

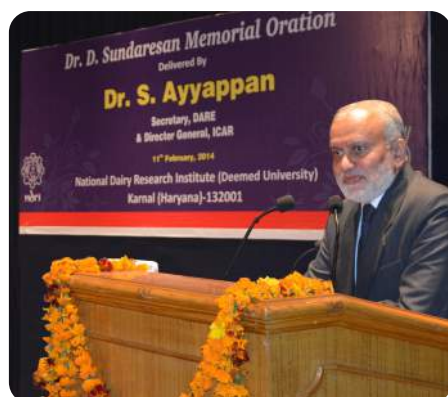
NDRI News

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From the Director's Pen

STOP PRESS



Hon'ble Secretary DARE and Director General ICAR delivered Dr D. Sundaresan Memorial Lecture on 11th February 2014.

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Buffaloes play an important role in the national economy by producing milk, meat and draught power. The contribution of buffaloes to the country's milk pail is substantial in spite of the fact that they are less (105 million) in numbers than cattle (199 million). The milk production from buffaloes is about 72 million metric tonnes of milk, which is about 56% of the total milk produced in the country. Owing to multifaceted contribution, the preference for buffaloes among the Indian farmers is also increasing as indicated by the consistent increase in buffalo population from 84.21 million in 1992 to 105.34 million in 2007. Recently, news coverage in media of a buffalo from Haryana sold to a farmer from Andhra Pradesh for whopping ₹ 25 lakh amply proves the worth of this prized animal for the farming community. It is a matter of pride to have 56.8 % of the total world buffalo population in the country. However, when the reproductive performance of Indian buffaloes is compared with Mediterranean buffaloes, it can be appreciated that there is enough scope for improvement. Analysis of the existing information on reproductive efficiency of buffaloes in the country clearly reveals that they attain late sexual maturity, calve at a later age, conceive at very later stage of post-partum period and the conception rate is very low. The age of puberty and sexual maturity in Murrah buffalo is 36 to 42 months in India. It is late as compared to other countries like Italy, where the buffalo heifers calve between 28 to 32 months of age. Similarly, the calving interval in buffaloes even goes beyond 16 months in rural households against the optimum value of 13-14 months.



Among the several factors affecting the reproductive performance, proper identification of estrus is the major bottleneck in achieving high conception rates in buffaloes. There are two important challenges in heat detection. The first is accurately recognizing signs of heat (heat detection accuracy) and the second is catching all possible heats in breeding buffaloes (heat detection efficiency). It is generally considered that majority of the events of the estrous cycle in buffaloes is similar to that of cattle; however, there are some unique features in this species that need to be understood properly. The ovaries of buffalo are smaller and have fewer tertiary follicle compared to cattle. The post-pubertal primordial follicle reserve is also very less in buffalo (10,000 – 20,000) compared to cattle (1, 00,000). Although the duration of the estrous cycle in buffalo is similar to that in cattle (range: 17-26 days; mean 21 days), there is greater variability of estrous cycle length in buffalo, with a greater incidence of both abnormally short and long estrous cycles. Buffaloes are shy breeders and express the behavioural signs of heat during a limited period of year. Thus, the importance of catching all the heats assumes significance

since in animals that show a seasonal trend in reproduction loss of 21 days is equal to loss of two cycles. Each missed heat is a missed opportunity; for each heat missed, the farmer incurs a loss of milk production of 21 days, in addition to bearing the feeding cost for animal maintenance, which tantamounts to about Rs. 3000 – 5000 depending upon the milk productivity.

Although several tools/methods have been developed and tested for their efficiency in identifying estrus in cattle, a majority of them have not been studied in detail in buffaloes. In addition, a majority of these tools have been tested under organized farm conditions and not under small holder production systems where only 2-3 animals are reared in a household. Any attempt to improve estrus detection should, thus, aim to either test/evaluate suitable tools/methods for their efficiency under small holder production system or to develop new methods like on-spot diagnostic tests. At NDRI, indigenous pedometers have been developed for estrus detection based on the activity pattern and are being validated on a large number of animals. Identification, isolation and characterization of the pheromones secreted during estrus would offer great

scope for developing “electronic nose” that can be used for identifying animals in estrus. Differential expression analysis of proteins in blood plasma, milk, urine and vaginal secretions by high throughput proteomics and mass spectrometry approaches during different stages of estrous cycle in buffaloes would help us to develop on-spot estrus detection kits.

To realize the dream of obtaining a calf per buffalo every 14 months in large scale, understanding the estrus biology and means to overcome the constraints in detection of estrus is very important since problems associated with estrus detection leads to increased calving interval. Recent knowledge has advanced our understanding of estrus biology in dairy animals and provided insight into behavioural, biochemical, endocrinological and other cues that could be used for estrus detection. With these developments in science, it is now possible to develop such promising tools/methods for improving estrus detection efficiency and accuracy in buffaloes.

(A.K. Srivastava)

RESEARCH

Effect of Different Levels of Chromium Supplementation on Immune, Endocrine Parameters, Nutrient Utilization and Productive Performance in Buffaloes

(Rijusmita Sarma, Veena Mani, Harjit Kaur, A. K. Tyagi and Neelam Kewalramani)

Twenty four pregnant Murrah buffaloes were equally distributed based on most probable production ability (MPPA), body weight and body condition score (BCS) in 4 groups and fed on standard rations supplemented with 0, 0.5, 1.0 and 1.5 ppm Cr as chromium chloride in groups C, T₁, T₂ and T₃ respectively. The experimental feeding continued from 60 d before expected date of calving to 150 d post calving. There was an increase (P<0.01) in DM, CP and TDN intake in T₂ and T₃ groups. Average milk yield and fat corrected milk (kg/d) improved significantly (P<0.01) in T₂ (22.4 and 28.78%) and T₃ (31.7 and 42.32%). Efficiency of utilization of nutrients was improved in T₂ (21.35%) and T₃ (26.56%). The beneficial effect of Cr supplementation was evident from the levels of hormones (insulin, leptin and cortisol), which was

suggestive of lower level of physiological stress experienced by such animals. Lymphocyte proliferation index, total phagocytic activity, Ig G and total antioxidant activity values were higher (P<0.01) in T₃ group showing better immune status. No case of retention of foetal membranes (RFM), pyometra was seen in treatment groups. The conception rate was 50 % in control, which increased to 83.33% in T₃ group. Therefore, supplementation of Cr @ 1.5ppm resulted in improved feed utilization, milk yield, immune status as well reproductive performance in buffaloes.

Studies on Accelerating the Clotted Cream Formation for in-Line Production of Rabri

(Rajendra Prasad Kumawat and Bikram Kumar)

Rabri is a concentrated, sweetened whole milk delicacy, containing several layers of clotted cream. Mechanized production of Rabri involves fast evaporation i.e. upto 30-35% concentration and followed by clotted cream formation. Product is heated continuously with low intensity heat and is kept without agitation till clotted

cream layer is formed. The process of free convection from product surface continues till required amount of clotted cream is collected, which is very tedious and time consuming process. The present investigation aimed at exploring the influence of forced convective flow of air on product surface to accelerate the formation of clotted cream. Experiments were conducted using forced convective air velocity in the range (1.5 to 4.5 m/s), Milk surface temperature (70°C to 90°C) and Fan angles (30° to 90°) for maintaining clotted cream layer (CCL) to sweetened condensed milk (SCM) ratio of 0.16. Operational parameters were optimized by using response surface methodology (RSM). Optimum parameters for accelerating the clotted cream formation for in-line production of Rabri were predicted as Fan Angles (30°), Milk Temperature in conical process vat (71°C) and Air Velocity (4.5 m/s). Rabri produced by using optimized operating parameters gave average quantity of CCL 80.7 (gm/5min), the average sensory score viz. flavour, body and texture, colour and appearance and overall acceptability as 8.46, 7.93, 8.51 and 8.38, respectively. The average values for firmness and stickiness were 0.584 (N) and -0.085 (N) respectively. The colour of the best sample in terms of L*, a* and b* were 78.9, 2.70 and 14.19 respectively. Free fatty acid (FFA) and acidity of rabri was 0.163 (µmol/gm) and 0.166 % (Lactic Acid) respectively. The time taken by existing system for removal of sufficient amount of Clotted Cream (SCM/CCL 0.16) was 4 hrs approximately, whereas forced convective air flow on the milk surface reduced the time to 2.2.hrs., thus, saving 45% time.

Assessment of Antioxidant Activity of Nanoencapsulated Curcumin in Mice Model

(T. P. Sari, Bimlesh Mann, Rajesh Kumar and Rajan Sharma)

Curcumin, the yellow pigment of turmeric (*Curcuma longa*) has been shown to possess lot of beneficial pharmacological activities because of its antioxidant activity. While utilization is currently limited due to its low bioavailability. So the aim of the present study was to validate the therapeutic benefits of nanoemulsion encapsulating curcumin (Size: 141.6 ± 15.4 nm) over unencapsulated curcumin against paracetamol induced oxidative stress in mice. The effect was evaluated by measuring the levels of oxidative biomarkers like

glutamate pyruvate transaminase, alkaline phosphatase, creatinine and blood urea nitrogen in the blood serum and the activity of endogenous antioxidant enzymes such as superoxide dismutase, catalase and glutathione peroxidase in liver homogenate. In addition, the extent of lipid peroxidation was also measured in liver homogenate. Treatment with nanoencapsulated curcumin at a dose of 30 mg/kg body weight both in preventive and curative groups of mice significantly attenuated paracetamol induced oxidative stress. Whereas, unencapsulated curcumin at the same dose failed to offer protection against oxidative stress. The enhanced action of nanoencapsulated curcumin was attributed to the stability as well as slow release of curcumin from the encapsulated particles. The study suggests that the improved bioavailability of nanoemulsion encapsulating curcumin can be utilized for the prevention as well as treatment of oxidative stress induced cell damage and associated diseases.

Milk Fermented with a Probiotic *Lactobacillus casei* Exhibits Positive Effect on Intestinal Health under High Fat Diet Fed Conditions

(Raghvendra Kumar, R. K. Sharma and Surender Jangra)

Environmental factors, such as a fat enriched diet and a sedentary lifestyle, are the causes of metabolic diseases like obesity and type 2 diabetes. Gut microbiota functions at the intersection between host genotype and diet to modulate host physiology and metabolism. Consumption of high fat diet for long duration is known to disturb the gut microflora (dysbiosis). It is a source of endotoxins whose increase in plasma is being related to obesity and insulin resistance through increased intestinal permeability. Effect of milk fermented with a probiotic strain of *L. casei* in modulation of intestinal function with reference to intestinal integrity/ permeability and related gene expression was evaluated using Swiss Albino mice fed on high fat diet (HFD). High fat (35%, w/w) diet feeding resulted in a significant increase in intestinal permeability as determined by using 4000 Da fluorescent-dextran and measurement of fluorescent in blood plasma. A positive effect of dietary supplementation of probiotic fermented milk on intestinal integrity/permeability could be observed. Expression of two important genes related to intestinal integrity (Occludin and ZO-1 tight junction proteins) was determined by qRT-PCR. Reduced

expression of both the tight junction proteins could be observed in HFD fed group which is in conformity with the increased intestinal permeability observed as a result of high fat feeding. Occludin was found to be up-regulated significantly to a level >2 fold as a result of dietary supplementation of probiotic fermented milk. A similar trend of up-regulation of ZO-1 was also observed in

probiotic fermented milk fed group, however, not to a significant level. Though, skim milk supplementation also exhibited positive effects, but these were not found to be statistically significant. Findings of the present study suggest a positive effect of dietary supplementation of probiotic *L. casei* containing fermented milk on intestinal functionality in high fat diet fed conditions.

EXTENSION

DAIRY EXTENSION DIVISION

Field/Farm Technician (FFT) Activity

The Field/Farm Technician (FFT) Laboratory of Dairy Extension Division provides a base for extension work in the adopted villages around Karnal and keeps the records of all extension activities of the division. The FFT Laboratory is operated through Stockman Centres. The Stockmen are the grass-root level workers through whom a live and regular contact between scientists and farmers is established. At 15 Veterinary Camps, 525 cases were treated for reproductive disorders and various Veterinary ailments. Ecto and Endo-parasite control programmes were conducted. Special attention was given to improve the productive and reproductive performance of dairy animals

Kisan Sangosthies

Fifteen Kisan sangosthies were organized at village level covering the following topics:

1. Control of ecto-parasite infestation
2. Role of mineral mixture in animal diet
3. Care and management of calving animals
4. Heat symptoms and correct time of insemination of dairy animals
5. Clean milk production practices in rural areas

Empowerment of Women and Mainstreaming of Gender Issues

Six women empowerment training and campaigns were organized for 146 women with the objective to create awareness in the field of dairying and home science and also impart skill in these areas so that farm women could generate more income from dairying.

Educational Visits and Tours: A total of 2873 visitors (students & Faculty) of 27 colleges/institutions/universities visited the institute. The groups were sensitized about the different research, teaching and

extension achievements and facilities available at the Institute.

Entrepreneurship Development on Small Scale Production of Milk Products: One on-campus 3 day training on “Entrepreneurship development on small scale production of Milk Products” was organized for Sidak SHG members of village Bazidpur from 18th – 20th December., 2013 The programme was organized with the objective to create awareness, impart skills in these milk product technologies and also mobilize the participants to adopt these technologies for sustainable income. Nineteen farmwomen were trained on fat testing, preparation of cream, butter & ghee. Beside this, the technology of gulab jamun, paneer, khoa, gulab-jamun, chhana murki & kalakand was also demonstrated.

Dairy Extension Education and Services at Farmer's Door through Mobile Extension Unit

During the quarter, 194 calls of farmers were attended using mobile extension unit facilities. In all 93 artificial inseminations were done and 35 pregnancy diagnoses of animals in the project area were carried out. One veterinary camp was organized in Abli village.

KRISHI VIGYAN KENDRA

Training Programmes Organized: In all 58 training programmes (on-campus and off-campus and 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 1746 farmers, women, rural youth and extension functionaries were imparted training.

Sponsored Training Programmes

Out of the total courses, KVK organized 15 sponsored training programmes on Scientific Dairy Farming, Clean Milk Production, Commercial Dairy Farming and Milk Processing for 401 farmers, rural youth and extension functionaries. In these training programmes 211

practicing farmers from Bihar, 130 trainees from Jharkhand, 38 trainees from Himachal Pradesh and 12 trainees from Assam, apart from 10 veterinary officers from Punjab state, were imparted training.

Exposure Study Visits Organized

During the period, KVK also organized 27 exposure cum study visits for 894 farmers and farm women from different districts of Uttar Pradesh, Gujarat, Odisha, Uttarakhand, Bihar, Rajasthan, Haryana and Himachal Pradesh states.

Animal Health Management Activities

Various Animal Health Management activities were organized through Stockman centers in adopted villages of KVK. At these centers, 518 cattle and 498 buffaloes were artificially inseminated and 422 calves were born. Besides these, 33 animals were treated, 31 calves were dehorned, 32 animals were given infertility treatment and one bull was castrated.

FLD on Fodder Crops Summer 2013

- During the summer season 2013, 12 FLDs on fodder crop Jowar variety Sudax Chari-1 (multicut) were

used in 3.22 hectare area under irrigated conditions. The average fodder yield was found 531 quintal per hectare. The overall performance of the varieties of Jowar fodder was found to be good.

- During the summer season 2013, 8 FLDs on fodder crop Maize variety African Tall were used in 2.0 hectare area under irrigated conditions. The average fodder yield was found 508 quintal per hectare. The overall performance of the variety of Maize fodder was found to be good.

On Farm Trials

- During the Kharif season 2013, 7 demonstrations for varietal evaluation under On Farm Trials (OFT) on paddy variety PB-1401 and PUSA-1121 in 2.8 ha area under irrigated conditions were arranged. The average yield was found to be 55.60 and 43.20 qtl/ha, respectively. The overall performance of the varieties of paddy was found to be good.
- Two OFTs of Okra crop were laid on 0.40 hectare area under irrigated conditions on different farmers' fields. The variety A-4 was used for conducting OFTs and the average yield of Okra was found to be 96 qtls/ha.

EVENTS

Training program on Advancements in Production, Functional, Rheological and Quality Aspects of Traditional Indian Dairy Products

National Training Program on "Advancements in Production, Functional, Rheological and Quality Aspects of Traditional Indian Dairy Products" was organized under the aegis of Centre of Advanced Faculty Training from 8th - 28th October, 2013. The training program was aimed at providing the requisite information in theory and practice relating to the emerging trends in Traditional Indian Dairy Products to the faculty/scientists of SAUs/ICAR institutions. Twenty three participants from different dairy and veterinary colleges from all over India participated in the training program. Dr. Ajit Kumar, VC, NIFTEM, Sonapat inaugurated the training program. Dr. Kusumakar Sharma, ADG (HRD), the chief guest at the valedictory function of the training program mentioned about the commitment of ICAR towards capacity building of the teaching and technical staff. Dr A. K. Srivastava, Director NDRI presided over the inaugural and valedictory sessions and apprised the participants and the faculty of NDRI on the key issues pertinent to the production, quality and shelf-life of the traditional dairy products through his inspiring address.

Awareness Programme and Workshop on Intellectual Property Rights for Agriculture & Allied Sciences

One day awareness programme and workshop on Intellectual Property Rights for Agriculture and Allied Sciences was organized under the aegis of Business Planning and Development Unit (BPD) and Institute Technology Management Unit (ITMU) of NDRI, Karnal on 18th October, 2013. About 175 participants including scientists of ICAR Institutions in Karnal and a large number of graduate and post graduate students attended the workshop. The workshop was inaugurated by Dr. A. K. Srivastava, Director, NDRI, Karnal. Dr. Kalpana Shastry, Head, Agricultural Research Systems Division, NAARM, Hyderabad; Dr. Y. S. Rajput, Head, Animal Biochemistry Division & In Charge, ITMU, NDRI, Karnal; Dr. P. K. Singh, Principal Scientist & In Charge, ITMU, NBAGR, Karnal and Ms. Purwa Rathi, Registered Indian Patent & Trademark Agent, M/s Legasis Services Pvt. Ltd., Pune were the resource persons for the workshop. Topics such as Innovation and IP Management in Agriculture: An Overview; Patent Search under Indian Context; Filing of a Patent: A Practical Approach and Protection of Plant Varieties and Farmer's Rights were covered for the benefit of the participants.

National Workshop on Operation, Refinement and Implementation of e-Courses in Dairy Technology

Under the NAIP sub-project entitled “Development of e-Courses for B. Tech. (Dairy Technology) Degree Programme”, a National Workshop on Operation, Refinement and Implementation of e-Courses in Dairy Technology was conducted on 4th October, 2013. A total 88 participants and students of B. Tech. (Dairy Technology) from NDRI and the Institutions from Kerala, Maharashtra, Uttar Pradesh and Punjab underwent training on Moodle.

Dr. G. R. Patil, Joint Director was the Chief Guest. Invited expert speaker, Dr. G. R. K. Murthy, Senior Scientist, NAARM, Hyderabad described the importance of Moodle platform - e-Learning Management System (LMS). Dr. R. C. Goyal, Emeritus Scientist, IASRI, New Delhi demonstrated the ICAR e-learning Portal on Agricultural Education (e-Krishi Shiksha), wherein on-line e-Courses are uploaded on ICAR portal. Dr. Vijay Kumar CPI & Head (DT) demonstrated the operation of 49 e-Courses of B. Tech. (Dairy Technology) uploaded on Moodle/ Moodle platform on-line as well as off-line and hosted on institute website (www.ndri.res.in). Copies of Training Manual for the operation of e-Courses were also provided to the participants during the workshop.

XVII National Conference of Agricultural Research Statisticians on “National Priorities in Agricultural Statistics and Informatics”

Two days Conference was jointly organised by NDRI and Indian Agricultural Statistics Research Institute, New Delhi on 27th November, 2013. Dr. R. S. Paroda, Chairman, Trust for Advancement of Agricultural Sciences, New Delhi was the Chief Guest. Dr. A. K. Srivastava, Director & Vice Chancellor NDRI presided over the inaugural function. Dr. U. C. Sud, Director IASRI delivered keynote address. Also, Dr. S. D. Sharma, Vice-Chancellor, Dev Sanskriti Vishwavidyalaya, Haridwar and Dr. V. K. Gupta, ICAR National Professor, also addressed the conference. About 100 agricultural scientists and statisticians across the country participated in this conference.

Dr. Paroda in his inaugural address, stressed upon the importance of statistics in agricultural development in the country. He described the huge volume of data being generated through various research experiments as 'data fatigue'. Further, he emphasised that value addition to the data should be considered on priority by the agricultural statisticians and scientists. Dr. Paroda said that Statistics can play a vital role in addressing the issues like climate change

and natural calamities. He advised the scientists that the research should be institute- and national-needs based rather than scientist-based, so that its benefits can reach the society at large. The statisticians can certainly help in achieving this goal by developing effective 'Decision Support Systems' for equipping the stakeholders with intelligent information to enable them to make informed-decisions. He mentioned the need to develop more efficient mid- and long-term weather forecasting models to help the farmers.



Dr. A. K. Srivastava, Director, NDRI in his Presidential Address highlighted the importance of Statistics and Informatics for the development of the Livestock in the country. He emphasised the need for proper application of statistical tools in analysing the research data, so as to draw valid conclusions from research experiments for making policy decisions at national and international level.

Dr. S. D. Sharma, described this conference as an important national forum for agricultural statisticians, where they can raise various research problems and get instant solutions through discussion and exchange of ideas. He stressed upon



the need to work in unison to get the best from the fraternity. Dr. V. K. Gupta, in his introductory remarks said that there is data explosion in terms of various parameters in the research datasets but the number of observations is very thin. Therefore, there is a need for development of statistical methodologies to effectively deal with such challenges.

Brainstorming Session on Milk Genomics and Human Health

A brainstorming session on “Milk Genomics and Human Health” was organized on 7th December, 2013. Milk is recognized as genetically and specially designed primary food by Mother Nature for mammals. The quality of milk and milk products depends on the milk composition, which is determined by genes, their interactions with environmental factors including nutrition and physiological state of milch animals. Milk composition not only provides market value by affecting milk processing attributes but also affects the public health to a greater extent. The event was organized to explore the current state of research and knowledge; future possibilities and prospects of milk genomics for human health.

Dr. A. K. Srivastava, Director & Vice-Chancellor, NDRI chaired the brainstorming session and delivered the introductory lecture on milk genomics and human health perspective in India. Dr. N. V. Patil, Director, NRC on Camel; Dr. S. K. Agarwal, Director, Central Institute for Research on Goats and Dr. Chaitanya G. Joshi, Professor & Head, Animal Biotechnology, AAU, Anand were also present on this occasion.

Presentations by invited and in-house speakers were followed by in-depth deliberations and discussions by expert panelists and resource persons on this emerging area. Recognizing its potential in dairy industry and human health, it was realized that milk genomics research in India should be strengthened. At this occasion, a competition amongst

students was arranged to present their views on the theme of the brainstorming session.

National Training on Climate Resilient Livestock and Production System

National Training on “Climate Resilient Livestock and Production System” was organized at NDRI, Karnal from 18th November to 1st December, 2013. The Training was inaugurated by Dr. K. K. Katoch, Vice Chancellor, CSK, HP Agriculture University, Palampur. Training was organized with the objective to strengthen the understanding on challenges and opportunities associated with the Climate Change and Climate Resilient Livestock and Production System. Training included lectures by the experts on different aspects of impacts of Climate Change, Genomic Technologies in animal production system for improving Resilience, Indigenous Technical Knowledge (ITK) practices for climate Resilience in Livestock species, visits to sites and other research institutes and practical demonstrations of different procedures and instruments.

A total of 11 Participants attended the training. Training included 28 theory lectures, eight practical sessions and visits to CSSRI and NBAGR sister ICAR Institutes at Karnal. Interactive sessions were organized for getting the feedback and resolving queries of the participants. Dr. A. K. Srivastava Vice Chancellor and Director NDRI, Karnal was the Chief Guest and Dr. R. P. Misra, In charge NAIP training cell was the Guest of Honor at the valedictory function on 30th November, 2013.

Motivational Talk on “Significance of Consciousness for Excellence in all Human Dimensions”

The Personality Development Cell of National Dairy Research Institute, Karnal has been regularly organizing lectures/discourses/seminars for the all round personality development of the faculty, staff and students.

In this series, NDRI organized a luminating talk by Sh Dinesh Kumar, Renowned Motivational Trainer & Founder Apno Kaaj Srejan on the topic “Significance of Consciousness for Excellence in all Human Dimensions” on 9th December, 2013. Sh. Dinesh Kumar is known for his philanthropic activities related to propagation and teachings of Indian ethos and his wonderful motivational skills for inspiring the people for self improvement and personality development. Dr. G. R. Patil, Joint Director (Academics) presided over the function. Dr. Avtar Singh, Principal Scientist, Dairy Cattle Breeding and Dr. Meena Malik, Associate Professor (English), NDRI were the coordinators for the programme.

Diploma in Dairy Technology IGNOU Study Centre DDT 1039 (P)

The induction meeting of the fresh batch of Diploma in Dairy Technology offered by IGNOU was organised on 28th December, 2013 in Dr. N.N. Dastur Mini Auditorium, NDRI, Karnal. The meeting was very well attended by all the Academic Counsellors and students. The students were provided with the study material and schedule of classes. The Presidential Address was delivered by Dr. G.R. Patil, Joint Director (Academic) NDRI, Karnal and Program Incharge, NDRI study centre. A special briefing about the course was

presented by Dr. Shivashrya Singh, the senior most academic counsellor of DDT and Dr. S. K. Kanawjia, Academic Coordinator, NDRI Karnal. Dr. Amit Kumar Jain and Dr. Tripathy, ARD, and Mr. Ramkishan from IGNOU, Regional Centre Karnal participated in the orientation program and introduced about IGNOU and guided the students about DDT Program. The students were advised to attend their classes regularly and take benefit of highly qualified and experienced faculty and the state-of-the-art infrastructure available at NDRI University and enrich their practical skills to serve the dairy industry in future.

राजभाषा एकक

संस्थान में दिनांक 11 नवम्बर, 2013 को राजभाषा मुख्य समारोह एवं पुरस्कार वितरण समारोह संपन्न हुआ। समारोह की अध्यक्षता संस्थान के निदेशक डा. ए.के.श्रीवास्तव ने की। इस समारोह में राजभाषा मास में आयोजित विभिन्न प्रतियोगिताओं के विजेताओं को प्रमाण-पत्र एवं नकद पुरस्कारों से पुरस्कृत किया गया।

इस अवसर पर मुख्य अतिथि के रूप में वैज्ञानिक एवं तकनीकी शब्दावली आयोग, मानव संसाधन विकास मंत्रालय, भारत सरकार के अध्यक्ष प्रो. केशरी लाल वर्मा ने आयोग की गतिविधियों के बारे में विस्तार से जानकारी दी। उन्होंने वैज्ञानिकों का अज्ञान किया कि वे अपने शोधपत्र तथा आलेख आयोग द्वारा प्रकाशित अति प्रतिष्ठित पत्रिका 'विज्ञान गरिमा सिंधु' में प्रकाशन हेतु भेजें जिससे आपके अनुसंधान कार्य का लाभ कृषक समुदाय एवं जनसामान्य तक आसानी से पहुंच सके।

संस्थान के निदेशक डा.ए.के.श्रीवास्तव ने संस्थान में राजभाषा हिन्दी के कार्यान्वयन को कारगर बनाने के लिए निष्ठापूर्वक प्रयासों से संस्थान में न केवल प्रशासनिक क्षेत्रों में बल्कि वैज्ञानिक-तकनीकी क्षेत्रों में भी हिन्दी का प्रयोग निरन्तर बढ़ रहा है। इस अवसर पर अतिथियों द्वारा संस्थान के प्रांगण में वृक्षारोपण भी किया गया।

नगर राजभाषा कार्यान्वयन समिति करनाल की अति महत्वपूर्ण 58वीं छःमाही समीक्षा बैठक राष्ट्रीय डेरी अनुसंधान संस्थान एवं केन्द्रीय मृदा लवणता अनुसंधान संस्थान के संयुक्त तत्वाधान में 17 दिसम्बर, 2013 को संपन्न हुई। समीक्षा बैठक में 'राजभाषा के उपयोग एवं कार्यान्वयन' विषय पर चिंतन एवं मनन किया गया। इस बैठक की अध्यक्षता डा. डी.के.शर्मा, निदेशक, केन्द्रीय मृदा लवणता अनुसंधान संस्थान, करनाल द्वारा की गयी। आयुक्त श्री बलबीर सिंह एवं नीरा मल्होत्रा के इस बैठक में 'कर्णोदय' पत्रिका के 12वें अंक का विमोचन किया गया तथा हिन्दी पखवाड़ा/मास के दौरान की गई नगर स्तरीय प्रतियोगिताओं के विजेताओं को भी पुरस्कृत किया गया। राजभाषा विभाग के क्षेत्रीय कार्यान्वयन कार्यालय (उत्तर-1), नई दिल्ली के उपनिदेशक शैलेश कुमार सिंह ने कंप्यूटर पर हिन्दी प्रशिक्षण, अनुवाद

प्रशिक्षण, कार्यसाधक ज्ञान, हिन्दी में मूल पत्रचार व हिन्दी दिवस आदि के बारे में अधिकारियों से चर्चा की। इसके अतिरिक्त राजभाषा प्रगति तिमाही रिपोर्ट ऑन लाइन भिजवाने के लिए कार्यालय का पंजीकरण राजभाषा विभाग की वेबसाइट में करवाने तथा नियमित रूप से तिमाही रिपोर्ट भिजवाने के बारे में चर्चा की गई। संस्थान के संयुक्त निदेशक (प्रशासन) श्री जे.के.केवलरमानी ने संस्थान का प्रतिनिधित्व किया तथा नराकास समिति के भी इस अवसर पर उपस्थित रहे। समिति सचिव श्री आर.एस.गौतम जी ने समिति की गतिविधियों पर प्रकाश डाला एवं छःमाही प्रगति रिपोर्टों की समीक्षा की। इस बैठक में करनाल स्थित केन्द्रीय कार्यालयों के 30 प्रशासनिक प्रधान, 20 वरिष्ठ अधिकारी तथा 40 राजभाषा अधिकारी तथा अन्य कार्मिक उपस्थित रहें।

Honours/Awards

Dr. Suman Kapila, Principal Scientist, Animal Biochemistry Division won "**Bio Nutra Senior Award**" for the paper entitled, "Characterization of novel osteogenic peptide from milk" during the National Conference on Bioactive Compounds and Functional Foods in Health and Disease Management from 15th-16th November, 2013 held at NIFTEM, Kundli, Sonapat.

Dr. Bimlesh Mann, Principal Scientist & Head Dairy Chemistry Division was awarded "**Prof Jiwan Singh Sidhu Award (2012)**" in the 7th International Food Convention organized by CSIR-CFTRI, Mysore, DFRL, Mysore and NIFTEM, Sonapat from 18th-21st December, 2013.

Dr. R. Senthil Kumar, Scientist, **Dr. B.S. Meena**, Sr. Scientist, **Mrs. Ritu Chakravarty**, Sr. Scientist, **Dr. K. S. Kadian**, Principal Scientist, Dairy Extension Division and **Dr. S. V. Singh**, Principal Scientist, Dairy Cattle Division received "**Best Paper Presentation Award**" for the paper entitled "Perception and Adaptation of Dairy Farmers on Climate Change in Haryana" at International Conference which was held on 5th – 8th December, 2013 in UAS, Bangalore.

Patents Filed

Sl No.	Application Number allotted by the Patent Office	Title of Patent	Innovator(s)	Date of filing
1.	2778/DEL/2013	A peptide with osteoanabolic and antiresorptive activity	Venkatesa Perumal Shanmugam, Suman Kapila and Rajeev Kapila	20.9.2013
2.	3472/DEL/2013	A strip based detection of added urea in milk and process for the same	Rajan Sharma, Panchal Bhaveshkumar R. and Y. S. Rajput	29.11.2013
3.	3703/DEL/2013	Aptamer specific for Betacasomorphin7 (BCM7)	Y. S. Rajput, Ahhishek and Rajan Sharma	18.12.2013

Patents Granted



Sl No.	Title of Patent	Innovator(s)	Patent No. & Date of grant
1.	Process for manufacture of spray dried cheddar flavour base/ concentrate	D. K. Sharma, B. D Tiwari	Patent No. 257068 30.08.2013
2.	Lab scale process for preparation of low cholesterol ghee	Darshan Lal, Manoj Kumar, Vivek Sharma, Raman Seth, Amit kumar	Patent No. 257783 01.11.2013
3.	A PCR based method of differentiating cow and buffalo milk	S. De, K. P.Singh, R. Singh, T. K. Datta, S. L.Goswami	Patent No. 257958 22.11.2013

Technologies Commercialized

Sr. No.	Title	Year	Name of Contracting Party	Price of Technology Sale
	Cation & anion mineral mixture	2013	Shakti Livestock Feeds (P) Ltd., Meerut U.P.	₹1.00 Lakh + ST+ 2% Royalty

क्रमांक : 011/020181

Sl. No. :

**भारत सरकार
GOVERNMENT OF INDIA
पेटेंट कार्यालय
THE PATENT OFFICE
पेटेंट प्रमाणपत्र
Patent Certificate
(Rule 74 of Patents Rules)**


Patent No. : 257958

Application No. : 1385/DEL/2007


Date of Filing : 28-06-2007

Patentee : INDIAN COUNCIL OF AGRICULTURAL RESEARCH (ICAR)

It is hereby certified that a patent has been granted to the patentee for an invention entitled "A PCR BASED METHOD FOR DIFFERENTIATING COW AND BUFFALO MILK" as disclosed in the above mentioned application for the term of 20 years from the 28 day of JUNE 2007, in accordance with the provisions of the patents Act, 1970.



Controller of Patents



Controller General of Patent,
Design & Trade marks

Date of Grant : 22/11/2013

Note :- The fees for renewal of this patent, if it is to be maintained, will fall/have fallen due on 28 day of JUNE 2009 and on the same day in every thereafter.

PERSONALIA

Joining

- Dr. R. K. Malik**, Principal Scientist and Acting Head (DM) joined as Head, Dairy Microbiology Division at NDRI, Karnal w.e.f. 27.12.2013.

Promotions

- Sh. Ramesh Chand**, Assistant Chief Technical Officer (F/FT) promoted as Chief Technical Officer (F/FT) w.e.f. 01.01.2013.
- Sh. Tara Chand**, Sr. Technical Officer (F/FT) promoted as Assistant Chief Technical Officer (F/FT) w.e.f. 01.01.2013.
- Sh. R. Keshava Murthy**, Technical Officer (F/FT) promoted as Sr. Technical Officer (F/FT) w.e.f. 13.01.2013.
- Sh. G. G. P. Patil**, Technical Officer (F/FT) promoted as Sr. Technical Officer (F/FT) w.e.f. 25.02.2013.
- Sh. Vinod Kumar**, Technical Officer (F/FT) promoted

as Sr. Technical Officer (F/FT) w.e.f. 01.07.2013.

- **Sh. Jai Pal**, Sr. Technical Assistant (L/T) promoted as Technical Officer (L/T) w.e.f. 01.07.2013.
- **Sh. Chandan Solanki**, T-3(L/T) relieved on 31.12.2013 to join the post of Scientist and to undergo FOCARS-99 training at NAARM, Hyderabad.

Retirements/Transfers

- **Sh. Shiv Balak Rai**, Technical Officer (W/S) retired from Council's service w.e.f. 31.10.2013.
- **Sh. Rishi Pal**, Sr. Technical Officer (L/T) retired from Council's service w.e.f. 31.12.2013.
- **Sh. Nihal Singh**, Technical Officer (F/FT) retired from Council's service w.e.f. 31.12.2013.

Demise

Dr. P. K. Roy, Principal Scientist (LPM), ERS of NDRI, Kalyani expired on 16.10.2013.

VISITS ABROAD

Dr. A. K. Srivastava, Director, NDRI, Karnal participated in the Regional Workshop on “Youth and Agriculture Challenges and Opportunities” at Isalambad, Pakistan from 23.10.2013 to 24.10.2013.

Dinesh Kumar Dahiya student of Dr A. K. Puniya, presented a paper "Trans-10, Cis-12 producing probiotic *Lactobacillus fermentum *DDHI27 suppress diet induced obesity in C57Bl/6J mice". In "V International Conference on Environmental, Industrial and Applied Microbiology", organized by Formatex Research Centre, Madrid, Spain, 2-4 October 2013.

Dr. A. K. Tyagi, PS, DCN Division, NDRI participated in the International Livestock Nutritional Conference at Lahore, Pakistan from 23.10.2013 to 24.10.2013.

Dr. B. S. Chandel, PS, DESM Division, NDRI participated in the conference on “Mainstreaming Livestock Value Chain” ACCRG, Ghana from 5.11.2013 to 6.11.2013.

Dr. A. K. Chakravarty, PS & I/C ABRC participated in the sixth meeting on “High Yielding during Buffaloes Semen

Collection, Quality Assurance, Preservation and Transportation” at Dhaka, Bangladesh from 16.11.2013 to 17.11.2013.

Mr. Tanedjeu Sonfack Kemgang student of **Dr. Suman Kapila**, Principal Scientist, Animal Biochemistry Division, got “Travel Grant Award” for presenting poster entitled, “Comparative Evaluation of Immunomodulatory Potential of three Probiotic Lactobacilli Strains” in the 2013 Fall Conference of the Korean Association of Immunologist held at Seoul, Korea from 7–8.11.2013.

Dr. Anil Kumar Puniya visited 'Institute of Biological, Environmental and Rural Sciences, Aberystwyth University, Aberystwyth, UK', under DBT-CREST's programme of Department of Biotechnology (Govt of India) from May 12, 2013 to November 1, 2013

DISTINGUISHED VISITORS

01.10.2013 FIJI Delegation



1. His Excellency **Mr. Inia Batikoto Seruirato**, Minister for Agriculture, Fishries & Forest.
2. **Mr. Yogesh J Karan**, High Commissioner.
3. **Mr. Filipe Aliferite**, Permanent Secretary for Rural Martime Development & National Disaster Management.
4. **Dr. Ganesh Chand**, Vice Chancellor
5. **Mr. Om Prakash Goundar**, Second Secretary, Fiji High Commission.

24.10.2013 15 member delegation from World Society for Protection of Animals (WSPA)

SOUTHERN CAMPUS, NDRI, BANGALORE

RESEARCH

Identification of Single Nucleotide Polymorphisms (SNPs) in TLR2 Gene and its Association with Somatic Cell Score in Milk of Holstein Friesian Crossbred Cattle

(P. V. Jadhav and D. N. Das)

The present study was carried out to investigate genetic polymorphism of *TLR2* gene exon 1 and exon 2 in 214 Holstein Friesian crossbred cows. Molecular characterization of *TLR2* gene was carried out by PCR-SSCP analysis. Exon 1 was amplified as a whole fragment while exon 2 of *TLR2* gene was amplified in overlapping fragments covering the whole exon 2 and then SSCP analysis was carried out. Molecular characterization of exon 1 and exon 2 of *TLR2* gene showed six SNPs in the HF crossbred population viz., *A827G*, *C1088G*, *C2155A*, *G2281C*, *G2410A* and *C2600T*. SNP *G2410A* and *C2600T* were found to be significantly associated with SCS ($p < 0.1$). A change of genotype GG (LSM for SCS 3.089 ± 0.197) to AA (LSM for SCS 3.375 ± 0.176) resulted due to presence of SNP *G2410A*, in the studied HF crossbred animals. On the contrary, animals with genotype GG were more resistant to mastitis and genotype AG was highly susceptible. Similarly for SNP *C2600T*, when a fixed model for least squares analysis was used including all the non genetic effects together, it was found that the genotype CC (LSM 3.089 ± 0.197) showed moderately significant lower SCS ($p < 0.10$) than the genotype TT (LSM 3.375 ± 0.176). It was observed that the SCC increased with the advancement of parity was also higher in third stage of lactation. A trend of higher SCCs was observed in rainy season. Unorganized farms showing unhygienic udder and stall hygiene status were also factors for more SCC. When a discriminate function was fitted, it was observed that log₁₀ SCC value was the most important factor in discriminating normal and mastitis infected animals.

Estimation of Genetic Merit of First Lactation Milk Yield using Both Phenomic and Genomic Information in Deoni Cattle

(S. Basak and D. N. Das)

Deoni is an important dual purpose cattle breed found in the semi-arid hilly areas of Karnataka, Andhra Pradesh and parts of Maharashtra. Evaluation of these animals is necessary to

estimate the true genetic merit. CYP11B1 and PPARGC1A genes are reported to be the candidate genes which control the functional traits like production and reproduction performance in cattle. It is reported that p.Ala30Val locus of CYP11B1 and c.1892+19T>C and c.3359T>C loci of PPARGC1A genes are found to be related with milk production traits. PCR RFLP study revealed two polymorphic band patterns for the CYP11B1 gene exon 1 and three band patterns for PPARGC1A gene at intron 9 and 3'UTR. Breeding value of the cattle was computed by LSA method conventionally and incorporating genotype information of CYP11B1 and PPARGC1A loci. However, Lower AIC and higher r^2 value indicated the model with genotype information was more precise for prediction than the model without genotype information.

TRAINING PROGRAMMES

- Five days training was conducted for five candidates on 'Special Cheese Training' from 25.11.2013 to 29.11.2013.
- Four day - Special Course on Mozzarella Cheese for the Karnataka Milk Federation (KMF) personnel from 26th – 29th Nov., 2013 was organized.
- Lead Auditor Training Programme on Food Safety Management System (ISO 22000:2005) for the PG Students of SRS of NDRI from 1st – 5th Oct., 2013. Eighteen students attended the training and successfully completed the Course.

Model Training Course on Management Strategies for Sustainable Livestock Production against Impending Climate Changes

The Directorate of Extension, Ministry of Agriculture, Govt. of India, New Delhi sponsored Model Training Course on "Management Strategies for Sustainable Livestock Production against Impending Climate Changes" was inaugurated on 18th November 2013 at SRS, NDRI. The MTC was inaugurated by the Chief Guest **Padmashree Dr. M. Mahadevappa**, Former Charmin ASRB & VC, UAS, Dharwad. The Chief Guest also released the Training Manual of the MTC and delivered inaugural address. **Dr. S. R. Sampath**, Former Head, SRS of NDRI, Bangalore graced the occasion as the Guest of Honour. Dr. Satish Kulkarni,

Head of the Station and Course Director presided over the programme. Twenty candidates from State Animal Husbandry Departments from different parts of the country participated in the MTC. On 25th November 2013, the valedictory of the MTC was held and Dr. N. P. Singh, Director, ICAR Research Complex for Goa graced the occasion as Chief Guest, released the e-learning material, presented participation certificates to the trainees and made informative presentation on 'Hydroponics technology'. Dr. Satish Kulkarni, Head of the Station presided over the programme. The entire training programme was coordinated by Dr. Mukund A. Kataktalware, Dr. S. Jeyakumar and Dr. K. P. Ramesha.

AWARDS & RECOGNITIONS

- **Dr. S. Jeyakumar**, Senior Scientist (Animal Reproduction) was awarded “**Merit of Excellence and Best Publication**” of the year 2012-13 by Central Agricultural Research Institute, Port Blair, Andaman and Nicobar Islands.

EVENTS

हिंदी सप्ताह दिवस

राजभाषा (हिंदी) को प्रोत्साहित करने के उद्देश्य से संस्थान में दिनांक 05.10.2013 से 12.11.2013 तक राजभाषा सप्ताह का आयोजन किया गया। इस दौरान केन्द्र पर कार्मिकों, उनके बच्चों एवं छात्रों के लिए हिंदी प्रतियोगिताएं आयोजित की गई। केन्द्र पर हिंदी दिवस 23.11.2013 को मनाया गया। इस अवसर पर डा. एस.नागभूषण, हिंदी विभाग, विजया डिग्री कालेज ने पधार कर समारोह की शोभा बढ़ाई। डा. सतीश कुलकर्णी, अध्यक्ष, रा.डे.अनु.सं., बंगलौर ने समारोह की अध्यक्षता की। विभिन्न प्रतियोगिताओं के विजेताओं को मुख्य अतिथि द्वारा पुरस्कार वितरित किए गए। डा. पी.के.दीक्षित, प्रधान वैज्ञानिक ने मुख्य अतिथि एवं अन्य उपस्थित व्यक्तियों का स्वागत किया। डा. मेनन रेखा रविन्द्र, वरिष्ठ वैज्ञानिक ने धन्यवाद ज्ञापन प्रस्तुत किया। समारोह का समन्वयन श्रीमती टी. आर. थिविजा कुमारी, तकनीकी अधिकारी (प्रेस एवं संपादन) रा.डे.अनु.सं., बंगलौर द्वारा किया गया।

EXTENSION ACTIVITIES

- During the period under report, sixty seven visitors in two batches comprising of students from educational institutes and farmers and entrepreneurs from various parts of southern region visited the institute. The visitors

were taken round the institute to various sections as per their needs and were explained the on going research and extension activities.

- Advisory services / technical advice was rendered to fourteen of the needy clientele during their personal visit to the institute. The profile of advisory included information to start a commercial dairy farm, technical inputs for scientific dairy farming, and training programme for setting up commercial dairy farm.
- Participated in 8th National Conference on KVK-2013 held at UAS, Bangalore during 23rd to 25th October, 2013. The recent advancements in dairy production and processing aspects and updation of research and extension activities of the institute was depicted in NDRI exhibition stall for the benefit of the participants of the conference which included the project coordinators and subject matter specialists of KVKs from all parts of the country.
- Participated in International Rashtriya Krishi Mela 2013 organized by University of Agricultural Sciences (UAS), Bangalore, held during 7th to 11th November, 2013 at GKVK Campus, UAS, Bangalore. NDRI stall depicted innovative and educative information on dairy production and processing technologies, Indigenous breeds of South India and Indigenous dairy products of the region for the benefit of the clientele groups. The exhibition was well attended by multitude of farmers, entrepreneurs and industrialists from all over the state and from other parts of the country.



Dr. S. Ayyappan, Hon'ble Secretary DARE and DG ICAR at the Krishi Mahila Mahotsav 2013 organised by IIHR Bangalore

- Participated in Krishi Mahila Mahotsav 2013 organised by IIHR, Bangalore under NAIP project, held during 7th and 8th December, 2013, to showcase the entrepreneurial activities of rural women beneficiaries. The clientele / beneficiary group of the Institute also participated in the event. The Institute stall depicted the needed technical information focused on rural women dairy entrepreneurship.
- Participated in 42nd Dairy Industry Conference organized by the Indian Dairy Association, held during 12th to 14th December 2013 at Chennai. The current research findings in dairy processing and the institute's transferrable technologies for the dairy industry were the theme of NDRI stall in the dairy industry exhibition.

EASTERN CAMPUS, KALYANI

Exhibition

The Institute actively participated in the extension programme under NAIP at ICAR research complex for eastern region, Patna, Bihar from 6th – 7th Dec., 2013 and organized exhibitions for showcasing region specific technologies. The scientists discussed in detail the regional issues, relevant activities, technical know-how, training programme, which are very much required for dairy farmers to increase their profitability and also gathered feedback from farmers in an interface meet.

Training & Demonstration on “Azolla Production for Livestock Feeding”

A Training cum Demonstration on “Azolla Production for Livestock Feeding” has been organized at ERS-NDRI, Kalyani on 20th December, 2013. Eighteen Livestock Development Officers from the department of Animal Resource Development, Nadia district, Government of West Bengal attended the Training Program. Dr. T. K. Dutta, Head, ERS welcomed the Trainee Officers and briefed about the usefulness of the training. A *Training Manual* was released and distributed among the trainees. Dr. Anupam Chatterjee, Senior Scientist & Training Coordinator, delivered a Key Note presentation on “Azolla Production for Livestock Feeding”, which was followed by detailed interaction with the trainees regarding different aspects of Azolla cultivation. Trainee officers participated in step by step practical demonstration of Azolla cultivation methods coordinated by Dr. A. Chatterjee and Mr. A. Goswami.

Off Campus Training and Demonstration on Azolla Cultivation

On special invitation from Ramkrishna Ashram KVK, Nimpith, West Bengal, ERS-NDRI imparted training on

cultivation of azolla for livestock feeding with audio visual presentation and live demonstration to twenty two Block Livestock Development Officers (BLDO), district North 24 Parganas, Govt. of West Bengal on 31st December, 2013.

Campus Training

- One 15 day training course was organized at ERS of NDRI, Kalyani on “*Artificial Insemination and Veterinary First Aid*” for selected field workers under Bardhaman Co-operative Milk Producers' Union Ltd. The course was conducted from 11th to 25th November, 2013 in which 7 unemployed and educated youth from Bardhaman Co-operative Milk Producers Union West Bengal actively participated.
- One day demonstration camp on “*Veterinary first aid, frontline fodder demonstration and scientist farmers' interaction*” was organized on 20th Nov., 2013 in the Dakkhin Chandamari village of Nadia District. In all 52 farmers came with one hundred thirty two (132) animals for treatment. 10 packs (1pack=200gm seed) berseem seed & 16 packs oat seed (1pack= 700g seed) were distributed to 12 dairy farmers.
- One nine day training course was organized at ERS of NDRI, Kalyani on “*Scientific Dairy Farming*” for unemployed educated rural youth nominated by Bodoland Territorial Council (BTC), Kokrajhar, Assam. The course was conducted from 5th to 13th December, 2013 in which 15 unemployed and educated youth from north eastern region actively participated.

FEATURE ARTICLE

Pricing of Milk and Milk Products - An Overview

(B. S. Chandel and Smita Sirohi)

Introduction

Price is the most important parameter of any commodity. It reflects the worth of a commodity in terms of quality, quantity and its characteristics. Beyond a mere medium of exchange, prices are the language of the markets. Prices transmit signals of the demand, supply, deficits, consumer preferences and taste across markets and across producers and consumers if allowed to set freely. Prices of milk and milk products (MMPs) are of specific interest because of their indispensable place in human diet. Milk is the ultimate food to a person or infant who can't take anything else. The monthly consumption expenditure on dairy products of an average Indian household has increased over time. The percentage share of expenditure on MMPs to the total monthly consumption expenditure has increased to 16.0 % in rural areas and about 19.2 % in urban areas in 2009-10 which was 13.4 % and 16.8 %, respectively during 1987-88.

The demand for MMPs in India has a strong potential for further growth. Several socio-economic factors are responsible for it. Appreciable increase in average income of a consumer is one of the factors responsible for increase in the demand for MMPs due to their income-elastic nature. Other factors such as urbanization, changing food habits and life style also reinforce growth in demand for dairy products. The total monthly per capita expenditure on MMPs stands at Rs 137.08 in urban areas and Rs 88.55 in rural areas as per the latest round of National Sample Survey (NSSO 66th round 2009-10).

On the production side, milk is a commodity produced largely by the marginal, small and landless farmers majority of whom are poor. In India, small and marginal farmers contribute the highest (68 %) to the total milk production. A remunerative price of milk serves multiple functions to these poor producers. It provides incentive to produce more while generating additional income.

There are various issues of interest related to pricing of milk and milk products. What are the pricing parameters of milk? Is it truly reflecting the quality, necessity and efforts put in producing the milk? What has been the past trend and growth

in prices of milk and milk products vis-à-vis major crops? What could be done at the policy level to make the prices of milk more remunerative and vibrant so that it performs all its market functions? An attempt has been made to answer some of these questions in this article based on the experience and the studies conducted at the Institute.

Nevertheless, all these questions are very tedious to seek answers in the present scenario of limited data available on prices and other parameters related to prices of livestock products especially that of milk and milk products. Whatever information is available, it is not available for all the markets and for all the years. The practical difficulties in collection of data from dairy sector are that there is no defined market place for the sale and purchase of milk and milk products, and the dairy animals are sold out more frequently than land.

Pricing of Milk

Broadly speaking, the milk production has been a fat based economy. It is understood that the value of milk is capitalized through ghee. Milk having high fat percentage fetches higher prices even after operationalization of two-axis pricing policy for cow milk. Similarly, the animal whose milk has higher percentage of fat, carries higher value.

This is more so in the absence of any other parameters of pricing milk like quality, clean milk production, somatic cell count, organic milk, etc. At the same time, these two products (milk and ghee) are the major constituents of consumption of MMPs of an average Indians who are vegetarian by majority. Milk and ghee accounted for almost 96 % in urban areas and 89 % in rural areas of the total monthly per capita expenditure on MMPs in 2009-10 (NSS 66th Round).

Presently, prices of milk are fixed either on pro-rata fat basis or two-axis basis where both fat and solid not fat (SNF) are given weightage. The price of fat & SNF are fixed by the Milk Unions depending on the price of ghee (butterfat) and skim milk powder (SMP). Based on the relationship between the prices of these two products and quantity of milk required to prepare a given quantity of SMP, price of SNF is taken 2/3 of the price of fat in practice. The estimation of fat contents in milk is easy and therefore, it is done at the cooperative society level or village level. While the determination of SNF in milk is difficult and time consuming and hence, SNF contents are either considered at specified minimum level or

estimated at Union level/District level. In this whole exercise, there is substantial subjectivity in the way the milk unions fix fat prices and lack scientific base for market considerations like ghee & SMP prices. Therefore, different growth rates have been observed in the prices of milk and ghee in the past. In some markets, price of ghee has increased faster than the price of milk while reverse was the case in another market.

In addition, milk producers need to be paid price for add-on parameters like quality, clean milk production, somatic cell count, organic milk, etc. in order to incentivize the quality and clean milk production. It was taken up at Government level in 1998 in Punjab. The Ropar Milk Union was the first in Punjab State Cooperative Milk Producers' Federation to offer an extra price per litre for good quality and clean milk. Farmers were also penalized at the rate of ten paise per litre if the milk was not confirming to the quality standards. After three years of implementation, it was observed that overall quality of milk improved in terms of extraneous matters and standard plate bacterial count.

Cost Based Pricing

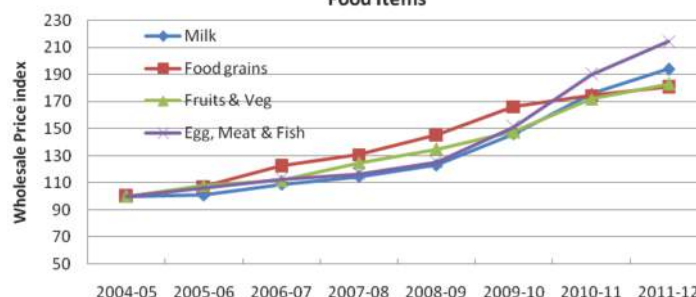
Bulk line cost is the method to fix price on the basis of cost of milk production which reckons that price should cover cost of milk production of 85 percentile farmers. The approach is contradicted on various accounts such as cost of milk production differs significantly among regions, seasons and breeds, non-availability of data on cost of milk production based on standard methodologies, and complexities inherent to dairy sector like frequent sale and purchase of animal, life time production, etc. Economically, cost based pricing brings in inefficiencies as it does not encourage the farmers and researcher to reduce the cost which goes against the overall welfare of the society in the long run. The same arguments go against adopting the minimum support price (MSP) for milk like many agricultural commodities. It is also thwarted because milk is a highly perishable commodity and it is difficult to develop any procurement system in the event prices dip below MSPs. There are a number of studies which indicate that market prices usually remain high for MSP commodities, which counteract consumers and net benefit to the society reduces. It will be rather more benefiting to both producers and consumers in the long run if better marketing and processing facilities are developed than resorting to MSP policy.

The prices of processed dairy products like ice-cream, butter, ghee, cheese, etc are based both partly cost of production & marketing and partly on prices set by dominating firm in the industry. But it is worth noting that in all these processed dairy products, raw material which is mainly the liquid milk, costs around 85-90 %. The processing cost of dairy products is generally low due to automation and low wage rates. The Gujarat Cooperative Milk Marketing Federation Limited (Amul) is the leading milk processor in India. The prices of processed dairy products charged by Amul are closely followed by other processors.

Wholesale Price Indices of Milk and Other Food Groups and Related Inputs

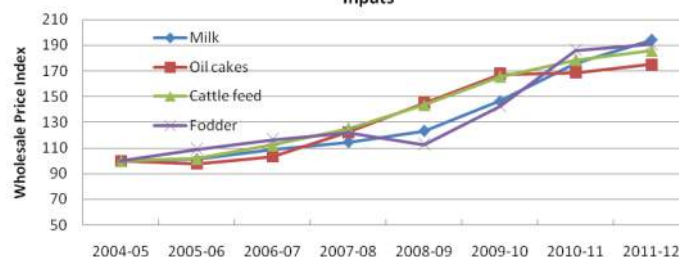
Price indices make the change in prices comparable among different items. This section compares the price indices of other food items and the milk production inputs with that of price index of milk based on data generated by Ministry of Commerce and Industry, GOI. Figure 1 shows the trend in wholesale price indices of milk and other major groups of food items.

Figure 1: Wholesale Price index of Milk and Other Major Groups of Food Items



The graph clearly shows that movement in milk price had been lower than all groups of food items till 2010-11. It was only after this year, it surpassed the price indices of food grains and, fruits and vegetables because of spurt in demand for milk. The comparison of price indices of major inputs used in milk production like oilcakes, cattle feed and fodder

Figure 2: Wholesale Price Indices of Milk and Major Milk Production Inputs



with that of price index of milk in Figure 2 also reveals that, in the year 2011-12, the increase in price of milk was higher than the prices of all inputs making milk production more remunerative. In most of the earlier year, increase in the price of milk was lower than the increase in prices of either two or all the three inputs.

Growth Rate in Prices

Among all MMPs, price data is available with some level of reliability on wholesale and retail prices of milk and ghee. A study has been conducted at NDRI on their prices in major markets of India to have an insight into the change in growth rates (CAGR) and instability over time. The study revealed that wholesale prices of milk and ghee and retail prices of milk have increased at a much lesser growth rate in the period (1998-07) as compared to earlier period (1988-97). This has been possible due to higher growth in milk production owing to increased population of crossbred and lactating animals. While comparing with crops, the growth in wholesale price of milk and ghee was found significantly lower than the wholesale prices of major food grain crops and oilseed cakes as shown in Table 1.

Table 1: Compound Annual Growth Rates of Wholesale Prices of Milk, Ghee, Major Crops and By-Products during 1998-07.

Markets	Milk	Ghee	Rice	Wheat	Gram	Mustard oilcake	Groundnut cake
Chennai	2.43	4.37	NA	8.40	9.12	NA	4.20
Kolkata	4.76	1.81	NA	5.88	9.48	2.88	7.08
Delhi	3.18	NA	3.36	5.16	7.68	5.28	NA
Kanpur	1.96	1.50	NA	NA	8.04	2.16	NA

NA stands for data not available

Contrary to the belief, the capitalization of milk production through ghee could not be confirmed because markets having higher price of ghee were not having higher price of milk. The instability analysis shows that the prices of milk were more stable than ghee prices which may be attributed to consistent market supply and alternative processing facilities, which were quiet obvious in milk. The overall trend appeared that instability in retail prices of milk was higher than wholesale prices of ghee, which was in turn higher than instability in wholesale prices of milk. The study concludes that granger causality relationship between wholesale and retail prices of milk were more pronounced than causality between wholesale prices of milk and ghee which means wholesale and retail prices of milk were more related than the wholesale price of milk and ghee.

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