वार्षिक रिपोर्ट 2011-2012

Annual Report
2011-2012

भाकृअनुप
ICAR

राष्ट्रीय पशु पोषण एवं शरीर क्रिया विज्ञान संस्थान
बेंगलूरू

National Institute of Animal Nutrition and Physiology
Bengaluru

NIANP

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Preface

It is my proud privilege to present the 16th Annual Report of the National Institute of Animal Nutrition and Physiology, Bangalore (NIANP) – one of the premier research institutions of the ICAR.

In the human life, the 16th year represents youthful vigour, enthusiasm and individual growth. Likewise, I am happy to say that the Institute with the completion of sixteen fruitful years of its inception and encouraged with is success in its accomplishments, is now stepping to the stage of rapid organizational growth, expansion of its research areas and tapping new ventures as well as providing newer directions towards achieving greater accelerated success in its mandated areas of research and developmental activities, particularly with the beginning of 12th Five Year Plan period from April 2012.

In this regard, the NIANP is striding towards 'framing fundamentals in feed and function' to design livestock prosperity in tune with ICAR's stride for 'Agrisearch with human touch'.

The research ambit of the Institute is canopied within 5 thematic areas, each theme addressing the fundamental and basic issues of nutrition and physiology for enhancing livestock production, productivity and reproduction.

The intellectual nurturing of research and priority setting has been ably carried out under the guidance of Dr. S.K.Ranjhan and a highly experienced team of members of the Research Advisory Committee. The stewardship of Institute Management Committee and the coordination of Institute Research Committee has paved way for all-round development of the Institute. The continued paucity of manpower in administrative, technical and supporting staff has no way been impediment to the growth of the Institute.

This has been possible mainly due to the cohesive 'team work' and 'dedication' of all the staff working with devolved responsibilities. Here, I wish to place on record the hard work and intellectual guidance provided by the former Directors of the Institute.

The matrix of national feed resources database is being re-visited with the logistics of novel and potential feed basket to augment the needs of the dynamic livestock across agro-climatic regions. Once completed, the data generated would cater the manifold issues of the researchers and policy planners. This concept is fortified with the creation of 'national feed portal' on nutrient requirements, standards and trade regimes for farmpreneurs. The futuristic vision is being mapped with satellite imageries, interpretation pixels of fodder crops and time-series models to provide quality information to various stakeholders, on the feed/fodder resource management.

The concern for 'green earth' has lead to the tapestry of methane emission from Indian livestock under outreach project. It classifies feed combinations that could placate methane emission. The approaches *in vivo* with rumen microbial manipulation have promising affirmations on methane suppression.The Annual Report 2011-12 focuses on providing green earth way forward.

The gut microflora archea in the realm of prebiotic and probiotics and its inclusion in total mixed ration has unfurled the efficacy of the nutraceutical products.

Lignin biodegradation has been the challenge for researchers, and at NIANP, we have taken this component as a 'Flagship Programme' and our efforts of 'immobilization of enzymes' differential white rot fungi for lignin degradation has borne fruits.

The limitation of buffalo, viz. low reproductive efficiency primal to delayed puberty, silent estrus, lack of effective early pregnancy detection, embryonic losses and lack of quality semen, have propelled this Institute on manifold studies to circumvent pathways that typifies the issues. Azolla as protein supplement, with envisaged meta-analytical designs reflected improvement in follicular growth. The role of LH receptor in follicular dominance has been established. Elucidation of probable mechanism to combat the atretic rate of bufaline follicles is pivotal to reproductive efficiency has been recognized. Pregnancy associated glycoproteins (PAGs) as diagnostic marker in buffaloes and developing suitable diatnostic kit is on the anvil. *In vitro* studies have revealed that IGF-1 improves progesterone production from luteal cells

thus improving embryonic survivability. A suitable fertility diagnostic kit to eliminate sub-fertile bulls to improve field fertility is being developed.

Consistent to the poultry industry's need of vertical accentuation in egg production, longer wavelength lights (red spectrum) improved egg production in commercial layer flocks by about 8 per cent. Stress reduction through inclusion of garlic in the grower and layer rations have shown to increase egg production by 2%. The results from mechanisms behind egg shell biomineralization during post molt production period would be commercially significant to the industry.

The triumvirate of protein, energy and mineral studies have witnessed a new dawn, with evaluation of copper chaperone for superoxide dismutase (CCS) as a sensitive biomarker of copper deficiency in sheep. Under AICRP, protocols for chelation process of minerals and studies on bioavailability of organic minerals has opened up new vistas in understanding the mineral needs of animals and ways to supplement.

Depletion of non-renewable bioresources has platformed researches on novel feed resources. Applicability of sheanut cake, tomato pomace, spent brewer's grain, maize products have yielded positive warrants improving the feed basket and slowly bridging the gap between availability and requirement of animal feed. Herbal supplements significantly reversed the altered parameters and offered protection against aflatoxin in broilers.The key agro-forest based non-conventional oil cakes viz. pongamia and neem have shown promising results.

The year witnessed an Innovative and Progressive Farmers' Meet, wherein feed formulation software was released and technical bulletins were distributed to the participants. Several technologies were showcased with an interactive session. A host of on-farm NAIP
workshops were organized for technology dissemination and feedbacks. Converting discovery with application ahd technology to commercial application has been new waves this year with two techniques commercialized and four patents applied.

Laurels from professional societies have been conferred on the scientists of the Institute for their meritorious research work/presentation. Scores of 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 have emanated from the Institute. The services to various organizations are beint continued. The overwhelming responses in these programmes have provided the fuel for further acceleration.

NIANP added a new facility of 'National Online Examination Centre' for conducting online examinations for Agriculture Research Services. The contributions of the ARIS, Library, Experimental Livestock Unit, Fodder Production Unit, Official Language Unit, ITMU and Sports Cell deserve commendations.

The unstinted support, guidance and encouragement received from Dr. S.Ayypappan, Honourable Secretary (DARE) and Director General, ICAR, Shri Rajeev Mehrishi, Special Secretary, ICAR and Prof. K.M.L.Pathak, Deputy Director General (AS) has been the most inspiring factors in our achievements and we owe them our gratitude. The help and support from Dr. B.S.Prakash, ADG (AN&P), Dr. Gaya Prasad, ADG (AH), Dr. S.C.Gupta, ADG (APB), Dr. Vineet Bhasin, Principal Scientist, Dr. Rajan Gupta, Principal Scientist, Dr. Neelam Gupta, Principal Scientist, Dr. Jyothi Mishri and Shri Pitamber, DS, ICAR is gratefully acknowledged in facilitation of the Institute progress.

I also wish thank the former Directors of NIANP, who have put a sound base and nurtured it well to see a bright tomorrow.

The valued coordination of the editorial board of Dr. Raghavendra Bhatta (Chairman), Dr. S.Jash and Dr. I.C.G.David in compilation, recension and editing with so much care and precision is praiseworthy. All the staff of the Institute need complements for their overall help and support.

Our firm conviction and commitment to the cause of animal nutrition and physiological research for national food security and sustainability hallowed in green and global economy shall usher a new era as we leap ahead with new thoughts, new vigour and new hopes.

(C.S.Prasad)
DIRECTOR

Bangalore,
12th May 2012

Executive Summary

Established in 1995 to conduct basic and fundamental research in Animal Nutrition and Physiology, the National Institute of Animal Nutrition and Physiology (NIANP) has completed 16 eventful and productive years. The Director is the head of the organization assisted and guided by the Research Advisory Committee (RAC) and Institute Management Committee (IMC). The Institute has 39 scientists, 10 technical, 9 administrative and accounts and 5 supporting staff. In 2010-2011, total plan and non-plan budget allocated was Rs. 808.4 lakhs and the expenditure was 795.6 lakhs, with 98.4 % utilization. The total revenue generated during the period was 19.51 lakhs. The institute spear-headed a path of progress in research front under five major programmes identified and approved by RAC and implemented by IRC. A bountiful of twenty four research projects funded from external sources is in place reflecting the institute's pedagogical prudence in the national canopy.

National database on livestock feed resources and forecasting models

A structured methodology and software platform has been developed to launch the refined livestock feed resources database with national acceptability. The livestock population and the feed balance (2009-10) have been estimated for the states of Andhra Pradesh, Tamil Nadu, Karnataka, Kerala, Maharastra, Madhya Pradesh, Gujarat, Rajasthan, Punjab, Haryana, Himachal Pradesh and Uttarakhand. Dry roughage balance (requirement vs. availability) was most acute for MP; greens in AP and Maharastra; concentrates in AP and TN. Haryana has higher number of large and small ruminant and poultry population. Haryana and Punjab are surplus in dry roughage balance. Though deficit in greens and concentrate requirement, Punjab has it in lesser magnitude. Uttarakhand like Haryana has higher number of large and small ruminant and poultry population. The dry roughages and greens are fairly even in HP and Uttarakand, whereas they are quite deficient in concentrate balance.

The Indian livestock feed portal is being developed to include the information on feed resources, nutrient requirements, feed standards, feed markets, imports and exports and feed assessment. A matrix of 712 feed resources with composition, mineral topography, rumen degradable and undegradable protein contents and amino acid profile have been scaled.

For the estimation of sorghum-stover production with remote sensing technique, information matrix on acreage of crop, plant population per unit area, soil fertility status, weather parameters were generated for Kurnool and Solapur districts in Andhra Pradesh and Maharashtra, respectively. The estimated acreage of sorghum was congruent with the official figures of the Department of Agriculture. The normalised differential vegetation index (NDVI) was generated to establish the relationship between leaf area index and biomass production.

In order to assess and forecast the feed resources availability for better management of livestock, linear time series models were developed by using Time Series Forecasting System. The total DM, CP and TDN availability in 2011 is estimated to be 511, 44.7 and 265 m tons respectively. The corresponding figures for 2025 would be 580, 49.5, 300 m tons, an increase of 13.5, 10.654 and 13.350 per cent respectively for DM, CP and TDN over 2011. Dry fodder, concentrates and green fodder contribute 62.5, 9.4 and 28.1 per cent respectively to the total DM availability in 2011. Similarly 36.6, 25.9 and 37.4 per cent of CP is available from dry fodder, concentrates and green fodder respectively. Corresponding percentages for TDN are 56.7, 13.5 and 29.8 respectively. The share of dry fodder and concentrates to the total DM, CP and TDN availability by 2025 is showing an upward trend and that of green fodder a decline.

Methane production and mitigation

The Outreach Project on methane in which NIANP is the lead centre, has twin objectives of developing a database on methane production potential of ruminant feeds available in different parts of the country and to develop mitigation strategies.

Determination of methane production potential of ruminant diets

The feed samples have been categorized as straws/by-products and concentrates and their methane production potential (MPP) were expressed as ml CH_4/ 100 mg truly digested substrate. Among the straws/ by-products MPP was lowest in rice polish 1.96 (containing high crude fat) and highest in Jowar kadbi 12.04. The methane % of the fermented gas in concentrates ranged from 20 to 29, much higher than straw probably due to higher digestibility of the samples. The MPP ranged from 1.03 in Kum Kum cake to 7.80 (home made compound feed). There was significant correlation between fibre fraction (NDF and ADF) and MPP among the feeds samples.

Efficacy of plant tannins as methane suppressants

Fifty six medicinal and aromatic plants were screened for their tannin content. The total phenol content among the samples ranged from <0.5 per cent to 9.0 per cent on DM basis. The improvement in gas volume (ml/200 mg DM) with PEG among the leaf samples ranged from 2.0 ml to 3.66 ml indicating that tannins suppressed gas production. The maximum methane suppression recorded was > 80 percent. The NH_3-N levels indicated protein protection by tannin whereas in few samples there was reduction in TVFA also. There was general reduction in the total protozoa count reflecting defaunation as one of the reasons for recued methanogenesis.

In the NFBSRA project on mitigation of methane emission through rumen microbial manipulations *in vivo* trials were carried out for studying the effect of selected plant products on feed intake, digestibility of nutrients, methane production and growth in crossbred steers and in growing male calves. The total DM intake and the digestibility of nutrients were comparable among different experimental groups. The methane production (g/day and g/kg DOMI) was reduced to about 19 and 15% (g/kg DOMI) due to supplementation of product K and G, respectively in growing male calves. The growth rate (g/day) was increased by about 50 and 17% due to supplementation of products K and G, respectively. Overall, the results indicated that the product K and G are having potential in reducing methane emission without affecting the fermentation and digestibility of feeds in cross-bred calves.

Prebiotics, probiotics and feed processing technology

Synthesis of xylooligosaccharides from agricultural byproducts viz., corn, gram straw, soyabean hulls, tur straw, sugarcane bagasse, ragi straw, corn cobs and corn husks were carried out. Corn husk were the richest source of hemicelluloses (37 to 39 % DM) followed by ragi straw (29.7%), natural grass (28.10%) and sugarcane bagasse (27%). Regarding enzymatic production of xylooligosaccharides it was noticed that, an enzyme dose of 2.65 units at pH 5.0, temperature of 40°C, incubation time of 24 h yielded highest concentration of xylobiose (1.075 mg/ml) and xylotriose (0.629 mg/ml). Application of 0.5% xylooligosaccharides in the diets of broilers exhibited lower levels of blood glucose and cholesterol after continuous feeding for three weeks. There was increase in the population of bifidobacteria at the caecum of birds receiving xylooligosaccharides diets as compared to control birds. Simultaneously there was decreasing trend in the population of *E.coli* and *Streptococci* at caecum of bird on diets containing xylooligosaccharides.

The evaluation of prebiotics on digestibility of total mixed ration prepared with different proportion of ragi straw and concentrate mixture, with prebiotic inulin (derived from chickory roots) at a level of 0.5 to 1% of TMR modulate the gut fermentation commensurating with *in vitro* dry and organic matters. Largely available and nutrient-rich *Moringa oleifera* (Drumstick), propelled its nutritive application as animal feed resource. The study substantiates incorporation of *Moringa* leaves to improve the digestibility *vis a vis* rumen fermentation of poor quality roughages.

Lignin degradation

Immobilized enzymes are of greater purity, greater control over enzymatic reaction as well as high volumetric productivity with lower residence

time. Based on the screening of white rot fungi, *Pycnoporous sangeus, Coriolus versicolor, Pleurotus flabellatus, Pleurotus Floridanus, Lenzites striata* and *Poria plascenta* were found to be most promising for lignolytic enzyme production. Enzyme treatment of ragi straw at 40% proved beneficial in enhancing digestibility as compared to that of enzyme supplementation. *G. lucidum* and *C. versicolor* yielded the best results.

Buffalo Reproduction

Buffaloes suffer from low reproductive efficiency mainly due to delayed puberty, silent estrus, embryonic losses and lack of effective early pregnancy detection in the females and lack of quality semen and exclusion of sub fertile bulls in males. Research at this institute focuses to combat the above problems to augment reproductive efficiency in this species.

Advancing the age at puberty is of utmost importance to the buffalo entrepreneur for better economic returns. Research at this institute has elucidated that a 20 per cent additional energy over and above in the ICAR recommended values for buffalo, advances puberty by 60 days in buffalo calves. Follicular development and maturation of oocytes are regulated by dietary proteins. Azolla as a protein supplement at 5 per cent dry matter level has shown to improve follicular growth. On the contrary, a high protein ration increases the levels of ammonia, urea and blood urea nitrogen which have a negative effect on ovulation and fertilization has been elucidated through meta analysis. The mechanism of action of ammonia on ovarian function is studied in sheep using in vitro techniques. The atretic rate of follicles in buffalo is very high compared to cattle. Elucidation of probable mechanism to combat this is pivotal. The role of LH receptor in follicular dominance has been established.

Attempt to make use of pregnancy associated glycoproteins (PAGs) as diagnostic marker in buffaloes and developing a suitable diagnostic kit employing any of the PAGs is in progress. In order to prevent early embryonic losses the beneficial role of antioxidants and prostaglandin E_2 has been established. An isoform of glutathione peroxidase GPx- 8 has been discovered in buffaloes which is different from that of cattle. In vitro studies revealed that IGF-I improves progesterone production from luteal cells thus improving embryonic survivability.

A suitable fertility diagnostic kit to eliminate sub fertile bulls to improve field fertility is on the anvil.

Avian Biology

Enhancing the productive efficiency of commercial layer hens to increase the total egg production is the need of the hour to address the nutritional security and improve the per capita availability of eggs. Research at this institute has focused to combat this problem by developing nutritional and management strategies to increase egg production. Providing artificial lighting at the poultry houses using longer wavelength lights (red spectrum) than incandescent lighting improved egg production in commercial layer flocks by about 8 per cent. Egg production also depends on the level of stress to which the birds are subjected to during the entire process of oviposition. Mitigation strategy to minimize stress by including garlic in the grower and layer rations have shown to improve overall egg production in birds by 2 %. Also, feeding of garlic sustained egg production beyond 72 weeks (up to 90 weeks) of age and resulted in production of eggs with lowered cholesterol (10%) and triglyceride (23%) and better egg shell quality. Enhancing egg production also warrants improved egg shell quality since increased ovulations should not interfere with the time spent on deposition of egg shell in the uterine shell gland. Zinc oxide fed at 2 per cent level to layer hens of 70 weeks of age for 10 days resulted in moulting due to a reduction in feed intake and duodenal calcium uptake. Studies to anvil into the probable mechanisms behind egg shell biomineralization during post molt production period is in progress.

Rumen Biotechnology

In the NAIP project on manipulation of the rumen ecosystem through modified rumen microbes Feruloyl esterase enzyme has been purified from pet32-FT3-7 BL21 strain and the dialyzed enzyme is used to conduct *in vitro* digestibility of finger millet straw. The digestibility of finger millet straw *in vitro* was increased with 1 and 3 mg level of supplementation when compared to control ('0' level of supplementation). The two levels of supplementation of the enzyme FAE, substantially improved the digestibility of FMS with the significance of this effect being dependent on the level of supplemented enzyme.

Feed quality and safety

Prevalence of unscrupulous market summons non-invasive methods of evaluation. Feed microscopy has been successfully used in cataloguing microscopic structures of wheat and rice bran and usual adulterants were documented. Image Analysis was performed to determine the particle measurements on characteristics viz. area and perimeter of the particles. The surface characteristics of some of the ingredients were documented with the help of surface plots. It revealed characteristic patterns which can be made useful in detection of adulterants.

In the outreach programme of monitoring livestock related drug residues and environmental pollutants, the soil, fodder and dung samples were analysed for lead, cadmium and arsenic from the dairy-zones of urban and peri-urban fringes of Bangalore. Most of the samples have shown the presence of Pb and Cd. In milk the range of Pb was 0.018 to 0.069 ppm and in water it ranged from of 0.009 to 0.060 ppm. Roughages like straw and green fodders contain higher Pb content than concentrate ingredients. Cadmium in milk and water was 0.006 and 0.014 ppm. Cadmium was found in feeds, dung, hair and soils. Roughages showed more Cd content than concentrate ingredients. Arsenic was not detected in all samples analyzed.

Graded level of fluoride supplementation in water to rats showed lowered antioxidant (Super oxide dismutase, ceruloplasmin) and immune status at higher levels of fluoride ingestion (30 & 60 ppm), beyond 6 months of supplementation period. Depressed liver antioxidant activity and change in radiology of femur bone in 30 ppm fluoride supplemented rats were partially ameliorated due to supplementation of boron, calcium carbonate and silicate binder.

Macro and micro nutrients

Studies to evaluate copper chaperone for superoxide *dismutase* (CCS) as a sensitive biomarker of copper deficiency in sheep was taken up. The partial sequences of sheep β-actin, SOD and CCS genes have been derived from the sheep liver tissue.

Feeding fresh azolla @ 2.0 kg /cow/day (Av. 90-100 gm dry azolla) as a green feed supplement resulted in marginal improvement in milk yield (5%) and milk composition.

Newer Feed Resources and xenobiotics

Under the DBT project, sheanut cake was evaluated as an alternate feed resource. The degradation kinetics of the Sheanut cake (SNC), expeller (SN-E) and solvent extracted (SN-SE) indicated that rate of degradation was 0.03702, 0.04802 and 0.03154, respectively with a half time ($t^{1/2}$) of 18.72, 14.43 and 21.98 h. When the *in vitro* gas samples were subjected to the analysis of methane, SNC, SN-E and SN-SE samples produced 2.8, 3.0 and 1.89ml methane/g DM whereas when it was incubated with added PEG, methane production was 7.42, 5.37 and 5.59 ml/g DM, respectively. Sheanut by-products could be used as a source of tannin (contains 7 MJ/kg DM ME and around 12 percent CP) to suppress methane emission in ruminants. There is a great potential for SNC to be incorporated in ruminant feeding not only as a source of energy and protein, but also to suppress methane emission

Shelf life is indispensible to compound feed formulations and such stabilizers are strong drivers for market growth. Tomato Pomace (TP) and Spent Brewer's Grain (SBG) have nearly 75% moisture. Microbial mould was inhibited with urea (0.03 level;

shelf life 3 days) and propionic acid (0.05 level; shelf life 2 days) for tomato pomace. Mould growth was arrested with urea (0.03 level; shelf life 4 days) and propionic acid (0.05 level; shelf life 2.5 days) for spent brewery grain. The relative drying capacity of milling by-products has been graded as de-oiled rice bran>rice bran>wheat bran upto 1.75:1 ratio and de-oiled rice bran> rice bran ⩾ at 2:1. The microbial count on shelf-life of SBG with DORB at 0.3 and 0.5 levels reveals lower colony development compared to RB at 10° and 27° C.

The results of the NAIP funded project on commercialization of maize products indicated that maize cobs could be used as feed source in the ration of sheep without adversely affecting nutrient intake and digestibility. The bulk density of maize cob and maize cob based diets could be increased 3- 9 folds by making complete feed blocks for easy storage and transportation.

Work was undertaken to identify herbal products that can prevent the growth of *Aspergillus parasiticus* (NRRL 2999) fungi and aflatoxin production in feed under *in vitro* conditions. Aflatoxin feeding significantly decreased serum total protein, cholesterol and hepatic marker enzymes and antioxidants and increased lipid peroxidation products in liver. Supplementation of *L. aspera* and *H. indicus* significantly reversed the altered parameters and offered protection against aflatoxin in broilers.

The DBT sponsored study addressed on detoxification of key agro-forest based non conventional oil cakes viz., jatropha (*Jatropha curcus*), pongamia (*Pongamia glabra*) and neem (*Azadirachta indica*). Long term feeding of detoxified neem seed cake replacing soybean meal for growing lambs caused similar responses in terms of ADG, FCE, nutrient digestibilities, N- balance as that of soyben fed group.

Technology translation

An Innovative and Progressive Farmers' meet was organized at the institute on 15th February, 2012. The objective of the meet was to invite innovative/ progressive livestock farmers to share their ideas, experiences, innovations and to motivate other farmers to benefit the larger farming community. Nine progressive farmers were felicitated on this occasion and each one of them shared their experiences and innovations. A book 'Farmers Profile' and a host of extension literatures and two feed formulations were released during the meet and distributed to all the participating farmers. More than 100 farmers participated in the meet and visited the exhibition arranged for them showcasing various technologies viz., formulation and balancing, area specific mineral mixture, azolla cultivation, silage making etc. During the scientist-farmer interaction session, a panel discussion was held, wherein queries of farmers in relation to livestock farming were answered by the experts.

Two workshops under NAIP on livestock health, feeding and management was held on 20th September 2011 at *Sanikere* village, *Challakere* cluster, Chitradurga district and on 28th January 2012 in Hosadurga cluster, Chitradurga district. One day workshop at Hadonahalli, on 'Fodder production and conservation' was organized on 28 June, 2011. Eighty farmers/farm women attended the workshop. There was an interaction session in which the farmers could get their queries cleared from the experts.

Human Resource Development

Several awards by professional societies and recognitions have been bestowed on the scientists of the Institute for their outstanding research work/presentation. 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, a 14 day National Agricultural innovation Project (NAIP) sponsored training programmed on 'Recent advances in methane estimation and mitigation strategies in ruminants' was organized at

the institute from August 5-18, 2011. The ICAR sponsored winter school on 'Functional genomic approaches for enhancing fertility in livestock' was organized by the institute from November 22 –December 12, 2011. A model training course on 'Recent trends in feeding practices for improving dairy production and management' was conducted from December 15-22, 2011 for the field officers of state department of animal husbandry and veterinary services. The 6th successive training program on Research Methodology, data management and Biostatistics was conducted from December 9-10, 2011. 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 are being continued.

Others

A 'National Online Examination Centre' of ICAR established at NIANP was inaugurated by Prof. MJ Modayil, Hon'ble Member ASRB, New Delhi, on December 2, 2011. This excellent facility is for conducting online examinations for Agriculture Research Services, NET, SRF/JRF ASRB, a grate support to the students of the southern states. This state of the art facility has provision for accommodating 100 candidates at a time and is one of the 24 centers in the country.

The Institute also observed official functions like Republic day, Independence Day, Hindi *Pakhwada*, National Integration Day. The kaleidoscopes of social functions like Ayudha puja, Pongal, Institute Foundation Day were adorned with the staff and their families. The Leap day, 2012 witnessed the adieu of Dr. K.T. Sampath as director. A warm welcome was accorded to Dr. C.S. Prasad who resigned the office of Vice Chancellor MAFSU, Nagpur and assumed the office of Director on March 12, 2012.

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 39 scientists including five women scientists in position.

Staff position as on 31. 03. 2012

Category	Sanctioned post	Staff in position
Director	1	1
Scientific	40	39
Technical	12	10
Administrative & Accounts	15	9
Supporting	8	5
Total	**76**	**64**

Priority setting and management

The Institute has a high powered Research Advisory Committee (RAC) comprising of eminent scientists in Animal Nutrition/Physiology who guides the research agenda of the Institute and set research priorities. Dr. S. K. Ranjhan, former Jt. Director, Indian Veterinary Research Institute, Izatnagar ad former FAO consultant 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, Project Prioritization, Implementation Monitoring and Evaluation Cell, Staff Welfare Club, IPR Cell, Institute Technology Management Unit were constituted to decentralize the management and devolve responsibilities for the smooth functioning of the Institute. The Institute Joint Staff Council has been constituted for promoting of 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 final year of the XI plan the new areas identified to strengthen the basic and fundamental research in niche areas have been accomplished to a great extent. The institute is coordinating AICRP on 'Improvement of feed resources' with 22 centres, Outreach Project on 'Methane emission in ruminants' with 7 centres and is a partnerin the outreach project on drug residues and environmental pollutants. The Institute scientists have been associated in four research projects funded by NAIP, three projects funded by NFBSRA, eight projects funded by DBT and one project funded by NICRA. Translation of discovery into application through technology generation and transfer is being effectively carried out by ATIC.

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 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 users level for production enhancement

Expenditure statement

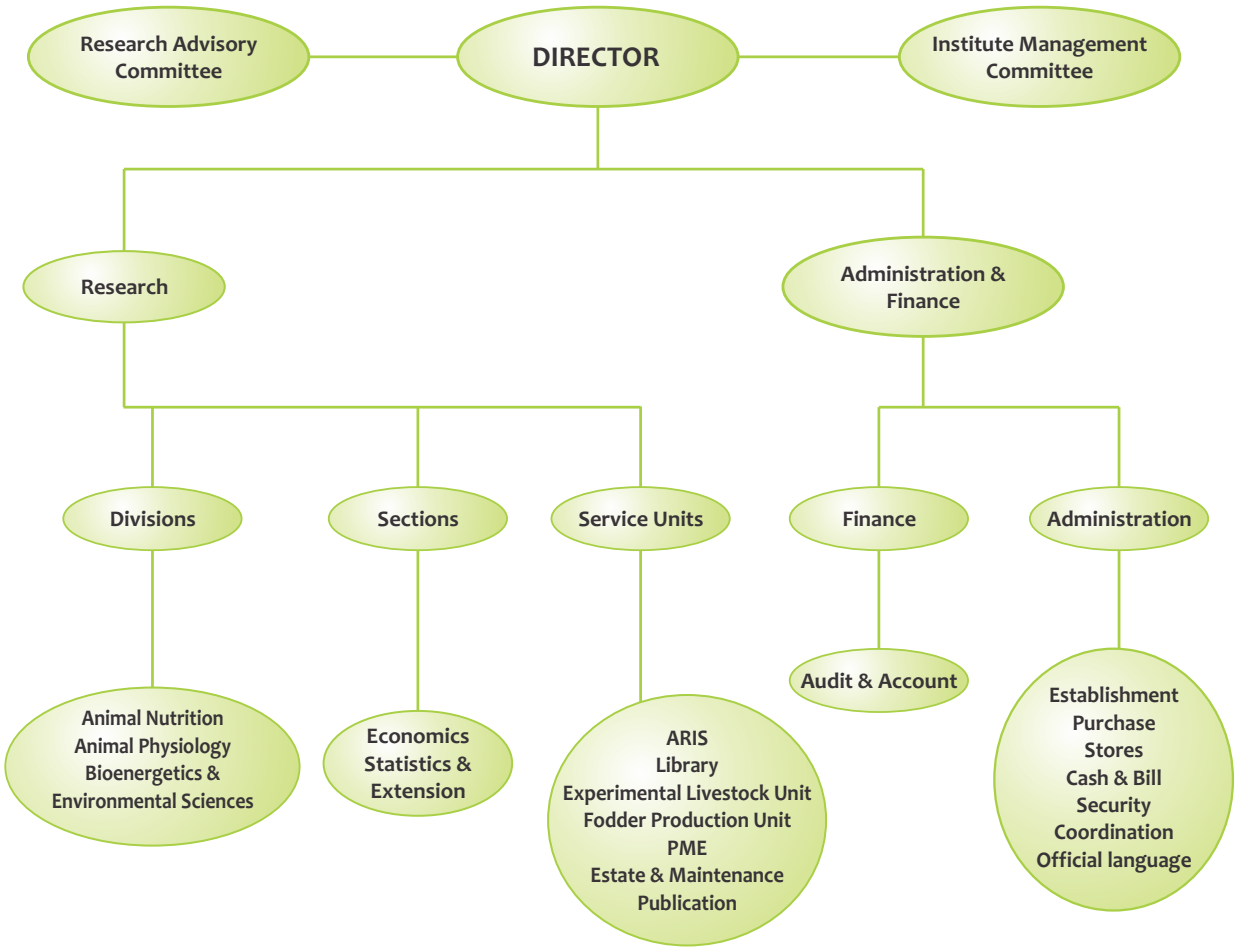
Statement showing the sub head wise expenditure under plan & non-plan budget (Rs. in lakhs)

		Plan (2011-12)		Non-Plan (2011-12)	
Sl No.	Sub Heads	RE	Expenditure	RE	Expenditure
A.	Institute				
	1. Establishment Charges	-	-	553.24	553.35
	2. OTA	43.00	42.95	15.00	14.93
	3. Travelling Expenses	10.00	10.00	2.00	2.00
	4. Other Charges including Equipment	321.36	321.42	165.00	151.20
	5. HRD	1.00	0.98	-	-
	6. Works	95.00	95.00	-	-
	Total (A)	470.36	470.35	735.24	721.54
B.	AICRP on Improvement of Feed Resources and Nutrient Utilization in Raising Animal Production and Outreach Program on Methane Emission.	338.00	325.25	-	-
	Total (B)	338.00	325.25	-	-
	Grand Total (A+B)	**808.36**	**795.60**		

Revenue generation (thousands)

Sl.No	Particulars	Amount
1.	Sale from Farm Product, livestock etc	3,68,738
2.	Training	80,000
3.	Internal Resources Generation Scheme	
4.	Other Receipts	
	Sale of Publication and CD	3,460
	Analytical testing Fee	3,61,180
	Miscellaneous Receipts	14,63,298
	TOTAL	**19,51,676**

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 two sections 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.

Research

Theme Area -1

Livestock feed resource management

Institute Projects

Project 1.2: Documentation and evaluation of brewery waste and tomato pomace as animal feed in Karnataka

S Jash, K Giridhar and SBN Rao

With increased gas between feed demand and availability, it is imperative to identify alternate unconventional feed resources to bridge this gap. Seasonal availability of tomato pomace and spent brewery grain across the Karnataka districts reveal the annual production (2010-11) of spent brewery grain and tomato pomace are 48,932 and 12,342 tonnes on fresh basis. Tomato Pomace (TP) and Spent Brewer's Grain (SBG) are abundantly available but due to high moisture they have very less shelf life. Shelf life is indispensible to compound feed formulations and such stabilizers are strong drivers for market growth. Hence, compound feed from novel 'high moisture' feed resources like TP and SBG summons for shelf life stabilizers. Attempts were made using chemical stabilizers like urea, propionic, lactic, and formic acids, by reduction of water availability (a_w) from the co-products. Microbial mould was inhibited with urea (0.03 level; shelf life 3 days) and propionic acid (0.05 level; shelf life 2 days) for tomato pomace. Mould growth was arrested with urea (0.03 level; shelf life 4 days) and propionic acid (0.05 level; shelf life 2.5 days) for spent brewery grain.

Ragi straw chopped (2-3 cm) was uniformly mixed with TP and SBG to provide about 35% DM packed *in-vitro* with foil. Ensilage studies on tomato pomace and spent brewer's grain with ragi straw showed significant deterioration after 34 and 56 days as evident from colour, pH, sensory evaluation and mould growth parameters for tomato pomace and spent brewery grain, respectively. The drying curve of spent brewery grain and tomato pomace illustrates flexion point of insolation at 50 and 80 minutes respectively. The relative drying capacity of milling by-products has been graded as de-oiled rice bran>rice bran>wheat bran upto 1.75:1 ratio and de-oiled rice bran> rice bran ⩾ at 2:1. The microbial count on shelf-life of SBG with DORB at 0.3 and 0.5 levels reveals lower colony development compared to RB at 10° and 27° C.

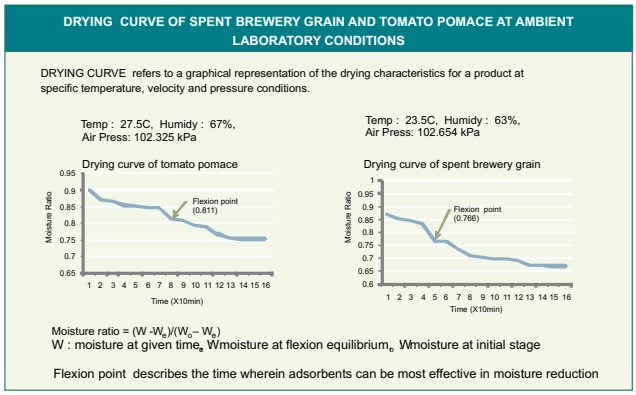


Fig. 1 Defined drying curves of tomato pomace and spent brewery grain

The shelf life of SBG and TP which is the critical factor could be enhanced by ensiling with either DORB, R or WB at 1.75:1 to 2:1 for use as animal feed

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

K Giridhar and S Anandan

The ground truth data on acreage and yield parameters of sorghum was collected from Kurnool district. The measured leaf area index (LAI), grain and stover yield values of a few plots from Kurnool district are presented in Table 1. LISS (Linear Imaging Self Scanner) sensor-III data of Indian Remote Sensing (IRS) satellite with a spatial resolution of 24 m, corresponding to the optimal bio-window of jowar crop was analyzed. By using maximum likelihood classification, sorghum growing areas in the district were identified. The estimated acreage compared well with the official figures obtained from the Department of Agriculture. Generated normalised differential vegetation index (NDVI) and established the relationship between leaf area index and biomass production. The grain yield values and grain to straw ratios obtained from the department of Agriculture were utilised to compute the stover yield. The total stover production of the district obtained from analysis of remote sensing data compared well with the value computed from the official data.

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

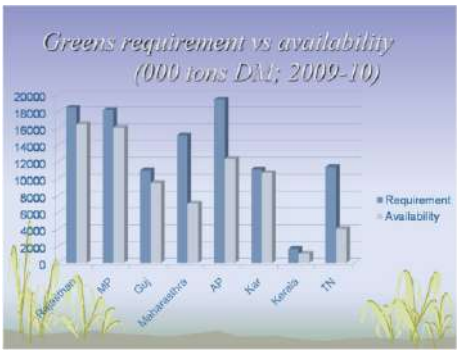
Field no.	LAI	Grain yield (Q/ha)	Stoveryield (Q/ha)
1	3.74	28	42.5
2	5.74	43.5	64
3	5.49	42	67.5
4	5.87	45	68
5	5.71	43.5	66.5
6	5.48	42	68.5
7	5.29	40.5	66
8	3.87	29	47.5
9	4.33	36	57.5
10	4.81	38.5	58

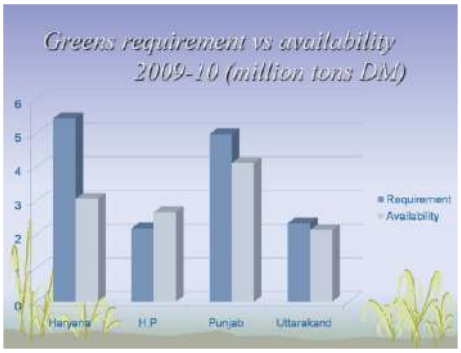
The estimated acreage of sorghum was congruent with the official figures of the Department of Agriculture. The normalised differential vegetation index (NDVI) was generated to establish the relationship between leaf area index and biomass production. The staimation of crop residues production through RS technique correlates well with the official figures in case of sorghum

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

S Jash, S Anandan and UB Angadi

Comparative estimation of large and small ruminants and poultry population for the states of Rajasthan, Gujarat, Madhya Pradesh and Maharastra with estimated figures of Tamil Nadu, Kerala, Karnataka and Andhra Pradesh was carried out. Madhya Pradesh accounted for the highest figure for indigenous cattle, while Tamil Nadu had the highest crossbred population and buffalo population was highest in Andhra Pradesh. All the magnitudes were least for Kerala. Sheep and goat population were highest in AP and Rajasthan, respectively. In poultry, AP had the highest number of layers, while Tamil Nadu increased in broilers.





Dry roughage balance (requirement vs. availability) was most acute in MP; greens in AP and Maharastra; Concentrates in AP and TN. Haryana had highest number of large and small ruminant and poultry population. Haryana and Punjab are surplus in dry roughage balance.

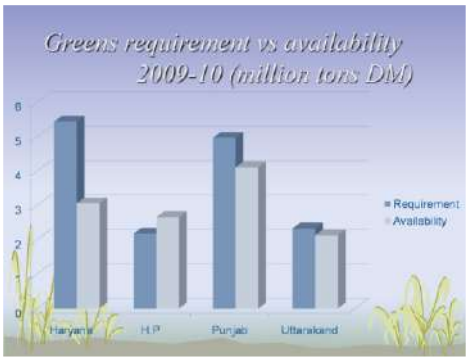


Fig 1. Feed balance across twelve states of India, spaning different agro-climatic regions

The acuteness of dry roughage balance (requirement vs. availability) was accentuated in Madhya Pradesh; greens in Andhra Pradesh and Maharastra; Concentrates in Andhra Pradesh and Tamil Nadu

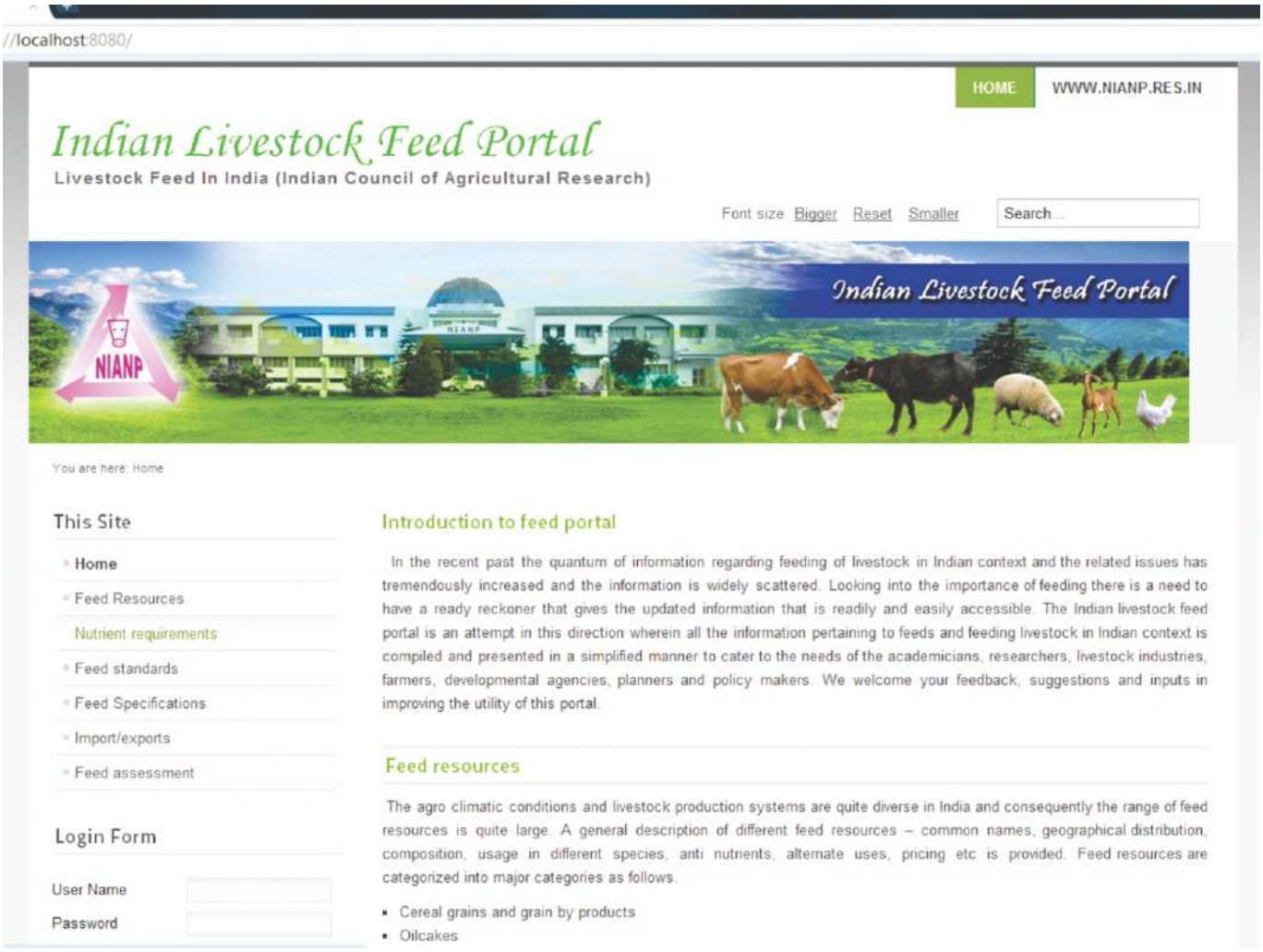
Project 1.6: Development of Indian livestock feed portal

S Anandan and UB Angadi

The information on 712 feed resources with regard to their proximate composition, fiber fractions, mineral composition, RDP/UDP content and amino acids was compiled from the literature. The recent information on export of feed assessment of feed resources has been updated.

A matrix of 712 feed resources with composition, mineral topography, rumen degradable and undegradable protein contents and amino acid profile have been scaled.

Feed Portal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Feed Resources
Nutrient requirements
Feed standards
Feed Specifications
Import/exports
Feed assessment
Login Form
User Name
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Introduction to feed portal
In the recent past the quantum of information regarding feeding of livestock in Indian context and the related issues has tremendously increased and the information is widely scattered. Looking into the importance of feeding there is a need to have a ready reckoner that gives the updated information that is readily and easily accessible. The Indian livestock feed portal is an attempt in this direction wherein all the information pertaining to feeds and feeding livestock in Indian context is compiled and presented in a simplified manner to cater to the needs of the academicians, researchers, livestock industries, farmers, developmental agencies, planners and policy makers. We welcome your feedback, suggestions and inputs in improving the utility of this portal.
Feed resources
The agro climatic conditions and livestock production systems are quite diverse in India and consequently the range of feed resources is quite large. A general description of different feed resources – common names, geographical distribution, composition, usage in different species, anti nutrients, alternate uses, pricing etc is provided. Feed resources are categorized into major categories as follows.
Cereal grains and grain by products
Oilcakes

Theme Area -2

Enhancing bio-availability of nutrients for increasing production efficiency

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

Raghavendra Bhatta and Vijay Kumar

To identify suitable tannin sources as methane suppressants, samples of tree leaves were screened for their phenolic fractions. The total phenol content ranged from 1.0 to 10.0 percent among the samples, whereas the tannin phenol was 0.5 to 9.0 percent. The condensed tannin was maximum in *Ficus bengalensis*, and hydrolysable tannin was high in *Leucena leucocephala.* Out of the 25 samples screened, three most promising tree leaves showing maximum methane suppression with PEG (as a tannin binder) were further screened using a basal diet consisting of finger millet straw and concentrate feed (40:60). The tannin-containing samples were incubated at 5, 10, 15, 20 and 25 per cent of the basal diet. The methane suppression recorded in samples with PEG was also observed when they were incubated with basal diet. As the tannin level increased in the incubation medium, the methane suppression also increased linearly. In sample A, the minimum methane suppression was 16.0 percent (at 5%) and 45.0 percent (at 25 %). In sample B, it was 19.0 and 46.0 percent and in C it was 11.0 and 30.0 per cent. The plateau was recorded at 15 percent tree leaves inclusion in the basal diet.

Twenty six male lambs with an average body weight of 13.0 kg were divided into four groups of six each. They are fed on complete feed blocks containing concentrate (Maize, wheat bran, DORB, Soybean meal, mineral mixture and salt) 70.0 % and ragi straw 30.0 %. The 3 experimental diets contained complete feed blocks without tree leaves (T0), with 10 percent each of tree leaves (T1, T2 and T3). The diets are isonitrogenous. The DMI (g/d) was 721, 701, 777 and 704 with ADG (g/d) 65, 67, 79 and 66 in T0, T1, T2 and T3, respectively. The DMD (%) was maximum in T0 (76.5) followed by T2 (75.8), T3 (74.4) and T4 (72.8). The inclusion of tree leaves did affect the intake and DM digestibility in growing lambs. The determination of methane supression *in vivo* is under progress.

Tree leaves containing appreciable amount of tannins have shown great potential to suppress in vitro rumen methanogenesis

Project 2.4: Evaluation of feed additives and processing technologies for development of total mixed ration

AK Samanta, S Senani, Manpal S and AP Kolte

Proven apprehensions on antibiotics have resulted in alternate pathfinders viz. prebiotics and prebiotics, to improve performance through enhancing gut health. Finally, their product formulations through densified blocks boosts dry matter intake, with decelerated transportation costs.

The evaluation of prebiotics inulin derived from chickory roots on digestibility of total mixed ration prepared with different proportion of ragi straw and concentrate at a level of 0.5 to 1% of TMR modulate the gut fermentation commensurating *in vitro* dry and organic matters. The prebiotics in TMR (50:50 ragi straw and concentrate), enhanced the IVDMD (%) from 60.3 to 70.9; with increase in TVFA concentration from 5.35 to 7.13 mEQ/dl. The screening of potential probiotic strains, reflected the ANPTB13 strain to enhance the TVFA production and decrease the ammonia nitrogen concentration of TMR.

Nationwide ubiquitous availability and popularity of nutrient-rich *Moringa oleifera* (Drumstick) leaves, propelled its nutritive application as animal feed resource. It contained (%)

OM 23.5, CP 20.4, CF 14.6, EE 6.70, NDF 19.5 and ADF 12.0. Ragi straw was fortified with *Moringa* leaves at T1 (100:0), T2 (80:20), T3 (50:50) and T4 (20:80). The TVFA concentration (mEQ/100 ml SRL) increased from 6.20 to 12.80 with increase of *Moringa* leaves. The Ammonia Nitrogen concentration peaked 5.60, 9.80, 12.88 and 20.72 mg/100 ml SRL in T1, T2, T3 and T4, respectively. The IVDMD (46.6 to 76.9%) and OMD (48.5 to 78.7%) also enhanced with the proportionate increase of *Moringa* leaves. The study substantiates incorporation of *Moringa* leaves to improve the digestibility *vis a vis* rumen fermentation of poor quality roughages.

Four Bannur lambs (ABW 14.40 to 15.02 kg) in each experimental group was maintained on densified complete feed blocks (Ragi straw: concentrate: 50:50). With G I as reference, G II probiotic-supplemented (TCD3: 13.1x10^{9}CFU/ day), G III pre-biotic (inulin) supplemented (0.5% of diet) for 21 days. TVFA concentration increased from 10.07 to 12.00 mEQ/100 ml as a result of administration of prebiotics. The ammonia nitrogen ranged from 17.97 to 22.17 mg/dl amongst the different treatment groups. The total viable bacterial population (10^8/ml) was 10.7, 30.7 and 18.7 in GI, II, and III, respectively. The rumen fungal population was 2.07x10^4/ml in control group, 1.65x x10^4/ml in probiotic group and 2.20 x10^4/ml in prebiotic group. The rumen protozoa population (10^5/ml) was 2.9, 11.6 and 13.9 in control, probiotic, and prebiotic groups respectively. DMI (% of BW) was 2.77 in control, 3.08 in probiotic and 2.97 in prebiotic groups. Possibly, the prebiotic inulin was able to modulate the gut microflora in growing lambs.

Moringa leaves improve the digestibility *vis a vis* rumen fermentation of poor quality roughages.
Prebiotic (inulin) @ 0.5% of TMR can modulate the gut microflora to support fermentation towards better nutrient utilization from densified complete feed blocks.

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

Manpal S, R Bhatta and A Dhali

Immobilization is a process for associating the 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. With this background the following objectives were formulated: (a). To screen various matrices for immobilization of white rot fungi for obtaining maximum yields of the lignolytic enzymes; 2. To characterize the lignin modifying enzymes viz. Manganese peroxidase, Lignin peroxidase and Laccase produced by various promising species of white rot fungi under different culture conditions and to determine factors affecting their maximum production; 3. To optimize the quantity of enzyme required for treating straw for maximum efficiency in enhancing *in vitro* and *in vivo* digestibility.

Based on the screening of white rot fungi *Pycnoporous sangeus, Coriolus versicolor, Pleurotus flabellatus, Pleurotus Floridanus, Lenzites striata* and *Poria plascenta* were found to be most promising for lignolytic enzyme production. The enzyme media from each individual fungi was concentrated and three dilutions of 20%, 40% and 60% were used for application to ragi straw. The treatments adopted were 1. enzyme sprayed and kept at room temperature for 24 h and then dried/ incubated and (b) enzyme sprayed just prior to feeding. The harvested and concentrated media from *Pleurotus flabellatus, Poria plascenta* and *Coriolus versicolor* was accumulated and proximate composition and IVDMD were studied at three concentrations of enzyme. *Coriolus versicolor* recorded the highest activities of laccase and lignin peroxidase of 70.2 and 82.1 U/mg, respectively followed by *Poria plascenta* which recorded 57.2 and 63.2 U/mg of laccase and lignin peroxidase activity. Ragi straw after enzyme treatment and supplementation with *Pleurotus flabellatus, Poria plascenta* and *Coriolus versicolor*

showed 40 % enzyme treatment resulting DM content of 86 %, CP 4.62 %, NDF of 65 %, ADF 32 % and with a reduction in lignin by 7.64 % with *Pleurotus flabellatus.* In case of *Poria placenta* a DM content of 90 %, CP 3.68 %, NDF of 69 %, ADF of 38.5 % and lignin content of 10.0 %were obtained which were similar to those obtained with *Coriolus versicolor.* The best value for IVDMD of 48.0 was obtained with *Pleurotus flabellatus* followed by 44.0 obtained with *Coriolus versicolor.*

Pleurotus floridanus *Lenzites striata* *Pycnoporous sangeus*

Fig: Growth of the fungi on Polyurethane Foam (PUF) cubes

In another study G. lucidum recorded the highest activities of laccase and lignin peroxidase of 280 and 297(U/mg), respectively followed by Pycnoporous sangeus which recorded 195 and 266 U/mg of laccase and lignin peroxidase activity. Ragi straw after enzyme treatment showed 40% enzyme treatment to accord the most promising results for all the three fungi. The IVDMD values showed G. lucidum to treatment resulted in the highest digestibility followed by Pycnoporous sangeus. Enzyme supplementation failed to give positive results with any of the fungi with regard to both changes in proximate composition or the IVDMD.

Enzyme treatment of ragi straw at 40% proved beneficial in enhancing digestibility as compared to that of supplementation. *G. lucidum* and *C. versicolor* yielded the best results.

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

DT Pal and J Ghosh

Copper chaperone for superoxide dismutase specifically delivers Cu to copper/zinc superoxide dismutase. The expression of copper chaperone for Superoxide Dismutase (CCS) in erythrocytes and liver tissue serves as a useful biomarker for assessing the ovine copper status.

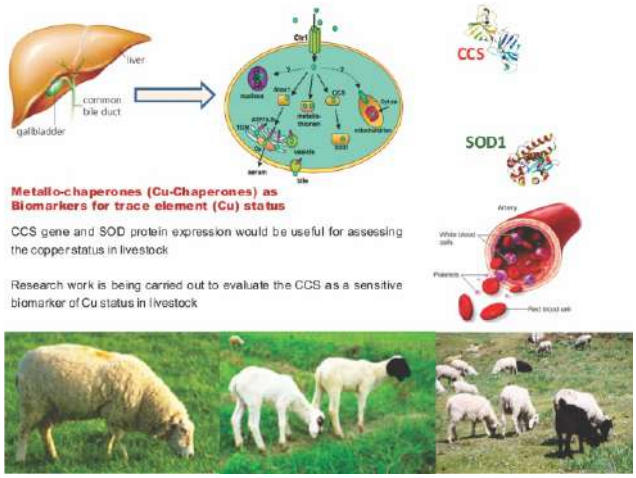


Fig 1. Representation of CCS gene and SOD protein expression as biomarker of copper

The expression of Copper chaperone for superoxide dismutase (CCS) and Cu/Zn-superoxide dismutase (Cu/Zn-SOD) at transcriptional and translation level are being studied in sheep for the purpose of using CCS molecule as a potential marker of copper status in sheep. The partial sequences of sheep β-actin, SOD and CCS genes have been derived from the sheep liver tissue.

Table 1 The Gene Bank accessions for sequences length of sheep β-actin, SOD and CCS genes

Name of the Gene	Gene Bank Accession Number	Sequence Length (bp)
ß-Actin	JN033788	542
SOD 1	JN033789	672
CCS	JN033790	400

As the peripheral blood is the 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.

Table 2. Primer synthesized for blood cells marker gene

Gene Name	Blood Cell	Acc No from which designed	Left primer 5'-3'	Start (bp)	Right Primer 5' -3'	Start (bp)	Product size
Bovine PTPRC /CD45	Leucocyte	XM_002694273	CGATGTTAAGCGAGAG GAATG (21bp)	373	TCTGAGGTGCTTCT GGTTCTC (21bp)	818	446 bp
Ovis aries Beta B globin	Erythrocyte marker	X14727	GGCAAGGTGAAAGTGG ATGA (20bp)		CAGAGGCCAGATGC TCAA (18bp)		492bp
Ovis aries integrin beta3	Platelet	FJ917401	TGAGGAGGTGAAGAAG CAGAG (21bp)	612	GGGATGACTTCGTT GTTGAGA (21bp)	1142	531 bp

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 and have been submitted to Gene Bank. The different blood cell marker gene primers were designed and synthesized for testing the presence CCS genes in whole blood or cellular fractions.

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

KS Prasad and DT Pal

Role of minerals in growth of rumen microbes is well established. Congruence to enhanced digestibility, the total mixed rations (TMR) concept is gaining improtance. This summons the appraisal of TMR effect on mineral release.

In vitro study was carried out with 60:40 paddy straw and concentrate mixture (T-1), T-1 plus 2% mineral (Ca, Cu, Zn & Mn) supplementation (T-2) and T-1 plus 2.5% mineral (Ca, Cu, Zn & Mn) supplementation (T-3) and paddy straw and concentrate mixture individually.

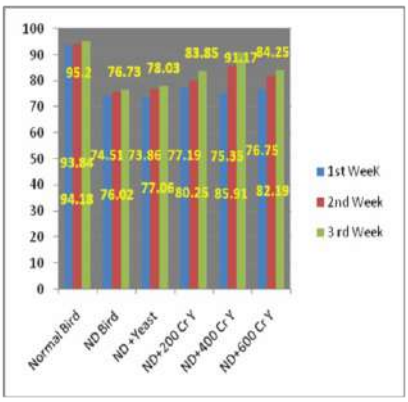
IVDMD were 53.5, 58.8 and 60.2 % at 72 hr of incubation in T-1, T-2 and T-3 respectively. There was increase in IVDMD in mineral supplemented groups compared to T-1, however no difference was observed between mineral supplemented groups (T-2 & T-3). A non-significant increase in NH_3-N and TVFA was observed in mineral supplemented groups.

Increase in IVDMD values in mineral supplemented groups compared unsupplemented groups indicating positive impact of supplementaing minerals on nutrient utilization *in vitro* was observed

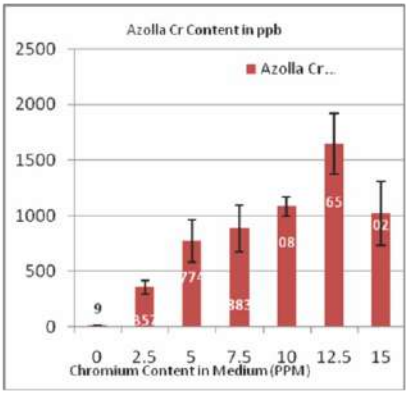
Project 2.12: Identification of molecular mechanism in stressed layer chicken fed with chromium

D Rajendran and A Dhali

Of late, chromium is being used as ameliorative nutrient during thermal and vaccination stress. As inorganic chromium (chromium chloride) is less bio-available, organic chromium has been used because of its better availability. Cr complex with yeast exhibited 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. It conjures to the effect of organic chromium supplementation on performance and carbohydrate metabolism related gene expression in stressed layer birds.

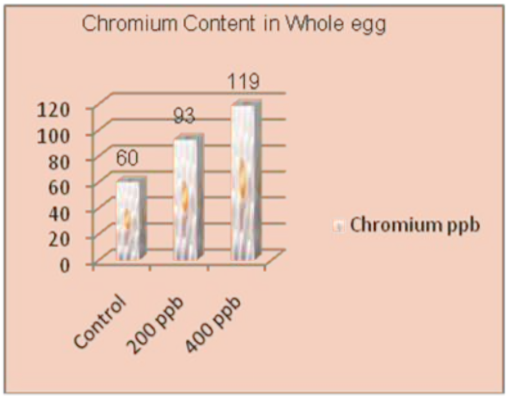


Field trial was conducted to study the level of chromium required to improve egg production in diseased stress condition. It was found that 400 ppb of the chromium is required to improve the egg production in disease condition.



The level of chromium enrichment in Azolla

Chromium chloride was used for enriching chromium content in the *Saccharomyces cerevisiae* culture. The level of chromium uptake increased with increasing the incubation time and varied from 154 to 226 mg /kg of yeast. Discreet levels of Chromium chloride was used for enrichment in the *Azolla*. It was found that 12.5 ppm level of chromium chloride yielded high level of chromium enriched *Azolla* as well as innate enrichment.



Effect of supplementation of Chromium on egg level

Chromium enriched yeast was produced by supplementation of chromium chloride in growth medium. At 12.5 ppm level of chromium chloride high level Azolla yield as well as Cr enrichment was achieved. 400 ppb of the chromium is required to improve egg production in disease stressed layer bird. Yolk colour improved by supplementation of chromium in the feed.

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

A Dhali and Manpal S

Expansins are a class of plant proteins that has role in cell wall loosening by disrupting the non-covalent 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.

The expression of cucumber expansin (gene cloned into salt induced expression cells GJ1158) was attempted with different NaCl concentrations (0.3, 0.4 and 0.5 M) at different temperatures (32 and 37°C), but no prominent expression was detected.

Recombinant plasmids were then purified from the clones and expression was attempted in cell free expression system, but no prominent expression was detected. Subsequently, purified plasmids were inserted into the expression cells BL21(DE3) PlysS and were cultured for 24 h in auto induction Media at 37°C. Following culturing, cell extracts were analyzed through 12.5% SDS-PAGE and significant expression of a protein of expected molecular weight (~30 kda) was observed (Fig 1).

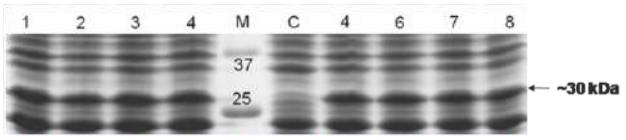


Fig 1. Expression of a protein of expected molecular weight (~30 kda). Lane-1: Clone-1, colony-1; Lane-2: Clone-1, colony-2; Lane-3: Clone-1, colony-3; Lane-4: Clone-1, colony-4, Lane-M: Protein molecular weight Marker; Lane-C: Control cell without expression plasmid, Lane-5: Clone-2, colony-1; Lane-6: Clone-2, colony-2; Lane-7: Clone-2, colony-3; Lane-8: Clone-2, colony-4

Standardization for producing recombinant expansins in microbial system is in progress

Theme Area -3

Improving productive and reproductive efficiency through physiological and nutritional interventions

3.1: Antioxidant mechanisms of buffalo oviduct and endometrium during estrous cycle

S C Roy, J Ghosh and K S Roy

The project was conceptualized to explore the status of various antioxidant enzymes of buffalo oviduct and endometrium during different stages of estrous cycle and early pregnancy. Oviduct, endometrial tissues and luminal fluids were collected from fresh female genitalia collected from the local slaughter house. Various antioxidant enzymes were quantified and antioxidant genes in oviduct and endometrial tissues were confirmed by isolation of RNA, synthesis of cDNA, gene cloning and sequencing.

Copper-zinc superoxide dismutase (Cu-Zn SOD) of 16 kDa, catalase (CAT) of 62.4 kDa and two isoforms of glutathione peroxidase-1 (GPX-1) of 28 and 65 kDa were detected in buffalo uterine and oviduct luminal fluid (ULF & OLF) and tissues using highly sensitive Chemiluminescence-based Western blot technique. The activities of these antioxidant enzymes were found to be modulated during different stages of estrous cycle and early pregnancy (Confirmed both by Western blot and spectrophotometric enzyme assays).

Catalase and Cu-Zn SOD were the major antioxidant enzymes of buffalo oviduct and found to be modulated during estrous cycle and early pregnancy and the level of which were significantly increased during mid-luteal stage of estrous cycle and early pregnancy compared to other stages of estrous cycle. Cu-Zn SOD was the major antioxidant enzyme of uterine luminal fluid and endometrium and this enzyme was significantly modulated during different stages of estrous cycle and early pregnancy and the level of which was also increased significantly during early pregnancy. Thus, an increased Cu-Zn SOD activity during early pregnancy suggests that early pregnancy in buffaloes may be associated with an increased superoxide anion production. Various antioxidant enzyme genes viz., SOD1, Catalase and GPx of buffalo oviduct and endometrial tissues were cloned and characterized and submitted the gene sequences to NCBI database and got the accession numbers (JF901934, JF901935, JF901936, JF901937, JF 901938, JF901939 and JF830811) for buffalo SOD1, Catalase, Copper chaperone of superoxide dismutase (CCS), GPx-1, GPx-2, GPx-3, and internal control gene beta-actin, respectively. Information on all the above buffalo genes is submitted for the first time.

Gene cloning and sequence analysis of buffalo GPx-8 revealed that buffalo has two isoforms of GPx-8. For the first time, a new isoform of GPx-8 was identified in buffalo. It has a deletion of 262 bp as compared to the large size isoform from the coding sequence. The new isoform of buGPx-8 might have lesser molecular weight (~10.139kDa) than cattle (~23.992kDa).

For the first time for any ruminant species, it was established that buffalo endometrium undergoes dynamic tissue remodeling during estrous cycle and early pregnancy. This is affected by modulated activities of matrix metalloproteases (MMPs) viz., gelatinases: MMP-2 and MMP-9 and tissue inhibitors of metalloproteases (TIMPs) viz., TIMP-1, 2, and 3. It was hypothesized that such tissue remodeling may be the possible cause of ROS production in uterine microenvironment and for which the activities of antioxidant enzymes are also modulated to scavenge excess ROS production. Each stage of estrous cycle and pregnant ULF demonstrated unique profile of gelatinase activities compared to serum/follicular fluid with a major gelatinase band of 60 kDa with highest activity in early-luteal stage.

In addition to a 32 kDa uterus-specific gelatinase band detected in both non-pregnant and pregnant ULFs, the pregnant ULF displayed three new gelatinase bands of 86, 78 and 57 kDa. Western blot technique confirmed the presence of MMP-2 (54 kDa), MMP-9 (76/73 kDa), TIMP-1 (32 kDa), TIMP-2(20 kDa) and two molecular weight forms (31 and 22 kDa) of TIMP-3 in buffalo ULF and endometrial tissues but with varying band intensities.

The antioxidant enzymes of buffalo oviduct and endometrium are modulated according to the stage of the estrous cycle and pregnancy.

Project 3.3: Nutrition-endocrine interaction in onset of puberty in buffaloes

JP Ravindra and CG David, Vijay kumar and PSP Gupta

Delayed puberty is an inherent problem in buffaloes resulting in delay in the animal entering productive life and thus affecting farmer's economy. Nutrition plays an important role in the process of attainment of puberty through its effect on endocrine events. Leptin is known to be a mediating hormone between the nutritional status of the animal and its reproductive function. The research project is conducted with the objective of understanding and establishing relationship between nutrition (energy), the gonadotropic, gonadal and leptin hormones, their secretion characteristics and ovarian follicle activity in attainment of puberty in female buffaloes. This helps in physiological interventions to overcome the inherent delay and advance age at puberty.

First a pilot study was conducted on a buffalo calf for standardizing GnRH challenge test and ultrasound scanning. The full study was initiated with three experimental groups of buffalo calves, group I served as control with normal feeding, Group II was fed with 20% extra energy using bypass fat and group III was fed 20% less than normal energy. The experiment was conducted until all the animals attained puberty. Regular ultrasound monitoring of follicular activity, GnRH challenge tests to ascertain status of hypothalamo-pituitary ovarian axis, regular recording of body weights, hormone estimation in blood samples collected regularly were carried out.

The calves had short luteal phases before showing first full length normal oestrous cycle. The calves had shown first ovulation much earlier to expression of first estrus as observed by estrus signs and progesterone profile. Feeding 20% higher energy resulted in better and earlier LH secretory response of the hypothalamus – pituitary axis to GnRH challenge. Calves fed with 20% higher energy showed higher follicular activity in terms of number and size. There was no significant difference in leptin levels between groups. The group with 20% higher energy attained puberty earlier to other two groups to the extent of 60 days. As compared with control, feeding 20% lower energy did not have any negative effects.

Feeding 20% higher energy had a positive effect on maturation of hypothalamo-pituitary ovarian axis, hormone secretion, follicular development and attainment of puberty but did not have any effect on circulating leptin levels indicating that its influence on puberty related events as observed in the present study involved other mechanisms

Project 3.4: Modulation of *in vitro* prostaglandin production in buffalo

S Mondal, S Nandi and IJ Reddy

Early embryonic mortality is a major impediment hampering the reproductive efficiency of buffaloes and accounts for major post fertilization losses. Recognition and establishment of pregnancy depends on the regulation of balance between PGE_2 and PGF_2. Considering the importance of PGES and PGFS in regulation of estrous cycle, recognition of pregnancy and embryo survivality, present study was taken with a view to explore the effect of modulators on *in vitro* prostaglandin production in buffalo.

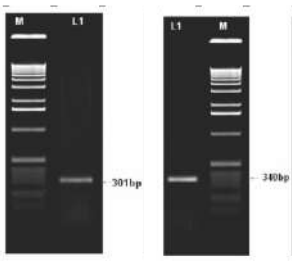


Fig. 1 Amplification of cDNA of 301 bp PGES (a), 340 bp PGES (b) from buffalo endometrium. Lane M: 1 kb DNA ladder; Lane 1: Amplified product

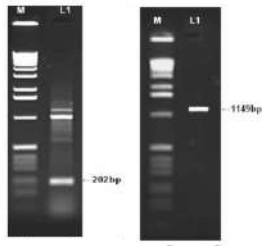


Fig.2 Amplification of cDNA of 202 bp PGFS (a) and 1149 bp beta actin (b) from buffalo endometrium. Lane M: 1 kb DNA ladder; Lane 1: Amplified PCR product

Buffalo uteri were collected from the local abattoir and classified into three stages: stage I (days 3 to 5), stage II (days 6 to 15) and stage III (days 16 to 21) of estrous cycle. The quantity of RNA was determined using spectrophotometric reading at OD_{260} and OD_{280}. Following first strand synthesis, PCR amplification of PGES and PGFS cDNA was carried out using gene specific primers designed on the basis of aligned nucleotide sequences available in GenBank. PCR product from 1% agarose gel was eluted by gel purification kit and checked in ethidium bromide stained 1% agarose gel. The eluted products of 301 bp, 340 bp and 466 bp fragments of PGES cDNA (Figure 1) and 202 bp (Figure 2) fragment of PGFS cDNA were found free of any non specific amplified product or unannealed primer dimmer

Optimized the PCR conditions for amplification of 301 bp, 340 bp and 466 bp fragments of PGES cDNA, 202 bp fragment of PGFS cDNA and 1149 bp β-actin cDNA

Amplified 301 bp, 340 bp and 466 bp fragments of PGES cDNA, 202 bp fragment of PGFS cDNA and 1149 bp β-actin cDNA

Project 3.5: Impact of different wave lengths of light on hypothalamic factors and reproduction in poultry

IJ Reddy, G Ravikiran and S Mondal

Light is an important environmental factor that influences the reproductive system of domestic avian species. Information on photo stimulation of reproductive function by different wavelengths of the visible light spectrum is limited and contradictory. The influence of photoperiod on reproductive activity in the male chicken was mediated by light from the red end of the spectrum. It has been shown that longer wavelengths are transmitted through neural tissue more readily than shorter wavelengths. This indicates that the interaction between the wavelengths and the quantum energy could be very important for the photo neuroendocrine events in the hypothalamus, an area of brain or in both. Therefore, it is particularly important to consider quantum energy (number of photons) when evaluating the effect of different light sources. The objective of this study was to establish relationship between different wavelengths of light, on GnRH, LH frequency, gonadal hormones and egg production in domestic hen during the later stages of egg lay from 16-72 weeks of age.

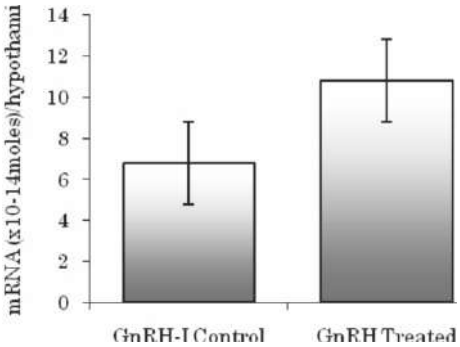


Fig. 1 Hypothalamic GnRH-I mRNA in control birds (exposed to normal spectrum of light) and treated birds (exposed to red spectrum of light)

Commercial layer birds were exposed to three different wave lengths of light to act as control (incandescent light; 450nm) experiment group 1 (red spectrum of light; 650nm) and experiment group 2 (blue spectrum; 475nm) to study the pattern of intersequence pause days and egg production. From 17 to 72 weeks birds exposed to red spectrum showed significantly higher (8%) egg production followed by those exposed to blue spectrum (4%) as compared to birds exposed to incandescent light. GnRH concentration fluctuated from 6.19 to 9.14 pg/ml during 19 to 72 weeks of production period. In other groups it fluctuated from 3.44 to 3.91 pg/ml. Higher expression of GnRH mRNA in the hypothalami of birds exposed to red spectrum of light compared to white incandescent light (Fig. 1) was observed.

Birds exposed to red spectrum of light (650 nm) had significantly higher egg production (8%) with concomitant increase in GnRH mRNA expression. This could be used as management tool in organized poultry farms for better economic returns

Project 3.7: Feeding of garlic on laying performance: effect on stress and egg lipids

G Ravi Kiran, I C G David, I J Reddy and K P Suresh

It is hypothesized that layer chicken is constantly subjected to stress beginning from growing period, during laying and senescence, which may have a negative effect on the recruitment of follicles and subsequent laying period. This may also produce a latent effect on production in senescent birds thus reducing the total laying potential of the bird. Feeding of garlic could mitigate these effects by boosting antioxidant enzyme status. In addition it may also result in production of eggs with lower lipid content through its known hypocholesterolemic activity.

- Feeding of garlic from 16 to 72 weeks of age increased the hen day egg production by 2 per cent
- Garlic feeding from 50th week of egg lay reduced the stress and significantly enhanced the egg production as evident from significantly higher plasma uric levels and catalase, SOD and glutathione levels in birds fed with garlic compared to control.
- Garlic feeding lowered the egg cholesterol and triglyceride levels by 10 and 23 per cent, respectively. This is supported by the widespread fatty degeneration in liver of birds not fed garlic.

Feeding of garlic at 1% significantly increased the productive age of layer hens beyond 72 weeks of age by minimizing production stress mediated through uric acid, SOD, glutathione peroxidise and catalase at the ovarian level.

It also lowered the cholesterol and triglyceride content of the eggs by 10 and 23 per cent resulting in production of designer eggs

Project 3.8: Proteomic analysis and characterization of pregnancy associated proteins in buffaloes *(Bubalus bubalis)*

J Ghosh, S C Roy, KS Roy

Efforts are being made to search for the protein markers of pregnancy in buffaloes through a combination of 2D electrophoresis and mass spectrometry of proteins of reproductive tissues and fluids of both pregnant and non-pregnant buffaloes. Endometrial tissues and uterine luminal secretions were collected from about days 43 – 75 of pregnancy and mid-luteal phase (days 5 – 10) buffalo reproductive tracts. In-gel digestion and mass spectra analysis and partial amino acid sequencing revealed five proteins that matched with the database 1) A hypothetical protein of *Bos taurus* (Bovine) of pI 10.6 and Mr. 12.27 kDa , 2) Ring finger protein 3-*Bos taurus* (Bovine), pI= 5.4 and Mr = 17.12 kDa, 3) GPD1 with pI= 6.1 and Mr = 37.5 kDa, 4) MHC Class II antigen (Bovine) pI= 5.2 and Mr = 10.8 kDa, and 5) Hepatocyte nuclear factor 4 gamma- *Bos taurus* (Bovine) with pI 9.5 and Mr = 48.5 kDa. Of these, the pI values and molecular weight of only 3 proteins matched with those of experimental values determined in the laboratory.

Comparison of caruncular tissue proteins of pregnant and non-pregnant animals revealed 7 spots which were up regulated in the pregnant animals and three spots which were down regulated in the non-pregnant animals.

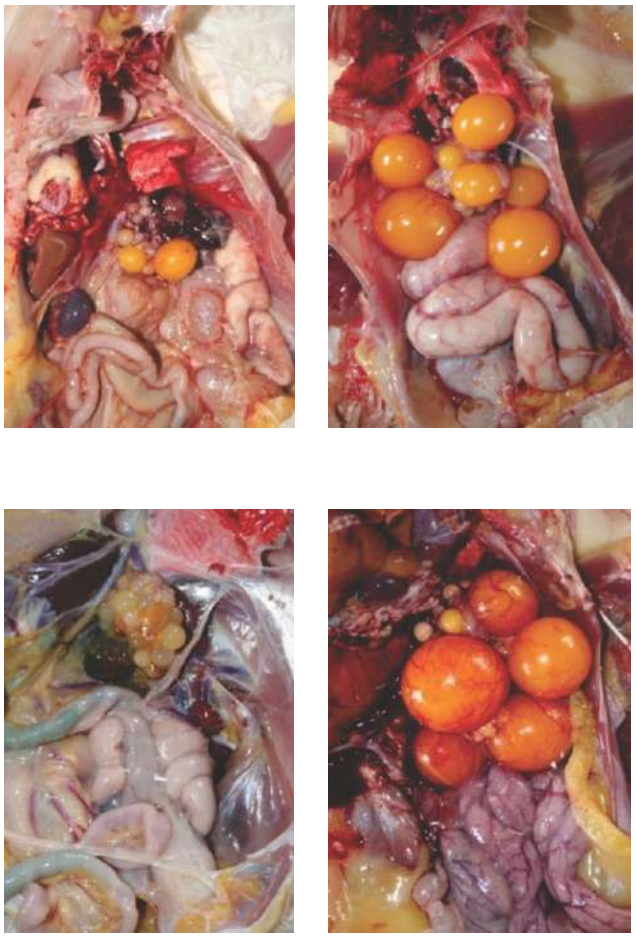
Project 3.9: Biophysical translation of nutrients during ovulatory cycle in domestic hen: Biomineralization of the egg

CG David, G Ravi Kiran, RU Suganthi and AM Mech

In poultry industry, an estimated 13 to 20 per cent eggs produced are cracked or broken between oviposition and retail sale which causes severe loss to poultry industry. Improving the egg shell quality will considerably reduce this loss. However, factors responsible for egg shell quality viz. breed, age and rearing conditions, moulting and particle size of calcium supplements 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. 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 molt to post molt production period.

Molting by feeding high levels of zinc was selected as best method to moult birds using meta analysis. The experimental flocks were moulted by feeding layer rations containing 2 per cent zinc oxide for a period of 10 days. Egg production dropped to 2.5% by day 5 and 0% from day 6 (Fig 1). Average feed consumption was only 53.59% and the average body weight loss was 19.04%. There was a significant reduction in the weights of ovary and oviduct with a significant reduction in the number of yellow yolky follicles on moulting. No mortality was recorded indicating of minimum stress to the birds during moulting period unlike the conventional methods.



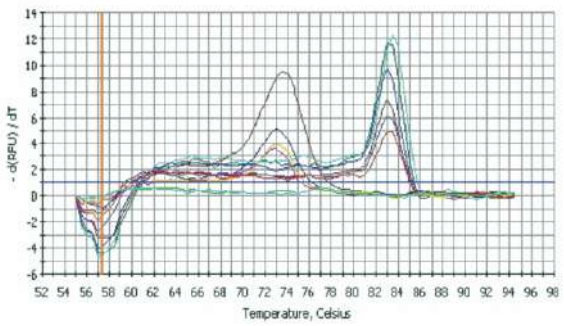
Ovary showing number of yellow yolky follicles on day 5 (A, B) and day 10 (C, D) and oviduct morphology in moulted (A, C) and non moulted (B, D) birds of 73 to 74 weeks of age.

Layer birds can be safely moulted by feeding 2 per cent zinc oxide for 10 days. The reduction in feed intake and duodenal calcium uptake resulted in the cessation of egg production

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

Vijay Kumar and CG David

To determine the effect of dietary energy on endocrine and immune responses and reproductive performance in sheep, feeding trials were conducted with different dietary energy in ewe lambs (Rambouilet x Bannur) which had almost matured to puberty in all groups. The results indicated that the feeding of protected fat (20 % highr energy) to increase the energy intake of the growing ewe lambs improved ($p<0.05$) the body weight gain and onset of estrus over the lower energy group. Higher number of animals conceived in the high dietary energy groups (15 out of 19) than in lower energy groups (8 out of 19). Both higher energy group and normal energy group showed better performance than the ewes kept in lower energy intake group. The growth rate was better in the ewe lambs in control and higher energy group. Birth weights of the lambs born to ewes in higher and normal energy group were higher than those in lower energy group. Their body weight gain and growth was also higher till weaning. The return to post partum estrus was also earlier in the animals fed with higher dietary energy.



Melt curve analysis of sheep IL-6 and iNOS m RNA expression in a gradient Real Time PCR

Feeding of protected fat to increase the energy intake of the growing ewe lambs significantly improved the body weight gain, 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

A significant proportion of animals maintained in the semen bank could be sub-fertile. Recent studies have delineated the role of sperm membrane proteins to poor fertility semen and thus sub-fertile bulls. This warrants developing an array of sperm functional and molecular tests which determine fertility in bulls. The objective of the project is to suggest suitable fertility diagnostic test(s)/kit for assessing bull fertility.

Analysis of Holstein Friesian bull spermatozoa revealed that bulls having 26.5kDa protein (Fig.1) had significantly higher straight line velocity (Fig.2) and Type-A (Fig.3) spermatozoa in the post thaw semen samples. Since type-A spermatozoa are the most fertile spermatozoa in the semen dose, the study suggests positive role of this protein on post thaw sperm motility and fertility. Further studies are in progress to confirm this finding with field fertility. The spermatozoa functional parameters were assessed in the neat and frozen semen samples collected from 13 buffalo bulls. The spermatozoa membrane integrity did not differ significantly but variation in the presence of 23- and 15-kDa spermatozoa membrane protein varied between bulls.

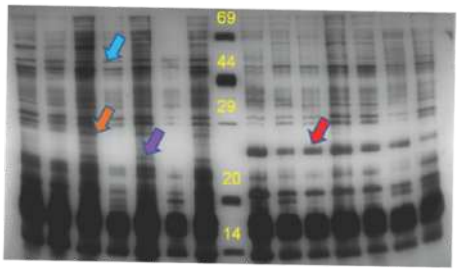


Fig 1 Sperm membrane protein profile in Holstein Friesian bull semen. Note: presence of 26.5kDa protein markedly vary between bulls apart from other proteins.

Holstein Friesian Bulls having 26.5kDa protein had significantly higher straight line velocity and Type-A spermatozoa in the post thaw semen samples.

In different fertile buffalo bulls, spermatozoa membrane proteins of approx. 15- and 23-kDa was observed

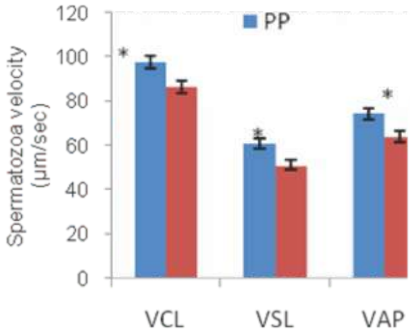


Fig.2 Sperm membrane protein profile in Holstein Friesian bull semen. Note: presence of 26.5kDa protein markedly vary between bulls apart from other proteins.

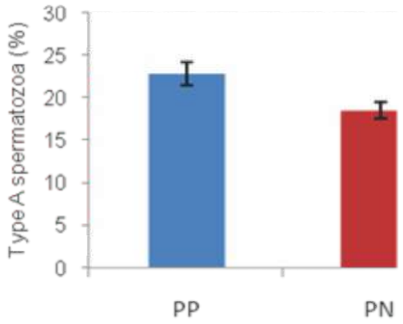


Fig.3 The percentage of post-thaw Type A spermatozoa in Holstein Friesian protein positive (PP) and protein negative (PN) bull semen.

3.12 Studies on the effect of feeding azolla on the reproductive efficiency in buffalo heifers

PSP Gupta and S Nandi

A feeding experiment for 21 weeks was carried out to test the effect of feeding azolla on the reproductive efficiency of cycling buffalo heifers. Twelve buffalo heifers were acclimatized and fed standard feeding for four weeks (pre-feeding period), which was followed by feeding period, where in six animals (control) were continued to be fed with normal feeding and the other six animals (treatment) were fed dried azolla equivalent to 500gm fresh / wet azolla per 100 kg body weight per day for eight weeks. In order to avoid variation in the quality of azolla that was fed to the animals, it was pooled after drying. The feeding period was followed by post-feeding period of five weeks. During all the three periods blood samples were collected for the analysis of various biochemical parameters and hormones. Ultrasound scanning of all the animals was performed through the three phases of experimentation in all the animals twice a week and the number of medium and large size follicles were recorded. Feeding of azolla significantly improved the turnover of large follicles (Table 1) and the occurrence of of estrus / expression of estrus symptoms / ovulations.The low breeding seasonal effect on the occurrence of estrus was alleviated by feeding azolla in the buffalo heifers, which was indicated by the progesterone profile. The peripheral plasma BUN, creatinine, protein, glucose, calcium and phosphorus were not significantly affected by feeding of azolla during any of the three phases of the experiment.

Table 1. Availability of different size categories of ovarian follicles during the Feeding period of azolla feeding experiment in buffalo heifers as observed by ultrasonography.

	medium	large	Total
Control	1.42 ± 0.14 ^{a}	0.12 ±0.04 ^{a}	1.54 ±0.13 ^{a}
Azolla Fed	1.28 ±0.15 ^{a}	0.43 ±0.07 ^{b}	1.71 ± 0.14 ^{a}

Values in a column with different superscripts differ significantly (P<0.05)

Feeding of azolla @500gm /100kg body weight per day improved the reproductive efficiency in buffalo heifers

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

S Nandi, PSP Gupta and S Mondal

The objectives of the study were to determine ammonia concentration in ovine follicular fluid at different stages of follicle development and to analyze mechanisms through which ammonia influences the ovine ovarian functions in ewes.

In order to elucidate the mechanisms of ammonia on ovarian functions, both *in vivo* and *in vitro* studies were carried out. The oocytes were collected from the slaughtered house ovine ovaries which were from small follicles and were cultured in media containing ammonia at the level of 0, 50, 100, 200, 300 µM. Significant impairment in oocyte maturation was observed at 300 µM. Similarly, oocytes from medium and large follicles were cultured in media containing ammonia at the level of 0,100, 150, 200, 300, 500 µM. Significant changes were observed at 300 µM and 500 µM. Granulosa cells when exposed ammonia (0, 50, 100, 200, 300, 500 µM) viability reduced to half at 200 µM level of ammonia. Similarly, cell proliferation (Monolayer formation) score was reduced to 1.01 ±0.01 in all droplets containing 200µM ammonia. An *in vivo study is* in progress.

Oocytes can withstand increased concentrations of ammonia but granulosa cells are more sensitive to higher concentrations which impair oocyte maturation. Exposure of granulosa cells to higher levels of ammonia (500 µM) results in irreversible loss of its functions.

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

KS Roy, S C Roy and J Ghosh

The objectives of the 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.

A trial was carried out in commercially available broiler birds by exposing the birds to 26°C (control) and 38°C (heat exposed). Changes like haemorrhages in heart, congestion, oedema, hyperaemia and massive haemorrhages in lungs, yellowish and pale liver, and oedema and haemorrhage in kidney were observed in heat exposed birds. The total RNA from heart, liver and skeletal muscle was extracted and the value of total RNA was higher in heat exposed birds in comparison to control group of birds. The mean total RNA yield value in heart muscle ranged from 8.65 µg /10mg of wet tissue in control to 10.5 µg /10mg in heat treated; in liver from 8.10 µg /10mg of wet tissue in control to 9.12 µg /10mg in heat treated; in skeletal muscle from 6.35 µg /10mg of wet tissue in control to 6.70 µg /10mg in heat treated.

A chemi-luminiscence based Western blot technique has been standardized and developed for confirmatory detection of HSP70 in heat stressed broiler birds.

Theme Area -4

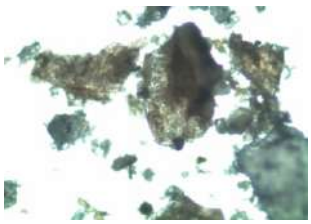
Feed quality and safety

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

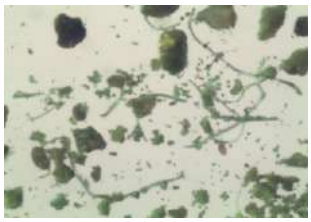
SBN Rao and S Jash

The microscopic structures of feed ingredients (maize grain, rice bran, wheat bran, ground nut cake, cotton seed cake, mustard cake, soybean meal, sorghum grain, gram husk, pea husk) from across retail chains, have been examined and documented. Similar matrix was graphed for common adulterants (paddy husk, saw dust and urea). Concentrate mixtures were formulated and structures were analysed using Image J software. Expeller Indian mustard (*Brassica nigra*) cake particles appeared amber typical to oil globules which were not appreciated when extracted with chloroform. Paddy husks have straight edges akin to rice bran barring thick longitudinal edges. Wheat and rice bran particles are distinguishable. Fine wheat bran particles appear like amoebiod structures, extricate from rice bran with fine longitudinal striations. Very fine particles of rice bran look like filaments. Similarly, wheat brans have irregular corrugated surface compared to rice bran which has straight edges. Saw dust has typical serrated edges which can be easily identified. Urea particles are thin needle shaped, while salt particles have spherical or cuboid structures and ground sorghum particles appear as pebbles (Fig 1)

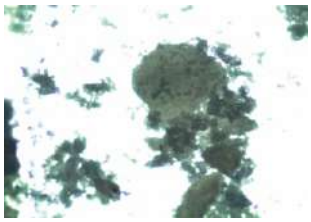
Rice bran



Wheat bran



Cotton seed meal

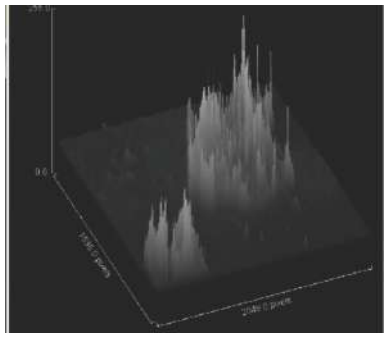


Concentrate mixture

A view of documented microscopic structures of feedstuffs

Image Analysis

During microscopy, it was occasionally observed that feed particles being very fine, it was not possible to distinguish the discerning features. Image Analysis was performed to determine the particle measurements on characteristics viz. area and perimeter of the particles. The surface characteristics of some of the ingredients were documented with the help of surface plots (Fig 2). It revealed characteristic patterns which would be useful in detection of adulterants.



Surface plot of soyben cake image analysis

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

Suganthi UR, CG David and KS Prasad

Aflatoxins are often encountered in feedstuffs at alarming concentrations in different parts of our country. Consumption of aflatoxin contaminated feed by poultry results in hepato toxicity, nephro toxicity, feed refusal, growth retardation, immune suppression and mortality, thereby the toxins besides affecting the health of birds, also causes economic losses in poultry. Hence the project was formulated to identify plant products that can prevent aflatoxicosis in broilers. The objectives were to screen locally available herbal products for their potent antifungal, antioxidant and/ or aflatoxin binding effect under in *vitro* conditions; to evaluate the effect of supplementation of selected herbal products in preventing aflatoxicosis in broilers.

Screening of herbal products for their antifungal effect against Aspergillus fungi

To determine the antifungal effect of herbal products, *Aspergillus parasiticus* (IMTECH 2797) was sub-cultured and the countable number of colonies was identified. Sixty different herbal products including leaves of trees and shrubs, dried spices, vegetables and medicinal and aromatic products were collected and screened for their antifungal effect in Czapek yeast extract agar media and out of them only three products inhibited fungal growth by 60-91% while others did not inhibit *Aspergillus* growth.

Effect of herbal products in preventing aflatoxicosis in broilers

A feeding trial was conducted in broilers to study the effect of the leaves of *L. aspera* and roots of *H. indicus* to ameliorate the toxicity induced by aflatoxin in broilers. Day old commercial broilers were divided into four dietary treatments viz., G1- basal diet free of aflatoxin, G2- basal diet+ 500ppb aflatoxin and G3- aflatoxin + *L.aspera* and *H. indicus* (1.0%, 1:1 ratio) and G4- aflatoxin + *L. aspera* and *H. indicus* (1.0%, 2:1 ratio). The birds were fed *ad libitum* with corn-soybean meal diet formulated to meet the nutritional requirements of growing chicks for 42 days.

Aflatoxin feeding significantly decreased serum total protein, cholesterol and hepatic marker enzymes and antioxidants and increased lipid peroxidation products in liver. Supplementation of L. aspera and H. indicus significantly reversed the altered parameters and offered protection against aflatoxin in broilers

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

NKS Gowda, D Rajendran and P Krishnamurthy

Graded level of fluoride supplementation in water to rats showed lowered antioxidant (super oxide dismutase, ceruloplasmin) and immune status at higher levels of fluoride ingestion (30 & 60 ppm), beyond 6 months of supplementation period. Liver, spleen, kidney and thyroid showed degenerative changes at 30 and 60 ppm of fluoride level after 3 months of ingestion. In the phase II, experiment was conducted to evaluate the efficacy of boron, calcium carbonate and silicated binder supplemented with 30 ppm fluoride in water for 4 months. Body weight gain, feed and water intake did not show any change. Depressed liver antioxidant activity and change in radiology of femur bone in 30 ppm fluoride supplemented rats were partially ameliorated due to supplementation of boron, calcium carbonate and silicate binder.

30 ppm Fluoride supplementation in drinking water to rats for 4 month period showed adverse effects and supplementation of of boron, calcium carbonate and silicate binder to water with 30 ppm of fluoride showed partial amelioration.

Theme Area -5

Bioinformatics, knowledge management and technology translation

Project 5.2: Calibration of mathematical models for forecasting the animal feed resources availability and requirement in Karnataka state

KP Suresh, G Ravikiran, K Giridhar and T Chandrappa

In order to assess and forecast the feed resources availability for better management of livestock, linear time series models were developed by using Time Series Forecasting System (TSFS). The climatic factors considered in the models were actual rainfall and the deviation of rainfall from normal and non-climatic factors such as yield, area under crop etc., were also included in the models.

Dry fodder, concentrates and green fodder contribute 62.5, 9.4 and 28.1 per cent respectively to the total DM availability in 2011. Similarly 36.6, 25.9 and 37.4 per cent of CP available is from dry fodder, concentrates and green fodder respectively. Corresponding percentages for TDN are 56.7, 13.5 and 29.8 respectively. The share of dry fodder and concentrates to the total DM, CP and TDN availability by 2025 is showing an upward trend and that of green fodder a decline.

The total DM, CP and TDN availability in 2011 is estimated to be 511, 44.7 and 265 m tons respectively. The corresponding figures for 2025 would be 580, 49.5, 300 m tons, an increase of 13.5, 10.654 and 13.350 per cent respectively for DM, CP and TDN over 2011.

Project 5.4: Knowledge and adoption of scientific feeding practices among dairy farmers: A field study

G Letha Devi , Prakash Khandekar and T Chandrappa

Imbalanced feeding and under nutrition are the major factors affecting production and reproduction at field level and hence there is a need to assess the adoption of available technologies and its impact on dairy production. Refinement in the feeding system of dairy cattle through adoptable technologies will improve productivity. There is a need to understand the adoption pattern of technologies developed, limitations faced by the end users and utility of such technologies.

Primary data from 180 respondents have been collected from Antarahalli, Managondanahalli, Hadonahalli and Koira villages through personnel interview method. A workshop was conducted in Hadonahalli on 'Fodder production and conservation', in association with KVK, Hadonahalli. The major animal feeds used were straw of ragi/ jowar/ maize, ground nut cake, kitchen waste and green fodder. There was high adoption rate for the practices such as feeding concentrates to animals, feeding green fodder and feeding colostrums to calf.

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

Prakash Khandekar and G Letha Devi

The data regarding locally available feed resources as well as fodder during different seasons of the year was organized into different tables for the design of the expert system. Design of expert system has been developed, using MS visual basic 2008 and C# programming language.

Project 5.7: Web based knowledge management system for animal nutrition and physiology

U B Angadi and G Letha Devi

The knowledge-base management system (Fig 1) is an exploitation of IT for farming community along with knowledge required for policy makers and researchers. This is an attempt to convert existing knowledge to electronic form (text, images, map, animation, audio and video), for making it one stop shop to advice the farmers according to their needs with available resources for maximum benefits, to establish strong functional linkages and consortia between researchers, extension workers, veterinary officers, farmers, industry and policy makers. It helps to overcome difficulties in existing transfer of technology efforts and strengthen the extension network, faster and wider dissemination of information.

In view of three categories of end-user, three modules have been created 1) Feed and animal resources information for policy and decision makers, 2) Research and development in animal nutrition and physiology for researches 3) Knowledge dissemination system for farming community and extension workers. Module – I: Information on different feeds and data on year and district wise feed availability in the country has been collected. Designed and created a database for the module. Module – II: Data on institute research programs, projects and publications have been collected and developed a database for the module. Multi-lingual extension bulletins in PDF form and videos on livestock management have been collected for on-line screening to disseminate the knowledge to farmers and extension workers. In addition to web-base, stand-alone knowledge disseminate system (Fig.2) also has been developed to facilitate to disseminate the knowledge in rural area where internet facility is not available.

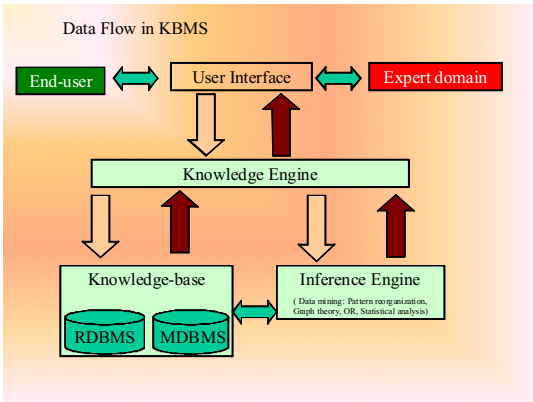


Fig. 1. Architecture of knowledge management system

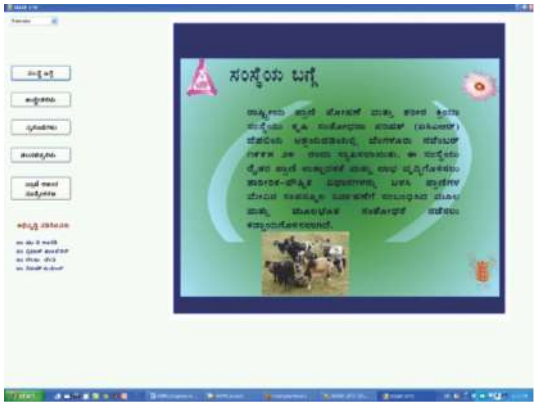


Fig. 2. Front screen shot standalone knowledge dissemination system

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.

Externally Funded Project

AICRP on Improvement of animal feed resources and nutrient utilization in raising animal production

Programme coordinator: *Dr. CS Prasad*

NKS Gowda and DT Pal

Azolla as green feed supplement is becoming popular amongst dairy farmers. It is easy to cultivate with less input. Nutritionally, azolla appears to be very promising and hence this study was conducted in dairy cattle under field condition to evaluate azolla as a green feed supplement. Twenty dairy farmers owning lactating cows yielding of 8-10 lit milk / cow / day were selected. Ten farmers were given all the physical and technical inputs for azolla cultivation. First group of dairy cows (n=10) were daily supplemented with @ 40 gm of area specific mineral mixture (ASMM) along with the existing feeding practices. Second group of dairy cows (n=10), in addition to ASMM were fed fresh azolla @ 2.0 kg /cow/day mixed with compounded feed. Daily milk yield and weekly milk composition were recorded for 45 days period. Analysis of azolla showed 4.5% dry matter and 22% crude protein, 55% NDF, 33% ADF and 18% ash on dry matter basis. It contained good amount of Ca, P, Mg and other trace minerals. Feeding fresh azolla @ 2.0 kg /cow/day (Av. 90-100 gm dry azolla) as a green feed supplement resulted in marginal improvement in milk yield (5%) and milk composition.

Azolla is a valuable green feed supplement for dairy animals, particularly under low input production system.

NABARD project on Use of areca sheath as a fodder source for dairy animals

NKS Gowda, S Anandan and DT Pal

In coastal regions of Karnataka there is a deficit of dry fodder and paddy straw is imported from neighboring districts, thus resulting in higher market price. Areca cultivation as a commercial crop is extensive in this region and there is a possibility of using the fallen areca sheath as a dry fodder for dairy animals. The NIANP with the financial support of NABARD, Bangalore under Rural Innovation Fund (RIF) scheme has evaluated the utility of areca sheath in feeding of dairy animals. The findings of this study indicated that areca sheath is superior to paddy straw in terms of higher value of energy (>49% TDN), relatively low anti-nutritional factors like lignin (<3%), low silica(<4%) and higher content of minerals like calcium, sulfur and copper. The NIANP has developed a technology using dried areca sheath in the form of total mixed ration (TMR) along with suitable proportion of concentrate to support milk production. The machinery required to process the areca sheath has been designed, procured and commissioned in milk producer's cooperative society at Panaje near Puttur taluk of Dakshina Kannada district in Karnataka. The society has provided the infrastructural facility (housing, electricity) for installing the areca sheath processing unit and to use this facility under Public-Private-Partnership (PPP) mode. There is a net saving of 50% (Rs. 14/cow/day) in the cost towards the dry fodder by using processed area sheath as compared to paddy straw.

Dr S Ayyappan, DG, ICAR visiting the areca sheath processing unit at Panaje

Feeding areca sheath in the form of total mixed ration has improved the milk yield, composition and is accepted as an alternate to paddy straw.

Formulation and evaluation of mineral mixture for small ruminants

NKS Gowda, DT Pal and P Krishnamurthy

Quantitative requirement of minerals for small ruminants (sheep/goat) have been already documented. Commercial mineral mixtures comprising the essential minerals are available for large ruminants (cattle/buffalo). However, specific mineral mixture formulations for small ruminants are not available, particularly under tropical livestock husbandry systems. Depending on the mineral requirement of sheep and goat, their feeding habit and production traits, there is a need to have specific mineral mixture supplement. Hence, this research was undertaken to formulate specific mineral mixture for sheep and goat and test their efficacy in improving growth and health. Accordingly, mineral mixture was formulated for sheep and goat to meet 100% requirement of most deficient trace minerals and partially meet the requirement of other minerals, with a consideration that remaining is to be met through feed and fodder. Feed grade quality moderate to highly bioavailable with higher elemental content, reasonably less expensive, and commercially easily available inorganic salts were employed to prepare the mineral mixture.

Two organized sheep and goat farms were selected to test the efficacy of mineral mixture in sheep and goat. In Veerakempanna farm at Anur village, mineral mixture supplementation study was undertaken in sheep and goat. In Subba Reddy farm at Kaiwara village, mineral mixture supplementation study in sheep was undertaken. The lambs/kids after weaning at the age of about 4 months were used in the experiment. First group of animals were not supplemented mineral mixture and second group of animals were supplemented with 5 gm of mineral along with concentrate mixture for 4 months period. In the experiment with sheep involving Rambouillet and Bannur lambs, an additional body weight gain of 17 and 7 gm/day/sheep was observed due to mineral mixture supplementation. Similarly, in the experiment with goats involving Sirohi kids, an additional body weight gain of 8 gm/day/goat was recorded due to mineral mixture supplementation. Also the immune status in lambs in terms of antibody titre against PPR vaccine and lymphocyte proliferation assay was higher in lambs supplemented mineral mixture.

Formulation of specific mineral mixture for sheep/goat and its supplementation to lambs/kids in farm condition improved their growth rate and health status.

Network Project

Veterinary Type Culture – Rumen microbes

A Thulasi, M Rajendran and M Bagath

Archaeal isolates obtained by Hungate's roll tube method were characterized morphologically and the molecular characterization was done by constructing 16S rRNA libraries. Various archaeal isolates obtained from the rumen fluid of small and large ruminats were purified. The methanogenic archaea identified based on the 16S rDNA analysis include *Methanomicrobium mobile* and *Methanobrevibacter ruminantium*. The repository has at present – number of cultures.

Appearance of a short rod shaped colonies of archea observed under the phase contrast microscope

Monitoring of livestock related drug residues and environmental pollutants

KSPrasad, SBN Rao and DTPal

Advent of drug prophylaxis with the intensification of livestock producing system has led therapeutic generic residues and/or their transitory metabolites in edible products for a considerable time, post-treatment. Regulatory agencies (Codex and EU) are insisting developing nations to have extensive programmes to ensure meat, milk and other animal products are safe, wholesome and high quality and residues of either drugs or contaminants should be below permissible limits. In this context, monitoring of drug residues and environmental pollutants in edible livestock products is becoming necessary to address concerns of consumers and international trade. Standardization of extraction, clean up for determination of pollutants in soil, feeds, fodders and animal products and their analysis in selected areas of Karnataka forms a framework in this direction.

The industrial area of Bangalore urban was surveyed and the industrial effluents were collected from ponds. The soil, water, feed, hair, milk and dung samples were collected in these areas and analysed for heavy metals. Most of the samples have shown the presence of Pb and Cd. In milk the range of Pb was 0.018 to 0.069 ppm (: 0.038 ppm). Water also showed presence of Pb with the range of 0.009 to 0.060 ppm. The roughages like straw and green fodders contain higher Pb content than concentrate ingredients. Hair, dung and soil samples also showed Pb content. Cadmium in milk and water was 0.006 and 0.014 ppm. Feeds, dung, hair and soils showed the presence of Cadmium. Roughages showed more Cd content than concentrate ingredients. Arsenic was non detectable in all samples.

Outreach Project

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

Coordinator: *C S Prasad*

Raghavendra Bhatta and Vijay Kumar

The programme has twin objectives of developing a database on methane production potential of ruminant feeds available in different parts of the country and develop mitigation strategies.

Determination of methane production potential of ruminant diets

The feed samples have been categorized as straws/by-products and concentrates and their methane production potential (MPP) were expressed as ml CH_4/ 100 mg truly digested substrate. The *In vitro* methane % of the *in vitro* gas in straws/by-products ranged from 15.0 to 23.5, with IVDMD between 40 (paddy straw) to 76.4 (hybrid Napier grass). Among the straws/by-products MPP was lowest in rice polish 1.96 (containing high crude fat) and highest in Jowar kadbi 12.04. The methane per cent of the fermented gas in concentrates ranged from 20 to 29, much higher than straw probably due to higher digestibility of the samples. The IVDMD (%) ranged from 45 (home made compound feed) to 75 (Maize grain). The MPP ranged from 1.03 in Kum Kum cake to 7.80 in home made compound feed. There was significant correlation between fibre fraction (NDF and ADF) and MPP among the feeds samples.

Efficacy of plant tannins as methane suppressants

Fifty six medicinal and aromatic plants were screened for their tannin content. The total phenol content among the samples ranged from <0.5 per cent to 9.0 per cent on DM basis. The tannin phenol (TP) content was higher than non-tannin phenol in all the samples. The TP content ranged from 0.5 percent to 8.0 per cent on DM basis. Out of the 56 samples tested only seven samples viz. *Pelargonium graviolens* (2.75), *Cinnamomum verum* (2.54), *Alpina galangal* (2.63), *Dioscorea floribunda* (2.37), *Lantana camera* (2.68), *Sapindus laurifolia* (2.63) and *Cinnamomum camphora* (2.04) contained > 2 % condensed tannin (CT).

The hydrolysable tannin was more than CT in all the samples and it varied from 0.5 to 6 %.

The improvement in gas volume (ml/200 mg DM) with PEG among the leaf samples ranged from 2.0 ml to 3.66 ml indicating that tannins suppressed gas production. The maximum methane suppression recorded was > 80 percent. The NH_3-N levels indicated protein protection by tannin whereas in few samples there was reduction in TVFA also. There was general reduction in the total protozoa count reflecting defaunation as one of the reasons for reduced methanogenesis.

National Fund for Basic and Strategic Research in Agriculture

Rumen microbial manipulations for mitigation of methane emission and productivity enhancement in dairy animals (co-operating center)

M Chandrasekharaiah, A Thulasi and M Bagath

In vivo trials were carried out for studying the effect of selected plant products on feed intake, digestibility of nutrients, methane production and growth in crossbred steers and in growing male calves.

Effect of selected methane inhibitors on methane emission and nutrient digestibility in crossbred steers.

A switch over design was conducted in 3 cross bred steers with 3 treatments ie. (1) Control (T0) (2) Product K (T1) and (3) Product G (T2). All the animals were given finger millet straw and concentrate mixture in the ratio of 70:30. The animals of group T0 were kept as control, while the animals of treatment groups T1 and T2 were given the products K and G at 25g/kg concentrate mixture. The animals were maintained on the above dietary regimen for about 40 days during which 5 days collection of dung, feed and residues and spot urine samples and the next 5 days collection of gases for estimation of methane emission from animals by SF_6 method was carried out.

The total DM intake was comparable among different experimental groups whereas the digestibility of nutrients was 7 to 8% higher in the supplemented groups. The methane production was reduced to about 23 and 20% (g/day) due to supplementation of products K and G, respectively in crossbred steers. Overall, the results indicated that the products K and G are having potential in reducing methane emission without affecting the fermentation and digestibility of feeds in cross-bred cattle. These products were selected as potential methane inhibitors to study their effect on growth and nutrient utilization in cross-bred male calves.

To study the effect of selected methane inhibitors on growth, nutrient utilization and methane emission in crossbred male calves.

Same products, K and G was also tested in growing male calves in a randomized control 3 group parallel design to study their effect on the intake, growth, nutrient utilization and methane emission. 15 animals were divided into 3 different groups ie. (1) Control (T0) (2) Product K (T1) and (3) Product G (T2). All the animals were given FMS and concentrate mixture in the ratio of 70:30. The animals of group T0 were kept as control, while the animals of treatment groups T1 and T2 were given the products K and G at 25g/kg concentrate mixture. The animals were maintained on the above dietary regimen for about 120 days during which 5 days collection of dung, feed and residues and spot urine samples and the next 5 days collection of gases for estimation of methane emission from animals by SF_6 method was carried out

The total DM intake and the digestibility of nutrients were comparable among different experimental period. The methane production (g/day and g/kg DOMI) was reduced to about 19 and 15% (g/kg DOMI) due to supplementation of product K and G, respectively in growing male calves. The growth rate (g/day) was increased about 50 and 17% due to supplementation of products K and G, respectively in growing male calves. Overall, the results indicated that the product K and G are having potential in reducing methane emission without affecting the fermentation and digestibility of feeds in cross-bred calves. Further, the growth rate of animals was increased significantly apart from reducing the methane emission without compromising the digestibility of nutrients with the product K. Hence, the patent application has been filed with product, K as potent methane inhibitor in cattle maintained on crop residue based diet.

Isolation, identification and molecular characterization of pure cultures of methanogens from ruminants done for the first time in India. Standardized methodology to study archaeal diversity in the rumen using DGGE.

The plant product K has been identified as potent methane inhibitor and the patent application (87/CHE/2012, dated 9th January 2012) has been filed with plant product K as potent methane inhibitor in cattle maintained on crop residue based diet.

Antiluteolytic strategies - a novel approach to enhance fertility in buffalo

S Selvaraju, JP Ravindra and IJ Reddy

Buffalo often considered as poor reproductive performer mainly due to its late maturity, lower conception rate, repeat breeding and prolonged intercalving interval. A major detriment to fertility in dairy cattle and buffalo is the high rate of embryonic mortality occurring during early pregnancy. Elucidation of molecular processes of luteal function is essential since a high incidence of early pregnancy losses attributed to luteal phase defects. The overall objective of the project is to understand the mechanisms and factors involved in CL function and to improve luteal functions.

The CL function is maintained by the presence of large luteal cells secreting higher levels of progesterone due to intense 3β-HSD activity. The lower level of progesterone in buffalores is attributed to fewer large luteal cells with less 3β-HSD activityduring the late luteal period. Lower secretory activity of lutal cells might trigger apoptotic cascade leading to regression of CL during late luteal phase as evident through end nick labeling of DNA using TUNEL assay. To combat apoptosis, the antioxidative defence enzymes viz., superoxide dismutase (SOD), catalase levels were increased with a concomitant decrease in the glutathione peroxidase enzyme level in the CL during the late luteal phase.

The expression of LH receptor, BMPR-II and 3β-HSD transcripts vary with the phase of the CL. The above transcripts predominated during the mid luteal phase whereas PGF_2 Fas, caspase 3 activities increased during the late luteal phase indicating the beginning of CL regression.

Supplementation of PGF_2 in cultured luteal cells decreased progesterone secretion whereas that of IGF-I and nitric oxide inhibitor significantly increased progesterone secretion by the luteal cells.

CL regression begins in buffaloe with the declining activity of 3β-HSD of the large luteal cells that may trigger the apoptotic cascade despite increased activity of SOD and catalase that combats apoptosis. Progesteone secretion from the luteal cells is positively regulated by IGF-I and negatively regulated by PGF2

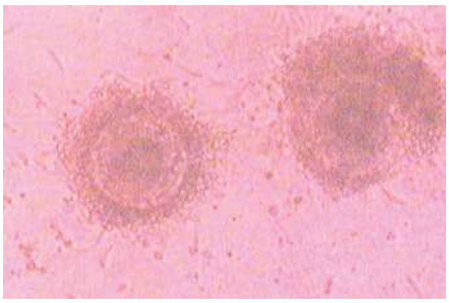
Deciphering the mechanism of aberrant maternal recognition of pregnancy (MRP) events in sheep and buffalo under heat and nutritional stress

S Mondal, S Nandi, PSP Gupta and IJ Reddy

The survivability of embryo during early embryonic life is mostly 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. Considering the role of prostaglandins in MRP and embryo survivability, studies on delineating the modulation of peripheral endocrine profiles as well as characterization and expressional profiling of genes involved in MRP during heat and nutritional stress have to be explored.

Maturation of sheep oocytes in vitro

Sheep oocytes having more than 5 layers of cumulus cells and granular homogenous ooplasm were cultured in oocyte culture media in a CO_2 incubator (38.5°c, 5% CO2 in air, 90-95% relative humidity) for 24 hours. The maturation rate of cultured oocytes was found to be 66%. Out of 66% matured oocytes, 70% was found to be in degree II cumulous expanded level (Figure 1) and rest 30% in degree I cumulous expanded level.



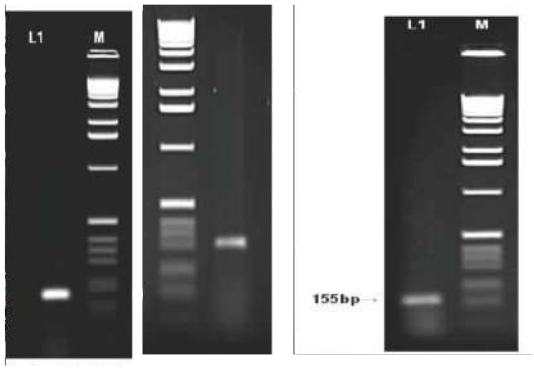
Matured sheep oocytes

Isolation and culture of sheep endometrial epithelial cells

After trypsin dispersion, the epithelial cells were released as single cells or clumps of different sizes. These cells began to attach to culture dishes within 24-48 h after seeding and reached confluence on 5 to 6 day in culture. In primary culture, epithelial cells exhibited cuboidal or columnar morphologies and showed contact inhibition at the stage of confluence. PGE_2 concentrations were highest ($P>0.05$) on day 5 culture supernatant as compared to Day 1 and Day 3 culture.

Amplification of genes involved in prostaglandin biosynthesis in buffalo

Using gene specific primers, amplified, 184 bp and 334 bp fragments of PGES gene and 155 bp fragments of PGFS gene in buffalo (Figure 2).



Amplification of cDNA of 184 bp PGES (a), 334 bp PGES (b) and 155 bp PGFS (c) from buffalo endometrium. Lane M: 1 kb DNA ladder; Lane 1: Amplified PCR product

National Agricultural Innovation Project

Value chain on commercialization of maize products

S Senani, AV Elangovan and NKS Gowda

Evaluation of CFB vs farmers feeding practices on milk production

A field study on the effect and profitability of feeding complete feed blocks on lactating cows was carried out in the Malavalli taluk of Mandya district. The control was similar to the existing farmers feeding practice, whereas in the treatment Complete Feed Block (CFB) made of straw and concentrate mixture in the ratio of 50:50 was fed. Over 45 days of feeding, use of CFB was found to increase farmer's incomeby Rs. 19.0 per day.

Evaluation of spent maize cob as feed for livestock

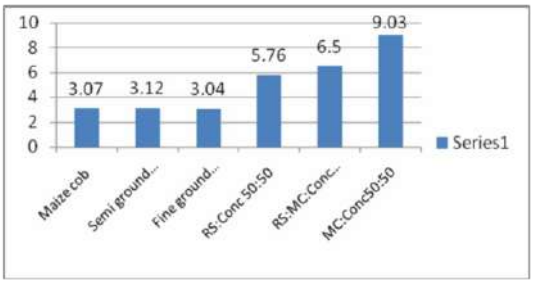
Eighteen lambs of 10 month age were randomly divided into three groups of 6 animals each and were fed a diet of roughage: concentrate at 50:50.

Maize cobs (above) and feed block using maize cobs (below)

The T1 served as control where animals were fed with ragi straw and concentrate mixture in the ratio of 50:50. In T2 group 50% roughage (ragi straw) was replaced with grounded maize cobs and in the T3 group the 100% ragi straw was replaced by grounded maize cobs. Maize cob was lower in CP (2.84 vs 4.05) and higher in NDF (95.49 vs 84.24) content. The DMI was 550, 558, 517 g/d in group T1, T2 and T3 respectively. Digestibility co-efficient of nutrients reveals that there were no significant differences in DM digestibility among the 3 groups and the values were 63.8, 60.8 and 60.9 for T1, T2 and T3 group respectively. The NDF digestibility values were 64.0, 60.1 and 57.6 in T1, T2 and T3 respectively.

Bulk Density Differences

The bulk density for as such, semi ground and finely ground maize cob was 3.0, 3.1 and 3.0 fold increased after making blocks. The feeds used in this study, maize cob: concentrate (50:50) and ragi straw: maize cob: concentrate (25:25:50) and ragi straw: concentrate (50:50) were also made in to blocks and bulk density changes were recorded. There was a net increase in bulk density to the tune of 5.7, 6.5 and 9.0 folds in treatment T1, T2 and T3 respectively.



Bulk density changes of maize cob in different forms and experimental diets

On the basis of this study it was concluded that maize cobs could be used as feed source in the ration of sheep without adversely affecting nutrient intake and digestibility. The bulk density of maize cob and maize cob based diets could be increased 3-9 folds by making blocks 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

The total number of primordial and Graafian follicles is very low in buffaloes along with this the rate of atresia is also high. Follicular development and atresia depend upon a sophisticated balance between survival and atretogenic factors. Hence the study was performed to localize the BMP-2 and Fas antigen in different classes of buffalo *(Bubalus bubalis)* ovarian follicles and to study the effect of BMP-2, FasL and IGF-I in the granulosa cells function.

BMP2 and BMPR-II may be crucially involved in the processes of folliculogenesis and steroidogenesis in buffalo. The findings also indicate that BMP2 may play a crucial role in development of medium and large size follicles in buffalo ovaries. 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. In follicular fluid, a significantly higher estradiol-17β concentration was observed in medium sized non-atretic follicle as compared to atretic follicle. The medium sized follicles with high estradiol-17β concentration may go for dominance.The follicular fluid progesterone concentration was significantly higher in dominant (>10mm diameter) non-atretic as 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.

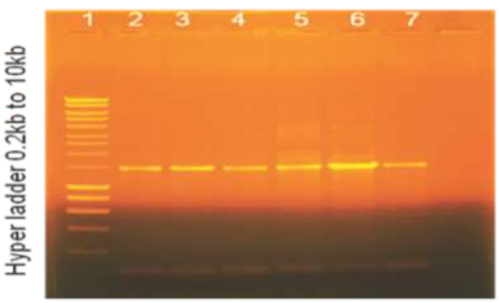
The medium sized follicles with high estradiol-17β concentration may go for dominance and the dominant follicle with high progesterone levels may destine ovulation soon.

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 and M Bagath

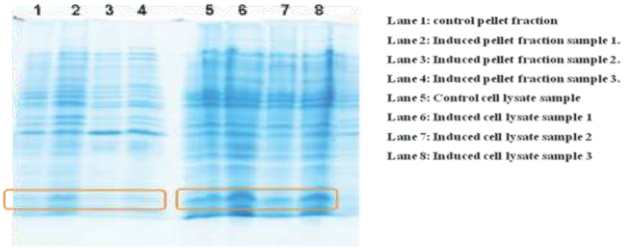
Feruloyl esterase enzyme has been purified from pet32-FT3-7 BL21 strain and the dyalized protein was used to characterize the FAE by determining its molecular weight, CD spectral analysis and enzyme activity studies. The feruloyl esterase activity of the different clones was quantified by HPLC method using ethyl ferulate as substrate. The FAE was classified by measuring of released of diFA and FA from the substrates, wheat bran and spent grain and also by comparing the nucleotide sequence similarity. Type A and D FAE will releases 5-5' di FA. Type A FAE show the sequence similarity with lipase while Type D FAE sequence similarity matches with xylanase. Since the FT3-7, TVM10A and TVM2A is showing the sequence similarity with xylanase and the able to release di FA and FA from the substrates wheat bran and spent grain we have placed this enzyme under Type D FAE.

pGEM-T vector harboring 1.3 Kb feruloyl esterase enzyme encoding gene were digested using *EcoR1.* The released product was gel eluted and sub-cloned into pYES2 shuttle vector, which was cut using the same restriction enzyme. The positive constructs of the pYES2-FT3-7 in *E.coli.* has been confirmed by the restriction analysis. The positive FAE construct was transformed in *Saccharomyces cerevisiae* by electroporation. The positive constructs of pYES2-FT3-7 in *Saccharomyces cerevisiae* has been confirmed by the colony PCR (Fig 1).



Checking of cloned product (pYES2 – FT37) in Saccharomyces cerevisiae by colony PCR for +ve clones.

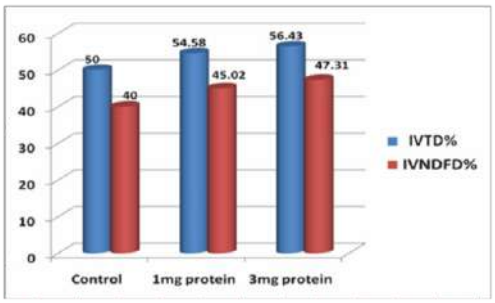
Standardized the expression conditions of the feruloyl esterase genes in *yeast*, SDS-PAGE analysis reveals that the level of FAE expression is less in yeast.



SDS PAGE Analysis of expressed protein FT3-7 Feruloyl esterase enzyme in Saccharomyces cerevisiae

Feruloyl esterase gene has been cloned in to the pQE trisystem shuttle expression vector. The pQE-FAE construct in *E.coli* was conformed by restriction analysis. The positive construct has been transformed in *B. fibrosolvens* by electroporation with various modifications in the protocol. The positive constructs of pQE-FT3-7 in *B. fibrosolvens* have been confirmed by the colony PCR. Checking of the expression of FAE in *B. fibrosolvens*, SDS-PAGE analysis reveals that there is no significant expression (Fig 2).

Feruloyl esterase enzyme has been purified from pet32-FT3-7 BL21 strain and the dialyzed enzyme is used to conduct *in vitro* digestibility of finger millet straw. The digestibility of finger millet straw *in vitro* was increased with 1 and 3 mg level of supplementation when compared to control ('0' level of supplementation). The two levels of supplementation of the enzyme FAE, substantially improved the digestibility of FMS with the significance of this effect being dependent on the level of supplemented enzyme (Fig 3).



Effect of FAE enzyme on in vitro digestibility of Finger millet Straw

Recombinant enzyme feruloyl esterase has been characterized and classified. The recombinant enzyme FAE showed significant increase in the digestibility of FMS.

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

A V Elangovan, KT Sampath, Prakash Khandekar, K Giridhar

The programe has the following objectives: 1. Identification and promotion of appropriate farming systems and income generating activities to strengthen the livelihood, economic security, equity and social capital; 2 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 IFS and IGA innovations; 3. Capacity building for Human resource development at different levels and Social capital formation through local organizations. The salinet achievements were,

- Wide popularization of fodder trees like Sesbania and Melia in the project villages
- Income generation through distribution of improved variety of birds for backyard poultry and breed improvement of sheep and goat.
- Improvement of local breed through artificial insemination in cattle and buffalo.
- Encouraged farmers for chaffing of fodders for better utilization.
- Promotion of complete feed, mineral mixture and TMR using locally available feed ingredients

Health camp

NAIP interaction

DBT Sponsored Projects

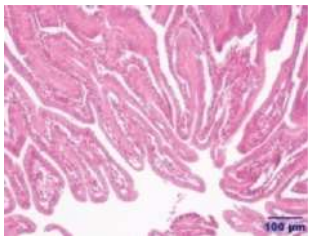
Detoxification and utilization of key agro-forest based non conventional oil cakes in the feeding of livestock

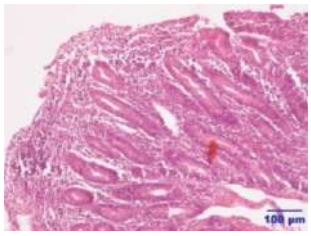
SBN Rao, AV Elangovan and S Jash

Evaluation of detoxified neem seed cake (DNC) on growth performance, nutrient utilization, blood biochemical profiles, carcass characteristics in male lambs

Eighteen lambs were divided in to three groups of six each and allocated to the following treatments: Group I: Control, Group II: DNC 25% and Group III: DNC 50% where in DNC replaced SBM at 0, 25, 50 percent levels. To get a replacement level of 25 and 50 %, DNC was used at 5.40 and 10.80 % of concentrate mixture. At the end of 90 days of feeding trial, ADG and FCE (Feed/gain) was similar in all the groups. DMI and OMI (% of LW and g/kg $W^{0.75}$) was found to be similar in all the groups indicating no adverse effect of DNC on nutrient intakes. Nutrient digestibilities and nutritive value were found to be similar in all the groups. The N-Balance (g/d) of DNC replaced groups was comparable to control. A significant reduction of rumen pH was recorded due to graded levels of supplementation of DNC. No change in biochemical parameters was observed. Humoral immunity status in terms of PPR antibody titer and cell mediated immunity status as measured by lymophocyte proliferation assay was found to be comparable in DNC supplemented compared to control. Similarly, pre-slaughter weight, dressed weight and carcass weight were found to be unaffected ($P<0.05$) due to DNC replacement. Meat quality evaluation in respect of *Longissmus dorsi* indicated analyzed parameters were found to be similar in all treatment groups. Significant increases in water holding capacity and muscle pigments were observed due to feeding of DNC. Organoleptic evaluation was carried out by semi trained panelists. The attributes were found to be similar in all the groups.

Histo-pathological changes observed showed that 25% NSC fed group had mild crypt elongation and fusion of villi in intestine (Fig 1) and other organs without any observable changes. The 50% DNC fed group showed fusion of intestine villi, loss of epithelial cells and with infiltration of mononuclear cells like macrophages, lymphocytes and plasma cells in the intestine (Fig.2). The intestinal lymph node showed mild loss of lymphocytes. The other organs showed no observable changes when compared to the control group. Thus it can be concluded that feeding DNC up to 10.8 % in concentrate mixture replacing 50 % soybean meal is found safe for lambs raised for meat production.





Intestinal villi showing mild crypt elongation Intestinal villi showing fusion, loss of epithelial cells and with infiltrationand fusion in 25 % DNC replaced groups of mononuclear cells like macrophages, lymphocytes and plasma cells in the intestine (H & E 100 µ m)(H & E 100 µ m)

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. Mild to moderate changes in intestinal villi were not to be of much consequence to overall performance of sheep.

Production of xylo-oligosaccharides from agricultural byproducts and its evaluation as prebiotic

AK Samanta, S Senani and AP Kolte

Xylooligosaccharides modulates the composition of colonic microflora in such a way that only a few of the potentially health promoting organisms becomes predominant in number. Its precursor, xylan is abundantly present in most of the agricultural byproducts in higher concentration (20-35% on DM basis). Xylan is considered as second largest occurring bio-molecules in this earth; immediately next to cellulose.

Corn husks, gram straw, soyabean hulls, tur straw, corn cobs and corn husks were the richest source of hemicelluloses (37 to 39 % DM) followed by ragi straw (29.7%), natural grass (28.10%) and sugarcane bagasse (27%). The steam application with sodium hydroxide was able to ensure highest yield of xylan ranging from 75 to 97%. This xylan was found to contain insignificant levels of reducing sugars and lignin-free. FTIR analysis revealed quality of xylan akin to pure xylan. The alkali soluble xylan was further utilized to generate xylooligosaccharides comprising of xylobiose and xylotriose by both acid and enzymatic hydrolysis. Thus chemically produced xylooligosaccharides from corn cobs was able to exhibit prebiotic effects on selected probiotic strains under *in vitro* system. An enzyme dose of 2.65 units at pH 5.0, temperature of 40°C, incubation time of 24 h yielded highest concentration of xylobiose (1.075 mg/ml) and xylotriose (0.629 mg/ml). In case of corn husks, enzyme dose of 6.62 units, pH of 6.0, and temperature of 50°C and incubation time of 16 h yielded highest concentration of xylooligosaccharides. For xylan of sugarcane bagasse: an enzyme dose of 2.65 units, pH 4.0 and temperature 30°C for 24 hours of incubation yielded highest concentration (1.307 mg/ml) of xylobiose.

Further, bulk quantity of xylooligosaccharides was produced from corn husks. Application of 0.5% xylooligosaccharides in the diets of broilers exhibited lower levels of blood glucose and cholesterol after continuous feeding for three weeks. There was increase in the population of bifidobacteria at the caecum of birds receiving xylooligosaccharides diets as compared to control birds. Simultaneously there was decreasing trend in the population of *E.coli* and *Streptococci* at caecum of bird on xylooligosaccharides in diets. Thus xylooligosaccharides (nutraceuticals) could be produced from the agricultural byproducts for augmenting gut health and functionality in birds.

In addition, a new and easy protocol was developed for endoxylanase assay for rapid screening of xylanase producing microorganisms. The newly developed method does not require staining by Congo Red and de-staining by sodium chloride solution, and the efficiency of the method was comparable with the existing Congo Red assay.

Xylooligosaccharides (an emerging nutraceutical) could be produced from several agricultural byproducts such as corn cobs, corn husks, ragi straw, sugarcane bagasse, natural grass, tur straw. The chemically generated xylooligosaccharides were found to exhibit growth stimulation for some proven probiotic strain in poultry birds.

Economic meat production from male buffalo calves and sheep under cultivated fodder based production system with sheanut (*Butyrospermum parkii*) cake based concentrate mixture supplemented with probiotics

Raghavendra Bhatta

The objective of this project was to determine the possibility of using Sheanut cake (*Butyrospermum Parkii*) as a source of protein/energy in ruminant ration. The degradation kinetics of the Sheanut cake (SNC), expeller (SN-E) and solvent extracted (SN-SE) indicated that rate of degradation was 0.03702, 0.04802 and 0.03154, respectively with a half time ($t^{1/2}$) of 18.72, 14.43 and 21.98 h. The *in vitro* incubation of SNC, SN-E and SN-SE with polyethylene glycol-6000 (as a tannin binder) showed an improvement of about 10.9, 7.6 and 11.9 ml of gas, respectively indicating significant effect of tannin on fermentation. The ammonia nitrogen values reduced in the absence of PEG, reflecting the potential of SN extractions in protein protection (bypass protein) in ruminant feeding. There was no significant reduction in the TVFA values in the absence of PEG indicating that the fermentation in general was not adversely affected by SN tannins. When the *in vitro* gas samples were subjected to the analysis of methane, SNC, SN-E and SN-SE samples produced 2.8, 3.0 and 1.89ml methane/g DM whereas when it was incubated with added PEG, methane production was 7.42, 5.37 and 5.59 ml/g DM, respectively. The tannin present in SNC, SN-E and SN-SE were responsible for suppression of methane to the tune of 61.0, 43.0 and 66.0 %. Hence, SN by-products could be used as a source of tannin to suppress methane emission in ruminants.

There is a great potential for using SNC in ruminant feeding not only as a source of energy and protein (ME 7 MJ/kg DM and 12 % CP) but also to suppress methane emission

Effect of Resveratrol and Carvacrol in ameliorating aflatoxin induced molecular changes in broilers

Manpal Sridhar, RU Suganthi and KV Pugalendi*

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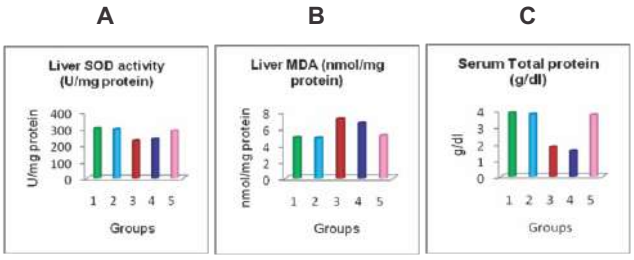
Among different mycotoxins, Aflatoxin B1 (AFB1) is the most toxic and predominant mycotoxin in feeds. Counteraction strategies using phytochemicals which could be easily adopted by the farming community needs attention. Due to the several protective effects and wide distribution of these products in the plant kingdom, resveratrol and carvacrol can be envisaged as chemo-preventive/curative agents against AFB1 in broilers.

A feeding trial was conducted in day-old male broiler chicks to study the effect of carvacrol in ameliorating aflatoxin toxicity for a period of 42 days. The birds were divided into five dietary treatments: G1:Basal diet; G2- Basal diet +1.0% carvacrol; G3- Basal diet+1.0ppm toxin; G4-Toxin+ 1.0% carvacrol; G5-Toxin + carvacrol (0.5%) and HSCAS (0.5%). Aflatoxin feeding affected serum and tissue hepatic marker enzymes, lipid peroxidation products and antioxidants while supplementation of carvacrol and HSCAS binder for aflatoxin improved the above mentioned parameters (Fig 1a, 1b and 1c)

Fig 1: Effect of caracole supplementation on liver SOD activity (A) liver MDA (B) and serum total protein (C) in broiler birds



Aflatoxin induced changes could be overcome by supplementing resveratrol as it has protective effect against aflatoxin induced toxicity

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

J Ghosh, SC Roy, KS Roy and A Dhali

The presence 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 animal species. Pregnancy diagnosis method based on this molecule is not available in buffaloes that hamper the optimisation of reproductive management in this species. This project is undertaken with an objective of producing recombinant pregnancy associated glycoproteins and then development of specific immuno-assay based on the recombinant protein molecules.

RNA from an early pregnant buffalo cotyledons and caruncles along with non pregnant caruncles was isolated. The cDNA was synthesised and the PCR was run with different sets of primers targeting the full open reading frame (ORF) of different PAG isoforms. The predominantly amplified bands were gel purified and ligated in the pJET cloning vector and cloned in *E. coli*. The positive insert in the isolated plasmid was confirmed by RE digestion and positive amplification by gene specific primers. Clones from each tissue samples were sequenced both directions using Big Dye method. Sequences were derived by reading the actual chromatogram and analysed using bioinformatic tools and confirmed that it matches with the PAG1 isoforms of other species predominantly. However there are regions in the sequence which matched with the other PAG transcripts as well. The authenticity of the sequence is confirmed by series of RE digestion experiments locating the sites in the derived sequence. Efforts are on to sub-clone the desired sequence in a suitable expression vector. The non-pregnant caruncle sample showed amplification near 500bp which had similarity in the 5' and 3' region of ORF with the other isoforms of PAG1 related transcripts.

Identified the predominant isoform of PAG by PCR amplification.

Confirmed that both caruncle and cotyledon express the same predominant PAG isoform

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

AK Samanta, S Senani and AP Kolte

At genesis, the gastrointestinal tract of piglet is germfree and it acquires diverse group of microflora during first few weeks of life. During last few decades antibiotics and hormones were used to enhance the performances of pigs. Furore on antibiotics fed to animals, have prompted for suitable alternatives. Possibly, the nutraceuticals and herbal residues may alter the gut microflorae towards beneficial bacterial community for nutrient utilization, thinner epithelial walls for higher mineral absorption, boosting of immunity, lowering of cholesterol, improvement of carcass quality etc.

The grower ration of pigs was subjected to pepsin - pancreatin digestion followed by *in vitro* evaluation for prebiotic potentiality with the presence of fecal inoculum. Source of inoculum was from Yorkshire pig, seven months old with approximate body weight of 70 kg. *In vitro* digestibility was carried out with the pepsin digested samples with different levels of inulin (chickory derived) with following combinations T_0: no prebiotic, T_1: 0.5% inulin, T_2: 1.0% inulin and T_3: 2% inulin. The pH of the fermentation media varied from 6.55 to 6.77 amongst the treatments. The total volatile fatty acids concentration was 2.7 mEQ/dl in T_0, 4.20 in T_1, 5.70 in T_2 and 6.40 in T_3. There was no difference in log CFU counts for total viable bacteria, *Bifidobacteria* population amongst the treatments. However, log CFU counts for *E. coli* and *Salmonella* were reduced from 4.47 to 3.35 and 5.93 to 5.86 respectively as a result of presence of prebiotics. The fiber degrading enzymes namely endoxylanase and carboxymethyl cellulase were recorded to increase from 23 mIU to 41 mIU and from 8.52 mIU to 12.04 mIU, respectively under the influence of different levels of prebiotics. The *in vitro* dry matter digestibility ranged from 49.8 to 55.5%; being lowest (49.8%) in To and highest in T_3, where substrate were fermented in the presence of 2% prebiotic. Similarly, in vitro organic matter digestibility was 51.51±1.2% in control, 53.8 in T_1, 56.1 in T_2 and 57.5 in T_3. Under *in vitro* system, prebiotic @2% of the diet was found to modulate the hind gut fermentation for increasing the both dry matter and organic matter digestibility.

Under *in vitro* fermentation system, prebiotic inulin @ 2% of diet modulates the hindgut fermentation in pigs for improving digestibility and as well as to reduce the population of harmful bacteria.

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

A V Elangovan and Manpal S

Phosphorus is the third costlier ingredient after energy and protein sources. Considering that around 50 to 60% of dicalcium phosphate can be replaced by phytase enzyme, the potential demand for phytase enzyme in the poultry feed is around 4000 tonnes/annum. Hence the project has been designed to identify fungal species suitable for commercial feed grade phytase enzyme production for feeding of poultry birds at low cost.

Transcriptomic profiling of spermatozoa for selection of fertile bulls

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

Conventional tests to evaluate fertility in bulls rely on sperm analysis viz., concentration and progressive motility that are the primary factors to decide fertility. However, semen sample with normal sperm count and/or with normal sperm motility does not invariably establish fertility. This warrants molecular approaches for assessing fertility in males. In the recent past, profiling of spermatozoa transcripts have been correlated with sperm functional parameters and fertility. This approach helps to identify novel transcripts which may play a role in fertility. These transcripts can be used to identify infertile males and eliminate them from breeding programmes which can improve fertility in dairy animals.

DST sponsored Indo-Japan Project

Growth factors in small oocyte development: Proteomics and genomic approaches

PSP Gupta, S Nandi and A Dhali

Granulosa cells were collected from the ovaries of superovulated (PMSG treated) mouse. The cells were cultured, transfected with SEMA3C SiRNA and then cultured with the growth factor Amphiregulin. Granulosa cell migration was recorded during the experiment. At the end of the experiment, protein expression profile of the cells was analyzed. The results indicated that SEMA3C is involved in granulosa cell migration. The COCs were collected from eCG primed mouse and cultured with the growth factor Amphiregulin and SMAD inhibitor (selectively suppress oocyte secreted factor-induced signaling pathway in cumulus cells). Following culturing, gene expression profile in the COCs was analyzed. The results indicated that SMAD pathway is required for the expression of Has2, Tnfaip6 and Ptgs2, but not Cyp11a1 or Areg transcripts, suggesting that SMAD pathway is selectively required for induction of cumulus expansion of COCs.

In vivo derived 2-cell stage mouse embryos were collected from the superovulated mice and cultured up to blastocyst stage under normal temperature (37° C) or heat stressed condition (39° C). Following culturing, gene expression profile was analyzed in the blastocysts. The results suggested that in mammalian embryos, heat stress induces apoptosis and possibly decreases the activity of TCA cycle. The caprine oocytes were classified as Small (⩽ 126µm), Medium (127-153µm) and Large (>153µm) based on their size. Studies on the in vitro maturation of goat oocytes in presence of Growth Differentiation Factor 9 (GDF 9) are in progress.

SMAD pathway is required for the expression of Has2, Tnfaip6 and Ptgs2, but not Cyp11a1 or Areg transcripts, suggesting that SMAD pathway is selectively required for induction of cumulus expansion of COCs. In mammalian embryos, heat stress induces apoptosis and possibly decreases the activity of TCA cycle.

National Initiative on Climate Resilient Agriculture (NICRA) sponsored project

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

K Giridhar, K P Suresh and G Ravikiran

The impact of climatic aberrations on the availability of feed resources for the livestock in India, future or near-term scenarios of availability can be forecasted to help the decision makers for developing adaptation strategies to ensure sustainable livestock production. The weather data of various districts for the past 40 years and feed resources' availability of Karnataka was collected. The models are being tested to study the effect of climatic as well as non-climatic factors on production of various crop residues in the state. It was observed that seasonal rainfall is having a significant effect on stover production in Karnataka state. The deviation of monthly mean maximum temperature and monthly mean minimum temperature from the long period average and their effect on stover production of different crops appears to be non-significant.

The preliminary modeling on impact of climate variation on feed resources availability revealed that seasonal rainfall is having a significant effect on stover production in Karnataka state.

Coconut Development Board sponsored project

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

AK Samanta and S Senani

Green coconut husks are abundant source of cellulose, hemicellulose and lignin. Global attention has been focussed on converting lignocellulosic material into various value added products.

Post manual chopping, the green coconut husks were dried at 60° C in forced hot air oven till constant weight. The grounded powder revealed presence of OM 96.2, total ash 3.73, cellulose 57.4, hemicellulose 15.2, CP 3.60 and klason lignin 3.5 percent. Attempts were made to fractionate xylan from green coconut husks with different levels of sodium hydroxide under overnight incubation at room temperature and steam application. The true recovery (%) of xylan was 5.12, 11.3, 13.9 and 18.4 for 2%, 4%, 8% and 12 % of sodium hydroxide application, respectively. Similarly, the true recovery (%) under the influence of steam was 10.2, 13.2, 16.9 and 30.8, respectively at different levels of sodium hydroxide. It is apparent that with increasing levels of alkali, there was increase in the recovery of xylan either at overnight incubation or by steam application.

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Dineshkumar D, Jash S, Elangovan AV, Reddy IJ and Rao SBN. Detoxified karanja (*pongamia pinnata*) seed cake as protein supplement for sheep – effect on intake, digestibility and blood profiles. pp 425-426.

Elangovan AV, Sharangouda, Charankumar ME, Pramod MC, Giridhar K, Murugappa A, Khandekar P and Sampath KT. Interventions for enhancement of milk production in Sanikere village of Chitradurga district. pp 84-86

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Giridhar K, Elangovan AV, Khandekar P, Sharangouda, Rajendra H and Sampath KT. 2011. Azolla-Navina Hosa Upa Aahara (Kannada). NIANP, Bangalore.

Giridhar K, Elangovan AV, Vijay Kumar, Khandekar P, Sharangouda and Sampath KT. 2011. Azolla-Pashudan Ke Liye Navin Poshak Purak Aahar (Hindi). NIANP, Bangalore .

Giridhar, K. 2011. Economics of maize cultivation for small holder. In: Maize info for farmpreneurs. Published by NIANP, Bangalore pp. 30-32

Mech A., Dhali A., Roy SC and Roy KS. 2012. Importance of reproduction management in animals.

Mech A., Ghosh J, Suganthi RU and Roy KS. 2012. Turkey farming a profitable enterprise.

D. T. Pal. 2011. Mineral Supplementation to Animals: Why and How

Rajendran D.2011. Feeding Strategies during early Lactation.

Rajendran D. 2012. Importance of total mixed ration in dairy cows.

Samanta AK, Senani S, Kolte AP, Manpal S. 2011. Scope of maize by products for complete feed block preparation. In: Maize info for Farmpreneurs. Ed. Senani, S, Kolte AP, Khandekar P and Raghupathi D. pp 19

Suganthi UR, Manpal S and Mech A. 2011. Know about Mycotoxins

Suganthi UR, Manpal S, David ICG, Rajendran D, Letha Devi and Mech A. 2012. Aflatoxin: The farmers Woe (exhibit presented in Kannada) and aflatoxin contaminated feeds exhibited in 'Innovative and Progressive Farmers Meet', organized at NIANP on 15.02.12.

Giridhar K., Elangovan AV., Sharangouda, Kandhekar P., Pramod C M. and Sampath KT. 2011. Pamphlets in English and Kannada

1. Improved agro-techniques for fodder Sorghum
2. Package of practices for fodder Maize
3. Improved agro-techniques for hybrid Napier Bajra
4. Production practices for fodder Bajra
5. Improved agro-techniques for Guinea grass
6. Production practices for Para grass
7. Management practices for fodder Cowpea
8. Package of practices for Lucerne
9. Azolla's cultivation and its usage as feed supplement for livestock
10. Rural poultry farming

गिरिधर के, ए वी इलांगोवन, विजय कुमार, प्रकाश खांडेकर, शरण गौडा और के टी संपत २०११. अजोल्ला–पशुधन के लिए एक पोषक पूरक आहार. तकनीकी बुलेटिन–७. राष्ट्रीय कृषि नवोन्मेषी परियोजना, राष्ट्रीय पशु पोषण एवं शरीर क्रिया विज्ञान संस्थान (भारतीय कृषि अनुसन्धान परिषद)

CD's

Rajendran D, Jash S, Suganthi RU and Anandan S. 2012. Feed Inventory [computer software]. NIANP, Adugodi, Bangalore

Rajendran D, Gowda NKS, Rao SBN and Prasad KS. 2012. TMR Maker [computer software]. NIANP, Adugodi, Bangalore

Media

Gowda NKS. 2011. Delivered a radio talk in *Kannada* on the topic 'Nutrition of dairy animals'. All India Radio, Bangalore on 19.5.2011.

Gowda NKS. 2011. Delivered a radio talk in *Kannada* on the topic 'Areca sheath as dry fodder for livestock'. All India Radio, Bangalore on 26.9.2011.

Patents filed

Chandrasekharaiah M, Thulasi A, Bagath M and Lyju JV. Reduction of methane emission. Filed on January 9, 2012

Gowda NKS, Anandan S, Pal DT and Sampath KT. Areca sheath as an alternate dry fodder for livestock. Filed January on 19, 2012

Gowda NKS, Pal DT, Krishnamoorthy P and Sampath KT. Mineral mixture as nutrients for small ruminants. Filed on February 1, 2012

Thulasi A, Chandrasekharaiah M, Bagath M, Prasanna KD, Santosh SS and Palanivel C. A Novel enzyme. Filed on January 9, 2012

Release of book on 'Farmers Profile' and extension literatures during Innovative Farmer's Meet
Dr. P Khandekar, Pr. Scientist, NIANP, Dr. M.S. Narayana, DGM, NABARD, Dr. Venkataramu, MD, Karnataka Milk Federation and Dr. KT Sampath, Director (L to R)

Trainings

Recent advances in methane estimation and mitigation strategies (NAIP Sponsored)

A 14 day National Agricultural innovation Project (NAIP) sponsored training programmed on 'Recent advances in methane estimation and mitigation strategies in ruminants was organized at the institute from 5-18th August, 2011, Dr. S. Abdul Rahman, former Dean Veterinary College, Bangalore and President Elect, Commonwealth Veterinary Association was the Chief Guest at the inaugural function. Twelve participants from different ICAR Institutes and SAUs attended the programme. Dr. HPS Makkar was the international guest faculty from FAO, Rome. The participants were given hands-on training on *in vitro* gas production test, sulphur hexafluoride tracer technique for methane estimation, real time PCR technique for archea, metagenomics approach and enumeration of protozoa, Dr. CS Prasad, Hon.Vice Chancellor, MAFSU, Nagpur was the chief guest at the valedictory function held on 18th August. Dr. K.T. Sampath, Director, NIANP and Dr. Raghavendra Bhatta, Senior Scientist were the course Directors and Dr (Mrs.) Manpal Sridhar, Pr. Scientist and Dr. Atul P. Kolte, scientist were the course coordinators. The training was well received and appreciated by the participants.

Dr. CS Prasad, Vice Chancellor, MAFSU, chief guest during the valedictory function with Dr. KT Sampath, Director, NIANP and Dr. Raghavendra Bhatta, Course Director.

Winter school on 'Functional genomics approaches to improve reproductive efficiency in livestock'

ICAR sponsored winter school on 'Functional genomic approaches for enhancing fertility in livestock' was organized by the institute from 22nd November to 12th December 2011. 22 participants attended from 14 states across the country. The winter school was inaugurated by Dr. A. Jagannatha Rao, Emeritus scientist, IISc and Chairman, DBT task force, Animal Biotechnology. The participants were exposed to recent concepts involving improving reproductive efficiency like expression of genes, role of paternal transcripts in sperm function, embryo production *in vitro*, genomic aspects of heat stress, application of stem cells, transgenesis, cloning, RNAi in animal reproduction, nutrigenomics, bioinformatics etc. The valedictory function was graced by Dr. Kusumakar Sharma, ADG (HRD) who distributed certificates and addressed the participants and spoke on 'Future thrust in research and education in animal science'. Dr. J.P. Ravindra, Principal Scientist was the course Director and Dr. S. Nandi Senior scientist and Dr. S. Selvaraju, Scientist were course coordinators.

Dr. Kusumakar Sharma, ADG (HRD), Chief Guest distributing participation certificates with Dr. KT Sampath, Director, NIANP and Dr. JP Ravindra, Course Director

Model training course on 'Recent trends in feeding practices for improving dairy production and management'

A model training course on 'Recent trends in feeding practices for improving dairy production and management' was conducted from 15-22 December 2011 for the field officers of state department of animal husbandry and veterinary services. 17 officers across the country attended the training programme. The training program covered different areas of dairy cattle feeding, reproduction and management. The trainees were exposed to recent developments in animal nutrition and reproduction including field visits. Dr KT Sampath, Director, NIANP was the Course Director and Dr NKS Gowda and Dr K Giridhar were the course coordinators.

Dr. Shivakumar, (former director of animal husbandry, govt. of Karnataka) Chief Guest during the valedictory function along with Dr. KT Sampath, Director, NIANP and Dr. NKS Gowda, course co-ordinator

Training program on 'Recent developments in dairying cattle feeding'

Sequel to the continued demands of feed industries of Kerala, Karnataka and Tamil Nadu a six days training programme was organized for feed mill managers. Recent advances in feed manufacturing technologies, feed formulation techniques and new trends in animal nutrition were discussed in detail. Training was conducted from April 25-30, 2011. Dr. S. Anandan and Dr. D. Rajendran were coordinators for the program.

Training program on 'Research methodology, data management and biostatistics'

The 6th successive training program on Research Methodology, data management and Biostatistics was conducted from 9-10th December 2011. Ninety five (95) participants from ICAR and other Institutes, universities and colleges from all over India attended the training program. The main objective of the training program was to provide training on Research method tools and Biostatistics to the researchers working in agriculture, animal science, basic sciences, behavioral & social sciences and medical sciences. The curriculum of training program was research methods such as study design, sample size estimation, randomization, blinding, sample selection techniques etc, and data management techniques. Dr. Sridharan, former Professor of microbiology, MSR medical college, Bangalore inaugurated the training program. Dr. AV Elangoan, Dr. Raghavendra Bhatta, Dr. Ravikiran and Dr. KP Suresh were core faculty members of the training program. Dr. Parkash Khandekar was the Course Director and Dr. K. T. Sampath was the Patron of the training program.

Dr. Sridharan, former Professor of microbiology, MSR medical college, Bangalore during the inauguration along with Dr. KT Sampath, Director, NIANP and Dr. KP Suresh, course co-ordinator

Other training programmes

Workshop on 'Maize value added feeds for milk production' for members of maize growers federation, Malvalli, Mandya, Karnataka, March 26, 2011

Workshop on 'Business opportunities for commercialization of maize value added products' for members of maize growers federation (co-organized) at Malvalli, Mandya, Karnataka, July 29, 2011

Workshop for farmers of maize growers federation on 'Formulations and quality control of cattle feeds' at NIANP, Bangalore, November 15, 2012

Two workshops under NAIP on livelihood on livestock health, feeding and management on 20th September 2011 at Sanikere village, Challakere cluster, Chitradurga district and on 28th January 2012 in Hosadurga cluster, Chitradurga district.

One day workshop on 'Fodder production and conservation' was organized at Hadonahalli on June 28, 2011. Eighty farmers/farm women attended the workshop. There was an interaction session at the end, in which the farmers could get their queries cleared from the experts.

Trainings undergone by staff

International

Bhatta R completed a 3-month training programme sponsored by the NAIP under the HRD programme in the field of 'Mitigation strategies for methane production from livestock' at the United States Department of Agriculture (USDA) Texas, United States of America from 01.09.2011 to 29.11.2011.

Chandrasekharaiah M completed training programme on 'Novel technologies in the area of molecular-biology for application in rumen microbial ecosystem' under NAIP at Molecular Biotechnology laboratory, Department of Diagnostic Medicine/ Pathobiology Kansas State University, College of Veterinary Medicine Kansas State University, Manhattan, United States of America from 22.8.2011 –22.10.2011

Pal DT completed a 3-month training programme sponsored by the NAIP under the HRD programme in the field of 'Identification of Selenium species in Selenium-enriched Yeast and their quantification by Ion Chromatography-Inductively Coupled Plasma Mass Spectrometry (IC-ICP-MS)' at Chemistry and Biochemistry Department, Duquesne University, Pittsburgh, Pennsylvania, United States of America from 01.05.2011 – 31.07. 2011

Samanta AK completed a 3-month training programme sponsored by the NAIP under the HRD programme in the field of nutraceuticals (animal science) at North Carolina State University, Raliegh, United States of America from 08.09.2011 to 6.12.201

Vijay Kumar completed a 3-month training programme sponsored by the NAIP under the HRD programme in the field of 'Biomolecules (Animal Science)' at Department of Agriculture Forests, Nature and Energy, University of Tuscia, Italy from 14.09. 2011 to 10.2. 2012

National

Arangasamy A and Suganthi UR

Participated in the winter school on 'Functional genomic approaches for enhancing fertility in livestock' from 22 November to 12 December 2011 at NIANP, Bangalore

Jash S

NAIP training course on 'Rapid and nondestructive evaluation of food quality and safety factors using spectroscopy and biosensing methods' at Central Institute of Post-Harvest Engineering and Technology, Ludhiana, from May 6-19, 2011

Basic course for use of Hindi on computers, Central Hindi Training Institute, Kendriya Sadan, Koramangala, Bangalore, August 1-5, 2011

National Training on Application of Nano Science & Technology in Agriculture, Nano science Technology Centre, TNAU, Coimbatore, December 15 - 28, 2011

Rajendran D

National Training on Application of Nano Science & Technology in Agriculture, Nano science Technology Centre, TNAU, Coimbatore, December 15 - 28, 2011

Rao SBN

NAIP training course on 'Rapid and nondestructive evaluation of food quality and safety factors using spectroscopy and biosensing methods' at Central Institute of Post-Harvest Engineering and Technology, Ludhiana, from May 6-19, 2011

Training programme on Data Analysis Using SAS under NAIP Project 'Strengthening statistical computing for NARS' at the Department of Agricultural Statistics, Applied Maths and Computer Science, GKVK, UAS, Bangalore, August 8-13, 2011

Roy KS

Attended the NAIP sponsored training on allele mining from 12-25 September 2011 at ISSR, Calicut, Kerala

Conference/Symposia attended

Sampath KT

Animal Ethics Committee Meeting at National Tuberculosis Institute, Bangalore

Meeting of Niche Area Committee on 'Biotechnology for animal health and productivity' for Vision 2025, organized by DBT, Govt. of India

Interaction meeting of the project coordinators

Brainstorming session on vision and scope for dairy development in Karnataka organized by Indian dairy association (SZ)

Directors' conference of ICAR Institutes

Meeting of the AICRP and network projects held by the Director General, ICAR

Meeting of the governing body of National Institute of Animal Biotechnology, Hyderabad, at Delhi

Meeting of the expert committee for NER R&D twinning programme of DBT, Govt. of India

Meeting to discuss roadmap on fodder production (Mission on Fodder) at ICAR

Meeting on research priorities for 12th Five Year Plan under the chairmanship of DDG (AS), ICAR

Conference of VCs and project coordinators of AICRP Projects

5th meeting of board of management of TANUVAS, Chennai

Annual review meeting of AICRP project and project on methane emission at MAFSU, Nagpur

4th Biennial conference of animal nutrition society of India and conference on livestock productivity enhancement with available feed resources, at GBPUAT, Pantnagar

Brainstorming Workshop on 'Biotechnological delignification of crop byproducts to produce digestible and nutrition rich feed' at University of Delhi, organized by DBT, Govt. of India

Section Committee FAD 5 meeting at Bureau of Indian Standards, Delhi

Directors of ICAR Institutes and Vice-Chancellors of SAUs Interface meeting

Staff

Ravindra JP, Nandi S, Gupta PSP and Reddy IJ

XX Annual SAPI Conference and International Symposium on Advances in Physiologic Research for Sustainable Development of Livestock and Poultry Production organized by Department of Veterinary Physiology, West Bengal University of Animal and Fishery Sciences, Kolkata. 2-4 November 2011.

Elangovan AV, Gowda NKS, Pal DT, Prasad KS, Manpal S, Suganthi UR, Rao SBN and Senani S

14th Biennial Conference of ANSI on 'Livestock productivity enhancement with available feed resources' from 3rd to 5th November 2011, held at GBPUA & T, Pantnagar.

Roy KS, Dhali A and Ghosh J

Seminar on sample and assay technologies- QIAGEN's whole workflow solutions, organized by QIAGEN India Pvt. Ltd. at Bangalore on 14th July 2011at Royal Orchid, Bangalore.

Roy KS , Dhali A and Roy SC

Illumina agriculture seminar series, organized by Spinco Biotech Pvt. Ltd. at Bangalore on 20th October 2011.

Rajendran D and Senani S

National Dialogue for application of nano technology in agriculture. First meeting. CIFE, Mumbai, October 7-9, 2011

Jash S, Rajendran D, Selvaraju S, Senani S and Thulasi A

National Dialogue for application of nano technology in agriculture. Second meeting. TNAU, Coimbatore, November 11-13, 2011

Anandan S

A farmer's interactive workshop on use of areca sheath as fodder, organized by Karnataka Milk Federation, Sirsi, Uttara Kannada, April 2, 2011

Resource on livestock nutrition at technology exhibition stall of NIANP during the National Krishi Mela, held at GKVK, UAS, Bangalore, November 16-20, 2011

Interactive meeting of Dr S Ayyappan, DG, ICAR with farmers of Panaje, Puttur, Dakshina Kannada, Karnataka on issues of dairying and agriculture, December 25, 2011

Angadi UB

Workshop on 'Information and communication technology in agriculture' held on 9th and 10th Aug. 2011 at e-Extension Unit, TNAU, Coimbatore
'One day partner's meet NAIP-NABG' on 19th Dec, 2011 at NBAGR, Karnal

Chandrasekharaiah M

NFBSRA Expert committee review meeting, NDRI, Karnal, April 1, 2011

9th international conference on 'Functional Food Components in Health and Disease', University of San Diego, California, USA , August 16-18, 2011

Consortium Implementation Committee (CIC) and Consortium Monitoring Unit (CMU) meeting of NAIP Project, NIANP, July 8, 2011; December 14, 2011; January 28, 2012

Annual Review workshop of NAIP Component -4 subproject, NASC complex, New Delhi, March 19-20, 2012

David CG

28th Annual conference and International symposium of the Indian Poultry Science Association, at Bihar Veterinary College, Patna from 22-24 December, 2011.

Dhali A

18th annual general body meeting of the National Academy of Agricultural Science, New Delhi, June 5, 2011.

Elangovan AV

The CIC and CAS meeting of NAIP livelihood project held on 13.10.2011 at University of Agricultural Sciences, GKVK, Bangalore.

The review meeting of the NAIP Maize Project held on 11-11-2011 at University of Agricultural Sciences, GKVK, Bangalore.

The heads of administrative and finance meeting at NAAS complex New Delhi on 22. 11. 2011.

Ghosh J

Frontiers in gene silencing and targeted gene editing in eukaryotes organizer: Sigma Aldrich India Pvt Ltd., at Bangalore on 18th July 2011

C-CAMP Technology Conclave at C-CAMP, NCBS, GKVK campus on18th November, 2011

Gowda NKS

National workshop on 'Reclaiming research in livestock development through policy intervention' IGNOU, New Delhi, April 26-27, 2011

The SAARC consultation meet on dairy production, NDRI, Karnal, May 25-26, 2011

Consultative meeting for the development of Bihar, organized by ICAR and Department of Animal Husbandry, Govt. of Bihar, Patna, June 21, 2011

Brain storming session on vision and scope for dairy development in Karnataka, organized by IDA (south zone), Bangalore, July 2, 2011

Annual review meeting of AICRP on Improvement of feed resources and nutrient utilization for raising animal production, MAFSU, Nagpur, October 22-23, 2011

Interactive meeting of scientists of Animal Science and Fishery on issues and action plan for XII plan with Honourable Union Minister for Agriculture and DG, ICAR, New Delhi, November 8, 2011

Interactive meeting of DG., ICAR with farmers of Panaje, Puttur, Dakshina Kannada, Karnataka on issues of dairying and agriculture, December 25, 2011

Brain storming session on micronutrients in soil-plant-animal-human continuum, BCKV, Kalyani, Kolkata, February 10-12, 2012

Jash S

Memorial/Endowment Lectures in honour of dairy doyens: Dr. K.K. Iya, Dr B.N.Mathur & Dr P.A.Shankar, organized by IDA (south zone), Bangalore, July 29, 2011.

National symposium on 'Emerging management concepts for sustainable livestock and poultry production' & XIX Annual Convention of ISAPM, Department of Livestock Production & Management, CoVS, GADVASU, Ludhiana, November 2-4, 2011

VIV –ILDEX India 2012 (International Exhibition on Livestock & Poultry Industry), Bangalore International Exhibition Centre (BIEC), Bangalore, February 22-24, 2012

Khandekar P

Rashtriya Krishi Mela 2011 organized by UAS, Bangalore, GKVK Campus during 16-21, Nov. 2011. An Institute stall was put up and various technologies related to livestock production were showcased.

National seminar on 'Attracting farm youth for sustainable agriculture' organized by UAS, Bangalore, GKVK Campus during 26-28, August 2011.

Innovative and progressive farmers meet 2011-12 at NIANP on 15/02/2012

Letha Devi G

Rashtriya Krishi Mela 2011 organized by UAS, Bangalore, GKVK Campus during 16-21, Nov. 2011. An Institute stall was put up and various technologies related to livestock production were showcased.

National seminar on 'Attracting farm youth for sustainable agriculture' organized by UAS, Bangalore, GKVK Campus during 26-28, August 2011.

Innovative and progressive farmers meet 2011-12 at NIANP on 15/02/2012

Mondal S

99th Session of Indian Science Congress, KIIT University, Bhubaneswar, 3-7 January, 2012

23rd Annual Conference of Physiological Society of India, NRI Medical College, Guntur, AP, 21-23 December, 2011

Manpal Sridhar

India women worker's conference from 9-10 November 2011 at NIANP organized by KMF, Bangalore and Ministry of women & child development, govt. of India, New Delhi.

The meeting-cum-workshop of the heads of the divisions and regional stations on 14-15 June 2011 at Bhopal.

The national consultation on gender perspective in agriculture held at NAAS Complex, New Delhi, 07 -10 August 2011.

7th meeting of the reconstituted task force of animal biotechnology-1 at TANVASU, from 23- 24 December 2011.

Nandi S

IVAMI conference, Veterinary College, Bangalore, 8-9 June, 2011

Pal DT

International Conference on 'Environmental toxicity and neurodevelopmental disorders, Dquesne University, Pittsburgh, Pennsylvania, USA , June 24, 2011

Meeting of NARS Scientists on *'Impact assessment of international training in frontier areas of agricultural sciences'* ANational Agriculture Science Centre, New Delhi, November 28-30, 2011

Prasad KS

Workshop-cum– meeting : Heads of the divisions and regional stations/centres, CIAE, Bhopal, June 14-15

Brain storming session on vision & scope for dairy development in Karnataka, organized by IDA (south zone), Bangalore, July 2, 2011

Memorial/Endowment Lectures in honour of dairy doyens : Dr. K.K. Iya, Dr B.N.Mathur & Dr P.A.Shankar, organized by IDA (south zone), Bangalore, July 29, 2011

Rao SBN

National Symposium on Innovative and modern technologies for agricultural productivity,food security and environmental management held at Hotel Saffron, Boutique Hotel, Mangalore on July 22-23, 2011

Rajendran D

National Seminar on 'Status and scope of pig farming in India- An appraisal' organized by Post graduate Research Institute in Animal Sciences, TANUVAS, November 17-18, 2011

National conference on 'Recent trends in nanoscience and technology' Vivekananda college of arts and sciences for women (Periyar University), Tiruchengodu, Namakkal, Tamilnadu January 23-24, 2012

International conference on molecular medicine (Vellore Institute of Technology, Vellore, February 19-22, 2012.

Ravindra JP

44th Annual Meeting of Society for Study of Reproduction, at Portland, Oregon, USA. July 31 - August 4, 2011

Roy SC

Frontiers in gene silencing and targeted gene editing in eukaryotes at Bangalore, on 18th July, 2011

99th Indian Science Congress, KIIT University, Bhubaneswar, Orissa 3-7 January 2012

Selvaraju S

27th annual convention and National Symposium on Reproductive biotechnologies for augmenting fertility and conservation of animal species with special reference to North Eastern Hill region at C.V.A.Sc, Central Agricultural University, Mizoram, 27-29th September 2011

Senani S

National conference of society of applied biotechnology "Innovative and modern technologies for agricultural productivity food security and environmental management" July 22-23, 2011, Mangalore.

International conference on nanoscience and technology at the cutting edge, 4th Bangalore Nano, December 7-9 , 2011, Bangalore

Suganthi RU

7th meeting of the reconstituted task force of animal biotechnology-1 at TANUVAS, from 23- 24 December 2011.

Thulasi A

Annual and Half Yearly Review workshop of the VTC –RM project in May 3, 2011 and September 25, 2011

Consortium advisory committee and Consortium monitoring unit meeting of NAIP Project, NIANP, Bangalore, July 8, 2011; December 14, 2011 and January 28, 2012

Lecture delivered

Anandan S

Fodder management and milk production. Confederation of Indian Industry (CII) Conference on – Competitiveness of the Indian Dairy sector & Technology – innovations for the present and future, Hyderabad December 7, 2011

Availability and demand of feeds and fodders in coming decade. CLFMA seminar – Challenges for Indian dairy sector in the coming decade, Pune January 24, 2012

David CG. Fluid balance at Veterinary College and Research Institute, Namakkal on 20-21 October, 2011

David CG. Neuroendocrine regulation of reproduction in avian species at Madras Veterinary College, Chennai, on 5th November, 2011.

Gowda NKS

Use of areca sheath as a dry fodder for dairy animals. Technical seminar in Kannada at Sirsi (2.4.2011), Sagar(16.6.2011) and Theerthahalli (17.6.2011), in workshop organized by Karnataka Milk Federation (KMF)

Feeding of breeding bulls. Guest lecture presented for the officers of semen banks at Central Frozen Semen Bank and Training Institute, Hessaraghatta on 16.7.2011

Aflatoxin and their management. Guest lecture presented for the graduate students at Oxford college of engineering & biotechnology, Hosur road, Bangalore on 24.9.2011

Balanced feeding of dairy animals (*Kannada*) In : One day workshop for farmers of maize growing areas in Malavalli, organized at NIANP on 15.11.2011

Resource at technology exhibition stall of NIANP during the National Krishi Mela, held at GKVK, UAS, Bangalore from 16.11.2011 to 20.11.2011.

Nutrition and balanced feeding of dairy animals (Kannada) In: technical workshop for dairy farmers organized by KMF, Bangalore on 17.1.2012.

Ravindra JP, Gupta PSP, Nandi S and Selvaraju S**:** Invited lecture on *Assisted Reproductive Technologies – Indian Scenario* at One day Workshop on Assisted reproductive technology organized by Veterinary College, Bangalore & Mini-Tub, West Germany at Bangalore on 1st November, 2011

Ravindra, JP. Guest lecture on Assisted Reproductive Technologies delivered at - Bangalore University on May 26, 2011.

Rajendran D

Optimizing micronutrient requirement of pigs at National Seminar on 'Status and scope of pig farming in India- an appraisal' organized by Post graduate Research Institute in Animal Sciences, TANUVAS, November 17-18, 2011

Selvaraju S

DNA staining of spermatozoa. Guest lecture at the training course in laboratory Technique for evaluation of frozen semen of CFSPTI, Hessarghatta, Bangalore on 20.08.2011

DNA staining of spermatozoa. Guest lecture at the training course in laboratory Technique for evaluation of frozen semen of CFSPTI, Hessarghatta, Bangalore on 21.09.2011

Suresh KP

Correlation, regression, GLM and mixed models using SAS conducted by Department of Agricultural Statistics, GKVK, UAS, Bangalore in August 2011.

'Research methodology, data management and biostatistics' at the training conducted by NIANP on 9-10th December 2011

'Base SAS and data preparation' at training organized by Department of Statistics, GKVK, Bangalore on 13-18 February 2012 under the NIAP project

'Base SAS for application of genomic data analysis' in the training program conducted by Department of Statistics, GKVK, Bangalore on 13-2-2012 and 18-2-2012.

'Research methodology and biostatistics' at pre-workshop of ISAR, 17th National Conference on 1st March 2012.

'Research methods and biostatistics' in the workshop conducted by Karnataka State Open University on 31-3-2012.

'Base SAS for biological scientists' in the one week training program on 'Data analysis using SAS" conducted by KVAFSU, Bidar on 13.3.2012.

In house seminars

Atul P Kolte

New Generation Sequencing Technologies and Applications, 23rd April 2011

Angadi UB

Demonstration of the Office Automation Software, 6th August 2011

Pal DT

Identification of Selenium species in selenium-enriched yeast and their quantification by ICP-MS and SIDMS, 13th September, 2011

Masayuki Shimada, Japan

Role of Growth factors in oocyte maturation, 9th November, 2011

Chandrasekaraiah M

Application of certain molecular biology techniques in rumen microbial ecosystem and monthly meeting 25th Nov 2011

Smita Jain

C-CAMP - an initiative to promote technology development, service and training in life sciences, 14th Dec 2011

Samanta AK

Nutraceuticals, 13th January 2012

Bhatta R

Mitigation Strategies for methane production from livestock, 13th January, 2012

Mr Rajneesh Rajpal, Springer (India) Pvt Ltd.

e-Books and protocols of Springer (India) Pvt Ltd 4th February, 2012

Vijay Kumar

Bio molecules, 28th February 2012

Awards and Honours

Bhatta R

Recipient of 'Best Veterinarian Award' from Karnataka Veterinary Association, Bangalore for outstanding contribution to the profession and society on 9th April 2011 during Annual Veterinary Meet of KVA held at Bangalore.

Conferred the Fellow of the Society for Applied Biotechnology

Chandrasekharaiah M

Best paper presentation award on 'Expression and biochemical characterization of two new feruloyl esterases derived from metagenome', International conference on Functional Foods Components in Health and Disease, University of San Diego, California, USA, August 16-18, 2011.

Elangovan AV

Recipient of the Kerala chapter award for best research paper XXVII Annual conference and national symposium of Indian Poultry Science Association at Bihar Veterinary College, Patna on 22-24 December 2011.

Giridhar K

Best oral paper presentation award (Giridhar K., Elangovan AV., Vijay Kumar., Kandhekar P., Sharangouda and Sampath K.T) in the annual seminar in *Hindi* "ANSH-2011" organized by National Aerospace Laboratories (NAL, CSIR), Bangalore, August 10, 2011

Winner of the quiz *(Hindi)* of the Town Official Language Implementation Committee organized by Central Silk Board, B.T.M. Layout, Madivala, Hosur Road, Bangalore, November 23, 2011

Gowda NKS

Winner of consolation prize for the technical article– Feeding of dairy animals (*Hindi*), with Verma S, Gowda NKS and Raghavendra A. CPRI, Bangalore, September 25, 2011

Winner of the oral abstract 'Protected fat supplementation to high yielding dairy cows in field condition (Gowda NKS, Pal DT, Raghavendra A, Verma S, Maya G and Sampath KT) and the poster 'Study of chelated copper and zinc on tissue utilization and immunity in rats' (Pal DT, Gowda NKS, Verma S, Maya G, Raghavendra A, Vallesha NC, Krishnamurthy P and Sampath KT) at 14th Biennial conference of ANSI on Livestock productivity enhancement with available feed resources. GBPUAT, Pantnagar, November 3-5, 2011

Jash S

Winner of the Inter-office Official Language program on extempore organized by National Aerospace Laboratories, HAL Airport Road, Bangalore, September 14, 2011

Winner of the quiz *(Hindi)* of the Town Official Language Implementation Committee organized by Central Silk Board, B.T.M. Layout, Madivala, Hosur Road, Bangalore, November 23, 2011

Consolation prize at the extempore speech competition (*Hindi*) of the Town Official Language Implementation Committee organized by Dept. of Space, Indian Space Research Organisation, Antariksh Bhavan, New BEL Road, Bangalore, November 21, 2011

Manpal Sridhar and Vijay Kumar

Awarded a consolation cash prize by the TOLIC during October 2011 for the best technical article in Hindi entitled Lignin in Lignocellulosics –a boon or a curse.

Awarded the second prize by the Official Language Implementation Committee of NIANP for technical article presentation in Hindi for the article entitled 'Lignin in Lignocellulosics' –a boon or a curse.

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

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

Pal DT

Nominated as member of Indian Academy of Veterinary Nutrition and Animal Welfare, Bareilly, Uttar Pradesh

Secured third prize in 'Hindi Noting and Drafting' and a consolation prize for 'Hindi Translation' competition during in-house "HINDI SAPTAH", NIANP, Bangalore during September 14-20, 2011

Samanta AK, Senani S and Suganthi UR

Conferred as Fellow of Society for Applied Biotechnology (FSAB)

Selvaraju S

Received the GB Singh memorial award 2010 for the best paper published in Reproduction in Domestic Animals by the ISSAR during 27th annual convention and National Symposium at C.V.A.Sc, Central Agricultural University, Aizawl, Mizoram, 27-29th September 2011. (Perumal, P., Selvaraju, S., Selvakumar, S., Barik, A.K., Mohanty, D.N., Das, S., Das, R.K. and Mishra, P.C.)

Meetings

Research Advisory committee

Sl. No.	Name & address	
1.	Dr. S.K. Ranjhan, Ex-Joint Director, IVRI	Chairman
2	Dr. K.T. Sampath Director, NIANP	Member
3	Dr. C.S. Prasad Assistant Director General (AN&P), ICAR	Member
4	Dr. N. Krishna Ex-Associate Dean, Veterinary College	Member
5	Dr. O.H. Shetty Prof. of Biochemistry, University of Hyderabad	Member
6	Dr. V.H. Rao Prof. & Head of Physiology, Vet. College, Tirupati	Member
7	Dr. D.C. Shukla Ex-Head of Physiology Division, IVRI	Member
8	Shri. N. Rajanna Ex. MLA	Member
9.	Shri. Prashant Paricharak Sholapur, Maharashtra	Member
10	Dr. J.P. Ravindra Pr. Scientist, NIANP	Member Secretary
11	Secretary's Nominee DAHD&F, Govt. of India	Spl. Invitee

Salient points of the proceedings of the sixteenth meeting of the Research Advisory committee held on 11th April 2011

The sixteenth meeting of the Research Advisory Committee of the Institute was held on 11th April 2011 under the chairmanship of Dr. S.K. Ranjhan, Ex-Joint Director, IVRI. Dr. KT Sampath, director welcomed the chairman and members of the RAC and highlighted the important research and other matters. He expressed confidence that the present RAC with experts in the fields of Animal nutrition, Physiology and Biochemistry will very effectively guide the research agenda of the institute.

Research Advisory Committee meeting in progress chaired by Dr. SK Ranjhan

The chairman of the RAC, Dr. S.K. Ranjhan mentioned that he has been associated with the research activities of the institute since its inception and is happy about the progress made by the institute due to good team work of scientists. He briefed about the deliberations of the meeting of the chairpersons of the RACs and Directors of ICAR institutes held under the Chairmanship of DG, ICAR during March 2011. In this meeting, he said, it was indicated that the RACs should monitor the AICRP and other externally funded projects, in addition to institute projects.

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.

Dr. S.K. Ranjhan and Dr. C.S. Prasad expressed that the NIANP being a premier institute, the projects taken up by its scientists should address the nutritional and physiological problems in a coordinated manner and understanding the mechanism at tissue level.

Dr K.T. Sampath, Director expressed his gratefulness to Chairman and members of the RAC for their interaction, guidance and valuable suggestions for further improving the focus and quality of research. He indicated that already steps have been taken to reduce the number of projects during the previous IRC meeting. A few of the projects that are at late stage of progress could not be stopped. However, many of these projects will be completed soon and with that the number of ongoing projects will be reduced.

Institute Reseach Commitee

The XV meeting of the IRC was held from June 2-4, 2011 in the seminar hall of the institute under the chairmanship of by Dr. KT Sampath, Director, NIANP. Prof. A. Jagannadha Rao, Rajaramanna Fellow of the Dept. of Biochemistry, Indian Institute of Science and and Dr. N. Krishna, former Assoc. Dean, ANGRAU, Hyderabad were invited as external experts to prospect the research matrix of various projects. The institute projects including the externally funded projects were discussed in the meeting.

Dr. AJ Rao, Professor, IISc, Bangalore, Dr. KT Sampath, Director, NIANP and Dr. N Krishna, former Dean, Veterinary College, Tirupathi during IRC meeting

Dr. A. J. Rao explained the benefits of scientific dialogues across generations and endorsed the boulevard of continuum learning. He emphasized for collaboration in priority areas with Indian Institute of Science. Dr. N. Krishna, lauded the young scientific community and desired for visibility of research through patents, inter-disciplinary collaborative approach and documentation through technical bulletins or video films for technology dissemination. At valediction, the chairman expressed satisfaction on the progress made and opined affirmation on proposals of external funded project for logical outcomes. He stressed on integrity in data presentation with respect to photographs, data-sheets and statistical interpretations and sharing of common research facilities.

Institute Management Committee

1.	Dr.K.T.Sampath Director, NIANP, Bangalore -560 030.	Chairman
2.	The Director Animal Husbandry & Vety. Sciences Member Govt. of Karnataka, Bangalore -560 001	Member
3	The Dean Vety. College KVAFSU, Bangalore -560 024.	Member
4.	Dr. V. V. Suryanarayana, Principal Scientist, IVRI	
5.	The Dean College of Veterinary & Animal Science S.V.V.U, Tirupati	Member
6.	Dr. S. Sridhar Principal Scientist, P.A.C.D., C.I.F.A.	Member
7.	F.A.O., NBAII	Member
8.	ADG (AN&P), ICAR	Member
9.	Shri. S.M. Hegde	Member
10.	Shri. Vinay Kore, MLA W.M.C., Maharashtra	Member
11.	Dr. Dinesh Bhonsle Hon. Secretary, CLFMA of India & Regional Sales Director	Member
12.	Dr. J.P. Ravindra Principal Scientist & I/c APD	Member
13.	Dr. A.V. Elangovan Administrative Officer NIANP, Bangalore – 560030	Member Secretary

The 27th Institute Management Committee meeting was held on 13-12-2011, the major agenda item regarding sharing of revenue from the commercialization of area specific mineral mixture to Nandi agrovet was discussed.

Institute Management Committee meeting in progress

Distiguished Visitors

1. Dr. S. Ayyappan, Secretary, DARE and DG, ICAR
2. Prof. M. J. Modayil, Member (Animal Science), ASRB
3. Dr. N.K.Bhattacharyya, former Director, CIRG, Makhdoom
4. Dr. D.V. Rangnekar, former Vice President, BAIF, Urulikanchan
5. Dr. A. J. Rao, Professor, Biochemistry, Indian Institute of Science, Bangalore
6. Dr. R. K. Sethi, Director, CIRB, Hisar
7. Dr. S. Abdul Rahman, President, Commonwealth Veterinary Association
8. Dr. Harinder Makkar, Animal Production Officer, FAO, Rome

Dr. Harinder Makkar, Animal Production Officer, FAO, Rome interacting with the Scientists

9. Dr. Ellen Hoffman, Dr. Prof. Burket, E. Schlect , Dr. Shitbread, S. von Cramon, Dr. Ramesh Ahuja Universities of Kassel and Gottingen, Germany
10. Dr. Masayuki Shimada, Associate Professor, Hiroshima University, Japan
11. Dr. Arun Varma, former ADG (ANP), ICAR
12. Dr. D. M. Das, Director of Animal Husbandry & Vety. Services, Govt. of Karnataka
13. Dr. Vivek Fellner, Dr. Kelly Zering, Dr. Paul Begey North Carolina University, USA

Dr. Vivek Fellner, Dr. Kelly Zering, Dr. Paul Begey of the North Carolina University, USA discussing with the Director Dr. CS Prasad about developing collaboration.

Other Activities

Infrastructure development

During the reported year, major civil works sanctioned under the 11th plan EFC have been taken up under the supervision of CPWD. The constructions of rain water harvesting system phase-1, storm water drains phase-1 and raising of the boundary wall at the northern side of the Institute campus have been completed.

The progresses of the other major civil works such as extension of the laboratory block and general store, and vertical extension of the Institute guest house at 1st floor are at full swing. These constructions are expected to be completed by another three to four months.

Fodder production unit

The fodder production unit is ensuring daily supply of green fodder to the experimental livestock unit (ELU) of the Institute. During the year, seasonal crops like Maize, Lucerne and Sorghum Sudan grass and perennials like Hybrid Napier Bajra and Para grass were cultivated. Two new plots with these perennial grasses were developed. The top feeds were supplied from *Sesbania* and *Gliricidia* trees. Cowpea was sown in two plots for green manuring purpose. Two shallow ponds were developed for Azolla cultivation for its use as supplemental feed. The seedlings of fodder trees like Melia and *Sesbania* and the culture of Azolla were supplied to a few farmers. Silage was prepared using Maize, Sorghum and Lucerne in the plastic bins as well as polythene and gunny bags. Method demonstrations were conducted on Azolla cultivation and silage preparation for the benefit of farmers and officials from Karnataka Milk Federation.

Experimental livestock Unit (ELU)

During the year 2011-12, 33 cattle, 26 buffalo, 134 sheep, 414 broiler poultry, 240 layer poultry and 150 rats were maintained at ELU under different research projects of Institute and externally funded schemes. About 120 tree saplings were planted all around the ELU campus for improving the greenery. Dr. Awachat, V B, Technical Officer (T6 – Veterinary) was recruited to assist in health care and general managemental aspects of livestock. One portable grinder was procured and installed for grinding small quantity feed and fodder. Civil works like mud filling, levelling of campus area and fixing grill doors were undertaken.

Library

An amount of Rs. 38.05 lakhs was incurred during the financial year (2011-12) towards the development of library and information resources infrastructure. Library received an amount of Rs.1.00 lakh under the ITMU for subscription of Indian Journals and procurement of textbooks. Total seventy six text books and ninety one Official Language books were procured during the year. Presently the library is subscribing to thirty eight foreign (including twenty one free online along with print version) and thirty five 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 493 gratis publications from India as well as from international institutions/organizations. The library has 2198 back volumes and 335 titles of unbound 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, books 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 four hundred and twenty four outside reader's request by sending their articles of interest by post / online under Consortium for e-Resources in Agriculture (**CeRA**). Library has rendered reprographic services to the staff, trainees, and students including our own, administration and accounts official purpose.

Official Language Implementation Cell

Quarterly meetings of OLIC and Hindi Workshops are held regularly. The institute celebrated Hindi Saptah (Week) from 14.09.2011 to 20.09.2011. During the Hindi Saptah varius competitions were conducted such as Hindi song competition, Hindi letter writing, Hindi noting & drafting competition, Hindi translation etc and winners were given prizes on the closing day. The Institute was represented in the competitions conducted by Town Official Language Implementation Committee, Bangalore (TOLIC) and Dr. Jash and Dr. K.Giridhar won first prize in Quiz Competition and Shri N. Raghavan won second prize in Crossword Puzzle. Hindi Books worth Rs.20,164/- were purchased during this year to promote Hindi readership as per Annual Programme of Official Language issued by the Dept. of Official Language, Govt. of India. Thirty six scientist and staff of our institute attended classes under Hindi Teaching scheme and in the Pragya Examination a pass percentage of 85 were obtained.

Staff welfare Club

Coincidental to auspicious investiture, the activities unfurled with invocation of Lord Ganesha on Ganesh Chaturthi. Max New York Life Insurance Co. Ltd. effort to circumvent unforeseen untoward surprises, through a presentation on financial securities and insurance planning was welcomed (September 21, 2011). Ayudha Puja, an integral part of the Navratri festival, wherein 'Worship of Implements' was observed (October 5, 2011). The gala confluence the trio-events of the Institute Foundation Day, National Integration and Kannada Rajyotsava were observed on November 24, 2011. Tributes and recollections were referred on the blooming of the institute, since its inception 16 years back. The 2012 New Year's celebration was observed reminiscing the National Mathematics Year. The winter-harvest festival of Pongal, timed by the astronomical winter solstice, marking the commencement of the northward journey of the sun from its southernmost-limit was organized jointly by the Club and the Experimental Livestock Unit.

February saw the trio- farewell of Shri Rajaram, Assistant Finance & Accounts Officer (Feb 10, 2012) following transfer to PDFMD, Mukhteswar; a combined farewell of Dr. K.T. Sampath, Director and Shri Shivashankar, Assistant, following their superannuation on the Leap Day, 2012. The SWC organized the event in honor of the contributions and acumen leadership of the Director and dedicated service of Shri Shivashankar. Dr. K.Pradhan, adorned the occasion as 'Guest d' Honor'.

Tomorrow's health codes spirit of the Nation – children's sports activities on the Republic Day

As March reminds of blooming Spring and step forward to the orchard of fulfillment and fragrance of aspirations, we welcomed Dr. C.S. Prasad as Director, NIANP on March 12, 2012. A gala event followed on March 14, 2012, wherein Dr. Prasad's homecoming to the NIANP was lauded. He rendered his first speech to the staff as Director, wherein he instilled spirit of dynamism and called for 'acceleration' to realize the spirit of development.

Dr. C.S. Prasad, Director is being felicitated by Dr. S.B.N. Rao, Vice President, SWC, on former's assuming the office of Director

Inauguration of National Online Examination Centre

A 'National Online Examination Centre' of ICAR established at NIANP was inaugurated by Prof. MJ Modayil, Hon'ble Member ASRB, New Delhi, on 2nd December 2011. The centre caters for online examinations for Agriculture Research Services, NET, SRF/JRF ASRB, a benefit to the students of the southern states. This state of the art facility has provision for 100 candidates to take exam at a time and is one of the 24 centers in the country.

ASRB online exam hall being inaugurated by Prof. M J Modayil, Hon'ble Member ASRB, New Delhi, on 2nd December 2011

Innovative farmers meet

An Innovative Farmers' meet was organized at the institute on 15th February, 2012. The objective of the meet was to invite innovative/ progressive livestock farmers to share their ideas, experiences, innovations and to motivate other farmers to benefit the larger farming community. Dr. Venkataramu, MD, KMF was the chief guest. Dr. M.S. Narayana, DGM, NABARD, Bangalore was the guest of honour and Dr. KT Sampath, Director NIANP presided over the function. Nine progressive farmers were felicitated on this occasion and each one of them shared their experiences and their innovative approaches. A book titled 'Farmers Profile' and a number of extension literatures were released during the meet and distributed to all the participating farmers. More than 100 farmers attended the meet and visited the exhibition arranged for them showcasing various technologies on feed formulation, importance of area specific mineral mixture, azolla cultivation, silage making etc. During the scientist-farmer interaction session, a panel discussion was held, wherein queries of farmers in relation to livestock farming were answered by the experts.

Smt. Bharathi Gunasekaran, a progressive farm woman being felicitated-

Dr. P Khandekar, Pr. Scientist, NIANP, Dr. M.S. Narayana, DGM, NABARD, Dr. Venkataramu, MD, Karnataka Milk Federation and Dr. KT Sampath, Director are seen (L to R)

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. N.K.S. Gowda	Pr. Scientist
Dr. Swaraj Senani	Sr. Scientist
Dr. M. Chandrasekharaih	Sr. Scientist
Dr. A.K. Samanta	Sr. Scientist
Dr. S. Anandan	Sr. Scientist
Mrs. A. Thulasi	Scientist (SG)
Dr. D.T. Pal	Sr. Scientist
Dr.D.Rajendran	Sr. Scientist
Dr. Soumitra Jash	Scientist (SS)
Dr. Atul P. Kolte	Scientist (SS)
Dr. M.Bagath	Scientist (*on study leave*)
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	Sr. Scientist
Dr. P.S.P. Gupta	Sr. Scientist
Dr. S. Mondal	Sr. Scientist
Dr. S.C. Roy	Sr. Scientist
Dr. Sumanta Nandi	Sr. Scientist
Dr. Ivan Corbon Godfrey David	Scientist (SS)
Dr. Jyotirmoy Ghosh	Sr. Scientist
Dr. S. Selvaraju	Scientist (SS)
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	Sr. Scientist
Dr. G. Ravi Kiran	Sr. Scientist
Dr. K.S. Roy	Sr. Scientist
Dr.Arindam Dhali	Sr. Scientist
Dr. (Mrs.) Umaya Suganthi	Scientist (SS)
Dr. Vijay Kumar	Scientist (SS)
Shri. S. Basavaraja	Technical Officer T(7-8)

Economics Statistics & Extension Division

Dr. Prakash Khandekar	Pr. Scientist and Incharge
Dr. K.P. Suresh	Scientist (SS)
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	T-5 (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 M	T-1 (W/S)

Aris Cell

Dr. U.B. Angadi	Scientist (SS)

Administration

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

Accounts & Audit

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

New Joining & Transfer

Shri. T.S. Ponnaiah	AO (Transferred and relieved from NIANP, Bangalore on 30-06-2011 (AN) to Directorate of Cashew Research, Puttur)
Shri. Raja Ram	Transferred from Project Directorate on Foot and Mouth Disease, Mukteswar and joined NIANP as AF&AO on 27-08-2011. Transferred from NIANP to Project Directorate on Foot and Mouth Disease, Mukteswar on 10-02-2012
Smt. M.S. Uma	Transferred and relieved from NIANP on 10-6-2011 to PDADMAS as PA.

Dr. A. Arangasamy	Transferred from NRCE Hisar and joined NIANP on 02-11-2011 as Scientist (SS)
Dr. Anjumoni Mech	Transferred from NRC (Mithun) Nagaland and joined NIANP on 04-05-2011 as Scientist

Recruitment/Appointment/Joining

Dr. C.S. Prasad	Director (Joined on 12-03-2012 FN) after relieving from Vice Chancellor, MAFSU
Shri. B. Riyaz Ahmed	AO on promotion, joined on 02-01-2012 (FN)
Shri. Shivarama M.	T-1 (W/S) (Joined on 30-04-2011 FN)
Dr. Awachat Vaibhav Bhagwan	T-6 (F/FT) Veterinary (Joined on 20-03-2012 FN)

NIANP bids adieu to Dr. K.T. Sampath, Director and Shri Shivashankar, Assistant

Dr. C.S. Prasad addressing the staff of NIANP after assuming the charge as Director

Annexures

List of Projects

A. Institute Research Projects

Programme -1 : Livestock feed and production modeling based on district-wise feed resource mapping

Project Name	Duration	
	Start	End
Documentation and evaluation of brewery waste and tomato pomace as animal feed in Karnataka	July, 2008	March, 2012
Estimation of crop acerage and production of fodder crops with remote sensing techniques	May, 2010	April, 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	April, 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 feed using the in vitro gas production technique (IVGPT) and the efficacy of plant tannins as methane suppressants/inhibitors	April, 2007	June, 2012
Evaluation of feed additives and processing technologies for development of total mixed ration	October, 2007	September, 2011
Production of lignolytic enzymes from white rot Aerobic fungi through immobilization and their efficacy in crop residues	June, 2008	May, 2012
Lignin degrading genes from natural ecosystems for enhancing digestibility of crop residues	July, 2008	March, 2012
Evaluation of copper chaperone for SOD (CCS) as a sensitive biomarker of copper deficiency in sheep	July, 2009	September, 2012
Mineral solubility in rumen from mixed rations and its effect on rumen	July, 2009	June, 2012
Identification of molecular mechanism in stressed layer chicken fed with dietary chromium	May, 2010	April, 2013
Production of recombinant expansins and its possible utilization for improving fibre degradability in ruminants	May, 2010	April, 2013

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

Project Name	Duration	
	Start	End
Antioxidant mechanisms of buffalo oviduct and endometrium during estrous cycle	January, 2006	December, 2011
Nutrition endocrine interaction in onset of puberty in buffaloes	July, 2006	September, 2011
Modulation of *in vitro* prostaglandin production in buffalo	January, 2007	December, 2011
Impact of wavelengths of light (640 nm and 455 nm) on hypothalamic factors on reproduction in poultry	August, 2008	March, 2012
Feeding garlic on laying performance : effect on stress and egg lipids	January, 2008	March, 2012
Proetomic analysis and characterization of pregnancy associated proteins in Buffaloes (*Bubalus bubalis*)	July, 2009	June, 2013
Biophysical translation of nutrients during ovulatory cycle of hen: bio - mineralization of egg	July, 2009	June, 2012
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	July, 2009	June, 2012
Studies on the effect of feeding *Azolla* on the reproductive efficiency in buffalo heifers	June, 2010	November, 2011
Elucidation of mechanisms of perturbation of ovarian functions by ammonia	June, 2010	May, 2013
Suppression of PRL transcription and translation in domestic hen during embryonic and later physiological stages in pituicytes by siRNA	July, 2011	June, 2014
Expression of HSP 70 mRNA in visceral organs of broiler chickens under acute heat stress	September, 2011	August, 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	March, 2012
Evaluation of selected herbal products to prevent aflatoxicosis in broilers	June, 2009	May, 2012
Study on metabolic effects of fluorosis and strategies for its counteraction	June, 2009	May, 2012

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

Project Name	Duration	
	Start	End
Calibration of mathematical models for assessing the animal feed resources and requirement in Karnataka State	October, 2007	September, 2011
Knowledge and adoption of scientific feeding practices among dairy farmers: a field study	July, 2009	June, 2011
An Expert System for computation of balanced ration for dairy animals in Karnataka state	July, 2009	March, 2012
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	July, 2011	June, 2014
Sustainability of dairy farming for small holder system in the emerging scenario	January, 2012	December, 2015

B. Externally Funded Research Projects

Funding Agency	Project	Duration	
		Start	End
ICAR-AICRP	AICRP on Improvement of feed resources and nutrient utilization in raising animal production (Co - ordinating centre)	April, 2002	March, 2013
ICAR-Network	Veterinary Type Culture – Rumen microbes component (Co - ordinating centre)	October, 2009	March, 2013
NFBSRA	Rumen microbial manipulations for mitigation of methane emission and productivity enhancement in dairy animals (Cooperating center)	February, 2007	January, 2012
NFBSRA	Antiluteolytic strategies -a novel approach to enhance fertility in buffalo (Cooperating center)	February, 2007	March, 2012
NFBSFARA	Deciphering the mechanism of aberrant maternal recognition of pregnancy (MRP) events in sheep and buffalo under heat and nutritional stress	January, 2011	December, 2015
NAIP	Elucidating the physiological and genomic regulation process of follicular development, oocytematuration and embryogenesis (Lead center)	January, 2008	June, 2012

Funding Agency	Project	Duration	
		Start	End
	(Cooperating center)		
NAIP	Livelihood security of rural poor in disadvantaged Chitradurga district of Karnataka through integrated farming system approach	April, 2009	December, 2013
	(Cooperating center)		
NAIP	Value chain on commercialization of maize products	November, 2008	June, 2012
	(Cooperating center)		
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	27 .1 .2009	30 .06 .2012
	(Lead center)		
DBT, GOI	Detoxification and utilization of key agro-forest based non conventional oil cakes in the feeding of livestock	13.02.2008	12.02.2013
DBT, GOI	Production of xylo - oligosaccharides from agricultural byproducts and its evaluation as prebiotic	18.9.2008	17.9.2011
DBT, GOI	Effect of reservatrol and carvacerol in ameliorating aflatoxin induced molecular changes in broilers	29 .09 .2010	28 .09 .2013
DBT, GOI	Evaluation of herbal residues and nutraceuticals as alternatives to antibiotics for improving the performance of pigs	15 .3 .2011	14 .3 .2014
DBT, GOI	Development of pregnancy associated glycoprotein (PAG) based immunodiagnostic kit in buffaloes	1 .6 .2011	27 .6 .2014
DBT, GOI	Mining markers of pregnancy in cell free body fluids of buffaloes (*Bubalus bubalis*)	13 .2 .2012	12 .2 .2015
DBT, GOI	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, GOI	Immobilized fungal phytase production and its dietary evaluation in broiler and layer chicken	17 .2 .2012	16 .2 .2015
DBT, GOI	Transcriptomic profiling of spermatozoa for selection of fertile bulls	28 .2 .2012	27 .2 .2015
OUTREACH, ICAR	Estimation of methane emission under different feeding system and development of mitigation strategies	April, 2008	March,2013

Funding Agency	Project	Duration	
		Start	End
	(Lead center)		
OUTREACH,	Monitoring of livestock related drug residues and environmental pollutants	November,2009	March,2013
ICAR NABARD	(Cooperating center) Use of areca sheath as a fodder source for dairy animals	April, 2010	September,2011
DST-WOSA, GOI	A heterologous vector mediated transformation system of Laccase gene from a novel white rot basidiomycete into *Pichia pastoris* for effective degradation of crop residues	22 .2 . 2011	21 .2 .2014
DST - JSPS	Growth factors in small oocyte development : proteomic and genomic approaches	1 .8.2011	31 .7 .2013
Coconut Development Board	Generation of xylooligosaccharides from green coconut husk for augmenting gut health and function	4 .10 .2011	3 .10 .2014