

Annual Report 2013-14



Central Institute for Research on Buffaloes

Hisar-125 001 (Haryana) India

(Indian Council of Agricultural Research)



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Central Institute for Research on Buffaloes
Hisar Haryana India

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Preface



The best way to predict the future is to create it.

– Abraham Lincoln

The 'Black gold' of the country is already shining with a glittering future. The species created headlines commanding high price tag while also contributing immensely to animal protein needs of the vegetarian population of the country as well as earning foreign exchange through surging export of buffalo meat. The country has made a grand specter on the World stage being top milk producer and leading meat exporter – with crucial contribution of 71.3 Million tones milk (53 % of total) and 86 per cent of the exported meat from buffalo alone, latter earning foreign exchange to the tune of ₹ 28,000 crores.

The changed scenario has invited heightened interest in buffaloes from all around, within the country and abroad. A number of international consultations have focused on improvement of buffalo genetics in SAARC countries as well as the rest of the world, glancing the elite buffalo germplasm that India harbors. Apart from that, buffalo development also plays a major role in alleviation of poverty in developing countries, particularly pertinent to India. Buffalo enterprise has a notable role in employment of rural communities' across gender and economic strata. Recent growing demand of buffalo products has pushed up dairy prices and spurred the development of commercial farms. Private sector investment has also supported accelerated improvement in genetics through artificial insemination, increasing automation in dairy management, advanced veterinary care and ICT based extension services.

This Annual Report comes amidst the concentrated efforts to strengthen the germplasm improvement program with ISO certification for the institute. New heights were achieved on many counts with active participation and effective dialogue with stake holders. Holistic approach and use of latest technology for research in varied spheres of buffalo production have reflected the Institute's vision of keeping pace with the rapidly changing ambit of buffalo farming. The past year has witnessed a remarkable effort from the Institute to further polish this precious treasure of the country through record improvement in productivity, germplasm production and dissemination with respect to the two most important buffalo breeds for the country – Murrah and Nili Ravi – being addressed by it directly. The bright prospects of the two breeds are evident by the strong growth curves shown during the year.

The interaction with primary stakeholder – the farmer of this country – was kept in focus leading to record number of farmers, farm women and educated unemployed rural youths being trained in improved buffalo husbandry practices, balanced nutrition and artificial insemination technologies. The institute also became birth-place of the Murrah Buffalo Breeders' Welfare Association, which will be crucial in guiding the institute research and extension activities on need-based and problem-solving aspects, directly benefiting the farmers.

This report provides a glimpse of the diversified activities of the CIRB during the period of 2013-14 and will serve as ready reference for researchers, extension personnel, stockholders and policy planners.

The team work of the scientists, technical and administrative personnel as well as the supporting staff contributed outstandingly in the progress and development of the institute, guided with encouragement and support of the Council, notably from Dr S Ayyappan, Secretary DARE, and Director General ICAR; Professor KML Pathak, Dy DG (Animal Sciences) and Dr B S Prakash, ADG (AN & P). I remain obliged to all of them for the same and assure of continued efforts with added vigour in the years to come.


Dr Inderjeet Singh
Director

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Executive Summary

Under the Murrah progeny testing programme bull nos. 2045 and 2062 from Murrah centre at GADVASU, Ludhiana ranked 1st and 2nd with sire indices of 2751 kg and 2505 kg and superiority over contemporary daughter of 21.66 and 9.49%, respectively. Bull No 3103 from CIRB, Hisar ranked 3rd with Sire Index of 2391 kg and superiority of 2.57% over contemporary daughters.

During the period under report 3962 Als with the semen of 10 test bulls of 14th set of Murrah were performed in ten adopted villages under field progeny testing program at CIRB, Hisar center. A total of 1933 pregnancies were confirmed and 1230 calvings were recorded. Daughter's first lactation milk yield records were completed for 50 daughters.

A total of 1,10,844 semen doses of Murrah were frozen, which is the highest ever annual frozen semen production. 9061 doses of frozen semen were supplied to network centres, 68593 doses were sold, 7600 doses were supplied to FPT units. Semen doses were sold to farmers from Haryana, Punjab, UP, Rajasthan and Bihar. Revenue generation from sale of semen was also highest (₹ 17.35 lac) since inception. A total of 34457 semen doses of Nili-Ravi were frozen and 27875 doses were sold.

Ninety six breeding males of Murrah were sold to various states (Haryana, M P and Rajasthan) for breeding and improvement of buffalo germplasm in the Country. This is the highest number of males sold for breeding purpose in a year. Seven breeding males

of Nili-Ravi were sold to farmers of Punjab.

The highest ever overall wet average of 8.01 kg/head/d was recorded in the Murrah herd with herd average of 4.95 kg/head/d and 305 or less day milk yield of 2291 kg. Similarly, in the Nili-Ravi herd overall wet average of 8.25 kg/head/d was recorded with herd average of 5.23 kg/head/d and 305 or less day milk yield of 2241 kg, which is the best performance of Nili-Ravi herd.

A total of 334 blood samples and related phenomics records of different breeds of buffaloes were added to the database repository.

A tool under the name 'Kalrumpscale' were designed for measuring 3D angular and linear orientation of buffalo external rump/ pelvic surface with the assumption of quantification of dairy characters.

Leptin exon 2 SNP (A125G) showed significant association ($P < 0.05$) with milk protein percentage during 24 week lactation period in Murrah buffalo.

A total of 10 calves were born through ETT in which embryos from superovulated elite dams were transferred to low yielding recipients. Four pregnant recipients are yet to calve. A female calf with high genetic merit was successfully born at Bado-Patti in District Hisar through embryo transfer technology, while 7 other embryo transfers in field could not establish pregnancies.

In handmade cloning, it was established that pre-treatment of donor cells with oocyte extracts and

selection of developmentally competent oocytes through BCB staining may enhance expression of developmentally important genes. The percentage of blastocysts from the BCB+ oocytes was higher (32.8%) than both the control oocytes (22.2%) and the BCB- oocytes (6.3%). Amniotic fluid cells may provide a better alternative source of cells to generate handmade cloned embryos in buffalo. Adult fibroblasts gave an overall cleavage rate of 62.8% and blastocyst formation rate of 19.1 %, while amniotic fluid cells gave an overall cleavage rate of 71.1 % and blastocyst rate of 29.9 %.

A positive relation was found between clusterin positive sperm cells and total abnormality while negative relation with percentage of sperm viability and HOS reactive sperm cells. Inverse relationship between CPS and different motility assessed by CASA was also observed.

Supplementation of 0.25 to 0.5% sericin to semen extenders (Andromed/Egg yolk extender) increased the survival of buffalo sperm in a dose-independent manner but higher concentration had detrimental effect on sperm motility, membrane integrity, antioxidant activity and lipid-peroxidation.

A feeding module was developed for 18-24 months old replacement buffalo heifers. A saving of 20% wheat straw (~635g/d) for each animal was recorded as compared to control (common practice of ad lib feeding of concentrate-straw in the ratio of 50:50). The cost of feeding was reduced in precisely

fed animals by ₹ 4.23 per day per animal. The digestibility of nutrients remained similar, except neutral detergent fibre (NDF), which was improved in treatment heifers. Two other feeding modules for calving to insemination and feeding module for improving performance in lactating buffaloes using additive were also developed.

To validate ITK known herbs against gastrointestinal parasites in buffalo calves plant parts viz. fruits of Kantkari (*Solanum xanthocarpum*) and Vidangh (*Embelia jerium cottam*), and bark of Siris (*Albizia lebbeck*) and Harshringar (*Nyctanthes arbortristis*) were extracted with petroleum ether, chloroform-methanol, methanol and water. Thus a total of 16 extracts were prepared. The extracts were subjected to in vitro evaluation for their efficacy against L3 larvae of *Haemonchus contortus*. Chloroform-methanol extract was found most effective irrespective of plant source.

Inclusion of *Cordia dichotoma* leaves at graded levels (5 to 20% of the substrate DM) with wheat straw improved true degradability of dry matter and reduced methane production (up to 13.86%) under in vitro system. Supplementation of *Cordia dichotoma* leaves at the rate of 5% of DM did not alter voluntary feed intake or milk production but increased (17%) body weight.

The institute organized 12 infertility treatment camps in collaboration with PNB Farmers Training Centre, Sucha Khera. Buffalo Mela was organized at the

Institute premises on February 1, 2014. In this annual event elite Murrah buffaloes, bulls and heifers (total 161) from all over Haryana and adjoining states participated. Murrah championship was major attraction in which judging was done under 7 categories. A Buffalo Mela was also organized on December 2, 2014 at CIRB sub-campus, Nabha to encourage farmers rearing true to breed Nili-Ravi animals.

Four calf rallies were organized in villages adopted under FPT project. Hundreds of farmers participated in these calf rallies along with their animals.

Training programmes on improved buffalo husbandry (6), Artificial Insemination (3) and buffalo nutrition (2) were organized at the maincampus, CIRB, in which 443, 56 & 193 farmers and rural youths participated. One training programme on improved buffalo husbandry was organized at subcampus in which 40 farmers participated.

A total of 34710 qtls green fodder, 5234 qtls silage, 922.3 qtls grain and 552 qtl of straw were produced at CIRB, Hisar campus while 45406 qtls of green fodder, 4089 qtls silage, 4699.5 qtls of grain and 3038 qtl of straw were produced at subcampus, Nabha.

Special Achievements:

- Achieved ISO 9001:2008 certification (BN8192/7295:0913) for the institute under the scope “Improved Buffalo Germplasm Production”
- Achieved an overall annual wet average of 8.01 kg in the Murrah herd and wet average of 8.25 kg in the Nili-Ravi herd, the highest ever since inception of the Institute.
- Successfully carried out ET in field. Ten embryo transfer calves born.
- Carried out 26 institute and 10 outside funded projects
- Developed 3 feeding modules for farmers
- Achieved excellent score in RFD with an improvement of 14.5% points over last year.
- Imparted trainings to 732 farmers, farm women and rural educated youths.
- Generated the highest ever revenue of over ₹ 312 lakhs

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- Ravi Buffalo Farm from the Punjab State Government. The Main campus has established a highly pedigreed breeding herd of Murrah whereas subcampus 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 health 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.

Staff Position

The institute has 32 scientists in position including 3 woman scientists (Table 1).

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 Cell, RFD Cell, Institute Technology Management Unit and AKMU have been created and assigned responsibilities for smooth functioning of research activities of the institute. For

Table 1 : Staff Position as on 31.3.14

S.No.	Category	Sanctioned Strength	Filled	Vacant
1	Scientific	40+1	32+1	8
2	Technical	44	40	4
3	Administrative	20	18	2
4	Skilled Supporting	71	68	3

the XII plan period flagship programs and priority areas were identified to focus on strategic research in niche areas. This institute is coordinating Network Project on Buffalo Improvement with 10 centers across the country, addressing 7 important buffalo breeds. The institute is also carrying out technology transfer through conducting training 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.

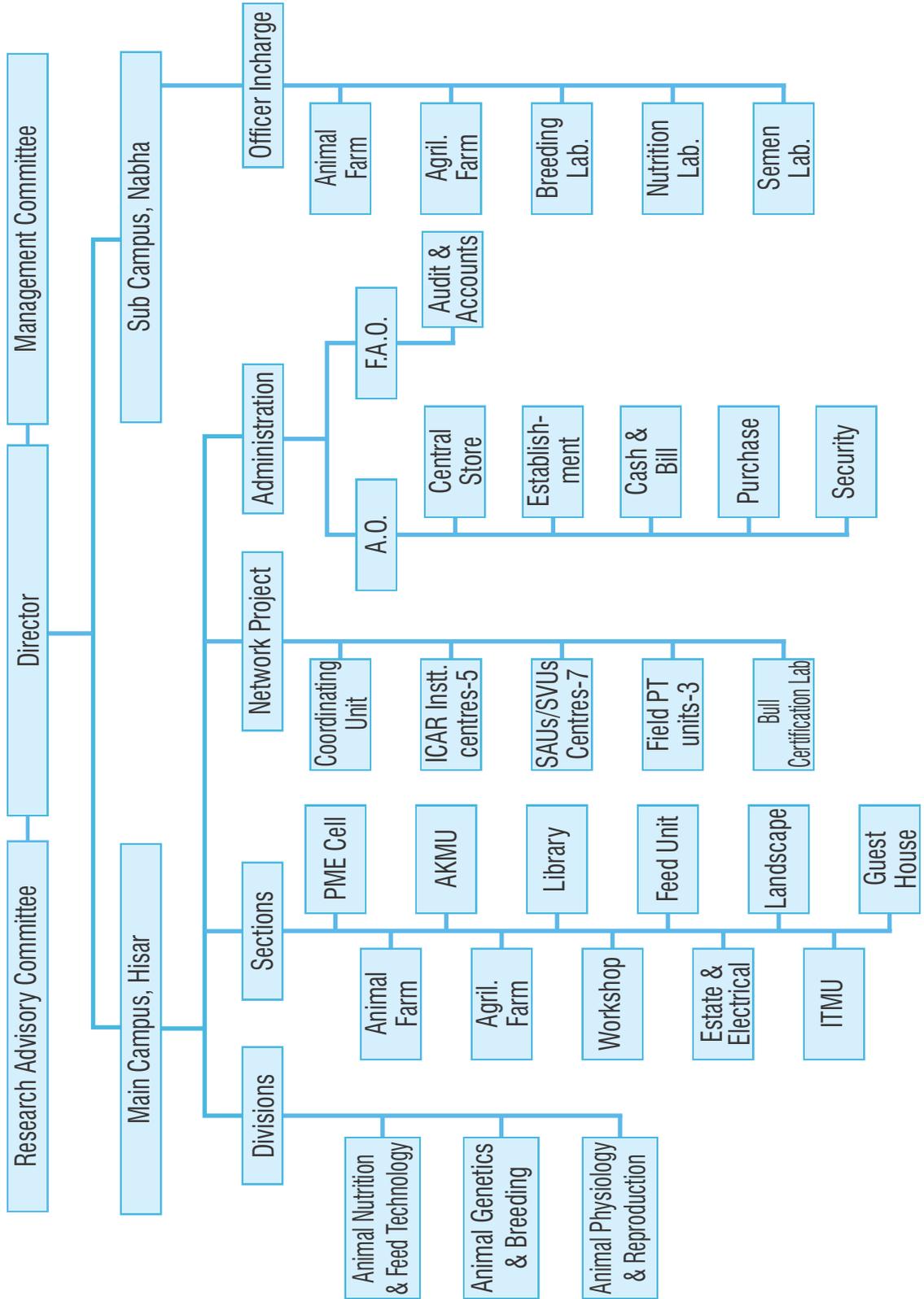
Financial Statement (2013-14)

The detail of fund allocation and actual utilization under various schemes/projects including revenue receipts for the year 2013-14 is given below (Table 2).

Table 2 : Financial Outlay (in lacs)

Head	Sanctioned Budget 2013-14	Expenditure 2013-14
Plan 2013-14	257.89	252.41
Non-Plan 2013-14	1788.00	1716.54
Network project on buffalo improvement	480.00	473.54
AICRP on improvement of feed resources	6.50	4.20
Intellectual property rights and Commercialization of technology	5.66	3.55
NAIP Projects (Component-I)	25.00	21.8
NFBSFARA Project	18.88	18.03
DBT Projects	2.20	1.96
Contract Research Project (M/S Elanco)	100.49	85.19
Revenue receipt	195.50 (target)	312.13 (achieved)

Organizational Setup



Research Achievements

Genetic Improvement

India possesses the largest buffalo population (112.9 million) having high genetic diversity (13 recognized breeds and 14 distinct populations). Buffaloes currently produce 62.35 million tonnes of milk contributing 51.2 per cent of the total milk (DADF, 2012). Buffalo meat production was 1103.85 thousand MT in 2012-13 (DADF, 2013). Some of the well-established breeds of buffalo native to India are Murrah, Nili-Ravi, Surti, Jaffarabadi, Pandharpuri, Banni, Mehsana and Bhadawari. Apart from this there are large nondescript populations of buffalo in the country. It is heartening to note that more than half of the milk production of the country comes from the buffalo but the genetic potential of the species still remains to be utilized to its fullest. For accelerating the pace of improvement in water buffalo country requires large number of breeding bulls/semen doses of high genetic merit. At present a wide gap exists between the availability and the requirement of superior buffalo bulls. To bridge this more emphasis is being given to include the farmers' buffaloes in the progeny testing programme. Traditional selection tools need to be combined with biotechnological tools. An integrated approach involving phenomics, genomics, proteomics and bioinformatics tools is essential for understanding and exploiting it in buffalo breeding programs for improvement in desired traits. Apart from milk, the species also significantly contributes towards meat as evident by export of 1.45 Million MT of meat worth Rs. 24435 cores to 85 countries during the year 2013-14 (<http://www.apeda.gov.in>). Research efforts are being made to

develop broiler line of buffaloes to tap the huge world meat market.

HERD PERFORMANCE

Murrah Herd

As on March 2014 the overall herd strength of Murrah buffalo was 449 including 144 calves born during the year. The buffalo herd included 151 adult buffaloes, 129 suckling calves (< 1 year), 92 young males and females (1-2.5 years), 66 heifers (> 2.5 years) and 11 breeding males (>2.5 years).

The overall wet average and herd average were 8.01 and 4.95 kg, respectively. The wet average recorded is an all-time high since inception of the Institute. The overall 305 days lactation milk yield and total lactation milk yield were reported 2291 and 2494 kg, respectively. During the year under report an average 105 buffaloes were in milk and 65 were dry.

The overall conception rate during the year 2013-14 was 51.22% that was significantly improved as compared to the previous year. The other reproductive traits viz. age at first calving, service period and calving interval were 45.62 months, 190 days and 495 days, respectively.

The overall calf (0-3 month) mortality was 5.42% which is also an improvement over the last year. Total buffalo herd mortality was 2.73% which is again lower as compared to the last year (3.16%).

A record number of 1,10,844 semen doses were frozen at Institute's semen freezing Lab during April

2013 to March 2014 (Previous record was 73095 doses in 2011-12). A total of 18,805 doses of frozen semen were used in Network project and 75,500 doses were sold during the period under report. It was for the first time that ninety six breeding males were supplied to various states (Haryana, M.P. and Rajasthan) in a year for breeding and improvement of buffaloes. The revenue generated from sale of semen was ₹ 17.35 lac, which is highest since inception.

Nili-Ravi herd

At present, a total of 467 buffaloes including lactating, bulls and young animals are maintained at sub campus. During the period under report the fifth set of Nili-Ravi bulls is being used for breedable females and

performance of progenies is being recorded. One hundred fourteen surplus animals were auctioned and the mortality rate was maintained at low level of 2.02%. The wet average of 8.25 kg and herd average of 5.32 kg were achieved for the period. Best ever average standard lactation yield during 2013-14 was recorded as 2297 kg.

The average body weight at birth was 33.36 and 36.01 kg for female and male Nili-Ravi buffalo calves, respectively. The growth rate of males was more up to 24th month of age. Females and males achieved 365.10 kg and 391.0 kg body weight at 24 months of age depicting best health and growth profile.

Overall conception rate was 34.16 % and average age

Table 3 : Detail of bulls of the 10th set of Network Project on Buffalo Improvement

Bull No.	Location	Dam No.	Sire No.	Dam's best lact. 305 day or less yield (kg)	Daughters 1st Lact. 305 day or less Av. Yield (kg)/N	Sire Index	% superiority over Cont. Daughters	Rank
2045	GADVASU	1835	3567	3369	2540/48	2750.98	21.66	I
2062	GADVASU	1819	1419	2672	2419/39	2505.26	9.49	II
3103	CIRB	1144	392	2942	2353/15	2361.41	2.57	III
1693	HAU	1050	392	3194	2343/13	2346.60	1.89	IV
2074	GADVASU	1794	3567	3050	2315/27	2320.64	0.74	V
2083	GADVASU	1888	2363	3063	2311/29	2314.86	0.47	VI
2990	CIRB	587/4.9	392	2655	2303/16	2302.96	-0.08	VII
507	IVRI	341	1923	2572	2244/13	2239.10	-2.96	VIII
ND2	NDUAT	119	-	2583	2198/12	2193.98	-12.92	IX
2073	GADVASU	1909	2184	2717	2210/43	2132.89	-8.07	X
3631	CIRB	-	-	18.0 kg Peak yield	2178/24	2121.83	-8.36	XI
ND1	NDUAT	106	-	2644	1997/10	2015.91	-16.04	XII
5396	NDRI	4635	4807	2617	2033/19	1950.04	-16.04	XIII

For all herds, first lactation 305 day or less milk yield was 2305.00 kg based on 308 daughters.

at first calving was 39.8 months. Overall service period, calving interval and dry period were 127,495 and 159 days, respectively.

A record number of 34457 semen doses were frozen during April 2013 to March 2014. A total of 27875 doses of frozen semen were sold during the period under report, which is also the highest for the subcampus.

Network Project on Buffalo Improvement

Data of daughters born from the 10th set of Murrah bulls which completed their first lactation, was compiled for various centres and filed units and sires were evaluated with contemporary daughter average index method. Bull no. 2045 and 2062 from GADVASU, Ludhiana ranked 1st & 2nd with respective

sire indices 2797.72 kg and 2473.18 kg and percent superiority 22.38% and 6.77% over contemporary daughters. Bull No 1693 from CCShAU, Hisar ranked 3rd with Sire Index 2544.74 kg and superiority of 5.96 % over contemporary daughters. The pedigree detail and sire index of the 10th set are presented in Table.

Under NWP on Murrah, semen collection and cryopreservation of bulls of XIV set is in progress. During the year 2013-14 frozen semen doses of superior Murrah bulls were produced at all Murrah centres.

Progeny Testing in Murrah

Test mating of 14th set bulls was initiated in institutional herds and field from January 2013. It will be continued upto June 2014. Preliminary selection

Table 4 : Production and reproduction characteristics of different breeds of buffaloes under Network Project on Buffalo Improvement during 2013-14

SN	Breed	Age at First calving (months)	Av. Service Period (days)	Av. Dry Period (Days)	Av. 305 day or less milk yield (Kg)	Wet Average	Av. Calving Interval (days)
1.	Murrah (weighted average of all centres)	42.87 (136)	152.68 (304)	155.60 (275)	2421.40 (337)	7.58 (312)	463.50 (277)
2.	Jaffarabadi	48.00 (24)	145.00 (33)	207.00 (43)	1639.00 (33)	6.90 (34)	523.00 (43)
3.	Nili Ravi	39.80 (42)	127.00 (67)	159.00 (67)	2241.00 (109)	8.25 (94)	446.00 (97)
4.	Surti	45.47 (8)	120.00 (25)	135.60 (16)	1481.00 (24)	5.11	401.00 (16)
5.	Bhadawari	50.10 (6)	175.00 (11)	214.00 (11)	1385.90 (21)	4.72 (21)	520.00 (11)
6.	Pandharpuri	43.26 (1)	106.00 (10)	110.00 (11)	1601.64	5.10	429.00 (10)
7.	Swamp	47.18 (2)	251.50 (2)	156.50 (2)	501.00 (4)	2.19 (8)	563.50 (2)

Table 5 : Semen Sale at Network centres during 2013-14

Breed		Semen Sold
Murrah	CIRB, Hisar	68635
	NDRI, Karnal	62054
	GADVASU, Ludhiana	24784
Sub-total		155473
Nili-Ravi	CIRB Sub Campus, Nabha	27875
Surti	RAJUVAS, Vallabh Nagar	2345
Jaffarabadi	MPKV, Kolhapur	8725
Bhadawari	IGFRI, Jhansi	4323
Sub-total		43268
Total		198741

of 15th set Murrah bulls (n=21) has been done and these bulls shall be used at all the Murrah centres for test mating from 1st July 2014 and continue upto December 31, 2015.

Field Progeny Testing

Under field progeny testing (FPT) program, semen of test bulls is used for artificial insemination in the field, followed by pregnancy diagnosis, calving of buffaloes and follow up of progenies till the completion of their first lactation milk records on the basis of monthly test day recording. During the period from April 2013 to March 2014, 3962 artificial inseminations with the semen of 10 test bulls of 14th set were performed in ten adopted villages. In all, 1933 pregnancies were confirmed and 1230 calvings were recorded, out of which 552 were females. In this period 71 progenies, 9 of 10th, 61 of 11th and 1 of 12th set, with an average AFC of 41.45 months, calved at various field unit centres. Monthly test day milk

recordings for these first calved progenies are in progress. During the year, the monthly test day milk recordings of 117 daughters were done at various field unit centers, out of which 50 daughters completed the lactation, 20 daughters were sold before the lactation was completed and recording of 47 daughters are in progress. The physical identification using injectable microchips has been done in all female progenies available in the field. As on 31st March 2014, 809 female progenies of 11th to 14th set of different age are standing at various field unit centers under the project for future milk recordings. Out of which 299, 439 and 71 daughters were less than 1 year, 1-3 years and more than 3 years, respectively.

Development of buffalo breeding herd analyser

Self-designed "F" type instrument was modified and utilized on 14 Murrah and 17 Nili-Ravi buffaloes maintained at Institute farm, Hisar and its sub campus at Nabha, respectively.

The major proportion of population of both Murrah and Nili-Ravi breed in their native tract have been distributed and configured into two types (Type-C with curled horns and Type-D with downward emerging horns along the other distinguished characters) other than non-descripts.

A tool under the name of 'Kalrumpscale' were designed for measuring 3D angular and linear orientation of buffalo external rump/pelvic surface with the aim of digital quantification of dairy

	Murrah-C	Murrah-D
Male		
Female		

Murrah breed: Types of horn shapes

	Nili-Ravi - C	Nili-Ravi - D
Male		
Female		

Nili-Ravi breed: Types of horn shapes

characters. A device named “KALRUMPSCALE” has been developed to measure buffalo rump angularity for identification of dairy characters.

Polymorphism in Leptin gene in relation to milk constituents, production and reproduction

The individual and the synergistic influence of identified SNPs in various exons of leptin and leptin receptor genes has been studied for milk constituents (fat, protein and lactose percentage), reproduction and production parameters. Leptin gene exon 2, intron 2 and exon 3 (w1/m2/m3 + mA/mB)

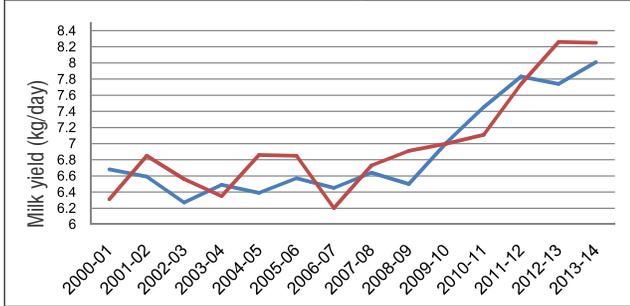
combinations showed significant ($P < 0.05$) association with milk protein and all other combinations showed non-significant ($P > 0.05$) association with milk yield, fat, protein and lactose among the studied population. The same identified SNPs were also analyzed for the 24 and 30 weeks lactation period of the studied population. In individual effect, only significant association ($P < 0.05$) was observed in protein percentage in 24 week lactation period in exon 2 (A125G) and wmm/ww genotype in synergistic manner.

The variations in leptin receptor gene exon 2 indicate the significant association ($P < 0.05$) for the SNPs combination 6, 9 + 1, 2, 3, 4, 5, 7, 8 for protein and lactose percentage. SNP G59A showed association with peak yield. Reproduction traits AFC, CI, DP and SP revealed numerical variation but non-significant ($P > 0.05$) association was observed for all the above mentioned traits.

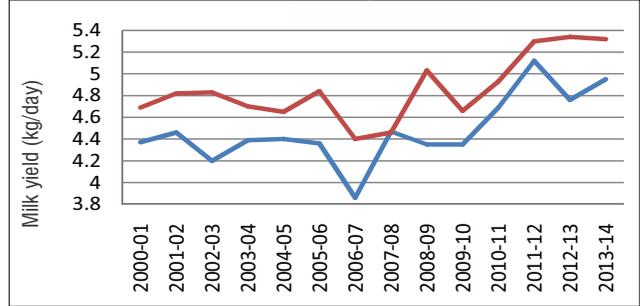
Genome resource database

A total of 334 blood samples and available performance records of different breeds of buffaloes namely Murrah (252 samples from CIRB, Hisar and GADVASU, Ludhiana), Bhadawari (42 samples from IGFR Jashi) and Nili-Ravi (110 samples from CIRB, Nabha) were collected from different centres of Network Project on Buffalo Improvement. These samples were added to the existing database repository of 2785 samples collected earlier.

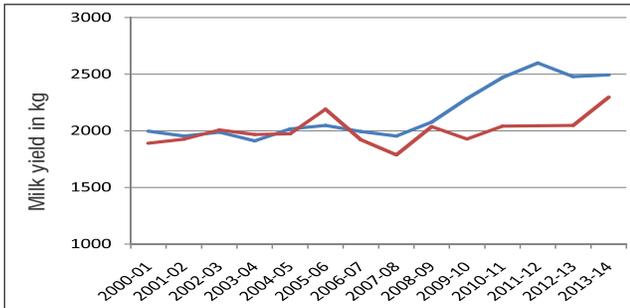
Wet average



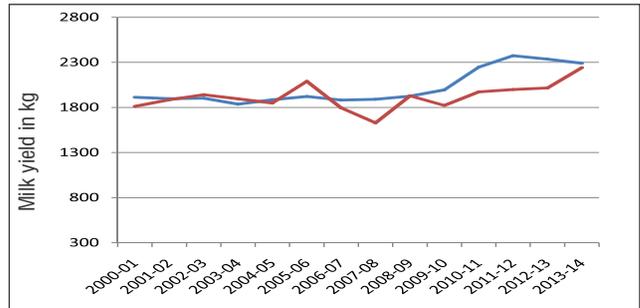
Herd average



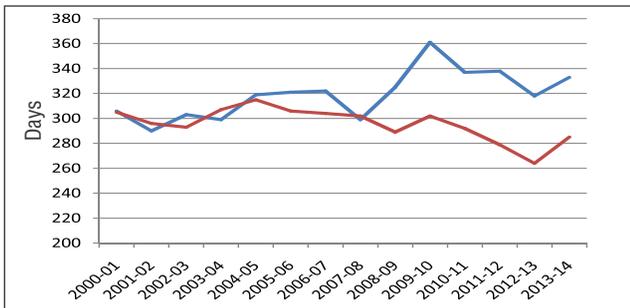
Average lactation yield



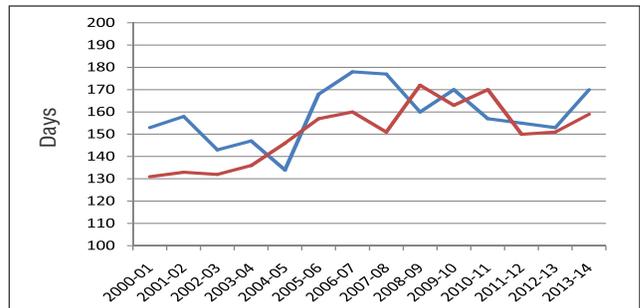
Average standard lactation yield



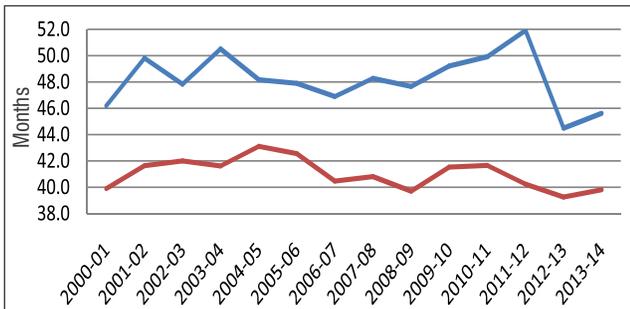
Average lactation length



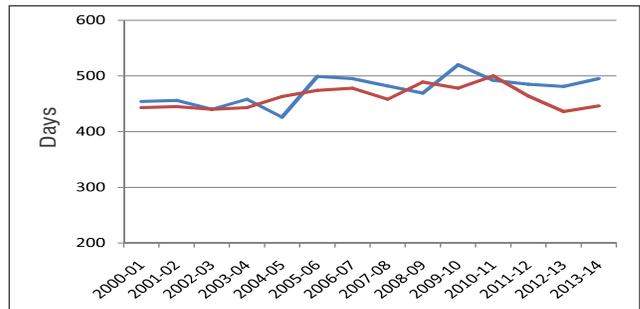
Dry period



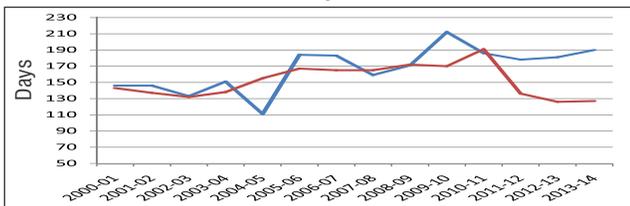
Age at first calving



Calving interval



Service period



— Murrah
— Nili-Ravi

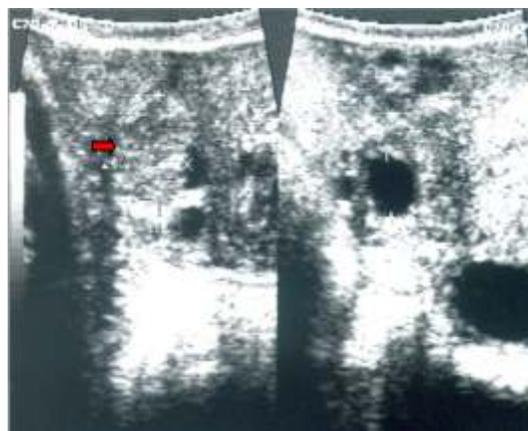
Improvement of Reproductive Efficiency

Efficient reproduction is cumulative result of good nutrition, better management and proper breeding strategies. An integrated approach of optimum nutrition, better management and application of reproductive biotechnologies is the desired route which can lead to sustainable livestock farming. Taking into consideration the new developments in different areas of research, better strategies can be devised for boosting production potential of buffaloes. Combination of advanced techniques is required for fully exploiting the production potential of animals. All the aspects affecting the health and production and their interrelationship in a holistic way is important to understand cumulative strength of these techniques. This integrated approach shall be helpful to provide better technology supported package of practices for end users.

Major research focus is on the aspects of semen cryopreservation, multiple ovulation embryo transfer, heat detection, estrus synchronization, induction of estrus and ovulation detection besides *in vitro* maturation, *in-vitro* fertilization, cloning and establishing the stem cells from different sources. Projects related to early detection of pregnancy using proteomics approach and use of ultrasonography in reproduction management are being implemented for strategic and practical application. Experiments are also going on fertility-associated seminal plasma proteins secreted by the accessory sex glands.

To understand the molecular basis of cyclicity in buffaloes microRNAs expressed in different

reproductive stages of buffalo corpus luteum were identified. CL from pregnant and cyclic genitalia were collected from slaughterhouse specimen, snap-frozen and stored at -80°C until further processing. For corpus luteum biopsy, one acyclic animal having a follicle diameter of 13 mm was administered GnRH treatment for ovulation and corpus luteum formation. Upon confirmation of CL formation it was biopsied on day 5 post GnRH treatment following standard surgical procedure. The collected CL was immediately snap-frozen in liquid nitrogen and then stored at -80°C until deep sequencing, which is in progress.



Biopsied corpus luteum formed post GnRH treatment

Buffalo owners face the problems of poor estrus behavior; silent estrus and delayed ovulation which disturb the normal fertilization and lead to repeat breeding. Efficient estrus detection is important for achieving high reproductive success in buffaloes. Therefore, farmers need to be conversant with the methods to predict and detect estrus. Farmers observe and pursue the phenomenon of 'Doka' in

buffaloes and associate it with estrus. Hence a new project is formulated on scientific validation of 'Doka' in buffaloes for improvement of reproductive performance under field and farm conditions. For conducting field survey on Doka in buffaloes, two proforma have been developed for collecting the information from farmers.

To implement the technology for induction of lactation in barren buffaloes at the field level, initiative has been taken with farmer's buffalo (Sh. Jagbir Singh S/o Sh. Ram Swaroop Singh, Village Sarsod, Barwala, Hisar). Treatment consisted of subcutaneous administration of estradiol 17b and progesterone @ 0.1 mg/kg body weight/day for 7 days in the buffalo that failed to conceive inspite of infertility treatment. At last, he adopted this technology and the animal started yielding 8.5 kg milk.

including 8 pregnant, (inseminated & conceived) and 6 non-pregnant (non-inseminated). These were screened for the presence of urinary and blood pregnancy specific proteins through sampling on 0, 7, 14, 21, 28 and 35- 42 days after AI/ estrus (Day 0). Simultaneously, these animals were examined through transrectal ultrasonography for the presence of CL and pregnancy confirmation. Samples such as urine, whole blood and blood serum were collected and preserved as serum, cDNA, urine (3 types- concentrated proteins, filterate and retentiate) for further study.

Interferon-t, a novel type I interferon, produced by 14-17 days conceptus acts in extremely low levels in extra-uterine tissues and peripheral circulation. Extremely low levels prevent its direct use as an early pregnancy diagnosis molecule. Studies on IFN-t



Before hormone treatment



After hormone treatment



Sh. Jagbir Singh, Sarsod, Hisar with his animal. Milk Yield=8.5 Kg

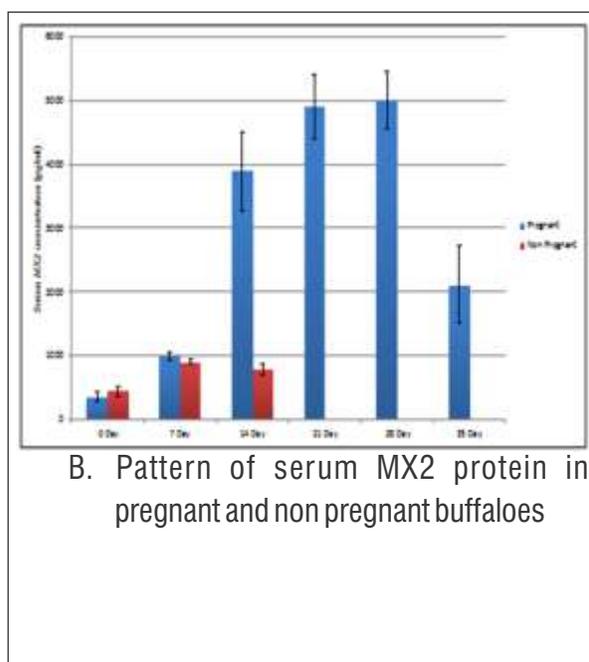
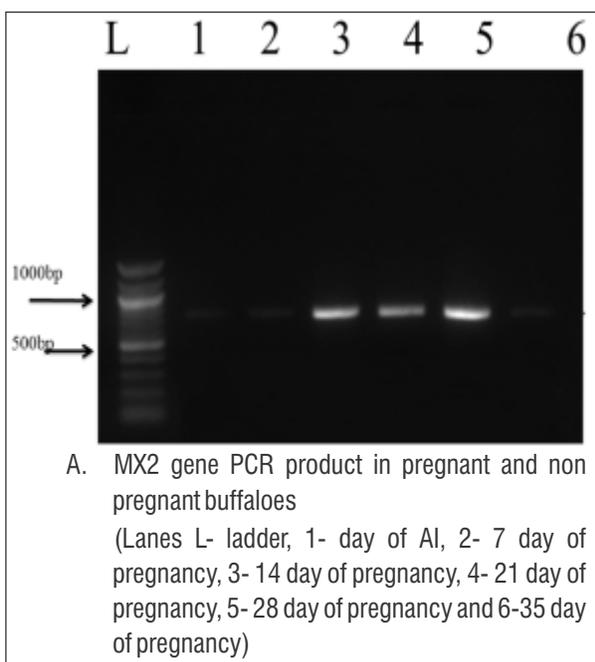
Induced lactation in farmer's buffalo at his doorsteps

Studies on development of cow side test for detection of pregnancy in buffalo by pregnancy associated proteins (PAPs) are in progress. In this endeavor, 14 cyclic heifers (day of estrus: Day 0) were selected,

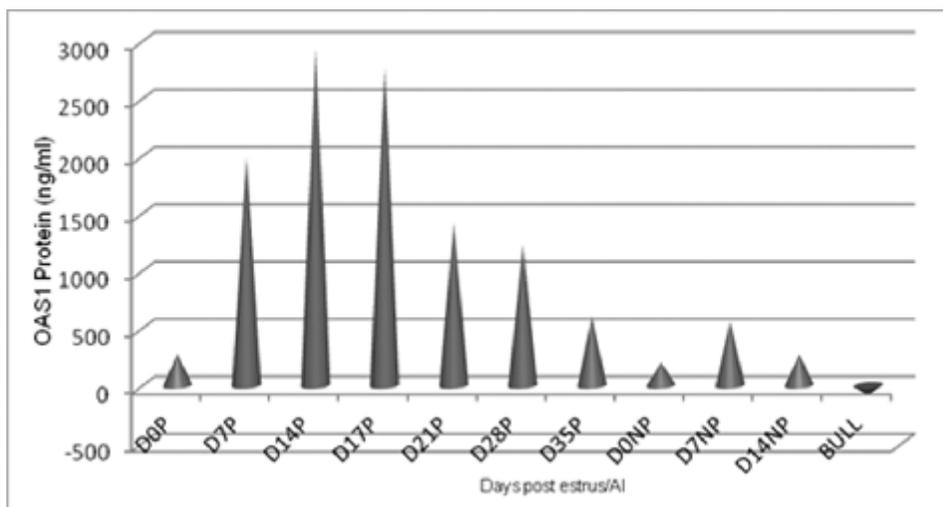
stimulated genes (ISG) viz. interferon-stimulated protein 15 kDa (Isg15), myxovirus-resistance 2 (MX2), and 2-5 oligoadenylate synthetase (OAS1), in peripheral blood leukocytes during early pregnancy

have been encouraging and can pave way towards development of a cow side test for early pregnancy diagnosis. These two genes were taken up in the current studies viz. MX2 and OAS 1. Results have been quite exciting and open new avenues for further experimentation.

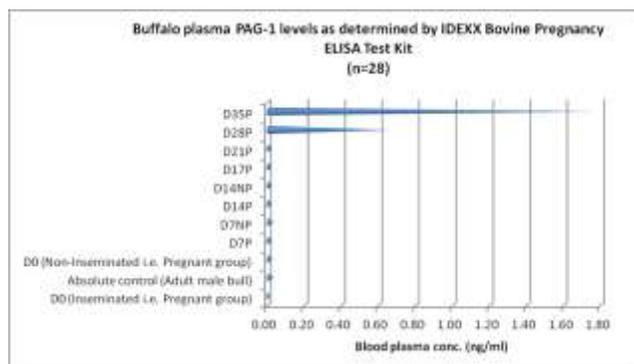
PAG, although an established pregnancy biomarker, is yet to prove its utility as an early pregnancy indicator molecule. There seemed to be clear elevation of the level of PAG on day 28 of pregnancy. Although the studies are not conclusive, on first look PAG-1 seems to be a good pregnancy biomarker for



Interferon tau stimulated MX2 gene PCR product and protein



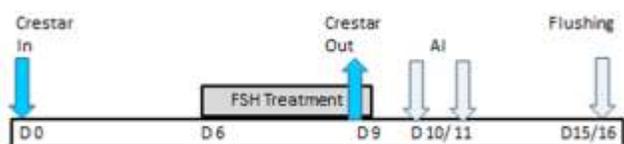
Serum OAS1 protein in pregnant, non-pregnant and male animals



Blood PAG-1 levels of buffaloes

detection of pregnancy around 28-35 days post AI in buffaloes. These results need to be analysed further on larger group on different categories to give a conclusive judgment.

Due to postpartum anestrus problem in high yielders, it is a difficult task to select the good donor animals for superovulation protocol. No reports for superovulatory response in acyclic anestrus animals are available. This study is, hence, designed to evaluate the superovulatory and embryo recovery response during induced estrus in acyclic buffaloes. Buffaloes were induced to superovulation using 400 mg FSH hormone in descending dose schedule under the influence of progesterone implant. It has been observed that buffaloes during anestrus period can be used for superovulatory treatment under the influence of progesterone implant.



Superovulation protocol for anestrus donor buffalo

Number of ovulatory follicles at estrus, number of CLs at flushing and viable embryo recovery did not vary significantly between cyclic and anestrus buffaloes. However, embryo recovery with use of 400mg FSH was lower as compared to 600mg FSH.

Table 6: Embryo recovery, transfer and freezing activity during the year 2013-14

Buffaloes superovulated	21
Viable embryo recovery per flushing	1.05
Total embryo recovery per flushing	1.14
Fresh Transfers	19/22
Frozen Transfers	4/4
Total transfers	23/26
Pregnancy	4/20
Pregnancy diagnosis due	3
Pregnancy with frozen embryo	01

Multiple ovulation and embryo transfer (MOET) for faster multiplication of elite buffaloes for conservation and multiplication of superior buffalo germplasm was under taken with the objective to produce pedigreed superior males and females. A female calf was successfully born in the field in Bado-Patti Village in District Hisar through embryo transfer technology. The embryo was produced in a very high yielding buffalo from the institute herd after insemination with the semen of a top ranking bull. The resulting embryo was flushed out and transferred fresh in the recipient which was of inferior type. This resulted in the birth of a female calf with good production potential as per the germplasm of its donor parents.



ETT born calf at farmer's doorsteps in village Bado-Patti

In IVF experiments, after 18 h of sperm-oocytes co-incubation, presumptive zygotes were cultured in 4 different IVC media (i. TCM-199 + granulosa cells + 10% FBS; ii. mCR2aa + 10% FBS; iii. mSOFaa + 100 nM bME and 3 mg/ml fatty acid free BSAs; iv. mSOFaa + 0.1 mg/ml PVA + 2.77 mM myo-inositol + 1.2 mM Phosphate + 10 ng/ml EGF) up to 8 days post insemination in a humidified CO₂ incubator (5% CO₂ in air) at 38.5°C. The medium was replaced with 50% of fresh IVC medium every 48 h. Total RNA was isolated from cleaved embryos at 8-16 cell stages from each group and cDNA was synthesized by cell to cDNA kit. β -ACTIN was used as reference gene for confirmation of cDNA and amplicons of GPX-4, MNSOD, IGF-2 and BAX with an expected length of 196 bp, 193 bp, 107 bp and 82 bp respectively, were detected by RT-PCR analysis in buffalo IVF embryos at 8-16 cell stages from medium, mSOFaa + 100 nM bME and 3 mg/ml fatty acid free BSAs and medium, mSOFaa + 0.1 mg/ml PVA + 2.77 mM myo-inositol +

1.2 mM Phosphate + 10 ng/ml EGF respectively. Work to determine the relative abundance of mRNA transcripts of these genes is in progress.

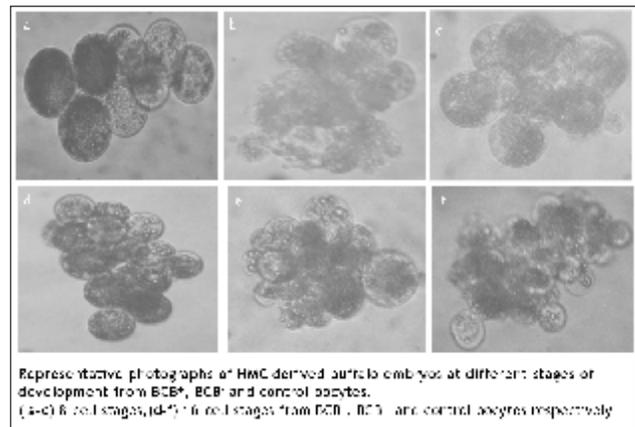
In hand-made cloning (HMC), experiments were conducted on exposure of fibroblast cells (as donor cells) to mature oocyte extracts, effect of source of donor cells, confluence stage of donor cells and fresh/frozen donor cells. For selection of developmentally competent buffalo oocytes, Brilliant cresyl blue (BCB) staining, as an indicator for glucose-6-phosphate dehydrogenase (G6PDH) activity, was used to select developmentally competent buffalo oocytes before in vitro maturation to yield higher overall efficiency of cloned buffalo embryo production. The buffalo fibroblast cells were exposed to mature oocyte extracts for one week, and then the expression of OCT4 and NANOG in extracts treated cells (ETCs) were significantly ($P < 0.05$) up-regulated in comparison with non-extract treated control group. This result showed that buffalo oocytes extracts could reprogram fibroblasts. A total 506 demi-cytoplasts were used to reconstruct 126 embryos; control oocytes ($n=54$), BCB+ oocytes ($n=50$) and BCB- oocytes ($n=22$). Ear pinna fibroblast cells from new born buffalo calf treated with oocyte extract was used for nuclear transfer in all three groups. In terms of the proportion of cleaved embryos recorded after NT, significant differences ($P < 0.05$) were found among the BCB+ oocytes (73.9%) and the BCB- oocytes (54.2%), whereas no significant differences in terms of the cleavage rate were recorded between the control oocytes (71.6%) and the BCB+ oocytes. The percentage of

blastocysts from the BCB+ oocytes was significantly ($P < 0.05$) higher (32.8%) than both the control (22.2%) and the BCB- oocytes (6.3%). The selection of the developmentally competent oocytes through BCB staining, when subjected to the process of NT using extract treated donor cells, lead to an improvement in overall blastocyst rate.

The efficiency of two cell type i.e adult fibroblast and amniotic fluid cell as donor for somatic cell nuclear transfer by HMC in buffalo was compared. A total of 796 demi-cytoplasts were used to reconstruct 191 embryos. Adult fibroblasts gave an overall cleavage rate of $62.8 \pm 1.8\%$ and blastocyst formation rate of $19.1 \pm 1.5\%$, while amniotic fluid cells gave an overall cleavage rate of 71.1 ± 1.2 and blastocyst rate of $29.9 \pm 2.2\%$. The results showed that there were significantly ($P < 0.05$) higher in vitro developmental potential of cloned embryos derived from buffalo amniotic fluid cells as compared to cloned embryos derived from adult fibroblasts.

The transcription profile of five genes, GLUT1, OCT4, DNMT1, BAX and BCL2, in preimplantation cloned embryos derived from BCB+ oocytes with extracted treated donor cell group was compared with control IVF embryos. The expression profiles for all genes at 8-16 cell stage in IVF and cloned embryos was same, which indicates that the nuclear transfer (NT) embryos showed the same level of transcription activity for these genes as their IVF counterparts. The results of the study suggests that the pre-treatment of donor cells with oocyte extracts and selection of developmentally competent oocyte through BCB staining may enhance expression of developmentally

important genes GLUT1, OCT4, DNMT1, BAX, and BCL2 in HMC embryos at levels similar to IVF counterparts, also amniotic fluid cells may provide a better alternative source of cells, to generate HMC embryos in buffalo. In experiments with stage of confluence, donor cells from more confluent cultures were better than less confluent cultures and fresh donor cells were better than frozen ones.



Efforts were made to find out more suitable cryo-protectant, effect of trehalose and sericin on freezability of buffalo bull semen. Sericin supplementation to extenders increased the survival of buffalo sperm in a dose-independent manner (0.25 and 0.5 %) but higher concentration (1, 1.5 and 2%) had detrimental effect on sperm motility, membrane integrity, antioxidant activity and lipid-peroxidation. Supplementation of 0.25-0.5% sericin in Andromed or egg yolk based semen extender improved frozen-thawed semen quality.

Towards establishment of fertility-associated seminal plasma proteins as biomarkers, commercially available antibody osteopontin corresponding to amino acids 170-183 (Abnova- ab 9078) showed immunoreactivity to ~80 kDa on Western blots of

seminal plasma proteins. Furthermore, for identification of clusterin in buffalo seminal plasma polyclonal anti-clusterin was used and a ~40 kDa band was identified on Western blot. To estimate the clusterin positive sperm (CPS) cells in frozen-thawed semen, 4 Murrah buffalo bulls' semen was analyzed by immunofluorescence assay using polyclonal antibody against clusterin in relation to semen quality. Immunofluorescence results showed that all clusterin positive spermatozoa were abnormal, but not all abnormal spermatozoa were clusterin-positive. Head and midpiece abnormalities and teratospermia were the most commonly observed abnormalities among the CPS. A positive relation was found between CPS cells and total abnormality while negative relation with percentage of sperm viability and HOS reactive sperm cells. We found inverse relationship between CPS and different motility parameter assessed by CASA (total motility, progressive motility and rapid motility). The accumulation of clusterin on abnormal spermatozoa may be an indication of unfavorable testicular conditions or individual germ cell aberrations that might have an effect on fertility but are undetectable by routine tests. Thus, CPS can be a potential marker for poor-quality ejaculates.

Under a contract research project, the use of rbST in buffaloes for increase in milk production is being studied under prevalent buffalo husbandry practices in the country. The rbST injections were administered in lactating buffaloes, and animals were monitored daily and samples were collected, preserved and analyzed as per the study protocol schedule in treated and control groups. All lab analysis w.r.t. lactoscan,

blood biochemistry, haematology, serum hormones (T3, T4, GH, IGF-1 and Leptin), milk IGF-1, serum BHBA and feed analysis have been completed. All data generated has been digitized, listed into Tables and ready for statistical analysis.

Equine mesenchymal stem cells from the amniotic fluid were cultured, characterized and differentiated into tenogenic cells with bone morphogenetic protein-12, under a collaborative project with NRCE for developing stem cell based therapy for tendon repair in equines.

Reactive oxygen species (ROS) is a consequence of amount of energy consumed during cellular metabolism and function in animals and oxidative stress so generated, can lead to cell dysfunction, thereby decreasing overall productivity of animal. If ROS exceeds the antioxidant defense in semen, oxidative stress may affect fertility/physiology of sperm and spermatogenesis. To explore the genetic variation in oxidative stress governing genes through SNP genotyping of bulls varying over field conception rate, semen/ sperm kinetics, motility and membrane integrity were studied as fertility parameters for elucidating relation of nucleotide variants and sperm quality and fertility of bulls. Bull-wise variation in post-thaw sperm motility, kinetics was studied through CASA. Variation in reduction of total motility, progressive and rapid motility was recorded as 8 to 49%, 30 to 59% and 31 to 56% respectively. Sperm membrane integrity test revealed incidence of non-reactiveness in sperms enhanced between 20 to 50% in post thaw semen of bulls.

Feed Resource Utilization and Improvement

Efficient conversion of materials inedible for humans, such as crop residues and by-products into human food by ruminants continue to play an important role in the livestock production systems. Efficient utilization of locally available feed resources and agro-industrial by-products, strategic supplementation of critical nutrients, development of complete feed diets/ total mixed rations for different categories of buffaloes and studies on the rumen microbial ecosystem, fermentation pattern and its manipulation have been the areas of research under this programme. Mitigation of methane emission, feeding and rearing of male and female buffalo calves for higher production, improving mineral utilization, precision feeding were in focus.

A feeding trial for precision feeding of calf starter was conducted on growing male buffalo calves. Twenty four calves, about 1-2 months old, purchased locally were divided randomly in three groups of eight each. Calves in Group-I were fed calf starter with 24% CP and 72% TDN, those in Group- II were fed calf starter with 21% CP and 72% TDN along with limiting amino acids lysine and methionine, and vitamin A and D, while those in Group-III were given calf starter with 18% CP and 72% TDN along with limiting amino acids and vitamin as per Group-II. All the animals were offered about one kg fresh green fodder and area specific mineral mixture (ASMM) @15 g/d/h. Feed intake and growth of the calves were recorded for a period of three months (Table 7). An increase (20.27%) in ADG was observed in Group- III in

comparison to control animals (Group-I). It was concluded that feeding of calf starter containing 18% CP and 72% TDN along with limiting amino acids lysine and methionine, and vitamin A and D can produce better growth as compared to high CP concentrate based diet.

A feeding module was developed for 18-24 months old replacement buffalo heifers (Avg. BW 250 kg) fed precisely as per the requirements for live weight gain of 700g per day. A saving of 20% wheat straw (635g/d) per animal was recorded as compared to control (common practice of ad lib feeding of concentrate-straw in the ratio of 50:50). The growth rate of about 750g per day (754.95 vs. 747.80 g in control and treatment group, respectively) was achieved during the experimental period of three months in both groups. The cost of feeding was reduced (₹ 73.06 vs. 77.29 per day) in precisely fed animals by ₹ 4.23 per day per animal. The digestibility of nutrients (Table 8) remained similar, except neutral detergent fibre (NDF), which improved in the treatment heifers. Precision feeding comprising concentrate mixture (18.3% CP) and wheat straw @ 1.24 kg and 0.89 kg per 100 kg body weight per day, respectively has been suggested to achieve 747.8 g average daily gain for 18-24 month old heifers.

Reducing the age at first calving is an important issue to increase the life time production of a buffalo. Higher age at puberty, and thus age at first calving, reduces the economic return of the buffalo farmers. As

nutritional status affects the puberty and subsequent reproduction, a project was undertaken to study the effect of different feeding regimes on age at first calving in buffalo heifers. Twenty four heifers (average age 17.15 months) were divided into two groups of 12 each and fed on 100% (group-I) and 115% (group- II) of their nutritional requirements. After one year of experiment, average daily body weight gain (g) was 532.2 and 538.9 in group I & II respectively. Eight heifers in group- I and six heifers in group- II showed the sign of heat and three heifers in each group became pregnant.

Male buffalo calves are neglected in feeding and management by most buffalo farmers. The growth rate of these calves responds differently to various feed combinations as well as management conditions. Thus, a precious resource is largely being

wasted. With the view to develop scientific feeding modules and package of practices for improving growth rates and thus augmenting meat production potential of such calves, a project has been undertaken. Eighteen calves, aged about 4 months, were purchased from the farmers and divided into three groups of six each. Calves in Group-I were fed all forage diet comprising of green and dry fodder ad lib, roughage: concentrate (70:30) diet in Group-II and roughage: concentrate diet (30:70) in Group-III. The data of growth rate and feed intake are being recorded until they attain the body weights appropriate for slaughter.

Routinely used mineral supplements have several limitations in their absorption in the gastro-intestinal tract and interactions among different minerals may also reduce their bioavailability to the animals.

Table 7 : Feed intake and body weight changes of calves fed calf starters with varying levels of crude protein

Attributes	Group-I (n=6) (24% CP, 72% TDN)	Group-II (n=6) (21% CP, 72% TDN+ limiting AA & Vit.)	Group-III (n=6) (18% CP, 72% TDN+ limiting AA & Vit.)
Intake (kg/d)			
Concentrate	0.85	0.85	0.85
Roughage	0.73	0.64	0.60
Total DM	1.58	1.49	1.45
Body weight (kg)			
Initial	59.6	59.8	58.4
Final (after 3 months)	79.6	82.0	82.4
Total gain	20.0	22.2	24.0
Average daily gain (g)	222	247	267

Table 8 : Digestibility (%) coefficient of nutrients and body weight gain in buffalo heifers fed ad libitum concentrate: straw 50:50 (Control) vs. precision feeding as per requirement (Treatment)

Attributes	Control(n=6) (Conc: Straw 50:50)	Treatment(n=6) (As per Requirement)
Digestibility (%)		
DM	61.48 ± 2.50	64.09 ± 3.15
CP	60.04 ± 3.50	60.74 ± 2.31
NDF	64.56a ± 3.11	67.99b ± 3.36
ADF	56.84 ± 2.97	58.75 ± 4.97
Body weight gain/d	754.95	747.80
Cost of feeding/d/animal, Rs	77.29	73.06

Feeding of organic minerals (minerals combined with some organic molecules) may improve bioavailability of some minerals and, is thus of environment friendly as well. Keeping this in view, a project was undertaken for development and supplementation of chelated zinc, copper and manganese in buffaloes.

Chelates of zinc using different physio-chemical conditions were prepared and the same for copper and manganese are in progress.

Mitigation of Green House Gas (GHGs) emissions from ruminant livestock is necessary for a cleaner environment and diverting the feed/dietary energy for productive purposes of ruminants (a large part of which is otherwise lost as methane). Therefore, a study was undertaken to investigate the effect of graded levels of Lasoda (*Cordia dichotoma*) leaves supplementation on in vitro rumen fermentation and methane mitigation potential on wheat straw based diets. Effect of dietary inclusion of suitable amount of leaves on the performance of lactating buffaloes was also assessed. Inclusion of *Cordia dichotoma* leaves at graded levels (5-20% of the substrate DM) with wheat straw improved true degradability of dry matter and organic matter of composite diet. Methane production was reduced by up to 13.86%,

Table 9 : Effect of incorporation of *Cordia dichotoma* leaves (LS) on in vitro rumen fermentation and methanogenesis of wheat straw (WS)

Attributes	Treatments				
	T1 (100%WS)	T2 (100% LS)	T3 (5% LS+ 95% WS)	T4 (10% LS+ 90% LS)	T5 (20% LS+ 80% WS)
TDDM, %	39.8 ^a	36.90 ^a	47.1 ^b	46.8 ^b	45.4 ^b
TDOM, %	40.3 ^b	37.5 ^a	47.9 ^c	46.9 ^c	45.9 ^c
Gas prod, ml/ 200mg DM/ 24h	19.0 ^a	17.0 ^a	26.5 ^b	25.0 ^b	27.0 ^b
Methane, ml/g DDM	49.8 ^c	28.7 ^a	44.8 ^b	44.1 ^b	42.9 ^b

^{a,b,c} means with different superscripts within a row differ significantly ($p < 0.05$); TDDM=truly degradable dry matter; TDOM=truly degradable organic matter; DDM= digestible dry matter

irrespective of the level of inclusion. However, addition beyond 5% level did not bring any further improvement (Table 9). Therefore, an in vivo trial was conducted with twenty lactating Murrah buffaloes for a period of 118 days. Supplementation of *Cordia dichotoma* leaves at the corresponding level (5% of DM) did not alter voluntary feed intake. Increased (17%) body weight was noted in buffaloes supplemented with leaves. Milk yield and composition, however, remained unaltered. The digestibilities of dry matter (68.2 vs. 67.7%) and organic matter (69.7 vs. 69.0%) were also comparable between the groups (Table 10). It was inferred that supplementation of *Cordia dichotoma* leaves (5% of DM) can reduce methanogenesis and

increase BW gain in lactating buffaloes fed wheat straw based diet.

Another study was conducted to investigate methanogenesis and fermentation pattern on wheat straw based diet with extracts of *Albizia lebbek* leaves, and supplementation of corresponding levels of leaves on rumen fermentation profile in buffaloes. Methanol and aqueous extracts caused most significant reduction in in vitro ruminal methane production. Supplementation (300g/animal/d) of Albizia leaves (ALB-1) to fistulated buffaloes resulted in increased total volatile fatty acids and propionate production; however, higher level (600g/animal/day) of supplementation (ALB-2) exerted negative effects on rumen fermentation. The study indicated that

Table 10. Effect of supplementation of *Cordia dichotoma* leaves (@ 5% of DM) on the performance of lactating buffaloes

Attributes	Control (n=12)	Additive (n=12)	SEM
Body weight (kg)			
Initial	489.5	472.2	16.4
Final	534.4	525	18.3
Total gain	44.9	52.8	8.95
Average Milk yield, kg/d	8.13	8.17	0.45
Feed intake, kg			
Concentrate	5.65	5.65	0.06
Green fodder	5.17	5.20	0.25
Wheat straw	3.20	3.30	0.14
Total	14.0	14.2	0.25
Digestibility (%) of nutrients			
DM	68.42	67.73	1.84
OM	69.72	69.04	1.89

supplementation of *Albizia lebbek* leaves @ 300g/buffalo/day can improve rumen VFA production and reduce methane production.

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

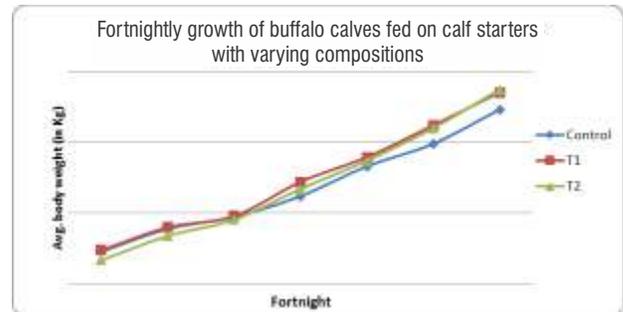
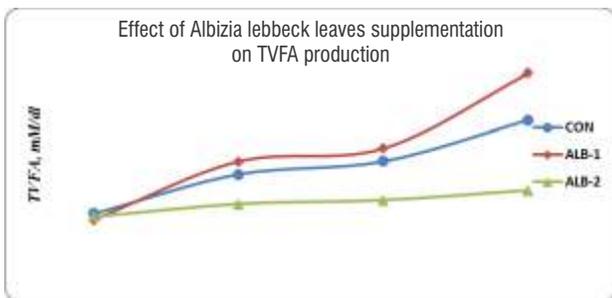
environmental pollution aspects, have generated interest in medicinal plants as alternative sources of anthelmintic drugs. Therefore, a project was undertaken to validate ITK known herbs against gastrointestinal parasites in buffalo calves. Plant parts viz. Fruits of Kantkari (*Solanum xanthocarpum*) and Vidangh (*Embelia jerium cottam*), and bark of Siris (*Albizia lebbek*) and Harshringar (*Nyctanthes*

Table 11 : In vitro mortality (%) of *Haemonchus contortus* larvae with various plant extracts

Extracts	Percent mortality at varying dose levels (mg/ml)				
	1	10	100	200	400
<i>Albizia lebbek</i> (bark)					
Pet Ether	8.33±5.89	14.29±10.10	21.05±8.42	27.27±3.54	37.33±3.54
Chl-Meth	8.89±3.27	12.50±4.72	30.77±3.37	46.67±4.42	55.81±1.84
Meth	7.69±5.44	11.11±7.86	21.05±8.42	41.38±2.02	40.26±7.38
Aq	0.00	0.00	0.00	0.00	10.53±2.41
<i>Nyctanthes arbortristis</i> (bark)					
Pet Ether	6.25±0.56	11.77±3.03	16.67±4.04	23.53±1.96	33.33±0.00
Chl-Meth	6.90±1.02	14.29±2.95	16.67±8.84	36.92±0.80	67.24±11.65
Meth	7.14±5.05	6.67±0.63	10.00±1.43	17.39±11.36	52.94±4.42
Aq	0.00	0.00	0.00	5.56±0.88	16.67±1.98
<i>Solanum xanthocarpum</i> (fruit)					
Pet Ether	7.14±5.05	10.00±7.07	20±00.00	17.39±5.61	32.00±9.43
Chl-Meth	9.09±6.43	11.76±0.98	15.38±5.30	43.64±1.12	71.82±0.56
Meth	5.56±3.93	12.50±1.77	15.38±5.30	19.05±1.29	25.30±3.48
Aq	0.00	0.00	0.00	8.33±0.99	13.80±0.68
<i>Embelia jerium cottam</i> (fruit)					
Pet Ether	8.33±4.42	11.11±1.77	15.38±5.30	21.05±1.57	40.54±3.11
Chl-Meth	9.53±7.07	14.29±2.95	21.05±1.57	38.10±7.86	82.57±1.07
Meth	11.11±8.70	13.33±7.07	16.67±8.84	30±4.29	37.74±3.03
Aq	0.00	0.00	0.00	0.00	6.45±1.51

arbortristis) were collected and extracted with petroleum ether, chloroform-methanol, methanol and water. Thus a total of 16 extracts were prepared. The extracts were subjected to in vitro evaluation for their

efficacy against L3 larvae of *Haemonchus contortus*. Chloroform-methanol extract was found most effective irrespective of the plant source (Table 11).



Group of buffaloes eating chaffed fodder



Optimization of Management Practices

In order to develop a feeding module for freshly calved buffaloes, twenty freshly calved buffaloes were divided into two equal groups i.e. control and treatment. Treatment group was supplemented with fenugreek seed (methi) powder @600 mg/kg body weight. Supplementation started soon after calving and continued either to first artificial insemination in cyclic buffaloes or up to 60 days in acyclic buffaloes. Supplementation had positive effects on ovarian activity. From treatment group, 9 out of 10 buffaloes were cyclic within 90 days and 7 were pregnant, whereas in control group 7 buffaloes were cyclic within 90 days. Average days taken for resumption of cyclicity were 36 in treatment as compared to 51 days in control group. Digestibility of feed dry matter were improved in treatment group. Therefore, the module with supplementation of fenugreek seed powder in diet of early postpartum buffaloes is helpful in early restoring of post – partum cyclicity in association with improvement in digestibility of nutrients. as compared to the practice of feeding in control group.

Institute's herd was screened for sub-clinical mastitis using California Mastitis Test (CMT). The mastitic

milk samples were used to screen for MRSA *Staphylococcus aureus*. The results obtained with the conventional method of standard disk-diffusion and molecular techniques such as PCR were the same i.e. no MRSA isolate was found among *S. aureus* strains.

To study the effect of pre-partum heifer management and its relation with subsequent production, 12 heifers in late pregnancy were divided into two groups of 6 each based upon their expected date of calving, dams' milk yield, body weight etc. The udders of first group buffaloes were not massaged and were not taken into milking parlour. This group was considered as untreated or control (T0) group. The udders of second group heifers were massaged at alternate day starting 30 days pre-partum after taking them into the milking parlour and the group was considered as treatment (T1) group. Results indicate that pre-partum udder massaging in primiparous heifers helps in developing udder as well as teat capacity/volume before calving. It also reduces fear of animals during milking operation resulting in quicker milk let-down and higher milk flow-rate. This practice favours management of primiparous buffaloes during subsequent lactation.

Development of Technologies and their Transfer to End Users

The institute has developed several technologies since its inception that were transferred to the farmers to increase the productive and reproductive efficiency of their buffaloes for economic milk production. The developed technologies are transferred through farmers' training, field visits, kisan melas, radio and TV talks and web portal based extension activities. Books, bulletins and popular articles are regularly written by scientists for dissemination of knowledge of scientific buffalo husbandry to the farmers in Hindi and Punjabi. Some of the technologies which found acceptance with the users are presented below.

Production, maintenance and dissemination of superior germplasm

Institute maintains highly pedigreed herds of Murrah and Nili-Ravi buffaloes and undertaking breed improvement program through selective breeding since inception. The genetic potential of bulls is evaluated through progeny testing. Due to intense selection pressure, production performance of Murrah and Nili-Ravi herds improved (Murrah: 5.95 kg in 1987 vs 8.0 kg in 2013-14; Nili-Ravi: 4.70 kg in 1988 vs. 8.25 kg in 2013-14).

192674 doses of frozen semen from test bulls and 60007 doses from progeny tested bulls are available for Murrah breed improvement.

About 454 Murrah and 302 Nili Ravi bulls of high genetic merit have been supplied to various developmental agencies and village panchayats in 12

States for increasing milk production through genetic improvement during the year. Murrah bulls were supplied to Haryana, M P and Rajasthan

Under field progeny testing program in adopted villages, 29097 AIs have been done so far with frozen semen of test bulls with conception rate of 48.5%. This includes 3962 AIs during the year with 48.8% conception rate. So far 277 daughters have been recorded and 48 daughters are currently under recording.

Improved protocol for buffalo semen cryopreservation

A simple, reliable and economic 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. A large proportion of buffalo semen ejaculates collected during summer months were being rejected due to the high incidence of post-thaw backward motility of sperm cells. Through thorough investigations about the phenomenon, stage of glycerolization was identified to be the most critical step responsible for backward sperm motility. Glycerolization at room temperature during initial stage of semen dilution reduced/eliminated the backward motility due to which 20 percent more ejaculates could be preserved annually, thereby enhancing the frozen semen production significantly. Overall semen freezing protocol improvement has resulted in almost 15% improvement in post-thaw motility leading to

improved frozen semen quality as well as fertility on artificial insemination.

Area-specific mineral mixture

Surveys of feeding practices carried out in Haryana revealed deficiencies of essential minerals like calcium, phosphorus, zinc and manganese in 70 percent buffaloes. On the basis of analysis of mineral intake vs requirement an area specific mineral mixture was formulated. The mineral mixture improves feed intake, milk production and reproductive efficiency. Seventy per cent of the supplemented buffaloes which were suffering from anaestrus conceived within a period of 4-6 weeks of area specific mineral mixture supplementation. Institute has been preparing and selling mineral mixture to the farmers at no profit no loss basis.

Feeding standards for different categories

Feeding standards have been developed for different categories of buffaloes, viz. growing males, growing heifers, lactating buffaloes and pregnant buffaloes. Nutrient requirement for heat and humidity stress have also been estimated and published. During the current year, 3 feeding modules were developed. These were feeding module for calving to insemination, feeding module for restricted feeding of replacement heifers and feeding module for improving performance in lactating buffaloes using additive.

Ultrasonography for fetal age and sex determination, pregnancy diagnosis and monitoring ovarian activity

Ultrasonography guided fetal age and sex determination technology has been standardized. The accurate diagnosis of fetal sex can be made at 55 day of gestation in buffaloes in contrast to 50 days reported in cows. By ultrasonography, fetal age can also be accurately assessed that is useful in better management of pregnant buffalo around calving. The length of gestation in buffalo can be estimated by following standard chart that is developed for crown-rump length of buffalo fetus on different days postinsemination. When this plot was used for determining the age of fetus in pregnant buffaloes the exact date of mating/gestation could be predicted with a precision of ± 1 to 2 days during first 60 days of gestation.

The non-invasive technique of ultrasonographic scanning has been standardized for diagnosis of ovarian activity, particularly for the study of follicular dynamics and luteal structures. With this technique, time of ovulation can be predicted very precisely to allow fixed time insemination and infertile buffaloes can be treated for specific problem.

A protocol has been standardized for early pregnancy diagnosis in buffaloes, with ultrasonic scanning. Pregnancy could be diagnosed as early as 26 days post insemination.

Identification of molecular markers for MAS

RAPDs, Microsatellites and traits governing specific genes as growth hormone, seminal fluid protein gene specific primers based buffalo genome characterization done for identification of genetic diversity and markers for higher milk production and bull performance

A twenty nucleotide base pair length having di-nucleotide repeats have been identified showing polymorphic expression of milk production in low and high milk producing buffaloes. Study revealed more than 30% dissimilarity between high and low yielding buffalo genotypes.

RAPD and SSR sequences were identified having potential of segregating high and low producing buffaloes with 47% and 44.4% dissimilarity coefficients, respectively.

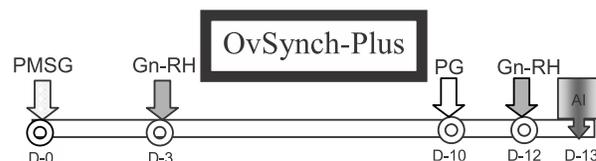
OvSynch plus protocol for estrus induction in buffaloes

Anestrus, in pubertal heifers and postpartum buffaloes, is the primary cause for low reproductive performance of buffaloes. The condition is associated with the presence of static ovaries and though follicular development may occur, none of the ovarian follicles becomes mature enough to ovulate. In anestrus animals, dominant 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.

'OvSynch Plus' protocol for estrus induction in buffaloes.



The major advantage of this protocol is that it induces estrus in cyclic (90%) as well as acyclic (65.5%) animals within a close window (24 h). 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. Pregnancy rates during breeding and off breeding season are 34.6% and 34.5%, respectively.

Embryo transfer technology

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

Supplementation of BSA in place of FCS in maturation medium 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.

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

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

Scrotal circumference for bull selection

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

Induction of lactation

Farmers often face the problems of conception failure, long calving interval, anestrus, cystic ovaries, specific abortions and repeat breeding. They can benefit by inducing such animals into lactation with induced lactation therapy. The buffalo is weighed and appropriate dose of hormones, Estradiol- 17b and progesterone each @ 0.1 mg/kg body weight/day each, is calculated for seven days therapy, dissolved in absolute ethanol and stored. On the day of treatment, 1 ml of each hormone solution is administered subcutaneously in the morning and evening at an interval of 12 hours, for seven consecutive days. Thereafter, on day 17, 19 and 21 of treatment, 10 ml Largectil injection and on day 16, 18 and 20, injection of 20 mg of Dexamethasone are also given intramuscularly. Between 15th and 21st day of treatment, udder massage is

given for fifteen minutes each in the morning and evening daily till the udder is turgid with milk, which is usually around 21st day when milking is started. The milk becomes normal in physical and chemical properties within 10 -15 days of 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.

Colostrum for higher growth and calf survival

Higher levels of immunoglobulins, absorbed within the first 16 h of birth, reduce mortality in calves and result in faster growth rate by 20-22 percent. High titre of circulating immunoglobulins in calves at an early age of 24 h showed the association with weight gain upto the age of 2 years. Status of immunoglobulin levels at such an early age could also predict the health status of calves. A critical level of these blood proteins required for the survival of calves has been assessed and it is 40-50 mg/dl.

Antioxidants in survival and growth of neonates

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

Uromol is a compound prepared by heating urea and molasses in the ratio of 1 : 3 and then mixing it with equal amount of wheat bran/deoiled rice bran. Four kg urea along with 12 kg molasses is slowly heated in a container for 30 minutes. Then equal amount (16 kg) of wheat bran or deoiled rice bran is mixed in it and the mixture is cooled to room temperature. This material contains 36 percent DCP and 72 percent TDN and can replace conventional compound feeds in the ration of buffaloes yielding 8-10 litres milk/day.

Urea molasses mineral blocks (UMMB)

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

Superior isolates of anaerobic fungus

Superior isolates of anaerobic fungus were isolated and evaluated for ability to increase in vitro digestibility of straw by buffalo rumen microflora. Such isolates have the potential to be used as feed additives. Among 165 isolates studies 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.

Enzyme supplementation

Fibrolytic enzyme supplementation can be used as feed ingredient in the concentrate mixture of calves to increase

the growth rate by 15%. Further, the cost of enzyme can be reduced by using feed grade enzyme or enzymes used in textile industry (cellulase) and paper industry (Xylanase).

Thermal stress management

Microclimate modifications with supplementation of niacin @ 6 gms/day/animal, yeast @10 gms/day/animal and mustard oil @150 gms/day/animal enhance milk production of lactating buffaloes by 17.7% through reduction in thermal stress.

DNA bank

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

Transfer of technologies

Institute is engaged in extension activities for propagation of technologies and knowledge on buffalo breeding, feeding, reproduction, health and management to the farmers through regular visits by the scientists/technical personnel in adopted villages, organizing trainings, demonstrations, lectures, calf rallies and treatment camps, etc.

The institute has developed linkages with farmers engaged in livestock rearing in general and buffalo rearing in particular with the objective of field progeny testing programme under Network Project on Buffalo Improvement, clinical camps and buffalo Melas, etc.

Apart from this, institute scientists participate in extension activities in collaboration with other organizations such as

ICAR institutes, State Agricultural Universities, state government Animal Husbandry Departments, Cooperative dairy unions, NGOs and other developmental agencies like banks, etc. At present, the institute is participating in similar projects with Punjab National Bank Farmers' Training Centre, Sachha Khera, Dist. Hisar. Institute itself also organizes tailor made training programs on various aspects of Improved Buffalo Husbandry practices, Balanced Nutrition and Artificial insemination for farmers, farm women, educated youth for entrepreneurship in buffalo farming as a profession.

Institute organizes annual Buffalo Mela to show case the technologies developed at the institute and inspire buffalo breeders for rearing superior quality animals. Elite animals in various categories of males and females are adjudged by a panel of eminent professionals and awarded.

ICT based extension activities

Various queries of farmers and neo-farmers venturing into buffalo farming are often received, which are adequately addressed by concerned scientists through email, telephonically or through Institute's consultancy cell and extension wing. In addition, Institute web-site is providing information on various aspects of buffalo and its own contributions including annual reports, publications and sire director etc. Institute scientists have developed 'Buffalopedia' – an interactive web-site for providing information to general public and farmers / entrepreneurs on varied aspects related to buffaloes and its farming.

Record sheet for farmers

Usually buffalo farmers do not keep records of their buffaloes for the economic and pedigree evaluation which include information about their production, reproduction,

health and nutrition. All the existing record registers are for organised dairy and very complicated for them to follow and maintain. CIRB published record sheets named “भैंस विवरणिका एवं मुल्यांकन : आर्थिक प्रगति का आधार” for maintaining and evaluating the buffaloes at farmers’ door step. More than one thousand such record sheets have been distributed to buffalo farmers for maintaining the records. CIRB staff alongwith field staff of State Animal Husbandry department can periodically compare the production and authenticate the records.

Institute laid increased emphasis on farmers’ trainings during the year. A training calendar was developed and in the series 11 training were organized at main campus and 1 at Subcampus Nabha. These include trainings on improved buffalo husbandry, AI and balanced nutrition. A total of 692 farmers were imparted trainings at Hisar and 40 farmers at Subcampus. The trainings aimed at improvement of buffalo husbandry practices for incorporating economic practices for balanced feeding, health and reproduction management together with emphasis on germplasm improvement.

During the period under report 56 layman inseminators were trained in artificial insemination in 3 training programs. Many of the rural youths trained in this institute are achieving as high as over 60 % conception rates with the frozen semen sourced from this institute.

The Institute organized 12 infertility treatment camps with PNB Sucha Khera at Banarkhan, Dhiktana, Sinsar, Sarsod Kabartha, Juglan, Mehndipur, Rajgarh dobhi, Bichpuri, Nandal, Jaganwala, Julhera and Bhaini Majra villages.

Buffalo Mela was organized at the Institute premises on 1/2/2014 in which 161 elite buffaloes from all over Haryana participated. Competitions were held in different categories like lactating, dry buffaloes, adult & young bulls, etc. Overall champion male and female animal of the show were also adjudged and awarded. The Haryana Kisan Ayog sponsored all the cash prizes to winners of various categories. More than 550 farmers also participated in these events. National Institutes like NDRI, NRCE, Central Sheep Breeding Farm, Tractor Training Center also put up their stalls.

Four calf rallies were organized in villages Jewra, Dhiktana, Kheri Berki and Sarsod. More than 300 farmers participated in these calf rallies along with their animals.

Institute participated in various extension events namely Krishi Vasant, Nagpur; Progressive Punjab Agriculture Summit, Mohali; Annual Dairy Mela, NDRI Karnal; Pashudhan Mela, IVRI Izatnagar and Haryana State Level Function, Jhajjar. CIRB organized Kisan Gosthis at village Karnoli and Baini Majra and demonstration of ultrasonography for field vets. Institute also organized demonstration of ‘OvSynch Plus’ and ‘Heat Synch’ protocols at village Dhangar.

Significant Events

30th Foundation Day

The Central Institute for Research on Buffaloes celebrated 30th Foundation Day and organized a Buffalo Mela cum Exhibition on 1st February, 2014. Dr Gurbachan Singh, Hon'ble Chairman, Agricultural Scientists Recruitment Board, New Delhi inaugurated the function while Dr RS Dalal, Member Secretary, Haryana Kisan Ayog distributed prizes to winners. Maj Gen (Retd) Shri Kant, Vice Chancellor, LUVAS, Hisar was the Guest of Honour. Besides Dr RK Singh, Director, NRCE; Dr (Mrs) Indu Sharma, Director, DWR; Sh Kuldeep Dhaliwal, Member, ICAR Governing Body and Dr SC Chopra, former Director, CIRB also graced the occasion. There were competitions for different categories of male and female buffaloes such as heifers, milk teeth and two to four teeth females, milch buffaloes, dry buffaloes, milk teeth males, two to four teeth males and breeding bulls.



Chief Guest, Dr Gurbachan Singh, Chairman ASRB flanked by Maj Gen (Retd) Shri Kant, Vice Chancellor, LUVAS and Dr RS Dalal, Member Secretary, Haryana Kisan Ayog and other dignitaries on the dias during 30th Foundation Day Buffalo Mela and Kisan Gosthi at CIRB, Hisar

Beside these animals, best male and best female animal of the show were also selected by the expert judging committees and all winning animals were awarded with certificate, shield and cash prizes, sponsored by Haryana Kisan Ayog.

The arrangement was made for exhibition to showcase recent technologies related to buffalo production and related agricultural activities. Several ICAR institutes like IVRI, NDRI, DWR, NRCE, besides CIRB and other Govt. departments like Central State Farm, Central Sheep Breeding Farm, Tractor Training Center, Regional Station for Forage and livestock related industries participated in the exhibition and put up their stalls. More than 550 farmers participated in these events with their prized Murrah animals. A Jaffarabadi bull of Sh Ravinder Singh Sandhu of Firozpur (Punjab) was another added attraction during the Mela.



Dr RS Dalal, Member Secretary, Haryana Kisan Ayog garlanding the Champion female buffalo of Sh Ishwar Singh of Village Singhwa Khas (District Hisar) during the Buffalo Mela



Chief Guest, Dr Gurbachan Singh, Chairman ASRB and Maj Gen (Retd) Shri Kant, Vice Chancellor, LUVAS appreciating a superior buffalo bull during Foundation Day Buffalo Mela at CIRB, Hisar

Nili-Ravi Buffalo Mela at CIRB Sub-Campus Nabha

Nili-Ravi Buffalo Mela, coinciding with the 26th foundation day of the CIRB Sub-Campus, Nabha was organized on 2nd December, 2013 at the sub-campus. Dr KML Pathak, Hon'ble Deputy Director General, ICAR (Animal Science) was the Chief Guest and Dr RK Singh, Director NRCE graced the occasion as the Guest of Honor. The centre is dedicated to conservation and improvement of Nili-Ravi breed of buffaloes, another equally important dairy buffalo breed as Murrah. The Nabha sub-campus of CIRB through this annual buffalo festival provides a platform for Nili-Ravi buffalo breeders and new generation buffalo dairy entrepreneurs from different parts of North India to showcase their animals and exchange views. Team of scientists adjudged best Nili-Ravi animals amongst the participating animals into three categories- heifers, milch buffaloes and breeding bulls. The Chief Guest lauded Punjab farmers for their enormous contribution towards food



Dr RS Dalal giving away the prize to champion bull of the show owned by Sh Karamvir Singh of Village Sunaria (Kurukshtra) during Buffalo Mela

security through high-end Agricultural and Livestock farming. Dr Pathak highlighted the importance of indigenous breeds of livestock, including the Nili-Ravi breed of buffalo, which is native to Punjab. He congratulated the Director and scientists for providing scientific inputs in buffalo production and breeding while joining hands with the most vital stake-holders, the buffalo breeders/ farmers. Dr Pathak announced greater incentives to farmers contributing to Nili-Ravi germplasm conservation and improvement while recognizing high milk, fat and protein yield of the species. On this occasion, Dr Inderjeet Singh, Director, acknowledged inspiration and cooperation from ICAR and the hard work put in by the scientists and staff for achieving unparalleled health and production performance of the Nili-Ravi herd at sub-campus. Dr Raman Malik, OIC of the sub-campus highlighted the increasing interest and enthusiasm of Punjab farmers towards modern farming technologies in general and Nili-Ravi buffalo breeding

in particular, that became evident from greater farmers' participation in the event as well as their continuous interaction with the institute's scientists.



Dr KML Pathak, Dy DG (AS), ICAR and Dr Inderjeet Singh, Director, CIRB, inspecting elite Nili-Ravi buffaloes during Nili-Ravi Buffalo Mela at CIRB Sub-Campus, Nabha

Farmers-Scientist Meet

A Progressive Farmers' Meet was organized at CIRB, Hisar on 21st June, 2013 to identify and address the issues related to buffalo husbandry in general and Murrah breeding, in particular. The participants included owners of champion Murrah bulls, champion high yielding buffaloes and variable scale pure Murrah organized farms. Sixty five registered progressive farmers and forty-five trainee rural youths participated in the meet. Sh Kuldeep Dhaliwal, Member, ICAR Governing Body, New Delhi as well as a progressive farmer himself, was the Chief Guest. In his inaugural address, Sh Dhaliwal expressed his pleasure at the CIRB initiative of organizing this relevant event for identifying farmers' needs and exerting to evolve solutions to their problems. He

exhorted the farmers to apply latest technologies developed by various ICAR institutes for maximizing profit from their decreasing land-holdings. Haryana farmers, gifted with world famous Murrah buffalo, can reap the maximum benefit with Murrah's global popularity. Farmers were sensitized to scientific breeding, reproduction, nutrition and healthcare aspects, besides the necessity of record keeping, breed conservation and improvement. Farmers' inputs reflected their efforts towards breed improvement and propagation, problems faced by buffalo breeders / livestock farmers and the possible options for addressing the same were also discussed.

Dr Inderjeet Singh, Director, CIRB stressed the need for recognizing virtues of the species and giving due attention to the diverse and elite buffalo germplasm. He emphasized on the role of male in breed improvement and the awareness required for maximizing the use of superior bulls. The Institute is facilitating the same for champion bulls owned by farmers as well. He highlighted the role of animal identification and record keeping towards the progress in dairy sector and development of new technologies, for which young and progressive farmers must come forward. CIRB shall facilitate the same by bringing out printed farmer friendly recording formats. Dr Singh also emphasized the increasing need for animal farm automation at different scales of operations for retaining younger generation in animal husbandry while highlighting the importance of milk

as a complete food, especially for growing children. He hoped this will be considered by the planners to be included in the school children's mid-day meal scheme, for a healthy young India, while giving boost to livestock sector as well.

On this occasion, the inspired farmers laid the foundation of 'Murrah Buffalo Breeders Association' for making collective efforts towards improvement of Murrah germplasm throughout the country. Dr Singh promised necessary support to the farmers' body towards common goal.



Sh Kuldip Dhaliwal, Member, ICAR, GB and Dr Inderjeet Singh, Director CIRB at the Progressive Farmers' Meet held on 21st June, 2013 at CIRB, Hisar

Dr Inderjeet Singh joins as Director, CIRB

Dr Inderjeet Singh joined as Director of the Central Institute for Research on Buffaloes on 30th April 2013. A reproduction scientist, Dr Singh has vast experience as researcher especially in the areas of assisted animal reproduction techniques like embryo transfer, fertility regulation, patho-physiology of reproduction and buffalo conservation. He proposed and implemented the elite field buffalo germplasm conservation from farmer's doorstep. He also played

key role in popularizing AI in buffaloes by starting trainings on AI as livelihood enterprise for educated unemployed rural youths. He has long list of projects awarded as competitive grants through agencies like NAIP, National Fund, DBT, US AID etc. He has represented India in international fora like Brazilian Congress on Animal Reproduction (2009), International Buffalo Conference (2010), Brazilian Buffalo Breeders Association (2011), Consultative meeting on Dairy Sector in SAARC countries (2011) and Affiliate Societies Meeting of IETS at Hannover, Germany (2013), besides guiding visiting scientists from Egypt. He has been associated with peer reviewed research journals like Asian Journal of Animal Reproduction, Animal Reproduction Science (Elsevier) and African Journal of Animal Research and acted as referee for research funding proposals for national and international funding bodies.



Dr RK Singh handing over the charge of Director CIRB to Dr Inderjeet Singh

While congratulating Dr Singh on his well deserved appointment, Dr RK Singh, Director, NRCE wished and hoped that CIRB shall establish itself as a leading research institute in animal sciences and scale new heights in achieving excellence in all spheres of its

activity. All the staff at CIRB congratulated Dr Singh and wished for continued improvement of the institute through his energy, vision, passion and experience.

DBT funded Short term training organised

A short term training on 'Reproductive Biotechnology - An Integrated Approach to Improve Reproductive Efficiency' funded by DBT, New Delhi was organized from March 11-26, 2014. Dr AK Rawat, Director, DBT, Govt. of India, inaugurated the programme. On this occasion, Dr Rawat underlined the enormous potential of reproductive biotechnologies in livestock research and production. He exhorted the



Release of training manual by Chief Guest Dr AK Rawat, Director, DBT in the presence of Director, CIRB and others

participants to grasp practical aspects and then disseminate this knowledge to improve the reproductive efficiency of the animals. The Chief Guest also released the compendium of the training programme lectures. Dr Inderjeet Singh welcomed the participants. Dr PS Yadav, Course Director informed that every lecture on selected topic by expert was followed by hands-on practice. Every participant got chance to perform the experimentation with his own hands and updated

knowledge in genetic improvement through reproductive biotechnology, stem cells biology, animal cloning, embryo transfer technology, ovum-pick-up and application of proteomics in reproduction. In this training program 22 participants from different part of country were enrolled.

Visit of Army Officers from India, Nepal and Myanmar

A team of nine officers from Remount Veterinary Corps of the Indian Army, Border Security Forces, Veterinary Core of Royal Nepal Army and Myanmar Army visited CIRB, Hisar on 29th August, 2013. Dr



Director CIRB interacting with the army officers from India, Nepal and Myanmar

Inderjeet Singh, Director of the institute welcomed the team and apprised the visitors about importance of buffaloes in agricultural sector of the country and the region as well as the research initiatives that the institute has taken to address the issues faced by farmers. The officers visited animal farm, semen freezing lab and other facilities in CIRB Campus. The visit was coordinated by Captain GT Adarsh from the EBS, Hisar and comprised Lt Col AS Rathore, Lt Col Mangesh Mehendale, Lt Col Nishant Rana, Lt Col

Anup R, Major Gautam Sharma, Asst Comdt Sandhip Gadhvi, Lt Col UB Rijal (Nepal Army) and Major Min Kyi (Myanmar Army). Visiting officers appreciated the institute's research contributions towards rural livelihood improvement in country through improved buffalo production systems.

Independence Day and Republic day celebrations

The institute celebrated Independence Day and Republic day with traditional fervor. On these occasions Dr Inderjeet Singh, Director, unfurled the Indian Tri-colour followed by singing the national anthem. During the 67th Independence day celebration, Dr Singh remembered the freedom fighters for their sacrifices for freedom of the country. He underlined various activities, achievements and initiatives undertaken during the year. He exhorted all members of the CIRB family to pay their tributes to these heroes through commitment to their duty for building a vibrant and prosperous India. Wards of the staff presented short programme reciting patriotic poems and song as well as making short speeches.



Director addressing the gathering on the 67th Independence Day at CIRB campus



Republic Day celebration

On the occasion of Republic Day, meritorious wards of staff were honoured and given cash prizes. Widows of deceased CIRB staff were also given monetary help through staff welfare fund.

Vigilance awareness week

During the 'Vigilance Awareness Week- 2013', noted columnist and Chief Guest of the function, Sh Devender Uppal quoted the noble words of writer, Publilius Syrus, "Even when there is no law, there is conscience". He discussed the Indian philosophy, where 'Karma' (doing) and honesty to oneself and the society are considered paramount. Dr Inderjeet Singh, Director CIRB chairing function stressed upon

the need for sincerity, transparency and honesty in working. He assured of a free and fair consideration of all issues while reiterating firmly dealing with all undesirable practices. On the occasion, participants including scientists and other staff openly expressed their views on issues of corruption. Dr Navneet Saxena, Principal Scientist said that a vigilant workforce is essential for the growth and progress of an organization. He also stressed on the four pillars of vigilance- truth, honesty, integrity and transparency. Dr AK Pandey, organizer of the event, apprised the audience about the history of the event and its importance for the well-being of any organization.

Celebration of Hindi week

CIRB celebrated Hindi week during 16-21 September, 2013. During this celebration, many competitions were organized among the staffs of the institute and sister institutes. Dr Ravi Datt Shastri, Principal (Rtd),



Jagannath Girls Arya School, Hisar, was chief guest and he motivated the staff of the institute for

conducting maximum work in Hindi. On this occasion Dr Inderjeet Singh, Director also encouraged all the scientists and administrative for working in Hindi.

ICAR Zonal Tournament (North-Zone)

ICAR Inter Zonal Tournament (North-Zone) was held at IIPR, Kanpur from 20-23 March, 2014. CIRB contingent was represented by 37 players and officials from the institute. The sports contingent participated in Badminton, TT, Races, throw events, Volleyball (Shooting and Smashing) Carrom, Chess and Kabaddi etc. Institute badminton team represented by Navneet Saxena, A K Pandey, A Majid, Viksit Kapil, V Mudgal became the champion of North Zone by defeating DWR, Karnal team in the final. Kabaddi team performance was also very appreciable as it won the silver medal.



Research Co-ordination and Management

Research Advisory Committee

The XVII meeting of Research Advisory Committee was held on 30 October, 2013 under the chairmanship of Dr P Thangaraju, former VC TANUVAS. Dr BS Parkash ADG (AN & P), Dr Inderjeet Singh, Director and RAC members participated in the meeting.



Prioritization monitoring and evaluation cell

The PME Cell is responsible for prioritizing research programmes of the Institute. It is also responsible for preparation/compliation of monthly, quarterly, six monthly progress reports and annual report of the Institute. The cell is also assigned the duties of arranging IRC meetings of the Institute and maintenance of the Research Projects Files (RPFs) of the scientists.

Institute Management Committee

Institute Management Committee's XXII meeting was held on 28 October, 2013 under the chairmanship of Director CIRB.



Institute Research Council

The meeting of IRC was held on 27-28 September, 2013, 18 and 24 October, 2013 under the chairmanship of Dr Inderjeet Singh Director CIRB. Dr NN Pathak, former Director CIRB, Dr RC Upadhyay, Head DCP Division, NDRI, Karnal and Dr KL Raheja, Retd. Prof. AGB, HAU were invited external experts in the meeting.



Publications and Patents

Research Papers

- Balhara AK , Mohanty AK , Gupta M , Jamwal M, Sunesh, Phulia SK and Singh I (2014). Bioinformatics and functional analysis of proteins in serum of early pregnant buffaloes. *Indian Journal of Animal Sciences* 84 (2): 140–145.
- Sadeesh EM, Shah F, Balhara AK, Thirumaran SMK, Balhara S and Yadav PS (2013). Effect of thiol compound supplemented culture medium on in vitro maturation of buffalo oocytes. *Ruminant Science* 2 (1) 59-62.
- Sadeesh EM, Shah F, Balhara AK, Thirumaran SMK, Balhara S, Kumar D, Yadav S, Singh I and Yadav PS (2014). Effect of hormones, sera, follicular fluid and oocyte quality on in vitro nuclear maturation and fertilization rate of Indian water buffalo (*Bubalus bubalis*) oocytes. *Journal of Cell and Tissue Research* 14 (1): 4165 - 4171.
- Singh P, Kumar D, Kumar P, Singh I and Yadav PS (2013). Successfully cryopreservation of buffalo bull semen collected distantly from farmer's doorstep and its quality assessed by CASA. *Agricultural Research* 2 (2) 148-152.
- Singh P, Rose MK, Yadav PS, Sharma R and Singh J (2013). Effect of cryoprotectants on freezing and culture behaviour of buffalo umbilical cord matrix cells. *Journal of Cell and Tissue Research* 13(2) 3625-3630.
- Yadav SP, Sikka P, Kumar D, Pandey AK, Sarkar SK and Yadav PS (2013). Variation in milk constituents during different parity and seasons in murreh buffaloes. *Indian Journal of Animal Science* 83 (7): 747–751.
- Dahiya, SS and Singh P (2013). Nutritional and other managemental practices for optimum semen production in buffalo bulls. *Buffalo bulletin* 32 (Special issue I): 277-284.
- Dey A, Paul SS, Pandey P and Rathore R (2014). Potential of *Moringa oleifera* leaves in modulating in vitro methanogenesis and fermentation of wheat straw in buffalo (*Bubalus bubalis*). *Indian Journal of Animal Sciences* 84 (5): 533-538.
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- Das KS, Singh JK, Singh G, Upadhyay RC, Malik R and Oberoi PS (2014). Heat stress alleviation in lactating buffaloes: Effect on physiological response, metabolic hormone, milk production and composition. *Indian Journal of Animal Sciences* 84 (3): 275-80.
- Abd-Allah SM, Sharma RK, Phulia SK and Singh I (2013). Superovulatory response following transvaginal follicle ablation in Murrah buffalo: Effect of FSH or PMSG+FSH. *Theriogenology Insight* 3 (2):87-93.
- Abd-Allah SM, Sharma RK, Phulia SK and Singh I (2013). Ultrasonic monitoring and biometry of

ovaries and ovarian structure during superovulation following transvaginal follicle ablation in Murrah buffalo. *Theriogenology Insight* 3 (1):11-16.

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Anand T, Bera BC, Rivesh T, Viad RK, Barua S, Virmani N, Malik P, Kumar D, Yadav PS and Singh RK (2013). Cytopathogenicity of buffalo pox and camel pox virus in buffalo fibroblast cells. *Indian Journal of Animal Science* 83(12): 1256-1260.

Gulati BR, Kumar R, Mohanty N, Kumar P, Somasundram RK and Yadav PS (2013). Bone morphogenetic protein-12 induces tenogenic differentiation of mesenchymal stem cells derived from equine amniotic fluid. *Cells Tissues Organs* 198(5): 377-389.

Kumar P, Gulati BR, Deep A, Kumar R, Mohanty N, Anand T and Yadav PS (2013). Gross anatomy, histomorphology and histochemistry of equine umbilical cord. *Indian Journal of Veterinary Anatomy* 25(2): 65-58.

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Das KC, Paul SS, Sahoo L, Baruah KK, Subudhi PK, Ltu K and Rajkhoa C (2014). Bacterial diversity in the rumen of mithun (*Bos frontalis*) fed on mixed tree leaves and rice straw based diet. *African Journal of Microbiology Research* 8 (13): 1426-1433.

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of crossbred cows. *Asian-Australasian Journal of Animal Science* 27 (3): 342-348.

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Review Papers

Balhara AK, Gupta M, Singh S, Mohanty AK and Singh I (2013). Early pregnancy diagnosis in bovines: current status and future directions. *The Scientific World Journal*. Article ID 958540, doi:10.1155/2013/958540.

Kumar P, Kumar D, Yadav PS and Singh I (2014). Directional freezing: Next-generation technique of semen cryopreservation. *Research News for U (RFNU)* 12: 129-135.

Ravi SK, Yadav PS, Singh RK, Talluri TR, Pal Y, Arangasamy A, Singh J, Sharma RC and Kumari S (2013). An overview on reproductive disorders in indigenous female equids. *Journal of Animal Research* 3(2).245-259.

Invited lectures/Lead Papers

Das KS and Das N (2013). Livestock production under arid and semiarid climate. Lecture delivered in 21 days training programme on “Recent trends in optimization of livestock health and production with special emphasis to hilly areas”, SKUAST Jammu, 29.11.2013 to 19.12.2013.

Bharadwaj A (2014). Economics of Buffalo Farming. DBT Sponsored Short Course on ‘Reproductive Technology – An Integrated Approach to improve Reproductive Efficiency’, 11-26 March, 2014, CIRB Hisar.

Yadav SP (2014). Practical use of genomic tools for efficient reproduction was delivered in the National Training programme Reproductive biotechnology – an integrated approach to improve reproductive efficiency. 11-26, March 2014, CIRB.

Kumar D and Yadav PS (2013). Future prospects of stem cells in intervention in livestock reproduction. XXII Annual National Conference and National Symposium on “Physiological and Nutri-genomic Interventions to Augment Food Security and Animal Welfare”, DUVASU, Mathura (UP), November 19-21, 2013, pp 59-65.

Sikka P (2013). Male Fertility governing genes in buffalo bulls. A lecture delivered in Training course entitled, “Techniques in Genetic Engineering and Bioinformatics”, LUVAS, Hisar, 29.10.13.

- Yadav SP (2014). Bioinformatics: Tools for Genome Analysis in the workshop on “Bioinformatics Tools & Techniques for Gene & Protein Analysis, GJUS&T, Hisar, 6-7 March, 2014.
- Yadav PS (2014). Fetal stem cells in livestock. Training course on cell culture and molecular diagnostic techniques, Department of Animal Biotechnology LUVAS, Hisar.
- Dahiya SS and Singh P (2013). Nutritional and other managemental practices for optimum semen production in buffalo bulls. In: Proceedings of the 10th World Buffalo Congress and 7th Asian Buffalo Congress, Phuket, Thailand, 6-8 May, pp. 285-294.
- Misra SS and Dey A (2014). Strategies for mitigation and adaptation to climate change for sustainable livestock production. In: Proceedings of the National Conference on Adaptation and Mitigation Strategies of Climate Change for Sustainable Livelihood, UBKV, Cooch Behar, 5-7 March, pp. 7-19.
- Presentations in conferences/ Symposia/ Seminar/ other scientific forum**
- Yadav SP, Sikka P, Kumar D, Sarkar S, Pandey AK, Yadav PS and Sethi RK (2013). Biochemical changes in milk during different parity and season in Murrah buffalo. The 10th World Buffalo Congress and the 7th Asian Buffalo Congress, Phuket, Thailand, 6-8 May, 2013 pp. 24.
- Sikka P, Lal D, Khanna S and Sethi RK (2013). Dried colostrum: A survival Kit for weaning buffalo calves. Ibid., pp. 230.
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- Paul SS and Yu ZT (2013). Naïve analysis of global diversity of gut anaerobic fungi. In: Proceedings of the International Congress on Gastrointestinal function, Chicago, USA, 15-17 April.
- Paul SS and Yu ZT (2013). Development of oligonucleotide microarray chip for analysis of diversity of ruminal archaea, fungi and protozoa. In: Proceedings of the International Conference on Greenhouse Gases and Animal Agriculture, Dublin, Ireland, 23-26 June, Poster no. 415.
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- Mudgal V, Mehta MK and Rane AS (2013). Utilization of lentil (*Lens culinaris*) straw in the ration of growing Barberi kids. Ibid., pp. 77.
- Dey A, Paul SS, Pandey P and Rathore R (2013). Efficacy of *Holoptelea integrifolia* leaves extracts

- in modulating rumen microbial fermentation for reducing methanogenesis in buffalo (*Bubalus bubalis*). In: Proceedings of the International Symposium of Association of Microbiologists of India on Frontier Discoveries and Innovations in Microbiology and its Interdisciplinary Relevance, Maharshi Dayanand University, Rohtak, 17-20 November, pp.156.
- Tadesse GM, Punia BS, Dey A, Saxena N, and Paul SS (2013). Manipulation of rumen microbial ecosystem in buffaloes (*Bubalus bubalis*) to improve fibre digestion and reduce methanogenesis using plant extracts. *Ibid.*, pp. 72-73.
- Manisha Kumari, Pradeep Kumar, D Kumar, SP Yadav, Balhara AK and PS Yadav (2013). The in vitro effect on sperm capacitation of water buffalo (*Bubalus bubalis*) bull. In: proceedings XXII Annual Conferences of Society of Animal Physiology of India (SAPI), Mathura, 19-21 November, pp. 110.
- Kumar, P, Singh, P, Kumar, D and Sikka P (2013). Effect of sericin on freezability of buffalo spermatozoa. *Ibid.*, pp. 39.
- Kumar P, Singh P, Kumar D and Sikka P (2013). Effect of sericin on freezability of buffalo spermatozoa. *Ibid.*, pp. 39.
- Kumari M, Kumar P, Kumar D, Balhara AK, Yadav SP and Yadav PS (2013). The in vitro effect of osteopontin on sperm capacitation of water buffalo (*Bubalus bubalis*) bulls. *Ibid.*, pp. 110.
- Nitharwal K, Singh P, Kumar P, Kumar A, Gupta AK and Bhakat M (2013). Effect of seasonal variation on post-thaw sperm kinetics of Murrah buffalo breeding bulls. *Ibid.*, pp. 2-3.
- Balhara AK, Kumar R, Soni N, Phulia SK and Sharma RK (2013). Proteomic analysis of urine in early pregnant buffaloes. In: proceeding of International Conference on “Innovative Trends in Natural/Applied Sciences and Energy Technology for Sustainable Development”, JNU, New Delhi, 27-28 July.
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- Dey A, Paul SS, Dahiya SS, Punia BS, Lailer PC and Saxena N (2013). Effect of fenugreek (*Trigonella foenum-graecum*) seed extracts on in vitro methanogenesis and fermentation of wheat straw based diet in buffalo (*Bubalus bubalis*). In: Proceedings of the Second National Conference of Indian Academy of Veterinary Nutrition and Animal Welfare, SKUAST, Jammu, 19-21 September, pp. 119.
- Mudgal V, Mehta MK and Rane AS (2013). Utilization of ammoniated lentil (*Lens esculenta*) straw in the ration of growing Barberi kids. *Ibid.*, pp. 21.
- Mohan C, Saxena N and Fozdar, BI (2014). Phytochemical screening of extracts of few ITK known angiospermic plants. In: Proceedings of the International conference on fostering innovation in drug discovery and development, Nirma University, Ahmedabad, 23-25 January, pp. 98.
- Mohan C, Saxena N and Fozdar BI (2014). In vitro anthelmintic activity of few indigenously known plants. In: Proceedings of the National conference on recent development in chemical sciences, GJUST, Hisar, 25-26 February, pp. 46.
- Das KS, Singh JK, Singh G and Nayan V (2014). Effect of heat stress management on haematology in lactating Nili-Ravi buffaloes. National Seminar on “New dimensional approaches for livestock productivity and profitability enhancement under era of climate change”, AAU, Anand, 28-30 January, pp. 5.
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Book/Book Chapters

- Das KS and Das N (2014). Edited book “Rabbit Production Management”. Stadium Press (India) Pvt. Ltd., New Delhi.
- Yadav, PS, Kumar P and Jerome A (2014). Reproductive biotechnology-an integrated approach to improve reproductive efficiency, CIRB, Hisar, ISBN 978-93-6156-440-9, pp. 1-222.
- Saxena N, Baruah KK, and Gupta R (2013). Unconventional feed resources and anti-nutritional factors. In: Handbook of Animal Husbandry (Fourth Edition), ICAR, New Delhi. pp. 213-245 (ISBN 978-81-7164-086-7).

- Kumar D and Yadav PS (2013). Future prospects of stem cells intervention in livestock reproduction. In: Physiology and Nutri-Genomics underpinning animal production, edited by Yadav S, Kumar J, Madan AK, Yadav B and Anand M, DUVASU, Mathura, ISBN 13:978-81-928693-1-5, pp. 59-65.
- Singh KP and Chaudhary AP (2013). Chapter 12, Study on daily milk yield, milk constituents and production system of Banni buffalo. *Ibid.*, pp. 111-114.
- Singh KP and Chaudhary AP (2013). Genetic Improvement of Livestock and Poultry, Edited by C V Singh and R S Barwal, Pub. By New India Publishing Agency, New Delhi, Chapter – 11: Production Performance and Identification of Superior Germplasm of Banni Buffalo under Field Condition, pp. 105-110. <http://www.bookfactoryindia.com/index.php?p=sr&uc=9789381450826>.
- Singh KP and Chaudhary AP (2013). Chapter 16. Goat genetic resources of Gujarat, *Ibid.*, pp. 143-150.
- Singh P, Kumar D and Kumar A (2014). Seasonal variation in the semen quality of buffalo bull. In: Climate Resilient Livestock and Production System, edited by Singh SV, Upadhyay RC, Sirohi S and Singh AK, Chapter 9, pp. 93-98.
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- Bharadwaj A (2014). Economics of Buffalo Farming'. *Ibid.*, pp. 215-220.
- Balhara AK and Sadeesh EM (2014). Proteomics for advancement of research in Animal reproduction. *Ibid.*, pp. 120-125.
- Jerome A, Sharma RK and Karuppanasamy K (2014). Therapeutic interference for reproductive disorder. *Ibid.*, pp. 221-223.
- Kumar D (2014). Stem cells and their role in reproduction. *Ibid.*, pp. 46-54.
- Kumar D and Kumar P (2014). Acrosome reaction and DNA damage during freezing. *Ibid.*, pp. 170-171.
- Kumar P and Kumar D (2014). Selection of bulls by proteomic approaches. *Ibid.*, pp.136-143.
- Kumar P, Kumar D and Singh P (2014). Semen freezing with modern tool as per MSP. *Ibid.*, pp. 167-169.
- Kumar P, Singh P and Kumar D (2014). In vitro bull fertility assessment techniques. *Ibid.*, pp. 172-174.
- Nayan V, Bhardwaj A and Yadav PS (2014). Indispensable culture considerations during in vitro embryo production for efficient reproductive biotechnology. *Ibid.*, pp. 88-100.
- Phulia SK and Sharma RK (2014). Techniques for estrus detection and synchronization. *Ibid.*, pp. 197-206.

- Punia BS, Yadav PS and Singh B (2014). Nutritional strategies for efficient reproduction. *Ibid.*, pp. 144-148.
- Sadeesh EM, Balhara AK, Selokar NL (2014). Requirements and procedures in *in-vitro* maturation and fertilization. *Ibid.*, pp. 190-196.
- Selokar NL, Chauhan MS, Singla SK, and Yadav PS (2014). Genetic modified livestock animals through transgenic technology. *Ibid.*, pp. 82-87.
- Sharma RK, Karuppanasamy K, Phulia SK and Singh I (2014). Ultrasonography and other image technique for improving reproductive efficiency. *Ibid.*, pp. 101-111.
- Sharma RK, Phulia SK and Singh I (2014). Ultrasonographic images of buffalo reproductive organs. *Ibid.*, pp. 207-211.
- Singh B, Mal G and Yadav PS (2014). Transgenic animal: technologies and roles in human health. *Ibid.*, pp. 69-81.
- Singh B, Mal G, Yadav PS and Rawat AK (2014). Stem cell research to advance livestock sector. *Ibid.*, pp. 55-68.
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- Singh P, Kumar P and Kumar D (2014). CASA: A modern tool for semen evaluation. *Ibid.*, pp. 126-135.
- Yadav PS (2014). Requirements, media preparation and cell culture procedures. *Ibid.*, pp. 175-189.
- Yadav PS and Singh I (2014). Reproductive biotechnology - An integrated approach for higher production. *Ibid.*, pp. 1-18.
- Dahiya SS (2014). Balanced feeding of buffaloes. *Ibid.*, pp. 214-226.
- Punia BS, Yadav PS and Singh B (2014). Nutritional strategies for efficient reproduction. *Ibid.*, pp. 142-148.

Technical/Popular articles

- Singh P, Kumar D and Kumar A (2013). Season and buffalo bull semen quality. National training on Climate Resilient Livestock and Production System, NDRI, Karnal, 18 November - 1 December, pp. 62.
- Dey A (2013). Green livestock production against global warming. *International Journal of Environmental Research and Development* 3(6): 18-24.
- Dey A and Duta N (2014). Exploring tanniferous tree leaves: potential applications in livestock production and health. *Universal Journal of Pharmacy* 3 (2): 20-25.

Technical bulletin/Compendium/Training manuals/Reports

- Paul SS and Dey A (2014). Final Report of NAIP project on Rumen Microbial Diversity (2008-13), CIRB centre, Hisar, pp. 1-79.
- Mudgal V, Dixit VB, Yadav SP, Phulia SK, Pandey AK, Boora A and Das KS (2013). Annual Report CIRB (2012-13), pp. 1-56.

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Radio and TV talks

बल्हारा ए के (2013)। भैसों के ब्यांत काल के समय देखभाल, सीधा प्रसारण, कृषि दर्शन कार्यक्रम दूरदर्शन, 13 दिसम्बर, 2013।

शर्मा आर के (2013)। भैसों का जनन संबंधित समस्याएँ, प्रसारण हिसार रेडियो, 24 मई, 2013।

दहिया एस एस (2013)। भैसों का पोषण एवं रख रखाव, दूरदर्शन प्रसारण, 19 सितम्बर, 2013।

दहिया एस एस (2014)। किसानों के पशुओं के लिए पोषण संबंधित जानकारी, दूरदर्शन प्रसारण, 2 फरवरी 2014।

पॉल एस एस (2013)। मिथेन उत्सर्जन कम करने के लिए जुगाली करने वाला पशुओं के खान-पान का प्रबन्धन. दूरदर्शन प्रसारण, 25 सितम्बर, 2013।

पुनिया बी एस (2013)। संतुलित आहार खिलाने का भैस उत्पादन में महत्व. ऑल इंडिया रेडियो प्रसारण, 3 अक्टूबर, 2013।

Awards

Dr Dharmendra Kumar, Scientist availed DBT CREST fellowship award for Stem Cell Biology and

Regenerative Medicine 2011-12 from 25 February, 2013 to 20 February, 2014.

Dr A Dey, Senior Scientist was awarded 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 20 April, 2014.

Dr KS Das, and Dr JK Singh received First Prize in Best Poster Presentation on “Effect of heat stress management on body weight changes, dry matter intake, milk yield and economics in lactating Nili-Ravi buffaloes” in National Seminar on “New dimensional approaches for livestock productivity and profitability enhancement under era of climate change” and XXI Annual Convention of Indian Society of Animal Production and Management held at AAU, Anand, Gujarat on 28-30 January, 2014.

Patents filed

Kumar R, Balhara AK, Gupta M, Phulia SK, Sharma RK and Singh I (2013). An in vitro method for detection of postpartum anestrus condition in buffaloes. Indian Patent Application No. 2940/DEL/2013 dated 04.10.2013.

Sikka P, Lal D, Khana S and Sethi RK (2013). BUFCOL - A Complete diet for enhanced survivability and growth of neonate buffalo calves. Indian Patent Application No. 1840/DEL/2013 dated 21.06.2013.

Trainings/Seminars/Symposia/ Conferences attended

Event	Period	Venue	Participants
Technical workshop on advancement in semen-analysis and production conducted by IMV India	Apr16, 2013	New Delhi	P Kumar
Brain storming session on “Buffalo estrus biology”	Apr 28-29,2013	NDRI, Karnal	RK Sharma
X World Buffalo Congress and VII Asian Buffalo Congress	May 6-8, 2013	Phuket, Thailand	SS Dahiya
Application cum Internal Auditor Course on ISO 9001: 2008	May 30 - Jun 4, 2013	CIRB Hisar	A Bharadwaj, AK Pandey, SP Yadav, P Sikka
MDP workshop on PME of Agricultural Research Projects	Jun 18-22, 2013	NAARM, Hyderabad	SS Paul
Executive Development Program on Leadership Development	Jun 25-29, 2013	NAARM, Hyderabad	I Singh
Brain storming session on “Improving reproductive efficiency in buffalo”	Jul 4-5, 2013	GADVASU, Ludhiana	RK Sharma
Recent advances in proteomics for biomarker discovery	Jul 8-17, 2013	ABTC, NDRI, Karnal	Sadeesh EM
International Conference on “Innovative Trends in Natural/Applied Sciences and Energy Technology for Sustainable Development” (ITNASETSD)	Jul 27-28, 2013	JNU, New Delhi	S K Phulia, AK Balhara
Training on General Management Programme for Scientist	Aug 26 - Sep 6, 2013	Hyderabad	R Malik
Workshop on Animal Bioinformatics and Genomics research programs under NABG	Sep 2, 2013	NBAGR, Karnal	AK Pandey, S S Paul, P Sikka
Short course on Precision feeding and nutrigenomic modulation of underlying physiology to ameliorate stress and promote production in livestock	Sep 4-13, 2013	NIAP, Bengaluru	N Saxena
Awareness Workshop of NFBSFARA, ICAR	Sep 6-7, 2013	NDRI, Karnal	SS Paul and P Sikka
Workshop on Right to Information Act, 2005	Sep 23-24,2013	ISTM, New Delhi	I Singh
Advanced training course on “updates on male infertility, semen technology and quality oocyte production”	Sep 16- Oct 7, 2013	GADVASU, Ludhiana	P Kumar

II National Conference of IAVN&AW	Sep 19-21, 2013	SKUAST, Jammu	A Dey, V Mudgal
Short course on Metagenomics- role of next generation sequencing and bioinformatics	Oct 15-24, 2013	AAU, Anand	A Dey, A Jerome
Conclave of semen bank In-charges of Northern India	Nov 4, 2013	NRRDL, Jalandhar, Punjab	P Kumar
Workshop on RTI act 2005	Nov 11-12, 2013	ISTM, New Delhi	RK Sharma
Next Gen Genomics and Bioinformatics Techniques Workshop	Nov 14-16, 2013	IGIB, CSIR, New Delhi	P Sikka, AK Pandey, SP Yadav
International Symposium of AMI on Frontier discoveries and innovations in microbiology and its interdisciplinary relevance	Nov 17-20, 2013	MDU, Rohtak	BS Punia, A Dey
XXII Annual conference of SAPI and National Symposium on “Physiological and Nutri-Genomic Interventions to augment Food Security and animal Welfare	Nov 19-21, 2013	DUVASU, Mathura	J.K. Singh, PS Yadav, P Kumar
National Training on Project formulation, risk assessment, scientific report writing and presentation	Dec 9-13, 2013	IARI, New Delhi	SS Paul and SP Yadav
Seminar on “Opportunities for Youth in Agriculture” by Haryana Kisan Ayog	Dec 21, 2013	Rohtak	I Singh
Stakeholders’ meet on livestock: organized by Haryana Kisan Ayog & Gou-sewa Ayog	Jan 8, 2014	Karnal	I Singh
National Livestock Championship	Jan 9, 2014	Mukatsar	I Singh
Brainstorming Workshop “Strategy related to Conservation & Productivity Enhancement of Farm Animal Genetic Resources”.	Jan 10, 2014	New Delhi	I Singh
Workshop on Reproductive biotechnologies for enhancement of livestock productivity	Jan 20-21, 2014	NIAB, Hyderabad	PS Yadav
National Convention on “Role of Veterinarians in Quality assurance of Livestock Products and International Trade” and XII Convocation of National Academy of Veterinary Sciences (I)	Jan 28-29, 2014	LUVAS, Hisar	I Singh, AK Balhara, A Boora, S Yadav, SS Paul, S Khanna, PS Yadav, A Bhardwaj, V B Dixit

ISSRF 'International Conference on Reproductive Health: Issues and Strategies under Changing Climate Scenario'	Feb 6-8, 2014	IVRI, Izatnagar	P Kumar, Jerome A
Workshop on dehydration of food and agricultural product: principles, practices & prospects,	Nov 2013 and Mar 25-26, 2014	NIFT EM, Sonapat	P Sikka
Awareness workshop on sexual harassment of woman at workplace	Mar 14, 2014	ISERA, New Delhi	P Sikka
Overseas visits			
Inception meeting on dairy buffalo breed development in SAARC countries	Nov 16-17, 2013	SAARC Agric. Centre Dhaka, Bangladesh	I Singh
International expert consultation workshop on genetic improvement for dairy buffaloes.	Nov 27-29, 2013	PCC, Manila, Philippines	I Singh

DBT CREST award fellowship for Stem Cell Biology and Regenerative Medicine 2011-12 was availed by Dr Dharmendra Kumar from February 25, 2013 to February 20, 2014

Dr Kumar worked on 'Characterization and differentiation of induced pluripotent stem cells' in the laboratory of Dr Wilfried A Kues, Principal Investigator, Institute of Farm Animal Genetics, Mariensee, 31535 Neustadt, Germany

Summary of research work

The induced pluripotent stem cells (iPS) cells were derived from transgenic crytom mice and mCherry porcine fetal fibroblasts through non-viral approaches. The crytom mice have red fluorescent eyes due to tdTomato gene which is cloned under alpha crystallin promoter and the gene expression

takes place exclusively in the eye lens. The mcherry in porcine cells expressed the ubiquitous red fluorescent in the fibroblast cells. For the present study, the female crytom mice of 4-6 weeks of age were selected, superovulated and mated. The fetuses were excised out and scanned on different days (10.5 to 15.5 days post fertilization) for reporter expression in the eyes (i.e. red fluorescent eye lens). The expression of tdTomato was confirmed in the foetuses by western blotting. The fetal fibroblasts derived from crytom mouse or mcherry porcine were electroporated with transposon and sleeping beauty transposase carrying 4 transcription factors or 6 transcription factors enclosed in piggyBac transposon system respectively to generate iPS cells. After electroporation of fibroblasts with transposon mediated reprogramming cassette, their morphology

started changing and formed colonies resemblance of embryonic stem cells. The iPS colonies were picked up and clonally expanded. They were confirmed by RT-PCR for expression of stemness genes such as OCT4, SOX-2, NANOG, KLF4, REX1 etc. Further they were characterized through expression of protein; detected by immunostaining and western blot methods at different passages of culture. The formed iPS cells from both species were able to form embryoid bodies and teratoma after

injection into the nude CD1-mice. The generated mouse iPS cells were also allowed to differentiate (in long term cultures) on different types (viz. P19 and NTERA) of cell lines used as feeders and in the absence of LIF in the medium to form lentoid bodies similar to eye lens lineage. Further, direct differentiation of fibroblasts to skeletal muscle was also performed through the over-expression of transposon mediated MyoD gene.



Women farmers from Haryana were trained on improved buffalo husbandry practices during 5-8 August, 2013. Thirty women farmers participated in the training.

Research Projects

Projects	Investigators	Duration
Institute-funded Projects		
Completed projects		
Leptin and its receptor gene polymorphism and their association with milk production traits in Murrah breed of buffaloes (<i>Bubalus bubalis</i>)	SP Yadav, AK Pandey, P Sikka, D Kumar, PS Yadav	Mar 2010 - Mar 2014
Effect of Fenugreek seed supplementation in buffaloes	AK Boora, BS Punia, KP Singh, AK Balhara, A Dey	Mar 2010 - Mar 2014
Molecular epidemiology of methicillin-resistant <i>Staphylococcus aureus</i> isolates from buffalo milk	AK Boora, S Yadav	Oct 2010 - Sep 2013
Prepartum heifer management and its effect on subsequent production in buffaloes	KS Das, JK Singh, G Singh, TP Singh	Sept 2012 - Mar 2014
Study on the relationship of feed utilization, growth rate, milk production and its composition with genetic improvement (selection) of Murrah and Nili-Ravi Buffaloes.	BS Punia, PC Lailer, R Malik, SN Kala	2009 - Mar 2014
Studies on the rumen ecosystem and its manipulation in buffaloes for better environment friendly and economical production commonly fed low medium and high quality diets.	BS Punia, PC Lailer, SS Paul	2009 to Mar 2014
Ongoing projects		
Integrated SOET and MOET for faster multiplication of elite buffalo germplasm	RK Sharma, I Singh, SK Phulia, D Kumar, Jerome A, S Khanna	Sept 2010 - Sept 2014
Effect of trehalose and sericin on freezability of buffalo bull semen	P Kumar, P Sikka, D Kumar	Nov 2010 - Mar 2014
Establishment of fertility-associated seminal plasma proteins as biomarkers through proteomics and nano technological approach in buffalo	P Kumar, D Kumar, AK Balhara, SP Yadav, PS Yadav, N Dilbagi, S Kumar	Dec 2012 - Nov 2015
mRNA expression of some candidate genes in buffalo IVF embryos cultured in different media	Sadeesh EM, PS Yadav, AK Balhara, SMK Thirumaran	Feb 2012 - Jan 2014
Development of database for Nili-Ravi buffaloes by haematological biochemical and endocrinological studies	JK Singh, KS Das, G Singh, KL Mehrara, V Mudgal, RC Upadhyay	Jan 2013 - Dec 2017
Cloning for conservation and multiplication of superior buffalo germplasm	PS Yadav, Sadeesh EM, RK Sharma, D Kumar, Birbal Singh	Sept 2010 - Aug 2014
Identification of genetic variants in genes related to oxidative status in relation to fertility in Murrah bulls	P Sikka, P Kumar	Nov 2013 - Dec 2015

Impact of buffalo migration on socio-economic conditions and dairy development index of farmers in Haryana	VB Dixit, A Bharadwaj, KP Singh, Aneesh KV	Aug 2011 - July 2014
Application of pedigree information and body condition score for development of buffalo breeding herd analyser	SN Kala	July 2011 - July 2015
Identification of miRNAs expressed in different reproductive stages of buffalo corpus luteum	Thirumaran SMK, Jerome A, SN Kala	Dec 2012 - Nov 2014
Identification of SNPs in genes related to meat production and their association with meat parameters in buffaloes (<i>Bubalus bubalis</i>)	AK Pandey, P Sikka, SP Yadav, SS Dahiya, N Khanna	Oct 2010 - Dec 2014
Effect of stimulants on fibre degradation, methane emission and fungal population in buffaloes	A Dey, SS Dahiya, BS Punia, PC Lailer, N Saxena, SS Paul	Apr 2012 - Apr 2015
Validation of ITK known herbs against gastro-intestinal parasites in buffalo calves	N Saxena, A Dey, V Mudgal, BS Punia, ML Sharma, RK Goel	Apr 2013 - Oct 2015
Development of modules for buffalo meat production	SS Dahiya, A Dey, PC Lailer, V. mudgal	Mar 2013 - Dec 2014
Effect of different feeding regimen on age at first calving	PC Lailer, V Mudgal, SS Dahiya, AK Boora, BS Punia	Apr 2013 - Dec 2015
New Projects		
Scientific validation of 'Doka' in buffaloes for improvement of reproductive performance under field and farm conditions	RK Sharma, AK Balhara, I Singh, Sunesh, PC Lailer, A Bhardwaj	Nov 2013 - Oct 2017
e-Bhains Vigyan Kendra- CIRB's virtual centre for training in buffalo husbandry and platform for scientist-farmer interactions	S Balhara, SK Phulia, AK Balhara, PC Lailer, P Sikka	Nov 2013 - Oct 2016
Studies on development and supplementation of chelated minerals in buffaloes	V Mudgal, N Saxena, SS Dahiya, BS Punia, K Kumar, ML Sharma	Apr 2013 - Mar 2015
Development of Feeding modules for Nili Ravi buffalo meat production	R Malik, SS Dahiya	Dec 2013 - Dec 2015
Effect of different feeding regimes on age at first calving in Nili-Ravi buffaloes	R Malik, KP Singh, BS Punia	Nov 2013 - Oct 2017
Outside funded Network/AICRP projects		
Network Project on Buffalo Improvement	I Singh, AK Pandey	July 1991 - Continued
Progeny testing of bulls under field conditions (FPT)	A Bharadwaj, VB Dixit, S Kakkar	2001- Continued
Genetic improvement of Murrah buffaloes (network project centre)	KP Singh, A Bharadwaj, S Khanna, A Boora, P Kumar and Sunesh	1991- Continued

Genetic Improvement of Nili-Ravi buffaloes (Network project centre)	R Malik, KS Das, KP Singh, JK Singh, TP Singh, R Mehta, KL Mehrara SN Kala, RK Sharma	1991 - Continued
Genetic improvement of Bhadawari buffaloes (Network project centre)	BP Kushwaha, SB Maity, Sultan Singh, KK Singh	2001 - Continued
AICRP :Improvement of feed resources and nutrient utilization in raising animal production	N Saxena	1993 - 2014
Institute Technology Management Unit (ICAR Scheme; Lead centre IVRI; partner :CIRB)	VB Dixit, SK Phulia, AK Balhara, P Sikka	2008 - 2014
Externally funded (competitive grant) research projects		
Early detection of pregnancy in cow and buffalo by pregnancy associated proteins (NF-BSFARA)	AK Balhara, I Singh	Jun 2012 - Mar 2015
Elucidating the physiological and genomic regulation process of follicular development, oocyte maturation and embryogenesis in buffalo (NAIP)	Inderjeet Singh and RK Sharma	Jan 2008 - Mar 2014
Contract Research Project		
Confirmation of lactation performance and animal safety of dairy animals of the Bubalus sp. treated with recombinant bovine somatotropin (M/S Elanco Animal Health Ltd)	I Singh, SS Paul, SK Phulia, RK Sharma, A Bharadwaj, S Khanna, AK Balhara, Jerome A and S Balhara	June 2012 - July 2014
Inter-institutional Projects		
Studies on the effect of photoperiod on growth and puberty of buffalo heifers (NDRI project with CIRB as collaborating institute)	AK Roy, M Singh, JK Singh, KS Das	June 2013 - 2015

Trainings Organized



Title	Duration	Participants	Venue/ collaboration	Training Organizer
Management, A.I. and common diseases in Buffaloes	March 11-25, 2014	40	CIRB, Nabha	KL Mehrara and R Mehta
Buffalo Husbandry and Artificial Insemination	April 28 - May 10, 2013	15	CIRB, Hisar	SK Phulia, V Mudgal and S Yadav
Improved Buffalo Husbandry	June 17-24, 2013	67	CIRB, Hisar,	P Kumar, A Dey and SP Yadav
Improved Buffalo Husbandry	July 8-15, 2013	69	CIRB, Hisar	BS Punia, SS Paul and AK Balhara
Improved Buffalo Husbandry	Aug 5-8, 2013	30	CIRB, Hisar	VB Dixit, P Sikka and S Balhara
Improved Buffalo Husbandry and Nutrition	Aug 19-26, 2013	68	CIRB, Hisar	SS Dahiya, KP Singh and A Boora
Improved Buffalo husbandry	Sept 2-9, 2013	86	CIRB, Hisar	VB Dixit, N Saxena and SMK Thirumaran
Improved Buffalo husbandry and AI	Sept 23- 30, 2013	25	CIRB, Hisar	AK Balhara, A Jerome and S Balhara
Improved Buffalo Husbandry	Oct 21-28, 2013	86	CIRB, Hisar	P Sikka, PC Lailar and S Balhara
Improved Buffalo Husbandry and Nutrition	Nov 22-29, 2013	125	CIRB, Hisar	BS Punia, SS Dahiya, A Jerome
Buffalo Husbandry and Artificial Insemination	Jan 13- 25, 2014	16	CIRB, Hisar	RK Sharma, and SK Phulia
Improved Buffalo Husbandry	Feb 17-22, 2014	86	CIRB, Hisar	PSYadav, AK Pandey and Sadeesh
Improved Buffalo Husbandry	Mar 11-25, 2014	40	CIRB, Nabha	KL Mehrara and R Mehta

Students Guided

Name of student	Degree / Fellowship	Title of Study Dissertation/Study	University/ Institute	Guide / Co-Guide
Fozia Shah	PhD	Studies on culture and characterization of various donor cells for production of transferable quality cloned embryos in water buffalo	LUVAS, Hisar	PS Yadav
Kaushalaya	PhD	Studies on stemness properties of cultured buffalo amniotic membrane cells	CDLU, Sirsa	PS Yadav
Sadeesh EM	PhD	Production of cloned buffalo embryos and expression profile of developmentally important genes during embryogenesis	IVRI, Izatnagar	PS Yadav
Jerome A	PhD	Studies on follicular candidate genes expression profile and estrus induction in buffaloes during summer season	IVRI, Izatnagar,	RK Sharma
Promila	PhD	Effect of sewage water irrigation on some nutritional and antinutritional quality of fodder	CDLU, Sirsa	N Saxena
Chander Mohan	PhD	Identification of active ingredients against GI parasites in extracts of indigenously known angiospermic herbs.	IGNOU, New Delhi	N Saxena
T Chandrasekar	MVSc	Relationship of prepartum body, udder and teat measurements with milk production performance in Nili-Ravi buffalo heifers	IVRI, Izatnagar	K.S.Das
Manisha Kumari	MVSc	Identification of osteopontin and clusterin in buffalo semen and their relation to semen quality	IVRI, Izatnagar	PS Yadav
Daoharu Baro	MVSc	Polymorphism of CD14 gene and its association with mastitis in Murrah buffaloes	LUVAS, Hisar	SK Phulia
Parveen Kumar	MVSc	Comparative studies on Ovsynch vs. double synch protocol for estrus synchronization during summer and winter season in buffaloes	LUVAS, Hisar	SK Phulia
Sandeep Kumar Malik	MVSc	Ovsynch-Plus and a modified Ovsynch-Plus treatment of anoestrus buffalo heifers during summer and winter seasons: Study of ovarian activity and post-treatment fertility	LUVAS, Hisar	RK Sharma
K Karuppanasamy	MVSc	Ovulatory and fertility response using modified GnRH based protocols for estrus induction in anovular buffaloes	IVRI, Izatnagar	RK Sharma
Sunil Kumar	MVSc	Proteomic analysis of follicular fluid in post-partum anestrus buffaloes	IVRI, Izatnagar	I Singh

CIRB Personnel

General Administration	
Dr Inderjeet Singh	Director (wef 30.4.2013)
Dr RK Singh	Director (wef 1.4.2013 to 30.4.2013)
Shri RK Sharma	Administrative Officer (upto 30.6.13)
Shri Chetan S Issar	Administrative Officer(wef 27.8.13)
Shri Mahesh Kumar	Fin. & Accounts Officer(wef 31.1.14)
Shri Raj Kumar	Asstt. Administrative Officer
Shri IS Kundu	Asstt. Administrative Officer
Shri Joginder Singh	Private Secretary
Shri Rajesh Kumar	Assistant
Shri Viksit Kumar	Assistant
Shri Girdhari Lal	Assistant
Shri Abdul Majid	Assistant
Shri Ashok Kumar	UDC
Smt Indira Devi	UDC
Shri Sandeep Kumar Chugh	UDC (On Deputation)
Shri Satbir Singh	UDC
Shri Dharam Pal	LDC
Shri Sunil Kumar	LDC
Shri Mahabir Singh	LDC
Animal Genetics & Breeding Division	
Dr (Mrs) Poonam Sikka	Principal Scientist & Head
Dr Anurag 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 Sudhir Khanna	CTO
Dr Satish Kakkar	CTO
Shri AKS Tomer	STO
Shri Balbir Singh	TO
Network Project on Buffalo Improvement	
Dr Inderjeet Singh	PC(B)
Dr A K Pandey	I/C Network Project
Dr BP Kushwaha	Principal Scientist (at IGFRI, Jhansi)

Smt Sunesh Balhara	Scientist
Dr. Sarita Yadav	Scientist (On study leave)
Shri Ram Chander	TO
Animal Nutrition & 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 MLSharma	ACTO
Shri Krishan Kumar	STO
Shri Mahender S Poonia	STA
Animal Physiology & Reproduction Division	
Dr PS Yadav	Principal Scientist & Head
Dr RK Sharma	Principal Scientist
Dr SK Phulia	Senior Scientist
Dr AK Balhara	Scientist
Dr Dharmendra Kumar	Scientist
Dr Varij Nayan	Scientist (on study leave)
Dr Jerome A	Scientist
Dr Pradeep Kumar	Scientist
Dr Sadeesh E.M.	Scientist
Dr Solekar Naresh Lalaji	Scientist (wef 10.10.2013)
Dr SR Bhardwaj	CTO
Dr AK Saini	TO
Transfer of Technology and Entrepreneurship	
Dr VB Dixit	Principal Scientist & Incharge
Shri Dharam Singh	STA
Prioritizing Monitoring & Evaluation Cell	
Dr SS Paul	Principal Scientist
Dr SP Yadav	Senior Scientist
Dr AK Balhara	Scientist
Shri Raj Kumar	STO

Results-Framework Documents Cell	
Dr SP Yadav	Senior Scientist & Incharge
Sh Ram Chander	Tech. Officer
AKMU	
Dr. SS Paul	Principal Scientist & Overall Incharge
Mrs Sunesh Balhara	Scientist & Incharge
Shri Raj Kumar	STO
Animal Farm Section	
Dr A Bharadwaj	Principal Scientist & Overall Incharge
Dr S Khanna	Chief Technical Officer & Incharge
Shri Subhash Chander	TO
Dr Rajesh Kumar	TA
Shri Satish Kumar	T ₁
Agricultural Farm Section	
Dr PC Lailer	Principal Scientist & Overall Incharge
Shri Surender Singh	ACTO & Incharge
Dr Shaitan Singh	STO
Shri Sushil Kumar	STO
Shri RS Pippal	STO (on deputation)
Landscape section	
Shri Surinder Singh	ACTO & Incharge
Shri Baljit Singh	STA
Workshop Section	
Dr PC Lailer	Principal Scientist & Overall Incharge
Shri Jitender Kumar	STO Incharge
Shri Kuldeep Singh	STA
Shri Bhim Raj	STA
Shri Sant Lal	STA
Shri Mahabir Singh	STA
Shri Ram Kumar	STA
Estate and Electrical Section	
Dr Sudhir Khanna	CTO Overall Incharge
Shri BPSingh	ACTO Incharge, Estate
Shri Rajesh Prakash	STO Incharge, Electrical
Shri RA Pachori	TO
Shri Gopal Singh	TO

Internal Security	
Shri Joginder Singh	Priv. Sec. & Incharge
Shri Satbir Kundu	UDC
Guest House	
Shri AKS Tomer	STO Incharge
Library	
Dr SS Dahiya	Principal Scientist & Overall Incharge
Shri VPS Punia	CTO & Incharge
Hindi section	
Dr AK Pandey	Principal Scientist & Incharge
Shri Sunil Kumar	LDC
PIO/APIO	
Dr RK Sharma	Principal Scientist & CPIO
Shri Chetan S Issar	AO & Transparency Officer
Shri Raj Kumar	AAO & APIO
PRO	
Dr AK Balhara	Scientist
Sub- Campus, Nabha	
Scientific	
Dr Raman Malik	Principal Scientist & Officer Incharge
Dr JK Singh	Senior Scientist
Dr Ghansham Singh	Senior Scientist
Dr KS Das	Senior Scientist
Technical	
Dr KL Mehrara	CTO
Shri Virender Singh	CTO (On deputation)
Shri Jagdish Prasad	CTO
Shri Rajiv Mehta	ACTO
Shri TPSingh	ACTO
Shri Daljit Singh	STA
Shri Balwinder Singh	STA
Shri Mohan Singh	STA
Shri Virender Kumar	TA
Administration	
Shri Narinder Kumar	AAO
Shri Tejinder Singh	UDC
Shri Jaspal Singh	SSS

Personalia

Appointments/Joinings/Promotion/Retirement/Resignation/Transfer



Dr Inderjeet Singh
Joined as Director, CIRB
on April 30, 2013



Dr C Zupeni Tsanglai
Joined as Scientist
on April 12, 2013



Shri Chetan S Issar
Joined as AO
on Aug 27, 2013



Dr Selokar Naresh Lalaji
Joined as Scientist
on Oct 10, 2013



Shri Mahesh Kumar
Joined as F&AO
on Jan 31, 2014



Shri Gopal Singh
Promoted from Senior
Technical Asstt. to
Technical Officer
w.e.f. July 2013



Shri Ishwar Singh
Casual Labour
Retired on Feb 28, 2014



Dr C Zupeni Tsanglai
Scientist
Resigned on Aug 8, 2013



Shri RK Sharma
AO
Transferred to CIRG,
Makhdoom on July 1, 2013



Dr Thirumaran SMK,
Scientist
Transferred to CSWRI Regional
Station, Mannavanur (TN)
on Dec 31, 2013

Demise



Shri MS Kairon
Tech. Officer
Born on 18.5.1957 in village Deban, Dist. Kaithal, Sh. Kairon joined CIRB on 31.10.1986 as T-1 (FFT), worked in Agril farm, Animal farm, Estate section, APR division and in central pool. Shri MS Kairon, a hard working Technical Officer passed away on Jan 30, 2014 in an accident.



BSCIC Certifications Pvt. Ltd.

Certificate Of Registration

QUALITY MANAGEMENT SYSTEM

This is to certify that

CENTRAL INSTITUTE FOR RESEARCH ON BUFFALOES
(Indian Council of Agricultural Research)
HISAR - 125 001, HARYANA, INDIA



Is hereby granted the Certificate Number: **BN8192/7295:0913**

Subsequent to the **assessment** conducted on **19-Sep-2013** and the organization has been found to be operating a Quality Management System which complies with the requirements of

ISO 9001:2008
for the following scope :

Improved Buffalo Germplasm Production

Originally Registered: 30 Sep 2013

Latest issue: 30 Sep 2013

Expiry Date: 29 Sep 2016

For BSCIC CERTIFICATIONS PVT. LTD.

Sanjay Seth
Managing Director

Page 1 of 1



Validity of this Certificate is subject to Annual Surveillance Audits to be done Successfully on or before 19-Sep-2014 and 19-Sep-2015 resp. (In case if Surveillance Audit is not allowed to be conducted; this Certificate shall be Suspended/Withdrawal).

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