



NDRI

News

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From the Director's Desk



A view of Independence Day Celebrations

The livestock sector contributes nearly 25.6% of the value of output at current prices in Agriculture, Fishery and Forestry sector. The overall contribution of Livestock Sector in total GDP was nearly 4.11% during 2012-13. Dairying in India is witnessing transformation from traditional production system to either semi-commercial or commercial production system, which requires high producing dairy animals. As per the 19th Livestock Census (2012), the increase in the population of exotic/crossbred female cattle between 2007 and 2012 was 34.78%. In Punjab, the exotic/crossbred population accounts to more than 45% of the total milch animals. All this indicates that the demand for high yielding cows is increasing day-by-day. However, high yielding animals are prone to metabolic diseases/disorders, if not given due care and attention, resulting in serious consequences on milk production and farm economy.

With the continuing intensification and commercialization of dairy production systems, the economic implications of metabolic diseases are becoming increasingly important at the farm and national level. Milk fever (parturient paresis) continues to remain as the most challenging impediment among the several metabolic diseases. Recent literature suggests that while the milk production is increasing on one hand, the incidence of metabolic diseases like milk fever is also increasing on the other hand. Milk fever, a metabolic disease caused by a low blood calcium level (hypocalcaemia) occurring in dairy animals during the peri-parturient period, seriously reduces the production potentials of animals, especially the crossbreds, as they stand more susceptible to this fever as compared to the indigenous animals. In a study conducted at Tamil Nadu, it has been reported that the average prevalence of milk fever in cattle and buffaloes was 13.67 and 11.99%, respectively. Based on this observed prevalence and the in-milk population (19.42 million crossbred cows and 51.05 million buffaloes – 19th Livestock Census), it can be estimated that the number of milch cows and buffaloes that may be affected with milk fever in India can be around 2.65 million crossbred cattle and 6.12 million buffaloes.

Losses associated with milk fever are due to deaths, reduction in the productive lifespan of affected cow, and reduction in milk production following each milk fever episode, as well as costs of prevention and treatment. It has been reported that about one in 20 affected cows, dies due to milk fever. Further, milk fever can contribute to dystocia, uterine prolapse, retained fetal membranes, metritis, abomasal displacement, and mastitis leading to serious economic loss. In Finnish Ayrshire cows, it has been reported that the milk loss due to milk fever varies between 1.1 kg/day and 2.9 kg/day per animal. In India, it has been reported that the loss due to milk fever is ₹ 1,068 per affected cow and ₹ 665 per affected buffalo. If this data is extrapolated based on the milch animal population, then the loss due to milk fever may be around 6900 million INR, which is a substantial loss to the Indian dairy sector.



Generally, about 80% of milk fever cases occur within a day of calving because the onset of lactation results in the sudden loss of calcium into colostrum and milk from blood and some cows are unable to replace the calcium quickly. High yielding animals are more susceptible to milk fever as the drain of calcium in milk is quite high in these animals. The signs of milk fever are mainly due to lowered blood calcium levels; in typical cases cows show some initial excitement or agitation and a tremor in muscles of the head and limbs followed by staggering and "sitting" position, often with a 'kink' in her neck. If the animals are not treated immediately, they finally lie flat on their side before circulatory collapse, coma and death. Major cow factors contributing to development of milk fever include increased age and parity, high milk production, previous history and more fattiness. Nutritional factors for milk fever development include grass based diets, high potassium feeding, decreased dry matter intake and high dietary cation-anion difference.

Milk fever control strategies include restoration of the blood calcium to normal levels. The feeding management of dry cows in the last 2 weeks before calving is very important, because it affects both the amount of calcium available to replace blood calcium and the efficiency with which the available calcium can be used. Four major milk fever control principles used in dairy animals include oral drenching around calving with a supplement of easily absorbed calcium, feeding of acidifying rations by anionic salt supplementation during last weeks of pregnancy, feeding low calcium rations during last weeks of pregnancy and pre-partum administration of vitamin D, and related metabolites and analogues. The current understanding of the cation-anion difference concept suggests that milk fever could be managed more effectively if dietary potassium is reduced. Further research on effective methods for managing dietary potassium, especially during peri-partum period would help us to evolve suitable milk fever control measures. Since milk fever is a 'gateway' condition to many other transition cow problems, taking a proactive approach around the time of calving would definitely help reduce the risk of milk fever.

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

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RESEARCH

Cloned Buffalo Produced from Frozen thawed Semen

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

A male cloned calf named 'RAJAT' produced through 'Hand-guided Cloning' was born on 23rd July, 2014 by normal parturition. Its weight at the time of birth was 32.0 kg. The calf is a clone of a highly ranked progeny-tested Murrah buffalo bull (MU-4393), which had died many years back. The donor cell was isolated from the frozen-thawed semen of this bull, which was born on 10th December, 1995. The bull ranked 'first' in 5th set of all India progeny-testing program had 22.29% superiority. This technology could be very useful in multiplying the number of best bulls and meet their demand in the country.

Enzyme-Spore based Assay (s) for Detection of Antibiotic Residues in Milk

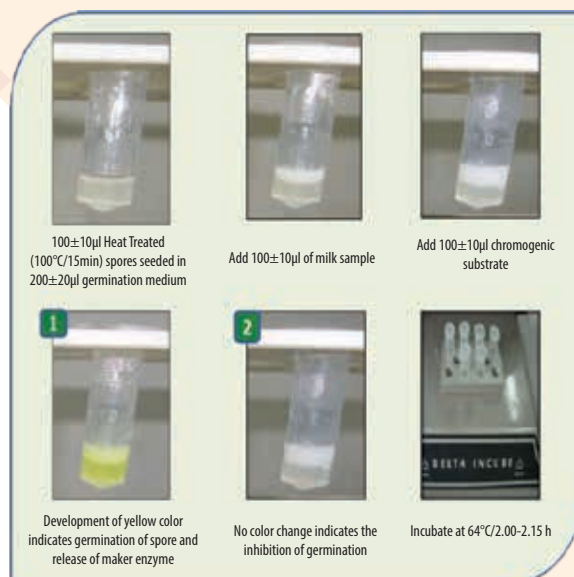
(N. Kumar, A. Khan, Shivani Arora, S. Shaikh and H. V. Raghu)

The presence of antibiotic residues in milk is a serious concern as this may affect consumer's health and also lead to the development of resistant microbial strains. The traditional methods available based on microbial inhibition, receptor binding, and enzyme colorimetric techniques are with inherent limitations. The bacterial spores have unique ability to sense environmental changes in response to specific "germinant" and transform rapidly into growing vegetative cells. This characteristic has been effectively used as biosensor for tracking microbial and non-microbial contaminants. A novel Enzyme-Spore Based Chromogenic Assay (ESBA) was developed based on specific marker enzyme (s) releases during spore germination and acted on substrate with the release of coloured compound, which can be observed visually in the absence of antibiotics. For production of enzyme-spore based assay, thermophilic strains of *B. stearothermophilus* were screened for different enzymes namely acetyl esterase, esculinase, β -D-galactosidase, β -D-glucosidase, α -D-galactosidase, α -D-glucosidase and α -D-mannosidase. A potential strain producing specific marker enzymes was selected and subsequently, spore production to an extent of 80-85% in novel "sporulation medium" was optimized. A reproducible, real time, simplified enzyme-spore assay in two stages using novel medium was developed. The working principle of enzyme-spore based assay is based on release of specific indicator enzyme (s) by germinating spores which will act specifically on chromogenic substrate resulting in coloured end product which is measured semi-quantitatively by visual



"RAJAT" CLONE OF MU-4393

observation. The Enzyme-spore based assay exhibited minimal false positive/negative observations at codex recommended limits of antibiotics when compares with microbial based receptor assay (Charm II assay) and ROSA test. The assay showed excellent performance in buffer/ or milk system in natural/ or spiked sample with wide range of application with different types of milk and milk products. The Enzyme spore based assay (s) has the potential for its commercial application for routine monitoring for antibiotics in milk under Indian conditions of milk production and processing.

**Direct Vat Set (DVS) Misti Dahi Culture**

(Siddivinayaka and S. Mandal)

Misti dahi is one of the most popular indigenous fermented milk products in India. Due to increasing demand, the organized sector including co-operatives and private dairies are taking up keen interest in its large-scale production. However, it is still prepared using undefined mixed strain starters and by traditional methods. Concentrated freeze dried starter cultures are not



MU - 4393

available. The availability of high quality concentrated starter cultures will be helpful for commercial scale production of good quality *Misti dahi* and cost of DVS culture is incurred only when production takes place. Thus, there is a need for development of cost-effective viable process for production of biomass *Misti dahi* culture. The present study is an attempt to produce concentrated freeze dried starter culture using whey based medium (WBM). Growth performance of *Misti dahi* culture was comparable in WBM (K=1.06) and M17 (K=1.14) broth. Increase in growth rate was observed in fermenter scale study (K=1.23) and it was further increased upon controlling of pH at 6.5 (K=1.43). Culture biomass was produced at fermenter level for preservation. Culture biomass was harvested by centrifugation, re-suspended in freeze-drying medium and subjected to freeze drying. Viable counts of freeze dried DVS cultures were 11-12 log cfu/g. Dry culture was packed in cryo-vials and vacuum sealed glass ampoules. Packed cultures were stored at $-20 \pm 1^\circ\text{C}$ and analyzed for viable counts and suitability in preparation of *Misti dahi*. Viable counts of DVS *Misti dahi* cultures remained in the range of 11-12 log cfu/g till 60 days and no significant differences in viability of culture in cryo-vials and in vacuum sealed glass ampoules were observed. Curd setting time of DVS culture was 8.5 h which remained same during storage, whereas for fresh culture, it was 6.5 h. Textural, physio-chemical, microbiological and sensory qualities of *Misti dahi* prepared using DVS and fresh culture were comparable for 30 days storage.

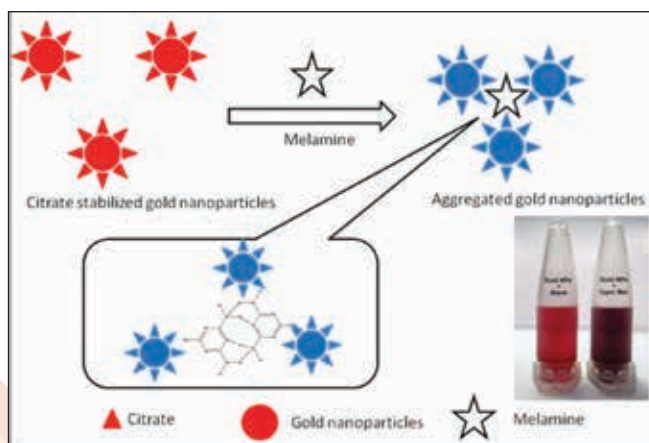


Misti dahi

Colorimetric Detection of Melamine in Milk by Citrate Stabilized Gold Nanoparticles

(Naveen Kumar, Raman Seth and Harish Kumar)

A colorimetric test was developed for detection of melamine in milk using Gold nanoparticles. Gold nanoparticles of 21 nm size were synthesized by citrate reduction method. The method is based upon the principle that the melamine causes the aggregation of gold nanoparticles and hence the wine red colour of gold nanoparticles changes to blue or purple. This change in colour can be visualized with the naked eyes or UV-Vis spectrometer. Under optimized conditions, gold nanoparticles are highly specific for melamine and can detect melamine up to a concentration of 0.05 mg L⁻¹.



Schematic representation of principle of melamine detection

EXTENSION

DAIRY EXTENSION DIVISION

Dairy Education at Farmers' Door

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

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

Empowerment of Women and Mainstreaming of Gender Issues

Nine women empowerment training 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 and maintain healthy atmosphere in their respective families. In these programmes, a total of 130 farm women were trained.

Educational Visits and Tours: A total of 3527 visitors (students & Faculty) from 32 colleges/Institutions/Universities visited the institute which were coordinated. The groups were sensitized about the different research, teaching and extension achievements and facilities available in the Institute.

Farmers' Farm School

A new educational approach "Farmers' Farm School" was started in village Gorgarh on 30th August, 2014. In this school, 15 active farmers were registered as students. Scientists of NDRI were taking classes regularly on every Friday and Saturday. Initially basics of animal husbandry and dairying were covered and at the end of month, a quiz was also organized.

KRISHI VIGYAN KENDRA

Extension Activities

- In all, 45 training programmes (On-campus and Off-campus & training-cum-visits) on different aspects of dairy production and processing, crop & vegetable production, vermi-culture, bee-keeping and home science were organized in which 1343 farmers, women, rural youth and extension functionaries were imparted trainings.
- KVK organized 10 sponsored training programmes on scientific dairy farming, clean milk production, commercial dairy farming, crop production, milk processing and vermicompost preparation for 302 farmers, rural youth and

extension functionaries. In these training programmes, 204 trainees from Himachal Pradesh, 19 from Haryana, 34 from Rajasthan and 45 trainees from Bihar were imparted training.

- KVK also organized 11 exposures cum study visits for 406 progressive farmers and farm women from different districts of Uttar Pradesh, Madhya Pradesh, Gujarat, Chhattisgarh, Assam, Haryana, Punjab and Himachal Pradesh.

- Various Animal Health Management activities were organized through Stockman centers in adopted villages of KVK. At these centers, 731 cattle and 453 buffaloes were artificially inseminated and as a result 484 calves were born. Besides these, 34 animals were treated, 36 calves dehorned, 20 animals given infertility treatment.

EVENTS

Sardar Patel Outstanding ICAR Institution Award Conferred to NDRI Karnal

NDRI Karnal added another feather to its cap by earning the most prestigious Sardar Patel Outstanding ICAR Institution Award. The much coveted award carrying a cash prize of ₹ 10 Lakh and a citation was presented to Dr. A. K. Srivastava, Director NDRI by the Hon'ble Prime Minister of India Sh. Narendra Modi Ji at the 86th Foundation Day and ICAR Award Ceremony held on 29th July, 2014. The award was given to Dr. A. K. Srivastava in the august presence of Sh. Radha Mohan Singh, Union Minister of Agriculture; Dr. Sanjeev Kumar Balyan, Union Minister of State for Agriculture and Food Processing Industries; Secretary DARE and Director General ICAR Dr. S. Ayyappan; Sh. Arvind R. Kaushal, Additional Secretary, DARE and Secretary ICAR and many distinguished luminaries and vice-chancellors from National Agricultural Research System.

The award was conferred upon NDRI for its outstanding achievements in the field of dairying. ICAR-National Dairy Research Institute, Deemed University Karnal, the pioneer Institute in dairy education, research and development, has been playing a lead role in dairy development in the country. The Institute has achieved landmark success in the area of animal cloning by producing the world's first buffalo cloned calves using 'hand guided cloning' through somatic cells derived from new born calf, seminal plasma, embryonic stem cell as well as adult animal cell. In the area of Dairy Processing research, the Institute has developed technologies for the manufacture of a variety of indigenous dairy products, formulated foods and health foods. New functional dairy products as well as inclusion of ingredients from other food groups such as cereals, fruits and vegetables is an example of the Institute's foray into the realm of composite foods. Besides, equipments have been designed for both small scale dairy operations and mechanized production. NDRI has developed research methodologies for economic evaluation of dairy production and processing systems, which have been recognized as empirical tools by researchers and development specialists. As a result of proactive steps taken by the Institute towards transfer of the technologies, industry has picked up some of the prominent innovations and technologies

developed by the Institute such as low cholesterol ghee, a new test for the detection of detergent in milk, a kit for antibiotic residues, area specific mineral mixture for animals and technology for iron fortified biscuits.



*Hon'ble Prime Minister of India Sh. Narendra Modi Ji conferring **Sardar Patel Outstanding ICAR Institution Award** to Director and Vice Chancellor, NDRI*

The award has been a great boost to the morale of the faculty and staff of the Institute and would definitely pave the way for many more such successes of the Institute in its journey towards excellence.

Training on Extension Management for Livestock Development

A four day Training Programme "Extension Management for Livestock Development" was organized at NDRI, Karnal, from 2nd to 5th July, 2014. The training programme was sponsored by National Institute for Agricultural Research Management, MANAGE, Hyderabad. This programme was aimed to facilitate orientation of extension functionaries on current scenario of livestock sector and familiarize them with various extension management approaches and models of entrepreneurship development in livestock sector.

The participants of the four-day training programme were Senior and Middle level extension functionaries working in Department of Animal Husbandry/K.V.Ks across the states of Maharashtra, Madhya Pradesh, Andhra Pradesh, Karnataka, Odisha, Jharkhand, Kerala, Chattisgarh, U.P., Meghalaya and Haryana.

In his address, Dr. A. K. Srivastava emphasized the need of a proactive role to be played by the Extension functionaries in the livestock sector of the country. He also made a presentation on "Livestock Production in India: Challenges and Opportunities", which gave a broad based as well as an in depth insight to the participants and invitees. Director, NDRI also stressed on the role of extension functionaries to educate farmers and motivate them to rear few good producing animals rather than rearing a larger herd size of low producing animals. Dr. N. Balasubramani, Deputy Director (OSPM), MANAGE, Hyderabad, introduced the objectives and significance of the training programme. A compendium of lectures during the training programme was also released by the Chief Guest.

National Training on Advances in Technology, Quality and Safety of Functional Dairy Food

NDRI organized National Training on "Advances in Technology, Quality and Safety of Functional Dairy Foods" sponsored by Indian Council of Agricultural Research under Centre of Advance Faculty Training programme at Dairy Microbiology Division, NDRI, Karnal from 8th – 28th July 2014.

The programme was formally inaugurated by Dr. Panjab Singh, Former DG, ICAR & V.C., B.H.U., Varanasi as Chief Guest. As many as 19 participants representing 11 states (Gujarat, Rajasthan, Maharashtra, Andhra Pradesh, Karnataka, Chhattisgarh, Bihar, Uttarakhand, Jammu & Kashmir, Assam and Haryana) attended the training programme. Besides the lectures by NDRI faculty, four guest lectures were delivered by eminent scientists in the area of their specialization viz. Dr. Neeraj Hajela, Yakult-Danone India, Dr. J. B. Prajapati, AAU, Anand, Dr. Rajesh Khadgawat, AIIM, New Delhi and Dr. M. K. Salooja, IGNOU, New Delhi.



Dr. Panjab Singh, Former-DG, ICAR & VC, BHU, Varanasi inaugurating the training programme by lighting the ceremonial lamp

Summer School on Engineering Interventions in Processing and Value Addition of Milk and Milk Products

ICAR Sponsored 21 days Summer School on "Engineering Interventions in Processing and Value Addition of Milk and Milk Products" was organized by Dairy Engineering Division of NDRI, Karnal during 3rd – 23rd September, 2014. The training was inaugurated by Dr. V. N. Sharda, Member, Agricultural Scientists Recruitment Board (ASRB), New Delhi.

National Seminar on Engineering Interventions for Global Competitiveness of Indian Dairy Industry

9th National Convention of Dairy Engineers & National Seminar on "Engineering Interventions for Global Competitiveness of Indian Dairy Industry" was jointly organized by ICAR-NDRI, Karnal and



A CD containing a compendium of lectures being released during National Seminar

Indian Dairy Engineers Association (IDEA) on 8th September, 2014.

The National Seminar was inaugurated by Hon'ble Governor of Haryana, Prof. Kaptan Singh Solanki. Delegates from twelve different states of India participated in the seminar. The Chief Guest stressed upon the development of Human Resource Development (HRD) in the livestock sector in the Indian context, especially, when it is widely expected that 21st century would be dominated by India at the global level. He was full of appreciation of the research and other achievements of the institute. On this occasion, he also gave away the awards for professional excellence to two dairy entrepreneurs Sh. Narendra Kumar Gupta and Sh. Mahesh Chander Chawla for their significant contributions. Later on, the Hon'ble Governor also interacted with the students of ICAR-NDRI.

7th National Seminar on Dairy Sector - The Key Player for Nutritional Security in India

The 7th National Seminar on 'Dairy Sector - The Key Player for Nutritional Security in India' was jointly organized by ICAR-NDRI and NDRI Graduate Association (NGA) on 19th September, 2014.



A view of inaugural ceremony during National Seminar

Shri. T. Nanda Kumar, Chairman, National Dairy Development Board, Anand (Gujarat) as the chief guest of the seminar expressed in his keynote address that almost about one third of population is below poverty line and the poverty is increasing in urban India. Though some social scheme of Govt. of India such as MNREGA does provide some income to the rural people to meet their food requirement, however still a lot of needs to be done for meeting the nutritional requirement of large population and milk is the most important component of the same. He expressed that dairying has proved to bring about nutritional security and income

to rural people. However, sustainability of the growth of this sector is very important by working very cautiously on the breeding policy, animal health care and feed and fodder availability for animals. There is also a need to look for improvement in processing technology, quality assurance system, etc. He also presented the award of excellence to Dr. B. N. Mathur, Ex-Director (Retd.), NDRI Karnal and Dr. Jagjit Singh Pujrath for their significant contributions in dairying in India. Dr. A. K. Srivastava, Director and Vice Chancellor, ICAR-NDRI, Karnal; Mr. Adrian Pollard, Managing Director, CHR-Hansen India limited and Sh. Sangram Singh Chaudhary, Executive Director, NDDB also shared their views on the occasion.

All India Animal Husbandry Officers' Workshop

All India Animal Husbandry Officers' Workshop (AIAHOW) was organized at ICAR-NDRI from 24th – 25th September, 2014. The workshop focused on the theme "Opportunities and Challenges in Dairying for Small Farmers". Through this Workshop, institute is disseminating its latest technologies, innovations and extension methodologies for the effective transfer of scientific information to the stakeholders. The workshop was attended by more than 100 delegates of seven states of the country comprising Senior Officers from Animal Husbandry & Veterinary Departments, Dairy Development, Department of Animal Husbandry Government of India, NGOs, KVKs, DARE and ICAR.

Dr. H. S. Sandha, Director, Animal Husbandry, Punjab was the chief guest on this occasion. Dr. R. K. Singh, Director & Vice chancellor of ICAR-IVRI, Izatnagar, chaired the valedictory session. Dr. A. K. Srivastava, Director & Vice Chancellor, ICAR-NDRI presided over the workshop.

Plenary sessions were categorized into four sub thematic areas: Livestock production technologies for sustaining small farmers, Newer milk processing technologies for small farmers, Innovative strategies for promoting entrepreneurship among small farmers and Emerging problems and issues of dairying under field Conditions.

The problems highlighted by the delegates in dairying for small farmers that need immediate concern included anoestrous and repeat breeding in dairy animals, dependence on para vet/ quacks for treatment of sick animals, drug resistance in animals, gradual reduction in availability of grazing lands, inadequate veterinary infrastructure, unavailability of village to village veterinary health care facility, poor conception rate, inadequate availability of good quality semen and lack of demonstrable model dairy unit for arousing farmers interest. A compendium covering the various topics relevant to the themes and sub themes was prepared and distributed to the delegates.

ICAR-NDRI Celebrated ICAR Foundation Day

ICAR-NDRI celebrated the ICAR Foundation Day on 16th July, 2014 in village Taraori. In this programme, all the Heads of the Divisions and Dairy production scientists, scientists of the Indian Agriculture Research Institute (IARI) Regional Station, Sugar Cane Breeding Research Institute (SBI) Regional Station located in Karnal and a large numbers of farmers from different villages participated in the programme.

Dr. A. K. Srivastava, Director, NDRI while addressing the gathering as a Chief Guest stressed that the farmers should integrate the various components of the mixed farming system of crop and dairy husbandry alongwith fisheries, bee keeping and mushroom production so that in case there is change in the weather that may not affect the income of the families. He further said that the



A view of dignitaries present during the celebration of ICAR-Foundation Day at village Taraori

policy makers, scientists and various state departments should evolve the strategies so to introduce different crop combinations in paddy-wheat production system which require less water and have equal profitability as compared to the present crop production system.

On this occasion, Dr. S. S. Atwal, Head, IARI, Regional Station touched various issues pertaining to the standing paddy crop and also informed that IARI has evolved a new variety of carrot which can be grown at the end of August. Dr. S. K. Pandey, Head, SBI, Regional Station informed that eight new varieties of the sugarcane will be available to the farmers soon and he suggested that farmers should properly irrigate the standing sugarcane crop. Dr. Shiv Prasad, Head, Livestock Production and Management Division gave tips to the farmers as to how to manage the cattle and buffalo under the prevalent hot and humid condition. Dr. R. K. Yadav from CSSRI and Dr. V. K. Pandita said that the farmers should prefer the foliar spray of urea in the various standing crops including the horticultural crops in case they observe the yellowing of leaves in some plants. Dr. Dalip K. Gosain, Programme Coordinator, Krishi Vigyan Kendra, NDRI urged that the farmers present in the programme should share the learnt recommendations made today amongst the fellow farmers of their villages so that they are also benefited.

On this occasion, Mr. Vikas Choudhary and Mr. Manoj Kumar progressive farmers of Taraori also explained their experiences on direct seeding of rice and conservation agriculture. Mr. Ram Singh a progressive dairy farmer also shared his views on scientific dairy farming. Dr. A.K. Srivastava, Director ICAR-NDRI and all the Head of the divisions later visited the research platform maintained by Mr. Vikas Choudhary and Mr. Manoj Kumar.

National Consultative Meeting on Standard Code of Practices for Humane and Sustainable Management of Animals

NDRI hosted a national consultative meeting on "Standard Code of Practices for Humane and Sustainable Management of Animals" at organized Commercial Dairies in India' in collaboration with World Animal Protection, India. Forty experts from different disciplines of animal husbandry and many progressive dairy farmers alongwith representatives of National Dairy Development Board, Animal Husbandry Department, Haryana and Animal Welfare Board of India attended this meeting.

Director and Vice-Chancellor of NDRI, Dr. A.K. Srivastava congratulated the team of scientists at NDRI and World Animal Protection for preparing standard practices which will guide

farmers for better management of their herd and will improve welfare of animals. He further added that for organized dairy, it is essential to capture recent technological inventions that they help in making farming economically beneficially, humane and sustainable.

Chairperson of Animal Welfare Board of India, Gen. Dr. R. M. Kharb also graced the occasion with his presence. He participated in detailed discussion and provided valuable inputs specially for creating a humane management plan for unproductive animals. He emphasised that animal welfare has always been a part of our civilization and animals should be treated humanely with love and compassion. Dr. N. S. R. Sastry presided over the technical sessions and helped the group to achieve desired goals by the end of the meeting. The team of experts from NDRI and World Animal Protection would also compile the document on standard dairy practices for organized farms in the country. Sh. Gajender Sharma, Country Director-India encouraged the farmers to adopt humane husbandry practices.

Bajra Lassi Launched at NDRI Parlour

Dairy based foods always have been an integral part of our rich cultural heritage and the nutritional advantages associated with consumption of these products are well established. Bajra lassi is a unique product developed by the scientists of NDRI under the NAIP project. The product is developed by combining Pearl millets (Bajra) and milk, followed by fermentation with suitable micro-organisms specially identified to enhance its nutritional and health-promoting virtues. The beverage is highly digestible and contains appreciable amount of fiber, micro-nutrients and healthy bacteria. The bacteria used in fermentation of bajra-milk composite reduced the levels of anti-nutrients such as phytic acid, phenolics present in bajra and make them suitable for consumption. The technological packages for such food products encourage farmers to cultivate millet crops on larger scales, sell their produce at higher price and thus, improve their livelihood.

The product technology has been purchased by M/s Mishti Farmer Producers' Company Ltd. formed by enthusiastic group of young entrepreneurs of Nagla Rodan village of Karnal district. They have undergone extensive training at Business Planning & Development (BPD) Unit of NDRI, Karnal and joined as incubatee firm with Society for Innovation in Dairying & Entrepreneurship (SINED), TBI located at NDRI. All technical assistance would be provided by NDRI to the entrepreneurs. Successful commercialization and marketing strategy formulation provide great scope to industry to develop nutritious and functional dairy foods with specified nutrients and health target. Sanjeev Singh and Naresh Kumar of M/S Mishti Farmer Producers' Company Ltd informed that they would open two outlets in Karnal to launch various healthy and quality dairy products to consumers.

Visit of NAIP Projects Review World Bank Team

World Bank team headed by Dr. Mohinder Singh Mudahar and supported by Dr. Miki Terasawa reviewed 23 NAIP projects on their completion on 23rd August, 2014. Dr. S. Kochhar and Dr. P. Katihaa from PIU (NAIP) accompanied World Bank team. The team appreciated all round achievements in NAIP projects executed at NDRI. The team took special interest in establishment of National Referral Center for Milk Quality and Safety, Business Planning and Development Unit and also in various kits and technologies developed under NAIP projects.

Technology of Probiotic Cultures Transferred to Sarvotham Care Ltd., Hyderabad



*The MoUs for transfer of two different technologies of probiotic cultures viz. *Lactobacillus fermentum* and *Lactobacillus plantarum* were exchanged between Sarvotham Care Ltd., Hyderabad and NDRI in the presence of Dr. S. Ayyappam, Secretary, DARE and DG, ICAR on 30th September, 2014 at New Delhi.*

हिन्दी दिवस समारोह

संस्थान में विगत वर्षों की तरह इस वर्ष भी हिंदी दिवस के अवसर पर दिनांक 15 सितम्बर, 2014 को शोधपत्र/पोस्टर प्रदर्शन प्रतियोगिता का आयोजन किया गया जिसमें वैज्ञानिकों एवं शोधछात्रों द्वारा बड़े सुन्दर एवं सरल ढंग से राजभाषा (हिंदी) में 16 शोधपत्र/पोस्टर प्रदर्शित किए गए। इस प्रतियोगिता का उद्घाटन संस्थान के निदेशक डा. ए.के. श्रीवास्तव द्वारा किया गया। इस अवसर पर मूल हिंदी लेखन प्रोत्साहन योजना के अन्तर्गत वैज्ञानिकों द्वारा मूल रूप से हिंदी में लिखे गए आलेख/पुस्तक/बुलेटिन/फोल्डर आदि के विजयी प्रतिभागियों के प्रमाणपत्र एवं नकद पुरस्कार भी वितरित किए गए तथा इस दिन आयोजित शोध-पत्र/पोस्टर प्रदर्शन प्रतियोगिता में सफल शोधछात्रों एवं वैज्ञानिकों को क्रमशः प्रमाण-पत्र सहित नकद 1100/-, 800/-, 600 एवं 500/- ₹0 के प्रथम, द्वितीय, तृतीय एवं प्रोत्साहन पुरस्कारों से पुरस्कृत किया गया।



संस्थान के निदेशक डा. ए.के. श्रीवास्तव निर्णायक मंडल के साथ पोस्टर प्रदर्शन प्रतियोगिता का निरीक्षण करते हुए

राजभाषा मास-2014 के दौरान प्रत्येक वर्ष नगर राजभाषा कार्यान्वयन समिति के सदस्य कार्यालयों (संस्थान सहित) हेतु एक प्रतियोगिता आयोजित की जाती है। इस वर्ष भी इस दौरान राजभाषा ज्ञान प्रतियोगिता का आयोजन किया गया। इस प्रतियोगिता में राष्ट्रीय डेरी अनुसंधान संस्थान से 11 तथा नगर स्थित केन्द्रीय सरकार के 22 कार्यालयों से कुल 33 प्रतिभागियों ने भाग लिया। सफल प्रतिभागियों को प्रथम, द्वितीय, तृतीय एवं प्रोत्साहन पुरस्कारों से पुरस्कृत किया जाएगा। ये पुरस्कार नगर राजभाषा कार्यान्वयन समिति की नवम्बर मास में होने वाली बैठक में प्रदान किए जाएंगे।

HONOURS/AWARDS

- Mr. Brajesh Kumar, Mr. Bhavesh Panchal, Mr. Rahul Thakur, Mr. Prerna Narula, Dr. Rajan Sharma, Dr. Y.S. Rajput and Dr. Bimlesh Mann got "First Prize for the Poster Presentation" on topic "Strip based tests for rapid detection of adulteration in milk" in the 7th National Seminar on "Dairy Sector: the key player for nutritional security in India" jointly organized by ICAR- National Dairy Research Institute and NDRI Graduates Association on 19th - 20th September, 2014.
- Mr. Brajesh Kumar, Mr. Bhavesh Panchal, Mr. Rahul Thakur, Mr. Prerna Narula, Dr. Rajan Sharma, Dr. Y.S. Rajput and Dr. Bimlesh Mann got "First Prize for the Hindi Poster Presentation" on topic "Paper strip ke madhayam se dugdh mai milavat ki sheegrah janch ke tarike" in Rajbhasha Maas celebration on 15th September, 2014.

PERSONALIA

Joining

- Dr. R. K. Malik**, Head, Dairy Microbiology Division joined as Joint Director (Research) at NDRI, Karnal w.e.f. 26.08.2014.
- Dr. Latha Sabikhi**, Principal Scientist joined as Head, Dairy Technology Division at NDRI, Karnal w.e.f. 10.09.2014.
- Dr. A. K. Chakravarty**, Principal Scientist joined as Head, Dairy Cattle Breeding Division at NDRI, Karnal w.e.f. 11.09.2014.

Retirements

- Dr. Lotan Singh**, Sr. Scientist (Dairy Economics) ERS of NDRI Kalyani retired from Council's service on 30.09.2014.
- Smt. Saroj Khurana**, AAO, NDRI Karnal retired from Council's service on 30.09.2014.
- Shri. M. Najundaswamy**, Chief Technical Officer (Library), SRS Bangalore retired from Council's service on 30.09.2014.
- Shri. P. Aravindakshan**, Assistant Chief Technical Officer, T-7 (L/T), SRS Bangalore retired from Council's service on 31.07.2014.

Relieving

- Dr. Shiv Prasad Kimothi**, Principal Scientist relieved from NDRI on his appointment to the post of Assistant Director General (Co-ordination), ICAR New Delhi on 28.08.2014.

VISITS ABROAD

- Dr. A. K. Tyagi**, Principal Scientist and **Dr. Sumit Arora** Principal Scientist visited Teagasc Monopark Food Research Centre Dublin, Ireland under Indo-Ireland Joint Project from 26.07.2014 to 31.07.2014.
- Dr. Dheer Singh**, Principal Scientist visited Leibniz Institute for Farm Animal Biology Institute at Germany from 25.08.2014 to 24.09.2014 for a Joint German DST-DAAD Collaborative Research Project.
- Dr. M. S. Chauhan**, Principal Scientist attended 2nd Annual South Asia Bio-safety Conference and deliver lecture of "Application of Reproductivity Biotechnology for Improvement of Dairy Animal Productivity at Colombo, Srilanka from 14.09.2014 to 17.09.2014.

TECHNOLOGIES COMMERCIALIZED

Sr. No.	Technology Name	Purchaser
1.	Bajra Lassi	Mishthi Farmer Producer Co.Ltd., VPO-Nagla Roran, Karnal
2.	High Protein iron-fortified bajara biscuit	Mrs. Santosh Yadav, 68, Nyaypuri, Karnal
3.	High Protein iron-fortified bajara biscuit	Sarvotham Care Ltd., 1-20-248, Umajay Complex, 1st floor, Rasool Pura, Secunderabad- 500003
4.	An indigenous probiotic strain of <i>Lactobacillus fermentum</i>	
5.	An indigenous probiotic strain of <i>Lactobacillus plantarum</i>	

BUSINESS TO BUSINESS (B2B) MEETINGS HELD

Sr. No.	Firm	Date of Meeting	Technologies
1	Mother Dairy, Delhi	26.07.2014	Strip based test for detection of maltodextrin in milk Rapid test for detection of antibiotic residues in milk Rapid test for detection of <i>Listeria monocytogenes</i> Rapid test for detection of Enterococci
2	Britannia Industries Ltd., Bangalore	26.07.2014	Sugar tolerating lactic culture for preparation of Misti Doi
3	Sarvotham Care Ltd., 1-20-248, Umajay Complex, 1st floor, Rasool Pura, Secunderabad- 500003	28.07.2014	An indigenous probiotic strain of <i>Lactobacillus fermentum</i> An indigenous probiotic strain of <i>Lactobacillus plantarum</i>
4	DSS Imagetech Pvt. Ltd. A-5, Mohan Co-operatives, Industrial Estate, Mathura Road, New Delhi	10.09.2014	A PCR based method for differentiating cow and buffalo milk A PCR based A1/A2 beta casein genotyping method for milk and milk product
5	Advay Gold, New Delhi	15.09.2014	Strip based test for detection of adulterants
6	Rajasthan Engineering and instruments Ltd., Jaipur	18.09.2014	Strip based test for detection of adulterants

PATENTS FILED

Sr. No.	Invention	Inventors	Application No. & Date	Date of filing
1	Micro-encapsulated flaxseed oil powder and a method of preparation thereof	Vivek Sharma, Ankit Goyal, Sumit Arora, Darshan Lal	2030/DEL/2014	18.07.2014
2	A strip for detection of Maltodextrin in milk and process for the same	Rajan Sharma, Yudhishtir Singh Rajput, Bimlesh Mann, Prerna Narula, Rahul Thakur, Brajesh Kumar	2097/DEL/2014	24.07.2014
3	Development of enzyme-spore based assay (s) for monitoring antibiotic residues in milk	Naresh Kumar, Alia Khan, Shivani Arora, Falguni Patra, Meenakshi Dahiya, Raghu H.V., Mandeep Balhara, Pradeep Kumar Sharma, Suleman Shaikh	2213/DEL/2014	05.08.2014
4	Marker enzymes and spore germination based assay for detection of <i>E. Coli</i> in milk and milk products	Naresh Kumar, Ramakant Lawaniya, Avinash, Bhawna Arora, Raghu H.V., Mandeep Balhara, Saurabh Kadyan, Vinai Kumar	2214/DEL/2014	05.08.2014

SOUTHERN CAMPUS, BANGALORE

RESEARCH

Identification of Genetic Variants of Lactoferrin Gene and its Association with Lactoferrin Content and Somatic Cell Count in *Bos Indicus* Cattle

(K. P. Ramesha, A. P. Singh, S. Isloor, M. Basavaraju, Akhila Rao, P. Divya, A. Anathraj and S. Varalakshmi)

Lactoferrin is a multifunctional protein present in bovine milk, which plays an important role in the innate host defence as an important component of the antimicrobial defences of the mammary gland and has an important role in prevention and control of mastitis. The present research was aimed at detecting gene variants of bovine lactoferrin gene and to elucidate the association between genetic variants with milk lactoferrin content and Somatic Cell Score (SCS) in *Bos indicus* cattle (Deoni, Malnad Gidda). The sequence analysis of lactoferrin gene revealed sixteen transitions and five transversions and no indels in Malnad Gidda cattle while in Deoni cattle 24 transitions and one transversions were observed. The mean SCS of milk (million cells/ml) was found to be 0.15 ± 0.02 , 0.09 ± 0.01 , respectively in Deoni and Malnad Gidda breeds. The milk lactoferrin content (mg/L) was 99.95 ± 7.48 and 225.20 ± 31.40 , respectively in Deoni and Malnad Gidda cattle. The lactoferrin content in Malnad Gidda cattle was significantly higher as compared to Deoni, Cross-bred cattle (ranged 42.59 to 91.89 mg/L) and Murrah buffaloes (ranged 11.75 to 47.13 μ g/ml) reared in the same region. The SSCP variants of exon 3 and exon 15 were found to have significant ($P \leq 0.05$) and highly significant ($P \leq 0.01$) effect on lactoferrin content while the variants of exon 2 and 6 were found to have association with milk Somatic

Cell Score. Studies on non-genetic factors influencing SCS and lactoferrin content indicated that SCS exhibited an ascending trend with the progression of lactation. Increasing trend of milk lactoferrin content was observed with the advancement of stage of lactation in both the breeds. Malnad Gidda cows left for grazing produced milk with higher lactoferrin content compared to stall fed cows. The study revealed high genetic variation in lactoferrin gene in indigenous cattle and the observed association between the genetic variants with SCS and lactoferrin content indicates the possibility of using these genetic variants in lactoferrin gene as prognostic markers for selection for high lactoferrin content, low somatic cell score and mastitis resistant animals.

EXTENSION ACTIVITIES

Exhibition: SRS, Bangalore participated in Dairy Tech. India 2014, International Exhibition on Dairy Products & Technology held during 22nd to 24th August, 2014 at Bangalore International Exhibition Centre (BIEC), Bangalore. NDRI stall depicted innovative & educative information on recent advancements in dairy production & processing technologies and indigenous dairy products of the region for the benefit of the clientele groups.

Dairy Education at Farmers' Door: "Dairy Education at Farmers' Door", was organized and visits were made by the multidisciplinary team on second Saturdays to villages in Bangalore South and Hosakote Taluks viz. Valepura, Balegere and Harohalli during July, August and September 2014, respectively. Interactions by the multidisciplinary team with the target group at their doorstep revealed the present status and problems in dairy farming.



15.4.1947 to 7.9.2014

Obituary

Dr. Manne Kamalakara Rao was born on 15th April 1947 in Ongole district of Andhra Pradesh. Joined ARS service as Scientist at NDRI, Karnal on 20-09-1976, Dr Rao was selected for the post of Head, SRS of NDRI from 02-03-2002 to 30-04-2007. He served in ICAR for about 35 years contributing significantly in the field of Animal Science in general and animal genetics & breeding and quantitative genetics in particular. As Head, Southern campus Bangalore. Dr. M. K. Rao retired from service upon superannuation w.e.f 30th April, 2009. Dr. Rao breathed his last on 7th September, 2014 at his residence in Ongole. NDRI family pays heartfelt condolences on his sad demise.

EASTERN REGIONAL STATION, KALYANI

RESEARCH

Induction of Estrus in Anestrus Heifers using Metastin and Hormonal Profiles in Anestrus vis-a-vis Cyclic Heifers

(M. Mondal, M. Karunakaran, S. K. Das, A. Mandal, A. Chatterjee, M. K. Ghosh, C. Bhakat and T. K. Dutta)

Twelve numbers of crossbred anestrus heifers were selected from the ICAR-NDRI, ERS farm. To characterize the endocrine profiles in these heifers, blood sample (3ml) from each animal were collected daily by jugular venipuncture for 24 days. Plasma samples obtained from the collected blood after centrifugation at 3000rpm at 4°C were used to estimate different reproductive hormones viz., estradiol-17 β , progesterone and LH. All hormones were found to be at basal level. No definite trend for any of the hormone estimated was recorded (Figure 1).

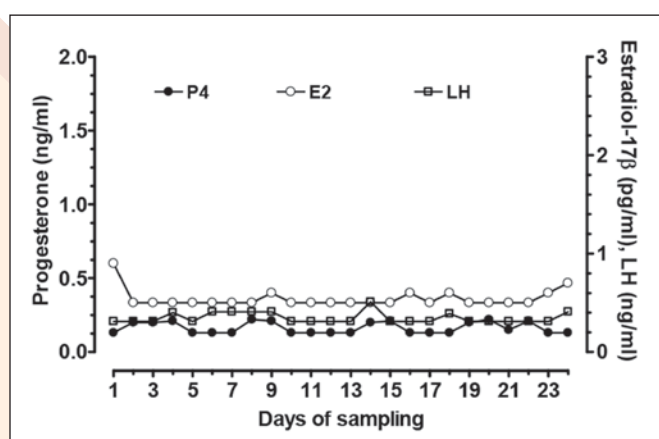


Figure 1. Hormonal profiles (mean $\pm$ SEM) in crossbred anestrus heifers

All these heifers were treated with metastin (peptide of 10 amino acid long) @ 200 μ g per animal intravenously. All animals were observed for visual signs of estrus. Blood samples were collected daily from each animal from the onset of estrus to next estrus. Plasma samples obtained from the collected blood were assayed for estradiol-17 β , progesterone and LH. Except one heifer (2082), all animals responded to the treatment. (Mean $\pm$ SEM) concentrations of plasma progesterone, estradiol-17 β and LH on different days of the estrous cycle are presented in Figure 2. The progesterone concentration was at the lowest level ($P < 0.001$; 0.19 $\pm$ 0.01 ng/ml) on the day of estrus (day 0). The concentration increased gradually thereafter to reach the peak level on day 13 of the cycle. The level decreased gradually to the lowest level again on the day of estrus in the next cycle. The (mean $\pm$ SEM) plasma LH concentrations differed significantly ($P < 0.001$) on different days of the estrous cycle. Appearance of a biphasic LH peaks was common in all responded animals. Occurrence of two or three E2 peaks was

evident for the heifers in the present experiment. In approx. 20% of the estrous cycles studied, two peaks of E2 was recorded, the first of which appeared on day 3 before the day of estrus and second was on the day of estrus. The 80% estrous cycles in the present investigation showed three E2 peaks; the first appeared on day 16 of the estrous cycle, second on day 3 before the day of estrus and third peak was on the day of estrus.

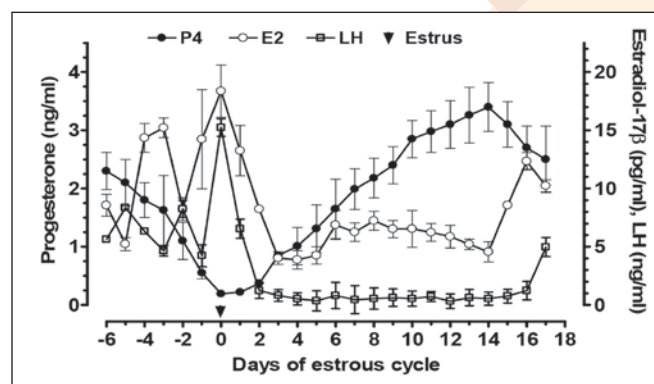


Figure 2. Hormonal profiles in anestrus heifers turned cyclic post-metastin treatment throughout the estrous cycle

EXTENSION ACTIVITIES

Training programme on Artificial Insemination & Veterinary First Aid for Field Workers

One 42 day training programme on "Artificial Insemination & Veterinary first aid" was organized at ERS, NDRI from 3rd June to 14th July 2014 for field workers. Total eleven field workers of different district of West Bengal participated in the training programme.

Head, ERS of ICAR-NDRI welcomed all the Trainees and briefed about the usefulness of the training. Dr Sanchita Garai, Scientist & organizer of this training programme delivered a key note presentation followed by detailed interaction with the trainees and all scientists and technical officers. Mr. J. K. Kewalramani, Joint Director (Admn. & Registrar), ICAR-NDRI, graced the valedictory function of the training programme and distributed training completion certificates the trainees. A *Training Manual* on Artificial Insemination & veterinary first aid in local language (Bengali) was released and distributed among the trainees.

Animal Health Camp

One day programme on "veterinary first aid, frontline fodder demonstration and scientist farmers' interaction" was organized on 16th September 2014 in the Dakkhin Chandamari village of Nadia District. Total nineteen (19) farmers came with fifty four (54) animals for treatment. 16 kg mineral mixture was distributed to 16 dairy farmers.

FEATURE ARTICLE

Nanotechnology in Food Processing: A Way Forward

(Bimlesh Mann, Rajan Sharma, P. N. Raju and Richa Singh)

Nanotechnology is perceived as one of the key technologies for initiating next revolution in many industries, including food processing industry. It offers some real and wide-ranging benefits to the whole of the food chain. A number of nanotechnology-

derived ingredients, additives and food contact materials are already available worldwide. But applications of nanotechnology in food sector are relatively recent compared with its use in drug delivery and pharmaceuticals. Nanotechnology has shown great potential for improving the effectiveness and efficiency of delivery of nutraceuticals and bioactive compounds in functional foods to improve human health. In food packaging, bionanocomposites

which are hybrid nanostructured materials with improved mechanical, thermal and gas barrier properties are being used. In the area of food safety for the detection of biological or chemical contaminants, nanosensors and nanoparticles based lateral flow assays can be developed.

Nanoparticulate Delivery Systems for the Bioactive Compounds

The current global interest in developing health-promoting foods provides a suitable opportunity to make use of bioactive components in such food formulations. Many bioactive components are not easily incorporated in foods because of their poor solubility; sensitive to oxygen, light, temperature, or undesirable sensory attributes. In such cases, new emergent approach like nano-encapsulation can be used to mask the unpleasant tastes and flavours of ingredients, to protect the encapsulated ingredients from degradation during processing and storage, to improve dispersion of water-insoluble food ingredients as well as to protect food antimicrobials from interfering food components and improve their delivery to the specific site.

The delivery of these molecules will, therefore, require food formulators and manufacturers to provide protective mechanisms that (1) maintain the active molecular form until the time of consumption and (2) deliver this form to the physiological target within the organism. Polymer-based delivery systems that enclose bioactive molecules have been developed extensively for the biomedical and pharmaceutical sectors. In spite of successful application of many synthetic polymers as delivery systems, these cannot be used in food applications that require compounds generally recognized as safe (GRAS). Food proteins and lipids show great promise for developing and engineering a range of new GRAS matrices with the potential to incorporate nutraceutical compounds and provide controlled release when administered through oral route. Milk proteins and lipids due to their good functional attributes can be exploited for the encapsulation and stabilization of fragile bioactives. Casein micelles have the ability to encapsulate nonpolar molecules such as lipids, flavorants, antimicrobials, antioxidants, and vitamins. Nanocomplexes of β -Lactoglobulin and pectin can entrap omega-3 fatty acids and confer protection to these fatty acids against its oxidation. The lipid and protein based nanoencapsulation systems that can be used for the protection and delivery of foods and nutraceuticals are nanoliposomes, nanoemulsions, nanomicelles and biopolymeric nanoparticles. Recently, a study was conducted at NDRI in which curcumin was encapsulated in medium chain triglyceride oil droplets of nanoemulsion prepared by ultrasonification using whey protein concentrate-70 and Tween-80 as emulsifiers. The prepared nanoemulsion with 91.00% encapsulation efficiency has average diameter 141 nm and showed therapeutic benefits over unencapsulated curcumin in mice model.

It can be foreseen that with improvements in manufacturing technologies, new strategies for stabilization of fragile nutraceuticals and development of novel approaches to site-specific carrier targeting, food-component-based materials will play an important role in increasing the efficacy of functional foods over the next decade. However, at the present stage, nano-encapsulation still requires fundamental research to fully define the relevant parameters controlling the system. There is need to establish methods which can be scaled up for preparation of nanoparticles such as nanoemulsions, nanoliposomes and nanomicelles etc. with special reference to encapsulate bioactive components to ensure design of ideal nutraceuticals carriers for use in the food industry. Studies are also required to evaluate the stability of bioactive encapsulated nanosystems under different environment of foods (such as oxygen, light, temperature, pH and water), compatibility with food matrix and interactions with different components of food.

Bio-nanocomposites in Food Packaging

Food packaging like any other packaging is an external means of preservation of food during storage, transportation and distribution. Food packaging is the largest user of plastics (~40%). The volume of plastics discarded annually creates a substantial waste which is causing a great threat to environment. Consequently, the approach of making packaging materials from biodegradable materials that can be disposed of through composting or recycling, got momentum. The use of biodegradable films for food packaging has been strongly limited because of the poor barrier properties and weak mechanical properties shown by natural polymers. Recently, a new class of materials represented by bio-nanocomposites has proven to be promising option in improving the mechanical, barrier and thermal properties of these biopolymer-based packaging materials. Polymer nanocomposites are created by dispersing an inert, nanoscale filler throughout a polymeric matrix in which the filler has at least one dimension smaller than 100 nm. Addition of relatively low levels of nanoparticles (less than 5%) have been shown to substantially improve the properties of finished plastic, increasing the deformability and strength, and reducing the electrical conductivity and gas permeability. Various inorganic nanoparticles have been recognized as possible additives to enhance the polymer performance. Among all, as of now the layered inorganic solids like clay have attracted attention by packaging industry due to their availability and low cost. Montmorillonite, hectorite, saponite and kaolinite are the commonly used layered silicates.

Bioactive Packaging

Bioactive packaging, in addition to proving as a passive barrier, can contribute to the control of microbial growth in food products, which cause spoilage or in case of pathogens, food borne diseases and illness. Antimicrobial (nisin, silver oxide, zinc oxide, magnesium oxide) nanoparticle can reduce the development of bacteria in the food product and antioxidant coatings can prevent oxidative changes in food. Further, bioactive packaging materials need to be able to keep bioactive compounds, such as prebiotics, probiotics, encapsulated vitamins or bioavailable flavonoids, in optimum condition until they are released in a controllable manner into the food product. Bioactive compounds that are encapsulated into the packaging itself are a promising approach because this would allow the release of the active compounds in a controllable manner.

Smart Packaging

Smart packaging is a technique in which package continuously monitors the internal environment and responds or communicates the changes to external environment or consumer, beyond performing the basic functions. The unique chemical and electro-optical properties of nanoscale particles especially TiO_2 and ZnO can be used to develop sensors that detect the presence of gases, aromas, chemical contaminants and pathogens. With the worldwide growing scientific evidence of the potential benefits of nanotechnology in food packaging, there exists huge scope to get benefitted. In India such applications are at nascent stage. Biopolymers from agricultural food stocks, food processing waste and other resources could be exploited for developing nanocomposite films for packaging applications.

Nanotechnology in Food Safety and Quality Assurance

In the food sector, one of the most important problems is the time-consuming and laborious process of food quality-control analysis. Innovative devices and techniques are being developed that can facilitate the preparation of food samples and their precise and inexpensive analysis. From this point of view, the development of nanosensors to detect microorganisms and contaminants is a particularly promising application of food nanotechnology. These so-called nanosensors, for example, an array of thousands of nanoparticles designed to fluoresce in different colours on

contact with food pathogens. Taking into account the crucial importance of time in food microbiology, the main aim of nanosensors is to reduce the time for pathogen detection. Such nanosensors could be placed directly into the packaging material, where they can detect chemicals released during food spoilage. Other types of nanosensors are based on microfluidics devices and could also be used to detect pathogens efficiently in real time and with high sensitivity. Nanoelectro-mechanical systems could be used in food quality-control devices because they consist of advanced transducers for specific detection of chemical and biochemical signals. Nanocantilevers are another innovative class of biosensors. Their detection principle is based on their ability to detect biological-binding interactions, such as between antigen and antibody, enzyme and substrate or cofactor and receptor and ligand, through physical and/or electromechanical signaling.

Biggest application of nanotechnology in the area of analytical chemistry and diagnostics is the development of lateral flow based assays. The development of lateral-flow assays has provided a convenient and inexpensive means for identification of target substances in biological specimens and a well known example is the commercially available pregnancy test kit. Components of lateral flow assay include nitrocellulose membrane, fiberglass pads and absorbent pads. In such flow system, usually gold particles of nanometer size are used. Gold nanoparticles (GNP) exhibit flow properties and therefore, it is advantageous to label GNP with ligand for their recognition by target molecules. Since GNP are coloured, they exhibit flow characteristics and could be functionalized for attachment of ligands; GNPs are widely used in Lateral Flow Assays. The movement of GNP through pores of membrane is fast and therefore, results could be obtained in minutes. Specificity of ligand towards target molecules determines reliability of results. At NDRI, lateral flow based methods have been developed for the detection of antibiotic residues (oxytetracycline and cephalixin) in milk. Aptamer-based lateral flow concept is being extended for the detection of contaminants, adulterants and pathogen detection in food system. Aptamers could bind GNP that could be used as ligands in lateral flow system. The interaction of aptamers with targets could be measured and therefore, specific aptamers could be selected. In near future, lateral flow system involving gold nanoparticles and aptamers would be very common for detection of analyte.

Regulatory Aspects of Nanomaterials in Food

Nanomaterials which include nanoparticles, nano-emulsions and nano-capsules are now being used in processed foods. Uncertainty exists over the regulations of nano-based products, and which linked in part with the lack of necessary safety data. So this indicates the urgent need of toxicological studies and safety evaluation. It means that there will be a growing need for strategies to regulate the risks, and establishment of liabilities, at the global level. This will pose a bigger challenge for the regulatory authorities because food laws in different countries may not conform to each other. It is evident from recent regulatory reviews that, at present, there is

no nano-specific regulation anywhere in the world. Furthermore, there is a lack of specific guidelines, guidance documents for testing, or testing requirements under any of the existing regulations that relate specifically to nanoparticles in terms of size or other distinct physicochemical properties. In due course, such issues are likely to be resolved through the development of global frameworks that relate to key international trade agreements, such as those administered by the World Trade Organization.

However, such technological developments are still new in India and many other countries, where there is only a marginal level of current applications. Considering the global nature of food business, and that several companies and research institutions are currently exploring new possible applications in the food and related sectors, it is not unreasonable to expect that nanofood products would be available to the consumer in an increasing number and variety in the coming years. Nanotechnology applications for food and health food sectors have undoubtedly opened up enormous opportunities for innovation and new developments, but at the same time have also raised new challenges in regard to ensuring the consumer safety.

XII AGRICULTURAL SCIENCE CONGRESS AT ICAR-NDRI KARNAL FROM 3rd- 6th FEBRUARY, 2015

The 12th Agricultural Science Congress (12 ASC) is going to be organized at ICAR-NDRI, Karnal from 3rd - 6th February 2015 on the theme "Sustainable Livelihood Security for Small Holder Farmers". This 4 day event will include 11 technical sessions on Crop/ Animal/ Engineering and Social Science issues apart from plenary lectures, poster sessions, round table meetings for policy formulation, farmers exhibition, inter-university students elocution contest and a grand all India Agri-Expo. A large number of participants cutting across the diaspora of researchers, policy makers, farmers, entrepreneurs and students are going to join the congress. Preparations for the event are in full swing at NDRI for hosting this mega event in most befitting manner and also to commemorate the silver jubilee of National Academy of Agricultural Sciences (NAAS). An outstanding line-up of speakers across the globe has already confirmed to participate in 12 ASC who will deliberate on the key topics in the field. The participation in 12 ASC will be very important for discussing the most burning issues in Indian Agriculture and creating opinion for technological innovations and policy reforms for the benefit of the small farmers. The 12 ASC team at NDRI remains committed to make the congress intellectually the most rewarding one.



Please register for 12 ASC, send abstracts and find all details about the event at www.agricongress2015.in

Dates to Remember: November 30, 2014 Early Bird Registration Closes// December 15, 2014 Abstract Submission Closes // January 1, 2015 Online Registration Closes

Editorial Board

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