



# NDRI News

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## From the director's desk



Institute Celebrated 1<sup>st</sup> B'day of cloned Buffalo Calf Garima on June 06, 2010

Dairying plays the most important role in agricultural GDP and Indian economy. In milk production, India by producing 100 million ton, is at number one in the world. In India, the livestock sector contributes to the tune of 8% of the National GDP out of which, 70% comes from milk alone. The expected target for milk production by 2020 is about 150 millions tonnes, but this is really a tall order to achieve, unless we get a proportional increase in quality feed and fodder resources. Acute shortage of feeds and fodders in our country is one of the major constraints to meet the requirement of huge population livestock. This shortage of feed & fodder ultimately also affects the production and reproduction potential of animals. As per the latest estimates, the green fodder and dry roughage were deficit to the extent of 62.76 and 23.46 %, respectively. To meet the demand for milk production, the quality feed and fodder are required for increasing their conversion efficiency into milk. Among all newer technologies, the technology involving ruminal escape of protein i.e. by pass protein has been proved to be more beneficial for enhancing milk production.



The two research findings i.e. (i) soluble dietary proteins are extensively degraded to ammonia in rumen but are not utilized by microbes at the rate by which these are degraded and (ii) proteins and amino acids administered post ruminally result in greater N retention as compared to when these are administered in rumen, led to make attempts to find the several ways for protecting soluble, high quality protein and limiting amino acids from microbial degradation within rumen.

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Different Methods for bypass proteins viz. Oesophageal groove Closure, Post ruminal Infusion, Tannic acid treatment, Formaldehyde treatment, Protection of amino acids, Calcium salts of fatty acid coated proteins and Heat treatment have been used for protecting the proteins. The major benefits of by pass protein in animals are Improved utilization of low quality protein, higher UDP resulting in higher availability of intact amino acids, more amino acid flux for tissue protein synthesis, increased flow of NAN at abomasums, increased efficiency of N utilization and N balance, increased growth rate and feed conversion efficiency, and increased net nutritional value of particular dietary protein.

As such feeding of by pass protein in lactating dairy animals certainly has relevance under Indian conditions, as the animals diets are generally low in energy and protein and moreover, it does not seem possible to meet the protein requirement of high yielding animals without applying such improved technology. As this juncture, it is essentially required that such technologies need be commercialized for taking maximum benefits of nutrients in high yielding animals under field conditions.

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

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## RESEARCH NEWS

### Three Stage Thin Film SSHE for Continuous Manufacture of Rabri

(Saroj Singh and A. K. Dodeja)

The performance evaluation of Three Stage SSHE was made for continuous manufacture of Rabri. The process and machine parameters were optimized in terms of sensory attributes and product quality. Trials were conducted by changing mass flow rate, type of sugar, acidity of milk and rotor speed of first and second stage SSHE. Data indicated that acidity has significant effect on body and texture and caramelised sugar has significant effect on flavour and colour. The fine flakes of homogenous mass is well formed by keeping third stage SSHE at low rotor speed, with required acidity level. The rotor speed has significant effect on sensory attributes as well as physico-chemical properties. Consumer acceptability of product so manufactured indicated that out of 100 consumers, 48 graded excellent and 45 graded very good. The feasibility study clearly established that Rabri can be manufactured continuously in three stage SSHE having capacity of 40 kg/hour of product formed.



Rabri Manufactured in Three Stage SSHE

### Low Calorie Artificially Sweetened Whey Lemon Beverage

(Sumit Arora, Vivek Sharma, B. K. Wadhwa, A. K. Singh, S. K. Tomar, M. K. Meena and A. Shendurao)

Technology has been developed for preparation of shelf stable low calorie artificially sweetened whey lemon beverage using a binary sweetener blend. Whey is a highly nutritious dairy product containing lactose, protein, minerals and water soluble vitamins. Whey beverages have been recognized as genuine thirst quencher, light, refreshing, healthy and nutritious.

#### Benefits of the Technology

- Maximum synergy with the best binary blend in sweetness intensity and overall acceptability (17.5%, 9.0%) with respect to single sweetener aspartame.
- Multiple sweetener approach involving use of binary blend resulted in 29% reduction of usage level when compared with single sweetener aspartame.
- Artificially sweetened whey lemon beverage using binary sweetener blend resembled sucrose sweetened whey lemon beverage in all the sensory attributes upto 5 days of storage (6-8° C)
- Binary sweetener blend retained its stability in whey lemon beverage throughout the storage period of 15 days as revealed by HPLC analysis.
- 61 % reduction in calorific value in comparison to sucrose sweetened whey lemon beverage.
- Cheaper than sucrose sweetened whey lemon beverage.



### Development of Off-Line Enzyme Substrate Based Assay for Monitoring Enterococci in Milk

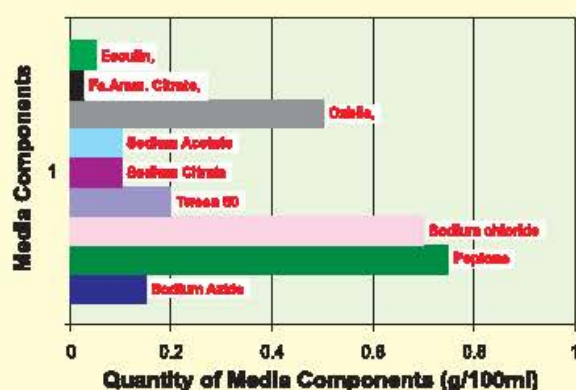
(G. Thakur, N. Kumar, H. V. Raghu, and R. K. Malik)

Detection of enterococci in dairy products still relies on time consuming and laborious conventional methods i.e. colony counts on citrate azide agar, which requires 48-72 hrs followed by biochemical confirmatory tests. An Enzyme Substrate Assay

(ESA) based on  $\beta$ -D-glucosidase activity was attempted for specific detection of *Enterococci* to meet the emerging demand of dairy industry. Four enrichment broths commercially available in the market were screened for selective recovery of enterococci based on  $\beta$ -D-glucosidase activity.

One of these broths namely Chromocult Enterococcus Broth (CEB) showed better performance in terms of selectivity and enzyme activity with partial inhibition of

**Fig. 1 Optimized Conc. Of Esculin Based Sodium Azide Medium (EBSAM)**



contaminants other than Enterococci. The selected medium was further improved for desired features by increasing the concentration of Sodium Azide from 0.06 to 0.15g/100ml resulting in significant inhibitory effect on growth pattern of *L. lactis*, *L. casei*, *Leuconostoc mesenteroides* and *L. monocytogenes*. Other media components and supplements were also optimized for enhanced sensitivity and selectivity of *Enterococcus spp.* The optimized selective enrichment medium i. e. Esculin Based Sodium Azide Medium (EBSAM) demonstrated superior features in terms of sensitivity, selectivity, fastness, accuracy etc. and may be a suitable substitute for existing media used for routine monitoring of enterococci in R&D Institutions (Fig. 1). The ESA developed with pure cells was found capable of detecting 7.52 log counts/ml in 1½ hrs with lowest detection limit of 1.47 log count/ml in 12 hours at

## Hypocholesterolemic Effect of Dietary Calcium in Rats

(Renu Sagwal and Vinod K. Kansal)

Effect of four dietary calcium levels (low calcium, moderate calcium, high calcium, and high dairy calcium, on the body fat metabolism and lipid profile was studied in male albino rats (8 weeks old) fed for 101 days. Feed intake and body weight gain were comparable in four dietary groups. There was no effect of dietary calcium levels on body fat pad mass and adiposity index. The faecal fat excretion was increased on moderate, high and high dairy calcium diets compared to low calcium diet. Fatty acid synthase activity was significantly decreased in liver on high dairy calcium diet and in retroperitoneal adipose tissue on moderate, high and high dairy calcium diets compared to low calcium group. Acetyl-CoA carboxylase activity in liver and retroperitoneal adipose tissue significantly decreased in moderate, high and high dairy calcium groups compared to low calcium group. Dietary

**Fig. 2 ESA: Test Procedure**



37°C. The impact of milk constituents on Enzyme substrate reaction time was moderate when tested with spiked milk samples and the assay sensitivity was reduced to 2.67 log counts/ml. Developed assay was screened for enterococci count with 32 samples of raw milk and it could detect 2.67, 3.50, 4.25 and 4.8 log counts within incubation period of 12, 7½, 6½ and 5 hr, respectively. ESA could also detect Enterococci log counts of 2.84 in pasteurized milk and 2.57 in dried products within 12 hrs of incubation; however, assay was insensitive at very low level of 1.13 and 0.915 log counts. As such ESA developed in current investigation may find industrial application as Hygiene Indicator test (Fig. 2) for detection of enterococci, pasteurized milk and dried dairy products and can be further optimized for assessing the hygienic status of equipment/utensils, air and water, personnel and plant environment.

calcium levels had no effect on epididymal adipose tissue and skeletal muscle carnitine phosphate transferase activity. There was a 77.6% and 88.1% decrease in liver mitochondrial-oxidation on high calcium and high dairy calcium diets, respectively, compared to low calcium group. There was an increase in short chain fatty acids in retroperitoneal adipose tissue of high dairy calcium group, compared to other three groups.

Total plasma cholesterol and VLDL+LDL-cholesterol concentrations decreased with increasing dietary calcium, and the high dairy calcium diet was most efficacious in decreasing plasma cholesterol concentrations. Triacylglycerol concentration decreased on moderate and high calcium diets when compared with low calcium diet. The atherogenic index was decreased by 18.4%, 30.0% and 50.0% on moderate, high and high dairy calcium diets, respectively, when compared with low calcium diet.

Dietary calcium had hypocholesterolemic effect in rats and the dairy calcium was more efficacious, but had no effect on body weight and fat mass in rats.



## ACADEMIC AFFAIRS/ DEEMED UNIVERSITY NEWS

### Scholars Qualified for the Award of Ph.D. Degree

| Scholar     | Guide/ Discipline                                    | Title of Thesis                                                               |
|-------------|------------------------------------------------------|-------------------------------------------------------------------------------|
| Vikas Vohra | Dr. A.K. Chakravarty<br>(Animal Genetics & Breeding) | Studies on Genetic Variability of Lactation Curve Traits for Karan Fries Cow. |

### Meetings

37<sup>th</sup> Meeting of Standing Committee on Scholarship financial Assistance & Academic Progress was held on 25<sup>th</sup> May, 2010.

### MoU and Collaborations

#### Foreign Universities

**NDRI as an Associate Member under Erasmus Mundus Programme of European Union :** NDRI, Karnal has been included as an Associate Member under Erasmus Mundus Programme of European Union for the European Master's Degree in Food Science, Technology and Nutrition. The programme is offered by the four major Consortium partners including Dublin Institute of Technology (DIT), Dublin (Ireland), Anhalt University of Applied Sciences, Bernburg (Germany), KaHo-Sint Lieven, Gent (Belgium) and University of Catholica, Porto (Portugal). NDRI, Karnal will offer competence module for the students of Erasmus programme and they can also join NDRI for their Master's dissertation work. Undergraduate students of NDRI will be given preference in selection of students for the

programme with fellowship. Likewise faculty of NDRI will also be featured as visiting faculty for the various modules offered during the degree programme at any of consortium partner.

#### Indian Universities

NDRI has signed Memorandum of Understanding (MoU) with the following institutions to collaborate in research and teaching activities.

- BHU, Varansi
- Manav Bharti University, Solan
- IGNOU, New Delhi

#### Visitors

The following officers from Ministry of Agriculture, Rawanda visited NDRI to have interactions on academic matters. These officers met the Rwandan students studying at NDRI in M.Sc./ Ph.D. programmes. These officers showed interest in training programmes organised at NDRI.

- Mr. Raphael Rurangwa, Director of Planning & Program Manager.
- Mr. Javier Gasasira, Project Director.

## TRANSFER OF TECHNOLOGY

### Training Programmes Organized

During the period under report, in all 33 training programmes (On-campus and Off-campus & training-cum-visits) on different aspects of dairy production and processing, crop & vegetable production, vermiculture, bee-keeping and home science were organized in which 793 farmers, women, rural youth and extension functionaries participated.

In addition, KVK organized 12 sponsored training programmes on Scientific Dairy Farming for 331 farmers and extension functionaries. Also one sponsored programme on Fodder production and milk production for 10 extension functionaries from Uttar Pradesh was organized. In these training programmes, 276 trainees from Uttar Pradesh, Punjab, Bihar and Assam state were imparted training.

KVK also organized four exposure and study visits for 58 farmers and farm women from Uttar Pradesh and Jharkhand states.

### Animal Health Management Activities

Various Animal Health Management activities were organized through Stockman centers in adopted villages of KVK. At these centers, 474 cattle and 162 buffaloes were artificially inseminated and as a result 366 calves were born. Pregnancy Diagnosis in 13 cattle and 20 buffaloes was carried out. Besides these, 28 animals were treated, 23 calves dehorned and 16 animals given infertility treatment. A Fertility Camp and an Ecto- and Endo-parasitic control was organized in village Darar.

### Extension Activities of KVK

On Farm Trials on Moong using variety S.M.L. - 668 were laid in village Nagla Rodan.



FLD on Summer Moong was conducted on 6 ha. for promoting SML - 668 on 15 locations in different villages.

KVK laid 5 FLDs on Jowar crop using variety Multicut SUDAX chari - 1.

KVK organized exhibitions at Pash Pustkalya, Karnal on 14th -15th April, 2010 and at the KVKs interface meeting at NASC Complex, New Delhi on 26th - 27th April, 2010.

### REVENUE GENERATION IN KVK (1st April to 6th June, 2010)

| Source                                 | Amount (Rupees) |
|----------------------------------------|-----------------|
| Training Fee from KVK courses          | 9,600           |
| Training Fee from sponsored programmes | 2,22,064        |
| Tuition Fee from visits conducted      | 6,000           |
| Vermicompost Unit                      | 530             |
| Bee-keeping Unit                       | 8,110           |
| Fisheries Unit                         | 8,340           |
| Room Rent from Farmers' Hostel         | 56,860          |
| Dairy Vikas Kendras                    | 13,890          |
| <b>Total</b>                           | <b>3,25,394</b> |

### Dairy Education at Farmers' Door

Dairy Extension Division continued the new Extension Education Programme "Dairy Education at Farmers' Door" to strengthen the effective dissemination of dairy production and processing technologies among farming community. A team of NDRI scientists including subject matter specialists from production, processing and management group visited villages viz. Nasirpur and Nasirpur Tila of Karnal district on 2nd Saturday of each Month during the period under report.

### 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 contact between scientists and farmers is established. The major activities being carried out through these Centers are: Up-grading of the existing breeds of dairy animals, cross-breeding in cows and selective breeding in local buffaloes through A.I. using high pedigree bulls; organizing fertility and veterinary aid campaigns; providing necessary treatment to the animals; and providing vaccination against contagious diseases. Veterinary aid campaigns were conducted in adopted villages to educate farmers regarding scientific methods of breeding, feeding and improved management practices, to reduce age at maturity and to minimize inter-calving interval and infertility.

| Activities                 | No. of Cases |
|----------------------------|--------------|
| A.I. in Cows               | 148          |
| Conception rate            | 42.20%       |
| A.I. in Buffaloes          | 43           |
| Conception Rate            | 34.00%       |
| No. of C.B. calves born    | 45           |
| No. of buffalo calves born | 11           |
| General Treatment cases    | 30           |

### Infertility and Veterinary aid Campaigns

A total of eight Camps were organized by Dairy Extension Division in Nasirpur-Tilla, Subari, Yamunanagar and Kulwaheri villages. During these Campaigns, 91 cases were treated for reproductive disorders and various veterinary ailments.

### Kisan Sangosthies

Eight Kisan sangosthies were organized at village level and a total of 80 farmers and 10 farm women participated.

### Women Empowerment Programmes

During the period under report, six training programmes/awareness campaigns of women empowerment through dairy self help group were organised on clean milk production and capacity building of women in the field of preservation of fruits and vegetables, importance of sprouted pulses in diet, cultivation of vegetables as an enterprise. A total of 161 farm women participated from villages Subri, Nasirpur Tilla and Shahpur.



### Training and Exposure Visits

A three day Training & Exposure visit on scientific dairy farming was organized at NDRI for 100 farmers of Deharadun District (UK) which was sponsored by J. K. Trust Gram Vikas Yojana, Deharadun District (UK) from 18<sup>th</sup> - 20<sup>th</sup> May, 2010.

### Extension Talks/Advisory Services

Three lecture/extension talks were delivered in training programme at IARI, New Delhi under National Extension Programme. Regular advisory services were provided to the individual farmers / NGO's / relevant departments all over the country in response to their particular / general queries regarding latest technologies of the Institute and modern dairy farming practices.

## RECENT HAPPENINGS

### 20<sup>th</sup> Indian Convention of Food Scientists and Technologists

20<sup>th</sup> Indian Convention of Food Scientists and Technologists was organized from 21<sup>st</sup>-23<sup>rd</sup> December 2009 at the Convention Centre, National Institute of Mental Health and Neurosciences, Bangalore. The Convention was organized jointly by Association of Food Scientists and Technologists, Central Food Technological Research Institute, Mysore, Defence Food Research Laboratory, Mysore and National Dairy Research Institute, Bangalore. The Convention was inaugurated by Dr. P. G. Chengappa, Vice-chancellor, University of Agricultural Sciences, Bangalore. A commemorative Souvenir was released by Dr. A. K. Srivastava, Director, NDRI, Karnal during the inaugural function.

The Convention was attended by about 1200 delegates both from India and abroad. The delegates comprised academicians, industry personnel, entrepreneurs consultants, food and medical professionals and students. The Convention was



*Release of commemorative souvenir at ICFOST-09*

deliberated in 20 Technical Sessions on issues related to nutrition and health, food safety, fermented products, specialized foods for dietetic disorders, convenience foods, pediatric and adult nutrition, food additives and fun foods, nutraceutical foods and socio economic issues concerning the food industry. An exhibition showcasing various products, equipment and services from the food processing industry was also organised during the convention.

### Reverie 2010

All India Inter University Youth Festival Reverie - 2010 was celebrated at NDRI from 2<sup>nd</sup> to 4<sup>th</sup> April, 2010. The Youth festival was inaugurated by Dr. Arvind Kumar DDG (Education) ICAR. In this mega event, five teams from different universities participated in various cultural, fine arts and literary competitions. Dr. Tej Pratap VC, C.S.K. Himachal Pradesh, Krishi Vishva Vidyalya, Palampur was the Chief Guest during the prize distribution function. Dr. A. K. Srivastava, Director and Vice Chancellor, NDRI presided over the function.





### E-Learning Workshop

A Workshop was organized by the Computer Centre on 26<sup>th</sup> April to sensitize the scientists of the Institute on 'Computerization of Research Project Information (RPF-I) and Content Management for E-Learning System using MOODLE' jointly under the auspices of the Institute Research Project, "Development and Evaluation of e-Learning Management System (e-LMS) for Dairy Education" as well as another sub-project, "Development of e-Course for B. Tech (Dairy Technology) Degree Program" under NAIP (Component - 1). The scientists were acquainted with recent efforts being made at ICAR and Institute levels to computerize the research project information and innovations in educational technologies to improve the efficiency of the system.

### Second Entrepreneurship Development Programme

Second Entrepreneurship Development Programme (EDP) on Milk Processing for Market Milk & Related Products was organized from 17<sup>th</sup> - 26<sup>th</sup> May 2010 by the Technology Business Incubator (TBI) at NDRI. All the technical knowledge in this programme was provided by the scientists of NDRI having vast experience in their field on the topics related to Dairy Development, Clean milk production, Homogenization and Pasteurization of Milk, UHT Sterilization and aseptic packaging of milk, Platform tests, Manufacture of sterilized flavored milk and chocolate milk - theory & practical, Sensory evaluation of milk and milk products. General topics like planning



a small-scale unit, Market survey tools, Preparation of schedule and techniques of data collection, Business plan format for micro and small enterprises, Marketing management, Legal requirements, Government policies, Bank schemes, Project report preparation were covered by the guest speakers from Banks, MSME & Industrialists and visit to successful Dairy Farms was also a part of the programme.

### World Veterinary Day- 2010

World Veterinary Day - 2010 was held on 27<sup>th</sup> April, 2010 at Dr. D. Sundaresan Auditorium, NDRI Karnal in which more than four hundred students, faculty members, State Veterinarians and progressive dairy farmers participated. Dr. P. N. Bhat, former Deputy Director General (Animal Sciences) and Ex. Director, IVRI, Izatnagar graced the occasion as Chief Guest and Dr. Gurmeet Singh, Deputy Director (AH) was Guest of Honour. Dr. A. K. Srivastava, Director and Vice Chancellor, NDRI Karnal presided over the function. While addressing the gathering in his presidential address, Dr. Srivastava, presented an overview of major diseases of zoonotic importance and emphasized about the need of awareness and to explore the possibilities of reducing them. Dr. P. N. Bhat, the Chief Guest highlighted the importance of linkages among the Veterinarians, human health specialists, para-vets and paramedics in improving public awareness about the animal diseases and their transmission to human population. He also emphasized on the need of developing contingency plans for combating threats related to bioterrorism. Dr Gurmeet Singh in his



*Glimpses of Reverie-2010*



*Dr. P. N. Bhat Chief Guest inaugurating the World Veterinary Day*

address emphasized on greater interaction between State Veterinary officers and Central Animal Husbandry as well as medical organisations for reducing incidence of Zoonotic diseases. Dr. R. C. Upadhyay, Organizing Secretary welcomed the guests and explained the importance of the World Veterinary Day - 2010 and its theme 'One World One Health'.



The World Veterinary Day, 2010 activities started on April 24, 2010 with a debate for students on "Role of Public and Private organisations on spreading awareness about the zoonotic diseases". About 200 undergraduate and post graduate students participated in debate.

### World Milk Day

NDRI celebrated World Milk Day by organizing National Workshop on Issues and Roadmap for Dairy Education and Research on 1st June, 2010. Padam Bhushan, Dr. R. B. Singh, Former ADG, FAO and Chairman, ASRB, New Delhi inaugurated the workshop. It was participated by the dairy scientists and policy makers from the professional dairy education Institutes in India. Inaugurating the Workshop, Dr. R. B. Singh shared his concern that there are about 1 billion people in World who remain hungry and 40% of world's malnourished children are in India. The Indian Livestock sector is performing better over crop sector and was supposed to grow at 6% but growth in this sector is hovering around 4-5%. Livestock sector employs more women and hence can empower women. In his key note lecture, Dr. B. N. Mathur, former Director NDRI emphasized the need for studying the system of dairy education in developed countries in USA, Norway, Germany, Switzerland, New Zealand, Australia and inculcate flexibility in course curriculum. India could be centre for providing dairy education to nationals from developing countries of Africa, Latin America and Caribbean. He also suggested that NDRI can become an International Centre for Tropical Dairy Farming. In the presidential address, Dr. A. K. Srivastava, Director, NDRI informed that livestock sector contributes



*Inauguration of the World Milk Day by lighting the ceremonial lamp*

28-30% to agricultural GDP and milk contributes 70% to GDP from livestock sector. Milk production in India is growing four fold over world average growth in milk production. However, the farmer is not getting his full returns. Wage disparity in dairy and non-dairy sector remains a matter of concern. He also emphasized that there is a need to develop suitable technologies for fortification of milk. As such milk is rich in many vitamins, micronutrients, good quality proteins etc but it lacks some of the Important vitamins and minerals, particularly Iron. He further suggested that there is a need for popularising the consumption of fermented milks and other fermented products as more use of dahi and fermented milk in daily intake of food helps in keeping gastro-intestinal tract healthy.



*Padam Bhushan, Dr. R. B. Singh, Former ADG, FAO and Chairman ASRB, New Delhi addressing the scientific community on the occasion of World Milk Day celebrations*



*Dr. C. S. Prasad, ADG, ICAR addressing the delegates on World Milk Day*

## National Academy of Dairy Science Launched

National Academy of Dairy Science was launched at Karnal on 1<sup>st</sup> June 2010. Dairy Scientists from different parts of the country gathered to launch the newly registered National Academy of Dairy Science (India). Padam Bhushan Dr. R. B. Singh, Former ADG, FAO and Chairman, ASRB, New Delhi inaugurated the Academy by handing over a copy of the registration certificate of the Academy to founder President of the Academy & Director, NDRI, Dr. A. K. Srivastava. Dr. R. K. Malik the founder General Secretary briefly introduced the objectives, proposed activities and constitution of the Academy. Dr. R. B. Singh expressed his optimism that this new Academy will work as a think tank and develop policy papers on different issues related to dairy education & research.

Director, NDRI explained that Mission of the Academy is to achieve recognition as a think-tank to provide views of the scientific community on dairying related issues, and to encourage and promote scientific and technological talent, making it a powerful instrument in fostering knowledge based vibrant dairy industry for the growth of national economy. This academy will also act as nucleus for promoting inter-institutional collaboration; facilitate conduct of

national and international workshops and work as a forum for nomenclature of degrees, disciplines and Institutions related to dairy sciences. Dr. Animesh Banerjee, Former President, Indian Dairy Association also expressed his views on this occasion. He felt that minimum standard and norms should be set for dairy science colleges. He regretted that many dairy science colleges are working under the

constraint of limited number of faculty & experts. Other dignitaries who graced the occasion were Dr. B. N. Mathur former Director, NDRI Karnal, Dr. R. P. Singh, Executive Secretary, Indian Agricultural Universities Association, New Delhi, Dr. C. S. Prasad & Dr. K. Mittal, Assistant Director General (s) at ICAR, New Delhi.



*Launch of National Academy of Dairy Science*



*Students from United States in an interactive meet with Director and Vice-Chancellor, NDRI*





### Garima, the Cloned Buffalo Calf Completes First Year on 6th June 2010

Last year, NDRI pioneered the cloning of buffalo using the novel technique called "Hand-guided Cloning Technique" by making modifications in the "Conventional Cloning Technique". Using this technique, a female buffalo calf Garima was born at NDRI on 6<sup>th</sup> June, 2009.

At one year of age "Garima" has grown from 43 kg at birth to 325 kg. She has gained body weight at the rate of over 770 g per day which is higher than the average growth rate of around 450- 600 g per day for normal buffalo calf. The growth rate during the first 6 months was 840g/day, during the second 6 months, the growth rate was 730g/d. At this rate of growth, Garima is likely to attain the body weight of 400 kg within next 3.5 to 4.0 months. At this age and weight she would be expected to attain sexual maturity and the decision to breed her could be taken at that time.

Different clinical/biochemical tests were done on Garima at regular intervals. The animal is having normal Hb content at 12.5 mg% & PCV 35%. The behavioural and the physiological parameters of the calf are normal. The scientists are closely monitoring the animal for the further developments including oestrus symptoms. Initially the body temperature, respiration and heart rate were recorded at every six hrs. interval and proper record of feeding schedule was maintained. To further pursue research efforts in the area of buffalo cloning this research effort of NDRI has attracted good funding through the National Agricultural Innovation Project.

### New Website of NDRI Launched

The new Website of NDRI was Inaugurated by Padma Bhushan Dr. R. B. Singh, Former, ADG, FAO and Chairman, Agricultural Scientists Recruitment Board (ASRB) on the occasion of the World Milk Day on 1st June. The new Website gives comprehensive information on Research, Education and Extension activities of the Institute. Most of the contents are easy to update dynamically. Faculty and senior officers can update the relevant information in a single click upload. The Website has been enriched by

provision of online services to farmers, dairy Industry, students and other stake holders. The website can be visited at <http://www.ndri.res.in/>. The Website has been developed under the National Agricultural Innovation Project funded sub-project entitled 'AGROWEB - Digital Dissemination System for Indian Agricultural Research (ADDISIAR)'. The model Website strictly conforms to the ICAR-approved 'Uniformity Guidelines for Websites of ICAR Institutes' developed under the above mentioned sub-project. The following three User Manuals pertaining to three Web-enabled software systems developed under this sub-project were also released on the occasion:

- Web-based Information System on Availability of Male Germplasm (Frozen Semen) at the Artificial Breeding Research Center;
- Web-enabled Decision Support System for Livestock Farm Management by Monitoring the Herd Strength and Expected Producing Ability of Cattle and Buffaloes
- Online Database of National Collection of Dairy Cultures (NCDC).

An institute publication entitled "Neuro-Computing Paradigm and its Dairy Applications - a Mathematical Primer" was also released on the occasion.

### Library Awareness Workshop

An Awareness Workshop under the aegis of Consortium for e-Resources in Agriculture (CeRA) of ICAR was organized at NDRI on 9<sup>th</sup> June, 2010. Dr. A. K. Srivastava, the Director and Vice Chancellor of NDRI, inaugurated the workshop. There was an elite group of about 70 scientists and students who are active users of library. Besides, in-charges of other ICAR Institutes located in Karnal were present. The Director emphasized on the need of easy access and fast dissemination of scientific information among the researchers and users. He also emphasised on the need and expertise on various components viz. PCs, Internet connectivity and skills. Subsequently, there were lectures by experts from various Service provider firms viz. Elsevier, Springer, Taylor & Francis, CSIRO etc. There were live demos of different softwares used for retrieval of information.



Padma Bhushan, Dr. R. B. Singh, Former ADG, FAO and Former Chairman ASRB Inaugurating the NDRI New Website





### Inauguration of Physiotherapy Unit at Human Health Complex

To provide better preventive and curative health care to the officials, their families and students of NDRI, Karnal, a Physiotherapy Unit has been established in the Health Complex of the Institute, which was inaugurated by Dr. A. K. Srivastava, Director & Vice-Chancellor, NDRI, Karnal on 16th June, 2010. Various physiotherapy gadgets have been installed in this unit to cater to the needs of the patients suffering from CVD, diabetes, arthritis, orthopedics etc.



*Dr. A. K. Srivastava, Director & Vice Chancellor, NDRI Inaugurating the Physiotherapy Unit at Human Health Complex*

### Conference on Science and Spirituality for Balanced Growth of India

One day Conference on Science and Spirituality for Balanced Growth of India was organized at NDRI on 17th June, 2010. This conference was organized jointly by Bhaktivedanta Institute and NDRI, Karnal wherein eminent educationists and spiritualists from IIT, Kharagpur, IIT, Kanpur, NIT, Kurukshetra and NDRI participated. The conference was inaugurated by Dr. S. L. Goswami, Joint Director (Res.) and had discourses by several speakers such as Mr. K. Vasudeva Rao President, Bhaktivedanta Institute from IIT Kanpur; Dr. Sudipto Ghosh, Assoc. Prof., IIT Kharagpur; Dr. Avtar Singh and Dr. R. K. Malik, Principal Scientists, NDRI, Karnal; Mr. Ankur Thareja and Mr. Robinro Sharma from Bhaktivedanta Institute; and Prof. R. K. Aggarwal, NIT, Kurukshetra.

### VISITS ABROAD

Dr. A. K. Srivastava, Director & Vice Chancellor NDRI attended the General Board Meeting of the Erasmus Mundus Masters Programme SE FOTECH. NUT "European Masters in Food Science, Technology and Nutrition" at KaHo Sint - Lieven, Gent, Belgium from 18th to 23rd May, 2010.

Dr. Rajen Sharma, Senior Scientist, Dairy Chemistry Division was deputed for training on Lateral Flow Separation of Aptamer Linked Nanostructures under NAIP Project entitled "Detection and

Mitigation of Dairy Pathogens and Detection of Adulterants using Chemical Biology" at Chemical and Life Sciences Laboratory, University of Illinois, Urbana-Champaign, USA from 10th March, 2010 to 8th May, 2010.

Dr. A.K. Punjya, Senior Scientist, Dairy Microbiology Division, visited Taiwan, under - Exposure visit to scientific laboratories/ institutions in advanced countries in frame of plan scheme "National Programme for Training of Scientists and Technologists Working in Government Sector" of Department of Science and Technology, New Delhi from 29th May to 6th June, 2010.

Dr. A. K. Punjya, Sr. Scientist, Dairy Microbiology Division, 'Chaired' a technical session on 'Food Microbiology' and also acted as a member of 'International Scientific Advisory Committee' during 'III International Conference on Environmental, Industrial and Applied Microbiology (Bio-Micro World 2009)' from 2nd to 4th December, 2009 held at University of Lisbon, Lisbon, Portugal.

Mr. Sanjay Kumar, Ph.D. Scholar, Dairy Microbiology Division presented his paper during 'III International Conference on Environmental, Industrial and Applied Microbiology (BioMicroWorld2009)' from 2nd to 4th December, 2009 held at University of Lisbon, Lisbon, Portugal.

Dr. S. K. Strohl, Sr. Scientist, Dairy Cattle Nutrition Division was deputed to undertake International training programme under HRD program of NAIP Component-1, ICAR, New Delhi and received three months training in the area of 'Methane Mitigation in Ruminants' from 15th Sept., 2009 to 15th Dec., 2009 at INRA, Centre de Clermont - Theix, France.

Dr. Vijay Kumar, Principal Scientist, Dairy Technology Division was deputed to attend international training on 'Creation of e-learning Modules/Multimedia Development Learning Management System, e-courseware creation etc. and hosting for agriculture sciences at Cornell University, USA from 10th - 28th March, 2010.

Dr. D. Malakar, Sr. Scientist, Animal Biotechnology Centre was deputed to attend 36th Annual Conference (IETS) and 23rd Annual Meeting SBTC held at Cordoba, Argentina from 6th - 16th January, 2010 Argentina.

Dr. A. K. Singh, Sr. Scientist, Dairy Technology Division was deputed to avail Erasmus Mundus Scholarship on the subject "Food Science Technology and Nutrition" at Belgium, Ireland & Germany from 14th Feb., to 14th May, 2010.

Dr. J. K. Kaushik, Sr. Scientist, Animal Biotechnology Centre was deputed to attend training on "Proteomics



under NAIP Project" at USA from 30<sup>th</sup> March to 12<sup>th</sup> April, 2010.

**Dr. (Mrs.) Suman Kapila**, Sr. Scientist, Animal Biochemistry Division was deputed to attend a training on "Nutraceuticals under NAIP - HRD Programme" from 31<sup>st</sup> March to 30<sup>th</sup> June, 2010 at USA.

### HONOURS/ AWARDS

**Vivek Sharma, Makwana Tushar, Sumit Arora, Amit Kumar, Darshan Lal, Raman Seth, B. K Wadhwa and G. S. Sharma** were awarded "First Best Paper Award" for their paper entitled "A rapid method of cholesterol estimation in ghee using non - enzymatic diagnostic kit" published in Ind. Journal Dairy Sci, 61 (5): 353-359 during 38<sup>th</sup> Dairy Industry Conference from 17<sup>th</sup> - 19<sup>th</sup> Feb, 2010 at NIMHANS Convention Centre, Bengaluru, organised by IDA (SZ).

**Sumit Arora, S. Yarrakula, K. Narendra, Vivek Sharma, B. K Wadhwa, A. K. Singh and G. S. Sharma** were awarded "Second Best Paper Award" for their paper entitled "Analysis of saccharin and acesulfame-k and their storage stability in kalakand" published in Ind. Journal Dairy Sci, 61 (5): 353- 359 during 38<sup>th</sup> Dairy Industry Conference, 17<sup>th</sup> - 19<sup>th</sup> Feb, 2010 at NIMHANS Convention Centre, Bengaluru, organised by IDA (SZ).

### Patent Filed

A Patent entitled "Development of Spore Inhibition Based-Enzyme Substrate Assay (SIB-ESA) for Monitoring Aflatoxin M1 in Milk" by Dr. Naresh Kumar, Namita Ashish Singh, Vinai Kumar Singh, Dr. Sunil Bhand and Dr. R. K. Malik was filed as a part of research work carried out under NAIP project "Development of Biosensors and micro-techniques for analysis of pesticide residues, Aflatoxins, heavy metals and bacterial contamination in milk" on 11/05/2010.

## PERSONALIA

### Joining

- Mr. Raghu H. V. Scientist (QAFS) joined at Dairy Microbiology Division, NDRI Karnal on 23<sup>rd</sup> April, 2010.
- Ms. Sellam P. Scientist (A.S. & P.E.) joined at Dairy Engineering Division NDRI Karnal on 23<sup>rd</sup> April, 2010.

### Promotion

- Dr. P. G. Satish, T-5, SRS, Bangalore promoted as T-6 w.e.f. 22.06.09.
- Sh. K. L. Sampath, T-5, SRS, Bangalore promoted as T-6 w.e.f. 1.7.2009
- Mrs. Neelam Bala, Assistant promoted to the post of AAO w.e.f. 1.5.2010.
- Sh. T. Nagaraj, Assistant, SRS, Bangalore promoted to the post of AAO w.e.f. 3.6.2010.
- Sh. P. Saha, T-6, ERS, Kalyani promoted as T-7/8 w.e.f. 01.01.09.

### Retirements

- Mr. R. C. Nagpal, T-7-8 (F/FT) Computer Centre retired from Council's services on w.e.f. 31.05.2010.
- Mr. P. R. Saini, AAO retired from Council's services on w.e.f. 30.04.2010.

### Demise

- Dr. B. G. Ladkhani, Former Faculty Member in the Dairy Technology Division passed away on 13<sup>th</sup> June, 2010.
- Dr. K. C. Tyagi, Former, Head, Dairy Extension Division expired on 19<sup>th</sup> June, 2010.
- Mr. Pankaj Davar, alumnus of the Institute (B.Sc. Dairy Technology - 1975-79) expired on 12<sup>th</sup> June, 2010.
- Sh. S. K. Basu, T-4 (FFT), ERS, Kalyani expired on 1<sup>st</sup> April, 2010.

## SOUTHERN REGIONAL STATION, BANGALORE

### RESEARCH NEWS

#### Studies on Crossbred Dairy Production Systems in Kerala

(A. Obi Reddy, P. K. Dixit, B. Srinivas and D. N. Das)

Kerala is the first state to introduce crossbreeding and implement large scale progeny testing programme. The milk production which showed a growth rate of 4.04 % from 1991-91 to 2001-02 started stagnating/ declining thereafter. Number of crossbreds also declined since 2001-02. The field study analysed the dairy production systems of Kerala. Breed

composition: During 1960-90, it was only Sunandini (Brown Swiss crossbreds) that dominated. Subsequently, Jerseys and HFs increased in numbers. The present study indicated 48 % HFs, 39 % Jerseys and 13 % Brown Swiss crossbreds. Breeding services: Unlike other, states almost 100 % of crossbreds are under AI. High pedigreed HF/ Jersey semen is being used. Conception rate of 39 % for I service, 34 % for II service, 18 for III service indicated further scope for improvement. Cost of breeding service is significantly higher when compared to other states. Milk Production: Large



farmer's wet average ranged 9 to 13.6 kg milk/ day/ animal. However, when looked at Societies the averages did not cross 7 kg. This is attributed to breed and inputs as large farmers are maintaining HF with reasonably adequate inputs and small farmers face constraints of feeding concentrate, green fodder, straw etc.

**Strategies to over come constraints:** Encourage dairying mainly in districts bordering Tamil Nadu and Karnataka as there are more constraints for dairy production in Coastal districts viz., land availability, fodder, straw, climatic stress, cost of labour etc. For breeding coverage, best quality crossbred bulls should be procured through outsourcing. All the input costs are exorbitantly high. The labour, the feed, green fodder, straw, veterinary aid are all costing high compared to other States. A system should be evolved to rationalize these costs failing which dairying will face tremendous challenge in near future. On the brighter side, incidence of mastitis is quite low and FMD is almost eradicated.

### Shelf-life Extension of Kunda by Active Packaging

*(F. Magdaline Eljeeva Emerald, K. Jayaraj Rao, Chand Ram and P. Heartwin Amaladhas)*

The shelf-life of kunda is limited mainly by mold growth and textural hardening, induced by headspace oxygen and moisture migration, respectively during storage. Microbial spoilage and hardening are induced by headspace oxygen and moisture migration through the package, respectively. The study was taken up to evaluate suitable packaging technologies and to optimize the package atmospheres for enhancing the shelf-life of kunda. Kunda was packaged in EVOH (LDPE/EVOH/LDPE-140 thick) and PET (LDPE/PET/Al foil/LDPE-134 thick) multilayer high-barrier pouches of 175x150 mm size, and under different atmospheres containing air, vacuum, 100% CO<sub>2</sub>, 100% N<sub>2</sub> and oxygen scavenger ('Ageless' ZPT 100MBC). The packaged samples were stored at 30°C



*Kunda packaged in EVOH films with and without oxygen scavenger*

for 180 days. The physico-chemical, rheological, microbiological and sensory characteristics of kunda were evaluated at regular intervals during storage. Ambient air packaging of kunda, both in low-barrier and high-barrier films, was found not effective in controlling the microbial spoilage. The product was spoiled in less than 12 days. Vacuum packaging did retard microbial growth, while , adversely affected the textural and sensory attributes of the product.

However, in active packaging, it was observed that moisture content in kunda did not change appreciably (19.38-22.91% db) during storage. The acidity of the samples increased from 0.40 to 0.70% (lactic acid). Also, there was only a marginal change in free fatty acid content and peroxide values, indicating that the fat in the kunda samples packaged with the scavenger underwent less deterioration. The total bacterial count in the product packaged in both the packaging materials alongwith the oxygen scavenger decreased from  $4.4 \times 10^3$  to  $7.2 \times 10^1$  (EVOH) and  $5 \times 10^1$  (PET) cfu/g, while the yeast and mold counts were not at detectable levels at the end of storage. Textural characteristics such as firmness ranged from 797.42 to 5199.01 g and consistency from 2230.38 to 14553.55 g.s. These variations in textural attributes did not influence the sensory acceptance of the product significantly. Based on sensory evaluation results, it was concluded oxygen absorber coupled with high-barrier packaging materials like EVOH and PET extended the shelf-life of kunda to more than 180 days without appreciable loss of quality. EVOH was recommended over PET because of its transparent property.

### Characteristics of Khoa Jalebi

*(C. N. Pagote and K. Jayaraj Rao )*

Traditional jalebi is generally made from fermented maida batter. In certain regions of Maharashtra, Madhya Pradesh and Rajasthan, jalebi is made using



*Khoa Jalebi samples collected from different markets in Maharashtra and Madhya Pradesh*

khoa as a major ingredient. Khoa jalebi samples were collected from Nagpur, Nasik and Indore, and characterized for the sensory characteristics. The jalebi samples were round to oval in shape with characteristic brown colour. The pieces were 4.2 to 8 cm size having 2 - 4 coil structure. The jalebi was sweet with pleasant taste and possessed chewy body. The sugar syrup did not ooze out as in case of traditional maida jalebi, but was held absorbed within the coil structure. The composition of the jalebi samples was: Moisture 17.48 - 34.04%; Fat 9.86 - 18.36%; Ash 1.14 - 1.55%; Protein 5.50 - 9.76%; Lactose 10.56 - 13.9%; Sucrose 18.56 - 27.4%; Water activity 0.721 - 0.872; pH 5.71 - 6.65.

### Training Programmes

- One week training was conducted on 'Maintenance of Starter Culture' from 01.01.2010 to 08.01.2010.
- One week training was conducted on 'Chemical Quality Evaluation of Milk and Milk Products' for trainees from Tamil Nadu from 18.01.2010 to 23.01.2010.
- Two day training programme was conducted on 'Scientific Dairy Farming Practices for Dairy Farmers' for trainees from Tamil Nadu from 21.01.2010 to 22.01.2010.
- Two week training was conducted on 'Microbial Techniques for Assessing Quality of Dairy Foods' for six farmers from Kerala from 18.01.2010 to 22.01.2010.
- Four B.Tech students of Dairy Technology College, Pusad registered for In-plant training for a period of four months from 25.01.2010 to 24.05.2010.
- Ten day training on 'Preparation of Ice-cream and Indigenous Dairy Products' was conducted from 27.01.2010 to 05.02.2010 for trainees from Karnataka and Andhra Pradesh.
- One B.Tech student from SKU Engg. College, Ananthapur registered for Laboratory training from 27.01.2010 to 26.04.2010.
- Ten day training was conducted on 'Production of Cheese and Related Products' for trainees from Coimbatore and Hyderabad from 01.02.2010 to 11.02.2010.
- One week training was conducted on 'Dairy Production' for farmers from 08.02.2010 to 15.02.2010 and 08.03.2010 to 15.03.2010.
- One week Training was conducted on 'Dairy Production' from 12.04.2010 to 17.04.2010.
- Four weeks In-Lab Training was conducted in Dairy Technology from 03.05.2010 to 03.06.2010.
- Five candidates underwent one week training on 'Dairy Production' from 17.05.2010 to 22.05.2010.
- Ten students of B.Tech. from Dr. Annasaheb Shinde College of Agricultural Engineering, Mahatma Phule Krishi Vidyapeeth, Rahuri, joined for 'Summer Placement Training' for one month with effect from 01.06.2010.
- Nine students of B.Tech. from College of Agricultural Engineering and Technology, Marathwada Agriculture University, Parbhani joined for 'Summer Placement Training' for one month with effect from 01.06.2010.
- Three students of M.Sc. (DT) from Sam Higginbottom Institute of Agricultural and Technological Sciences, Allahabad were admitted for In-plant Training on 01.06.2010 for period of one month.
- Training programme on 'Livestock Geonomics & IP Protection in Livestock Biotechnology' for 21 day from 01.06.2010 to 21.06.2010 was conducted.



*Trainees at the cattle yard of the station*



*Trainees at the forage farm of the station*

### Extension Activities

- During the period (January - June 2010), 880 visitors in five batches comprising students from various Educational Institutes of Southern Region, farmers and entrepreneurs visited the institute.
- Advisory services / technical advice was rendered to fifteen clientele during personal visits to the Institute, on training programme on dairy processing technologies & scientific dairy farming aspects, know-how on preparation of indigenous dairy products and feasibility of starting mega dairy projects.

- Extension literature on dairy production and processing were distributed to the needy clientele groups, visitors and trainees during their visits to the Institute and during outdoor visits viz., rural extension programmes and exhibitions. An exclusive extension literature on Indigenous Breeds of Southern India was prepared for the benefit of the progressive dairy farmers.
- An Orientation Programme was organised during the month of June for inplant trainees / students of College of Agricultural Engineering, Mahatma Phule Krishi Vidhyapeeth, Rahuri, and College of Agricultural Engineering & Technology, Marathwada Agricultural University, Parbhani, Maharashtra. The students were presented with an introductory lecture about the genesis of the Institute and ongoing research and development activities. The students were taken round the Institute to various sections for acquaintance.
- Regular weekly visits were made by extension team to the adopted villages under Rural Extension

Programme for the benefit of the clientele group in the adopted villages to provide necessary veterinary services and technical advice in the villages.

- The station Participated in the exhibition organized at IIHR, Bangalore during 16<sup>th</sup> Jan 2010.
- The station participated in the Horti Expo 2010-exhibition, organised at UHS campus, Bangalore held during 28<sup>th</sup> to 30<sup>th</sup> May 2010.



*A view of Farmers at the NDRI Stall*

## EASTERN REGIONAL STATION, KALYANI

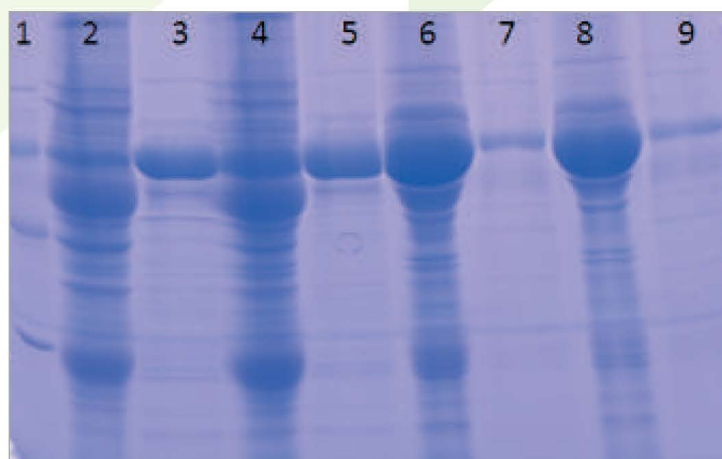
### RESEARCH NEWS

#### Isolation and Fractionation of Cattle Oviductal Secretory Proteins

(S. K. Das, A. K. Mohanty, A. Santra and A. Chatterjee)

Oviductal tissues were collected from the Kolkata slaughter house and brought to laboratory keeping in ice pack. After removing fascia and other tissues, oviducts were cut into small pieces and kept in 100 ml normal saline at -20°C. The trimmed oviducts were subjected to freeze and thaw repeatedly for 5-6 times.

The thawed oviductal tissues were centrifuged and the supernatant containing oviductal secretory proteins were fractionated by ammonium sulfate precipitation (30%, 40%, 50% and 60%). The protein samples were dialyzed in 50 mM Tris-HCl pH 7.0 buffer to remove ammonium sulfate. Dialyzed sample was loaded into a manually packed SP Sephadex cation exchange column, extensively washed and were eluted in 50 mM Tris-HCl pH 7.0 containing 1.5 M NaCl. The eluted protein fractions were dialyzed in normal saline, quantified and lyophilized for further use.



1. Molecular weight marker
2. 30% cut off protein pellet
3. 30% cut off protein supernatant
4. 40% cut off protein pellet
5. 40% cut off protein supernatant
6. 50% cut off protein pellet
7. 50% cut off protein supernatant
8. 60% cut off protein pellet
9. 60% cut off protein supernatant



Most of the oviductal secretory proteins were found to be precipitated at 30% ammonium sulfate precipitation. The eluted proteins were of cationic (basic) in nature and subjected to extensive dialysis in the presence of normal saline. The unbound fractions from DEAE Sephadex column contained the secretory proteins belonging to the neutral range and

subjected to dialysis in normal saline followed by quantification and lyophilization. In the present study, three different fractions (viz. cationic (basic), anionic (acidic) and neutral) of oviductal secretory proteins have been fractionated which will further be used to observe their effect in IVMFC.

### EXTENSION ACTIVITIES

- The training programme on "AI and Veterinary First Aid" was conducted from 8th March to 28th April, 2010. Eleven participants underwent this training, Ten trainees were sponsored by Ichhamati Milk
- A 15 day training on Scientific Dairy Farming was imparted to 18 unemployed rural youth and dairy farmers from Kalna 1 subdivision of Hoogly district from 10<sup>th</sup> - 26<sup>th</sup> May, 2010.
- A group of 30 farm women and farmers from Kalna-II subdivision of Burdwan visited the NDRI farm for orientation on Improved Dairy Management Practices on 9<sup>th</sup> June, 2010.
- Three village level Motivational Interaction Meetings on "Methods to ensure production of quality milk for higher remuneration." were organized in three women dairy cooperative societies of Ichhamati Milk Union, 24 (N) Parganas

on 24<sup>th</sup>, 28<sup>th</sup> May and 05th June, 2010 attended by the scientists and technical persons of the institute.

- Three Awareness programs on fodder development of Coix and establishment of perennial grasses were organized on 16<sup>th</sup>, 23<sup>rd</sup> and 29<sup>th</sup> June, 2010 in three Chilling Plant circles of Ichhamati Milk Union.



*Students undergoing Training Programme at Biotechnology lab*

- Seven B.Sc. (Biotechnology) students from Durgapur college of Commerce and Science (DCCS), affiliated to Burdwan University are undergoing their project work training in the area of embryo biotechnology for one month (since 1<sup>st</sup> June, 2010) under the supervision of Dr. S. K. Das, Sr. Scientist, Dairy Biotechnology Section, ERS, NDRI, Kalyani. Union and one by an NGO from 24 (N) Parganas.



*Inauguration of the Security Post at NDRI Gate by Dr. P. N. Bhat, Former DDG (AS) ICAR and Former Director, IVRI*

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