Annual Report 2012-13

Central Institute for Research on Buffaloes

Hisar-125 001 (Haryana) India

(Indian Council of Agricultural Research)

New Delhi

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

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Preface

Phenomenal growth in buffalo meat export, witnessed during the past five years with opening of export oriented abattoirs, has helped India achieve the position of leading carabeef exporter in the world. Since 2008, when India exported 672,000 tonnes, shipments of buffalo meat have almost trebled. According to APEDA, exports of meat and its products increased to $3.29 billion in 2012-13 against $2.91 billion in the previous year. This has added another feather to the cap of the world's top milk producing country, where buffalo's contribution to total milk production (117 Million metric tonnes) is over 55%.

The country is well geared to consolidate its position in these spheres with huge germplasm diversity and research efforts of the Central Institute for Research on Buffaloes addressing both the dimensions. During the last decade, number of milch buffaloes increased from 29 to 34 million and average daily milk production per buffalo also increased from 3.96 to 4.34 kg. The institute is concentrating on its perceived agenda of superior germplasm production and dissemination with the application of modern reproductive biotechnologies. The deficiencies of productive and reproductive performance are being addressed through physiological, nutritional and managemental strategies.

During the year, the Nili Ravi breed maintained at sub-campus of the institute has shown the premise to be another star milch breed of buffalo. Breeding plan for Murrah buffaloes under the Network Project on Buffalo Improvement and analysis of its results have given another set of progeny tested proven bulls and ready stock of frozen semen doses from these bulls – the only stock of progeny tested buffalo bull semen in the world. So far, twenty two top ranking progeny tested bulls have been identified for elite mating and production of bull calves. Modern technologies are being blended with traditional practices to derive the advantage of both. Farmers' interactions with institute scientists are witnessing rapid expansion.

The Annual Report 2012-13 is presented with a commitment for further improvement and development in tune with the changing horizons of buffalo farming in the country and socio-economic status of the stake-holders. The strengths of the institute in terms of its innovative research teams, competent technical and administrative staff and hardworking supporting staff shall be enough to realize the mandated objectives.

The crucial encouragement and timely support received from Dr S Ayyappan, Secretary Department of Agricultural Research and Education, and Director General, ICAR and Professor KML Pathak, Deputy Director General (Animal Sciences), ICAR are our strength behind these accomplishments, besides encouraging us to embark upon our commitment for confronting the future challenges. I am grateful to Dr BS Prakash ADG (AN&P), Dr SC Gupta ADG (AP&B), ICAR, Dr RK Sethi former Director and Dr RK Singh who was having additional charge of Director CIRB for their continuous support and guidance for accomplishing the tasks for the development of the species.

Dr Inderjeet Singh
Director

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Executive Summary

- Bull no. 1994 from GADVASU, Ludhiana top ranked set IX with sire index value of 2487 kg followed by bull no 5258 from NDRI Karnal having sire index 2466 kg with per cent superiority of 11.73% and 10.52 %, respectively over contemporary daughters.
- Under FPT programme 4204 artificial inseminations with the test bulls of 14th set were performed in ten adopted villages. In all 2093 pregnancies were confirmed and 1159 calvings were recorded, out of which 574 were females.
- DNA/ Blood and phenomics records of various breeds of buffaloes were added in the Database. A total of 332 bloods samples of the Murrah and Nili-Ravi breeds have been collected and 519 animals records were collected/ updated.
- In Murrah, the age at first calving (44.48 months) was significantly reduced as compared to the previous year (51.91 months). In Nili-Ravi the overall wet and herd averages were 8.26 and 5.34 kg, respectively.
- A total of four nucleotide variations were observed in the coding region of Murrah leptin gene. There were two variations in the exon 2 and two in the exon 3. Both the mutations in exon 2 were nonsynonymous while in the exon 3 mutation one mutation is nonsynonymous and another is a silent transversion mutation.
- Forty four viable embryos were obtained under ET program, out of which 10 were frozen and 34 were transferred in recipients resulting in total 12 pregnancies and one pregnancy was in farmer's buffalo in village Bado Patti.
- For buffalo cloning, 48 reconstructed and activated embryos were cultured and one reconstructed embryo reached upto morula stage.
- Total of 63,857 semen doses were produced, 13,188 semen doses supplied to network project centers and 80,081 doses sold. From farmers' champion bulls 20,271 semen doses were frozen, out of which 10,567 doses were supplied/sold and 9,704 doses are in stock.
- *In-vitro* differentiation of eMSCs to tenocytes was achieved and confirmed by expression of Decorin and Tenomodulin by RT-PCR and immuno-cytochemistry.
- CAPN2 and UBC genes were slightly over-expressed in mastitis affected udder. Transcript levels of IL-1β and IL-6 genes decreased significantly immediately after oxytocin administration and increased thereafter on the first day of seven day OT administration. IL-1β and IL-6 transcript signatures may be of prognostic value in clinical mastitis.
- No significant correlation ($p<0.05$) was deduced between the detected polymorphism of buffalo FGF2, STAT5A and UTMP genes and repeat breeding.
- Vitronectin is a host defense protein reported for the first time in buffalo milk.
- Proteomic analysis of blood sera during early pregnancy indicates differential expression of pregnancy specific proteins Synaptojanin-1, Apolipoprotein A-1 and B, Keratin 10 and Von Willebrand factors.
- The number of cleaved IVF embryos obtained from

defined PVA + myo-inositol + phosphate + EGF culture medium was higher as compared to other three IVC media used.

- Precision feeding of female buffalo calves indicated that a targeted growth rate of about 750g per day can be achieved.
- Out of various combination of inorganic salts, a mixture of $NaHCO_3$, K_2CO_3, $NH_4H_2PO_4$, Na_2SO_4, $MgCl_2$ and NH_4Cl at 0.3, 0.3, 0.015, 0.60, 0.60, 0.03 per cent, respectively in the fermentation medium significantly improved true digestibility, fibre digestibility and volatile fatty acid production of wheat straw.
- Leaves of Sahjan, Lasoda, Siris and Guava and fruits of Clove and Lasoda were found to have antimethanogenic activity. Aqueous extracts of *Albizia lebbek* leaves and *Cordia dichotoma* ripe fruits were having highest (94%) methane reduction potential.
- *Moringa oleifera* leaves exerted positive associative effect on fermentation which resulted in increase in gas production, true degradability of dry matter and organic matter and microbial biomass production with the concomitant reduction in methanogenesis.

Extension Activities

- The institute organized 12 infertility treatment camps in collaborations with PNB Farmers Training Centre, Sucha Khera.
- Buffalo Mela was organized at the Institute premises on March 9, 2013. In this annual event, 175 elite buffaloes from all over Haryana and adjoining states participated. More than 550 farmers also participated in the event.
- A Buffalo Mela was also organized on December 1, 2012 at CIRB sub-campus, Nabha. In this event about 100 farmers participated along with their animals.
- Five calf rallies were organized in villages Dhiktana, Jewra, Sarsod, Juglan and Bichpari. More than 300 farmers participated in these calf rallies along with their animals.
- Training programmes on improved buffalo husbandry, AI and buffalo nutrition were organized at the main and sub-campus, CIRB.
- Sixty farmers were trained through five trainings in artificial insemination and animal husbandry as vocational programs.

Buffaloes grazing in the agriculture farm of the institute.

Introduction

India has over 111.3 million buffaloes constituting about 57.3 per cent of the total world population. Despite being less in number than cattle (199.08 million) in the country, buffaloes currently produce 62.35 million metric tonnes of milk which is about 51.2 per cent of the total milk produced in the country. Besides milk, 1.62 million metric tonnes of meat is also produced from this animal and buffalo draft power accounts for about 10 per cent of the total draft power contributed by the work animals. In addition to milk, meat and draft, buffaloes also produce 0.52 million metric tonnes of skin and hides. Considering great significance of buffalo for the country, Central Institute for Research on Buffaloes was established on 1st February, 1985 to undertake research on all aspects of buffalo production including milk, meat and draft. A sub-campus of the Institute was established at Nabha on 1st December 1987.

Past achievements

- Institute has so far supplied over 499 Murrah bulls and 230 Nili-Ravi bulls of superior genetic merit to various developmental agencies and village Panchayats in the country.
- Breeding programs in Murrah, Nili-Ravi, Surti, Jaffarabadi, Bhadawari, Pandharpuri and Swamp buffaloes are being undertaken at various centers of the Network Project on Buffalo Improvement, scattered across the country in their respective breading tracts.
- The Institute has over 2.17 lakh doses of frozen semen in its semen bank under progeny testing programme.
- Technology for ET was standardized and as a result 20 calves were born through ETT at the Institute.
- Early positive pregnancy diagnosis with sonographic technique was done as early as day 25 post-insemination.
- 'Ovsynch-Plus' protocol was developed for inducing oestrus in summer acyclic buffaloes. It was observed that conception rates are higher when buffaloes develop corpus luteum following both the GnRH injections.
- Achieved success in *in-vitro* fertilization of buffalo oocytes. Technology for cryo-preservation of buffalo oocytes and embryos was standardized. The technique of micromanipulation of embryos was also studied in buffaloes.
- *Enterolobium timbova* leaves were successfully used for removal of protozoa from the rumen of buffaloes. It was established that defaunation is beneficial for growth under certain feeding conditions. Defaunation effects of certain agents in the decreasing order were: copper sulphate > sodium lauryl sulphate > Enterolobium leaves > Neem seed kernels.
- Studies have indicated that growing Nili-Ravi heifers require 103.3 - 129.5 Kcal/Kg $W^{0.75}$ ME for maintenance at various body weights. Maintenance requirements for CP were in the range of 6.49 - 9.49 g/Kg $W^{0.75}$. The requirements of ME for each gram of gain in BW were in the range of 6.18 - 12.9 Kcal. The requirements of CP for each gram of gain in body weight were in the range of 0.24 - 0.42 g.

- Two grainless concentrate mixtures, isocaloric and isonitrogenous, were formulated in such a way that cereal maize grain was completely replaced with brans of wheat and rice and this resulted in body weight gain of 500 g/day. The cereal of conventional concentrate mixture can be replaced with rice/wheat bran without affecting growth performance and nutrient utilization.
- Colostrum feeding during early post-natal life ensures better calf survivability due to absorption of more amounts of immunoglobulins present in the colostrum. The immunoglobulin level at 24 hour may predict the health status of calves. A critical level of these blood proteins has been assessed for survivability of calves. Study also revealed the sex variation in absorption of immunoglobulins.
- Studies on artificial induction of lactation were undertaken in buffaloes. In successful cases the peak milk yield ranged between 2.5 to 7.0 litres/day and was attained between 20th to 75th day after start of milking. In poor responders however, peak milk production was as low as 250 ml to 800 ml only and these buffaloes dried off in 75 days. No significant differences were observed in the haematological parameters before and after treatment for induced lactation in buffaloes.
- To establish the basal values of various proteins and calcium, blood samples were collected from peripubertal non-pregnant heifers and non-pregnant problem heifers and analyzed for total protein, albumin, globulin and calcium. The proteins, including albumin and globulin, were slightly higher in normal peri-pubertal heifers but calcium was marginally lower as compared to problem heifers.
- Studies on the effect of feeding 'complete feed blocks' (CFB) on growth and production performance of buffaloes revealed that the average milk yield, fat, SNF and TS percent did not differ (P>0.05) significantly among different groups. Milk yield was 5.27, 5.33 and 5.71 kg/day in control, Wheat straw based CFB (WSCFB) and Bajra kadabhi based CFB (BKCFB) groups, respectively. Similarly, average fat was 7.16, 7.31 and 7.12 percent in control, WSCFB and BKCFB groups, respectively. Respective SNF was 9.84, 9.55 and 9.95 percent and TS was 17, 16.92 and 17.07 percent in these groups.
- A multi-residue method for three neonicotinoid pesticides viz. imidacloprid, acetamiprid and thiacloprid was developed using HPLC. Percent recovery from 0.5 to 2 ppm concentration varied in the range of 81.17 percent to 95.6 percent for imidacloprid, 84.99 percent to 92.76 percent for acetamiprid, and 88.50 percent to 96.96 percent for thiocloprid. The detection limit depending upon the peak to noise ratio was observed to be 5, 10 and 20 ppb, respectively for imidacloprid, acetamiprid and thiocloprid.
- The transcript signatures of genes of proteolytic system and pro-inflammatory cytokine genes were evident in normal/mastitis affected udder tissue, skeletal muscle, and milk derived somatic cells. IL-1β and IL-6 transcript signatures may be of prognostic values for clinical mastitis. CAPN2 and UBC genes were slightly over expressed in mastitis affected udder.
- Polymorphism of key genes might be controlling embryonic growth and survival, these may be Fibroblast Growth Factor 2 (FGF2), Signal Transductors and Activators of Transcription (STAT5A) and Uterine Milk Protein (UTMP) genes. Though novel SNPs in buffalo FGF2, STAT5A and UTMP gene intron and exon regions there was no significant correlation ($p<0.05$) deduced between the detected polymorphism and repeat breeding.
- A total of 43011.8 qtls of green fodder and 1067 qtls grains were produced at CIRB, Hisar campus while 42899 qtls of green and 5303 qtls grain were produced at sub-campus Nabha during the Rabi and Kharif seasons of the year. 6081 qtls of fodder were preserved as silage for use during green fodder scarcity season.

AKMU

The AKMU maintains the website (http//www.cirb.res.in) of the Institute and provides computing facilities to the scientific and other staff of the Institute. Apart from this it maintains the e-mail, EPABX and internet connectivity. During the year high speed internet connectivity was provided in the old building for the scientists and the officials. Website of the institute is being updated regularly.

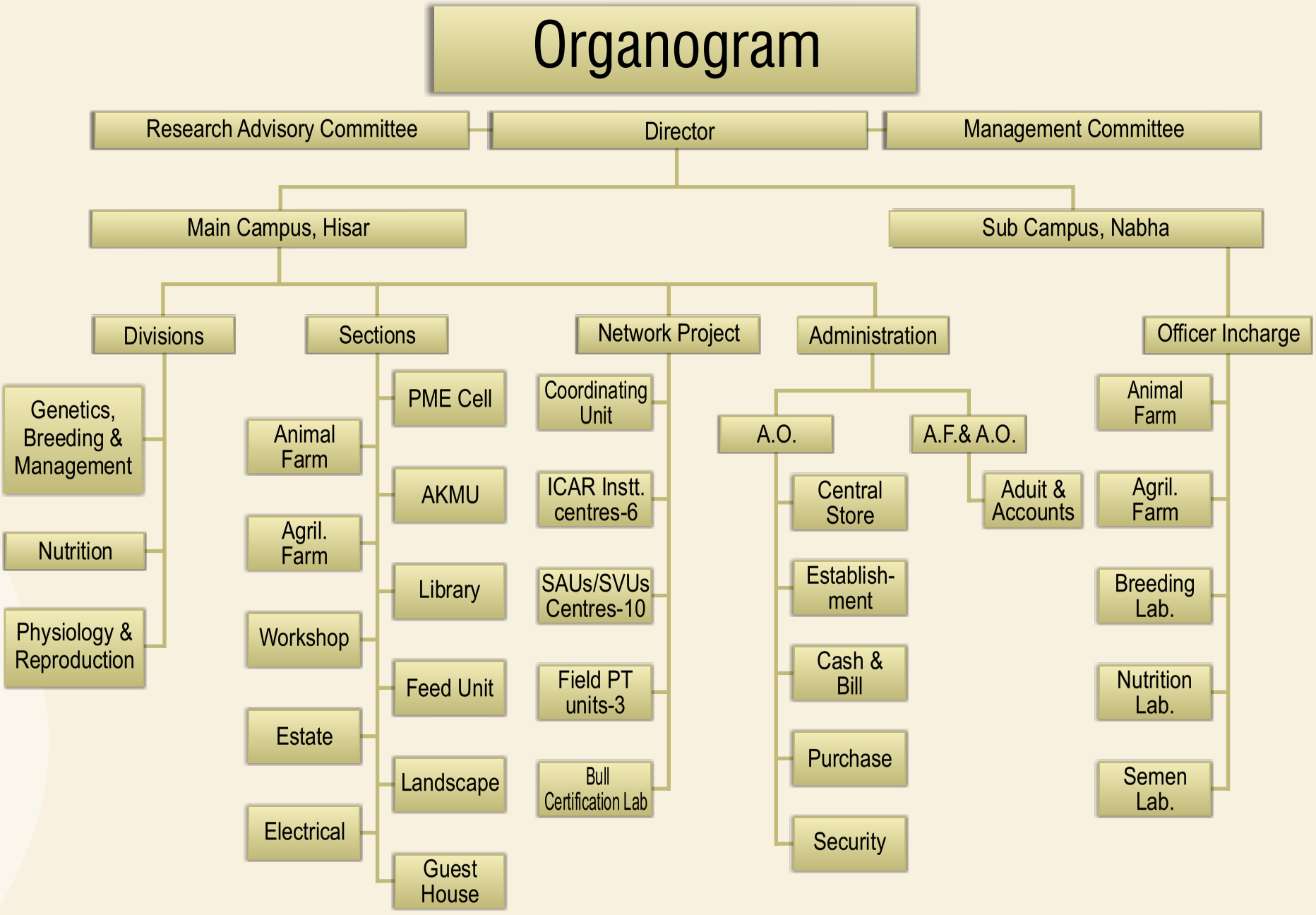
Table 1 : Staff Position of CIRB

S.No.	Category	Sanctioned Strength	Filled	Vacant
1	Scientific	40+2	33+1	7+1
2	Technical	44	41	3
3	Administrative	20	17	3
4	Skilled Supporting	71	68	3

Table 2 : Financial Outlay (in lacs)

Head	Sanctioned Budget 2012-13	Expenditure 2012-13
Plan 2012-13	**365.39**	**364.56**
Non-Plan 2012-13	**1713.41**	**1710.68**
Network project on buffalo improvement	350.00	350.00
Buffalo Genome Project	12.76	7.42
AICRP on improvement of feed resources	6.70	2.87
Intellectual property rights and Commercialization of technology	4.60	0.24
NAIP Projects	18.38	6.41
NFBSFARA Project	47.17	36.86
DBT Projects	2.90	2.55
	16.40	16.40
ELANCO Project	117.90	50.09
Revenue receipt	160.00 (target)	217.34 (achieved)

Organogram


Research Advisory Committee
Director
Management Committee
Main Campus, Hisar
Sub Campus, Nabha
Divisions
Sections
Network Project
Administration
Officer Incharge
Genetics, Breeding & Management
Nutrition
Physiology & Reproduction
Animal Farm
Agril. Farm
Workshop
Estate
Electrical
PME Cell
AKMU
Library
Feed Unit
Landscape
Guest House
Coordinating Unit
ICAR Instt. centres-6
SAUs/SVUs Centres-10
Field PT units-3
Bull Certification Lab
A.O.
A.F.& A.O.
Central Store
Establish-ment
Cash & Bill
Purchase
Security
Aduit & Accounts
Animal Farm
Agril. Farm
Breeding Lab.
Nutrition Lab.
Semen Lab.

Research Achievements

Genetic resource improvement

India is endowed with substantial diversity of buffalo germplasm which includes thirteen well-defined breeds and vast population of non-descript type. Being a multipurpose animal providing milk, meat and draft, buffalo remains the primary source of livelihood subsistence for millions of small holding farmers in India. There is tremendous increase in the demand of buffalo milk. The species is also a resource of meat as well as cheap draft power. Buffalo has assumed its place of pride in the Indian farming system, which is to be sustained and boosted. Genetic resource improvement is one of the major programs of the institute and the progress made under this program during the period is as under :

Murrah herd Performance

The herd strength of Murrah buffalo as on 31.3.2013 was 517, which included 196 adult buffaloes, 104 suckling calves, 115 young males and females (1-2.5 years), 85 heifers (> 2.5 years) and 17 breeding males (>2 years). During the period 118 progenies were added while 26 animals of different age groups were auctioned and sold.

The overall calf mortality (0-3 months) was 5.92 percent while overall herd mortality during 2012-13 was 3.16 percent. These parameters were within the targets.

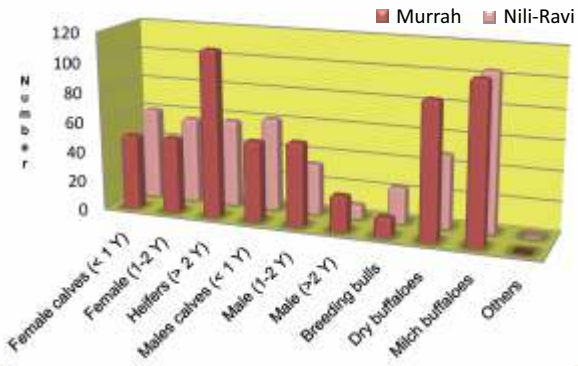
The overall wet average and herd average recorded during the year was 7.74 and 4.86 kg, respectively. The overall 305 days lactation milk yield and total lactation milk yield were 2335 and 2478 kg, respectively, while average peak yield was recorded as 11.23 kg per buffalo.

The overall conception rate during the period was 45.75%. Age at first calving reduced significantly to 44.48 months as compared to the previous year (51.91 months). Service period and calving interval of 174 and 481 days, respectively, were recorded. Reproductive traits improved as compared to last year performance for service period (181 days) and calving interval (485 days).

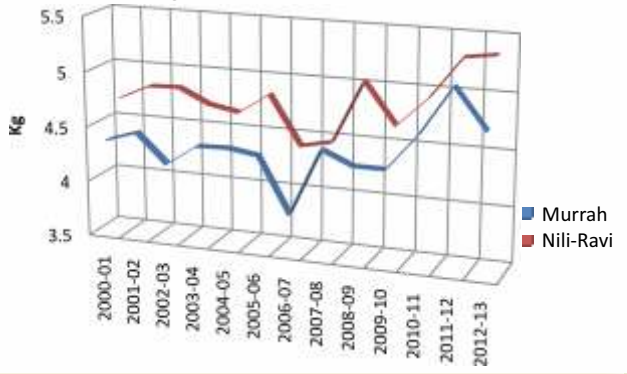
Nili-Ravi herd performance

At present, a herd strength of 460 is maintained at sub campus, including lactating, dry buffaloes, heifers, calves and bulls. During the period under report the fourth set of

Herd Strength of Murrah and Nili-Ravi buffaloes



Herd Average of Murrah and Nili-Ravi buffaloes



Nili-Ravi bulls is being used for test matings at farm and performance of progenies of previous set bulls is being recorded. Sixty five surplus animals were auctioned and mortality rates were 3.75 and 1.49 per cent for young calf and overall herd, respectively. The wet average of 8.26 kg and herd average of 5.34 kg were achieved which were the highest since inception of the sub-campus. Average lactation yield during 2012-13 was 2048 kg.

The average body weights at birth were 32.3 and 34.2 kg for female and male buffalo calves, respectively. The growth rate of female calves was higher than the male calves during 6 to 12 months of age. Female and male calves achieved 352 kg and 382 kg average body weight at 24 months of age, respectively.

Overall conception rate was 40% and bull-wise it ranged from 25 to 54.72% in Nili-Ravi buffaloes. Majority of buffaloes conceived during October to February. The average age at first calving was 39.6 months which is optimum. Overall service period and calving interval were 126 and 436 days, respectively.

Network project on buffalo improvement

Data of daughters born from the 9th set of Murrah bulls which completed their first lactation was compiled and sires were evaluated. Bull no. 1994 from GADVASU, Ludhiana was adjudged top ranking with sire index of 2487 kg followed by bull no 5258 from NDRI, Karnal having sire index of 2466 kg with superiority of 11.73 and 10.52 %, respectively, over contemporary daughters. The pedigree detail and sire indices of the set are presented in table 3.

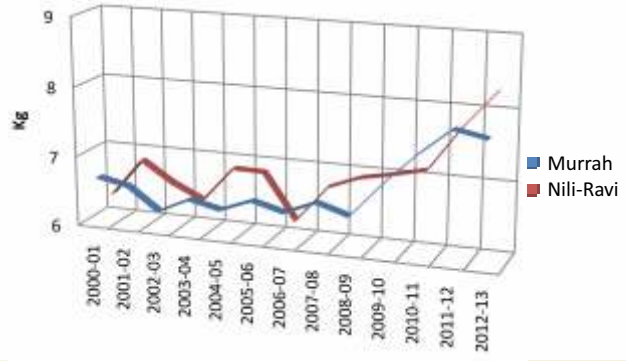
The two top ranked proven bulls are to be used for elite mating at the institutional herds for production of superior male calves. These calves shall be reared for use as future breeding bulls.

Test mating with 14th set bulls was initiated in institutional herds as well as in field units from January 2013 and it will continue upto June 2014.

FIELD PROGENY TESTING

Under field progeny testing program (FPT) semen of test bulls is used for AI 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 2012 to March 2013, 4204 artificial inseminations with the test bulls of set 13th and 14th were performed in ten adopted villages. In all 2093 pregnancies were confirmed and 1159

Wet average of Murrah and Nili-Ravi buffaloes



305 days' or less lactation yield of Murrah and Nili-Ravi buffaloes

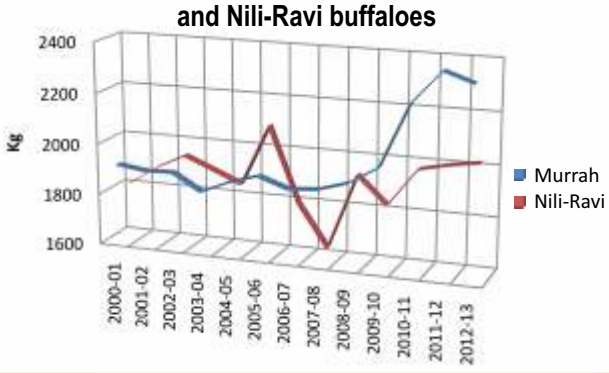


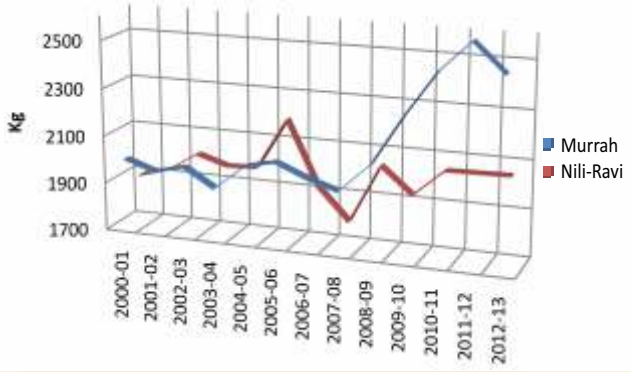
Table 3 : Progeny Testing evaluation of 9th set bulls (Murrah breed)

SN	Bull No.	Location	Date of birth	Dam No.	Sire No.	Dams best lactation 305 day or less yield (kg)	Daughters 1st Lact. 305 day or less Av. Yield (kg)/N	Sire Index	% superiority over Cont. Daughters	Rank	No. of semen doses as on 31-03-13
1	1575	CCS HAU	05-09-02	1050	4523	3194	2240.8/18	2241.17	0.09	VIII	1725
2	1903	GADVASU	02-01-02	1802	1933-PT	2718	2250/20	2253.68	0.68	VII	660
3	1913	GADVASU	12-02-02	1795	1922	2740	2216.7/14	2213.58	-1.21	X	892
4	1940	GADVASU	26-07-02	1530	584	2775	2200.5/17	2190.7	-2.29	XII	1552
5	1964	GADVASU	05-12-02	1819	1933	2672	2147.8/23	2107.78	-6.23	XIV	3016
6	1994	GADVASU	16-06-03	1884	392-PT	2938	2431.7/18	2486.61	11.73	I	3191
7	2582	CIRB	23-02-01	P-224	1573	2836	2279.5/24	2298.07	2.8	IV	3875
8	2592	CIRB	20-03-01	1393	1666	3336	2097.8/28	2018.21	-10.53	XV	175
9	2720	CIRB	12-11-01	515/4.9	1573	2664	2274/15	2280.07	1.91	VI	4584
10	2910	CIRB	25-10-02	1338	4506-PT	3062	2239/19	2238.82	-0.03	IX	509
11	5112	NDRI	24-03-01	3791	2704	3333	2268.2/30	2285.68	2.23	V	2202
12	5197	NDRI	13-11-01	3783	1666	2831	2316.3/12	2319.83	3.76	III	2704
13	5218	NDRI	09-02-02	3447	2583	2912	2158.7/22	2125.67	-5.38	XIII	3068
14	5258	NDRI	01-08-02	4066	1706	3305	2539.3/7	2466.2	10.52	II	2313
15	5312	NDRI	21-01-03	3492	2361	3534	2158.5/3	2206.6	-1.5	XI	1715

- All herds first lactation 305 day or less milk yield was 2239.3 kg based on 270 daughters.
- All centers shall use the semen of bull no. 1994 and 5258 for elite mating from January 2013 onwards.

calvings were recorded, out of which 585 were males and 574 were females. The female progenies at different field unit centres were identified and implanted with microchips for identification. Seventy one progenies (1 of 9th, 49 of 10th and 21 of 11th set) calved at various field unit centres. The average age at first calving of these 71 calved daughters was 41.64 months. During the year, monthly test day milk recordings of 116 daughters were done at various field unit centers, out of which 49 daughters completed the lactation and recording of 51 daughters are in progress. Sixteen daughters were sold before the lactation was completed. As on 31st March 2013, 622 female progenies of 10th to 13th set bulls are standing at various centers for future milk recordings, including 278, 302 and 42 daughters aged less than 1 year, 1-3 years and more than three years, respectively. The physical identification using injectable microchips has been done in all female progenies born and standing at various field unit centres.

Average lactation yield of Murrah and Nili-Ravi buffaloes



Average lectation length of Murrah and Nili-Ravi buffaloes

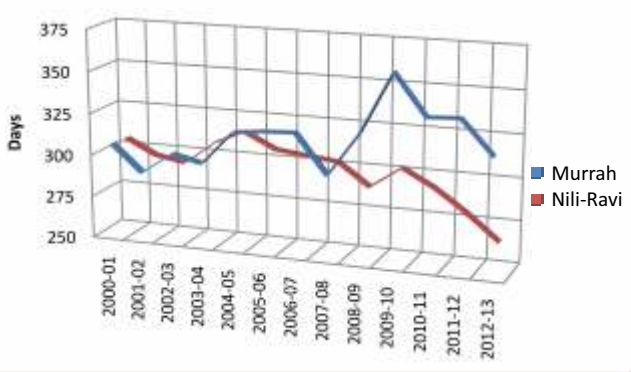


Table 4 : Average milk constituents (%) of Murrah buffaloes of Institute herd during 2012-13

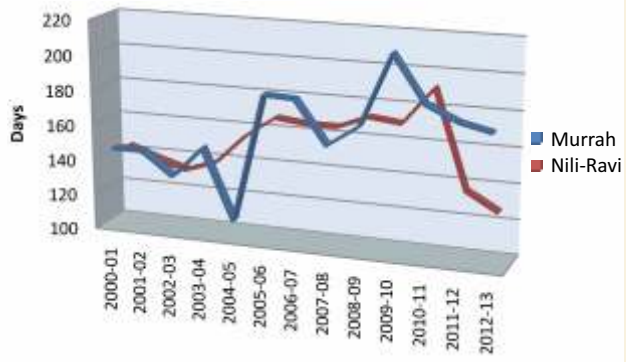
Month	n	Fat	SNF	Protein	Lactose
April 12	110	8.00 ± 0.08	8.07 ± 0.07	3.58 ± 0.02	4.40 ± 0.02
May 12	104	7.87 ± 0.08	8.13 ± 0.06	3.58 ± 0.02	4.36± 0.02
June 12	103	7.96 ± 0.08	8.00 ± 0.06	3.57 ± 0.02	4.36± 0.02
July 12	102	7.75 ± 0.08	7.92 ± 0.05	3.53 ± 0.02	4.31 ± 0.02
August 12	101	7.81 ± 0.09	7.97 ± 0.05	3.52 ± 0.01	4.30 ± 0.02
September 12	109	7.46 ± 0.10	8.02 ± 0.05	3.48 ± 0.01	4.28 ± 0.02
October 12	118	7.34 ± 0.09	8.07 ± 0.05	3.50 ± 0.01	4.30 ± 0.01
November 12	110	7.42 ± 0.08	8.21 ± 0.04	3.48 ± 0.01	4.22 ± 0.01
December 12	109	7.42 ± 0.09	8.33 ± 0.04	3.53 ± 0.01	4.29 ± 0.01
January 13	97	7.51 ± 0.08	8.19 ± 0.04	3.52 ± 0.01	4.38 ± 0.02
February 13	89	7.59 ± 0.08	8.32 ± 0.04	3.60 ± 0.01	4.46 ± 0.02
March 13	88	7.86 ± 0.08	8.58 ± 0.04	3.69 ± 0.02	4.61 ± 0.02
Overall	1240	7.66 ± 0.02	8.14 ± 0.02	3.54 ± 0.01	4.35 ± 0.01

Table 5 : List of Murrah bulls selected for 14th set

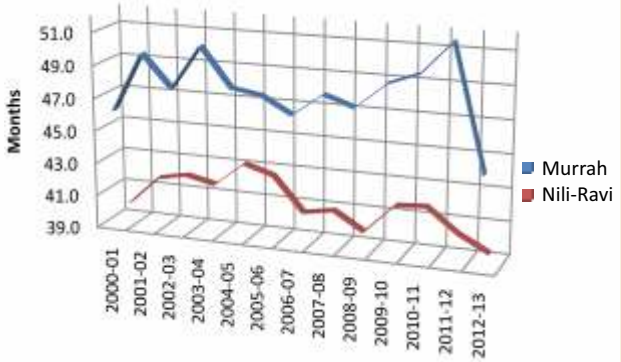
SN	Bull no	Location	Date of birth	Dam No	Sire No/ Set No	Dams best lactation 305 day or less yield (kg)	Dam's 305 day or less Avg yield (kg)/N	Semen availability (as on 18th Sept)	Bull's expected BV	Health status TB/JD/B/ IBR/Trich/ Lept as in Nov 2012
1.	4196	CIRB	10-05-10	3586	1153-PT	3304	2842/3	No	2473	-ve
2.	4439	CIRB	Purchase	-	-	22 kg PY	-	Yes	-	-ve
3.	4093	CIRB	10-09-09	3133	3255	3040	2692/3	No	2426	-ve
4.	4100	CIRB	18-09-09	3033	2154	2971	2530/3	No	2375	-ve
5.	6066	NDRI	08-04-09	402	4393-PT	3505	2934/2	No	2502	-ve
6.	6136	NDRI	25-09-09	5517	2148	4341	4135/3	Yes	2877	-ve
7.	6014	NDRI	02-10-08	5234	1693	3072	2939/2	Yes	2503	-ve
8.	6044	NDRI	15-01-09	430	4371-PT	3567	3338/2	Yes	2628	-ve
9.	2369	GADVASU	24-08-10	P2138	5496	3114	2779/5	No	2877	-ve
10.	2383	GADVASU	13-10-10	P2489	3267	4636	3673/3	No	2453	-ve
11.	2357	GADVASU	24-07-10	P2488	1933	3559	2952/3	No	2733	-ve
12.	1010	IVRI	04-11-10	701	3267	2850	2746/3	No	2443	-ve

Note : From each bull 10,000 semen doses are to be frozen.
PT = Progency Tested Bull.

Service period in Murrah and Nili-Ravi buffalo herds



Age at first calving in Murrah and Nili-Ravi heifers



Buffalo Genome

DNA/ Blood and phenomics records of various breeds of buffaloes were added in the Database. A total of 332 blood samples of the Murrah and Nili-Ravi breeds have been collected and 519 animals, records were collected/updated thus making updates in DNA resource repository and phenomics database. Aliquotes of DNA, generated under 'DNA repository' maintained at CIRB Hisar and NBAGR, Karnal were exchanged. Repository maintains germplasm of Nili-Ravi (Nabha) and Murrah (GADVASU Ludhiana and NDRI, Karnal other than CIRB, Hisar).

The nucleotide sequences of different exons of leptin and leptin receptor gene were analyzed. Three variations were detected in exon 2 of leptin gene. Two variations were detected in the coding region and one in intron 2. Both the mutations in the coding region were nonsynonymous and leading of substitution of amino acid. At codon position CCC 25 CGC there is a transversion leading to change in the amino acid Proline to Agrinine. A missense mutation at codon position 41 (GGG 41 AGG) is a transition that leads to change in Glycine to Agrinine. The third nucleotide variation lies in the intorn 2 of the leptin gene leading to a transition of nucleotide C to T. In exon 3 of leptin gene a total of two variations were detected, both in the coding region. The mutation at the coding region CAG 103 CGG is nonsynonymous and leading to substitution of Glutanine to Agrinine. The second variation is a silent transversion.

Development of SNP typing protocol based on leptin gene is a convenient and economic SNPs typing method suitable for

```
EXON2F    GAAAATGCGCTGTGGACCCCTGTACCAATTCCTGTGGCTTTGGCCCTATC 50
EXON2F    GAAAATGCGCTGTGGACCCCTGTACCAATTCCTGTGGCTTTGGCCCTATC 50
Exon2F    GAAAATGCGCTGTGGACCCCTGTACCAATTCCTGTGGCTTTGGCCCTATC 50
          **************************************************

EXON2F    TGTCCTACGTGGAGGCTGTGCCCATCCCCAAGGTCCAGGATGACACCAAA 100
EXON2F    TGTCCTACGTGGAGGCTGTGCCCATCCCCAAGGTCCAGGATGACACCAAA 100
Exon2F    TGTCCTACGTGGAGGCTGTGCCCATCCGCAAGGTCCAGGATGACACCAAA 100
          ************************** *********************

EXON2F    ACCCTCATCAGGACAATTGTCACCGGGATCAATGACGTCTCACACACGGT 150
EXON2F    ACCCTCATCAGGACAATTGTCACCGGGATCAATGACGTCTCACACACGGT 150
Exon2F    ACCCTCATCAGGACAATTGTCACCAGGATCAATGACGTCTCACACACGGT 150
          ************************ **********************

EXON2F    AGGGAGGGACTGGGAGATGAGGTA 174
EXON2F    AGGGAGGGACTGGGAGAGGAGGTA 174
Exon2F    AGGGAGGGACTGGGAGATGAGGTA 174
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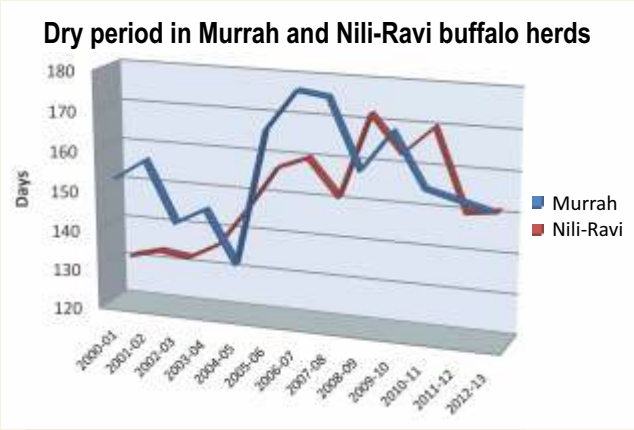
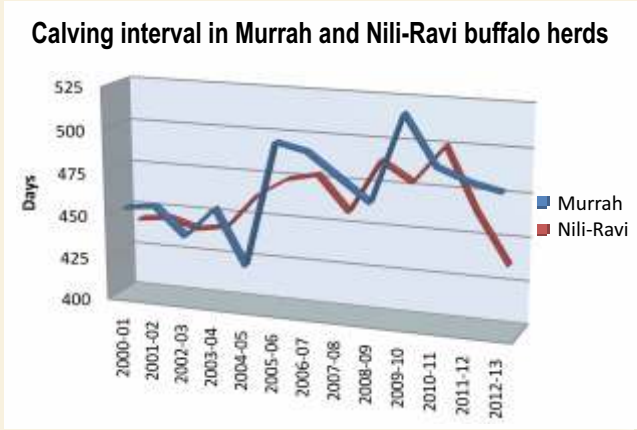
Leptin Gene Exon 2 Nucleotide Sequence

the analysis of multiple samples. In SNP Typing Protocol of Leptin Gene Exon_3 there is a mutation at the restriction site of the PstI (PstI ctgca|g) restriction enzyme. When we digest the sequence if there is T base pair at mutation position it will generate two fragments, otherwise single fragments. This way we can identify this particular mutation in any buffalo population with the Pst I restriction enzyme digestion without going for sequencing.

Seminal acidic fluid protein gene reportedly governs sperm stability and fertilization efficiency in many species. 35 Murrah bulls carrying the gene segment governing high and low field conception rate were subjected to SNP genotyping and sequencing. Nucleotide polymorphism was detected in exon 4-5 of the gene. Four haplotypes were identified. Relation between incidence of SNP alleles and mean ± SD of sperm motility and other semen quality parameters, estimated by CASA was estimated in high and low conception rate sub-groups of bulls. Study inferred SNPs as suggestive molecular marker for bulls screening. Presence of sequence specific restriction site in exon IV of seminal acidic fluid protein gene is identified in this study giving way to





develop a SNP Typing protocol for screening bulls for fertility.

For SNP genotyping of meat genes in Murrah male calves a total of 16 male calves are being reared at institute experimental farm. Monthly body weight is being recorded for growth studies. These calves will be slaughtered. SNP analysis was done in Calpastatin (CAST) Gene Exon_7, Exon_8 and Growth Hormone Receptor Gene Exon_5.

Development of digital buffalo herd analyser

Twenty six adult Murrah buffaloes and 27 adult Nili-Ravi buffaloes, from respective herds of the institute, were classified under various categories and measured physically and linearly with their PS-Length (PSL) (cms/inch), Height at Wither (HW) (cms/inch) and Heart Girth (HG) (cms/inch) for comparing the estimated values depicted from digital images. For insertion of referential object lay out, two Digit Marker Plates (DMP) of arbitrary rectangular dimension were got fabricated and used in getting imaging in five views of body surface of buffaloes. The dimensions of plates were fixed as Length x Width i.e. 50.4 cms (19.842 inch) x 12.0 cms (4.724 inch). The digital image of 26 and 27 adults Murrah and Nili-Ravi buffaloes respectively, were obtained with five sketches at (i) right side (ii) left side (iii) back side (iv) front and (v) upper views using 2D camera of Polaroid make. The downloaded data of Exif (Exchangeable Image File) Format of 2D digital images n=26x5 and n=27x5 of Murrah and Nili-Ravi adult buffaloes, respectively, were checked and screened against their image event specifications.

The differences between estimated linear measurements and observed physical/ manual measurements were absolutely ranged 0.88 to 22.27 cms and 0.15 to 17.68 cms for PS-Length and Height at Wither respectively in Murrah buffaloes. Whereas in Nili-Ravi buffaloes, the differences ranged 1.73 to 23.48 cms and 1.03 to 20.99 cms for PS-Length and Height at Wither respectively.

The estimation of Heart Girth (HG), viewed as 3D image, was carried out by combining the Horizontal Width (near chest) identified from Upper View and Vertical Depth measured from Right/Left View. The Horizontal and Vertical Depth were considered as minor and major axis of elliptical shape respectively. The circumferences of such elliptical shapes were evaluated by substituting minor and major axis values in a formula. The differences ranged 2 to 6 cms which require specific modifications in evaluation of image values.


Semen processing

Improvement of Reproductive Efficiency

Reproduction is the mainstay of dairy industry as it opens the way for getting milk as well as the calf for next generation. Economics of the livestock rearing mainly depends on efficient reproduction. For faster multiplication of superior animals through improvement of reproductive efficiency various physiology and reproduction research experiments on males and female buffaloes were undertaken, including those on semen freezing, effect of cryopreservation on integrity of buffalo sperm membrane and DNA in relation to fertility, embryo transfer, cloning, lactation physiology, proteomics to detect early pregnancy, polymorphism of key genes in survival of embryos, the developmental genes in *in-vitro* developed embryos and identification of fertility -associated seminal plasma protein in spermatozoa and seminal plasma.

Aim of all assisted reproductive techniques is to multiply elite males and females at a faster rate. Besides the research projects for improvement in semen freezing protocols, semen was frozen for the current set of bulls selected under the network project on buffalo improvement. These semen doses from the superior bulls are provided to the network and field progeny testing centers for genetic improvement of buffaloes. During the period 63,857 frozen semen doses were produced, 13,138 semen doses were supplied to network project centers and 80,081 doses were sold for Rs 15.39 lakhs. At the same time 20,271 semen doses were frozen from farmers' champion bulls out of which 10,567 doses were supplied /sold and 9,704 are in stock. ICAR flashed this activity as a success story on its' website.

For the biometric analysis of buffalo sperm head, rapid papanicolaou (PAP), and Harris' haematoxylin (HH) staining were identified to be the methods of choice for best digitilization of buffalo spermatozoa sperm head biometry. Cryopreservation results in shrinkage of sperm head, a loss in percentage motility, reduced acrosomal and plasma membrane integrity, decreased viable sperm count as well as an increased percentage of apoptotic, early necrotic and necrotic sperm. Buffalo sperm from high fertile (HF) group differed significantly from low fertile (LF) bulls in length of major and minor axis and various motility parameters. The percent apoptotic sperm were significantly low in the HF group compared to LF. Viable sperm were significantly higher in HF than LF group. On the basis of VAP, VSL, integrity of acrosome, plasma membrane and DNA, bull no 183 is predicted to have better fertility among the test animals.

Under embryo transfer, donor females in spontaneous estrus were inseminated with the semen from proven bulls. Non surgical embryo flushing was done on day 5/6 post insemination. Embryos were searched, evaluated and graded before transfer to the recipients. Good embryos were transferred to the healthy recipients and ultrasound scanning was used to confirm CL formation and pregnancy. Pregnant females are cared and watched till birth of calves. This year embryo transfer was extended to the field. In this effort the recipients were selected from the heifers in natural heat in villages where the progeny testing program is already in progress. These heifers were not inseminated at estrus and used as recipients. On the day of embryo transfer these

heifers were examined with ultrasound for the ovaries having CL and the embryos were transferred in the horn in the same side. For increasing embryo yield from elite females it was conceptualized to recover single embryo on day 5/6 post-insemination (Day 0= estrus/ insemination) followed by start of superovulatory treatment between day 9-12 in the same cycle. The strategy was tried but did not yield expected result. It was observed that if recovery for single embryo is carried out on day 5/6 post-insemination, 35.3% buffaloes returned to estrus between day 10-13 of cycle. This results in postponement of subsequent superovulation or wastage of superovulatory treatment if it has already been started. This also disturbs the whole process of already planned programming of donor superovulation and recipient synchronization. Hence, it was deduced that single embryo recovery cannot be carried out in the same cycle. Early return to estrus following single embryo recovery on day 5/6 post-insemination has not been reported in buffaloes. Early return to estrus indicates the lysis of CL due to release of prostaglandin from uterine endometrium. This release may be elicited due to uterine flushing, uterine ballooning at the time of flushing and or cervical stimulation during catheterization of uterus. It has also been observed that CL is unresponsive to luteolytic effect of prostaglandin until day 7 of cycle.

For effective implementation of embryo transfer, MOET is desired. However, buffaloes in general show poor response to superovulation during nonbreeding season hence superovulation and ET work was carried out mainly during breeding season. For superovulation, PMSG and FSH hormones are used. PMSG has the advantage of lower cost and single administration. However, superovulatory response is reportedly poor as follicles continue to grow even after insemination. FSH treatment is quite expensive hence, it was planned to partly replace the costly FSH hormone with small dose of PMSG with the aim to reduce the cost of superovulatory treatment. Five buffaloes were programmed to receive either FSH alone for five days (9 injections in tapering dose, 1.5 vial) or PMSG (1000 IU, First injection) followed by FSH (7 injections in tapering dose, 1 vial) from day 9 of the estrous cycle for 8 cycles in total. Largest Dominant Follicle (DF) was also ablated before the start of treatment. An injection of GnRH was also administered at the time of first AI to cause the ovulation of large follicles formed in response to superovulatory response. The average numbers of ovulations with FSH alone were 5 in contrast to only 2 with FSH+PMSG. No embryo could be recovered during the non-breeding summer season. However, during the breeding season, the experiment was repeated and 10 buffaloes were selected as donors for three repeated superovulation programming. Animals in heat were programmed to start the superovulatory treatment on any day from day 9-11 of estrus cycle (Day 0= estrus). Injection Folltropin-V was administered in tapering dose schedule (0/5, 5/4, 4/3, 3/2, 2/2 ml morning and evening) for 4.5 days (total dose 600 mg, i.e. 1.5 vial). Ablation of largest DF was also carried out to enhance the superovulatory response. PG injection was given to donors along with 3 and 2 ml dose of FSH in the morning and evening (5 ml each). The results were much improved and are summarized in Table 6.

Table 6 : Embryo recovery, transfer, freezing record

Fresh Transfer	33/29	Pregnancy	8/22
Frozen Transfer	5/5	Pregnancy diagnosis due	12
Total transfer	38/34	Pregnancy at Farm	7/16
Embryo frozen	11	Pregnancy at Village	1/8
Viable embryo recovery	1.52	Frozen embryo transfer at Farm: Village	1:4
Total embryo recovery	1.76	Pregnancy with frozen embryo	Nil
Total viable embryo recovery 1:2:3 Crop	22:10:12		

Donors flushed during summer season have large number of exfoliated uterine cells in the flushed media as compared to those flushed during winter season on day 5/6 for embryo recovery. This makes searching of embryo difficult due to large uterine debris. The high concentration of degenerated exfoliated uterine cells in the uterine lumen of inseminated buffalo may also create unfavorable environment leading to embryonic mortality and conception failure during summer season.

In cloning work aimed at conservation and multiplication of superior buffalo germplasm, buffalo ovaries (n=2246) were collected from slaughter house and oocytes (n= 2413) were aspirated, cultured in 100-µl droplets of the medium for 24 h. After 24 h maturation, cumulus–oocyte complexes (COCs) with expanded cumulus mass were subjected to cumulus removal by hyaluronidase treatment, zona removal by pronase treatment and were subsequently manually bisected using microbalde. Donor cells were obtained either from the ear pinna or amniotic fluid cells. The couplet was aligned with an AC pulse (9-15V) using BTX Electro cell Manipulator 2001.

In the period under report 48 reconstructed and activated embryos were cultured in RVCL +1 % BSA (FAF). Out of the reconstructed cloned embryos one embryo reached upto morula stage.

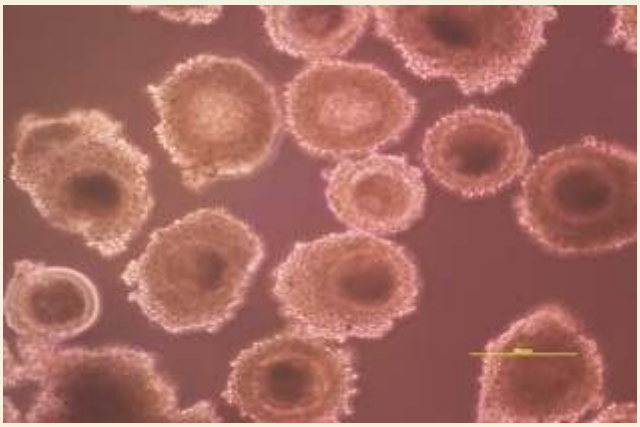
In IVF experiments, the number of cleaved embryos obtained from defined PVA+ myo-inositol+ phosphate +EGF medium was higher as compared to three other IVC media used. During the period, 880 ovaries were collected from Delhi slaughter house immediately after slaughter and 825 ovaries were used for aspiration of oocytes; the remaining 55 ovaries that were either devoid of follicles or cystic were discarded. A total of 1013 COCs were isolated from follicles (2–8 mm in diameter). Around 810 usable quality COCs were washed thrice with IVM medium and from this, groups of 10-15 COCs were cultured in 100-µL droplets of the IVM medium for 24 h in a humidified CO_2 incubator (5% CO_2 in air) at 38.5^{0}C. After 24 h maturation, around 762 COC's with expanded cumulus mass were subjected to IVF with frozen thawed buffalo semen. At the end of sperm- oocytes 18h co- incubation, the cumulus cells were washed from the oocytes by gentle pipetting and presumptive zygotes were separated from the sperm droplets. Embryos derived from IVF were cultured in 4 different IVC media up to 8 days post insemination in a humidified CO_2 incubator (5% CO_2 in air) at 38.5°C in different culture media viz. (1) TCM-199+granulosa cells+10%FBS (2) mCR2aa+10%FBS (3) mSOFaa+100 µM βME and 3 mg/ml fatty acid free BSAs (4) mSOFaa+0.1mg/ml PVA+2.77mM myo-inositol+1.2mM Phosphate+10ng/ml EGF and the medium was replaced with 50% fresh IVC medium every 48 h. The number of cleaved IVF embryos obtained from defined PVA+ myo-inositol+ phosphate +EGF medium was higher as compared to other three IVC media used.

The two main parameters used to evaluate the efficiency of embryo production systems are the blastocyst rate and morphological appearance of the embryos. Although very useful, these parameters are insufficient for a precise estimate of embryo viability, and therefore the need for development of alternative methods. Studies of gene expression in cells and embryos related to embryo development, embryo quality and stress response provide a better understanding in several biochemical pathways at the molecular level, and can contribute to the development of more efficient protocols for *in vitro* embryo production. A study was conducted to assess the mRNA expression of embryo development, quality and stress response genes in buffalo IVF embryos in different culture media.

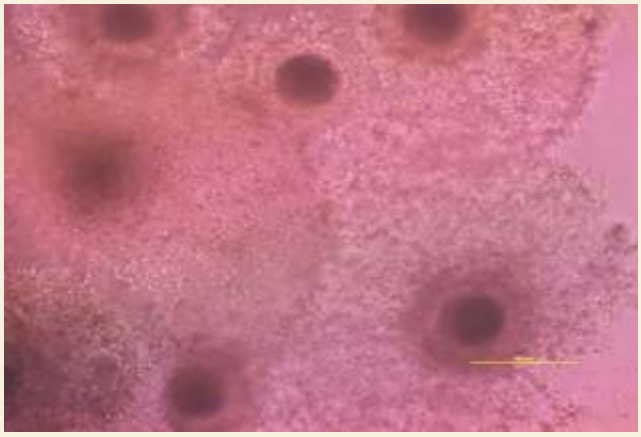
Polymorphism of key genes controlling embryonic growth and survival, Fibroblast Growth Factor 2 (FGF2), Signal Transductors and Activators of Transcription (STAT5A) and Uterine Milk Protein (UTMP) genes were identified which may have role in early embryonic survival. Though novel SNPs in buffalo FGF2, STAT5A and UTMP gene intron and exon regions no significant correlation ($p>0.05$) was deduced between the detected polymorphism and repeat breeding.

Two hundred lactating buffaloes were screened with CMT kit for mastitis. Milk samples of all CMT positive cases were subjected to bacteriological examination, milk composition and haematology. Protein, lactose and fat content of milk was

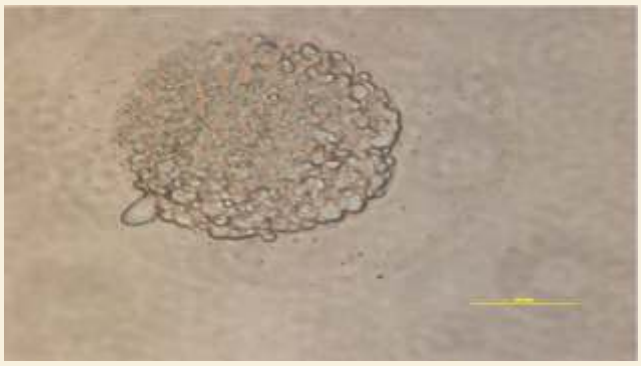
Immature buffalo oocytes of usable quality



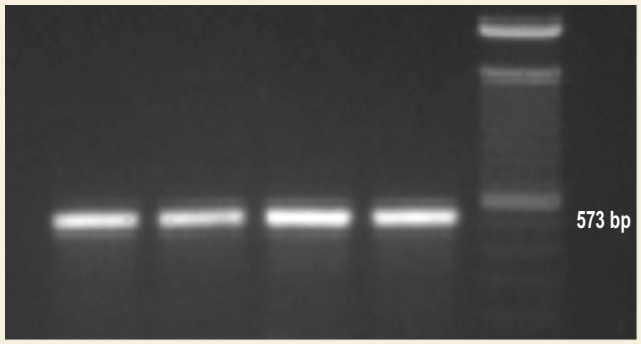
In vitro matured oocytes with expanded cumulus mass



Representative developmental embryo in blastocyst stage from defined culture media



Representative gel photograph of the mRNA expression of GAPDH in buffalo embryos cultured in (1) TCM-199+granulosa cells+10%FBS (2) mCR2aa+10%FBS (3) mSOFaa+100 µM βME and 3 mg/ml fatty acid free BSAs (4) mSOFaa+0.1mg/ml PVA+2.77mM myo-inositol+1.2mM Phosphate+10ng/ml EGF



lower in clinical mastitis as compared to normal milk. Values of WBC counts, neutrophils, eosonophils, basophils were significantly ($p<0.05$) higher in clinical mastitis than the normal case. A method for removal of high abundant proteins form milk was developed and standardized. Removal of high abundant protein especially casein was done by decreasing pH and centrifuging defated milk and the process is repeated till samples became transparent and then pH is normalized. The 10 depleted samples were run for 2-DE based proteomic analysis. A total of 727 spots in 110 match sets were taken for comparison of the level of expression in 5 gels of different stages. Maximum number of spots (193) were detected in NAD, 172 in normal, 153 in mixed subclinical, 139 in subclinical and 70 spots was observed in clinical cases. Densitometry analysis showed 17 differentially expressed proteins in milk samples from normal, subclinical and subclinical- mixed and clinical cases of mastitis. All the spots were analysed by LC MS-MS. Peptide masses were searched against SIB based ExPASy and NCBI databases employing Mascot (in-house MASCOT-server) for protein identification. Host defense related proteins i.e. β-lactoglobulin, β-galactosidase, keratin, type I, Lactoferrin, HP6 protein, Kappa casein, Alpha-S2 casein, β-casein and Vitronectin precursor were identified. Vitronectin is reported in buffalo milk for the first time. Differentially expressed proteins during different types of mastitis relate to the type of infection, which can have field diagnostic application for appropriate therapeutic interventions.

The transcript signatures of genes of proteolytic system and pro-inflammatory cytokine genes were evident in normal/mastitis affected udder tissue, skeletal muscle, and milk derived somatic cells. IL-1β and IL-6 transcript signatures may be of prognostic values for clinical mastitis. CAPN2 and UBC genes were slightly over expressed in mastitis affected udder. Transcript levels of IL-1β and IL-6 gene decreased significantly immediately after oxytocin

administration and increased thereafter on first day post-seven day OT administration.

Proteomic analysis of blood sera of early pregnant buffaloes indicated differential expression of pregnancy specific proteins. Sera samples obtained at weekly intervals from early pregnant (Day 0 to Day 42 post-AI) buffaloes, and on days 0, 7 and 14 from non-pregnant cyclic buffaloes, were subjected to 2-dimensional gel electrophoresis. Densitometric analysis of these gels revealed presence of at least 65 2-D gel spots in which proteins were differentially expressed, up-regulated, down-regulated or had specific appearance at a specific stage during early buffalo pregnancy. Comparison with ExPASy and NCBI databases matched 48 of these spots with known proteins, but with varying degrees of confidence in terms of Mascot score and the species. Some of these identified spots appear promising pregnancy bio-markers, especially synaptojanin-1, apolipoprotein A-1, apolipoprotein B, Keratin 10 and Von Willebrand factors, which are documented to have role in embryogenesis and early pregnancy. Gene ontology based functional analysis of the identified proteins suggested that most of these were involved in regulatory, catalytic, cell differentiation and transporter functions. Involvement of identified proteins in 23 pathways, including the embryogenesis specific Wnt signalling pathway, confirms the essentiality of these proteins in early pregnancy. The protein-protein interaction data from current experiment showed existence of network of 9 proteins from the identified proteins. Considering that proteomics in animal research is still in its infancy, it is a while a way before practical applications of such experiments could be realized.

In a collaborative project with NRCE, equine mesenchymal stem cells from the amniotic fluid were cultured, characterized and differentiated into tenogenic cells. A total of 17 samples were collected and 11 primary colonies were propagated successfully from the amniotic fluid cells at the time of foaling. Amniotic fluid derived mesenchymal stem cells were plastic adherent and had typical spindle shape with long cytoplasmic processes. Growth kinetics of eMSCs, assessed by analyzing cell doubling time and plating efficiency, decreased as the number of passages advanced. The eMSCs expressed CD73 and CD90 and were negative for CD34 and CD45. The eMSCs were directed to *in vitro* differentiation towards tenocytes. Differentiation was confirmed by expression of Decorin and Tenomodulin by RT-PCR and immunocytochemistry.

Treatment of anestrous : Inserting CIDR

Feed Resource Utilization and Improvement

Improvement in nutritional quality and utilization of locally available feed resources, supplementation of diets with deficient nutrients, development of complete feed diets/total mixed rations for different categories of buffaloes, utilization of various agro-industrial byproduct in the rations have been the areas of research in this programme. In addition, dietary manipulation of the rumen fermentation and manipulations/ modifications of rumen micro-organisms are regarded as the most potential approaches for improving the degradation of low quality feeds/fodders in the rumen which are being addressed. Mitigation of methane production/emission both by the dietary and rumen microbial modification are receiving added attention of scientists/ researchers.

Nutritional inputs constitute over 70% of the cost of buffalo production enterprise. Studies on establishment of relationship between genetic improvement and nutrition of animals are of paramount importance as improved (superior) animals would require quality and specified nutrients to become more useful and economical asset to their keepers (farmers).

The studies being undertaken in this project are planned to assess and establish relationships of nutrition with performance in buffaloes at the Institute especially under the network mode, as per the availability of data over the years and availability of animals of existing sets for conducting digestibility/ metabolic studies, wherever necessary. Data pertaining to health, reproduction and production performance of Murrah and Nili-Ravi herds of CIRB were mined and tabulated year wise for the period from 1992-93 to 2006-2007. Averages of results of this data were analyzed for the three five year periods (1992-97, 1997-2002 and 2002-07) and these are presented in tables 7 and 8. During the period under report data pertaining to the period 2007-2012 was mined and is being tabulated year wise for further analysis.

The low growth rate of buffalo calves/heifers results in high age at puberty and thus high age at first calving. Age at first calving in buffaloes is higher than exotic or crossbred cattle. So if we can reduce the age at first calving in buffaloes it will add to profitability of dairy farmers. Keeping this in view a new project on," Effect of different feeding regimens on age at first calving (AFC)" has been taken up during the year.

A feeding trial for precision feeding along with digestibility trial was carried out on growing female buffalo calves. Twenty calves of the age between 18-24 months were divided randomly in two groups. Group-I (Control) was fed normal feed constituting 50:50 concentrate to roughage *ad lib* and green at the rate of 3 kg per day. Group-II, was fed strictly according to nutrient requirement as per Paul's standard @ 2.18% of the body weight including 3 kg green. Daily feed intake in terms of concentrate, roughage and total dry matter intake was recorded. Growth of the buffalo calves was also recorded fortnightly. Preliminary results of the experiment are presented in table 9. The data indicates that the growth of about 750 g/day as targeted was achieved in both the groups. However slightly higher growth was observed in control group which can be attributed to higher feed intake.

Table 7 : Health, reproduction and production performance of Murrah herd at CIRB, Hisar

Period	Avg. herd size as on 31/3	Avg. mortality (%)	Avg. AFC (months)
1992-97	623	7.4	52.8
1997-02	650	4.0	47.5
2002-07	725	5.4	48.2

Period	Milk Produced (Total, kg)	Herd avg.	Wet avg.
1992-97	322172	3.52	5.52
1997-02	336223	4.29	6.64
2002-07	347494	4.24	6.43

Average annual feed consumption/h/d (kg)

Period	Green	Dry	Concentrate
1992-97	21.78	3.12	2.42
1997-02	16.74	2.67	2.75
2002-07	16.63	1.88	2.82

Table 8 : Health, reproduction and production performance of Nili-Ravi at CIRB, Nabha

Period	Avg. herd size as on 31/3	Avg. mortality (%)	Avg. AFC (months)
1992-97	349	8.4	47.2
1997-02	409	4.0	40.6
2002-07	465	3.0	41.0

Period	Milk produced (Total, kg)	Herd avg.	Wet avg.
1992-97	183316	3.69	5.99
1997-02	222408	4.55	6.33
2002-07	262163	4.60	6.56

Average annual feed consumption/h/d (kg)

Period	Green	Dry	Concentrate
1992-97	29.36	1.23	1.75
1997-02	25.44	1.29	1.30
2002-07	20.69	1.34	2.10

India exports more than 500,000 tons of meat annually, of which major share is from buffalo meat. Buffalo meat is derived mainly from surplus male calves and animals slaughtered at the end of their productive life. It is well known that the male buffalo calves are being neglected in feeding and thus a precious resource is largely being wasted. Thus there is a need to develop scientific modules and package of practices to economically utilize their meat production potential. Keeping this in view, work has been undertaken to develop the feeding modules for economical meat production from buffalo calves. The data of feed intake and growth will be recorded till they attain the required body weight for slaughter on total roughage, high roughage (70%) and low roughage (30%) diets.

Studies were also undertaken on the rumen ecosystem and its manipulation in buffaloes for better, environment friendly and economical production on commonly fed low, medium and high quality diets. The project aims to gain and further improve the understanding of factors which control digestion and metabolism in ruminant animals especially buffaloes on common farm rations, with reference to the activities and contribution of the three groups of microbes. During the year, biochemical and microbial aspects were studied in the rumen of buffalo steers given various diets. Gas production (carbon dioxide, methane) and fermentation pattern were studied using dietary substrates incubated *in vitro* with rumen inocula. Studies were also conducted to see the effects of various plant extracts (secondary metabolites) on mitigation of methane emission by rumen microbes *in vitro*.

Rumen microbial diversity in domesticated and wild ruminants and impact of additives on methanogenesis and utilization of poor quality fibrous feeds were studied. A combination of various inorganic salts at different doses has been studied *in vitro* to find out their effect on gas production, fibre digestion and volatile fatty acid (VFA) production when wheat straw was incubated with buffalo rumen liquor. Out of various combinations, a mixture of $NaHCO_3$, K_2CO_3, $NH_4H_2PO_4$, Na_2SO_4, $MgCl_2$ and NH_4Cl at 0.3, 0.3, 0.015, 0.60, 0.60, 0.03 per cent, respectively in the fermentation medium

significantly improved true digestibility, fibre digestibility and volatile fatty acid production of wheat straw. Another study conducted with the addition of *Moringa oleifera* leaves to wheat straw based diet exerted positive associative effect on fermentation which resulted in increase in gas production (up to 2.30%), true degradability of dry matter (up to 11.47%), true degradability of organic matter (up to 13.39%) and microbial biomass production (up to 35.60%) with the concomitant reduction in methanogenesis (up to 18.11%) when compared with the calculated value of the mixture. Plant extracts also have the potentiality to modify the rumen fermentation towards reduced methanogenesis and increased feed utilization. More than thirty extracts were prepared (using various solvents) from ten locally available leaves and fruits. Some of them were tested at different dose levels with wheat straw based diet under *in vitro* system by measuring gas production and various rumen fermentation parameters. Results indicated that the leaves of Sahjan, Lasoda, Siris and Guava and fruits of Clove and Lasoda have antimethanogenic properties with aqueous extracts of *Albizia lebbek* leaves and *Cordia dichotoma* ripe fruits having highest (94%) reduction potential. The dry matter degradability, microbial biomass production and total volatile fatty acid production were significantly increased with the addition of C*ordia dichotoma* extracts. There was also increased production of propionate with inclusion of the extract. Therefore, C*ordia dichotoma* whole ripe fruit extract was found as a potent antimethanogenic and rumen fermentation stimulating agent. Further *in vivo* studies are being carried out.

On recommendation of the IRC fifty six buffaloes were included to validate the effect of fenugreek seed (Trigonella foenumgraecum) supplementation on reproduction. Out of these twenty eight buffaloes were supplemented @ 600 mg/kg body weight and the same number of buffaloes were included for the control group. Digestibility trial was done on twelve animals divided in control and treatment group. Analysis of faecal samples is in progress.

Feeds and fodders in the ration of dairy animals do not

Experimental rumen fistulated buffaloes

Table 9 : Average daily dry matter intake and body weight gain in two groups

	Group-I			Group-II		
Fortnight	Avg. DMI /animal/ day (Kg)	Avg. Conc. Intake/ animal/day (Kg)	Avg. Weight gain/ day (g)	Avg. DMI /animal/ day (Kg)	Avg. Conc. Intake/ animal/day (Kg)	Avg. Weight gain/ day (g)
1	6.13	3.11	677	5.32	3.05	545
2	6.33	3.25	561	5.62	3.21	611
3	6.33	3.36	875	5.73	3.25	870
4	6.69	3.37	857	5.98	3.30	819
5	6.72	3.39	878	6.27	3.31	878
Avg	**6.44**	**3.30**	**770**	**5.78**	**3.22**	**745**

contain all the essential minerals required for their bodies as per the different physiological functions. Availability of different minerals supplied through mineral mixture depends on their sources. In routine practice minerals supplemented through their inorganic sources have several limitations in their absorption. Interactions among different minerals also pose hurdle for proper availability of different minerals. Most of the inorganic minerals are being routinely supplied in their sulphate form, which also makes a possibility of using excessive sulphur in their ration. It has been reported that when minerals are combined with some organic molecule (organic mineral) there is better bioavailability for the body of animal and less excretion in feaces which is also environment friendly. Keeping these aspects in view studies on development and supplementation of chelated minerals in buffaloes are being undertaken.

Feed unit of the institute for in-house preparation of concentrate mixture for balanced ration

Group of well-fed buffaloes

Optimization of Management Practices

Management principles applied judiciously and articulately help in optimum economic efficiency of buffalo production systems. Proper integration and implementation of various management practices and economics of various management operations are the key to the success of a buffalo farm. The ideal management is one where animals are comfortable in a hygienic surrounding and full exploitation of their genetic potential is possible. Towards achievement of this goal, study was done on the use of microclimate modifications through fogger fans and ceiling fans in the shed and supplementation of niacin @ 6gms/day/animal, yeast @10 gms/day/animal and mustard oil @150 gms /day/animal. In addition, alterations of feeding time, frequency as well as the type of ration were made. Based on the study, a package has been developed which helps to maintain normal physiology, body weight and dry matter intake for economic milk production in lactating buffaloes through reducing thermal stress during hot-dry and hot-humid summer months.

Buffalo calves are prone to infection of GI tract with helminths causing high mortality. Helminth control in domestic animals is widely based on the use of anthelmintic drugs. However, the efficacy of these drugs has been reduced, because of resistant nematode strains. The high costs of these drugs, residual concern in food from animal origin and environmental pollution have stimulated interest in medicinal plants as an alternative source of anthelmintic drugs. Plant parts known to have anti-helmintic properties are fruits of Kantkari & *Embelia jerrium cottam* and bark of *Albizia lebbeck* & *Nyctanthus arbortristis*. All these samples were got authenticated from NISCAIR New Delhi. Known amount of plant parts were taken in extraction unit having 5L capacity round bottom flask. The extraction was done with petroleum ether followed by chloroform: methanol, methanol and water in a sequential manner. The extracted solvent so obtained was concentrated to near dryness using a rotary evaporator/nitrogen based concentrator. This evaporation was done at a temp range of 40-50°C. A total of sixteen concentrated extracts were prepared and are kept at low temperature in refrigerator for further analysis.

Animal herd, especially breedable males and females need to be kept free from infectious diseases and this requires regular testing. Similarly new animals introduced to the herd should also be free. During the period under report, buffalo breeding bulls of XI, XII, XIII, XIV set & future breeding bulls (Murrah), Vth set (Nili Ravi) and samples received from CIRB Herd (Murrah), field animals spotted for purchase in CIRB Hisar and animals spotted for purchase under Elanco Project at CIRB, Hisar were screened for various diseases transmitted through semen. Out of 99 animals screened for Tuberculosis and Johnin disease none was found reactive. All the animals (i.e. 226 by RBPT, 344 By ELISA and 9 animals by MRT) tested for Brucella were found negative for the disease. Among 81 animals tested for detection and estimation of BHV-I (causative agent of IBR) antibodies, 27.9% (29 out of 81 tested) animals were detected positive using commercially available ELISA kit. Semen from 14 bulls out of ELISA positive animals was tested for the presence of virus by RT-PCR and all the samples were found negative. Prepucial washings and smegma from 8 bulls were found

negative for Campylobacter fetus venerealis and Trichomonas.

Five attempts were made for PCR optimization for molecular exploration by mecA gene amplification of staphylococcus aureus isolates suspected for methicillin resistance, but could not succeed. Now, attempts are being made with some modification in the protocol to optimize the same.

Survey conducted in the breeding tract of Nili Ravi buffaloes in Amritsar, Tarntarn, Ferozepur and Gurdaspur districts of Punjab indicates most of the animals are mixture of Murrah and Nili Ravi and pure Nili Ravi animals are very less in number. Data also revealed that there was demand of Nili-Ravi bulls/ semen among the farmers for breeding Nili-Ravi buffaloes. During the period 13,245 semen doses were sold to farmers.

Management of buffaloes for improved production

Intellectual Property Management and Transfer/ commercialization of agricultural technology system scheme

Details of patent filed & granted, technologies developed, disseminated and commercialized were prepared and sent to ZTMC, IVRI. During this period patent on Field Shukranu Janch Darshi dated 09/02/2013, Dispatch No. 2-284/E-1/99/4007 was filed. Also showcased technologies developed by the institute in the visitor's room of the institute. Information supplied to ZTMC, IVRI regarding new technologies developed by the institute like Colostrum supplement for enhancing survivability in calves. Also information regarding Creation/ updation of phenomics database of different breeds of buffalo, Creation of DNA bank database of the resource population, Sequencing, SNP detection and expression studies of various regions of candidate gene, Semen conservation and dissemination from institute and field champion bulls was sent to ZTMC, IVRI.

A study was conducted in 4 districts of Murrah tract i.e. Hisar, Rohtak, Jind and Bhiwani to assess the impact of buffalo migration on socio-economic conditions of farmers in Haryana. The information about villages where maximum sale of buffaloes took place was collected through an exploratory survey. Traders from Rohtak, Kalanour, Jind and Julana were asked to identify the villages where maximum number of buffaloes are sold. Singhwa from Hisar, Kungar from Bhiwani, Deshkhera from Jind and Ghutan from Rohtak district were identified. From these villages a list of farmers was prepared who were involved in sale of buffaloes and data were collected from 30 farmers from each village. Data were also collected from 50 traders located at Jind, Julana, Kalanour and Rohtak. Data collection from 120 farmers belonging to 4 villages of 4 districts is in progress.

During the data collection it was considered imperative to find out Murrah buffalo characters which determine the price of buffaloes. Thus, 50 traders and 50 scientists were selected to study their opinion besides farmers who constituted the study sample. Thus 18 characters which determine the price of a Murrah buffalo were identified and got rated on a five point continuum. Similarity in the opinion of scientists and traders was reported for parameters which determine the price of a buffalo.

Development of Technologies and their Transfer to End Users

To undertake technology transfer is one of the mandates of the institute. The institute has developed several technologies since its inception that are easily transferable to the farmers to increase the production and reproductive efficiency of their buffaloes. During the period under report 60 lay man inseminators were trained in artificial insemination and animal husbandry in 5 training programs. Many of the farmers trained in this institute are achieving ~60 % conception rates with the frozen semen obtained from this institute. The developed technologies are also transferred through field camps, kiasn melas, radio and TV talks. Books, bulletins and popular articles are regularly written for knowledge dissemination to the farmers. Some of the technologies which have been found acceptable by the users are given below.

Production and maintenance of superior germplasm

Murrah and Nili-Ravi bulls of high genetic potential are bred at the Institute and its Sub Campus, Nabha. Young bull calves are selected on the basis of dam's milk yield and reared under intensive management system. The genetic potential of bulls is evaluated through progeny testing. The Institute has so far sold more than 499 Murrah bulls and 230 Nili-Ravi bulls of high genetic merit to village Panchayats and developmental agencies. These are expected to contribute towards overall improvement of buffaloes in the village/area.

Improved semen cryopreservation protocol

A simple, reliable and economical method for freezing of buffalo semen has been developed and found to be effective to freeze the static ejaculates successfully, a phenomenon specific to buffaloes which greatly reduces the efficiency of utilization of buffalo semen for artificial insemination.

A large proportion of buffalo semen ejaculates collected during summer months are rejected due to the high incidence of post-thaw backward motility of sperm cells. Through thorough investigations about the phenomenon, stage of glycerolization was identified to be the most critical step responsible for backward sperm motility. Glycerolization at room temperature during initial stage of semen dilution reduced/eliminated the backward motility due to which 20 percent more ejaculates could be preserved annually, thereby enhancing the frozen semen production.

Embryo transfer technology

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

Scrotal circumference for bull selection

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

Super ovulation with ablation of dominant follicle

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

Sexing of IVF produced embryos

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

Ultrasonography for monitoring ovarian activity

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

Early pregnancy diagnosis and fetal sex determination

Sonographic technique was used for confirmatory diagnosis of pregnancy in buffaloes as early as 25 days post insemination. Fetal sex determination was made at day 55 post insemination based on the location of the genital tubercle.

Estimation of gestational age

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

'Ovsynch plus' protocol for estrus induction

Anestrus, either in pubertal heifers or in postpartum buffaloes, is the primary cause for low reproductive output of buffaloes. The condition is associated with the presence of static ovaries and though follicular development may occur, none of the ovarian follicles becomes mature enough to ovulate. In anestrus animals, doninant follicle (DF) undergoes atesia 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.

Induction of lactation

Farmers rear the dairy animals for milk production and livelihood but they are commonly facing the problems of conception failure, long calving interval, anestrous, cystic ovaries, specific abortions and repeat breeding. They can benefit by inducing such animals into lactation by induced lactation therapy. The buffalo is weighed and appropriate dose of hormones, Estradiol- 17b and progesterone @ 0.1 mg/kg body weight/day each, is calculated for seven days therapy, dissolved in absolute ethanol and stored. On the day of treatment, 1 ml of each hormone solution is administered subcutaneously in the morning and evening at an interval of 12 hours, for seven consecutive days. Thereafter, on day 17,19 and 21 of treatment, 10 ml Largectil injection and on day 16, 18 and 20, injection of 20 mg of Dexamethasone are also given intramuscularly. Between 15th and 21st day of treatment, udder massage is given for fifteen minutes each in the morning and evening daily till the udder is turgid with milk, which is usually around 21st day when milking is started. The milk becomes normal in physical and chemical properties within 10 -15 days of start of milking and the amount of milk yield increases with time. Almost 60-75 percent of the buffalo's milk yield potential can be achieved following induced lactation.

Colostrum for higher growth and calf survival

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

Antioxidants in survival and growth of neonates

Advanced pregnant (270 to 280 days' gestation), buffaloes are administered two doses of antioxidant micronutrients, consisting of vit A (Palmitate), vit D_3 and vit E (dl- alpha Tocopherol acetate, within 30 days before calving, at 15 days intervals. These buffaloes secreted 25-80% more Ig protein in colostrum than control buffaloes. Calves born to treated buffaloes were also supplemented with mineral mixture @ 5 g/calf/day, colostrum feeding @ 10% of birth weight, concentrate mixture started 10 to 15 days after birth and green folder offered after 3 weeks, in order to achieve high growth rate and survival. Calves born to vitamins administered buffaloes and further supplemented with mineral mixture gained 10 percent higher body weight and 30% better immunity status. Calves bearing higher body weight and better immunity are economically more rewarding for meat and milk industry.

Conservation of green forages

The commonly grown fodders in India are legumes like berseem, lucerne or cowpea and non-legumes i.e. maize, bajra (pearl-millet), sorghum, oats, barley, guinea grass, rye grass, napier grass etc. Legumes are recommended for hay making, whereas, non-legumes are preferred for silage making.

Hay-making : The legume crops have sufficient protein content and they can be conserved by drying carefully into good quality hay which can replace the costly concentrate mixture in the growing and lactating buffaloes. The main legume crop is the berseem, which is surplus with the farmers in the month of February and March particularly in Northern India.

Silage making : Silage is generally prepared by wilting non-legume forage crops in the field and then chaffing the material at 35 percent dry matter. The fodder is pressed thoroughly and covered properly to create anaerobic environment. The silage is ready after 40 days and has the same nutritive value as the green crop.

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.

Area specific mineral mixture

Surveys of feeding practices carried out in the villages of Hisar district revealed deficiencies of essential minerals like calcium, phosphorus, zinc and manganese in 70 percent buffaloes. These buffaloes were given specially formulated area specific mineral mixture in their ration. Seventy per cent of the buffaloes conceived within a period of 2-4 weeks after feeding area specific mineral mixture.

Superior isolates of anaerobic fungus

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

Enzyme supplementation

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

Thermal stress management

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

Area specific mineral mixture

ETT Calf with Dam

Women and Gender Issues

Contribution of women in buffalo husbandry activities is well known. In Haryana it is the women who manage and take care of their buffaloes. They feed and water the buffaloes, milk them, clean the sheds and undertake household processing of the milk. Therefore, the role of women in buffalo production is of paramount importance. Buffaloes also produce dung and offsprings which is also looked after by the women.

During the period under report a training programme on Improved Buffalo Husbandry was organized specially for women farmers during July 9-13, 2012. In this event 27 women farmers from nearby villages like Shikarpur, Kabrail and Sirsana participated. During this training programme, lectures were delivered on different aspects of buffalo husbandry viz breeding, feeding, management and health. Women were also sensitized about the need of colostrum feeding, balanced feeding and some of the improved practices like urea treatment, silage making and mineral blocks. Practical demonstrations were also conducted on preparation of balanced rations and mineral mixture.

Research Co-ordination and Management

Prioritization monitoring and evaluation cell

The PME Cell is responsible for prioritizing research programmes of the Institute. It is also responsible for preparation/compilation 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.

Research Advisory Committee

The XVI meeting of Research Advisory Committee was held on June 22, 2012 under the chairmanship of Dr P Thangaraju, Former VC TANUVAS, Dr BS Prakash ADG (AN & P) Dr RK Sethi, Director and RAC members Dr SK Dwivedi Former Director NRC Equines Hisar, Dr SN Laharia Former Head of Department of Extension Education CCS HAU, Hisar, Dr KP Agarwal Principal Scientist and Head

Physiology and Reproduction CIRG Makhdoon and Dr SP Tiwari Dean, Veterinary University, Durg participated in this meeting. Dr RK Sethi, Director, CIRB welcomed the RAC and introduced institute scientists to the Chairman and members of RAC. Dr Thangaraju emphasised to have innovative ideas to solve problems in buffalo farming and to publish the research in good journals with good impact factor.

Dr BS Prakash, ADG (AN & P) mentioned that challenge with the CIRB is to increase the existing level of milk production from 2400 liters per lactation to 3000 liters per lactation in a fixed time frame. He stressed that magic mantra for success is "Innovation" and suggested to be in touch with other institutes to avoid duplication of work. Action taken report on recommendations of 15th RAC was presented by Dr PS Yadav Secretary, RAC and it was approved by the RAC after thorough discussions.

Dr RK Sethi, presented the achievements and priority programs of the institute and mentioned that projects are formulated according to the priorities of the XII Five year plan. Institute achieved highest wet average, overall milk production and significant decrease in calf mortality at main as well as sub-campus, together with substantial increase in agriculture farm produce being the highest since inception of the institute. He apprised the RAC with the progress in construction of modern automatic animal sheds. Progress of the Network Project including Field Progeny testing (FPT) was also presented. RAC made important recommendations like the need to develop semen sexing technology, work on buffalo cloning, effective estrus detection method and exhorted the scientists to take technologies to the field for the benefit of stake holders.

Institute Research Committee

IRC meeting of the institute was held under the chairmanship of Dr RK Sethi, Director, CIRB on Nov 3, 2012. In this meeting six completed projects and nine new projects were discussed besides the ongoing projects. Second IRC meeting of the institute during the year was held on March 26, 2013. During this meeting five completed projects and four new projects were discussed. Besides ongoing projects, externally funded and network projects were also discussed. It was also decided during the meeting that for presenting papers at review meetings outside the institute, a presentation must be made by the concerned scientist in the institute itself before doing it at an outside platform.

Significant Events

The Annual Buffalo Mela and Exhibition was held on March 9, 2013 at the institute's mela grounds. This annual event of Central Institute for Research on Buffaloes was inaugurated by Dr S Ayyappan, Hon'ble Secretary (DARE) & Director General (ICAR). Dr KML Pathak, Deputy Director General (Animal Science), Dr RK Singh, Director NRCE, Dr Indu Sharma, Director DWR, Dr DK Sharma, Director CSSRI Karnal, Dr MP Yadav, Advisor Haryana Kisan Ayog and Dr RS Dalal, Secretary Haryana Kisan Ayog also graced the occasion. Dr RK Sethi, Director CIRB welcomed the dignitaries and enthusiastic farmers.

This event attracted large number of buffalo farmers, breeders and new generation, fast-growing buffalo dairy entrepreneurs from different parts of North India. Showcasing the contribution of institute towards rural livelihood through buffalo husbandry, this event has started taking shape of an important event. Buffaloes and bulls were judged into seven categories - heifers, milk teeth and two to four teeth females, milch and dry buffaloes, young bulls, milk

Dr S Ayyappan, Hon'ble Secretary (DARE) & Director General (ICAR), Dr RK Sethi, Director CIRB, Dr MP Yadav, Advisor Haryana Kisan Ayog and Dr RS Dalal, Secretary Haryana Kisan Ayog felicitating Mohini, the best buffalo heifer of the show and her owner Shri Jasbir Singh

Buffalo Mela cum-Exhibition at CIRB, Hisar on 9th March, 2013

teeth and two to four teeth males and breeding bulls. Besides these animals, best male and female animals of the show were also selected by a team of experts drawn from several other departments/ institutions.

The chief guest lauded buffalo breeders for food security through milk production and CIRB scientists for the relevent scientific inputs. Calling buffalo as the 'black gold' of India, he stressed that except its black skin color, all its contributions to the society are purest white. He also mentioned sound financial condition of these proud buffalo owners visible by the shine in their eyes and contented faces. Speaking on the occasion, Dr RK Sethi, Director, CIRB acknowledged the cooperation from ICAR, hard work put in by the CIRB scientists and keen interest of the buffalo owners. He thanked the Haryana Kisan Ayog for co-hosting the event. Dr MP Yadav, highlighted the need for greater linkage with the buffalo breeders in the state with emphasis on transferring newer technologies for their added advantage to the farmers.

Modern Animal Sheds Inaugurated by DG, ICAR

Two newly constructed state-of-the art animal housing facilities viz. Modern Animal Sheds and Bull Shed were inaugurated by Dr S Ayyappan, Hon'ble Secretary (DARE) & Director General (ICAR) in the presence of Dr KML Pathak, Deputy Director General (Animal Science), Dr RK Sethi, Director CIRB, Dr RK Singh, Director NRCE, Dr Indu Sharma, Director DWR Karnal, Dr DK Sharma, Director CSSRI Karnal, Dr MP Yadav, Advisor, Haryana Kisan Ayog besides a gathering of eminent scientists and staff of the institute. Highlighting the features in these newly constructed

Dr S Ayyappan, Hon'ble Secretary (DARE) & Director General (ICAR) inaugurating the modern animal sheds at the Central Institute for Research on Buffaloes, Hisar.

'Buffalopedia' launched on CIRB Website:

Buffalopedia (http://www.buffalopedia.cirb.res.in) - an online database cum interactive information dissemination system on buffalo production has been made available at the official website of the Central Institute for Research on Buffaloes Hisar (http://cirb.res.in). This database was formally made online on March 9, 2013 by Dr S Ayyappan, Hon'ble Secretary DARE & Director General ICAR, in the presence of Dr KML Pathak, Deputy Director General (AS), ICAR, Dr MP Yadav and Shri Kuldip Dhaliwal, Member ICAR GB. *Buffalopedia* webpoartal is prepared using 'Joomla' content management software on PHP based platform. It presents buffalo husbandry data - facts, figures, demonstrations, examples, graphics. The scientific concepts, practices and vocabulary used in buffalo husbandry configure the contents of database in user-friendly formats.

sheds, Dr Sethi, informed the dignitaries that perhaps these are the first of its kind public sector animal housing facilities in India. Dr Sethi mentioned that these sheds shall be equipped for automatic feeding, milking, cleaning and data recording of about 200 milch buffaloes and 100 followers under the ultra modern animal management system.

Besides the modern sheds, the Hon'ble DG also inaugurated the newly constructed Bull shed adjacent to the semen freezing lab. He congratulated the Director, scientists and staff of the institute on commissioning of these facilities. The DG acknowledged the fact that the institute has made a major impact on the buffalo farmers, who look at the institute as the platform for guidance in husbandry practices for addressing their problems. He impressed upon the scientists to give voice to the buffalo dairy farmers' concerns so as to make agriculture in general and buffalo farming in particular, a viable economic enterprise. Adding another facility for the visitors at the institute, Hon'able DG inaugurated the newly built visitors' room.

Launching of Buffalopedia

Buffalo Mela at Nabha

A Nili-Ravi buffalo mela was organized at the CIRB, Sub campus, Nabha on 1st December, 2012 on the occasion of silver jubilee year of the establishment of sub campus. More than 90 buffalo farmers registered themselves and over 100 animals participated in the competitions. The best bull award was received by Shri Gurpreet Singh of village Birdhno and best female award was won by Shri Roop Singh of village Rasidan. On this occasion Chief Guest Shri Inderjit Singh, Director, Punjab Dairy Development Board (PDDB), Chandigarh gave away the prizes. Dr RK Sethi Director, CIRB, Dr BK Joshi, Director, NBAGR, Dr RK Singh, Director, NRCE and Officer Incharge sub-campus Nabha were also present.

Calf rallies

Calf rallies were organized in 5 adopted villages for female progenies born under the FPT project and competition was held under three categories (calves <1 year, heifers 1-2 years and heifers >2 years). The prizes were given to the winners.

Dhiktana	Jan 31, 2013
Jewra	Feb 2, 2013
Sarsod	Feb 8, 2013
Juglan	March 1, 2013
Bichpari	March 2, 2013

An elite Nili-Ravi Bull

Glimpses of Buffalo Mela at Nabha

Celebrations

Independence Day & Republic Day

Like previous years, this year also the institute celebrated the Independence day and the Republic day. On these occasions Director Dr RK Sethi unfurled the Indian tri-colour followed by national anthem and addressed the scientists, technical officers, supporting staff and their families. The 66th Independence Day of India was celebrated with traditional fervor. Speaking on the occasion Dr Sethi remembered the freedom fighters and their sacrifices. He also mentioned about various activities and initiatives undertaken in the institute during the year. He also stated that the scientists of the institute were engaged in research for evolving suitable technologies and production system for improving the productivity of buffalos, while the technical, administrative and supporting staff continued to help them in their endeavor. A cultural programme was also organized on this occasion in which the children of staff participated.

Calf rally at village Jewra

Independence day and Republic day Celebrations

Celebration of Agri-Education Day

Agri-Education day was celebrated in the institute on Nov 27, 2012. On this occasion 400 childrens from six schools of Hisar were invited and apprised about the scope of agri-education in the country. During this event an exhibition and visit to labs was arranged for them.

Publications

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Jerome A, Pandey AK, Sharma RK and Yadav PS. Buffalo UTMP gene exon 4 partial CDS - Jx910448.

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Awards / recognition

J Singh, A Mann, D Kumar and PS Yadav : Best poster award in International Conference on Biotechnology, Department of Biotechnology, CDLU, Sirsa, Sept 18-20, 2012.

KP Singh : Best Article Award (Second), for Hindi article published in Pashudhan Prakash, Vol. II, 2011, awarded on Sept 21, 2012, NBAGR, Karnal.

KP Singh : Best Poster Award in National Seminar on New Paradigms in Livestock Production from Traditional to Commercial Farming and Beyond and 20th Annual Convention of ISAPM, NDRI, Karnal, Jan 28-30, 2013.

SP Yadav : Best presentation in the National Seminar on Promising Trends in Science Galaxy, MDU, Rohtak, March 20, 2013.

Radio & TV Talk

AK Balhara (2012). *Garmi ka pashuo par prabhav*. Live telecast, AIR, Jun 2, 6 PM.

AK Balhara (2012). *Badelte Mosam main pashuo ka rakhrakhav*. Live telecast, AIR, Sept 27, 6 PM.

Dharmender Kumar (2012). *Bhains palan main kratrim garbadhan ka mahtwa*. Live telecast, AIR, Oct 17, 5 PM.

Dharmender Kumar (2013). *Bhainso ka anuvanshik sudhar*. Live telecast, AIR, Jan 30, 4.45 PM.

PC Lailer (2012). *Pashuo ke liye santulit aahar*. Live telecast, AIR, Dec 13, 6 PM.

RK Sharma (2012). *Bhains main Janan samasya*. Live telecast, AIR, June 16, 6 PM.

RK Sharma (2012). Phone in programme answering farmers problem regarding production and reproduction. Live telecast, AIR, Dec 31, 6 PM.

SK Phulia (2012). *Bhainso main janan sambhadi samasya evam samadhan*. Live telecast, AIR, Apr 16, 6 PM.

SK Phulia (2013). *Bhainso main kratrim garbadhan*. Live telecast, AIR, Jan 26, 6 PM.

SP Yadav (2012). *Pashu kharedate vakt kya-kya sawdhaniya rakhe*. Live telecast, AIR, Nov 13, 6 PM.

Sunesh Balhara (2012). *Krashi evam pashu palan main computer technology ki bhumika*. Live telecast, AIR, July 3, 6 PM.

E–lesson developed

Balhara AK, Phulia SK, Jerome A and Singh I (2012). Events in early embryonic development and importance of early pregnancy diagnosis. (http://www.buffalopedia.cirb.res.in /index.php? option=com_content&view=article&id=326&Itemid=254& lang=hn).

Balhara AK, Jerome A and Singh I (2012). Buffalo under Heat Stress. buffalopedia (http://www.buffalopedia.cirb.res.in/ index.php?option=com_content&view=article&id=327&Itemid=255&lang=en).

Kumar P, Kumar D, Kumari M, Yadav SP, Sharma RK, Phulia SK and Yadav PS (2013). Bhainso me Kritirim Garbahdhan Buffalopedia (http://www.youtube.com/watch? v=EoE14GIKFhI&feature=youtu.be).

Nayan V, Bhardwaj A, Balhara A, Jerome A, Phulia S K and Singh D (2012). Mastitis in Buffalo: Risk Factors. (http://www.buffalo pedia.cirb.res.in/index.php? option=com_content&view=article&id=328&Itemid=256 & lang=en).

Singh I, Jerome A and Balhara AK (2012). Anestrus in buffaloes. (http://www.buffalopedia.cirb.res.in/index.php?option=com_content&view=article&id=251& Itemid=199 & lang=en).

Singh I, Jerome A and Balhara AK (2012). Abortions in buffaloes. (http://www.buffalopedia.cirb.res.in /index.php?option=com_content&view=article&id=283 &Itemid=202&lang=en).

Trainings/ seminars/ symposia/ conferences attended

Event	Venue	Name of Participants
Institute Research Committee meeting of NDRI	NDRI, Karnal, Aug 9, 2012	Inderjeet Singh
XI Annual Review Meet of Network Project on Buffalo Improvement	NDRI, Karnal, Aug 24, 2012	AK Pandey, S Khanna
International Conference on Biotechnology	CDLU, Sirsa, Sept 18-20, 2012	PS Yadav, SK Phulia, AK Balhara, Jerome A, P Kumar, A Dey
Consortium Advisory Committee meeting of National Fund	Delhi University, Delhi, Oct 3, 2012	Inderjeet Singh, AK Balhara
Interface of ICAR Institutes-SAUs-Development Departments and stakeholders	NDRI, Karnal, Oct 19, 2012	Inderjeet Singh, RK Sethi
Annual Conference of Society of Animal Physiologists of India	Navsari, Nov 6-8, 2012	PS Yadav
VII National Conference on KVK	PAU, Ludhiana, Nov 20-22, 2012	VB Dixit, A Bharadwaj, AK Pandey SK Phulia, V Mudgal
National Symposium and Annual Convention of ISSAR	AAU, Khanapara, Nov 21-23, 2012	Inderjeet Singh, P Kumar
National conference on Nexgen Biotechnology: Amalgamating Science and Technology	KU, Kurukshetra, Nov 23-24, 2012	SK Phulia, AK Balhara and Sunesh
VIII Animal Nutrition Conference of Animal Nutrition Association, India	RAJUVAS, Bikaner, Nov 28-30, 2012	N Saxena, A Dey and V Mudgal
Meeting of Incharges of PME cells by NAIP	NDRI, Karnal, Dec 8, 2012	Inderjeet Singh
II International NGS data analysis workshop	University of Pune, Dec 10-13, 2012	AK Pandey
XXII Meeting of the ICAR Regional Committee No. V	IARI, Pusa, N. Delhi, Dec 14-15, 2012	RK Sethi
National Symposium of Indian Society for Sheep and Goat Production and Utilization	CIRG, Makhdoom, Mathura, Dec 22-23, 2012	SK Phulia, A Dey and V Mudgal
ICAR Chemists' Conclave.	IARI, New Delhi, Jan 14-15, 2013	N Saxena

Event	Venue	Name of Participants
X National symposium on "Integrated Development of Vast Biodiversity of Indigenous Livestock for Long Term Rural Livelihood Security"	GBPUAT, Pantnagar, Feb 7-8, 2013	KP Singh
Stress management -medical angle	NAARM, Hyderabad, Feb 12-14, 2013	PS Yadav
Short course on "Multipronged approaches for the diagnosis and surveillance of brucellosis"	PD_ADMAS, Bengaluru, Feb 19-28, 2013	S Khanna
National Workshop on ''Foresight and Future Pathways of Agricultural Research through Youth in India''	ICAR, New Delhi, Mar 1-2, 2013	A Dey
National Seminar on "Recent trends of nanotechnology in pharmaceutical research"	GJUS&T, Hisar, Mar 2, 2013	N Saxena
Interactive meeting of Head of divisions	New Delhi, Mar 4, 2013	PS Yadav, VB Dixit
National Seminar on 'Technological and Policy Interventions for Sustainable Cattle Breeding in India'	PDC, Meerut, Mar 14, 2013	P Sikka
National Symposium of Indian Society for Buffalo Development on 'Buffalo for Sustainable Food Security'	AAU, Khanapara, Mar 15-16, 2013	RK Sethi, I Singh, SS Dahiya, VB Dixit, A Bharadwaj, SS Paul, SK Phulia, A Dey, V Mudgal, AK Bhalara, Thirumaran SMK

Award of DBT CREST fellowship (2010-11) to Dr SS Paul from Dec15, 2011 to Dec 7, 2012

Dr Paul worked in the laboratory of Dr Zhongtang Yu, Assocate Professor, Department of Animal Sciences, Ohio State University, Columbus Ohio (USA)

Summary of Research Work :

A microarray was developed, containing 895 oligonucleotide (17-50 mer) probes and covering 16S ribosomal RNA gene of archaea, mcrA gene of archaea, internal transcribed spacer and 28S ribosomal RNA gene of anaerobic fungi and 18S ribosomal RNA gene of rumen protozoa. The developed chip was successfully used for tracking the dynamics of archaea, fungi and protozoal communities for various *in vitro* and *in vivo* rumen manipulation studies. The use of the chip indicated that there is severe suppression in most of the species of archaea on dosing with garlic oil plus nitrate or saponin plus nitrate to rumen fluid of cow. Similarly, use of the chip for analysis of samples from cows differing in feed efficiency indicated significant difference in some of the archeal genus and species level operational taxonomic units. This is the first comprehensive microarray currently available for studying archeal, fungal and protozoal communities in rumen and thus useful for providing direct linkages of microbial genes/populations to rumen ecosystem processes and functions and will contribute to developing effective means to improve rumen function and reduction in emission of methane from rumen.

Research Projects

Projects	Investigators	Duration
Identification of genetic variants in genes related to oxidative status in relation to fertility in Murrah bulls.	P Sikka, P Kumar	July 2013 - Dec 2015
Proteomic analysis of Murrah bull sperm and seminal plasma in relation to fertility and freezability.	S Yadav, Inderjeet Singh, AK Balhara, SK Phulia, Sunesh	April 2013 - March 2015
Studies on development and supplementation of chelated minerals in buffaloes.	V Mudgal, N Saxena, SS Dahiya BS Punia, K Kumar, ML Sharma	April 2013 - March 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
Leptin and its receptor gene polymorphism and their association with milk production traits in Murrah breed of buffaloes (Bubalus bubalis).	SP Yadav, AK Pandey, P Sikka D Kumar, PS Yadav and RK Sethi	March 2010 - June 2013
Molecular epidemiology of methicillin-resistant Staphylococcus aurous isolates from buffalo milk.	N Rana / Ashok Kumar S Yadav	Oct 2010 - June 2013
Application of pedigree information and body condition score for development of buffalo breeding herd analyzer.	SN Kala	July 2011 – July 2015
Identification of mi RNAs expressed in different reproductive stages of buffalo corpus luteum.	SMK Thirumaran A Jerome, SN Kala	Dec 2012 - Nov 2014
Identification of SNPs in genes related to meat production and their association with meat parameters in buffaloes (Bubalus bubalis)	AK Pandey, P Sikka, SP Yadav, SS Dahiya, Neeta Khanna (LLRUVAS)	Oct 2010 - Dec 2013
Integrated SOET and MOET for faster multiplication of elite buffaloes Germplasm.	RK Sharma, Inderjeet Singh, SK Phulia D Kumar, A Jerome, S Khanna	Sept 2010 - Aug 2013
Cloning for conservation and multiplication of superior buffalo Germplasm	PS Yadav, Sadeesh EM, RK Sharma D Kumar, B Singh	Sept 2010 - Aug 2014
mRNA expression of some candidate genes in buffalo IVF embryos cultured in different media	Sadeesh EM, AK Balhara, SMK Thirumaran, PS Yadav	Feb 2012 - Jan 2014
Effect of trehalose and sericin on freezability of buffalo bull semen.	P Singh / P Kumar P Sikka, D Kumar	Nov 2010 - June 2013
Establishment of fertility-associated seminal plasma proteins as biomarkers through proteomics and nanotechnological approach in buffalo.	P Kumar, D Kumar, AK Balhara, SP Yadav & PS Yadav, N Dilbaghi & S Kumar (GJU)	Dec 2012 - Nov 2015

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 - 2017
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 - 2017
Effect of stimulants on fibre degradation, methane emission and fungal population in buffaloes.	Avijit Dey, SS Dahiya, BS Punia PC Lailer, N Saxena	April 2012 - April 2014
Validation of ITK known herbs against gastro-intestinal parasites in buffalo calves.	N Saxena, A Dey, V Mudgal BS Punia and ML Sharma	Nov 2012 - Oct 2015
Development of modules for Buffalo meat production.	SS Dahiya, A Dey, PC Lailer, V Mudgal	Dec 2012 - Dec 2014
Effect of different feeding regimen on age at first calving.	PC Lailer, V Mudgal SS Dahiya, AK Boora, BS Punia	Dec 2012 - Dec 2015
Developing database for Nili-Ravi buffaloes by hematological biochemical and endocronological studies.	JK Singh, KS Das, G Singh, KL Mehrara, RC Upadhyay (NDRI), V Mudgal	Jan 2013 - Dec 2017
To exploit full genetic potential of Nilli Ravi buffaloes with optimum plane of nutrition.	R Malik, G Singh, KP Singh, KL Mehrara R Mehta, TP Singh, SS Kundu (NDRI)	Jan 2013 - Dec 2016
Network / AICRP projects		
Genetic improvement of Murrah buffaloes.	KP Singh	July 1991 - continued
Progeny testing of bulls under field conditions (FPT).	A Bharadwaj, VB Dixit, RK Sethi, S Kakkar	April 2001 - continued
Network project on Nili-Ravi buffaloes.	R Malik, KS Das, KP Singh	2001 - continued
Network project on Bhadawari buffaloes.	BP Kushwaha, SB Maity Sultan Singh, KK Singh (IGFRI)	2001 - continued
Improvement of feed resources and nutrient utilization in raising animal production (AICRP)	N Saxena	1993 - continued
Externally funded projects		
Elucidating the physiological and genomic regulation process of follicular development, oocyte maturation and embryogenesis in buffalo (NAIP).	Inderjeet Singh, RK Sharma Lead-centre: NDRI, Partners: CIRB, IISc & NIANP	Jan 2008 - Mar 2013
Rumen microbial diversity in domesticated and wild ruminants and impact of additives on methanogenesis and utilization poor quality fibers feed (NAIP).	SS Paul, NAIP, Lead-centre: IVRI Partner: CIRB, GADVASU	July 2008 - March 2013
Effect of rBST supplementation on optimally fed lactating buffaloes (M/s. ELANCO Animal Health Ltd.).	Inderjeet Singh, A Bharadwaj SS Paul, RK Sharma, SK Phulia, AK Balhara, A Jerome, Sunesh, S Khanna	June 2012 - March 2014
Early detection of pregnancy in cow and buffalo by pregnancy associated proteins (PAPs) (NF-BSFARA).	AK Balhara, Inderjeet Singh Lead Centre: NDRI, Partner: CIRB	June 2012 - May 2015
Isolation and characterization of equine mesenchymal stem cells from amniotic fluid (DBT).	PS Yadav, Lead Centre: NRCE Partners: CIRB & LLRUVAS	April 2012 - Oct 2013
Institute Technology Management Unit (ICAR Scheme)	VB Dixit, Lead-centre: IVRI Partner: CIRB & others	2008 - 2014

Trainings Organized

Title	Duration	Participants	Venue/ collaboration	Training Organizer
Improved buffalo husbandry and AI	April 16-26, 2012	15 from Haryana	CIRB, Hisar	A Boora and Sadeesh EM
Improved buffalo husbandry and AI	May 14-24, 2012	15 from Haryana, Punjab, Raj.	CIRB, Hisar	AK Balhara and D Kumar
Improved buffalo husbandry and AI	June 11 -21, 2012	13 from Haryana	CIRB, Hisar	SK Phulia, V Nayan
Improved buffalo husbandry and AI	July 2-13, 2012	15 from Haryana, Punjab	CIRB, Hisar	R K Sharma and Jerome
Improved buffalo husbandry and AI	Dec 16-28, 2012	15 from Haryana	CIRB, Hisar	PS Yadav and S Yadav
Improved buffalo husbandry	Oct 3-7, 2012	30 from Jodhpur ATMA, Rajasthan	CIRB, Hisar and ATMA Rajasthan	VB Dixit, SK Phulia, SP Yadav A Dey, V Mudgal
Improved buffalo husbandry and AI	May 7-12, 2012	38 farmers	CIRB, Hisar	VB Dixit, SK Phulia, SP Yadav
Buffalo production and management	May 7-11, 2012	30 farmers	CIRB, Hisar	VB Dixit, SP Yadav, SK Phulia
Buffalo production and management	July 9-13, 2012	27 women	CIRB, Hisar	VB Dixit, P Sikka, Sunesh Balhara
Animal Nutrition and Management	Feb 1-11, 2013	25 farmers	CIRB, Hisar	SS Dahiya, A Dey, V Mudgal
Emerging buffalo diseases and their management	April 21, 2012	07 farmers	CIRB, Nabha	K S Das, G Singh, R Malik
Commercial buffalo production	May 18 - 24, 2012	30 farmers	CIRB, Nabha	G Singh, KS Das, R Malik, JK Singh
Dairy buffalo management for improved production	Sep 25 - Oct 4, 2012	30 farmers	CIRB, Nabha	KS Das, JK Singh, R Malik KP Singh
Feeding management and formulation of concentrate ration for different category of buffaloes	March 6 -12, 2013	17 farmers	CIRB, Nabha	R Malik, G Singh, KS Das PC Lailer, KP Singh

Students Guided

Name of student	Degree / Fellowship	Title of Study	Institute	Guide / Co-Guide
Saber Mohamed Abd-Allah	PDF	Study of superovulation protocol for high ovulation rate and low cost in Buffalo MOET. (DST-FICCI sponsored CV Raman visiting Fellowship)	CIRB, Hisar	Inderjeet Singh R K Sharma D Kumar
Tamer Eweda Ramadan	PDF	Manipulation of reproductive performance in lactating buffaloes using melatonin and CIDR (DST-FICCI sponsored CV Raman post-doc Fellowship)	CIRB, Hisar	Inderjeet Singh S K Phulia A K Balhara
GM Tadesse	PDF	Manipulation of rumen fermentation by using plant extracts. (DST-FICCI sponsored CV Raman post-doc Fellowship)	CIRB, Hisar	BS Punia N Sexena A Dey
AK Balhara	PhD	Proteomic analysis of pregnancy-specific serum proteins in buffalo	LLRUVAS, Hisar	Inderjeet Singh
P Kumar	PhD	Purification and characterization of PAGs in buffaloes	IVRI, Izatnagar	RK Sharma
Rajesh Kumar	PhD	Genetic Polymorphism of HSP70, LHR, LEPR genes and Selective Minerals Status in Postpartum Anestrous Buffaloes	LLRUVAS, Hisar	Inderjeet Singh
Fozia Shah	PhD	Studies on Donor Cells for Production of Cloned Embryos and their characterization in buffalo (Bubalus bubalis)	LLRUVAS, Hisar	PS Yadav
Sadeesh EM	PhD	Production of cloned buffalo embryos and expression profile of developmentally important genes during embryogenesis	IVRI, Izatnagar	PS Yadav
Kaushalya Ghosh	PhD	Studies on stemness properties of cultured buffalo amniotic membrane cells	CDLU, Sirsa	PS Yadav
Mrs Sarla	PhD	Molecular Characterisation of major candidate gene associated with reproductive traits in buffaloes	GJUS&T Hisar	SK Phulia
Maneesha Kumari	MVSc	Identification of osteopontoin and culstrin in buffalo semen and their relation to semen quality	IVRI, Izatnagar,	PS Yadav
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	LLRUVAS, Hisar	RK Sharma
Rakesh Kumar	MVSc	Effect of Coumestrol on efferent ductules and spermatogenesis in adult male dogs	LLRUVAS, Hisar	Inderjeet Singh

CIRB Personnel

General Administration	
Dr RK Sethi	Director (till 31-03-2013)
Dr RK Singh	Director (from 31-03-2013)
Shri RK Sharma	Administrative Officer
Shri Raj Kumar	Asstt. Administrative Officer
Smt Shammi Tyagi	Asstt. Fin. & Accounts 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 Satbir Singh	UDC
Shri Dharam Pal	LDC
Shri Sunil Kumar	LDC
Shri Mahabir Singh	LDC
Buffalo Genetics & Breeding Division	
Dr VB Dixit	Principal Scientist & Head (till 30-3-13)
Dr (Mrs) Poonam Sikka	Principal Scientist & Head (from 31-3-13)
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 Thirumaran SMK	Scientist
Dr Ashok Kumar	Scientist
Dr Sudhir Khanna	T-9
Dr Satish Kakkar	T-9
Shri AKS Tomer	T-6
Shri Balbir Singh	T-5
Shri Baljeet Singh	T-4
Shri Dharam Singh	T-3

Network Project on Buffalo Improvement	
Dr RK Sethi	Director & PC(B)
Dr BP Kushwaha	Principal Scientist (IGFRI, Jhansi)
Dr AK Pandey	Principal Scientist
Smt Sunesh Balhara	Scientist
Shri Ram Chander	T-5
Buffalo Nutrition Division	
Dr BS Punia	Principal Scientist & Head
Dr SS Dahiya	Principal Scientist
Dr PC Lailer	Principal Scientist
Dr Navneet Saxena	Principal Scientist
Dr SS Paul	Principal Scientist
Dr Avijit Dey	Senior Scientist
Dr Vishal Mudgal	Senior Scientist
Dr ML Sharma	T-7-8
Shri Krishan Kumar	T-6
Buffalo Physiology & Reproduction Division	
Dr Inderjeet Singh	Principal Scientist
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 Sarita Yadav	Scientist
Dr AK Saini	T-5
Transfer of Technology and Entrepreneurship	
Dr VB Dixit	Incharge
Shri Dharam Singh	T-3

Central Pool	
Shri Mohinder Singh Kairon	T-5
Feed Unit	
Dr SS Dahiya	Principal Scientist & Incharge
Shri MS Poonia	T-3
Prioritizing Monitoring & Evaluation Cell	
Dr VB Dixit	Principal Scientist & Incharge (till 7-11-12)
Dr Inderjeet Singh	Principal Scientist & Incharge (from 8-11-12)
Dr RK Sharma	Principal Scientist
Dr SP Yadav	Senior Scientist
Shri Raj Kumar	T-6
Shri R A Pachauri	T-5
Results-Framework Documents Cell	
Dr SP Yadav	Senior Scientist & Incharge
Sh Ram Chander	T-5
AKMU	
Mrs Sunesh Balhara	Scientist & Incharge
Shri Raj Kumar	T-6
Animal Farm Section	
Dr KP Singh	Principal Scientist & Overall Incharge
Dr Ashok Kumar	Scientist & Incharge
Dr SR Bhardwaj	T-9
Shri Subhash Chander	T-5
Dr Rajesh Kumar	T-3
Agricultural farm	
Dr PC Lailer	Principal Scientist & Overall Incharge
Dr Shaitan Singh	T-6
Shri Sushil Kumar	T-6
Workshop Section	
Shri Surinder Singh	T(7-8) Overall Incharge
Shri Jitender Kumar	T-6 Incharge
Shri Kuldeep Singh	T-4
Shri Bhim Raj	T-4
Shri Sant Lal	T-4
Shri Ram Kumar	T-3
Landscape section	
Dr Inderjeet Singh	Principal Scientist & Overall Incharge
Shri Surinder Singh	T(7-8) Incharge
Shri Baljeet Singh	T-4
Shri Mahabir Singh	T-4
Estate section	
Dr Sudhir Khanna	T-9 Overall Incharge
Shri BPSingh	T-7-8 Incharge
Shri Raj Kumar	T-6

Electrical Unit	
Shri RK Sharma	Adm. Officer & Overall Incharge
Shri Rajesh Prakash	T-6 Incharge
Shri Gopal Singh	T-4
Internal Security	
Shri AKS Tomer	T-6 Incharge
Shri Subhash Chander	T-5
Guest House	
Shri AKS Tomer	T-6 Incharge
Library	
Dr VB Dixit Incharge	Principal Scientist & Overall Incharge
Shri VPS Punia	T-9 Incharge
Hindi section	
Dr AK Pandey	Principal Scientist & Incharge
Shri Sunil Kumar	LDC
PIO/APIO	
Dr RK Sharma	Principal Scientist & PIO
Shri RK Sharma	AO & Transparency Officer
Shri Raj Kumar	AAO & APIO
PRO	
Dr AK Balhara	Scientist
Dr Pardeep Kumar	Scientist
Sub-campus, Nabha	
Scientific	
Dr JK Singh	Sr Scientist & Officer Incharge (till 10-7-12)
Dr KP Singh	Pr Scientist & Officer Incharge (from 11-7-12 to 31-12-12)
Dr Raman Malik	Pr Scientist & Officer Incharge (from 1-1-13)
Dr Ghansham Singh	Senior Scientist
Dr KS Das	Senior Scientist
Technical	
Dr KLMehrara	T-9
Shri Jagdish Prasad	T-9
Shri Virender Singh	T-9 (On deputation)
Shri Rajiv Mehta	T(7-8)
Shri TPSingh	T-7-8
Shri RS Pippal	T-6 (On deputation)
Shri Daljit Singh	T-4
Shri Balwinder Singh	T-4
Shri Mohan Singh	T-4
Shri Virender Kumar	T-2
Administration	
Shri IS Kundu	AAO
Shri Narinder Kumar	AAO
Shri Tejinder Singh	UDC

Personnel Milestones

Appointments / Joinings

1. Shri Satyawan
   S/o Shri Tulsi Ram
   SSS
   May 22, 2012
2. Dr Vishal Mudgal,
   Senior Scientist,
   Animal Nutrition
   Aug 17, 2012
3. Dr Sarita Yadav,
   Scientist,
   Veterinary Microbiology
   Nov 30, 2012
4. Shri Balwant Singh
   SSS
   Feb 13, 2013
5. Shri Dilbag Singh
   SSS
   Feb 13, 2013
6. Shri Rajbir Singh
   SSS
   Feb 13, 2013

Promotions

1. Dr AK Saini
   granted advance increment
   in the grade of T-5,
   w.e.f. July 1, 2005.
2. Shri VPS Poonia
   promoted from T(7-8)
   to T-9, w.e.f Jan 21, 2006
3. Dr Satish Kakkar
   promoted from T(7-8)
   to T-9, w.e.f. Feb 20, 2008.
4. Dr PC Lailer
   promoted from Senior Scientist
   to Principal Scientist,
   w.e.f. Jan 1, 2009
5. Dr Navneet Saxena
   promoted from Senior Scientist
   to Principal Scientist,
   w.e.f. Jan 1, 2009
6. Dr RK Sharma
   promoted from Senior Scientist
   to Principal Scientist,
   w.e.f May 19, 2009
7. Dr Raman
   Malik promoted from Senior Scientist
   to Principal Scientist, w.e.f. Jan 1,
   2010
8. Shri T P Singh
   promoted from T-6 to
   T(7-8), w.e.f. Oct 19, 2010
9. Shri Rajiv Mehta
   promoted from T-6 to
   T(7-8), w.e.f Jan 1, 2011
10. Dr SP Yadav
    promoted from Scientist to
    Senior Scientist, w.e.f Jan 17, 2011
11. Shri B P Singh
    promoted from T-6 to
    T-7-8, w.e.f. Aug 29, 2011
12. Shri Mahender Singh Poonia
    promoted from T-3 to
    T-4, w.e.f Dec 12, 2011
13. Dr Shaitan Singh
    promoted from T-5 to
    T-6, w.e.f. Jan 1, 2012
14. Dr Ashok Kumar
    Scientist promoted to next RGP,
    w.e.f. Jan 8, 2012
15. Shri Jagdish Prashad
    promoted from T(7-8) to
    T-9, w.e.f. Feb 3, 2012
16. Shri Mahabir Singh
    promoted from T-3 to
    T-4, w.e.f. June 29, 2012.
17. Sh Jitender Kumar
    promoted from T-5 to
    T-6, w.e.f. July 1, 2012
18. Shri Sushil Kumar
    promoted from T-5 to
    T-6, w.e.f. July 1, 2012
19. Shri Mohinder Singh
    promoted from T-4 to
    T-5, w.e.f July 1, 2012
20. Shri Satish Kumar
    promoted from SSS to T-1,
    w.e.f. Sept 15, 2012

Retirements

1. Smt Shyama Devi
   DPL (TS) on June 30, 2012
2. Shri Ishwar Singh
   SSS on Dec 31, 2012
3. Dr RK Sethi
   Director on March 31, 2013

Demises

1. Shri Vinod Kumar
   SSS on April 05, 2012
2. Shri Hanuman Das
   SSS on July 23, 2012
3. Shri Rameshwar
   SSS on Sept 13, 2012

Dr RK Sethi Director, CIRB superannuated on March 31, 2013. Acting Director Dr RK Singh, Dr BS Punia and Dr AK Pandey presenting a memento to him on the occasion.

Buffalo Mela

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