वार्षिक रिपोर्ट

Annual Report

2012 - 2013

राष्ट्रीय पशु पोषण एवं शरीर क्रिया विज्ञान संस्थान
बेंगलूरू

National Institute of Animal Nutrition and Physiology
Bengaluru

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NIANP-Annual Report 2012-2013
National Institute of Animal Nutrition and Physiology
Bengaluru, Karnataka

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Preface

Internationally, third millennium is surging with technologies, options and bounties. With its juvenile ethos, NIANP is orchestrating the aspirations of the ICAR towards iconic heights.

In 2012-13, the NIANP witnessed an accelerated phase: commencing with its onerous responsibility of the refinement of national database on livestock feed resources, forecasting models, feed portal and touch screen kiosk for ration balancing, matrix on methane production potential of ruminant feeds and its mitigation modules, genesis of xylan from green coconut husks and palm press fibres, harvest of lignolytic enzymes, myriad conglomeration of reproductive cytology and avian biology. It also ushered cruising across enzymatic catalysis of lignocellulosic crop residue complex. It irradiated on feed microscopy, non-conventional oil cakes, pollutants, silage technology to pineapple wastes and herbal antifungal concoctions.

As the conduit of research needs to percolate to the stakeholders, the institute organized the scientist-industry interface and the second edition of 'Innovative and Progressive Farmers Meet' unvealed by Dr. S. Ayappan, Secretary DARE and DG, ICAR on 24th Jan, 2013. The platform assented the private industry and the techno-savvy livestock farmpreuners on an expedition of ideas, experiences and motivation.

The institute's badge glittered with laurels and recognitions from publications in peered reviewed international journals, nurturing human resources and skill development through ICAR and Ministry of Agriculture sponsored training courses. To cultivate on future prospects of agriculture and veterinary science education, the maiden 'Agricultural Education Day' was observed on 3rd Dec, 2012. The crescendo of this academia was the realization of MoU with Jain University, Bangalore for self actualization of knowledge empowerment. Enhancement of research finesse through overseas training gathered momentum under NAIP, DBT and DST sponsored programs. The institute exchequer had modest development through consultancy and analytical services and filing of patents. As we tread relentless march towards near perfection and the pursuit of goals of 'food security' 'eco-sustainablility' and 'social harmony', let us resolve to toil hard, with consistency.

The Staff Welfare Club adorned the liveliness of the Institute on National Days and social festivities. The Hindi Pakhwada inculcated the spirit of national language and fervor of integration.

This publication records my sincere gratitude for the visionary guidance, encouragement, incessant exhilaration and constant support received from Dr. S. Ayyappan, Honorable Secretary, DARE and Director General ICAR and Prof. K. M. L. Pathak Deputy Director General (Animal Science). Sincere thanks are being extended to Dr. B.S. Prakash, ADG (AN&P), Dr. Gaya Prasad, ADG (Animal Health), Dr. SC Gupta, ADG (AP & B), Dr. Vinit Bhasin (Pr. Sci.) and Dr. Rajan Gupta (Pr. Sci.) for co-coordinating and facilitating the institute's activities.

A bouquet of acknowledgement is being extended Dr. K. Pradhan, chairman of the QRT, Dr. S. K. Ranjhan, former chairman of the RAC and Dr. K.M. Bujarbaruah, present chairman of the RAC along with the honorable members of these august bodies for orchestrating the matrix management of the institute.

The ensemble of the editorial board of Dr. Raghavendra Bhatta (chairman), Dr. Corbon Godfrey David, Dr. Atul Kolte and Dr. Soumitra Jash summons appreciation for their synchronous endeavour in compilation, revision and punctual dawning for the timely bloom of this annual report.

I also wish to place on record, the excellent work carried out by the in-charges of the divisions/ sections, scientists, Administrative officer, Finance and accounts officer and assistant administrative officer and their team of dedicated staff which has made possible for this positive growth of the institute. It has been truly a team work which is laudable.

My optimism affirms this publication to cater a valuable information casket to the professionals of scientific and academic institutions, field extension personnel and policy innovators engaged in the livestock and allied sector – the key whetstone of rural prosperity and harbinger of poverty alleviation.

May 2013

C.S. Prasad
Director

Executive Summary

The Institute was established in November, 1995 to address issues on basic and fundamental research in animal nutrition and physiology, has completed 17 years of progressive excellence. The Institute has 41 scientists, 9 technical, 15 administrative and accounts and 5 supporting staff. In 2012-13, total plan and non-plan budget allocated was Rs 1108.16 lakhs and the expenditure was Rs 1099.36 lakhs, with 99.2 % utilization. The total revenue generated during the period was Rs 33.5 lakhs. The institute has well structured five major programs which forms the basis of formulating various research projects and activities.

National database on livestock feed resources, forecasting models and feed portal

The feed resource and livestock database at different levels viz. District, State, agro-eco region and Country were updated with improved methodology and recent data. The total database is brought out in a compact disk with software support for graphical user interface to define query as per the requirements of the user. The out put information can be formatted in tabular, graphical and GIS map formats. The feed base version 2012 has incorporated features like district wise inter census growth rate for different categories of livestock, category wise requirements of feeds in terms of fodder and concentrates and improved tools for graphical and special presentation of results.

The Indian livestock feed portal is under development that contains information on feed resources, nutrient requirements, feed standards, feed markets, imports and exports and feed assessment. The database created in MYSQL-RDBMS currently hosts information on 750 feed resources with composition, mineral topography and nutrient content.

Accurate estimation of crop residue production using remote sensing technique is being attempted for Rabi jowar. Identification of spectral signature of Rabi jowar and mapping to spatial distribution was completed. The estimates arrived by remote sensing for acreage under Rabi jowar crop compared well with official data available with agriculture department.

To assess the impact of climate variation on dry and green fodder production in different States of India, and to develop the models for predicting the impact of climate variation on animal feed resources, data sets on feed resources and climate parameters with 40 years' information were prepared for the states of M.P, Rajasthan, Maharashtra, Goa and Assam. The models were tested to see the effect of climate variables on feed resources production. SAS time series method and Auto-regressive models were used for the analysis.

Enteric methane production and mitigation

NIANP is leading an outreach program on methane emissions from livestock with twin objective of developing a database on methane production potential of ruminant feeds available in different parts of the country and to develop mitigation strategies using secondary plant metabolites. The methane production potential of different feed resources was ranked. The methane production was less in legume fodder than cereal fodder due to more soluble carbohydrates in the cereal fodder. The straws produced more methane than green fodder. Tree leaves produced less methane than green and dry fodder due to presence of tannins. Total mixed ration considerably reduced methane production than feeding fodder and concentrate separately and the methane reduction is directly proportional to the level of concentrate in the TMR. An equation is developed to calculate methane production potential of feeds based on the nutrient composition of the feed ingredient/diet combination.

Efficacy of plant tannins as methane suppressants

Experiments were conducted to demonstrate that tannin level and source in the total mixed ration influences methane production from ruminants with a plateau being observed at 10-15 % incorporation of tannin containing leaves. Identification and distribution of methanogens in the sheep rumen was carried out by whole metagenome sequencing. In an experimental trial, 10% jack leaves that were identified for its methane reducing effect in *vitro* were fed in TMR to assess the effect on production parameters. The trial revealed significant improvements in daily weight gain in lambs.

Fifty six tree leaves, medicinal and aromatic plants were screened for their phenolic constituents. Seven samples contained more than 2 per cent condensed tannins (CT). The hydrolysable tannin content was more than CT in all the samples. Out of the samples screened 37 samples showed up to 10 % methane suppression; 12 samples showed 10-20 %; 5 samples 21-30 %; 8 samples 30-40 %; 5 samples 40-50% and 7 samples showed >50 % *in vitro* methane suppression. There was general reduction in the total protozoa count reflecting defaunation as one of the reasons for reduced methanogenesis.

Prebiotics production from agricultural waste

Green coconut husks and palm press fibres were evaluated as source of xylan, a precursor for xylo-oligosaccharides. The compositional analysis of green coconut husks and palm pressed fiber revealed 15.3 and % 23.6 % hemicellulose, respectively. Different levels of alkali with physical treatments were used to extract xylan and 85 % recovery of xylan was achieved. Purity of extracted xylan was established by FTIR analysis. Between green coconut husks and palm press fiber, the latter was found to be rich (23.6 %) in xylan content. Both potassium hydroxide and sodium hydroxide was effective to ensure higher yield of xylan only in presence of steam. The xylan was free from glucose, pectin or lignin.

Lignin degradation

Lignolytic enzymes harvested from *Coriolus versicolor* and *Ganoderma lucidium* by immobilization were used for *in vivo* digestibility studies in sheep. The animals were fed with enzymes treated straws (individual enzyme enriched culture media and in combination). Enzymes produced by both the strains improved average daily gain and dry matter intake in respective groups except in the combination group where both the enzymes were mixed and used for treatment. Although there was no significant difference in the pH and TVFA of the rumen fluid collected 4-h after feeding, the NH3-N and protozoa count increased in enzyme treated groups. The rumen enzymes viz. xylanases, proteases and fibrolytic enzymes also revealed similar improvements in the enzyme treated groups over control.

Reproduction in ruminants

India possesses the world's largest population of buffaloes which contribute to more than 50 % of the total milk production. However, buffaloes suffer from low reproductive efficiency mainly due to delayed puberty, silent estrus, lack of effective early pregnancy detection and embryonic losses. Research at this institute focuses to combat the above problems to augment reproductive efficiency in this species.

Follicular development and maturation of oocytes are regulated by dietary proteins. Feeding of azolla as a protein supplement at 5 per cent dry matter level (500gm /100kg body weight per day) improved the reproductive efficiency in buffalo heifers by improving follicular growth. High protein diet increased ammonia level in follicular fluid which could not be completely compensated by supplementation of soluble sugar. High ammonia level in follicular fluid impairs the functions of

oocytes and ovarian somatic cells. Oocyte quality is compromised in animals fed with imbalanced diet in cycling animals. The transcripts for GDF-9, FGF-2, FGF-9 and GAPDH were found in the small oocytes of goats. Growth differentiation Factor 9 and Fibroblast Growth Factor were found to improve significantly the small oocyte growth, *in vitro* maturation and granulosa cell function. Since the rate of occurrence of atretic follicles in buffalo is higher compared to cattle, elucidation of the probable mechanism(s) to overcome this problem is crucial. About ten specific proteins have been found in atretic and non atretic follicles which may signify specific functions to these proteins during the process of apoptosis, which needs to be elucidated. Attempt to make use of pregnancy associated glycoproteins (PAGs) as diagnostic marker in buffaloes and developing a suitable diagnostic kit is in progress.

Augmenting the reproductive efficiency of sheep would improve the livelihood of the marginal sheep farmers. Research conducted has shown that feeding of 20 per cent additional energy through protected fat increases the energy intake of the growing ewe lambs significantly and improved the onset of estrus and conception rate.

Bull fertility

The thyroid hormone tri-iodothryonine (T_3) is significantly lower in bulls with low fertility compared to high fertile bulls hence, and could play a plausible role on conception rate. A suitable fertility diagnostic kit to eliminate sub fertile bulls to improve field fertility is on the anvil. On the other hand, sperm functional parameters (plasmalemma integrity, mitochondrial membrane potential, sperm functional membrane integrity) and hormonal (serum IGF-I and testosterone) levels were significantly lower in sub-fertile bulls, however no differences were observed in DNA distribution, suggesting that advanced cellular and molecular studies are essential to predict semen fertility. In continuation it was observed that TIMP-2 protein was identified as a putative motility marker for buffalo and cattle semen. The low motility of the buffalo spermatozoa were associated with aberrant expression of CatSper-3 ion channel proteins.

Avian biology

Enhancing the productive efficiency of commercial layer hens vertically i.e. to increase the total egg production in these birds is the need of the hour to combat the increasing demand for poultry produce to the increasing population so as to meet the per capita requirement of eggs. Research at this institute has focused to address this issue by developing nutritional and management strategies to increase egg production. Modulation of prolactin levels by partial knockdown of prolactin gene using SiRNA technology, to augment egg production is in progress. Since, enhancing egg production also warrants improved egg shell quality, studies have shown that age associated deterioration in egg shell quality may be related to decrease in absorption of calcium from the duodenum and activity of carbonic anhydrase in egg shell gland and may not be due to variation in the matrix protein of the egg shell.

The molecular mechanism involved in combating stress has not been fully understood. It has been shown that the expression of one of the molecular chaperons like heat shock protein-70 has been up regulated in brain and skeletal muscle of broiler strain birds exposed to heat stress compared to those reared under thermo neutral environment.

Rumen biotechnology

Ligno cellulose complex present in the crop residues is not completely digested in the rumen because of the complex bonds. To improve digestibility of fibrous feeds, gene construct encoding feruloyl esterase was amplified in *E. coli* BL21 stain. These

newly prepared conformed constructs were transformed in to *Butyrivibrio fibrisolvens* by electroporation. Further, FAE encoding gene was also cloned in pYES2 shuttle vector and transformed in *Saccharomyces cerevisiae*. A crude FAE enzyme preparation was obtained for *in-vivo* experiments in crossbred cattle to study the effect of FAE on rumen fermentation and microbial diversity. The denaturing gradient gel electrophoresis analysis revealed that there were different organisms which appeared and other disappeared in control and trial samples. Supplementation of FAE enzyme showed improved digestibility and rumen fermentation in crossbred steers fed paddy straw based ration.

Feed quality and safety

Prevalence of adulterants in feed summons non-invasive method of evaluation. Feed microscopy has been successfully used in cataloguing microscopic structures of various feed ingredients. Microscopic structures of commonly available feed ingredients and materials suspected to be adulterated in retail chains were documented using bright field microscopy coupled with top illumination. The image characteristics of documented structures were found out using open source image analysis software.

In the outreach programme of monitoring livestock related drug residues and environmental pollutants, the soil, fodder and dung samples were analyzed for lead, cadmium and arsenic from the dairy-zones of urban and peri-urban fringes of Bangalore. The samples of soil, water, fodder, feed, milk, hair and dung collected from 3 villages from Bangalore - Tumkur National Highway (N.H-4), where large number of dairy farms exist showed presence of Pb, Cd and As. The lead (ppm) was 12.66 in soil, 0.31 in water, 4.06 in fodder, 0.46 in milk, 12.38 in hair and 3.93 in dung. The corresponding values of cadmium were 4.29, 0.22, 3.1, 0.35, 8.72 and 2.98 ppm and Arsenic were 3.28, 0.034, 0.58, 0.17, 2.39 and 0.99 ppm.

Detoxified unconventional cakes were evaluated for replacing soybean cake in concentrate mixture. Feeding of detoxified neem seed cake replacing soybean meal in growing lambs showed no changes in terms of ADG, FCE, Nutrient digestibilities, N-Balance and biochemical parameters and carcass characteristics.

Various isolates of aspergillus were screened for phytase activity along with isolates from soil samples. The identified strains were used for production of phytase by immobilization on PUF cubes. Preliminary feeding trial conducted in poultry showed that the laboratory developed phytase is able to release phosphorous from phytic acid but the efficiency was not as good as the commercial phytase at same dose level.

Macro and micronutrients

For developing a biomarker to assess the Cu deficiency, a feeding trial with Cu-adequate (10mg/kg) and Cu-deficient (3mg/kg) in sheep was carried out and the copper status was monitored using biochemical markers. After 3months of feeding on semi-purified diet (3mg/kg Cu), there was decrease in 28.02% of plasma Cu, 35.76% of RBC-Cu, 27.42% of ceruloplasmin and 15.15% of plasma SOD and 27.02% of RBC-SOD activity in Cu-deficient sheep. As the peripheral blood is one main target for using CCS as molecular marker, the different blood cell marker gene primers were designed and synthesized for testing the presence of those genes in whole blood or cellular fractions. The RNA isolation has been made from whole blood as well as from the different cellular fractions of blood and confirmed the presence of CCS and SOD1 genes in peripheral blood cells.

As inorganic chromium (chromium chloride) is less bio-available, organic chromium has been tried to alleviate stress. Cr complex with yeast exhibited the highest magnitude of biological activity. However the cost of production was higher in case of yeast.

The alternative method was tried for production of organic chromium. Laboratory level trial was conducted to enrich chromium content in azolla. Various levels viz, 0, 2.5, 5, 7.5, 10, 12.5, 15 and 50 ppm of chromium chloride was added in the medium and found that 12.5 ppm level of chromium in inorganic form would be optimum for Cr enrichment as well as yield. The cost of production of chromium enriched azolla is 10 times lesser than the cost of chromium enriched yeast. It was found that supplementation of the chromium yeast at 400 ppb can reduce the cholesterol content of the yolk and increases the chromium content in stressed layer.

Fluoride is a cumulative toxin ingested by livestock mostly through water. Effort was made to study the ameliorative effect of boron and calcium chloride against fluorosis in growing rats. Boron and calcium chloride at 50 ppm level was supplemented to water containing 30 ppm of fluoride and offered to growing male rats. The changes occurred in bone and teeth of rats due to ingestion of 30 ppm of fluoride in water for a period of 4 months were completely ameliorated due to supplementation of 50 ppm of boron and calcium chloride in water

Nano-P prepared (NCP) from dicalcium phosphate was analyzed for mineral content and compared with dicalcium phosphate (DCP). The NCP was incorporated in the semi-purified diet of growing rats at 50 and 100% level replacing DCP. Feeding trial was conducted for 45 days and data on feed intake, fecal mineral outgo, mineral content in bone and growth rate were recorded. The DCP contained 23.5% Ca, 16.9% P, whereas NCP contained 30.0% Ca, 15.6% P. The feed intake was lower and FCR was better in rats of 100% NCP incorporated dietary group. Gut absorption of P was more in NCP incorporated groups. Bone ash, Ca, and P contents were lower in 100% NCP incorporated dietary groups.

Newer feed resources and xenobiotics

Silage technology was adopted with or without anti-fungal agents to enhance the keeping quality of pineapple fruit residue (PFR). The PFR contained 7.50% CP, 56.0% NDF, 19.70% ADF, 1.26% lignin and 10.8 MJ ME / Kg on DM basis. Silaging of PFR with or without 0.25% (w/w) urea was found effective in preserving PFR. Lactic acid content was highest and fungal count was least in PFR silage preserved for 15 days period. Feeding trial in growing sheep using PFR as total mixed ration along with concentrate mixture at 65:35 ratio for 75 days showed similar growth performance and nutrient utilization as compared to maize silage.

The spent maize cobs and the stovers which are not generally used as feed materials were tried as silage using pineapple waste, Azolla and molasses. Use of 50:50 Maize stovers and pineapple waste and ground maize cob and pineapple waste yielded good quality silage after 21 days of anaerobic fermentation. A feeding trial in lambs was conducted where 100 and 50% ragi straw was replaced with grounded maize cobs without any effect on intake and digestibility of nutrients in 60:40 ration.

Various herbal products were studied for their antifungal effect against the aflatoxin producing fungi, *Aspergillus parasiticus viz.* spices, oils, pulp of fresh vegetables, fresh leaves, roots, seeds and tubers. All the products were tested at concentration of 1.0% in fungal media. The oil of *Cymbopogan citratus* (lemongrass) inhibited *Aspergillus* growth by (41%) and produced tiny colonies without spores. Further fresh leaves of *Azardirachta indica, Cyanodon dactylon, Citrus limonum, Ocimum sanctum* and the pulp of *Zingiber officinale* and *Capsicum frutescens* inhibited fungal growth by 7-25%. The oils of *Azardirachta indica, Olea europaea, Brassica juncea, Linum usitatissimum, Ricinus communis* and the other products studied did not show any fungicidal effect. In another study, control of fungal infestation and aflatoxins was

attempted using chemicals on QPM and Nithyasree variety of maize grain. With QPM copper sulphate (0.1%), citric & benzoic acid (0.25%), sodium propionate (0.25 and 0.5%) were the most effective with 100% inhibition of aflatoxin biosynthesis by *A. parasiticus.*

Technology translation

The 2nd Innovative and Progressive Farmers Meet was inaugurated by Dr. S. Ayappan Secretary DARE and DG, ICAR on 24th Jan, 2013 at NIANP. The objective of this meet was to recognize innovative/ progressive livestock farmers of Karnataka and neighbouring states and to share their ideas, experiences, innovations to motivate other fellow farmers for benefitting the larger farming community. About 150 farmers from different states participated in the meet. Ten progressive farmers including 2 women were felicitated on this occasion. Two publications (bilingual) entitled *Farmers Profile* and *Livestock Farming Info Book* was released on the occasion. In the afternoon, an interaction session on a theme *Promising Innovations for Prosperity – Convergence of Stakeholders* was organized.

The exclusive mineral mixtures formulated for sheep and goat have been commercialized. The use of areca sheath an alternate roughage source for incorporation in total mixed ration has been popularized by installation of few chaffing machines at farm-gate level.

Human resource development

Several awards by professional societies and recognitions have been bestowed on the scientists of the Institute for their outstanding research work. The scientists of the institute have published several research papers in peer reviewed national and international journals in addition to presentation of lead papers and research abstracts in conferences, seminars, symposia and workshops.

As a continuous process in providing training and skill development to various stake holders, twenty-one day winter school entitled 'Advances in functional genomic concepts and techniques for quality ruminant and poultry production' sponsored by ICAR, a model training course on 'Advances in improving reproductive efficiency in livestock under filed condition – Knowledge transfer'' sponsored by Directorate of Extension, Department of Agriculture & Cooperation and a seven day 'Hands on Training program' entitled 'Isolation and molecular characterization of anaerobic rumen microbes' were organized at the Institute.

Agricultural Education Day was organized for the first time on 3rd Dec., 2012 with the main focus on creating awareness on future prospects of Agriculture and Veterinary Science Education among students of class XI and XII. Over 50 students from Government Pre-University College, Adugodi, participated.

As a part of enhancing research skills in niche areas the scientists of the institute were sent for training abroad under NAIP, DBT and DST sponsored programs. As a part of services, feed analysis, hormone assay, micronutrients, and estimation of aflatoxin and consultancy services to various organizations were provided.

Others

The Institute also observed official functions like Republic day, Independence Day, Hindi *Pakhwada* and National Integration Day. The kaleidoscopes of social functions like Ayudha puja, Pongal were adorned with the staff and their families. On the 'Foundation day' of the institute all the retired staff were felicitated by Dr. Gurbachan Singh, Chairman, ASRB, New Delhi who was the chief guest.

Introduction

The National Institute of Animal Nutrition and Physiology (NIANP) was established in 1995 under the aegis of the Indian Council of Agricultural Research (ICAR) to conduct fundamental studies on basic physiological and nutritional problems related to bio-physical translation of nutrients for productive functions in livestock.

Location

The Institute is located in the heart of sprawling Bangalore city on the national highway No. 7 on Hosur road about 8 kms from the city railway station and 40 kms from the new Bangalore international airport.

Faculty

The Institute headed by Director has 41 scientists including five women scientists in position.

Staff position as on 31. 03. 2013

Category	Sanctioned post	Staff in position
Director	01	01
Scientific	40	41
Technical	12	09
Administrative & Accounts	17	15
Supporting	06	05
Total	**76**	**71**

Priority setting and management

The Institute has a high powered Research Advisory Committee (RAC) comprising of eminent scientists in Animal Nutrition/Physiology who guide the research agenda of the Institute and set research priorities. Dr. K. M Bujarbaruah, Vice Chancellor, Assam Agricultural University, Jorhat is the Chairman of the Committee. The other members include scientist from the field of Animal Nutrition, Physiology, Biotechnology and Reproductive Biology.

The functioning of the Institute is supervised by Institute Management Committee (IMC) headed by the Director of the Institute as Chairman and members drawn from state government, university and public including industry personals. A number of internal committees like Central Purchase Committee, Library Committee, Official Language Implimentation Committee, Priority Setting Monitoring and Evaluation Cell, RFD cell, Staff Welfare Club, IPR Cell, Institute Technology Management Unit have been constituted to decentralize the management and with devolved responsibilities for the smooth functioning of the Institute. The Institute Joint Staff Council has been constituted for promoting healthy and congenial work environment.The Institute Research Council (IRC) of the Institute provides a platform for effective professional interaction in respect of project review and implementation.

Being the start of the XII plan, new thrust areas were identified to strengthen the basic and fundamental research in niche areas. The institute is coordinating AICRP on 'Improvement of feed resources' with 21 centres, Outreach Project on 'Methane emission in ruminants'with 7 centres and is a partner in the outreach project on drug residues and environmental pollutants.Besides, the institute scientists have been associated in four research projects funded by NAIP, one project funded by NFBSRA, eight projects funded by DBT and one project funded each by NICRA, Coconut Development Board and ICSSR. Translation of discovery into application through technology transfer is being effectively carried out through the extension section.

Vision: *Productivity enhancement for profitable and sustainable livestock production*

Mission: *Improving production and reproductive efficiency in livestock through basic physiological and nutritional approaches*

Mandate

The mandate of the institute is to conduct fundamental studies on basic physiological and nutritional problems related to biophysical translation of nutrients for productive functions in livestock by:

- Unraveling basic physiological and nutritional principles and conducting research on fundamental aspects arising out of research in animal production in the country
- Effectively utilizing the scientific manpower at specialized level at one place and demonstrating how of nutrition and physiology principles function in practice and thereby improve rural economy through better livestock feeding and management approaches.

Objectives

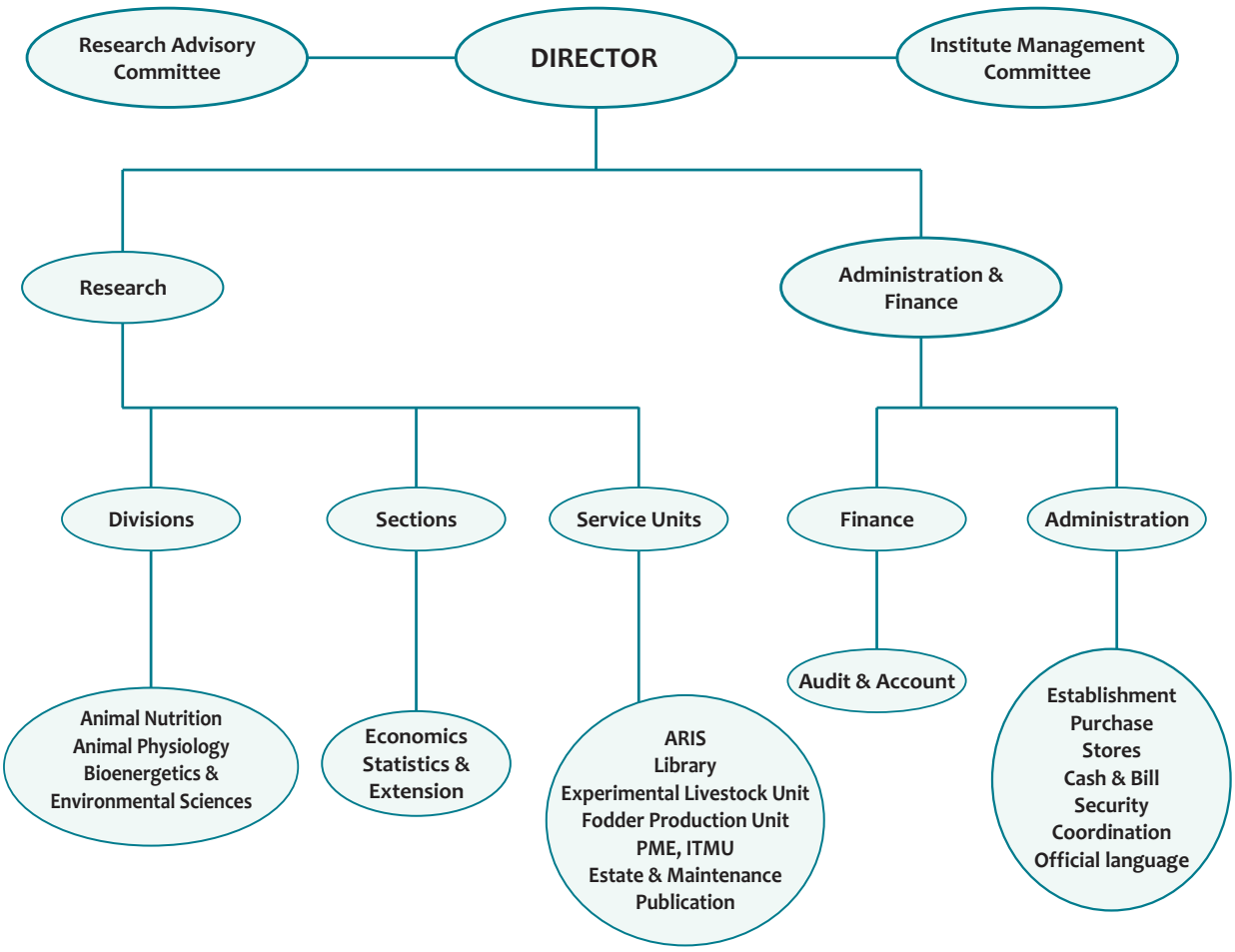
To achieve the mandate of the institute the following broad objectives and programs have been outlined:

- To carry out quantitative and qualitative assessment of feed resources and to develop district-wise information system
- To enhance availability of nutrients through various approaches viz., strategic supplementation, biotechnological interventions and feed processing technologies
- To enhance reproductive efficiency of livestock through physiological and nutritional interventions
- To address the issues of feed quality and safety
- To develop strategies for validation of evolved technologies at user's level for production enhancement.

Institute programs

Prog. 1	Deconstruction of ligno-cellulosic biomass for improving feed utilization (Flagship programme 1)
Prog. 2	Biogeography of gut microbes in animals (Flagship programme 2)
Prog. 3	Novel approaches for assessing and improving nutrient bioavailability, animal reproduction and productivity
Prog. 4	Feed informatics, feed quality & safety and value addition
Prog. 5	Climate change impact on livestock
Prog. 6	Technology translation to connect discovery with application

Organizational Setup



The matrix mode of management is adopted in the research activities which provides devolved responsibilities for effective implementation of multidisciplinary / interdisciplinary programmes. For administrative purposes the institute has identified three research divisions and one section with strong support of central facilities and computerized administrative set up. Director is the Head of the Institute supported by administrative and financial wings. To strengthen the local decision-making and research monitoring, Research Advisory Committee, Institute Management Committee and Staff Research Council play vital role through periodical meetings.

Expenditure statement

Statement showing the sub head wise expenditure under plan & non-plan budget (Rs. in lakhs)

Sl. No.	Sub Heads	Plan (2012-13) RE	Plan (2012-13) Expenditure	Non-Plan (2012-13) RE	Non-Plan (2012-13) Expenditure
A.	Institute				
	1. Pay and allowances	0.00	0.00	757.37	748.63
	2. OTA				
	3. Travelling Expenses	14.99	15.00	2.00	2.00
	4. Other Charges including Equipment	199.09	199.50	106.11	109.73
	5. HRD	3.92	3.50	0.00	0.00
	6. Works	21.00	21.00	0.00	0.00
	Total (A)	239.00	239.00	869.16	860.36
B.	AICRP on Improvement of Feed Resources and Nutrient Utilization in Raising Animal Production and Outreach Program on Methane Emission.	190.00	190.00	-	-
	Total (B)	190.00	190.00	-	-
	Grand Total (A+B)	**429.00**	**429.00**	**869.16**	**860.36**

Revenue generation (Rs. in lakhs)

Sl.No	Particulars	Amount
1.	Sale from Farm Product, livestock etc	2.17
2.	Other Receipts	
	Sale of Publication and CD	0.37
	Analytical testing Fee	1.33
	Miscellaneous Receipts	29.58
	TOTAL	**33.45**

Research

Institute Projects

Livestock feed resource management 1

Project 1.4: Estimation of production of crop residues with remote sensing techniques

K Giridhar and S Anandan

This project was undertaken to to study the spectral signatures of rabi jowar and map the spatial distribution. In addition, study of relationship between biophysical parameters of jowar crop, to remote sense the derived indices, estimation of stover yield from rabi jowar crop through remote sensing and geographical information system (GIS) techniques was also envisaged.

The data on acreage, leaf area index (LAI) as well as grain and stover yields of sorghum were collected from Solapur district in Maharashtra. Similar observations were taken from Kurnool district also. The measured values of leaf area index, grain and stover yield from Solapur district are presented in Table 1.

Project 1.5: Refinement of livestock feed resources and development of dynamic database

S Jash, S Anandan and UB Angadi

Under the database project on the assessment of feed resources and requirements for different livestock species, availability vis a vis requirements for all the districts, states, agro-eco-region and country has been carried out. The information was brought out in the form of a compact disc FEEDBASE 2012. Some of the features in the FEEDBASE 2012 include updated livestock numbers based on the district wise inter census growth rate for different categories of livestock, category wise requirements of feeds in terms of fodder (dry, green) and concentrates and better display of the information in graphical and spatial form for easier comprehension.

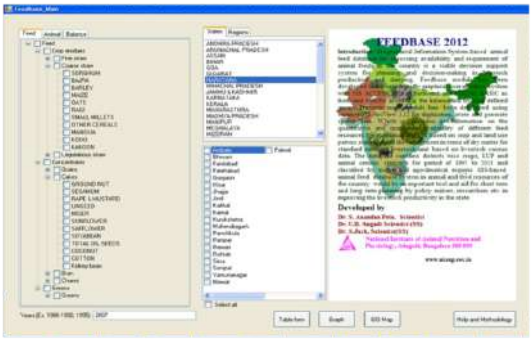
Table 1. LAI and Yield of rabi sorghum from selected fields in Solapur district

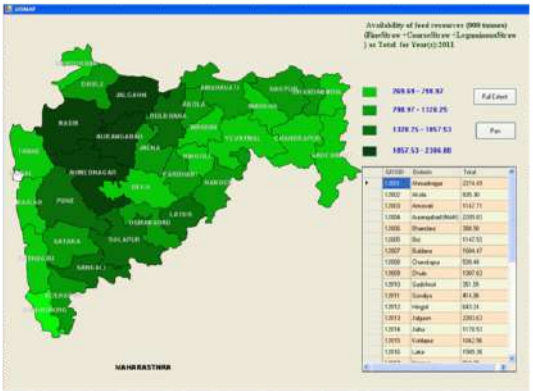
Field no.	Leaf area index	Grain yield (Q/ha)	Stoveryield (Q/ha)
1	1.82	7.2	12.6
2	1.93	7.4	1 2.2
3	1.69	5.8	10.1
4	2.01	7.9	13.5
5	1.86	7.6	12.6
6	2.20	8.0	14.0
7	1.75	6.5	11.5
8	1.92	7.8	12.7
9	2.23	8.1	13.2
10	1.87	7.3	12.3

The acreage under rabi sorghum in Kurnool and Solapur districts estimated with imagery analysis compared well with the official data obtained from Agriculture department.

The Feedbase-12

- Contains data of animal feed resources based on crop production statistics and fodder data based on land use pattern
- Contains district wise livestock census data of 5 census (1987, 1992, 1997, 2003 and 2007)
- Graphical user interface tool to define query as per the requirements of the user
- Based on the query the desired information is displayed in tabular, graphical and GIS Map forms





Snap shots of feed database

Project 1.6: Development of Indian livestock feed portal

S Anandan and U B Angadi

The objectives of the project is to develop information portal on livestock feeds and feeding to serve as one stop shop for all the information pertaining to livestock feeds and feeding and to maintain and update the portal to facilitate ready access to information and provide a platform for the exchange among experts and between experts & end users (industry, livestock owners).The portal contains information on feed resources, feed assessment, feed requirements, feed markets, feed imports/exports, livestock production and productivity. The data on Indian feeds numbering around 750 pertaining to its general description, image, common names, usage in different species, production, availability and its composition (proximate, mineral, RDP/UDP), information on feed exports and imports, specifications for different raw materials and finished products like compound feeds, price structure of various feed resources including crop residues over the recent years from different regions have been uploaded in the portal. Information related to the livestock numbers, productivity and total production of important livestock produce like milk, eggs, meat and fish are also provided. A database of the compiled information has been developed by creating tables and integrating those using MYSQL RDBMS.

Snap shot of portal - Feed resource description

A matrix of 750 feed resources with composition, mineral topography, rumen degradable and undegradable protein contents and amino acid profile have been scaled

Enhancing bio-availability of nutrients for increasing production efficiency 2

Project 2.3: Assessing the methane production potential of commonly available ruminant feeds and the efficacy of plant tannins as methane suppressants

R Bhatta and V Kumar

Besides environmental pollution, methane emission from ruminants represents a loss of the dietary energy (6-8% of the GEI). This loss is significant in the context of animal production system being practiced in India, as feed cost alone represent 60-70% of the total cost of animal production. Therefore our livestock production strategies should be to aim at eco-friendly sustainable livestock production, which accounts for minimum methane generation. Therefore, research efforts are needed in this direction so that we are able to find out practical solutions for reducing methane production through dietary intervention.

The objective was to assess the potential of tannins from tree leaves as methane suppressants. For that three most promising tree leaves identified during extensive *in vitro* studies have been further screened using a basal diet containing 'no-tannin'. As the tannin level increased in the total mixed ration (TMR), the methane suppression also increased linearly. The plateau was recorded at 10-15 percent tree leaves inclusion in the TMR. The rumen fluid from the sheep was subjected to NGS and it is compared with the rumen fluid from treatment to determine the effect of tannin on rumen microbial diversity. The major methanogen from sheep rumen were identified.As the tannin level increased in the total mixed ration (TMR), the *in vitro* methane suppression also increased linearly.

The incorporation of 10 % jack leaves in the TMR has shown significant improvement in the daily weight gain of lambs.

Twenty four lambs were divided into 4 groups of six each. Three experimental diets were prepared containing 10 percent each of selected tree leaves. The diet without any tree leaves served as the control. The feeding trial was conducted for 90 days and a digestion trial was conducted for 7 days. The DMI (g/kg BW) were 35.7, 34.2, 36.1 and 34.7, respectively in T0, T1, T2, T3 and T4, respectively with their ADG (g/d) being 65, 67, 79 and 66, respectively. The DMD were 76.5 in control and 74.4, 75.8 and 72.8 in experimental groups, respectively. The incorporation of jack leaves at 10 % in the TMR has shown significant improvement in the daily gain in lambs.

As the tannin level increased in the total mixed ration (TMR), the in vitro methane suppression also increased linearly. The incorporation of 10 % jack leaves in the TMR has shown significant improvement in the daily weight gain of lambs.

Project 2.5: Production of lignolytic enzymes from white rot fungi through immobilization and their efficacy in enhancing digestibility of crop residues

S Manpal, R Bhatta and A Dhali

Chemical transformation catalysed by enzymes is a prime approach for exploitation of crop residues but their use is limited by factors such as high cost, instability and solubility in aqueous media. Immobilization means associating enzymes with an insoluble matrix so that it can be retained in proper reactor geometry for its economic reuse under

stabilized condition. Immobilized enzymes are of greater purity, greater control over enzymatic reaction as well as high volumetric productivity with lower residence time and are highly stable as compared to native enzymes.

The objectives of this project were to screen various matrices for immobilization of white rot fungi for obtaining maximum yields of the lignolytic enzymes; to characterize the lignin modifying enzymes viz. MnP, LiP and laccase produced by various promising species of white rot fungi under different culture conditions and to determine factors affecting their maximum production and to optimize the quantity of enzyme required for treating straw for maximum efficiency in enhancing *in vitro* and *in vivo* digestibility.

The effect of treating ragi straw with lignolytic enzymes harvested from *Coriolus versicolor* and *Ganoderma lucidium* in a 1:2.5 (w/v) ratio both individually and in combination on the in *vivo* digestibility and body weight changes in sheep was evaluated. After 7d of immobilization, enzyme rich media from both the fungi were used for treating ragi straw of 2.3 cm length at a concentration of 1:2.5 by spraying at room temperature overnight. Four groups of sheep (5-each) were fed with 350 g concentrate mixture to meet the energy and protein requirement. In addition, control group of sheep received *ad lib* untreated ragi straw, test group 1 (Gp1) received *ad lib* ragi straw treated with enzyme media from *C. versicolor* (Enz. 1) while group 2 (Gp 2) received *ad lib* amount of straw treated with enzyme media from *G. lucidium* (Enz. 2) and group 3 (Gp 3) received *ad lib* amount of straw treated with a mixture of the enzyme Enz. 1 and Enz. 2 in an equal volume.

The initial body weight was similar among the groups (24.0 ± 0.2 kg). After 40- days of feeding trial, the total gain in control, Gp. 1, Gp 2 and Gp 3 were 3.90, 4.50, 4.30 and 3.90 with a corresponding ADG (g/d) of 97.5, 112.5, 107.5 and 97.6, respectively. The DMI was higher in Gp 3, as compared to control and Gp1, whereas it reduced in Gp2. Five units improvement in the DMD in Gp 1 and Gp 2, compared to that of control was recorded. However, when the straw was treated with the combination of both the enzyme it failed to improve the digestibility. Although there was no significant difference in the pH and TVFA of the rumen fluid collected 4-h after feeding, the NH_3-N and protozoa count increased in Gp-2 and Gp-3.

The rumen pH in the control group at 0 hr was 6.67 ± 0.22 while in the experimental groups it was higher ($P>0.05$). Feeding treated straw recorded high activities of xylanase in groups II (62.4 units) and III (65.5 units) as compared to 59.44 units in control. Protease activity elicited a similar trend with group II and III recording high activity of 5.67 and 3.71 units while control sheep showed only 2.15 units. Activities of other fibrolytic enzymes also recorded favorable changes as compared to the control group.

Production of lignolytic enzymes by immobilization on Poly Urethane Foam (PUF)

Treatment of coarse roughages such as ragi straw with enzyme media from white rot fungi improved rumen enzyme activity and fibre digestibility

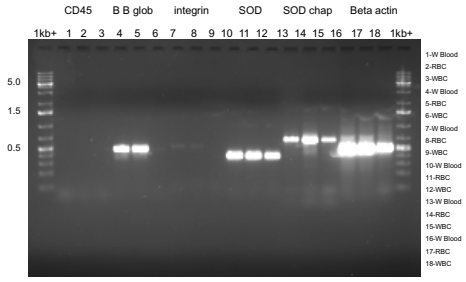
Project 2.8: Evaluation of copper chaperone for SOD (CCS) as a sensitive biomarker of copper deficiency in sheep

DT Pal and J Ghosh

Genes that change their expression levels in response to dietary copper availability may constitute potential biomarkers of copper status in animals. The insertion of copper into SOD1 is dependent on the copper chaperone for SOD1 (CCS). In this study, the possibility of the expression level of CCS reflecting copper status and serve as a useful marker of copper status was explored. The study has been undertaken to evaluate the transcriptional and post-translational regulatory mechanism of this protein in response to dietary copper.

As the peripheral blood was our main target for using CCS as molecular marker, the different blood cell marker gene primers were designed and synthesized for testing the presence of those genes in whole blood or cellular fractions. The RNA isolation has been made from whole blood as well as from the different cellular fractions of blood and confirmed the presence of CCS and SOD1 genes in peripheral blood cells.

A feeding trial with Cu-adequate (10mg/kg) and Cu-deficient (3mg/kg) in sheep was carried out and the copper status was monitored using following traditional biochemical markers. After 3months of feeding a semi-purified diet (3mg/kg Cu), there was decrease in 28.02% of plasma Cu, 35.76% of RBC-Cu, 27.42% of ceruloplasmin and 15.15% of plasma SOD and 27.02% of RBC-SOD activity in Cu-deficient sheep.



RNA isolated from whole blood as well as different cellular fractions and tested the presence of target genes by PCR amplification

In the process of developing useful biomarkers for assesiing the copper status in sheep the partial sequences of sheep β-actin, SOD and CCS genes, derived from the ovine hepatic tissues were characterized

Project 2.9: Mineral solubility in rumen from mixed rations and its effect on rumen fermentation and animal performance

KS Prasad and DT Pal

Studies on mineral release in rumen from individual forages and feed ingredients were conducted. The concept of total mixed rations is picking up and it enhances the digestibility of feed in rumen, but the studies on rumen release of minerals in mixed rations are scanty. Hence the present study is taken to record the release of minerals from total mixed rations in the rumen and to study the effect of Total mixed rations with & without mineral supplementation on the performance in sheep.

In sacco study was conducted for 72 h with 60:40 paddy straw and concentrates and with and without Ca, Cu, Zn & Mn supplementation (2 % and 2.5%). There was an increase in IVDMD, NH_3-N in mineral supplemented groups.

Improved IVDMD in mineral supplemented groups compared to control group indicated positive impact of minerals on nutrient utilization

Biochemical indices indicating copper status in sheep

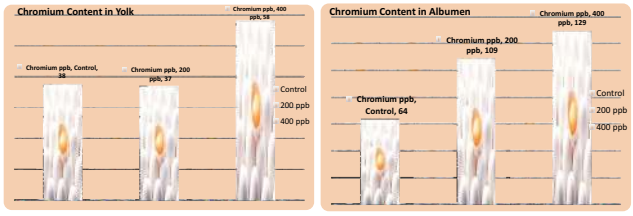
	Cu - Adequate		Cu - Deficient	
	0 day	90 day	0 day	90 day
Plasma Cu (mg/L)	1.62 ± 0.24	1.91 ± 0.22	1.57 ± 0.20	1.13 ± 0.10
RBC - Cu (mg/L)	1.37 ± 0.28	2.03 ± 0.17	1.51 ± 0.27	0.97 ± 0.11
Ceruloplasmin (mg/L)	161 ± 25.3	190 ± 8.68	140 ± 12.0	102 ± 11.7
Plasma SOD (units/ml)	13.6 ± 0.26	14.5 ± 0.21	13.3 ± 0.28	11. 3 ± 0.18
RBC - SOD (units/ml)	21.3 ± 1.24	24.20 ± 0.54	21.3 ± 0.93	15. 6 ± 0.65

Project 2.12: Identification of molecular mechanism in stressed layer chicken fed with chromium

D Rajendran and A Dhali

In recent years chromium is used as stress alleviating nutrient during thermal and vaccination stress. As inorganic chromium (chromium chloride) is less bio-available, organic chromium has been tried to alleviate stress. Cr complex with yeast exhibits the highest magnitude of biological activity. Elucidation of the interaction between stressors and cellular response and alleviation of this response by chromium supplementation would provide a better insight in understanding the role of Cr in alleviating stress. Preliminary study with organic chromium has shown positive response in alleviating stress in layers recovering from Newcastle disease.

Use of chromium enriched yeast has given good response. However the cost of production was higher in case of yeast. The alternative method was tried for production of organic chromium. Laboratory level trial was conducted to enrich chromium content in azolla. 0, 2.5, 5, 7.5, 10, 12.5, 15 and 50 ppm level of chromium chloride was added in the medium and found that 12.5 ppm level of chromium in inorganic form would be optimum for Cr enrichment as well as yield. The cost of production of chromium enriched azolla is 10 times lesser than the cost of chromium enriched yeast. It was found that supplementation of the chromium yeast at 400 ppb can reduce the cholesterol content of the yolk and increases the chromium content in stressed layer.



Effect of supplementation of Chromium on egg content

Chromium enriched yeast was produced by supplementation of chromium chloride in growth medium. At 12.5 ppm level of chromium chloride high yield of Azolla and Cr enrichment was achieved

Project 2.13: Production of recombinant expansins and its possible utilization for improving fibre degradability

A Dhali and S Manpal

Despite many efforts, improvement of the degradability of coarse feed materials in the rumen remains a major challenge. Expansins are a class of plant proteins that enable and regulate the extension of plant cell walls. Considerable evidences are there on its role in cell wall loosening by disrupting the bonds within cellulose microfibrils and between the other cell wall polysaccharides and the microfibrils. Therefore, fibre digestibility of the coarse feed materials treated with these proteins may be improved due to better cellulose availability. Hence, the current research project has been taken up with the objectives; 1) standardizing the methods of producing recombinant expansins in microbial system, and 2) investigating the role of recombinant expansins on fiber degradability *in vitro*.

The expression of tomato expansin was attempted in two different *E coli* strains. Transformed cells were grown in LB medium and protein expression was induced with suitable inducer at 25°C and subsequently cultured in the same temperature for 10-11 h. Targeted protein was found to be expressed only in one *E coli* strain and it was located in the inclusion body (Fig 1). The expressed protein was purified from inclusion body under denaturing conditions to confirm the identity of the targeted fusion protein with HQ tag (Fig 2).

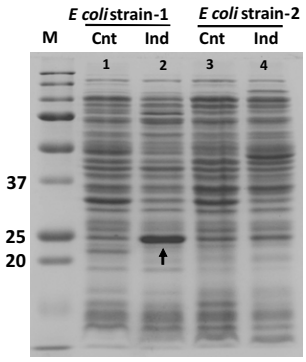


Fig 1. Prominent expression of a protein of expected molecular weight (~27 kda) was observed in E coli strain-1 (Lane-2). M: molecular weight marker; Cnt: control cells; Ind: induced cells

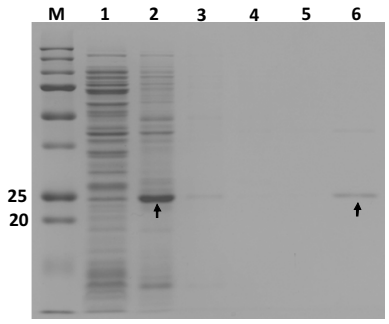


Fig 2. Expressed protein was purified under denaturing condition through affinity chromatography using Ni-NTA resin

M: molecular weight marker; Lane-1: soluble cell extract; Lane-2: purified Inclusion body; Lane-3: column flow through after resin binding; Lane-4: wash buffer, pH 6.3; Lane-5: elution buffer-1, pH 5.9; Lane-6: elution buffer-2, pH 4.5

Targeted protein was found to be expressed only in one E coli strain and it was located in the inclusion body. The expressed protein was purified from inclusion body under denaturing conditions to confirm the identity of the targeted fusion protein with HQ tag

2.14. Dietary manipulation for production of Omega-3 enriched chicken meat

A Mech, V Sejian, R U Suganthi and C G David

Recently ω-3 fatty acid enriched functional foods are becoming very popular among consumers due to its health benefits. Linseed (*Linum usitatissimum*) oil is one of the richest dietary sources of α-linolenic acid. Nevertheless, a widely encountered problem of such dietary supplementation has been oxidation of unsaturated fatty acid in muscles resulting in rancid flavor and deterioration in meat quality. Several spices used in traditional Indian cuisine have been shown to possess antioxidative properties; curryleaf (*Murraya koenijii*), ginger (*Zingeber Officinale* Roscoe) and turmeric powder (*Curcuma longa*) to name a few. This study investigates the effect of dietary curry leaf, ginger and turmeric powder supplementation on overall performance, meat antioxidative status and fatty acid profile of chicken fed with linseed oil. The focal endeavour of this project is to exploit the possible utilization of natural antioxidants as dietary supplement to prevent lipid per-oxidation in ω-3 PUFA enriched poultry meat and thus improving the meat quality especially the functional meat produced through dietary ω-3 fatty acid supplementation.

The recovery of methanolic extract of natural antioxidants from curry leaves, turmeric and ginger was 9-15%.

2.15 Precision feeding in relation to protein for enhancing milk production performance in cattle

M Chandrasekharaiah, MN Soren and SBN Rao

Microbial protein plays an important role in protein nutrition of ruminants, as more than half of the amino acids absorbed in the ruminants are derived from the microbial protein synthesized in the rumen. The microbial protein synthesized in the rumen may not be sufficient to meet amino acids/protein needs of high/medium yielding cows and hence a substantial amount of dietary metabolizable protein must be fed to achieve higher milk production. Therefore, this project has been initiated to develop strategic protein supplements in order to enhance milk production without affecting microbial protein synthesis and to make the best use of more expensive protein supplements. On farm trials in lactating crossbred cows in under progress.

Improving productive and reproductive efficiency through physiological and nutritional interventions 3

Project 3.9: Biophysical translation of nutrients during ovulatory cycle in domestic hen: Biomineralization of the egg

CG David, RK Gorti, RU Suganthi, A Mech and HP Amaladhas (SRS of NDRI)

In poultry industry, an estimated 13 to 20 per cent eggs produced are cracked or broken between oviposition and retail sale which causes substantious loss. Improving the egg shell quality will combat the above crisis. However, factors responsible for egg shell quality and the basic mechanisms involved in the biomineralization of egg are not fully understood. Hence, improving egg shell quality warrants a comprehensive research to understand the basic mechanisms that are responsible for better egg shell quality through improved biomineralization of the egg.

Moulting has been *in vogue*, which improves egg production and also shell quality. The precise mechanism behind the improved shell quality is not fully understood. The causes for better intestinal absorption of calcium, and improved post moult egg production with better egg shell quality in layer birds largely remain obscure with the role of various specific proteins in the oviduct, egg shell gland, and shell membrane and in the egg shell itself following moulting. Hence, this study has been taken up 1) to study the mechanism behind biomineralization involving absorption, secretion and transformation of dietary calcium to calcium carbonate during ovulatory cycle in layer chicken and 2) to unravel the physiological basis of biomineralization during transition from moult to post moult production period.

An age associated decline in the eggshell breaking strength was observed which improved in eggs laid during the post moult production period. The deterioration in the eggshell strength was associated with concurrent decline in the duodenal calcium uptake and carbonic anhydrase activity in the egg shell gland. On the other hand the deterioration in egg shell strength was not associated with variation in the presence or absence of various matrix proteins in the egg shell.

> Age associated deterioration in egg shell quality may be related to decrease in absorption of calcium from the duodenum and activity of CA in egg shell gland and may not be due to variation in the matrix protein of the egg shell

Project 3.10 : Effect of dietary energy on endocrine and immune responses and reproductive performance in sheep

CG David, A Arangasamy and A Mishra

The basic information on the effect of dietary energy to be supplemented with protected fats is lacking in the Indian breeds of sheep as well as in the breeds obtained by cross breeding with exotic sheep for breed improvement. If the dietary energy in the form protected fat is utilized better for inducing early maturity and better reproductive performance in sheep instead being wasted during the microbial metabolism in rumen then this technology can be

transferred to farmers for obtaining better monetary returns.

To determine the effect of dietary energy on endocrine and immune responses and reproductive performance in sheep, feeding trials were conducted with different energy (standard level and 20 per cent higher) using bypass fat (Megalac™) in ewe lambs. The results indicated that rreproductive performance was better in the animals fed with higher energy requirement than the group of animals fed normal energy. Ewe lambs fed by pass fat showed early onset of puberty compared to those fed on standard control diet (100 % vs. 50 %) i.e. within 15 days of ram introduction, towards the end of non breeding season. Ewes fed on high energy ration had 85.7% conception rate compared to 66.7% ewes fed on standard control ration.

Feeding of protected fat to increase the energy intake of the growing ewe lambs significantly improved the onset of estrus and conception rate

Project 3.11: Development of fertility diagnostic test(s)/ kit in assessing bull fertility

S Selvaraju, JP Ravindra, D Rajendran and A Arangasamy

Presence of sub-fertile bulls may lead to reduced fertility and economic loss to the dairy industry. It has been established that no single test is sufficient to predict fertility. Therefore, for breeding soundness evaluation to select fertile bulls warrants inclusion of functional and molecular tests. Hence objective of the project is to select suitable fertility diagnostic test(s) for assessing bull fertility that can be amalgamated to produce diagnostic kit to rule out sub fertile bulls in breeding programmes to augment reproductive performance.

Metabolic hormones such as T_3 and T_4 showed that T_3 was significantly (P<0.01) lower in below average fertile bulls compared to above average fertile bulls (table1). Testosterone (serum), IGF-I (serum and seminal plasma), T3 (serum) and T4 (serum) levels were not influenced (P>0.05) by the presence or absence of 26.5kDa protein.

Differences in circulating levels of T3 and T4 hormones between bulls showing above and below average conception rates (the average conception rate (CR) was 52%)

	CR below average (n=7)	CR above average (n=9)
T3 (nmol/L)	1.69 ±0.1[a]	2.21±0.1[b]
T4 (nmol/L)	54.5 ±9.7	44.14 ±3.5
CR (%)	46 ± 2.27	57.2 ±1.0

Means bearing different superscripts differ significantly (p<0.05)

T3 is significantly lower in bulls with low fertile compared to high fertile hence, T3 could play a plausible role on conception rate

3.13: Elucidation of mechanisms of perturbation of ovarian functions by ammonia

S Nandi, PSP Gupta and S Mondal

Blood and follicular fluid ammonia concentration, rather than BUN, illustrate the undesirable effects of protein metabolites on reproductive parameters. However, mechanism is unclear. Hence, the study was undertaken a) to determine ammonia concentration in ovine follicular fluid (FF) and mechanism of accumulation of ammonia in FF and b) to analyze mechanisms through which ammonia influences the ovine ovarian functions

Both *in vivo* and *in vitro* approaches were undertaken to elucidate the mechanisms of ovarian dysfunctions by ammonia. Adult cycling ewes were estrous synchronized and made into three groups: a) Group I (n=10): Maintenance Diet, b) Group-II (n=10): High ammonia producing diet using urea feeding, c) Group-III (n=10): High ammonia producing diet using urea feeding + Soluble sugar (jaggery). Supplementation of soluble sugar reduced the urea and ammonia levels in blood, urea

but not ammonia levels in follicular fluid. Ewes fed with high ammonia generating diet though exhibited natural estrus had significantly lower levels of estradiol and progesterone compared to control diet. Low metabolic activity of granulosa cells (GC) was observed in ovarian follicles of ewes fed with ammonia generating diet and in ammonia conditioned GC as evidenced by MTT assay. The effect of glucose (0, 1, 1.5, 2.5, 5 and 10 mM) as energy source was tested on maturation of oocytes conditioned with 300 µM of ammonia. It was observed that addition of glucose (1.5 mM) improved the maturation rate in ammonia conditioned oocytes however; higher concentration (5, 10mM) decreased the maturation rate. Granulosa cells recovered from ovaries of *in vivo* treated ewes and granulosa cells cultured under influence of ammonia were examined for apoptosis by hematoxylin –eosin stain. Apoptosis of GC were significantly higher in ovaries of ewes fed ammonia generating diet as well as ammonia conditioned granulosa cells.

High protein diet increase ammonia level in follicular fluid which could not be completely compensated by supplementation of soluble sugar. High ammonia level in follicular fluid impairs the functions of oocytes and ovarian somatic cells. Oocyte quality is compromised in animals fed with imbalanced diet though animal may come to heat.

3.14 Suppression of prolactin gene expression during the *ex ova* period in birds

I J Reddy, A Mishra and HNN Murthy

Control of serum prolactin (PRL) by chemical and active immunization methods against PRL and its releasing hormone VIP decreased PRL and enhanced egg production in birds, but had certain limitations at field level. Control of higher levels of PRL may lead to improved reproductive performance thereby leading to enhanced egg production. Therefore, studies were taken up to control higher levels of PRL by using RNA interference in hen anterior pituicytes.

An *in vitro* study was conducted in primary cultured anterior pituicytes obtained from 72 and 82 weeks old whiteleg horn (WLH) hens to knock down the PRL gene expression by RNA interference and also for assessing its role on the PRL, PRL mRNA, protein content of PRL, prolactin receptor (PRLR) and growth hormone (GH) mRNA. Designed three si RNAs for PRL based on turkey and chicken prolactin mRNA. Three silencers were designed using algorithms with two tt overhangs to knockdown PRL and best one would be selected based on knock down of PRL content in *in vitro* anterior pituicytesa.

Sense:CGAAGGCUGUAGAGAUUGAtt:AntisenseUCAAUCUCUACAGCCUUCCag. Length: 21:21: Percent G/C:29%:48% Molecular Weight:6900:6500: Molar: 220600:197200: Annealed MW: 13400 bSense: CCAGACUCUUUGCUUUUUAtt:

Antisense UAAAAAGCAAAGAGUCUGGag. Length: 21:21: Percent G/C: 29 %: 38% Molecular Weight: 6600: 6800. Molar: 196400: 228300 Annealed MW: 13400 c.Sense:GUUUUGAAGUGCCGCCUAAtt:Antisense.UUAGGCGGCACUUCAAAACtt Length: 21:21: Percent G/C: 29%:43% Molecular Weight: 6700:6700. Molar: 204100:203400 Annealed MW: 13400. A stable and chronic suppression of prolactin during early stages of embryonic development in chicks by using siRNA transfection vector may lead to higher egg production in native and dual purpose hens.

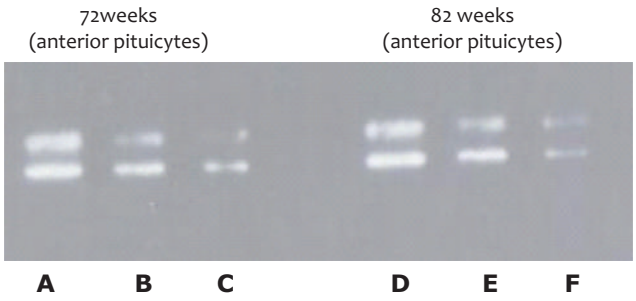


Fig. 1(a-f): PRL expression in control and siRNA transfected anterior pituicytes with VIP stimulation(5×10-7M) and without VIP stimulation in primary cultured cells of anterior pituitary glands obtained from at 72 and 82 weeks of age in domestic hen. PRL gene was clearly suppressed (C and F) following RNA interference.(A): Control, (b): siRNA with VIP, (c): siRNA without VIP, (d): Control, (e): siRNA with VIP and(f): siRNAwithout VIP

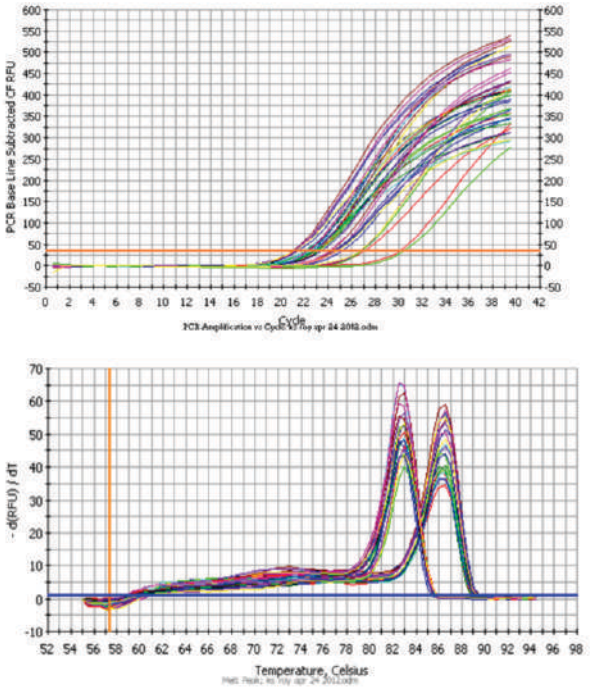
Project 3.15: Expression of HSP70 mRNA in visceral organs of broiler chickens under acute heat stress

K S Roy, S C Roy and J Ghosh

The objectives of this study were to detect the localization of HSP70 in visceral organs of broiler birds and to find out the relationship between the expression of HSP70 mRNA and protein.

The HSP70 in visceral organs namely heart, liver, brain and skeletal muscle has been detected. The total RNA yield was higher in heat-exposed birds in comparison to control group of birds. The HSP70 mRNA expression study through Real time PCR showed that in brain and skeletal muscle, the expression was up-regulated in heat exposed birds. The level of HSP70 was higher in the tissue lysates of heart, liver and skeletal muscle in comparison to control.

Real time PCR for HSP70 gene in different tissues of acute heat stressed broiler chickens



Ct values and Fold changes in the level of HSP70 mRNA in control and heat exposed broiler chickens

	HSP70	GAPDH	ΔCt	ΔΔCt	Fold Change
Brain Control	22.89	17.74	5.15		
Treatment	21.95	17.26	4.69	-0.465	1.38031735
Heart Control	20.91	16.82	4.09		
Treatment	21.98	17.71	4.27	0.18	0.882703
Liver Control	22.92	18.19	4.73		
Treatment	26.69	21.32	5.37	0.64	0.64171295
Kidney Control	22.86	18.37	4.49		
Treatment	24.40	19.69	4.71	0.22	0.85856544
Muscle Control	21.64	13.67	7.97		
Treatment	21.14	14.41	6.74	- 1.235	2.35381347

HSP70 expression study revealed that in brain tissue and skeletal muscle, the level of expression was up-regulated in heat exposed birds in comparison to control

3.16 Skewing sex ratio through nutritional manipulation in rat

A Arangasamy, S Selvaraju, D Rajendran and JP Ravindra

Production of calves of desired sex using sex selected semen will be helpful to improve farm productivity and economy of the farmer. An attempt was made to check the theory of Stolkowski which hypothesizes that mineral (Na, K, Ca, Mg) imbalances in the diet of the female before fertilization affects the sex ratio of the progeny.

A study was undertaken to determine the effect of calcium and magnesium administration in rats on skewing sex ratio. Administration of 3% calcium (2% in drinking water and 1% in feed) and 0.4% magnesium (drinking water) for 15 days preceding mating period resulted in no change in skewing of sex ratio. However, when administered for 21 days including the 7 day mating period resulted in skewing of sex ratio by 6.75 %. In another trial 1 % Ca and 1% Mg was supplemented in water to breeding female rats for 21 days including during breeding time. The sex ratio was skewed by 3.85 %.

There was a non-significant change in serum mineral profile of Ca, Mg, B, Cu, Fe between control and treatment groups, however significant ($P< 0.01$) decrease in the level of serum P from day 1 to day 15 in rats supplemented with calcium and magnesium was observed. Testosterone levels in serum and follicular fluid showed minor variation between the groups. There was a non-significant decrease in levels of T_3 in rats supplemented with calcium and magnesium. On the other hand a significant increase in the level of T_4 was observed in rats supplemented with calcium and magnesium.

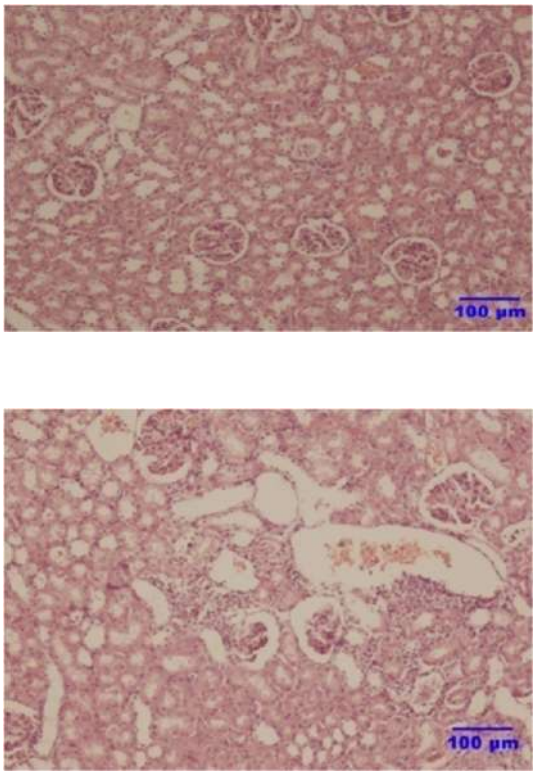


Fig 1 Tubular and glomerular damage infiltration of mononuclear in the interstitial space

Histomorphology of major visceral organs, *viz.*, liver, spleen, heart and lungs, did not show any major changes between the groups. However, there was glomerular and tubular damage and infiltration of mononuclear cells in the interstitial space of kidney of rats supplemented with calcium and magnesium.

Feed quality and safety 4

Project 4.2: Feed microscopy: An advanced method for evaluation of feed quality in animal nutrition

SBN Rao and S Jash

This project was taken up with twin objectives of documentation of microscopic structures of feedstuffs and adulterants using feed microscopy and application of latest image analytical techniques for detection of adulterants in feedstuffs. Energy supplements (maize grain, broken rice, sorghum grain, pearl millet, finger millet, coarse millet), protein supplements (soybean meal, ground nut meal, cotton seed meal, copra meal, mustard meal) and milling by-products (rice bran, rice polish, wheat bran, outer coating of wild bean, pea husk, gram husk) were examined under the microscope and documented. Potential adulterants like saw dust, paddy husk and urea were also documented. Saw dust and paddy husk could be detected microscopically when mixed with bran using this technology. A variety of mineral salts like calcium carbonate, di-calcium phosphate, copper sulphate, zinc sulphate, sodium sulphate, cobalt sulphate, common salt were documented. Similarly potential adulterants used in the mineral mixtures like brick powder and silica particles were also documented. An Image database was constructed for easy viewing of documented structures (Fig 1).

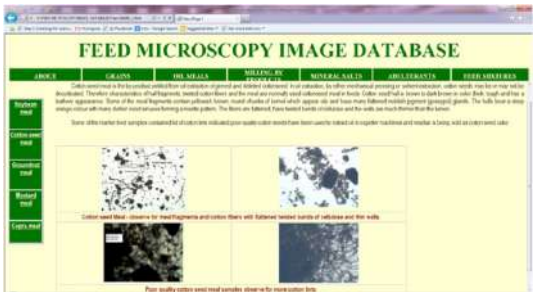
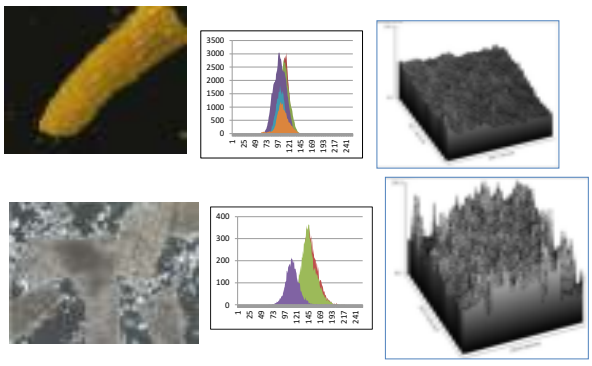


Fig 1: Feed image database depicting documented structures of cottonseed meal

Another important part of the study was to apply advanced image analytical tools for detection of adulterants in the feed stuffs. Particle measurements like area and perimeter of the fine feed particles were determined. Surface plots have been performed on few ingredients to find out some of the characteristic patterns. It is possible to quickly detect adulterants from feedstuffs by using feed microscopy coupled with image analysis which will be a useful tool for feed manufactures (Fig 2).



Identification of rice bran from paddy husk on the basis of feed microscopy and image analysis (Original image, histogram and surface plots)

Fig 2: Application of image analysis for detection of adulteration

Microscopic structures of commonly available feed ingredients and materials suspected to be adultrated in retail chains were documented using bright field microscopy coupled with top illumination.
Image characteristics of documented structures were found out using Image analysis software. This could be a conlusive and useful tool in identifying adulterants in feeds

Project 4.3: Evaluation of selected herbal products to prevent aflatoxicosis in broilers

RU Suganthi , CG David and KS Prasad

Aflatoxins are produced by the fungi *Aspergillus parasitcus* and *Aspergillus flavus*. Contamination by the fungi alters the nutritional quality of feeds whereas consumption of aflatoxin contaminated feed by poultry affects liver and egg production. Hence this project was formulated with the objectives to screen locally available herbal products for their potent antifungal, antioxidant and/ or aflatoxin binding effect under in *vitro conditions* and to evaluate the effect of supplementation of selected herbal products in preventing aflatoxicosis in broilers

Various herbal products were studied for their antifungal effect against the aflatoxin producing fungi, *Aspergillus parasiticus*. The products tested included spices, oils, pulp of fresh vegetables, fresh leaves, roots, seeds and tubers. All the products were added at the concentration of 1.0% to the potato dextrose agar media. Among the products studied, oil of *Cymbopogan citratus* (lemongrass) inhibited *Aspergillus* growth by (41%) and produced tiny colonies without spores (Fig.1).

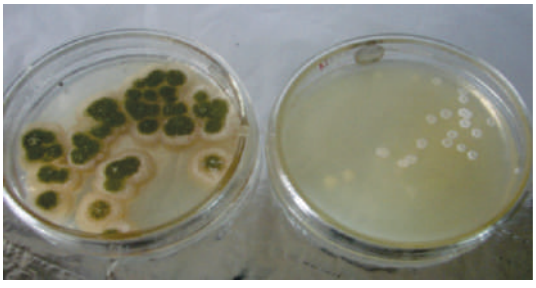


Fig.1. Effect of *C. citratus* on growth of *A. parasiticus*

Fresh leaves of *Azadirachta indica, Cyanodon dactylon, Citrus limonum, Ocimum sanctum* and the pulp of *Zingiber officinale* and *Capsicum frutescens* inhibited fungal growth by 7-25%. The oils of *Azadirachta indica, Olea europaea, Brassica juncea, Linum usitatissimum, Ricinus communis* and the other products studied did not show any fungicidal effect.

Under *in vitro* conditions, the oil of *Cymbopogan citratus* exhibits antifungal effect against Aspergillus *parasiticus* isolated from various sources.

Project 4.4: Study on metabolic effects of fluorosis and strategies for its counteraction

NKS Gowda, D Rajendran and P Krishnamurthy

Fluoride is a cumulative toxin ingested by livestock mostly through water. Effort was made to study the ameliorative effect of boron and calcium chloride against fluorosis in growing rats. Boron and calcium chloride at 50 ppm level was supplemented to water containing 30 ppm of fluoride and offered to growing male rats. The changes occurred in bone and teeth of rats due to ingestion of 30 ppm of fluoride in water for a period of 4 months were completely ameliorated due to supplementation of 50 ppm of boron and calcium chloride in water.

Boron and calcium chloride supplementation in water ameliorates fluorosis.

Bioinformatics, knowledge management and technology translation 5

Project 5.5: An expert system for computation of balanced ration for dairy animals in Karnataka

P Khandekar and G Letha Devi

Feeding accounts for more than 65 per cent of the recurring cost, hence any improvement in this will improve productivity. There is a great need for an intuitive knowledge based system, which may suggest the balanced feeding for dairy animals. The objectives of the project were to design and develop an expert system for computation of balanced ration based on the selectable ingredients available locally for dairy animals and to evaluate the expert system under field conditions for the use by the dairy farmers.

An expert system on balance feeding for dairy animals has been developed using Visual Basic as front-end for visual tools and MS Access as back-end for database. The database consists of two main data tables. 1. Feed requirement: contains data related to feed and nutrient requirement, animal category, animal body weights and milk yield in terms of DM, CP, TDN, Digestible Energy, Ca, P, CF etc. 2. Feed availability: consists the name of the feed, its compositions. The system is developed based on Least Cost Ration (LPP) techniques. It is user friendly and provides instant solution.

Project 5.6: Web based knowledge management system for animal nutrition and physiology

UB Angadi and G Letha Devi

Web based knowledge management system documents, protects and disseminates expert knowledge to the end-users in both animal and location wise in a personalized and timely manner. It also offers power to communicate, interact, exchange knowledge instantly among farmers, researchers, decision makers and industries worldwide within short period. Information can be accessed any time by the users. The objectives of the project was to develop a module to establish strong linkages between farmers, researchers, students, extension workers, industries and decision & policy makers with a single window delivery system. The proposed system encompasses the following three modules.

Module I-Animal and Feed Resources Module: Database has been created in MySQL for the module and uploaded the data of animal and feed resources into the database. The feed and animal resources module contains district level animal and feed resources data of all states for the period of 1985 to 2012.

Module II-Research Information Module: Database created using MYSQL RDBMS and collected the data regarding institute research projects since 1995 to till date, publications from the project have been uploaded into the database.

Module III- Knowledge Dissemination Module: A stand-alone knowledge system has been developed

to facilitate dissemination of knowledge in rural areas where internet facility is not available. This module consists general information and mandate of the institute, publications in PDF form, videos and images. This module also has "Feed Assist" for advising farmer to feed dairy animals as per expert's recommendation with available feed resource, based on least cost formulation.

Web based knowledge management system has been initiated and home page has been developed. Standalone knowledge dissemination system has also been developed to disseminate knowledge and new technologies in rural area where internet facility is not available.

Project 5.7: Application of statistical and bio-informatics tool for analysis and modeling of genes related to production and reproduction in livestock

RK Gorti and KP Suresh

The project was undertaken to develop a) database of gene sequences available in the public domain on improving the productive and reproductive efficiency (Selected traits) ; b) suitable statistical procedure to predict the class of genes associated with productive and reproductive traits and c) statistical procedure to predict the pattern of gene sequence in predicted class

Data collection (30 number of DNA gene sequences for milk yield from public domain), application of Markov models to predict the significant pattern or short sequence.

Different genome sequences of *Bos taurus* were obtained from database of National Center for Biotechnology Information(NCBI).Different genome sequences are cathepsin S, cathepsin L2, cathepsin H, cathepsin O of different chromosomes. These genomes are checked for different motifs using Motif Scan Software.

Finding all known motifs that occur in a sequence is known as Motif scanning. Using Motif Scan Software, we checked for possible domains present in the genome sequences obtained from NCBI. In the output we got information like model, domain, sequence start and terminal, score, E-value and motif sequences. Further studies have to be done on the motifs we got regarding their significance in protein binding.

5.8: Sustainability of dairy farming as a means of livelihood

G Letha Devi and P Khandekar

Dairying is a major occupation in rural India providing substantial employment and income. There is a need to understand livelihood security of the livestock farmer and its different dimensions to find out the lacunae and suggest suitable measures for improving their quality of life. The objectives of the project were to assess the socio-cultural, economic and ecological sustainability of dairy farming, to assess the level of livelihood security of dairy farmers in Karnataka and to identify the extension needs in achieving livelihood security of dairy farmers

Interview schedule and an equal interval scale for measuring the livelihood security of farmers have been developed. Reliability and validity of the interview schedule has been tested.

Externally Funded Projects

AICRP

Improvement in animal feed resources and nutrient utilization for raising animal production

Programme coordinator: **Dr. CS Prasad**

NKS Gowda and DT Pal

Phosphorus is one of the most limiting mineral in livestock and efforts are required for its better utilization. One of the strategies is to use it in nano form. An effort was made to evaluate the nano-phosphorus prepared at TANUVAS, Chennai. Nano-P prepared (NCP) from dicalcium phosphate was analysed for mineral content and compared with dicalcium phosphate (DCP). The NCP was incorporated in the semi-purified diet of growing rats at 50 and 100% level replacing DCP. Feeding trial was conducted for 45 days and data on feed intake, fecal mineral outgo, mineral content in bone and growth rate were recorded. The DCP contained 23.5% Ca, 16.9% P, whereas NCP contained 30.0% Ca, 15.6% P. The feed intake was lower and FCR was better in rats of 100% NCP incorporated dietary group. Gut absorption of P was more in NCP incorporated groups. Bone ash, Ca, and P contents were lower in 100% NCP incorporated dietary groups.

The utilization of nano – P was was marginally better than DCP in growing rats

Outreach Project

Estimation of methane emission under different feeding systems and development of mitigation strategies

Programme coordinator: **Dr. CS Prasad**

R Bhatta

Besides environmental pollution, methane emission from ruminants represents a loss of the dietary energy (6-8% of the GEI). This loss is significant in the context of animal production system being practiced in India, as feed cost alone represent 60-70% of the total cost of animal production. Therefore our livestock production strategies should aim at eco-friendly sustainable livestock production, which accounts for minimum methane generation. Generation of a database on methane production under different production systems adopting a common protocol would be useful in drawing mitigation strategies. The programme has twin objectives of assessing the methane production from ruminants fed ragi (finger millet) based diets and development of mitigation strategies using secondary plant metabolites.

The feed samples have been categorized as straws/by-products and concentrates. The methane production potential (MPP) is expressed as ml CH_4/ 100 mg truly digested substrate. Methane production was less in legume fodder than cereal fodder *(more soluble carbohydrate in legumes)*. The straws produced more methane than green fodder. Tree leaves produced comparatively less methane than green and dry fodder *(tannins)*. *In vitro* methane production was lower in TMR than dry fodder. In TMR, methane production decreased as the concentrate proportion increased. Feed ingredients have been catalogued based on their MPP.

An equation was developed to determine the MPP, based on the nutrient composition of the feed ingredient/ diet combination.

Fifty six tree leaves, medicinal and aromatic plants were screened for their phenolic constituents. The total phenol content among the samples ranged from <0.5 per cent to 9.0 per cent on DM basis. Seven samples contained more than 2 per cent CT. The HT content was more than CT in all the samples and its content varied from 0.5 to about 6 per cent. Out of the samples screened 37 samples showed up to 10 % methane suppression; 12 samples showed 10-20 %; 5 samples 21-30 % ; 8 samples 30-40 %; 5 samples 40-50% and 7 samples showed >50 % *in vitro* methane suppression. There was general reduction in the total protozoa count reflecting defaunation as one of the reasons for reduced methanogenesis.

Straws produced more methane than green fodder. Tree leaves *(tannins)* produced comparatively less methane than green and dry fodder. *In vitro* methane production was lower in TMR than dry fodder due to better fermentation. In TMR, methane production decreased as the concentrate proportion increased.

Evaluation of pineapple fruit residue to use it as livestock feed (NABARD funded)

CS Prasad, NKS Gowda and S Anandan

Silaging is a most practical method of preserving Pineapple Fruit Residue (PFR) and the nutritive value of PFR silage is better than maize green fodder. Pineapple is cultivated in states of Kerala, Karnataka, Assam and North- Eastern region. Out of the processed fruit, more than 70% is non-edible for human consumption and presently wasted. Due to high moisture and sugar content, the PFR is spoiled within 2 days. Hence, a research effort was made to preserve the PFR and evaluate it for nutritive value. Silage technology was adopted with or without anti-fungal agents to enhance the keeping quality. The PFR contained 7.50% CP, 56.0% NDF, 19.70% ADF, 1.26% lignin and 10.8 MJ ME / Kg on DM basis. The nutritive value of PFR was similar or better than maize green fodder. Silaging of PFR with or without 0.25% (w/w) urea was most effective in preserving PFR. Lactic acid content was highest and fungal count was least in PFR silage and good quality silage was prepared in 15 days period. Feeding trial in growing sheep using PFR as total mixed ration along with concentrate mixture at 65:35 ratio for 75 days showed similar growth performance and nutrient utilization as compared to maize silage fed sheep. No adverse effect was recorded.

Network Projects

Veterinary type culture – Rumen microbes

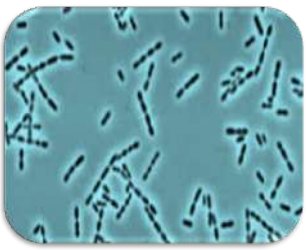
A Thulasi, D Rajendran and M Bagath

Anaerobic bacteria were isolated from domestic ruminants and identified based on morphology and the sequence homology of the DNA encoding 16S rRNA. All cultures submitted to the repository were given accession numbers. The number of cultures in the repository at present includes:

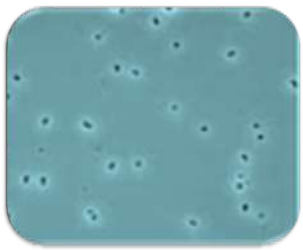
Fungi- 94 cultures (*Neocallimastix, Piromyces, Anaeromyces, Orpinomyces*)

Bacteria - 60 cultures (*Bacillus licheniformis, Butyrivibrio, Eubacterium limosum, Megashaera elsdinii (buffalo), Megasohaera elsdinii (oat) Olsenella sp., Prevotella sp., Streptococcus bovis, Streptococcus equines, Streptococcus gallolyticus, Streptococcus lutetinsis, Streptococcus sanguinis, Veillonella parvula*) and Clostridium *spp.*

Methanogenic archaea – 8 cultures (*Methanomicrobium mobile and Methanobrevibacter ruminantium*).



Ruminococcus spp



Ruminococcus albus

Monitoring of livestock related drug residues and environmental pollutants

KS Prasad, SBN Rao and DT Pal

The widespread use of pesticides in agricultural practices and use of certain insecticides as ectoparasiticides in veterinary medicine to control pests and residues of other environmental pollutants like heavy metals are directly/ through soil, water and feeds, lead to the presence of these residues in edible products of animal origin viz. milk, meat and eggs. International regulatory agencies like Codex and EU insist on developing nations to ensure residues of either drugs or contaminants below permissible limits. In this context, monitoring of drug residues and environmental pollutants in livestock products for human consumption is becoming necessary to address concerns of consumers and international trade. In this context this centre is monitoring environmental pollutants in soil, feeds, fodders and animal products.

The samples were collected from 3 villages which were around 5-9 km away from Bangalore - Tumkur National Highway (N.H-4), where large number of dairy farms exist and very less vehicle movements were seen. The samples of soil, water, fodder, feeds, milk, hair and dung obtained from these areas showed presence of Pb, Cd and As. The lead (ppm) is 12.66 in soil, 0.31 in water, 4.06 in fodder, 0.46 in milk, 12.38 in hair and 3.93 in dung. The corresponding values of cadmium were 4.29, 0.22, 3.1, 0.35, 8.72 and 2.98 ppm and Arsenic were 3.28, 0.034, 0.58, 0.17, 2.39 and 0.99 ppm.

Pb, Cd, & As are exceeding the MRL in some of the samples tested.
Pb is less in feeds where as Cd is higher than the permissible limits.

National fund for basic and strategic frontier application research in agriculture

Deciphering the mechanism of aberrant maternal recognition of pregnancy (MRP) events in sheep and buffalo under heat and nutritional stress

(Lead centre: NIANP; Co-operating centres- NDRI, Karnal & CSWRI, Avikanagar)

S Mondal, IJ Reddy, S Nandi and PSP Gupta

The survivality of embryo during early embryonic life is solely dependent on the efficiency with which the maternal recognition of pregnancy (MRP) is established. Heat and nutritional stresses have been found to alter the maternal uterine micro-environment and thereby affect MRP by modulating ovarian, luteal and endometrial function. The study was undertaken with the objectives to: (i) studythe effect of heat and nutritional stresses on ovarian functionand *in vivo* production of embryos and fertility, (ii) delineate the modulation of peripheral endocrine profiles as well as characterization and expressional profiling of genes involved in MRP during heat and nutritional stress and (iii) study the effect of heat and nutritional stress on gene expression changes during late transition stages of embryonic development.

Optimization of in vitro maturation protocol for sheep oocytes

Oocytes having more than 5 layers of cumulus cells and granular homogenous ooplasm were chosen for the present study. The maturation rate of cultured oocytes was found to be 74.07%. Out of 74.07% matured oocytes, 75% was found to be in degree II cumulous expanded level (Figure 1) and rest 25% in degree I cumulous expanded level.

Impact of heat stress on maturation of sheep oocytes in vitro

The maturation rate of cultured oocytes was found to be 74.07%. Control cultures were maintained at 38.5°C for 24 hr. Heat stressed cultures were acclimated at 38.5°C for 6 hr and then placed at 40.5°C for 18 hr as well as 42.5°C. *In vitro* heat shock at 40.5°C for 18 hrs resulted in shedding of cumulous cells and oocyte degeneration (Figure 2). Heat stress decreased (P<0.05) protein, glucose, chloride, urea and calcium content of matured sheep oocytes. However, heat stress did not decrease (P>0.05) ammonia and phosphorous content of sheep oocytes.

Assessing the effect of heat stress on cultured sheep endometrial epithelial cells

Control cultures were maintained at 38.5°C for 24 hr. Heat stressed cultures were acclimated at 38.5°C for 6 hr and then placed at 40.5°C for 18 hr as well as 42.5°C. *In vitro* heat stress (40.5°C & 42.5°C) increased (P>0.05) protein, glucose, urea, phosphorous, PGE_2 and PGF_{2a} in cultured endometrial epithelial cells. Significant increase (P<0.05) in PGE_2 levels was found in 42.5°C stressed culture as compared to control group (38.5°C).

Amplification of genes involved in MRP in sheep

Following first strand synthesis, PCR amplification of 301 bp PGES, 236 bpPGFS, 261 bp integrin and 202 bp COX-II cDNAs was carried out in sheep endometrium using gene specific primers (Figure 3).

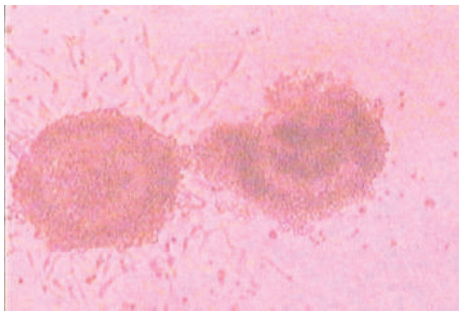


Fig.1: Sheep oocytes following *in vitro* maturation

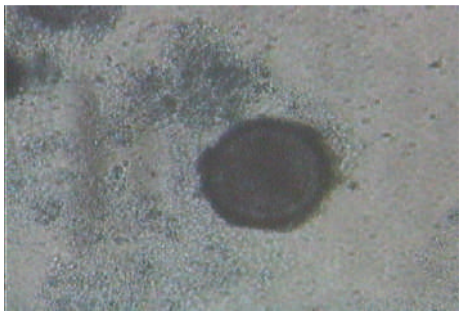


Fig. 2: Sheep oocytes following *in vitro* heat stress

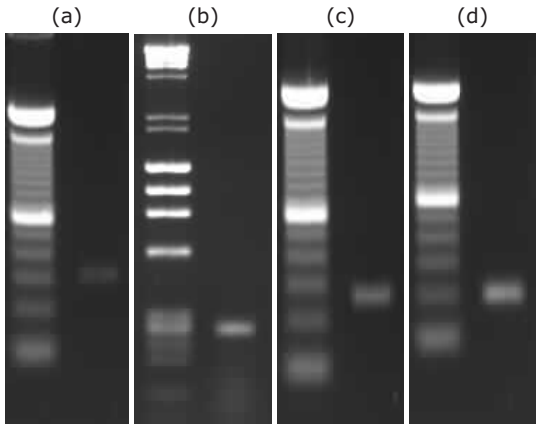


Fig.3 : Amplification of cDNA of 301 bp PGES (a), 236 bp PGFS (b), 261 bp integrin and 202 COX-II (d) from sheep endometrium. Lane M: 1 kb DNA ladder; Lane 1: Amplified PCR product

The in vitro maturation rate of sheep oocytes was 74.07%. Heat stress adversely affected thegrowth and maturation of sheep oocytes by decreasing protein, glucose, chloride, urea, ammonia, calcium and phosphorous content, where as, it increased protein, glucose, urea, phosphorous, PGE_2 and PGF_{2a} in cultured sheep endometrial epithelial cells

National Agricultural Innovation Project

Value chain on commercialization of maize products

S Senani, AV Elangovan and NKS Gowda

Maize is the third most important cereal crop after wheat and rice.The objective of the project was to evaluate maize grain processing by-products and different cultivars as livestock feed/fodder.

A feeding experiment in lambs was conducted to compare commercial, Nithysree hybrid and QPM maize as part of concentrate mixture. There was no effect on the intake and digestibility of nutrients in different groups. The QPM variety containing higher amount of lysine, methionine and tryptophan amino acids did not show any advantage in feeding ruminants. In another study, control of fungal infestation and aflatoxins was attempted using chemicals on QPM and Nithyasree variety of maize grain.On QPM copper sulphate (0.1%), Citric& Benzoic acid (0.25%), sodium propionate (0.25 and 0.5%) were the most effective with 100% inhibition of aflatoxin biosynthesis by *A. parasiticus.*

Using maize grain, maize hay, spent maize cobs, maize stovers, complete feed blocks were developed. Feeding of complete feed block was found to increase milk production and reduce cost on feeding. There was a net profit of Rs 19/- per day per animal when feed blocks were used as compared to farmers feeding practices. In another study different silage inoculums were evaluated for production of good quality maize silage. The maize silage could be made even without using any inoculums. The technology of maize silage was popularized and over 300 farmers were trained for production of Maize silage in the project implementation area.

The spent maize cobs and the stovers which are not generally used as feed materials were tried to make in to silage using pine apple waste, Azolla and molasses. Use of 50:50 Maize stovers and pineapple waste and ground maize cob and pineapple waste yielded good quality silage after 21 days of anaerobic fermentation. A feeding trial in lambs was conducted where 100 and 50% ragi straw was replaced with grounded maize cobs without any effect on intake and digestibility of nutrients in 60:40 ration. By use of hydraulic pressure maize cobs were converted in to blocks which increased its bulk density to 5 folds and facilitated easy storage and transportation.

In sheep, grounded maize cobs could completely replace ragi straw without adversely affecting intake and digestibility.
The bulk density of maize cob and maize cob based diets could be increased 3- 9 folds by converting to feed block for easy storage and transportation.

Elucidating the physiological and genomic regulation process of follicular development, oocyte maturation and embryogenesis in buffalo

JP Ravindra and S Selvaraju

Low follicle number and high follicular atresia in buffalo ovary are among some of the contributing factors for low reproductive efficiency in this species. Basic mechanisms in follicle development in buffaloes are poorly understood. The present work was taken up with objective to characterize the apoptosis pathway in follicular development and molecular profiling of follicles in normal cycles in buffalo. In the work on features of follicular atresia it was found that although atresia can occur at all the stages of follicular development, highest percentage was observed at the preantral stage. The initial structural change associated with the follicular atresia was seen primarily in the granulosa cell layer.

Fas- Fas-Ligand system has an important role in regulating ovarian follicular apoptosis in buffalo. IGF-I can increase the granulosa cell steroidogenic activity and can overcome the effect of Fas-L. This suggests that IGF-I could rescue the follicles from Fas-L mediated apoptosis. The effect of Fas-L was maximum in small size follicles than other class suggesting that this pathway is very efficient in inducing apoptosis in small follicles.

BMP2 and BMPR-II may be crucially involved in the processes of folliculogenesis and steroidogenesis in buffalo. BMP-2 may overcome the FasL mediated apoptosis only in small size follicle. The findings also indicate that BMP2 may play a crucial role in development of medium and large size follicles in buffalo ovaries.

The follicular fluid progesterone concentration was significantly higher in dominant (>10mm diameter) non-atretic follicles compared to atretic follicles suggesting that luteinization of granulosa cells starts before ovulation of dominant follicle and the dominant follicle with high progesterone levels may destine for ovulation soon.

A significantly higher estradiol-17β concentration was observed in medium sized non-atretic follicle compared to atretic follicle. The medium sized follicles with high estradiol-17β concentration may go for dominance. In the dominant follicle (>8mm), the luteinization of granulosa cells starts before ovulation. The dominant follicle with high progesterone levels may be destined for ovulation soon. 3β-HSD transcripts were upregulated in non-atretic follicles and LHR transcript is involved in dominance and ovulation.

Follicular fluid protein profiling and their identification showed differences in proteins of follicular fluids of different size and functional classes of follicles. Clear differences were obvious in atretic and non atretic (5-8 mm) follicles. Around 20 protein spots were found in all 5-8 mm (atretic and non atretic), preovulatory and atretic (10 mm) samples. Spot detection (similarity and differences) and protein identification by MALDI/TOF of atretic and non atretic follicles of different classes has revealed differential expression of 10 identified proteins.

The presence of specific proeins in atretic and non atretic follicles may signify speicific funcitons of these proteins which needs to be elucidated

Follicle size	Identified proteins by MALD I/TOF
Atretic (5-8mm)	YLP motif containing protein 1 (Nuclear protein ZAP3) (ZAP113)
	Vacuolar ATP synthase subunit S1 precursor (V -ATPase S)
	Integrin alpha -11 precursor
	Cleavage and polyadenylation specificity factor subunit 1
Non atretic (5-8 mm)	A-kinase anchor protein 9 isoform 2
	Suppressor of Ty 6 homolog protein (Chromatin structural protein)
Atretic , Nonatretic (5-8 mm) and Preovulatory follicles	coiled -coil domain -containing protein 132 isoform b
	kelch repeat and BTB domain -containing protein 2
	exocyst complex component 4 isoform a
	Splicing factor and arginine/serine -rich 16

Manipulation of rumen ecosystem through modified rumen microbes encoding novel fibrolytic enzymes using nucleic acid based technologies for the improved utilization of crop residues

M Chandrasekharaiah, A Thulasi, M Bagath and PK Malik

Ligno cellulose complex present in the crop residues is not completely digested in the rumen because of the complex bonds. If these bonds were hydrolyzed, more energy would be available for ruminants. In this project the gene encoding the feruloyl esterase was relegated and cloned in to the pQE trisystem shuttle expression vectors. The constructs were first transformed in *E.Coli* DH5 α for high copy number and constructs were analyzed by restriction analysis. The positive constructs were transformed in to the *E.Coli* BL21 stain for protein expression.

These newly prepared conformed constructs were transformed in to *Butyrivibrio fibrisolvens* by electroporation. The positive constructs were then studied for expression and the expression conditions were standardized in *Butyrivibrio fibrisolvens*. Further, FAE encoding gene was also cloned in pYES2 shuttle vector and transformed in *Saccharomyces cerevisiae*. Induction of FAE in yeast was standardized by various concentrations of Galactose and Raffinose. A crude FAE enzyme preparation was obtained for *in-vivo* experiments in crossbred cattle to study the effect of FAE on rumen fermentation and microbial diversity. The DGGE gel bands revealed that there were different organism which appeared and some which disappeared in control and trial samples (Figure 1). Supplementation of FAE enzyme showed improved digestibility and rumen fermentation in crossbred steers fed with paddy straw based ration.

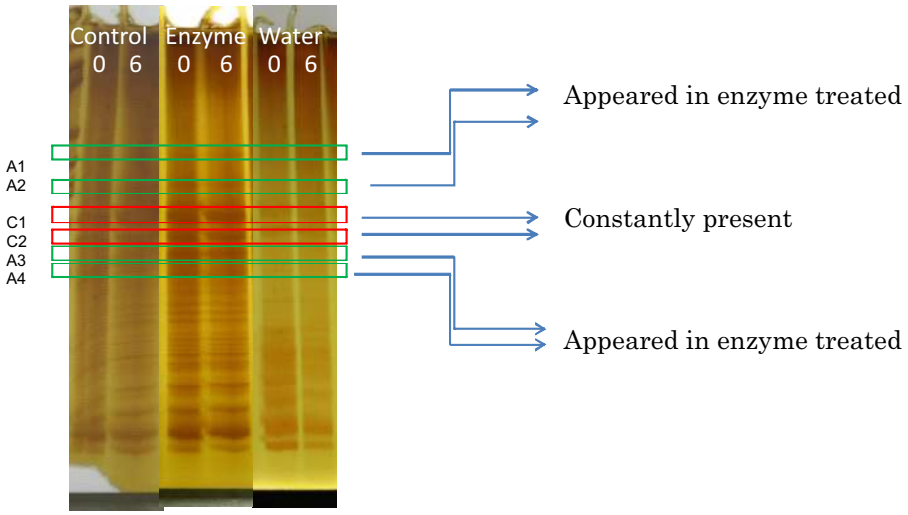


Fig.1: Microbial Diversity observed in DGGE gel

Constantllypresent: C1corresponding toRummeliibacillusstabekisiistrain B1-37c-21 16S ribosomal RNA gene, partial sequence.
C2: Uncultured rumen bacterium clone YRMCB134 16S ribosomal RNA gene, partial sequence

Appeared new: A1: Uncultured rumen bacterium clone Ovine_172TNT(Control) 16S ribosomal RNA gene, partial sequence,
A2:Rummeliibacillusstabekisii strain B1-37c-21 16S ribosomal RNA gene, partial sequence
A3:UnculturedBacteroidetesbacterium clone OMEGA_pl_cont_7_G05 16S ribosomal RNA gene, complete sequence
A4: New Species. Not found in NCBI.

The gene encoding the FAE has been successfully transformed in Yeast and *Butyrivibrio fibrisolvens*. The recombinant microbes showed significant increase in the digestibility of different crop residues. DGGE studies showed greter microbial diversity in animals supplemented with FAE enzyme

Livelihood security of rural poor in disadvantaged chitradurga district of karnataka through integrated farming systems approach

A V Elangovan, P Khandekar and K Giridhar

Objectives of this project were identification and promotion of appropriate farming systems and income generating activities to strengthen the livelihood, economic security, equity and social capital; development of appropriate public and private partnerships and linkages to ensure necessary value chain to improve market linkages and efficiency for the output/s arising from (Integrated farming system) IFS and IGA (Income generating activity) innovations and capacity building for Human resource development at different levels and Social capital formation through local organizations.

The following activities were carried out during this period -Timely health care and regular vaccinations through Animal Husbandry Departments; Enhancement of fodder base through cultivation of fodder trees like Sesbania, Gliricidia, Melia etc. and Azolla cultivation; Popularisation of balanced feeding and area specific mineral mixture supplementation; Assistance in opening of milk collection stations / milk route; Promotion of complete feed using locally available ingredients.

Feeding of Azolla to local cows and buffaloes improved milk yield per lactation per animal from 204 to 336 liters, and the gross income improved by 49% to Rs.9978 per household maintaining two cows.
In sheep, use of mineral mixture and top feeds along with proper health care enhanced gross income by Rs.22,650 per flock size of 30 per household.

DBT Sponsored Projects

Detoxification and utilization of key agro-forest based non conventional oil cakes in the feeding of livestock

SBN Rao, AV Elangovan and S Jash

The project was aimed to develop a suitable detoxification methodology for production of detoxified meals from Jatropha, Neem and Karanja seeds. *In vitro* studies were conducted to find out the optimum level of incorporation of the detoxified meals. In a long term growth study, detoxified karanja cake could be included at 18 % of concentrate mixture replacing 50 % soybean meal in the diets of lambs without afftecting growth rate, nutrient digestibility and N-balance. Immune status of these lambs was also not affected due to feeding of detoxified karnaja cake. However, at higher levels it reduced growth rate, digestibility and immune status as well.

In another long term growth trial, detoxified neem cake was incorporated at 5.4 and 10.8 % of concentrate mixture replacing 25 and 50% soybean meal in lambs. Feeding of two levels exerted similar affects on growth rate, nutrient digestibility of lambs. Immune status of these lambs was comparable to control which received soybean meal as sole protein supplement.

In addtion, 90 day lactaion trial was conducted in crossbred milch cattle. Detoxified neem and karanja meals were used at 3.78 % and at 5.85 % of total mixed ration (TMR). Feeding of TMR improved milk yield (Fig 1) during 90 day lactation period. Nutrient intake, digestibility and nutritive value of TMR were similar and incorporation of dNC and dKC did not have any adverse effect. Blood biochemical and selected hormonal profiles were not affected due to incorporation of unconventional oil cakes in TMR. Milk composition of cows as well as milk production efficiency was unaffected due to feeding of TMR containing dNC and dKC.

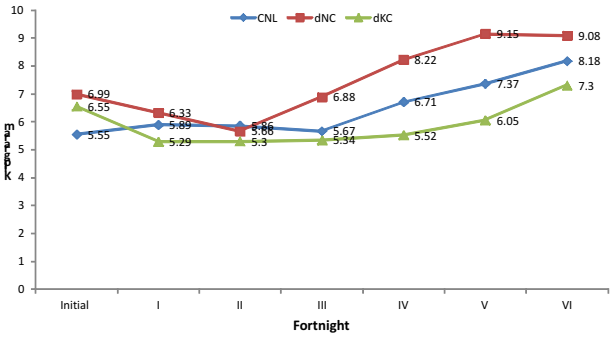


Fig 1. Fortnightly FCM yield (kg/d) in different treatment groups

CNL= control; dNC= detoxified neem cake; dKC= detoxified karanja cake

Long term feeding of detoxified neem seed cake replacing soybean meal in growing lambs showed no changes in terms of ADG, FCE, Nutrient digestibilies, N- Balance and biochemical parameter and carcass characteristics

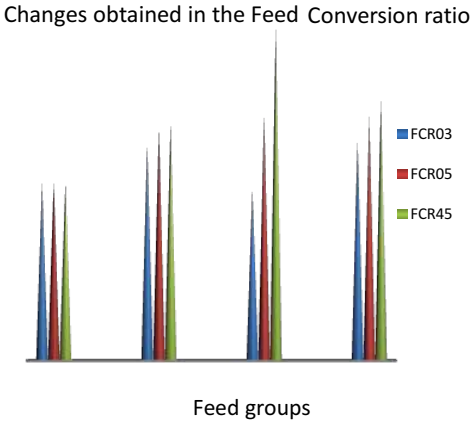
Effect of resveratrol and carvacrol in ameliorating aflatoxin induced molecular changes in broilers

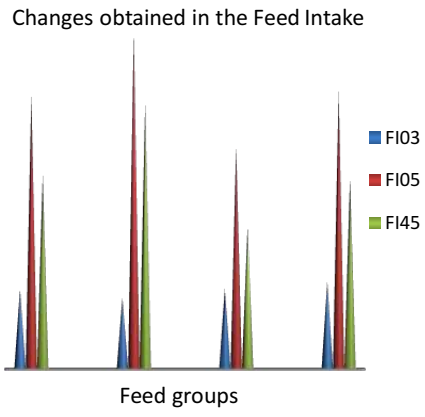
S Manpal, RU Suganthi and
KV Pugalendi (Annamalai University)

Among different mycotoxins, Aflatoxin B1 (AFB1) is the most toxic and predominant mycotoxin in India. AFB1 is a hepatotoxin and it causes liver damage, kidney damage, growth retardation, immunosuppression and mortality in poultry. Further the toxic residues are transferred to poultry products which in turn affect the quality of products and health of consumers. Counteraction strategies using phytochemicals that could be easily adopted by the farming community need to be focussed. Due to the protective nature wide distribution in the plant kingdom, resveratrol and carvacrol can be envisaged as chemo-preventive/curative agents against aflatoxin B1 in broilers. The objectives were to evaluate the efficacy of resveratrol to ameliorate aflatoxicosis and its molecular effects in broilers and to determine the protective role of carvacrol to overcome aflatoxicosis and its molecular effects in broilers

The results of the feeding experiment conducted in broilers to study the effect of Resveratrol in ameliorating aflatoxin toxicity reflected changes in body weight of the broiler birds from third week onwards. The feed conversion ratio was maximum (3.04) between the fourth and fifth week in the group fed toxin along with 1% resveratrol. Feed intake showed significant variation both between groups as well as within groups in the fifth week as well as between the fourth and fifth weeks. Aflatoxin affected serum and tissue hepatic marker enzymes improved on supplementation resveratrol.

The results of the feeding experiment conducted in broilers to study the effect of a combination of both Resveratrol and Carvacrol to overcome aflatoxicosis and its molecular effects in broilers reflected significant changes ($P<0.05$) with regard to body weight gain of the broiler birds in the fifth week. Weakness of leg muscles was pronounced in the group of birds fed aflatoxin. Significant changes ($P<0.05$) were obtained with regard to feed intake of the broiler birds in the fifth week fed combination of resveratrol and carvocrol.





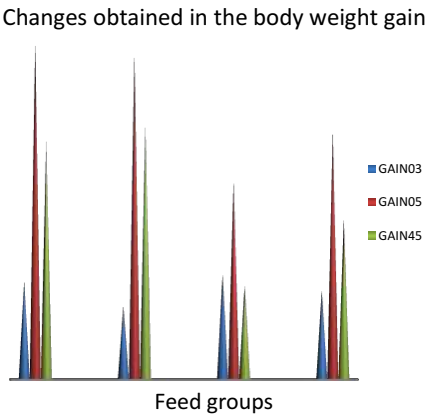
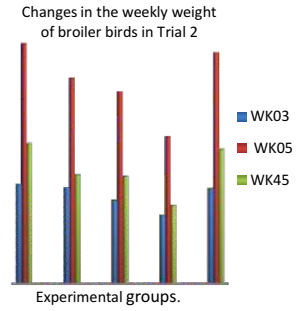
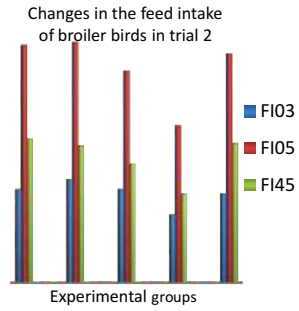


Fig.1: Changes obtained in the feed conversion ratio, feed intake and body weights of broiler birds in the resveratrol feeding trial





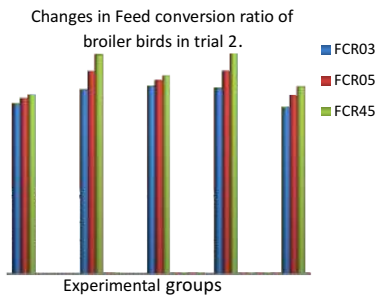
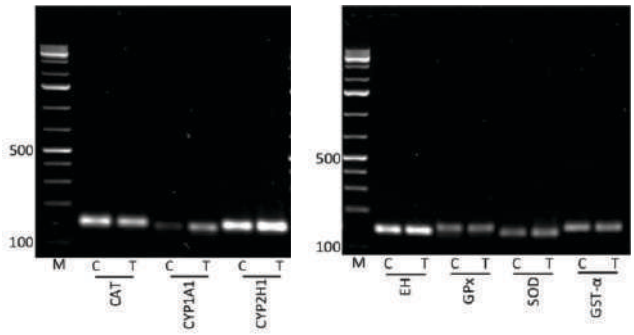


Fig.2: Weekly changes obtained in the gain in body weight, feed intake and feed conversion ratio of broiler birds in the combined resveratrol and carvacrol feeding trial

Agarose gel electrophoresis of the PCR products of Catalase (CAT, 130 bp), Cytochrome P450 1A1 (CYP1A1, 125 bp) and Cytochrome P450 2H1(CYP2H1, 137 bp) showed higher expression in the case of the latter two(Plate 1). Agarose gel electrophoresis of the PCR products of Epoxide hydrolase (EH, 128 bp), Glutathione peroxidase (GPx, 140bp), Superoxide dismutase (SOD, 122bp) and Glutathione S-transferase-α (GST-α) did not show any significant variation in expression.

Plate 1.(A).Agarose gel electrophoresis of the PCR products of Catalase (CAT, 130 bp), Cytochrome P450 1A1 (CYP1A1, 125 bp) and Cytochrome P450 2H1(CYP2H1, 137 bp)(B). Epoxide hydrolase (EH, 128 bp), Glutathione peroxidase (GPx, 140bp), Superoxide dismutase (SOD, 122bp) and Glutathione S-transferase-α (GST-α).



Significant improvement in body weight gain and feed intake in broiler birds were obtained by feeding a combination of Resveratrol and Carvacrol to overcome aflatoxicosis

Evaluation of herbal residues and nutraceuticals as alternatives to antibiotics for improving the performance of pigs

AK Samanta, S Senani and AP Kolte

Following restrictions of antibiotics and hormones in animal diet, there is a growing interest on identifying plant based feed additives for maintenance of gut health and functionality. In this

line, herbal residues and nutraceutical such as prebiotics is important. Under such circumstances attempt were made to unravel the gut microflora following supplementation of herbal residues and nutraceuticals in the diet of growing pig.

Twenty piglets were raised on grower ration (carried out in collaboration with SVVU, Tirupati). The animals were grouped into four: comprising of five in each group. Animals under control group (Group I) received only grower ration, while Group II received the same diet supplemented with tetracycline (25g /quintal), Group III received same diet supplemented with herbal residues (2% over and above the ration), Group IV same diet supplemented with nutraceuticals (2% over and above the ration). After continuous feeding for a period of three months, fecal samples were collected for studying the changes in the hind gut microflora.

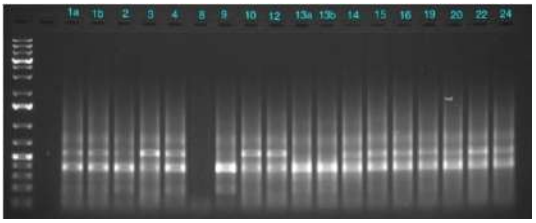


Figure 1 Terminal fragments generated from FAM labelled PCR products of fecal samples by MspI enzymes. Lane 1 – 4 (Group I: control), Lane 8,9,10,12 (Group II : supplemented with tetracycline @25g /quintal), Lane no. 13-16 (Group III: supplemented with herbal residues @ 2%), Lane no. 19, 20, 22, 24 (Group IV: supplemented with nutraceuticals @2%)

Application of restriction enzymes such as MspI, Cfr131 (Sau 3AI), BsuRI, AluI, HhaI and HinfI generates terminal fragments (FAM labelled) representing operational taxonomic units of phylotypes inhabited at the hindgut of pigs.

Immobilized fungal phytase production and its dietary evaluation in broiler and layer chicken

A V Elangovan and S Manpal

The objective of the study was to screen *Aspergillus niger* and other promising species for phytase activity; Immobilization and production of phytase enzyme; Determination of application rate and efficacy of phytase enzymes through feeding trials in broilers and layers and economics of raising poultry birds through use of supplemental phytase enzymes.

Screening of fungal cultures of *Aspergillus* and other promising species for phytase activity

Aspergillus strains were obtained from NCIM, Pune, MTCC Chandigarh and soil samples from different parts of India and poultry droppings were screened for phytase activity. Screening test was carried out based on the plate agar method categorized for phytase producing activity depending upon the diameter of clear zone. The results of the study indicated that certain fungal strains were found to produce clearance zone ranging between 4.3 – 4.5cm indicating good phytase activity.

Production and testing of phytase enzyme

The fungal strain with best phytase activity was taken for bulk production through immobilization technique using PUF cubes. Preliminary feeding trials indicated broiler chicken was able to utilize the lab phytase but however, its efficacy could not match with the commercial phytase, indicating probably higher dose of lab phytase may be required.

Culture without phytase activity Culture with phytase activity

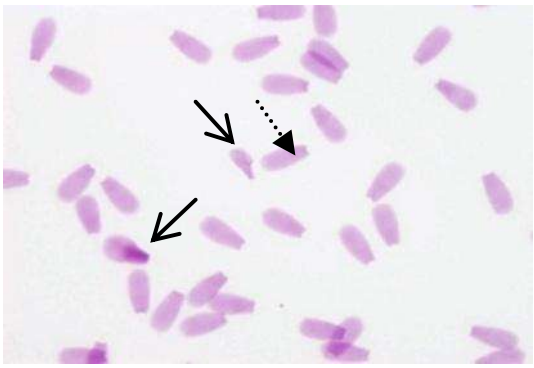
Transcriptomic profiling of spermatozoa for selection of fertile bulls

S Selvaraju, JP Ravindra, AP Kolte, CG David and A Arangasamy

It is plausible that the available semen evaluation tests do not invariably predict fertility. There is a need for approaches at cellular and molecular levels for assessing/determining fertility in males. The spermatozoa also provide certain transcripts essential for fertilization, embryo development and possibly successful birth and health of the offspring. Profiling of spermatozoa transcripts has suggested correlation of sperm functional parameters and fertility. Hence, these transcripts can be used to diagnose sub-fertile males for elimination and to improve fertility in dairy animals. The project focuses on identifying fertility regulating transcripts/ genes to assess potentially fertile bulls before introducing into the AI programme.

The plasmalemma integrity, mitochondrial membrane potential, sperm functional membrane integrities were significantly (P<0.01) higher in fertile bulls compared to infertile animals. Similarly, the spermatozoa positive for both functional membrane and acrosomal integrities were also significantly (P<0.01) higher. The percentage of spermatozoa with lost acrosome during osmotic resistance test was higher in infertile animals compared to fertile group of bulls and was found to be non-significant. The analysis of spermatozoa nuclear morphology and the percentage of spermatozoa with normal chromatin did not differ significantly between fertile and infertile bulls.

The serum insulin like growth factor-I (IGF-I, ng/ml) and testosterone (ng/ml) levels were significantly (P<0.05) higher in fertile groups compared to infertile animals. However the seminal plasma IGF-I (ng/ml) levels were non-significantly higher in fertile bulls. Though certain sperm functional parameters and hormonal (serum IGF-I and testosterone) levels differ among different fertile bulls, no differences were observed in certain parameter such as DNA distribution, suggesting that advanced cellular and molecular studies are essential to predict semen fertility.



The spermatozoa chromatin structure integrity in bulls: dotted arrow: Normal and solid line arrow :abnormal

Mining markers of pregnancy in cell free body fluids of buffaloes (Bubalus bubalis)

(Cooperating center: Indian Institute of Science)

J Ghosh, SC Roy, U Tatu and AJ Rao

The existing methods of early pregnancy diagnosis based on determination of non return to cycle and progesterone assays at the time of impending estrus are indirect and not foolproof for buffalo. Pregnancy diagnosis based on conceptus released proteins and miRNA molecules has better potential in this species because this method confirms the presence of conceptus directly, which is an added advantage. The present project is thus designed with the following objectives - to profile and identify novel proteins and miRNA in early pregnant buffaloes urine and tracking novel proteins and miRNA in maternal serum and urine samples throughout pregnancy, at parturition and post partum.Established small RNA isolation protocol proved good for further downstream applications such as sequencing and quantitative assay Nine buffaloes were monitored for estrous cycle and daily urine samples were collected from six

buffaloes during the whole cycle length of 21 days from the normally cycling animals. Pregnancy of the animal was confirmed and monitored by frequent examination of the animals at 30 days interval for any failure of pregnancy or problem. The yields in plasma/serum samples were found less as compared to urine. Quality of small RNA was found good for further down-stream processing.

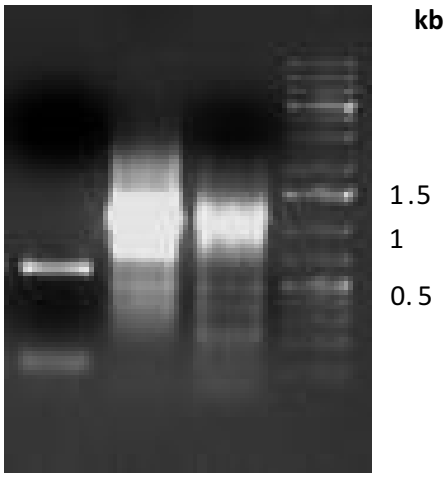
Established small RNA isolation protocol proved good for further downstream applications such as sequencing and quantitative assay

Development of pregnancy associated glycoprotein (PAG) based immunodiagnostic in buffaloes (*Bubalus bubalis*)

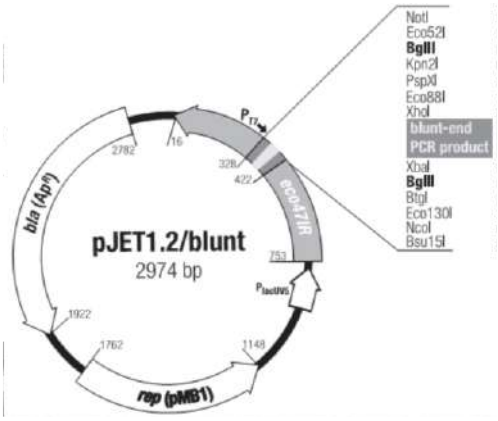
J Ghosh, SC Roy, KS Roy and A Dhali

Availability of conceptus released biomarker, pregnancy associated glycoproteins (PAG), in blood circulation of cattle and other ruminant species has changed the whole concept of pregnancy diagnosis in farm animals. Pregnancy diagnosis based on this molecule is not available in buffaloes that hamper the optimisation of reproductive management in this species. This project was undertaken to produce recombinant PAGs and then development of specific immuno-assay for the recombinant protein molecules.

The major expressed band of buffalo PAG was identified, cloned and sequenced from the cotyledon and caruncular tissues of early pregnant buffaloes. The full open reading frame of PAG genes was targeted using varying combinations of right primers and a single left primer and cloned in the pJET1.2 cloning vector. The analysis of sequence revealed that the major expressed band in buffalo has maximum similarity with the PAG7 sequence of buffaloes and other species. Accordingly the target gene sequence was sub-cloned in pFN 6A (HQ) expression vector. Effort to express the protein in *E coli* based system is in progress.



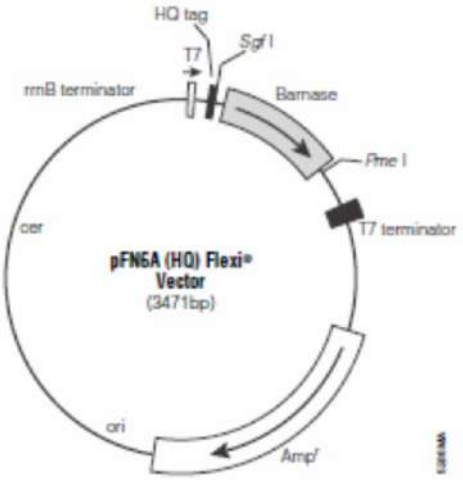
(a)



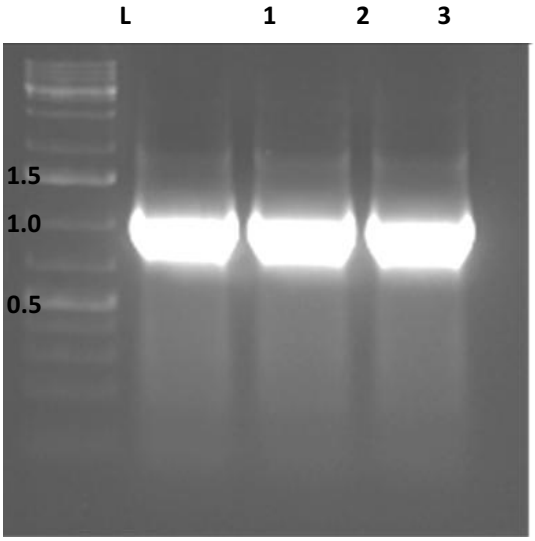
(b)

Fig 1: (a) Agarose gel image of PCR amplified buffalo PAG with gene specific primers (PAG L - R1). Lane 1: non-pregnant endometrium, lane 2: pregnant cotyledon and lane 3: pregnant caruncle. The major transcripts (the most intense bands) were cut out from the gel, eluted and ethanol precipitated before inserting into pJET1.2/blunt vector, L: 1kB plus ladder.

(b) pJET1.2/blunt Vector map showing the multiple cloning site regions where the blunt end PCR product was ligated.



(a)



(b)

Fig 2:(a) pFN6A (HQ) Flexi vector map showing the restriction sites for insertion of gene of interest. (b): Confirmation of gene insert in the flexi vector by PCR amplification of PAG gene using gene specific primers L : 1kB plus ladder, 1-3: Plasmids from clones of transformed Top 10 cells.

The sequence analysis of predominantly expressed PAG identified as PAG7 in buffaloes Successfully sub cloned the PAG7 in *E coli* based expression vector pFN6A(HQ)

Molecular cloning and characterization of buffalo sperm CatSper and a few other fertility associated proteins for development of a fertility assay to screen sub-fertile buffalo bull semen

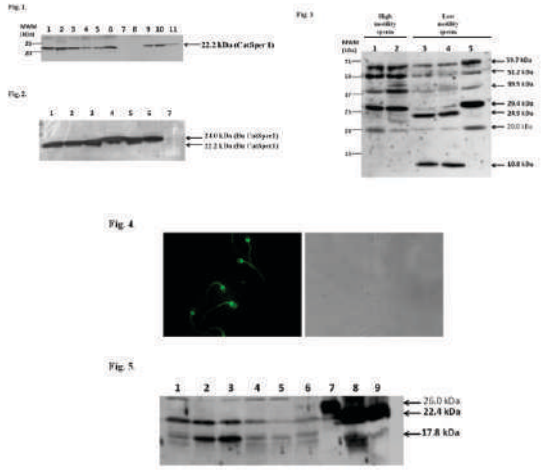
SC Roy, J Ghosh, KS Roy, A Dhali and A Mech

The buffalo/cattle semen sample is usually graded as freezable or non-freezable based on the motility parameter of the semen. Eventually, this method of grading is very subjective and depends on the eye estimation of an examiner which generally varies from person to person. Currently, not a single fertility marker-based assay is available to predict the fertility status of buffalo bull semen. Thus, there is an urgent need to identify and characterize specific fertility marker(s) of buffalo bull semen. Recently, CatSper (Cation channel of Sperm), a pH-dependent sperm-specific calcium ion channel, has been found to be associated with fertility of spermatozoa in mouse and human. Similarly, binder of sperm 5 (BSP5) and tissue inhibitor of metalloproteinase-2 (TIMP-2) were found to be associated with fertility of cattle bull semen. In this project, an effort was made to characterize these fertility associated proteins of buffalo bull semen for developing a fertility assay.

Buffalo and cattle semen samples were collected using artificial vagina and the samples were centrifuged to separate seminal plasma and sperm. By chemiluminescence-based Western blot technique using heterologous antibodies, both buffalo and cattle sperm membrane CatSper-1 was detected at approx. 22.2 kDa (Fig. 1). Further, in the low motility buffalo semen CatSper1 was detected at 24.0 kDa (Fig. 2). However, using a heterologous CatSper-3 antibody, five immunoreactive protein bands of molecular mass 59.7, 51.3, 39.5, 29.5 and 20.0 kDa were detected in buffalo sperm extracts (Fig. 3) and a single immunoreactive band of approx. 39.5 kDa was detected in cattle sperm extract. Surprisingly, in low motility buffalo sperm these five protein bands were significantly reduced. In contrast, the low motility buffalo sperm displayed

two new immuno-reactive protein bands at 24.9 and 10.8 kDa. CatSper1 protein was immuno-localized to post-acrosomal region and principal piece of buffalo spermatozoa (Fig. 4). To the best of our knowledge, this is first report of molecular characterization of CatSper1 and CatSper3 proteins of buffalo and cattle sperm.

Among other fertility associated proteins, attempts were made to detect the presence of TIMP-2 and BSP-5 in buffalo and seminal plasma. In both buffaloes and cattle, two molecular forms of TIMP-2 (22.4 and 17.8 kDa) were detected in seminal plasma (Fig.5). However, in both buffalo and cattle, the low motility semen samples were associated with significantly lower expression of TIMP-2 as compared to high motility semen. A duplex band (34.7 and 27.2 kDa) of BSP5 was detected in all buffalo seminal plasmas. However, a 10.2 kDa immunoreactive band that was detected in cattle seminal plasma was absent in buffalo seminal plasma indicating to a species-dependent expression of these proteins. Now, efforts are on to validate these Western detections by tandem mass spectrometry. The very objective of this work is to investigate whether the levels of these proteins in sperm extract or seminal plasma of buffalo semen are related to the fertility levels of the bulls.



Low motility buffalo spermatozoa were associated with aberrant expression of CatSper-3 ion channel proteins. TIMP-2 protein was identified as a putative motility marker for buffalo and cattle semen.

DST Sponsored Project

Growth factors in small oocyte development: Proteomics and genomic approaches (Indo-Japan)

PSP Gupta, S Nandi and A Dhali

Oocyte secreting factors like Growth Differentiation factor-9 (GDF9) and Bone Morphogenic Protein (BMP or GDF 9B) are being studied for their role in the domestic animal ovarian function in recent times. This project was conceived to study their role in the small oocyte growth and development in goats with proteomic and genomic approaches.

The effect of GDF 9 and FGF on *in vitro* maturation of small caprine oocytes was studied. The 20 and 30 ng/ml of FGF and GDF-9 respectively, were found to be optimum for oocyte maturation. IVM of small oocytes was significantly less ($P<0.05$) compared to that in large oocytes. Growth factors had significantly improved the IVM rates i.e control Vs FGF (@20ng): 74 % and 80%, control Vs GDF-9 (@30ng): 73 % and 80%, respectively.

As follicle became larger, the concentrations of glucose and cholesterol got increased while that of triglycerides got decreased. The protein (control Vs FGF: 84 and 194 µg/oocyte; control Vs GDF-9: 83 and 188 µg/oocyte) calcium (control Vs FGF: 0.81 and 2.88 µg/oocyte; control Vs GDF-9: 0.76 and 2.52 µg/oocyte) and phosphorus (control Vs FGF: 0.71 and 1.94 µg/oocyte; control Vs GDF-9: 0.76 and 1.96 µg/oocyte) contents were significantly higher in matured small oocytes cultured in 20 and 30 ng/ml of FGF and GDF-9, respectively compared to the immature (control) small oocytes.

A study was conducted to examine the effect of Growth differentiating factor-9 (GDF-9) and Fibroblast growth factor (FGF) on caprinegranulosa cells functions *in vitro*. The results suggested that viability (94 % Vs 95%), cell number increment (control: $1.26X10^5$ /ml Vs. treatment: $1.66 X10^5$ /ml),

monolayer formation score (control: 1.63 Vs treatment: 2.5), metabolism (as evidenced by MTT assay) and ability to support oocyte growth (control: 78% Vs treatment: 82%) was higher in treatment group compared to the control.

Detection of the transcripts of growth factors in goat COC

Immature goat COCs were aspirated from the slaughter house ovaries. Total RNA was purified from the pooled COCs and was reverse transcribed into cDNA using random primer. Suitable PCR primers were designed or adopted from the previously reported literatures to amplify the transcripts of GDF-9, FGF-2, FGF-10, FGF-8 and GAPDH. PCR amplifications (35 cycles) were conducted and the amplified products were analyzed through 1% agarose gel (Fig 1).

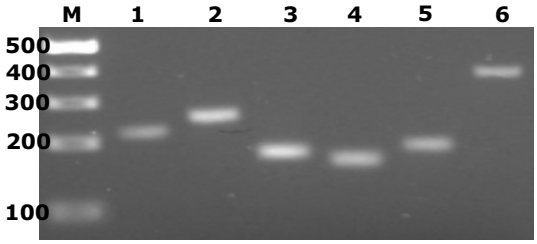


Fig.1 Amplification of the transcripts of GDF-9 (Lane-1: 220 bp; Lane-2: 258 bp), FGF-2 (Lane-3: 172 bp), GAPDH (Lane-4: 154 bp), FGF-10 (Lane-5: 183 bp) and FGF-8 (Lane-6: 376 bp) from immature goat COCs. Lane-M indicates DNA marker

Growth differentiation Factor 9 and Fibroblast Growth Factor were found to improve singificantly the small oocyte growth in vitro maturation and granulosa cell function. The transcripts for GDF-9, FGF-2, FGF-9 and GAPDH were found in the small oocytes of goats.

A heterologous vector mediated transformation system of Laccase gene from a novel white rot basidiomycete into *Pichia pastoris* for effective degradation of crop residues. (Phd Research)

P Vidya *Guide: S Manpal*

The objective of the study was screening, identification and cultivation of a novel laccase producing white rot fungi, isolation of the laccase gene/genes and integration into a suitable plasmid, expression of the recombinant laccase enzyme from *Pichia pastoris* and testing for the efficacy of recombinant laccase enzyme, in the breakdown of lignin-*in vitro.*

A 38 fold purification of laccase having a specific activity of 14621 was obtained employing 70% ammonium sulphate fractionation and Sephadex G-50 gel filtration chromatography. Ultrafiltration did not increase the purification fold as it distributed the activity equally in the outlet as well as the sample.

Purified laccase had an optimal pH of 5.0 and was stable in the pH range from 3.5 to 5.0. The optimal temperature was 35°C and it displayed considerable stability within the range of 25 to 65°C and 50% residual activity after 20 min of incubation at 80°C and 30% after 2 hrs of incubation at that temperature indicating its thermo stability. Higher residual activity was seen at lower temperatures.

Activity of laccase enzyme after purification

Purification steps	Total volume(mL)	Laccase total activity(U)	Total protein concentration (µg)	Specific activity	Purification fold
Crude extract	1300	1316510	3472	379	1
70 % Saturation	40	220400	41	5375	14
Dialysis	48	139200	10.0	1392	3.6
Sephadex G - 50	45	24345	1.665	14621	38

Very low K_M value and high V_{max} values for this novel *Schizophyllum communae* NI-07 laccase reflect its high affinity for AB .The mycelia of NI-07 immobilized in PUF cubes provided higher laccase production than that of the submerged and solid state fermentation.

Copper sulphate increased the activity of the purified laccase when used at low concentrations. EDTA and Ethanol increased the activity at both the concentrations used where as Sodium azide inhibited the enzyme.

Laccase obtained from Immobilized NI-07 showed greater pH stability and thermostablity as compared to the native enzyme.

NICRA Project

Modelling the impact of climate variation on feed resources' availability for livestock

K Giridhar, K P Suresh and G Ravikiran

The analysis of the impact of previous climatic aberrations on the availability of feed resources for the livestock will help to forecast future or near-term scenarios of availability. This information can help in developing adaptation strategies to ensure sustainable livestock production.

The objective was to assess the impact of climate variation on dry and green fodder production in different States of India, and to develop the models for predicting the impact of climate variation on animal feed resources in India.

The data sets on feed resources and climate parameters with 40 years' information were prepared for the states of Madhya Pradesh, Rajasthan, Maharashtra, Goa and Assam. Tested the models to see the effect of climate variables on production of feed resources. SAS time series method and Auto-regressive models were used for the analysis.

The climate variability, especially, the seasonal rainfall, impacted the production of crop residues in all the five states

Coconut Development Board sponsored project

Generation of xylooligosaccharides from green coconut husks for augmenting gut health and function

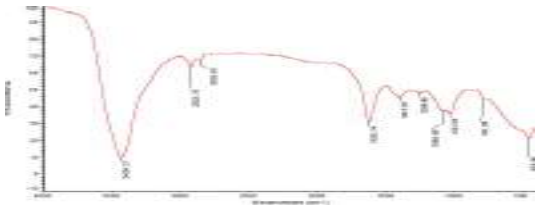
AK Samanta and S Senani

There is an enormous generation of green coconut husks as wastes following consumption of coconut water. Routinely, the green coconut husks is dumped along with municipal wastes or used as fuel as these are not matured enough to make use in the coir industries. On the other hand, there is growing demands for plant sourced bioactive compounds for augmentation of gut health and treatment of gastrointestinal disorders. Keeping in mind the above issues, attempts were made to fractionate xylan, a precursor for xylooligosaccharides.

The green coconut husks (after consumption of coconut water) were collected, chopped and dried. Palm pressed fiber (after oil extraction) was collected from a local firm. The compositional analysis of green coconut husks revealed organic matter 96.2 %, cellulose 57.5 % hemicelluloses 15.3 % and Klasson lignin 3.50 % and that of palm pressed fiber was organic matter 93.4 %, total ash 6.64 %, NDF 77.1 %, ADF 53.6 %, cellulose 48.9 %, hemicelluloses 23.6 % and Klasson lignin 2.49 %. The extraction of xylan from green coconut husk was carried out using various levels of sodium hydroxide or by application of steam. There was increase in the yield of xylan with increased levels of either sodium hydroxide or potassium hydroxide. Potassium hydroxide at a level of 4% resulted in 85% recovery of original xylan in the presence of steam. However, a maximum yield of xylan was obtained with 8% sodium hydroxide in the presence of steam. Further, FTIR analysis of xylan revealed elimination of ester bonds or absence of pectin. The absorbance spectra noticed at 3434, 1401, 1033 and 792 cm^{-1} were associated with xylan.

Palm press fiber was also subjected to xylan fractionation through various levels of alkali (2, 4, 8 and 12%). Following incubation at room temperature, neither sodium hydroxide nor potassium hydroxide was able to ensure higher yields (%) of xylan and true yield varied from 2.6 to 11.6. However, application of steam enabled true yield of xylan almost 28.5 % with 12% sodium hydroxide and 25.7 % with 12% potassium hydroxide, indicating complete recovery of xylan from palm press fiber. The alkali extracted xylan (100 mg) obtained through various fractionation protocol was dissolved in 100 ml of milli Q water. Reducing sugars (mg/ml) varied from 0.084 to 0.230 in the xylan of green coconut husks and 0.020 to 0.231 in the xylan of palm press fiber. While glucose concentration in all xylan samples was between 0 to 0.161 mg/dl.

Between green coconut husks and palm press fiber, the latter was found to be rich (23.6 %) source of xylan. Both potassium hydroxide and sodium hydroxide was effective to ensure higher yield of xylan only in presence of steam. The xylan were free from glucose, pectin or lignin.



FTIR analysis of xylan obtained from green coconut husksby 2% NaOH + steam application

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Patents filed

No. 2954/CHE/2012 dated 20.07.2012 - *Methane reduction using plant secondary metabolites* filed at patent office, Intellectual property rights, Chennai (R Bhatta, KT Sampath and CS Prasad)

Academics

Student's Research

Student	H. Lalpanmawia,
Guide	Dr. A V Elangovan
Subject	Animal Nutrition

Title of the thesis/ research work: Effect of dietary fungal phytase on the performance of broiler chicken

Objectives:

To assess the effect of fungal phytase on growth performance in broiler chicken.

To study the calcium and phosphorus utilization on phytase supplementation in broiler chicken.

A total of 192 day old broiler chicks, vaccinated against Newcastle disease obtained from commercial hatchery were divided in a Completely Randomised Design (CRD) into four dietary treatments. Chicks were housed in battery cages fitted with heating arrangements, feeders, waterer and dropping trays, 24hr light, proper air ventilation and reared under standard managemental conditions. Each dietary treatment included six replicates and each replicates had eight chicks. The dietary treatments consisted of one positive control group, Group I without any phytase enzyme (0.45% available P during starter and 0.40% during finisher phase), one negative control group, Group II (0.32% available P during starter and 0.28% during finisher phase) and two treatments with negative control diets, supplemented with two different enzymes, Group III (laboratory produced phytase) and Group IV (commercial phytase) to meet the phosphorus requirements. Experiment was carried out for 5 weeks. The control diet consisted of 3000 ME (kcal/kg) and 22% CP with 1% calcium and 0.45% available phosphorus during starter phase and 3050 ME (kcal/kg) and 20% CP with 1% calcium and 0.40% available phosphorus during finisher phase. The results indicated broiler chicken was able to utilize the lab phytase but however, its efficacy could not match with the commercial phytase, indicating probably higher dose requirement of lab phytase.

Student	S Shree Vidhya
Guide	Dr. Jyotirmoy Ghosh
Subject	Biotechnology

Title of the thesis/ research work: Recombinant production and characterization of buffalo pregnancy associated glycoprotein (PAG)

Pregnancy associated glycoproteins are secretary product of placentome which is available in ruminant maternal circulation. Detection of this molecule in the circulation forms the basis of pregnancy diagnosis in ruminants. The main difficulty in development of assay is non availability of purified protein in the market. Obtaining pure protein from the source has impediment because of scarce availability of material needed to process and the cumbersome method to purify the protein. Recombinant production of protein provides the best alternative since the gene of interest can be obtained from a small amount of tissues which can then be inserted in the expression vector to produce the bulk amount of protein in vitro. Yeast as a protein expression system has the advantage of better expression potential of mammalian protein because they can grow rapidly in simple media and produce high biomass within a reasonable short period of time. Their genetics is more advanced and can be manipulated easily. Report suggest that PAG has extensive N- terminal glycosylation and yeast cells have the capacity of producing N-glycosylated proteins, this system would be ideal for recombinant PAG production.This project is designed with an objective of producing the recombinant PAG in yeast system with an aim to characterize the protein for future use.

Student	S. Nazar
Guide	Dr. J Ghosh
Subject	Biotechnology

Title of the thesis/ research work: Angiogenesis patterns in corpus luteum, oviduct and endometrial tissues during different stages of estrous cycle in buffaloes

Angiogenesis or neo-vascularization process happens in the female reproductive tract with the changing cycle of reproduction and found to have role in development of ovarian follicles, corpus luteum and creation of the micro environment in the oviduct and uterine lumen for early embryonic development. This process is not characterized in different important parts of the reproductive tract of buffaloes which might answer some of the critical event occurring during the cycle or implantation process and would help explaining some of the causes of early pregnancy loss in buffaloes. Similarly the epithelial gap junctions play an important role for the permeability of the serum components in the uterine lumen which act as the media for early conceptus development. The serum derived components in follicular fluid, oviduct and uterine secretions plays an important role for the early embryonic developmental. It is therefore pertinent to understand the formation of gap junctions and its control in the important parts of reproductive organ during buffalo estrous cycle. This project envisaged to assess 1) the changes in micro blood vasculature in ovarian corpus luteum, oviduct and uterine endometrium during different stages of estrous cycle. 2) the expression of genes and factors responsible for angiogenic process and gap junction formations in ovarian corpus luteum, oviduct and uterine endometrium during different stages of estrous cycle. Elucidation of both the process in ovarian structures, oviduct and endometrium would ultimately lead to understanding of the basic physiology of buffalo reproductive tracts during estrous cycle and in turn would help designing the manipulation strategies for improvement of reproductive efficiency in this species.

Student	Dr. Gurupriya V. S.
Guide	Dr. S. C. Roy
Subject	M.V.Sc. (Biochemistry)

Title of the thesis/ research work: Cryogenic changes in major proteases and protease inhibitors of buffalo (*Bubalus bubalis*) and cattle (*Bos taurus*) semen

Proteases and protease inhibitors are secreted by the accessory sex glands of the male reproductive tract and get mixed with the sperm during ejaculation. The exact functions of proteases and protease inhibitors of seminal plasma are currently unknown. It has been hypothesized that proteases are associated with fertility of semen. In human, proteases and their regulators have been reported to play role in sperm storage, maturation, activation and semen coagulation. Recently, various proteases and protease inhibitors have also been detected in turkey and boar semen. In this project, it has been proposed to characterize some of the major proteases and protease inhibitors of buffalo and cattle semen and also to detect the changes in cryopreserved semen. The study will help in developing a suitable semen extender in near future for effective cryopreservation buffalo semen.

Student	M. Saravanan
Guide	Dr. R Bhatta
Subject	Biochemistry

Title of the thesis/research work: Effect of nutrient-interaction on digestibility, microbial biomass yield (MBM), rumen fermentation stoichiometry, methanogenesis and microbial diversity by *in vitro*.

Greenhouse gases (GHG) are found in the atmosphere and absorb radiation with an identical wavelength, at the same time causing an elevation of temperature in the lower layers of the atmosphere. However, it needs to be stressed that methane has 23 times higher global warming potential (GWP) than that of CO_2. Many strategies have been found to reduce the methane emission. However, most of them have inconsistent efficacy or are toxic to host animals at concentrations that are effective in mitigating methane production. Additionally, concerns also arise over potential toxicity to the final products. In recent studies, tropical plants containing tannins/saponins have been found to suppress or eliminate protozoa from the rumen and reduce methane and ammonia productio). Although tannins are generally regarded as antinutritional. However, effectiveness of plant tannins varies depending upon the source, type and content of tannins. With appropriate feeding strategies there should be potential to reduce methane at the stage of formation. The objectives of this study are effect of nutrient-interaction on rumen fermentation stoichiometry and methanogenesis; effect of nutrient-interaction on digestibility; effect of nutrient-interaction on microbial biomass yield (MBM) and Partitioning factor (PF); effect of nutrient-interaction on rumen microbial diversity and effect of nutrient-interaction ratio on methane production and energy expenditure in sheep.

Student	Luna Baruah
Guide	Dr. R Bhatta
Subject	Biotechnology

Title of the thesis/ research work: Molecular characterization of rumen methanogens using methane suppressing bioactive components of novel plants from northeast of India

Global warming is a universal problem due to the emission of greenhouse gases (GHG) by anthropogenic activity. Agricultural emissions of methane accounts for 60% of the total methane from anthropogenic sources, of which 25% arises from enteric fermentation in livestock. Methane emissions in the ruminants also account for 2%-12% of gross energy loss of feeds depending upon the type of diets. In ruminants the methanogenesis occurs in the large fermentative chamber known as rumen by large number of different genre and species of bacteria, protozoa, but more specifically by methanogens. The rising concentration of methane and loss of productivity due to gross energy loss have encouraged researchers to find alternative strategies to mitigate GHG emissions. Tannins represent an important class of plant secondary metabolites and are produced by the plants in their intermediary metabolism. The proposed research work orients towards exploiting the methane suppressing property of novel plant species from northeast of India, with the objective of comparing whole plant and commercially available extracted tannin on rumen fermentation parameter; studying the effect of whole plant and commercially available extracted tannin on total methanogens, protozoa associated methanogen, fibrolytic bacteria and protozoa.

Student	Somashekar. L
Guide	Dr. J. P. Ravindra
Subject	Biochemistry

Title of the thesis/ research work: Predicting bull fertility based on seminal proteins and Sperm membrane proteins

In many circumstances, the factors contributing to the low fertility in bulls are largely unknown. Hence molecular approaches involving biochemical and biotechnological tools could be used to analyse seminal components. Proteomic approach could be a powerful method to identify the proteins involved in regulating spermatozoa function and fertilization. Seminal proteins are either directly or indirectly involved in the fertilization process. These seminal proteins could be either fertility enhancing or reducing function. Analysing such fertility regulating proteins in seminal plasma and sperm membrane are considered to be helpful to predict fertility. Attempts have been made to correlate seminal plasma components and bull fertility and these studies provided promising results which can be applied to the breeding industry. Analysis of semen samples revealed that several sperm surface proteins are associated with sperm functions. The molecular weights of these proteins are ranging from 14 to 70 kDa. Importantly; the identification of a fertility enhancing protein in bull spermatozoa would facilitate the development of a fertility test which can be useful for selection of bulls for the bovine artificial insemination industry. Conversely, identification of fertility reducing proteins also may pave the way for developing contraceptives in humans. Hence, identifying and characterizing the seminal proteins in relation to sperm functional parameters may pave the way to improve fertility in male.

Student	Parthipan. S
Guide	Dr. S. Selvaraju
Subject	Biochemistry

Title of the thesis/ research work: Identification of functional transcripts involved in fertility regulation of bull spermatozoa

The presence of mRNA population in spermatozoa has been confirmed. The role of spermatozoa mRNA in spermatozoa function and early embryonic development has not been studied in detail. The spermatozoa mRNA reflect spermatogenesis gene expression, and/or a prognosis value for fertilization. Since these mRNAs are delivered to oocytes, analysing mRNA profiles in spermatozoa could be helpful as a diagnostic tool to understand the role of male in influencing fertility. Identification along with quantification of certain important mRNA molecules in mature spermatozoa may provide a better understanding of spermatogenesis and fertilization. The broad objective of the present study is to assess the expression levels of certain spermatozoa transcripts involved in fertilization.

Innovative farmers meet

Innvovative farmer being felicitated by Dr.S.Ayappan Secretary DARE and DG, ICAR

Release of compendium by dignitories

The 2nd Innovative and Progressive Farmers Meet was inaugurated by Dr.S.Ayappan Secretary DARE and DG, ICAR on 24th Jan, 2013 at NIANP. The objective of this meet was to recognise innovative/ progressive livestock farmers of Karnataka and neighbouring states and to share their ideas, experiences, innovations to motivate other fellow farmers for benefitting the larger farming community. About 150 farmers from different districts of Karnataka participated in the meet. Ten progressive farmers including 2 women were felicitated on this occasion. Two publications (bilingual) entitled *Farmers Profile* and *Livestock Farming Info Book* was released on the occasion. In the afternoon, an interaction session on a theme *Promising Innovations for Prosperity – Convergence of Stakeholders* was organized.

The other dignitaries who were present on the occasion were Dr. M.Mahadevappa former chairman ASRB experts and illustrious personalites like Dr. K.D.Kokate, DDG (Extn.); Dr. K.M.L. Pathak, DDG (Animal Sciences), Dr. A.S. Nanda, Animal Husbandry Commissioner, Govt. of India. The panel meeting was chaired by Dr.K.Narayana Gowda, VC, UAS, Bangalore and the panalists included very eminent experts, Dr. D.M. Das, Director (AH), Govt. of Karnataka, Dr. K. Prabhudeva, Director of Extension, KVAFSU; Dr. A.S. Khanna, Regional Head, NDDB, Mrs. Leivang, AGM, NABARD, Bangalore and Dr. H. Upendra, Professor & Head, Veterinary Medicine from Veterinary College, Hebbal, Bangalore.

Trainings organized

Distribution of certificates of the winter school at the Valedictory function on16th October

Participnt receiving the certificate during the valedictory function

Winter School on 'Advances in functional genomic concepts and techniques for quality ruminant and poultry production'.

A twenty- one day winter school entitled 'Advances in Functional Genomic concepts and Techniques for quality Ruminant and Poultry Production' sponsored by ICAR was organized from September 26 to October 16, 2012. Seventeen participants from various states participated in the training programme. Four guest faculty one each from CARI, Izatnagar, CCMB, Hyderabad, CDRI, Lucknow and RRC of CIFA, Hessarghatta also delivered lectures to the participants. Participants were distributed the certificates on 16th October at the Valedictory function presided over by Dr.M.Mahadevappa, former Chairman, ASRB and Dr.C.S.Prasad, Director, NIANP were present.

Model training course on 'Advances in improving reproductive efficiency in livestock under filed condition – Knowledge transfer'.

Model training course on 'Advances in improving reproductive efficiency in livestock under filed condition – Knowledge transfer'' sponsored by Directorate of Extension, Department of Agriculture & Cooperation, Ministry of Agriculture, Government of India was held from February 14-21, 2013. Dr. H. Rahman Director,PDADMAS was the chief guest and distributed the certificates.

Particpnt receiving the certificate from Dr. CS Prasad, Director, NIANP during the valedictory function

VTC – Rumen microbes -Hands on training on Isolation and molecular characterization of anaerobic rumen microbes. 12-18 March 2013

A seven day 'Hands on Training program' was conducted under the sponsorship of the Network project on Veterinary Type culture – Rumen microbes entitled - Isolation and molecular characterization of anaerobic rumen microbes, was organized at the Institute from 12th -18th March, 2013. Six participants from various States attended the program and were given hands on training on the isolation of rumen bacteria, fungi and methanogenic archaea, microbiological and biochemical characterization of various microbes, extraction of DNA from microbial samples, amplification of the region encoding 16S rRNA and the internal transcribed spacer region, ligation and electro transformation, selection of positive clones and bioinformatic analysis of sequences. The valedictory function was graced by Dr. C.S. Prasad, Director, NIANP and distributed the certificates to the participants.

Presentation of guest lectures

Agricultural Education Day was organized for the first time on 3rd Dec., 2012 at our institute with the main focus on creating awareness on future prospects of Agriculture and Veterinary Science Education among pre-university students. Over 50 students from Government Pre-University College, Adugodi, and Bangalore participated. A science related quiz programme was also organized and prizes were distributed to the winners. The students showed keen interest and interacted with the scientists of the institute.

Dr. Basavraj Sajjanar, ARS Scientist (Biotechnology, Animal Sciences) from NIASM, Baramati was imparted professional attachment training for three months in the area of "*Effect of heat stress on expression of different heat shock proteins in broiler birds*".

The following Training Programmes were organized under NAIP Livelihood project:

- Balanced feed preparation and improved practices for dairy farmers on 04-08-2012
- Health and Nutrition Management of Sheep and Goat on 12-10-2012

Animal Health Camps were organized under NAIP Livelihood project:

At Challekere (15-05-12), Hiriyur (30-08-12) and at Hosadurga (04-02-13)

Meetings, Conference & Symposia attended by Dr. CS Prasad, Director

Sl. No.	Details of the Meetings	Place	Dates
1	Meeting to discuss XIIth Plan EFC of the Institute with DG	ICAR, New Delhi	27.4.2012
2	Meeting of to discuss fodder platform with DG	ICAR, New Delhi	9. 5.2012
3	National seminar on status, opportunities and sustainability of dairying in Jharkhand, organized by the Deptt. of A.H. & Fisheries,	Jharkhand, Ranchi	1.6.2012
4	Interaction with the German Team regarding collaboration on Rural - Urban Interface	UAS, Bangalore	5.6.2012
5	Interaction with KMF officials regarding issues pertaining to chelated mineral mixture, feed supplements.	Bangalore	6.6.2012
6	Annual Review Workshop of NICRA project	CRIDA, Hyderabad	14.6.2012
7	23rd meeting of ICAR Regional Committee	SBI, Coimbatore	15 / 16.6 2012
8	Meeting to discuss the use of mineral mixture and establishment of feed mill plant	Sirsi, Karnataka.	23.6.2012
9	Meeting to discuss fodder development programmes with Secretary, DAHDF	ICAR, New Delhi	29.6.2012
10	Meeting to finalize technical programme of Animal Science Component of NICRA with DG	ICAR, New Delhi	3.7.2012
11	Inter - Session Meeting of Consultative Committee with the DAHDF	ICAR, New Delhi	18.7.2012
12	Institute - Industry Interface Meeting	Bangalore	20.7.2012
13	Feed & Feed Ingredients Conclave (CLFMA)	Bangalore	21.7.2012
14	Inaugural function of the training on Research Methodology and Biostatistics	PD - ADMAS, Bangalore	27.7.2012
15	South Asian Dairy Congress	NDRI, SRS	26.8.2012
16	National Consultation Meet on Integrated Development of Uttara Kannada District of Karnataka, organized by CMFRI, Kochi	Karwar	1.9.2012

17	National Symposium on Managing Uncertainties in Livestock Sector , organized by CLFMA	Kolkata	13.9.2012
18	Expert Committee meeting on climate change, organized by DAHDF, Min. of Agriculture, Govt. of India	New Delhi	20.9.2012
19	Meeting to discuss 'Technologies for Skill Development' with DG	ICAR, New Delhi	8.10.2012

Trainings undergone by staff

International

Giridhar K

International training on 'Crop Simulation Modeling and Impacts of Climate Change on agricultural production systems' from 11 to 22 February,2013 at Chiang Mai University, Thailand

Gupta PSP

One year Post-Doctoral Training in Reproductive Physiology (Granulosa cell proteomics and Genomics) at Michigan State University, USA under DBT-CREST award program.

National

Malik PK and Arangasamy A

NAIP sponsored National Training programme on 'Assessment of microbial diversity by next generation sequencing (NGS) for taxonomic and metabolic reconstruction of the gut microbes' 22.8.2012 – 4.9.2012 at NIANP, Bangalore

Attended by staff

VIII Biennial Animal Nutrition Association Conference, at Bikaner from 28-30 November 2012

Anandan S, Bhatta R, Chandrasekharaiah M, Gowda NKS, Manpal Sridhar, Malik PK, Prasad KS, Rao SBN, Samanta A K, Soren NM, Sejian V

Panel discussion on Status and challenges in companion animal nutrition Organized by Waltham Ltd. at Veterinary College, Bangalore on October 10th 2012.

Bhatta R, Elangovan AV

Feed and feed ingredients conclave 2012': Future outlook for feed industry vis-a-vis demand – supply of oil meals & price outlook' conference organized by the Solvent Extractors Association of India (SEAI) Hotel Taj Vivanta, Bangalore on July 21st 2012

Bhatta R, Elangovan AV, Manpal Sridhar, Rao SBN, Malik PK, Rajendran D, Soren NM,

XXI Annual conference of Society of Animal Physiologist of India (SAPI) and National Symposium on "Physiological research in changing environmental scenario for sustainable livestock and poultry production" organized by Department of Veterinary Physiology and Biochemistry, VCVSAH, NAU, Navsari-396450, Gujarat between 6-8 November 2012.

Mishra A, Ravindra JP, Roy KS, Reddy IJ, Sejian V

Name of the Scientist	Title	Date
Anandan S	Participated as invited speaker in the Symposium on Detoxification and Use of Physic Nut and Castor Bean Cake conducted by EMBRAPA, Ministry of Agriculture, Livestock and Food supply	Brazil, July 2 - 3, 2012
	Participated as invited speaker in the seminar on Scientific Processing of Cotton Seed oaraganized by All India Coton Seed Crushers Association	Guntur, December 26, 2012
A ngadi UB	International Conference on Statistics and Informatics in Agricultural Research on	December 18 - 20, 2012 IASRI, New Delhi
	Two Days meeting on 'Development of Feed Resource Information System for Ethiopia	February 26 - 27, 2013 at ILRI, H yderabad

Arangasamy A	Workshop on health monitoring of laboratory animals.	June 16, 2012 at Indian Institute of Science Bangalore
	23 rd International conference of ISSRF	February 07 – 09, 2013 at Thiruvananthapuram
Bhatta R	Workshop of the Technical Advisory Group (TAG) of the Food and Agriculture Organization (FAO) of the United Nations	February 12 - 13, 2013 at FAO Rome, Italy
	Annual Review meeting of the 'Outreach project review meeting'	March 22, 2013 at NAS Complex, New Delhi
	One day Scientific Seminar	March 1 st 2013 at PGIVAS, MAFSU, Akola
	QRT - AICRP review meeting of South zone	November 16 - 17, 2012 KVASU, Thrissur
	Resource person in the in teractive session during the Innovative farmers meeting	January 24, 2013 at NIANP
David CG	Workshop on health monitoring of laboratory animals	June 16, 2012 at Indian Institute of Science Bangalore
	29 th Indian poultry science Association Conference (IPSACON 2012)	December 5 - 7, 2012 at Hyderabad
Dhali A **Kolte AP**	Ion PGM Workshop	February 7 - 8, 2013 Life Technologies,Whitefield, Bangalore
	Workshop on developing winning research proposals in agricultural research,	November 19 - 21, 2012, NAARM, Hyderabad.
Elangovan AV	CMU meeting	January 2, 2013 at KVK, Hiriyur
	CIC and CAS meeting of NAIP livelihood project	28th February 2013, at UAS, GKVK, Bangalore
	XXIX Annual conference & National symposium Of Indian Poultry science association	December 5 - 7, 2012 at Hyderabad
Giridhar K	Third international agronomy congress on ' Agriculture Dive rsification, Climate Change Management and Livelihoods'	November 26 to 30, at IARI, New Delhi

	International conference on 'Increasing agriculture productivity and sustainability in India'	January 8 to 9, 2013 at National Institute of Advanced Studies, Bangalore
	Annual Workshop of NICRA	June 12 - 14, 2012 at CRIDA, Hyderabad
Ghosh J	23 rd Annual meeting of the ISSRF and International conference on Repromics - Omics in reproduction	Feb 7 - 9, 2013 at Rajiv Gandh i Centre for Biotechnology, Thiruvanthapuram
	Workshop on qPCR arranged by Bio Rad	October 19, 2012 at IIsc, Bangalore
Gowda NKS	XXIII ICAR Regional Committee meeting	June 25 - 26, 2012 at Coimbatore
	Scientist - Feed industry meeting	July 20, 2012 at NIANP, Bangalore
	South Asian Dairy Congress organized by Media Today Group	August 26, 2012 at Bangalore
	QRT - AICRP review meeting o f East zone South zone	12 - 13 October 2012 at Bhubaneswar 16 - 17, 2012 November at KVASU, Thrissur
	Resource person in the interactive session during the Innovative farmers meeting	January 1, 2013 at NIANP
	Annual review meeting of AICRP on feed resources at NASC	March 21 - 22, 2013 at New Delhi
Khandekar P	Animal health Camp at Challekere cluster of Chitradurga district organized under NAIP livelihood project	May 15, 2012 at Challekere
	Kisan Mela 2013 organized by BAU, Sabour	17 - 18, 2013 March at Katihar
Letha Devi G	National seminar 'New paradigms in livestock production: from traditional to commercial farming and beyond'	January 28 - 30, 2013 at NDRI, Karnal
	Kisan Mela 2013 o rganized by BAU, Sabour	17 - 18, 2013 March at Katihar
Manpal Sridhar	Foundation Day Celebrations and Seminar on Newer Initiatives for Dairy Development	July 1st 2012 at SRS of NDRI

	Meeting of the reconstituted Task Force on Animal Biotechnolog y - I	December 4, 2012 in SKUAST - Jammu
	Zonal workshop (South zone) of financial management including FMS - MIS	January 1 st 2013 at NIANP
	Seminar 'Walking with Science - An Eppendorf perspective' on the occasion of International women's Day	March 8, 2013 at Hotel Goldfinch,Bangalore
Mondal S	Workshop on health monitoring of laboratory animals	June 16, 2012 held at Indian Institute of Science Bangalore
	24 th Annual Conference of Physiological Society of India,	December 12 - 14, 2012, Andhra Medical College, Vishakapatnam
	100 th Session of Indian Science Congress	January 3 - 7, 2013 at Calcutta University, Kolkata
Nandi S	Seminar on newer initiatives for Dairy development	July 1 st, 2012 at NDRI (SRS), Bangalore
	16th ADNAT Convention on Animal Geneti cs and Genomics, A IMSCS,	De cember 16 - 19, at 2012 Hyderabad
	6th Annual Convention of Association of Biotechnology and Pharmacy (ABAP) and International Conference on Environmental Impact on human health and therapeutic challenges - (ICEHT - 2012)	December 20 - 22 at SVV University, Tirupathi.
Pal DT	Workshop on Project Developmen" held at NAARM, Innovative and Progressive Farmers Meet	December 20 - 23, 2012 at Hyderabad January 24, 2013, NIANP
	Brainstorming workshop on *Capacity Building Program under NAIP* organized by NA IP , and IFPRI, New Delhi held	February 21, 2013 at NASC Complex, New Delhi
	Kisan Mela 2013 organized by BAU, Sabour	17 - 18, 2013 March at Katihar
Prasad KS	Pre RMP program on 'Management Developm ent program on Leadership Development'	April 9 - 20, 2012 at NAARM, Hyderabad

Rao SBN	One day trainng programme on Right to Information Act 2005 for first appellate authorities and Transparency Officers on	December 22, 2012
	National Workshop on Health Monitoring of Laboratory Animals	June 6, 2012 at Indian Institute of Science, Bangalore
Rajendran D	National workshop on Health Monitoring of Laboratory Animals	June 6, 2012 at Indian Institute of Science, Bangalore
	International Seminar on future of livestock health: a paradigm change to maximize productivity for economic gains	September 6 - 8, 2012 at Madras veterinary College, Chennai
	Annual Meeting on ZTM - BPD South Zone 2012 - 13 organised by Zonal Technology Management – Business Planning and Development unit in association with Directorate of Oil seeds Research	March 7, 2013
	Management Training Programme on Techn ology Management for Research	Feb 28 - 6 March, 2013 at NAARM Hyderabad
Ravindra JP	Resource person in the workshop cum poultry industry stakeholder's consultative group meet on Alleviation of heat stress in commercial and backyard poultry	March 02, 2012 Veterinary College and Research Institute, Namakkal
	National Seminar on Application of science and technology to promote agricultural growth and value addition organized by JSS Colleg e, KVAFSU, UAS and other universities of Karnataka	December 3, 2012 at JSS College of arts, commerce and science, Mysore
Roy KS	One day Scientific Seminar	March 1 st 2013 at PGIVAS, MAFSU, Akola,
Roy SC	81st Annual Meeting of the Society of Biological Chemists (India) and Symposium on Chemistry and Biology: Two Weapons Against Disease	November 8 - 11, 2012 at Science City Auditorium Complex, Kolkata,
	International Conference on REPROMICS - OMICS in Reproduction and 23rd Annual Meeting of the Indian Society for the Study of Reproduction and Fertility (ISSRF)	February 7 - 9,2013 at RGCB, Thiruvananthapuram

Samanta AK	Institutional Ethical Committee of National Ayurveda Dietics Research Institute,	November 5th, 2012 Bangalore
	Task force meeting of Animal Biotechnology – I of DBT	May 21 – 22, 2012 at SKUAST, Srinagar
	DBT task force meeting on Animal Biotechnology – I	December 4 – 5, 2012 at SKUAST, Jammu
	Third International Conference on natural polymers, biopolymers, biomaterials, their composites, blends, IPNs, polyelectrolytes and gels: Macro to nano scales.	October 26 – 28, 2012. at MG University, Kottayam, Kerala
	Second National Symposium on 'Innovative approaches and modern technologies for crop productivity, food safety and environmental'	November 19 - 20, 2012 at Thrissur, Kerala
Sejian V	Second Joint Indo - Tunisian Workshop on Agricultural Biotechnology and Human Health organized by Department of Biotechnology, Government of India	May 04 - 05 2012 at Bangalore
Senani S	25th Bangalore Nano International Conference	December 5 - 7, 2012
Suganthi RU	International Conference on Advances in Biotechnology and Patenting	February 18 - 21, 2013 at Tamil Nadu, India
	Workshop on *How to write for and get published in journals* organized by Springer Publishers	January 28th 2013 at Christ University Campus, Bangalore

In house seminars

Date	Speaker	Topic
April 20, 2012	Dr. Utpal S. Tatu, Professor, Division of Biochemistry, Indian Institute of Science, Bangalore	Application of Proteomics in Animal Science Research: reference to blood protozoan parasites in human and animals
April 28, 2012	Dr. B R Shome, Principal Scientist, PD ADMAS, Bangalore	Antimicrobial Resistance
June 11, 2012	Dr. Sandeep Shastri, Pro Vice Chancellor, Jain University	Activities and prospects of collaboration with the Jain University, Bangalore
July 27,2012	Dr. N.K.S. Gowda, Principal Scientist, Member Secretary IAEC	Institute Animal Ethics Committee and its role
July 27, 2012	Dr. Atul Kolte, Scientist, Member IBSC	Institute Bio safety Committee and its role
Dec 3, 2012	Dr. Masayuki Shimada, Associate Professor, Department of Applied Animal Science, Hiroshima University, Japan	Cryopreservation of Sperm
Dec 3, 2012	Dr. Jyunya Ito, Associate Professor, School of Veterinary Medicine, Azabu University, Japan	Cryopreservation of oocytes and embryos
Feb 25 2013	Dr. PSP Gupta, Principal Scientist, Animal Physiology	Role of WNT signalling in granulosa cell estradiol synthesis in cattle
March 26 2013	Dr. K. Giridhar, Senior Scientist Animal Nutrition Division	Crop Simulation Modelling

Awards and Honours

Bhatta R

Conferred the Fellow of the Animal Nutrition Association (FANA)

Recognized as an expert of the Technical Advisory Group (TAG) of the Food and Agricultural Organization (FAO), Rome for the initiative on 'Partnership on the Environmental Benchmarking of Livestock Supply Chains'

Dhali A

Conferred as Fellow of the Society of Applied Biotechnology, India

Gowda NKS

Member of working group Number V of 'Interagency group on micronutrients' Coordinated by Indian Council of Medical Research(ICMR), New Delhi.

Conferred as Fellow of Animal Nutrition Association

Member of feed advisory committee of Central Cattle Breeding Farm, Hessaraghatta, Bangalore for the period 2011-2013

Gupta PSP

PG faculty of Physiology and Climatology Divison of IVRI, Izatnagar.

Manpal S

Expert for selection committee of two SRF's under DBT project 'Periphyton enhancement-a sustainable technology for seed rearing and grow -out culture of carps with special refeence to the peninsular carp *Labeo fimbriatus*' at RRC,CIFA, Hessarghatta on 27th December 2012.

Mondal S

Dr. K. Anji Reddy Prize for best poster presentation and Merit prize for best abstract at Physicon 2011 organised by Physiological Society of India, Guntur,

Nandi S

Selected as Associate of National Academy of Sciences (NAAS), 2012

Fellow of Society for Applied Biotechnology (FSAB)

Fellow of Academy of Sciences for Animal Welfare (FASAW)

Fellow of Association of Biotechnology and Pharmacy (FABAP)

Nil's Lagerlof memorial award-2012 by the Indian Society for Study of Animal Reproduction (ISSRF)

Rajendran D

Conferred Fellow of International Society of Biotechnology

Roy KS

Dr. J. N. Pandey Memorial Best Poster Presentation Award in XXI Annual Conference and National Symposium on 'Physiological Research in Changing Environmental Scenario for Sustainable Livestock and Poultry Production' of SAPI at NAU, Navsari, Gujarat from 6 to 8 Nov2012.

Roy SC

Project Reviewer of research projects of Czech Science Foundation (www.gacr.cz/en), main funding agency for basic research under Czech Republic.

Samanta AK

Talent Award by Society for Biotechnology on 19th November, 2012 at Thrissur, Kerala.

Best paper award By Alumni association of NDRI – SRS for manuscript entitled "Complete feed block: its preparation and effect on animal production" on 27th February, 2013.

Selvaraju S

Cutting-edge Research Enhancement and Scientific Training- Award 2011-12 of Department of Biotechnology, New Delhi.

Selvaraju,S., P. Raju, SBN.Rao, S. Raghavendra, S. Nandi, D. Dineshkumar, A. Thayakumar, S. Parthipan, JP. Ravindra were awarded Nils Lagerlof award at ISSAR Conference 2012 for the best research paper entitled, "Evaluation of maize grain and polyunsaturated fatty acid (PUFA) as energy sources for breeding rams based on hormonal, sperm functional parameters and fertility published in Reproduction Fertility and Development. 2012. 24(5):669-78.

Linkages and collaboration outside the country

Food and Agricultural Organization (FAO), Rome for the initiative on 'Partnership on the Environmental Benchmarking of Livestock Supply Chains' (R. Bhatta)

Hiroshima University, Hiroshima-Higashi, Hiroshima, Japan under the DST-JSPS sponsored Indo-Japan Project. (PSP Gupta)

Research Advisory Committee

Research Advisory Committee of the Institute (2011-12)	
Dr. S.K. Ranjhan, Director, Hind Agro, New Delhi	Chairman
Dr. C.S. Prasad, Director, NIANP	Member
Dr. B.S. Prakash, Assistant Director General (AN&P), ICAR	Member
Dr. N. Krishna, Ex - Associate Dean, Veterinary College	Member
Dr. O.H. Shetty, Prof. of Bioc hemistry, University of Hyderabad	Member
Dr. V.H. Rao, Prof. & Head of Physiology, Vet. College, Tirupati	Member
Dr. D.C. Shukla, Ex - Head of Physiology Division, IVRI	Member
Shri. N. Rajanna, Ex. MLA	Member
Shri. Prashant, Paricharak Sholapur, Maharashtra	Member
Dr. J.P. Ravindra, Pr. Scientist, NIANP	Member Secretary
Secretary's Nominee, DAHD&F, Govt. of India	Spl. Invitee

Highlights of the Proceedings of the XVII meeting of the Research Advisory committee of the National Institute of Animal Nutrition and Physiology, Bangalore held on 5th May, 2012

The seventeenth meeting of the Research Advisory Committee of the Institute was held on 5th May, 2012 under the chairmanship of Dr. S. K. Ranjhan, Ex-Joint Director, IVRI. The other members present were Dr. C. S. Prasad, Director, NIANP, Dr. N. Krishna, Dr. D. C. Shukla, Dr. V. H. Rao, Dr. O. H. Setty, and Dr. J. P. Ravindra. Dr. N. Rajeswara Rao, Director, CFSPF was the special invitee representing Dept. of AHD & F, GOI.

Dr. C. S. Prasad, Director, NIANP welcoming the chairman and members to the XVII meeting of the institute's Research Advisory committee (RAC), briefed them about the research and related activities of the institute during the period. He made a brief presentation of the XII plan EFC proposal of the institute, highlighting the major programs including the new flagship programs.

The chairman of the RAC, Dr. S.K. Ranjhan welcoming Dr. Prasad as Director of the institute expressed his happiness on his taking over and mentioned that he has been associated with the institute in one way or the other and he is greatly pleased with the progress made by the institute during the course of time. He also appreciated the well structured programs of the institute and the need based and practical approach taken up in addressing fundamental issues related to Animal nutrition and physiology. He also had a word of appreciation to the scientists of the institute for their commendable job.

Following this, the outcome of the completed projects, progress of the ongoing projects and the

proposals of new projects to be undertaken were presented by the in-charges of the respective divisions and units with interaction with the scientists and the RAC members.

The chairman and members appreciated the good work being carried out by the institute. The Chairman reiterated that the on-going institute projects should be brought under the five programs identified for XII Plan.

All the members emphasized the need to impart training in the areas of strength so that the end users are benefitted. With no other agenda items to be discussed, Dr. J.P. Ravindra, member secretary thanked the chairman and members of the RAC for their guidance and valuable contributions.

Research Advisory Committee of the Institute (2012-13)

Dr . K. M Bujarbaruah, Vice Chancellor , Assam Agricultural University, Jorhat	Chairman
Dr . B.S. Prakash, ADG (AN&P), ICAR, Delhi	Member
Dr . C.S Prasad, Director , NIANP, Adugodi, Bangalore	Member
Dr . S.V . Deshmukh, Associate Dean, Veterinary College, MAFSU, Parbhani	Member
Dr . M.N. Razdan, Retd. Dean, (CCSHAU), Bangalore	Member
Dr . G. Dinakar Raj, Prof. & Head, Dept. of Animal Biotechnology, Madras Veterinary College, Chennai	Member
Dr . S. S. Raju, Principal Scientist, NCAP, New Delhi	Member
Dr . P. G. Phalke, CLFMA of India, Mumbai	Member
Shri S. M. Hegde, Uttara Kannada, Karnataka	Member
Shri.Vinay Kore, MLA, Warana Milk cooperative, WaranaNagar , Distt. Kolhapur	Member
Dr . J.P. Ravindra,Pr . Sci., NIANP	Member Secretary
The Secretary/Nominee, Dept. of Animal Husbandry, Dairying and FisheriesGovt . of India, Krishi Bhavan, New Delhi	Spl. invitee

RAC meeting chaired by Dr. K. M Bujarbaruah

Highlights of the Proceedings of the Eighteenth meeting of the Research Advisory committee of the National Institute of Animal Nutrition and Physiology, Bangalore held 15th and 16th February, 2013

The eighteenth meeting of the Research Advisory Committee of the Institute was held on 15th and 16th February, 2013 under the chairmanship of Dr. K. M Bujarbaruah, Vice Chancellor, Assam Agricultural University, Jorhat. The other members present were Dr. C.S. Prasad, Director, NIANP, Dr.B.S. Prakash , ADG (AN&P), ICAR, Dr. S.V. Deshmukh, Dr. M.N. Razdan, Dr. G. Dinakar Raj, Dr. S. S Raju, Shri. S.M Hegde, Shri. Prashanth Paricharak and Dr. J. P. Ravindra.

The Director, NIANP welcomed the chairman and members of the newly constituted Research Advisory committee (RAC) to the XVIII meeting and introduced the members to the chairman and others. He briefed them about the research achievements and related activities of the institute during the period through a power point presentation. He also made a brief presentation of the XII plan SFC proposal of the institute highlighting the major programs including the new network programs proposed and the budget sought.

The chairman, Dr. K.M. Bujarbaruah expressing his appreciation for the upkeep of the beautiful campus and the leadership provided by the Director, expressed that NIANP should take up research truly reflective of national perspective that it possesses. Technology developed / output should have national relevance and the institute should bring in the scientists of other institutes into the ambit of its research activities. The Chairman expressed the hope that the Institute, under the leadership of its present Director, Dr C S Prasad, will achieve newer heights in developing and delivering the kind of technologies needed to push up productivity growth in livestock and poultry sector in India.

Following this, the outcome of the completed projects, progress of the ongoing projects and the proposals of new projects to be undertaken were presented by the in-charges of the respective divisions and units with interaction with the scientists and the RAC members.

Following presentations the chairman and the members appreciated the good work of the scientists and thanked the incharges for excellent presentation. The chairman thanked all the members of the RAC for their active participation in the discussions and valuable inputs. The members appealed to scientists to take up projects some of which cater to scientific community while others to stake holder community. It was suggested that scientists should do a thorough review search before taking up new projects.The meeting ended with vote of thanks from the member Secretary. On the second day the RAC members visited the laboratories and interacted with the scientists.

Institute Research Committee meeting

The XVI meeting of IRC was held from 18-20th June 2012 in the seminar room of the institute under the chairmanship of Dr. C. S. Prasad, Director, and NIANP. In his opening remarks, Chairman stressed need for critical evaluation of new projects. He affirmed the triumvirate of 'dedication, commitment and team-work' to achieve goals as delineated in 'Results Frame Document' – the prime monitoring benchmark of performance. A total of 55 research projects [new (5), ongoing- institute (28) and ongoing-externally funded (22)] have been discussed in detail in the meeting. In his closing remarks, Chairman observed that the discussed research projects were relevant to present scenario and it is essential to bring out tangible results for technology translation and its application.

Institute Research Committee co-ordinated the evaluation of completed projects and ongoing projects on 18/10/2012 for its impact assessment in

terms of various indicators like technical, physical, financial, social/environmental, knowledge products, organizational development. Dr. Mallikharjunappa, Former liaison officer, VC's Camp office, Veterinary college, Hebbal, Bangalore acted as external expert for technology validation of completed projects. Dr. Chandrapal Singh, Professor & Head, Dept. Of Animal Nutrition, Veterinary College, KVAFSU, Hebbal, Bangalore was external expert for Animal Nutrition related projects. Dr. V.V.S. Suryanarayana, Emeritus Professor, IVRI, Hebbal, Bangalore acted as external expert for Animal Physiology related projects. Incharges of Animal Nutrtion division, Animal Physiology division, Bio-energitics & Environmental Sciences division, Extension, Statistics and Economics division have facilitated the project evaluation.

Dr. CS Prasad, Director, NIANP discussing the research projects with external experts

Institute Management Committee	
Dr.C. S. Prasad Director, NIANP, Bangalore - 560 030.	Chairman
The Director, Animal Husbandry & Vety. Sciences Member Govt. of Karnataka, Bangalore	Member
The Dean Vety. College, KVAFSU, Bangalore Dr. V. V. Suryanarayana, Principal Scientist, IVRI	Member
The Dean, College of Veterinary & Animal Science S.V.V.U, Tirupati	Member
Dr. S. Sridhar, Principal Scientist, P.A.C.D., C.I.F.A.	Member
F.A.O., NBAII	Member
ADG (AN&P), ICAR	Member
Shri. S.M. Hegde	Member
Shri. Vinay Kore, MLA, W.M.C., Maharashtra	Member
Dr. Dinesh Bhosle, Hon. Secretary, CLFMA of India & Regional Sales Director AB Vista	Member
Dr. J.P. Ravindra, Principal Scientist & I/c APD	Member
Shri. B. Riyaz Ahmed, Administrative Officer	Member Secretary

Following members were present: Dr. C.S. Prasad, Chairman, Dr. S. Yathiraj, Dean, Veterinary College, KVAFSU, Bangalore, Dr. N. Sridhar, Principal Scientist, C. I. F. A. Hessarghatta, Bangalore, Shri. N. Chandrasekhar, F.A.O., NBAII, Bangalore, Dr. J.P. Ravindra, Principal Scientist & I/c APD and Shri. B. Riyaz Ahmed, Administrative Officer and Member Secretary, NIANP. The following agenda items were approved by the Council vide letter F. No. 29-2/2013-IA-1 dated 05-03-2013: The Confirmation of the proceedings of the 28th meeting of IMC held on 18-05-2012. Chairman informed that the proceedings of 28th IMC on 18-05-2012 has been approved by the council. Review of the action taken on the recommendations of the proceedings of the 29[8th] meeting of the IMC held on 18-05-2012

Special Meeting of the IMC held on 13-03-2013

Special Meeting of the IMC was held on 13-03-2013 to discuss the draft report of QRT (2007-2012) presented by Chairman of the QRT Dr. K. Pradhan,. The proceedings of the special meeting was approved by Council.

Quinquennial Review Team 2007-2012

In consonance with the policy of the Indian Council of Agricultural Research to have Quinquennial review (five yearly achievement audit) of its institutes, the 3rd QRT of the National Institute of Animal Nutrition and Physiology was constituted by Director General, ICAR vide letter No. F.No. 29-4/2008-IA-I dated 29.6.2012 for the period 2007-12 with the following members and specific terms of reference.

Prior to the commencement of the review process, a preliminary meeting of Chairman, Dr. K.Pradhan with DG, ICAR, DDG (AS) ICAR and Director, NIANP was held at Krishi Bhavan, New Delhi on 28th June 2012 to finalize the members of QRT and draw the modalities for submitting the report in scheduled time.

The first meeting of the QRT was held at the institute on 7th Aug, 2012. The Chairman in his opening remarks appraised the members about the importance and relevance of the QRT in providing guidance for the future plans of the institute, setting priorities in research and recommending focused road map for the overall growth and development of the institute in addition to reviewing the progress of various activities of the institute in all fronts.

Director, NIANP made a brief presentation about the institute activities and the proposed programs and thrust areas of the XII plan including the AICRP on feed resources and nutrient utilization in raising animal production and the Outreach programme on methane emission and mitigation for the period from 2007-2012. Then the members discussed various issues and made some observations.

The Chairman in consultation with members developed a schedule for reviewing the progress of both institute research activities and the AICRP and Outreach programs within a time frame.

The QRT made zone-wise review the progress of AICRP and made field visits to see the impact of the technologies at farm-gate level.

Dr. K. Pradhan, Ex Vice Chancellor, OUAT, Bhubaneshwar	Chairman
Dr. V.K. Gupta, National Professor, IASRI, New Delhi	Member
Dr. O.P. Dhanda, Former ADG, (AN&P), ICAR, New Delhi	Member
Dr. T.K. Walli, Former Head of Nutrition Div., NDRI, Karnal	Member
Dr. S.K. Rastogi, Prof. & Head, Vet. Physiology, GBPUAT,	Member
Dr. Utpal Tatu, Prof. Dept. of Biochemistry, IISc, Bangalore	Member
Dr. J.P. Ravindra, Principal Scientist, NIANP, Bangalore	Member secretary

The Team then visited the laboratories and experimental farms, interacted with scientists and had an overall review of the various activities of the institute. In addition to the preliminary meeting, the QRT met twice at NIANP and reviewed the research work presented by the scientists, visited the various facilities and interacted with the scientists, technical, administrative and supporting staff and Incharges of various committees/cells constituted by the Director of the Institute. The draft QRT report was prepared and presented to IMC on 12.3.2013. Following interaction with IMC, the report was finalized on 13.3.2013 for submission to the council.

QRT team discussing with Heads/I/cs of the Divisions

Summary of recommendations and future thrusts emphasized by the QRT:

The ICAR constituted a QRT under the Chairmanship of Dr. K. Pradhan and five expert members representing different disciplines to review the activities of NIANP, Bangalore, AICRP on feed resources and the methane production programme for the period 2007-2012. The team had several meetings with scientists, administrative and supporting staff and discussed issues relating to research, technology generation and dissemination, administrative and financial matters and staff welfare activities.

The team also went through the earlier QRT reports, RAC, IRC and IMC proceeding and such other documents relevant to the review. In order to assess the impact of the AICRP in the field, the team visited villages and interacted with farmers in various parts of the country where the AICRP was functioning. The Director of the institute provided the required inputs and logistic support throughout the visits and meetings. The QRT identified the following trust programs to be addressed by the institute while visioning for future.

- Development of bio-fortified feeds in collaboration with crop scientists.
- Developing molecular markers for assessing fertility and pregnancy in farm animals.
- Studies on life cycle assessment of greenhouse gas emission.
- Developing synthetic gut micro flora for optimizing nutrient use efficiency.
- Studies on systems biology including metabolomics and bioinformatics.
- Development of biosensors for up/down regulating genes using pen side kits.
- Partitioning of nutrients for various productive functions.
- Production of animals of desired sex.
- Targeted gene regulation for lower residual feed intake (RFI) for improved feed efficiency.
- Physiogenomic approach for improving heat tolerance in livestock.

Distiguished Visitors

Name of the visitor	Date
Dr. M.Rajashekhar, former Director, PD - ADMAS, Bangalore	28.4.2012
Dr. Sandeep Shastri, Vice - Chancellor, Jain University, Bangalore	11.6.2012
Dr. Sudha Deshmukh, Dean, Sciences, Jain University, Bangalore	
Dr. S.K.Bandyopadhyay, Member, ASRB, New Delhi	22.6.2012
Dr. Charan Das Mahant, Hon'ble Union Minister of State for Agriculture and FPI	9.7.2012
Shri Sudhir Bhargav, Hon'ble Member, Governing Body, ICAR	11.7.2012
Dr. A.K.Srivastava, Director, NDRI, Karnal	20.7.2012
Dr. Balram Singh Yadav, Chairman, CLFMA, Mumbai	
Dr. Harinder Makker, FAO Rome	23.7.2012
Dr. Carolyn Opio from FAO, Rome	
Dr. A.S.Nanda, Animal Husbandry Commission er, Govt. of India, New Delhi	31.7.2012
Dr. C.D.Mayee, former Chairman, ASRB, New Delhi	18.8.2012
Dr. James Reecy, Iowa state University, USA	27.8.2012
Dr. B.S.Prakash, Asstt. Director General (ANP), ICAR, New Delhi	29.9.2012
Dr. D.V.Guruprasad, forme r Director General of Police, Govt. of Karnataka	19.11.2012
Dr. Gurbachan Singh, Chairman, ASRB, New Delhi	24.11.2012
Dr. K.Prabhakar Rao, Vice - Chancellor, SVV University, Tirupati	
Dr. C.Renuka Prasad, Vice - Chancellor, KVAFSU, Bidar	
Dr. Rishendra Verma, Joint Director, IVRI, Izatnagar	11.12.2012
Dr. P.Manjunath, Professor, Medicine, University of Montreal, QC, Canada	15.12.2012
Dr. T.P.Rajendra n, ADG (Crop Science), ICAR, New Delhi	8.1.2013
Shri P.K.Pujari, IAS, Financial Adviser (DARE), New Delhi	11.1.2013

Dr. Charan Das Mahant, Hon'ble Union Minister of State for Agriculture and FPI visiting online examination centre

Dr. T.G.Nagaraja, Professor, Kansas State University, USA being felicitated by Dr. C.S. Prasad, Director, NIANP

Shr i Devendra Kumar , Director (Finance), ICAR, New Delhi

Dr . M.M.Pandey , Dy. Director General (Engg), ICAR, New Delhi 19.1.2013

Dr . S.Ayyappan, Secretary, DARE & Director General, ICAR, New Delhi 24.1.2013

Dr . M.Mahadevappa, former Chairman, ASRB

Dr . K.M.L. Pathak, Dy . Director General (AS), ICAR, New Delhi

Dr . K.D.Kokate, Dy . Director General (AE), ICAR, New Delhi

Dr . K.Narayana Gowda, Vice - Chancellor , University of Agricultural Sciences, Bangalore

Shri G.C.Pati, , IAS, Secretary to Govt. of India, Ministry of Agriculture, Deptt. of A.H., D. & Fy., New Delhi 31.1.2013

Shri G.C.Pati, , IAS, Secretary to Govt. of India, Ministry of Agriculture, Deptt. of A.H., D. & Fy., New Delhi visiting the labs

Dr. M.M.Pandey, Dy. Director General (Engg), ICAR discussing with Director

Shri.S. Biswas, Principal Secretary, Animal husbandry, Govt. of Kerala, 31.1.2013

Dr . M. P. Yadav, Former , VC, Sardar Vallabhai Patel Univ. Agriculture & Technology, Meerut 31.1.2013

Dr . T.G.Nagaraja, Professor , Kansas State University, USA 7.2.2013

Dr . Chandan Rajkhowa, Director , NRC on Mithun, Jharnapani, Nagaland

Dr . K.M.Bujarbaruah, Vice - Chancellor , Assam Agricultural University,Jorhat 15.2.2013

Dr . A.P .Srivastava, National Coordinator , NAIP , ICAR, New Delhi 28.2.2013

Dr. A.S.Nanda, Animal Husbandry Commissioner, Govt. of India, New Delhi visiting NIANP facilities

Prof. James Reecy, Iowa State University, USA during NAIP training programme

Other Activities

Infrastructure

During this year, the Extension of Laboratory blocks and General stores, Guest House first floor were completed and were inaugurated by Dr. S. Ayyappan, DG, ICAR.

Institute Technology Management Unit

The Institute Technology Management Unit handles intellectual property and services provided by institute scientists and laboratories for sample analysis, consultancy projects, contract research and commercialization of technologies developed in the institute. Area Specific Mineral Mixture technology developed at NIANP was commercialized to M/s Totagars Co-operative Sales Society Ltd, Sirsi, and Karnataka. The mineral Mixture for Small Ruminants (Sheep & Goat) developed by NIANP was commercialized to M/s Nandi Agrovet, Bangalore. One patent application on "Methane reduction using plant secondary metabolites" has been filed.

The Institute has offered sample analysis services to various organizations. The services include proximate analysis, micro and macro mineral analysis, toxicological testing of the feed samples, hormone estimation etc. Under this service the institute has processed approximately 125 external samples for various analyses.

The state and district-wise FeedBase was updated and new version is available through ITMU. A consultancy research project for International Livestock Research Institute, Hyderabad was completed during the year, generating revenue of Rs. 2,14,534/-. A contract research project on "Evaluation of 'Ration plus for ruminants' in lactating dairy cows" was taken up generating revenue of Rs. 2,50,001/-. One contract research and One International consultancy projects are under process.

The Institute Technology Management Unit has published two booklets namely Technology Profile and NIANP Technologies an overview. These publications features technologies ready for commercialization like use of areca sheath as an alternative to dry roughage in TMR (Patent Applied), process for preparation of xylo-oligosaccharides form ragi straw (Patent Applied),process for production of xylo-oligosaccharides from corn by products. Technologies under development like pregnancy diagnostic kit for buffaloes,Semen sample evaluation kit,Biochemical/molecular marker for Cu and Zn status in animals, fungal phytase production through immobilization,herbal preparations for controlling growth of mycotoxin producing fungi in feed, nutraceuticals production from green coconut husk and pineapple fruit residue as livestock feed are also provided in the publication.

Fodder production unit

This unit is entrusted with the responsibility of round the year supply of green fodder to the experimental livestock unit (ELU) of the Institute. During the year, various crops like maize, jowar (variety: CoFS-29), sorghum sudan grass, Hybrid Napier Bajra, guinea grass and para grass were cultivated. Demonstration plots with new varieties of fodder were developed. The top feeds were regularly supplied from Sesbania and Gliricidia trees raised on the field bunds. Azolla cultivation continued in shallow ponds for its use as supplemental feed. The seedlings of fodder trees like Melia and Sesbania, stem cuttings of Gliricidia, and the culture of Azolla were supplied to several farmers. Silage was prepared using maize, sorghum and lucerne in the plastic bins as well as polythene and gunny bags. Demonstrations were organised on Azolla cultivation and silage preparation in plastic bags and bins for the benefit of farmers.

Experimental Livestock Unit (ELU)

During this year at Experimental livestock unit, 23 cattle, 13 buffaloes, 114 sheep, 100 rats and 700 broiler poultry were maintained for different experiments. Totally 10 experiments under different institute and externally funded projects were undertaken by scientists. About 120 tree plantations are being maintained for improving the green canopy of the farm. There is one Technical officer and one Veterinary Officer for managing the livestock unit.

Library

An amount of Rs 26.53 lakhs was incurred during the financial year (2012-13) towards the development of library and information resources infrastructure. Total 'Eighteen'text books have been procured during the year. Presently the Library is subscribing to 30 Foreign (including 4 Online and 12 free online along with print version Journals) and 31 Indian Journals to keep the scientists and technical staff abreast of the latest scientific and technical developments both in India as well as abroad.

Besides these, the library subscribes seven general magazines, seven newspapers and has received 407 gratis publications from India as well as from International Institutions/Organizations. The library has 2661 back volumes and 80 unbound titles of Indian and Foreign journals. The Library facilities are also offered to the officials, students of Veterinary Colleges, Universities, researchers and other ICAR Institute officials for their reference work. The library has developed Library Web Portal (i.e www.nianp.res.in). This portal contains library history, book in stack, journal holdings (since 1995), online journals, database collection, current subscribed journals, Scholar Publications (with abstracts), non-book materials etc. The same has been updated regularly. Computerization of the Library is under progress. This Library has fulfilled 528 requests from outside reader's by sending articles of their interest by post / online under Consortium for e-Resources in Agriculture (CeRA). Library has collected all the publications published since 1995, intending to launch Institutional Repository and title, author source, abstracts of all the scholar publications have been made available for retrieval and dissemination purpose. Library has rendered reprographic services to the staff, trainees, and students including our own, administration and account section's.

Official Language Implementation Cell

Quarterly meetings of official language implementation committee and Hindi Workshops were held regularly every quarter. The Institute celebrated Hindi Saptah from 14.09.2012 to 21.9.2012. During the Hindi Saptah various competitions were organized such as Hindi Song, Hindi letter writing, Hindi noting and drafting, Hindi translation and Hindi Paper presentation. The winners of the different competitions were given cash prizes o n the closing day. The institute was represented in different competitions organized by town official language implementation committee (TOLIC), Bangalore. Shri N Rahgavan won first prize in Crossword puzzle and written quiz. In pursuance of Annual programme of the Department of Official Language, Govt. of India efforts were directed to achieve the annual targets. Ms Mirdula (Assistant) and Sri Ananth Murthy (LDC) attended Basic training programme for working in Hindi on Computer. Sri Lakshman Gowda was nominated for long term Unicode based computer Hindi typing training organized by Hindi Training Sub-Institute, Bangalore.

Staff Welfare Club

Unfurling of the National Flag by
Dr. CS Prasad, Director

Like preceding years, Staff welfare club organized various events. Independence Day was celebrated and various sports activities were organized for staff children of NIANP. Our staff has paid devotion to Lord Ganesha for three days (19-9-2012 to 21-9-2012) depicting the cultural integrity of NIANP where people of all religions had participated in Puja. Our staff has welcomed New Year with hope to strive better to achieve continuous success. Pongal is celebrated in Karnataka with traditional fervor and it is closely related to livestock activities. SWC in connection with Experimental Livestock Unit organized this event with great zeal. Republic day was celebrated where Director unfurled National Flag and addressed the staff.

On the 'Foundation day' of the institute all the retired staff were felicitated by Dr. Gurbachan Singh, Chairman, ASRB, New Delhi who was the chief guest.

Dr. Gurbachan Singh, Chairman ASRB, speaking
on the occasion of Institute's Foundation Day

Various sports were organized by Sports Secretary and prizes were distributed. A friendly cricket match was also held and Director's team won the trophy.

Dr. CS Prasad, Director lifting the cricket trophy

Apart from this SWC organized fare well to Dr. K. P. Suresh and Dr. Vijay Kumar who were transferred to other sister ICAR organizations. SWC has presented them silver plaques as a token of rememberence from NIANP staff. SWC bid farewell to Mr. S. Basavaraja who superannuated on 31/1/2013 after a long service of year. A silver plaque was presented to him as a token of love and affection from NIANP staff.

Women's cell

The Reconstituted Women's Cell of the National Institute of Animal Nutrition and Physiology is functioning with Dr.Manpal Sridhar as chairperson, Mrs.Kalaivani, AAO and Dr.K.Giridhar, Senior scientist (Male representative) as Members. Mrs.Usha Nanaiah Secretary of Womens commission,Bangalore is the external member of

the Cell.The Cell meets regularly and looks into the welfare of approximately thirty women employees ,both permanent staff as well as contract and also the students working in the various externally funded projects. All grievances and Complaint's received are immediately addressed by the Committee. The cell also caters to complaints received by the families of staff members residing in the campus and helps in amicably solving issues. Lectures by external experts pertaining to family and women issues are arranged by the cell for the benefit of the Institute employees.

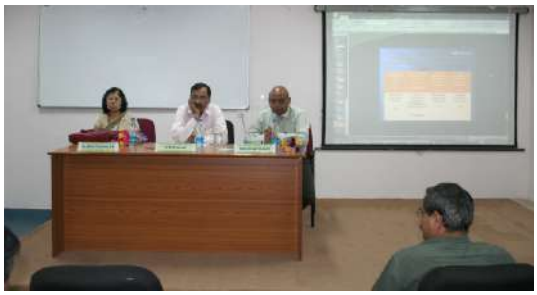
ICAR Zonal Sports Meet

A contingent of 18 participated in ICAR Zonal Sports Meet held between 18-22 February 2013 at Sugarcane Breeding Institute, Coimbatore.

NIANP contingent at Zonal Sports Meet held at Coimbatore

Academic Cell

NIANP is having MOU with Jain University, Bangalore and Bangalore University, Bangalore to offer research programs leading to Ph.D. degrees. Also collaborated with KVAFSU, Bangalore and IVRI, Izatnagar for guiding PG and Ph.D. students in various subjects. At present there are 11 Ph.D. and 3 M.V.Sc. students in this institute who are registered in above mentioned different universities.



Jain University officials during the signing of MoU with NIANP

ARIS Cell

ARIS cell has equipped with two new servers, one for the institute web server and another one for feed portal and web based knowledge base management system in animal nutrition and physiology. The ARIS has 100MBPS National Knowledge Network (NKN) connection and through this the ARIS cell has provided high speed internet connection to all systems to provide adequate impetus to strengthen and share knowledge in academic and research community.

The project entitled Developing, commissioning, operating and managing an online system for net/ars prelim examination in ASRB, is under progress (April 2010- March 2014). The ICAR, CCPI is Dr. C. S. Prasad, Director, NIANP and the nodal officers are Dr. U. B. Angadi and Dr. A. P. Kolte.

Dr. S.K.Bandyopadhyay, Member, ASRB, New Delhi reviewing the ASRB online examination facility

Personnel

Dr. C. S. Prasad	Director
Animal Nutrition Division	
Dr. K. S. Ramachandra	Pr. Scientist (on lein)
Dr. K. S. Prasad	Pr. Scientist and Incharge
Dr. S. B. N. Rao	Pr. Scientist
Dr. M. Chandrasekharaiah	Pr. Scientist
Dr. A. K. Samanta	Pr. Scientist
Dr. Swaraj Senani	Pr. Scientist
Dr. N. K. S. Gowda	Pr. Scientist
Dr. S. Anandan	Pr. Scientist
Dr. K. Giridhar	Sr. Scientist
Mrs. A. Thulasi	Scientist
Dr. D. T. Pal	Sr. Scientist
Dr. D. Rajendran	Sr. Scientist
Dr. P. K. Malik	Sr. Scientist
Dr. N. M. Soren	Sr. Scientist
Dr. Soumitra Jash	Scientist
Dr. Atul P. Kolte	Scientist
Dr. M. Bagath	Scientist
Shri. N. Shivakumar	Technical Officer T-6
Dr. Awachat Vaibhav Bhagwan	Technical Officer T-6 (F/FT) (Veterinary)
Shri. H. S. Narayana Rao	T-2 (Lab Technician)
Animal Physiology Division	
Dr. J. P. Ravindra	Pr. Scientist and Incharge
Dr. J. R. Ippala	Pr. Scientist
Dr. P. S. P. Gupta	Pr. Scientist
Dr. S. Mondal	Sr. Scientist
Dr. S. C. Roy	Sr. Scientist
Dr. Sumanta Nandi	Sr. Scientist
Dr. Jyotirmoy Ghosh	Sr. Scientist
Dr. V. Sejian	Sr. Scientist
Dr. Ashish Mishra	Sr. Scientist
Dr. Ivan Corbon Godfrey David	Scientist
Dr. S. Selvaraju	Scientist
Dr. (Mrs.) Anjumoni Mech	Scientist
Dr. A. Arangasamy	Scientist
Shri. Veeranna Kadakol	T-3 (Lab Tech)

Bio-Energetics & Environmetal Sciences Division

Dr. (Mrs.) Manpal Sridhar	Pr. Scientist and Incharge
Dr. A. V. Elangovan	Pr. Scientist
Dr. Raghavendra Bhatta	Pr. Scientist
Dr. K. S. Roy	Sr. Scientist
Dr. G. Ravi Kiran	Sr. Scientist
Dr. Arindam Dhali	Sr. Scientist
Dr. (Mrs.) R. Umaya Suganthi	Scientist
Dr. Vijay Kumar	Scientist (Till 11-05-2012)
Shri. S. Basavaraja	Technical Officer (Till 31-01-2013)

Economics Statistics & Extension Division

Dr. Prakash Khandekar	Pr. Scientist and Incharge
Dr. U. B. Angadi	Scientist
Shri. T. Chandrappa	Scientist (on study leave)
Dr. (Mrs.) G. Letha Devi	Scientist

Fodder Production Unit

Dr. K. Giridhar	Sr. Scientist
Shri. B. H. Venkataswamy	Technical Officer T-6 (F/FT)

Library

Shri. G. S. S. R. Krishnan	Technical Officer T-6 (Lib)

Estate/ Maintenance

Shri. V. Ramesh	Technical Officer T-6 (W/S)
Shri. D. R. Govinda	T-2 (F/FT)
Shri. Shivarama	MT-1 (W/S)

Aris Cell

Dr. U. B. Angadi	Scientist

Administration

Shri. B. Riyaz Ahmed	AO
Shri. N. Raghavan	PS
Mrs. R. Kalaivani	AAO
Shri. S. R. Nataraja	Assistant
Shri. S. R. Sreenivasa	Assistant
Shri. Sureshbabu	Assistant
Mrs. J. V. Jyothi	Assistant
Mrs. Prema Nagaraj	LDC
Shri. Lakshman Gowda	LDC
Shri. Naveen Kumar	LDC

Accounts & Audit

Shri. Joseph George	FAO
Miss. M. P. Mridula	Assistant
Mrs. B. Geetha	UDC

Supporting Staff

Shri. Chennamaraiah	SSS
Shri. K. S. Srikanta Shastry	SSS
Smt. Ningamma	SSS
Smt. Mahalakshmi	SSS
Shri. K. Narayana	SSS

Transfer

Dr. K. P. Suresh	Transferred and relieved from NIANP, Bangalore on 30-04-2012 to PDADMAS, Bangalore
Dr. Vijay Kumar	Transferred and relieved from NIANP, Bangalore on 11-05-2012 to NRCE, Hissar, Regional Station, Bikaner
Shri. S. R. Nataraj	Transferred from PDADMAS, Hebbal and joined NIANP as Assistant on 10-07-2012
Shri. Joseph George	Transferred from CIRG, Makhdoom and joined at NIANP as F&AO on 09-10-2012

Recruitment/Appointment/Joining

Dr. Pradeep Kumar Malik	Joined at NIANP as Senior Scientist on 23-04-2012.
Dr. Nira Manik Soren	Joined at NIANP as Senior Scientist on 22-05-2012.
Dr. Ashish Mishra	Joined at NIANP as Senior Scientist on 01-08-2012.
Dr. Sejian Veerasamy	Joined at NIANP as Senior Scientist on 04-06-2012.
Miss Mridula M. P.	Assistant (Direct recruitment from ASRB) and joined at NIANP on 24-05-2012
Shri. Anbu R.	Assistant (Direct recruitment from ASRB) and joined at NIANP on 02-07-2012
Shri. Ananthamurthy	Joined as LDC on 24-12-2012.
Shri. M. Naveen Kumar	Joined as LDC on 27-12-2012.

Retirement

Shri. S. Basavaraja	T.O. T-9 (LT) retired from council's service and relieved from NIANP on 31-01-2013

Dr. CS Prasad, Director felicitating Shri. Basavaraja on his superannuation

Annexure

List of Projects

A. Institute Research Projects

Programme No. 1: Livestock feed and production modeling based on district-wise feed resource mapping

Project Name	Duration	
	Start	End
Estimation of production of crop residues with remote sensing techniques	May 2010	March 2014
Refinement of Livestock feed Resources and Development of dynamic database information system	July 2010	June 2014
Development of Indian Livestock Feed Portal	May 2010	Sept. 2013

Programme 2: Enhancing bio-availability of nutrients for increasing production efficiency

Project Name	Duration	
	Start	End
Assessing the methane production potential of commonly available ruminant feeds using the in vitro gas production technique (IVGPT) and the efficacy of plant tannins as methane suppressants/inhibitors	April 2007	March 2013
Production of lignolytic enzymes from white rot Aerobic fungi through immobilization and their efficacy in crop residues	June 2008	March 2014
Evaluation of Copper chaperone for SOD (CCS) as a sensitive biomarker of Copper deficiency in animal	July 2009	Sept. 2013
Mineral solubility in rumen from mixed rations and its effect on rumen fermentation and animal performance	July 2009	Sept. 2013
Precision feeding in relation to protein for enhancing milk production performance in cattle	June 2012	June 2014
Identification of molecular mechanism in stressed layer chicken fed with dietary chromium	May 2010	March 2014
Production of recombinant expansins and its possible utilization for improving fibre degradability in ruminants	May 2010	April 2013
Dietary manipulation for production of omega-3 enriched chicken meat	June 2012	May 2015
Molecular profiling of rumen acetogens at different developmental stages in sheep	July 2012	March 2015

Programme 3: Improving productive and reproductive efficiency through physiological and nutritional interventions

Project Name	Duration	
	Start	End
Biophysical translation of nutrients during ovulatory cycle of hen: bio-mineralization of egg	July 2009	Sept. 2013
Effect of dietary energy on endocrine and immune responses and reproductive performance in sheep	July 2009	June 2012
Development of fertility diagnostic test (s) /kit in assessing bull fertility	May2010	March 2014
Elucidation of mechanisms of perturbation of ovarian functions by ammonia	June 2010	May 2013
Suppression of prolactin gene expression in the *ex ovo* period in birds	April 2012	March 2014
Expression of HSP 70 mRNA in visceral organs of broiler chickens under acute heat stress	Sept. 2011	August 2014
Skewing sex ratio through nutritional manipulation in rat	July 2012	June 2014

Programme 4: Feed quality and safety parameter assessment

Project Name	Duration	
	Start	End
Feed Microscopy: An advanced method for evaluation of feed quality in animal nutrition	July 2009	Sept. 2012
Evaluation of selected herbal products to prevent aflatoxicosis in broilers	June 2009	March 2014
Study on metabolic effects of fluorosis and strategies for its Counteraction	June2009	April 2013

Programme 5 : Bio-informatics, knowledge process out-sourcing and technology testing

Project Name	Duration	
	Start	End
An Expert System for computation of balanced ration for dairy animals in Karnataka state	July 2009	June 2013
Development web based knowledge Management system in animal nutrition and physiology	April 2011	March 2014
Application of statistical and bioinformatics tool for analysis and modeling of genes related to production and reproduction in livestock	Oct.2011	Sept. 2014
Sustainability of dairy farming as a means of livelihood	Dec. 2011	Nov.2014

B. Externally Funded Projects

Funding Agency	Project Name	Duration	
		Start	End
ICAR_AICRP	AICRP on Improvement of feed resources and nutrient utilization in raising animal production (Co-ordinating centre)	Arpil 2002	March 2013
ICAR_Outreach	Outreach Programme - Estimation of methane emission under different feeding system and development of mitigation strategies (Lead center)	April 2008	March 2013
ICAR-NETWORK	Veterinary Type Culture – Rumen microbes component	Oct. 2009	March 2013
ICAR-NFBSFARA	Deciphering the mechanism of aberrant maternal recognition of pregnancy (MRP) events in sheep and buffalo under heat and nutritional stress(Lead center)	Jan. 2011	Dec. 2015
NAIP	Elucidating the physiological and genomic regulation process of follicular development, oocyte maturation and embryogenesis (Cooperating center)	Jan. 2008	June, 2012
NAIP	Livelihood security of rural poor in disadvantaged Chitradurga district of Karnataka through integrated farming system approach (Cooperating center)	Apr. 2009	Dec. 2013
NAIP	Value chain on commercialization of maize products (Cooperating center)	Nov. 2008	June 2012
NAIP	Manipulation of rumen ecosystem through modified rumen microbes encoding novel fibrolytic enzymes using nucleic acid based technologies for the improved utilization of crop residues (Lead center)	21.1.2009	30.6.2014
DBT	Detoxification and utilization of key agro-forest based nonconventional oil cakes in the feeding of livestock	13.2.2008	12.02.2013
DBT	Effect of reservatrol and carvacerol in ameliorating aflotoxin induced molecular changes in broilers	29.09.2010	28.09.2013
DBT	Evaluation of herbal residues and nutraceuticals as alternatives to antibiotics for improving the performance of pigs	15.3.2011	14.3.2014
DBT	Development of pregnancy associated glycoprotein (PAG) based immunodiagnostic kit in buffaloes	1.6.2011	27.6.2014
DBT	Mining markers of pregnancy in cell free body fluids of buffaloes (*Bubalus bubalis*)	13.2.2012	12.2.2015
DBT	Molecular cloning and characterization of buffalo sperm CatSper and few other fertility associated proteins for development of a fertility assay to screen sub-fertile buffalo bull semen	17.2.2012	16.2.2015
DBT	Immobilized fungal phytase production and its dietary evaluation in broiler and layer chicken	17.2.2012	16.2.2015

ICAR	Outreach - Monitoring of livestock related drug residues and environmental pollutants (Cooperating center)	Nov. 2009	March 2013
DST-WOSA	A heterologous vector mediated transformation system of Laccase gene from a novel white rot basidiomycete into *Pichiapastoris* for effective degradation of crop residues	22.2.2011	21.2.2014
ICAR	NICRA- Modeling the impact of climate variation on feed resources availability for livestock	Sept. 2011	March 2014
Coconut Development Board	Generation of xylooligosaccharides from green coconut husk for augmenting gut health and function	4.10.2011	3.10.2014
DST-JSPS	Growth factors in small oocyte development : proteomic and genomic approaches	1.8.2011	31.7.2013
DBT	Transcriptomic profiling of spermatozoa for selection of fertile bulls.	28.2.2012	27.2.2015
ICSSR	Vulnerability of Crop – Livestock farming system to climate variability and global economic change: A perspective of Karnataka state.	Aug. 2012	July 2014
NABARD	Evaluation of pineapple fruit residue to use it as livestock feed.	April 2010	Sept. 2011
DBT	Bioconversion of agricultural wastes for production of nutraceuticals to improve gut health in animals	6.2.2013	5.2.2016