

## From the Director's Desk

Dairy farming is an integral component of the Indian farming system having strong synergy with crop production systems. The share of the livestock sector in the national and agricultural GDP is about 4.5% and 25.8%, respectively. Milk occupies the prime position among livestock output as share of value of output of milk group in the total livestock sector is about 67%. In India, livestock is the main source of livelihood to the 15-20% landless rural families and 80% of the land-owners who are small and marginal farmers. Dairying is, therefore, an avenue for productive employment for the farmers' family.

Commercial Dairy Farming has emerged as enterprise and offers enormous opportunities for gainful employment and sustainable means to augment farmers' income. Value addition to milk is definitely the most effective way to increase higher margins to the processor and better returns to the farmers. Scattered milk production system coupled with lack of adequate cold chain infrastructure adds to the problem of milk procurement and transportation of quality milk to the points of processing. As such the farmers do not have access to the market or means to transport the milk and are, therefore, dependent on middlemen who collect the milk from them and sell to consumers. Such an arrangement often leads to reduced milk price being paid to the farmers and middlemen pocketing major share of the profits. The entire risk in this value chain is borne by the farmers.

Rapid urbanisation and concomitant growth in demand for value added dairy products have created greater opportunities for new dairy processing units. A holistic dairy enterprise where on-farm processing is also a part of the venture holds a viable solution to meeting this demand and increasing farmers' income. Organizing farmers into groups as Farmer Producer Organizations (FPOs) carrying out all activities of agriculture following the principles of cooperative organization, is an effective method to deal with lack of access to inputs, technology and marketing. These organizations collectively manage procurement, processing, packaging and marketing of their produce. There are many such model FPOs in place including some supported by ICAR-



NDRI. The members of such FPOs have more control on procurement, processing, quality assurance and retailing of their produce. There are obvious advantages of processing the milk at or nearby the farmers' premises, rather than selling it to middlemen as it takes care of the problems of inadequate cold chain facilities and raw milk transportation.

Most of the milk sold currently at the farmers' doorsteps is in unprocessed liquid form having limited profit margin. The milk collected at the farm must be converted into products for retail sale. Diversifying into value added products increases the profit margins manifold. Some of the products that may be considered for manufacture at the farmers' level are the traditional and popular products, such as *dahi*, *lassi*, *paneer*, *ghee*, *khoa*, *chhana* and products made from them along with ice cream, *kulfi* and frozen dairy foods. The markets for *dahi*, *paneer* and *ghee* are expected to be valued at Rs. 807.1 billion, Rs. 1281 billion and Rs. 3937 billion, respectively by 2023. Although *dahi* is largely a homemade product, the demand for branded packaged *dahi*, particularly in the urban market is on the upswing. *Paneer* is one of the most important culinary items in India, particularly for the vegetarians. The manufacturing process is not elaborate and does not require sophisticated equipments. Beverages made from whey, the by-product from *paneer* manufacture adds to the income and also helps to avoid environmental pollution by draining the untreated

FROM THE DIRECTOR'S DESK	RESEARCH	EXTENSION	EVENTS	HONOURS/ AWARDS	DINSTINGUISHED VISITORS/ PERSONALIA	राजभाषा एकक	SOUTHERN CAMPUS, BENGALURU	EASTERN CAMPUS, KALYANI
1	2	5	7	9	11	11	12	15

whey. Similarly, extending household efforts to make *ghee* into a collective form to manufacture the product ensuring its purity and quality, packaging it in suitable containers/pouches and selling in urban markets is a guaranteed and time-tested way to earn profit. The estimated market size of *khoa*-based sweets is Rs. 520 billion. The manufacture of *khoa* is largely in the hands of private traders (*halwais*) who make it using the traditional method. However, with the development of innovative techniques for mechanized production of *khoa*, there is much scope for its industrial-scale manufacture. Collective efforts to organise the production and wholesale marketing of *khoa* and *chhana* would fetch remunerative prices than marketing them through third party vendors. The ice cream industry in India generated revenue of more than Rs 107 billion in 2016 and is estimated to increase to about Rs. 243 billion by 2021. *Kulfi*, the traditional Indian variant of ice cream is also finding its way into the formal market, in novel flavours such as natural fruits, *gulukand* and *paan*, besides the traditional almond, cardamom, pista and saffron flavours. Although India is not traditionally a cheese making country, Indians over the years are slowly acquiring a taste for cheese and several varieties are now available in metropolitan markets. Farmstead/artisanal cheeses made on farm in small batches in European and American farms have

caught the interest of some Indian entrepreneurs. Several artisanal cheese makers are now selling their products in the market and online at premium price. Value addition to milk would also help in creating a value chain, with scope for allied industries such as those for packaging material, small scale packaging equipment, additives, condiments etc.

ICAR-NDRI, through the Business Planning and Development (BPD) Unit and Krishi Vigyan Kendra provides training in the areas of dairy processing to farmers, farmwomen and prospective entrepreneurs. The BPD Unit offers entrepreneur sensitisation programs and conducts various training programmes including short term courses for interested candidates. It also assists in incubation of startup ventures. Mentoring by domain experts and continuous handholding has helped several trainees to start their own processing units and establish their own brands. I am certain that these initiatives of the institute will go a long way in creating new dairy entrepreneurs, which in turn will benefit the farmers and help realize the dreams of the government to double the farmers' income by 2022.



(R. R. B. Singh)

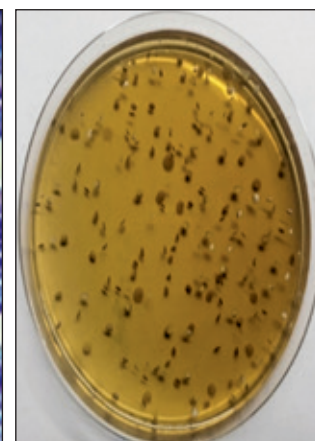
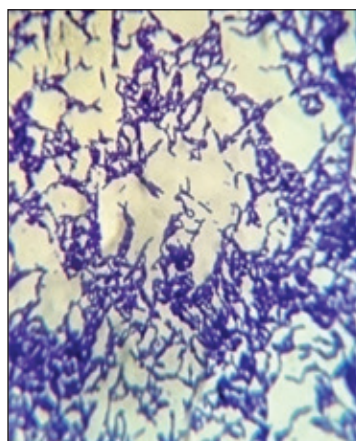
## RESEARCH

### Screening and Characterization of *Lactobacillus* Strains for Probiotic Attributes Isolated From Faeces of Murrah Buffalo Calves

(Anukarna Singh, Sachin Kumar, Bhawna Tyagi, Prasanta Kumar Choudhury, Rashmi H.M., Vinay V. V., Banakar, P. S., Nitin Tyagi, Amrish Kumar Tyagi)

Probiotics are used in animal nutrition to enhance growth and metabolic activity by stimulating digestion and immunity besides acting as prophylactic and therapeutic bugs. *Lactobacillus* strains were isolated from the faecal samples of Murrah buffalo calves and their probiotic potential *in vitro*. A total of 96 isolates were isolated and based on Gram-positive, catalase negative and resistant to vancomycin; 55 isolates were presumptively identified as *Lactobacillus* species and further confirmed by genus specific PCR. On the basis of cell surface hydrophobicity [n- Hexadecane (>10%) and xylene (>15%)] and autoaggregation (>20%), 17 isolates were selected and further grouped by amplified ribosomal DNA restriction analysis (ARDRA) and identified by 16S rDNA sequencing. Cluster analysis from the phylogenetic tree revealed 4 different groups comprising of *L. reuteri* (11), *L. salivarius* (4), *L. mucosae* (1) and *L. agilis* (1); similar to the groups formed by ARDRA. Seven different isolates were selected on the basis of their

tolerance to gastrointestinal condition viz. bile tolerance, pH resistance and tolerance to phenol. The isolates were further evaluated for co-aggregation, hydrolytic enzyme activity, and pathogenic attributes with a standard strain (*L. acidophilus* NCDC-15). The principal component analysis biplot projection based on probiotic attributes indicated that *L. reuteri* BF-H9 and *L. reuteri* BF-E7 were found to be the most promising probiotic candidates for future applications.



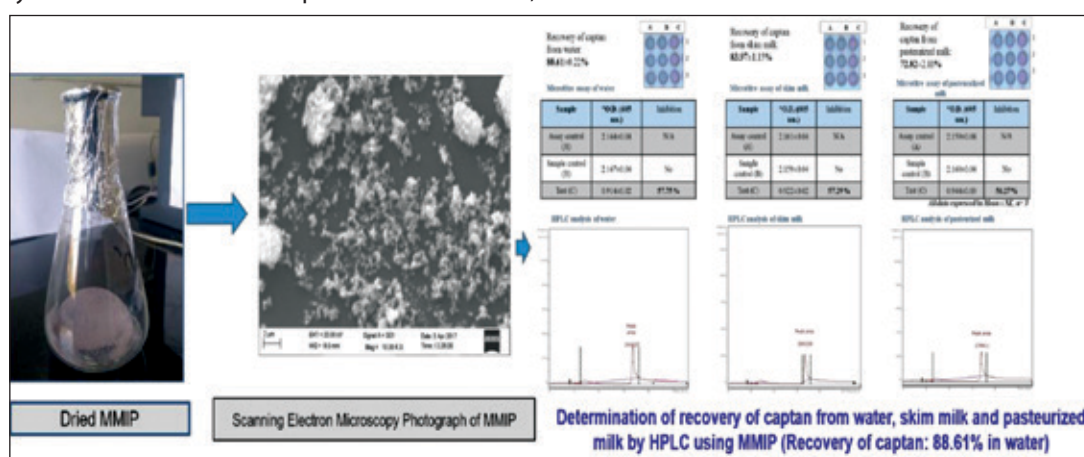


## Magnetic Molecularly Imprinted Polymer Mediated Microtitre Assay for Captan Pesticide Detection in Water

(Brijesh Kumar, Raghu H. V. and Naresh Kumar)

Magnetic molecularly imprinted polymers (MMIP) were synthesized based on iron magnetite encapsulated polymer of methacrylate (monomer) and ethylene glycol dimethacrylate (monomer-cross-linker) for selective extraction of captan pesticide from natural samples. Different parameters like pH, temperature and solvent for binding, washing and elution were optimized. The selectivity of prepared polymers was tested for binding with other pesticides wherein, minimum cross reactivity was observed in the presence of maneb,

atrazine, carbendazim and thiram. Successful recovery of  $88.61 \pm 0.22\%$  with 1 ppb LOD for captan spiked in water with in a time period of 3.30-4.0 h was achieved. Finally, developed MMIP based micro-titer assay would definitely be a cost effective option as compared to conventional techniques as it exploits the use of bacterial spores as an inexpensive source of enzyme, eliminating the need of expensive sample treatments as MMIP can be reused and has long shelf-life.



## Omega-3 Fatty Acid Encapsulated Nanoemulsion Matrices Stabilized by Milk Protein Hydrolysates Using Catastrophic Phase Inversion Method

(Rajeev Kumar, S. A. Hussain and R. R. B. Singh)

Oil-in-water (O/W) nanoemulsions represent a suitable colloidal delivery system to encapsulate  $\omega$ -3 fatty acids. Low-energy emulsification method is easy to fabricate, less expensive, environment friendly and energy efficient approach to prepare nanoemulsions. However, low-energy approach requires highly surface active synthetic emulsifiers for obtaining good emulsion stability. Synthetic surfactants may have adverse health effects. Thus, milk derived peptides are an alternative to cater to these issues. An attempt was made to replace synthetic emulsifiers with milk peptides (casein hydrolysates, and  $\beta$ -casein fraction [f1-23]) for the preparation of  $\omega$ -3 fatty acid encapsulated edible nanoemulsions using catastrophic phase inversion method (Low-energy approach). Process variables viz. oil phase (medium chain triglyceride oil), surfactant to oil ratio (SOR), mixing speed were optimized for the preparation of stable O/W nanoemulsion matrix. Among the different emulsifier combinations tried, combination Tween80: casein hydrolysate (2:1) resulted in smallest particle size. Incorporation of  $\omega$ -3 (flaxseed oil) was also optimized in nanoemulsions. It was found that ratio of Flaxseed oil: MCT

oil (1:1) resulted in better encapsulation efficiency (>90%) and polydispersity index (<0.3) when compared with the remaining samples. The study indicated that stable O/W low-energy nanoemulsions could be prepared by employing milk derived peptides as emulsifiers for the successful delivery of  $\omega$ -3 fatty acids.

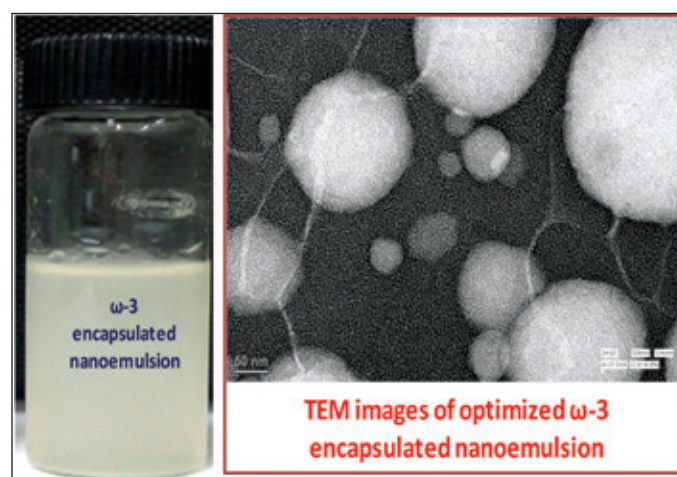
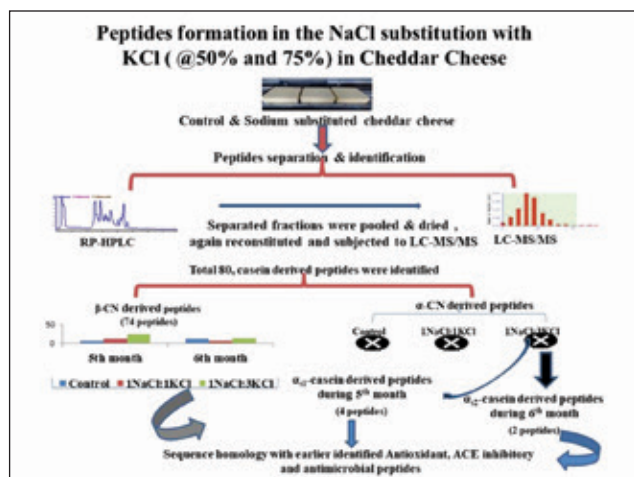


Image:  $\omega$ -3 encapsulated nanoemulsion sample and its TEM image

## Peptide Profiling of Sodium Substituted Cheddar Cheese

(Rita, Bimlesh Mann, Rajan Sharma, Rajesh Bajaj and Richa Singh)

Control cheddar cheese and low sodium cheddar cheese were prepared by substituting sodium chloride (NaCl) with the potassium chloride (KCl) @ 50% and 75% level along with flavor enhancer (HVP) and bitter blocker (AMP). Peptides released during the ripening process were screened via RP-HPLC and LC-MS/MS techniques. A total of 80 water soluble peptides in control, 1NaCl:1KCl and 1NaCl:3KCl cheddar cheeses were estimated during the 5<sup>th</sup> and 6<sup>th</sup> month of ripening period. Out of these, 74 peptides were  $\beta$ -casein derived and observed to be present in all types of cheeses. However two  $\alpha_{s2}$ -casein derived peptides and 4  $\alpha_{s1}$ -casein derived peptides were observed to be released only in 1NaCl:3KCl cheddar cheese. Control and 1NaCl:1KCl cheddar cheeses were found to enrich only with  $\beta$ -casein fractions. All these identified peptides exhibit the antioxidant, ACE inhibitory and antimicrobial peptides as sequences of these peptides have been described previously. Cheddar cheese prepared with the high concentration of potassium chloride >50% leads to more release of ACE inhibitory, antimicrobial and antioxidant peptides.



## TRAININGS ORGANISED

- Dairy Technology Division and BPD Unit organized a training programme on "Milk Processing" from November 12 to December 11, 2018 for prospective entrepreneurs.
- Two training programmes were organised by Dairy Technology Division on November 22, 2018 and December 3, 2018 for 50 goat farmers from Uttar Pradesh and Bihar, respectively at Central Institute for Research on Goats, Makhdoom under the ICAR-ILRI project on 'Development of goat milk and meat value chains in Bihar and Uttar Pradesh'. The trainees were given demonstrations on making *paneer* and cheese from goat milk and *jaljeera* from the resultant whey.

- National Training Programme was organized on "Nanotechnological and Biochemical Techniques for Assessing the Quality & Safety of Milk & Milk Products" under the aegis of Centre for Advanced Faculty Training in Dairy Processing at Dairy Chemistry Division.



Dr. R. R. B. Singh, Director, NDRI releasing a CD containing lectures during CAFT programme

- A winter school was organized on "Nutritional Strategies to Enhance Livestock Productivity and Farm Economy" from September 5 to 25, 2018 in which 24 candidates from 17 states participated.



Dr. R. R. B. Singh, Director, NDRI with the participants

- A training programme sponsored by MANAGE, Hyderabad on "Refresher Programme on Management of Modern Dairies for Established Agripreneurs under Agri-clinic and Agri-business Centre" was organized at NDRI, Karnal from December 26 to 29, 2018. In this programme, 16 lecture cum practical classes on scientific dairy farming were organized for 34 participants.



Participants of the training programme



## INSTITUTE TECHNOLOGY MANAGEMENT COMMITTEE (ITMC)

### Patents Granted

S. No.	Title of the Patents	Patent Numbers	Date of Filing	Inventors of the Patents	Patent Grant Numbers	Grant Dates
1.	Estimation of Tannin Metabolites in Blood Serum and Cow Milk using HPLC	1831/DEL/2004	27/09/2004	Keshab Barman and S. N. Rai	301155	19.09.2018
2	Three Stage Thin Film Scraped Surface Heat Exchanger for Continuous Manufacture of Khoa	583/DEL/2010	12/03/2010	A. K. Dodeja, Dharm Pal and S. P. Agrawala	304816	21.12.2018

**Technology Transfer:** A Technology for “Anionic Mineral Mixture for Reducing Post-Partum Problems in Cattle and Buffaloes” was transferred by Animal Nutrition Division to M/S

West Bengal Chemical Industries Limited, 145/1, Jessore Road, Lake Town, Kolkata- 700089, West Bengal on December 10, 2018 and revenue earned was Rs. 2.5 lakh.

## EXTENSION

### DAIRY EXTENSION DIVISION

#### Dairy Education at Farmers' Door

Dairy Extension Division organized ongoing 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 subject matter specialists from production, processing and management groupS visited a new cluster of villages viz. Deepo, Subri and Pingli in Karnal district on 2<sup>nd</sup> Saturday of every month. The feedback was obtained from the participating farmers. The key point of interactions were related to management of silent heat in animals; adulteration in milk; care of newly born calves and cutting management of berseem and oats crop. These issues were thoroughly discussed so that yield of next cutting may not be hampered.

#### Kisan Sangoshthies

Seventeen Kisan Sangoshthies were organized at village level on measures for control of mastitis in dairy animals; management of silent heat; role of mineral mixture in animal diet; care and management of calves and clean milk production practices in rural areas.

#### Empowerment of Women

Three women empowerment trainings and campaigns were organized with the objective to create awareness in the field of dairying and home science and also impart skills in these areas so that farm women could generate more income from dairying to cater to the needs of their respective families. A total of 31 farm women participated in these programmes.

### Educational Visits and Tours

A total of 3723 visitors (students & faculty) of 71 colleges/ Institutions/Universities visited the Institute. The groups were sensitized about different research, teaching and extension achievements and facilities available at the Institute.

#### Farmers' Farm School

A new educational approach “Farmers Farm School” (5<sup>th</sup> batch) of NDRI was started in village Deepo, Karnal. In this school, 20 marginal and landless women farmers registered as students. Scientists of NDRI took classes regularly on every Friday and Saturday. Basics of animal husbandry alongwith agriculture were taught and at the end of month, a quiz was also organized.

### KRISHI VIGYAN KENDRA

- KVK organized 22 training programmes, (on-campus), on dairy production and processing, crop production, crop diversification and bee keeping for 754 farmers, women and rural youth from Haryana and other states of the country.
- KVK organized 10 sponsored training programmes on dairy production for 291 farmers, farm women and rural youth from different districts of Bihar sponsored by Directorate of Dairy Development, Bihar, Patna and ATMA, Pauri Garhwal (U.K). Apart from this, KVK organized three training programmes on integrated training in dairy production and processing sponsored by Directorate of Dairy Development, Jharkhand, Ranchi for 47 farmers, farmwomen and rural youth from Jharkhand state.
- KVK also organized 33 exposures cum study visits for 1119 progressive farmers, farm women and rural

youth from different districts of Gujarat, Uttar Pradesh, Rajasthan, Himachal Pradesh, Haryana, Madhya Pradesh, Uttarakhand, Punjab and J&K.

- KVK organized 27 training programmes (off-campus) in nine villages of Karnal district namely Kulwehri, Daha Jagir, Dabri, Kunjpura, Gharaunda, Nasirpur, Badagaon, Rindal and Nilokheri on crop residue management, crop production, home science & vermicompost attended by 1589 farmers and farmwomen.
- KVK celebrated Kisan Mahila Divas participated by 95 farmwomen from six villages Nabipur, Padhana, Rindal, Geer, Charao and Barota of Karnal district on October 15, 2018. The theme of the Mahila Kisan Divas was "Kheto ki Parali Khet Mein". Women were educated and sensitized to impress upon male members of the farming families, not to burn paddy straw and mix it in the fields using machines available in the market for the purpose. Dr. Latha Sabikhi, Head, Dairy Technology Division was the Chief Guest of the function.
- KVK arranged a training programme for students under Village Adoption Programme of NIFTEM in different villages of Karnal district. The students were made to interact with former trainees of KVK to motivate them to start their own enterprise. The programme was organized from November 26, 2018 to December 3, 2018.
- KVK celebrated Kisan Divas on December 23, 2018 during Swachhta Pakhwara (December 16 - 31, 2018). About 30 farmers from Karnal district and other states participated in programme.
- KVK organized "Soil Health Day" participated by more than 90 farmers and farmwomen from different villages of Karnal district and other states on December 5, 2018 to impress upon the importance of soil health in crop production. Farmers were educated about importance of assessing the soil health and linking it with productivity. Dr. R. R. B. Singh, Director NDRI Karnal was the Chief Guest. He honoured three farmers who had done excellent work in conservation of soil health. at the function.
- KVK organized demonstrations on *in-situ* management of paddy straw on 27 ha field of 11 farmers in village Kulwehri, 63 ha field of 47 farmers in village Kunjpura and 38 ha field of 18 farmers in village Dabri of Karnal district.
- KVK mobilized school students to spread the message of *In-situ* management of paddy straw in the fields by organizing *prabhat pheries* in the villages. About 435 students of Govt. schools in four villages Kulwehri, Kunjpura, Dabri and Nilokheri took out processions in their respective villages, with playcards conveying the message of ill effects of crop residue burning and

requested farmers not to burn crop residue to save environment and soil health.

- KVK organized three awareness camps in village Dabri, Kulwehri and Kunjpura in the month of October 2018 attended by 31 farmers. KVK also organized four on-campus awareness programmes on *in-situ* crop residue management using machines for 285 farmers from Karnal district.
- KVK organized a Kisan Mela on December 28, 2018 to demonstrate various agriculture implements for *in-situ* management of paddy straw in the fields and the latest techniques developed by various research Institutions in Karnal. The mela was visited by about 500 farmers. The experts on crop residue management delivered the lectures to the farmers to highlight the importance of *in-situ* management of crop residue in the fields. The mela was inaugurated by Dr. Rajbir Singh, Director ICAR-ATARI Zone I Ludhiana, and Dr. R. R. B. Singh, Director, ICAR-NDRI Karnal presided over the function. The farmers doing excellent work in *in-situ* management of crop residues were honored by Chief Guest.
- KVK organized a 'Farmers Scientist Interface' for 90 farmers from Karnal district on November 16, 2018 to highlight the importance of *in-situ* management of crop residues. The experts in crop residue management delivered lectures to the farmers and clarified the doubts of the farmers related to crop residue burning.
- KVK developed pamphlets and folders on *in-situ* crop residue management for distribution among farmers in villages and to those coming to KVK to attend various training programmes. KVK also created awareness among farmers regarding *in-situ* crop residue management using happy seeder, zero tillage and MB plough. Wall paintings were done in three adopted villages namely Kunjpura, Dabri, Kulwehri for wide publicity of crop residue management. Hoardings and banners, conveying the message on *in-situ* crop residue management were placed at prominent places for maximum outreach among farmers in the district.



Dr. R. R. B. Singh, Director, NDRI Karnal addressing farming community in a Village

## EVENTS

### A Brainstorming Session on Breeding Strategies for Sustainable Cattle Production

ICAR-NDRI organized a Brainstorming session on "Breeding Strategies for Sustainable Cattle Production" on November 2 - 3, 2018. Dr. Trilochan Mohapatra, Secretary, DARE & Director General, ICAR, New Delhi said that there should be one broad breeding policy for the country and each state may have separate breeding strategies for the improvement of breeds of milk animals as per their habitat and local resources. He also advised on use of semen and follow up of progeny performance in the field as well as integration of phenomic and genomic data. He stressed on disease resistance and climate resilience and longer productive life traits unique to indigenous breeds of cattle. Dr. J. K. Jena, Deputy Director General (Animal Sciences & Fisheries) asked professionals working with different organizations to join together and think for developing breeding strategies not only for NDRI but also for the country as a whole. He also emphasized that the superior germplasm of suitable breeds be used for dairy cows under field conditions. Dr. S. S. Honnappagol, Animal Husbandry Commissioner,

Department of Animal Husbandry & Fisheries, Government of India, outlined the various developmental activities initiated across the country under Rashtriya Gokul Mission (RGM) and also initiative taken up on genomic selection in bovines. Dr. V. K. Taneja, Advisor to Govt. of Punjab, former, DDG (AS) & Vice Chancellor, GADVASU, Ludhiana suggested for the need to have qualified man power for implementation of breeding strategy in the present scenario.

Dr. R.R.B. Singh, Director, ICAR-NDRI, Karnal presented the key issues for discussion in the session for breeding strategies for sustainable production in dairy cattle. He sought suggestions for delineating the guidelines for implementation of breeding strategies to be followed at the NDRI for enhancing milk production. He also stressed on the incorporation of quantitative genetics, reproductive biotechniques and other techniques for augmenting productivity. Around 50 delegates and experts from various ICAR Institutes, SAUs, NGOs and research scholars across the country participated in the session.



*Dr. Trilochan Mohapatra, Secretary (DARE) & Director General, ICAR, New Delhi inaugurating the brainstorming session*



*Dr. Trilochan Mohapatra, Secretary (DARE) & Director General, ICAR, New Delhi addressing the scientific community*



*Dr. R. R. B. Singh, Director, NDRI, Karnal flagging the key issues*

### 26<sup>th</sup> Annual Conference of Agricultural Economics Research Association (India)

ICAR-NDRI organized the 26<sup>th</sup> Annual Conference of Agricultural Economics Research Association (India) on theme 'Agricultural and Sustainable Development Goals' on November 15 - 17, 2018. About 200 participants deliberated on various topical R&D issues in the conference.

The conference was inaugurated by Dr. Ramesh Chand, Member NITI Aayog, Government of India. Various topics discussed in the Conference were (1) natural resources, climate change and risk; (2) poverty, food and nutrition security including social protection, (3) market, price and value addition, (4) technological change and (5) rural transformation and mechanization. Besides this, special sessions were organized on resilience in dryland agri-food systems to achieve SDG targets for India and strengthening social science research for sustainable agricultural development. During the conference, Dr Uma Lele lecture was organized

and an Alumni Meet was hosted for the former students of Division of Dairy Economics, Statistics and Management. Dr. R. R. B. Singh, Director, ICAR-NDRI said that investing in the agricultural sector can address not only hunger and malnutrition but also other challenges including poverty, water and energy use, climate change, and unsustainable production and consumption.



*Dr. Ramesh Chand, Member NITI Aayog inaugurating the conference by lighting the ceremonial lamp*



## National Symposium on Augmentation of Animal Productivity under Changing Socio-Economic Scenario

ICAR-NDRI organized a two day National Symposium on "Augmentation of Animal Productivity under Changing Socio-Economic Scenario" on November 27, 2018. Dr. Gaya Prasad, Vice Chancellor, Sardar Vallabhbhai Patel University of Agricultural and Technology, Meerut inaugurated the symposium and said that the low productivity of the animals is still a point of concern and the time has come to tackle this problem in a scientific way by all the scientists of Animal Sciences.



*The Chief Guest being felicitated during inaugural session*

Dr. Moti Lal Madan, Ex-DDG (ICAR) said that dairying profession can be used as an effective way to tackle the poverty reduction in the country. However, low productivity of the animal is an issue and this is also reflected in high number of non-productive animals. Dr. R. R. B. Singh, Director, NDRI said that the per capita availability of milk has increased in the country from 130g per day since independence to present level of 355g per day, which is more than the 300 g per day recommended by Indian Council of Medical Research (ICMR). Highlighting the role of animal physiologists, he said that the increasing animal productivity under changing climate would have to be tackled effectively.



*Dr. Gaya Prasad, VC, SVPuat, Meerut delivering inaugural speech during National Symposium on Augmentation of Animal Productivity under Changing Socio-Economic Scenario at NDRI, Karnal*

## Discourse on Disaster Management

NDRI organized a discourse on 'Disaster Management' for its faculty and students on October 12, 2018. Sh. Brij Bhusanji, National Coordinator, Scientists & Engineering wing (SEW), Division of Rajyoga Education & Research Foundation (RE&RF) was the resource person. The talk was organised under the Campaign on Nature, Environment and Disaster Management for empowering the self and facing both the man-made and natural disasters successfully.



*Sh. Brij Bhusanji, being felicitated for his discourse on Disaster Management*

## Orientation Programme for the Freshers

NDRI organized an orientation programme for its fresher students on 8<sup>th</sup> October, 2018 to realise the vision of NDRI to produce excellent and accomplished human resource by helping students pursue both their professional and personal goals with greater self-awareness, self-esteem, understanding and focus. The orientation programme culminated into the Freshers' Day celebrations on November 6, 2018. The students were exposed to multifarious extra-curricular group activities such as Theatre & Dramatics, Dance, Music, Art & Craft, Literary, Soft Skills and Yoga. It was made mandatory for all the new comers to choose and participate in any group activity as per their interest, aptitude and liking, thus, throwing open to them a world of avenues for expressing their hidden talents and creativity. Besides academics, the month long Foundation Program included English & Hindi Diagnostic Tests, Team Building Exercises/Games, Workshops on 'Competition and Excellence', 'Communication Skills', 'Peer Pressure', 'Personality Development', 'Soft Skills', 'Entrepreneurial Skills', 'Leadership and Management', 'Gender Equality' and sessions on Poetry writing.



*Dr. Avtar Singh delivered a talk on Competition and Excellence*





*Dr. Hemlata Maheshwar, Professor Jamia Milia Islamia University being felicitated for her talk on Gender Equality*

### Two day Workshop on 'Life is Awesome'

NDRI organized a workshop for the fresher students on 'Life is Awesome' on October 12 - 13, 2018. Dr. Farhat Umar Paul, Consultant, Dept. of Animal Husbandry was the resource person for the workshop. The workshop included four sessions on Life Lessons; Personal Development; Leadership & Management and Creativity and Innovations. Dr. Farhat gave students a CAPSule i.e. Clarity+ Action+ Purpose+ Self Discovery+ Leadership plan to enable them to lead to awesomeness. Dr. Farhat told students that their goals, like compass, would define their journey of life and would help them to navigate. He elaborated that goals give us direction, focus, discipline, motivation, make us human and ultimately provide us success and glory. He emphasized that setting goals is the first step in turning invisible into visible. He classified the

goals as SMART (Specific, Measureable, Attainable, Relevant and Time specific) and BHAG (Big, Hairy and Audacious Goals). He asked students to write their SMART and BHAG goals and be connected towards accomplishment of these goals.

Many activities were organized covering ice breaking exercise, Teiger's personality test, leadership exercises and journey to self-discovery. The speaker told that self-discovery provides human beings with harmony in mind, body and soul; strengthens the weak spots, provides confidence and control over the self. He provided students with tips to inculcate leadership qualities, i.e., to have vision, to have courage to make things possible, have honesty/ integrity/ truthfulness, have humility and strategic planning. Through Teiger's personality test, students were apprised with the kind of personality they possess. He told students that we gel well with two kinds of people: First, the ones who are like us; and second, the ones we want to be like. The workshop ended with the video by Mr. Yakeen on 'The Power of Belief'.

### MoU signed

A Memorandum of Understanding (MoU) was signed between ICAR-National Dairy Research Institute (NDRI) and Institute of Rural Management Anand (IRMA) in November 2018 to engage in research and academic activities, like students and faculty exchange programmes, collaborative research projects, and integrated dairy management PG degree programme for undergraduate students of ICAR-NDRI (Deemed University).



**Dr. A. K. Tyagi**, Head, Animal Nutrition Division received "**Fellow of National Academy of Agricultural Sciences (India)**" from National Academy of Agricultural Sciences (India), NASC, DPS Marg, Pusa, New Delhi.

**Dr. A. K. Tyagi**, Head, Animal Nutrition Division received "**Fellow of Animal Nutrition Association (India)**" from Animal Nutrition Association (India) during 1<sup>st</sup> Biennial Animal Nutrition Association Conference, November 19 – 21, 2018 at Patna.

**Dr. A. K. Tyagi**, Head, Animal Nutrition Division received "**Vaisvik Industrial Research Award (Cash Prize 1.51 lakhs)**"

from Vividhlaxi Audyogik Samshodhan Vikas Kendra, Mumbai.

**Dr. Rishika Vij** got **Dr. P. K. Dwarikanath** memorial "**Young Scientist Award**" in the XXVII Annual Conference of Society of Animal Physiologists of India and National Symposium on Augmentation of Animal Productivity under Changing Socio-Economic Scenario held on November 27 – 28, 2018 at NDRI for the paper entitled "Bioavailable Bioactive Peptide Enables Bone Health and Ailment Recoveries through Osteoblast Interactive Pathways".

**Dr. Pradip V. Behare**, Scientist (Sr. Scale), Dairy Microbiology Division received "**Young Scientist Award – 2017**" by Society

for Upliftment of Rural Economy, Varnasi on November 1, 2018 during International Conference on Rural Livelihood Improvement for Enhancing Farmers' Income through Sustainable Innovative Agricultural and Allied Enterprises held at BIT, Patna.

**Dr. B. S. Meena**, Principal Scientist, Dairy Extension Division was conferred "**SEE Fellow Award-2018**" by Society of Extension Education during 9<sup>th</sup> Extension Education Congress held at Gangtok (November 15-17, 2018).

**Dr. Sanchita Garai**, Scientist, Dairy Extension Division was conferred "**Young Scientist Award-2018**" by Indian Society of Extension Education during National Seminar held at Kolkata (December 5-7, 2018).

**Dr. B. S. Meena**, Principal Scientist, Dairy Extension Division was conferred "**Best Paper Presentation Award-2018**" for paper entitled "Technological Change in Dairy Farming in Trans-gangetic Plains and Its Effect on Employment Generation by Society of Extension Education during 9<sup>th</sup> Extension Education Congress held at Gangtok (November 15-17, 2018).

**Dr. Sanjit Maiti**, Scientist, Dairy Extension Division was conferred "**Best Paper Presentation Award-2018**" by Indian Society of Extension Education during National Seminar held at Kolkata (December 5-7, 2018).

**Dr. Sachin Kumar**, Scientist, Animal Nutrition Division was conferred "**Associate Fellowship of National Academy of Dairy Science (India)**" at Tirupati on September 9, 2018.

**Dr. Writdhama Prasad** and **Dr. K. Khamrui**, Dairy Technology Division received "**Best Thesis (PhD) Award**" in Processing Group for the year 2017-18 by Society For Upliftment of Rural Economy (SURE) at International Conference on Rural Livelihood Improvement by Enhancing Farmers' income through sustainable Innovative Agri and Allied Enterprises (RLISAAe) scheduled on October 30 to November 2, 2018.

**Mr. Bhagwat Sameer Kisan**, M.Tech (DT) 2<sup>nd</sup> year student guided by **Dr. Sangita Ganguly** received "**Best Oral Presentation Award**" for paper entitled 'Milk Protein Matrix as Carrier of Probiotic Organism' at National Conference on 'Advances in Biopolymers' by Association of Food Scientists and Technologists, India (AFSTI), Srinagar chapter held on October 30 – 31, 2018.

**Mr. Ankush Shinde, Dr. Ganga Sahay Meena, Dr. Sanket Board, Ms Jyoti Handge, Mr. Minanath Giri and Dr. Ashish Kumar Singh**, Dairy Technology Division received "**Best Oral Presentation Award**" for the paper entitled "Effect of Sodium Tripolyphosphate and Sodium Hexametaphosphate on Quality Properties of Buffalo Milk Protein Concentrate 60"

during 11<sup>th</sup> National Convention & Seminar on "Dairy Process Engineering from Farm to Table" organized at Indore during October 21-22, 2018.

**Ms. Neha Chaudhary, Dr. Latha Sabikhi, Dr. Shaik Abdul Hussain, Dr. Sathish Kumar, M.H. and Dr. Suman Kapila**, Dairy Technology Division received "**Best Oral Presentation Award**" for the paper entitled "Preparation of *Embllica officinalis* (Amla) Encapsulated Stable W/O/W Double Emulsion and its Controlled Release Study" presented at International Conference on "Rural Livelihood Improvement for Enhancing Farmers Income through Sustainable Innovative Agri and Allied Enterprises (RLISAAe)" held at BIT, Patna, Bihar during October 30 to November 1, 2018.

**Dr. K. Khamrui** and **Dr. Writdhama Prasad**, Dairy Technology Division received "**Best Oral Presentation Award**" for the paper entitled "Development of Whey Protein Based Curcumin Encapsulate" presented at International Conference on Rural Livelihood Improvement by Enhancing Farmers' income through Sustainable Innovative Agri and Allied Enterprises (RLISAAe) held at BIT, Patna, Bihar during October 30 to November 2, 2018.

**Ms. Swati Tiwari, Ms. Neelam Upadhyay, Dr. A. K. Singh and Dr. Bhavesh Baria**, Dairy Technology Division received "**Best Oral Presentation Award**" for the paper entitled "Green Biorefinery Approach: A Novel Way for the Extraction of Carotenoids from Carrot Bio-waste" presented at 50<sup>th</sup> Annual International Conference in Food Science and Nutrition organised by Nutrition Society of India during November 15-17, 2018 at ICMR-National Institute of Nutrition, Hyderabad.



Ms. Swati Tiwari receiving award

**Dr. Sachin Kumar**, Scientist, Animal Nutrition Division received "**First Oral Presentation Award**" during 11<sup>th</sup> Biennial Animal Nutrition Association Conference, November 19 – 21, 2018 at Patna.

**Dr. Asit Das**, Principal Scientist, Animal Nutrition Division received "**Second Oral Presentation Award**" during 11<sup>th</sup> Biennial Animal Nutrition Association Conference, November 19 – 21, 2018 at Patna.



**Dr. Sachin Kumar**, Scientist, Animal Nutrition Division received **"Third Oral Presentation Award"** during Asian Regional Conference on Goats from October 22 to 26, 2018 at Jaipur.

**Dr. Nitin Tyagi**, Senior Scientist, Animal Nutrition Division received **"Third Poster Presentation Award"** during

11<sup>th</sup> Biennial Animal Nutrition Association Conference, November 19 – 21, 2018 at Patna.

**Mr. Manpreet Singh**, M.V.Sc Scholar got the prestigious JENESYS fellowship (Japan-East Asia Network of Exchange for Students and Youths)

**Ms. Mamta Joyaswal** awarded with PM Fellowship for her Ph.D. thesis work.

## DINSTINGUISHED VISITORS/PERSONALIA

### DISTINGUISHED VISITORS

- 9.10.2018 Shri Parshottam Rupala, Minister of State for Agriculture & Farmers' Welfare and Panchayati Raj, Government of India.
- 13.11.2018 Twenty one member delegation from 2018 Class of Resource & Agricultural Leadership (REAL), Montana State University, USA.
- 15.12.2018 His Excellency Parasivum Pillay Vyapoory, President of Mauritius.

### PERSONALIA

#### Joining/Appointment

Sh. Saurabh Kadyan, Scientist (Dairy Microbiology) joined at ICAR-NDRI, Karnal after being relieved from ICAR-NAARM, Hyderabad w.e.f. 1.10.2018.

Sh. Gaurav Kr Deshwal (Dairy Technology) joined at ICAR-NDRI, Karnal after being relieved from ICAR-NAARM, Hyderabad w.e.f. 3.10.2018.

#### Retirement/Relieving

Dr. (Mrs.) Jancy Gupta, Principal Scientist, Dairy Extension Division retired from Council's service w.e.f. 30.11.2018.

## राजभाषा एकक

### तिमाही हिन्दी बैठक का आयोजन

संस्थान के निदेशक एवं कुलपति महोदय की अध्यक्षता में संस्थान राजभाषा कार्यान्वयन समिति की तिमाही बैठक संस्थान दिनांक 12.12.2018 को संपन्न हुई। समिति ने गृह मंत्रालय, राजभाषा विभाग द्वारा जारी चालू वित्तीय वर्ष 2018-19 के लिए केन्द्र सरकार के सभी कार्यालयों के लिए मदवार तय किए गए न्यूनतम वार्षिक लक्ष्यों के कार्यान्वयन के बारे में विस्तार से चर्चा करके कई महत्वपूर्ण निर्णय लिए।

### संस्थान की अन्य राजभाषा गतिविधियाँ-

- » संस्थान के निदेशक डा. आर.आर.बी. सिंह की अध्यक्षता एवं श्रीमती सीमा चोपड़ा, निदेशक(राजभाषा), भारतीय कृषि अनुसंधान परिषद, नई दिल्ली के मुख्य आतिथ्य में दि. 10.10.2018 को राजभाषा हिन्दी उल्लास मास के दौरान

आयोजित की गई विभिन्न प्रतियोगिताओं के 99 विजेताओं को प्रमाणपत्रों से सम्मानित किया गया।

- » रिपोर्टाधीन अवधि में 3 प्रभागों का राजभाषा निरीक्षण किया गया। दि. 7.12.2018 को स्थापना 5 की डेस्क का, 19.12.2018 को कृषि विज्ञान केन्द्र का एवं 22.12.2018 को डेरी प्रौद्योगिकी प्रभाग का निरीक्षण करके दृष्टिगत हुई कमियों का निराकरण करवाया गया।
- » राजभाषा नियम 8(4) के तहत 16 विषयों से संबंधित प्रशासनिक कार्य हिन्दी में निपटाने के लिए विनिर्दिष्ट किया गया है।
- » नवनियुक्त 3 अवर श्रेणी लिपिकों (एल.डी.सी.) को संस्थान प्रमुख की ओर से अपना संपूर्ण प्रशासनिक कार्य हिन्दी में निपटाने के लिए व्यक्तिशः आदेश जारी किए गए हैं।
- » संस्थान में हिन्दी पत्राचार की वृद्धि के लिए सभी संवर्ग के स्टाफ के लिए हिन्दी ईमेल प्रोत्साहन योजना प्रारंभ की गई है।

## SOUTHERN CAMPUS, BENGALURU

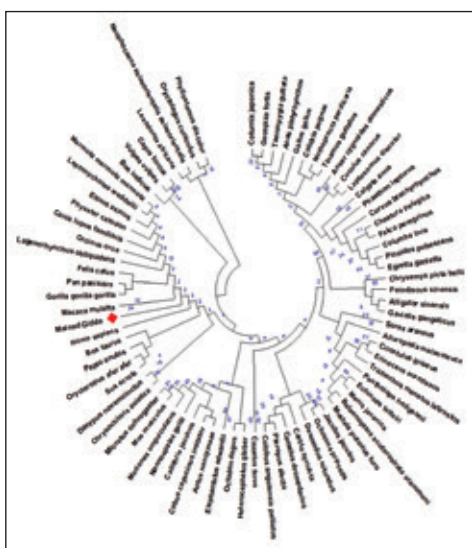
### RESEARCH

#### Whole Genome Sequencing and Hybrid assembly of Malnad Gidda Cattle—a Dwarf Breed from Western Ghats of Karnataka, India

(K.P. Ramesha, R. C. Vinod Kumar and T. S. Keshava Prasad)

The Malnad Gidda is a dwarf cattle breed possessing an array of unique physiological adaptations but not much information is available at molecular level.

Therefore, a draft map of genome of these cattle was established. Genomic DNA from the blood was obtained and sequenced with paired-end and mate-pair reads on an Illumina HiSeq-2500 with



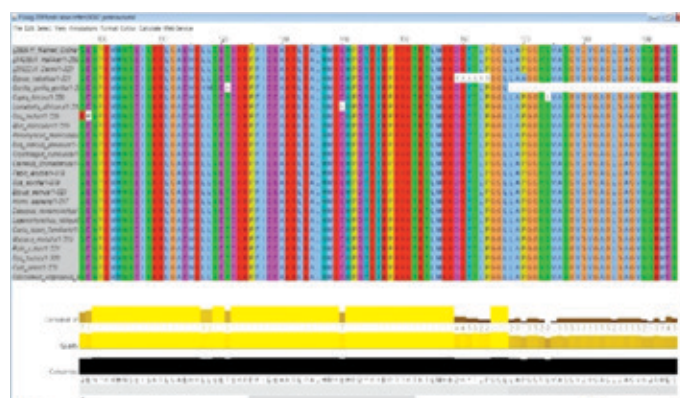
long reads using PacBio platforms. MS/MS-based proteomics of semen of bulls from this breed using high-resolution Orbitrap fusion mass-spectrometer was performed. Hybrid denovo assembly of the raw sequencing reads were drafted using MaSuRCA tool and obtained ~2.1Gb of genome size with N50 of ~50Kb consisting of 108,453 scaffolds. Augustus software was employed to predict genes from the assembly and was integrated with proteomics data using Proteome Discoverer 2.2 for improved genome annotation. A total number of 1,974 and 2,816 proteins in seminal plasma and spermatozoa were identified, respectively. Also, with reference to *Bos taurus*, ~700 genes are found to be unique to this genome, of which 171 proteins are supported by proteomic data and orthology evidence. Further, reference-based alignment against *Bos taurus* resulted in ~92% concordant mapping and harbour ~51,049 non-synonymous variants using BWA and GATK pipelines. Phylogenetic tree for the protein SOX 2 between Malnad Gidda and 76 mammalian species was obtained by MEGA tool by maximum likelihood method shown in Figure.

The draft map of Malnad Gidda genome could be a valuable resource for research to identify molecular underpinnings for the unique biological traits in Malnad Gidda cattle, in particular and *Bos indicus* cattle, in general.

#### Genome Annotation and Variant Analysis of Hallikar and Deoni Breeds of Cattle (*Bos indicus*) of India using whole Genome Sequencing Approach

(N. Azharuddin, K. P. Ramesha and Keshava Prasad)

Deoni and Hallikar breeds of cattle in India are endowed with qualities of heat tolerance, disease resistance and the ability to thrive under extreme climatic stress. Genomic DNA was extracted from each breed and sequenced at the coverage of 50x paired-end and 20x mate-pair on Illumina HiSeq-2500 platform. Denovo assembly was performed to generate the draft genome sequence of these breeds using ABySS. The assembly resulted in ~2.1Gb with 4.7 and 4.5 million long scaffolds with a weighted average N50 of 4 Kbp and 5 Kbp for Deoni and Hallikar, respectively. Further, genome annotation revealed ~40,000 protein-coding genes. Reciprocal BLAST of these predicted proteins was carried out against the *Bos taurus* reference database. About 700 proteins novel to the assembled genomes were identified. Out of which, 132 proteins from Deoni and 144 proteins from Hallikar were further supported by orthologous evidence obtained from BLAST against non-redundant database. The raw Illumina reads were aligned to the reference genome using the Burrow-Wheeler Aligner and obtained 89.70% and 90.40% of concordant mapping for Deoni and Hallikar, respectively. Further, downstream variant analysis of the





mapped reads was performed using Genome Analysis Toolkit (GATK). The variant annotation was carried out using snpEFF and identified 51,000 and 51,096 non-synonymous variants for Deoni and Hallikar, respectively. SOX2 Protein alignment between different species (1<sup>st</sup> three organisms are Malnad Gidda, Hallikar and Deoni) obtained by Jalview software is shown in the figure. In this analysis, candidate genes involved in the production of testosterone (HSD17B3) and semen quality (CATSPER2) harbour breed specific non-synonymous homozygous variants with higher read depth with reference to *Bos taurus*. The genome drafts of these indigenous breeds of Indian origin can help to understand the genetic markers associated with traits of interest in cattle.

### Development of Synbiotic Based Functional Dairy Spread

(Devaraja, H.C., Jayaprakasha, H.M., Jayaraj Rao, K.)

A synbiotic functional dairy spread was developed using dairy ingredients viz. whey protein concentrates, caseinates, whey powder & butter and synbiotic curd prepared using combination of prebiotics and probiotic bacterial strains. The ingredients viz. WPC – 80, sodium caseinate, butter, curd and sodium tri polyphosphate (STPP) were optimized. The synbiotic curd was prepared using the mixed culture containing *L. acidophilus* and *L. casei* and fructo-oligosaccharides as prebiotics. The final product conformed to the FSSAI requirements for probiotic product.

### Optimization of Electrospinning of Casein-derived Peptides

(Rashmi Kumari, F. Magdaline Eljeeva Emerald, Heartwin A. Pushpadass, B. Surendra Nath and Laxmana Naik, N.)

Casein-derived peptides were obtained by enzymatic hydrolysis of casein using a selected enzyme and ultrafiltering the hydrolysate. The permeate was blended with gelatin and the effect of voltage and concentration was studied. The levels considered were polymer solution concentration, flow rate and voltage with mean fibre diameter and encapsulation

efficiency as responses. In order to determine the optimum production conditions for electrospun nanofibres, the signal-to-noise (S/N) ratio was used. Among the three control factors, concentration of polymer solution had the highest influence on both mean fibre diameter and encapsulation efficiency. The mean diameter of the nanofibres ranged from 91.63 to 292.15 nm and the encapsulation efficiency ranged from 51.66 to 96.87%. Lowest mean fiber diameter of 91.63 nm and the highest encapsulation efficiency of 96.87% were observed at the optimized conditions.

### Evaluation of Commercially Available Sexed Semen Technology under Cooperative Dairy Production System in Karnataka

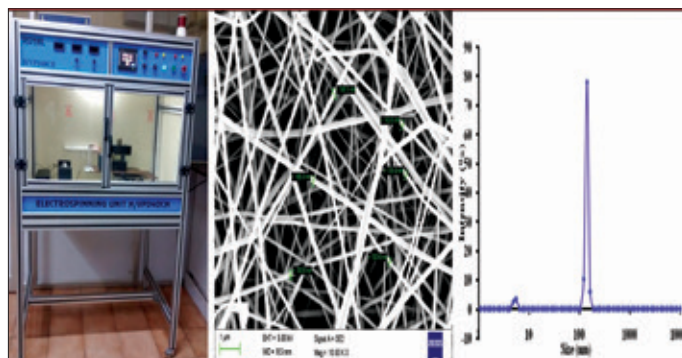
(S. Jeyakumar, A. Kumaresan, Srinivasa Poornachandra and K.P. Ramesha)

The fertility of commercially available sexed semen was evaluated in Holstein Friesian cattle maintained by dairy co-operative farmers of Bangalore Milk Union Limited, Karnataka Milk Federation, Ramnagara district, Karnataka through mass synchronization and timed AI protocol. After an initial field survey and selection, a total of 121 (118 at field and 3 at LRC farm) HF crossbred/graded heifers and first lactation post partum cows belonging to 111 farmers of 45 villages were selected and subjected for oestrus synchronization programme. Out of 121 cattle subjected for AI, 40 became pregnant with a synchronized pregnancy rate of 33%. Out of 38 cattle, 37 cattle delivered female calves and one cow delivered a male calf with 97.36% birth of females and a skewed sex ratio of 1:2.7 at birth (male to female). The pregnancy rate was higher in heifers (36.73%) than lactation cows (30.55%). Calves born via AI of sexed semen did not differ in any respect physically from those produced via conventional semen, and none of the heifers/cows showed any dystocia. These results indicated that better selection, nutritional status and the current protocol for synchronizing estrus could serve as an effective approach for successful implementation of sexed semen technology under field conditions.

### EVENTS

#### Institute – Industry Meet

The Institute – Industry meet was organized on October 6, 2018 to explore collaboration opportunities with dairy industry as well as to transfer technologies developed at NDRI, Bengaluru. Two prominent industrialists were invited as Chief Guests to the Meet: Mr Sunil Reddy, Managing Director



of Dodla Dairy Ltd., Hyderabad and Mr Sanjay Singal, Chief Operational Officer of ITC Ltd., Bengaluru. Director of ICAR-NDRI, Dr RRB Singh presided over the inaugural programme. Technology brochures published by NDRI Karnal and Bengaluru were released during the inaugural programme and distributed to industry representatives. Various technologies developed at NDRI Karnal and Bengaluru were presented to industry representatives during the meet. A few industry personnel were also given opportunity to present their views and perspectives on what NDRI is expected to do for the Indian dairy industry. The Meet was organised in three sessions. In all 54 persons representing 30 industries participated in the Meet.

## EXTENSION ACTIVITIES

- A total number of 234 visitors in 13 batches comprising farmers from different parts of Karnataka, field extension/veterinary officers, students from various educational institutes and general visitors visited the Institute. They were explained about ongoing research, teaching and extension activities of the Institute.
- Advisory services were rendered to 17 clientele during their personal visits to the Institute and mail enquiries. The clientele information needs comprised dairy start-ups, management of indigenous cattle, cattle feed formulation, hydroponic fodder cultivation and processing techniques of milk into milk products.
- An Exposure cum Training programme was organised for 160 trainees comprising farmers, farm women and farm youth in six batches from six districts of Tamilnadu under 'Support to State Extension Programmes for Extension Reforms' (SSEPERs) under Agricultural Technology Management Agency (ATMA) scheme. The trainees were made aware of technical know-how of scientific dairy farming aspects in breeding, feeding

and healthcare aspects by lecture presentations in local language, visit to Livestock Research Centre and Experimental Dairy Plant. With special emphasis on clean milk production, a demonstration session of machine milking and recommended package of practices on clean milk production was organised for the benefit of farmer trainees.

- Interactive sessions with clientele groups and field extension officials were organized in the new cluster of six villages in Devanahalli taluk of Bangalore Rural District for outreach programmes and rural extension activities. The new cluster of six villages, Devaganhalli, Kempalingpura, T. Hosahalli, Peddanahalli, Kempathimmanahalli and Hunganvadi comprised 640 household of which 60-70% of the households were practising dairy farming. Extension team visited village-wise dairy farm households to analyse specific problems to be addressed in dairying and dairy cattle management.



*Veterinary services being provided to farmers*

- Participated in the **Krishimela 2018** at UAS, GKVK, Bengaluru from November 15 to 18, 2018. The event focused need-based knowledge sharing in recent advancement in dairy production and processing aspects and show-casing of Institute activities and technologies for the benefit of the farming community of the region.
- Under the collaborative project of Farmer FIRST Programme of the Council, by ICAR-IIHR and SRS of ICAR-NDRI, the planned activities in terms of institute interventions included, Clean Milk Production campaign and Demonstration of Machine Milking, Interactive sessions with Women Self-Help Groups to address their farm-related problems and Dairy Cattle Health & Infertility Camps. Mastitis was the common problem in the project villages, which was addressed through a package of recommendations for clean milk production and for mastitis prevention and management.



*Farmers of Tamil Nadu at Southern Regional Campus, Bengaluru*



## EASTERN CAMPUS, KALYANI

## RESEARCH

**Utilization of Himalayan Forest Tree Leaves as Feed Additives for Reducing Ruminal Methanogenesis**

(T. Taku, A. Santra, S. K. Das and T. K. Dutta)

Manipulation of rumen microbial ecosystem for reducing ruminal methane production and ciliate protozoal population and improving TVFA and propionate production for efficient utilization of dietary energy and protein, is a useful strategy to improve production efficiency of ruminant animals. North-eastern Himalayan forest has a wide variety of tree leaves, which are not yet tested for their potential as herbal feed additives in ruminants' diet to reduce ruminal methanogenesis and ciliate protozoal population. Two multipurpose Himalayan forest tree leaves viz. Kadam (*Anthocephalus cadamba*) and Sarumu (*Quercus griffithii*) were collected from Tripura and Arunachal Pradesh, respectively and their effect was studied as natural feed additives on ruminal methanogenesis *in vitro*. It was concluded from the study that Sarumu (*Quercus griffithii*) tree leaves might be used as feed additives to manipulate rumen fermentation for reducing ruminal methanogenesis for efficient utilization of dietary energy.

**Thermo-comfortable Thatched Roof Shed Influences the Milking Behaviour of Dairy Cows**

(D. K. Mandal, Ajit Kumar, C. Bhakat, A. Mandal, A. Chatterjee, S. Rai and T. K. Dutta)

Livestock housing plays an important role in buffering the effects of external environment on animals' body. A study was conducted on 40 Jersey crossbred cows divided in two groups, each containing 20 animals and they were kept in two different housing patterns i.e., existing shed (control group) and thermo-comfortable shed (experimental group). The main aim of this study was to investigate the effects of housing designs on milking behaviour of the cows. Thermo-comfortable shed was made up of thatched roof having ridge ventilation roofing design. The main axis orientation of the shed was East-West direction. Due to changes in roofing material, design and axis orientation, the micro environment of presently developed cow-shed became cooler, more ventilated, thermal radiation

protective and comfortable than the existing traditional asbestos roofed shed. Housing comfort significantly influenced cows' behaviour in the milking parlour. Dairy cows kept in thermo-comfortable sheds were more docile and exhibited less temperament score as compared to those kept in existing shed and the differences were significant ( $P < 0.01$ ). Milk flow rate, milking durations and milk parlour exit score were non-significantly higher in cows kept in thermo-comfortable shed as compared to those kept in asbestos shed. Incidence of vocalization and expression of eliminative behaviour such as defecation and urination in milking parlour were lower in cows of treatment group compared to that of control. The study concluded that use of paddy straw as roofing material and changes in roof design and axis orientation of cow-shed might positively modulate the expression of milking behaviour of dairy crossbred Jersey cows.

## EXTENSION ACTIVITIES

- Under TSP and NEH projects two Scientists-Farmers' interaction session- cum-input distribution camps were organized in different villages of Sikkim, Meghalaya and Tripura, respectively. From those camps several inputs like veterinary medicines, livestock feed and chicks were distributed. Farmers were appraised about the recent advances of scientific animal husbandry practices.
- In the camp organized at Martong, Yangthang and Nandok villages of Sikkim Vanaraja Day Old, a total of 2000 Chicks, Poultry Starter Feed 1200 kg, Mineral Mixture 200 kg were distributed among 109 tribal farmers.
- Under TSP and NEH projects, two Scientist-Farmers' interaction session-cum-input distribution camps were organized at Lumdynri and Umshorshor village of Meghalaya, respectively. In the camp organized at Lumdynri village of Ri Bhoi district in Meghalaya, a total of 23 Piglets, 1150 kg Pig feed, 650 kg Poultry feed and 375 Poultry Birds (3 week) were distributed among 39



tribal farmers. On the other hand, in the Umshorshor village of Meghalaya, 22 Piglets, 1100 kg Pig feed and 600 kg Poultry Feed were distributed among 50 farmers.

- Under TSP project, one Scientist/Farmers' interaction session-cum-input distribution camp was organized at Maharani ADC in Dhalai district of Tripura. Local MLA Shri Asish Das was the special guest during the camp. A team of scientists/Officers apprised the tribal farmers about the recent advances in dairy farming and recommended the technologies for enhancing their farm income. Mineral

mixture and veterinary medicines were distributed among the farmers. Thirty goats were also distributed among tribal farmers during the occasion.

- Under NEH project, another Scientist Farmers' interaction session-cum-input distribution camp was organized at Singhinala village in Dhalai district of Tripura. Inputs like mineral mixture, veterinary medicines etc. were distributed among the farmers and their proper use was demonstrated to the farmers. Apart from those inputs, 30 goats were also distributed among the farmers.

## Livestock and Agriculture Mela organized at Ajodhya Hills, Purulia, West Bengal

'Livestock and Agriculture Mela' under Tribal Sub Plan project was organised in the tribal dominated Ajodhya Hills of Purulia district in West Bengal on November 22, 2018. Around 600 tribal farmers visited the Mela. One veterinary health camp was also organized in the mela, in which vaccination of livestock was carried out and veterinary medicines were distributed among the tribal farmers. Through the camp, 857 desi (indigenous) cows, 20 heifers, 39 calves, 53 buffaloes, 1595 goats, 5 Sheep and 2243 birds were treated/vaccinated. In the Mela, agricultural technologies were showcased A total of 2200 chicks were distributed among 220 tribal farmers and 60 Black Bengal goats were distributed among 30 tribal farmers in the Mela. Livestock competition was also organized and farmers were awarded for possessing good quality animals (Cattle, buffalo and goat). Quiz competition was organized to check the knowledge level of the farmers. The Mela was presided over by Dr. Bimlesh Mann, then Joint Director (R) of ICAR-NDRI and Sri Sujoy Banerjee, President, Purulia Zilla Parishad was the Guest of Honour.



## Organized camp at Ranchi district, Jharkhand

Eastern Regional Station of ICAR-NDRI in collaboration with Divyayan Krishi Vigyan Kendra, Ramakrishna Mission-Ranchi organized one input distribution cum Scientists-Farmers' interaction camp under the Tribal Sub-plan Project on December 12, 2018 at Simratoli village in Angara block of Ranchi, Jharkhand state. This activity was as per the initiative of Government of India to uplift the livelihood status of Tribal farming community in selected aspirational districts identified by 'Niti Ayog'. The selected village is completely dominated by tribal population and the main occupation of the villagers was agriculture including livestock farming. Several inputs like 60 Black Bengal goats, 500 ducks and mineral mixture were distributed among the tribal farm family. One interaction session was also organized

with the farmers to inform them about the recent scientific and practical advances in animal husbandry. The team of scientists visited the household of the tribal farmers and interacted with them to identify their problems and provided suitable solutions at the doorstep of the farmers.

## Training Programmes Organized

Two training programmes were organized from November 13-17, 2018 one training programme on 'Scientific Goat Farming' was organized in which 34 trainees participated. Another training programme was organized from November 27 to December 6, 2018 on 'Scientific Dairy Farming', in which 30 female trainees were trained in different aspects of dairy farming.

### Editorial Board

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