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Annual Report
2014-15

ICAR- Central Institute for Research on Buffaloes
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Preface

Buffalo epitomizes the 'Made in India' quality that is the pride of the country. Nature and generations of farsighted breeders have gifted the country with diverse, versatile and highly productive buffalo breeds. Each one is bestowed with virtues to endure vagaries of diverse climates, survive on local vegetations, and yet yield high quality fat, solids, minerals and vitamins rich milk. Lately, such superior germplasm has been in the national and international news for its qualities, multi-million price tags, besides buffalo meat earning the distinction of being the largest exported agricultural commodity. This provides the country with opportunity to 'Make in India' the top notch buffalo germplasm for domestic and international market.

Towards this end, the ISO-9001-2008 certified ICAR-Central Institute for Research on Buffaloes has been striving through development of technologies for exploiting the potential of various buffalo breeds as well as to disseminate the latest known-how to stake holders for its practical adoption. During the year under report, the institute strived for further improvement in the performance of its herds of Murrah and Nili Ravi, setting new records of milk production in both the herds. Frozen semen production of Murrah scaled new heights with a further increase over last year's record production, same being true for Nili Ravi. Dissemination of superior Murrah germplasm in the form of breeding bulls has seen a surge – poised to benefit the buffalo farmers in far off places. Phenomic and genomic repository of various breeds has been enriched. A new digital in-house developed tool for judging the performance of individual buffalo is being tested for its authentication in Murrah and Nili Ravi animals.

The institute's stronger commitments and capabilities got expressed with the grant of FAO-IAG certificate in feed analysis. The progress in application of hand-made cloning technique for multiplication of elite animals has shown promise, the quest for early pregnancy molecule of diagnostic value is closer to realization, benefits of embryo transfer technology are being harnessed. Similarly, economic feed formulations for optimizing age at first calving in heifers and growth of surplus male calves for meat production, development of chelated minerals and identification of methane producing microbial populations and strategies for its mitigation remained in focus during the year. Initiatives were taken for validating the indigenous technical knowledge for predicting estrus and in the control of gastro-intestinal parasites. Another milestone included various prestigious national and international awards and recognitions won by institute scientists with their contributions in diverse fields of research.

Zest of all efforts of the institute scientists and staff is percolation of laboratory research to the end-user for its ultimate utility. In this regard, a record number of trainings were organized for farmers, scientists, field veterinarians and other stake-holders in the institute as well as at many other places. Drought advisories were shared with field veterinarians in ten workshops in different districts for implementation in the face of scant monsoon rains. One village was adopted in Rajasthan to undertake field progeny testing and four villages in tribal belt of Udaipur district were adopted for implementation of tribal sub plan. Trainings, field visits and surveys have been conducted to assess the needs and accordingly, required inputs have been listed for dissemination. Realizing the limitations of the institute in its penetration into the vast field, information technology based initiatives have been strengthened with the launch of *'e-bhains gyan kendra'* as well as *'Whatsapp'* for dissemination of latest information and knowledge into the target groups. The *'Buffalopedia'* has been enriched with more pertinent information and is being updated on a regular basis, in addition to use of the mass media.

This has been possible with the sagacious guidance and support from the Council and dedication of scientists and staff of the institute, which is hoped to be further strengthened in the years to come for discharging our commitments to the nation.

Inderjeet Singh
Director

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Executive Summary

- In Murrah progeny testing programme, of Network Project, bull 1693 from LUVAS, Hisar ranked first with sire index of 2320.39 kg, followed by bull No. 2045 from GADVASU, Ludhiana with sire index of 2320.29 kg.
- During the period under report, 4129 Artificial insemination (AI) with the 6 test bulls of 14th set and 15 test bulls of 15th set were performed in ten adopted villages. The conception rate in the field was 52.75%. Ninety three progenies calved and the average age at first calving was 42.20 months. Monthly test day milk recordings are in progress. During the year, 52 daughters completed lactation.
- Total 1, 27, 209 semen doses of Murrah buffalo bulls were frozen. Total 37,416 doses of frozen semen were supplied to network project, FPT units and other agencies. 57,761 semen doses were sold and Rs. 13, 67,881 revenue was generated by sale of frozen semen of Murrah bulls.
- Thirty eight breeding bulls of Murrah and three Nili–Ravi were sold to various states and developmental agencies for breeding and improvement of buffalo germplasm in the country.
- The overall wet average (8.25kg) and herd average (5.77 kg) in Murrah herd was reported highest since inception of the institute that revealed an improvement of 3.0 and 16.15 percent, respectively, as compared to the performance in 2013-14.
- The 305 days lactation milk yield and total lactation milk yield of Murrah buffaloes during 2014-15 reported as 2355 and 2502 kg, respectively, revealed significant improvement of 2.79 and 4.51 percent as compared to last year performance.
- The overall conception rate during the year January to December 2014 was 52.34 percent, improved as compared to the previous year conception rate (51.22 %). The other reproductive traits such as age at first calving (AFC), service period and calving interval were observed 42.84 months, 168.43 days and 472.92 days, respectively. The AFC was reported lowest since inception of the project and service period and calving intervals reflected improvement of 11.58 and 4.44 percent as compared to the 2013-14 performance.
- In Nili-Ravi herd, the overall wet average, herd average, 305 days milk yield, and total lactation milk yield were reported as 8.48 kg, 5.98 kg, 2384 kg and 2464 kg, respectively, which revealed an improvement of 2.79, 12.41, 6.38 and 7.27 percent, respectively, over the performance of 2013-14 and these values were the highest ever for this breed.
- In Nili-Ravi Buffaloes, the reproductive traits includes service period, calving interval and AFC were observed 112 days, 420 days and 39.9 months, respectively During the period under report, the overall calf mortality (0.70 %) was lowest since inception of the project.
- A total of 498 blood DNA samples of Murrah and Nili-Ravi buffaloes and related phenomics records were added to the database repository.
- A total of nine flushing were carried out. 13 embryos were recovered of which 10 were viable. These 10 embryos were transferred in 9 recipients. Four frozen embryos were also transferred in four recipients. Four pregnancy from fresh embryos were established and are due for calving.
- Protocol was developed to super-ovulate anovular buffaloes that are otherwise normal and elite using progesterone implant.
- In buffalo cloning, two semen donating bulls were targeted and somatic cell lines from tail and seminal plasma of bull were established and characterized using vimentin and keratin marker. Tail derived cells were fibroblast type, where seminal plasma derived cells were epithelial type. Established cells were used for production of cloned embryos, and embryo production rate was 40%. Six blastocyst stage embryos of tail-derived cells of bull (Mu-4354) were transferred into 6 recipient animals, three recipients were found pregnant at day 30. Out of three pregnancy established, one got aborted and remaining two pregnancies are maintained at 6 months.
- For detection of early pregnancy biomarker in buffalo, MX2 was found a pregnancy biomarker protein detected in urine before start of next estrous cycle.

- Ablation of dominate follicle prior to super-ovulatory treatment in buffalo enhanced the super-ovulatory response, and increased recovery of viable embryos.
- Endogenous level of osteopontin in buffalo seminal plasma was estimated and ranges from 6- 30 pg/ml. This protein is potential biomarker for assessment of bull fertility.
- Egg yolk based extender can be replaced with soya lecithin and liposome based extender for cryopreservation of buffalo semen.
- In vitro development and gene expression patterns of buffalo in vitro fertilized embryos generated in the defined SOFaa system were better than those generated in undefined serum supplemented medium, TCM-199, mCR2aa.
- Expression of HSP70 gene was found to be higher in acyclic and cyclic buffaloes during summer as compared to winter season.
- Economical and more efficient calf starter was prepared using precision feeding technique (use of lysine and methionine) which leads to about 20% enhancement in growth rate and simultaneously 10% reduction in the cost of feeding as compared to conventional calf starter feeding.
- Use of improved feeding regimen enhanced average daily gain (539 vs. 532g) with reduction in age of first calving by 22 days (26 months vs. 26 months and 22 days) in Murrah buffalo heifers.
- Area specific mineral mixture under TSP scheme was developed for tribal villages of Slumber Tehsil, Dist. Udaipur, Rajasthan.
- Substantial host specificity in community structure of archaea was reported between cattle and buffaloes. Population of *Methanobacterium*, *Methanomicrobium* and *Methanosphaera* were substantially different in these two host species. These findings may open new directions for further exploration of rumen fermentation pattern in buffaloes.
- The institute organized 14 infertility and health camps in the villages during the period. The buffaloes were examined for various reproductive health and infertility problems using ultrasonographic evaluation of uterus and ovaries. PBN Farmers Training Centre, Sucha Khera supported the activities of health camps in the villages.
- Three trainings on artificial insemination, one skilled development training for A I workers and one training for field veterinarians on "Ultra-sonography" were organized. Total 44 unemployed rural youth were trained for A I and 20 field veterinarians were trained to monitor the status of uterus and ovaries with ultra-sonography.
- Total eight trainings on "Improved Buffalo Husbandry and Nutrition" were organized during the year. 617 farmers including women farmers benefited from the training.
- Four calf rallies were organized in villages adopted under FPT project. Hundreds of farmers participated along with their animals.
- Three buffalo melas were organized at main campus, Hisar and Sub-campus Nabha. About 2000 farmers from Haryana and Punjab participated in the melas. CIRB honored farmers who contributed for the conservation of superior Murrah and Nili-Ravi buffalo germplasm, improvement in productivity and created awareness in the villages for maintaining elite and superior quality buffaloes.
- ICAR-CIRB made efforts to increase agriculture farm land arable under fodder production. During the year under report, Institute has developed about 170 acres land of Agriculture Farm to meet the requirement of fodder and grains production for animal feeding.
- Agriculture farm production at Nabha and Hisar campus reported record yield of 6967 quintals of grains (wheat/ Barley/ Rice/ oats). Similarly 83806 quintals green fodder and 4598 quintals of wheat straw were produced at the two campuses.

Introduction

Central Institute for Research on Buffaloes (CIRB) was established by transfer of erstwhile Progeny Testing Bull Farm, Hisar from the Haryana State Government, to the Indian Council of Agricultural Research in the year 1985. Available infrastructure, land, assets and buffalo herd of the Progeny Testing Bull Farm were transferred to the CIRB and the institute started functioning from 1st February 1985.A sub-campus was established in December 1987 at Bir Dosanjh, Nabha, District Patiala, Punjab with the transfer of Nili Farm from the Punjab State Government.The Main campus has established a highly pedigreed breeding herd of the world famous buffalo breed Murrah whereas sub-campus has established a highly pedigreed breeding herd of Nili-Ravi buffaloes. The institute carries out research on various aspects of buffalo improvement including conservation, improvement and propagation of germplasm, development of optimum diets and feeding systems, enhancement of reproductive efficiency and management practices for augmenting milk, meat and draught performance of the species.

The Vision

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

The Mission

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

The Mandate

- To promote and undertake research on all aspects of buffalo production.
- To establish nucleus breeding herds of important buffalo breeds.
- To act as a repository of information on all aspects of buffalo production and development.
- To collaborate with national and international institutes in the area of buffalo research and development.
- To undertake extension activities for technology transfer.

Table 1 : Staff position as on 31/03/2015

Staff Category	Sanctioned Strength	Filled	Vacant
Scientific	41	32	9
Technical	44	36	8
Administrative	20	18	2
Skilled Support	71	68	3

Priority setting and management

The institute has a Research Advisory Committee (RAC) comprising of eminent scientists who guide research agenda of the institute. The functioning of the institute is supervised by Institute Management Committee (IMC) headed by the Director and members drawn from different institutes and related agencies.A number of sections like Priority Setting, Monitoring and Evaluation (PME) Cell, Result Framework Documentation (RFD) Cell, Institute Technology Management Unit (ITMU) and Agricultural Knowledge Management Unit (AKMU) have been created and assigned responsibilities for smooth functioning of research activities at the institute. Specific research activities are managed through three subject matter divisions viz. Animal Genetics and Breeding, Animal Nutrition and Feed Technology and Animal Physiology and

Reproduction. For the XII plan period flagship programs and priority areas were identified following detailed discussion with scientists, RAC and stake holders to focus on strategic research in niche areas. The institute is coordinating Network Project on Buffalo Improvement with 10 centers across the country, addressing seven important buffalo breeds. The institute is also carrying out technology transfer through conducting trainings for farmers, field days, web based extension activities besides traditional methods of extension in order to disseminate modern buffalo husbandry practices based on research and development in the area through its Transfer of Technology and Entrepreneurship (TOTE) unit.

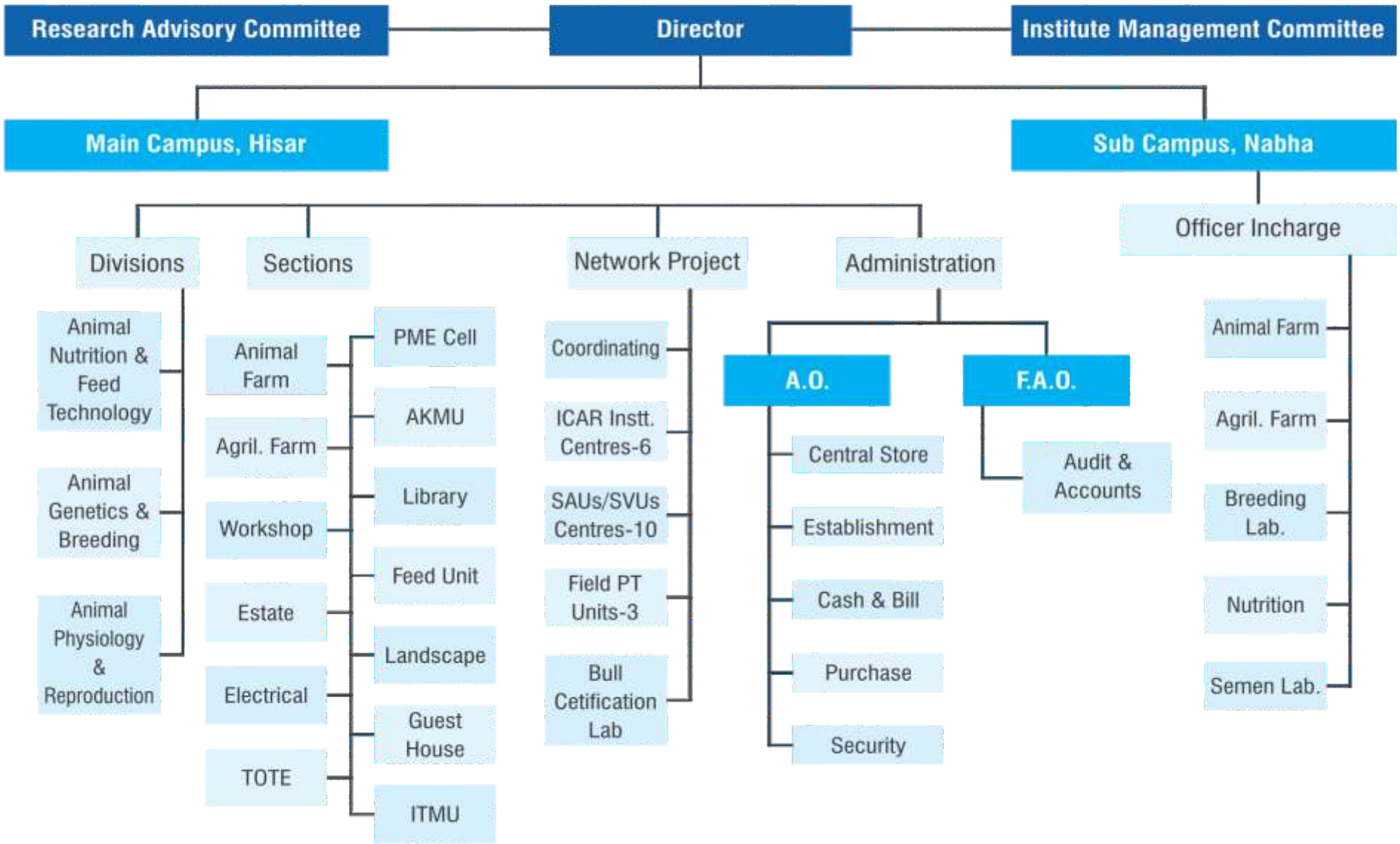
Financial Statement (2014-15)

The details of fund allocation and actual utilization under various schemes/projects including revenue receipts for the year 2014-15 are given in the Table below.

Table 2 : Financial Outlay 2014-15 (Rs. In lacs)

Head	Sanctioned Budget 2014-15	Expenditure 2014-15
Plan 2014-15	277.00	275.84
Non-Plan 2014-15	2039.00	2019.27
Network Project on Buffalo Improvement	400.00	394.71
AICRP on Nutritional and Physiological Interventions	19.50	15.35
IPR & Commercialization of technology	5.50	3.63
NAIP Project (Comp. – I)	8.80	7.98
NFBSFARA Project	7.86	6.17
DBT Project	2.95	2.95
Bioinformatics Project (CABin)	6.70	0.00
Elanco Project (April 2012 to March 2014)	168.42	156.82
Revenue Receipts	----	**356.83**

Organizational Setup



Research Achievements
Genetic Resource Improvement

NETWORK PROJECT ON BUFFALO IMPROVEMENT (NWPBI)

The NWP (B) was initiated in 1993 with the aim to produce progeny tested bulls for improvement of buffaloes across country Seven important buffalo breeds are covered under eighteen (funded/non funded/ICAR/University based) centres. Conservation of Bhadawari, Swamp and Nili-Ravi breeds are going on along with improvement. In 2001 field progeny testing programme in Murrah was initiated at CIRB, Hisar, NDRI, Karnal and GADVASU, Ludhiana with the aim to produce more number of daughters per bull for evaluating sires with more accuracy.

Genetic Improvement of Murrah Buffalo

Test mating from 15 bulls (6 bulls from CIRB Hisar, 5 bulls from GADVASU Ludhiana and 4 bulls from NDRI Karnal) of 15th set was initiated in June 2014 and will continue upto December 2015 for genetic improvement under the Network Project on Buffalo Improvement through progeny testing.

Progeny Test Evaluation of Bulls

Data of daughters born from the 10th set of bulls which completed 1st lactation were compiled and bulls were evaluated with BLUP method (Harvey, Model-8) Bull no. 1693 from LUVAS, Hisar top ranked with sire index of 2320.39 kg followed by bull no 2045 from GADVASU, Ludhiana having sire index of 2320.29 kg.

Top Ranking Bull No. 1693	
Number	1693
Location	LUVAS, Hisar
Born On	27-10-2003
Dam No.	1050
Best Yield (kg)	3194
Av. Yield (kg)	2803/3 (2270)
Sire No.	392 (PT)
No of semen doses available	2016

Table 3 : General Herd information of the Participating Murrah Herds in 2014-15.

Centre	Herd Strength	Breedable buffaloes	Percent Calf Mortality (0-3 months)	AI	Conception	CR %
NDRI, Karnal	540	270	11.86	368	152	41.3
CIRB. Hisar	520	232	9.19	363	190	52.34
GADVASU, Ludhiana	251	133	12.99	183	62	33.88
LUVAS, Hisar	269	139	8.2	294	114	38.8
IVRI, Izatnagar	173	77	1.54	102	53	51.96
LRS, Mamnoor	110	60	0.0	48	23	57.5

CIRB, Hisar centre achieved higher 305 days or less standard lactation milk yield compared to 2013-14. The performance of LUVAS centre is highest for wet average and GADVASU centre recorded highest standard lactation milk yield among all the centres.

Average age at first calving reduced at all the centers and it is lower than the values of 2013-14 for respective center.

Table 4 : Production Performance of Participating Murrah Herds in 2014-15

Centre	Av. Lactt. Yield Kg.	N	Av. Lact Length (days)	N	305 days days or less milk yield (kg.)	N	Av. Peak yield (kg.)	N	Wet. Av. (kg)	Herd Av. (kg.)
NDRI, Karnal	2486.3	119	305	119	2223.6	124	12.86	124	8.05	5.1
CIRB. Hisar	2501.7	110	313	110	2354.7	110	11.26	110	8.25	5.77
GADVASU, Ludhiana	2949	46	353	46	2674	46	14.84	46	7.97	4.98
LUVAS, Hisar	2653.4	62	300	62	2584.4	62	12.9	62	8.70	5.6
IVRI, Izatnagar	2189	53	289	53	2136	53	10.89	53	6.8	4.49
LRS, Mamnoor	16.18	11	303	11	1626.45	11	7.38	34	5.9	3.36

Table 5 : Reproductive Performance of Participating Murrah Herds in 2014-15

Centre	Average Age at First Calving (months)	N	Average Service Period (days)	N	Average Dry Period (days)	N	Average calving Interval (days)	N
NDRI, Karnal	40.39	35	134.71	71	111.45	40	420.97	40
CIRB. Hisar	42.84	61	168.4	88	149.3	88	472.9	88
GADVASU, Ludhiana	38.6	23	160	40	185	40	513	41
LUVAS, Hisar	43.6	33	118	69	120	39	423	39
IVRI, Izatnagar	37.64	18	123.8	55	162.3	44	439.5	44
LRS, Mamnoor	---	---	141	34	198	34	462	34

Table 6 : AI done at Murrah FPT centres and females born during 2014-15

Centre	AI done	Total Pregnant	No. of Calving	Female Born	Male Born
CIRB	4129	1993	1093	528	565
GADVASU	8316	3810	2958	1447	1511
NDRI	3941	1556	1860	905	955

Table 7 : General Herd Performance of Participating Herds of other Breeds In 2014-15

Centre	Herd Strength	Breedable buffaloes	Calf Mortality in % (0-3 months)	AI	Conception	CR %
Nili Ravi, CIRB Sub Campus, Nabha	493	178	0.81	429	169	39.39
Surti, LRS Vallabhnagar, RAJUVAS	133	44	7.78	55	21	38.18
Pandharpuri, Kolhapur, MPKV	77	34	5.88	30	16	53.33
Jaffarabadi, Junagarh, JAU	288	151	0.00	155	58	57.5
Bhadawari, Jhansi, IGFRI	102	53	14.71	44	22	50.00
Swamp, Khanapara, AAU	71	41	22.22	20	12	60.0

Table 8 : Production Performance of Participating Herds of other breeds in 2014-15

Centre	Av. Lactation Yield (kg.)	N	Av. Lactation Length (days)	N	305 day or less day milk yield (kg)	N	Av. Peak Yield (kg)	N	Wet. Av. Kg	N	Herd Av. (kg)	N
Nili Ravi, CIRB Sub Campus Nabha	2464	119	2464	119	2384	115	12.38	115	8.48	99	5.98	140
Surti, LRS Vallabhanagar RAJUVAS	1493.4	41	1493.4	41	1444	41	9.71	41	4.69	---	3.22	---
Pandharpuri, Kolhapur, (MPKV)	1421.3	12	1421.3	12	---	---	7.04	12	4.57	7	2.12	22
Jaffaradbadi, Junagarh (JAU)	2397	37	2397	37	2096	37	11.8	37	7.38	33	3.01	82
Bhadawari, Jhansi (IGFRI)	1639	21	1639	21	1478	21	7.33	21	4.22	28	2.5	44
Swamp, Khanapara (AAU)	724.13	2	724.13	2	301	1	3.0	2	0.7	6	0.21	19

Table 9 : Reproductive performance of Participatng Herds of other breeds in 2014-15

Centre	Average AFC (months)	N	Av. Service Period (days)	N	Av. Dry. Period (days)	N	Av. calving Interval (days)	N
Nili Ravi, CIRB Nabha	39.9	36	122	88	138	88	420	88
Surti, RAJUVAS	47.01	10.	162	18	177	10	446	10
Pandharpuri, Kolhapur, (MPKV)	44.32	2	109	10	108	10	429	10
Jaffarabadi, Junagarh (JAU)	46.6	5	140	30	177	30	450	30
Bhadawari, Jhansi (IGFRI)	53.97	15	182	15	216	15	534	15
Swamp, Khanapara (AAU)	63.33	10	458.33	4	256	4	774	4

Field Progeny Testing

Under field progeny testing program (FPT) at CIRB Hiasr, 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 April 2014 to March 2015, 4129 AI with the 6 test bulls of 14th set and 15 test bulls of 15th set were performed in ten adopted villages. The use of 15th set was initiated from July 2014. The conception rate in the field was worked out to be 52.75%. In this period 1993 pregnancies were confirmed and 1093 calving (565 males, 528 females) were recorded. Ninety three progenies, 1 of 10th, 39 of 11th, 52 of 12th and 1 of 13th set were also calved and the monthly test day milk recordings are in progress. The average age at first calving for these 93 daughters calved was 42.20 months. During the year, the monthly test day milk yield was recorded for 138 daughters, out of which 52 daughters completed the lactation, 20 daughters sold before the lactation was completed and recording of 66 daughters are in progress. The physical identification using injectable microchips have been done in all female progenies born in the field. As on 31st March 2015 a total of 904 female progenies of 11th to 14th set are available in the field for future milk recordings, out of which 289, 546 and 69 daughters were less than 1 year, 1 to 3 years and more than three years, respectively.

Performance of Murrah Herd

The overall wet average (8.25 kg) and herd average (5.77 kg) were reported highest since inception of the project in 2014-15 and revealed an improvement of 3.0 and 16.15 percent, respectively, as compared to the performance of 2013-14. The 305 days lactation milk yield and total lactation milk yield during 2014-15 was reported 2355 and 2502 kg, respectively, revealed significant improvement 2.79 and 4.51 percent as compared to last year performance. The overall conception rate during the year January to December 2014 was reported 52.34 percent, improved as compared to the previous year conception rate (51.22 %). The other reproductive traits viz. Age at first calving, service period and calving interval were observed 42.84 months, 168.43 days and 472.92 days, respectively. The AFC was reported lowest since inception of the project and service period and calving intervals improved @ 11.58 and 4.44 percent as compared to the 2013-14 performance.

During the year 2014-15, sixty one heifers calved and thirty seven daughters completed their first lactation. The overall Calf mortality was reported 9.19 % and overall buffalo mortality for all age groups in CIRB herd was reported 5.38 percent.

Performance of Nili-Ravi Herd

Total herd strength of Nili-Ravi buffalo was 467 and 126 calves (56 males and 68 females) added due to birth during 2014-15. The overall wet average, herd average, 305 days milk yield, and total lactation milk yield reported: 8.48 kg, 5.98 kg, 2384 kg and 2464 kg, respectively, which revealed an improvement of 2.79, 12.41, 6.38 and 7.27 percent, respectively, over the performance of 2013-14. The reproductive traits Viz. service period, calving interval and AFC were observed 112days, 420days and 39.9 months, respectively during April 2014 to March 2015. The overall calf mortality (o.70 %) was lowest since inception of the project. Total 31474 semen doses of Nili-Ravi buffalo were frozen and 23325 semen doses were disseminated in Nili-Ravi buffaloes farm, Nabha and in field.

Table 10 : Performance of Murrah and Nili-Ravi buffalo herds during 2014-15

Sr. No.	Traits	Murrah Herd Hisar	Nili-Ravi Herd Nabha
1	305 days or less milk yield (kg)	2355	2373
2	Total Lactation Milk Yield (kg)	2502	2447
3	Wet Average (kg)	8.20	8.42
4	Herd Average (kg)	5.64	5.96
5	Age at First Calving (months)	42.38	39.9
6	Calving Interval (days)	472.92	420.0
7	Service Period (days)	168.43	112.0
8	Calf Mortality (%)	9.19	0.70
9	Conception Rate %	52.34	39.5
10	Semen doses produced	1,27,209	31474
11	Semen doses disseminated	95,177	23325
12	Bulls sold	38	3

Analysis of Production Performance of Murrah Herd

For performance appraisal of production traits (total lactation milk yield, 305 days or less milk yield, peak yield, lactation length, dry period, service period and calving interval) of Murrah buffaloes calved during the year 1993 to 2012 and maintained at Animal Farm section, CIRB, Hisar, were analyzed under P G research by least squares method using mixed model. Data was grouped according to year of calving (four years in each group), season of calving (summer: April to June, rainy: July to September, autumn: October-November and winter: December to March) and parity (1 to 5). All the production traits significantly influenced by year and season of calving and parity. Highest milk production traits were reported for buffaloes calved during the years 2009 to 2012 and in winter season. Present findings also indicated that the buffalo calved during 1993 to 2008 revealed no improvement in productivity, but from 2009 onwards significant improvement reported in total lactation milk yield, 305 days or less lactation milk yield, and peak yield. The reproductive traits viz. service period and calving interval mean across period of calving, season of calving and parities was reasonably consistent, except first parity and year of calving during the period of 1993 to 1996.

Germplasm Conservation and Dissemination

Total 15 Murrah young bulls tentatively selected as future breeding bulls and 6 superior males were selected for test mating of 15 set. A total 1,27,209 and 31,474 semen doses of Murrah and Nili-Ravi bulls, respectively were frozen and 95,177 and 24,637 doses, respectively were disseminated under network project in farmers' herds. 41 breeding bulls were sold to different agencies during 2014-15.

Table 11 : Performance of Murrah Herd at CIRB-Hisar from 1993 – 2012

Variables	No.	Least Squares Mean± SE for Production Traits			
		TLMY (kg)	305DMY (kg)	PY (kg)	LL (day)
Parity 1	657	1927.48±25.42	1810.88±25.19	8.30±0.11	342.42±4.35
Parity 2	417	2192.25±24.83	2065.06±24.63	10.04±0.11	318.94±4.28
Parity 3	256	2255.49±27.21	2128.91±26.90	10.52±0.12	298.89±4.71
Parity 4	180	2272.20±31.36	2156.88±30.88	10.78±0.14	297.61±5.52
Parity 5	127	2266.66±36.53	2142.91±35.87	10.76±0.16	300.58±6.51
Years of Calving					
1993-1996	148	2050.11±58.96	1961.75±57.59	9.62±0.27	310.16±10.73
1997-2000	356	2145.73±33.78	2031.09±33.22	9.99±0.15	304.47±5.99
2001-2004	488	2121.98±27.96	1984.51±27.62	9.59±0.13	310.44±4.88
2005-2008	355	2102.56±34.78	1961.39±34.18	9.82±0.16	318.47±6.19
2009-2012	290	2493.70±48.62	2365.99±47.56	11.38±0.22	314.89±8.81
Season of Calving					
Summer	127	2173.72±35.05	2063.60±34.44	9.95±0.16	311.82±6.25
Rainy	647	2164.39±22.63	2047.96±22.53	10.11±0.10	304.20±3.82
Autumn	429	2178.35±24.21	2043.03±24.03	9.96±0.11	308.42±4.15
Winter	434	2214.81±24.36	2089.13±24.18	10.29±0.11	322.96±4.18
Overall	1637	2182.82±20.19	2060.93±20.22	10.08±.096	311.68±3.35

Table 12 : Elite Germplasm Conservation and Dissemination during 2014-15.

Items	Murrah	Nili-Ravi
Opening balance of frozen semen doses	2,52,681	4,91,642
Frozen semen straw prepared	1,27,209	31,474
Frozen semen straw supplied / sold	95,177	24,637
Closing Balance of frozen semen doses	3,02,097	4,98,479
Breeding bulls sold	41	3

Identification of SNPs in genes related to meat production and their association with meat parameters in buffalo (*Bubalus bubalis*)

Sire-wise male and female calves (minimum 5 calves each sire) were selected from the Nili-Ravi buffalo herd of Nabha Sub-Campus. Samples were collected and DNA (n=72) was isolated for genomic studies. The monthly body weights of the calves were recorded from the Nabha Sub-campus records register. The meat parameters like pH, water holding capacity (WHC), Shear force for meat tenderness, colour (Lightness, Yellowness and Redness) and percent moisture, protein fat and ash has been carryout with the help of LPT Division, LUVAS,Hisar.

Genomic/ Phenomics Database

Updated the already existing DNA/phenomics database. Blood samples (498) of Murrah and Nili-Ravi herds from CIRB and LUVAS were collected.

Identification of genetic variants in genes related to Oxidative status in relation to fertility in Murrah bulls

Semen quality and kinetics was analysed to identify phenotype determinant for high and low semen quality and bull performance for selective genotyping w.r.t. to oxidative status. Percentdecrease in sperm kinetics parameters under cryopreservation was determined to evaluate semen quality in bulls. Estimated percent decline in post- thaw sperm velocity [VAP, VSL, VCL]; head /tail movement [ALH] and BCF were recorded in range of 16 to33, 21 to 31.8, 14 to 31.3, 15.3 to 22 and 0.33 to 3.6 percent, respectively over the studied sub-groups of animals. Three factor analysis revealed significant difference in estimated post thaw declinein sperm head size, elongation, Mass, Progressive and RAPID motility in individual animals. Post-thaw HOST sensitivity, indicating sperm cell membrane sensitivity revealed variation from 21 to 48%. Sperm motility, velocity, sperm count, color and viscosity data in sixty eight ejaculates of eight bulls over summer and rainy seasons for post thaw quality was subjected to Three factor ANOVA, correlation and Multiple Regression [path Analysis] to evaluate promising phenotype determinant for semen quality. Estimated variation in sperm kinetics over individual animals was more significant than different seasons, based on which selective genotyping of bulls will be carried out for oxidative status.

Improvement of Reproductive Efficiency

Reproduction is an important consideration in the economics of livestock production. In the absence of regular breeding and calving at the appropriate time, buffalo husbandry will not be profitable. A healthy calf each year is the usual goal and this is possible only by increasing the reproductive efficiency. To improve the poor reproductive efficiency of Buffalo, several techniques such as artificial insemination, superovulation, ovum pick-up, in vitro maturation, in vitro fertilization, cloning and embryo transfer, appropriate nutrition and hormonal intervention have been applied. Male contributes much more (64%) than the female (36%) towards expected genetic improvement of milk production between generations. Improvements in semen freezing protocols and identification of biomarkers for early fertility assessment are essential for improvement in male reproduction.

Current research focus is on the aspects of multiplication of superior germplasm using application of animal cloning and multiple ovulations with embryo transfer and in vitro fertilization. Studies on the important developmental genes in in-vitro produced and cloned embryos are being undertaken to understand the molecular mechanism in buffalo embryonic development. Research related to fertility-associated seminal plasma proteins biomarkers and pregnancy biomarkers using proteomics approach are being implemented for strategic and practical application. In this, emphasis is on identification of candidate proteins in urine and serum of buffaloes based on studies in human and bovines.

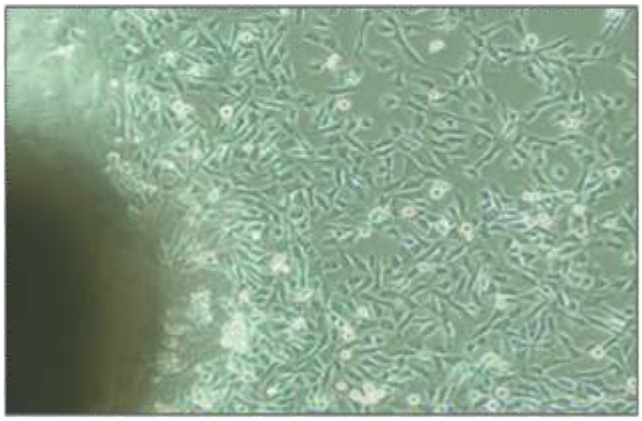
For implementation of tradition knowledge, experiments are going on to validate the 'Doka' condition in buffaloes for improvement of reproductive performance under field and farm conditions. Since nutrition plays major role in the production of dairy buffaloes, research is also being taken up on nutrition reproduction interaction. Different combinations of hormonal therapy are also being tested in cyclic and non-cyclic buffaloes in different seasons for round the year breeding.

Buffalo cloning

Currently, aim is to produce quality bulls using somatic cell nuclear transfer (SCNT) technique. For bull cloning, somatic cells from fresh semen and tail were cultured in vitro. In case of semen-derived somatic cells, fresh semen was diluted 1:5 in DPBS+ and 2.5 ml of it was layered over a column of 20, 50, and 90% Percoll (2.5 ml each) in a 15 ml Falcon tube. The Falcon tube was centrifuged at 400xg for 25 min after which contents of the 20% layer were collected and were washed 2-3 times with DPBS+ by centrifugation at 400xg for 10 min. The contents were then washed once with DMEM/F12 supplemented with 10% FBS, and were cultured in 4-well dish in the culture medium. Other somatic cells were aseptically collected from buffalo ear and tail skin tissue with the help of an ear notcher in sterile Ca2+and Mg2+-containing DPBS supplemented with 50 µg/ml gentamicin (DPBS+). The tissue was finely cut into 1-2 mm size pieces, which were cultured in 10 µl of DMEM/F12 medium (1:1 ratio), supplemented with 20% FBS, 0.68 mM L-glutamine and 50 µg/ml gentamicin in a CO_2 incubator in T-25 culture flasks. After 12 h, 3 ml of fresh medium was added to the flask to keep the attached explants submerged. The cells from the outgrowth were removed by trypsinization after they reached confluence, which usually took 5-7 days. The cells were sub-cultured and grown in T-25 flasks till they attained confluence following which they were passaged up to 10 times. Aliquots of cells at early passages (passage 2-3) were cryopreserved in

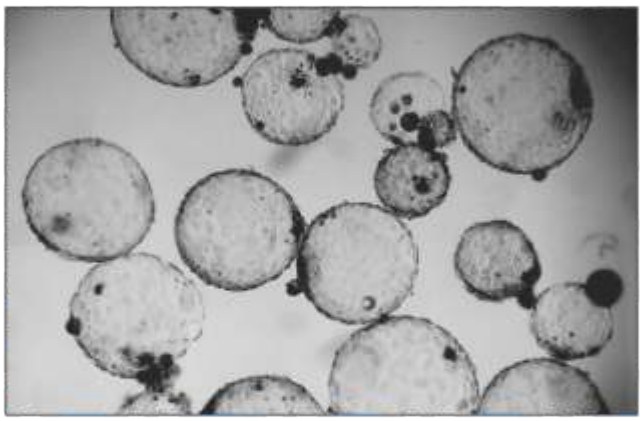
Table 13 : Effect of donor cells type on In vitro developmental competence of handmade cloned embryos

Donor Cell type	Fused Embryos/ oocytes cultured (n)	Cleaved embryos n (%)	Blastocysts n (%)	Recipient n (%)	Pregnancy status n (%)
Tail-derived cells	60	56 (93.3)	29 (51.8)	6	3 (50%)
Semen-derived cells	90	85 (94.4)	24 (28.2)	5	0
IVF (Internal Control)	983	312 (31.7)	36 (11.5)	-	-



Tail-derived somatic cells

Semen-dervied somatic cells.



Cloned embryos produced from somatic cells of Bull (MU-4354)

DMEM/F12 containing 10% dimethyl sulphoxide (DMSO) and 20% FBS, and were stored in liquid nitrogen for future use.

Further, recipient oocytes (*in vitro* maturation, cumulus/zona removal and manual enucleation) were prepared and then fusion, activation and culture of cloned embryos were performed according to established protocols in laboratory. In vitro fertilization of matured oocytes was performed according to our earlier established protocol. Details of embryos production are mentioned in Table 13.

In parallel, recipient buffaloes were prepared for embryo transfer. One cloned blastocyst was transferred on day 7/8 into ipsilateral uterine horn. Pregnancies were confirmed by ultrasonography at days 28-35. Six blastocyst stage embryos were transferred into 6 recipient animals, out of which three recipients were found pregnant. Surplus 10 cloned blastocysts were cryopreserved in LN_2. In addition, two frozen-thawed cloned blastocysts were also transferred into a recipient animal at village Jakhaldadi, Sirsa.

Superovulation and embryo transfer

Ablation of dominant follicle prior to start of super-ovulatory treatment

Super-ovulatory 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 super-ovulatory treatment also this DF suppress other subordinate follicles to grow in response to FSH treatment. This result in development of less number of pre-ovulatory follicles leading to lower ovulation and embryo production. Therefore, DF was ablated using ultrasound guided transvaginal follicle ablation assembly prior to start of super-ovulatory treatment. The technique is minimal invasive and

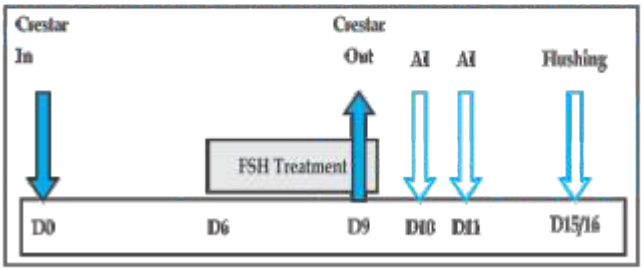
have no ill effect on animal fertility. After giving caudal epidural anesthesia (Xylocain 6ml), dominant follicle was visualized on ultrasound scanner (Esaote, Aquila Vet) connected to a 7.5-MHz micro convex array transvaginal transducer equipped with a needle guide and connected to a regulated vacuum pump (K-MAR-5100, Cook IVF Co. Australia) having a negative pressure of 60 m Hg. Super-ovulatory treatment was initiated 24 hr later using 600 mg FSH hormone in descending dose schedule between day 9-12 of estrous cycle.

The super-ovulatory response in terms of number of large follicles > 10 mm (13.87±0.87 vs 12.67±1.51) at AI, number of ovulations (5.50±0.49 vs 5.07±0.56) and viable embryo recovery (1.38±0.24 vs 0.73±0.25) was significantly higher in ablated group as compared to non-ablated group. The findings suggest that ablation of DF prior to super-ovulatory treatment is helpful in increasing the super-ovulatory response as well as availability of more viable embryos.

Protocol for superovulation of anoestrus buffaloes

High producing donors may remain acyclic for long period due to production stress. Superovulation in donors is started during high progesterone environment at mid phase of oestrous cycle. But in acyclic animals progesterone level is low and due to absence of CL animals can't be put in to superovulation program to bring them in timed heat. Hence, a protocol was developed for superovulation of anoestrus buffaloes that are otherwise normal and have a good body condition score. The protocol consist of administration of subcutaneous progesterone ear implant (Crestar, Intervet) without giving additional I/M injection to create the progesterone priming at the start of treatment (Day 0). This is followed by administration of 400 mg FSH in descending dose schedule from Day 6 for four days. Crestar is removed in the morning of Day 9. Prostaglandin injection was not injected as these buffaloes were not having CL in the ovary. Buffaloes were inseminated three times at 12 hr interval on Day 10 and 11. Subsequently, buffaloes are flushed on Day 15/16 for embryo recovery.

Four anoestrus buffaloes were super-ovulated using this protocol. The number of DF ≥10mm on the day of insemination was 14.25±5.81 and number of CLs at the time of embryo recovery was 3.00±0.91 respectively. The findings suggest development of higher number of DFs but lower ovulation rate in anoestrus buffaloes. Trials may be carried out whether GnRH may be helpful in increasing the ovulation rate. Out of four donors only one donor yielded four viable embryos (1.25±1.25). The findings suggest that anoestrus buffaloes may be programmed using progesterone implant.

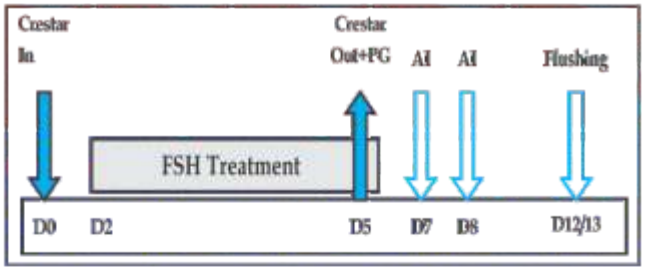


Protocol for superovulation of donors at random stage of estrous cycle

Super-ovulatory treatment requires initiation of super-ovulatory treatment at mid stage of oestrous cycle (Day 9-12), so that donors can be brought to oestrus on defined day of cycle by injecting prostaglandin at the end of treatment. This requires examination of donors and start of oestrus synchronization treatment at least 13 to 24 days before initiating the super-ovulatory treatment. This again need 10-12 days more when donors are programmed, inseminated and finally flushed for embryo recovery. This means that each donor is regularly examined/ treated atleast 23-35 days before flushed for embryo recovery. Long-time planning for such an event is difficult for such specialized technique considering the availability of manpower. Moreover, apart from donors, recipients have also to be synchronized and examined for suitability of transfer. Hence, there is need to develop protocol so that donors can be programmed, inseminated and flushed in a short span of time. A protocol was developed using progesterone implant that require minimum handling and examination of donors for superovulation.

Protocol consists of examination of donors and administration of subcutaneous ear implant (Crestar, Intervet) to all donors having a well-developed CL on day 0 of examination. A five day FSH treatment can be initiated between day 2-5 of Crestar insertion (day 0). Crestar is removed and prostaglandin injection is given on day 4 of super-ovulatory treatment. Buffaloes are inseminated 48hr after Crestar removal thrice at 12 hr interval. Embryo recovery is made on day 5/6 post-insemination. Using this protocol, only 12 to 17 days are required for programming, superovulation, insemination and embryo recovery. This protocol effectively reduces the programming to embryo recovery period by 50% as against conventional protocol.

Using this protocol a total of 9 donors was super-ovulated. The number of DF at the time of AI, number of CL detected and viable embryo recovery was 8.89±1.51, 3.11±0.79, 1.11± 0.73 respectively. The findings suggest that this protocol may be used for superovulation at random stage of cycle.



Stem cell research

Many studies suggested that placentae amniotic membrane is valuable source of stem cells in human as well as in livestock species. Advantages of amnion over other sources of stem cells included abundant availability, ethically non objectionable and non-invasive source. We have observed that both presumptive epithelial-like and fibroblast-like cells were cultured and maintained from term amnion. These cells were shown the positive expression of pluripotency markers (OCT-4, SOX-2, NANOG, TERT), mesenchymal stem cell markers (CD29, CD44, CD105) and negative for haematopoietic marker (CD34) genes at different passages. In addition, these cells were also positive for alkaline phosphatase staining. We have successfully differentiated the amniotic membrane-derived cells into adipogenic, chondrogenic and osteogenic lineages of cells in vitro. In conclusion, amniotic membrane-derived cells expressed pluripotent and mesenchymal stem cells markers and have propensity to differentiate into cells of mesenchymal lineages cell type upon directed differentiation in vitro.

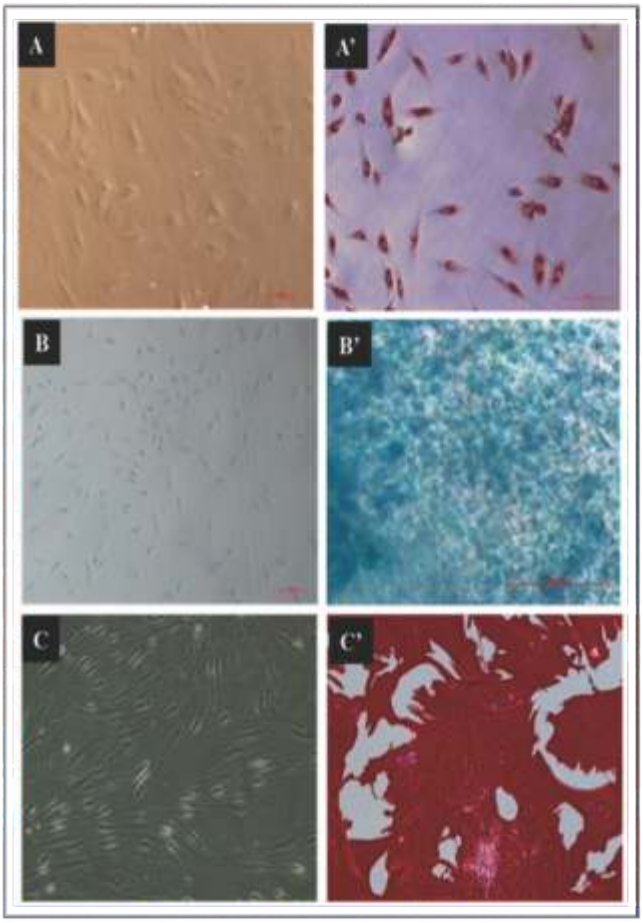


Fig. : Multipotent differentiation potential of cultured cells, (A) Non-induced control for adipogenic differentiation, (A') Oil red O positive adipogenic differentiated cells. (B) Non-induced control for chondrogenic differentiation, (B') Alcian blue positive chondrogenic differentiated cells, (C) Non-induced control for osteogenic differentiation, (C') Alizarin red positive osteogenic differentiated cells.

In addition to mesenchymal stem cells from term amnion, we also cultured the epithelial cells in buffalo. We found that cultured cells were of polygonal in shape, resistance to trypsin digestion and expressed cytokeratin-18 indicating that they

were of epithelial origin. These cells have negative expression of mesenchymal stem cell markers (CD29, CD44, and CD105) and positive for pluripotency marker (OCT4) genes indicated that cultured cells were not contaminated with mesenchymal stem cells. Immunofluorescence staining with pluripotent stem cell surface markers, SSEA-1, SSEA-4, TRA-1-60 and TRA-1-81 indicated that these cells may retain pluripotent stem cell characteristics even after long period of differentiation. Differentiation potential of these cells was determined by their potential to differentiate into cells of neurogenic lineages using retinoic acid. In conclusion, AE cells expressed pluripotent stem cell markers and have propensity to differentiate into cells of neurogenic lineage upon directed differentiation in vitro.

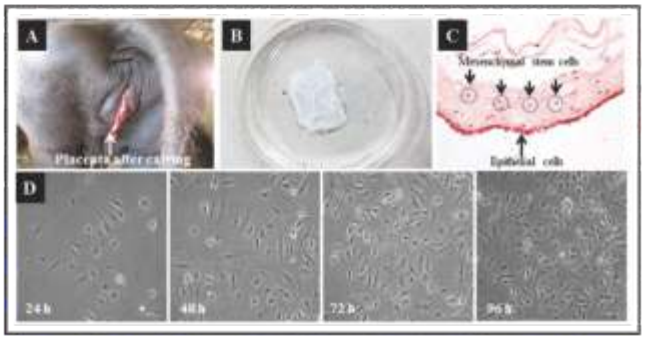


Fig. : Culture of buffalo amniotic membrane-derived epithelial-like cells. (A) Hanging placenta after calving in buffalo, (B) Amniotic membrane collected from term placenta, (C) Histo-morphology of amniotic membrane, (D) Polygonal epithelial cells at different time interval during culture.

Traditional knowledge: Scientific validation of 'Doka' in buffaloes

Field survey on 'Doka' was conducted from 200 farmers of Hisar, Bhiwani and Fatehabad districts. The frequencies were tabulated for various variables and data was analysed. Blood and milk sample were collected on 3rd/4th day of Doka expression. Fat percentage was significantly ($p<0.01$) lower in doka expressing as compared to the control animals. Whereas, no change in somatic cell count in milk and haematological parameters of doka expressing buffaloes as compared to the normal. Both ovaries were examined for follicles and corpus luteal status with real-time ultrasonography. We found that in 65% cases, there was mature CL, whereas in only 10% no CL was observed or the animals were acyclic. Ultrasound examination shows a large follicle in the Doka animals. Generally Doka appeared after 7.26±0.26 hours of milking and animal come in to estrus after 3.15±0.7 day of finishing Doka. However, Gubdoka starts 10.92±1.9 day after AI and duration was significantly ($p<0.01$) higher than the Doka.

In vitro model

In vitro development and gene expression patterns of in vitro fertilized embryos generated in the defined SOFaa system were better than those generated in undefined serum supplemented media such as TCM-199, mCR2aa.

Corpus luteum (CL) from cyclic ovaries, pregnant and CL formed post GnRH was selected and used for deep sequencing. Mature miRNA using Bowtie program and using various nc-RNA sequence databases for deducing novel miRNAs. In addition unaligned from mirBase stem loop sequences will be further used for novel miRNA prediction by aligning with mouse, human, cattle, buffalo, sheep and goat. Expression of miRNAs in corpus luteum of pregnancy differed significantly from GnRH induced CL and cyclic CL. More than 5000 and 150 conserved and novel miRNAs respectively were deduced from different reproductive stages of buffalo corpus luteum depicting the role of several housekeeping and apoptotic genes regulating corpus luteum tropism.

Summer anestrous

In an attempt to induce estrus during summer season in buffaloes, we used fabricated progesterone implants which resulted in 87.5% estrus induction (7 out of 8) with 57% ovulation (4 out of 7). It was evident that low level of progesterone have a negative impact on ovarian cyclicity in buffaloes. Circulating levels of progesterone was higher in cyclic animals as compared to acyclic animals. Similarly cortisol level in acyclic and cyclic buffaloes did not differ significantly but were significantly higher in summer than winter season. Serum estradiol

concentration in acyclic, summer and winter season differed non-significantly. Follicular hormonal profile estimation revealed significantly higher estradiol level in acyclic, summer and winter groups as compared to the respective serum estradiol levels. Furthermore the level of serum estradiol was significantly higher in cyclic animals during the pre-ovulatory periods as compared to acyclic animals. Follicular progesterone levels were also significantly higher than serum progesterone levels in all three groups. Higher E2:P4 ratio was deduced in all three groups depicting progressive follicular growth. Furthermore, gene expresion levels of aromatase, LHR, Caspase 3, BCL2 between acyclic, summer and winter were non-significant depicting the expression of genes during folliculogenesis irrespective of cyclicity and season. Similarly, folicular cell sexpressed LHR in all three groups and there was low expression of apoptotic genes. Expression of HSP70 was found to be higher in acyclic and cyclic buffaloes during summer as compared to winter group owing to its protective function in follicular environment. From these findings, the potential scope of progesterone delivery through polymers for inducing cyclicity in buffaloes is evidenced.

Early Detection of Pregnancy in Buffalo by Pregnancy Associated Proteins (PAPs)

In a study to identify and detect candidate proteins in urine & serum of and buffaloes based on studies in human and bovine, it was found that serum levels of MX2 and OAS1 increase significantly during pregnant buffaloes during 14-28 post AI. Preliminary results show that serum level of MX2 and OAS1are above 2000pg/ml and 1000pg/ml in pregnant respectively. MX2 protein is also detectable in urine during early pregnancy.

Semen biology

Endogenous level of osteopontin in seminal plasma

Osteopontin is an acidic protein, rich in aspartic acid, glutamic acid and serine. In bulls, osteopontin is secreted by ampullae and vesicular glands, indicating that the protein found in seminal plasma originates mainly from these glands. It is very interesting that this multi-functional protein is also found in the male reproductive tract and associated with fertility. For the first time endogenous level of osteopontin in buffalo seminal plasma estimated which ranges from 6-30 pg/ml.

Liposomes a better alternative to egg yolk for semen extender

Due to some limitations like wide variability of egg yolk composition, risk of microbial contamination and presence of steroid hormones, therefore demands for alternative of egg yolk in freezing extenders have increased in recent years. The alternative to egg yolk based extender (EY) can be soya lecithin based extender (SL) and liposome based extender (LP). We have compared commercially available SL and LP (IMV, L'Aigle, France) extenders with EY for post-thaw quality of buffalo semen. For comparison of post-thaw semen quality, 50 ejaculates (ten ejaculates from each bull) were collected from five Murrah buffalo bulls. The ejaculates of each bull was divided into three equal fractions and extended in EY, SL and LP, and then cryopreserved. Results showed that higher total, progressive and rapid motility were found in LP among other extenders. In vitro assessment of sperm longevity by incubation at 38°C resulted in better sperm kinetics and motility in LP in comparison to other extenders. Furthermore, sperm cryopreserved in LP travelled significantly more distance as compared to EY, SL. After considering these factors, it is concluded that the animal protein-free LP is more efficient for the cryopreservation of buffalo semen.

MX2 and OAS1 gene transcript in pregnant buffaloes

MX2 gene transcript in pregnant animals in 1.5% agarose gel.

Lane 1-100 bp DNA Ladder, Lane 2,3,4,5,6 & 7 shows 0,7,14,21 28 & 35 days of pregnancy respectively. Lane 8 represents NTC.

QaS1 gene transcript in Pregnant heifers, Non-pregnant cyclic heifers and Bulls

Lane L-100 bp ladder, Lane 1-7-413 bp of OAS1 gene in Pregnant heifers at 0,7,14,17,21,28, and 35 days, Lane 8-10- Non-pregnant cyclic heifers at 0,7 and 14 days, Lane 11- Bull (Negative control).

Effect of different feeding regimen on age at first calving (AFC)

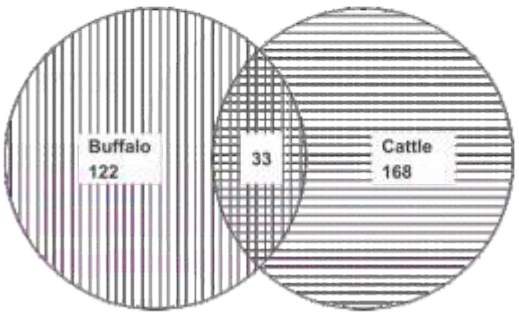
Age at first calving in buffaloes is higher than exotic or crossbred cattle which negatively affect the economic returns to the buffalo farmers. Thus reducing age at first calving in buffaloes is the prime concern, which may be helpful for cost efficiency as well as it will improve profitability and milk production of a dairy farmer as well. By taking these facts into considerations a project on "Effect of different feeding regimen on age at first calving (AFC)" in buffaloes has been taken. In which 24 heifers were divided into two groups of 12 each and fed for a period of one year as per Pal & Lal (2010) recommendations in group one i.e. control and treatment group was fed 15% higher than the recommendations. Average daily gain (ADG) was remained 532.20 and 538.90 gm in control and treatment groups respectively and average daily dry matter intake remained comparable between both the groups. Detailed data are presented in table below.

Table 14. Body weights & feeding cost in heifers

Parameters	Control	Treatment
Initial body weight (kg)	206.70	206.00
Final body weight (kg)	401.00	402.70
Net gain in weight (kg)	194.30	196.70
Average daily gain (g)	532.20	538.90
Feed cost/heifer/day (Rs)	61.00	62.10
Feed cost/kg live weight gain (Rs)	114.65	115.30
Age at sexual maturity (Days)	802	779
Weight at sexual Maturity (kg)	364.40	377.00

An integrated investigation of microbial communities involved in methane production and fibre digestion in rumen of buffaloes

A total of 1750 chimera free sequences of ruminal archaea of buffalo and 4328 sequences of ruminal archaea of cattle were identified in GenBank/RDP database dataset. The sequences from rumen content of buffalo were assigned to 1 phylum, 3 classes, 3 orders, 3 families and 5 genera while sequences from cattle rumen were assigned to 3 phyla, 5 classes, 6 orders, 7 families and 9 genera. Sequences from buffaloes were clustered into155 species level OTUs and those from cattle were clustered into 201 species level OTUs and only 33 OTUs were shared between cattle and buffaloes (Fig1). A small number of shared OTUs among cattle and buffalo datasets indicate that archaeal communities of rumen are greatly affected by host species. Proportion of *Methanobacterium* (1.2% of archaea in buffalo vs 9.9% of archaea in cattle), *Methanomicrobium* (26.7% of archaea in buffalo vs 3.7% in cattle) and *Methanospaera* (1.4% of archaea in buffalo vs 12.6% in cattle) showed differential distribution. The rarefaction estimates showed that collective sequences explained 84% coverage in buffalo and 64% coverage in cattle. The study indicated that there is substantial host specificity in community structure of archaea in cattle and buffaloes. Population of *Methanobacterium*, *Methanomicrobium* and *Methanosphaera* are substantially different in these two host species. Future studies need to be undertaken on metabolic pathways of predominant group of methanogens.



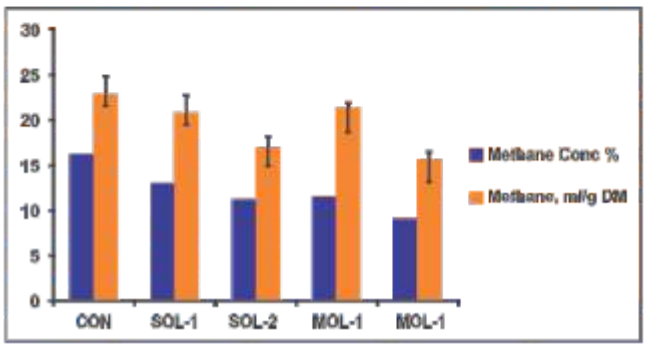
Venn Diagram at distance 0.03

Effects of Vegetable oils on *In Vitro* Rumen Fermentation and Methane Production in Buffaloes

Ruminant nutritionists are exploring various technologies to mitigate enteric methane emissions. Fat supplementation is one of the dietary interventions to decrease enteric methane emissions. However, efficacy on rumen methanogenesis varies with the concentration, type and fatty acid composition of fats or oils. Therefore, the present study was undertaken to investigate the effects of sesame (SOL) and mustard (MOL) oils on methanogenesis and fermentation pattern by *in vitro* gas production test with different doses (0, 0.4 and 0.8ml/30ml buffered rumen fluid) of each oil and 200mg of sorghum hay as substrate using rumen fluid inocula of cannulated buffalo steers.

Dosing of both the oils resulted in increased total gas production and decreased ($p<0.05$) methane production. Although, increase in gas production was higher for MOL than that of SOL, no difference in methane production (ml/g DM) was recorded between SOL and MOL at corresponding doses. But, methane concentration (%) in head space gas was lower ($p< 0.001$) in MOL than that of SOL (Fig.). Linearly ($p<0.001$) decreased degradability of DM and NDF was evident with increasing doses of oils, however, the effects were more pronounced with MOL (Table 15). The reduction in MBP and PF followed the same trend of linearity ($p<0.001$) with increased doses of oils with substantial effects in case of MOL. Acetate production was not affected, but propionate and butyrate production was increased ($p<0.05$) with addition of oils, irrespective of type and doses. The ratio of acetate to propionate (A: P) was reduced ($p<0.01$) with addition of oils, however, no difference between SOL and MOL was noted.

It is concluded that both SOL and MOL can reduce methane production; however, feed degradability is also affected with increasing doses. Mustard oil exerted greater inhibitory effects on degradability and microbial biomass production. Hence, sesame oil is better than mustard oil as methane inhibiting agent. Further studies need to be taken up to find out optimal dose and combination of oils.



Effect of sesame and mustard oils on *in vitro* ruminal methanogenesis

Table 15. Effect of sesame and mustard oils on *in vitro* ruminal methanogenesis and fermentation

Attributes	Treatments				
	CON	SOL-1	SOL-2	MOL-1	MOL-2
TDDM (%)	64.27^{c}	52.36^{b}	48.26^{ab}	47.11^{a}	44.06^{a}
NDFD (%)	52.36^{c}	36.49^{b}	31.01^{ab}	29.49^{a}	25.41^{a}
Gas prod (ml/g DM)	141.06^{a}	159.01^{abc}	151.50^{ab}	185.83^{c}	173.43^{bc}
MBP (mg/g DM)	332.38^{d}	190.48^{c}	155.97^{b}	62.31^{a}	57.01^{a}
PF	4.59^{c}	3.32^{b}	3.20^{b}	2.54^{a}	2.55^{a}
Methane Conc (%)	16.14^{d}	12.96^{c}	11.19^{b}	11.48^{bc}	8.93^{a}
Methane (ml/g DM)	22.84^{c}	20.64^{bc}	16.97^{ab}	21.28^{bc}	15.50^{a}
Acetate (mM/dl)	3.19	2.87	3.03	3.00	2.98
Propionate (mM/dl)	0.74^{a}	0.84^{ab}	0.91^{b}	0.81^{ab}	0.80^{ab}
Butyrate (mM/dl)	0.19^{a}	0.25^{ab}	0.32^{b}	0.29^{b}	0.28^{b}
A:P ratio	4.29^{b}	3.44^{a}	3.34^{a}	3.73^{a}	3.73^{a}

CON= Control, SOL-1 and SOL-2 are sesame oil and MOL-1 and MOL-2 are mustard oil (0.4ml and 0.8ml/30ml, respectively)

^{a,b,c,d} means with different superscripts within a row differ significantly

Studies on development and supplementation of chelated minerals in buffaloes

Inorganic mineral supplements commonly used in the ration of animals have several limitations in their absorption in the gastro-intestinal tract due to interactions among different minerals, thus have reduced bioavailability for animals. Use of organic minerals (minerals combined with organic molecules) may improve bioavailability of these minerals and hence remains environment friendly too. Keeping this in view, a project on development and supplementation of chelated zinc, copper and manganese in buffaloes was undertaken. Chelates of zinc, copper and manganese using different physio-chemical conditions were prepared and will be tested for their *in vivo* effect on growing buffalo calves.

Validation of ITK known herbs against GI-parasites in buffalo calves

Helminthiasis in young ruminants leads to huge economic losses. The reduced efficacy of anthelmintic drugs on resistant nematode strains, high cost of these drugs and concern of drug residues in food of animal origin, as well as environmental pollution aspects, have generated interest in medicinal plants as alternative sources of anthelmintic drugs. Therefore, a project was undertaken to validate ITK known herbs against gastrointestinal parasites in buffalo calves. Different ITK known herbs were extracted and the extracts were then fractionated on column chromatography using silica gel as the stationary phase and organic solvents of varying polarity as eluant. The fractions were collected and tested for their efficacy against these parasites. The effective extracts were then pooled and were first analysed on HPLC for standardizing the HPLC conditions in order to have the best separation. The standardized conditions were then used for prep-HPLC at NDRI karnal to get the purified fractions. Simultaneously the fractions were subjected to prep-TLC for the collection of purified fractions. The purified fractions were subjected to various spectral analysis like UV-visible spectroscopic scan and Mass spectrometry. Further these purified fractions are being tested for their anthelmintic activity to determine the active ingredient. On the other hand the extracts prepared are mixed in 11 different combinations for determining synergistic/antagonistic properties in order to find the most suitable combination for the development of herbal feed supplement/formulation.

Developed feeding module on economic calf starter using Precision feeding Approach

An experiment on feeding of calf starter using precision feeding approach on 18 young male buffalo calves (2-3 months old) in three groups for 90 days was conducted. Three calf starters with different protein levels (viz. 25.81 in Control and 21.17 & 20.14 in Treatment/supplemental groups) maintaining TDN at 72% were prepared and fed @ 1.5% of body weight. Wheat straw was provided *ad lib*, while one kg green fodder was fed daily to the each animal. The limiting amino acids viz. lysine and methionine (100 and 50; 200 and 100 g/qtl) were added at two different levels for compensating deficit of these amino acids due to reduction in protein content of calf starters. Improved growth rates (222, 247 and 267g average daily body weight gain) and saving of 10.40 on cost of feed per kg weight gain was observed in lowest protein group with desired lysine and methionine supplementation.

Development of modules for buffalo meat production

The potentialities of buffaloes as food animals to meet present and future demands of rapidly growing population deserves special attention because of its capacity to convert economically course roughages and other cereal by-products into meat. The innate potential of buffaloes, especially the value of male calves is fast gaining momentum. For obtaining optimum growth rate for production of quality meat a project is being undertaken to develop feeding modules for growing buffalo calves for meat production. Long term feeding experiment (12 months) was conducting on growing male buffalo calves (4 - 5 months age and 80 kg body weight). Eighteen calves were divided in three similar groups and fed as follows. Group -1: All forage diet comprising of green and dry fodder *ad lib*, group -2: roughage: concentrate (70:30) and group -3: roughage: concentrate (30:70). The data under the period of report revealed that average growth rate (g/h/d) of 319, 436 and 606 was achieved in three groups with dry matter intake (kg per 100 kg B. Wt.) of 2.36, 2.60 and 2.63 in group 1, 2 and 3, respectively. Overall average feed cost per animal per day over a period of nine months was Rs 19.09, 36.06 and 56 in group 1, 2 and 3, respectively. The experiment will continue till the caves will attain the body weight of 300 kg.

Development of Technologies and their Transfer to End Users

The institute has developed several technologies and transferred them to the farmers with the aim to increase the production potential and reproductive efficiency of their buffaloes. During the period under report, 109 rural youths were trained in artificial insemination, 840 farmers in Improved Buffalo Husbandry, including 233 farm women and 20 Animal Husbandry Department officials were trained in the use of Ultrasonography in buffalo reproduction. In addition, interactions were held with 438 field veterinarians in 10 districts/places of Haryana and Rajasthan to apprise about livestock management aspects under drought conditions. The developed technologies are also transferred through field visits, kisan melas, radio and TV talks and web portal based extension activities. Institute organized 14 buffalo infertility camps and animals were examined for various reproductive health and infertility problems (ovarian activities and developmental impairments) by the scientists and technical staff using Ultrasonographic evaluation of uterus and ovaries, followed by appropriate treatments with medicines provided according to the uterine health / ovarian conditions. The follow-up treatment was given to the animals as required for specific infertility problems. 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.

Area-specific mineral mixture

Surveys of feeding practices carried out in Haryana revealed that deficiencies of essential minerals like calcium, phosphorus, zinc and manganese. On the basis of analysis of mineral intake vs requirement, an area specific mineral mixture was developed. With the supplementation of this mineral mixture in the ration of anestrus buffaloes, seventy per cent buffaloes conceived within a period of 4 weeks. 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 for encouraging adoption of this technology.

Under Tribal sub Plan (TSP) Scheme, a separate Area Specific Mineral Mixture was developed based on assessment of macro and micro elements from available feeds and fodder resources in the area for adopted villages of Udaipur district in Rajasthan.

Feeding standards for different categories of buffaloes

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

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. Among 165 isolates studied, the isolate Neocallimastix sp. CF 17 showed the highest CMCase and xylanase activity in pure culture medium containing straw. Growing buffaloes fed with encapsulated culture of the fungus resulted in 20 % increase in growth rate.

Thermal stress management

Buffaloes have poor thermoregulatory system and are much vulnerable to extreme climatic conditions particularly in summers. Buffaloes are more sensitive to direct solar radiation than cattle

due to their black body color, which is conducive to heat absorption. Relatively small number of sweat glands per unit area of skin, and thick epidermal layer of the skin is a limiting factor in heat loss by conduction and radiation. Heat stress results from the animals' inability to dissipate sufficient heat to maintain homeothermy. Microclimate modifications together with supplementation of niacin @ 6 gms/day/animal, yeast @10 gms/day/animal and mustard oil @150 gms/day/animal leads to enhanced milk production of lactating buffaloes by reducing thermal stress. Another recommendation is to feed major part of ration during early morning (6-8 AM) and late night (8-10 PM) and also increasing the frequency of feeding. It is also advisable that feed partially mixed wet ration (sanni), but moisture content should not exceed 50% in total ration. Wallowing at least twice daily or water sprinkling during hot period of the day helps in heat dissipation and lessen the impact of heat stress.

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). For this purpose, a study was undertaken on mixed supplementation of xylase and cellulase(cellulase and xylanase @ 6000 and 15000IU / Kg DM of substrate) in the diet of growing calves, which resulted in increased the digestibility of DM, OM and CF digestibility. It resulted in significantly higher growth rate in supplemented group (486.42±25.28 g/d) as compared to control group (411.23±17.85 g/d). Its supplementation also increased the DMI/d in treatment group or in other word it increased the appetite. Supplemented group calves get more energy per unit of fodder and through higher DMI. However, individual supplementation of the enzymes could not reach up significant level. The inclusion level of this mixed enzyme is around 1 kg/ton of concentrate. The cost of commercial enzymes i.e. xylase and cellulose vary between the Rs 200 to 250/kg and are usually used in huge quantities in textile industry (cellulose) and paper industry (xylanse).

Urea molasses mineral blocks (UMMB)

Urea molasses mineral blocks are prepared in the same way as Uromol, except the addition of mineral mixture, salt and binder. By *ad-lib* feeding of 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 yielded even better results.

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 liters milk/day.

Scrotal circumference for bull selection

Scrotal circumference of 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. This should form an important criterion for the selection of breeding bulls.

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, which is another issue in buffalo. Through 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 improvment has resulted in almost 15 percent point improvement in post-thaw motility and improved frozen semen quality and fertility with artificial insemination.

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, abortions and repeat breeding. Such farmers can benefit by inducing these animals into lactation with induced lactation therapy. The buffalo is weighed and appropriate dose of hormones viz. Estradiol- 17b and progesterone @ 0.1 mg/kg body weight/day each, is calculated for seven days therapy, dissolved in absolute ethanol and stored. On the day of treatment, 1 ml of each hormone solution is administered subcutaneously in the morning and evening at 12 intervals, for seven consecutive days. Thereafter, on day 17, 19 and 21 of treatment, 10 ml Largectil injection and on day 16, 18 and 20, injection of 20 mg Dexamethasone are also given intramuscularly. Between 15th and 21st day of treatment, udder massage is given for fifteen minutes each in the morning and evening daily till the udder is turgid with milk, which is usually around 21st day when milking is started. The milk becomes normal in physical and chemical properties within 10 -15 days of the 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.

Embryo transfer technology

Efforts have been made in developing and improving the embryo transfer technology for buffaloes which has resulted in the production of 34 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 standardized together with the embryo cryopreservation technique. This technique utilizes oocytes obtained from abattoir ovaries followed by their *in-vitro maturation*, fertilization and culture of the resulting embryos to transferable stage. The technique of IVF is of immense use in faster multiplication of elite germplasm. The ultrasound guided ovum pick up technique in live superior dams is not found suitable in buffalo, therefore *in-vitro* abattoir oocytes for IVF or cloning may be more suitable.

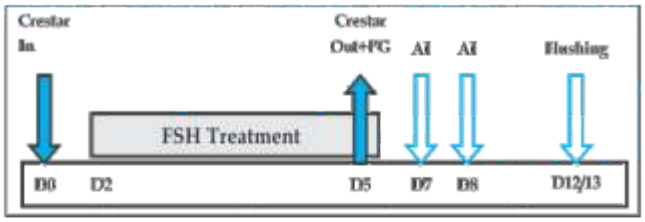
Improved protocol for oocyte vitrification

Supplementation of BSA in place of FCS in the invitro oocytes 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.

Superovulation Protocols

Super-ovulatory treatment requires initiation of treatment at mid stage of oestrous cycle (Day 9-12), so that donors can be brought to oestrus on defined day of cycle by injecting prostaglandin at the end of treatment. This requires examination of donors and start of oestrus synchronization treatment at least 13 to 24 days before initiating the super-ovulatory treatment. This again needs 10-12 days more when donors are programmed, inseminated and finally flushed for embryo recovery. This means that each donor is regularly examined/ treated atleast 23-35 days before flushed for embryo recovery. Long-time planning for such an event is difficult for such specialized technique considering the availability of manpower and inherent biological variations in

donors and their ovarian structure. Moreover, apart from donors, recipients are also to be synchronized and examined for suitability for embryo transfer. Hence, there is need to develop protocol so that donors can be programmed, inseminated and flushed in a short span of time. A protocol was developed using progesterone implant that requires minimum handling and examination of donors for superovulation. Protocol consists of examination of donors and administration of norgestomet subcutaneous ear implant (Crestar, Intervet) to all donors having a well-developed CL on day 0 of examination. A five day FSH treatment can be initiated between day 2-5 of Crestar insertion (day 0). Crestar is removed and prostaglandin injection is given on day 4 of super-ovulatory treatment. Buffaloes are inseminated thrice at 12 h intervals, starting at 48h after Crestar removal. Embryo recovery is made on day 5/6 post-insemination. Using this protocol, only 12 to 17 days are required for programming, superovulation, insemination and embryo recovery. This protocol effectively reduces the programming to embryo recovery period by 50% as against conventional protocol.

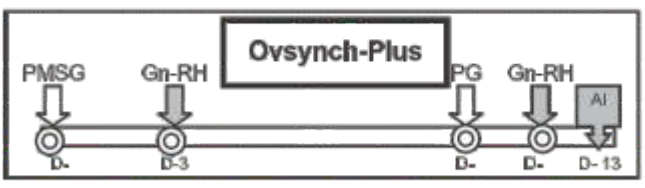


When the superovulatory treatment in buffaloes starts from day 9-12 of the estrous cycle (Day 0 = Estrus), ovary invariably contains a large dominant follicle (DF) ranging from 12- 15 mm which suppresses the growth of other subordinate follicles. During superovulatory treatment also this DF suppresses other subordinate follicles which 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 minimally invasive and has no ill-effect on animal fertility. Ablation of DF resulted in better superovulatory response, embryo recovery and establishment of pregnancies in recipients.

Ov Synch plus protocol for estrus induction in buffaloes

Anestrus, in pubertal heifers and postpartum buffaloes, is the primary cause for low reproductive and lower lifetime productivity of buffaloes. The condition is associated with the presence of static ovaries. 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 72 h later 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.

Developed Ovsynchplus protocol for estrus induction in buffaloes



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.

Method for estimation of gestational age and pregnancy diagnosis

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 through assessment of gestational age.

Fetal age can be accurately assessed for better management of pregnant buffalo at the time of calving. The length of gestation in buffalo can be estimated by following standard chart that is developed for crown-rump length of buffalo fetus on different days post insemination. When this plot was used for determining the age of fetus in pregnant buffaloes, the exact date of mating could be predicted very precisely.

Ultrasonographic fetal sex determination

Ultrasonography guided fetal 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, based on location of the genital tubercle. The technique is useful in progeny testing as well as for production of breeding bulls in bull mother farms.

Ultrasonography for monitoring ovarian activity

The non-invasive technique of ultrasonographic scanning has been standardized for monitoring ovarian activity with respect to turnover of different sized follicles, development and regression of corpus luteum, presence of cystic ovarian structure and ovarian quiescence. This technique is very useful for follicular dynamics studies. With the use of this technique, time of ovulation can also be predicted very precisely to allow fixed time insemination.the technique has helped in development of suitable protocols for ovarian function.

Production, maintenance and dissemination of superior germplasm

Institute maintains highly pedigreed herds of Murrah and Nili-Ravi buffaloes aimed at breed improvement through selective breeding particularly for the production of superior breeding bulls and bull mothers. The genetic potential as reflected in and production performance of Murrah and Nili-Ravi herds, improved from about 5 kg in 1991 to 8.42 in Nili Ravi and 8.25 kg in Murrah during 2014-15.

Nearly two lakh doses of frozen semen from test bulls and over sixty six thousand doses from progeny tested bulls are available for Murrah breed improvement. About 492 Murrah and 305 Nili Ravi bulls of high genetic merit have been supplied to various developmental agencies and village panchayats in different States for improvement of production performance of buffalo genetic resources. Under field progeny testing program in adopted villages, 21,752 AIs have been done so far with frozen semen of test bulls with conception rate about 48%.

Standardization of lactation curve

Fitting of curve was carried out on daily milk yield, recorded during 1993-2000 on animals maintained at animal farm of CIRB, Hisar, using MilkBot® a statistical model available as open source (DairySight LLC, Argyle, NY; http://milkbot.com). Raw data was compatibly formatised to achieve aforesaid curve fitment and related inference. The estimates of scale, ramp, decay and offset parameters were basic components to partition the lactation curve which control the magnitude of milk yield without changing the shape of the curve. The quantification of persistence was determined as the rate of decline in production after peak milk yield. Parametric values obtained from curve will be associated with buffalo body weight and conformation established (by Digital Images) for high merit dairy characters. The significant interference of parities, seasons and lactation stage in such partitions of lactation curves /tabulations will certainly predict the milk yield at

early stage in the shape of catalogues/ ready reckoners used to take decision on future planning, culling,screening and selection of sires.

Tongue Colour: Phenotypic Marker for Identification of Nili Ravi and Murrah Buffaloes

The data of tongue colour in Nili-Ravi and Murrah buffaloes were classified according to phenotype and genotype of tongue colour (Table). Analysis of data revealed that there is possibility of two forms of genes controlling the basic tongue colour. The pink gene is dominant over the black in Nili-Ravi buffalo. Similarly, in Murrah buffalo, back colour is dominant over pink. An animal with one of each "Heterozygous" will have gray or spotted / mixed type tongue colour, thus revealing inheritance of tongue colour, by incomplete dominance gene interaction. The genotypic frequency of tongue colour in Nili Ravi buffalo was observed 0.66, 0.28 and 0.05 for pink (BB), gray / spotted (Bb) and black (bb), respectively (Table 16). The corresponding figures for Murrah buffalo were 0.02, 0.08 and 0.90, respectively. The gene frequency for pink colour gene in Nili Ravi and Murrah buffalo was calculated as 0.80 and 0.05, respectively. The corresponding black colour gene frequency was 0.20 and 0.95 for Nili Ravi and Murrah buffalo, respectively.

The findings on tongue colour pattern revealed that pink colour in Nili Ravi buffalo and black tongue colour in Murrah buffalo are governed by dominant genes. The mix type or gray or spotted colour of tongue might be due to the incomplete dominance gene interaction, which dilutes the basic colour of tongue. The findings on tongue colour conclude that pure bred Nili-Ravi buffaloes have pink colour of tongue and pure Murrah animals have black tongue as an added breed characteristic. The mixed tongue colour (pink and black), grey, pink in Murrah and black tongue colour in Nili Ravi indicates inter-mixing in Murrah and Nili-Ravi buffalo breeds.This also indicates that breed purity is greater in Murrah as compared to Nili Ravi, which is getting diluted due to crossbreeding with Murrah/indiscriminate breeding.

Identification of molecular markers for MAS

Identified more than 30 per cent dissimilarity in high and low yielding buffalo genotypes assessed through NTSYS analysis of polymorphic amplicons of size 0.56 to 3.2 kb achieved per individual using panel of 15 RAPDs. Microsatellite having di-nucleotide repeats of twenty nucleotide base pair length has been identified which enables segregating genotypes of different level of milk production in sub-groups of Murrah buffaloes.

Table 16 : Frequency for Colour of Tongue in Nili Ravi and Murrah Buffaloes

Tongue colour types	Buffalo Breeds				Total
	Genotype	Nili Ravi	Genotype	Murrah	
Black	bb	26	BB	865	891
Gray/ Mixed/ Spotted	Bb	125	Bb	74	199
Pink	BB	296	bb	15	311

Black tongue in pure Murrah buffalo

Pink tongue in pure Nili-Ravi buffalo calves

Identification of novel SNPs in Exon 2 and Exon 3 of Leptin gene in Murrah buffalo

Genetic variation in buffalo Leptin gene sequence has been analysed in Murrah buffalo. Study revealed two novel SNPs in Exon 2 and 1 SNP in second intronic region. Association of identified unique SNPs in leptin and its receptor gene was studied with milk yield and its constituents which elucidated significant ($P < 0.05$) association of SNPs in exon 2, intron 2 and exon 3 (w1/m2/m3+mA/mB) synergism with per cent protein in milk.

Mutation leptin sequence at the nucleotide position 125 in the exon 2 lies in the restriction site of the MspI (C|CGG) enzyme generating either of two (125 and 49 bp) or single fragments depending upon position of base G. Rapid screening of buffalo population is possible by restriction typing protocol for SNP to identify subgroups of different performance levels.

For male selection is also required with respect to fertility of individual bull. In this regards, seminal acidic fluid protein gene, known to govern sperm stability and so the fertilization efficiency in cattle bulls has been partially sequenced in 35 Murrah bulls, recorded for high and low field conception rate. SNP genotyping and sequencing revealed nucleotide polymorphism across exon 4-5. Four haplotypes were identified from sequence analysis. Relation between occurrence of SNPs and mean sperm motility and other estimated semen quality parameters by CASA was analysed w.r.t. high and low conception rate bulls. Identified SNPs are suggestive markers for bulls screening w.r.t. conception rate. A sequence specific restriction site has been identified in exon IV of seminal acidic fluid protein gene. Using restriction protocols of identified enzyme, SNP typing protocol can possibly be used for rapid screening of bulls fertility.

cDNA libraries (forty clones) for small RNAs constructed from the mammary gland tissue of buffalo heifer were sequenced. Six numbers of putative micro RNA sequences in the range of 18-26 nt have been found which are partially matching with the micro RNAs of various species reported in the micro RNA database, miRBase. The identified putative miRNAs were not completely matching to the cattle genome sequences, thus considered as putative micro RNAs or micro RNA like short sequences, specific to buffaloes enriching buffalo mi RNA database.

Deep sequencing for identification and analysis of miRNAs expressed in different reproductive stages of buffalo corpus luteum which included corpus luteum from cyclic ovaries, pregnant and the CL formed post GnRH. Deep sequencing resulted in detection of more than 5000 conserved and 150 novel miRNAs from different reproductive stages of buffalo corpus luteum depicting the role of several housekeeping and apoptotic genes regulating corpus luteum trophism. Thus, the role of miRNAs was corroborated with the biological functions of different stages of corpus luteum as deduced by deep sequencing.

DNA bank

DNA repository of 3617 buffaloes has been established at the institute for genome analysis. Phenotypic data on all the animals is being collected which shall be used for establishing linkages with performance traits and identification of molecular markers.

Putative micro RNA	Match with
Clone M25	hairpin precursor sequence of Bos taurus, bta – miR23; Bovine immune related and embryonic tissue adipose tissue and mammary gland
Clone M31	miRNA of Petromyzonmarinus, an ancestral sea vertebrate
Clone M16	miRNA of human, hsa-mir-4691-3p.
Clone M33	hairpin precursor of bta-mir-339
Clone M25a	miRNA of Homo sapiens, hsa-miR-4452

Colostrum feeding for higher growth and calf survival

Higher levels of immunoglobulin get absorbed within 16 h of birth, reduce the mortality in calves and result in faster growth rate by 20-22 percent. High titer of circulating immunoglobulin's in calves at an early age of 24 h was associated with weight gain up to 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 as 48-50 mg per 100 ml.

Antioxidants in survival and growth of neonates

Advanced pregnant (270 to 280 days' gestation) buffaloes, administered two doses of antioxidant micronutrients, consisting of vit A (Palmitate), vit D and vit E (dl- alpha 3 Tocopherol acetate) at 15 days intervals within 30 days before calving, 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 starting 10 to 15 days after birth and green fodder offered after 3 weeks, in order to achieve high growth rate and survival. These calves gained 10 percent higher body weight and had 30% better immunity status, and hence more suitable for higher meat and milk production in their lifetime, as compared to unsupplemented calves born to non-antioxidant administered buffaloes.

Transfer of Technologies

The institute has developed linkages with farmers and created awareness regarding producing and rearing elite buffalo germplasm, improvement in production and reproduction efficiency and scientific buffalo husbandry practices through organizing calf rallies in eleven adopted villages, buffalo milk competitions, shows and championships held during Murrah and Nili – Ravi buffalo melas organized at CIRB, Hisar and Sub-campus Nabha. Institute participated in other extension activities in collaboration with other organizations like State Agricultural/Veterinary Universities, state Animal Husbandry Departments, and other developmental agencies like banks, etc. One Rajasthan village has been added to the list of already adopted ten Haryana villages, besides four villages in tribal district of Rajasthan.

Different types of extension activities like training programs on Artificial Insemination, Improved Buffalo Husbandry and Nutrition, training for women and drought awareness interaction meetings with the Veterinary Surgeons to mitigate drought situation in Haryana and Rajasthan were organized. The Institute also organized infertility and health care camps in field.

ICT initiatives for knowledge sharing

Apart from real time face to face interaction with various stakeholders, the institute has also embarked upon a program to disseminate buffalo husbandry knowledge and technology through the application of modern information and communication technologies (ICT). Buffalopedia (http://www.buffalopedia.cirb.res.in), an internet accessible information resource launched on the official website of the Central Institute for Research on Buffaloes provides concise information on various aspects of buffalo statistics, breeds, health, reproduction, nutrition and management aspects.

An easily comprehensible, farmer friendly digital audio-visual information dissemination platform has been devised and named 'e-BhainsVigyan Kendra (ई-भैंसविज्ञानकेन्द्र)'. This is aimed to serve asCIRB's virtual centre for training in buffalo husbandry and platform for scientist-farmer interactions. It is at www.ebhainsgyan.cirb.res.in. One audio-video based e-Lesson The process of 'Milk formation in Buffalo' has been made online at *www.ebhinsgyan.cirb.res.in*

In the same endeavour, "Whatsapp" mobile app was launched at the Institute website with cell no. 9416600631 for extension activities. Institute has also been operating toll free Helpline No. 1800-180-1043 for buffalo farmers.

Important Events and Meetings

Institute Management Committee

The XXIII meeting of the Institute Management Committee (IMC) was held at CIRB, Hisar on 26 July, 2014. Progress made by the Institute in research, infrastructure development, field activities, buffalo herd performance, agricultural farm productivity, trainings for farmers and overall organizational management including XII plan SFC administration and audit and accounts were discussed. Institute Management Committee approved the Condemnation of unserviceable items, write of losses on account of mortality and construction of trainee students Hotel were approved. The IMV also approved the appointment of part time medical office as well as constitution of grievances redressal committee.

Institute Research Committee

The meeting of Institute Research Committee (IRC) was held under the Chairmanship of Dr. Inderjeet Singh, Director, CIRB-Hisar for appraisal of the research achievement of the on-going and completed research projects for the year 2014-15. The IRC reviewed the progress research projects in the area of buffalo nutrition, physiology & reproduction, genetics & breeding and externally funded projects. Chairman IRC emphasize that more efforts has to be done in terms of technologies and publications.

Date	Division
11.04.2014	Animal Nutrition & feed Technology
08.05.2014	Animal Physiology and Reproduction
15.05.2014	Animal Genetics and Breeding
26.03.2015	Animal Physiology and Reproduction
28.03.2015	Animal Nutrition & feed Technology
30.03.2015	Animal Genetics and Breeding

Research Advisory Committee

XVIII meeting of Research Advisory Committee was held under the chairmanship of Dr. UK Mishra, Vice Chancellor, Chattisgarh Kamdhenu Vishwavidyalaya, Durg at CIRB, Hisar on March 11, 2015. The other members of the RAC were Dr Inderjeet Singh, Director; ICAR-CIRB, Dr SBS Yadav, Ex Dean, CVAS, Bikaner; Dr SN Maurya, Ex Vice-Chancellor,UPDDUPCVVV; Dr DN Kamra, National Professor, IVRI; Dr SK Gupta, Ex Dean, CV & AH, Sher-e-Kashmir University of Agricultural Sciences & Technology, Jammu; Sh. Ved Pal, Karnal and Dr SS Dahiya, Principal Scientist & Member Secretary. Dr Inderjeet Singh, Director, CIRB welcomed the Chairman and other members of newly constituted RAC to its first meeting and special invitees. Chairman in his opening remarks stressed that the research programmes should be focused to benefit farmers and other stakeholders. Quality buffalo bulls and their semen is the need of the hour for the nation and this institute has a colossal responsibility to fulfill this demand with the application of modern biotechnological tools. Towards this end, the Institute should emphasize on registration of top ranking buffaloes and produce future bulls. Digitization of data should be given more emphasis. Director apprised the RAC about the salient achievements and future activities of the institute. He also informed about the activities being undertaken in the field, especially lab to land, trainings and semen freezing of the champion field bulls. The action taken report on the recommendations of the XVII RAC was presented and approved after discussion. This was followed by presentations by Heads / In-charges on respective programme of research.In view of the discussions RAC made following recommendations:

i. Behavioral studies in relation to reproduction need to be undertaken especially to address silent estrous, estrous detection and "Doka";

ii. Whole genome approach in two breeds (Murrah and Nili-Ravi) is to encouraged;

iii. Workout multidisciplinary projects through integration of existing projects;

iv. Nanotechnology approach to be explored to improve nutrient and mineral utilization;

v. E-repository of information pertaining to buffaloes should be strengthen and updated from time to time and

vi. Methane mitigation studies using plant extract have potential and should continue further.

XII Annual Review Meet of Network Project on Buffalo Improvement

XII Annual Review Meet of Network Project on Buffalo Improvementwas conducted at Livestock Research Station, Vallabhnagar, RAJUVAS, Bikaner on 9-10 September, 2014 under the Chairmanship of Prof. Dr K M L Pathak, DDG (AS) ICAR-New Delhi. Dr A K Gahlot, Vice Chancellor, RAJUVAS, Bikaner, Dr Inderjeet Singh, PC(B) and Director CIRB, Hisar, Dr R S Gandhi, ADG (AP&B) ICAR, Dr R K Nagda, Dean, College of Veterinary and Animal Science, Navania, Vallabhnagar and DrVineetBhasin, Principal Scientist (AG&B) ICAR were also present in the annual review meeting. All Principal Investigators presented the progress reports of their respective centers. The performance of each centre was discussed, reviewed and recommendations were made for further improvement.

'Havan' to usher in the New Year 2015

New Year 2015 was ushered in at the Institute with a Havan and Puja. The resolutions made by Institute staff on this auspicious day, to be followed with determination and perseverance were aimed at improving oneself in every field and achieving greater success in all spheres of activities with hardwork, dedication and a reuse of belonging to the institute. All categories of staff participated in event.

Swachh Bharat Mission

Hon'ble, Prime Minister of India, Sh. Narendra Modi launched the "Swachh Bharat Mission" to ensure hygiene, waste management and sanitation across the nation in his Independence Day speech from Red fort in Delhi on 15 Aug 2014.He exhorted country people for this pious cause to make country clean, this will be our tribute to Mahatma Gandhi on his 150th birth anniversary to be celebrated in the year 2019. The staff of CIRB, Hisar and Sub Campus, Nabha undertook 'Swachh Bharat Mission' with high spirit and every member of the Institute participated in this weekly activity wholeheartedly. Resultantly, the premises of the institute (Animal farm, office building and residential area) now appear neat, clean, aesthetic and refreshing.

Kisan Diwas Celebrations

ICAR-CIRB celebrated the Kisan Diwas on 23

Staff of CIRB, Hisar and Sub Campus, Nabha cleaning th respective campus

December, 2014 to promote awareness among farmers for scientific management of dairy animals, clean milk production and improvement in animal productivity. Dr. Inderjeet Singh, Director, CIRB, delivered the inaugural address and emphasized the efforts required to develop strong linkages with farmers and work for the improvement in dairy animal productivity that will transform the lives of farmers and thus make their contribution more prominent in the global economy. Scientist of the Institute apprised farmers about the functions of breed association/ societies, record keeping and animal identification, balanced nutrition, reproduction management and other important aspects of buffalo rearing. Sh. H.K. Singh, Deputy Registrar, Central Herd Registration Scheme, Rohtak also addressed the farmers on need for animal identification and recording and assured all help in this regard.

Rashtriya Ekta Diwas

The Institute celebrated Sardar Vallabh bhai Patel's birth anniversary as 'Rashtriya Ekta Diwas' on October 31, 2014. All the Scientists and Staff took the pledge to preserve the unity, integrity and security of the nation and also strive hard to spread this message among fellow country men in the spirit of unification of country which was made possible by the vision and actions of late Sardar Vallabh bhai Patel.

Dr. Inderjeet Singh, Director, ICAR-CIRB started with the Sardar Patel Quote "Your goodness is impediment in your way, so let your eyes be red with anger, and try to fight the injustice with a firm hand. On this occasion, plantation activity was taken by the staff in the campus.

Meeting with farmers on occasion of Kisan Diwas Celebrations at CIRB, Hisar

Scientists and staff taking pledge on 31st October, 2014 during Rashtriya Ekta Diwas at CIRB, Hisar

Independence Day and Republic Day Celebrations

Independence Day was celebrated on 15th August 2015 with great zeal and enthusiasm. Dr. Inderjeet Singh, Director, ICAR-CIRB, unfurled the National Flag. The event was witnessed by scientists, staff and their family members, those participated in the competitions of patriotic songs and poem recitation. Director addressed the gathering and cited the sacrifices of the Martyrs for making the country independent and emphasized on the sincerity, devotion, honesty and integrity to serve the institute and the nation to realize the dreams of martyrs.

With great patriotic enthusiasm, ICAR-CIRB, Hisar celebrated the Republic Day of India on 26 January 2015 which marked the 65th anniversary of the adoption of the Constitution of India. The event commenced with the flag hoisting by Dr. Inderjeet Singh, Director, ICAR-CIRB followed by the National Anthem sung by one and all. The staff and children delivered speeches in Hindi and English. The Director CIRB greeted the scientists, technical, administrative staff and their family with his motivational address and laid emphasis upon the role of every staff in the progress of the institute and country. Later on sweets were distributed amongst the staff and their families.

National Science Day Celebrations

National Science Day was celebrated at Institute with great enthusiasm on 28th February 2015 to commemorate the invention of the Raman Effect by the renowned physicist, Sir Chandrasekhara Venkata Raman in the year 1928. On this occasion, Institute organized essay and drawing competitions for school students on theme "Animal Husbandry for Livelihood" where in more than 60 students were participated in this event. On this occasion, motivation videos were also shown to Institute staffs to encourage them for doing productive science for the stakeholders. Dr. Neeraj Dilbaghi, Professor, Department of Bio & Nano Technology, Guru Jambheshwar University of Science & Technology, Hisar, graced the closing ceremony as chief guest, and delivered a talk on "Small Science Big Dreams", where he highlighted the importance of nano-particles in the daily life of the people. Dr Inderjeet Singh, Director, ICAR-CIRB also highlighted the role of science in transforming society by citing various examples of scientific occurrences, and he encouraged the competitions winner students of by presenting prizes.

Presenting prize to winner student

Drawing made by student on occasion of National Science Day

हिन्दी सप्ताह का आयोजन

15–22 सितंबर, 2014 के दौरान हिन्दी सप्ताह का आयोजन किया गया। इस अवसर पर संस्थान में हिन्दी की निम्नलिखित प्रतियोगितायें आयोजित की गई :

- संस्थान के अधिकारियों एवं कर्मचारियों के बच्चों के लिए निबंध प्रतियोगिता।
- संस्थान, अन्य केन्द्रों एवं कार्यालयों के अधिकारियों व कर्मचारियों के लिए परिच्छेद अनुवाद (अंग्रेजी से हिन्दी), हिन्दी शब्दानुवाद (अंग्रेजी से हिन्दी), हिन्दी निबंध प्रतियोगिता, हिन्दी टंकण प्रतियोगिता।
- हिन्दी सप्ताह का समापन समारोह दिनांक 23 सितंबर, 2014 को आयोजित किया गया।

समापन समारोह के दौरान वाद–विवाद, आशुभाषण एवं कविता पाठ की प्रतियोगितायें आयोजित की गई समापन समारोह में निर्णायक मण्डल के सदस्य के तौर पर डॉ0 संदीप कुमार, हिन्दी अनुवादक टी.टी.सी हिसार एवं डॉ0 गीतू, सहायक प्राध्यापक, एम.एम. पी.जी. कालेज, फतेहाबाद पधारें। मुख्य अतिथि के तौर पर पधारें डॉ0 बी. एन. त्रिपाठी, निदेशक, अश्व अनुसंधान केन्द्र, हिसार। मुख्य अतिथि द्वारा हिन्दी में सर्वाधिक कार्य करने वाले एवं विभिन्न प्रतियोगिताओं के विजेताओं का पुरस्कार प्रदान किये गए।

Extension Activities

Ultrasonography training for field vets and veterinary college faculties

The purpose of the ultrasonography training was to promote the advancement of knowledge and high standards of large animal ultrasound imaging of reproductive tract and its interpretation for better reproduction management. Toward this purpose, the Institute organized the Ultrasonography training for field vets on 8-12 December 2014. In this training, 20 participants from field and veterinary collage were acquainted in theoretical and practical hand on experience on basic principal of ultrasound, technical specifications of ultrasound for field/ lab use, ultrasonographic appearance of buffalo ovaries and uterus, early pregnancy diagnosis and fetal age determination, fetal sex determination, follicular dynamics and response of GnRH based protocol for estrus induction and ovulation synchronization, use of ultrasound in management of infertility, transvaginal ultrasound guided ovum pick technique, ultrasound examination of buffalo mammary gland.

Valedictory function of training on "Ultrasonography in large animal reproduction" at CIRB

Trainings on Artificial Insemination

Artificial insemination (AI) is only reproductive technique extensively used in the field for genetic improvement livestock population. There is tremendous scope for unemployed rural youths to accept AI as a profession and become a self-employed entrepreneur. During this year, Institute organized three trainings dated on 23-28 June, 14-19 July and 23-30 August 2014 where in 15, 15 and 14 rural youths were participated respectively. During these trainings, youths were hand on experience on AI. Apart from AI, youths were acquainted with the knowledge in buffalo breeding, feeding, reproduction, management practices, animal healthcare and clean milk production. Aim of such training programs is the development of the necessary human resource for buffalo husbandry on scientific lines and encouraging entrepreneurship among the youth for self-employment.

In addition, 65 layman AI workers were trained on AI for breed improvement on 20-27 January 2015.

Rural youth receiving a certificate for AI training

Improved Buffalo Husbandry Trainings

Farmers training programme were organized to impart knowledge in area of the buffalo breeding, feeding, reproduction, management, animal healthcare and clean milk production with the aim for development of the necessary human resource for buffalo husbandry on scientific lines and encouraging entrepreneurs among the youth for self-employment. Total 617 farmers including women were benefited through such trainings, list of trainings are given below.

Title	Place	Duration	No. of trainees
Improved Buffalo Husbandry	Hisar	5-10 June 2014	60
Improved Buffalo Husbandry	Hisar	4-9 August 2014	54
Improved Buffalo Husbandry and Nutrition	Hisar	12-22 September 2014	62
Improved Buffalo Husbandry	Hisar	13-21 October 2014	75
Improved Buffalo Husbandry and Nutrition	Hisar	3-12 January 2015	98
Improved Buffalo Husbandry and Nutrition	Hisar	7-16 February 2015	218
Improved Buffalo Husbandry and Nutrition	Hisar	7-16 March 2015	154
Improved Buffalo Husbandry	Nabha	7-9 July 2014	24

Buffalo Husbandry awareness camps for 'Farm Women'

Village	Duration	No. of trainees	Activities
Dadlain	8-10 July 2014	65	Women are backbone of animal husbandry in many states. They are undertaking all farm activities such as milking, feeding, watering, bathing and grooming of buffaloes. If rural women are aware of advances in husbandry practices, they will implement them at the earliest. In some state/region women self-help groups are also engaged in milk marking as well as value addition. Total 223 farm women were benefited through Buffalo Husbandry awareness camps.
Durjanpur	20-22 August 2014	30	
Mandi Kalan	27-29 October 2014	64	
Santhali, Narwana	27 October 2014	44	
Balsamand	24 December 2014	50	

Infertility camps

Date	Village	Event	Activities
16 /05/2014	Dhiktana	Infertility camp	During and infertility camps, buffaloes were examined for various reproductive health and infertility problems (ovarian activities and developmental impairments) by the scientists and technical staff of the institute. Ultrasonographic evaluation of uterus and ovaries at field level was carried out for accurate diagnosis. Health camps were also organized in collaboration of PNB, Farmer training centre, Saccha Kheda, District Jind, throughout the state of Haryana. For infertility camps medicines and treatment were provided according to the uterine health / ovaries conditions. The follow-up treatment was also given to the animals required for infertility problems. Supplementation like area specific mineral mixture, anthalmentics were given according to the animal health status. Extension literature on scientific management practices was distributed to the buffalo owners for increasing awareness and motivating the farmers to adopt scientific buffalo husbandry for better economic returns
10 /07/2014	Dablain	Infertility camp	
10 /07/2014	Sarsod	Infertility camp	
22 /08/2014	Durjanpur	Infertility camp	
19 /09/2014	Juglan	Infertility camp	
23 /10/2014	Mandi	Health Camp	
14 /11/2014	Bichhpari	Health camp	
16 /12/2014	Sarsod	Infertility camp	
27 /12/2014	Jahsal(Raj.)	Farmers-Scientists interaction	
03/01/2015	Bichhpari	Infertility camp	
07/01/2015	Sirsa	Infertility camp	
24 /01/2015	Jewra	Health camp	
09/02/2015	Mangali	Health camp	
24/02/2015	Jhansal	Infertility camp	
12/03/2015	Kaimeri	Infertility camp	

Calf Rallies

Village	Date	Activities
Sarsod	16/01/2015	Calf rallies were organized for female progenies born under FPT program to create awareness among farmers for superior germplasm conservation and improvement in productivity.
Bichpari	17/01/2015	
Dhiktana	21/01/2015	
Jewra	22/01/2015	

Drought Advisory Consultation Meetings

District	Date	No. of VS/ Officials	Activities
Fatehabad (Haryana)	18 July, 2014	51	"Drought advisory and consultation meetings were organized with field vets of southern Haryana and Northern Rajasthan districts during their monthly meetings for mitigating the impact of drought like situation. Handouts on various management strategies were prepared and distributed in English and Hindi for field vets and farmers. These included information of housing, health, feeding and reproduction management under stressful situations.
Sirsa (Haryana)	21 July, 2014	55	
Hanumangarh (Rajasthan)	30 July, 2014	51	
Hisar (Haryana)	4 August, 2014	38	
Bhiwani (Haryana)	7 August, 2014	68	
Rewari (Haryana)	29 August, 2014	46	
Khetri (Raj.)	19 August, 2014	26	
Sri Ganganagar (Raj.)	20 August, 2014	36	
Narnaul (Haryana)	28 August, 2014	42	
Hansi (Haryana)	4 September, 2014	25	

भैंस मेला आयोजित

एक वर्ष पहले गठित की गई मुर्रा भैंस ब्रिडर्स कल्याण संगठन, देश भर में मुर्रा नस्ल की भैंसों को रखने वाले किसानों को संगठित करने के लिए केन्द्रीय भैंस अनुसंधान संस्थान, हिसार के सहयोग से शुरू कि गई थी। मुर्रा भैंस ब्रिडर्स कल्याण संगठन ने केन्द्रीय भैंस अनुसंधान संस्थान, हिसार के साथ मिल कर भैंस मेला आयोजित किया था। डॉ0 विरेन्द्र अंतिल, प्रबन्धक निदेशक, हरियाणा पशुधन विकास निगम ने भैंस मेले का उद्घाटन किया। इस अवसर पर केन्द्रीय भैंस अनुसंधान संस्थान, हिसार के निदेशक डॉ0 इन्द्रजीत सिंह ने नस्ल सुधार के लिए उच्च कोटी के वीर्य से कृत्रिम गर्भाधान पर बल दिया तथा सभी भैंस पालकों को पशु संबधी सभी रिकॉर्ड को संजोने के महत्व पर भी प्रकाश डाला। समारोह में डॉ0 बि.एन. त्रिपाठी, निदेशक, राष्ट्रीय अश्व अनुसंधान संस्थान, हिसार डॉ0 रमेश सेठी, पूर्व निदेशक एंव प्रधान भारतीय भैंस विकास सोसायटी, डॉ0 एच के सिंह, डिप्टी रजिस्ट्रार, केन्द्रीय पशु पंजिकरण सकीम, भारत सरकार तथा श्री रामदिया लोहान, प्रधान मुर्रा भैंस ब्रिर्डस संगठन ने भी मंच से किसानों कों समबोधित किया।

डा. गजेन्द्र सिंह जाखड़, महानिदेशक, पशु पालन एवं डेयरिंग विभाग, हरियाणा ने समारोह में चैम्पियन पशुओं के मालिकों को पुरस्कार वितरित किए। इस अवसर पर उन्होंने विभाग द्वारा पशुपालकों के कल्याण के लिए अनेक योजनाओं का ब्यौरा दिया तथा पशुओं से किसान को होने वाले आर्थिक लाभ को और बढ़ाने हेतु उत्तम नस्ल के पशु पालने पर बल दिया। मेले में कुल 126 मुर्रा नस्ल के पशु आए।

Nili Ravi buffalo Mela at Sub campus Nabha

ICAR-CIRB celebrated its foundation day at "Sub-Campus, Nabha" on December 2nd, 2014. Dr. Suresh S.Honnappagol, Commissioner, Animal Husbandry, New Delhi was the chief guest on this occasion. Dr. Inderjeet Singh, Director, PCDDB, Punjab, Dr. P K Uppal, Advisor AH, Punjab Government were the guest of honors. Dr. Inderjeet Singh, Director, CIRB, welcome the chief guest, dignitaries and farmers. More than 250 farmers were participated the buffalo Mela and 85 Nili-Ravi buffaloes of farmers participated under different categories of events. Chief Guest expressed the concerned for conservation and improvement of valuable Nili-Ravi germplasm.

Dr. Suresh S.Honnappagol, Animal Husbandry Commissioner, Government of India, New Delhi appreciating Nili-Ravi Buffalo during foundation Day of CIRB Nili-Ravi Sub-campus Nabha, Punjab.

Buffalo Mela at CIRB main campus

CIRB also organized 9th Buffalo Mela at its main campus Hisar on 16-18 March, 2015, with the aim to have an open interaction with farmers and scientists and also to honors farmers who contributed for the conservation of superior Murrah and Nili-Ravi buffalo germplasm, improvement in productivity and created awareness in the villages for maintaining elite and superior quality buffaloes. Dr. R S Dalal, Secretary, Haryana Kisan Aayog, was the Chief Guest and inaugurated the event. Dr. Dalal exhorted the farmers to get benefits with various government schemes for better economical returns, particularly laying emphasis on diversification in dairy sector.

Dr Inderjeet Singh, Director CIRB, Hisar in his addressed highlighted the need for faster

dissemination of improved technologies and practices on a wider scale in the field. He said, first time milk yield competition event included in Buffalo Mela would motivate farmers to have more productive elite buffalo and to boost production of quality animals resulting in better milk yield. Dr Balbir Singh Sheokand, Director Extension, LUVAS, Hisar, complimented farmers for rearing beautiful Murrah animals.

Sh. Dushyant Chautala, Hon'ble Member of Parliament-Hisar and member ICAR Governing Body, graced the closing ceremony as Chief Guest and distributed prizes and certificates to proud owners of champion Murrah animals in seven categories and facilitated progressive farmers, who serve as motivators to fellow farmers. Sh. Chautala complimented to owners of champion Murrah animals, the breed with its have in Haryana, for not only winning prizes but also preserving and developing this world's most important buffalo breed which is popular with all countries having buffalo farming.

Sh. Dushyant Chautala, Hon'ble Member of Parliament (Lok Sabha) Hisar and member ICAR Governing Body Chief Guest during the closing ceremony appreciating champion Murrah bull and distributing prizes and certificates to the winners of various competitions.

He highlighted the issues of elite buffalo germplasm conservation, improvement in buffalo productivity and nutritional security. 333 Murrah buffaloes were participated in various categories of competitions and more than 1000 farmers visited the buffalo mela. Dr S.S. Dahiya, Principal Scientist CIRB anchored the closing ceremony and proposed vote of thanks.

Chief guest Dr. RS Dalal inaugurated Annual Buffalo Mela at CIRB, Hisar on March 18, 2015.

Sh. Dushyant Chautala, felicitating Sh. Roop Singh, Vill. PO: Rashidan Tohana, for conserving elite Nili-Ravi buffalo germplasm.

Judging committee member marking a prize winning buffalo

Tribal villages adopted by the Institute under TSP scheme

Buffalo husbandry in tribal area of Rajasthan is very popular and mostly taken under by the tribal women for domestic need of the milk. The low milk production and poor reproduction performance of buffaloes was observed in tribal. Hence, ICAR-CIRB, plan to introduce the 'Murrah and 'Nili Ravi' superior germplasm through A I and natural breeding for improvement of local buffalo population. Institute also planned to support fodder management and proper utilization of feed resources through silage making and chaffing to minimize the fodder losses under traditional feeding practices prevalent in the village. The introduction of superior 'Murrah' and 'Nili Ravi' buffalo germplasm probably well suited to the area for faster improvement in milk production. The proper utilization of feed and fodder resources will be helpful to make significant improvement in buffalo productivity and livelihood of the tribal farming community.

The institute organized off Campus training and demonstration programmes on buffalo husbandry practices in Tulsion Ka Namala, Chatpur, Bhanso Ka Namala and Roba tribal villages of Kherad gram panchyat, Tehsil: Slumber, Dist. Udaipur (Rajasthan). Scientists addressed the tribal women, young students and farmers during the training for importance of buffaloes, improvement strategies, contribution proposed by CIRB under TSP scheme, support for buffalo management activities, importance of training and exposure visit of buffalo keepers for updating buffalo management knowledge. Tribal women attended the programme in large numbers. The visit was very informative for scientists about the problem of buffalo husbandry in tribal villages and lectures delivered in training motivated the tribal buffalo keepers. It helped scientists to chalkout the interventions required for improving productivity of livestock and economic condition of the tribal.

Director CIRB, Dr. Inderjeet Singh addressed the school children in tribal village during the meetings for motivating the tribal to adopt scientific livestock rearing practices under TSP scheme.

Scientist CIRB addressing the group of tribal farmers, women and youth regarding buffalo improvement strategies.

Jaffarabadi Buffalo Breeding Tract Visited

Jaffarabadi is another high yielding buffalo breed, together with large body size making it suitable for meat production. A center of the Network Project on Buffalo Improvement (NWPB), Jaffarabadi Buffalo unit is operating in its home tract at Junagadh Agriculture University. Centre was visited by Institute Scientists and progress of project, data management and constraints in implementation of technical programme of the project were discussed with the Director of Research, Junagadh Agricultural University, PI of Jaffarabadi Buffalo unit, Research scientist and other staff associated with the project.

Jaffarabadi buffalo germplasm unit, feed unit, semen freezing laboratory and field units under field progeny testing programme were also visited in Loyj, Kankasa and Bamanwada villages of Jaffarabadi buffalo breeding tract. Jaffarabadi buffalo yielded 26 kg. milk in a day as per record. The center was advised to further improves this precious breed by infusing superior germplasm from field.

Visit of semen freezing laboratory, JAU, Junagadh.

Elite Jaffarabadi buffalo productivity potential of yielding 26 kg Milk in a day.

CIRB participated in Madhya Pradesh Krishi Mohatsav

Dr. Inderjeet Singh, Director, CIRB and Dr. K P Singh were invited to deliver lectures to farmers for scientific buffalo rearing, improved management practices, infertility problems and improvement in buffalo productivity during "Madhya Pradesh Krishi Mohatsav" during its closing ceremony on 20th October, 2014. Krishi Mohatsav was a one month long program to disseminate modern farming practices to every root and corner of state , which culminated into mega event where nearly 20,000 farmers were participated.

Dr. Inderjeet Singh, Director, CIRB, shared experiences with farmers on buffalo production and highlighted the importance of balanced feeding, reproductive and health care, improvement in buffalo productivity and management practices as well as improvement of germplasm.

Dr Inderjeet Singh delivering lecture to farmers during 'Madhya Pradesh Krishi Mohatsav' closing Ceremony at Jabalpur.

CIRB participated in Banni Pashu Mela

CIRB participated in Banni Pashu Mela organized by Banni Breeders' Association at Hodka in Kutch of Gujrat on 27-28 September, 2014. The institute put up stall on this occasion to display information on buffalo genetic resources, vision and mission of the institute, services provided to buffalo farmers, importance of mineral mixture feeding and health management of buffaloes. Dr K P Singh delivered inaugural lecture for improvement of Banni buffalo production system and utilization of elite male germplasm from Banni area. Around two thousand maldharis of Banni area and farmers from other parts of the country participated in Banni Pashu Mela. Dr. V.B. Dixit also interacted with farmers and investigated on the husbandry practices in area and emphasized need to improve nutrition and preventive health care.

Dr K P Singh delivered inaugural lecture in Banni Pashu Mela

Publications

Research Papers
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- Sadeesh EM, Shah F, Balhara AK, Thirumaran SMK, Yadav S and Yadav PS (2014). Effect of growth factor and antioxidant on *in vitro* maturation of oocytes and cleavage rates of *in vitro* produced Indian buffalo (*Bubalus bubalis*) embryos. Vet. Arhiv. 84 : 459-474.
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- Kumar D and Kues WA (2015). Transposon mediated derivation of induced pluripotent stem cells and further differentiation to lentoid bodies-a cataract model. International Conference on Reproductive Health and 25th Annual Meeting of ISSRF, held at NIRRH, Mumbai (February 14-17, 2015) pp-61.
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Technical / Popular Articles / Lead Paper / Book Chapters

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Radio / TV Talks

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- SK Phulia (2014) Talk on Conception in buffaloes telecast on 06.06.2014 by Doordarshan Hisar.
- RK Sharma (2014) Talk on reproduction management in buffalo, telecast on 13.06.02014 by Doordarshan Hisar .
- SK Phulia (2014) Talk on Identification and prevention of mastitis telecast on 19.06.2014 by Doordarshan Delhi.
- RK Sharma (2014) Talk on Reproductive problems and Management in buffalo 19.06.2014 at 5.00 to 6.00 PM live on DD Krishi Darshan Delhi.
- RK Sharma (2014) Talk on management of buffaloes during drought condition telecast on 14.08.2014 by DD Hisar .

Awards and Recognition

- ***Dr. Selokar NL*** research on buffalo cloning has been entered in Limca Book of Records-2014. This Indian record book is equivalent to the Guinness Book of World Records with emphasis on unique achievements of Indians within the country and abroad.
- ***Dr. VB Dixit*** was awarded with K N Singh Memorial Award for excellence in Extension Research on February 28, 2014 for contribution in Extension Research.
- ***Dr. Avijit Dey*** was awarded with Dr. K. Pradhan Young Scientist Award for the biennium 2011-13 by the Animal Nutrition Society of India (ANSI) at Global Animal Nutrition Conference (GLANCE 2014), Bengaluru on April 20, 2014.
- ***Dr. Dharmendra Kumar*** received ICSCC Young Investigator award from International Centre for Stem Cells, Cancer and Biotechnology, Pune, India during 5th International Conference on Stem Cells & Cancer 2014, Nov 8-10, 2014 at JNU, New Delhi.
- ***Dr. SS Paul*** received Best Paper Award for 'An analysis of comparative diversity of Archea in rumen of buffalo and cattle' in the IX biennial conference of animal nutrition association held at Assam Agricultural University, Guwahati from 22-24 Jan, 2015
- ***Dr. Vishal Mudgal*** was awarded with ANA Dr. U.B. Singh Memorial Young Scientist Award for his outstanding research achievement in the field of Animal Nutrition in IXth Biennial Animal Nutrition Association conference held at Assam Agriculture University, Guwahati from 22nd to 24th Jan, 2015.
- ***Dr. Selokar NL*** received prestigious Best PhD Thesis Award 2014-15 during 13th convocation ceremony held on 14th February, 2015 at National Dairy Research Institute (NDRI), Karnal. The award has been conferred upon his outstanding achievements in the field of buffalo cloning.
- ***Dr. Dharmendra Kumar*** received Prof. G. P. Talwar Young Scientist Award 2015 from Indian Society for Study on Reproduction and Fertility (ISSRF) during International Conference on Reproductive Health and 25th Silver jubilee Annual Meeting of the ISSRF, Feb 14-17, 2015 at NIRRH, Mumbai, India.

Training/Seminars/Symposia/Workshop/Conferences Attended

Event	Period	Venue	Participant
Global Animal Nutrition Conference (GLANCE -2014) Animal Nutrition Society of India (ANSI)	April 20-22, 2014	Bengaluru	Punia BS, Dahiya SS, Paul SS, Malik R, Dey A, Mudgal V and Saxena N
Buffalo Data Recording Workshop	April 21-23, 2014	Lahore, Pakistan	Singh I
Summer School on Recent Advances in Transgenesis in Livestock's	May 22- June 11, 2014	Animal Genetics Division, IVRI, Izatnagar	Selokar NL
Leaders in Development	June 2-13, 2014	Harvard Kennedy School, Cambridge, USA	Singh I
National Workshop on "Technologies for sustainable rural development - Having potential for socio-economic upliftment"	July 4-5, 2014	AMPRI, Bhopal	Mudgal V
ICAR-NAVS expert consultation on Strategies for breeding buffaloes round the year (2014)	July 04, 2014	New Delhi	Kumar P, Sikka P, Singh KP, Bharadwaj A and Balhara AK
Workshop on Hi Tech solution on bovine semen analysis and laboratory management organized by IMV	July 15, 2014	NASC Complex, New Delhi	Sharma RK and Kumar P
SLCARP International Research Symposium, Sri Lanka Council for Agricultural Research Policy	August 11-12, 2014	Colombo, Shri Lanka	Dey A
XIIth Annual Review Meet of Network Project on Buffalo Improvement	September 9-10, 2014	LRS Vallabhnagar, RAJUVAS	Bharadwaj A
Workshop on fundamentals of mass spectrometry-based proteomics for beginners	September 21-23, 2014	IOB, Bengaluru	Kumar P
ICAR-SAUs-Development departments and stakeholder interface on "Farmers and industry participation in agricultural growth"	October 18, 2014	NDRI, Karnal	Kumar P
5th International Conference on Stem Cells and Cancer (ICSCC-2014): Proliferation, Differentiation and Apoptosis	November 8-10, 2014	JNU, New Delhi	Kumar D
ISSAR conference 'Research and Innovations to improve Animal Fertility and Fecundity'	November 20-22, 2014	DUVAS, Mathura	A Jerome
Society of Animal Physiologist of India (SAPI–2014) Annual Conference	November 27-28, 2014	CIRB,Hisar	Saxena N, Paul SS, Mudgal V, Yadav PS, Sharma RK, Phulia SK, Balhara AK, Kumar D, Jerome A, Kumar P,

Event	Period	Venue	Participant
			Sadeesh EM, Selokar NL, Sunesh, Yadav SP, Bharadwaj A, Singh KP, Sikka P, Dey A
CAFT training on 'Advances in OMIC data analysis-learning by example'	December 3-23, 2014	ICAR-IASRI, New Delhi	Jerome A
IX Biennial Conference of Animal Nutrition Association	January 22-24, 2015	AAU, Khanapara	Punia BS, Saxena N, Paul SS, Dey A and Mudgal V
XII Agriculture Science Congress	February 3-6, 2015	NDRI, Karnal	Dey A and Kumar P
International Conference on Reproductive Health and 25th Annual Meeting of ISSRF	February 14-17, 2015	NIRRH, Mumbai	Kumar D

Post Graduate Research Students

S. No.	Student	Degree	University	Year	Thesis Title	Major/ Co-Major Guide
COMPLETED						
1	Fozia Shah	PhD	LUVAS, Hisar	2010-2014	Studies on Culture of Donor cells for production of Cloned Embryos and their characterization in Buffalo (Bubalis bubalis)	PS Yadav
2	Sarla	PhD	GJUS&T, Hisar	2011-2014	Molecular Characterization of major candidate genes associated with reproductive traits in buffalo (*bubalis bubalus)*	SK Phulia
3	Jerome A	PhD	IVRI, Izatnagar	2012-2014	Studies on follicular candidate genes expression profile and estrus induction in buffaloes during summer season	RK Sharma
4	Sadeesh EM	PhD	IVRI, Izatnagar	2012-2014	Production of cloned buffalo embryos and expression profile of developmentally important genes during embryogenesis	PS Yadav
5	Sunil Kumar	MVSc	IVRI, Izatnagar	2012-2014	Proteomic analysis of follicular fluid in postpartum anestrus buffaloes	Inderjeet Singh
6	Vikram Jakhar	MVSc	LUVAS, Hisar	2012-2014	Age and parity adjustment factors for milk production in Murrah Buffalo	KP Singh
7	Lukumoni Burgohain	MVSc	LUVAS, Hisar	2012-2014	Serum proteomics and analysis in the peripheral blood of early pregnant buffalo	AK Balhara
8	Shambhu Sharan Gupta	MVSc	LUVAS, Hisar	2012-2014	To study the expression of OAS-1 gene transcript and comparison of conventional and molecular methods for the early pregnancy diagnosis in buffaloes	AK Balhara

S. No.	Student	Degree	University	Year	Thesis Title	Major/ Co-Major Guide
9	T Chandrasekhar	MVSc	IVRI, Izatnagar	2012-2014	Relationship of pre-partum body, udder and teat measurements with milk production performance in Nili-Ravi buffalo heifers	KS Das
				PURSUING		
10	Chander Mohan	PhD	IGNOU, New Delhi	2011-2015	Identification of active ingredients against gastro - intestinal parasites in indigenously known angiospermic plants	Navneet Saxena
11	Kaushalya	PhD	CDLU, Sirsa	2012-2015	Studies on stemness properties of cultured buffalo amniotic membrane cells	PS Yadav
12	Mahavir Chaudhary	PhD	LUVAS, Hisar	2012-2015	Genetic studies on production, fertility and longevity traits in Murrah and Nili - Ravi buffalo	KP Singh
13	Gyanendra Singh Katiyar	MVSc	IVRI, Izatnagar	2013-2015	Effect of rumen protected fat and protein supplementation on reproductive performance and blood biochemical profile in postpartum buffaloes (Bubalus bubalis)	Inderjeet Singh
14	Rahul Rathore	MVSc	IVRI, Izatnagar	2013-2015	Field investigation of infertility and efficacy of GnRH based protocols for treatment of anestrus condition in buffaloes	RK Sharma
15	Papori Sharma	PhD	LUVAS, Hisar	2014-2016	Studies on epigenetic characteristics of somatic cells in water buffaloes	PS Yadav
16	Dheer Singh Swami	MVSc	LUVAS, Hisar	2014-2016	Studies on buffalo (*Bubalus bubalis*) semen quality following supplementation of male specific mineral mixture in feed and semen additives in freezing extender	P Kumar
17	Parveen Kumar	MVSc	LUVAS, Hisar	2014-2015	Comparative study on Ovsynch*versus*Doublesynch protocol for estrus synchronization during summer and winter season in buffalo	S K Phulia
18	Lokesh Kumar	MVSc	LUVAS, Hisar	2015-2016	Evaluation of efficacy of different treatment protocols for estrus induction in buffaloes under field conditions	S K Phulia

Research Projects

Title of the project	Duration	PI and Co - PIs
COMPLETED		
Integrated SOET and MOET for faster multiplication of elite buffalo germplasm	Sept. 2010 - Mar. 2015	RK Sharma, Inderjeet Singh, SK Phulia, D Kumar, A Jerome, S Khanna
Impact of buffalo migration on socio - economic conditions and dairy development index of farmers in Haryana	Aug. 2011 - Mar. 2015	VB Dixit, A Bharadwaj, KP Singh and KV Aneesh
mRNA expression of some candidate genes in buffalo IVF embryos cultured in different media	Feb. 2012 - Mar. 2015	Sadeesh EM, AK Balhara, SMK Thirumaran, PS Yadav
Identification of mi RNAs expressed in different reproductive stages of buffalo corpus luteum.	Dec. 2012 - Mar. 2015	A Jerome, SN Kala
ON GOING		
Cloning for conservation and multiplication of superior buffalo germplasm	Sept. 2010 - Mar. 2017	PS Yadav, Sadeesh EM, RK Sharma, D Kumar, Naresh Selokar
Identification of SNPs in genes related to meat production and their association with meat parameters in buffaloes (Bubalus bubalis)	Oct. 2010 - Dec. 2015	AK Pandey, P Sikka, SP Yadav, SS Dahiya
Application of pedigree information and body condition score for development of buffalo breeding herd analyzer	July 2011 - July 2015	SN Kala
Effect of stimulants on fiber degradation, methane emission and fungal population in buffaloes	Apr. 2012 - Mar. 2016	Avijit Dey, SS Dahiya, BS Punia, PC Lailer, N Saxena, SS Paul
Validation of ITK known herbs against gastro - intestinal parasites in buffalo calves	Nov. 2012 - Oct. 2015	N Saxena, A Dey, V Mudgal, BS Punia, ML Sharma
Establishment of fertility-associated seminal plasma proteins as biomarkers through proteomics and Nano technological approach in buffalo	Dec. 2012 - Nov. 15	Pardeep Kumar, D Kumar, AK Balhara, SP Yadav, PS Yadav
Development of modules for buffalo meat production	Jan. 2013 - Mar. 2016	SS Dahiya, A Dey, PC Lailer
Development of database for Nili-Ravi buffaloes by hematological, biochemical and endocronological studies	Jan. 2013 - Dec. 2016	JK Singh, KS Das, G Singh, KL Mehrara, V Mudgal
To exploit full genetic potential of Nilli Ravi buffaloes with optimum plane of nutrition	Jan. 2013 - Dec. 16	Raman Malik, G Singh, KP Singh, KL Mehrara, R Mehta, TP Singh
Effect of different feeding regimen on age at first calving	Apr. 2013 - Mar. 2016	PC Lailer, V Mudgal, SS Dahiya, Ashok Kumar, BS Punia
Studies on development and supplementation of chelated minerals in buffalo	Apr. 2013 - Mar. 2016	V Mudgal, N Saxena, SS Dahiya, BS Punia, K Kumar, ML Sharma
Identification of genetic variants in genes related to oxidative status in relation to fertility in Murrah bulls	Jul. 2013 - Dec. 2015	P Sikka, P Kumar
e - Bhains Vigyan Kendra - virtual centre for training in buffalo husbandry and platform for scientist - farmer interactions	Nov. 13 - Oct. 16	Sunesh Balhara, SK Phulia, AK Balhara, PC Lailer, P Sikka
Scientific validation of 'Doka' in buffaloes for improvement of reproductive performance under field and farm conditions	Nov. 2013 - Oct. 2017	SK Phulia, RK Sharma, Ashok Balhara, Sunesh, A Bharadwaj

Title of the project	Duration	PI and Co - PIs
Development of feeding modules for Nili Ravi buffalo meat production	Dec. 13 - Dec. 15	Raman Malik, SS Dahiya, PC Lailer
An integrated investigation of microbial communities involved in methane production and fiber digestion in rumen of buffaloes	Apr. 2014 - Mar. 2017	SS Paul, A Dey, BS Punia, SP Yadav, A Jerome, P Sikka
EXTERNALLY FUNDED/ AICRP		
Early detection of pregnancy in calves and buffalo by pregnancy associated proteins (PAPs)	Jun. 2012 - May 2015	AK Balhara, Inderjeet Singh, SK Phulia (NF - BSFARA)
Nutritional and physiological interventions for enhancing reproductive performance in animals	2014 - 2017	RK Sharma, SK Phulia, V Mudgal, Jerome A, Pardeep
Institute Technology Management Unit	2008 - 2017	VB Dixit
CABA-IASRI project	Nov 2014 - Contd.	P Sikka, SS Paul, KP Singh, Sunesh, Jerome A, Balhara AK
Network Project on Buffalo Improvement	1991 - Contd.	Inderjeet Singh, PC; AK Pandey, I/C
- Progeny testing of Murrah bulls under field conditions (FPT)	2001 - Contd.	A Bharadwaj, V B Dixit, S Kakkar
- Genetic improvement of Murrah buffaloes	1991 - Contd.	K.P Singh, Ashok Boora, A Bhardwaj, Sunesh, S Khanna, Pradeep
- Genetic Improvement of Nili - Ravi buffaloes	1989 - Contd.	Raman Malik, KP Singh
- Genetic improvement and conservation of Bhadawari buffaloes	2001 - Contd.	BP Kushwaha, SB Maity, Sultan Singh, KK Singh

Distinguished Visitors

- Sardar Ajit Singh Kohar, Hon'ble Minister for Transport, Legal and Legislative Affairs, Govt. of Punjab visited CIRB, Hisar on 14th October, 2014 and showed keen interest in the conservation of elite buffalo germplasm and appreciated the Institute contribution in buffalo husbandry.

- Dr. Suresh S. Honnappagol, Animal Husbandry, Commissioner, Government of India, New Delhi. Prof. P K Uppal, Advisor AH, Punjab Government and Sh. Inderjeet Singh, Director, Punjab Dairy Development Boardvisited Nili-Ravi buffalo farm, Sub campus, Nabha on 2nd December, 2014.

Dr. Inderjeet Singh explaining research activities to Sh. Ajit Singh Kohar

- Sh. Dushyant Chautala, Hon'ble Member of Parliament (Lok Sabha) and Member ICAR Governing Body, visited CIRB, Hisar on 11th February 2015. He addressed the farmer-trainees at institute and interacted with the scientists regarding the role of buffalo husbandry in farmers' livelihood. He enquired about various aspects of buffalo farming to make it more remunerative for the farmers.

Director, Dr Inderjeet Singh, explaining research in pregnancy diagnostics development to Sh. Dushyant Chautala

- Sixty farmers from Madhya Pardesh-Ujjain (under Mukhya Mantri Khet Tirath Yojana) and Bihar (sponsored by Zhetij Agro-Tech. Comp. Ltd.) visited the CIRB, Hisar campus.

MP Farmers under Mukhya Mantri Khet Tirath Yojana visited CIRB campus

- 175 B.V.Sc & A.H. students and Scientists from College of Veterinary Science, Sardarkrushinagar Dantiwada Agricutural Unviversity (SDAU), Gujarat and G B Pant University, Pantnagar, U S Nagar, Uttarakhand, visited the institute laboratories and Buffalo Farm.

B V Sc & A H students G B Pant University, Pantnagar visited CIRB, Hisar on 24.09.2014

BVSc & AH Final Year Students of SDAU, Gujarat visited institute

CIRB Personnalia (as on 31.03.2015)

General Administration	
Dr Inderjeet Singh	Director
Sh Chetan S Issar	Administrative Officer
Sh Mahesh Kumar	Fin. & Accounts Officer
Sh Raj Kumar	Asstt. Administrative Officer
Sh IS Kundu	Asstt. Administrative Officer
Sh Joginder Singh	Private Secretary
Sh Rajesh Kumar	Assistant
Sh Viksit Kumar	Assistant
Sh Girdhari Lal	Assistant
Sh Abdul Majid	Assistant
Sh Ashok Kumar	UDC
Smt Indira Devi	UDC
Sh Satbir Singh	UDC
Sh Dharam Pal	LDC
Sh Sunil Kumar	LDC
Sh Mahabir Singh	LDC
Sh Sandeep Kumar	UDC (On Deputation)
Animal Genetics & Breeding Division	
Dr (Mrs) P Sikka	Principal Scientist & Head
Dr A Bharadwaj	Principal Scientist
Dr AK Pandey	Principal Scientist
Dr KP Singh	Principal Scientist
Dr SN Kala	Senior Scientist
Dr SP Yadav	Senior Scientist
Dr Ashok Kumar	Scientist
Dr Satish Kakkar	CTO
Sh AKS Tomer	STO
Animal Nutrition and Feed Technology Division	
Dr BS Punia	Principal Scientist & Head
Dr SS Dahiya	Principal Scientist
Dr PC Lailer	Principal Scientist
Dr Navneet Saxena	Principal Scientist
Dr SS Paul	Principal Scientist
Dr Avijit Dey	Senior Scientist
Dr Vishal Mudgal	Senior Scientist
Dr ML Sharma	ACTO
Sh Krishan Kumar	STO
Sh MS Poonia	STA

Animal Physiology & Reproduction Division	
Dr PS Yadav	Principal Scientist & Head
Dr RK Sharma	Principal Scientist
Dr SK Phulia	Principal Scientist
Dr AK Balhara	Scientist
Dr D Kumar	Scientist
Dr Varij Nayan	Scientist (on study leave)
Dr Jerome A	Scientist
Dr Pradeep Kumar	Scientist
Dr Sadeesh EM	Scientist
Dr Selokar NL	Scientist
Shri RS Pippal	T6
Prioritizing Monitoring & Evaluation Cell	
Dr SS Paul	Principal Scientist
Dr SP Yadav	Senior Scientist
Dr AK Balhara	Scientist
Sh Raj Kumar	STO
PRO	
Dr AK Balhara	Scientist
Results - Framework Documents Cell	
Dr SP Yadav	Senior Scientist & Incharge
Sh Ram Chander	Tech. Officer
AKMU	
Dr. SS Paul	Pr. Scientist & Overall Incharge
Mrs Sunesh Balhara	Scientist & Incharge
Sh Raj Kumar	STO
CPIO/APIO	
Dr RK Sharma	Principal Scientist & CPIO
Hindi Section	
Dr AK Pandey	Pr. Scientist & Overall Incharge
Sh Sunil Kumar	LDC
Library	
Dr SS Dahiya	Pr. Scientist & Overall Incharge
Sh VPS Punia	CTO & Incharge
Vigilance Officer	
Dr Anurag Bharadwaj	Principal Scientist

Agricultural farm	
Dr PC Lailer	Pr. Scientist & Overall Incharge
Sh SS Malik	ACTO & Incharge
Dr RA Pachori	STO
Workshop Section	
Dr PC Lailer	Pr. Scientist & Overall Incharge
Sh Jitender Kumar	STO Incharge
Sh Kuldeep Singh	STA
Sh Bhim Raj	STA
Sh Sant Lal	STA
Sh Mahabir Singh	STA
Sh Ram Kumar	STA
Estate section and Electrical Section	
Dr SK Phulia	Pr. Scientist & Overall Incharge
Sh BP Singh	ACTO Incharge, Estate
Sh Rajesh Prakash	ACTO Incharge, Electrical
Sh Sushil Kumar	STO
Sh Gopal Singh	TO
Landscape section	
Sh AKS Tomar	STO & Incharge
Transfer of Technology and Entrepreneurship	
Dr VB Dixit	Pr. Scientist & Overall Incharge
Animal Farm Section	
Dr A Bharadwaj	Pr. Scientist & Overall Incharge
Dr S Khanna	CTO & Incharge
Dr Shaitan Singh	STO
Sh S Chander	TO
Dr Rajesh Kumar	TA

Internal Security	
Sh Sushil Kumar	STO
Guest House	
Sh Raj Kumar	STO & Incharge
Network Project on Buffalo Improvement	
Dr Inderjeet Singh	Project Co-ordinator
Dr A K Pandey	Pr. Scientist and I/C
Dr BP Kushwaha	Pr. Scientist (IGFRI, Jhansi)
Dr Sarita Yadav	Scientist (On study leave)
Sh Ram Chander	TO
Sub - Campus, Nabha	
Scientists	
Dr Raman Malik	Pr. Scientist & Officer Incharge
Dr Ghansham Singh	Principal Scientist
Dr JK Singh	Senior Scientist
Technical	
Dr KL Mehrara	CTO
Sh Virender Singh	CTO (On deputation)
Sh Jagdish Prasad	CTO
Sh Rajiv Mehta	ACTO
Sh TP Singh	ACTO
Dr Ashwani Saini	STO
Sh Daljit Singh	STA
Sh Balwinder Singh	STA
Sh Mohan Singh	STA
Administration	
Sh Narinder Kumar	AAO
Sh Tejinder Singh	UDC
Sh Jaspal Singh	SSS

Promotion

- Sh Rajesh Prakash, STO promoted to the next higher grade of ACTO w.e.f. 23.6.2014
- Sh Ashwani Saini, TO promoted to the next higher grade of STO w.e.f. 01.07.2010
- Dr Ghansham Singh Senior Scientist promoted to Principal Scientist w.e.f. 18.12.2013
- Dr SK Phulia Senior Scientist promoted to Principal Scientist w.e.f. 19.09.2013

Transfer

- Dr. K. S. Das transferred from Sub campus Nabha to ICAR-Zonal Project Directorate, Zone –II, Kolkata on 09.05.2014.

Retirements

1. Dr. S.R. Bhardwaj, CTO on 20.4.2014
2. Shri Satbir Singh, Casual Labourer (TS) on 30.4.2014
3. Shri Dharam Singh, STA on 30.6.14
4. Shri Dhanna Ram, Casual Labourer (TS) on 30.6.2014
5. Shri Amar Dass, Casual Labourer (TS) on 30.6.2014
6. Shri Dharambir Singh, Casual Labourer on 31.01.2015
7. Shri Hoshiyar Singh, Casual Labourer (TS) on 31.03.2015

Sad demise

Shri Balbir Singh Ahlawat, TO (20.01.1959 – 06.08.2014) was born at Village Lijwana Khurd, Distt. Jind (Haryana) and joined his service as Milk Recorder in Govt. Progeny Testing Bull Farm of Animal Husbandry Deptt., Haryana on 03.11.1981. Consequent upon establishment of CIRB, he was absorbed in ICAR services w.e.f. 1.2.1985 as T-1 and currently he was working as Technical Officer.

Shri Virender Kumar Sharma, Technical Assistant (10.03.1961 – 23.09.2014) started his career as DPL at CIRB, Hisar on 03.03.1986. Later he joined as T1 on 28.02.1998 at Sub campus Nabha. At the time of his untimely sad demise, he was holding the post of Technical Assistant.

Sectoral News

Buffalo Meat– The largest exported agricultural commodity

India is top milk producing country in the world, with a majority share of buffalo milk. Buffalo milk & meat products considered to be the healthiest, because it is low in calories (fat) and cholesterol and high in protein. It is also rich in zinc, vitamin B 12, iron, riboflavin and thiamin. It has almost 2-3 folds cost advantage over mutton and goat meat. Its utility in meat processing is on increase because of higher content of lean meat and less fat. About 19% of total meat produced in the country is originating from buffalo, though the major chunk (45%) comes from poultry.

The export of buffalo meat reached an all-time high at Rs. 29,282 crore in 2014-15, making buffalo meat as the largest exported agricultural commodity in value terms, surpassing Basmati rice, which has been the largest exported agricultural commodity so far. This also accounted for over 22% of the overall agricultural commodities exports from the Agricultural and Processed Food Products Exports Development Authority (APEDA) basket pegged at Rs. 1,30,458 crore during 2014 - 15. Countries such as Vietnam, Malaysia, Egypt, Thailand and Saudi Arabia are the key export destinations for the buffalo meat products. Though the prime contributing factor has been the setting up of modern mechanized abattoirs catering to the export market, efforts to eliminate diseases such as rinderpest have also earned confidence of the importers. As per the notification of World Organization for Animal Health, India is free from several trade-related livestock diseases like Bovine Spongiform Encephalopathy (BSE) and Rinderpest which provides us an opportunity to capitalize on buffalo meat. More concerted emphasis is required in efforts to eliminate Foot and Mouth disease as well, which is constraining opening up of new markets particularly in the western countries for making the export of livestock products more profitable.

Loss of precious buffalo germplasm in commercial urban dairies

An on-the-spot study of numerous commercial dairies in Jabalpur (M.P.) indicated that although superior Murrah buffaloes (about 50,000) are reared in various private dairy farms for milk production, majority farms reported over 90 percent calf mortality and around 25 percent culling of buffaloes annually for economic considerations. These figures indicate that about 40,000 calves and 12,000 buffaloes are removed every year from the production cycle leading to unidirectional departure of this valuable germplasm. This is the picture of only one city while similar situation is rampant in many commercial dairies in and around big cities. In order to address this problem, there is an option to establish calf rearing centres in such places to save this elite germplasm. These calves when 3 months old or more can be given to poor subsistence farmers who can rear them to adulthood with grazing and little other feed inputs. This way, the precious germplasm can not only be saved, but also address the priority of the government in poverty alleviation.

Salient Achievements

ISO- Certification

The ICAR-Central Institute for Research on Buffaloes is an ISO 9001-2008 certified institute. The first Annual Surveillance Assessment was conducted on 18th September, 2014 by BSCIC Certification agency and the institute has been recommended for continuation of ISO 9001:2008 under the scope "Improved Buffalo Germplasm Production".

FAO-IAG Accreditation

Division of Animal Nutrition and Feed Technology, ICAR- Central Institute for Research on Buffaloes, Hisar got accreditation of "FAO-IAG Proficiency Test 2014 for Feeding-stuffs" organized jointly by Food and Agriculture Organization of the United Nations (FAO) and the International Analytic Group (IAG), conducted by the Institute for Animal Nutrition and Feed, Austrian Agency for Health and Food Safety. Aim of this proficiency test was to assess the performance of laboratories in developing countries in feed analysis. One hundred seventeen laboratories from 45 countries participated in this ring test. Samples were provided by FAO-IAG and institutes were asked to submit reports on various parameters after conducting analysis as per their own protocol without prescribing any method. The parameters for which CIRB successfully passed the proficiency test include feed ingredient analysis parameters (moisture, crude protein, crude fibre, total ash, acid insoluble ash, neutral detergent fibre, acid detergent fibre, acid detergent lignin, and Hohenheim gas production test) and mineral nutrients (calcium, phosphorus, magnesium, iron, copper and zinc). The test results demonstrate reliability and accuracy of feed and mineral testing laboratories at the Institute.

Revenue Generation

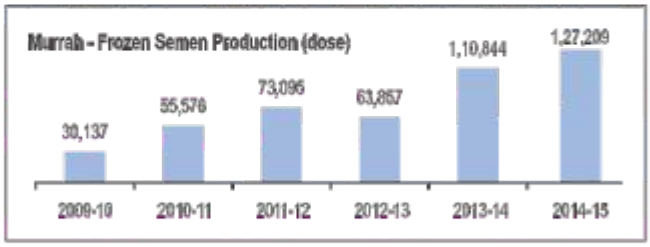
Revenue generation increased during the year to Rs. 356.83 lakhs against Rs. 312.13 lakhs during 2013-14 and Rs. 217.34 lakhs during 2012-13. This is apart from the savings effected in expenditure through the use of farm produce in animal feeds and fodder. Additional funds were attracted through contract research project.

Herd performance

Significant improvement is reported in performance traits of Murrah and Nili Ravi buffalo herds at the CIRB Main campus and Sub Campus, respectively, with the best-ever productive (Wet and Herd Averages) and reproductive (Age at First Calving & Calving Intervals) performance – aimed at converting these herds into elite Bull-Mother farms. The wet average (8.25 and 8.48 kg/head/day), herd average (5.77 and 5.98 kg/head/day), age at first calving (42.8 and 39.9 months), calving interval (473 and 420 days), 305 days or less lactation milk yield (2353 and 2384 kg) and average peak yield (11.26 and 12.38 kg) were achieved in the Murrah and Nili Ravi breeds, respectively. High conception rate of 52.34% was achieved in Murrah herd and the lowest ever calf mortality (0.72%) was recorded in Nili Ravi buffaloes. The overall improvement for lactation milk ranged from 3 % to 7 %, while for service period around 11 % reduction is reported in 2014-15 as compared to 2013-14 performance. Similarly improvement in wet average is about 3 % and in herd average it ranged from 12 to 16 %. The significant improvement in Murrah and Nili-Ravi buffalo herds' productivity reflect the best management practices and health care adopted at Institute herds. The high milk production and reproduction traits performance evidence that Nili-Ravi is another comparable milch breed as the renouned Murrah.

Frozen semen production

Achieved highest annual frozen semen production, both for Murrah and Nili Ravi breeds, including field bulls of Murrah breed. The annual frozen semen production in Murrah continued to be above 1,00,000 for the second consecutive year, with a new record production of 1,27,209 doses during the current year. For Nili Ravi record number of 31,474 semen doses were frozen and 24,137 doses were sold.



Grain and fodder Production

A record yield of 6967 quintals of grains (wheat/ Barley/Rice/oats) was obtained which is not only sufficient to meet the requirement of grain component of the concentrate feed for the two herds – leading to saving on the expenditure on this account, but surplus grain was also sold to earn revenue. Similarly total 4598 quintals of wheat straw were produced to be fed to the institute herds and surplus straw was sold. Green fodder production was 83806 quintals.

Agriculture Farm Land Development

The institute is facing problems of soil salinity, aggravated by scarcity of canal water, high water table and unsuitable ground water for irrigation. Soil reclamation has been attempted in about 200 acres under two phases of desalination with subsurface drainage system with the collaboration of ICAR-Central Soil Salinity Research Institute, Karnal, with some success. Efforts are being made to make total agriculture farm land arable for feed and fodder production as well as for animal grazing. During the year, institute got 170 acres of Agriculture Farm land cleaned by removing wild bushes, preparing layout, fencing and ploughing. Its reclamation efforts will be continued for making it arable and useful in feed and fodder production from Rabi season of 2015-16.

ICAR Zonal Tournament (north-zone)

ICAR Inter Zonal Final tournament for the year 2014 was held NDRI, Karnal from 10-14 March, 2015. Institute Badminton team participated in the Finals being North Zone champion. In the ICAR Inter Zonal Finals the team represented by Dr Navneet Saxena, Dr A K Pandey, Dr Vishal Mudgal, Sri Abdul Majid and Sri Viksit Kapil became ICAR champion for 2014.

Workshop/Conference Organized

ICAR-NAVS Expert Consultation on Strategies for Breeding Buffaloes Round the Year

Under the aegis of Indian Council of Agricultural Research (ICAR), National Academy of Veterinary Sciences, India (NAVS) the institute organized One day Expert Consultation on 'Strategies for Breeding Buffalo Round the Year' on 4th July, 2014, at NASC Complex, New Delhi. Dr. S Ayyappan, Secretary, DARE & DG, ICAR in his inaugural address highlighted the need of specific interventions for breeding buffaloes round the year to enhance life time productivity of this species for meeting nutrient requirements of population. He reminded the pride that farmers

take in rearing this ' black gold' and champion animals indeed earn name, fame and wealth to their owners. Dr. K M L Pathak, DDG (AS) highlighted the poor reproductive efficiency, high calf mortality and animal health as the major limiting factors in buffalo husbandry and emphasized the effective R & D strategies to ensure regular breeding of buffaloes. He emphasized the importance of buffalo as the milch animal for India and its increasing popularity in the rest of the world. This puts the onus on institutational herds to excel and get recognisition as the nucleus centres of elite germplasm to meet the demand of the country and abroad. All aspects of buffalo production, reproduction and management need to be addressed in an integrated approach making the best use of modern technologies. Sixty seven experts from all over the country participated in the consultation meet.

After thorough discussions, the house agreed on the following key recommendations :

- Adoption of Assisted Reproductive technology including Embryo transfer technology, cloning & IVF for rapid multiplication of elite buffaloes and production of lite male bull calves through widespread training and skill development be carried out.
- Artificial insemination system including production of good quality semen should be strengthened in public - private partnership to improve its efficiency.
- Marker assisted selection for important reproductive traits like-early puberty, early post-partum breeding, animals exhibiting good fertility in summer months, the phenomenon of "Doka" (milk retention), need to be explored.

National Symposium on Physiological Determinants of Climate Resilient Sustainable Animal Production

Annual Conference of the Society of Animal Physiologists of India (SAPI) and National Symposium were held during 27-28 November, 2014 at ICAR-CIRB, Hisar. The conference was inaugurated by Prof. M.L. Madan, Former DDG (Animal Science), ICAR who also delivered a key note address. Prof. J.S. Bhatia, Former ADG (Education), Dr. B S Prakash, ADG (ANP) ICAR; Dr. BC Sarmah, President, SAPI; Dr. PK Das, General Secretary, SAPI and Dr N N Pathak were the other eminent speakers during the symposium. Dr. Inderjeet Singh, Director, ICAR-CIRB, Hisar highlighted the theme of the conference and revealed that time has now come that livestock sector should make difference in the lives of farmers. Over 175 scientists, researchers, and post graduate scholars from different states participated in the symposium. Dr P S Yadav, was the Organizing Secretary.

Recommendations of the notable symposium were

1. Climate smart package of practices needs to be developed and made available to farmers for round the year breeding and milk availability.
2. Improvement in assisted reproductive technologies like AI, IVF, ET, cloning and stem cells research in Indian animals, should be continued with application of advanced technologies like ultrasonography, flow-cytometery and other imaging technologies. Research in the area of sperm sexing should be encouraged in collaboration with basic science research institutes.
3. Unique adaptive characteristics of Hypothalamic proteins should be studied in indigenous animals and compared with less adaptive breeds so that breeds having better adaptation could be conserved.

Results-framework Document (RFD)

for

ICAR - Central Institute for Research on Buffaloes

2013-14

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.

Mission

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

Objectives

1. Development, improvement and faster multiplication of superior buffalo germplasm.
2. Improvement in feed efficiency /region specific feeding modules.
3. HRD and capacity building/technology showcasing through extension activities.

Functions

To promote and undertake research in all aspects of buffalo production and transfer of technology. Genetic improvement associated progeny testing, performance recording, certified semen production, freezing and faster multiplication of superior germplasm involving biotechnological tools. Improvement of production, reproduction, nutrient utilization and buffalo husbandry practices to economize buffalo productivity through All India Network Project on Buffalo Improvement in collaboration with SAUs/SVUs and other national institutions and establish linkages with international agencies and dissemination of developed technologies.

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Annual (April 1, 2013 to March 31, 2014) Performance Evaluation Report in respect of RFD 2013-2014 of RSCs i.e. Institutes.

S. No.	Objectives	Weight (%)	Actions	Success Indicators	Unit	Weight	Target/Criteria Value					Achievements	Performance		Percent achievements against Target values of 90% Col.	Reasons for shortfalls or excessive achievements, if applicable
							Excellent	Very Good	Good	Fair	Poor		Raw Score	Weighted Score		
							100%	90%	80%	70%	60%					
1	Development, improvement and faster multiplication of superior buffalo germplasm	60	Genomics studies & creation of phenomics/ DNA repository for Marker Assisted Selection	Collection/ update of phenomics data and DNA repository of different breeds of buffalo	Number	10	350	300	250	200	150	**334**	96.8	9.68	111.3	Gap between very good and excellent values is high
			Selection of future set (s) of bulls and progeny testing of 10th set of bull	Selection of bull on the basis of pedigree records and physical parameters	Number	9	15	13	11	9	8	**15**	100	9.0	115.4	Target set as per the technical program of the network project
			Dissemination of superior germplasm through production of disease free semen/frozen embryo	Semen doses production/ bull	Number	8	15000	14000	12000	10000	8000	**14113**	91.13	7.29	100.8	-
				Artificial insemination in field	Number	8	4100	3800	3500	3000	2500	**3969**	95.63	7.65	104.4	-
				ET at farm and in field	Number	5	20	18	15	12	10	**23**	100	5.0	127.7	Due to better recovery of good quality embryos
			Improvement in production and reproduction in Murrah and Nili-Ravi herds	Lactation yield in Murrah	Kg	5	2400	2350	2300	2250	2200	**2291**	78.2	3.91	97.4	-
				Calving interval in Murrah	Days	5	460	475	490	510	540	**495**	77.5	3.875	96	-
				Lactation yield in Nili- Ravi	Kg	5	2200	2150	2100	2050	2000	**2241**	100	5	104.2	-

S. No.	Objectives	Weight (%)	Actions	Success Indicators	Unit	Weight	Target/Criteria Value					Achievements	Performance		Percent achievements against Target values of 90% Col.	Reasons for shortfalls or excessive achievements, if applicable
							Excellent	Very Good	Good	Fair	Poor		Raw Score	Weighted Score		
							100%	90%	80%	70%	60%					
				Calving interval in Nili-Ravi	Days	5	450	480	500	520	540	**444**	100	5	108.1	Better feeding and management of herd
2	Improvement in feed efficiency /region specific feeding modules	15	Developing balanced feeding practices	Developing feeding modules for milch and meat buffaloes	Number	8	3	2	1	0	0	**03**	100	8	150	-
			Rearing buffalo male calves for meat production	Buffalo broiler production	Number	7	40	35	30	25	20	**48**	100	7	137.1	Additional experiment also conducted at subcampus Nabha
3	HRD and capacity building/ technology showcasing through extension activities	14	Training programmes	Farmer's training programme on buffalo husbandry/ AI/ nutrition	Number	7	12	10	9	8	7	**13**	100	7	130	Due to high demand of training programs
			Extension and transfer of technologies	Organization of buffalo mela, calf rallies, infertility treatment camps	Number	7	10	8	7	6	5	**18**	100	7	225	More emphasis on field activities
	Efficient Functioning of the RFD System	3	Timely submission of Draft RFD (2013-14) for approval	On-time submission	Date	2.00	15/05 /2013	16/05 /2013	17/05 /2013	20/05 /2013	21/05 /2013	**14.05. 2013**	100	2.0	-	-

S. No.	Objectives	Weight (%)	Actions	Success Indicators	Unit	Weight	Target/Criteria Value					Achievements	Performance		Percent achievements against Target values of 90% Col.	Reasons for shortfalls or excessive achievements, if applicable
							Excellent	Very Good	Good	Fair	Poor		Raw Score	Weighted Score		
							100%	90%	80%	70%	60%					
			Timely submission of results for RFD (2012-13)	On-time submission	Date	1.00	01/05/2013	02/05/2013	05/05/2013	06/05/2013	07/05/2013	**16.04.2013**	100	1.0	-	-
	Administrative Reforms	4	Implement ISO 9001 as per the approved action plan	% Implementation	Percent	2.00	100	95	90	85	80	**100**	100	2.0	-	-
			Prepare an action plan for Innovation	On-time submission	Date	2.00	30/07/2013	10/08/2013	20/08/2013	30/08/2013	10/09/2013	**26.07.2013**	100	2.0	-	-
	Improving internal efficiency/ responsiveness/service delivery of Ministry/ Department	4	Implementation of Sevottam	Independent Audit of Implementation of Citizen's Charter	Percent	2.00	100	95	90	85	80	**84.74**	69.481	1.39	-	-
				Independent Audit of implementation of public grievance redressal system	Percent	2.00	100	95	90	85	80	**100**	100	2.0	-	-

Total Composite Score : **95.80**
Rating : **Excellent**

AGES
Österreichische Agentur für Gesundheit und Ernährungssicherheit GmbH

IAG - Feedingstuff
Institute for Animal Nutrition and Feed
Chairperson: DI Irmengard Strnad

Performance
of participation in
FAO-IAG Proficiency Test 2014 for Feedingstuffs

Division of Animal Nutrition and Feed Technology
Central Institute for Research on Buffaloes
Indian Council of Agricultural Research
Haryana, India
participated in this proficiency test as laboratory with code: 14

Scope: Analysis of two samples (Green Meal Pellets and Complementary Feed for pigs) for constituents, different fibre parameter fractions, some undesirable substances and different feed additives respectively.

Performance Data:
Sample 1 Green Meal Pellets:
Number of parameter analysed: 16; Number of outliers: 1

Sample 2 Mixed Feed:
Number of parameter analysed: 12; Number of outliers: 2

This proficiency test was organized by
International Analytical Group (IAG) section Feedingstuff, p.a. and
Livestock Production Systems Branch (AGAS) of the Food and Agriculture Organization of the United Nations (FAO),
conducted by the
Austrian Agency for Health and Food Safety, Institute for Animal Nutrition and Feed.

Chairperson of IAG
Section Feedingstuff

I.Strnad
(November 2014)

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