



NDRI News

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From the Director's Desk

Stop Press...

NDRI GETS ISO 9001: 2008 CERTIFICATION

NDRI has been certified ISO 9001:2008 Institute to undertake research, teaching, training and consultancy in the field of dairy programmes, Dairy Production, Dairy Processing and Dairy Management.

Production of calves of desired sex has long been a dream of Livestock farmers. In India, the need to preselect the gender of young ones in dairy animals is gaining momentum day by day owing to (i) limited availability of elite bulls (ii) large number of unproductive young bulls (iii) ban on slaughter of cattle (iv) very large proportion of unproductive cows and bulls giving tough competition on limited resources and (v) shortage of feed and fodder. Among the dairy animals in India, sex pre-selection assumes much significance in crossbred animals since more and more number of crossbred males are either being left at crossroads or allowed to die during calf-hood owing to their poor drought capacity. It has been estimated that if sex pre-selection is applied with 80% tilt towards female in crossbred animals, additional 10-11 million tonnes of milk can be obtained in a year with the existing management conditions. Further sex pre-selection will not only increase the genetic progress from the daughter-dam path but would also help in producing good male germplasm from elite bulls for future breeding.

The most promising tools developed till date for sex pre-selection is sexing of embryos and sexing of semen. Sexing of embryos requires well trained manpower, sophisticated facilities and when super ovulation is practiced, it involves endocrine manipulations. Possible damage to embryo during biopsy and reduced conception rate with cryopreserved embryos are additional limiting factors for routine use of sexed embryos. Thus, the use of sexed semen for artificial insemination is recognized as more pragmatic and an easy way to pre-select the sex of offspring. Several other methods including albumin gradient (or) gradient swim down procedure, Percoll density gradient method, swim up procedure, identification of H-Y antigen, volumetric differences, centrifugal counter current distribution, flow cytometry etc have also been tried to sort X and Y bearing spermatozoa but with variable results. Among the available techniques, fluorescence-activated cell sorting, using flow cytometry is the only method proven to be commercially viable with good accuracy. This method utilizes the difference in DNA content (3 - 4.2%) between X and Y bearing spermatozoa for sorting. Although proved to be efficient, the loss of spermatozoa (not able to sort into either X or Y) is to the tune of up to 60% in this method. However, under Indian conditions, it is possible to use this waste population of spermatozoa for routine AI program, which will help in better utilization of male germ plasm. With the existing flow cytometry based high-purity sorting method, sorting rates up to 8000 spermatozoa/second (each sex X and Y) can be achieved with an input rate of 40,000 X - Y spermatozoa/second. Currently the spermatozoa concentration in each sexed semen dose is 2 million/insemination. Thus, with the available technology, 14 doses each of X and Y sex per hour can be produced per instrument leading to production of 336 doses of each sex per instrument, if it runs continuously for 24h. However, the machine and the process of sex sorting are covered under patent.

Developing an indigenous methodology for sex sorting of spermatozoa would definitely reduce the cost of production. However, due to the pressing need of time, the pragmatic approach could be to source the machine, and start producing sexed semen. However, there are some issues that need to be addressed before indigenous production of sexed semen using the borrowed technology. The authenticated data on differences in



DNA content between X and Y spermatozoa in crossbred and several indigenous breeds is not available and thus, the flow cytometry based sex sorting technology requires to be well standardized before its application on these breeds. Also it is not known that how the spermatozoa of crossbred and indigenous bulls will behave during sorting and during cryopreservation after sorting. Yet another concern is the reduced conception rate with sexed semen. Across the globe, when fixed time insemination is practiced, the conception rates in artificial insemination using sex sorted semen are lower than those with unsorted semen. If we immediately start using the sexed semen under field conditions, it is expected that the conception rates would still go down since we have not yet standardized the insemination methods for our cattle breeds. Currently, the average conception rate in dairy cattle when inseminated with 20 million spermatozoa is 30-35%. When 2 million spermatozoa will be used for insemination with sexed semen, the conception rate is expected to go down further. Thus, to improve the conception rate with sexed semen, there is an urgent need to standardize the dose and site of insemination with sex sorted spermatozoa for indigenous and crossbred animals and also to train the inseminators on low-dose insemination procedures. Once sexed semen is available, majority of stakeholders will like to use it for producing female, which will lead to decreased availability of quality males, which are already in shortage. Hence, we need to frame a stringent policy for using sexed semen, otherwise uncontrolled use of sex sorted semen would skew the sex ratio towards one sex and lead to unforeseen problems.

Since the success of sexed semen industry depends upon the sorting speed, accuracy and the fertility of sorted spermatozoa, research efforts are to be taken up to develop indigenous method(s) for differentiating X and Y bearing spermatozoa and to sort at high rates along with high accuracy and high fertility. As such, identification of sperm surface markers specific for X or Y bearing spermatozoa and using them in sorting or killing of unwanted sex bearing spermatozoa could also be an option. Further, developing designer bulls that produce only one type (either X or Y) of spermatozoa by knocking out the other type is also possible, however it requires intensive research. To make sexed-semen available at the earliest possible time, a new project on "Sexing of semen in cattle" was launched recently by ICAR under a new 12th Plan Scheme and NDRI is committed to make the "dream" of Indigenous production of sexed semen into "reality".

A. K. Srivastava
(A. K. Srivastava)

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RESEARCH

GARIMA Delivers 2nd Calf "Karishma"

(M. S. Chauhan, S. K. Singla, R. S. Manik, P. Palta, Shiv Parsad, S. S. Lathwal, Anuj Raja, Amol Sahare and Basanti Jyotsana)

Garima, a cloned buffalo, earlier born at NDRI produced second female calf named "Karishma" on 27th December, 2014 through normal parturition. The weight of the calf at the time of birth was 35 kg and the newborn calf is keeping good health.

The Garima was born on 22nd August, 2010 using embryonic stem cells as donor cell through hand guided cloning technique. GARIMA was inseminated with frozen-thawed semen of a progeny tested bull of NDRI No. 5258 on 27th February 2014, which resulted in conception. She was maintained under standard scientific management system during her gestation. Earlier, a female buffalo calf MAHIMA was born to 'Garima' a cloned buffalo mother at NDRI, Karnal on 25th January, 2013, which was the first calf born from cloned buffaloes, produced through hand guided cloning technique.

ICAR - NDRI Produced Clone of Endangered Wild-buffalo of Chhattisgarh

(M. S. Chauhan, S. K. Singla, R. S. Manik, P. Palta, S. S. Lathwal, Anuj Raja and Amol Sahare)

A clone of the only wild-buffalo in Chhattisgarh in semi-captivity has been produced through the 'Hand-guided Cloning Technique' at ICAR- National Dairy Research Institute, Karnal. The female calf was named "Deepasha" and was born on December, 12, 2014. The calf was born by normal parturition, and its weight at the time of birth was 32 kg.

Udanti in Chhattisgarh is left with a lone female wild buffalo in the State's Udanti Wildlife Sanctuary and popularly named as ASHA and is a darling of the whole department. The lone female bred with males during several natural-matings has delivered male calves only and is a cause of concern for Chhattisgarh state, as nobody wants that this buffalo gets eliminated from the system due to aging or other risks. Through their technical

partners Wildlife Trust of India, they approached NDRI for assistance by initiating research to copy their wild animals. NDRI accepted the challenge of exploring the totally unknown path of research with their partial funding from the state and support in sampling the tissue from the animals.

An *in-situ* breeding programme to save wild buffaloes from becoming extinct is going on for the past many years in Udanti. Chhattisgarh's state animal, known locally as 'Ban Bhainsa', is similar to the bison in appearance but is a different species and it is their pride animal. The species is in the Red List of International Union for Conservation of Nature (IUCN). It is also a Schedule I animal under the Wildlife Protection Act 1972.

Scientists are of the opinion that besides multiplication of superior germplasm through cloning, conservation of endangered species through cloning has great potential. As our domestic buffalo has evolved from wild-buffalo, there is a need to extract few traits of biological and/or economic importance from these wild animals in future.

This novel achievement of producing cloned calf from endangered species has opened up new windows of applications of cloning technology.

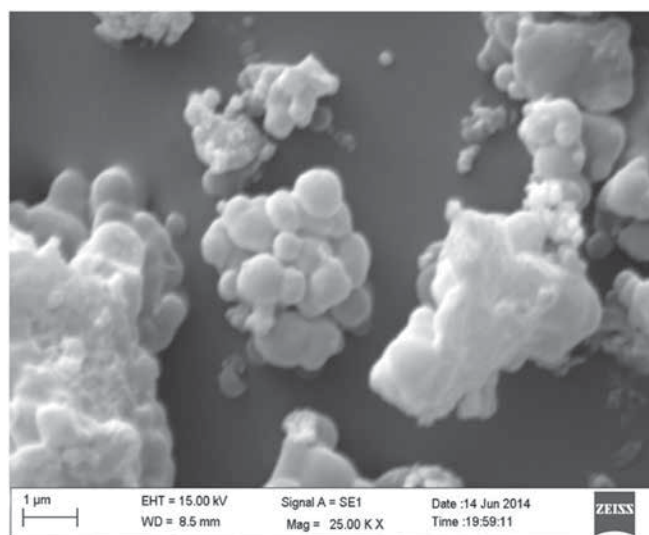
Magnet can Attract Antibiotic from Food Matrix

(Y. S. Rajput, Rajan Sharma, Sneha Aggarwal and Gulab Singh)

Imprinted polymer against oxytetracycline, cephalexin and cefquinome were prepared over the surface of iron magnetite and evaluated for extraction of antibiotics from food matrix. The imprinted polymers against these antibiotics were prepared by polymerization of methacrylic acid and ethylene glycol dimethacrylate in presence of respective antibiotics. Iron magnetite was prepared from FeCl_2 & FeCl_3 and exhibited superparamagnetic property which behaved like magnet in magnetic field. The selectivity of imprinted polymers over non-imprinted polymer was determined under different experimental conditions for selecting appropriate binding



A cloned female calf named Deepasha



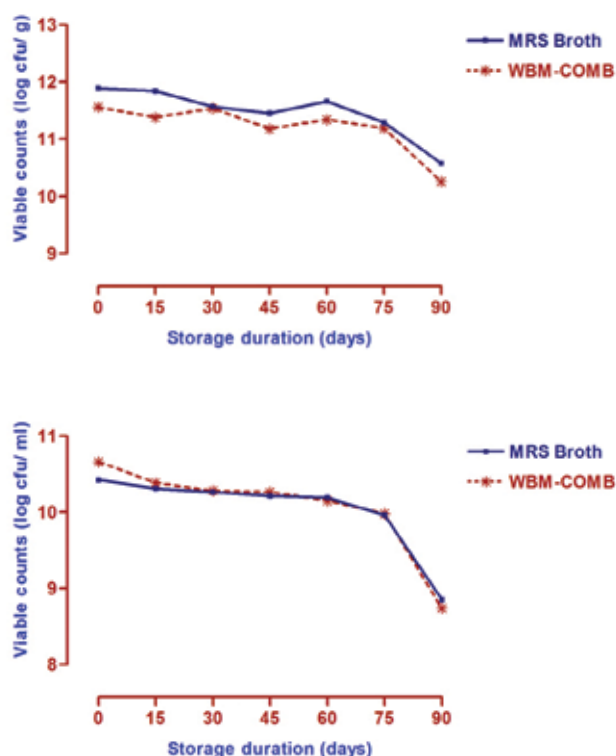
SEM Image of Oxytetracycline imprinted magnetic polymer

and elution conditions. These polymers extracted 62% to 94% antibiotics from water, milk, honey and egg white.

Direct Product Probiotic (DPP) *Lactobacillus casei* NCDC 298 Culture

(S. Mandal, Pritee, P. V. Behare, K. Khamrui and S. K. Tomar)

The cell biomass of a probiotic potential strain of *Lactobacillus casei* NCDC 298 was produced under batch fermentation in MRS broth and Whey Based Medium at pH 6.0 (inoculation rate 6.0-7.0 log cfu/ml). The early stationary phase culture (9.0-10.0 log cfu/ml) was obtained after 10 h at 37°C. Cell biomass was concentrated from the culture media by centrifugation (10000 rpm for 10 min at 4°C) and preserved as frozen concentrate as well as freeze dried powder forms. Viable counts were in the range of 11-12 log cfu/g of freeze dried powder, which was stable during storage at -20°C till 75 days. On the other hand, viable counts were in the range of 10 - 11 log cfu/ml of frozen concentrate, which were stable during storage at -20°C till 60 days. Preserved *L. casei* NCDC 298 biomass was incorporated in fermented milk beverages @ 8 log cfu/ml of final product. The viable counts were also found stable during storage under refrigeration condition till 7 days. The concentrate *Lactobacillus* culture can be used for value addition to fermented and non-fermented dairy products.



Survival of preserved *L. casei* NCDC 298 during storage (-20°C): (a) freeze dried & (b) frozen concentrate

Production of α-glucosidase Inhibitory Milk Bioactive Peptides by using *Lactobacillus* spp.

(P. Patil and S. Mandal)

Diabetes is a metabolic disorder characterized by high blood glucose level (Hyperglycemia). One therapeutic approach to

decrease postprandial hyperglycemia is to retard absorption of glucose through inhibition of carbohydrate-hydrolyzing enzymes, e.g., α-amylase and α-glucosidase. Bioactive peptide fragments are formed during degradation of the milk proteins by digestive enzymes in the gastrointestinal tract or by proteolytic lactic acid bacteria (LAB) during fermentation of milk. Therefore, inhibition of α-glucosidase by using milk derived bioactive peptide is an effective strategy for controlling/managing of Type 2 diabetes. Hence, the present study was carried out to exploit the proteolytic activity of *Lactobacillus* spp. for the production of milk peptides having α-glucosidase inhibitory activity. Hydrolysates from all fermented milk samples of *Lactobacillus* spp. were evaluated for their proteolytic activity and potential to inhibit α-glucosidase. Among 21 strains of *Lactobacilli*, the proteolytic activity measured using OPA method ranged between 1.77 to 3.13 mg of leucine/ml whereas unfermented milk sample had very low peptide content (0.046 mg/ml). It is evident that during fermentation milk protein undergoes proteolysis to varying extent by extracellular proteinases of *Lactobacilli*. Among the different species of *Lactobacillus*, the proteolytic activity was maximum for *L. rhamnosus* NCDC 24 (3.13 ± 0.02 mg/ml) followed by *L. helveticus* NCDC 288 (3.10 ± 0.02 mg/ml). The α-glucosidase inhibitory activity was highest for the hydrolysate from *L. helveticus* NCDC 288 and *L. helveticus* NCDC 292 i.e. 46.62 ± 0.88% and 43.83 ± 0.53%, respectively, followed by *L. rhamnosus* NCDC 24 (40.12 ± 1.38%). The α-glucosidase activity of all strains assessed increased with most of the cases during fermentation with increase proteolysis. High correlation coefficient between development of α-glucosidase inhibitory activity and proteolytic activity was found with eight *Lactobacillus* strains i.e. (r > 0.90). Five *Lactobacillus* cultures were selected for further study. The peptide fractions of 10 and 3KDa were prepared by ultrafiltration process and tested for α-glucosidase inhibitory activity. The results from this study showed that peptides with α-glucosidase inhibitory activity can be generated by using *Lactobacillus* spp. from milk proteins. Therefore, these peptides can be produced in fermented dairy product by selected proteolytic strains of Lactic Acid Bacteria or peptides rich formulation can be incorporated into functional foods or administered via nutraceuticals.

Effect of Humectants on Water Activity Modification and Sensory Properties of *Khoa* Using Model *Khoa* System

(R. Badola, R. R. B. Singh and A. K. Singh)

Khoa, produced by heat desiccation of different types of milk, resulting different total solids and textural attributes, constitute the base and filler for the production of variety of popular traditional sweets. During the preparation of *khoa*, desiccation destructs most of the microorganisms, but the high water activity (0.96) of *khoa* limits its shelf-life not to be more than 3 days at room temperature and 14 days at refrigeration temperature. Further desiccation may reduce the water activity but could lead to dryness and discolouration in final product. Therefore, attempts were made using certain humectants viz., polyols (sorbitol and mannitol), polydextrose, maltodextrin and corn-syrup in model *khoa* system on water activity modification of *khoa*. Effect of addition of humectants on

EXTENSION

sensory parameters viz., colour and appearance, flavour, body and texture and instrumental colour parameters viz., lightness (L^*), redness/greenness (a^*) and yellowness/blueness (b^*) of khoa were also studied. It was observed that all the humectants employed in the present study resulted in significant reduction in water activity. However, at higher levels, these humectants showed negative effect on the sensory acceptability of the final product. There was no significant effect ($P < 0.05$) on colour attributes by various humectants studied. It was revealed that among several humectants, the khoa incorporated with corn syrup was found as the most acceptable from sensory aspects.

DAIRY EXTENSION DIVISION

Dairy Education at Farmers' Door

Dairy Extension Division organized the Extension Education Programme "Dairy Education at Farmers' Door" to strengthen the effective dissemination of dairy production and processing technologies among farming community. Under this programme, a team of NDRI scientists including subject matter specialists from production, processing and management group visited villages viz. Khrijpur and Wazidpur Karnal district on 2nd Saturday of each Month. The key points of interactions were:

- Breed improvement of dairy animals
- Preventive measure of Mastitis
- Practices of good quality curd preparation
- Fodder management
- Paneer Making

Empowerment of Women and Mainstreaming of Gender Issues

Fourteen women empowerment training courses were organized with the objective to create awareness in the field of dairying and home science and also impart skill in these areas so that farm women could generate more income from dairying and maintain healthy atmosphere in their respective families. In these training programmes, a total of 193 farm women were trained.

Educational Visit and Tour

A total of 3364 visitors (students & faculty) of 155 colleges/Institutions/Universities visited the Institute. The groups were sensitized about the different research, teaching and extension achievements and facilities available in the Institute.

Exposure visit & Training of Livestock Assistants and Field Coordinators

An Exposure visit & Training in collaboration of Centre for micro finance, Malviya Nagar, Jaipur was organized on "Scientific Dairy Farming" at ICAR-National Dairy Research Institute, Karnal during 3rd-5th December, 2014 for the benefit of 36 livestock assistants and field coordinators working in different NGOs in Rajasthan. This training was designed in such a way that technological information would be transferred alongwith the extension techniques so that it will be an active learning on the

parts of the participants who in turn can motivate the livestock farmers for increasing farm productivity. The status of the animal husbandry and various issues influencing the livestock sector were fully covered in the training so that it would be more convenient for livestock assistants and field coordinators to work with the various clientele groups in the rural areas.

Model Training Course on Good Dairy Farming Practices: a Way Forward for Organic Farming

An eight day Model Training Course on "Good Dairy Farming Practices: a Way Forward for Organic Farming" sponsored by the Directorate of Extension, Department of Agril. & Coopn., Ministry of Agriculture, Govt. of India and organized by ICAR-NDRI Karnal from 29th October to 5th November 2014. This Model Training Course was aimed to facilitate orientation of Animal Husbandry, Veterinary and Dairying Officers on current scenario of livestock and familiarize them with various components of good dairy farming. A total of 25 participants representing 14 states (Maharashtra, Jharkhand, Tripura, Meghalaya, Nagaland, Manipur, Uttarakhand, Uttar Pradesh, Himachal Pradesh, Kerala, Madhya Pradesh, Gujarat, Bihar and Punjab) attended the training programmes. Besides the lectures by NDRI, NBAGR, CSSRI faculty, five guest lecturers were delivered by eminent scientists viz. Dr. Mahesh Chander, IVRI, Izatnagar, Dr. J. K. Mahapatra, PD FMD, Mukteswar, Dr. Manisha Rani, NCOF, Ghaziabad, Dr. Manojit Biswas, NABARD, Chandigarh and Vikash Chaudhary, YPAD.

Farmers' Farm School

A new educational approach "Farmers' Farm School" of NDRI was started in village Gorgarh, Karnal. In this school, 20 active farmers were registered as students. Scientists of NDRI were taking class as regularly on every Friday and Saturday. In this period, basics of animal husbandry alongwith wheat cultivation were covered and monthly quiz was also organized.

Progressive Dairy Farmer Meet-2014

ICAR-National Dairy Research Institute, Karnal organized "Progressive Dairy Farmers Meet-2014" on 7th October, 2014. In this meet, about 200 progressive dairy farmers from various



Dr. R. S. Paroda, Chairman, Haryana Kisan Ayog addressing progressive dairy farmers and scientific community

districts of Haryana as well as from other states, personnel from NGOs and officials from related government departments actively participated. The meet was inaugurated by Dr. R. S. Paroda, Chairman, Haryana Kisan Ayog. He emphasised on evolving strategy of quality fodder seed production, marketing and processing of milk and milk products. He advised that farmers should be provided latest know-how through skill oriented training, artificial insemination, bio-gas and diversification technologies to be promoted. On this occasion, five innovative farmers were honoured with “NDRI Appreciation Certificates” by the Chief Guest, Dr. R. S. Paroda.

Dr. A. K. Srivastava, Director & Vice Chancellor, NDRI (Deemed University) apprised about the present status and future road map of livestock sector in Haryana. He categorically mentioned that about 20 per cent of the people are in BPL (Below Poverty Line) category. This segment of society can also be provided with a descent livelihood option by involving them in commercially oriented dairy farming. He emphasized for development of Murrah buffalo and our indigenous cow (Sahiwal, Tharpaker, Gir, Haryana, etc.) besides selective cross breeding.

During an open discussion, various issues of dairy sector such as processing of claim under Livestock Insurance Scheme, consulting farmers before framing of policies, technologies for by-products utilization, mastitis, labour problem, bio-gas, subsidies, creating of animal zones, cheap milk testing kit, etc. were raised and discussed at length. In this regard, Director, NDRI ensured that within 2-3 years technology may be perfected and farmers may get sex semen of indigenous breeds so that only female calves will be born. This will solve the problem of stray bull.

KRISHI VIGYAN KENDRA

Training Programmes organized

- In all, 38 training programmes (On-campus, Off-campus & study-cum-visits) on different aspects of dairy production and processing, crop production, crop diversification, bee-keeping and home science were organized in which 1064 farmers, women, rural youth and extension functionaries were imparted trainings.
- KVK organized 14 training programmes on Scientific Dairy Farming, Clean Milk Production, Commercial Dairy Farming, and Bee Keeping for 360 farmers, rural youth and extension functionaries sponsored by various state government departments including ATMA. In these training programmes, 143 trainees from Bihar, 105 trainees from Himachal Pradesh, 67 from Jharkhand and 40 from Gujarat were imparted training.
- KVK also organized 14 exposures cum study visits for 480 progressive farmers and farm women from different districts

of Uttar Pradesh, Madhya Pradesh, Gujarat, Chhattisgarh, Kerala, Rajasthan, and Himachal Pradesh.

- Various Animal Health Management activities were organized through Stockman centers in adopted villages of KVK. At these centers, 535 cattle and 543 buffaloes were artificially inseminated and 375 calves were born. Besides these, 23 animals were treated, 37 calves were dehorned and 19 animals were given infertility treatment.
- As per the directions from ICAR and initiatives from Government of India, KVK team visited various villages of Karnal District to educate farmers on recourse conservation, soil management and cleanliness apart from crop production and animal husbandry.
- KVK organized a special ten days orientation programme for the newly recruited six programme coordinators from Goa, Rajasthan, Tamil Nadu and Assam states at the KVK from 26th November, 2014 to 6th December, 2014.
- KVK also organized an Exposure cum study visit of 28 progressive farmers from Karnal and Kaithal district to Indo-Israel project at Gharaunda, Dist Karnal (Haryana) on 19th December, 2014 to expose them to protective cultivation of vegetables.
- KVK produced about 125, 50 and 30 qtls of paddy seed of varieties Pusa-44, Pusa-1121 and Pusa-1509, respectively at its crop production unit.
- KVK also produced and sold about 818.90 kg of table fish of different breeds at its fish demonstration unit.

Front Line Demonstrations (Summer Season – 2014)

- A total of 13 demonstrations of maize varieties African Tall and J-1006 were laid in 4.80 hectare area under irrigated condition. In the demonstration plots, an average fodder production of 501.4 and 457.0 qtl per hectare respectively was recorded.
- A total of 18 demonstrations of jowar variety Hybrid Red Chari (Multi cut) were laid in 6 hectare area under irrigated condition. In the demonstration plot, an average fodder production was found to be 689 qtl per hectare.
- A total of 17 demonstrations of Bajra variety FBC-16 of PAU Ludhiana were laid in 6 hectare area under irrigated condition. In the demonstration plot, an average fodder production was found to be 454 qtl per hectare.
- A total of 15 demonstrations of summer moong variety MH-421 of CCSHAU Hisar were laid in 6 hectare area under irrigated conditions to motivate farmers for crop diversification to improve the fertility of soil. In the demonstration plot, an average production was found to be 5.68 qtl per hectare.

EVENTS

ICAR Institutes-SAUs-Development Departments & Stakeholders Interface

ICAR-NDRI, being the hub Centre organized ICAR Institutes-SAUs-Development Departments & Stakeholders Interface on 18th October, 2014. The theme of the interface was

“Farmers and Industry Participation in Agricultural growth”. The participants to this interface were 06 Vice-Chancellors of State Agricultural Universities located in Haryana, Punjab and Himachal Pradesh, 08 Directors of ICAR institutes, 200 Farmers and 40 entrepreneurs. The two way focus of the interface was i)

To apprise the farmers about the new things happening in the Research Institutes/ Universities and Industry (ii) To share the experience and innovations adopted by farmers in the field of Agriculture, Animal Husbandry and Fisheries.

Prominent personalities such as Dr. A. K. Srivastava, Director & Vice-Chancellor; Dr. K.S. Khokhar, Vice-Chancellor, Chaudhary Charan Singh Haryana Agriculture University; Hisar, Dr. B. S. Dhillon, Vice-Chancellor, Panjab Agriculture University, Ludhiana; Dr. V. K. Taneja, Vice-Chancellor, GADVASU, Ludhiana; Major Gen. Shrikant, Vice-Chancellor, LLRUVAS, Hisar; Dr. K. K. Katoch, Vice-Chancellor, CSK Himachal Pradesh Krishi Vishwavidyalaya, Palampur addressed the farmers and entrepreneurs on this occasion.

Major Recommendations

- Strengthen the veterinary services; the rural youths should be trained as livestock technician who can serve the livestock farmers.
- Resource persons from other SAUs and ICAR Institutions should contribute to the Farm School since farmers have diverse needs and problems.
- Self help group creation on the model of NDRI should be demonstrated to others as a success story.



Director & Vice-Chancellor NDRI interacting with VCs of SAUs

Impact of Climate Change on Livestock Productivity and Health

Two days special group meeting of experts working in the area of climate change was jointly organized by National Dairy Development Board (NDDB), Anand (Gujarat) and ICAR-National Dairy Research Institute, Karnal.

Chief Guest, Sh. T. Nanda Kumar, Chairman, NDDB remarked that we need to have, "Climate Smart Livestock Policy" to mitigate the effects of climate change on livestock production. The recommendations made for adaptation to changed climate should be farmer friendly and be available in that particular region as Indian dairy farmer is most often dependent on the local resources. In addition, he said that the climate change may affect the quality and quantity of food across the world. He also released a book on mastitis in dairy animals.

Prof. Dr. A. K. Srivastava, Director and Vice Chancellor, ICAR-NDRI, Karnal, welcomed the delegates and highlighted the issue of Climate Resilient Indian Livestock Sector for its continuous contribution in nutritional security. He explained the role of climate change on productivity of dairy animals, feed and forage production and also discussed the adaptation and management strategies to alleviate the problem. There should be awareness programs and proper policies to minimize the impact of climate change on livestock health.

Dr. A. K. Sikka, DDG (ICAR-NRM), on this occasion also shared his views on livestock specific methane measurement and management system. He also emphasized on the shelter and manure management issues and said that these should be livestock and area specific. Any technology made for adaptation to changed climate should be cost effective, simple and farmer friendly.

During this event, Dr. M. R. Garg, NDDB, Anand, Dr. R. C. Upadhyay, ICAR-NDRI, Karnal, Dr. Philippe Lecomte, CIRAD, France, Dr. J. Slingenbergh, Ex Head of EMPRESS Animal Health, FAO, Rome, Italy; Dr. Harinder P S Makkar, Animal Production Officer, FAO, Rome, Italy; Dr. F. E. de Buissonje and Dr. Theun



Group of participants at the Interface



Prof. Dr. A. K. Srivastava, Director and Vice Chancellor, ICAR-NDRI, addressing the scientific community



Director NDRI conducting a session during the workshop



Group of participants

Vellinga, Wageningen University, took part in the round table discussions on different themes related to the impact of climate on livestock productivity and health. Delegates also visited Climate Resilient Livestock Research Center and other facilities of ICAR-NDRI, Karnal.

Major Recommendations

- There is a need of evaluation and documentation of GHG emissions in different agro climatic zones and on area specific feeding systems.
- There is a need of ration balancing, refining data collection, set up policies, delivery at farmers level to reduce emissions.
- The possibility of reducing unproductive/ low producing animals should be explored by improving breeds and species selection. The selection will facilitate improvement in productivity and emission reduction.
- There is a need of developing thermal index for Indian livestock so that information may be adapted in modelling for livestock sector, integrated in agriculture system modelling, and tagging.

Workshop on Probiotics in India: Way Forward

A "Workshop on Probiotics in India: Way Forward" was organized at ICAR-NDRI, Karnal under the aegis of DST (India)-MoBIE (New Zealand).

Dr. R. K. Malik, Joint Director (Res.) welcomed the guests. Prof. Harjinder Singh, Co-Director Riddet Institute, Massey University, New Zealand and Dr. S. K. Varshney, Director, International

Cooperation, Department of Science and Technology, Govt. of India, New Delhi participated in the workshop besides scientists from Punjab University, Chandigarh, Longowal Institute of Engineering & Technology, CIPHET Ludhiana, Yakult India Pvt. Ltd. New Delhi and NIFTEM, Kundli.

Prof. (Dr.) A. K. Srivastava, Director & Vice Chancellor, ICAR-NDRI, Karnal gave a presentation, highlighting that milk and milk products are the best matrix for the delivery of probiotics. He also mentioned that the antibiotics of the 20th century will be replaced by probiotics in 21st century, with beneficial micro-organisms in human gut.

Prof. Harjinder Singh highlighted the microencapsulation of probiotics in his presentation; he elaborated the mechanism of his patented technology of microencapsulation.

The theme of Indo-New Zealand research and academic collaboration was presented by Dr. S. K. Varshney. He shared all the scientific and research policies governed by Department of science and technology for the welfare of scientists and research scholars.

Presentations were also delivered on different topics by eminent scientists and industrialists including Mr. Arup Nag, Riddet Institute, Dr. S. K. Tomar, ICAR-NDRI, Dr. Geeta Shukla, PU, Chandigarh, Dr. Neerja Hajela, Yakult-Dannone and others about probiotics in Indian context.

Entrepreneurship Development through BPD

Business Planning and Development (BPD) unit of ICAR-NDRI has organized seven training programmes from October, 2014 to December, 2014. Fifty-five trainees participated in two Entrepreneurship Development Programmes (EDP) on "Commercial Dairy Farming". Fourteen veterinary officers from Tripura state were trained in the area of Infertility management in dairy animals" in two batches. A group of 20 youths from Assam underwent "Hands on Training in value added dairy products". EDP programme on "Cheese manufacture" was attended by seven young entrepreneurs from different parts of the country. Under the Business Incubation programme, M/s Mishti Farmer Producer Company Ltd., Karnal launched the "Bajralassi" and other dairy products in Karnal market. The company has a strong network of 250 dairy farmers.



Group of participants at the workshop on probiotics

1st Dr. Verghese Kurien Memorial Oration on National Milk Day

ICAR-NDRI conferred "1st Dr. Verghese Kurien Memorial Oration Award" on Dr. (Ms.) Amrita Patel, Ex-Chairperson, NDDB, on the occasion of National Milk Day organised on 26th November, 2014. The function was presided over by Dr. A. K. Srivastava, Director and Vice Chancellor, ICAR-NDRI. Dr. Verghese Kurien Memorial Oration award has been instituted by ICAR-NDRI in the fond memory of Dr. Verghese Kurien, the undisputed milkman of India, who is remembered for his vast contributions to the field of Dairy science and is honored as the architect of 'White Revolution'.

Dr. (Ms.) Amrita Patel, while delivering the Oration to commemorate the contributions of Dr. Kurien to Dairy science, said that the management of livestock requires a holy approach, which also includes the judicious use of feed and fodder that can reduce the emission of greenhouse gases. She also greatly appreciated the contributions of ICAR-NDRI in dairy research and developmental programmes in the country. In her tribute to Dr. Kurien, She said that the most important way to serve the nation is to serve our farmers.



Dr. (Ms) Amrita Patel, Ex-chairperson, NDDB Anand receiving the 1st Dr. Verghese Kurien Memorial Oration Award

World Food Day

On the occasion of World Food Day, College of Food Processing Technology and Bio-energy of Anand Agricultural University

organised a two days National Seminar-cum-Tech Fest "ADROIT 14" on "Food Quality and Safety- New Technologies and Applications", during 15th -16th October, 2014 at Anand. There was an opportunity for young minds to enhance their abilities and expand their horizon of knowledge, by showcasing their innovations, ideas and skills through events such as Mech-art, Poster presentation, Food Quiz, New Product development, Ad-mad, etc. Three M.Tech students – Mr. Amir Vahora, Mr. Bhavesh Baria and Mr. Ravi Prajapati - represented National Dairy Research Institute, Karnal in various events. The team comprising of Mr. Amir Vahora and Mr. Ravi Prajapati was ranked first among the 35 participating teams in the Food Quiz. Ravi Prajapati bagged the second prize in the Poster Presentation with his poster on "Design and Development of In-Line System for Mechanized Production of Traditional Indian Dairy Products". During the event of New Product development, the NDRI team introduced a product "Beet-Jamun", which received a good response from the visitors and participants.



Student of NDRI Deemed University receiving award

NDRI Staff and Villagers Joined Together to Make India Clean

ICAR-NDRI undertook a noble initiative in starting Prime Minister's mission of making India completely clean by 2019 which completes 150 years of birthday of Father of Nation Mahatma Gandhi on 8th October, 2014. The staff and students of Dairy Extension Division joined together with villagers of Kulwehri in Karnal district in conducting cleanliness campaign by involving the villagers including women, youth and



A view of cleanliness campaign in the village of Kulwehri

elected local body representatives. Mr. Surinder Kumar, village president, scientists and students of Dairy extension actively participated in the cleanliness campaign. Both villagers and staff of NDRI took oath that “we will practise cleanliness from our personal life to home and whole community now onwards” and make a clean and healthy nation by 2019. Chaupal of the village, streets, main roads, inside roads/lanes were cleaned by the villagers and staff of NDRI.

Rashtriya Ekta Diwas

Following the directives of the Ministry of Home Affairs, Govt. of India, the birth anniversary of Sardar Vallabhbhai Patel was observed as “Rashtriya Ekta Diwas (National Unity Day)” on 31st October, 2014 at ICAR-NDRI, Karnal. Since, the occasion provided an opportunity to re-affirm the inherent strength and resilience to withstand the actual and potential threats to the unity, integrity and security of our nation, therefore, a pledge taking ceremony followed by collective singing of the National Anthem. The Pledge was administered by Dr. A. K. Srivastava, Director and Vice-chancellor, ICAR-NDRI, Karnal. All the Scientists, Officers, Staff and Students of the Institute attended the Pledge taking ceremony and also ran for the unity on this occasion.



A view of campaign run for unity at NDRI Campus

17th IJSC Meeting

The 17th IJSC Meeting was held on 5th November, 2014 under the Chairmanship of Dr. A. K. Srivastava Director, NDRI, Karnal. All agenda items were discussed critically in light of the administrative rules and regulations. The following recommendations were emerged:

- Recognition of hospitals for specialized treatment.
- Construction of toilet at Cattle Yard.
- Procurement and distribution of liveries of staff in time.
- Installation of water cooler nearby LWO Office.
- Repair of A&B type quarters and flush systems.
- Replacement or renovation of water store tank of NDRI quarters.
- Repair or replacement of dust bins at residential area.
- Medical bills approved by private recognized Hospitals may be reimbursed and these medical bills should not be placed in medical Screening Committee.
- Meeting of Departmental Promotion Committee (DPC) of Technical Staff twice in a year for timely promotion.

- Construction of vehicle parking shed at Cattle Yard.
- Issues of certificates to the children participating in the sports/cultural activities conducted by NDRI Staff Club.
- Increase of suit length of ladies/gents from 8.60 meter to 9 meter and 4.50 meter to 5 meter respectively for making full sleeve dresses.
- Grant of honorarium to MTS/Group ‘D’ officials in accordance with office memorandum No. 17011/01/2011–Estt. (AL) dated 17th April 2013.
- Construction of children park at SRS, Bangalore.



Group of IJSC members

Chairman IJSC, assured the house for implementing the above recommendations with immediate effect. It was decided that the next meeting of IJSC would be held at the Regional Station i.e. SRS Bangalore.

Training on Value Addition in Milk

Business Planning & Development (BPD) Unit of NDRI organized training on “Value addition in milk” for farmers group, Assam during 14th -18th October, 2014.

Food Quiz Contest

Students of Dairy Technology Division participated in 11th National Dairy Products Judging Contest and 7th Dairy and Food Quiz Contest held from 6th-7th October, 2014 at SMC College of Dairy Science, Anand Agricultural University, Anand, Gujarat. Our team secured First Prize in both the contests.

TRANSFER OF TECHNOLOGY

Mass Scale Commercialization of Technologies

MoUs were signed for commercialization of following technologies

1. A PCR based method for differentiating Cow and Buffalo milk.
2. A PCR based method for differentiating A1 and A2 milk.
3. Sugar tolerating lactic culture for preparation of Misti Dahi.
4. Strip based Test for Detection of Maltodextrin in Milk.
5. Strip based Test for Detection of Neutralizers in Milk.
6. Strip based Test for Detection of Added Urea in Milk.
7. Strip based Test for Detection of Hydrogen Peroxide in Milk.
8. Strip based Test for Detection of Glucose in Milk.

TECHNOLOGY TRANSFER



Sugar tolerating Lactic Culture for preparation of Mishti Dahi to M/s Namaste India Foods (P), Kanpur



A PCR based method for differentiating A1 and A2 milk and Cow and Buffalo milk to A2-Milk Research Corporation



MoU signed for commercialization of "Strip based test for adulteration-detection in milk" to Rajasthan Electronics and Instruments Limited during the 233rd Governing Body Meeting of ICAR, New Delhi



Bajra Lassi to Mishti Farmer's M/s Producers company Limited, Karnal



High Protein iron fortified biscuit to a woman entrepreneur M/s Santosh Yadav, Karnal

The technologies were purchased by (i) A2-Milk Research Corporation, Raipur, Chhattisgarh, (ii) Namaste India Foods Pvt. Ltd. Kanpur. (iii) Rajasthan Electronics and Instruments Limited. Jaipur (iv) Mother Dairy Fruit & Vegetable Private Limited. Delhi.

The total amount realized from sale of technologies was **Rs 25,39,336 /-**

- Dairy Technology Division transferred three technologies viz. to Mishthi Bajra lassi, Farmer Producer Co. Ltd., Karnal; high

protein iron-fortified biscuit Mrs. Santosh Yadav, Karnal; and high protein iron-fortified bajra biscuit Sarvatham Care Ltd. Secunderabad, respectively.

- A Technology for production Misti Dahi having improved body and texture using well characterized fast acidifying high sugar tolerating lactic culture was transferred to Namaste India Foods Pvt. Ltd., Kanpur-UP through MOU exchange on 1st November 2014.

Patent Granted

Patent granted for A Novel Process of Sporulation, Activation and Germination in Thermophilic Bacteria for Rapid Detection of Antibiotic Residues in Milk.

Kumar N., Patil G. R., Rane S., Malik R. K. (2014). **Indian Patent No. 264145 dated 9.12.2014.**

HONOURS/AWARDS

- **Mr. Rohit Sharma**, Ph.D. student under **Dr. Rajeev Kapila**, Principal Scientist, Animal Biochemistry Division, was awarded **"Young Investigator Award"** for oral presentation entitled **"Administration of milk fermented with probiotic *Lactobacillus fermentum* and *L. rhamnosus* alleviates immunosenescence, improves antioxidant capacity and resists pathogenic *E.coli* infection in aging mice"** during 2nd Annual Conference of Probiotic Association of India and International Symposium on "Probiotics and Microbiome : Gut and Beyond" on 3rd - 4th November, 2014 at India Habitat Centre, New Delhi.
- **Ms. Vamshi Saliganti**, Ph.D. student under **Dr. Rajeev Kapila**, Principal Scientist, Animal Biochemistry Division was awarded **"Best Poster Award"** entitled **"*L. rhamnosus* (MTCC 5897) fermented milk administration to mothers and offspring during suckling weaning transition alleviates ovalbumin induced allergy in newborns"** during 2nd Annual Conference of Probiotic Association of India and International Symposium on "Probiotics and Microbiome : Gut and Beyond" on 3rd - 4th November, 2014 at India Habitat Centre, New Delhi.
- **Ms. Rashmi, H. M.**, Scientist, Dairy Microbiology Division was conferred **"Young Investigator Award (First award of Rs. 10,000)"** and a citation for her paper entitled **"Exploring probiotics and postbiotics for their potential to stimulate GLP-1 secretion from enteroendocrine cells"** by **Mallapa, R.H., Panwar, H., Singh, R., Batish, V. K. and Grover, S.** (2014) at 2nd Annual Conference of PAi and International Symposium on "Probiotics and Microbiome : Gut and Beyond", New Delhi on 3rd - 4th November, 2014. The award carried a cash prize of Rs. 10,000 and a citation.
- **Ms. Namita Rokana**, Ph.D. student, Dairy Microbiology Division was given **"Best Poster Award (Rs. 2000)"** for poster entitled **"Modulation of intestinal barrier function to alleviate *Salmonella* infection in mice by oral administration of fermented milks produced with *Lactobacillus plantarum* Lp91"** by **Rokana, N., Singh, R., Mallapa, R.H., Batish, V. K. and Grover, S.** (2014) at 2nd Annual Conference of PAi and International Symposium on "Probiotics and Microbiome : Gut and Beyond", New Delhi on 3rd - 4th November, 2014. The award carried a cash prize of Rs. 2,000 and a citation.
- **Ms. Manpreet Kaur**, Ph.D. student under **Dr. A.K. Puniya**, Principal Scientist, Dairy Microbiology Division received **"Best Poster Award"** during "5th International Conference on Advances in Food Technology and Health Sciences (ICFTHS-2014)" organized by "International Institute of Food and Nutrition Sciences (IIFANS)" from 15th -16th October, 2014 at Jawaharlal Nehru University, New Delhi.
- **Ms. Aishwarya Panicker, Mr. Pradip Behare, Dr. A. K. Mohanty**, Dairy Microbiology Division received **"Best Poster Award"** for their poster entitled **"Differential Proteome analysis of putative probiotic *Lactobacillus Fermentum* BIF 19 strain"** during 2nd Annual Conference of PAi and International Symposium on "Probiotics and Microbiome : Gut and Beyond" at India Habitat Centre, New Delhi from 3rd - 4th November, 2014.
- **Dr. Y. S. Rajput**, Head Animal Biochemistry and **Dr. M. S. Chauhan**, Principal Scientist selected as NAAS Fellows from the year 2015.
- **Dr. A. Kumaresan**, Sr. Scientist (AGRO) selected as NAAS Associate from the year 2015.



Ms Namita Rokana, Ph.D, Student receiving Best Poster Award from Director, Vice-Chancellor, NDRI, Karnal



Ms. Rashmi, H. M., Scientist, Dairy Microbiology Division receiving Young Investigator Award from Director & Vice-Chancellor, NDRI, Karnal

PERSONALIA

Joining

- Dr. I. K. Sawhney, Principal Scientist joined as Acting Head, Dairy Engineering Division at NDRI, Karnal w.e.f. 01.10. 2014.
- Dr. J. P. Sehgal, Principal Scientist joined as Acting Head, Dairy Cattle Nutrition Division at NDRI, Karnal w.e.f. 17.10. 2014.
- Dr. B. S. Chandel, Principal Scientist joined as Acting Head, Dairy Economics Statistics & Management Division at NDRI, Karnal w.e.f. 04.12. 2014.

Promotions

- Sh. Bhagwan Dass, Assistant promoted as AAO at NDRI, Karnal w.e.f. 01.10.2014.

Retirement

- Mr. Dhanu Sherpa Technical Officer (F/FT), Hospitality retired from Council's service on 31.10.2014.
- Mr. Sarwan Kumar, Sr. Technical Officer (W/S), Maintenance Section retired from Council's service on 30.11.2014.
- Mrs. M. K. Vedavathi, Assistant Chief Technical Officer, SRS, Bangalore retired from Council's service on 30.11.2014.

- Mr. Ramesh Chand, Assistant Chief Technical Officer, (F/FT) Farm Section retired from Council's service on 31.12.2014.
- Mr. G. D. Joshi Chief Technical Officer (Photo), Communication Centre retired from Council's service on 31.12.2014.

Transfer

- Dr. (Mrs.) Anupama Mukherjee, Sr. Scientist joined NDRI Karnal after her transfer from NRC-M, Jharnapani, Mediziphema, Nagaland on 19.12.2014.

DISTINGUISHED VISITORS

16.10.2014	Two member delegation from Sri Lanka Poultry Development Company, (Private) Limited, 45-56, 3 rd Floor Nawam Mawatha, Colombo-2. Mr. H. L. T. Sera, Secretary of Ministry of Livestock Development, Sri Lanka. Mr. Mohamed Cader, Chairman
14.11.2014	Prof. Richard Ipson alongwith two other senior faculty member /HOD's from University of Copenhagen, Denmark.

SOUTHERN CAMPUS, BANGALORE

EXTENSION ACTIVITIES

Visitors/ Advisory Services

During the period under report, 110 visitors visited the institute in three batches comprising students from various educational institutes, and entrepreneurs of southern region. The visitors were taken round the Institute to various sections as per their needs and were explained about the ongoing research and extension activities. Advisory services / technical advice were rendered to needy clientele during personal visits to the Institute.

Exhibition

SRS, Bangalore participated in Krishimela 2014 organised by UAS, Bangalore held during 19th - 21st November, 2014 at GKV Campus, Bangalore. NDRI stall depicted innovative and educative information on dairy production & processing technologies, indigenous breeds of South India and indigenous dairy products of the region for the benefit of the clientele groups. The exhibition was well attended by farmers, farmwomen, rural youth and entrepreneurs from all over Karnataka.

Dairy Education at Farmers' Door

As a new initiative at SRS, the 'Dairy Education at Farmer's Door', was organized and visits were made by the multidisciplinary team on Second Saturdays to villages in Bangalore North Taluk viz. Kalkere, Channasandra and Heerehalli during October to December 2014 respectively. Necessary technical advice was provided on various aspects of scientific dairy farming, green fodder production, clean milk production and scientific dairy animal management aspects to the needy clientele group at their doorsteps.

Clean India Campaign was held on 11th October, 2014 at Kalkere Village of Hoskote Taluk where emphasis was made on clean milk production by awareness creation through expert talks and distribution of brochures on clean milk production.

EVENTS

Clean India Campaign

To commemorate the birth anniversary of Mahatma Gandhi Ji, Clean India Mission was initiated on 2nd October 2014 at SRS of NDRI. Staff and students of the Institute assembled at the office and took oath on "Clean India" initiatives. As a part of the programme, Scientists, Technical Staff, Administrative Staff, Skilled Support Staff and students took part in cleaning the office premises, laboratories, hostels, cattle yard, roads etc. The programme was executed with all earnest & dedication and it was a great feeling to all.

World Food Day

World Food Day was celebrated on 16th October, 2014 and a technical session on the theme 'Emerging Statutory and Regulatory Issues for Food Industry' was organized at SRS, Bangalore in association with the Bangalore chapter of AFST (1). Dr. R. Jayaraman, Former VP (R&D) Britannia Industries, Dr. Bhuvanendra Kumar, Novozymes, Bangalore, Dr. Sachin Achintalwar, Senior Manager, Regulatory Affairs, AB Mauri India Pvt. Ltd., Dr. M. Anuradha, Director Research and Biotech Finishing School participated in the deliberations. Dr. Satish Kulkarni, Head, SRS Presided over the function.

Pre-placement Workshop

A pre-placement workshop on soft skills development was held on 22nd November, 2014 to help the current batch of students

in their career development. Technical consultants from the industry as well as HR consultants mentored the students at SRS on various aspects of placement.

Hindi Week Celebration

Hindi Week was celebrated at SRS, Bangalore from 22nd – 30th September, 2014. During the celebrations, hindi competitions were conducted for the staff members as well as for their children and students of the Station. Hindi Day was celebrated at the Station on 30th October, 2014. The occasion was graced by Sri. D. N. Shyam Prasad, Director, Airport Authority of India, Bangalore. Dr. Satish Kulkarni, Head, NDRI, Bangalore presided over the function. Prizes to the winners/runners of the competitions were distributed by the Chief Guest.

Visit of Deputy Director General (AS), ICAR

Dr. K. M. L. Pathak, Deputy Director General (AS), ICAR along with Dr. A. K. Srivastava, Director, NDRI Karnal visited SRS of NDRI on 18th of December, 2014. A meeting of Scientists, Technical Staff & Ph.D. Scholars of the station was convened. Dr. B. Surendra Nath and Dr. P. Heartwin highlighted the salient achievements of the section and activities of the recent period. On the occasion, DDG released the Course Manual of the Engg. Section & Publication by Dairy Production section. DDG also inaugurated the Facebook page of the SRS of NDRI. Later, Dr. A. K. Srivastava had detailed meetings with Scientists, Staff and Students, where he gave a presentation on the Vision 2050 of NDRI.

EASTERN CAMPUS, KALYANI

RESEARCH

Effect of Supplementation of Area-specific Mineral Mixture (KALMIN) on Productive and Reproductive Performance in Black Bengal Goats

(M. K. Ghosh, A. Chatterjee, M. Mondal, M. Karunakaran, C. Bhakat, T. K. Dutta)

The present study was conducted to observe the effect of area specific mineral mixture (ASMM) on growth performance, body condition score, puberty, blood metabolites (Glucose, NEFA and AAN) and enzymes (SGOT and SGPT) in Black Bengal goats. For the purpose, goats were divided into four groups viz. Group I, II, III and IV supplemented with 0, 1, 2 and 3 g/day/animal ASMM, respectively. It was inferred that area specific mineral mixture @2.0g/day/animal in growing Black Bengal goats may be of great use for enhancement of growth and age at puberty.

Rumen Fermentation Pattern and Ciliate Protozoal Population in Growing Crossbred Cattle Fed Animal Feed Grade Wheat alongwith Paddy Straw

(D. Chandrashekhar Keshav, A. Santra, A. Mandal, S. K. Das and T. K. Dutta)

Quality of a good sizable proportion of wheat grain deteriorated during storage at FCI due to lack of proper storage facility and declared unfit for human consumption which is designated as animal feed grade wheat. Therefore, experiments were conducted to study the rumen fermentation pattern and ciliate protozoal population in growing crossbred cattle fed graded level of animal feed grade wheat. Twelve growing Jersey crossbred male calves about 7-8 months of age, were randomly divided into 3 groups (G1, G2 and G3) of 4 animals each, so that average body weight of each group was similar. These animals were maintained under individual feeding on roughage (paddy straw) and concentrate based ration under stall feeding to meet out maintenance and growth (600 g average daily gain) requirement (NRC, 2001). Roughage and concentrate mixture were offered separately and their ratio was tried to maintain at 40:60 throughout the experimental period. 3 types of iso-nitrogenous concentrate mixtures (C1, C2 and C3) were prepared in which, maize grain was serially replaced by animal feed grade wheat at 0, 30 and 50% level in concentrate mixture C1, C2 and C3, respectively. Animal feed

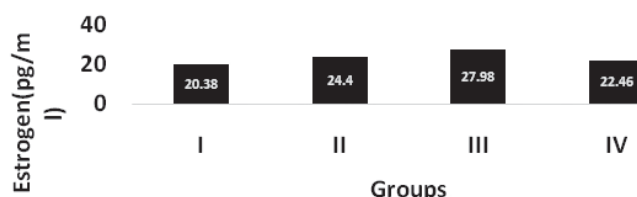
grade wheat (AFW) which was used in the present experiment, contained 55 to 70 % sound grains.

It was concluded that animal feed grade wheat may be used in the ration of growing cross-bred calves by replacing maize grain to formulate economize ration.

Effect of Area-specific Mineral Mixture (KALMIN) Supplementation on Endocrine Parameters in Prepubertal Goats

(M. Mondal, M.K. Ghosh, A. Chatterjee, M. Karunakaran, C. Bhakat, T. K. Dutta)

The present study was undertaken to find out the effect of area specific mineral mixture (ASMM) on endocrine parameters during pubertal process in growing Black Bengal goats. It was revealed that progesterone level at starting of experiment differed significantly ($P < 0.05$) among different groups, except at day 30 and 60. From starting to end of experiment, value of progesterone showed inclined trend. In conclusion, progesterone level varied with different level of area specific mineral supplementation. Supplemented groups showed significantly higher level of progesterone hormone in comparison with non-supplemented group. Plasma progesterone concentrations were found to be highly correlated with onset of puberty.



Plasma estradiol-17 β concentrations (mean \pm SEM; pg/ml) in different groups at various time points

EVENTS

Scientists-Dairy Industry Partners Interface Meet

ERS-NDRI-Dairy Industry Meet was organized on 27th October, 2014 at ERS-NDRI, Kalyani, Nadia, West Bengal under the Chairmanship of Prof. (Dr.) A. K. Srivastava, Director, NDRI to discuss the various issues and challenges of dairy industry in the eastern part of India. Scientists' from NDRI, Karnal and ERS-IVRI

and other researchers. State Livestock officers were present in the meet. Representative from Kishan Milk Union, Krishnagar, Ichamati Milk union, Red Cow Dairy Ltd., Kolkata, Natures Dairy, Hooghly, NEST Dairy, Kolkata, Metro Dairy, Kolkata, and other Dairy industry partners, NABARD, Kolkata, NGOs, and progressive farmers from West Bengal also participated in this Industry meet. The keynote address pertaining to issues and challenges of dairy industry at this region was delivered by Prof. (Dr.) A. K. Srivastava, Director, NDRI. He informed about various technologies available at NDRI, Karnal and these technologies were presented afterwards by the scientists of NDRI, Karnal to participant from Industries with a focus on commercial transfer of technologies.

Brain Storming Session on Breeding Policy of ERS, NDRI

A Brain Storming Session on "Breeding policy of ERS, NDRI herd" was organized on 28th October, 2014 at ERS-NDRI, Kalyani, Nadia, West Bengal under the chairmanship of Dr. R. K. Malik, Joint Director (Research), NDRI, Karnal. Experts from NDRI, Karnal, ERS-IVRI, Kolkata, West Bengal University of Animal and Fishery Sciences, State Livestock sectors actively participated to frame out the new breeding policy of ICAR-NDRI-ERS herd.



Midterm IRC Meeting

The midterm IRC meeting was held at ERS-NDRI, Kalyani on 20th Oct, 2014 under the chairmanship of Dr. G.R.Patil, Joint Director (A). Dr. R. K. Malik, Joint Director (Research), NDRI co-chaired the meeting. The progress of the ongoing projects was presented by the respective principal investigators.

Dairy Mela - 2014

Dairy Mela was organized as a part of Golden Jubilee Celebration on 11th December 2014, in the adopted village Muratipur (near Kalyani, West Bengal). Dr. G. R. Patil, Joint Director (Academic), NDRI chaired the celebration. Approximately 200 people including Livestock farmers, Students, Trainees, Scientists, Technicians and Local officials attended the celebrations. Various programmes were organized throughout the day viz. Cattle Health- cum- Fertility Camp, Cattle Show and Judging, Distribution of mineral mixture to the livestock owners, Display of Transferable Technologies through Posters, Quiz on Dairy Cattle Management, Distribution of bilingual (English and Bengali) Technical Folders to the dairy farmers, distribution of prizes to the best cattle owners /dairy farmers etc.

Golden Jubilee Meet Celebrated

Eastern Regional Station of National Dairy Research Institute (ERS-NDRI), Kalyani, Nadia celebrated the Golden Jubilee Meet on 13th December, 2014, under the chairmanship of Prof. (Dr.) A. K. Srivastava, Director, NDRI. The theme was Dairying in Eastern India: Opportunities and Challenges. Representative from Milk Union, ERS-IVRI, Kolkata, CEO and Director, PBGS and ARD, WB Govt., Director, ZPD-II, Kolkata, Dean, F/O Dairy Technology, Ex-Dean, Vet. faculty, WBUAFS, and other dignitaries from ICAR institutions and universities and farmers from different districts also participated in this celebration. The chairman released the golden jubilee 'SOUVENIR' and 'ERS-NDRI at a Glance' on this occasion. The achievements of ERS-NDRI for the last 50 years were presented by Dr. T. K. Dutta, Head, ERS. In his key note address, the Director, NDRI stressed on efforts to be made by the ERS team for the development of technologies for higher milk production for nutritional and economic security of small and marginal dairy farmers of this region. He has also emphasized on the practices to be followed by the farm women and children for their nutritional security.



Dr. A. K. Srivastava, Director & Vice-Chancellor, NDRI releasing a Golden Jubilee Souvenir and ERS-NDRI at a Glance

FEATURE ARTICLE

Current Status of Embryonic Stem Cells Technology in Buffalo

(M.S. Chauhan, R.S. Manik, P. Palta, S.K. Singla and M.K. Singh)

Embryonic stem cell (ES) cell lines were first established in mice by Evans and Kauffman in 1981 by culturing ICM in the presence of murine embryonic fibroblast (MEF) feeder layer and leukemia inhibitory factor (LIF), and since then they have been used extensively for studying the mechanism of pluripotency and cell differentiation. Upon removal of LIF from the culture medium, they cease to express pluripotency markers such as Oct 4, Nanog, Sox, rapidly losing the capacity

for self-renewal, differentiating into a variety of cell types and forming embryoid bodies. Well-characterized ES cell lines have been derived only from mice. An important point in the production of ES cells is the criteria used to define them. These include morphological similarities to ES cells of other species, indefinite undifferentiated proliferation *in vitro*, potential to differentiate into three embryonic germ (EG) layers and specific characteristics detected through immunohistochemical and molecular markers. Attempts to establish stem cell lines have been made in a number of mammalian species (Toyoka *et al.*, 2003., Sharma *et al.*, 2011).

Isolation and Characterization of Embryonic Stem Cell

The ability of buffalo ES cells produced to form random and specific cell types through spontaneous and directed differentiation, respectively, confirmed their pluripotency. Study showed the presence of surface markers SSEA-1, SSEA-3, SSEA-4 and intracellular markers OCT-4, SOX-2 and NANOG on buffalo ES cells both by immunofluorescence and RT PCR (Sharma *et al.*, 2013, Zandi *et al.*, 2013). At NDRI, Karnal, buffalo ES cells have been isolated from *in vitro* produced blastocysts. The ability of buffalo ES cells to form embryoid bodies (EBs) and to spontaneously differentiate to neuron cells, muscular cells and epithelial cells was demonstrated by our group (Verma *et al.*, 2007, Anand *et al.*, 2009) at NDRI, Karnal. Developed buffalo ES cells express *NF-68* and *NESTIN*, specific for ectodermal lineage; *BMP-4* and α -skeletal actin, specific for mesodermal lineage and α -fetoprotein, *GATA-4* and *HNF-4* specific for endodermal lineage confirming the ability of ES cells to differentiate to all the three germ layers.

Many other transcription factors, besides OCT4, NANOG and SOX2 appear to maintain ES-cell pluripotentiality in other species (Saito *et al.*, 2003). Some of these include c-Myc, Rex1, B-Myb, Foxd3, Gbx2, UTF1, Fgf4, Pem, Sall4, and Zfx. However, many of these factors are not exclusively expressed by pluripotent ES cells and can be found in other cell types. Oct4, Sox2, and Nanog has been recognized as the regulatory core activating genes critical for self-renewal and to repress genes initiating differentiation, thus, controlling ES-cell pluripotency. The exogenous supplementation of growth factors is very species specific e.g. for human ESCs, FGF-2 is essential but for murine ES Cells, LIF is able to support their undifferentiated state (Nicholas *et al.*, 2009).

Application of ES Cells in Farm Animals

ES cells have varied applications for farm animals as well as humans, like enabling studies on the fundamental events in embryonic development, production of therapeutic delivery systems, gene targeting, and regenerative medicine. Production of pluripotent ES cells from farm animal species might have a big influence on the genetic modification of these animal species. Availability of ES cells is expected to be especially useful in cloning technology, gamete (oocyte, sperm) formation. Also, in the context of gene targeting, use of ES cells could overcome current limitation on efficient gene transfer by providing an abundance of stem cells to be genetically manipulated by using conventional recombinant DNA techniques.

Somatic cell cloning through nuclear transfer, to produce healthy cloned animals, remains remarkable but highly inefficient and prone to epigenetic errors. The high rates of mortality throughout development create serious animal welfare issues, which limit the acceptability of somatic cloning (David *et al.*, 2003). In animal breeding, improved genetic markers, correlated to specific livestock production traits, will provide confidence in cloning selected embryos and their derivatives, especially undifferentiated embryonic stem cells. This will enable rapid dissemination of the most recent elite genotypes to avoid the genetic lag associated with cloning adults. Furthermore, for the production of transgenic animals, embryonic stem cells might also be beneficial, because they are more amenable to precise genetic modifications and result in higher cloning efficiencies than somatic cells in the mouse. It can be said that for agricultural applications, embryonic stem cell cloning will ultimately prove more useful than somatic cell cloning.

Normal Physiology of Cloned Buffalo 'Garima-II' Produced from Embryonic Stem Cell

It is now established that transgenic animals having foreign gene, have played and anticipated to continue to play an important role in pursuit of knowledge for understanding the genetic basis of human disease. There is an ever increasing need for animal models instead because of the complexity of biological processes that form the basis of most diseases. Moreover, the pluripotency of ES cell can also be judged by developing ES cell into whole animal. Having realized the potential of embryonic stem cells, NDRI achieved successful cloning using Embryonic Stem Cell as a donor cell and produced a female buffalo calf through 'Hand-guided Cloning Technique'. The calf named 'Garima-II' was born at NDRI, Karnal on August 22, 2010. The ES cell used for producing Garima-II was from an ES cell colony derived from buffalo blastocysts (stage of embryo when it gets preimplanted in the uterus) generated using *in vitro* fertilization (IVF) technique.

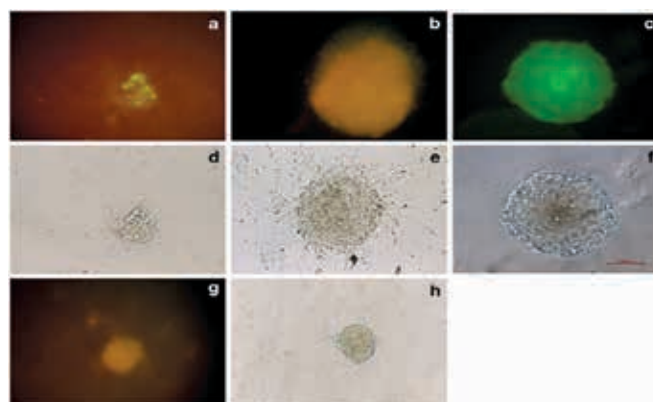
Garima II produced through cloning has absolutely normal physiological processes as has been proved by the successful delivery of offspring female calf named as "Mahima" on January 25, 2013 and another female calf "Karishma" in December, 2014 after Garima-II was inseminated with frozen-thawed semen of a progeny tested bull.



'Karishma' a second normal calf born from cloned buffalo Garima-II

Buffalo Spermatogonial Stem Cells

Spermatogonial Stem Cells (SSCs) have the unique ability to self-renew and to produce progeny that undergo differentiation to spermatozoa. The SSCs were isolated from testes of 3–7 months old buffalo calves and disaggregated by double enzymatic digestion. Mixed population of isolated cells were then plated on Datura stramonium agglutinin (DSA) lectin coated dishes for attachment of Sertoli cells. Spermatogonial cells isolated have spherical outline and two or three eccentrically placed



Buffalo type-A spermatogonial colonies: (a, d) OCT 4 was detected within the colony cells, (b, e) Positive expression of CD-9, (c, f) colonies showing SSC specific marker i.e. Dolichos biflorus agglutinin, (g, h) SSEA-1 was also seen in the colonies.

nucleoli, created a colony after proliferation during first week or immediately after passage. After 7–10 days of culture, the resulted developed colonies of spermatogonial cells expressed the spermatogonial specific genes like Plzf and VASA and other pluripotency related markers viz. alkaline phosphatase, DBA, CD9, CD90, SSEA-1, OCT-4, NANOG and REX-1. (Kala *et al.*, 2012)

Major Outcome by Buffalo Embryonic Stem Cell Research

- Buffaloes 4 embryonic stem cell (ES) lines have been developed and characterized.
- Embryonic stem cell research translated into cloned buffalo calf 'Garima-II'
- GFP expressed transgenic embryos using ES cell as donor cell were produced.
- Buffalo Oct-4 and NANOG gene was cloned and characterized.
- Transfection of NANOG, LIF and FGF2 gene construct into buffalo fibroblast cell and ES cells and maintained their pluripotency for longer time.
- Spermatogonial stem cells are maintained under *in vitro* culture system.

Conclusion

The generated ES cell lines will have great potential/use in buffaloes. These ES cells have very varied applications like enabling studies on the fundamental events in embryonic developmental, production of therapeutic delivery systems, regenerative medicine, etc. The use of ES cell technology in farm animals may overcome current limitation on efficient gene transfer by providing an abundance of stem cells to be genetically manipulated by using conventional recombinant DNA techniques. Besides these uses, ES cells provide a powerful tool for the studies of early embryonic development, gene targeting, cloning, chimera formation and transgenic animal production. Because of their potential use for targeted gene manipulation, ES cells could have enormous agricultural, biomedical and pharmaceutical applications through cloning and transgenesis.

Spermatogonial Stem cells have great potential for self proliferation and then differentiation ultimately leading to formation of spermatozoa. Spermatogonial stem cells are the only adult stem cells that contribute genes from one generation to the next. High genetic merit semen of exotic bulls could be produced from indigenous bulls in harsh tropical climate. Also, transgenic animals could be produced by transfer of transgenic donor stem cells. Furthermore, these cells will also provide an opportunity to preserve the genetic material of valuable males.

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