	2225	2328	-3.80	X
6044	**NDRI**	**15-01-09**	**430**	**4371PT/V**	**3567**	**34**	**2469**	**2479**	**+2.43**	**II**
6066	NDRI	08-04-09	402	4393 PT/V	3505	06	2441	2419	-0.04	VI
6136	NDRI	25-09-09	5517	2148/XI	4341	54	2413	2423	+0.14	V
6014	NDRI	02-10-08	5234	1693PT/X	3072	49	2344	2353	-2.77	IX
2357	**GADVASU**	**24-07-10**	**P2488**	**1933PT/VI**	**3559**	**51**	**2473**	**2487**	**+2.78**	**I**
2369	GADVASU	24-08-10	P2138	5496/XI	3114	130	2458	2464	+1.85	IV

* Calculated by BLUP Model

Genetic Improvement of Murrah Buffalo

Test mating from 18th set initiated with 15 bulls (3 bulls from CIRB Hisar, 4 bulls from GADVASU Ludhiana, 4 bulls from NDRI Karnal and 4 bulls from LUVAS Hisar) completed on 30th June 2020 at associated centres of Murrah main unit and field progeny testing unit for genetic improvement under the Network Project on Buffalo Improvement. Test mating of 19th set is in progress and continue till December 2021.

Annual Review Meet of Network Project on Buffalo Improvement

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

Genetic improvement of Nili-Ravi buffalo

Project "Genetic Improvement of Nili-Ravi buffaloes (Network Project on Buffalo Improvement), the sub-campus has completed test mating of 8th set of bulls, and progeny testing was completed up to the 4th set. The performance recording of progenies of 5th set of bulls is also completed and the evaluation and ranking of bulls is to be done. Nine young future bulls were selected for test mating under 9th set of the progeny testing programme. A total of 152 (86 female and 66 male) calves of high genetic merit were born this year. The test mating (352 inseminations) were carried out during this year resulting in 159 pregnancies. Nominated mating (45 inseminations) using progeny tested bulls of first 4 sets were also carried out

resulting in 20 pregnancies. The Overall mortality of 4.22% and calf mortality of 6.28% were recorded during year 2020. The overall conception rate during this period was 45.09%. During this period, 32 daughters of 06 bulls under progeny testing programme completed 1st lactation. The overall wet average (8.94 kg), herd average (6.17kg), 305-day lactation yield (2576 kg), total lactation yield (2645 kg), average pea a yield (13.50 kg) and lactation length (303 days) were achieved during the year. Improvement in reproductive traits viz., service period (138 days), age a first calving (44.72 months), calving interval (446 days) and dry period (147 days) were achieved during year 2020. The total milk produced during this year was 335485.40 kg, out of which 279224 kg was sold, thereby, generating revenue of Rs. 13949671. During the period of high production and low demand of raw milk, the institute processed the surplus into Khoa and sold the same for Rs. 365316. A total of 18890 semen doses were produced at Sub-campus Nabha, out of which 4450 doses were used for insemination and 3100 doses were sold to field inseminators. The total grain (4011.65 qtl) and green fodder (53050.5) qtl were produced by agriculture farm. The agriculture produce were sold and revenue of Rs.1448955 was generated. The overall revenue generated by the sub-campus during year 2020 was Rs. 19589250/-.

A total of 152 (86 female & 66 male) calves of high genetic merit were born during this period. Test mating (357 inseminations) were carried out during this period resulting in 159 pregnancies. Furthermore, nominated matings (40) with progeny tested bulls of 1st to 4th Sets were carried out resulting in 20 pregnancies. A total of 32 daughters of 06 bulls under progeny testing programme completed 1st lactation. The wet average (8.94 kg, second highest), herd average (6.17 kg), 305 days lactation milk yield (2576 kg), total lactation milk yield (2645 kg), peak yield (13.56 kg, highest ever) and lactation length (303 days) were achieved in Nili-Ravi herd. The reproductive traits viz., service period (138 days), th calving interval (446 days), dry period (147 days) were achieved during the year 2020. Herd Life Production (up to 4 or more Lactation completed) of 40 buffaloes was estimated. The average productive days were 1519 and average milk yield per day of herd life was 4.28 litres. A total of 18890 semen doses were produced at the Sub Campus or procured from semen station Nabha. Out of which, 4450 doses were used at farm for insemination/testing and 3100 doses were sold to field inseminators. Overall motility of 4.22% and calf motility of 6.28% was recorded during this period. The overall conception rate of 45.09% was recorded. Milk production of 335485 kg was recorded during this year, and 279224.0 kg was sold. Total 106 animals were sold through public auction and on book value to farmers, universities and various developmental agencies

Field Progeny Testing of Bulls (FPT) – CIRB Hisar

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 2020 to December 2020, 3592 artificial inseminations were performed using test bulls of 18th and 19th set of test bulls. The use 18th set was completed in July 2020 and 19th set was initiated. The conception rate in the field was worked out to be 53.49%. In this period 1954 pregnancies were confirmed and 1554 calving (males 848, females 706) were recorded. In addition, 154 progenies, 43 of 15th, and 111 of 16th set were also calved and monthly test day milk yield were/ being recorded. The average age at first calving for these 154 daughters was 39.92 months. During the year 284 daughters were recorded, out of which 127 daughters completed the lactation, 28 daughters sold before the lactation was completed and recording of 129 daughters are in progress. The physical identification using ear tagging has been done in all female progenies born in the field. As on 31st December 2020, 1248 female progenies of 15th to 18th set of different age are standing at various field unit centres for future recordings.

Causes of buffalo calf mortality and its management

SK Khurana, S. Yadav, A. Boora, Sanjay Kumar

Calf mortality is very important in deciding economics of buffalo dairy farming. Major conditions which cause mortality in buffalo calves are diarrhea, pneumonia and septicemia caused mainly by several bacterial, viral and parasitic agents. Two survey proforma were used. First proforma was for survey of buffalo calf mortality/ health survey from buffalo farmers having unorganized farms and also from organized farms including several parameters related to calf mortality like housing, management, feeding and other parameters. another proforma was regarding veterinarian's observations.

Village buffalo farms (245) in unorganized sector were surveyed. These were from 17 villages from Haryana including

Gangwa, Ladwi, Bhuthan Kalan, Thuian, Cheemon, Rawalwas Kalan, Dhani Majua, Dabra, Hasanga, Dhabi Khurd, Jhalania, Dalher, Ruksana, Kaimri, Talwandi Rana, Dhanora and Chillar. From Punjab there were 6 villages including Valtoha, Khanpur Barring, Rajgarh, Bajidpur, Bhunsi and Harjou Kalan. Survey of buffalo calf mortality/ health from two organized farms of CIRB located at Hisar and Nabha was also done. Additionally, survey of 16 small peri-urban private buffalo dairy units at Hisar, Barwala and Adampur was also done. Survey of observations of 76 veterinarians regarding buffalo calf mortality was also done. Clinical biosamples (202) yielded E coli (90), Klebsiella pneumoniae (30) and Salmonella spp. (20). None of the 104 samples from in contact apparently healthy buffalo calves yielded any bacteria of pathogenic significance.

Villages	No. of Samples	E. Coil	Klebsella pneumoniae	Salmonella enteritidis
Bhuthan Kalan	38 (25)	13	6	3
Rawalwas Kalan	47 (32)	12	5	4
Gangwa	58(35)	11	6	4
Ladwi	46 (32)	13	4	5
Kaimri	70(45)	20	7	4
Dabra	29 (21)	12	2	0
Talwandi Rana	18 (12)	9	0	0
Total	**306 (202)**	**90**	**30**	**20**

Figures in parenthesis show clinical samples from diseased buffalo calves only
Total samples include samples from in-contact apparently healthy calves also

Several parameters were surveyed, however parameters showing significant relation of calf mortality are shown here:

	Parameters	Percentage
●	Premises with Natural Light	10.2
	Artificial Light	17.3
●	Abundant or Adequate ventilation	10.5
	Low ventilation	18.4
●	Drainage channel	9.6
	No drainage channel	17.3
●	Plastered wall	11.7
	Without plaster wall	12.6
●	Kutcha floor	12.1
	Pucca floor	11.9
●	Cleaning of premises	
	2 times or more/day	11
	One time	13.7
●	Density of animals	
	(Most appropriate and appropriate)	10.6
	Not appropriate	18.3

Further, all the isolates were subjected to invitro antimicrobial susceptibility testing against 30 antimicrobial agents as per method of Bauer et al., 1966. The percentage of isolates coming under the category as sensitive, intermediate and resistant was calculated on the basis of zone size interpretative chart provided by the manufacturer (Hi Media). The percentage of E coli isolates coming under the category of sensitive, intermediate and resistant for antimicrobial agents were amikacin 30 mcg (76.6, 23.3, 0); ampicillin 10 mcg (0, 13.3, 86.6); azithromycin (76.6, 16.6, 6.6); ciprofloxacin 5 mcg (80, 3.3, 16.6); clindamycin 2 mcg (0, 3.3, 96.6); colistin 10 mcg (93.3, 0, 6.6); co-trimoxazole 25 mcg (70, 0, 30); erythromycin 15 mcg (0, 3.3, 96.6); gentamicin 10 mcg (50, 43.3, 6.6); gentamicin 120 mcg (100, 0, 0); kanamycin 30 mcg (3.3, 56.6, 40); methicillin 5 mcg (0, 0, 100); nalidixic acid 30 mcg (33.3, 36.6, 30); nitrofurantoin 300 mcg (76.6, 10, 13.3); ofloxacin 5 mcg (83.3, 3.3, 13.3); penicillin 10U (0, 0, 100); polymyxin B 300U (26.6, 0, 73.3); rifampicin 5 mcg (96.6, 0, 3.3); sparfloxacin 5 mcg (3.3, 0, 96.6); spectinomycin 100 mcg (80, 10, 10); streptomycin 10 mcg (13.3, 60, 26.6); streptomycin 300mcg (90, 0, 10); tetracycline 30 mcg (36.6, 33.3, 30); tobramycin 10 mcg (13.3, 73.3, 13.3); vancomycin 30 mcg (0, 0, 100); oxytetracycline 30 mcg (30, 0, 70); enrofloxacin 10 mcg (33.3, 0, 66.6); amoxicillin/ sulbactam 30/15 mcg (0, 0, 100); ceftriaxone 30 mcg (60, 16.6, 23.4); cefoperazone/ sulbactam 75/ 30 mcg (0, 0, 100).

The percentage of Salmonella spp. isolates coming under the category of sensitive, intermediate and resistant for antimicrobial agents were amikacin 30 mcg (90, 5, 5); ampicillin 10 mcg (85, 10, 5); azithromycin (80, 10, 10); ciprofloxacin 5 mcg (75, 15, 10); clindamycin 2 mcg (80, 15, 5); colistin 10 mcg (75, 10, 15); co-trimoxazole 25 mcg (100, 0, 0); erythromycin 15 mcg (100, 0, 0); gentamicin 10 mcg (95, 5, 0); gentamicin 120 mcg (90, 10, 0); kanamycin 30 mcg (90, 5, 5); methicillin 5 mcg (100, 0, 0); nalidixic acid 30 mcg (0, 0, 100); nitrofurantoin 300 mcg (0, 0, 100); ofloxacin 5 mcg (90, 5, 5); penicillin 10U (75, 20, 5); polymyxin B 300U (90, 5, 5); rifampicin 5 mcg (100, 0, 0); sparfloxacin 5 mcg (90, 5, 5); spectinomycin 100 mcg (95, 5, 0); streptomycin 10 mcg (90, 10, 0); streptomycin 300mcg (100, 0, 0); tetracycline 30 mcg (100, 0, 0); tobramycin 10 mcg (90, 10, 0); vancomycin 30 mcg (85, 10, 5); oxytetracycline 30 mcg (90, 10, 0); enrofloxacin 10 mcg (90, 5, 5); amoxicillin/ sulbactam 30/15 mcg (95, 5, 0); ceftriaxone 30 mcg (95, 5, 0); cefoperazone/ sulbactam 75/ 30 mcg (95, 5, 0).

The percentage of Klebsiella pneumoniae isolates coming under the category of sensitive, intermediate and resistant for antimicrobial agents were amikacin 30 mcg (84, 4, 12); ampicillin 10 mcg (12, 12, 76); azithromycin (72, 12, 16); ciprofloxacin 5 mcg (88, 8, 4); clindamycin 2 mcg (0, 4, 96); colistin 10 mcg (0, 12, 88); co-trimoxazole 25 mcg (88, 12, 0); erythromycin 15 mcg (0, 0, 100); gentamicin 10 mcg (0, 12, 88); gentamicin 120 mcg (92, 4, 4); kanamycin 30 mcg (16, 40, 44); methicillin 5 mcg (0, 0, 100); nalidixic acid 30 mcg (12, 60, 28); nitrofurantoin 300 mcg (12, 72, 16); ofloxacin 5 mcg (88, 8, 4); penicillin 10U (0, 4, 96); polymyxin B 300U (0, 28, 72); rifampicin 5 mcg (0, 8, 92); sparfloxacin 5 mcg (80, 16, 4); spectinomycin 100 mcg (80, 12, 8); streptomycin 10 mcg (72, 20, 8); streptomycin 300mcg (68, 24, 8); tetracycline 30 mcg (64, 24, 12); tobramycin 10 mcg (20, 64, 16); vancomycin 30 mcg (0, 0, 100); oxytetracycline 30 mcg (28, 48, 24); enrofloxacin 10 mcg (0, 4, 96); amoxicillin/ sulbactam 30/15 mcg (0, 0, 100); ceftriaxone 30 mcg (64, 28, 8); cefoperazone/ sulbactam 75/ 30 mcg (0, 20, 80).

Multiple antibiotic resistance (MAR) values were calculated based on the drug resistance of the isolates against conventional antimicrobials. MAR value greater than 0.2 considered as potential threat for spreading multi drug resistant (MDR) isolates in environment.

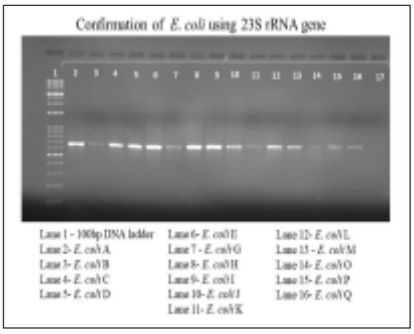
Multiple Antibiotic Resistance (MAR) value

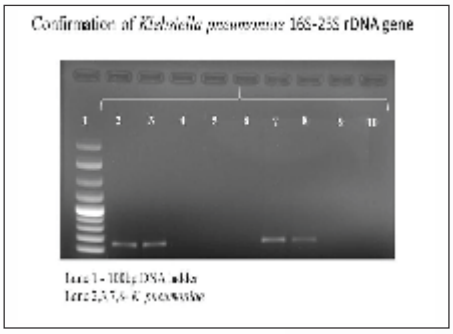
Sr. No.	Species	Number of isolates			Average 'MAR' Value
		Total isolates	MAR' Value (<0.2)	MAR' Value (>0.2)	
1	E. coli	90	28	62	0.36
2	K. pneumoniae	30	4	26	0.28
3	Salmonella enteritidis	20	3	17	0.29

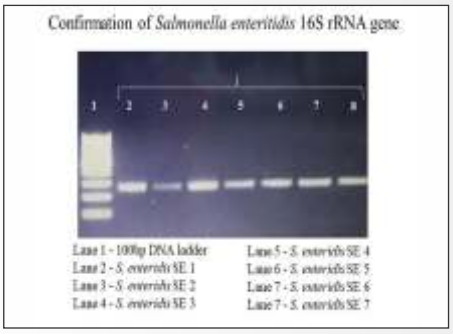
Molecular Characterization

Confirmation of bacterial species was done by PCR using the primers listed below:

Sr. No.	Bacterial species	Gene Name	Primer Sequence	Product Size (bp)	Reference
1	E. coli	23S rRNA	F- GCTTGACACTGAACATTGAG	662	Khaled et al. (2010)
			R- GCACTTATCTCTTCCGCATT		
2	Klebsiella pneumoniae	16S-23S rDNA	F- ATTTGAAGAGGTTGCAAACGAT	130	Liu et al., (2008).
			R- TTCACTCTGAAGTTTTCTTGTGTTC		
3	S. enteritidis	16S rRNA	F- TGTGTTTTATCTGATGCAAGAGG	304	Alvarez et al. 2004

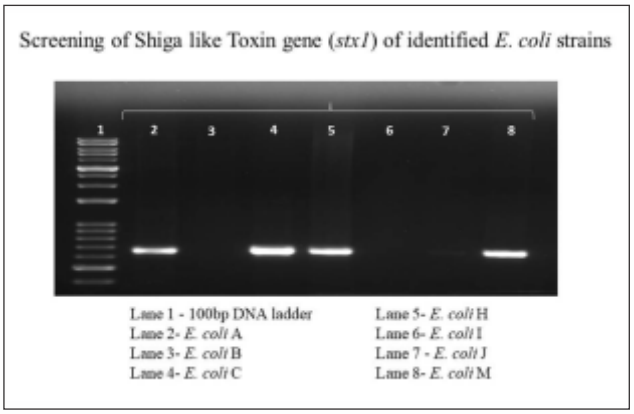


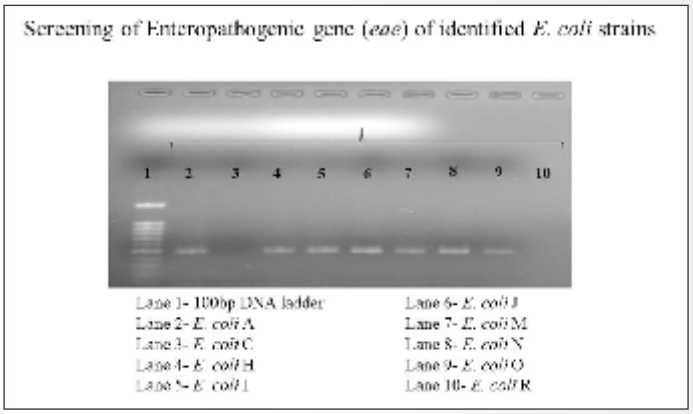




Further screening of virulence associated genes of E. coli was done by PCR using the primers listed below:

Sr. No.	Gene Description	Gene Name	Primer Sequence 5' to 3'	Product Size (bp)	Reference
1	EPEC (enteropathogenic E. coli)	eae	TCA ATG CAG TTC CGT TAT CAG TT	482	Vidal et al. (2004)
			GTA AAG TCC GTT ACC CCA ACC TG		
2	STEC (Shiga-like toxin) or verotoxic	stx1	CAG TTA ATG TCG TGG CGA AGG	348	Cebula et al. (1995)
			CAC CAG ACA ATG TAA CCG CTG		





The percent of E coli isolates with virulence genes is shown in table:

No. of Isolates	eae (482 bp) %	Stx1 (348bp) %
90	(36) 40.0%	(21) 23.3%

The significant information and conclusions were:

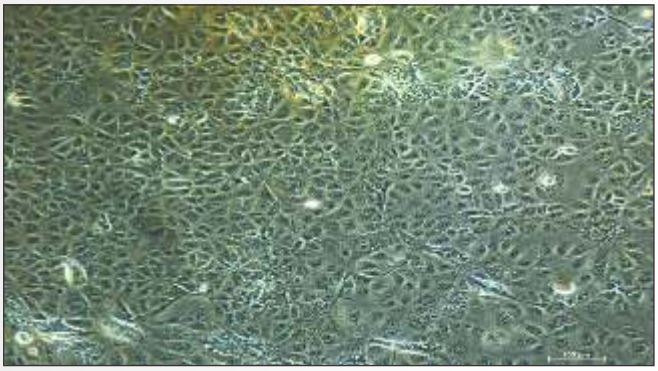
- Ventilation, lighting, drainage and cleaning of premises have significant relation with mortality in calves. Calf mortality could be reduced significantly by introducing better managemental practices.
- E. coli is the important pathogenic bacteria followed by K. pneumoniae and S. enteritidis responsible for calf-hood diseases. Virulence factors of E coli play an important role in calf mortality.
- Antibiotic sensitivity & resistance pattern of these isolates was also determined. A large proportion of the isolates were Multiple Drug Resistant (MDR) having average MAR values between 0.28 to 0.36, which warrants for stricter envormental hygiene and judicious use of antibiotics.
- **Gentamicin and ofloxacin** should be preferred antibiotics against E. coli, **gentamicin, ofloxacin and ciprofloxacin against** K. pneumoniae and **erythromycin, methicillin, streptomycin** and tetracycline against S. enteritidis being most effective.

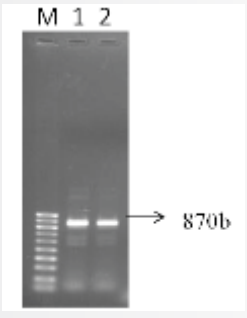
Challenges of high producing buffaloes: identification and management

Ashok Boora and Sarita Yadav

Isolation and Molecular characterization of Group A bovine rotavirus from buffalo calves in India between 2020-2021.

Group A bovine rotavirus (RVA) is a major causative agent of neonatal calve diarrhea and calf mortality worldwide. Till date, 14 G serotypes and 14 P genotypes for group A rotaviruses have been identified. The purpose of this study was to detect, isolate and molecular characterization of group A rotavirus strains from buffalo calves, concerning the genotype of RVA circulating locally in the region. A total of 99 fecal samples were collected from both healthy (n = 80) and diarrheic (n = 19) buffalo calves less than three months age in an organized farm at CIRB, Hisar and farmer doorstep during October 2020-January 2021. The dams of these calves were not vaccinated against rotavirus. Five samples tested positive for group A rotavirus (RVA) by antigen capture ELISA and PAGE were further subjected for virus isolation in MA-104 cell line. Viral RNA was extracted from these cell culture adapted virus strains and VP7 and VP4 genes were amplified by reverse transcription-polymerase chain reaction. Sequencing and phylogenetic analysis are undergoing to determine Rotavirus P and G genotypes. This data will assist in understand the epidemiology of the RVA in India and implementation of effective bovine rotavirus control to ensure the use of appropriate bovine rotavirus genotype and strains in the development of bovine rotavirus vaccine in India.





Agarose gel electrophoresis of PCR amplified gene product of VP4 gene (864 bp size) of Bovine Rota Virus in lane 1& 2. M: 100 base marker., Lane 1, 2: 733, 5722 sample number from buffalo calves. Primers: Bov4Com5 and Bov4Com3 (Isegawa et at., 1993)

Virus isolation in MA104 cells: 500 µl of the processed clinical sample from buffalo calves were used to infect MA104 cells. Cytopathic effect was observed at 7th blind passage. A: Mock-infected B: Virus-infected cells.

Pathogen specific prevalence of mastitis pathogens and their antibiogram

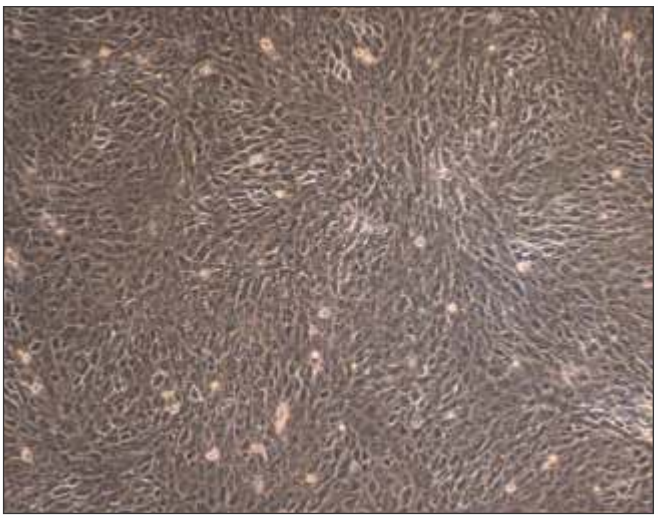
Sarita Yadav, Ashok Boora

Herd of Murrah buffalo from CIRB (n=75 milch buffaloes),Niliravi from subcampusNabha (n=100) and at farmers doorstep (n=11) were screened for mastitis by CMT and SCC in the year 2020-2021.SCC greater than 1,00,000/ ml from composite samples were used for further microbial examination. Microbial examination of mastitic buffalo milk samples (n=16) from CIRB herd,Nabha (n=16)andfarmers doorstep (n=11) were done. The overall animal level prevalence of mastitis (subclinical and clinical) was 23.12.%.The most prevalent udder pathogens isolated from composite milk samples were coagulase-negative Staphylococcus, representing 55.55 % of all recovered isolates followed by Staphylococcus aureus (18.52%), mixed infection (20.37%), Escherichia coli (12.96%),Streptococcus spp (7.41%), Pseudomonas (5.55%) and other coliform. Coagulase negative Staphylococcus had the highest sensitivity to Gentamic in and AMS by disc diffusion method. Staphylococcus aureus, Streptococcus, Pseudomonas and E. Coli showed highest sensitivity to Gentamicin followed by Ceftriaxone. The highest resistance was recorded for Penicillin.

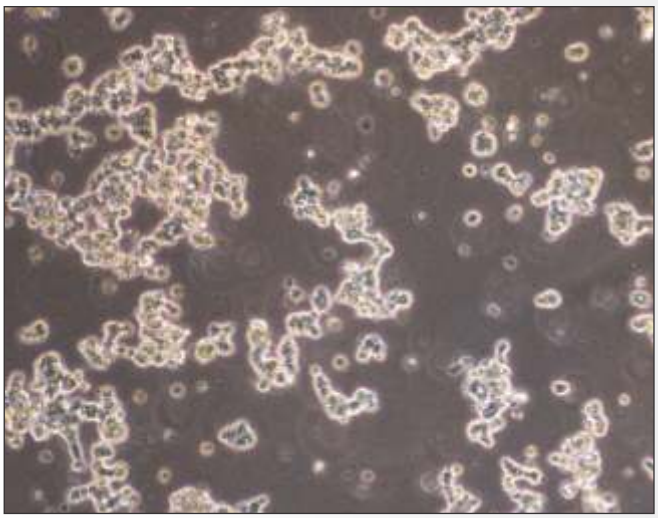
Seromonitoring, Isolation and identification of Bovine herpes virus-1 (BoHV–1)

Infectious bovine rhinotracheitis (IBR) is an infectious disease caused by a herpesvirus, BHV-1. The syndrome includes fever, eye, nasal discharges,perineal dermatitis, pustulo-vaginitis, balanoposthitis and abortion. Serum samples of the buffaloes from CIRB, Hisar, CIRB regional station, Nabha, Punjab and Gujarat were examined for antibodies to BHV-1 using ELISA kit for serodiagnosis of IBR or BHV-1(bioX diagnostics, , BIO K 238/2), catalogue number 5030750. Serological screening revealed that 82 out of 90 animals (91.11%) were presented with neutralizing antibodies against BHV-1.Further, at farmers doorstep, a three- and half-month abortion in Murrah buffalo was attended and IBR infection was diagnosed as a causative agent of abortion by successful virus isolation and PCR.

A. Mock-infected cells



B. Virus-infected cells



Virus isolation in MDBK cells from vaginal swab of abortion case in Buffalo. Cytopathic effect was observed at 4th blind passage. A: Mock-infected B: Virus-infected cells.

Improvement of Reproductive Efficiency

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 good fertility and reproduce normally similar to non-cloned bulls. Urine based pregnancy diagnostic kit is being tested at farm and field with encouraging results. The division also organizes extension and outreach programs. These programs transfer research-based knowledge that fill the gap between fundamental research and its application to the farmer for managing their animal's reproductive health across the country. Scientists are making efforts to improve the buffalo farming techniques through both basic/discovery and translational/development research.

Production of multiple copies of elite buffalo using cloning technology

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

The objectives of this project are to produce multiple clones of elite animals, improve the cloning efficiency and to study the growth of clones and reproduction of produced clones. During reporting period, already established somatic cells of 3 superior Murrah buffalo (Male: Mu4354 and Mu2558, Female: Mu4316) were used as donor cell for cloning purpose. During this period, a total of 414 embryos were reconstructed from doublet method and out of them, 88 reached upto blastocysts stage. A total of 41 embryos were transferred and out of these 3 animals were found pregnant at one month of diagnosis. These pregnancies were lost as unnoticed.

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

Evaluation of telomere length of cloned calves

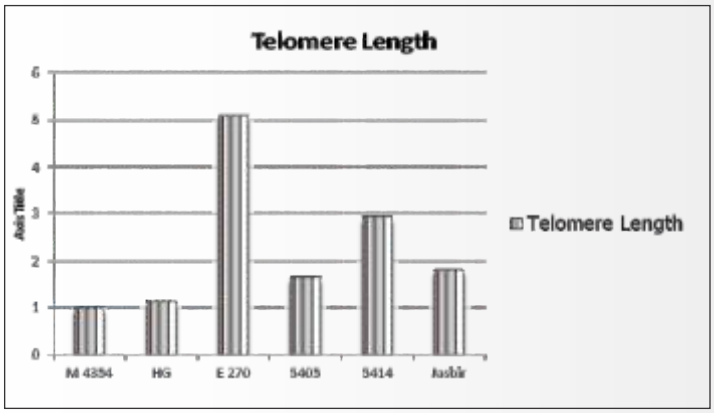
Telomeres are repetitive DNA sequence that protect ends of chromosome from early degradation and maintains genomic stability. Telomere biology is relevant to genetic reprogramming of donor cells in somatic cell nuclear transfer (SCNT) methods. Abnormal telomere reprogramming could be one of the possible reasons for lower efficiency of reproductive cloning methods. Recently, we reported the production of multiple clones of a superior buffalo bull and a re-clone of earlier

cloned buffalo (Yadav et al., 2020, Current Science, 119 (7); 1077). To determine the role of nuclear reprogramming and telomere activity, the present study was framed to devise a simple protocol for determination of telomere length in cloned buffalo. We assessed the relative telomere length (RTL) status in seven newborn clones of M 29 using quantitative PCR (qPCR) approach. DNA from 3 non-cloned, age matched animals was used as control. We also performed the comparative telomere length between a re-cloned calf with their cloned bull (HG, donor of re-clone) and from adult donor animal (Mu 4354, donor for cloned). For this, qPCR reactions (20µl each) were prepared using 50ng DNA of each sample with cyclic conditions (10 min at 95°C, 35 cycles of 95°C for 15 s, 52°C for 1 min followed by melt curve). Mean Ct values were determined for all samples for SCG and Tel primers. ΔCt (Ct_{sample}- $Ct_{reference}$) was calculated for Tel primer and SCG gene. ΔΔCt (ΔCt_{Tel} - ΔCt_{SCG}) and fold change was calculated for each sample. RTL was highly variable in cloned from that of age matched control animals. Relative telomere length of re-clone (E 270) and clone E268 was 15.15 and 4.08 times longer than that of non-cloned animals and other clones have similar telomere length ranging from 1.3-2.43-fold longer with their control. Overall telomere length of M29 cloned new born calves was not significantly different from their adult donor bull except one has shorter RTL. Re-cloned E270 showed RTL 5.01-fold higher with its donor HG. No significant demarcation of telomere length was observed between HG clones with its adult bull. In a subsequent analysis, RTL of cloned calf HG with its progenies (P1, P2, P3) were analyzed to determine the telomere length association among generation. A significant difference was detected across generation (2.5 fold higher than their parent bull). Our results indicate telomere length of most clones was normal or even elongated when compared to age matched controls however one clone found with reduced telomere length compared to the cell line used for SCNT. At present, we are analyzing adult clones to determine telomere reprogramming in buffalo clones to evaluate the effects of SCNT on aging.

Relative telomere length of HG clone, E 270 Reclone and three progenies of HG (5405, 5414, Jasbir) to M 4354 donor

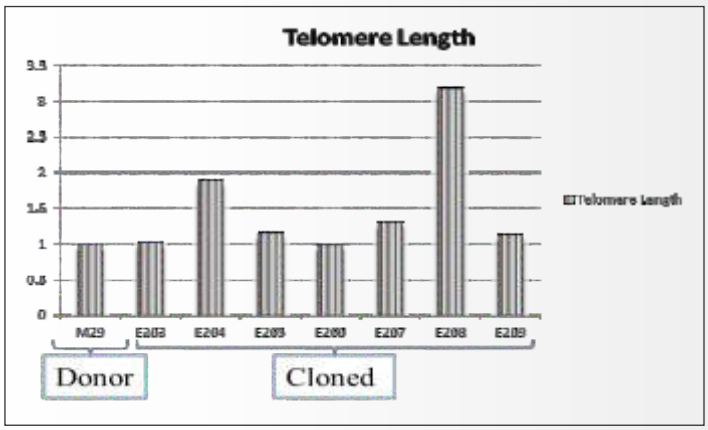
Sr. No.	Samples	Telomere Length
1	M 4354	1
2	HG (Clone)	1.1383
3	E 270 (Reclone)	5.089
4	5405 (P1)	1.651
5	5414 (P2)	2.944
6	Jasbir (P3)	1.806

P*-Progeny



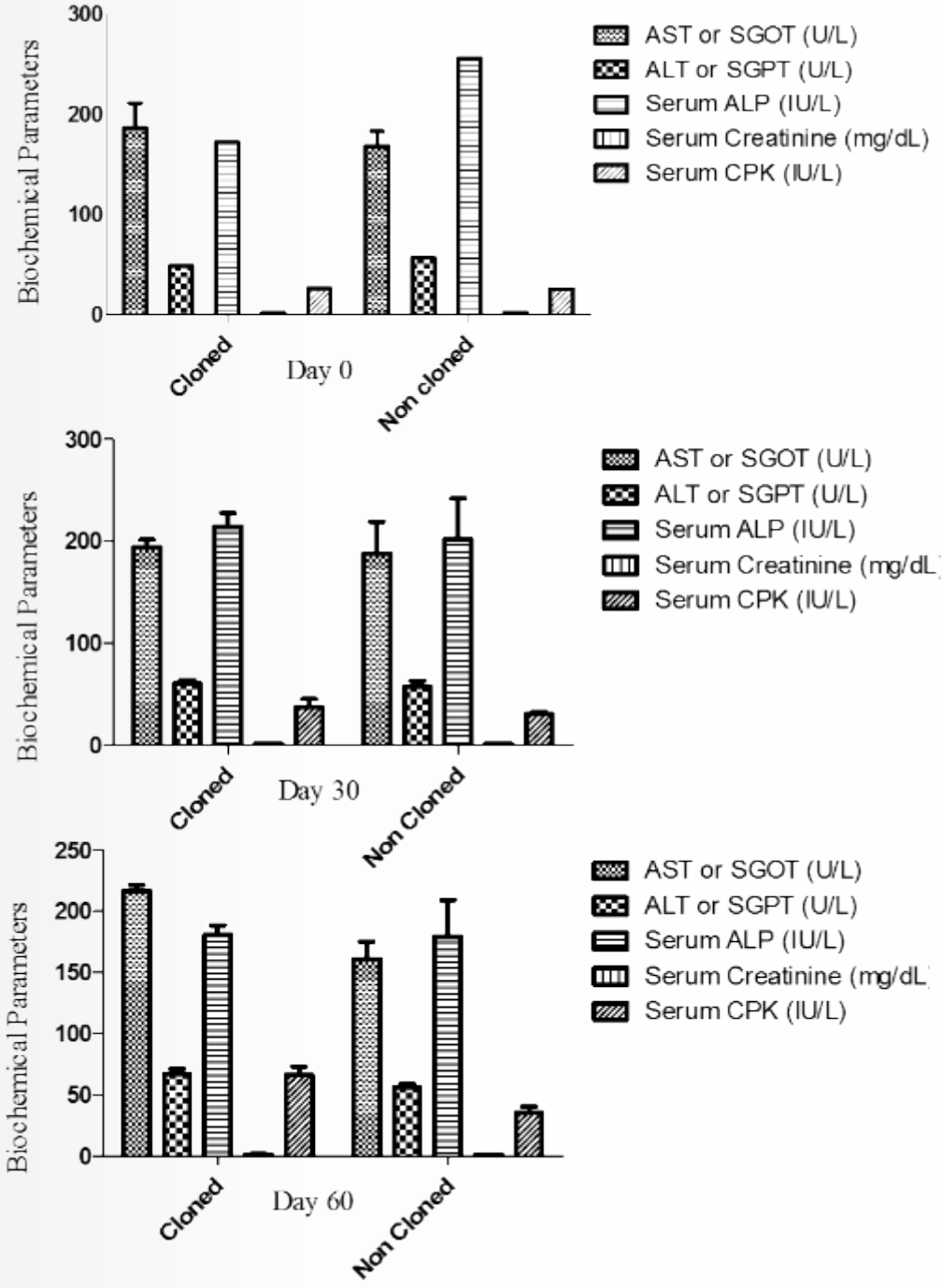
Relative comparative analysis of telomere length of Cloned calves (with in 4 hours of birth) with Donor (M 29)

Samples	Telomere Length
M29	1
E263	1.028
E264	1.898
E265	1.152
E266	0.989
E267	1.305
E268	3.182
E269	1.125



Evaluation on cloned calf blood haematology and biochemistry

We regularly evaluate the blood biochemistry parameters of cloned and non-cloned control buffalo calves such as: alanine aminotransferase (ALT) or SGPT, aspartate aminotransferase (AST) or SGOT, serum alkaline phosphatase (ALP), serum creatinine and creatine kinase (CK), or creatine phosphokinase (CPK).



Hematological parameters viz. WBC, LYM, MON, NEU, EOS, BASO, LYM, MON, NEU, EOS, BASO, RBC, HGB, HCT, MCV, MCH, MCHC, etc. were also evaluated and found in normal range.

Haematological and biochemical Parameters of Cloned Buffalo Bull Calves

Hematological parameter	Cloned	Non cloned
	Day 0	
WBC (WBC)	9.28±0.65	6.73±0.31
LYM% (LYM%)	51.88±2.94	47.61±2.82
MON% (MON%)	5.75±0.88	5.2±0.34
NEU% (NEU%)	41.68±3.62	46.47±2.52
EOS% (EOS%)	0.61±0.15	0.61±0.02
BASO% (BASO%)	0.06±0.009	0.09±0.06
LYM# (LYM#)	4.77±0.37	3.19±0.15
MON# (MON#)	0.55±0.12	0.34±0.03
NEU# (NEU#)	3.89±0.45	3.13±0.27
EOS# (EOS#)	0.060±.02	0.04
BASO# (BASO#)	0	0
RBC (RBC)	8.66±0.19	9.33±0.34
HGB (HGB)	115.62±2.48	115±6.08
HCT (HCT)	37.38±0.79	38.55±2.45
MCV (MCV)	43.23±0.53	41.3±1.1
MCH (MCH)	13.28±0.17	12.8±0.2
MCHC (MCHC)	308.62±1.38	311±4
RDW_CV (RDW_CV)	18.42±0.16	18.3±1.3
PLT (PLT)	431.5±46.07	464±32
MPV (MPV)	5.53±0.28	5.35±0.25
	Day 30	
WBC (WBC)	9.33±0.62	8.97±0.42
LYM% (LYM%)	47.07±4.05	46.8±2.50
MON% (MON%)	7.67±0.77	8.58±1.02
NEU% (NEU%)	42.15±3.06	43.93±2.51
EOS% (EOS%)	0.55±0.06	0.54±0.09
BASO% (BASO%)	0.03±0.01	0.14±0.08
LYM# (LYM#)	4.64±0.41	4.22±0.39
MON# (MON#)	0.73±0.11	0.76±0.08
NEU# (NEU#)	3.89±0.29	3.92±0.20
EOS# (EOS#)	0.05	0.04
BASO# (BASO#)	0	0
RBC (RBC)	8.54±0.25	9.28±0.27
HGB (HGB)	116.5±2.73	118.5±3.28
HCT (HCT)	38.23±1.06	38.42±1.34
MCV (MCV)	44.8±0.38	41.45±0.82
MCH (MCH)	13.6±0.15	12.75±0.17
MCHC (MCHC)	304.5±1.94	308±2.41
RDW_CV (RDW_CV)	20.2±0.34	18.6±0.38
PLT (PLT)	320.25±33.19	407±40.17
MPV (MPV)	5.72±0.24	6.5±0.57

	Day 60	
WBC (WBC)	8.69±0.48	9.98±0.80
LYM% (LYM%)	49.53±3.17	42.53±4.63
MON% (MON%)	7.07±0.54	9.81±1.15
NEU% (NEU%)	94.56±3.23	42.05±2.11
EOS% (EOS%)	0.54±0.05	0.56±0.10
BASO% (BASO%)	0.03±	0.15±0.07
LYM# (LYM#)	4.49±0.44	4.87±0.51
MON# (MON#)	0.62±0.05	0.95±0.16*
NEU# (NEU#)	3.75±0.25	4.45±0.12*
EOS# (EOS#)	0.04±	0.05±0.01*
BASO# (BASO#)	0	0
RBC (RBC)	8.60±0.29	8.93±0.19
HGB (HGB)	116.87±2.5	119.5±2.9
HCT (HCT)	37.86±1.19	39.02±0.97
MCV (MCV)	44.27±0.73	42.55±0.65
MCH (MCH)	13.47±0.25	12.95±0.16
MCHC (MCHC)	305.5±2.16	307.25±2.10
RDW_CV (RDW_CV)	19.95±0.50	19.05±0.12
PLT (PLT)	329.37±32.84	316.25±11.4
MPV (MPV)	5.72±0.24	6.45±0.59

Semen production of cloned bulls

Earlier produced cloned bulls namely- Hisar-Gaurav and Sach-Gaurav produced more than 12000 and >2000 semen doses respectively. Using semen of Hisar-Gaurav, more than 60 progenies are already born with normal health and are growing well. One female 4909 born using Hisar-Gaurav donor 4354 semen at CIRB farm produced 3449 lit milk in first lactation which records highest ever at this institute and one male progeny is also screened for progeny testing program. The available frozen semen doses are being used for fertility evaluation and for artificial insemination in interested farmer's animals. The Sach-Gaurav semen parameters such as ejaculated volume, sperm concentration and mass sperm motility and other in vitro test are found similar to other non-cloned bulls. In addition, morphometric analysis, viability, plasma membrane integrity, and computer-assisted sperm analyzer (CASA) indices of cloned bull sperm were found similar to that of non-cloned bulls.

Progeny of cloned bull

Frozen semen of Hisar-Gaurav has been used for artificial insemination at CIRB farm as well as HIteck Sach dairy farm Sirsa and consenting farmers. More than 60 calves has been produced with normal health, indicate normal fertility of cloned bull. We used fresh semen of Hisar-Gaurav in 15 oestrous synchronised female buffalo at our experimental herd and out of that 13 were found pregnant and 11 delivered normal calves.

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

Cryobanking of primary somatic cells of elite farm animals:

We also established finite somatic cells line derived from tail-skin biopsies of 17 elite buffaloes. The informative data such as buffalo details (breed, date of birth, sex, and age at the time of tissue biopsy collection, and production traits), the number of cryovials stored, and freezing dates were recorded in an electronic file and a printed inventory record is maintained. The established somatic cells were flat, had spindle-shaped morphology, and expressed vimentin (a fibroblast-like cell type marker) and the negative expression of cytokeratin-18 (an epithelial cell type marker). Altogether, we cryopreserved 970 cryovials (0.1 million cells per vial) from two buffalo breeds, namely Murrah and Nili-Ravi (at least 45 cryovials per animal), for cryobanking. Somatic cell nuclear transfer (SCNT) experiments demonstrated the utility of cryopreserved cells to produce cloned buffaloes. Importantly, these cryopreserved somatic cells are made available to scientific communities for their utilization in cell-based research (Dua et al., 2021).

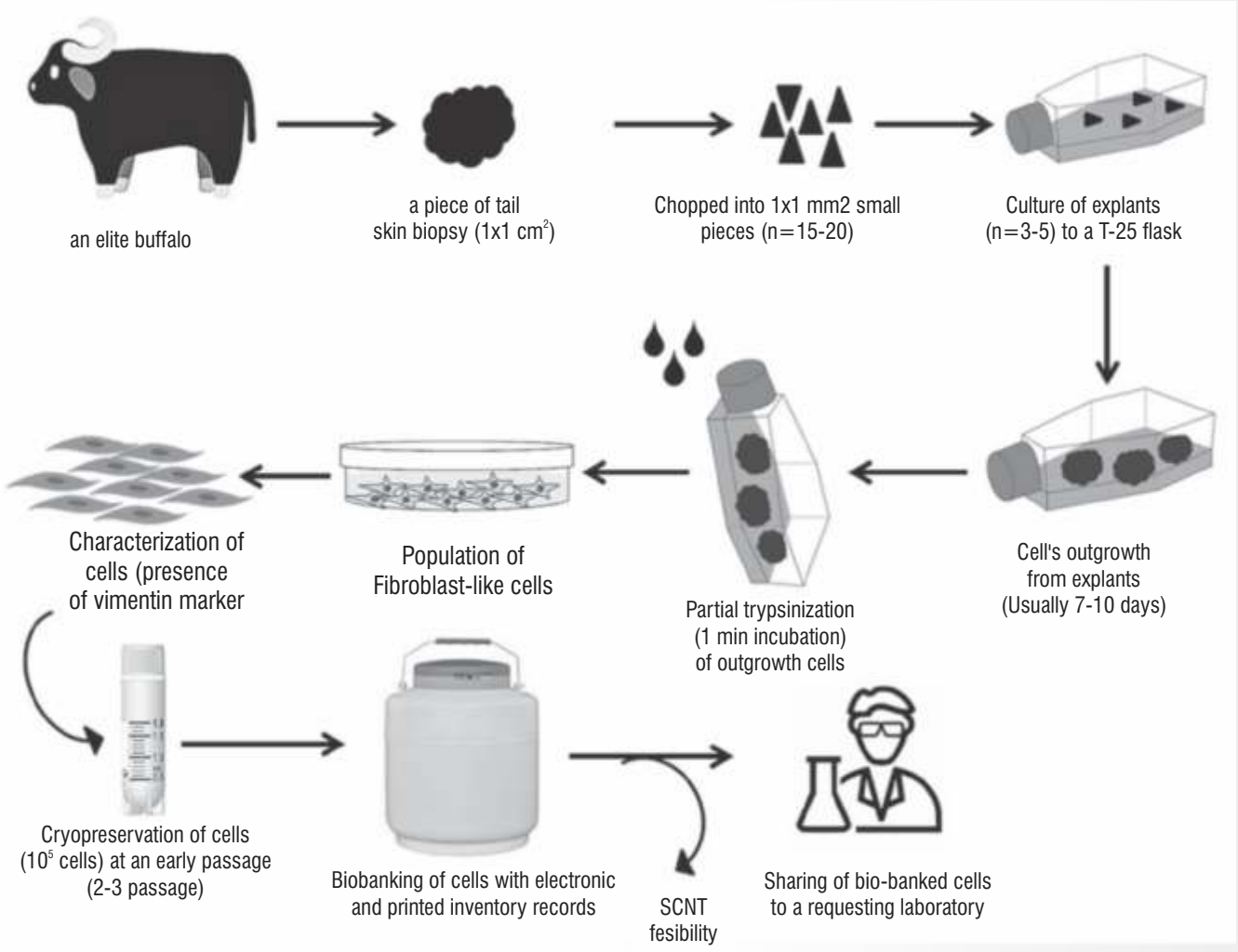


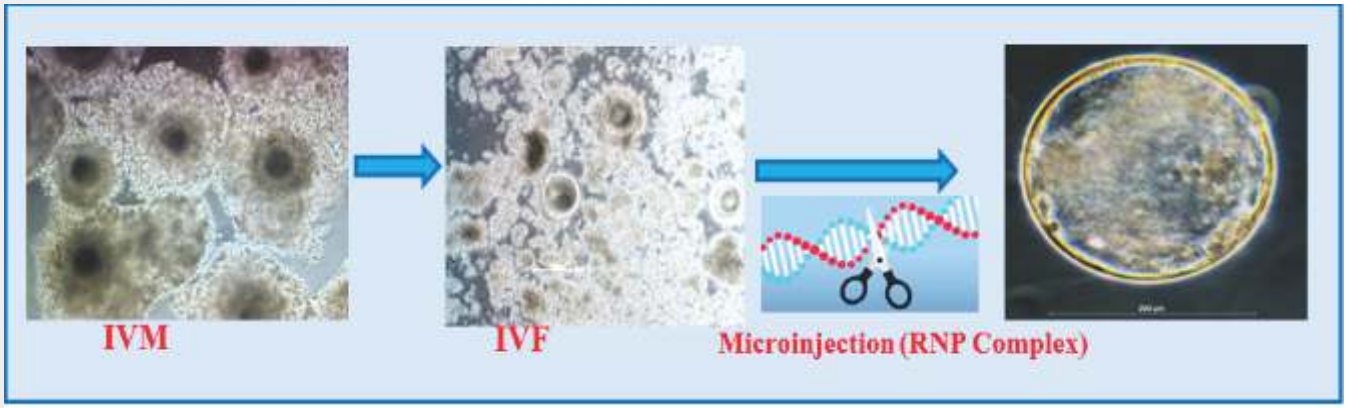
Figure: Schematic presentation of somatic cell cryobanking of elite buffaloes.

Deciphering the functional role of pluripotency transcription factor OCT4 during buffalo embryogenesis applying CRISPR/Cas9

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

Oct4 plays indispensable roles in early embryo development and cell lineage specification. Oct4 binds to the octamer sequence motif (5′-ATTTGCAT-3′) and controls the expression of genes involved in embryonic development. Low

expression of Oct4 suggests inferior quality embryos, reduced blastocysts formation and developmental failures. To determine whether CRISPR/Cas9 can be used to understand the transcriptional regulation of early embryonic development we aimed to target Oct4. To achieve this Oct4 guide sequences were designed insilico. Cas9-gRNA RNP complex will be prepared and delivered to single stage zygote via intra cytoplasmic microinjection. Validation of Oct4 KO will be performed using a T7E1 assay and Sanger sequencing. The insights gained from these investigations will advance our understanding of buffalo embryogenesis and will suggest Oct4 role in the progression of the buffalo blastocyst.



Climate Vulnerability Modelling for buffalo farming systems

AK Balhara, SK Phulia, Sunesh Balhara, Sanjay Kumar and PC Lailer

In any system, the adaptive capacity (AC) describes the resilience of the system. It indicates, the available resources with which the system can bounce back to normalcy after any eventuality as caused due to a climate change event. The exposure (E) indicates the natural conditions which makes the system prone to climate change. The sensitivity (S) index basically indicates nutrient supply and biological components in the animal population which includes the population structure, nutrients in soil, disease occurrence, nutritional levels etc. A buffalo specific model was developed for representing different data type and mathematical quantification of vulnerabilities.

Scheming was made for converting different data type to a common form using 3-point Linkert scale and/or 3 point Ordinal scale. All text information represented mathematically on 1-3 scale. The developed model, gave quantitative measurement of vulnerability:

Vulnerability Index = Adaptive Capacity – (Exposure + Sensitivity)

i.e. VI = AC- (E+S) ----------Eq (1)

The number of indicators varied for each index and therefore there is variation in the score weight. Mathematically, for a system to be in balance/equilibrium i.e. no vulnerability, adaptive capacity should be equal to sum of exposure and sensitivity

i.e. 0 = AC- (E+S) ----------Eq (2)

Therefore, AC = (E + S) **----------**Eq (3)

Considering that exposure and sensitivity are equally important, mathematically

E = S ----------Eq (4)

Further, a score weight for each sub-indicator under each index was assigned as to satisfy Eq (1). Each sub-indicator under adaptive capacity was assigned a weightage of 1, therefore overall total score of AC become 20. Considering equations 2,3 and 4 all indicators were assigned score weight as indicated in table below:

Type of index	Indicators (standards)	Number of Sub-indicators	Scale of Sub-Indicator	Score Weight	Maximum score	Maximum score
Adaptive capacity (AC)	Human, Social, Physical& Natural, and Financial assets	20 (5 for each indicator)	1-3	1	5x4x3 = 60	5x4x1=20
Exposure (E)	Exposure indicators	6	1-3	1.67	6x3x1.67 = 30	6x1x1.67=10
Sensitivity (S)	Sensitivity indicators	16	1-3	0.625	16x3x0.625 = 30	16x1x0.625=10

This is worth noting that although there are unequal number of indicators, score meet the criteria described as per equation 3 i.e. AC equals sum of E and S. assigned to All indicators although with unequal number of sub-indicators. The indicators are dynamic i.e. indicators and weightage can be deleted/ added /modified as per need. For a resilient, stable and sustainable systems adaptive capacity should be higher.

The model was tested on data collected for representative areas studied across five states (Bihar, Gujarat, Haryana, UP, Punjab and Rajasthan) :

State	Area	AC	E	S	VI	Interpretation
Bihar	Nawada and Patna	28.4	9.7	29.2	-10.5	Moderately high
Gujarat	Banni, Kutch	33.2	25.2	18.8	-10.8	High vulnerability
Haryana	Hisar	39.3	16.4	18.6	04.3	Adapted
UP	Meerut and Etawah	31.4	12.3	24.0	-04.9	Low vulnerable
Punjab	Patiala	39.1	15.2	20.4	03.5	Adapted
Rajasthan	Kherad	34.3	24.6	27.2	-17.5	High vulnerable

AC = Adaptive capacity, **E** = Exposure , **S** = Sensitivity, **VI** = Vulnerability Index

Survey and Dissemination of Knowledge for Hygienic AI practices for enhancing Buffalo Fertility

A Jerome, MH Jan, VB Dixit, RK Sharma

The present project was designed to conduct survey and disseminate of knowledge for hygienic AI practices for enhancing buffalo fertility. In this project, questionnaires were developed for inseminators as well as stakeholders with respect to standard artificialinsemination practices underfield conditions. Also, semen dose were distirubuted for field inseminations and recording of the conceptions rates of various inseminators was done. Based on the survey, it was deduced that Absence of clean infrastructure for artificial insemination under field conditions, hence development of infrastructure for hygiene AI facilities under field conditions is needed. In addition, package of practices about knowledge of hygienic AI practices was developed which could be disseminated to AI technician and stakeholders.

Buffalo sperm dosages in relation to its functional parameters and field fertility outcome

Sajjan Singh, Pradeep Kumar, Jerome A, RK Sharma

In this project, 10 inseminators was used for field fertility study. Around 2300 semen straws comprising of three sperm dose i.e. 20, 16 & 12 million/straw were distributed for field inseminations. Based on the results, no significant different in sperm kinetics, membrane integrity, mitochondrial membrane potential as well as superoxide status parameters between the three dose groups. The conception rates of 60.34% (20 million/straw), 61.97% (16 million /straw) and 60.12% (12 million /straw) was obtained under field condition.

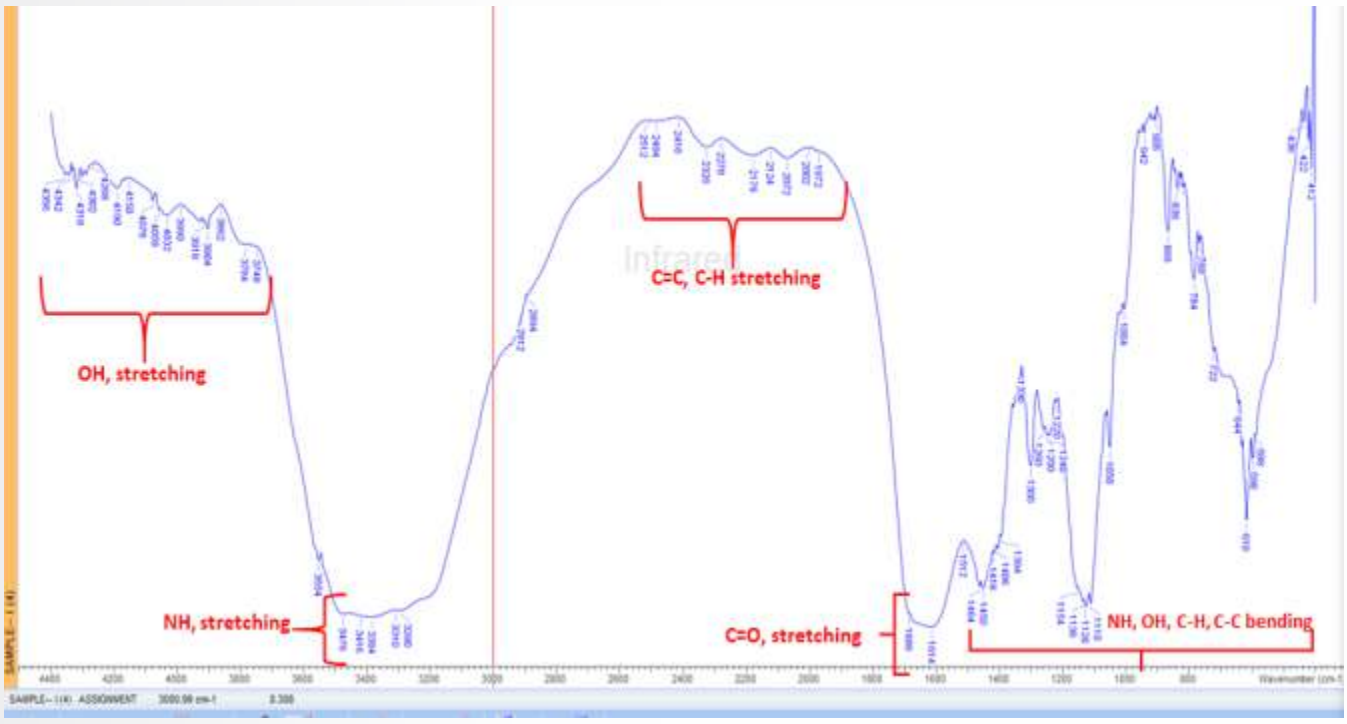
Urinary metabolite analysis and characterization

Suman, AK Balhara, SK Phulia, Sunesh Balhara and RK Sharma

Precipitated urinary metabolites were obtained from urine samples and categorised into non-pregnant and pregnant (days 35, 60, 90, 120 and 240-days post AI). Crystallized precipitates were analyzed using ^{1}HNMR, FTIR and Mass Spectroscopy. Melting points were determined in open capillaries on a "Ganson" electric melting point apparatus and are uncorrected. Homogeneity of obtained precipitates was checked by TLC. Thin layer chromatography (TLC) was developed in 3:2 (v/v) petroleum ether and ethyl acetate and R_f value was calculated. Infra-Red spectra (4000-350 cm^{-1}) of the obtained precipitates were recorded in KBr pellets on Perkin Elmer FT-IR-R2X spectrophotometer and the frequency of functional groups were expressed in cm^{-1}. Mass Spectra was obtained on an Agilent QTOF instrument. These spectra are used to determine the elemental or isotopic signature of a sample, the masses of particles and of molecules, and to elucidate the chemical identity or structure of molecules and other chemical compounds.

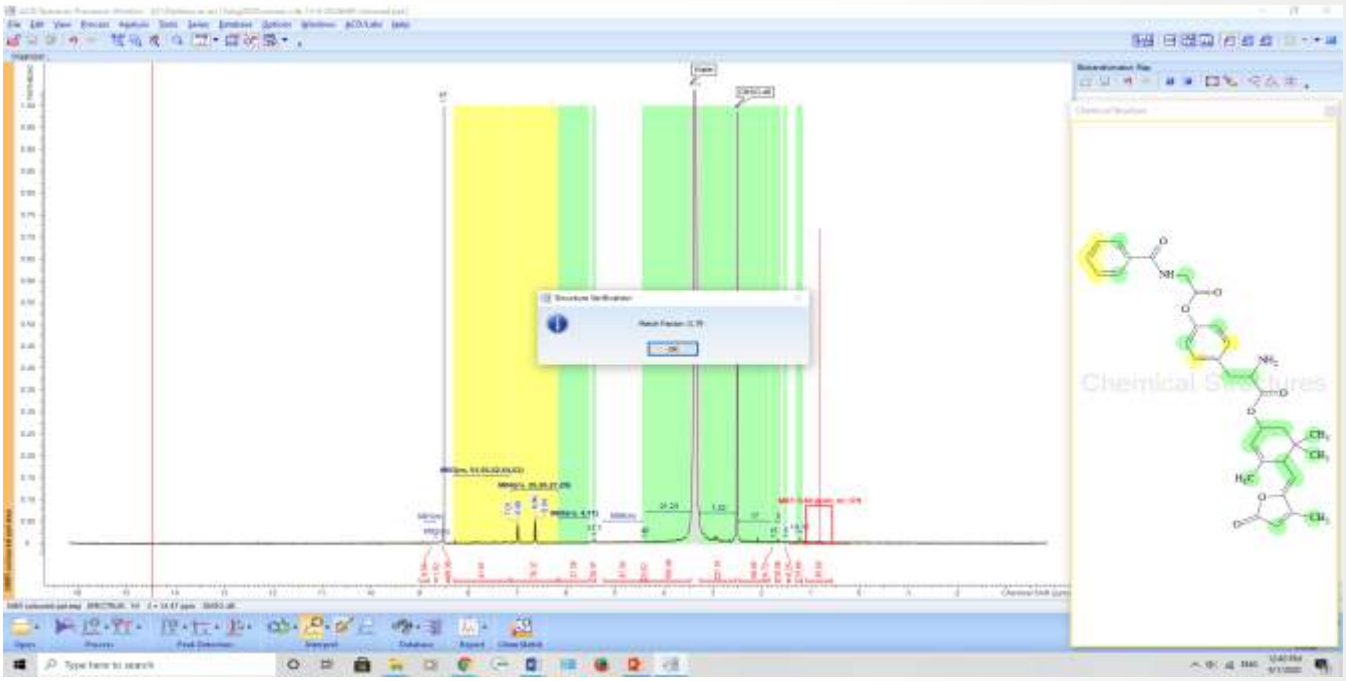
Data of NMR, FTIR and Mass spectrometry was processed under ACD/Spectrus Processor **www.acdlabs.com** for processing and verifying and reporting an IR/NMR/MS dataset. Drag and drop experimental data to identify which peaks match certain structural elements and confirm chemical structures automatically based on MS, NMR and IR data. The MS chromatogram shows the intensity of particular ion by XIC and TIC.

The recrystallized and crude coloured precipitates on FTIR characterization reported values of 1686 (C=O, stretching), 1972-2512 (C=C, C-H stretching), 3290-3476 (N-H, O-H strong stretching), 3700-4356 (O-H, weak stretching) as indicated in figure below. This indicates presence of (C=O), (N-H), (C-CH_2), (O-H), (C=C), (C-O-C) and NH_2 functional groups in the obtained compound.



Representative Differential, FTIR spectra of coloured precipitates showing functional group signals of indicated functional groups

δ values of coloured crude precipitates of pregnant animals, crystallized precipitates of pregnant and non-pregnant animals are lies in the range of (0.80- 8.88 ppm). NMR data of precipitates revealed an aromatic region (δ 6.5-8.0, Ar-H) in the pregnant animals but absent in non-pregnant animals.



Representative NMR spectra of urinary precipitates analysed using ACD/Spectrus Processor

Feed Resource Utilization and Improvement

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

Dietary phytogenic feed additive blends reduce ruminal ammonia production with improvement of nitrogen utilization efficiency in Murrah buffalo

Avijit Dey, Y Mery Chanu, SS Paul, SS Dahiya

About 94% of global anthropogenic emissions of NH_3 to the atmosphere originate from the agricultural sector of which close to 64% is associated with livestock management. The efficiency of N utilization in ruminants is very low due to deamination of most of the amino acid nitrogen entering the rumen, resulting high rate of ammonia production exceeding the capacity microorganisms of rumen for utilization of ammonia. Dietary manipulation to improve ruminal N utilization efficiency is one of the most effective measures to reduce livestock NH_3 emissions. The study evaluated potential of blends of eucalyptus oil and aqueous extract of mulethi (root of Glycyrrhiza glabra) to reduce rate of ruminal ammonia production without affecting feed digestion to improve nitrogen utilization efficiency and performance of Murrah buffalo (Bubalus bubalis). Based on preliminary independent studies with graded doses of eucalyptus oil and mulethi root aqueous extract in modulating in vitro rumen fermentation, four blends of feed additive comprising of graded doses (5,10,15, 25 μL) of eucalyptus oil and a fixed quantity (15 μL) of aqueous extract of mulethi roots were prepared and examined for their effects on in vitro rumen fermentation, methane and gas production in 100 mL calibrated glass syringes by standard IVGP protocol. Rumen liquor was collected from four rumen fistulated Murrah buffaloes fed a total mixed ration. Out of four blends, blend-1

comprising of 5 μL eucalyptus oil and 15 μL aqueous extract (233.6 g / L DW) of mulethi per 40 mL in vitro medium was found to reduce ammonia production significantly ($P<0.001$) without affecting feed digestibility. An equivalent dose of blend-1 (10.5 mL eucalyptus oil and 7.35 g mulethi root powder/h/d) fed to four rumen fistulated buffaloes for twenty-four days resulted in 50% reduction ($P<0.05$) in rumen ammonia level with no inhibition in feed fermentation or short chain fatty acids production. The total bacterial population including Ruminococcus albus, Fibrobacter succinogenes, Butyrivibrio fibrisolvens and Megasphaera elsdenii as well as anaerobic fungi and methanogenic archaea remained unaffected ($P>0.05$). Twelve buffalo calves (avg. BW 137.5± 9.2 kg, 8-12 months old) divided into two groups of six each and fed a total mixed ration (concentrate: roughage; 60:40) with or without supplementation of blend-1 for about 3 months demonstrated 14% increase ($P<0.05$) in average daily gain in BW with a trend ($p<0.10$) in improvement of feed or protein utilization efficiency (1.4 vs 1.1 g CP/g ADG; 21.4% increase). Thus, supplementation of eucalyptus oil- mulethi root blend could reduce ruminal ammonia production and improve feed utilization efficiency in ruminants.

Table 1. Effects of best blend of feed additives (Blend-1) supplementation to rumen cannulated buffaloes on ruminal pH, short chain fatty acids, ammonia-N, enzyme activities, and abundances of microbial population

Attributes	CON	EMB	SEM	p-value
pH	6.4	6.5	0.12	0.776
Short chain fatty acids production (mM/dL)				
Acetate	10.2	7.9	1.00	0.183
Propionate	2.9	1.9	0.38	0.114
Butyrate	1.4	0.81	0.23	0.122
Acetate: Propionate	3.5[a]	4.1[b]	0.12	0.023
NH_3-N (mg/dL) *	22.2[b]	11.3[a]	1.59	0.008
Enzyme activities (mIU/mL)				
Carboxymethyl cellulase (Endo-1,4 β-glucanase)	19.3	24.6	1.83	0.060
Xylanase (Endo-1,4 β-xylanase)	84.9	73.7	4.12	0.074
β–glucosidase (β-D-Glucoside glucohydrolase)	16.7[b]	11.7[a]	0.76	0.0001
Acetyl esterase (Acetic-ester acetylhydrolase)	38.2	39.3	1.14	0.489
Protease	18.2[b]	7.9[a]	0.020	0.0001
Microbial abundance (log16 S RDNA copy numbers/30ng DNA)				
Total bacteria	11.85	11.35	0.520	0.536
Ruminococcus albus	6.76	5.92	0.315	0.132
Fibrobacter succinogenes	7.66	6.81	0.900	0.542
Butyrivibrio fibrisolvens	6.32	6.21	0.225	0.379
Megasphaera elsdenii	4.48	4.83	0.345	0.142
Anaerobic fungi	8.03	7.10	0.256	0.062
Total archaea	7.41	6.34	0.402	0.120

CON= Co ntrol group
EMB= Eucalyptus-Mulethi Blend (control diet with a blend of 10.5 mL eucalyptus oil and 7.35 g mulethi root powder/ hd/ d)
SEM= Standard Error of Mean
*Measured at 2h post-feeding
Means followed by different superscript letters (a,b) in a row differ significantly ($p<0.05$)

Table 2. Growth rate and feed efficiency of buffalo calves supplemented with feed additive

Attributes	CON	EMB	SEM	p- value
Body weight (kg)				
Total gain+	60.8[a]	69.4[b]	3.06	0.049
ADG (g)	724.0[a]	826.0[b]	37.5	0.049
Dry matter intake (kg/d)				
Concentrate	3.13	3.19	0.19	0.444
Wheat straw	1.45	1.49	0.11	0.25
Total	4.59	4.69	0.29	0.304
FCR	6.37	5.73	0.38	0.057
CP intake (g/d)/g ADG	1.40	1.10	0.11	0.084
TDN intake (g/d)/g ADG	5.14	4.11	0.45	0.115

CON (Control group) = diet containing concentrate mixture and wheat straw

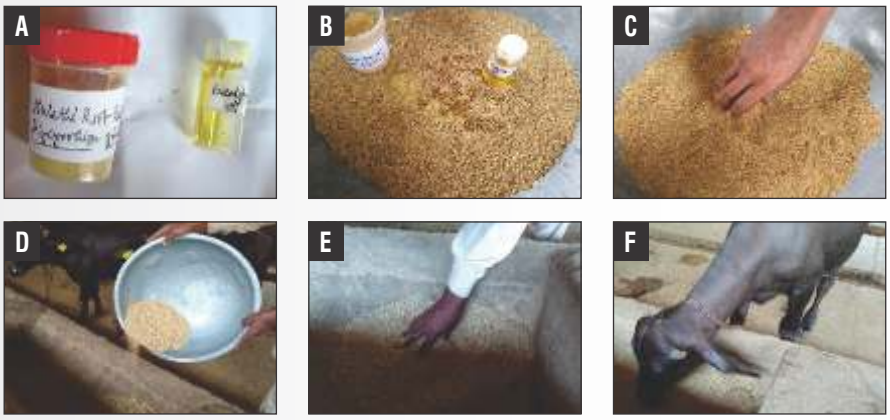
EMB (Treatment group) = control diet supplemented with blend of 2 mL of eucalyptus oil (60% purity) and 1.05 g mulethi root powder per 100 kg BW per day.

+After 84 days

ADG, Average daily gain; FCR, Feed conversion ratio (kg DMI/ kg gain); CP, Crude protein; TDN, Total Digestible Nutrients

[a,b]Mean values bearing different superscript within a row vary significantly (p0.05)

Fig.1 Preparation of Eucalyptus oil- Mulethi powder blend supplemented with concentrate mixture fed to buffalo calves



(A) = Mulethi roots, grounded to form powder and Eucalyptus oil used as feed additive

(B-C) = Requisite quantities of Mulethi and Eucalyptus oil were placed into a small portion of concentrate mixture and mixed uniformly

(D-E) = The premix was placed into the manger and mixed with the other portion of concentrate mixture thoroughly

(F) = Feeding to buffalo calf

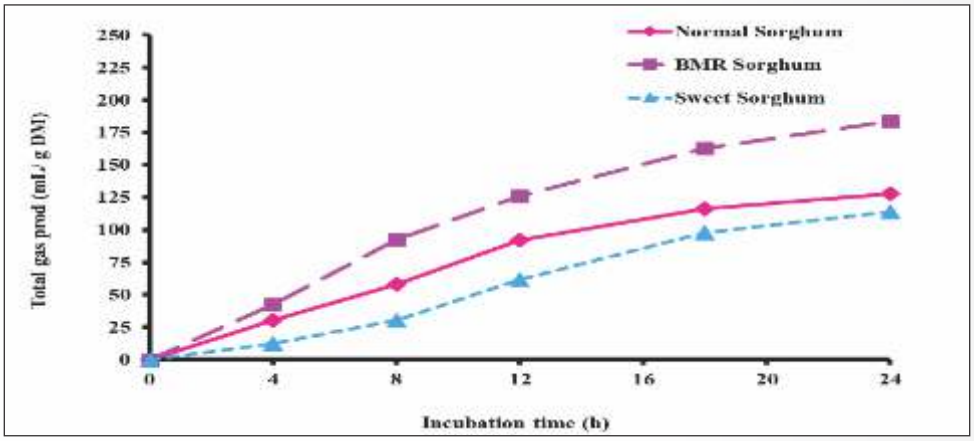
Exploring feeding potential of stovers from novel sorghum (*Sorghum bicolor L.*) cultivars by *in vitro* fermentation technique

Avijit Dey, S.S. Paul, A.V. Umakanth, B.V. Bhat, P.C. Lailer, S.S. Dahiya

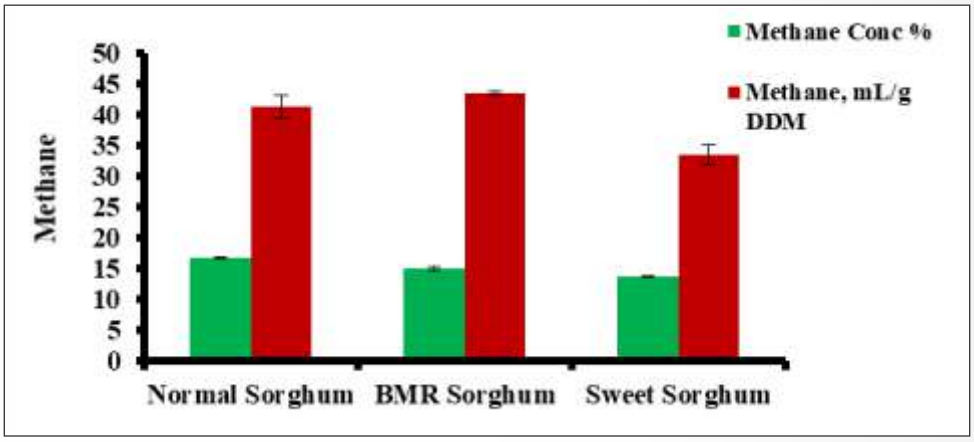
Low in nutritional quality of crop residues limit ruminant production in Asia and many parts of the world. Therefore, production of quality crop residues through plant breeding programme without conceding grain yield is of prime importance. The present experiment envisaged the feeding value of stovers from three different novel sorghum (Sorghum bicolor L.) cultivars by in vitro fermentation pattern, gas production, microbial abundance and ruminal enzyme production in buffalo. Stovers from three different genotypes of sorghum cultivars viz. normal sorghum (CSV-27), brown midrib (bmr) sorghum (SPV-2018) and sweet sorghum (CSH 22SS) were analyzed for proximate principles and fibre fractions. Each stover sample was incubated (200 ± 5 mg) with 30 ml buffered rumen fluid in 100 ml calibrated glass syringes at 39^{o} C for 24 h following in vitro gas production system using rumen liquor from Murrah buffaloes for analysing fermentation pattern. The stover sample of bmr sorghum contained lowest ($P<0.05$) acid detergent fibre (ADF) among the three cultivars examined,

which resulted with highest (P<0.05) hemicellulose (37.72%) content. Lowest acid detergent lignin (ADL) was found in stovers of bmr cultivar (1.27%) and highest in sweet sorghum (8.36%). The fermentation pattern of bmr sorghum stovers exhibited higher (P<0.05) total gas production, dry matter degradability, VFA production, ruminal enzymes (CMCase, xylanase, acetyl esterase) and abundance of total ruminal bacterial population than normal and sweet sorghum stovers. Therefore, this study establishes the enhanced feeding value of stovers from bmr sorghum cultivar compared to normal and sweet sorghum cultivars for ruminant production.

Variation in *in vitro* gas production during fermentation of different sorghum stovers with buffalo rumen fluid



In vitro head space methane concentration and total methane production during fermentation sorghum stovers



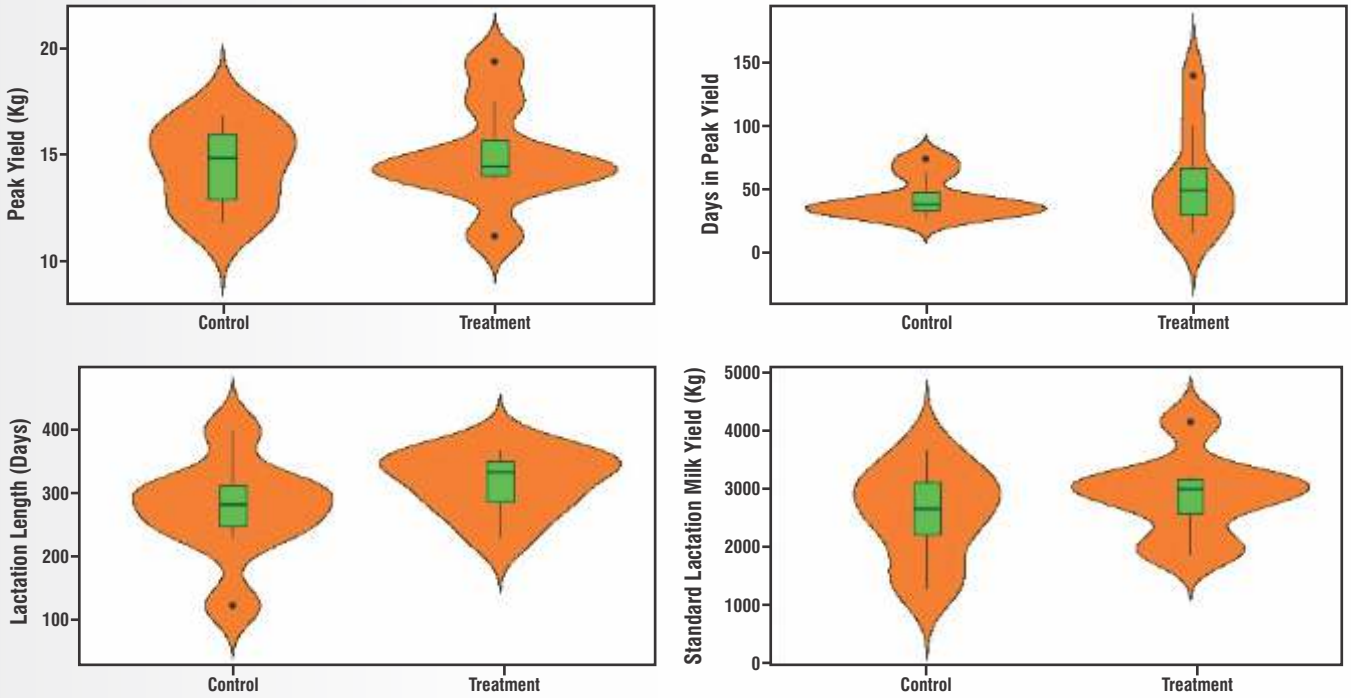
Galactogogue herbal mixture supplementation in buffaloes

N Saxena, V Mudgal, P Sikka, ML Sharma, Krishna Kumar

Twenty-four lactating buffaloes at 2-6 parity were selected randomly and divided into two groups of 12 each. The nutrient requirement was fulfilled as per the ICAR (2013) feeding standard. Galactogogue herbal mixture was supplemented to the treatment group buffalo by replacing wheat bran (2%) in the concentrate mixture. The milk production was recorded for the whole lactation length. Although the milk production parameters were numerically high for the supplemented group, these were not significant (p >0.05) .

Table 3: Galactogogue herbal mixture on lactation performances of buffaloes

• Parameters	Control	Treatment
Total lactation milk yield (TLMY)	2688.6 ± 604.2	3020.9 ± 499.9
Standard Lactation Milk Yield (305 or less days)	2617.5 ± 520.2	2934.4 ± 457.9
Lactation Length	275.6 ± 39.28	307.9 ± 23.92
Peak Yield	13.49 ± 1.26	13.98 ± 1.62
Days in Peak Yield	41.63 ± 11.02	55.86 ± 27.96



Development and supplementation of nano-minerals in buffalo

V Mudgal, N Saxena

Mineral mixture is a common component of concentrate mixture being used in the ration of animals. Sources of minerals plays very crucial role due to difference in bioavailability. It is being assumed that nano-minerals due to their smaller size will be having higher surface area and thus absorption in gastro-intestinal tract of animal. Zn and Cu nano-particles prepared in laboratory are under testing for their bioavailability in growing buffalo calves.

Body weights of buffalo heifers (fed nano Zn and /Cu) for a period of initial six months

Attribute	Control	TI	T2	T3
Day 0 (kg)	259.89	259.90	259.89	259.34
Day 180 (kg)	339.45	336.33	341.94	344.17
ADG (g/day)	441.97	424.63	455.83	471.27

Experimental feeding of Zn and / Cu nano minerals to growing buffalo heifers for six months showed no difference ($P>0.05$) in ADG (g/d). As the experiment is in progress, the final conclusion could be drawn after completion of feeding trial and analysis of blood samples.

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

RK Sharma, SK Phulia, V Mudgal, P Kumar, Jerome A

An experiment was conducted to deduce the Pituitary responsiveness to GnRH analogue on day21 of post-partum and its effect on fertility of animal. In this study, the effect of GnRH (Busrelin acetate 10 ug: 2.5 ml I/V) when administered on day 21 post calving. Animal were monitored using ultrasound to observe the development of CL at different time interval and pregnancy status following insemination. Animals were inseminated after a voluntary waiting period of 50 days post calving as per routine farm practices. The experiment was carried out to compare its effect during summer as well as winter season. The preliminary findings revealed that 10% buffaloes during summer season and 20 % buffalo during winter season resume their cyclicity by day 21 post calving. By day 28, 30% buffaloes that calved during summer and 60 % that calved during winter season resumed their cyclicity. This clearly indicates that season has a great influence on resumption of ovarian cyclicity. GnRH administration on day 21 post calvingwas found to improve the early resumption of cyclicity during winter calved (83.3%) and summer calved buffaloes (80%) by day 28 postpartum. Furthermore, 10% buffalo that calved during winter season and 40% that calved during summer season did not resume cyclicity by day 90 postpartum. Administration of GnRH on day 21 postpartum helped in resuming early cyclicity in all animals during both seasons. In majority of buffaloes (>70%), uterine involution occurred by day 35 post-partum in control group. In this study it was observed that higher percentage of animals conceived early postpartum in treatment group (54.5%) as compared to control (35%) within 90 days post-partum.

In another experiment wherein, the use of combination of anti-stressor with CIDR was done inbuffaloes to enhance the response of hormonal treatment for cyclicity induction and pregnancy rates.33 anovular lactating buffaloes (> 90 days postpartum) were screened from a herd of 140 lactating buffaloes were randomly divided into two groups. They were maintained on normal balanced diet as per standard feeding and managemental conditioned followed at the farm for a period of one month. All animals were monitored for one month without giving any anti-stress feed supplement. Thereafter, anti-stress feed supplement (a preparation consisting of sodium bi-carbonate and additional minerals and vitamins ~ 100gm daily) was given for a period of 40 days. Animals of treatment as well as control group were inserted intravaginal CIDR implant 15 days after feed supplementation. The implants were removed on day 7 after its insertion and were injected 400 IU PMSG at the time of implant removal. Fixed time insemination using frozen thawed semen was made at 48 and 60 hr after implant removal. Animals were monitored using ultrasound scanning and palpation per rectum for reproductive status. Preliminary results of this experiment showed that the overall estrus induction and conception rate was better in treated group compared to control group.

The effect of progesterone supplementation on time of ovulation in buffaloes with respect to mid heat was investigated. A total of 30 buffaloes were included in the experiment and randomly divided in to two groups (Treatment, n=13; Control, n=17). Animals in treatment group were administered progesterone hormone (750 mg, I/M) at the time of insemination. Only those buffaloes were included in the group those were having a clear vaginal discharge, good uterine tone and a large follicle >12 mm on ultrasound scanning. Buffaloes reported in heat in the morning were examined per rectally in the evening and inseminated and those reported in evening were examined and inseminated using single straw on next day morning. Ultrasound scanning was carried out at 6 hr interval without holding the ovary for size of follicles and sudden disappearance of largest ovulatory follicle as its ovulation. Preliminary findings suggest that progesterone supplementation delay the time of ovulation, facilitate follicular cyst formation and reduces conception rate in buffaloes if administered at the time of insemination.

Transfer of Technology Unit

Convergence for Dairy Development : A synergistic Approach

VB Dixit, H Tripathi, Sajjan Singh, SK Khurana, R Chabra

Convergence of all the concerned agencies/organizations was aimed at promoting integrated approach for dairy development in this project. To achieve this objective a model of convergence was developed and tested under field conditions. It helped in reaching large number of farmers and provided specialized services at a lower cost. As a result, it hastened the process of dairy development in the country. It lead to increase in the knowledge of farmers about clean milk production. The results indicated that quality of milk produced by the farmers improved. Ultimately, it helped in reducing the Somatic cell counts in the milk which lead to clean milk production by the farmer. Moreover due to regular testing of milk samples and treatment of infected animals milk yield also increased.

Survey on impact of covid-19 on buffalo production

VB Dixit, Sunesh Balhara, Gururaj M

During the Covid-19 crisis, Central Institute for Research on Buffaloes conducted an on line survey to study the impact of pandemic on buffalo production. The questionnaire was uploaded on the face book page and website of the institute on 19th May 2020. In a span of 12 days 50 farmers responded and data were also collected from 50 progressive farmers also on telephone to validate the response. The findings of the survey revealed that 80 per cent respondents neither purchased nor sold buffaloes during this period. Majority of respondents (76%) opined that there was decrease in the price of buffaloes. A major proportion of respondents (86%) viewed that maintenance cost of buffaloes increased due to problem in transportation of feed ingredients. Regarding information on milk production and consumption 44 and 64 percent respondents, respectively were of the view that it increased during the crisis. While 56 and 60 percent respondents respectively felt that market surplus of milk and demand for milk decreased during this period. About one third respondents observed that there was decrease in the price of milk leading to reduction in the income of farmers. Therefore, the farmers wanted subsidy on inputs and increase in the rate of fat during procurement of milk.

Economic Analysis of Milk Supply Chain in Buffalo Production System

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

India has the world's largest Buffalo population with 109.85 million headcounts contributing 20.45 per cent to total livestock population (20th livestock census, 2019). About 56.63 per cent of the buffaloes are descript type and remaining 43.37 per cent of non-descript (Kumar et al. 2019). There are 17 recognized breeds of buffaloes in the country (nbagr.res.in) and in which about 48.25 million headcounts are Murrah and 0.67 million headcounts are Niliravi breed. The breeding tract of the Murrah falls in the districts of Rohtak, Hisar, Jind and Fatehabad of Haryana, whereas Amritsar, Gurdaspur and Firozpur districts of Punjab fall in breeding tract of Niliravi. Haryana and Punjab are dairy progressive states in India in terms of milk production stands at sixth and eighth position, respectively. In both states about 80 per cent of the milk is contributed by the buffaloes. These two states are putting continuous efforts to increase milk productivity of the buffaloes, because buffaloes are lifeline of many resource poor farmers such as small & marginal farmers and women's to generate reasonable income and employment from buffalo husbandry. In both the states women's contribution in the buffalo husbandry is significant. To determine the growth and share of the buffalo husbandry in income and employment generation of the farmers depends on the milk marketing channels in the states. Therefore, in this backdrop present study planned to conducted estimate the role of milk supply chains in buffalo production system to enhance the livelihood of the dairy farmers in Punjab and Haryana.

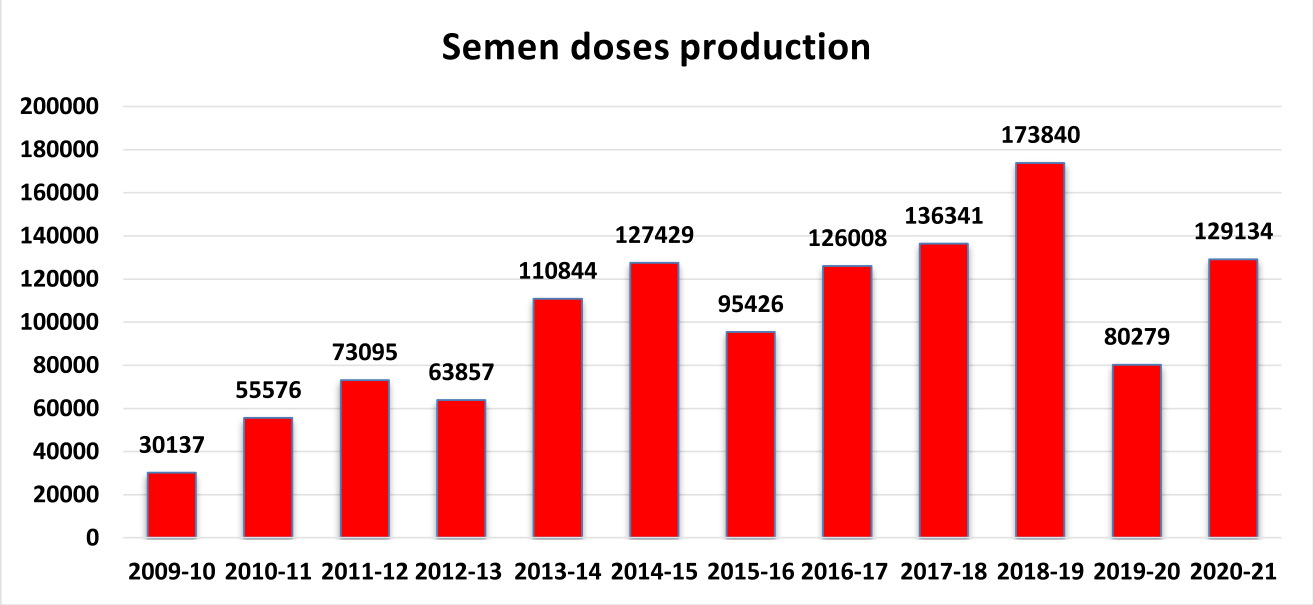
Development of Technologies and their Transfer to End Users

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

Impact of quality semen produced by institute

Institute maintains a high pedigreed herd of Murrah and Nili-Ravi buffaloes. The institute has been undertaking breed improvement programme through selective breeding since its inception. The genetic potential of bulls is evaluated through progeny testing. Due to intense selection pressure, production performance of Murrah and Nili-Ravi herds improved from about 5.86 kg in 1991 to 9.09 kg during 2019 in Nili Ravi and 4.80 to 9.79 kg in Murrah during 2020.

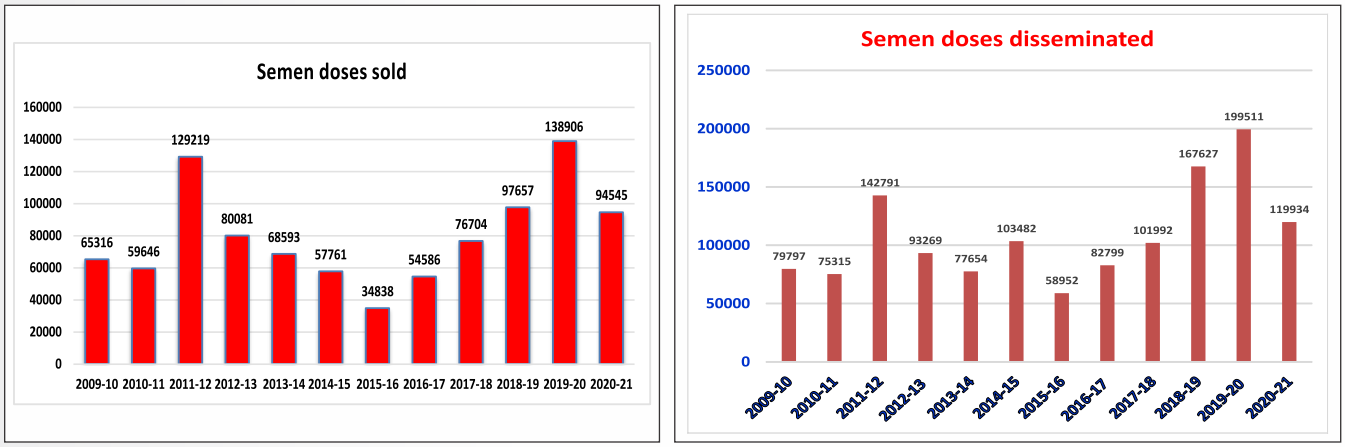
More than four lakh doses of frozen semen from test bulls and over sixty thousand doses from progeny tested bulls are available for Murrah breed improvement. About 444 Murrah and 302 Nili Ravi bulls of high genetic merit have been supplied to various developmental agencies and village panchayats in 12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



Number of frozen semen doses produced during last ten years (2009-2020)

Dissemination of quality germplasm (semen) for breed improvement

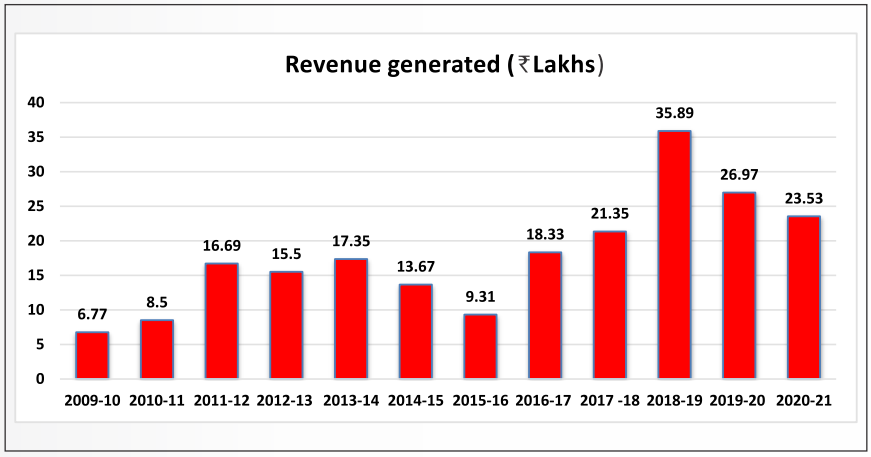
The quality semen cryopreserved from test bulls and progeny tested bulls having >50% post-thawed motility is used at our farm, Netwok centres and adopted villages for genetic improvement of the buffalo herd. The surplus quality frozen semen doses is being sold to farmers/stakeholders/researchers to dissiminate quality buffalo germplasm for improvement in the production of country buffaloes. Detail of the semen sold year wise depicted in the figure given below:



Number of frozen semen doses sold and disseminated (2009-2020)

Revenue generated through sale of semen

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



Revenue generation (Rs., lakhs) from sale of semen during last ten years (2009-2020)

Improved protocol for buffalo semen cryopreservation

A simple, reliable and economical method for freezing of buffalo semen has been developed and found to be effective to freeze the static ejaculates successfully, a phenomenon specific to buffaloes which greatly reduces the efficiency of utilization of buffalo semen for artificial insemination. A large proportion of buffalo semen ejaculates collected during summer months are rejected due to the high incidence of post-thaw backward motility of sperm cells. Through thorough investigations about the phenomenon, stage of glycerolization was identified to be the most critical step responsible for backward sperm motility. Glycerolization at room temperature during initial stage of semen dilution reduced/eliminated the

backward motility due to which 20 percent more ejaculates could be preserved annually, thereby enhancing the frozen semen production. Overall semen freezing protocols improved resulting in almost 15% improvement in post-thaw motility and improved frozen semen quality and fertility on artificial insemination.

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

Sericin for improved semen freezing

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

Ready to use buffalo semen extender

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

Improved protocol for oocyte vitrification

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

Area-specific mineral mixture

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

Feeding standards for different categories of buffaloes

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

Ultrasonographic fetal sex determination in buffaloes

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

Method for estimation of gestational age

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

Ultrasonography for monitoring ovarian activity

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

Early pregnancy diagnosis in buffaloes

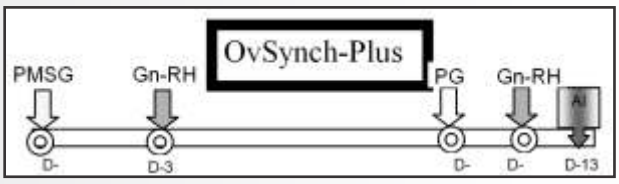
A protocol has been standardized for establishment of early pregnancy diagnosis in buffaloes. With ultrasonic scanning, pregnancy could be diagnosed as early as 26 days post insemination. The technique can be used to assess date of service in case of unobserved mating.

Identification of molecular markers for MAS

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

OvSynch plus protocol for estrus induction in buffaloes

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



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

Embryo transfer technology

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

of immense use for faster multiplication of elite germplasm and progeny testing of bulls after collecting oocytes from live animals.

Scrotal circumference for bull selection

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

Super ovulation with ablation of dominant follicle

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

Sexing of IVF produced embryos

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

Cloning of breeding bulls for semen production

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

Frozen repository of somatic cells

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

Induction of lactation

Farmers rear the dairy animals for milk production and livelihood but they are commonly facing the problems of conception failure, long calving interval, anestrous, cystic ovaries, specific abortions and repeat breeding. They can benefit by inducing such animals into lactation by induced lactation therapy. The buffalo is weighed and appropriate dose of hormones, Estradiol- 17 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 given intramuscularly. 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.

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.

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 seventy eight thousand subscribers and more than 27M 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 eight 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.icar.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.

Human Resource Development

Nodal Officer: Dr. Avijit Dey, Pr. Scientist
Co-Nodal Officer: Dr. Jerome A, 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 2020, HRD unit of ICAR-CIRB has facilitated the training of 5 Scientists, 2 Technical officers and 2 Administrative staff along with 16 Skilled Supporting Staff of the institute.

Sr. No.	Name of Staff	Subject Area	Duration and Training Institute
		Scientists	
1	Dr. Gururaj Makarabbi,	Professional Attachment Training at ICAR, NIVEDI, Bengaluru	3rd June to 2nd Sept, 2020
2	Dr. Meeti Punetha	Professional Attachment Training at GBPUAT, Pant Nagar	3rd June to 2nd Sept, 2020
3	Dr. Gururaj Makarabbi	Online Training Programme on 'Market Research and Value Chain Management of Agricultural Commodities'	17-21 Nov. 2020, ICAR-NAARM, Hyderabad
4	Dr. AK Balhara, Sr. Scientist	Climate Change: Challenges & Response (Online training)	14 -18 Dec. 2020, National Academy of Administration, Mussoorie
5	Dr. A Dey, Pr. Scientist		
		Technical Officers	
1	Sh. Rajesh Parkash, ACTO	Training Programme on Motivation, Positive Thinking and Communication Skills for Technical Officers of ICAR (Online Mode)	Dec. 17-22, 2020, ICAR-NAARM, Hyderabad
2	Sh. AKS Tomar, ACTO		
		Administrative Staff	
1	Sh. Sunil, LDC	Training program on establishment matters for UDC and LDC	3-9 Jan. 2020, ICAR-CIFE, Mumbai
2	Sh. Narender, AAO	Capacity Building Programme for CJSC Members of ICAR Institutes/HQs	27-31 Jan, 2020, ICAR-NAARM, Hyderabad
		Skilled Supporting Staff	
1	Sh. Ashok	To improve skills and efficiency of Skill Supporting Staff	19-21 Mar. 2020, ICAR-CIRB, Hisar
2	Sh. Gopi Shri Ram		
3	Sh. Anil Kumar		
4	Sh. Chander		
5	Sh. Rajender		
6	Sh. Hari Kishan		
7	Sh. Hawa Singh		
8	Sh. Ram Het		
9	Sh. Satish Kumar		
10	Sh. Joginder Singh		
11	Sh. Jarnail Singh		
12	Sh. Rati Ram		
13	Sh. Sadhu Ram		
14	Sh. Shri Nath		
15	Sh. Rajesh Kumar		
16	Sh. Mukhtiar Singh		

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Research and review articles

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Germplasm identified /registered

Breed Accession no. INDIA_BUFFALO_2600_CHHATTISGARHI_01016 for Chhattisgarhi Buffalo as 16th buffalo breed in India

Breed Accession no. INDIA_BUFFALO_1606_GOJRI_01017 for Gojri Buffalo as 17th buffalo breed in India

Gene accession number submitted

Gene Accession no. SRA accession: PRJNA546485, link: https://www.ncbi.nlm.nih.gov/sra/PRJNA546485 by Sikka P (2019) SRA submission SUB5692555, "Bubalus bubalis Raw sequence reads, reference PRJNA546485.

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Selokar NL, Kumar D Sharma RK and Yadav PS. (2020). Genomic editing through CRISPR technology, perspective and translational applications. In World Congress on Reproductive Health with Emphasis on Reproductive Cancers, Infertility and Assisted Reproduction & 30th Annual Meeting of ISSRF held at Shri Mata Vaishno Devi University, Katra, Jammu (India) from 14-16th February, 2020, pp-52.

Participation in Seminars/Conferences/Workshops/Meetings

Event	Date	Venue	Participants
Online Workshop on Training Management Information System (TMIS) for HRD Nodal Officers	8 May 2020	ICAR	Dr. A Dey Dr. Jerome A
Webinar on “Applications of Flow Cytometry in Semen Analysis”	21 & 22, July 2020	SRS, ICAR-NDRI	Dr. Jerome A
Webinar on 'NABL Accreditation of ICAR Laboratories'	22 July 2020	ICAR, New Delhi	Dr. Jerome A
International E-Workshop on 'Reproductive Diagnostic Techniques for Bovine Infertility'	28 & 29 Sept. 2020	Veterinary College and Research Institute, Orathanadu, TANUVAS	Dr. Jerome A
International E-Conference "Expanding Horizons in physio-Biochemical and Molecular Approaches for Improving Livestock Health and Production".	19 & 20 Oct. 2020	Organized by Veterinary College and Research Institute, Orathanadu, TANUVAS	Dr. Jerome A
World Congress on Reproductive Health with Emphasis on Reproductive Cancers, Infertility and Assisted Reproduction & 30th Annual Meeting of ISSRF	14-16th Feb., 2020	Shri Mata Vaishno Devi University, Katra, Jammu (India)	PS Yadav Dharmendra Kumar Naresh Selokar & Jerome A
XXVIII Annual Conference of SAPI and National Symposium on Physiological approaches to address environmental challenges for increasing animal productivity and farmer's income	18-19, Feb., 2020.	Division of Animal Physiology & Biochemistry, ICAR-CSWRI, Avikanagr	Dharmendra Kumar
Sensitisation Training-cum-Workshop on ICAR Research Data Repository for Knowledge Management (KRISHI: https://krishi.icar.gov.in)	26-27, Feb., 2020.	ICAR-CIRB, Hisar	Dharmendra Kumar

RESEARCH PROJECTS

Sr. No.	Project Title	Project Workers	Funding Source	Duration
1.	Molecular analysis of methanogenic archaeal diversity in rumen of Murrah buffaloes fed different diets	S Yadav, SS Dahiya, PC Lailer, Avijit Dey, A Boora, SK Khurana	IRC	Nov 2018 – Oct 2021
2.	Causes of Buffalo calf mortality and its management	SK Khurana, S Yadav, A Boora, Sanjay Kumar	IRC	Dec 2017- May 2020
3.	Challenges of high yielding buffaloes: Identification and their management	A Boora, S Yadav, SK Khurana, AK Balhara, PC Lailer	IRC	Jul 2017- Jun 2020
4.	Development of need based mobile apps to improve the performance and productivity of buffaloes	H Tripathi, VB Dixit, D Kumar, S Singh	IRC	Apr 2018- Mar 2020
5.	Effect of supplementation of galactogogue herbal mixture to lactating buffaloes on production performance and blood biochemistry	N Saxena, P Sikka,V Mudgal, ML Sharma, K Kumar	IRC	Aug 2017- Mar 2020
6.	In vitro evaluation of efficacy of certain aflatoxin detoxifying agents	R Singh	IRC	Jan 2019- Dec 2021
7.	Development of feeding module for increasing health promoting fatty acids in milk and reducing methane production in buffalo	A Dey, SS Dahiya	IRC	Apr 2018- Mar 2021
8.	Development and supplementation of nano-minerals in buffalo	V Mudgal, N Saxena, SS Dahiya	IRC	Sep 2017- Aug 2020
9.	Buffalo sperm dosages in relation to its functional parameters and field fertility outcome	S Singh, P Kumar, Jerome A, RK Sharma	IRC	Mar 2018- Apr 2020
10.	Climate Change and buffalo farming in India: risk assessment and vulnerability - adaptation studies for enhancing the resilience	AK Balhara, SK Phulia, RK Sharma, A Boora, PC Lailer, A Dey, V Nayan, S Balhara, S Kumar	IRC	Jun 2017- May 2020
11.	Genetic improvement of Murrah buffaloes (Network project CIRB, Hisar Centre)	KP Singh, A Bharadwaj, P Kumar,	NWP – ICAR	Jul 1991- Contd
12.	Genetic improvement of Nili Ravi buffaloes (Network project, CIRB Sub-Campus Nabha Centre)	S Kumar, FC Tuteja, MH Jan, R Mehta	NWP – ICAR	Apr 1990- Contd
13.	Performance recording and improvement of Bhadawari buffaloes (IGFRI centre)	BP Kushwaha, IGFRI: SB Maity, Sultan Singh	NWP – ICAR	Apr 2001- Contd
14.	Progeny testing of bulls under field conditions (FPT) (CIRB Hisar)	A Bharadwaj, VB Dixit,	NWP – ICAR	Apr 2001- Contd
15.	National Agricultural Innovation Fund (Institute Technology Management Unit	SK Khurana, Sanjay Kumar, AK Balhara, Dharmendra Kumar, A Jerome, Raj Kumar Chaudhary	ICAR	Apr 2008- Contd
16.	Diversified farming through livestock and agriculture – Farmers First Programme	**CIRB:** S Yadav (wef Jan 2, 2019) KP Singh (upto Jan 2, 2019), A Boora, S Singh **CCSHAU:** Bharat Singh Sunita, Satpal Baloda **IARI:** Manjeet Singh **IASRI:** Anil Kumar, Sukanta Dash	ICAR	Feb 2016- Mar 2020

Sr. No.	Project Title	Project Workers	Funding Source	Duration
17.	Nutritional and physiological interventions for enhancing reproductive performance in animals	RK Sharma, SK Phulia, V Mudgal, Jerome A, P Kumar	AICRP	Nov 2014-Mar 2020
18.	Development of early pregnancy diagnostic assay through discovery of biomarkers in cattle and buffalo	AK Balhara, Varij Nayan, SK Phulia	DBT	Jun 2018-May 2021
19.	Molecular markers for improving reproduction of cattle and buffaloes-CIRB Centre (Lead Centre – NDRI, Karnal)	V Nayan, RK Sharma, A Bharadwaj, Rajesh Kumar	BMGF	Jul 2018-Jul 2023
20.	An integrative trancriptomics and DNA methylomics approach to understand the dynamic features of biotic stress responses associated with mastitis in buffaloes (Network Project on Agricultural Bio-informatics - CABin)	**CIRB:** V Nayan, SK Phulia, A Bharadwaj **IASRI:** MA Iquebal, D Kumar, Sarika	ICAR	Jan 2019 - June 2020
21.	Production of myostatin gene edited buffalo bulls using system	N Selokar	DBT	Jan 2019-Jan 2022
22.	Production of multiple copies of buffalo bulls using animal cloning technology – Lead Centre	PS Yadav, N Selokar, D Kumar, RK Sharma, P Kumar, R Kumar	NASF	Apr 2018-Mar 2022
23.	Diversified uses of Azolla	**IARI :** G Abraham, P Jaiswal, **CIRB:** V Mudgal, SS Dahiya	ICAR	May 2018 – March 2020
24.	Reproductive Performance of Murrah Buffaloes in Relation to Milk Production	S K Phulia, RK Sharma, A K Balhara, A Bhardawaj, Sunesh, KP Singh	IRC	Feb.,2020 to Jan., 2023
25.	Survey and dissemination of knowledge for hygienic AI practices for enhancing buffalo fertility.	Jerome A, MH Jan, VB Dixit, RK Sharma	IRC	July 2019-Dec 2020
26.	Reproductive Performance of Murrah Buffaloes in Relation to Milk Production	S K Phulia, RK Sharma, A K Balhara, A Bhardawaj, Sunesh, KP Singh	IRC	Feb., 2020 to Jan., 2023
27.	Molecular analysis of methanogenic archaeal diversity in rumen of Murrah buffaloes fed different diets	S Yadav, SS Dahiya, PC Lailer, A Dey, A Boora, SK Khurana	IRC	Restarted from 20.12.2019 to Dec 2022
28.	In vitro evaluation of efficacy of certain aflatoxin detoxifying agents	R Singh	IRC	Jan 2019-Dec 2021
29.	Assessment of newly developed Sorghum cultivar on milk production and nutrient utilization in Buffalo	**CIRB:** A Dey, PC Lailer, SS Dahiya, **IIMR:** AV Umakant, VA Tonapi	IRC	May 2019 - April 2020
30.	Evaluation of Quality Protein Maize in the ration of Buffaloes.	V Mudgal, N Saxena, SS Dahiya	IRC	Sept 2020 - Aug. 2021
31.	Evaluation of feed additives on growth rate, nutrient utilization and methane production in buffalo calves.	**CIRB:** A Dey, PC Lailer, Jerome A, SS Dahiya, **IVRI:** Putan Singh, A K Verma	IRC	July 2020 to Aug. 2021

Sr. No.	Project Title	Project Workers	Funding Source	Duration
32.	Climate Change and buffalo farming in India: risk assessment and vulnerability - adaptation studies for enhancing the resilience	AK Balhara, SK Phulia, RK Sharma, A Boora, PC Lailer, A Dey, V Nayan, S Balhara Sanjay Kumar	IRC	June 2017-May 2020
33.	Testing and validation of pregnancy diagnosis kit (PregD) in Mithun	AK Balhara, SK Phulia, RK Sharma, (Vikram R, MH Khan, Mitra A)	ICAR	Nov. 2020-Oct. 2022
34.	Network Project on Agricultural Bioinformatics And Computational Biology Under Cabin Scheme Title: Immunoreagent design, drug discovery and -omics approaches for buffalo production and reproduction ICAR Project	**CIRB:** V Nayan, SK Phulia, Rajesh Kumar **IASRI:** MA Iqebal, Ratna Prabha **NRCE:** A Bharadwaj	ICAR	July 2020-June 2025
35.	Investigating molecular basis of seasonal variation on seminal attributes for identification of probable biomarkers of semen quality in buffaloes (DBT funded multi-institutional project)	Pradeep Kumar Dharmendra Kumar, Jerome A (Lead centre-NDRI, Karnal)	DBT	Sept. 2020-Aug. 2023

Trainings / Institutional Activities

1. Workshop/seminars/summer institute/farmers day/field visit/ milk recording etc. organized at the Centre.

Training workshop on 'KRISHI' Portal in collaboration with ICAR-IASRI, New Delhi at CIRB, Hisar from February 26-27, 2020.

Coordinators: IASRI: S Dash & S Sarkar CIRB: Navneet Saxena & VB Dixit

Date	Event	No. of Participants	Venue
21.01.2020	Goshthi on Buffalo clean milk production	32	Badi Nyangal
23.01.2020	KisanGoshthi	18	B. Nyangal
03.02.2020-05.02.2020	Milk competition (18 buffaloes participated)	100	Badi Nyangal
05.03.2020	SCSP training	35	Badi Nyangal

36th Foundation Day Celebration

A 5-day program was organized to commemorate 36th Foundation Day of the institute which was concluded on 5 February with the Kisan Mela and seminar. About 300 farmers participated in this program. Dr. BS Punia was the chief guest and Dr. Yashpal Sharma, Director NRCE Hisar was special guest. A milk competition was also organized in MGMG adopted village BadiNyangal, Tehsil Rajgarh, Rajasthan. Steel buckets were distributed to 100 progressive buffalo farmers under the field progeny program. Punjab National Bank Sacha Kheda also set up its stall on the occasion. The Farmers First Project has also contributed on the occasion in which 100 belcha were distributed to progressive farmers.

Vigilance Awareness Week -2020

Vigilance Awareness Week was organized from 27th October to 02nd November 2020 at ICAR-Central Institute for Research on Buffalo, Hisar. On the first day of the week, the employees of the institute and their children participated in the poster making competition and the message of removing corruption was highlighted. The next day employees of the institute participated in an essay competition on the subject 'Vigilant India, Prosperous India'. Dr. Satbir Singh Dahiya, Director, administered a pledge of vigilance to all the employees on 29.10.2020 at 11.00 AM and appealed the staff of the institute that all people should be sincere and alert in every sphere of life. In continuation, the Director administered the oath of unity on the occasion of National Unity Day on 31.10.2020 in the premises of the Institute. On the last day of the program Dr. Navneet Saxena, the Vigilance Officer gave a lecture on vigilance and discussed with all the employees how to be vigilant or increase vigilance in all kinds of activities of the institute. In the concluding programme the prizes were distributed to the winning contestants by the Director. During all these programs guidelines for COVID 19 was followed such as social distancing and use of masks to protect against corona.

Poster making competition

Administration of integrity oath

Essay competition on “Vigilant India, Prosperous India”

Gathering during presentation by Vigilance Officer on the final day

Distribution of prizes to winning contestants in essay writing and poster competitions

Farmers Training Programs organised

Farmers Training Programs organised

Sr. No.	Date	Title	Number of Participants	Coordinators
General Training Programs on buffalo farming organized by ICAR-CIRB Main Campus Farmers First Project (FFP)				
1.	4-13 March, 2020	Scientific buffalo production and farm diversification	86	Ashok Boora Bharat Singh
2.	5-7 November, 2020	Online training	20	Ashok Boora, S Yadav
Trainings organized under SCSP Program				
1.	13-15 October, 2020	Improved buffalo husbandary	35	VB Dixit, Saxena N and M L Sharma
2.	6-8 October, 2020	Scientific buffalo Husbandry	24	Sajjan Singh, Sunesh, Sarita
3.	19-23 December, 2020,	Buffalo Husbandry and Dairying at Village Kajla, Hisar	20	S K Phulia, R K Sharma, Jerome and Vishal Mudgal
4.	17-20 March, 2021	Buffalo Husbandry and Dairying at ICAR CIRB, Hisar	25	Ram Singh and Guru Raj
5.	13-17 March, 2020	AICRP SCSP Sub-Plan के अंतर्गत ''भैंस पालन में कौशल विकास प्रशिक्षण''	20	Dr. RK Sharma, Dr. SK Phulia, Dr. V Mudgal, Dr. Jerome A
6.	19-26 February, 2020	''वैज्ञानिक विधि से भैंस पालन'' under SCSP	--	CIRB, Nabha
7.	09 March, 2020	"Diseases in Animals" on the topic "Prevention, care of diseases and control of ecto endo parasites in dairy animals".	--	KVK, Rauni, Patiala

Outreach Programs organized

Sr. No.	Date	Details	Venue	Number of Participants	Scientists Involved
Front line demonstrations/Trainings/Camps/Kisan Gosthis/Miscl. at farmers' doorstep					
1.	15/10/2020	organized womens day t0 create awareness among the participants about improved buffalo husbandry	15th October at Bari Naygal (Rajasthan).	70	V. B. Dixit, Saxena N and M L Sharma
2	30/12/2020	Mastitis detection	TSP adopted villages Kherar, Udaipur	50	S K Phulia A K Balhara, Sunesh
3	31/12/2020	Preg-D: Pregnancy Diagnosis		10	
4	31/12/2020	Internet use	NRC Mithun, Jharnapani, Nagaland NEH	40	S K Phulia, A K Balhara
5	22/03/2021	Preg-D		4	

Mera Gaon Mera Gaurav-2020

No. of Team of Scientists	No. of Scientists	No. of Villages	No. of Blocks	No. of Districts
06	24	26	11	06 (Haryana+ Rajasthan + Punjab)

Table -1: Activities organised by CIRB – Hisar under MGMG

Sr. No.	Name of Activity	No. of Activities Conducted	No. of farmers participated & benefitted*
1	Visit to village by teams	24	401
2	Interface meeting/ Goshthies	3	136
3	Training organized	8	217
4	Demonstrations conducted	24	311
5	Mobile based advisories (No.)	628	628
6	Literature support provided	383	383
7	Awareness created	23	612
8	Input support provided (q)	14	120
	Total	**1107**	**2808**

*Many farmers are common in various events/activities organised

Milk competition organized in the MGMG village to commemorate institutes' foundation day

Training on “Unnat Bhains Palan” 03-10 February, 2020, CIRB, Hisar

Distribution of Swachhta Awareness Posters to the Anganwadi workers at Naloi village

Training on “Scientific buffalo Husbandry” under SCSP from 19th – 26th February., 2020 at CIRB, Sub Campus, Nabha for the farmers from MGMG Village.

Republic Day Celebration

Independance Day Celebration

Foundation Day & Kisan Gosthi

Milk Competition

SCSP Training Programme

Training on Improved buffalo husbandry organized at on campus & off campus

Training on Improved buffalo husbandry

Vigilance awareness week

ICAR Research Data Repository for Knowledge Management

Swacchta Abhiyan

Academic and Reseach Collaborations

University/Institute/Organisation entering in MoU with ICAR-CIRB Hisar	Scope of Collaboration	Date of MoU
Rajasthan University of Vetrinary and Animal Sciences, Bikaner (Rajasthan)	Academics (UG teaching and PG research) and Research	18.05.2019
Hitech Sach Dairy, Sirsa (Haryana)	Biotechnological reserch – buffalo cloning	02.01.2019
Nanaji Deshmukh Veterinary Science University, Jabalpur (M.P.)	PG Research	01.09.2018
Bihar Animal Sciences University, Patna (Bihar)	Academics – UG teaching and PG research	05.07.2018
Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar (Haryana)	Academics (UG teaching and PG research) and Research	09.05.2014

Patents

Application/ 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 and Inderjeet Singh
1840/DEL/2013	BUFCOL-A complete diet for enhanced survivability & growth of neonatal buffalo calves	Granted on 21.11.2019	P Sikka, D Lal, S Khanna, RK Sethi
Filed			
1451/DEL/2015	Kalrump Scale - A device to measure Buffalo rump angularity for identification of dairy characters	07.01.2017	SN Kala
201711039431	Process for improving riverine buffalo sperm viability and uses thereof	06.11.2017	Ravindra Kumar, Jerome A, Pradeep Kumar, Monika Saini, Dharmendra Kumar, Rakesh Kumar Sharma and Inderjeet Singh
201711046302	Composite feed additive for reducing methane emission and improving fibre utilization in ruminants	22.12.2017	Avijit Dey, SS Paul, SS Dahiya, AK Balhara, Jerome A, BS Punia and YM Chanu
202011013074	Urine based pregnancy detection method for ruminant livestock animals.	25.3.2020	AK Balhara, Suman, Archana, Rajesh Kumar, Mayukh Ghosh , SK Phulia, RK Sharma, P Sikka, Sunesh Balhara, Sudershan Kumar, AK Mohanty, Inderjeet Singh and SS Dahiya

Success Stories

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

AK Balhara, Suman, Sunesh, SK Phulia, RK Sharma and AK Mohanty

Pregnancy diagnosis is an important intervention in achieving high lifetime productivity from dairy animals. A non-pregnant animal is a burden on the farmer and therefore it should be identified at the earliest and bred immediately. The Preg-D kit is the prototype of a urine based novel technique for pregnancy diagnosis in dairy animals which has been developed at the ICAR-Central Institute for Research on Buffaloes, Hisar under the multi-institutional project 'Development of early pregnancy diagnostic assay through discovery of biomarkers in cattle and buffalo' funded by the Department of Biotechnology, Govt. of India.

The kit utilizes a simple thermophilic biochemical colour reaction in urine to diagnose pregnancy and can be performed by any literate person. The method works on cyclization of multiple embryonic growth-related urinary metabolites containing carboxylic acid group. The cyclization leads to formation of coloured lactone ring compounds. Reagent A is a proton donating agent, activated by reagent B. The protons (H+ ions) initiate and the heating step fastens this cyclization process. In the end step, Reagent C intensifies the colour and precipitates out this the lactone complex. Colour intensity is highest at around day 150 till end of pregnancy and this has been confirmed by measuring intensity at wavelength 665nm.

Preg- D bovine pregnancy diagnosis kit

The kit does not require any instrumentation to read results - interpreted by seeing development of colour. 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. Since the method requires a specific temperature to accomplish cyclization, customized heat blocks were sourced locally. The heat blocks can be operated on home supply electricity as well as car battery.

The method and kit are suitable for pregnancy diagnosis after completion of estrous cycle in cows/buffaloes. Considering that the pregnancy establishment biological process in bovine is complete around day 40 post insemination, the method (and hence kit) gives high accuracy around days 30-40 of pregnancy. However, the kit is sensitive and can preliminarily diagnose pregnancy as early as day 18 in majority of animals. For better accuracy of results, test should be repeated after 12-15 days. Tested in over 1000 samples, the kit has an overall accuracy, sensitivity and specificity of about 80%, 90% and 77%.

Success Stories

Establishment of cryobank of primary somatic cells of elite buffaloes

Seema Dua, Sonu Bansal, Naresh L. Selokar, Dharmendra Kumar,
R K Sharma, Pradeep Kumar, Rajesh Kumar, Prem Singh Yadav

Recent advances in cryobiology allow the cryopreservation of any type of cells, including germ cells; however, the cryopreservation of somatic cells (fibroblast cells) is straightforward due to easy tissue biopsies and less labor intensive establishment of culture and non-requirement of complex culture conditions. Earlier, primary somatic cells have successfully been cryopreserved in farm animals such as cattle, sheep, goat, pig and horse, but not in buffalo. In India, among farm animals, buffalo is an important farm animal species that provides milk, meat, and draught power and considered as 'Black Gold'. India owns the best buffalo breeds such as Murrah and Nili-Ravi, which are famous all over the world for its potential to produce a high quantity of milk. Keeping in view the importance of buffalo breeds, we established a somatic cells bio-bank at ICAR-CIRB, Hisar. At present, we have finite somatic cells line derived from tail-skin biopsies of 26 elite male and female buffaloes of three breed including cloned animal somatic cells (Table 1).

Table 1 Cryobanking of primary fibroblast-like cells of elite buffaloes.

Female

Buffalo breed	Buffalo identification/No	305 d or less MY (kg)	PY (kg)	Sex	Number of cryovials stored
Murrah	Mu 4462	4045	23.4	Female	80
	Mu 4316	4765	23.9	Female	45
	Mu 4978	3872	15.8	Female	45
Nili-Ravi	NR 460			Female	80
	NR 900	2689		Female	50
	NR 822			Female	50

Male

Buffalo breed	Buffalo identification/No	Dams best lact 350 or less days yield (kg)	Sex	Number of Cryovials stored
Murrah	M- 29	4600	Male	50
	Mu 2501	3053	Male	50
	Mu 2594	3557	Male	50
	Mu 2565	3287	Male	60
	Mu 2383	4636	Male	70
	Mu 2558	3574	Male	50
	Mu 4354	3605	Male	70
	Mu 4093	3040	Male	60
	C263	4600	Male	50
	C264	4600	Male	50
	C265	4600	Male	45
	C266	4600	Male	50
	C267	4600	Male	50

Buffalo breed	Buffalo identification/No	Dams best lact 350 or less days yield (kg)	Sex	Number of Cryovials stored
	C268	4600	Male	40
	C269	4600	Male	45
	C270	3605	Male	50
Nili-Ravi	NR 480	4050	Male	60
	NR 507	3089	Male	45
	NR 252	3743	Male	55

The informative data such as buffalo details (breed, date of birth, sex, and age at the time of tissue biopsy collection, and production traits), the number of cryovials stored, and freezing dates were recorded in an electronic file and a printed inventory record. The established somatic cells were flat, spindle-shaped morphology, and expressed vimentin (a fibroblast-like cell type marker) and the negative expression of cytokeratin-18 (an epithelial cell type marker) shown in Figure 1. Altogether, we cryopreserved 1350 cryovials (0.1 million cells per vial) from two buffalo breeds, namely Murrah and Nili-Ravi for future applications. We have also checked the utility of these cells to produce cloned buffaloes using somatic cell nuclear transfer (SCNT) technique.

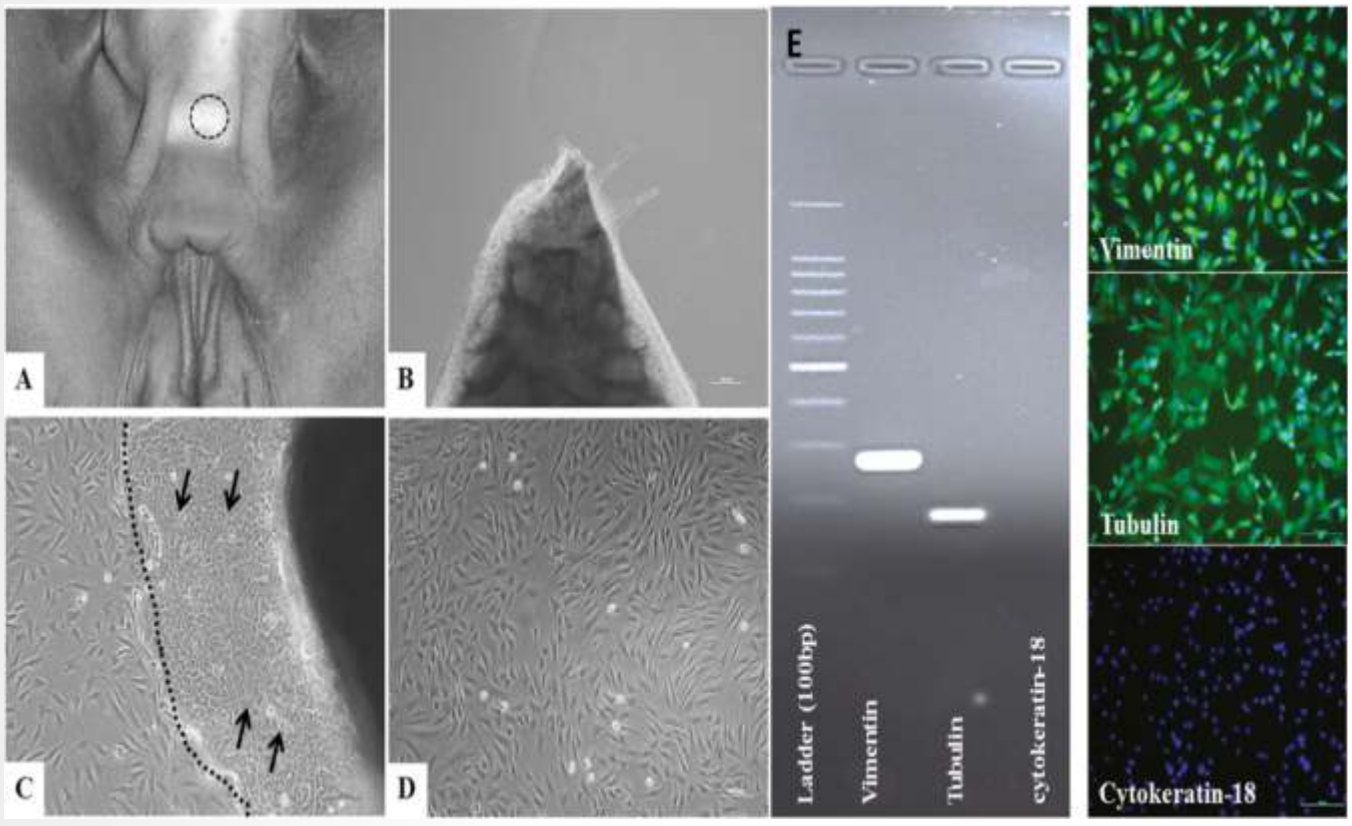

Fig. 1 Isolation, culture and characterization of skin tissue derived buffalo fibroblast cells for bio-banking.

Importantly, these cryopreserved somatic cells are made available to scientific communities for their utilization in cell-based research. For accessing these cells and informative associated data, a written request needs to submit via email to Director, ICAR-CIRB, Hisar on director.cirb@icar.gov.in. The guidelines of the government of India will be followed for supplying these cryo-banked somatic cells.

SPECIAL EVENTS ORGANIZED

Event	Coordinator(s)/ Key Person(s)	Date	Venue
Observance of Constitution Day Celebrations	Jerome A and V Nayan	26 November, 2020	ICAR-CIRB
Mini-symposium on Recent Developments in Buffalo Research	PS Yadav, D Kumar and Naresh L Selokar	08 October, 2020	Zoom online
Kisan Gosthi Frontline demonstration Animal Health Checkup camp	SK Phulia, AK Balhara, Sunesh, Chandershekher, and Harikesh Meena	29 December, 2020	Zoom online
Kisan Gosthi	SK Phulia, AK Balhara, Sunesh, Chandershekher, and Harikesh Meena	30 December, 2020	TSP adopted villages Kherar, Udaipur
Animal Health Checkup camp	AK Balhara, SK Phulia, Sunesh and Chandershekher	30 December, 2020	TSP adopted villages Kherar, Udaipur

Recognition and awards

Name of Scientist (s)	Details of award	Date
Fellowship		
Dr. Pradeep Kumar	ICMR-DHR fellowship	14.01.2020
Scientific Society/Bodies Awards		
Dr P S Yadav Dr Dharmendra Kumar Dr Naresh Selokar Dr R K Sharma Dr Pradeep Kumar	Nanaji Deshmukh ICAR Award for Outstanding Interdisciplinary Team Research 2019 for Animal Sciences & Fisheries	16.07.2020
Journal Award		
Dr Jerome A	Certificate of Excellence in Reviewing – International Journal of Tropical Disease and Health	17.07.2020

Distinguished Vistors

Name of Visitor	Organisation	Dates/Duration
Sh. Ranbir Gangwa	Deputy Speaker, Haryana	28.07.2020
Sh. Om Parkash Dhankhad	Minister of Agriculture, Govt. of Haryana	29.07.2020
Prof. Chhattarpal Singh	Minister Govt. Of Haryana, Chairman, Chamber of Intellectual, Haryana.	01.10.2020
Dr. Vallabh Bhai Kathuria	Chairman, Rashtriya Kamdhenu Aayog, Govt. of India, New Delhi.	24.10.2020
Maj. Gen. Shrikant	SM, VSM (Retd.) President, National Academy of Veterinary Sciences. Former Vice-Chancellor, LUVAS, Hisar	24.10.2020
Sh. Gautam Sardana	Municipal Corporation, Hisar	30.12.2020

A. Student Completed Research 2020

Sr No	Name of the scholar	Degree	Subject/Discipline	University	Year	Advisor Major/Co-Major	Title of the thesis
1	Diksha	Ph.D.	Vety. Physiology	LUVAS, Hisar	2018-20	Dr. Ashok K Balhara	Evaluation of infrared thermography for monitoring udder health in buffaloes
2	Ajit Verma	Ph.D.	Vety. Reproduction Gynaecology and Obstetrics	LUVAS, Hisar	2018-20	Dr. S.K. Phulia	Seasonal comparison of progesterone-based protocol for induction of estrus and fertility in buffaloes under farm and field conditions
3	Eias Elzein Ibrahim Osman	Ph.D.	Veterinary Medicine (Theriogenology)	Sudan University of Science & Technology, Sudan.	2018-20	Dr RK Sharma	Evaluation of Ovarian Potential for In vitro Embryo Production in Indian Buffalo at Haryana State, India.
4	Amit Kumar	M.V.Sc.	Vety. Gynaecology and Obstetrics	LUVAS, Hisar	2019-20	Dr. Jerome A.	Deciphering peripheral IGF-1 variation across age-groups and the effect of seminal IGF-1 supplementation on sperm functionality in male buffalo
5	Sandeep	M.V.Sc.	Vety. Physiology	LUVAS, Hisar	2018-20	Dr. Avijit Dey	Evaluation of dietary cottonseed oil and eucalyptus leaf meal supplementation on milk fatty acids profile, methane production, nutrient utilization and production performance of Murrah buffalo
6	Arjun V.	M.V.Sc	Vety. Gynaecology and Obstetrics	LUVAS, Hisar	2019-20	Dr. D Kumar	Study on the role of seminal plasma, mitochondrial targeted antioxidant and mitochondrial uncoupler to mitigate 'dilution effect' in buffalo semen

Student Completed during 2020

Amit Kumar	M.V.Sc.	Animal Reproduction (VGO)	LUVAS, Hisar	2019-20	Jerome A	Deciphering peripheral IGF-1 variation across age-groups and the effect of seminal IGF-1 supplementation on sperm functionality in male buffalo
Dr MA Vakil	PhD	Veterinary Physiology	LUVAS, Hisar	2020	P S Yadav	Studies on epigenetic characteristics of somatic cells in water buffaloes
Dr Arjun V	M.V.Sc.	Animal Reproduction	LUVAS, Hisar	2020	Dharmendra Kumar	Study on the role of seminal plasma, mitochondrial targeted antioxidant and mitochondrial uncoupler to mitigate dilution effect in buffalo semen
Dr Ajit Verma	Ph.D.	Animal Reproduction	LUVAS, Hisar	2020	SK Phulia	Seasonal comparison of progesterone -based protocol for induction of estrus and fertility in buffaloes under farm and field conditions

B. Student Ongoing Research 2020

Sr. No.	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-till date	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 till date	Dr. Naresh Selokar	CRISPR-based manipulation of the CD18 in cultured fibroblast cells of buffalo (Bubalis bubalis)
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	Rajesh Kumar	Ph.D.	Veterinary Gynaecology and Obstetrics	LUVAS, Hisar	2018-till date	Dr. R.K. Sharma	Hormonal interventions for improving post-partum fertility in Murrah Buffaloes
5	M. Naveen Swaroop	Ph.D.	Animal Biochemistry	NDRI, Karnal	2019-till date	Dr. Varij Nayan	Prognostic blood miRNA and lncRNA during estrous cycle of buffalo
6	Prashant Kumar	Ph.D.	Animal Biochemistry	NDRI, Karnal	2020-till date	Dr. Varij Nayan	In vitro studies on the effect of silver and silica nanoparticles on the steroidogenic and apoptotic pathway in cultured buffalo granulosa cells
7	Pushpanjali Singh	M.Sc.	Animal Biochemistry	NDRI, Karnal	2020-till date	Dr. Varij Nayan	Serum metabolites and minerals profile during buffalo estrous cycle
8	Devender Kumar	PhD	Animal Reproduction (VGO)	RAJUVAS, Bikaner	2020-21	Dr. Jerome A	Deciphering the seasonal variation in semen functional and biochemical attributes in buffalo bulls
9	Dr. Mala Singh	PhD	Animal Physiology	NDRI, Karnal	Continue.. (temporary dropped)	Dr. SK Phulia	Proteomic evaluation of uterine and vaginal cytology during early pregnancy in buffaloes.

ICAR-CIRB Personnel

General Administration

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Shri Ravinder	Administrative Ofûcer
Smt Shammi Tyagi	Fin. & Accounts Ofûcer
Shri Joginder Singh	Private Secretary
Shri Narender Kumar	Asst Adm. Officer
Shri Rajesh Kumar	Asst Adm. Officer
Shri Girdhari Lal	Asst Adm. Officer
Shri Viksit Kumar	Assistant
Shri Abdul Majid	Assistant
Shri Ashok Kumar	Assistant
Smt Indira Devi	Upper Div. Clerk
Shri Satbir Singh	Upper Div. Clerk
Shri Dharam Pal	Lower Div. Clerk
Shri Sunil Kumar	Lower Div. Clerk
Shri Mahabir Singh	Lower Div. Clerk
Smt. Savita	Lower Div. Clerk

Sub- Campus, Nabha, Patiala

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Dr. Mustafa Hasan Jan	Scientist
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Sh. Rajiv Mehta	Chief Tech. Officer
Shri RS Pippal	Asst. Chief Tech. Officer
Dr. AK Saini	Senior Tech. Officer
Shri Daljit Singh	Tech. Officer
Shri Mohan Singh	Tech. Officer
Shri Tejinder Singh	Upper Div. Clerk

Transferof Technology and Entrepreneurship (TOTE) Unit

Dr. VB Dixit	Principal Scientist & In-charge
Dr. Hema Tripathi	PrincipalScientist
Dr. Sajjan Singh	PrincipalScientist
Shri Gopaldat Tiwari	Technician

Priority Setting, Monitoring and Evaluation (PME) Cell

Dr. SK Khurana	PrincipalScientist (w.e.f. 18.06.2019)
Dr. Sanjay Kumar	Senior Scientist
Dr. Dhramendra Kumar	Senior Scientist
Smt. Sunesh	Scientist
Dr. Naresh Seloakr	Scientist
Sh. Raj Kumar	Asst. Chief Tech. Officer

Network Project on Buffalo Improvement (NPBI)

Dr. Satbir Singh Dahiya	Project Coordinator (B)
Dr. K P Singh	Principal Scientist & In-charge
Dr. BP Kushwaha	Principal Scientist (at IGFRI, Jhansi)
Dr. Sanjay Kumar	Sr. Scientist (at CIRB, Nabha)
Sh. Ram Chander	Technical Officer

Animal Nutrition & Feed Technology (ANF&T) Division

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Dr. Navneet Saxena	Principal Scientist
Dr. Ram Singh	Principal Scientist
Dr. Avijit Dey	Principal Scientist
Dr. Vishal Mudgal	Senior Scientist
Dr. Sarita Yadav	Scientist
Dr. Gururaj M	Scientist
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Shri Krishan Kumar	Asst. Chief Tech. Officer

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

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Public Information (PI)

Dr. RK Sharma	CPIO, Hisar
Dr. Mustafa	CPIO, Nabha
Sh. Ravinder	Transparency Officer
Sh. Rajesh Kumar	Nodal Officer

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

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Dr. Hema Tripathi	Pri. Sci., Nodal Officer
Dr. A. Dey	Pri. Sci., Nodal Officer (w.e.f. 11.05.2020)
Dr. Jerome A.	Scientist, Co-Nodal Officer

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Academic Coordinator	
Dr. Ashok Kumar Balhara	Senior Scientist
Dr. Sanjay Kumar	Senior Scientist

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Dr. A Bharadwaj	OIC (w.e.f. 01.06.2020)
Shri BP Singh	ACTO In-charge, Estate
Shri Rajesh Prakash	STO In-charge, Electrical

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Shri Ramchander	Tech. Officer & In-charge
Shri Kuldeep Singh	Tech. Officer
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Shri Sant Lal	Tech. Officer
Shri Satpal	Tech. Officer
Shri Ram Kumar	Senior Tech. Assist.

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Sh. Surender Singh	In-charge
Shri Baljeet Singh	Technical Officer
Shri Satish	Senior Technician
Shri Jagdeep	Technician

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Dr. Jerome A	Scientist

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

Hindi section	
Dr. Vishal Mudgal	Senior Scientist
Shri Dharampal	LDC

Vigilance Officer	
Dr. Navneet Saxena	Principal Scientist

Animal Farm Section	
Dr. Anurag Bharadwaj	Overall In-charge
Sh. AKS Tomar	In-charge
Dr. Rajesh Kumar	Senior Technical Asst.

Landscape Section	
Shri AKS Tomar	ACTO & In-charge

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