

NDRI *News*

Director's Desk



*Dr. Verghese Kurien (1921-2012)
NDRI pays homage to 'Father of
White Revolution in India'*

Brucellosis, one of the major zoonotic diseases, is highly significant in terms of public health and economic concern in many parts of the world. All 9 species of *Brucella*, i.e. *B. abortus*, *B. melitensis*, *B. suis*, *B. ovis*, *B. canis*, *B. Neotomae*, *B. microti*, *B. ceti* and *B. pinnipedialis* are non spore forming facultative intracellular coccobacilli devoid of any classical virulence genes. Among these species, *B. melitensis* and *B. abortus* are the most important and common species of public health importance in India.

Chronic brucellosis in dairy animals results in placentitis and abortion in pregnant females or orchitis and epididymitis in males. The most common mode of transmission between animals is by contact with the placenta, fetus, fetal fluids and vaginal discharges from an infected animal. Infected males can transmit the disease to the females during mating as the organisms (especially *B. ovis*, *B. suis* and *B. canis* than *B. abortus* and *B. melitensis*) are excreted in the semen. Abortion during last trimester of pregnancy is the most important sign and then they become lifelong carriers and continue to shed the organisms in milk and uterine discharges during subsequent lactations and pregnancies, respectively. Although *Brucella* organisms are present in udder and milk, they do not induce inflammatory reactions in the udder. Human brucellosis is considered as a life-threatening debilitating disease characterized by weakness, fever, malaise, arthritis, osteomyelitis, endocarditis or meningoencephalitis.

The prevalence of brucellosis with respect to different species of *Brucella* and their biotypes in various species of livestock in different geographical zones of India under varying socio-cultural and economic conditions is yet to be worked out. However, the available epidemiological evidences suggest that brucellosis is prevalent in all domestic animals, besides wild animals, in all states with wide variation in prevalence varying from as low as 0.13% to as high as 44%. Although, there is no accurate data



of economic losses due to brucellosis, the estimated losses due to brucellosis cost India at least Rs.350 million every year on account of milk, milk and meat producing animals, and loss of man-days.

There is no single test which could identify all the infected animals with 100% sensitivity. Generally, diagnosis is carried out through bacterial isolation and identification of *Brucella* from clinical samples, bacterial genome detection through molecular techniques like PCR and detection of antigen by enzyme linked immunosorbent assays. The antibodies produced due to infection are not differentiated from those produced after vaccination. Intracellular localization of *Brucella* species often fails to respond to the antimicrobial therapy and natural defense molecules like antibody and complement. Requirement of long duration treatment and failure of therapy due to lack of intracellular penetration of antibiotic, inappropriate choice of drug, dose or duration led to treatment mediated control of bovine brucellosis less popular. Since the treatment of animal brucellosis is not recommended, mass vaccination of livestock needs to be encouraged. Presently, there are four vaccine strains for use in animals; namely *B. abortus* S19; *B. abortus* RB51; *B. melitensis* Rev1 and *B. suis* strain 2. However, the vaccines available for control of brucellosis are far from ideal. Therefore, the search still continues to develop a better

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vaccine particularly one which has no abortifacient properties, can facilitate differentiation of vaccinal and infection antibodies besides being avirulent for man. In many countries, use of B. abortus strain 19 vaccine in cattle has resulted in the elimination of brucellosis.

Taken together, it is needless to say that a well-planned and operational animal brucellosis control programme is urgently needed to ward off huge economic losses to livestock industry. Although vaccination is the most promising way to control Brucellosis, it is not 100% effective in preventing brucellosis; successful protection can be achieved in about 70% of the vaccinated cattle. Thus, vaccination coupled with good husbandry practices

is essentially required to control the disease. Surveillance to find infected animals, investigation of affected herds and vaccination of replacement calves in high-risk areas are important features in Brucellosis control program. Another important aspect is to diagnose the disease in affected animals, which would require laboratory facilities at local, regional and national level. We also need to strengthen the research on diagnosis, management, development of brucellosis vaccines and define a strategy for effective vaccination and control program.

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

RESEARCH

A Novel Enzyme-Substrate Based Bio-Assay for Detection of *Listeria Monocytogenes* in Milk

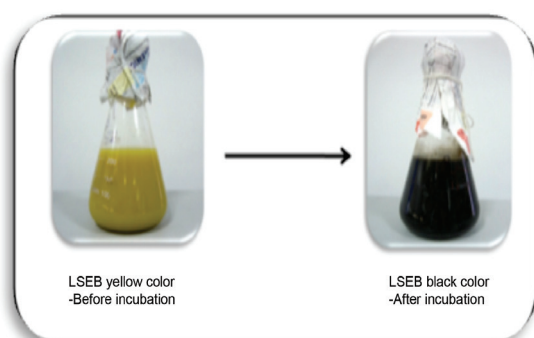
M. Balhara, N. Kumar, G. Thakur, H. V. Raghu, V. K. Singh and Shabnam

Division of Dairy Microbiology

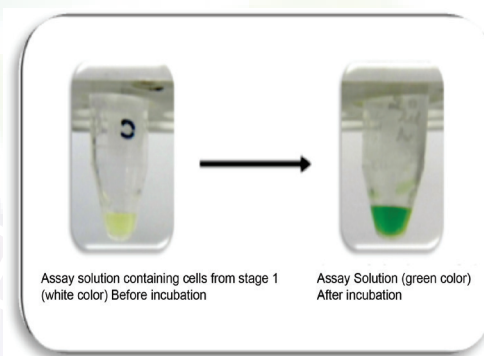
"Two-stage bio-assay" has been developed for detection of *L. monocytogenes* based on the principle

of targeting "enzyme-substrate reaction for specific marker enzyme (s) to release free chromogen that can be visually detected by color change, after initial enrichment of the bacterium in novel selective medium i.e. LSEM" for 24 ± 1 hr followed by 2nd stage reaction on enzyme mixture for 4.0 ± 0.30 min.

ASSAY PROCEDURE



Stage-1



Stage-2

Patent application IPR/ FA/ 12037-L/2012

Novel Features:

- Cost effective enzyme assay (Rs. 91 per test).
- Rapid detection of *L. monocytogenes* within one working day as against 5-7 days protocol in conventional method.
- Novel LSEM medium with selective growth of *L. monocytogenes* in presence of other contaminants.
- Immense industrial application for complying regulatory FSSAI standards for milk and milk products.
- Wide scope of application to raw, pasteurized and dried milks.
- Internal as well as third party validation at M/s SGS India Pvt. Ltd. Gurgaon.
- Non-exclusive license fee cost of Technology is Rs~7.5 lakhs

An Enzyme Substrate Assay for Detection of *E. Coli* O157:H7 in Milk

Bhawna Arora, Naresh Kumar, Ramakant Lawaniya, H. V. Raghu, Avinash and V. K. Singh

Division of Dairy Microbiology

Despite the great strides that have been made in improvement of real-time detection of *E. coli* O157:H7,

there are still no satisfactory methods in terms of time, cost, sensitivity and selectivity. In this study attempts were made to develop real-time enzyme substrate assay for detection of *E. coli* O157:H7 in milk. Different commercial media available for *E. coli* were screened for better growth and enumeration of the target organism while suppressing / inhibiting the growth of the contaminants.

Tergitol-7 broth was selected based on better performance of *E. coli* in terms of its log counts at different time intervals. ATPC medium was developed into a chromogenic medium (GAL-ATPC / GUD-ATPC medium) by addition of selected enzymes substrates at optimized concentration and volume. The markers enzymes namely β -D-galactosidase, α -D-galactosidase and β -D-glucuronidase (GUD) were screened in target organism individually as well as in combination for preliminary detection of *E. coli* O157:H7 / K-12. The concept is under validation with wide range of milk products for its industrial application.

Interpretation:

- Positive reaction for GUD enzyme with GAL positive reactions gives the confirmation of *E. coli* in the developed test method.
- Negative reaction for GUD enzyme with GAL positive reaction gives confirmation of *E. coli* O157:H7 in the developed test method.

Effect of Raw or Full Fat Extruded Soybean Seeds as a Partial Replacement of Groundnut Cake in Lactating Cows

Sachin Gautam and J. P. Sehgal

Division of Dairy Cattle Nutrition

The soybean (extruded or raw) had better amino acid composition than groundnut cake and maize. Fifty percent of groundnut cake in the concentrate mixtures was replaced by extruded full fat (T1) or raw soybeans (T2), respectively in the ration of lactating cows. The digestibility of DM, OM, and NFE was significantly higher in group fed extruded soybean than in other groups. Crude protein digestibility was significantly higher in both the treatment groups but it was the highest in raw soybean fed group. The digestibility of CF, NFE, NDF, ADF, ADL, cellulose and hemicellulose was not influenced by replacing GNC with soyabean (raw or extruded). Nitrogen balance (g/d) was also significantly higher in T1 (53.76) groups as compared to C (37.22) and T2 (39.15) and all the animals were found to be positive in nitrogen balance. The average milk yield (kg/d) was significantly higher in T1 as compared to control and T2 groups. The milk components (fat, protein, lactose and SNF) were statistically similar in all the experimental groups. Though, the cost of extruded full fat soybean was higher compared to raw soybean or groundnut cake,

but economics net return/income per animal /day was better in ration substituted with extruded full fat soybean as a partial replacement of groundnut cake. Net return per day/animal was higher by Rs. 49.1 in extruded full fat soyabean as a potential replacement of groundnut cake (T2) as the milk yield was higher by 1.4 kg/day than control and T2 group.

Nitric Oxide Signaling in Buffalo Sperm Functions

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Division of Animal Biochemistry

Nitric oxide (NO) is an important signaling molecule synthesized from the enzymatic conversion of L-arginine to L-citrulline by NADPH dependent nitric oxide synthases. NO concentration was significantly higher in the highly fertile and lower in low fertile cryopreserved spermatozoa of proven fertility bulls. Cryopreserved samples supplemented with L-Arg (1 mM) or spermine-NONOate (10 μ M) produced nitric oxide which protected spermatozoa from lipid peroxidation and rendered improved post- thaw motility, viability and membrane integrity. The extent of protein tyrosine phosphorylation varied with different agonists. Tested inhibitors of adenylate cyclase/PKA pathway as well as guanylate cyclase/PKG pathway were used to ascertain their involvement in nitric oxide induced acrosome reaction. Spermine-NONOate (100 μ M) was identified as an inducer of acrosome reaction for buffalo spermatozoa. Spermine-NONOate (100 μ M) induced acrosome reaction caused the increase in protein tyrosine phosphorylation of p20, p30, p32, p38, p45, p49, p69, p80 and p105 subset of proteins. Spermine-NONOate caused more tyrosine phosphorylation of p20 and p30 proteins as compared to other inducers but these proteins were absent in the genistein (PTK inhibitor) treated sample. Among the inducer of AR, progesterone induced significantly more ($P < 0.05$) tyrosine phosphorylation of p32, p38, p45, p49, p80 and p105 proteins as compared to LPC. L-NAME and PKG inhibitor also caused the significant inhibition of tyrosine phosphorylation of p20 protein. H-89 (an inhibitor of PKA) completely inhibited the tyrosine phosphorylation of p20 protein. In presence of ODQ (sGC inhibitor), there was significantly reduced tyrosine phosphorylation of p20, p32, p38 and p49 proteins and addition of the spermine-NONOate could able to overcome the inhibition of tyrosine phosphorylation. Inhibitors of protein tyrosine kinase (genistein), protein kinase G (Rp-8-pCPT-cGMPS), protein kinase A (H-89), soluble guanylate cyclase (ODQ) and scavenger of nitric oxide (haemoglobin) decreased the percent acrosome reaction significantly ($P < 0.05$). An analogue of cAMP (db-cAMP) and cGMP (8-Br-cGMP) increased the percent acrosome reaction significantly ($P < 0.05$). Therefore, nitric oxide released from spermine-NONOate, induced acrosome reaction through activation of both adenylate cyclase/PKA pathway as well as guanylate cyclase/PKG pathway.

Capacitation Associated Tyrosine Phosphoproteins in Buffalo (*Bubalus bubalis*) and Cattle Spermatozoa

Jagan Mohanrao Gali and Suresh Kumar Atreja
Division of Animal Biochemistry

The spermatozoa are compartmentalized, highly polarized and terminally differentiated cells with no transcriptional and translational activity. At ejaculated mammalian sperm lack fertilizing ability as they are released in a functionally immature form. The capacity to fertilize eggs is only acquired after they have been ejaculated in the female reproductive tract and this phenomenon is termed as capacitation. Sperm capacitation includes a cascade of biochemical modifications, including cholesterol efflux, Ca^{2+} influx and cAMP/PKA-dependent/independent protein tyrosine phosphorylation, which is specifically considered as the biochemical marker for capacitation. The identification and functional characterization of the capacitation associated tyrosine phosphorylated proteins shall form the basis to understand the biological meaning of sperm capacitation as it is poorly understood either *in vivo* in the female reproductive tract or *in vitro*. In the present study, the tyrosine phosphoproteins were identified in the capacitated buffalo and cattle spermatozoa using 2-D immunoblotting and mass spectrometry. Among several proteins identified in the buffalo capacitated sperm, serine/threonine-protein phosphatase PP1-gamma catalytic subunit, MGC157332 protein, alpha-enolase, 3-oxoacid CoA transferase 2 and actin-like protein 7A were identified for the first time as tyrosine phosphorylation substrates in mammalian spermatozoa.

Azolla meal: A Potential Feed Supplement for Calves

Chatterjee, N. Arvindraj, M. K. Ghosh, P. K. Roy and T. K. Dutta

Eastern Regional Campus, Kalyani

Azolla (mosquito fern, duckweed fern, fairy moss, and water fern) is a small free floating aquatic fern native to Asia, Africa, and the America. The fern Azolla has a symbiotic blue green algae *Anabaena azollae*, which is responsible for the fixation and assimilation of atmospheric nitrogen. Azolla is an attractive protein



source for animal feed. An experimental azolla production unit has been established at ERS-NDRI Kalyani campus and the cultivation of azolla has been standardized.

It is a fair source of plant protein (250.9g kg^{-1}). The mean concentration (% of DM) of crude fibre, ether extract, total ash, NFE, NDF and ADF in *Azolla microphylla* were 12.62, 4.06, 19.87, 38.37, 68.43 and 37.60, respectively. The mean calcium and phosphorus concentration (% DM) in *Azolla microphylla* were 4.30 ± 0.16 and 0.63 ± 0.01 , respectively.



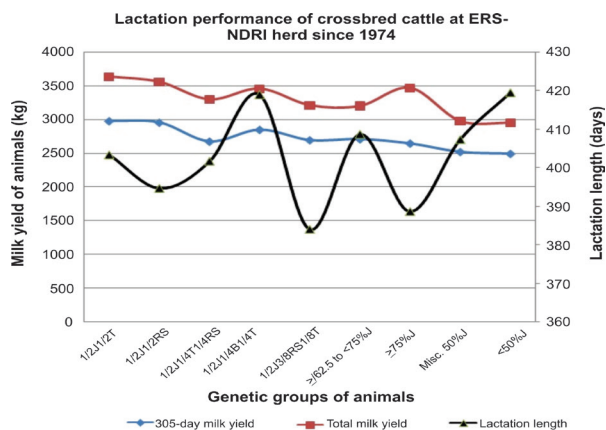
A growth trial (105 days) was conducted on ten crossbred male calves distributed into two groups. The animals in control group (T_0) were fed with paddy straw (around 45 %), green fodder (around 15%) and concentrate mixture (around 40%). In the treatment group (T_1) dried *Azolla microphylla* meal was supplemented @ 60 g / animal (equivalent to 1 kg fresh azolla) replacing 10 % of concentrate mixture. There was no significant difference in DM intake and digestibility of nutrients in crossbred calves when Azolla was supplemented. The average daily live weight gain was significantly ($P < 0.05$) higher in T_1 (423.6 g/d) than in T_0 (389.9 g/d). The growth rate (ADLG g/d) increased by around 9 % in the treatment group. The feed conversion efficiency was also improved significantly in the treatment group. It can be inferred from the present study that Azolla can be utilized as good alternative source of protein and other essential nutrients for the ruminants.

Lactation Performance of Crossbred Cattle

A. Mandal, M. K. Ghosh, P. K. Roy, R. S. Gandhi, S. K. Das and T. K. Dutta

Eastern Regional Campus, Kalyani

Lactation performance of Jersey crossbred animals, maintained at the institute was evaluated since inception of this herd. Data on 731 lactation records comprising first to thirteen lactations of 274 Jersey crossbred animals extended over 39 years (1974-2012) were used. Genetic composition of animals revealed that majority of animals falls in 3-breed cross (41%) followed by 2-breed (33%) cross. Different environmental factors like period and season of calving, lactation number and genetic group of



animals significantly affected the most of the lactation traits. The study also revealed that the half-breds of Jersey and Tharparkar crosses produced higher 305-days milk (2981.65 ± 51.14 kg) and total milk yield (3636.09 ± 66.86 kg) as compared to animals of other genetic groups in this agro-climatic region (Fig.). The animals having less than 50% Jersey inheritance produced lowest 305-days milk (2495.35 ± 92.44 kg) and total milk (2948.68 ± 121.01 kg) among all genetic groups. Hence, the result indicated that the half-breds of Jersey and Tharparkar crosses is the most suitable for obtaining the optimum productivity in this agro-climatic region.

Successful Overcoming Postpartum Anoestrus of Cattle through Reproductive Management in Village Conditions

S. Dutta, A. Mandal, R. A. Dey, A. Goswami, S. K. Das and T. K. Dutta

Eastern Regional Campus, Kalyani

The impact analysis of transfer of technology on reproductive performance of cattle was conducted in four villages (Pipli-II, Beri-II, Dackbungalow and Natungram) in 24 parganas district of West Bengal. Anoestrus cows were treated with three different types of treatments (viz. T1: massage of ovary +



iodine tamponing; T2: massage of ovary + iodine tamponing + deworming and T3: massage of ovary + iodine tamponing + deworming + mineral mixture + vitamin-A + Tonophosphan). The massage of ovary and iodine tamponing was applied biweekly for 3 weeks in first group of animals. In second group of animals, deworming of animals with Albendazole (10mg/kg body wt) was given along with massage of ovary and iodine tamponing. In third group of animals, Vitamin A injection (2ml/ animal for alternative day for 6 inj.) and tonophosphan (5ml/animal/day for 6 days) and mineral mixture (30gm/day/animal for 15 days) was given along with ovary massage, iodine tamponing and deworming. A total of 254 anoestrus cows were treated out of which 179 (70%) animals responded and subsequently 99 animals were conceived (55% conception rate). The result revealed that only reproductive stimuli (ovary massage, iodine tamponing) helps to obtain 42% conception rate, whereas, vitamin A, tonophosphan and mineral mixture supplementation along with ovary massage, iodine tamponing and deworming to animals may help to obtain 77% conception rate among treatment responded animals. The cost incurred per animal in group III to bring them into cyclic condition and conception stage was Rs. 200 followed by Rs. 150 in group II and Rs. 100 in group I animals.

EXTENSION

KRISHI VIGYAN KENDRA (KVK)/DAIRY TRAINING CENTER (DTC)

Training Programmes

Twenty two 22 on-campus training programmes on different aspects of scientific dairy farming, milk processing, clean milk production, fisheries, vermiculture, and home science were organized in which 641 farmers, women, rural youth and extension functionaries from various states were imparted training. Out of the total programmes, KVK organized 15 sponsored training programmes for various states and agencies in the country.

Participants from Various States in the Training Programmes

State	No. of Beneficiaries
Assam	50
Bihar	231
Delhi	10
Haryana	234
Madhya Pradesh	1
Maharashtra	3
Odisha	2
Punjab	4

Rajasthan	31
Uttar Pradesh	11
Uttarakhand	62
West Bengal	2
Total	641

DAIRY EXTENSION DIVISION

Extension Activities

NDRI organized the Extension Programme entitled "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 of NDRI, visited villages viz. Khrijpur and Wazidpur Karnal district on 2nd Saturday of the month.

Issues Emerged

- **Tick Control Problem:** Tick infestation was a serious problem in these villages. However, since this problem had also been reported by the preceding teams under this programme, due action was taken by the Dairy Extension Division, NDRI, Karnal and Tick Control treatment was administered on the animals.
- **Anoestrus:** The scientists educated the farmers on recommended breeding and feeding practices to resolve this problem.
- **Low Milk Production during Summer:** The scientists informed/educated the farmers to offer balance nutrition to their animals, so that milk yield could be maintained as per animal potential.

Kisan Sangosthies

A series of Kisan Sangosthis was organized in the villages of Karnal district under NABARD assisted project entitled 'Dairy Extension Education and Services at Farmer's Door through Mobile Extension Unit: An Action Research'. During these Kisan Sangosthies, some problems of the following were identified by the specialist team:

- Mineral deficiency in lactating cattle and buffalo.
- Repeat breeding.
- Problem of mastitis.
- Tick problems.
- Unawareness of clean milk production.
- Low price of milk.
- Lengthy process of getting loans and unawareness of loan schemes offered by State Government and Nationalized Banks, etc.

The teams were accompanied by veterinary doctors and bank functionaries, who provided solutions to these problems.

REGIONAL CAMPUS, BANGALORE

- A total number of 454 visitors in nine batches comprising of students from various educational institutes from various parts of southern region, farmers and entrepreneurs visited the campus. The visitors were taken round the institute to various sections as per their needs and were explained the ongoing activities of the station.
- Advisory services / technical advice was rendered to the needy clientele during their personal visits to the campus. The profile of information needed included availability of publications in dairy farming aspects, technical know-how and consultancy facilities for dairy business projects and training programmes on dairy management aspects.
- Participated in Dairy Tech India 2012, International Exhibition on Dairy Products & Technology held during 25th to 27th August 2012 at Palace ground, Bangalore. NDRI stall depicted innovative & educative information on dairy production & processing technologies, Indigenous breeds of South India & Indigenous dairy products of the region. The exhibition was well attended by small / large scale dairy entrepreneurs and industrialists from all parts of the country and abroad.
- Six days training was conducted for eight candidates on 'Commercial Dairy Production' from 24.09.2012 to 29.09.2012.



Freshers' Day Fiesta at NDRI, Karnal

EVENTS

National Seminar on "Global Opportunities and Concerns in Dairy and Food Sector"

National seminar on "Global Opportunities and Concerns in Dairy and Food Sector" was organized jointly by NDRI Graduate Association and National Dairy Research Institute on 28th-29th September, 2012 at NDRI, Karnal. The seminar was attended by about 350 participants from all over the country. The seminar was inaugurated by the Chief Guest Dr. R. B. Singh, President, National Academy of Agricultural Sciences who delivered the key note address. He said that due to increasing demand for milk and milk products, the food and dairy industry must gear itself to meet not only domestic demand but also expand its share from global perspective. Sh. G. C. Pati, Secretary, Dept. of Animal Husbandary, Dairying and Fisheries, Ministry of Agriculture, Govt. of India presided over the function. Madam Harjot Kaur, Managing Director, Bihar Co-operative Society and Dr. K. C. Dangi, Director General, Animal Husbandary, Govt. of India were the Guests of Honour. Dr. A. K. Srivastava, VC and Director, NDRI, Karnal called upon the delegates to make best use of global opportunities and address the challenges before Indian industry to make it more remunerative and competitive at the global level. Global opportunities and concerns besides safety and innovative health and nutritious dairy products were discussed at length in the two days meeting. Dairy industry needs to take appropriate and concrete steps to meet the rising demands for dairy products due to expanding incomes, changing dietary patterns, population growth, changing demographics and lifestyle. Besides opening of new avenues, there are certain issues which need dairy industry's attention on priority. Valedictory function was presided over by Dr. A. K. Srivastava, Director, NDRI. Dr. B. K. Joshi, Director, NBAGR, Karnal was the Chief Guest and Dr. J. S. Punjraht, Executive Director, Reliance India Ltd., Chandigarh was the Guest of Honour. The major recommendations included export potential of dairy products, capturing domestic market, value added dairy products besides probiotic and prebiotic dairy products, supplementation with bioactive peptides, omega-3 fatty acids, vitamins, minerals, whey products, production of high quality safe milk and milk products meeting the International standards, improvement in cold chain infrastructure, road network facilities and regulations like APMC act.

XI Annual Review Meeting of Network Project on Buffalo Improvement

The 11th Annual Review Meeting of Network Project on Buffalo Improvement was organized at NDRI, Karnal on August, 24, 2012. A total of 31 delegates participated

from ICAR, Krishi Bhavan, New Delhi, seven centers of Murrah breed and six centers of other breeds of buffalo. The meeting was held to review the progress of each center and implementation of the programme. The meeting was inaugurated and chaired by Prof. (Dr.) K. M. L. Pathak, Deputy Director General (Animal Science), ICAR, Krishi Bhavan, New Delhi. In his address, Dr. Pathak highlighted the importance of the project and advised that every centre should focus on the identified work. Prof. A. K. Srivastava, Vice-Chancellor & Director, NDRI, Karnal in his address highlighted the importance of buffalo in India and in Global map. Earlier Dr. Rishendra Verma, Joint Director (Research), NDRI, Karnal delivered the welcome address delineating the research areas on buffalo improvement. Dr. S. C. Gupta, ADG (AP & B), ICAR, Krishi Bhavan, New Delhi mentioned about the strength of project planning and how to maximize the coordination of the centers. Dr. R. K. Sethi, Director and Project Coordinator highlighted the overall progress of the project of all the centers. Principal Investigators of seven centers of Murrah breed (NDRI, Karnal; CIRB, Hisar; GADVASU, Ludhiana; IVRI, Izatnagar; SVVU, Mamnour; KVASU, Pookot and ICAR Research Complex, Patna) and six centers of Nili Ravi (CIRB, Sub Campus), Jaffarabadi (JAU, Junagadh),



Inauguration of Amravati Wing of Kaveri Hostel by DDG (AS) ICAR

Pandharpuri (MPKV, Kolhapur), Surti (RAJUVAS, Vallabhnagar), Bhadawari (IGFRI, Jhansi) and Swamp (AAU, Khanapara) breeds of buffalo presented the annual progress reports. The need to strengthen all the aspects of buffalo improvement by the various centers was also emphasized. The proposal of new centers for XII Plan and the technical programme for 2012-13 and XII Plan proposal was also discussed in the meeting.

Personality Development Lecture on Stress Management

A lecture on "Stress Management" was organised on 17th September 2012 at NDRI, Karnal under the aegis of Personality Development Cell. B K Sunita, Senior Rajyoga Teacher and B K Ved Vyas, Scientist, Bhabha

Atomic Research Centre gave presentations to foster positive, stress-free and harmonious environment and work culture at the Institute. Dr Avtar Singh, Principal Scientist, and Dr Meena Malik, Associate Professor coordinated the programme.

राजभाषा एकक

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Computer Centre

- The Computer Centre imparted 4-week summer training to three M.Tech./M.Sc. (Bioinformatics) students sponsored by Department of Computational Biology and Bioinformatics, Sam Higginbottom Institute of Agriculture Technology & Science (SHIATS) Deemed University, Allahabad, Uttar Pradesh
- The Computer Centre provided scientific data analysis consultancy to as many as 20 students (8 PhD and 12 M.Sc. students) from different Dairying disciplines for completing their theses.
- A special software program was developed (in FORTRAN language) for genetic gain estimation to find out the best method of sire evaluation on the basis of breeding value.
- A new decision support module was added to the existing in-house developed Medical Bill Generation software (operational in Cash & Bill Section) to find out an employee's monthly/ yearly claimed total medical amount.
- Primary Rate Interface (PRI) system with 30 inbuilt channels has been successfully installed at the EPABX, which is cost effective solution.

REGIONAL CAMPUS, BANGALORE

NDRI Foundation Day and Seminar on Newer Initiatives for Dairy Development

A seminar was organised to commemorate NDRI foundation day at Southern Regional Campus, Bangalore on 1st July, 2012. The celebration was inaugurated by Dr. A. K. Srivastava, Director and Vice-chancellor, NDRI, Karnal. In his address, he emphasised that the demand for milk is expected to increase to 200-210 million tonnes a year by 2020 as against the present annual production of about 120 million tonnes. Strengthening dairy farming sector in the country is vital to ensure the food security and to tackle nutritional deficiencies. He reiterated better collection systems, higher productivity of animals and clean milk production and processing were the need of the hour. Dr. Satish Kulkarni, Head, of the campus while welcoming the dignitaries and participants narrated the role played by National Dairy Research Institute and its Southern Campus for the development of the dairy industry in the country.

Commemorating the celebration, a seminar on "Newer initiatives for Dairy Development" was organized. Dr. N.V. Belavadi, Consultant, National Dairy Development Board, Dairy Services, New Delhi delivered Zal R. Kothawala Memorial Lecture on "National Dairy Plan – A recent initiative for Dairy Development". Dr. Belavadi delineated the striking features of National Dairy Plan and also underlined the growing relevance of new generation dairy co-operatives and producers companies. Dr. C. S. Prasad, Director, National Institute of Animal Nutrition and Physiology chaired the Session.

Technical sessions were conducted on 'Food Safety and Standards Act, 2006', 'Human Resource Requirements for Dairy Industry' and 'Sub-clinical Mastitis – A Threat to Sustainable Milk Production'.

Major Recommendations

- The awareness on the act FSSA, 2006 and its implementation, development of logistics with regard to training and development of human resources, infrastructure should be given priority.
- Need based Certificate Courses of different durations be developed to cater to the HRD needs of the growing dairy industry.
- The incidence of sub-clinical mastitis should be surveyed and all attempts be made to prevent the loss to the dairy industry through the occurrence of sub-clinical and clinical mastitis.

Hon'ble Minister for State for Agriculture and Food Processing visits Southern Campus

Dr. Charan Das Mahant, Union Minister for State for Agriculture and Food Processing Industries, Govt. of India visited the Southern Campus of NDRI on 9th July, 2012. The Hon'ble Minister took round the institute visited the Laboratories and addressed the staff. On behalf of the institute, Dr. Satish Kulkarni, Head of the Station felicitated the Minister.



Guest Lecture

Sh. Animesh Banerjee, Former IDA President, delivered a talk on 'Dairy Industry: Vision and Growth' on 30th August 2012 at Bangalore. Dr. Satish Kulkarni presided over the function.

Teachers' Day

The students of the campus celebrated the 'Teacher's Day' on 5th September 2012 to mark their respect to the teachers.

Dr. R. Nagarcenkar, Former DDG (AS) ICAR was the Chief Guest and Dr. Satish Kulkarni Presided over the function. Quiz competition was also organised for the teachers.

Engineers' Day Celebration at SRS, NDRI

The Dairy Engineering Section of SRS celebrated the Engineers' Day on 15th September 2012 to commemorate the birth anniversary of Sir Mokshagundam Visvesvaraya. Dr. Satish Kulkarni, Head, presided over the function.

Hindi Day

As part of promotion of Hindi language, Hindi Week was celebrated in the Institute from 15.09.2012 to 21.09.2012. During the celebration, Hindi competitions were conducted for the Staff members as well as for their Children and Students. Hindi Day was celebrated at the Station on 22.09.2012. The occasion was graced by Dr. Arvind Kumar, Head, Department of Hindi, Jain University, Bangalore.

REGIONAL CAMPUS, KALYANI

Training Organized

One 15 day training programme was organized at Eastern Campus, Kalyani on *Scientific Dairy Farming* for unemployed rural youth and dairy farmers. The course was conducted from 10.09.12- 24.09.12 in which 11 trainees from different districts participated.

AWARDS/HONOURS

- **Dr. Raj Kumar Duary** was awarded **Jawaharlal Nehru** Award for P.G. Outstanding Doctoral Thesis Research in Agricultural and Allied Sciences 2011 held on 16th July 2012 at NASC Complex ICAR, Delhi. He has done his Ph.D under the guidance of Dr. Sunita Grover on "Modulation of gene expression by indigenous probiotic lactobacilli under simulated in vitro gut environment."
- **Dr. Raj Kumar Duary** awarded "**Best Young Researcher Award (Second Prize)**" for his paper on "Potentiality of two promising putative indigenous strains of probiotic lactobacilli for boosting gut health and immunity" presented in '1st Annual conference of Probiotic Association of India (PAI) and International Symposium on probiotics for human health on 28th-29th August, 2012.
- **Dr. V. K. Batish**, Former Head and Emeritus Scientist was elected Fellow of National Academy of Agricultural Sciences for the year 2012-2013 for his outstanding contributions in the area of Biotechnology and Microbiology.
- **Mr. A. Giri, Dr. S. K., Kanawjia, Dr. Y. Khetra,** and **Mr. R. Kumar** were awarded "**Best Prize**" for their research poster presentation entitled "Development of processed cheese spread with enhanced functional attributes" at XL Dairy Industry Conference on 'Indian Dairying: Perspective 2020' organized by Indian Dairy Association at New Delhi, on 2nd - 5th February, 2012.
- **Ms. Aparna Sudhakaran .V, Dr. V. K. Batish** and **Dr. (Mrs.) Sunita Grover** were awarded the "**Best Paper Award (Third Prize)**" for the poster entitled "Modulation of anti-inflammatory response in LPS stimulated cell line and mouse model with indigenous putative probiotic lactobacilli" presented in '1st Annual conference of Probiotic Association of India (PAI) and International Symposium on probiotics for human health on 28th-29th August, 2012.
- **Mr. A. Giri,** and **Dr. S. K., Kanawjia,** were awarded "2nd Best Prize" for the oral presentation entitled "Enrichment of processed cheese spread with functional ingredients" at

International conference on 'Food and Nutrition Technology for Public Health Care', organized by International Institute of Stress Management and Allied Sciences, at Jawaharlal Nehru University, New Delhi, on 4th - 5th May, 2012.

- **Mr. A. Kumar, Dr. S. K. Kanawjia, Dr. Y. Khetra, Mr. A. Giri, and Mr. R. Kumar** were awarded "**2nd Best Prize**" for their research poster presentation entitled "Development of functional chocolate soft cheese" at International Conference on 'Food and Nutrition Technology for Public Health Care', organized by International Institute of Stress Management and Allied Sciences, at Jawaharlal Nehru University, New Delhi, on 4th - 5th May, 2012.

Training Programme

- **Mr. Dambar Bahadur Khadka**, a M.Sc. student of Food Science, Technology and Nutrition from Kaho-sint-Lieven, University College, Gent, Belgium under Erasmus Mundus, SEFOTECH. NUT programme joined training (Placement) at NDRI, Karnal under the supervision of Dr. Bimlesh Mann, Principal Scientist, Dairy Chemistry Division on 16th July, 2012 for a period of three months.

VISITS ABROAD

- **Dr. Anil Kumar Puniya**, Principal Scientist, Dairy Microbiology Division for participation in the 1st International Conference in Animal Nutrition and Environment from 13th – 18th September, 2012 at Khon Kaen, Thailand.
- **Dr. Magan Singh**, Sr. Scientist, FR&MC was deputed for exposure visit Training and Up-gradation of Technical Knowledge in Admn. & Management at Japan from 29th– 30th September, 2012.

PERSONALIA

Joining

- **Dr. V. P. Singh**, Joint Director (A) joined on 13.07.2012 after transfer from IVRI, Izatnagar.
- **Dr. Rishendra Verma**, Joint Director (Res.) joined on 16.07.2012 after transfer from IVRI, Izatnagar.
- **Sh. S. George**, CF&AO joined as comptroller at this Institute on 26.07.2012.
- **Dr. Nitin Tyagi**, Sr. Scientist (Animal Nutrition) joined NDRI on 17.08.2012.
- **Dr. Mukesh Bhakat**, Sr. Scientist (LPM) joined on 29.08.2012.

- **Dr. R. C. Upadhayay**, Principal Scientist (Acting Head) Dairy Cattle Physiology joined as regular Head Dairy Cattle Physiology Division NDRI on 30.08.2012.
- **Sh. Ashok Malik**, Sr. Admn. Officer joined on 01.09.2012.
- **Dr. Gautam Mandal**, Sr. Scientist (LPM) joined on 07.09.2012.

Retirements/Transfers

- **Dr. G. R. Patil**, Joint Director (A) relieved from NDRI, Karnal w.e.f. 13.07.2012 to join at IVRI, Izatnagar.
- **Dr. Rameshwar Singh**, Head, Dairy Microbiology relieved from NDRI to join as project director, DKMA, ICAR.
- **Dr. J. S. Jeyakumar**, Scientist (SS) joined SRS of NDRI, Bangalore after his transfer from Central Agricultural Research Institute, Port Blair to SRS of NDRI, Bangalore. on 18.06.2012.

DISTINGUISHED VISITORS

- 1.1.2012 Five member delegation from High Commission of the Republic of Mozambique University of Zambeze
- **Prof. Dr. Bhangy Cassy**, Vice Chancellor, Uni. Of Zambeze.
 - **Prof. Dr. Daniel Chongo**.
 - **Prof. Dr. Custodio Boane**.
 - **Prof. Dr. Fabiao Cumbe**.
 - **Mr. Lourenco Lazaro Magaia**, Director for Cooperation.



Director, NDRI interacting with the delegation from the republic of Mozambique

- 22.08.2012 **Mr. Adriaan Vernooij**, Agriculture Counsellor, Agriculture Department of the Embassy of the Kingdom of Netherlands, New Delhi with **Mr. Mukanjay Singh**, Delhi Embassy.

NDRI PAYS HOMAGE TO DR. VERGHESE KURIEN – A MARVEL IN INDIAN DAIRY PANORAMA

One just can't imagine the present day scenario of Dairying in India sans Dr Verghese Kurien. Widely acclaimed as the "father of the white revolution" in India, Dr Kurien was the harbinger and architect behind the success of the world's largest dairy development program, known as the Operation Flood. A marvel in Indian Dairy Panorama, he is recognized as a visionary transforming the lives of millions of dairy farmers by empowering them through cooperative movement free from the clutches of bureaucratic set-up. His contribution to the field of Dairying and community leadership was well recognized through a number of awards such as Ramon Magsaysay Award (1963), Padma Shri (1965), Padma Bhushan (1966), Krishi Ratna Award (1986), Wateler Peace Prize Award of Carnegie Foundation (1986), World Food Prize Award (1989), International Person of the Year (1993) and Padma Vibhushan (1999).

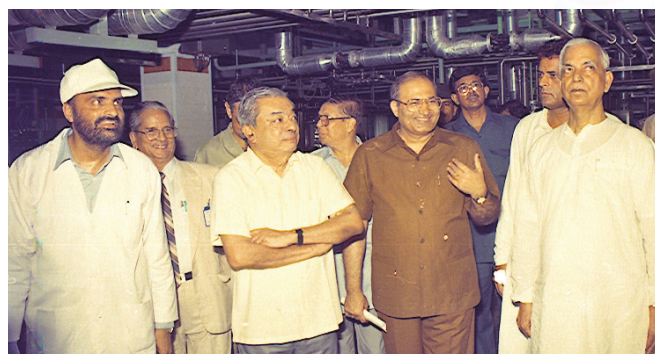


Inauguration of Model Dairy Plant at NDRI by Dr. V. Kurien

He was born on November 26, 1921 in Kozhikode, Kerala and graduated with Physics from Loyola College, Madras in 1940. He completed his B.E. (Mechanical) from the Madras University and went to USA on a government scholarship for his Masters in Mechanical Engineering from Michigan State University. In between, **he underwent nine months of specialized training in Dairy Engineering at the Imperial Institute of Dairying at Bangalore**. In 1965, the National Dairy Development Board (NDDB) was created under the leadership of Dr. Verghese Kurien with the objective to replicate the success story of Amul, throughout the country. In 1973, he set up Gujarat Cooperative Milk Marketing Federation for effective marketing of the products produced by the dairies. Under his stewardship, India became the largest producer of milk in the world.

An illustrious alumnus of National Dairy Research Institute (NDRI), he possessed an extraordinary far-sighted approach and **chaired the first Quinquennial Review Team of NDRI** and translated his vision into mission mode. He was a true believer of the fact that the rural development process required real professional transformation and with this vision in mind, he created institutions like Institute of Rural Management (IRMA). To ensure the smooth functioning of the organization, he always delegated greater responsibility to his subordinates. He was a great believer in innovation and always motivated others for innovative work. NDRI had privilege to have him **inaugurated the Model Dairy Plant at NDRI, a state-of-the-art commercial Dairy Plant, established in the year 1996 at NDRI, Karnal installed on turnkey basis by the National Dairy Development Board**.

NDRI pays homage to Dr Verghese Kurien, who will always remain enshrined in the hearts of Indians for his undaunted zeal and visionary approach towards transformation of Indian Dairy Industry. He became a legend in his lifetime



Dr Kurien at Model Dairy Plant, NDRI

for building a cooperative dairy movement that provided livelihood security to the millions of poor farmers and made India self-reliant in milk production. So great and immense are his achievements that his demise marks the end of an era. During this era, a milk deficit nation - where availability per capita per day was 117 gm - not only became self-sufficient at 263 gm per capita per day but also achieved the laurel of becoming the largest milk producing nation. This period would always be remembered as a golden chapter in the history of the Indian dairy industry!

Our salutations to this great soul of India!

FEATURE ARTICLE

Complementary Food Based on Milk Nutrients and Underutilized Crops

NAIP Project on "Value chain on composite dairy foods with enhanced health attributes"

Dairy Technology Division, NDRI, Karnal

Dietary requirements of human beings differ with the age. It has now been scientifically understood that the

nutrition of a human being during the first thousand days, including the gestation period, is critical for leading a healthy life ahead. Recent reports revealed that the child malnutrition is more common in India than in sub-Saharan Africa. In India, around 46% of all children below the age of three are stunted and 47% are underweight and many of these children are severely malnourished. Breast milk is an excellent

source of nutrients and protective factors that assist in growth and development of an infant. However, around 4-6 months mother's milk alone would not be sufficient to meet the nutritional requirement of infant and complementary feeding or weaning based on a dietary regime rich in calories, proteins and other micro-nutrients is needed during the transition to only adult foods. Majority of nutritional deficiency disorders appears due to poor emphasis on weaning foods. Weaning practices are largely governed by the socio-economic status and dietary habits of the people. Any nutritional deficiency during weaning phase cannot be reversed by corrective measures and manifested by poor immunity, mental development and several other disorders. Complementary foods are foods other than breast milk or infant formula (liquids, semisolids and solids) introduced to an infant to provide all vital nutrients in suitable form and desired quantity. Designing of complementary food is quite a challenging task and an ideal complementary food should deliver nutrients in easily assimilable form, having soft consistency, low dietary bulk, free from any synthetic additives and should have been prepared hygienically.

Several commercial weaning food preparations are available in market place, which have been formulated to cater the nutritional needs of the infants, but these products are not affordable by the large segment of the society. A process for the development of complementary food based on a composite of whey-skim milk-pearl millet and barley malt is developed with the objective to harness the nutritional and therapeutic virtues of dairy by-products and coarse cereals. India is the largest producer of coarse grains including millets, which have attracted the attention of stakeholders because of their quality protein, fatty acid profile and richness in micronutrients particularly, iron & zinc. However, millets also contain anti-nutrients like tannins, phytate, polyphenols, enzyme inhibitors and oxalates that limit their utilization in health foods. Suitable processing interventions such as steeping, germination, roasting were utilized to reduce the levels of phytic acid, tannins and polyphenols. The germination of pearl millet grains activated the various hydrolytic enzymes mainly α -amylase and process of germination also improved the digestibility of protein and starch. Milk ingredients are integral part of any complementary food due to the excellent quality of milk proteins. Among the milk ingredients whey and whey nutrients offer great opportunity for complementary foods development.

Whey proteins are one of the best quality food proteins with a high PER (3.6), biological value (104), NPU (95) and PDCAAS score that make them an ideal protein source for fortification of wide range of food stuffs. Whey proteins are rich source of all essential amino-acids specially the sulphur containing amino-acids i.e. cysteine and methionine and branched chain amino-acids (BCCA), which make them superior to meat, soy and casein. Tryptophan, which acts as building block for niacin, is present in high amount in whey proteins. Liquid whey can be utilized as such or in concentrated form as whey powder for the production of higher value added products like lactose, whey protein concentrates (WPC) or whey protein isolates (WPI). Complementary food was prepared by the spray or tray drying of a thermally stable blend of whey, skim milk, pearl millet flour, barley malt, maltodextrin and corn flour (Fig.1). The dried mix was further blended with sugar and flavouring. The finished product meets all the specifications laid down in the statutory FSSR (2011) for milk-cereal based complementary food. Another low cost weaning mix is prepared by extruding the pearl millet and barley grits, which improve their nutritional profile and digestibility. The extrudates were milled, mixed with skim milk powder (SMP), de-mineralized whey powder (DWP) or WPC in various ratios along with sugar and flavouring to develop a nutritious and acceptable weaning mix. The mix was fortified with suitable iron and zinc salt to enhance their nutritional quality. The nutrimit contained 14.5% proteins, 82mg/100g iron, 46 mg/100g zinc and 1900mg/100g calcium content. On the basis of work carried out at the Institute, it could be inferred that milk ingredients specially the dairy by-products could be effectively utilized in combination with locally available underutilized crops to develop low cost weaning mix.



Fig. 1. Milk-whey-cereal based complementary food

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