



NDRI News

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From the Director's Desk

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ICAR- National Dairy Research Institute as the country's premier Dairy Research Institution has developed considerable expertise over the last nine decades in different areas of Animal Production, Dairy Processing, Dairy Business Management, Dairy Extension and Human Resource Development. Information generated at the Institute and the services offered have contributed enormously to the growth of Dairy Industry as a whole and well-being of millions of milk producers and consumers of milk and milk products. Realizing the challenging need of the national and global Dairy Trade, the Institute is continuously working to develop its R&D and HRD programmes to align to the nation's need in terms of food security, employment generation, poverty alleviation and economic prosperity.

Human resource development (HRD) and Capacity Building are integral to our organizational goal. Through our various initiatives and multilayered engagements for institutional capacity building, we have been able to address both the intangible and tangible capacities. The Institute has accelerated efforts for skill up-gradation, procedural improvements and organizational strengthening to optimize resource use efficiency and human potential in various activity domains.

Starting with short training programs, Associateships and Indian Diploma in Dairying initiated at the erstwhile Imperial Institute for Animal Husbandry & Dairying way back in 1923 to build capacities of the Indian Dairy Sector which was in the state of infancy, the Institute started formal B. Sc. Dairying course in 1957 after the relocation of the institute to the present Karnal campus. Over the years, it has established itself as a global centre of learning in all facets of Dairy Science. The Institute has till date produced a large pool of outstanding professionals viz., 1510 undergraduates, 2824 Postgraduates of Masters' level and 1343 of Doctoral level for building capacities of not only the Indian Dairy sector but also the entire National Agricultural Research System. The programmes of NDRI Deemed University are constantly reviewed and updated to impart requisite knowledge levels to the graduates to make them academically proficient in meeting the emerging global challenges. The Institute continues to attract international students from a host of countries such as Nepal, Bangladesh, Afghanistan, Iran, Iraq, Myanmar, Mauritius,



Sri Lanka, Vietnam, Ethiopia, Rawanda, Sudan, Camaroon, Holland, Egypt and many other for training and education in Dairying.

The Institute also focuses on creating opportunities for the students to enhance their professional competence and over-all personalities. Besides the Livestock Research Centre with nearly 2000 dairy animals, Artificial Breeding Research Centre having >125 bulls, two Dairy Processing Units with 10,000 LPD & 60,000 LPD capacities, a vibrant Agricultural Technology Information Centre (ATIC) and the KVK for imparting training on all aspects of Dairy Education, the Institute has recently added a world class National Referral Centre for Milk Quality & Safety. The Institute has also created a modern Sports Complex with the provision for multiple indoor sports facilities and Gymnasium to address the physical and mental health of the students. Starting with the academic session 2017-18, a unique initiative "Foundation Program for Freshers" was started to sensitize students towards important extra-curricular activities aimed at fostering in them elements of values, leadership, teamwork, communication, sports, literary and cultural creativity so that they develop into a well organized individuals. During the four weeks of exposure to various activities, the innate talents of the students are identified and subsequently nurtured through regular weekend training and mentoring in various clubs.

The Institute has also been recognized as Centres of Advanced Faculty Training in the disciplines of Animal Genetics & Breeding and Dairy Processing to impart advanced training to human resources available with the State Agricultural Universities and Central Universities with Agricultural Faculty so that they in turn can impart contemporary knowledge in cutting edge science to the students at their respective Universities. Over the last more than two decade, CAFTs have conducted 67 courses and trained faculty of almost all the



NDRI ranked first among all Agricultural Universities of India. Director, NDRI receiving the award from Hon'ble Union Minister for Agriculture and Farmers Welfare



Universities imparting Dairy and Animal Science education. NDRI has been proactive in leveraging its core competence to the global communities by offering well structured practical cum theory lessons in the form of short term International Training Programs. There are 30 such courses being offered covering contemporary knowledge base for addressing problems related to animal breeding, feeding, milk processing and marketing.

Scientists at the Institute are very competitive and have attracted over 85 crore rupees as external grants to support research initiatives at the Institute. This has led to capacity building not only in terms of state-of-the-art laboratories equipped with all necessary modern instruments but also created opportunities for developing new networks and multi disciplinary and multi institutional collaborations. The Institute has collaborative programs going on with USA, United Kingdom, Germany, Australia, New Zealand, South Africa and Brazil and looks forward to many more such future collaborations.

ICAR-National Dairy Research Institute, Karnal established Technology Business Incubation facility way back in 2009 with financial support from Department of Science and Technology and subsequently integrated it with Business Planning and Development (BPD) Unit set up under the aegis of Indian Council of Agricultural Research during the implementation of National Agricultural Innovation Project (NAIP) to harness the scientific knowledge and innovation available at the Institute for the benefit of entrepreneurs, students, industry and farming community. Over the last five years, the BPD Unit has organized 79 Entrepreneurship Development Programs (EDPs) to train 1473 participants in the field of dairying. Besides, 14 programmes have been organized for various Government officials/Pvt. Sector/NGO/Developmental Agencies to train their employees in the field of scientific dairy farming, value added dairy products, fertility management of dairy animals etc. BPD Unit also organized capacity building programmes for farmers, farm women and rural youths and actively participated in the Unnat Bharat Abhiyan Scheme of Govt. of India. Several off campus training programs were organized for progressive farmer groups in Lalukheri, Muzaffarnagar (UP) and Piprakothi, Motihari, (Bihar). It also organized Entrepreneurship Camp for the students of NDRI and other institutions. One of the thrust areas of BPD has been incubation services being provided to the entrepreneurs at very initial stages of business. The hand-holding approach has been a great success with 10 graduated incubatees having successfully set up their enterprise and 12 incubatees still enrolled with the unit. Further, 4 of our incubatee companies have been identified as start up and awarded the certificate of recognition by Govt. of India. BPD unit through its EDP programs and continuous mentoring has successfully guided about 200 entrepreneurs to initiate their start ups mainly in dairy farming, milk processing, bakery and other food processing ventures. BPD Unit has also signed MoU with Aarambh Startup Advisor Pvt. Ltd., Gurgaon for their assistance in guiding entrepreneurs for non-technical aspects of enterprise.

Subsequent to the initiative taken by the Indian Council of Agricultural Research towards 'competency-based training for all', the Institute has set up Human Resource Management (HRM) unit for coordination and effective implementation of training programmes custom made for each group of human resources. Over the last five years, 132 scientists, 78 technical personnel, 24 administrative and 59 supporting staff have undergone such competency based training.

Community engagement for building capacities and enabling farmers to adopt technologies for harnessing benefits of the thriving dairy sector continues to be central to our outreach programs. An Extension Education Programme "Dairy Education at Farmers' Door" has been continuing for over 8 years to strengthen the effective dissemination of dairy production and processing technologies among the farming community. The Institute has also initiated in

2014 a unique programme "Farmers' School" for imparting non-formal education to farmers in all aspects of agricultural operation. So far two batches of farmers (44) have passed out and the third batch with 20 enrolled women farmers are to be soon awarded certificates. These farmers serve as mentors to many more farmers and have multiplier effect in terms of dissemination of technical knowhow. Mera Gaon Mera Gaurav and Farmer First are the new initiatives of the ICAR being implemented to increase interface with the farmers and encourage their participation as partners in research problem identification and finding their solutions through technological innovations. Several other activities like Grameen Dairy Melas, Calf Rallies, Veterinary Camps, Women Agriculture Days, Field Days and on-farm demonstrations are routinely carried out to sensitize and increase awareness among the stakeholders particularly farmers about the new scientific know-how on animal husbandry including milk and crop production. A three-day mega event called "National Dairy Mela" is organized at the NDRI campus every year to encourage farmers adopt scientific dairy farming practices. The events conducted include animal shows, milk competitions for different species and breeds of animals, exhibition stalls for display & demonstration of new technologies, kisan sangosthies, dairy product making competitions etc.

Krishi Vigyan Kendra (KVK) and Dairy Training Centre (DTC) at NDRI conduct regular training programmes for farmers and rural women in order to acquaint them with modern dairy farming practices. Since its inception in 1976, more than 3800 training programmes for various categories of end users have benefitted more than 65,000 rural youths, school drop-outs, farm women, farmers and ex-servicemen. The Dairy Extension Division of the Institute has developed information packages in the form of video films and multimedia packages on clean milk production, hygienic milk processing and packaging and scientific calf rearing based on Information and Communication Techniques (ICT). Keeping in view the significance of ICT in relation to Transfer of Technology (TOT) in the current scenario, the Agricultural Technology Information Centre (ATIC) of the Institute works as a single window delivery system for all queries related to technologies available at the Institute.

The Institute annually organizes "Dairy Husbandry Workshop" and "Institute-Industry Interface" for stakeholders in the Government and other Developmental agencies and also the Dairy Industry to apprise them with the new technological developments having taken place at the institute during the preceding year and receive feedback from the field. This two way exchange of information has greatly benefitted the stakeholders and the Institute and definitely increased our effectiveness and social impact.

This continued emphasis on capacity building will be further strengthened during the coming years as the Institute is gearing up for taking new initiatives for introducing elements of learning outcome centric modules to the curriculum and forging newer ties with the global universities to offer the faculty and students international mobility arrangements in the form of internships, sandwich, dual degree and twinning programs. It is also envisaged to engage Alumni and leading Industry as partners in curriculum development, fostering entrepreneurship among students and career guidance. Implementation of quality management systems (QMS) coupled with on campus and virtual classroom interaction with the international faculty and introduction of mechanism of continuous students' & peer feedback are some of the other futuristic initiatives proposed to catapult the Institute to greater heights of academic excellence and prepare the students for entrepreneurial ventures and global career opportunities.



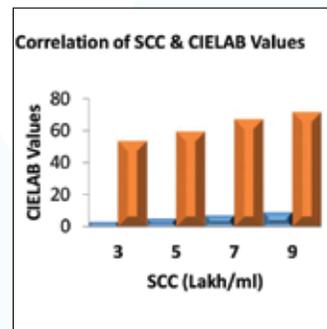
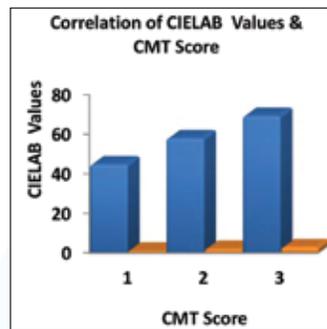
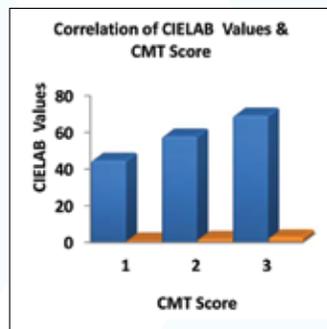
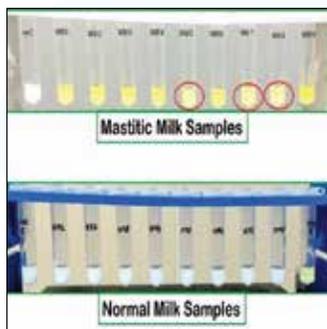
(R. R. B. Singh)

RESEARCH

Simple and Rapid Enzyme Substrate Assay for Detection of Subclinical Mastitis

(Abhinav Tirkey and Chand Ram)

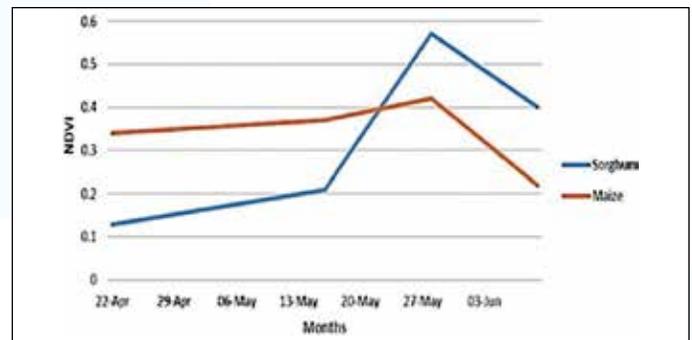
An enzyme substrate assay was developed for detection of subclinical mastitis. The test is simple, rapid and it gives results in 10 minutes. The process conditions for sample and substrate volume, time and temperature of incubation of the test were optimized. The developed test is suitable at society level with minimum infrastructure requirement. The test was optimised and validated in laboratory. The process showed better correlation with conventional tests.



fodder crops mainly grown in different districts of Haryana are Barley, Lucerne, Sorghum and Maize, which are mostly sown by March and harvested by June for summer season. LISS-III images were pre-processed followed by the estimation of Normalized Differential Vegetation Index (NDVI) for different dates between March and June. It was observed from the NDVI based temporal profiles that fodder crops mostly showed high NDVI in the month of May and low in the months of March and June. Whereas, other crops had different NDVI-temporal profiles and trees maintained a high NDVI throughout. Different profiles helped in discriminating fodder crops from others. Based on the spectral profiles different classes were made using ISODATA-Unsupervised classification technique.



Fodder cultivation area (hectares) in different districts of Haryana



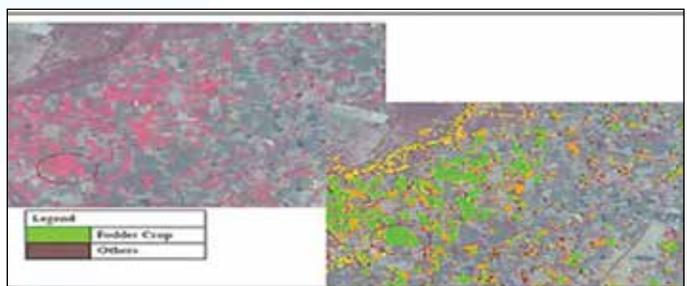
NDVI spectral profile for sorghum and maize

Fodder Crop Area Estimation using Remote Sensing Techniques in Districts of Haryana

(Magan Singh, Sumi Kala, Sujay Dutta, Shashank Dwivedi, Rajesh Kumar Meena and V. K. Meena)

Low productivity of livestock in India is attributed to the non-availability of proper feed and fodder. Remote sensing techniques can provide an important input in various fodder development activities. It facilitates discriminating between fodder and other crops and then assessing its availability. A study using Remotely Sensed Image from, Indian Remote Sensing Satellite (IRS-P6) Linear Imaging Self-Scanning Sensor (LISS-III) multi-temporal data was used to discriminate fodder and other crops in different districts of Haryana during summer season i.e. from March to June. The field location (Latitude, Longitude) of fodder growing areas was recorded using hand held GPS. Ancillary information such as village name, crop condition, date of sowing, and harvesting was also collected. These field locations were used to collect different crop signatures for the spatial assessment of fodder crops in the study area. The

Pixel count from classified image based was used to estimate the area under fodder crops for different districts of Haryana. The total area under fodder cultivation in Haryana was around 37000 ha with highest being in Hisar district (6000 ha) followed by Bhiwani (3500 ha) and Kurukshetra (3000 ha).



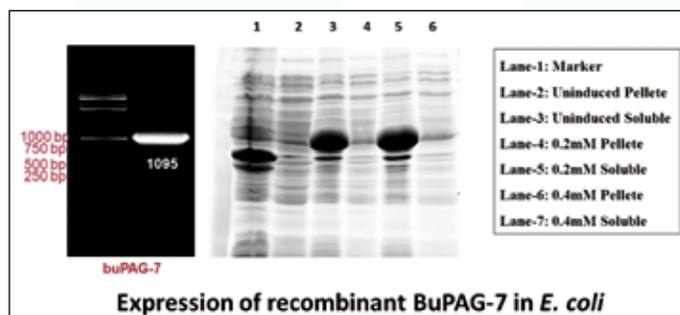
Fodder crops as identified using LISS-III imagery of different dates for summer season

Molecular Cloning and Expression of Buffalo Pregnancy Associated Glycoproteins for Early Detection of Pregnancy

(Munna Lal Yadav, Sudarshan Kumar, Suman Choudhary, Masoud Lotfan, Jai K. Kaushik and Ashok K. Mohanty)

Development of simple strip based early pregnancy detection kit for cattle and buffalo is requirement for milk producing countries. Presently, no method is available for early pregnancy diagnosis for use by farmers except progesterone based strips, which is not generally preferred due to its non-specificity. Pregnancy associated glycoprotein (PAGs) are a group of glycoproteins which are embryo specific pregnancy markers and are considered ideal candidates for developing pregnancy diagnostic kits. Different isoforms of PAGs are expressed by the binucleate cells of fetal cotyledons starting from 25th day of pregnancy till parturition. The level of PAGs rises to detectable levels in maternal blood and milk during pregnancy on 25th day onwards after fertilization. As pregnancy failure occurs, PAG concentrations drop and disappear from milk and maternal blood.

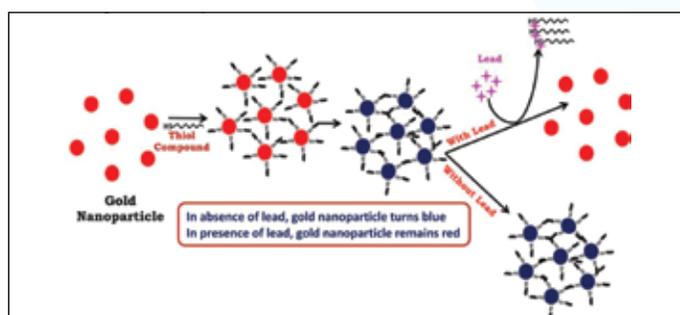
PAG-7 is a predominant isoform, which is expressed in buffalo during early pregnancy. Buffalo specific PAG-7 gene in bacterial expression system (*E. coli*) was successfully cloned and expressed. Expression analysis of recombinant PAG-7 was done by induction with different concentration of IPTG. Solubility of the expressed protein was checked at various temperatures and was found to be partially soluble at 37°C. PAG-7 was purified using His trap affinity column. Recombinant purified proteins by different chromatography are being used for generation of antibody. The best interacting antibody will further be used for ELISA and strip based Lateral Flow Assay. Preliminary standardization for development of lateral flow strip has been done.



Label Free Method for Detection of Heavy Metal Load in Water Developed

(Jyoti Gahlaut, Yudhishtir Singh Rajput, Sunita Meena, Dhiraj Kumar Nanda and Rajan Sharma)

Gold nanoparticles possess unique optical properties. Its colour is dependent on size. Size of gold nanoparticles is in range of 10 nm to 40 nm, which on aggregation increases. Dispersed gold nanoparticles are red in colour while aggregated gold nanoparticles are purple or blue. Gold nanoparticles exhibit plasmon resonance peak at 520 nm. On aggregation, absorbance at 520 nm decreases and absorbance at



650 nm increases. Sulphur from thiol compounds can bind gold with unusual strength. Certain selected thiol compounds can aggregate gold nanoparticles. Heavy metals can also bind to sulphur and thus, can prevent thiol-induced aggregation of gold nanoparticles. A method for detection of lead (dynamic range from 10 nM to 100 µM) has been developed. Metals such as mercury and chromium were more effective in comparison to lead. Thus, developed method can be used for assessing heavy metal load in water samples. Amongst several thiol compounds, 4-methylthio-1-butanol induced aggregation of gold nanoparticles was altered in presence of heavy metals.

Biofunctional Properties of Synbiotic Fruit Yoghurt

(Jagrani Minj and Shilpa Vij)

Biofunctional synbiotic fruit yoghurt (SFY) was prepared by using *in vitro* screened probiotic yoghurt bacteria, prebiotic inulin and fruit pulp. ST 144 and LB 144 showed good probiotic attributes and were selected for the preparation of synbiotic fruit yoghurt. The conditions were optimized for preparation of synbiotic fruit yoghurt (SFY) using Response Surface Methodology (RSM) by taking independent factors sugar, fruit pulp (mango, blueberry, strawberry raspberry) and inulin and their response antioxidant activity. Among all the yoghurts, SFY blueberry showed highest polyphenol contents and antioxidant activity. ACE inhibitory activity and flavonoid contents of the same sample were also higher than the other SFYs. The 10 kDa bioactive peptide fraction prepared from the SFY (blueberry) showed significantly higher antioxidant activity. ACE-Inhibitory activity and the antimicrobial activity (expressed in zone of inhibition). LC-MS/MS-MS sequencing of 10 kDa bioactive peptide fractions showed many peptide sequences like antioxidant peptides, ACE-Inhibitory peptides, antimicrobial peptides and immunomodulatory peptides. Anti-cancerous peptides and anti-thrombotic peptides were also identified from the same sample. *In vivo* study revealed that oxidative stress biomarker enzymes ALT, AST and ALP were significantly decreased in SFY and 10 kDa peptide fed group of animals whereas, the antioxidant enzyme levels CAT, SOD, and GP_x in erythrocyte and liver homogenate samples were increased significantly in these groups. Faecal microbiological analysis for *lactococci*, *lactobacilli* and coliform count showed significant changes in the log count cfu/mL among different diet fed group of animals. It was concluded that synbiotic blueberry yoghurt and its bioactive peptides have significant antioxidative properties alongwith other bio-functional properties.



Production and Characterization of Alpha-Glucosidase and Dipeptidyl Peptidase-IV Inhibitory Milk Bioactive Peptides Using *Lactobacillus* spp.

(Prasad S. Patil and Surajit Mandal)

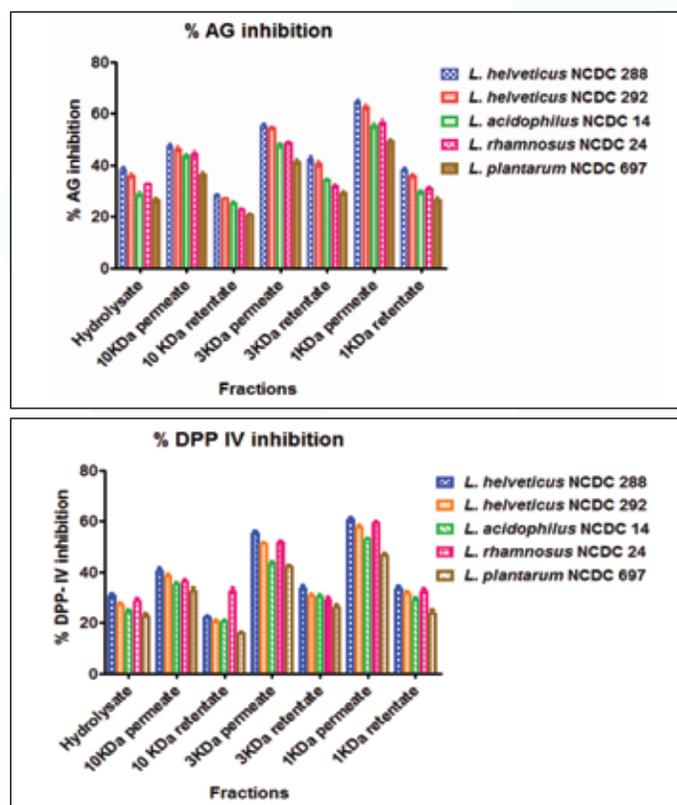
Bioactive peptides with alpha-glucosidase and DPP-IV inhibition potential were generated by fermenting buffalo skim milk with proteolytic *Lactobacillus* spp. Fermented buffalo skim milk prepared by as many 21 strains of *Lactobacillus* as a single culture was analyzed for peptide content, alpha-glucosidase and DPP-IV enzymes inhibition profiles. Peptide contents (measured by OPA method) ranged between 2.30 and 4.63 mg of leucine equivalent/ml of skim milk fermentate. Alpha-glucosidase and DPP-IV inhibitory activities were found to be the highest in skim milk fermented with *L. helveticus* NCDC 288. On the basis of higher enzyme inhibitions, cultures namely *L. helveticus* NCDC 288, *L. helveticus* NCDC 292, *L. acidophilus* NCDC 14, *L. rhamnosus* NCDC 24 and *L. plantarum* NCDC 697 were selected. Peptides in skim milk fermentate were fractionated by ultrafiltration (10, 3 and 1 kDa ultrafiltration membranes) and higher alpha-glucosidase and DPP-IV inhibitions were observed in 1 kDa permeates. Peptides in 1 kDa permeate were further fractionated by RP-HPLC. Two fractions from *L. helveticus* NCDC 288 and one fraction from *L. rhamnosus* NCDC 24 showing maximum enzyme inhibitory activities were sequenced by LC-MS/MS and 14 different peptides originated from caseins and whey proteins were identified. Most of the sequenced peptides were structurally similar with previously reported alpha-glucosidase and DPP-IV inhibitory peptides (VLPVPQK). Thus, peptides rich formulation with alpha-

glucosidase and DPP-IV inhibitory potential can be prepared from milk by selected proteolytic *Lactobacillus* sp. for the development of functional foods and nutraceuticals.

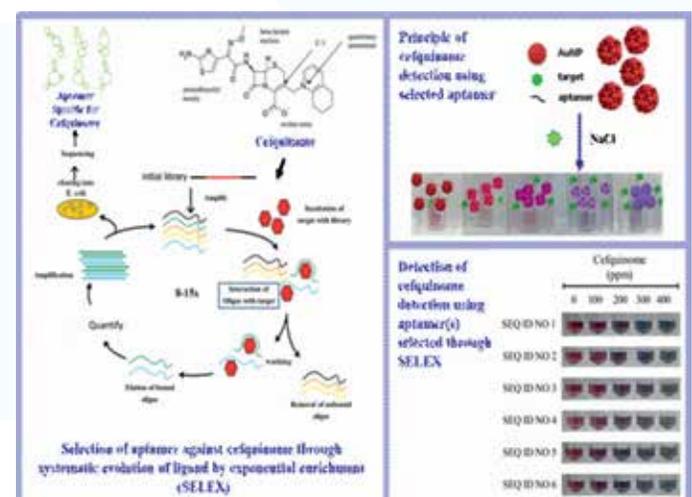
Selection of aptamer(s) against cefquinome for its use as ligand in gold nanoparticle based aptasensor

(Amit Kumar Barui, Rajan Sharma, Y. S. Rajput and Bimlesh Mann)

Cephalosporins are part of β -lactam group of antibiotics, preferred over other antibiotics in livestock due to their short withdrawal periods. Among cephalosporins, cefquinome is frequently used in therapy of infectious diseases in dairy cows. The vast majority of tests for antibiotics residues in milk are currently done by microbiological screening tests (MST) or by β -lactam receptor tests, which lack selectivity as these do not allow substance identification. MST when applied in milk lack sensitivity for cefquinome which has a maximum permissible limit of 20 ppb as per European Union. In present work, aptamers against cefquinome are generated and tested for establishing proof-of-principle of recognition of cefquinome by generated aptamer. Aptamers for cefquinome were selected from a random pool (10^{14}) of ssDNA sequences which has 18nt long constant regions at both 5' and 3' ends and 36nt long random sequences between constant regions. The aptamers were selected through the Systematic Evolution of Ligands by Exponential Enrichment (SELEX). The aptamer pools obtained after SELEX were sequenced. Examination of sequences of aptamers revealed 6 different aptamer sequences. The generated aptamers against cefquinome exhibited dissociation constant values in the range of 83-266 nM. Each of the aptamers was further tested for its ability to be used in aptasensor. All aptamers recognized cefquinome as indicated by colour change (red to purple or blue) of aptamer coated gold nanoparticle in presence of 200 ppm cefquinome. The study resulted in generation of a number of aptamers against cefquinome and proof-of-principle for detection of cefquinome by aptamers.



Alpha-glucosidase and DPP-IV inhibitions by ultra-filtered fractions of skim milk fermentate



Selection of aptamer(s) against cefquinome for its use as ligand in gold nanoparticle based aptasensor

EXTENSION

DAIRY EXTENSION DIVISION

Dairy Education at Farmers' Door

Dairy Extension Division organized the ongoing Extension Education Programme "Dairy Education at Farmers' Door" to strengthen the effective dissemination of dairy production and processing technologies among farming community. A team of NDRI subject matter specialists from production, processing and management group visited a new cluster of villages viz. Subri, Dadupur and Shahpur in Karnal district on 2nd Saturday of each month. 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 crops for the benefit of farming community.

Kisan Sangosthies

A total number of 10 Kisan sangosthies were organized and the issues related to management of silent heat, care and management of calves, clean India campaign, measure for control of mastitis in dairy animals, role of mineral mixture in animal diet and clean milk production practices in rural areas were discussed. The team of extension scientists gave solutions to the problems related to these issues faced by farmers.

Empowerment of Women and Mainstreaming of Gender Issues

Twelve women empowerment trainings and campaigns 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 farmwomen could generate more income from dairying to cater to the needs of their families. By these programmes, 190 farmwomen and farmers were trained in villages Gorgarh, Subri, Kulwahri, Dungro and Gumto.

Educational Visits and Tours

A total numbers of 2071 visitors (students & faculty) of 32 colleges/Institutions/Universities visited the Institute. The groups were sensitized about different research, teaching and extension achievements and facilities available in the Institute.

Farmers' Farm School

NDRI has started 3rd Batch of Farmers' Farm School (FFS) for farmwomen under education and extension programme, which aims at enhancing the productivity of agricultural practices in this series. A two day exposure and training on preparation of Rasmalai and Kulfi was organized for 20 farmwomen enrolled in third batch at women empowerment lab of the Institute. Regular classes were organized

on every Friday and Saturday for educating the farmwomen in dairy farming and its allied activities in village Gorgarh.

INSTITUTE TECHNOLOGY MANAGEMENT COMMITTEE (ITMC)

Patent Granted

S. No.	Title of Patent	Inventors	Date of Filing	Patent Grant No.	Grant Date
1	A Process for the Preparation of Ready to Reconstitute Kheer Mix (1076/DEL/2006)	A. A. Patel, G. R. Patil, R. B. Singh, N. Tyagi, V. Tripathi and A. Jha	27.04.2006	284267	15/06/2017

Technologies Transferred

S.No	Name of Technology	Name of Firm	Date
1.	Sugar Tolerating Lactic Cultures for Preparation of Misti Doi (Misti Doi Culture – 15 Freeze Dried Ampolues)	NIF Private Limited, Village Bahrapur, Teshil Bilhaur, Kanpur, Uttar Pradesh	21.04.2017
2.	Whey Jaljeera Drink	J. R. Agritech Pvt Ltd, Aligarh, UP	04.05.2017
3.	Whey Mango Drink		
4.	DNA Based Method for Differentiation of Cow, Buffalo, Sheep, Goat and Camel Milk	Pradeshik Cooperative Federation Ltd. Lucknow	05.06.2017

ITMU Meeting

- 34th ITMU meeting was organized at NDRI, Karnal on 17th April, 2017. Director, NDRI, Dr. R. R. B. Singh chaired the meeting. The policy issues related to technology transfer were discussed.

Transfer of Technology

- MoU was exchanged for the transfer of technology of DNA based method for differentiation of cow, buffalo, sheep, goat and camel milk on 05.06.2017 between Pradeshik Cooperative Federation Ltd. Lucknow and ICAR-NDRI.



Director, NDRI with IJSC Members and other officials of the Institute.



MoU being exchanged for the transfer of technology

EVENTS



International Training Programme on Modern Dairy Technology and Management

An International training programme on "Modern Dairy Technology and Management" was organized from 15th – 29th April, 2017 at NDRI, Karnal by Dairy Extension Division of the Institute in collaboration with National Institute for Agricultural Extension Management (MANAGE), Hyderabad, under the USAID programme Feed the Future – India Triangular Training. The training programme was attended by 24 participants from 9 different countries i.e. Afghanistan, Botswana, Ghana, Kenya, Liberia, Malawi, Mongolia, Mozambique and Uganda.

The training aimed at sharing of information, knowledge and technologies suitable for mechanization of small farms in the African and Asian countries.

Dr. K. P. Singh, Vice-Chancellor, Chaudhary Charan Singh Haryana Agricultural University, Hissar was the Chief guest and Dr. R. R. B. Singh, Director NDRI, Karnal presided over the programme. The main objective of this training programme was to acquaint the participants with knowledge in principles, planning and technical approach for establishing dairy farms, processing of milk and development of marketing network and value chain in milk production, processing and marketing to minimize the marketing channels. On this occasion, Dr. P. Chandra Shekara, Director, MANAGE, Dr. Inderjeet Singh, Director, ICAR-CIRB, Hisar, Dr. P. C. Sharma, Director, ICAR-CSSRI, Karnal were also present.



Entrepreneurship Camp

Business Planning and Development Unit organised an "Entrepreneurship Camp and Got-an-Idea Challenge Season-2" at NDRI, Karnal during 29th – 30th May 2017 attended by students and entrepreneurs from different academic Institutions across the country. Dr. A. K. Singh, Incharge, Business Planning and Development Unit acted as the member of Jury and Mentor for the Got-an-Idea Challenge Season-2. In all, 117 applications were evaluated for the Start-ups in the various fields from the different

states. Ten Start-up teams were selected from the first round on 30th June, 2017 for further mentoring.

Workshop-cum-Interactive Session on the Art of Understanding Reasoning and Argumentation

Student Empowerment Unit of ICAR-NDRI organised a "Workshop-cum-Interactive Session on the Art of Understanding Reasoning and Argumentation" on 6th May, 2017. Mr. Deepak Maun and Ms. Purwa Rathi, illustrious alumni of NDRI were the resource persons for this workshop. The objective of this workshop was to guide and motivate the participants to work on some of the crucial aspects of communication and nurture them for their personal growth. The art of understanding reasoning and argumentation is very crucial in one's personal as well as professional life. This theme was chosen to help the students to get a deeper and more holistic understanding of the problem of effective reasoning and argumentation for being successful in putting forth their ideas effectively. In the open interaction session, the resource persons also shared their journeys and experiences, and the role that NDRI played in their success.



A glimpse of the workshop on the art of understanding reasoning and argumentation

Trainings Organized

- Dairy Technology Division and BPD unit jointly organised an EDP on "Milk Processing and Value Addition" for 26 participants from 29th May to 7th June, 2017. Dr. G. S. Meena and Dr. Shaik Abdul Hussain coordinated the activities of the training.
- Dairy Technology Division also organised a training programme on "Basic Aspects of Milk and Milk Processing" for 25 farmers of Motihari, Bihar from 27th - 29th June, 2017. Dr. Yogesh Khetra coordinated the training.

International Yoga Day

An International Yoga Day was celebrated at NDRI, Karnal on 21st June, 2017 with the help of expert trainers of Yoga. All the students and staff members alongwith their families attended this programme. Certificates towards participation were issued to the students by the Institute.

HONOURS/AWARDS

ICAR Awards to NDRI on the Occasion of 89th Foundation Day of ICAR Celebrated on 16th July, 2017:

- ICAR- National Dairy Research Institute, Karnal has been ranked first among all Agricultural Universities of India including 4 Deemed Universities. The award was received on 16th July, 2017 by **Dr. R. R. B. Singh**, Director and Vice Chancellor, ICAR-NDRI, Karnal at Delhi from **Sh. Radha Mohan Singh Ji** Honorable Union Minister for Agriculture and Farmers Welfare.
- Dr. A. Kumaresan**, Senior Scientist, Southern Campus, Bengaluru received "**Bharat Ratna Dr. C. Subramaniam Award**" for outstanding teachers 2016.



Dr. A. Kumaresan, Senior Scientist, Southern Campus, Bengaluru receiving Bharat Ratna Dr. C. Subramaniam Award

- Dr. K. Laxmana Naik N.**, Dairy Chemistry Division, Southern Campus, Bengaluru received "**Jawaharlal Nehru Award For P.G. Outstanding Doctoral Thesis Research**" in Agricultural and Allied Sciences 2016.



Dr. K. Laxmana Naik N., receiving Jawaharlal Nehru Award For P.G. Outstanding Doctoral Thesis Research

- Dr. Shrabani Saugandhika, D.**, Animal Biotechnology Centre, NDRI, Karnal received "**Jawaharlal Nehru Award For P.G.**

Outstanding Doctoral Thesis Research" in Agricultural and Allied Sciences 2016.

- Ms. Prem Kumari Mehta**, Private Secretary, Dairy Technology Division, NDRI, Karnal received "**ICAR Cash Award Scheme 2016 for Administrative Category**" employees of ICAR on 16th July, 2017.



Ms. Prem Kumari Mehta, Private Secretary receiving award

- Sh. Kulvinder Singh**, Skilled Supporting Staff, Dairy Chemistry Division, NDRI Karnal Received "**ICAR Cash Award Scheme 2016 for Supporting Category**" employees of ICAR on 16th July, 2017



Sh. Kulvinder Singh, Skilled Supporting Staff receiving award

VISIT ABROAD

Dr. (Mrs.) Smita Sirohi, Head, DES&M Division was deputed to attend 18th IFCN Dairy Conference on "Dairy Development - Past, Present and Future" from 10th - 14th June, 2017 at Kiel, Germany.

DISTINGUISHED VISITORS

- 17.4.2017 Mr. Mark Wallace, Attache for Agricultural Affairs and Dr. Vijay Intodia, Agricultural Specialist from US Embassy, New Delhi.
- 5.6.2017 Hon'ble Haribhau Kisanrao Bagade, Speaker of Maharashtra Legislative Assembly alongwith Director, Aurangabad District Co-operative Milk Producers' Union Ltd., Aurangabad.
- 19.6.2017 HCS Extra Assistant Commissioner (HCS Probationers, UT) (30 No.) from Saina Nehwal Institute of Agricultural Technology, Training & Education, CCS, Haryana Agricultural University, Hisar.

PERSONALIA

Joining/Appointments

- Dr. Bimlesh Mann, Head, Dairy Chemistry Division, NDRI, Karnal has been entrusted the additional responsibilities of Acting Joint Director (Research), NDRI, Karnal for further period of six months w.e.f. 01.04.2017.
- Sh. Raj Kumar, Sr. A. O. joined at NDRI, Karnal after transfer from ICAR-CIPHET, Ludhiana w.e.f. 03.04.2017.
- Dr. Vedamurthy G.V. Scientist joined at Animal Biochemistry Division, NDRI, Karnal after transfer from ICAR-CSWRI, Avikanagar w.e.f. 06.04.2017.
- Dr. Sadeesh E. M. Scientist joined at Animal Biochemistry Division, NDRI, Karnal after transfer from ICAR-CIRB, Hisar w.e.f. 20.04.2017.
- Dr. Anil Kumar Dixit, Principal Scientist joined at Dairy Economics Statistics & Management Division after relieving from ICAR-CIPHET, Ludhiana w.e.f. 20.06.2017.

Promotions

- Dr. Anupama Mukherjee, Sr. Scientist, Animal Genetics & Breeding Division, NDRI, Karnal promoted as Principal Scientist w.e.f. 23.08.2014.
- Dr. A. Kumaresan, Sr. Scientist (Animal Reproduction & Gyna) Southern Campus, Bengaluru promoted as Principal Scientist w.e.f. 09.07.2015.
- Dr. S. Jeyakumar, Sr. Scientist (Animal Reproduction) Southern Campus, Bengaluru promoted as Principal Scientist w.e.f. 16.08.2015.
- Dr. P. Heartwin Amaladhas, Sr. Scientist (ASPE) Southern Campus, Bengaluru promoted as Principal Scientist w.e.f. 02.09.2015.
- Dr. Kaushik Khamrui, Sr. Scientist, Dairy Technology Division, NDRI, Karnal promoted as Principal Scientist w.e.f. 03.03.2016.

Transfers/Retirements

- Sh. R. C. Meena, Sr. A.O. NDRI, Karnal transferred from NDRI to join his duties at ICAR-DRMR, Bharatpur (Rajasthan) w.e.f. 01.04.2017.
- Sh. Ashok Mallick, Sr. A.O. NDRI, Karnal transferred from NDRI to join his duties at ICAR-CIRG, Makhdum w.e.f. 08.05.2017.
- Sh. Raj Kumar, Sr. A.O. NDRI, Karnal transferred from NDRI to join his duties at ICAR-CIPHET, Ludhiana w.e.f. 16.06.2017.
- Sh. N. K.Jain, Assistant Administrative Officer, E.V (Coord.) Section retired from Council's service w.e.f. 30.04.2017.
- Dr. O. K. Hooda, Principal Scientist, Animal Physiology Division, NDRI, Karnal retired from Council's services w.e.f. 30.06.2017.
- Dr. Suresh Kumar Singla, Principal Scientist, Animal Biotechnology Centre, NDRI, Karnal retired from Council's services w.e.f. 30.06.2017.

SOUTHERN CAMPUS, BENGALURU

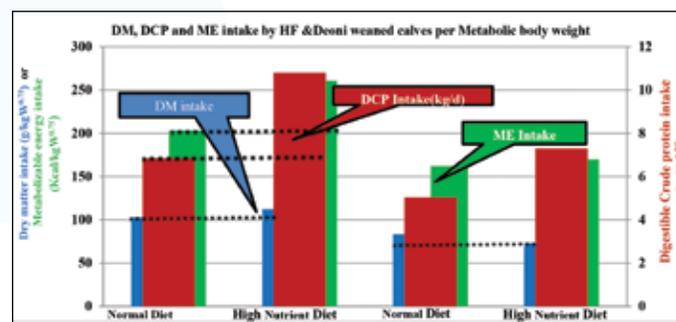


RESEARCH

A Distinctive Phenotypic Plasticity of Digestive System in Deoni Genotypes

(Ajay Singh and Bandla Srinivas)

An interesting phenotypic plasticity in dietary intake, particularly protein, due to limited plasticity of digestive system in Deoni weaned calves was observed in comparison to HF crossbreds. This is the very limitation that affecting the age at maturity and attaining late body maturity for milk production at 3rd or 4th lactation by Deoni breed compared to HF crossbreds by at least 30 to 40% of time lapse. Plasticity of protein and energy intake in Deoni cattle is necessary to



improve in order to address profit feasibility traits like maturity, first calving and peak lactation performance.

EXTENSION ACTIVITIES

- A total number of 730 visitors comprising 199 students from various educational Institutes, 531 farmers and entrepreneurs of Southern region visited the Campus. The visitors were taken round to various sections and briefed about the ongoing activities.
- Advisory services /technical advice were rendered to fourteen clientele during personal visits and mail enquiries. The profile of information needs of the advisory farmers/entrepreneurs comprised commercial dairy farming, cattle feed formulation, management of buffaloes and indigenous dairy animals.
- Extension literature on clean milk production, indigenous dairy animals and dairy products of the Southern region was distributed to the needy clientele groups during the visits, rural extension programme and exhibitions.
- Mera Gaon Mera Gaurav: Visits were made by the multidisciplinary team to the selected five villages of Devanahalli Taluk, Bengaluru. The multi-disciplinary team visited farmer households and interacted with the farmers regarding dairy farm management and the problems faced in dairy farming. Necessary technical advice was rendered on various aspects of scientific dairy farming to the farmers as per their needs.
- An orientation programme was organised, for 12 batches of 531 dairy farmers, 294 farmwomen and 237 trainees from CTI-KMF, Bengaluru from Tumkur, Kolar and Bengaluru Rural districts during April to June, 2017. The trainee farmers visited fodder demonstration unit, livestock research centre and Institute fodder farm. The information related to scientific dairy farming, animal health care and clean milk production was also provided as per their needs.
- Lecture presentations were made off-campus, by subject matter specialists on "Green Fodder Cultivation & Animal Husbandry Practices" on 19th May, 2017, "Scientific Feeding of Dairy Cattle" on 25th May, 2017 and "Hydroponic fodder production" on 27th May, 2017 for the benefit of dairy farmers.
- Under the collaborative Farmers' First Programme, ICAR-IIHR and SRS: ICAR-NDRI, 'Animal Infertility and Health Camp' was organised in the project villages on 29th April, 2017 on World Veterinary Day. Sixty dairy animals of the beneficiary farmers were treated and mineral mixture supplement was distributed to the farmer beneficiaries. Green fodder production in farmers' dairy units with improved fodder varieties was advocated as an essential component of dairy farming in the project villages and improved varieties of green fodder seeds of Fodder Maize, Jowar and Cowpea were distributed among the selected 110 farm beneficiaries of the project villages.



A view of animal fertility and health camp

- An informative audio-visual Compact Disc / Digital Video Disc on ongoing activities with a comprehensive information on the ongoing research, teaching & training and extension activities of Southern Campus of ICAR-NDRI was documented for the benefit of the multitude of clientele groups, visiting the Institute from all parts of the country.

EVENTS

Green NDRI and Green Bengaluru Programme

Southern Campus of ICAR-NDRI, Bengaluru in collaboration with Adamyta Chetana Foundation, Bengaluru organized "Tree Plantation Programme" on 7th May 2017 as part of Green Bengaluru drive launched by the Foundation. During the programme, seventy two tree saplings of various traditional varieties were planted in the Campus. The tree planting was initiated by Dr Tejaswini Ananth Kumar, Founder of Adamyta Chetana Foundation and Shri. H. N. Ananth Kumar, Hon'ble Union Minister for Parliamentary Affairs and Chemicals & Fertilizers, Govt. of India, in the presence of Justice Rama Jois, Former Governor of Jharkhand and Bihar states, Dr. K. P. Ramesha, Head, SRS of ICAR-NDRI, and local Corporators, Mrs Saraswatamma and Mrs Sarala Mahesh Babu. Inaugurating the programme, Shri. Ananth Kumar appreciated the green ambience of the Campus and motivated people towards planting more and more trees.



Planting of saplings at SRS, Bengaluru

World Milk Day Celebrated

World Milk Day was celebrated on 1st June 2017 in association with Indian Dairy Association (South Zone) and Alumni Association of ICAR-NDRI, Bengaluru. Dr. Suresh Babu, Director (Animal Husbandry), Karnataka Milk Federation, Bengaluru was the



Yoga for Physical and Mental Health was organised at Southern Campus, Bengaluru on 14th June, 2017

Chief Guest. Addressing the gathering, Dr. Suresh Babu stated the importance of celebrating World Milk Day and recalled the contribution of institutions which made India world's largest milk producer country. He emphasised the need for closer professional association among KMF, NDRI and IDA for developing dairy sector

in the changed scenario. Dr. K. P. Ramesha, Head, SRS of NDRI and President Alumni Association, NDRI Bengaluru stressed on the importance of creating awareness about the attributes of milk among people to enhance milk consumption. Dr. S. Ayyappan, NABARD Chair Professor also graced the occasion.

EASTERN CAMPUS, KALYANI



RESEARCH

Nutritional Evaluation of Five Aquatic Plants Available in New Alluvial Zone of West Bengal

(A. Chatterjee, Hemkrushna Khune, D. K. Mandal, C. Bhakat, M. K. Ghosh and T. K. Dutta)

A study was carried out to evaluate the comparative chemical composition of five naturally occurring aquatic plants (*Spirodela polyrrhiza*, *Lemna minor*, *Pistia stratiotes*, *Ipomoea reptans* and *Salvinia auriculata*) collected from various ponds, water logged areas and other water bodies in new alluvial zone of West Bengal. *Pistia* and *Lemna* had nearly similar DM (6.50 & 6.51) which was slightly lower than *Spirodela* (7.02) and *Salvinia* (7.34). *Ipomoea*, being a semi aquatic plant, had significantly ($P < 0.05$) higher DM content (9.92) than all other plants. Organic matter content in the five aquatic plants ranged from 79.20 ± 0.57 (*Lemna*) to 87.12 ± 0.37 (*Salvinia*). Crude protein (CP) content of *Spirodela*, *Salvinia*, *Pistia*, *Ipomoea* and *Lemna* were $16.86 \pm 0.28\%$, $9.42 \pm 0.66\%$, $9.65 \pm 0.28\%$, $16.27 \pm 0.85\%$ and $18.05 \pm 0.75\%$, respectively. *Salvinia* and *Pistia* had significantly lower CP content than other three plants. *Lemna* having highest CP content was statistically similar to *Spirodela* and significantly higher than *Salvinia*, *Pistia* and *Ipomoea*. Though, the Total Ash content was around 20% of DM in two duckweed species (*Lemna* and *Spirodela*) but only around 14 % of Total Ash content (around 3 % of DM) was Acid Insoluble Ash (AIA). *Ipomoea*, *Lemna* and *Spirodela* had significantly higher Ether Extract content than *Salvinia* and *Pistia*. ADF content was also significantly higher in *Pistia* and *Salvinia* than *Spirodela*, *Ipomoea* and *Lemna*. The ($P_A + P_{B1}$) protein fraction, which are highly degradable in rumen, was much higher in *Ipomoea* than other four plants. *Lemna* having highest P_{B2} fraction followed by *Salvinia*, *Spirodela*, *Pistia* and *Ipomoea* had much lower P_{B2} fraction. Fraction P_C that is neither degraded in rumen nor digested in lower tract was much higher in *Salvinia* ($11.69 \pm 0.06\%$) than other four plants. *Lemna* and *Pistia* and *Spirodela* were found to be good source of Ca and P. All the plants were found to be rich in Fe and Zn and poor source of Cu and Co. Concentration of Mn showed wide range of variation (8.9 to 679 mg/kg). *Spirodela*, *Pistia* and *Lemna* were very good source of Mn. Based on the overall chemical composition of the five aquatic plants, it was found that *Spirodela*, *Lemna* and *Ipomoea* were comparatively much better source of nutrients than *Salvinia* and *Pistia*.

Management of Repeat Breeding in Crossbred Cows with Intra Uterine Antiseptic, Antibiotic and Estrus Synchronization

(M. Karunakaran, Somenath Dutta, Ajoy Mandal, Mohan Mondal, Saroj Rai and Rajalaxmi Behera)

The study was carried out to evaluate the therapeutic effectiveness of intra uterine antiseptic, antibiotic and estrus synchronization and fixed time insemination in ameliorating the repeat breeding problem in crossbred dairy cows. Thirty Jersey X Red Sindhi crossbred cows in their second to fifth lactation with repeat breeding problem were used in the study. All the cows were maintained in the intensive feeding and management system of rearing. All the cows were gynaeco-clinically examined. First group of cows (T1; n=10) were administered with 30 ml of povidone iodine (Wokadine, Wockhardt, 5% w/v) intra-uterinely on the day of detected estrus and cows were inseminated in the subsequent estrus. Second group of cows (T2; n= 10) were administered with 1.5 g of cephalexin (Lixen IU, Virbac) intra uterine during mid estrus and inseminated 1 hr post cephalexin administration. Third group of cows (T3; n=10) were estrus synchronized with Ovsynch protocol, i.e., GnRH - 10 µg busereline acetate (Receptol Vet, MSD Animal Health) i.m. at Day 0, 500 µg of PGF₂ α (Clostenol, Zydus) i.m. at Day 7 and a second dose of GnRH at Day 9 and Timed AI was performed at 12 and 24 h after the second-GnRH treatment. All animals were diagnosed for pregnancy via per rectal palpation on day 60 post AI. The first service conception rate in group I, II and III were recorded as 30%, 70% and 50%, respectively. The first service conception rate was higher in group II animals (70%) treated with cephalexin followed by group III treated with Ovsynch protocol. Intrauterine administration of cephalexin improved the conception rate in the present study due to its bactericidal effect thus eliminating subclinical uterine infection. Cephalexin is first generation cephalosporin and remains a choice for intrauterine antibiotic with broad spectrum activity against both gram positive and negative bacteria. In the group III the cows treated with Ovsynch protocol, 50 % cows conceived. Increase in pregnancy rate in Ovsynch protocol may be due to prevention of delayed ovulation and anovulatory defects. GnRH administration ensures timely ovulation and efficient progesterone release for embryonic development results in better conception in repeat breeding cattle. It can be concluded that intra uterine infusion of cephalexin and Ovsynch protocol of synchronization could give better conception rate in dairy cows suffering with the problem of repeat breeding.

EXTENSION ACTIVITIES

- Eastern Campus of ICAR-NDRI is regularly organizing several extension programmes in different parts of West Bengal as well as Eastern and North Eastern parts of India. The details of extension programmes carried out during 1st April, 2017-30th June, 2017 are as follows:



Certificates being given to participants

- A training programme on "Scientific Dairy Farming" was organized from 26th April to 6th May, 2017. Eleven trainees from different districts of West Bengal participated in the training programme. During the training programme, different aspects of dairy farming like scientific feeding, health care and management, improved breeding etc. were discussed and practical sessions were organized to explain various facets of scientific dairy farming.

Four veterinary health camps and field training programmes for Diploma in Animal Husbandry and Dairying for third year students



Students of ERS, Kalyani treating animals and demonstrating Azolla technology in a village

of ICAR-NDRI, Kalyani were organized in Muratipur and South Chandamari villages to expose them to real problems in village level and to motivate them to apply their knowledge to solve the problems in real life situations. A total number of 148 animals were treated and 59 farmers got benefited in these camps.

- During the exposure visits, guided trips were arranged. A total of 127 farmers from several parts of West Bengal visited the campus to get first hand knowledge about dairy farming. Apart from that, teachers from Jawahar Navodaya Vidyalaya of different states also visited the Institute.
- A team of scientists and technical officers visited Piprakothi in Motihari, Bihar and participated in *Krishi Mela* during 17th -18th April, 2017. Various scientific dairy farming practices including high yielding fodder crops were exhibited during the mela. Extension literature was also distributed among the farmers during the occasion.



Farmers visiting exhibition stall of ERS, Kalyani during Krishi Mela



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