KERALA VETERINARY AND ANIMAL SCIENCES UNIVERSITY

Pookode, Wayanad, Kerala

REPORT ON

RESEARCH ACTIVITIES

2016-17

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Lakkidi (P.O), Pookode, Wayanad – 673576, Kerala State

Report on Research Activities 2016-17

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MESSAGE

Prof. (Dr.) M. R. Saseendranath
Vice-Chancellor

Greetings from Kerala Veterinary and Animal Sciences University!

It is indeed heartening that Kerala Veterinary and Animal Sciences University is coming out with the Annual Research Report for the year 2016-17. This university was established with the prime objective of conducting research programmes that contribute to the wellbeing of farmers and promote the animal agricultural sector economically and technically. Keeping this objective in mind, I am extremely proud to know that the university has taken the momentous step of publishing the detailed report of various research activities conducted at different stations of the institution.

The university has been undertaking farmer and entrepreneurship development programmes from the very beginning. Our organisation remains committed to fostering sustainable livelihoods for the farming community of the state and opening up new innovative pathways for them. I hope this report will throw light on the way forward as we move together to amend the research policy of the university. I congratulate each and every member who was actively involved in research activities of the university and I wish all success to everyone.

Prof. (Dr.). M. R. Saseendranath

Vice-Chancellor

PREFACE

Dr. C. Latha
Director of Academics and Research

Kerala Veterinary and Animal Sciences University was established with the objective of undertaking various research projects and developing innovative technologies for the betterment of veterinary profession and farming community and thereby to contribute to the economic development of the whole state. For attaining the goals of the university, our scientists have been actively undertaking various research projects using the funds available from the ICAR, NABARD, DST, DBT, RKVY etc.

Now it is my privilege to inform one and all that the university is coming out with a much awaited detailed report of various research projects undertaken at the different stations of the university including M.V.Sc. and Ph.D. research projects. The Annual Research Report 2016-17 is a compiled report of research conducted from 1st April, 2016 to 31st March, 2017. The compilation and documentation of the research activities will help in sharing the research findings among the veterinary community and transferring the technologies developed to various stakeholders interested in this sector.

I am pleased to see that the whole team under different departments of the university have been taking their best efforts for accomplishing the goals of the university. Whole hearted co-operation and team spirit are the two elements that make an establishment a successful one. I thankfully congratulate each and every one for their co-operation and I place on record my sincere thanks to the team engaged in the preparation and release of this Annual Research Report.

Dr. C. Latha
Director of Academics and Research

About the University

Kerala Veterinary and Animal Sciences University (KVASU) came into existence on 14th June, 2010 as per Ordinance No.44/2010 and later Act 3/2011 of the Government of Kerala. This institution presently undertakes academic, research, extension and entrepreneurship activities in animal production and dairy sector.

The University aims,

- to implement new courses and curricula based on the advances in the field of Veterinary and Animal Sciences
- to advance and disseminate learning and knowledge in Veterinary and Animal Sciences, Dairy Science and allied fields by fostering and promoting Veterinary and Animal Science research
- to undertake extension activities
- to collaborate and co-operate with regional, national and international research institutions and exchange any information that may be advantageous to livestock development in the State
- to act as the primary consulting and advisory body of the state government and various other agencies involved in policy making and implementation in the Veterinary and Dairy sectors

Kerala Veterinary and Animal Sciences University has three faculties, eight constituent colleges, 16 research stations and 12 schools/ centers.

Faculties under Kerala Veterinary and Animal Sciences University include

1. Faculty of Veterinary and Animal Sciences
2. Faculty of Dairy Science
3. Faculty of Poultry Science

The eight constituent colleges of the University are:

1. College of Veterinary and Animal Sciences, Mannuthy, Thrissur
2. College of Veterinary and Animal Sciences, Pookode, Wayanad
3. College of Dairy Science and Technology, Mannuthy, Thrissur
4. College of Dairy Science and Technology, Pookode, Wayanad
5. College of Dairy Science and Technology, Chettachal, Thiruvananthapuram
6. College of Dairy Science and Technology, Kolahalamedu, Idukki
7. College of Food Technology, Thumburmuzhy, Chalakudy, Thrissur
8. College of Avian Sciences and Management, Thiruvazhamkunnu, Palakkad

The research stations of the University and the year of establishment are as follows:

1. University Veterinary Hospital, Kokkalai, Thrissur 1904
2. University Livestock Farm and Fodder Research and Development Scheme, Mannuthy, Thrissur -1917
3. Livestock Research Station, Thiruvazhamkunnu, Palakkad-1950

4. University Poultry and Duck Farm, Mannuthy, Thrissur – 1950
5. University Veterinary Hospital, Mannuthy, Thrissur- 1961
6. Centre for Pig Production and Research, Mannuthy, Thrissur-1965
7. University Goat and Sheep Farm, Mannuthy, Thrissur- 1965
8. Cattle Breeding Farm, Thumburmuzhy, Chalakkudy, Thrissur- 1973
9. All India Co-ordinated Research Project on Poultry for Eggs, Mannuthy, Thrissur- 1976
10. University Dairy Plant, Mannuthy, Thrissur- 1985
11. Centre for Advanced Studies in Poultry Science, Mannuthy, Thrissur- 1986
12. Centre for Advanced Studies in Animal Breeding and Genetics, Mannuthy, Thrissur- 1986
13. Meat Technology Unit, Mannuthy, Thrissur- 1992
14. Base Farm, Kolahalamedu, Idukki – 2000
15. Instructional Livestock Farm Complex, Pookode, Wayanad- 2004
16. Avian Research Station (ARS), Thiruvazhamkunnu -2015

Chancellor's Award for the Best Emerging Young University for the year 2016-17 was bagged by the University. Kerala Veterinary and Animal Sciences University has received 11 externally aided projects. The faculty have published 5 books/ book chapters, around 147 articles in peer reviewed journals and 81 articles in compendium during this period. The faculty members and students have also received 35 awards during 2016-17.

Research Policy

1.0 PURPOSE

This policy sets the framework to spearhead research at the Kerala Veterinary and Animal Sciences University (KVASU) consistent with its policy on research. The research policy shall help to –

a. Identify core areas of research.
b. Give direction to research activities carried out in different disciplines of basic science, veterinary science, animal science and dairy science.
c. Promote multi-disciplinary research.
d. Instil quality in research through competition among faculty members seeking research funds.
e. Act as the lead guide with a clear-cut policy on research and extension.

2.0 ORGANISATIONAL SCOPE

This is a university-wide policy and exceptions are to be accepted only with due approval by its Research Council.

3.0 VISION

The University aspires to be recognized nationally and internationally as the University of choice, in nurturing meritorious/ renowned Veterinarians, Dairy/ Livestock Products Technologists and professionals in related disciplines by entrenching a strong research culture. The research undertaken shall (a) promote sustainable and profitable animal production systems (b) provide quality care and veterinary services (c)assure food safety and quality and security of the State (d) disseminate modern scientific knowledge and skill (e) foster professionalism in animal welfare and ethics and (f) help the government to modify/ formulate policies based on scientific information and data.

4.0 MISSION

Sustainable animal production and development through –

a. Scientific breeding and production of superior quality stock and germplasm.
b. Model livestock and poultry enterprises and integrated farming systems.
c. Cost-effective interventions in feeds and feeding.
d. State-of-the-art hospitals, accredited laboratories, advanced diagnostics and superior vaccines for better diagnosis, treatment and control of animal diseases, food-borne diseases and management of infertility.

e. Production and evolution of value-added formularies. Internationally competent graduates/ professionals who can foster and promote veterinary, animal science and dairy research.
f. Control and prevention of zoonotic diseases.
g. Effective animal waste management.
h. Conservation and utilization of domestic and wild animal biodiversity.
i. Animal welfare measures in veterinary and animal science education and research.

5.0 CORE AREAS OF RESEARCH

5.1 Animal Production and Management

a. Continued improvement of stock through scientific intervention, and evaluation of various domestic and exotic animal genotypes. Breeding for disease resistance. Evolving new strains of animals and poultry adapted to local conditions.

b. Conservation, characterisation, evaluation and improvement of domestic animal and avian biodiversity.

c. Model livestock farms for optimum utilization of genetic potential of animals through micro-environmental interventions in different ecological zones; adoption of scientific management practices, user-friendly and less labour intensive technologies in routine farm operations; integration of bio-fuel technologies and value addition of farm wastes for higher net farm income.

d. Developing of feeds and fodders; cost-effective feeding schedules based on the availability of feed, fodder, other raw materials and unconventional feeds appropriate for small, medium and large livestock/poultry production units to make animal farming sustainable and economically viable.

e. Development of reproductive technologies for augmenting fertility and production in livestock.

f. Impact of climate change in animal production. Mitigation of greenhouse gas emissions and their link to climate change.

g. Application of biotechnological tools for improvement of animal and poultry production.

5.2 Animal Health

a. Development of vaccines, vaccination protocols and diagnostics for control, surveillance of diseases of farm and companion animals and disease forecasting.
b. Better strategies for treatment and control of disease of livestock and poultry, reproductive disorders and zoonotic and food-borne disease, to maintain a high standard of animal health and fertility.
c. Advanced molecular biological techniques for diagnosis of viral, bacterial, rickettsial, fungal, algal, protozoan and metazoan diseases and diseases due to infectious protein particles/ prions.
d. Investigations on disease of livestock and poultry due to deficiency or toxicity.

5.3 Improvement in Veterinary Care/Support Service

a. Research, development and refinement of medical/ surgical treatment and diagnostic strategies to sustain and improve health of farm and companion animals; development and use of biomaterials for veterinary use.
b. Research and development of newer drugs and drug molecules. Ethno veterinary medicine and health care of animals.

5.4 Biotechnology

a. Molecular characterization of domestic animal biodiversity, marker assisted selection
b. Bioinformatics
c. Development of diagnostic kits.
d. Gene expression studies- nutrigenomics
e. Embryo transfer technology, oestrous synchronization.
f. Manipulation of rumen ecosystem for improving productivity.

5.5 Livestock Products and Processing

a. Processing, packaging, preservation and storage, transport and marketing of meat, milk, egg and their products from the farm to the consumer, with quality management.
b. Traceability of food of animal origin and development of healthy low fat functional foods.
c. Value addition of livestock and poultry products
d. Development of production process through modern innovative technologies for traditional, fermented, functional and ethnic foods.

e. Energy conservation measures in dairy and food processing.
f. Low cost farm mechanisation for small scale milk and meat processing.
g. Physicochemical and microbiological characterisation of milk from different species and their value addition-Starter culture technology
h. Adulterants/contaminants in dairy and meat products

5.6 Extension and Economics

a. Technology validation through farmer participatory research/ on-farm research; development of client based knowledge sharing methods in the practice of Veterinary Science.
b. Documentation and evaluation of indigenous technical knowledge.
c. Economic feasibility of different systems of animal production and transfer of technology.
d. Evolving a mechanism to monitor the cost of production, market intelligence and suggesting periodic revision in the pricing of dairy, meat and egg products.
e. Utilisation of Information and Communication Technology (ICT) for linkages with other institutions for tele-imaging and diagnosis.

5.7 Other Core Areas

a. Need-based/ Problem-oriented research and adaptive research.
b. Animal welfare
c. Animal wastes management
d. Rearing of pet animals, birds and fishes as a livelihood.
e. Organic farming systems, nutrient cycling, insect and disease control.
f. Laboratory animal breeding and development of animal models.
g. Wildlife conservation and welfare
h. Veterinary forensics

6.0 OUTCOME

1. Food security and food safety for the state
2. Growth and development of the State of Kerala based on animal production systems.
3. Self-sufficiency in animal germplasm, production inputs and animal products.
4. Healthy and immune animals.
5. Better employment opportunities to economically weaker sections of people.
6. Equitable development and poverty alleviation through animal farming.

7.0 SUMMARY

The Kerala Veterinary and Animal Sciences University research policy is framed with an emphasis on research leading to sustainable development in animal production, thereby assuring food safety and security. It focuses on animal welfare and health, the effects of animal production on the environment, and application of new technologies to increase animal production.

Research Projects

1. Externally Aided Projects

Sl. No	Name of the Project	Funding Agency	Principal Investigator	Department	Total outlay (Lakhs)
1	Establishment of State of the art Large Animal Surgical teaching facility in the Department of Surgery and Radiology, Mannuthy	RKVY	Dr. S. Anoop	Veterinary Surgery and Radiology, CVAS, Mannuthy	50.00
2	Identification of the Causative Genes and Mutations Conferring Resistance Against Tick Infestation in Cattle	KSCSTE	Dr. C. N. Dinesh	Animal Breeding and Genetics, CVAS, Pookode	30.42
3	Clinical applications of Porcine derived collagen graft in Veterinary Practice	KSCSTE	Dr. S. Anoop	Veterinary Surgery and Radiology, CVAS, Mannuthy	15.56
4	Laboratory and field trials on oil adjuvant inactivated vaccine for the control of new duck disease in Kerala	Animal Husbandry Department, Kerala	Dr. Priya P. M.	Veterinary Microbiology CVAS, Mannuthy,	15.38
5	Investigation of therapeutic and bio-preservative potentials of lactoferrin of Vechur cow milk	Dept. of Animal Husbandry	Dr. Uma. R.	Veterinary Biochemistry CVAS, Mannuthy,	15.29
6	Early life care of calves and its implication in future milk production	Dept. of Animal Husbandry	Dr. M. K. Narayanan	Veterinary Surgery and Radiology, CVAS, Mannuthy	13.50

7	Development of recombinant vaccine for control of Salmonellosis in Poultry	DBT	Dr. Prejit	Veterinary Public Health, Pookode	13.33
8	Field studies on hoof disorders in goats to develop a protocol for its clinical management	Agricultural Technology Management Agency	Dr. Laiju M Philip	Veterinary Surgery and Radiology	5.80
9	Evaluation and prophylactic management of laminitis for enhancing production in dairy cattle	Dept. of Animal Husbandry	Dr. Laiju M Philip	Veterinary Surgery and Radiology, CVAS, Mannuthy	3.64
10	Development of a field based protocol for management of congenital and early musculoskeletal disorders in ruminants	Dept. of Animal Husbandry	Dr. Sudhesh S Nair	Veterinary Surgery and Radiology, CVAS, Mannuthy	2.84
11	Maintenance of healthy hoof in dairy cattle for production benefit and welfare in ruminants	KSCSTE	Dr. Laiju M Philip	Veterinary Surgery and Radiology	2.00

Laboratory and field trials on oil adjuvant inactivated vaccine for the control of New Duck disease in Kerala

Riemerella anatipestifer isolates obtained from different parts of Kerala were serotyped by slide and tube agglutination tests. Then oil adjuvant vaccine was developed employing the predominant isolates. Both laboratory and field trials for vaccination were conducted, which yielded good immune response, for a minimum period of 6 months.

Development of recombinant vaccine for control of Salmonellosis in poultry

Successfully obtained high level expression of OmpC proteins. Developed different vaccine groups *and* successfully vaccinated100 birds with dose of 150 µg/bird of each protein preparation each along with control. Demonstrated increased Humoral immune (HI) response of vaccinated birds by ELISA. Demonstrated increased Cellular immune response of vaccinated birds by FACS. Demonstrated protective efficacy (PE) of cocktail vaccine against *S.* Typhimurium challenge. Demonstrated protective efficacy of cocktail vaccine against *S.* Enteritidis. Outcome-Developed vaccine could afford satisfactory protective response and organ clearance against virulent *S. Typhimurium* and *S. Enteritidis* challenge in birds.

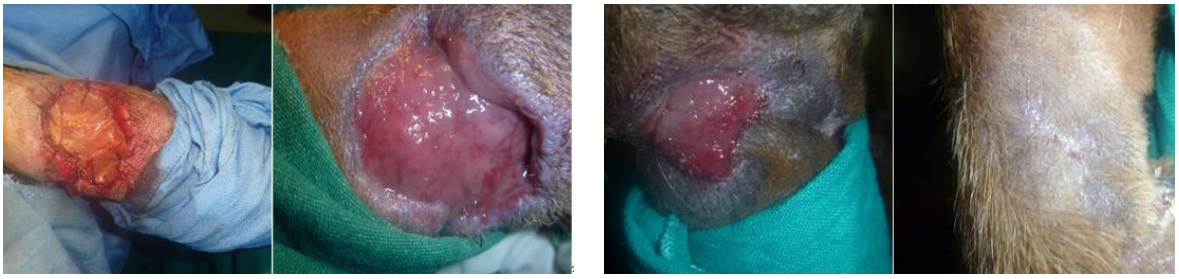
Early life care of calves and its implication in future milk production

The project had the proposed objective of improvement of 50 cross bred calves from age of birth to cows through scientific management model as future dairy herd development for sustainable milk production. Field based intervention on calf rearing by monitoring growth for initial 100 days of early life care in calves resulted in average weight gain of 400 g/ calves and age at fertility by 13- 14 months and age at first calving by 24 months.

Clinical applications of porcine derived collagen graft in veterinary practice

Objectives of the project was to develop low cost surgical treatment procedures for curing common diseases like corneal damage and cutaneous wounds of pet and farm animal and to

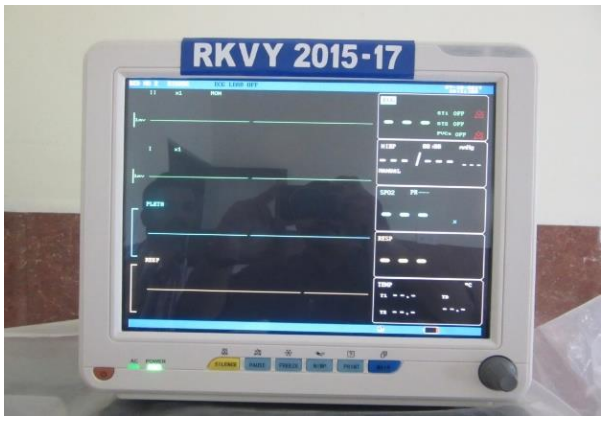
develop at least two patentable clinical formulations of xenogeneic grafts for veterinary use. Porcine cholecyst derived collagen scaffold is found to be very effective in the management of corneal defects in dogs. Porcine small intestinal submucosa (SIS) derived collagen sheet has been used successfully in the treatment of pigmentary keratitis after superficial keratectomy. The project is being undertaken in the Teaching Veterinary Clinical Complex and Department of Veterinary Surgery and Radiology attached to College of Veterinary and Animal Sciences, Mannuthy. The grafting techniques have been very widely used for the treatment of corneal ulcers in dogs and collagen sheet of porcine cholecyst origin has found to be very effective in augmenting healing process. Work has been started to use these materials in the treatment of extensive skin wounds also. Patent application filed: A method for fabricating corneal grafts using mammalian cholecyst derived extracellular matrix - Filed through Sree Chithira Thirunal Institute of Medical Science and Technology. Ref. No. 5649/CHE/3013 of 7-12-2013.



Wound treatment with Porcine Cholecyst derived collagen grafts

Establishment of State of the art large animal surgical teaching facility in the department of surgery and radiology, Mannuthy

The project with a total financial outlay of Rs. 50,00,000/- (Rupees fifty lakhs only) was undertaken with the following objectives, *viz.*, to establish a large animal surgical teaching facility for veterinary undergraduate and post graduate students, to impart high quality surgical procedures to the cases referred to the TVCC from different parts of the state and to establish a facility to record and demonstrate surgeries to students using Closed Circuit Television System (CCTV system). The achievements are**:** Established a fully equipped State of the art Large Animal Operation theatre. Established a CCTV system in the theatre for undergraduate teaching. Installed Large Animal Anaesthesia system with Ventilator for the first time in Kerala. Conducted a training programme on Large Animal Anaesthesia under the banner if ISVS, Kerala Chapter to the Veterinarians practicing in the field**.**

	**Large Animal Operation**
	**Large Animal Anaesthesia machine with ventilator**
	**Anaesthesia Monitoring system**
	**Shadow less lamp**

Maintenance of healthy hoof in dairy cattle for production benefit and welfare in ruminants

As part of the project a documentary on Hoof Care in Dairy Cattle was produced in the telecastable format by Prasar Bharathi, Doordarshan Kendra, Thiruvananthapuram The documentary on Hoof care in Dairy Cattle was telecasted through Dooradarshan Malayalam Channel on 21.11.2017 at 5.30 pm, and re telecasted on 22.11.2017 at 7.00 am and 11.30 pm. Booklets and leaflets on the importance of hoof care were distributed to the farmers during seminars, field demonstrations, awareness classes and field visits. Posters were distributed in different milk societies and veterinary institutions for the popularization of hoof care.

Evaluation and prophylactic management of laminitis for enhancing production in dairy cattle

Dairy cows reared under stall fed condition on concrete floor were affected with subclinical laminitis and resultant hoof disorders. Majority of lesions are prevalent in hind feet than fore feet. Lesions of hoof identified were sole ulcers, toe ulcers, white line lesions in adult dairy cattle and tender sole in recently calved primiparous cows. Heel erosions were the predominant lesion of lameness in organised farms followed by sole and white line haemorrhage. Lameness due to digital dermatitis decreased locomotion with negative consequences for lying and feeding behaviour.

Field studies on hoof disorders in goats to develop a protocol for its clinical management

Goats reared under stall fed condition were commonly affected with lameness due to overgrown and misshapen hooves. Prevalence of the overgrown hoof, foot rot and white line lesion were among the observed hoof lesions in goats. Lesions were observed in both forelimbs and hind limbs more prevalence in forelimbs compared to cattle. High incidence of foot rot in rainy seasons can be effectively prevented with use of foot bath with combination of 5 Per cent Zinc Sulphate and 2 Per cent Sodium Lauryl Sulphate.

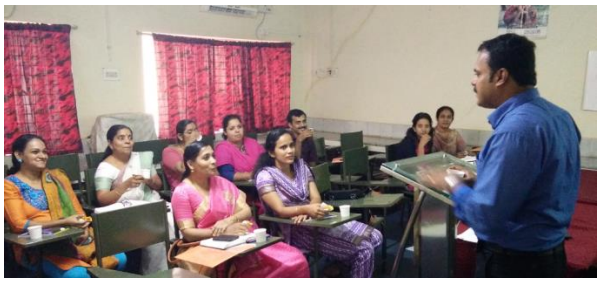
White line lesions Technique followed in hoof trimming

Retroarticular abscess


Development of a field based protocol for management of congenital and early musculoskeletal disorders in ruminants

All the findings of the studies were consolidated to formulate a field based protocol for treating congenital and early musculo skeletal disorders in young ruminants. Prepared resource materials in the form of 5 instructional DVD's on the various musculoskeletal disorders and their management by field based protocols. The results of the study disseminated among the field veterinarians in the form of this training in the form of one day training and workshop was conducted to 40 veterinary officers of Thrissur district in 10 batches of each from 6-9 Feb 2017 on topic "Management of congenital and early musculoskeletal disorders in ruminants".




2. Network Projects

Sl No	Name of PI	Funding Agency	Title of the project	Total outlay (in lakhs)
1	Dr. A. P. Usha	ICAR	All India Coordinated Research Project on Pig	88.75
2	Dr. P. Anitha	ICAR	ICAR-AICRP on Poultry for Eggs (75- ICAR fund, 25- Plan fund)	54.75
3	Dr. A. P. Usha	ICAR	Mega Seed Project on Pigs	48.00
4	Dr. K Anilkumar	ICAR	AICRP- Field Progeny Testing Project (122-49-0013-1408)	29.28
5	Dr. Thirupathy Venkatachalapathy	ICAR	AICRP on Goat Improvement	27.66
6	Dr. B Sunil	ICAR	Outreach programme on zoonotic diseases	8.00
7	Dr. Usha Narayana Pillai	ICAR	Outreach programme on ethnoveterinary medicine	1.94

Outreach programme on ethnoveterinary medicine

The current research is on antifungal properties of a particular plant. *In vitro* study was conducted in three plants and of which one plant with least minimum inhibitory concentration was selected. Toxicity studies of three extracts of the plant were conducted in rabbits. TLC, HPTLC and HPLC analysis were carried out. *In vivo* studies of the three extracts are being conducted now.

Outreach programme on zoonotic diseases

A total of 250 samples were collected from slaughter house 1, out of which two samples were positive for *Listeria innocua*. The total occurrence of the *Listeria* spp. from the slaughter house was 0.80 per cent. Out of the 325 samples analysed from the slaughter house 2, 4.92 Per cent of the samples were positive for *Listeria* spp. One of the meat samples was positive for *L.monocytogenes.* Ten isolates of *L.innocua* were obtained from different sources. *L.welshimeri* was reported from cutting table surface swabs, hand wash and water samples. A total of 280 samples were collected from different sources of slaughter house 3. Out of which, 4.29 Per cent of the samples were positive for *Listeria* spp. None of the samples from the slaughter house was positive for *L. monocytogenes. Listeria ivanovii* was reported from knife swab, hand wash and effluent samples. All together 285 samples were collected from SH 4 and 4.56 Per cent samples were positive for *Listeria* spp. One of the dung samples from the slaughter house was positive for *L.monocytogenes*. Overall occurrence of Listeria spp in meat production chain was 3.77 per cent. Two samples were positive for *L. monocytogenes,* which revealed the presence of six virulence genes *ie., hlyA, actA, prfA, plcA, inlA and iap. L. innocua, L. welshmeri* and *L. ivanovii* were identified using PCR amplification of *iap gene*

In UPDF, Mannuthy highest occurrence of *Campylobacter* spp. was found in monsoon (4.44 per cent) followed by post monsoon (1.33 per cent). Cloacal swab samples were the single most contaminating source with 66.67 Per cent during monsoon and 20 Per cent during post monsoon. The organism could not be detected from any other samples collected from egg production chain. Chicken eggs in the Table Egg Production Chain (TEPC) and Hatching Egg Production Chain (HEPC) in the UPDF, Mannuthy, were not contaminated with *Campylobacter* spp. In UPDF, Mannuthy, 43.33 Per cent of the cloacal swab samples were found to be contaminated with *Campylobacter* spp. The critical point of contamination for *Campylobacter* spp. in egg was found to be the cloaca of the bird. A total of 218 samples from various sources (cage, stunning area, bleeding area, defeathering area, evisceration area, cutting area and washing area) in the chicken processing line of slaughter house in Ernakulam district

were screened for the presence of *Campylobacter* spp. Fifty three isolates (24.31Per cent) of *C. jejuni* obtained from the surface swab of cage and stunning area and carcass swab after bleeding, evisceration, cutting table surface swabs, hand wash, water samples and effluent samples**.** All the water sources were found to be positive except the water sample taken from defeathering area. *C. jejuni* was detected in 77.78 Per cent of water samples collected from cholera outbreak area of Palakkad district. The well water samples from Chalakkudy residential area were found to be infected with 71.43 Per cent of *C. jejuni* 13.33 Per cent of water sample collected from rivers of Thrissur district was contaminated with *C. jejuni.*

All India co-ordinated research project on pig

All India Co-ordinated Research Project on Pigs was started in this Centre on 01-08-1993. As per the technical programme a foundation stock of indigenous pigs was established in the centre for cross breeding with Large White Yorkshire. Basic information with respect to management, disease prevalence and nutrition were collected in Desi stock. Earlier period field units were also established for assessing their suitability under field conditions. Inter-se mating of 75 Per cent crossbreds were done during the year 2016-2017. The health status of breeding stock is improved with utmost care and management. The centre has successfully fulfilled the demand of the farmers by supplying 396 fattening piglets (75 Per cent crossbreds) and also generated receipt of Rs 13.04 / lakhs during the year 2016-17 including income from sale of culled animals. Crossbred pigs (75 Per cent) were produced by inter-se mating and their production, reproduction and carcass traits were studied. The breeding stock number was increased; health status of farm stock was improved with utmost care and management. Artificial Insemination Programme has been continued to exploit the genetic potential of superior males. The semen was collected using gloved hand technique and it was further diluted using suitable diluents after evaluating the semen quality. An Artificial Insemination Laboratory was also established to evaluate the semen quality. A comprehensive breeding schedule has been introduced for prompt selection / culling of the stock. Three brochures and a monograph on Angamaly pigs were published and two projects have been completed.

Release of new pig variety developed at Mannuthy

Release of Publication

Farm Visit

“Mannuthy White” the crossbred pig variety developed at Mannuthy

Distribution of Piglets under Tribal Sub Plan AICRP on Pigs at Malakkappara, Athirappally Panchayath Chalakudy, Thrissur District Kerala

Integrated Farming – Garden peas cultivated utilizing the washing from the sheds

Waste water recycling at the farm

Visitors at the farm

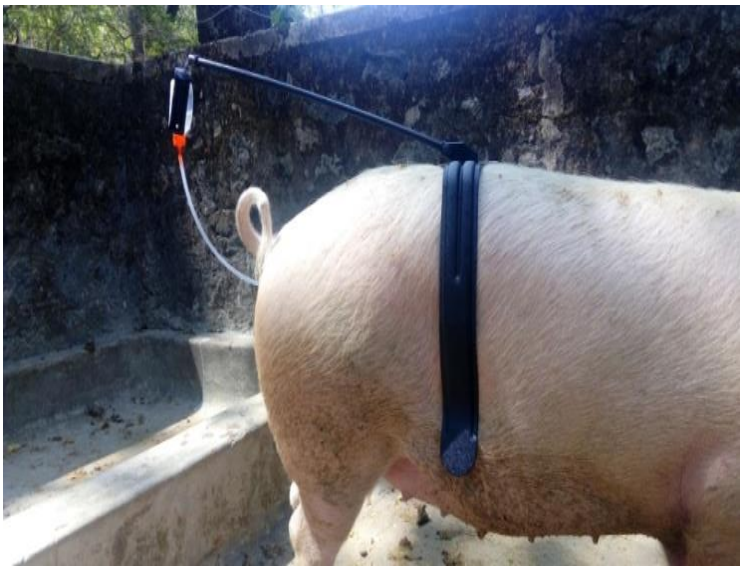
Biosecurity measure at the farm

Piglet Distribution to farmers

Mega Seed Project on Pigs

The Mega Seed Project on Pigs was initiated in the centre w.e.f 19-02-2015. 23 males and 106 females were maintained as breeding stock. The foundation stock has been established and used for crossbreeding with Large White Yorkshire to evolve 75 Per cent crossbred progenies. The centre has successfully fulfilled the demand of 22 farmers by supplying 656 fattening piglets (75 Per cent crossbred) and also generated receipt of Rs. 16.7 / lakh during the year. Crossbred pigs (75Per cent) were produced by inter-se mating. The breeding population and health status of the farm have improved. Artificial insemination programme was initiated to exploit the genetic potential of superior males. Semen was collected using the gloved hand technique using dummy female and dilution was undertaken with suitable diluents after evaluating the semen quality. A comprehensive breeding schedule has been introduced for prompt selection / culling of the stock.

Back fat thickness - ultrasound monitor



AI in pigs using catheter holder

Pregnancy detector

3. Plan Projects

Sl No	Name of Project	Name of the Department	Financial outlay in Lakhs
1	Scaling up of piglets	CPPR, Mannuthy	80.00
2	Increasing productivity of cross bred cattle of University Livestock Farm Mannuthy (CATTLE)	ULF, Mannuthy, FRDS	60.00
3	Modernization of Vechur cattle conservation centre (122-49-0013-6100)	Centre for Advanced Studies in Animal Genetics and Breeding, Mannuthy	40.00
4	Enhancing productivity of crossbred cattle at LRST	Livestock Research Station, Thiruvazhamkunnu	35.37
5	Vetconnect for providing 24x7 Veterinary Services	Department of Veterinary Surgery and Radiology	35.00
6	Improving backyard poultry production by supplying cross bred chicks from improved hens	AICRP on Poultry for eggs, Mannuthy	30.00
7	Strategies for improving fodder production of Kerala state	University Livestock Farm and Fodder Research Station, Mannuthy, ULFRDS, Mannuthy	30.00
8	Project on buffalo improvement	Livestock Research Station, Thiruvazhamkunnu	27.15
9	Augmenting biotechnology and molecular biology research in KVASU, Mannuthy (122-49-0013-6555)	Centre for Advanced Studies in Animal Genetics and Breeding, Mannuthy	26.00
10	Assessing performance of Murrah buffalo herd for milk & meat production in hot & humid climate of Kerala	ULF, Mannuthy, FRDS	25.00

11	Comprehensive approach to economic broiler rabbit production (122-49-0013-6470)	Centre for Advanced Studies in Animal Genetics and Breeding, Mannuthy	25.00
12	State of art silage production for small holder dairy production unit	Livestock Research Station, Thiruvazhamkunnu	21.83
13	Evaluation of performance of crossbred pigs (25 Per cent share of AICRP on pigs)	CPPR, Mannuthy	20.00
14	Waste water management for eco friendly swine production	CPPR, Mannuthy	20.00
15	Centre for rehabilitation of stray puppies under end programme	Department of Veterinary Surgery and Radiology	20.00
16	Conservation and sustenance of farm animals genetic resources of Kerala	Livestock Research Station, Thiruvazhamkunnu	19.66
17	Augmenting of milk production through better reproductive management techniques	Livestock Research Station, Thiruvazhamkunnu	18.99
18	Establishment of an eco farm at the base farm, Kolahalamedu	Base Farm, Kolahalamedu	16.00
19	Poultry improvement for eggs (25 Per cent of state share of AICRP)	AICRP on Poultry for Eggs, Mannuthy	16.00
20	Field progeny testing of crossbred bulls (122-49-0013-6003)	Centre for Advanced Studies in Animal Genetics and Breeding, Mannuthy	16.00
21	High range climate study centre	Base Farm, Kolahalamedu	15.00
22	Conservation, characterization and popularization of native chicken varieties of Kerala	CASPS, Mannuthy	15.00
23	Pullet production to support self help groups in backyard poultry rearing	CASPS, Mannuthy UPDF	15.00
24	Screening and diagnosis of fish and aquatic animal diseases	Veterinary Pathology, CVAS, Pookode	15.00

25	Establishment of a seed production unit of Malabari goat	Livestock Research Station, Thiruvazhamkunnu	14.89
26	Developing an Alternate approach to hiefer production system in Kerala	Livestock Research Station, Thiruvazhamkunnu	13.99
27	Artificial Insemination for improving reproductive efficiency in pigs	CPPR, Mannuthy	10.00
28	Conservation and maintenance of Angamali pigs of Kerala	CPPR, Mannuthy	10.00
29	Effect of dietary supplementation of xylanase and β-glucanase on growth performance in weaned piglets	CPPR, Mannuthy	10.00
30	Effect of different levels of energy supplementation on breeding performance in gilts	CPPR, Mannuthy	10.00
31	Strengthening of the centre for Pig production and research	CPPR, Mannuthy	10.00
32	Screening of bovine repeat breeders for leptospirosis	Department of Veterinary Microbiology	10.00
33	Hatchery waste disposal and its effective utilization	CASPS, Mannuthy	10.00
34	Advanced Mycotoxin testing facility in poultry feed.	UPDF	10.00
35	Molecular characterisation of infectious agents of zoonotic importance from brain and other tissue materials from domestic and wild animals	Veterinary Pathology, CVAS, Pookode	10.00
36	Establishment of germplasm repository for domestic animal diversity of Kerala (122-49-0013-6045)	Centre for Advanced Studies in Animal Genetics and Breeding, Mannuthy	10.00
37	Centre for advanced studies in animal genetics and breeding (122-49-0013-6462)	Centre for Advanced Studies in Animal Genetics and Breeding, Mannuthy	10.00

38	Strengthening of school of applied animal production and biotechnology. (114-89-0003-6222)	Centre for Advanced Studies in Animal Genetics and Breeding, Mannuthy	10.00
39	Establishment of transfusion medicine unit for field adoption	Department of Veterinary Clinical Medicine, Ethics and Jurisprudence	9.00
40	Intensive productivity augmentation measures in establishment of heritage farm	Base Farm, Kolahalamedu	9.00
41	All India coordinated research project for goat improvement (122-49-0013-6001)	Centre for Advanced Studies in Animal Genetics and Breeding, Mannuthy	9.00
42	Development of live vaccine against new duck disease in Kerala	Department of Veterinary Microbiology	8.00
43	Development of multiplex PCR for simultaneous detection of canine haemoparasites	Veterinary Parasitology	8.00
44	Renovation of cattle shed, office, quarters and canteen building at LRST	Livestock Research Station, Thiruvazhamkunnu	8.00
45	Identification and assessment of nutritive value of herbal products for feeding of livestock”	Department of Animal Nutrition	7.00
46	Establishment of biologically integrated farming of livestock, fodder, cash crops and fish at LRST	Livestock Research Station, Thiruvazhamkunnu	6.55
47	Etiological and clinical investigations on respiratory infections in goats	Dept of Veterinary Epidemiology & Preventive Medicine, CVAS, Pookode	6.50
48	Investigations on infectious etiology of thrombocytopenia in dogs	Dept of Veterinary Epidemiology & Preventive Medicine, CVAS, Pookode	6.00
49	Development of an *in vitro* diagnostic test for detection of anthelmintic resistance	Veterinary Parasitology	6.00

50	Development of multiplex PCR for quick differential detection of avian oncogenic viruses in poultry	Veterinary Pathology, CVAS, Pookode	6.00
51	Feeding strategies to manipulate rumen fermentation in crossbred cattle of Kerala	Animal Nutrition	5.00
52	Complete feeds for dairy cows as a solution for the feed and fodder scarcity of Kerala	Animal Nutrition, CVAS, Poookode	5.00
53	Clinical investigations on chlamydiosis in pet birds of Thrissur district	Veterinary Clinical Medicine, Ethics and Jurisprudence	5.00
54	Occurrence of *Toxoplasma gondii* in feline, caprine, human and environment samples- A One Health Approach	Veterinary Public health	5.00
55	Augmentation of Biotechnology	Veterinary Microbiology	5.00
56	Molecular characterization of *Haemonchus* sp. in cattle	Veterinary Parasitology	5.00
57	Evaluation of lactation performance and establishment of a system of milk recording in crossbred cow of Kerala for sire evaluation (122-49-0013-6218)	Centre for Advanced Studies in Animal Genetics and Breeding, Mannuthy	5.00
58	Characterization and SNP analysis candidate genes for lean meat production ability in Murrah buffaloes (122-49-0013-6556)	Centre for Advanced Studies in Animal Genetics and Breeding, Mannuthy	5.00
59	Analysis of repeated measures data from animal experiment	Statistics	4.79
60	PCR based detection of classical swine fever in carrier and infected pigs of Wayanad, Kozhikode and Kannur district of Kerala	Dept of Veterinary Epidemiology & Preventive Medicine	4.50
61	Forecasting the lifetime milk production of cattle.	Statistics	4.29
62	Screening and evaluation of medicinal plants for anticancer activity	Veterinary Pharmacology and Toxicology, Mannuthy	4.25
63	Establishment of small animal dermatology unit	Veterinary Clinical Medicine, Ethics and Jurisprudence	4.00

64	Anti-microbial effect of plant derived essential oils and antibiofilm effect of chitosan on Enterohaemorrhagic *E.coli* on beef carcasses	Veterinary Public health	4.00
65	Occurrence of *Toxoplasma gondii* in human, animals and environmental samples –A One Health Approach	Veterinary Parasitology	4.00
66	Molecular characterisation of lactoferrin of indigenous goat breeds of Kerala	Veterinary Biochemistry	4.00
67	Comparative studies on Gut Associated Lymphoid Tissue (GALT) in domestic fowl and duck at different ages	Veterinary Anatomy & Histology	3.00
68	Prevalence of Aflatoxin in cattle feed in Thrissur district	Department of Livestock Production and Management	3.00
69	Occurrence of thermo tolerant Campylobacter in dogs and cats in Thrissur, Kerala	Veterinary Public health, CVAS, Mannuthy	3.00
70	Comparative histological and immunohistochemical studies on the pancreas of Malabari and Attappady Black breeds of goats	Veterinary Anatomy & Histology	2.50
71	Development of DNA barcoding for wild life forensics	Veterinary Biochemistry	2.50
72	Molecular characterisation of genes associated with type 2 diabetes in dogs	Veterinary Biochemistry	2.50
73	Identification and assessment of nutritive value of herbal byproducts for feeding of livestock	Department of Animal Nutrition	2.00
74	Phenotypic characterisation of local breeds of cattle of Kerala	Livestock Research Station, Thiruvazhamkunnu	1.99

Comparative studies on Gut Associated Lymphoid Tissue (GALT) in domestic fowl and duck at different ages

The anatomical organization and post-natal developmental pattern of gut associated lymphoid tissue (GALT) was studied in White Leghorn chicken and Kuttanad ducks at three different ages, *viz*., day-old, three months and six months. The lymphoid tissue was well developed in chicken when compared to duck. Maximum development of lymphoid tissue was seen in the three month old birds of both species. The results of the present study will definitely contribute to identify the sites for local application of vaccines in these two species. The major lymphoid tissues in chicken and duck, important for induction of immunity after oral vaccination are oesophageal and pharyngeal tonsils and for cloacal vaccines are the cloacal lymphoid tissue.

Comparative histological and immunohistochemical studies on the pancreas of Malabari and Attappady black breeds of goats

Histological and immunohistochemical studies were conducted on the pancreas of both Malabari and Attappady Black breeds of goats. Histological studies showed that majority of the pancreatic parenchyma in both breeds were composed of serous secretory acini. The endocrine component of pancreas in both breeds showed groups of cells arranged as islets of Langerhans as well as isolated endocrine cells located among acini. Immunohistochemical studies revealed that among different endocrine cells B-cells were the majority. No direct revenue was generated from the study. However, results of the present study will form a base for framing further physiological, pathological and endocrinological studies.

Identification and assessment of nutritive value of herbal byproducts for feeding of livestock

Established data bank on nutrient profile of various Ayurvedic medicinal residues. Assessed the nutritional value of Ayurvedic medicinal residues in ruminant feeding by *in vitro* and *in vivo* feeding trials. Investigated the effect of addition of Ayurvedic medicinal residues on fibre utilization, microbial protein production and methane emission in ruminants.15 samples of fodder and herbal byproducts were collected and analysed for their proximate composition. Based on these data, samples were identified for their potential use as feed ingredients.

Feeding strategies to manipulate rumen fermentation in crossbred cattle of Kerala

In vitro rumen fermentation parameters (pH, TVFA, rumen ammonia) of different Total Mixed Ration (TMR) prepared was estimated. The TMRs were ranked based on the rumen fermentation parameters. This data base can be used for TMR preparation in future. Production efficiency can improved by selecting the most beneficial TMR

Complete feeds for dairy cows as a solution for the feed and fodder scarcity of Kerala

Recommended a low cost complete ration as the sole source of feed for lactating dairy cows, containing the adequate amount of nutrients, especially energy, protein and fibre in the form of NDF, for use among the dairy farmers of Kerala, with no additional concentrate and roughage.

Anti-microbial effect of plant derived essential oils and antibiofilm effect of chitosan on Enterohaemorrhagic *E.coli* on beef carcasses

Of the three essential oils, Eugenol and Cinnamaldehyde has exhibited a minimum inhibitory concentration (MIC) of 0.1 Per cent whereas allicin showed MIC of 0.5per cent. Cinnamaldehyde at concentrations of 0.2 and 0.4 Per cent caused a significant reduction in the growth rate of EHEC in beef stored at 7^{o}C. Hundred Per cent reduction was observed at 1.5 Per cent of chitosan on polystyrene surfaces. The observed log reduction was 0.962 and 2.08 for 1 and 1.25. When both the surfaces were compared, more biofilm formation was observed on the polystyrene surface. The most effective concentrations which was found effective against EHEC biofilm was 1.5 Per cent of chitosan on stainless steel and polystyrene surface.

Occurrence of *Toxoplasma gondii* in feline, caprine, human and environment samples- A One Health Approach

Overall occurrence of *T. gondii* in feline faecal sample was 4.47 per cent. Caprines in the area revealed an overall seroprevalence of 41.30 per cent. Caprine milk samples did not reveal presence of the parasite. Seropositivity of 52.46 Per cent was recorded in the human serum samples. Toxoplasma DNA was detected in six out of 61 soil samples. None of the water samples showed presence of the parasite

Occurrence of thermo tolerant Campylobacter in dogs and cats in Thrissur, Kerala

A well-structured questionnaire was formulated to collect data regarding the hygienic practices followed by pet owners and awareness of owners with regard to Campylobacteriosis from in and around Thrissur, Kerala. Of the 200 pet owners interviewed only nine percent were aware about Campylobacteriosis. Ninety one Per cent of the respondents adopted the practice of washing their hands after handing pets with a minority of only 10 Per cent washing hands with soap. A total of 150 dog and 50 cat faecal swab samples were analysed for the presence of *Campylobacter* spp. All the samples collected were subjected to conventional culture and molecular techniques. Multiplex PCR was employed to distinguish between *C. jejuni* and *C. coli*. RFLP was performed to identify the presence of *C. lari* and *C. coli* in the samples.Of the 150 dog samples analysed 24 (16 per cent) were positive for *Campylobacter* spp. of which two isolates were confirmed as *C. jejuni* and five were positive for C. *coli* .Of the 50 cat samples

analysed, 11 samples were positive for *Campylobacter* spp. None of them were positive for *C. jejuni,C. coli, C. lari* and *C. upsaliensis*.

Artificial Insemination for improving reproductive efficiency in pigs

Under the project, AI is successfully being practised in purebred animals of CPPR. Facilities for AI have been established in the centre. The piglets produced by AI are selecting as breeding stock. Standardisation of keeping quality of Boar semen is also underway.

Conservation and maintenance of Angamali pigs of Kerala

Angamali animals are conserved in the centre under the project. Desired traits like mothering ability, disease resistance is being incorporated in different crossbred strains. Application for Angamali breed registration was submitted to NABGR, Karnal. A monograph of Angamali pigs has been prepared.

Effect of dietary supplementation of xylanase and β-glucanase on growth performance in weaned piglets

Improved the growth performance of piglets has been observed under the project on dietary supplementation of xylanase and β-glucanase. Distributed 50 such weaned piglets to the farmers.

Effect of different levels of energy supplementation on breeding performance in gilts

The Large white Yorkshire gilts with uniform body weight were randomly selected and maintained under different levels of energy supplements till two weeks after breeding. The birth weight, litter size and growth rate of their piglets in different experimental groups were evaluated and it was found that the high energy diet enhanced the breeding performance of animals. Distributed 50 such piglets to the farmers.

Evaluation of performance of crossbred pigs (25 Per cent share of AICRP on pigs)

The new crossbred variety ‘Mannuthy white’ was released. 88 piglets were sold to fattening units.

Scaling up of piglets

Semen from three Large White Yorkshire boars were purchased from ICAR research complex, Goa. Increased the production of hybrid progenies with desirable qualities like lean meat, enhanced feed efficiency etc. 1032 fattening piglets were sold under the scheme.

Development of live vaccine against new duck disease in Kerala

Riemerella anatipestifer isolate selected for oil adjuvant vaccine preparation was attenuated to an extend, to prepare live vaccine candidate. Then, live vaccine was developed and laboratory

trials were conducted on a small scale. The live vaccine developed could be employed to control the *Riemerella anatipestifer* infection as it was needleless.

Screening of bovine repeat breeders for leptospirosis

One hundred and fifty serum samples collected from bovine repeat breeders were screened for leptospirosis by ELISA and10 Per cent were found to be positive for antibodies against *Leptospira.* Uterine discharges from 50 repeat breeders/ aborted cows did not reveal amplicons specific to *Lip l 32* gene of pathogenic *Leptospira.*

Augmentation of biotechnology

Detected many major pathogens (*Mycoplasma gallisepticum*, Infectious laryngotracheitis virus, Infectious Bursal Disease virus, Classical Swine Fever virus and Porcine Circovirus) affecting domestic animals and poultry population in Kerala by PCR.

Centre for rehabilitation of stray puppies under end programme

80 dogs were operated, 50 Veterinarians were trained on ABC programmes

Vetconnect for providing 24x7 veterinary services

24 x 7 Veterinary services were provided at door step by call center facility and ambulance with driver / Paravet and veterinarian.

Poultry improvement for Eggs

Physical progress/Results/Achievements

Trait (s28 generation)	IWN	IWP
Egg weight at 64 weeks of age (g)	54.16±0.37	55.3±0.13
Egg number up to 64 weeks	256.69±1.52	261.35±1.4
Body weight at 64 weeks	1544.00 ±6.31	1585.00±6.34

Output/Deliverables:

Table eggs- 524365

Day-old commercial chicks- 20673

Breeding birds- 300

Birds for meat purpose -2836

Improving backyard poultry production by supplying crossbred chicks from improved hens

Procured 50 male birds of Australorp, RIR from UPDF for producing crossbred chick.Weekly around 2000-4000 crossbred chicks were supplied to needy farmers.Installed air conditioner in egg store room of hatchery building.Constructed farm roads for easy transportation of feed, birds and eggs.

Output/Deliverables:

Crossbred chicks supplied: 102521

Conservation, characterization and popularization of Native Chicken varieties of Kerala

Study on prolactin gene polymorphism in native chicken and IWN strain of White Leghorn was carried out by using Agarose gel electrophoresis and the study revealed that CC and CT genotypes of C-2402T site of promoter 2was having significantly ($p<.0.05$) early sexual maturity and higher egg production compared to TT genotype. Dr. M. Azhaguraja, M.V.Sc. Student of Poultry science department of College of Veterinary & Animal Sciences has successfully completed his thesis work by using this project.Under selection for egg production in Native chicken, out of 600 female birds, 250 high producing females and 50 cocks were selected and they were crossed to get S_2 generation chicks.

Pullet Production to support self help groups in backyard poultry rearing

A total of 1026 number of day old female chicks of WL crossbred, 631 number of day old female chicks and 80 number of day old male chicks were purchased from AICRP on poultry for eggs, Mannuthy. The chicks were reared for a period of 4-6 weeks and sold to farmers during the month of June, July & October. A second batch of 1604 number of Crossbred day old female chicks & 396 number of Crossbred day old female chicks were purchased from AICRP on poultry for eggs, Mannuthy during September 2017 and the birds are under rearing and will be sold after 1 month.

Hatchery waste disposal and its effective utilization

During the last year under the head farm development, work has been allotted for an amount of Rs.2,41,190/-.The works include clearing the site, leveling the site, spreading of quarry waste & tile was laid where the grinding machine for the project was installed.An electric dryer was developed to dry the final product to be obtained.As per MoU, standardization of process (hatchery waste conversion into fertilizer) is being carried out by the scientists of Soil Science Department, College of Agriculture, Vellayani, Trivandrum.

Advanced Mycotoxin testing facility in poultry feed.

Equipments such as -20^0 C deep freezer, Gel documentation system and safety hood cabinet was purchased for advanced Mycotoxin testing Laboratory. The facilities available in the mycotoxin laboratory were utilized for analysis of aflatoxin in feed ingredients and compounded feed and confirm whether the value obtained is within the acceptable limit using ELISA and TLC. Around 50 samples were done per month. The facilities created through this project were utilized for various research projects including PG project work

ELISA READER

PCR MACHINE

Development of multiplex PCR for simultaneous detection of canine haemoparasites-

Developed a multiplex PCR for simultaneous detection of highly pathogenic vector borne diseases in dogs which was more sensitive than microscopic detection. Recorded an alarmingly rising prevalence of small *Babesia* species in dogs. Identified the subclinical/ carrier status of infection in 40 Per cent dogs studied and the presence of significant haematological alterations in PCR positive dogs. A highly sensitive PCR protocol for use in any laboratories. Phylogenetic evaluation of *Babesia gibsoni, B. canis, E. canis* isolates of Kerala. Recorded the molecular evidence of these pathogens in tick vectors. Updated the nucleotide database of parasites useful for accession by researchers world wide. Provided employment to a research associate during the period.

Development of an *in vitro* diagnostic test for detection of anthelmintic resistance

Standardized larval development assay for the *invitro* detection of anthelmintic resistance in GI nematodes of goats. Compared the results of larval development assay with that of Egg hatch assay for detection of anthelmintic resistance. Screened the resistance status of organized goat farms by larval development assay. Provided employment to a research associate during the period.

Molecular characterization of *Haemonchus* sp. in cattle

Molecular characterization of the prevalent economically important strongyle in Kerala which form the basis for further diagnosis from other strongyles in Kerala. Provided employment to a research associate during the period.

Occurrence of *Toxoplasma gondii* in human, animals and environmental samples –A one health approach

High incidence of *Toxoplasma gondii* in household kitten indicate the need for public health awareness on risk of *Toxoplasma gondii* from cats as human beings get the infection from oocyst. An increased seroprevalence detected in a span of 20 years in the two Govt. Goats farms in Kerala

Development of multiplex PCR for quick differential detection of avian oncogenic viruses in poultry

Financial achievement was met. Samples of liver and spleen from suspected cases of avian leucosis/Marek's disease/Reticuloendotheliosis were collected for molecular diagnosis. RNA/DNA (according to the suspected disease) was extracted. But the primer could not be standardised.

Molecular characterisation of infectious agents of zoonotic importance from brain and other tissue materials from domestic and wild animals

A molecular laboratory for diagnosis of rabies and other infectious diseases was established for the first time in the Department of Veterinary Pathology, Pookode. Standardized PCR techniques for rabies and other infectious diseases. Brain samples and other tissue materials were screened for the presence of pathogens like rabies lyssa virus, SHV-1, CDV, FPV and FIPV from domestic animals mainly dogs and cats. Standardised the techniques of immunohistochemistry for brain tissue using various markers.

Screening and diagnosis of fish and aquatic animal diseases

Cultural examination and molecular tests revealed presence of *Aeromonas hydrophila* in all the clinically affected fish samples (100 per cent). There were samples positive for *Aeromonas salmonicida* (57.69 per cent), *Pseudomonas fluorescens* (19.23 per cent) *Pseudomonas aeruginosa (15.38* per cent). *Saprolegnia* was the predominant fungal infection notice (23.07 per cent). The predominance of *A. hydrophila* has to be viewed critically as it can cause infection in human beings in contact.

Establishment of a seed production unit of Malabari goats at livestock research station, Thiruvazhamkunnu

Established a model seed production unit of Malabari goat. Construction of new goat shed. Developing an alternate approach to heifer production system in Kerala. Rearing heifers economically by practicing early weaning and proper nutritional management. Augmenting of milk production through better reproductive management techniques. Established of biologically integrated farming of livestock, fodder, cash crops and fish at Livestock Research Station, Thiruvazhamkunnu Established of model demonstration unit of integrated farming system.

Enhancing productivity of dairy cattle at livestock research station, Thiruvazhamkunnu

Purchased elite crossbred dairy cows. Production of high quality seed material – crossbred female calves per year. Renovation of office, quarters and other building at Livestock Research Station, Thiruvazhamkunnu. Renovation of office, canteen, quarters and cattle shed

Newly constructed goat shed

Renovation of cattle shed

Malabari goat unit

Molecular characterisation of lactoferrin of indigenous goat breeds of Kerala

Characterized the full coding region of lactoferrin of indigenous goat breeds of Kerala for the first time and found that they possess five non-synonymous mutations that may affect their functions.12SrDNA, 16SrDNA and cytochrome b genes in spotted deer, hog deer and sambar deer were characterized for species identification. Among the above 12SrDNA primer could amplify 12SrDNA gene specific for birds, animals and reptiles under study.Coding region of type 2 diabetes linked gene - KCNJ 11 was characterised in Labrador retriever and boxer breed of dogs and found variations in the nucleotide sequence, suggestive of difference in the incidence of diabetes among the two breeds of dogs.

Screening and evaluation of medicinal plants for anticancer activity

Erythrina variegata and *Mimosa pudica* were screened *in vitro* for anticancer activity against MCF and MDA-MB231 human breast cancer cell lines. The plant extracts were analyzed for active phytochemical constituents by chromatographic methods. The apoptotic potential of the plant extracts to exhibit anticancer activity was evinced through AO/EB staining, Hoechst staining and free radical scavenging activity. The apoptotic potential of the plant extracts were confirmed by Western blotting. *Erythrina variegata* was found to exhibit anticancer activity by inducing apoptosis. *Mimosa pudica* was found to exhibit anticancer activity by inducing apoptosis

Vechur cattle conservation project

Currently, the Vechur Cattle Conservation Centre of the university is working primarily as a conservation unit with the mandate of conserving Vechur cattle with the importance of keeping our heritage, a valuable tool for future studies on adaptability to climatic stress and disease resistance and as a small cow for the farmers who need milk only for their home consumption. The selective breeding for genetic improvement of the herd is undertaken with a systematic

breeding schedule to minimize the rate of inbreeding. A few Kasargod dwarf animals are also maintained at the Vechur cattle farm as a part of conservation of indigenous cattle breeds. Extension activities at Vechur farm are creating awareness about importance of conservation of indigenous cattle breeds. Providing chilled neat semen and frozen semen of Vechur and Kasargod dwarf bulls for the cows registered as field units. Supply of limited numbers of heifers and adult Vechur cows to farmers. Supply of indigenous cow dung and urine to farmers for organic manure and producing traditional medicines. Activities are creating awareness about importance of conservation of indigenous cattle breeds. Providing chilled neat semen and frozen semen of Vechur and Kasargod dwarf bulls for the cows registered as field units. Supply of heifers and adult Vechur cows to farmers. Supply of indigenous cow dung and urine to farmers for organic manure and also for producing traditional medicines.

4. PhD and PG Projects

Sl. No.	Title of the Thesis/Dissertation	Degree conferred	Department
1	Comparative evaluation of closed and open static intramedullary interlocking nail fixation in dogs	Ph.D	Veterinary Surgery and Radiology
2	Development of ELISA based diagnostics for early detection of coproantigens in bovine amphistomosis	Ph.D	Veterinary Parasitology
3	Adaptability profile of male cattle and buffalo calves to varying temperature humidity index (TH 1) in Kerala	Ph.D	Veterinary Physiology
4	Epidemiological surveillance of enterohaemorrhagic *Escherichia coli*	Ph.D	Veterinary public health
5	Antitumour properties of *Annona muricata* and curculigo orchioides on induced mammary tumours in mice	Ph.D	Veterinary Pharmacology
6	Comparison of immunity related genes in Vechur and crossbred cattle and their expression profile in clinical and subclinical mastitis	Ph.D	Veterinary Biochemistry
7	Augmenting reproductive efficiency in post parturient does with intravaginal progesterone sponges, prostaglandin F2α and gonadotropin releasing hormone	Ph.D	Animal Reproduction Gynaecology and Obstetrics
8	Evaluation of semen preservation protocols and artificial insemination techniques to augment fertility in Malabari goats	Ph.D	Animal Reproduction Gynaecology and Obstetrics
9	Development of meat line of Kuttanad ducks (*Anas platyrhynchos domesticus*)	Ph.D	Poultry Science
10	Swot analysis of the duck farming system towards its sustainability in the Kuttanad region of Alappuzha district	Ph.D	Veterinary and Animal Husbandry Extension
11	Economics of farming systems in Kerala	Ph.D	Livestock Production Management

12	Molecular and Immuno histochemical studies on tumours of nasal sinuses in domestic animals	Ph.D	Veterinary Pathology
13	Screening of geriatric dogs for chronic kidney disease (CKD) and its management	M.V.Sc	Veterinary Clinical Medicine Ethics and Jurisprudence
14	Clinical investigations on immune mediated haemolytic in dogs	M.V.Sc	Veterinary Clinical Medicine Ethics and Jurisprudence
15	Clinical investigations on oedema of limbs in dogs	M.V.Sc	Veterinary Clinical Medicine Ethics and Jurisprudence
16	Characterization and expression profiling of Toll Like Receptor 2 (TLR2) and bovine peptidoglycan recognition protein-1 (PGLYRP) genes in Vechur and crossbred cattle of Kerala	M.V.Sc	Animal Breeding, Genetics and Biostatistics
17	Tissue expression, characterisation and SNP analysis of myogenin (MYOG) gene in native goat breeds of Kerala	M.V.Sc	Animal breeding, Genetics and Biostatistics
18	Intellectual property management systems in the south zone animal science research institutes of ICAR	M.V.Sc	Veterinary Extension
19	Profiling of selected bovine and buffalo muscles for palatability related attributes	M.V.Sc	Livestock Production Technology
20	Hurdle technology for development of shelf stable barbecued chicken	M.V.Sc	Livestock Products Technology
21	Development of pet kibbles using processed animal byproducts	M.V.Sc	Livestock Products Technology
22	Molecular detection of rotavirus in poultry of Kerala	M.V.Sc	Veterinary Microbiology
23	Diagnosis of leptospirosis in canine blood and urine using Real time-PCR	M.V.Sc	Veterinary Microbiology
24	Effect of dietary supplement of Lecithin and carnitine of growth in piglets on high fat diet	M.V.Sc	Animal Nutrition
25	Nutritive evaluation of unconventional feeds using in vitro gas production technique	M.V.Sc	Animal Nutrition

26	Evaluation of hydroponics fodder as a partial feed substitute in the ration of crossbred calves	M.V.Sc	Animal Nutrition
27	Performance of early lactating crossbred cows at different ratio of concentrate and roughage	M.V.Sc	Animal Nutrition
28	Clinico-pathological investigations on snake envenomation in dogs	M.V.Sc	Veterinary Surgery of Radiology
29	Clinico-pathological evaluation of metabolic syndrome in obese dogs	M.V.Sc	Veterinary Surgery of Radiology
30	Comparative evaluation of isoflurane, sevoflurane and ketamine anaesthesia in cats	M.V.Sc	Veterinary Surgery and Radiology
31	Comparative evaluation of porcine cholecyst derived collagen and bovine dermal origin collagen for the treatment of wounds in dogs	M.V.Sc	Veterinary Surgery and Radiology
32	Comparative efficacy of Cyanacrylate adhesive and contract lens in management of corneal ulcers in dogs	M.V.Sc	Veterinary Surgery and Radiology
33	Screening and therapeutic management of parasitic infections in captive Asian elephants (*Elephas maximus indicus*)	M.V.Sc	Veterinary Epidemiology and Preventive Medicine
34	Foot and mouth disease vaccinaton-post vaccinal seroconversion in captive Asian elephants (*Elephas maximus indicus*)	M.V.Sc	Veterinary Epidemiology and Preventive Medicine
35	Evaluation of mast cell presponse in caecal coccidiosis of broiler chicken in sub-lethal aflatoxicosis	M.V.Sc	Veterinary Pathology
36	Pathological effects of intracheal instillation of doped ceriumoxide nanoparticles in rats	M.V.Sc	Veterinary Pathology
37	Protective effect of piper longum (Thippali) and vitamin C in chlorpyrifos toxicity of rats	M.V.Sc	Veterinary Pathology
38	Evaluation of mast cell response in caecal coccidiosis broiler chicken in sub-lethal ochratoxicosis	M.V.Sc	Veterinary Pathology
39	Survival rate of immature and in vitro matured bovane oocytes vitrafied using cryoloop method	M.V.Sc	Animal Reproduction Gynaecology and Obstetrics

40	Endometrial cytology in postpartum cross-bred dairy cows and its correlation with fertility	M.V.Sc	Animal Reproduction Gynaecology and Obstetrics
41	In vitro fertility assessment of frozen bovine spermatozoa as influenced by breed and season	M.V.Sc	Animal Reproduction Gynaecology and Obstetrics
42	Fertility management in crossbred cattle during heat stress by fortifying luteal function	M.V.Sc	Animal Reproduction Gynaecology and Obstetrics
43	Efficacy of medical management and surgical transcervical catheterisation for canine cystic endometrial hyperplasia	M.V.Sc	Animal Reproduction Gynaecology and Obstetrics
44	Evaluation of dietary protein level for growth in Kuttanad ducks	M.V.Sc	Poultry Science
45	Identification of snps of ovocalyxin-32 gene in iwn strain of white leghorn and its association with production traits	M.V.Sc	Poultry Science
46	Hypoglycaemic effect and toxicological evaluation of costus specious in diabetic rats	M.V.Sc	Veterinary Pharmacology
47	Hypolipidemic and antioxidant effects of *Averrhoa bilimbi* (Irumban Puli) fruit in rats fruit in rats fed with high fat diet	M.V.Sc	Veterinary Pharmacology
48	Occurrence of Campylobacter SPP in chicken egg production chain	M.V.Sc	Veterinary Public Health
49	Identification of critical control points in beef production chain with special reference to Listeria species	M.V.Sc	Veterinary Public Health
50	Exome wide DNA capture and next generation sequencing in Vechur cattle of Kerala	M.V.Sc	Animal Production & Biotechnology
51	Performance of malabari kids in broiler goat production system	M.V.Sc	Livestock Production and Management
52	Clinical evaluation of surgical denervation of coxofemoral joint and medical therapy for the management of hip dysplasia in dogs	M.V.Sc	Veterinary Surgery and Radiology
53	Clinico-biochemical and diagnostic imaging studies on gastric disorders in dogs	M.V.Sc	Veterinary Clinical Medicine, Ethics, and Jurisprudence

54	Clinical and radiographical evaluation of healing of fracture of long bones in goats treated with bioceramic implants	M.V.Sc	Veterinary Surgery and Radiology
55	Quality charcteristics of functional chicken cutlet incorporated with *Amorphophallus paeonifolius* (yam)	M.V.Sc	Livestock Products Technology
56	Quality characteristics of functional chicken nuggets incorporated with *Maranta arundinacea* (arrow root) and *Eleusine coracana (*finger millet)	M.V.Sc	Livestock Products Technology
57	Molecular characterization of ompc and ompf genes and evaluating their potential in the detection of *salmonella* spp. In chicken	M.V.Sc	Veterinary Public Health
58	Expression of vascular endothelial growth factor (*vegf*) and its biological receptor, *vegfr2* in granulosa cells of malabari goat	M.V.Sc	Veterinary Physiology
59	The effect of organic and inorganic zinc on gene expression of glucose transporter and growth in malabari kids	M.V.Sc	Animal Nutrition
60	Nutritive evaluation of cashew apple waste in broilers	M.V.Sc	Animal Nutrition
61	Evaluation of different extracts of *Phyllanthus emblica* (nellika) leaves for anti-dyslipidemic effect in albino rats	M.V.Sc	Veterinary Pharmacology and Toxicology
62	Detection of molecular characterization of emerging viral pathogens of pigs	M.V.Sc	Veterinary Microbiology
63	Biomechanical and histopathological assessment of *in vivo* remodelling response of decellularised bovine pericardium	M.V.Sc	Veterinary Pathology
64	Isolation and characterization of PDC-109 like protein(S) from Vechur bull seminal plasma	MSc.	Animal Production & Biotechnology
65	Mixed model repeated measures analysis of variance in animal experiments	MSc.	Animal Breeding, Genetics and Biostatistics
66	Forecasting the lifetime milk production of cattle	MSc.	Animal Breeding, Genetics and Biostatistics

67	Artificial neural network for weather forecasting	MSc.	Animal Breeding, Genetics and Biostatistics
68	Sample size determination for animal experiments	MSc.	Animal Breeding, Genetics and Biostatistics
69	Characterisation of solute carrier family11 member 1(SLC11A1) gene in native breeds of goat	MSc.	Animal Breeding, Genetics and Biostatistics
70	Isolation of theca cells from goat ovarian follicles and expression of CYP 19 gene in the isolated cells	MSc.	Veterinary Physiology
71	Assessment of carrier status of canine haemoparasites in common ixodid ticks of Thrissur.	MSc.	Veterinary Parasitology
72	Isolation of lactic acid bacteria with exopolysaccharide production potential and its suitability in fermented dairy products	MSc.	Dairy Science
73	Quality characteristics of low fat set yoghurt incorporated with solids from elephant foot	MSc.	Dairy Science
74	A study on evaluation of efficiency of methylene blue reduction test in assessing the microbial quality of milk	MSc.	Dairy Science
75	Preparation of low fat shrikhand from goat milk	MSc.	Dairy Science
76	Preparation of folate enriched yoghurt by employing lactic acid bacteria	MSc.	Dairy Science
77	Development and quality evaluation of synbiotic yoghurt prepared with oat flour and probiotic *Bifidobacterium bifidum*	MSc.	Dairy Science
78	Quality characteristics of low fat set youghurt incorporated with solids from elephant foot	MSc.	Diary Science
79	Identification and classification of indigenous forage in Thrissur district	MSc.	Livestock Production and Management
80	Socio economic profile and present management status of aviculturist in Thrissur district	MSc.	Livestock Production and Management

81	Detection of rickettsial pathogens of ticks of wild mammals and reptiles	MSc.	Centre for Wildlife Studies
82	Population status and nesting ecology of mugger crocodiles (*Crocodylus palustris.* lesson, 1831)	MSc.	Centre for Wildlife Studies
83	A study on microhabitat selection and distribution of bicoloured frog (*Clinotarsus curtipes. Lerdon*, 1854) tadpole within a hill stream with special reference to river continuum concept	MSc.	Centre for Wildlife Studies
84	Characterisation of mono amine oxidase a (mao a) gene,transcript fropm asian elephant (*Elephas maximus*): a possible candidate for risk taking behaviour	MSc.	Centre for Wildlife Studies
85	Floral diversity and animal utilization of forest marshy grassland in Wayanad wildlife sanctuary	MSc.	Centre for Wildlife Studies
86	Host species preference of fig wasps in south Wayanad forest division	MSc.	Centre for Wildlife Studies
87	Effect of edges on non-volant small mammals in two adjacent habitats of Wayanad wildlife sanctuary	MSc.	Centre for Wildlife Studies
88	Density and diversity of invasive plant species in different habitats of south Wayanad forest division	MSc.	Centre for Wildlife Studies
89	Dynamics of human elephant conflict and around Wayanad wildlife sanctuary	MSc.	Centre for Wildlife Studies

Development of ELISA based diagnostics for early detection of coproantigens in bovine amphistomosis

Sensitive method using coproantigen sandwich ELISA is the first of its kind standarised for early detection of amphistomosis which will help in timely treatment of the disease thus preventing economic loss to farmers. Nucleotide sequences of four species of amphistomes in the present study forms the first report which provides primary sequence data of the rDNA ITS2+region of the amphistome flukes.

Effect of incorporation of spent rosemary leaf meal as an ingredient in kid starter

An experiment in kids was conducted by incorporating 10 and 20 Per cent spent rosemary leaf meal in kid starter. From the results it could be concluded that spent rosemary leaf meal at 10 and 20 Per cent levels can be included in kid starter ration without any adverse effects.

Effect of incorporation of spent cumin seeds (*Cumin cyminum*) on growth performance of broiler chicken

An experiment was conducted to assess the effect of dietary incorporation of spent cumin (*Cuminum cyminum*) seeds on growth performance of broiler chicken. On summarizing the results, it can be concluded that incorporation of spent cumin seeds as unconventional feed up to 10 Per cent level can be recommended on growth performance of broiler chicken

Nutritional management of early weaned Large White Yorkshire piglets by functional amino acid supplementation

A study was conducted to evaluate the effect of functional amino acid supplementation in piglets weaned at 21 days of age. Piglets can be weaned at 21 days of age without compromising on growth rate. Supplementation of functional amino acids like arginine and glutamine are beneficial.

Effect of *Polyalthia longifollia* and *piper betle* on feed additive in broiler chicken

An experiment was conducted for a period of 42 days using two hundred numbers of day-old straight run commercial broiler chicks (Vencobb) to study the effect of dietary supplementation of *Polyalthia longifolia* (Aranamaram) and *Piper betle* (Vettila) leaf meal on growth performance, nutrient utilization and technoeconomics of production. On summarizing the results, it could be inferred that *Polyatlhia longifolia* or *Piper betle* leaf meal at 0.2 Per cent can be effectively used as feed additive

Evaluation of unconventional feed based complete rations for crossbred dairy cows in early lactation

A study of three month was conducted to assess the comparative evaluation of conventional and selected unconventional feed based complete rations in dairy cows on the basis of production performance and economics. Two isonitrogenous and isocaloric complete rations, T1 and T2 with out and with unconventional feed pineapple waste, respectively were formulated as per ICAR (2013). Twelve dairy cows with per day milk yield 10 litres of milk within ten days of lactation were randomly divided to two groups of six each, and allotted randomly to two experimental rations. The results suggests that both complete rations were performed well and were comparable, T2 (with pineapple waste) is better than T1 in milk yield (sig. at 1 Per cent level). Cost per kg milk production is less in T1 by Rs. 2.60. Pine apple waste can be used to replace 1/3rd of energy source in paddy straw based complete ration containing 35 Per cent NDF for cows. This type of complete feeds will help the farmers by reducing the cost of production especially in fodder deficient areas of Kerala. This may contribute great in promoting cattle rearing and improving the profit, even in the cities where fodder availability almost nil. On summarizing the results, it could be inferred that *Polyatlhia longifolia* or *Piper betle* leaf meal at 0.2 Per cent can be effectively used as feed additive.

Clinicopathological investigations on snake envenomation

Based on the findings of the study 20 minutes whole blood clotting test could be considered as an easy and reliable field level method to differentiate neurotoxic and haemotoxic bites along with clinical signs

Clinical investigations on oedema of limbs in dogs

Based on the study infectious diseases are predominant in causing oedema in dogs (ehrlichiosis, babesisosis, microfilariosis)

Clinical investigations on immune mediated haemolytic anemia in dogs

Based on the study it is concluded that all the dogs positive for haemoparasitic infection should be screened for IMHA and incorporate immunosuppressive therapy in positive cases along with specific therapy.

Clinicopathological evaluation of metabolic syndrome in obese dogs

Based on the study, Ezetimibe was considered as a better choice than Rosuvastatin in treating metabolic syndrome in dogs.

Hypolipidemic and antioxidant effects of *Averrhoa bilimbi* (irumban puli) fruit in rats fed with high fat diet

The current experiment was conduct to demonstrate the hypolipidemic and antioxidant properties of *Averrhoa bilimbi* (Irumbanpuli) fruit in rats receiving fat rich diet and to assess the level of expression of HMGCR gene in liver. Phytochemical screening and identification of functional groups present in *A.bilimbi*fruit using Fourier transform infrared (FTIR) spectroscopy was also carried out in the study. Forty eight adult male Wistar rats were randomly divided into six groups containing eight animals in each group. For all groups except normal control (Group 1) hyperlipidemia was produced by giving the fat rich diet for 15 days. Groups 2 remained hyperlipidemic throughout the experiment. Group 3,4 and 5 were fed with *A. bilimbi* fruit powder at doses of 125, 250, and 500 mg/kg body weight orally respectively from 16th day along with high fat diet for 30 days. Standard drug rosuvastatin was given orally to orally to Group 6 at a dose rate of 10mg/kg body weight from 16th day along with high fat diet. Blood was collected on days zero, 15, 30 and 45 and serum biochemical parameters namely total cholesterol, triglycerides, LDL-C, VLDL-C, HDL-C and atherogenic index were estimated. On 45th day, the animals were sacrificed and samples of liver and kidney were collected to estimate the antioxidant parameters like SOD, GSH and LPO. Treatment of *A. bilimbi* at various doses resulted in significant reduction of lipids namely total cholesterol, triglycerides, LDL-C, VLDL-C,A.I and elevated the HDL-C fraction in hyperlipidemic rats. Histopathological examination showed marked reduction in lipid droplets both in liver and kidney. The level of expression of HMGCR gene in liver was significantly down regulated compared to normal control group. Therefore, it could be concluded that A. *bilimbi* has hypolipidemic and antioxidant potential in high fat fed rats and might be due to down regulation of HMGCR gene in liver.

Antitumour properties of *Annona muricata* and *Curculigoorchioides* on induced mammary tumours in mice

The present study was performed to assess the in vitro cytotoxic potential of methanolic extract of seeds of *Annona muricata* and rhizomes of *Curculigoorchioides* in 4T1 mammary carcinoma cell line. Cytotoxic study of methanolic extract of seeds of *A.muricata* and chloroform extraction of methanolic extract of seeds of *A. muricata* (CMAM) exhibited reduction in cell viability as62.43±1.23 to 78.47±1.21 and 22.53±0.72 to 46.9±0.55 percent whereas methanolic extract of rhizomes of *C. orchioides*, chloroform fraction of methanolic extract of rhizomes of *C. orchioides*and water fraction of methanolic extract of rhizomes of *C.*

*orchioides*was found to be in the range of91.33±0.67 to 99.27±0.39,92.13±0.96 to 98.47±0.35,92.13±0.72 to 98.43±0.58 percent respectively. CMAM was selected as the best fraction compared to others as it showed cytotoxicity. Phytoconstituent evaluation has shown the presence of various annonaceousacetogenins. Pharmacological effect of CMAM was elucidated by invitro employing hemolytic assay, antioxidant assay, MTT assay, Sulphorhodamine B (SRB) assay, cell morphological assessment was done using acridine orange ethidium bromide (A0/EB), Hoechst 33258 and 4'6-diamidino-2-phenylindole (DAPI), intracellular reactive oxygen species assay, DNA fragmentation assays using NanoDrop™, terminal deoxynucleotidyl transferase dUTPnickendlabeling (TUNEL) assays. Single oral dose of CMAM shows moderate toxicity with LD_{50} of 310mg/kg. CMAM at the dose rate of 15.5 mg/kg and 31mg/kg showed decrease in mean tumor weight, serum tumor markers, increase in body weight and antioxidant enzyme levels, reduced cellularity, cytoplasmic vacuolation with no toxic effects. In vitro and in vivo studies revealed the role of anti-apoptotic gene Bcl2. Thus it was suggested as an ideal candidate for the treatment of mammary tumors.

Occurrence of *Campylobacter* spp. in chicken egg production chain

A total of 450 samples comprising of cloacal swab, feed, litter, wash water, wash cloth, plastic tray, filler flat, air, water, hand wash of handling and sales personnel and eggs were collected from egg production chain University Poultry and Duck Farm (UPDF), Mannuthy, Thrissur. 120 chicken eggs were also collected from the retail markets during monsoon and post monsoon season. The overall occurrence of *Campylobacter* spp. in UPDF, Mannuthy was found to be 2.89 per cent. A high occurrence of *Campylobacter* spp. was found in cloacal swab samples during monsoon (66.67 per cent) than post monsoon (20 per cent). The occurrence of Campylobacter spp. in retail eggs was found to be 6.67 Per cent during monsoon season. of the 17 isolates, 14 were identified as *C. jejuni* and three as mixed infection caused by both *C. jejuni* and *C. coli*. The confirmed isolates were 100 Per cent sensitive to Amikacin, Chloramphenicol, Imipenem, Kanamycin, Moxifloxacin, Neomycin, Netillin, Nitrofurantoin, Sparfloxacin, Streptomycin and Tobramycin

Identification of critical control points in beef production chain with special reference to *Listeria* species

Out of a total of 1140 samples consisting of dung from cattle before slaughter, knife swabs, carcass swabs before and after evisceration, cutting table surface swabs, operator hand wash, beef, air, water and effluent samples were collected from beef slaughter chain, 3.77 Per cent samples were positive for *Listeria* spp. including *L. monocytogenes, L. innocua, L. welshmeri*

and *L. ivanovii*. Two samples were positive for *L. monocytogenes*. The important points of contamination were found to be dehiding and evisceration.

Epidemiological surveillance of enterohaemorrhagic *Escherichia coli* (EHEC)

The occurrence of EHEC in different samples viz., raw and pasteurized milk, meat, fruits vegetables, cattle dung and human stool were assessed. The positive isolates were screened for the presence of virulent genes. Quantification of organisms in positive samples were done using Real- Time PCR assay. Occurrence of EHEC in positive samples were correlated with that of environmental samples.

Nutritional management of early weaned large white Yorkshire piglets by functional amino acid supplementation.

A study was conducted at Centre for Pig Production and Research, Mannuthy to study the effects of dietary supplementation of functional amino acids in early weaned Large White Yorkshire piglets on growth performance, nutrient digestibility, villus height, gut health and techno economics of production. Forty LWY piglets of either sex, weaned at three weeks of age belonging to Centre for Pig Production and Research, Mannuthy were used as experimental animals. The piglets were divided into four groups as uniformly as possible with regard to age, sex and weight and were randomly allotted to four dietary treatments. There were five replicates for each treatment with two piglets in each replicate. Piglets were fed with pre-starter ration (22 Per cent CP and 3200 kcal ME) upto body weight of 5.5 kg and starter/creep ration (20 Per cent CP and 3200 kcal ME) from 5.5 to 18 kg body weight. Ration formulation was be as per NRC (1998). The four dietary treatments are given below:- T1 -Control ration (without amino acid supplementation).T2- Control ration + 0.7 Per cent Arginine + 1 Per cent Glutamine.T3- Control ration + 0.35 Per cent Arginine + 0.5 Per cent Glutamine.T4- Control ration + 0.18 Per cent Arginine + 0.25 Per cent Glutamine

All the animals were maintained under uniform management conditions. The animals were fed twice daily *adlibitum* for one hour and the balance of feed was collected and weighed after each feeding. The record of daily feed intake was maintained throughout the experimental period upto attainment of 18 kg body weight. The bodyweight of all the experimental animals was recorded weekly. At the end of the feeding trial a digestibility study for three days was conducted in all the experimental animals by total collection method. For evaluation of intestinal development, one piglet per treatment group was slaughtered at the end of the experiment and the small intestine was collected for histological measurements. The samples of feed, faeces and small intestine collected in this study are undergoing analysis.

Effect of weaning age on performance of Large White Yorkshire pigs

A study was conducted at Centre for Pig Production and Research, Mannuthy to evaluate the effect of weaning on the performance of LWY pigs. 18 LWY sows in last week of gestation were selected, weighed and randomly assigned into three groups of T1, T2 and T3. Sows in T1, T2 and T3 were weaned at 42-, 35- and 21-day post-farrowing respectively. Piglets in T1, T2 were fed with creep ration containing 20 Per cent CP and T3 with 22 Per cent CP. T2 and T3 feed were supplemented with lactose @ 10 Per cent and 15 Per cent inclusion level respectively. Sows were fed as per the feeding plan existing in farm. Average daily feed intake of piglets, body weight of sows and piglets at fortnight interval was recorded. Visual fecal score was done for a period of 10 days post weaning to study the occurrence of diarrhea. Weekly Body Condition Score (BCS) of sows was taken till weaning. Piglets of T2 and T3 were also fed with same creep ration as that of T1 after attaining the age of 42 day. Behavior of sows and piglets was also recorded and evaluated as part of the study. Feed samples of all three treatments were collected for analysis.

Molecular detection of Rotavirus in poultry of Kerala

One hundred and forty three fecal samples were collected from diarrhoeic poultry and screened for the presence of avian rota virus by RT- PCR and RNA- PAGE. Five samples were found to be positive in RNA- PAGE revealing Group A rotavirus electropherotype. Eleven samples were detected positive for Group A rotavirus in RT- PCR and thus, RT-PCR was found to be a rapid, sensitive and specific technique for the routine diagnosis of avian rota virus infection in poultry.

Diagnosis of leptospirosis in canine blood and urine using Real time-PCR

Seventy five samples (sera, whole blood and urine) were collected from canine leptospirosis cases and were tested using MAT, PCR and real-time PCR, respectively. The sensitivity, specificity and accuracy of PCR and real-time PCR with MAT were compared. The real-time PCR assay standardized in the study was found to be more sensitive than the conventional PCR. The diagnosis of leptospirosis can be made quicker and quantification of the organisms in the sample is possible, which would aid in more efficient management of leptospirosis.

Identification and protein profiling of the bacterial isolates from corneal diseases in dogs

Staphylococcus aureus, *Corynebacterium xerosis* and *Klebsiella pneumoniae* were isolated from corneal diseases in dogs. A duplex PCR was developed separately for simultaneous detection of *Staphylococcu*s and *Klebsiella* and for *Corynebacterium* and *Klebsiella.* Duplex PCR offers a rapid method for the simultaneous detection of the pathogens associated with

corneal disease which in turn will help to select a suitable strategy for the treatment and control of the condition.

Development of recombinant OmpF proteinbased indirect ELISA for the detection of *Salmonella* antibodies in poultry

Salmonellosis isone of the most frequently reported poultry disease worldwide. The study developeda highly promising and reliable ELISA based diagnostic tool for detection *Salmonella* antibodies using rOmpF proteinand is regarded as safe antigento be used for sero-diagnosis.

Molecular detection and characterization of common enteric bacterial pathogens of public health significance

The infectious diarrhoea due to enteric bacterial pathogen leads to high mortality and morbidity among infants and young animals. The study was carried out to detection and characterize the enteric bacterial pathogens of public health significances from diarrhoeal stools of infants and faecal samples of young animals, foods (milk and meat) and environmental (soil and water from residential areas) samples from three taluks of Wayanad district. The occurrence enterohaemorrhagic *E. coli*, *S.* Typhimurium, *Shigella*, *Y. enterocolitica*, *V. cholera*, *L. monocytogenes* and MRSA was evaluated. Regular surveillance of enteric bacterial pathogens coupled with their antibiogram studies is necessary for designing prevention and control strategies for enteric bacterial pathogens.

Identification of restricted ovulator in the IWN and IWP strains of white leghorn.

Selection based on markers can be used for more accuracy and efficiency to achieve genetic improvement.The study revealed that the SNPs of ovocalipin -32 gene was associated with production traits in layers. The SNPs C 381 G>C was significantly associated with body weight and shell thickness. The SNP C494 A>C was significantly associated with egg number, age at sexual maturity and egg weight at a later stage. Hence these two SNPS can be used as markers in selection.

Determination of protein levels of growth in Kuttanad Ducks.

The dietary protein requirement for growth in Kuttanad ducklings was studied using feed of 2800 ME and crude protein content of 16,18,20 and 22 percent. The results indicated that ducklings receiving 20 percent crude protein showed better growth performance than the other treatments. The feed efficiency was poor at the 12^{th} week. The processing yield at 12^{th} week was also similar to that at 8^{th} week.

Molecular detection of caprine theileriosis and anaplasmosis

Identified *Theileria ovis, T.lestoquardi* and *T.luwenshuni* in goats in Kerala. Molecular survey revealed carrier status of theileriosis and anaplasmosis among goats of Kerala. Confirmed the presence of these Theileria species in ticks of goats for the first time in south India

Biomechemical and histopathological assessment of *in vivo* remodeling response of decellularised bovine pericardium

The biomechanical properties and histopathological response of decellularised and gluteraldehyde treated bovine pericardia were studied before and after implantation. The materials were subjected to biomechanical testing and properties such as load at maximum load, tensile strength, strain at maximum load and Young's modulus. The decellularised bovine pericardium significantly differed and found advantageous with respect to the mechanical properties over gluteraldehyde treated implants. Both type of implants were largely accepted by all the experimental animals which was indicated by increased neovascularisation, fibroblast proliferation and collagen deposition. After evaluating mechanical strength before and after implantation and histopathological response to both type of implants, it was concluded the decellularised bovine pericardia as a better biomaterial than gluteraldehyde treated material that can be used as a biological scaffold.

Exome wide DNA capture and next generation sequencing in Vechur cattle of Kerala

The study was undertaken to assess the genetic variants present in the exonic regions of Vechur cattle by exome wide DNA capture and Next Generation Sequencing technology. When the sequenced reads were mapped to the *Bos Taurus* reference genome downloaded from Ensembl 17,16,847 variants (15,78,749SNPs and 1,38/,098 indels) were identified. Comparing these variants with dbSNP database revealed 3,59,034 novel variants in Vechur cattle. The annotations of the 1,11,500 variants identified in the exonic regions, confirmed that 93,294 variants were located in the coding region, 2,558 variants in non- coding genes,495 variants in ncRNA and 15,153 variants in the un-translated regions. The functional annotation of the variants in the exonic regions identified 62,693 silent, 37,564 non-synonymous,1,345 frame shift,799 inframe,322 nonsense,67 start loss and single stop loss variants.

In order to validate the NGS data, three missense novel SNPs identified in two innate immune genes were selected for genotyping 50 Vechur animals by PCR-RFLP techniques. The SNP (A-t Transvesion) located at 15241430th position of chromosome 27, which is 1348th position of exone 4 of *Toll like receptor 3* genes, was found to be polymorphic with two genotypes AA and AT. The SNP (G-A transition) identified at 35815099th position of

chromosome 28, that is 21st position of exon 1 of *surfactant protein D* gene was polymorphic with two genotypes GG and GA. The SNP (A-C transversion) at 35824058th position of chromosome 28, that is 52nd position of exon 7 of *surfactant protein D* gene, was found to be polymorphic with three genotypes AA, AC and CC.

Augmenting reproductive efficiency in post parturient does with intravaginal progesterone sponges, prostaglandin F2a and gonadotropin releasing hormone

With the objective of studying the effect of intravaginal progesterone sponges, prostaglandin F 2α and gonadotropin releasing hormone for improving the reproductive efficiency in postparturient does the study was carried out at University Sheep and Goat Farm, Mannuthy. A total of 70 postparturient healthy goats that had kidded at least twice were selected randomly and classified into seven groups as Group I, Group II, Group III, Group IV, Group V, Group VI and Group VII. All the animals were weaned on day 30 postpartum and the treatment were started on day 31 postpartum. The Group I animals were subjected to Cosynch treatment, Group II animals to the Modified Cosynch, Group III as the Ovsynch group, Group IV as Modified Ovsynch, Group V as control, Group VI as GnRH single injection and Group VII as the continuous buck exposure group. All the animals in treatment groups (Group I to IV, VI and VII) were inseminated at observed oestrus post treatment and reinseminated 24 after the first insemination. The control animals were inseminated at their first postpartum oestrus after 30 days of weaning. Blood and exfoliative vaginal cytology was collected from animals in Group I to IV) on the days of treatment (day 0), day 7, day of observed oestrus, day 10 and day 21 post insemination for the estimation of serum progesterone level and to record the cell pattern on different days. However, in Group V, VI and VII, blood and exfoliative vaginal cytology were taken on day of observed oestrus, day 10 and day 21 post insemination. The animals were also subjected to ultrasound examination on day of treatment (day 0), day of observed oestrus and for pregnancy diagnosis on day 25 and day 40 post insemination. Data obtained was subjected to statistical analysis. With regard to oestrus response, out of the ten animals in Group I, nine animals (90 per cent) responded to the treatment. In Group II, III and IV the oestrus response were 80, 60 and 70 per cent. In the Group V, VI and VII, the oestrus response was 100 per cent. The mean time taken for the onset of oestrus in Group I, II and IV were 43.67±3.62 h, 44.88±1.02 h, 25.33±0.74 h, respectively. However, the onset of oestrus were longer in Group III (8-9 days), Group V (within 7 days), Group VII (3-10 days) and in control group the first postpartum oestrus was found between 48-72 days postpartum. The intensity of oestrus, behavioural and physiological signs was found lowest in Group IV and

highest in Group V, VII and VII. The total mean duration of oestrus was found to be 26.49±0.95 h in the experimental groups and no significant difference was found between groups. On exfoliative vaginal cytology, during oestrus the predominance of superficial cells were observed whereas during luteal phases there was predominance of intermediate cells. With regard to ovarian ultrasonography, the average length and breadth of the right and left ovary were 1.42±0.03 cm and 1.55±0.04 cm, 1.05±0.02 cm and 1.05±0.03 cm respectively. The does that possessed dominant follicle above 0.7 cm diameter at the time of oestrus had a higher chance for becoming pregnant. The serum oestradiol was found similar between groups. However, with regard to overall progesterone profile in different groups, there was significant difference in progesterone level on different days within groups. The progesterone profile of goats in Group II, differed significantly between conceived and non-conceived animals on the day of treatment, day 7, da10 and day 21. However in Group VI and VII, a significant difference was obtained on day 10 and day 21 between conceived and non-conceived animals. In the present study, those animals that had a lower progesterone level (<1ng/ml) on the day of observed oestrus had a higher chance to become pregnant. The ultrasonographic studies using Real time B-mode ultrasound revealed the earliest detection of fluid filled structure with embryo in uterus on day 20 post insemination. The heartbeat of the developing embryo was first recorded on day 24 post insemination. By day 35, the foetal number could be assessed and the presence of placentomes were detected on day 45 post insemination by transrectal ultrasonography.

Evaluation of semen preservation protocols and artificial insemination techniques to augument fertility in Malabari goats

The study was undertaken to identify suitable extenders for chilled and frozen preservation of Malabari buck semen and to further identify the ideal site of deposition and frequency of artificial insemination (AI) required for chilled and frozen semen. The study was conducted in two phases. The first phase involved comparison of different extenders for chilled and frozen semen preservation of Malabari buck semen. Spermatozoa progressive motility, viability, abnormality, acrosome integrity, hypo osmotic sperm swelling response and malondialdehyde as an indicator of reactive oxygen species mediated damage were assessed for both chilled and frozen modes of sperm preservation. Egg yolk - citrate, Tris - egg yolk and Goat milk based extenders were compared for their efficiency in chilled semen preservation of buck semen (n = 20). The Tris – egg yolk based extender was found optimum based on analysis of semen quality parameters after 24, 48 and 72 h of preservation. For cryopreservation, Soybean lecithin

based extender (Bioxcell), Skim milk based, Egg yolk based (Triladyl) and Tris based extenders were used for evaluation (n=20). The Triladyl extender was found to be the best suited for Malabari buck semen cryopreservation after analysis of pre freeze and post thaw semen characteristics. Phase two involved fertility studies by artificial insemination involving semen processed and preserved by the selected extenders. The inseminated does were classified based on the semen used (type of preservation), site deposited (os cervix/ deep cervical/ intra uterine) and the dose of AI (single/ double on consecutive days) to form 12 groups, each having at least 10 animals each. The non return rate at 45 days and conception rate at 45 days using ultrasonography were studied. Additionally, the kidding rate and litter size were also noted. It could be recommended that for chilled semen and cryopreserved semen, insemination at the deep cervical region was better. Better conception rates were obtained with cryopreserved semen when the AI was carried out with two doses of semen on consecutive days of oestrus

Survival rate of immature and *in vitro* matured bovane oocytes vitrafied using cryoloop method

Successful cryopreservation of oocyte using vitrification ensures the availability of large number of oocytes for in vitro maturation (IVM) and in vitro fertilization (IVF). The present study was carried out to evaluate effect of meiotic stage on survival rate of bovine oocytes after cryoloopvitrification and to assess viability using morphological evaluation and trypan blue staining. Ovaries of 36 slaughtered cattle were selected and randomly allotted to three groups. Oocytes were recovered by follicular aspiration. Half of the group I culture grade oocytes (n=44) were subjected to trypan blue (0.05Per cent) staining for viability assessment and aceto-orcein staining for evaluation of nuclear status. Culture grade oocytes in group II (n=38) were matured in vitro after cryoloopvitrification and culture grade oocytes in group III (n=39) were vitrified after in vitro maturation. A total of 241 oocytes were aspirated and yield of immature oocytes per cow was 6.69. Trypan blue staining of culture grade oocytes obtained by morphological evaluation in group I yielded only 81.82 Per cent live oocytes. Aceto-orcein staining of group I culture grade oocytes revealed that 54.44 Per cent of oocytes were in GV stage. Morphological survival rate of mature vitrified oocytes in group III was higher than immature vitrified and matured oocytes in group II (66.67 Per cent vs 52.63Per cent). Cumulus expansion, polar body extrusion and trypan blue dye exclusion rate were also higher in group III, whereas nuclear maturation rate was almost similar. The meiotic stage at which cryoloopvitrification was carried out had no significant influence on survival rate, viability, cumulus expansion, polar body extrusion and nuclear maturation rate of bovine oocytes. Hence

immature bovine oocytes can be preserved using cryoloop technique, where facilities are not available for IVM. Compared to morphological evaluation, trypan blue staining technique was found to be more reliable for assessing oocyte viability.

Endometrial cytology in postpartum cross-bred dairy cows and its correlation with fertility

The study was undertaken with the objectives of characterizing endometrial cytology in postpartum dairy cows and determining the prevalence of subclinical endometritis with reference to its effect on subsequent fertility. The study was conducted in KVASU farms at Mannuthy and Thumboormuzhi. Twenty-four apparently healthy postpartum cross-bred dairy cows were subjected to detailed clinico-gynaecological and vaginoscopic examination. Endometrial sampling was done using uterine cytobrush (UC) and uterine lavage (UL) on 30, 40 and 50 days postpartum (DPP). The mean (±SE) Per cent of polymorphonuclear (PMN) cells by UC were 7.53 ± 1.56, 3.23 ± 1.75and 1.35 ± 2.21 in normal group and 9.80 ± 1.84, 10.20 ± 2.07and 17.01 ± 2.61in endometritis group on 30, 40 and 50 DPP, respectively. Whereas by UL, the PMN cells Per cent were 7.64 ± 1.76, 4.92 ± 1.41 and 1.21 ± 1.74 in normal group and 11.20 ± 2.08, 14.60 ± 1.67 and 21.70 ± 2.06in endometritis group, respectively, on 30, 40 and 50 DPP. In normal group, significant difference between UC and UL on both 30 and 40 DPP. In the endometritis group, significant difference was observed between UC and UL on 30, 40 and 50 DPP. The endometritis group cows were treated with intrauterine infusion of 100 µg *E. coli* lipopolysaccharide (LPS). The mean (±SE) pH of vaginal discharge in normal and endometritis group was 7.17 ± 0.15 and 8.20 ± 0.11, respectively and pre and post intrauterine treatment of endometritis group was 8.20 ± 0.11 and 7.40 ± 0.12, respectively. The conception rates after first, second and third service (overall) observed in this study were 42.86, 64.29 and 78.57 Per cent in normal group; 20, 50 and 60 per cent, respectively, in endometritis group after LPS treatment. From the results of the study, it could be inferred that endometrial cytology could be used for a presumptive diagnosis of SCE. Metricheck and disposable vaginal speculum are recommended for routine diagnosis of endometritis. The prevalance of endometritis in KVASU farms was found to be 41.67 per cent. E.coli LPS has a reasonable therapeutic effect in the management of SCE and thereby increase the conception rate.

***In vitro* fertility assessment of frozen bovine spermatozoa as influenced by breed and season**

Frozen semen of four animals of each breed- crossbred Holstein Friesian (CBHF-Holstein Friesian X Gir), crossbred Jersey (CBJY- Jersey X Red Sindhi), Vechur (VR) and Kasargod Dwarf (KD)- produced from August 2015 to May 2016 during South west monsoon, Post-monsoon, Winter and Summer were procured from semen bank of KLDB, Dhoni. Minimum two samples of each bull (n=16) processed during each season were subjected to different in vitro fertility tests like routine semen quality tests (post-thaw motility, viability and abnormality), sperm function tests (acrosome integrity and hypo-osmotic swelling test), fertility tests (bovine cervical mucus penetration test and in vitro capacitation test with heparin). In vitro capacitation was assessed indirectly by inducing acrosome reaction using Lysophosphatidyl choline and it was evaluated by Trypan Blue-Giemsa staining. Statistical analysis of collected data revealed that season had significant (P<0.05) effect on post-thaw motility, sperm abnormality, response to hypo-osmotic swelling and induced acrosome reaction whereas, breed had significant (P<0.05) effect only on post-thaw motility and bovine cervical mucus penetration distance of frozen bull semen. Among four seasons, winter was found to be better for frozen semen production and among breeds CBHF and KD semen exhibited better frozen semen quality than that of other two breeds. The crossbred semen samples studied did not show any significant reduction in quality during summer season in midlands of Kerala and also they showed better performance during winter compared to the indigenous cattle. This may be attributed to the combination of genetic makeup in the crossbreds. But during humid seasons, monsoon and post monsoon, frozen semen of indigenous bulls were better in quality. The results of present study indicate that crossbreeding policy of cattle in Kerala can be continued by employing the most adaptable superior bulls along with the conservation of indigenous animals to overcome the effects of global warming. Also distribution of frozen semen can be reviewed with alterations in supply chain by substituting quality semen produced during favourable seasons for AI during adverse climatic conditions based on the geographic location to enhance the fertility in female animals.

Fertility management in crossbred cattle during heat stress by fortifying luteal function

A study was conducted among crossbred cattle with the objective to assess the effect of heat stress on fertility and also to evaluate the effect of fortifying luteal function by using hCG, on fertility. Apparently healthy cycling crossbred cows detected in oestrus were utilized for the study. The experiment was carried out at ULF & FRDS, Mannuthy in two phases viz. period of the year with average low THI (November- January) and period of the year with

average high THI (March –May). In each phase animals were divided randomly in to treatment and control groups of 10 animals each. Cervical mucus was collected during oestrus for study of rheological properties and BCMPT; artificial Insemination (AI) was done in all the animals and those in treatment groups were administered 1500 IU hCG on day 6 post AI. Blood samples were collected on day 6, 12 and 24 post-AI for progesterone assay and pregnancy was confirmed by rectal examination on day 45 post AI in non-returned animals. The average THI of the station was calculated as per LPHSI (1990) formula using meteorological data from CAADECCS, Mannuthy. Average values during low and high THI phase were 79 and 83.5 respectively. Mean duration of standing oestrus in low THI period and high THI period did not differ significantly (24.67 ± 0.98 vs24.70 ± 1.17 h). Contrary to the previous reports, intensity and duration of oestrus was not affected by heat stress. Transparency of oestrual mucus was not affected by heat stress Mean spinbarkeit value during heat stress was significantly higher, which was contrary to previous reports. Mean spinbarkeit value was significantly higher among conceived than non-conceived animals. Majority of animals had typical fern pattern in both the phases and heat stress did not seem to influence the fern pattern. Per cent of animals exhibiting typical fern pattern was more among conceived animals than non-conceived animals. Cervical mucus penetration distance was not affected by heat stress, but it was significantly higher among conceived animals than non-conceived. Though there was no significant difference between phases regarding progesterone level on 6thand 12thday post AI, concentration on 12thday during comfortable period was higher than that recorded during heat stress. Administration of hCG had no significant effect on subsequent luteal function Mean serum progesterone level in both the phases was significantly higher in conceived animals compared to non-conceived animals on 6th, 12thand 24thday post. The pregnant animals in both phases had mean serum progesterone levels of >2ng/ml on day 24. The conception rate was better in low THI phase than during high THI phase (37.7 vs 25 per cent). Conception rate was higher in treatment group than control (40 vs 25 per cent). Even though hCG administration did not significantly increase progesterone level in treated animals, better conception was recorded among treated animals. Also, better conception was recorded during low THI phase (comfortable period).

Efficacy of medical management and surgical transcervical catheterisation for canine cystic endometrial hyperplasia

As a part of the study, a preliminary survey was conducted to investigate the occurrence of cystic endometrial hyperplasia (CEH) in bitches from 2013 to 2015.Twelve bitches under six years of age with CEH were included in the study and grouped into two. Group I animals were subjected to medical management (mifepristone-cabergoline-prostaglandin combination) and Group II animals underwent surgical trans-cervical catheterization. Physical, physiological, haematological and biochemical parameters and ultrasound characters of the affected uterus were studied and compared. Progesterone concentration was estimated at weekly intervals till clinical recovery. Preliminary survey revealed that CEH was frequently reported in the Labrador (20.44Per cent) and Rottweilers (19.95Per cent). A negative correlation was observed between age of animals and the number of cases reported with CEH. Higher percentage of occurrence of CEH was in the age group of two and three years (27.1Per cent). All clinical signs subsided 14 days after commencement of treatment in both the groups. The major micro-organism obtained from vaginal swab was E. coli (59Per cent). Leucocytosis was observed in animals in both the group (range 16.5-44.210 3 /mm 3) with neutrophilia (range 77-91Per cent), lymphopenia and normocytic normochromic anaemia before treatment and values were in normal physiological range by Day 21 in Group I and by Day14 in Group II. Elevation in BUN and creatinine was observed in both the groups before treatment. Even though the level of progesterone was not abnormally high in CEH affected animals with respect to the stage of oestrous cycle however, it reduced to basal levels after treatment. Ultra sonographically mean thickness of uterine wall, trace area and diameter of largest sacculation were reduced after treatment and became normal by Day 14. Based on the clinical recovery the surgical group had an earlier recovery though it involved a time consuming surgical procedure. Till detailed studies on conception rates are available both surgical and medical management to retain breeding potential have to be considered positively.

Economics of dairy farming systems in Kerala

The present study was conducted to study the management practices, trends and issues of various dairy production systems in Kerala, to study the variation in cost and profitability of milk production under different dairy production systems, to assess the influence of various assistance schemes in the economy of milk production and to evaluate the present milk pricing policy of Kerala and suggest modifications. The study was carried out selecting 350 farm households belonging to three groups based on number of milch animals. The study covered

five agro climatic regions, five districts and 10 blocks to represent the state. The stratified random sampling method was used for selection of study area and samples.

In small, medium and large farms, the herd size was 3.13 ± 0.08, 9.52 ± 0.3 and 36.38 ± 3.65 respectively. The investigation on investment on capital assets showed that, the major share of capital expenditure was on milch animals followed by buildings. The labour use pattern in the small (99.4 per cent) and medium (70.9 per cent) farms were dependent solely on family labour. While in large farms, there was more (52.0 per cent) dependence on paid labour. The adoption index of recommended management practices was highest (90.04 per cent) in large farms followed by medium (89.40 per cent) and small farms (84.36 per cent). The wet average (l/day) was 8.98, 8.00 and 10.00 in small, medium and large farms respectively. The dry average (l/day) was 8.13, 6.65 and 7.86 in small, medium and large farms. The average daily price/litre realized from society was Rs.29.43, 29.79 and 29.64 in small, medium and large farms respectively. The major share of milk produced in small, medium and large farms were sold to society. A significant association was observed between adoption class and assistance class. In all farm types, majority of the farms showed medium level dairy farm performance. High price of concentrate feed was the major constraint in feeding. In all types of farms, infertility was the major breeding constraint. On milch animal basis, the average cost/litre of milk (cost B) was 32.51, 34.29, 29.08 and 32.29 in small, medium, large and overall farms respectively The average cost per litre of milk after deduction of imputed family labour cost (cost A) was 22.02, 26.33, 27.08 and 24.34 (Rs/litre) in small, medium, large and overall farms respectively. On milch animal basis, the net return per day per milch animal was Rs.23.34, 10.39, 27.74 and 20.58 respectively in small, medium, large and overall farms respectively. The net return after deduction of imputed family labour cost was Rs.92.59, 52.42, 43.12 and 70.51 in small, medium, large and overall farms respectively. The estimated milk production function for different farms revealed that overall farms showed positive and highly significant effect of concentrate and adoption index and significant effect of total roughage ($P < 0.05$) with R2 value as 67.0 per cent. The marginal Value Products (MVP) of inputs in milk production for different farms showed that, in small farms the MVPs of two inputs viz. roughages and labour were significantly less than unity, signifying over utilization of these inputs. The MVP value of concentrate was significantly higher than unity indicating their underutilization in milk production process. The mean technical efficiency in small, medium and large farms was 99.80, 83.22 and 99.96 Per cent respectively. A critical analysis of present milk pricing policy was done suggesting modifications and derived a new formula for pricing of milk considering significant factors.

Swot analysis of the duck farming system towards its sustainability in the Kuttanad region of Alappuzha district

The present study titled SWOT analysis of duck farming system towards its sustainability in Kuttanad region of Alappuzha district was undertaken among a sample duck farmers of Kuttanad region of Alappuzha district. The objectives were to study the profile of duck farmers, strengths, weaknesses opportunities and threats of duck farming vis-à-vis solutions for sustainability.

The profile of the duck farmers of Kuttanad revealed that a majority of them were of old age with more than 10 years of experience in duck farming. Most of them had school level education and were literates. It was seen that both men and women were involved in duck farming chores apart from engaging hired labourers. Regarding employment generation it was seen that various rearing systems in vogue viz. back yard, nursery and semi-intensive rearing, the duration of employment was 23, 82 and 77 days/ annum respectively. Nomadic system provided full time employment for farmers and labourers throughout the foraging season. Average annual income generated under the various systems of rearing viz. backyard, nursery, semi-intensive and nomadic systems were Rs; 5,036.55, Rs. 93,077.65, Rs.2,30,119.00 and Rs. 3,50,750 .00 respectively. The communication behaviour of the farmers was obviously low as revealed from their extension agency contact, mass media exposure and training exposure. Even as the knowledge of scientific duck farming was medium, the attitude towards the same was favourable. Regression analysis indicated that six Per cent variation in attitude was explained by family income and extension agency contact. But, family income was negatively and significantly correlated with attitude even when mass media utilization was positively and significantly correlated. With respect to knowledge, flock size, land holding, hired labour utilization and extension agency contact were significant in explaining 22.1 Per cent variation in the duck farmers knowledge of scientific duck farming. Moreover, knowledge was positively and significantly correlated with flock size, land holding, income from duck farming, family income, hired labour utilization, extension agency contact and mass media utilization.

The SWOT analysis of duck farming system revealed that the most important strengths of duck farming system were social features, followed by product feature, production system features and the bird features in that order while the weaknesses were bird features, social features and production system features in that order. Among the various categories of external factors of duck farming system, market for current products and market possibilities were the important opportunities. Major threats were social features, policy features and input supply chain features. Strategies formulated from SWOT matrix to attain sustainability of duck

farming system in Kuttanad were those focusing on maximizing strengths vis-a-vis exploiting the opportunities. So also maximizing the advantages of the opportunities to overcome the weaknesses.

Delphi analysis brought out the constraints as well as their solutions in the process of arriving at strategies for ensuring sustainability of duck farming in Kuttanad. SWOT analysis and Consensus Delphi method were in fact employed to work in tandem and as research method triangulation towards arriving at the strategies for attaining sustainability in duck production. Health care management, general management, social, economic, marketing, policies and environmental constraints were found to be major areas of constraints. The solutions for these constraints gave an insight into the strategies to be adopted for attaining sustainability. These strategies were discussed from three important perspectives of sustainability analysis viz. practices to be stopped, practices that can continue and new practices to be taken up. The practices to be stopped were the practices of keeping unvaccinated birds, taking them out for foraging, introducing unvaccinated new birds into the flock indiscriminate use of antibiotics, farmer-vaccinators, large scale conversion of paddy fields, extensive burning of the stubble, the excessive dependency on indigenous knowledge, over-dependency on hired labour, availing credit from private money lenders, unhygienic waste disposal and indiscriminate use of chemicals in agriculture. The practices that can continue were the training initiatives in duck farming, promotional programmes on organic farming and integrated farming, supplying vaccines and essential medicines through the local veterinary institutions, maintaining duck farmer registry and strengthening the government hatcheries. The new practices to be taken up were mandatory vaccination , strict surveillance and monitoring, awareness creating campaigns, forming a labour pool participating those persons willing to be labourers, including duck farming under MNREGA, entrepreneurship development programmes for youths, promotional programmes on nomadic duck farming, forming APCOS model co-operatives, setting up feed mixing units, quality control labs at regional level for testing feed, subsidized duck feed to farmers, implementing insurance schemes appropriate to different systems of duck rearing, initiatives for adequately subsidized loans with minimum interest and sufficient repayment period, organized market outlets, marketing of value added products, branding of native products, safe and scientific waste disposal practices, converting farm and slaughter waste into bio-fertilizer, licensing of farms, slaughter houses and the connected selling outlets and establishing a full-fledged disaster management cell.

Intellectual property management systems in the south zone animal science research institutes of ICAR

The study analysed the extent of institutionalization of IPR regime in the four south zone animal science research institutes of ICAR. An inventory of intellectual property management practices developed for this purpose was used to elicit responses from the Institute Technology Management Unit (ITMU) authorities. In the IP commercialization realm, one third of the practices only was followed by the institutes, in general. The study also explored scientists' perception about potential of IPR enforcement in the institutional technology management, based on the responses of the scientists to a scale developed for this purpose. Out of eighty-three scientists working in the institutes, seventy-two responded. More than three fourth of them had high level of perception. The strengths, weaknesses, opportunities, and threats pertaining to the Intellectual Property Management Systems (IPMSs) of the institutes were analysed based on the responses of the scientists and other selected stakeholders. SWOT analysis, enriched with weighted SWOT matrix technique brought out specific strategies to improve and develop the IPMSs further. The findings implied that employing market watch and market intelligence interventions was essential to promote commercial viability of technology products. The study recommended strategic emphasis on IPR and technology management training for the scientific community, fool proof in- house patent watch mechanism, prioritization of trademarks and Geographic Indications as commercialization tools, development of PPP commercialization models, strengthening of business incubation facilities for start-ups, and measures to ensure freedom to operate through centralized procurement and in-licensing of proprietary research tools as envisaged by ICAR policy framework. Mooting policy discussions in academic spheres on IPR related techno legal and ethical issues including patents blocking research, broad based patents impacting research, misuse of monopoly rights, 'tragedy of anticommons' and ethical issues related to biotechnology patents would be of immense help to resolve issues and bring in combating institutional mechanisms.

Comparison of immunity related genes in Vechur and crossbred cattle and their expression profile in clinical and subclinical mastitis

The study was carried out to investigate the expression of TLR2, TLR4, and TLR9 in crossbred and Vechur cattle using RT-qPCR, to better understand the immune resistance mechanisms against mastitis and also characterized the promoter and mRNA sequence of TLR genes in Vechur cattle. RT-qPCR analysis in somatic cells of crossbred cattle showed a significant up

fold increase in gene expression of TLR2, TLR4 and TLR9 in mastitis caused by both S. aureus and E. coli. The expression was also found to be higher in sub-clinical mastitis than clinical mastitis. So, during the early stage of mammary infection these TLRs are expressed at high level to subside the sub-clinical mastitis without precipitating into clinical mastitis.

After challenging the PBMCs with TLR agonist in vitro, the relative expression of mRNA of all three TLR genes was found to be higher in Vechur cattle than the crossbred cattle and the expression of TLR2 mRNA was relatively higher in Vechur breed as compared with other TLRs. These findings suggest that one of the reasons for the development of resistance to mastitis in Vechur cattle is associated with the level of expression of TLRs in response to infection.

The promoter region sequence of TLR2 of Vechur cattle with the Bos taurus sequence showed 98 Per cent similarity whereas TLR4 and TLR9 revealed 99 Per cent similarity. TLR2 and TLR9 revealed variations for three sequence motifs. All three TLR mRNA sequences showed 99 Per cent homology with Bos taurus sequence and exposed variations for 17 nucleotides in TLR2, 7 nucleotides in TLR4 and 5 nucleotides in TLR9 mRNA. The sequence of TLRs displayed more number of LRR repeats in the ectodomain of Vechur cattle, which may promote the recognition of pathogen ligand specificity. The primary structure showed highest Per cent of leucine amino acid for all three TLRs and alpha helix is the prominent secondary structure seen in all TLRs followed by beta turn and random coil. Phylogenetic tree for TLR genes showed all Bovidae family falling under the same group, indicating the conserved nature of TLR genes. The presence of unique structural features and substantial variation for TLR genes in Vechur cattle, may change the confirmation of TLR proteins, which may influence the binding affinity and interaction with pathogen to boost the innate host disease resistance in Vechur cattle

Screening of geriatric dogs for chronic kidney disease (CKD) and its management

Stage 1 and stage 2 dogs are having asymptomatic CKD and stage 3 & 4 show more symptoms.Other diseases will coexist with CKD. Dietary modifications, antacids, phosphate binders, fatty acid supplementation and treatment for specific diseases are given. Early diagnosis and intervention and management are important to slow down the progression of CKD among dogs.

Screening and therapeutic management of parasitic infections in captive Asian elephants (*Elephas maximus indicus*)

Parasitic infections, including gastrointestinal, hepatobiliary and haemoparasitic infections adversely affect the health of elephants. Captive Asian elephants under the custodianship of various temples, individuals and the Department of Forest and Wildlife, Kerala formed the subjects of this study. The faecal samples, blood smears, serum, and whole blood samples were collected, processed and analysed to screen for parasitic infections and to assess the impact of parasitic infections on the haematobiochemical parameters. Ova of Strongyle spp, (7/54), Bivitellobilharzia spp, (1/54) and the protozoan, Buxtonella spp., along with motile ciliates (1/54) were found in the faecal sample examination by direct and concentration methods. Additionally, Anaplocephala spp. and Cobboldia spp. Were recovered from the faeces of two elephants. Examination of geimsa stained blood smears revealed the presence of unsheathed microfilariae in one elephant. Trypanosoma evansi was detected in one out of 89 animals by polymerase chain reaction targeting VSG gene. The same elephant also tested positive for Babesia and Theileria spp. By PCR using genes specific primers. Indirect ELISA for antibodies against Toxoplasma gondii revealed 18 Per cent seroprevalence. Infected elephaants ere successfully treated according to appropriate protocols

Foot and mouth disease vaccinaton-post vaccinal seroconversion in captive Asian elephants (*Elephas maximus indicus*)

The study was undertaken to determine the dosage of oil-adjuvant trivalent Foot and Mouth Disease (FMD) vaccine sufficient to develop protective antibody titre in adult healthy elephants, persistence of post- vaccinal antibody titre and to recommend a vaccination protocol against FMD in elephants. A total of 18 captive elephants under the custodianship of Department of Forests and Wildlife, Temples and private individuals from Thrissur, Ernakulam, Kollam and Trivandrum districts formed the materials for study. The owners were advised to provide uniform management to the animals as far as possible. Health status of the elephants was ensured prior to vaccinations by cliical examination and assessement of haemato-biochemical parameters. Presence of haemo-parasites and gastro- intestinal parasites were ruled out by microscopic examination of blood smears and faecal samples. The animals were divided into three groups of six each and were subjected to prophylactic vaccination with three different doses i.e., six ml., eight ml and 10 ml of oil- adjuvant trivalent FMD vaccine (Raksha O vac Trivalent). Sera samples from the dog of vaccination and 15^{th}, 30^{th}, and 180^{th} post day vaccination were collected and subjected to Liquid Phase Blocking (LPB) ELISA to

determine the development of antibody titre against FMD virus (FMDV) Serotypes O, A and Asia -1. All the animals had non-potective titre against the three serotypes on day zero. Protective titres developed against all three serotypes on 30 dpv which declined gradually by 180 dpv in all elephants irrespective of the dose of the vaccine. None of the animals had protective titr by 180 dpv. It is concluded that six ml of vaccine is enough to produce protective titre in elephants against FMD. Further research is needed to study about the persistence of protective antibody titre following vaccination against FMD in Asian elephants

Hypoglycaemic effect and toxicological evaluation of costus specious in diabetic rats

The present study was performed to evaluate the hypoglycemic effect and sub-acute toxicity of ethanolic extracts of rhizome of Costus speciosus in Sprague Dawley rats. Animals were divided into six groups for hypoglycemic study and three groups for subacute toxicity. Except normal control group, diabetes was induced in all groups by alloxan monohydrate intraperitoneal administration at the dose rate of 130mg/kg. Diabetic positive control rats were treated with gilbenclamide at 0.25mg/kg; others were treated with ethanolic extract of rhizome of Costus speciosus at concentrations of 250,500 and 750 mg/kg. All the treated groups showed significant reduction in blood glucose levels with maximum reduction in highest concentration. Subacute toxicity on day 28th revealed increased concentrations of serum urea, bilirubin, AST, ALT albumin and leukocyte counts with reduced globulin level. Histopathological findings showed changes in liver and kidney in all the three treated groups. Results from the study validate the hypoglycemic effect of Costus speciosus and its toxic effects in a dose-dependent manner.

Sample size determination for animal experiments

Formula for determining the sample size using Power analysis method and Resource equation method. Sample size calculation for different statistical tests such as one-sample t-test, paired t-test, two-sample t-test, one-sample test for proportion, two independent proportions, linear regression, multiple linear regression, one-way and two-way ANOVA design with examples from Veterinary and Animal Sciences. Recommended resource equation method for ANOVA. Addressed methods to determine the suitable sample size for different experiments.

Mixed model repeated measures analysis of variance in animal experiments

Studied the use of mixed models in repeated measures data and illustrated the same with data sets. The methods for determination of the most appropriate covariance structure in mixed model were given and illustrated. Recommended the use of mixed model for analysis of repeated measures designs in animal studies.

Artificial neural networks for weather forecasting

Studied Artificial neural networks for weather forecasting. Predicted the average temperature for Thrissur for different months in the year 2017.Forecasting the lifetime milk production of Cattle. Lactation milk yield and lactation length are positively associated to lifetime milk yield whereas the relationship was negative with age at first calving and dry periods. Recommends the use of ANN for prediction of lifetime milk yield from early lactation traits.

Adaptability profile of male cattle and buffalo calves to varying temperature humidity index (THI) in Kerala

Six castrated male cross bred calves and six castrated male buffalo calves between four to seven months of age were selected from the University Livestock Farm and Fodder Research and Development Scheme, KVASU, Mannuthy, for the study. The study was conducted for one year. Same twelve animals were used throughout the experiment. In the study, there was no significant correlation of Rectal Temperature (RT) with THI in both buffalo and crossbred cattle calves. The RT remained consistent throughout the experimental period even though the THI varied from 76.5 to 82.0. A positive correlation was noticed between Pulse Rate (PR), Respiratory Rate (RR) and THI in buffalo and crossbred cattle calves. The rates of increase in RR and PR with increase in THI were significantly more in buffaloes compared to crossbred cattle calves. Growth rate of buffalo and crossbred cattle calves had a negative correlation with THI.

Temperature Humidity Index showed a negative correlation with TEC, Hb concentration and volume of packed red blood cells in buffalo and crossbred cattle calves. The rates of reduction in volume of packed red blood cells and Hb levels were significantly higher in buffalo calves compared to that of crossbred cattle calves. THI had no significant influence on the mean corpuscular volume (MCV) and mean corpuscular haemoglobin (MCH) of buffalo and crossbred cattle calves while MCHC showed a positive correlation with THI of all the animals under study. THI was positively correlated with the plasma volume of buffalo and crossbred cattle calves and the rate of increase in plasma volume was more pronounced in buffalo calves compared to crossbred cattle calves.

Temperature humidity index had no significant correlation with levels of serum total protein, serum albumin, serum globulin and albumin / globulin ratio in buffalo and crossbred cattle calves. The study revealed that THI had a significant negative correlation with the levels of T3 and T4 in buffalo and crossbred cattle calves. The cortisol levels had no significant correlation with temperature humidity index. The expression of HSP90 was significantly up

regulated in the buffalo and crossbred cattle calves at THI of 82 compared to THI of 76.5. Buffalo calves showed higher fold increase in HSP90 expression compared to that of crossbred cattle calves at a THI of 82.0.

The results of the present study indicated that all the animals under study were adapted to a THI range of 78.5 to 82.0, but buffalo calves put on additional effort to maintain homeothermy than crossbred cattle calves.

Effect of dietary supplement of Lecithin and carntine of growth in piglets on high fat diet

An experiment was carried out for a period of 98 days in fifty six weaned female Large White Yorkshire piglets of two months of age belonging to Centre for Pig Production and Research, Mannuthy, with an average body weight of 21.7 kg to assess the effect of dietary supplementation of lecithin and carnitine on growth in piglets fed on high fat diet. The piglets were divided into five groups as uniformly as possible with four replicates in each group and were randomly allotted to five dietary treatments, T1 (control ration as per NRC, 1998), T2 (control ration supplemented with five Per cent animal fat), T3 (T2 plus 0.5 Per cent lecithin), T4 (T2 plus 150 mg of carnitine per kg diet), T5(T2 plus 0.5 Per cent lecithin plus 150 mg of carnitine per kg diet) using completely randomized design. Data on daily dry matter intake, body weight at fortnightly intervals, body weight gain, average daily gain, feed conversion efficiency, digestibility of nutrients, mineral availability, gross energy of feed and faeces, blood parameters (total protein, total cholesterol, triglycerides, HDL cholesterol, LDL cholesterol, calcium, phosphorus and magnesium) were used for evaluation of work. Cost of feed per kg body weight gain was also estimated.

The results of the study indicated that the pigs under dietary treatments T2, T3, T4 and T5 shows significantly improved growth performance with regards to average final body weight, body weight gain, total dry matter intake than control group (T1)during overall period. However, pigs under growing stage responded more on dietary supplements than those under finisher stage by exhibiting significant improvement for all growth parameters. But no differences were observed among the dietary groups on nutrient digestibility, mineral availability and serum biochemical profile. Elevated serum lipid profile was observed for T2 (only fat added group) which could be significantly reduced by supplementation of fat along with either 0.5 Per cent lecithin or 150 mg of carnitine/kg diet and carnitine was found to have more effect on increasing HDL cholesterol than lecithin. In economic point of view, dietary

supplementation of animal fat at 5 Per cent level (T2) during early grower phase would be beneficial for improving the growth in weaned LWY piglets without dietary modifiers.

Evaluation of hydroponics fodder as a partial feed substitute in the ration of crossbred calves

An experiment was conducted for 90 days using eighteen weaned crossbred calves of three to four months of age to study the effect of feeding hydroponics maize fodder on growth performance and nutrient utilization, as a partial feed substitute. The calves were divided into three groups I, II and III of six each as uniformly as possible with regard to age, sex and body weight and were allotted to three dietary treatments T1, T2 and T3 respectively. All the experimental calves were fed (ICAR, 2013) with calf starter containing 70 Per cent TDN and varying levels of CP. The calf starter in dietary treatments T1, T2 and T3 contained 24, 20 and 17 Per cent of CP, respectively. The T2 and T3 treatments were made iso-nitrogenous with T1 by supplementing hydroponics maize fodder. Good quality green grass was offered ad libitum to all the calves. Data on dry matter (DM) intake, average body weight gain (ADG), feed conversion efficiency (FCR), digestibility of nutrients, rumen fermentation parameters and haematological values were used for evaluation of the study. The cost per kg body weight gain was also calculated.

The results obtained in the present study showed significant difference among different treatment groups regarding DM intake, total body weight gain, ADG and FCR with a higher ($P<0.05$) values observed for calves belonging to T3 than groups T1 and T2. Data on digestibility of nutrients does not reveal any difference ($P>0.05$) among treatment groups. Rumen fermentation parameters (rumen pH, total volatile fatty acids (TVFA) and rumen ammonia nitrogen) showed significant difference among treatment groups. Group T3 had lower ($P<0.05$) rumen pH and ammonia nitrogen than other two groups. Group T3 had higher ($P<0.05$) concentration of TVFA compared to group T1. However, group T2 had similar concentration of TVFA compared to both groups T1 and T3. Haematological parameters (plasma glucose, plasma protein, albumin, globulin and BUN) did not show significant difference ($P>0.05$) among treatment groups. Cost per kg gain was significantly ($P<0.05$) lower in T3 (Rs.102.14) than groups T2 (Rs. 111.64) and T1 (Rs. 119.82).

On conclusion, feeding of hydroponics maize fodder as a partial feed substitute of calf starter on protein basis at seven Per cent level improves the DM intake, total body weight gain, ADG, total VFA and lowers the cost per kg body weight gain. Moreover, replacing the calf starter with hydroponics maize fodder, on protein basis at four Per cent level, maintains the

growth performance of calves compared to those fed control diet. From the overall results, it can be concluded that hydroponics maize fodder can effectively substitute up to 30 Per cent of protein in calf starter without compromising the growth performance.

Molecular and Immuno histochemical studies on tumours of nasal sinuses in domestic animals

This study was undertaken to evaluate the expression pattern of certain specific markers (proteins, cytokines and enzymes) and the role of tumour associated macrophages (TAMs) in sinus tumours of domestic animals through immunohistochemical techniques. From the study, it was concluded that the detection of specific proteins, enzymes and cytokines can be used as an early diagnostic measure of these neoplastic conditions. Tumour ultrastructure was studied using Transmission Electron Microscopy and etiological investigations were performed by polymerase chain reaction. Histological classification of sinus tumours were done in bovine, canine and porcine species. the epithelial origin of all the tumours were confirmed by immunohistochemical positivity to antipancytokeratin and negativity to aniivimentin antibodies.

Evaluation of mast cell response in caecal coccidiosis of broiler chicken in sub-lethal aflatoxicosis

Seventy-two numbers of day-old broiler chicks were randomly divided into four groups including control (TI), aflatoxin control (T2), coccidia control (T3) and treatment group receiving both aflatoxin and coccidia (T4) for the estimation of mast cell response, heamatobiochemical and histopathological alterations during sub-infectious dose of caecal coccidiosis in sub-lethalaflatoxicosis. Toxin fed birds exhibited dullness and diarrhoea during the experimental period and degenerative changes were observed in the liver, kidney, intestine, proventriculus and gizzard. Immune suppression as a result of lymphoid depletion were observed in the lymphoid organs. Lesions observed were more severe in T4 than T2 and T3. Villous epithelium exhibited irregular areas of necrosis and desquamation as well as various intracellular developmental stages. Caecal lesions in T4 were more severe than T3. On toluidine blue staining, mast cells were observed as pinkish purple elongated or round granular structures in caecum, spleen, thymus and bursa of Fabricius. Significant variations were observed in the haemato - biochemical parameters in sub-infectious dose of coccida under influence of low-level Aflatoxin. Thus it was identified that Sub-lethal Aflatoxicois is a constant threat to broiler industry and produces immune suppression making the birds more

prone to coccidiosis even under reduced infective dose due to suppression of mucosal immunity.

Pathological effects of intracheal instillation of doped ceriumoxide nanoparticles in rats

Nanotechnology is concerned with the use of technology to manufacture tailored nanostructures by manipulation of elements in their atomic and sub-atomic level in order to get products of novel properties which is different in nature. Cerium is a rare earth lanthanide metal and a strong oxidizing agent. Recently the use of CeO2 NPs as a diesel fuel additive to reduce the ignition temperature of carbonaceous diesel exhaust particle (DEP) and subsequent reduction of the emission of particulate matter from diesel engine has been explored. It is thought that the most common route of CeO2 exposure is likely through inhalation and ingestion. Hence a study was designed to explore the pathological effects of this particle taking rat as animal model. Doped cerium oxide in two doses was instilled intratracheally and rats were euthanized and post mortem examination was done with the tissue were subjected to histopathological evaluation. Hematological examination revealed increased Hb and VPRC count and bio chemical evaluation showed increase in serum alkaline phosphatase in the high dose long term exposure group. Histopathologically, the group sacrificed earlier showed vascular changes like congestion, hemorrhage and mild to moderate changes like rounding of the clara cells, deciliation of the ciliated epithelium. The group sacrificed later revealed proliferative changes in the peribroncheoler region along with the vascular changes. The liver and kidney also showed mild to moderate degree of vascular and degenerative changes. Ultrastructural observation of the electron dense instilled particles, swollen clara cells with necrotic blebs in the TEM and whitish colored fibrous mass in the SEM were noticed.

Development of a meat line of Kuttanad ducks (*Anas platyrhynchos domesticus*)

A selection experiment was conducted in Kuttanad ducks at University Poultry Farm, Mannuthy under Kerala Veterinary and Animal Sciences University with the objective of developing a meat line. One thousand and eighty eight day-old Kuttanad ducklings procured from progressive farmers of Kerala formed the base generation (S_0). Based on body weight at eighth week, top ranking 150 females and 25 males were selected through individual selection method. From the 25 sire families, 979, 969 and 1610 ducklings were produced by artificial insemination in S_1, S_2 and S_3 generation in pedigreed hatches. Body weight, feed consumption and mortality were recorded at fortnightly intervals till 12^{th} week of age in each generation. Genetic parameters for body weight at 8, 10 and 12 weeks were estimated using full sib correlation method. Selection differential, intensity of selection and response to selection were

calculated for body weight at 8 weeks. Carcass characteristics were evaluated at 8, 10 and 12 weeks of age in four generations. The body weight at 18 and 40 weeks, feed consumption from 13 to 40 weeks, age at first egg and age at 10 and 50 Per cent production, duck housed egg production and egg weight at 30 and 40 weeks were recorded in the selected parent stock of S_0, S_1 and S_2 generations.

The mean body weight at 8 weeks was 1103.38 g in the S_0 generation. An improvement of 270.51 g could be recorded at 8 weeks in S_3 generation. The results also indicate that a compensatory growth mechanism is present in ducks wherein the lower body weight in the early stages of growth are compensated in the subsequent weeks and they attain 90 Per cent of the adult body weight by 12 weeks of age. The heritability estimates for body weight at 8 weeks of age based on sire plus dam components (h^2s+d) were 0.251, 0.313 and 0.243 in S_1, S_2 and S_3 generations. The regression coefficients indicate that higher increase in body weight per generation was obtained for body weight at 8 weeks (94 g) rather than for body weight at 10 (56 g) and 12 weeks (55 g). The carcass characteristics of male and female Kuttanad ducks at 8, 10 and 12 weeks of age showed that there was improvement in the eviscerated yield of carcass over generations and S_3 generation attained the highest yield at 8 weeks. The performance of parent stock indicated that selection had not altered their egg production performance. Artificial Insemination at 5 days interval could achieve 89 Per cent fertility in the parent stock.

The results of the selection experiment indicate that selection for body weight at 8 weeks was effective in improving the body weight and a line of Kuttanad ducks with meat characteristics could be developed. The carcass characteristics especially the eviscerated yield and yield of cut-up parts over generations indicate that the meat producing potential of Kuttanad ducks has improved as a result of selection. It could be concluded that Kuttanad ducks could attain its optimum meat production characteristics at 8 weeks and hence it could be considered as the ideal age for processing.

Nutritive evaluation of unconventional feeds using in vitro gas production technique The study assessed the chemical composition, digestibility, and fermentation metabolites of six unconventional feedstuffs: bamboo leaves (BL), turmeric waste (TW), spent cumin (SC), cooked barley residue (CBR), water hyacinth (WH), and soya sauce waste (SSW) as ruminant feedstuffs through in vitro gas production test. The crude protein content ranged from 11.82 Per cent (CBR) to 17.98 Per cent (WH), while the ether extract was higher in SSW, followed by TW. The neutral detergent fiber (NDF) content was lower in WH (46.6Per cent) and higher

in TW (65.83Per cent), while the acid detergent fiber (ADF) was higher in TW and lowered in SSW. Spent cumin had higher lignin than turmeric waste. Gas production (mL/200 mg; 24 h) was higher ($p < 0.05$) in CBR and lowest in the SSW sample. The digestibility of dry matter (DM) and organic matter (OM) followed the same pattern and were higher ($p < 0.05$) in CBR and lower in the BL sample. The microbial biomass production (mg/200 mg DM) was significantly ($p < 0.05$) higher in SSW and lower in CBR and BL samples. The ME (MJ/ kg DM) was higher ($p < 0.05$) for CBR and lower for BL and SSW samples. The NH3-N (mg/100 mL) concentration was higher ($p < 0.05$) in BL and SSW and lower in other samples. Acetate production was higher ($p < 0.05$) in WH and lowest in other samples, while CBR and WH samples yielded more ($p < 0.05$) propionate than other samples. Total short-chain fatty acids (SCFA) production was higher ($p < 0.05$) in CBR and WH and lowest in other feed samples. Newer feedstuffs like cooked barley residue spent cumin and water hyacinth were highly digestible and rich in energy and therefore can be fed to ruminants.

Evaluation of hydroponics fodder as a partial feed substitute in the ration of crossbred calves

An experiment was conducted for 90 days using eighteen weaned crossbred calves of three to four months of age to study the effect of feeding hydroponics maize fodder on growth performance and nutrient utilization, as a partial feed substitute. Results indicated that feeding of hydroponics maize fodder as a partial feed substitute of calf starter on protein basis at seven Per cent level improves the DM intake, total body weight gain, ADG, total VFA and lowers the cost per kg body weight gain. Moreover, replacing the calf starter with hydroponics maize fodder, on protein basis at four Per cent level, maintains the growth performance of calves compared to those fed control diet. From the overall results, it can be concluded that hydroponics maize fodder can effectively substitute up to 30 Per cent of protein in calf starter without compromising the growth performance.

Performance of early lactating crossbred cows at different ratio of concentrate and roughage

A study was conducted to assess the different proportions of roughage and concentrate in crossbred dairy cattle. The results indicated that a portion of concentrate mixture (upto 20 Per cent on DM basis) can be replaced with various combinations of legume tress/shrub fodders such as calliandra, desmanthus and stylosanthes cultivated under silvo pasture system without affecting production performance and nutrient utilization in crossbred dairy cows.

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containing different levels of neutral detergent fibre on milk composition parameters of lactating dairy cows". National Conference on Enhancing Nutritional Security through Climate Smart Farming Practices organised by the Cooch Behar Association of Cultivation for Agricultural Sciences (COBACAS), in collaboration with Uttar Banga Krishi Viswavidyalaya (UBKV) and held at Kalimpong, West Bengal from 17-3-2017 to 18-3-2017.

17. Biju Chacko, K. M. Syam Mohan, K. Ally, K. Shyama, K. S. Anil and C. T. Sathian. 2017. "Effect of paddy straw plus non forage fibre sources based complete feeds containing different levels of neutral detergent fibre on production and reproduction parameters of lactating dairy cows". Poster presentation in National Conference on Enhancing Nutritional Security through Climate Smart Farming Practices organised by the Cooch Behar Association of Cultivation for Agricultural Sciences (COBACAS), in collaboration with Uttar Banga Krishi Viswavidyalaya (UBKV) and held at Kalimpong, West Bengal from 17-3-2017 to 18-3-2017. Book of Abstracts (PP-1-10) p.59.
18. Dr Deepa Chirayath. 2016. Detection of *Brugian sp*. microfilariae in a domestic cat in Thrissur, Kerala. 9th Kerala Veterinary Science Congress, 2016.
19. Lali F. A., Anilkumar K. and Aravindakshan T. V. 2017. Single nucleotide polymorphism analysis and molecular breeding value estimation of dairy traits in crossbred cattle of Kerala. XIV Annual Convention of Society of Conservation of Domestic Animal Biodiversity and National Symposium on Biodynamic Animal Farming for the management of Livestock Diversity under changing Global Scenario 8-10 February, 2017.
20. Sethulekshmi C, Latha C, Sunil B, Gleeja V L, Aravindakshan T V, Prejit and Beena A K. 2016.Occurrence and molecular characterization of Enterohaemorrhagic *E.coli* in vegetables and fruit juices. Kerala Veterinary Science Congress, 2016. Pattikad, November 12 &13, 2016
21. Vrinda Menon, K Latha C, Sunil B, Sunanda A, Nithya K. R. 2016.Survivability of *L. monocytogenes*in major river waters in Kerala. Kerala Veterinary Science Congress, 2016. Pattikad, November 12 &13, 2016

22. Latha C, Deepthi V, Sethulekshmi C, K VrindaMenon.2016. Awareness of School Children on the role of Personal hygiene in the control of Zoonoses. Kerala Veterinary Science Congress, 2016. Pattikad, November 12 &13, 2016

23. Neethu K. P., Vrinda Menon K., Latha. C., Anu. C. J., Deepthi, V. 2016. Isolation and biofilm formation of Salmonella species obtained from salad vegetables. Kerala Veterinary Science Congress, Pattikad, November 12 &13, 2016

24. Sunil B, Latha C, Nithya K. R, K. Vrinda Menon, Binasy M, Ashok K.2016. Occurrence of Campylobacter species in a Chicken Processing line from Ernakulam District, Kerala. Kerala Veterinary Science Congress, 2016. Pattikad, November 12 &13, 2016

25. Saju G, K Vrinda Menon, Latha C, Sunil B, Sethulekshmi C, Deepa J.2016. Antimicrobial effect of Bacteriophage on *L. monocytogenes* in Chicken and fish. Kerala Veterinary Science Congress, 2016. Pattikad, November 12 &13, 2016

26. Latha, C, Anu C J, Sunil B, Ajay Kumar, V J and Deepa Jolly.2016. Prevalence of *Listeria monocytogenes, Yersinia enterocolitica, Staphylococcus aureus*and *Salmonella enterica* Typhimurium in meat and meat products using multiplex PCR. XIV Annual conference of IAVPHS. Udaipur, November 21 and 22, 2016

27. Sunil B, Latha C, Nithya K R, Vrinda Menon, K, Binsy Mathew, Ashok Kumar.2016. Occurrence of Campylobacter in drinking water from wells in Chalakudy in Kerala. XIV Annual conference of IAVPHS. Udaipur, November 21 and 22,

28. Muralikrishna P, Kumarswamy N. P, Ajay Balakrishna Thorat, Vani R. P, Vrinda Menon K, Binsy Mathew.2016. Assessment of awareness on the important public health issues in Thrissur, Kerala. XIV Annual conference of IAVPHS. Udaipur,November 21 and 22, 2016

29. Naicy Thomas, R. Thirupathy Venkatachalapathy, T.V. Aravindakshan and Elizabeth Kurian. (2017). Tissue mRNA distribution and expression levels of genes relating to reproduction in prolific Malabari and low-prolific Attappady Black goats. National Symposium: Bio Dynamic Animal Farming for The Management of Livestock DiversityUnder Changing Global Scenario and XIV annual convention of Society for Conservation of Domestic Animal Biodiversity. CVAS, Mannuthy. February 8-February 10.

30. Anu Bosewell, Naicy Thomas, T. V. Aravindakshan and Elizabeth Kurian. 2017. *In silicoanalysis of a novel SNP (c.C880T) in*caprine*SLC11A1*gene. National Symposium: Bio Dynamic Animal Farming for The Management of Livestock DiversityUnder Changing Global Scenario and XIV annual convention of Society for Conservation of Domestic Animal Biodiversity. CVAS, Mannuthy. February 8-February 10.

31. Silpa, M. V., Naicy Thomas, G. Radhika, T.V. Aravindakshan, Anu Bosewell and Charlotte Coretta Rodricks. (2017). Molecular characterization and detection of two novel SNPs of *SIRTUIN3* (*SIRT3*) gene in Malabari and Attappady Black goats. National Symposium: Bio Dynamic Animal Farming for The Management of Livestock Diversity Under Changing Global Scenario and XIV annual convention of Society for Conservation of Domestic Animal Biodiversity. CVAS, Mannuthy. February 8-February 10.

32. Elizabeth Kurian,Naicy Thomasand T.V. Aravindakshan (2017). Ovarian expression levels ofGDF9 and RBP4 genes in Soviet Chinchilla and Grey Giant rabbits. National Symposium: Bio Dynamic Animal Farming for The Management of Livestock Diversity Under Changing Global Scenario and XIV annual convention of Society for Conservation of Domestic Animal Biodiversity. CVAS, Mannuthy. February 8-February 10.

33. Naicy Thomas, R. Thirupathy Venkatachalapathy and T.V. Aravindakshan. (2017). Comparison and differential expression of NGF and FSHR genes and their interactions in reproductive tissues of prolific and low prolific goats of Kerala. Proceedings of 29th Kerala Science Congress. Marthoma College, Thiruvalla, Kerala, January 28-January 30.

34. Anu Bosewell, Naicy Thomas, T. V. Aravindakshan. (2017). Evaluation of mRNA expression and characterisationofSLC11A1 gene in Malabari and Attappady Black goat. Proceedings of 28th Kerala Science Congress. Malappuram, Kerala, January 28-January 30.

35. Silpa M. V., Naicy T., Radhika G., Aravindakshan T.V., Joan J., Anu B. 2016. Ovarian expression of Sirtuin 3 (SIRT3) mRNA in Malabari and Attappady Black goats. Proceedings of the 8th Kerala Veterinary Science Congress, Thrissur, Kerala, November 12- November 13.

36. Ahmad, S. M., Sankar, S., Akkara, T. S., Reshma, S., Chandran, A. R., Vinayamohan, P. G. and Mini, M. Characterization of the causative agent from a case of urinary tract infection in dog. In: *Proceedings of National Congress on Canine Practice*, 27th -29th April, 2016, COVAS, Pookode.

37. Chandran, A. R., Subi, T. K., Sankar, S., Reshma, S., Akkara, T. S., Ahmad, S. M., Vinayamohan, P.G. and Mini, M. Leptospirosis in a dog infected with *Leptospira interrogans* serovar Australis- a case studty. In: *Proceedings of National Congress on Canine Practice*, 27th -29th April, 2016, COVAS, Pookode.

38. Ambily, R., Joseph, S., Mini, M., Krishna, S.V. and Abinay, G. Evaluation of molecular and serological tests in the diagnosis of canine leptospirosis in an endemic area. In: *Proceedings of National Congress on Canine Practice*, 27th -29th April, 2016, COVAS, Pookode.

39. Akkara, T. S., Sankar, S., Reshma, S., Ahmad, S. M., Chandran, A. R., Ashok, R. U., and Vinayamohan, P. G. and Mini, M. Isolation and characterization of the causative agent from a case of otitis in dog. In: *Proceedings of National Congress on Canine Practice*, 27th -29th April, 2016, COVAS, Pookode.

40. Mahesh S. H., Nimisha S., Prejit, Vinod V.K., Jess V. and Pratheesh P. T. 2018. Occurrence of Vibrio cholera from Water Sources of Outbreak Areas in Palakkad and Malappuram Districts, Kerala. In: Proceedings of Kerala Veterinary Science Congress, 12-13th January, 2016, Pattikad, Thrissur.

41. Mahesh S. H., Prejit, Pratheesh P. T., Nimisha S., and Vinod V. K. 2018. Prevalence and Antibiogram Study of Listeria Monocytogenes from Raw Milk Samples Collected from Retail Markets of Wayanad District. In: Proceedings of 30th Kerala Science Congress, 28-30th January, 2018, Government Brennan College, Thalassery

42. Nimisha S., Prejit, Pratheesh P. T., Vinod V.K. and Mahesh S.H. 2018. Study on House Hold Refrigerator As a Potential Reservoir for Foodborne Pathogen Staphylococcus Aureus. In: Proceedings of 30th Kerala Science Congress, 28-30th January, 2018, Government Brennan College, Thalassery

43. Pratheesh P.T., Nimisha S., Mahesh S. H. and Prejit. 2018. Exploring the Potential of Microalga Chlorella Vulgaris as a Platform for Developing Edible Subunit Vaccine Against Salmonellosis in Poultry. In: Proceedings of 30th Kerala Science Congress, 28-30th January, 2018, Government Brennan College, Thalassery

44. Binoj Chacko, C. S. Suja and P. Anitha 2016. Comparative production performance of long- term selected pure White Leghorn strains. Proceedings of XXXXIII IPSACON, Guwahati, Assam

45. Binoj Chacko, C. S. Suja and P. Anitha. 2016. Heritability and correlation for egg production and other traits in long term selected population of White Leghorn. Proceedings of XXXXIII IPSACON, Guwahati, Assam

46. Suja C. S., Binoj Chacko, P. Anitha and Greeshma Girijan. 2016. Effect of dietary supplementation of Marigold petals, Red amaranth leaves, Curry leaves and Turmeric powder on egg yolk pigmentation in Native and White Leghorn layers. Proceedings of XXXXIII IPSACON, Guwahati, Assam

47. Suja, C. S., K. Mani., D. Kannan and A. M. Safiullah. 2016. Cost effectiveness in producing iodine enriched egg. Proceedings of XXXXIII IPSACON, Guwahati, Assam

48. Suja, C. S., K. Mani., D. Kannan and A. M. Safiullah. 2016. Role of iodine enriched egg in human nutrition. Proceedings of XXXXIII IPSACON, Guwahati, Assam

49. Sankaralingam, S. 2016. Comparison of reproductive performance of different varieties of fancy chicken with the White Leghorn birds. In: *Proceedings of Kerala Veterinary Science Congress 2016*, held on 12th to 13, November, 2016 at Pattikad, Thrissur, Kerala, India, 394-395.

50. Hitaishi V. N, Bindu Lakshmanan, Jain Jose K, Praveena E Jose, H. Shameem and Lucy Sabu. 2017 Detection of *Theileria* species in naturally infected goats of Kerala by PCR RFLP. XXVIth National Congress of Veterinary Parasitology & International Symposium Veterinary College, Shimoga. 15th to 19th February, 2017

51. Jain Jose K, Bindu Lakshmanan, Aravindakshan T. V, Hitaishi V N and Syamala, K.2017. Molecular detection of *Babesia gibsoni* isolates from Kerala XXVIth National Congress of Veterinary Parasitology & International Symposium Veterinary College, Shimoga. 15th to 19th February, 2017

52. Jain Jose K, Bindu Lakshmanan, Aravindakshan T. V. and Hitaishi V. N. 2017. Evaluation of DNA extraction protocols from ixodiod ticks 29th Kerala Science Congress at Marthoma College, Thiruvalla 28 -30 January 2017.

53. Bindu L, Vinodkumar, K, Aravindakshan T. V., Hitaishi V. N., Ambily, V. R. and Lucy S 2016. Equine trichomonosis- A case report. Kerala Veterinary Science congress, Thrissur 2016 12-13 November,2016

54. Shameem, H., Devada, K., Bindu Lakshmanan and Lucy Sabu. Abattoir studies on the prevalent amphistomes in cattle Thrissur District International Conference on Microbiology, Agriculture and Environmental Sciences. Sept1-2, Hyderabad

55. Jayasree, S., Shameem, H., Gleeja, V.L. and Prejit, K. 2016. Studies on bovine amphistomosis in Kanjhikuzhy panchayat of alappuzha district, Kerala Kerala Veterinary Science Congress Nov12-13, Thrissur

56. Reni, J., Shameem, H., Smitha, S., Radhika, R., Thirupathy, V.R., Lucy Sabu and Mercey, K. A. 2016. Incidence of coccidiosis in an organised goat farm in Thrissur Kerala Veterinary Science Congress Nov12-13, Thrissur

57. Shameem, H., Radhika, R., Lucy Sabu and Giridas, P.B. 2016. Compendium on Kerala Veterinary Science Congress., A report on *Cobboldia elephantis* infection in a captive elephant. Kerala Veterinary Science Congress Nov12-13, Thrissur

58. Radhika, R., Lucy Sabu and Krishnan, S. 2016. Compendium on p118. Prevalence of coccidiosis in cattle of different agroecological zones and seasons of Kerala. National Symposium on climatic driven food production systems- Agrometeorological interventions Dec20-22, Coimbatore

59. Asha Rajagopal and Lucy Sabu Report of invitro detection of benzimidazole resistance in organised goat farm Kerala Veterinary Science Congress Nov12-13, Thrissur

60. Radhika, R., Lucy Sabu and Krishnan, S. 2016. Prevalence of buxtonellosis in cattle at different agroecological zones and seasons of Kerala. Kerala Science Congress Compendium on 28th -30th Jan, Thiruvalla

61. Shameem, H., Devada, K. and Jayavardhanan, K. Characterisation of partially purified somatic antigens of G. crumenifer.29th Kerala Science Congress28th -30th Jan, Thiruvalla

62. Shameem, H., Devada, K., Bindu Lakshmanan, Siju Joseph, Lucy Sabu and Usha, A.P. Standardisation of coproantigen sandwich ELISA for diagnosis of bovine amphistomosis International Symposium on Current concepts in diagnosis and control of parasitic diseases to combat climate change Shimoga 15th -17th Feb

63. Syamala and Marykutty Thomas. Assessment of different indicators for gastro intestinal worm burden in native goat population of Kerala reared under resource poor condition SOCDAB 20178/2/17-10/2/17 Mannuthy.

64. Syamala and Marykutty Thomas. Validation of FAMACHA eye colour chart using sensitivity and specificity analysis in Attapady black goats of Kerala Kerala Science Congress 2017 28-30th Jan 2017

65. Syamala and Marykutty Thomas. Unravelling the relationship between body condition scoring and host resilience /resistance to natural gi parasitism in Attapady Black goats of Kerala Kerala Veterinary Science Congress November 12-13th 2017

66. Deepa P. M. 2016.Presented paper in the National Symposium on "Newer approaches in diagnosis and management of diseases for sustainable health and production" organized by ISVM from 17 -19 February 2016.

67. Deepa P. M.2016. "Evaluation of *in vitro* trans differentiated islet like cells in the treatment of canine diabetes" in the XIII th Annual Convention of Indian Society for Advancement of canine practice and National symposium on "Concepts of one health in canine health care management" organized by ISACP from 27-29 April 2016.

68. Hamza Palekkodan, Jinesh kumar N. S, Prasanna K. S, Sajitha I. S, Anoopraj R, Mammen J Abraham 2017. A rare case of epitheloid haemangiosarcoma in a rottweiler dog. In Proceedings: National Conference on Trends in cancer research under one health concept, pp.102.

69. Reji Varghese, Jinesh Kumar N. S, Hamza Palekkodan, Dinesh P. T., Sooryadas S., Umesh C. G., Syam K. Venugopal. 2016. Mandibular osteosarcoma in a rottweiler and its management. National Conference on Trends in cancer research under one health concept, pp.58.

70. Hamza Palekkodan, Anoopraj R., Sabeer Hussain., Sooryadas, S. and others. 2016. Pyothorax due to oesophageal perforation in a dog a case report. In proceedings XIII th National Congress on Canine Practise. pp. 110

71. Shyam S., Sabeer Hussain K. V., Hamza Palekkodan, Anoopraj, R. and others. 2016. Post mortem investigation of Spirocercosis in stray dogs. In proceedings XIIIth National Congress on Canine Practise. pp. 108

72. Sabeer Hussain K. V., Hamza Palekkodan and others. 2016. A case report of canine chondroblastic osteosarcoma. In proceedings XIIIth National Congress on Canine Practise. pp. 108

73. Nasreen Fathima. M.S., Hamza Palekoodan and others.2016. Warfarin poisioning-A report on histomorphological observation in a dog. In proceedings XIIIth National Congress on Canine Practise. pp. 109

74. Yashash R Kumar, Hamza Palekoodan and others.2016. Chronic splenic torsion in a German Shepherd dog-A case report. In proceedings XIIIth National Congress on Canine Practise. pp. 109

75. Marykutty Thomas. 2016. Economics of salvaging male buffalo calf production in Kerala. Proceedings of Kerala Veterinary Science Congress

76. Marykutty, T and Syamala.K.2016. Unravelling the relationship between the body condition score and host resistance/resilience to natural gastro intestinal parasitism in Attappdy Black goats of Kerala. Proceedings of Kerala Veterinary Science Congress.

77. Sabin G., Saseendran P. C., Anil K.S., and Gleeja V. L. 2017. Identification of dairy farming systems in Kerala, Kerala Veterinary Science Congress, Thrissur, Kerala, November 12- November 13.

78. Usha, A. P., Benjamin, E. D. and Suraj, P. T. 2017. Mannuthy White – a new cross bred pig variety. Brochure. Kerala Veterinary and Animal Sciences University.

79. Suraj, P. T., Usha, A. P. and Benjamin, E. D. 2017. Waste management in pig farms. Brochure. Kerala Veterinary and Animal Sciences University.

80. Benjamin, E. D., Usha, A. P., Suraj, P. T. and Lali F Anand 2017. Artificial insemination in pigs. Brochure. Kerala Veterinary and Animal Sciences University.

81. Venketachalapathy, R, Usha, A. P., Benjamin, E. D. and Suraj, P. T. 2017. Ankamali Pigs. Monograph. Kerala Veterinary and Animal Sciences University.

Awards and honours received by faculty and students

1. Dr. Indu V Raj, Assistant Professor, bagged Second best paper award for oral presentation in the session Basic Veterinary and Allied Sciences, for research paper entitled "'A comparative study on the tonsils in the oropharynx of goats." by Indu V. R., Lucy K. M., Ashok N., Maya S. and Chungath J. J. 2016. in the 8th Kerala Veterinary Science Congress held at Pattikad, Thrissur from 12-13 November 2016
2. Dr. Indu V Raj, Assistant Professor, Dr. Md. Hafeezuddin Silver Jubilee Medal and Award for the Best Paper in "Anatomy of Wild and Zoo Animals" for the research paper entitled 'Functional anatomy of the jaw of leopard' authored by Indu V. R., Lucy K. M., Ashok N. and Chungath J.J. in XXXI Annual Convention of IAVA &National Symposium held from 21st to 23rd December 2016 at College of Veterinary Science, Rajendranagar, Hyderabad.
3. Dr. Indu V Raj, Assistant Professor, Late Shri L.O. Dhande Memorial Award for the Best Paper in "Forensic Anatomy Including Archeological Study" for the research paper entitled 'Anatomical basis for forensic identification of skull of big cats' authored by Indu V. R., Lucy K. M., Ashok N. and Chungath J.J. in XXXI Annual Convention of IAVA &National Symposium held from 21st to 23rd December 2016 at College of Veterinary Science, Rajendranagar, Hyderabad.
4. Dr. Sumena K.B., Assistant Professor, bagged second prize for Best oral presentation Award in Wild life section for the oral presentation of the paper "Pectoral limb bones of Black Drongo (*Dicrurusmonocercus*)"in 8th Kerala Veterinary Science Congress, Pattikkad 2016.
5. Best paper award for Dr Sajith Purushothaman on International conference on " Herbal and natural component as the future of pharmacology" held at Avinashilingam University, Coimbatore on 28th Feb-1st March, 2016
6. Best paper award for Dr Jasmine Rani. K on International conference on " Herbal and natural component as the future of pharmacology" held at Avinashilingam University, Coimbatore on 28th Feb-1st March, 2016.
7. Dr. Biju Chacko Secured the award for the best oral presentation in the 3rd National Conference on Enhancing Nutritional Security through Climate Smart Farming Practices, organised by the Cooch Behar Association of Cultivation for Agricultural Sciences (COBACAS), in collaboration with Uttar Banga Krishi Viswavidyalaya

(UBKV) and held at Kalimpong, West Bengal from 17-3-2017 to 18-3-2017, for the paper entitled, "Effect of paddy straw plus non forage fibre sources based complete feeds containing different levels of neutral detergent fibre on milk composition parameters of lactating dairy cows". Biju Chacko, K. M. Syam Mohan, K. Ally, K. Shyama, K. S. Anil and C. T. Sathian.

8. Dr Madhavan Unny secured Second Prize for Poster presentation in Wild Zoo and Exotic Animal Medicine session in Indian Society for Veterinary Medicine, 35th Annual Convention on 22-24th January 2017-ISVM
9. Dr Muhammed E. M. secured Rothamsted International Fellowship from Rothamsted Research, UK.
10. Dr. Naicy Thomas secured, Dr. G. Nirmalan Trust Award for Best Research Paper 2017
11. Dr. Suja C. S- Conferred with IPSA Dr. P. Kothandaraman Memorial Award for best presentation during XXXIII IPSACON -2016 held at AAU, Guwahati on November 3-5, 2016.
12. Deepa PM secured best presentation award in seminar organised by ISVM
13. Dr. Priya P. M., Assistant Professor, received the Best Oral Presentation award in IPSACON-2016 organised by Indian Poultry Science Association.
14. Dr. Ambily, R., Assistant Professor, received the Best Oral Presentation award in KVSC 2016 organised by Indian Veterinary Association, Kerala.
15. Dr. Ambily, R., Assistant Professor, received the Best paper award in Life Science in the 26th Swadeshi Science Congress.
16. Dr. Prejit secured Center for Molecular Dynamics Nepal -*International travel Grant*- NEPAL- Invited speaker for the workshop entitled "Zoonotic Disease Pandemic Preparedness for South Asia" in 2017.
17. Dr. Prejit secured FAO of UN- International travel Grant- BANGKOK- Invited Indian delegate of the "Workshop on Development of Governance Structure and Roadmap for Establishment of a South Asia One Health Disease Surveillance Network" in 2017.
18. Dr. Jesss Vergis secured Dean's Medal in 2016 for the institution building responsibilities at college
19. ISVS Gold medal and Best paper presentation Award -Wild Animal Surgery Session

2017 for the paper entitled Symphyseal and transverse fracture of mandible in an Indian Grey Mongoose (*Herpestes edwardsi*) and its surgical management in of 41st Annual Congress and National Symposium of Indian Society of Veterinary Surgery (ISVS) held from 14 to 16, December at College of Veterinary Science, Sri Venkateswara Veterinary University, Tirupati.

20. Dr. Suja C. S. received the IPSA Dr. P. Kothandaraman Memorial Award for best presentation during XXXIII IPSACON -2016 held at AAU, Guwahati on November 3-5, 2016.
21. Dr. P. Anitha received Appreciation from DDG (ICAR) as team leader of AICRP Mannuthy centre for the best centre among AICRP layer centres at national level consecutively during years from 2012-2016
22. Dr. P. Anitha received Dr. Kothandaraman Memorial Award for best oral presentation (Co- worker) -2016- Indian Poultry Science Association.
23. Dr. Radhika G. secured Dr. G. Nirmalan Memorial Award 2016 for best research article given by IVA, Kerala
24. Dr. Bindya Liz Abraham secured Best Poster award given by SOCDAB 2017
25. Dr. Uma R. secured Best Poster Award: Indian Veterinary Association Kerala Chapter
26. Dr. Saranya. K.S., M.V.Sc scholar, bagged second prize for the poster presentation "Anatomical studies on the proventriculus of duck, swan and domestic fowl" authored by Saranya, K.S., Ashok, N., Sridevi, P., Lucy, K. M., Indu, V. R., Sreeranjini, A. R. and Ajith. J. G. 2016 in Kerala Veterinary Science Congress-2016 held at Hotel Dream city, Pattikkad, Thrissur on 12th and 13th November 2016 by Indian Veterinary Association, Kerala.
27. Dr. Ponnada Sridevi, M.V.Sc scholar bagged Dr. C. Vijayaragavan Award for best paper in avian anatomy for the presentation "Comparative gross anatomical studieson the oropharynx and tongue of Mute swan and Kuttanad duck" authored by P. Sridevi, A. R. Sreeranjini, K. S. Saranya, K. M. Lucy, N. Ashok., V.S. Bharati and J. G. Ajith in XXXI Annual Convention of IAVA &National Symposium held from 21st to 23rd December 2016 at CVAS, Rajendranagar, Hyderabad.
28. Best poster award for M.V.Sc student Dr Minu Sarrah on International conference on "Herbal and natural component as the future of pharmacology" held at Avinashilingam

University, Coimbatore on 28th Feb-1st March, 2016

29. Dr. Nayana Kumara received Third prize for oral presentation in Companion Animal – Non infectious diseases session in Indian Society for Veterinary Medicine, 35th Annual Convention on 22-24th January 2017-ISVM
30. Dr. Thejaswini Secured first prize for oral case presentation in Clinical conference 2016.- Directorate of Clinics, TANUVAS
31. Dr. Savitha R. -Best Thesis award in PG Diploma on One Health, COHEART, KVASU:
32. Dr. M. V. Silpa, M.V.Sc. student won 1st prize in oral presentation for the paper-Silpa M.V., Naicy T., Radhika G., Aravindakshan T.V., Joan J., Anu B. 2016. Ovarian expression of Sirtuin 3 (SIRT3) mRNA in Malabari and Attappady Black goats. 8th Kerala Veterinary Science Congress, Thrissur, Kerala, November 12- November 13.
33. Anu Bosewell-Msc Animal Botechnology. Gold Medal for first rank in MSc (2016) from Kerala Veterinary and Animal Sciences University, Wayanad, Kerala
34. Dr. Rinsha Balan, Ph. D Scholar received 2nd place in best oral presentation in KVSC 2016 organised by Indian Veterinary Association, Kerala.
35. Ponnala A. K.- Second Best Poster award given by SOCDAB 2017

Schools and Centres

1. School of Applied Animal Nutrition and Feed Technology, Mannuthy

About the centre

The School of Animal Nutrition and Feed Technology is established with objectives to undertake research projects in the field of Animal nutrition and also to impart training to various stake holders in dairy sector. A diploma course in feed technology is being offered to enhance man power in feed mill operations.

Research Activities

i. KVASU Research projects

- Revolving Fund on “Supply of mineral mixture for various classes of livestock and poultry

Major activities/Achievements

- Best paper award for Dr Sajith Purushothaman on International conference on "Herbal and natural component as the future of pharmacology" held at Avinashilingam University, Coimbatore
- Best paper award for Dr Jasmine Rani. K on International conference on " Herbal and natural component as the future of pharmacology" held at Avinashilingam University, Coimbatore.

Publications

- N. Elanchezhian and Ally, K. Replacement of maize by wheat bran on growth and feed intake pattern in pigs. 2016. *Indian J. Vet. Anim. Sci. Res.* **45** (1).

2. School of Applied Animal Production and Biotechnology, Mannuthy

About the centre

Modern Biotechnology has tremendous potential to improve animal productivity and health. School of Animal Production and Biotechnology (SAAPBT) has been established in KVASU for conducting research, education and training programmes in identified and frontier areas of Biotechnology such as genetic engineering, hybridoma technology, Molecular Diagnostics, Animal forensics, Reproductive Biotechnology and Animal Genomics. The school was undertaking two new post graduate programmes in the Academic year 2014-15 M.V.Sc. Animal Biotechnology, and MSc. Animal Biotechnology. These courses were designed to

build up technically trained manpower resource base, empowering them with all skills necessary to use biotechnology as a tool for improvement of human and animal health and livestock production including molecular diagnostics, improved vaccines, wild life conservation and forensics and epidemiological and climate change studies. State-of-the-art laboratory facilities for research in various areas of biotechnology are available in SAAPBT.

Trainings conducted

- Hands on training on "Basic Molecular Biology Techniques" from 1st to 7th April 2016
- "INTRODUCTION TO BIOINFORMATICS TOOLS" from 9th to 12th August 2016.

Research Activities

i. KVASU Research projects

- State Plan Project 2016-2017- Strengthening of School of Applied Animal Production and Biotechnology – P.I. Dr. T. V. Aravindakshan- 10 lakhs

ii. Masters /Doctoral Research projects

- Isolation and characterization of pdc-109 like protein(s) from Vechur bull seminal plasma- Kavyanjali Karthikeyan - (13-MSVM-01)
- Assessment of carrier status of canine haemoparasites in common ixodid ticks of Thrissur-Jain Jose K- 14-MSVM-17
- Characterisation of *solute carrier family 11 member 1 (SLC11A)* gene in native breeds of goat-Anu Bosewell -14-MSVM-18
- Isolation of theca cells from goat ovarian follicles and expression of *CYP 19* gene in the isolated cells- Anjana A- 14-MSVM-19
- Exome wide DNA capture and next generation sequencing in Vechur cattle of Kerala - Reshma R. S.- 14-MVM-17

Major activities/Achievements

- Four students successfully completed MSc. Animal Biotechnology Programme and one student in M.V.Sc Animal Biotechnology in the year 2016-17.
- Conducted two hands on trainings on Molecular Biology and Bioinformatics for research scholars, students and faculties from different universities in India.

Publications

- Anu Bosewell, Naicy Thomas and Thazhathu Veettil Aravindakshan .2016. "Characterisation of Exon 9 of Solute Carrier Family 11 Member A1 Gene in Vechur Cattle" *Biotechnology in Animal Husbandry*, **32** (3): 251-260.

- Reshma, R. S., T. V. Aravindakshan, G. Radhika, and Thomas Naicy. 2016. "Identification of single nucleotide polymorphisms in Toll-like receptor genes-TLR2, TLR4 and TLR9 by next generation sequencing in Vechur cattle." *J. Indian Vet. Assoc., Kerala* **14** (2): 27-31.

3. School of Bio Energy and Farm Waste Management, Mannuthy

About the centre

The School of Bio-energy and Farm Waste Management was established with Dr. Francis Xavier (Professor Farms) as the Implementing officer and Dr. Joseph Mathew (Prof and Head CVAS, Pookode and Dr. Deepak Mathew (Assistant Professor, CVAS, Mannuthy to carry out teaching and research in the highly advanced and cutting edge technology of bio-energy (No. KVASU/DAR/R2/3579/2011 dated 27.04.2012) The school established an Animal Fat Biodiesel Laboratory, 1st of its kind in India at Pookode campus on 06/05/2014. The bio-diesel plant was established as a pilot plant to demonstrate the cutting edge technology of utilisation of waste for the production of renewable fuel, for further research and not as a commercial production plant.

Research Activities

i. State Plan

Integrated Solid Waste Management in Veterinary College Campus, Mannuthy. Enhancement of aerobic composting through mechanical shredding and forced oxygenation and thermal studies

ii. Masters /Doctoral Research projects

M. Tech research project

Goutham Varma	2017	M V Sc LPM CVAS, Mannuthy, Thrissur	Enhancing Biogas Production by co-digestion of livestock manures
Justin Jacob Thomas	2016	Internal Cumbustion Engineering Division, Dept. of Mechanical Engineering, Anna University, Chennai	Reactivity controlled compression ignition combustion using alternate fuel blend

Shaeen. M	2016	Manufacturing Engineering, KMCT College of Engineering, Kozhikode	Utilization of bidiesel in different engine systems

B. Tech students project

Adarsh M.P Adhvaid J Aijin K. A Ajmal Hussain K Akashnadh N. V	2016	8th Sem, Mechanical Engineering Govt. Engineering College, Thrissur	A study on engine performance, combustion, emission of various biodiesel blends
Vishist P.V Dhanumol Vidyasree Subrahmanian K	2016	8th Sem, Mechanical Engineering M.E.S. College of Engineering, Kuttipuram	A study of Engine testing using different biodiesel blends
Fahad C.I Geethu M Gopika S. Kumar Greeshma. S	2016	8th Sem, Chemical Engineering, Govt. Engineering College, Kozhikode	Production of biodiesel from chicken waste
R. Praveen V. Prasanth B. Nanthakumar M. Naveen kumar	2016	8th Sem, Mechanical Engineering Selvam College of Technology, Namakkal, Tamil Nadu	A study on combustion emission characteristics of various biodiesel

The Biodiesel produced at the pilot plant was validated by the Quality control lab of Bharat Petroleum Corporation, Kochi Refinery on 09/04/2016.

Publications

- Sivadasn P. and Abdul Samad P. V. 2016. Exhaust emission analysis on engine using biodiesel produced from broiler slaughter waste. International Journal of Research and Engineering. **3** (7): 55-58.

- John Abraham, Ramesh Saravanakumar, Francis Xavier and Deepak Mathew. 2015. Biodiesel production from broiler chicken waste. International Journal of Biological, Bio-molecular, Agricultural, Food and Biotechnological Engineering. **9** (12).

4. School of Zoonoses Public Health and Pathobiology

About the School

Objectives:

- To generate, transfer and apply knowledge in the concerned disciplines or the protection and promotion of animal and human health and their well-being in consonance with the theme of 'Health for all in 21st century' and the mission will be routed through: education, research, industry support and public and Institutional Services
- To promote an interdisciplinary approach on education, research and diagnosis of infectious, metabolic and toxic conditions
- To produce a database on the various diseases
- The collaborating departments: Dept. of Veterinary Public Health, Dept. of Veterinary Microbiology, Dept. of Veterinary Parasitology, Dept. of Veterinary Pathology and Dept. of Veterinary Epidemiology and Preventive Medicine

Trainings conducted

- Training on Biosafety measures for Medical College Staff (Participants -25) and PG students (Participants: 85)
- Awareness programme (awareness class, exhibition, quiz and drawing competitions on 'Know Zoonoses to No zoonoses' or school students at Ponnani. Participants (500)

Research Activities

i. KVASU Research projects.:

- Strengthening of School:- Assessment of prevalence of *Vibrio cholera* in water sources and human diarrhoeic faecal samples from in and around Thrissur District of Kerala.

Major activities/Achievements:

- The study revealed that elevated API and troponin value suggested cognitive heart failure as the immediate cause of death in ascetic broilers which help the poultry sector.
- During the training programme, 15 candidates from different institutions in Kerala were given sufficient theoretical and practical hands on training on basic techniques like

cultivation of leptospires, MAT, PCR, preparation of recombinant proteins, its purification and incorporating them in diagnostic tests like ELISA and Dot-ELISA. This had equipped the trainees for diagnosis of leptospirosis which is an endemic disease in Kerala

5. Centre for Advanced Studies in Poultry Science, Mannuthy

About the centre

Centre for Advanced Studies in Poultry Science (CASPS) was established in 1985 as recognition for its contribution in various fields of activities. Establishment of AICRP on Poultry improvement, Release of crossbred chicken for backyard- Gramasree & Gramalakshmi, release of high yielding ILM-90, ICAR Revolving Fund poultry project, NATP project on Ducks and successful conduct of IV World Water Fowl conference, RKVY project etc. are the significant milestones of the centre.

Mandate

- Academic programmes of the Poultry Science and Veterinary faculty
- Research on advanced areas in Poultry Science
- Implementation of Externally aided projects
- Transfer of Technology (TOT) programmes
- Research activities
- Conservation of poultry germplasm
- Selection and breeding for egg production
- Evolving of birds for backyard rearing
- Nutritional requirement studies of poultry species
- Management studies on chicken, duck, quails and turkeys

1. Trainings conducted

Sl. No.	Title of the Programme	Place	Duration		Name of the sponsoring agency	No. of Partici-pants	No. of Papers presented	Approx. cost involved
			From	To				

1	Training on Egger nursery and poultry farming for farmers	CAS in Poultry Science, Mannuthy	05-09-2016 to 06-09-2016		13 nos		9,100/-
2	Training on Current trends in Quail farming for Farmers	CAS in Poultry Science, Mannuthy	20-03-2017 to 21-03-2017		14 nos		9,800/-
3	Training on Egger nursery and poultry farming for farmers	CAS in Poultry Science, Mannuthy	24-03-2017 to 25-03-2017		14 nos		9,800/-
3	Training on Broiler production and management for farmers	CAS in Poultry Science, Mannuthy	29-03-2017 to 30-03-2017		11 nos		7,700/-

Research Activities

i. KVASU Research projects.

- Conservation, characterization and popularization and of native chicken varieties in Kerala – 15 lakhs
- Pullet production to support self help groups in backyard poultry rearing – 10 lakhs
- Hatchery waste disposal and its effective utilization – 10 lakhs

- Centre for Advanced Studies in Poultry Science (Advanced Studies mycotoxin testing facilities for Poultry Feed – 10 lakhs

ii. Masters /Doctoral Research projects

Degree (Ph. D, M.V.Sc/ MSc)	Title of the project
M.V.Sc	Identification of restricted ovulator in the IWN and IWP strains of white leghorn.
M.V.Sc	Determination of protein levels of growth in Kuttanad Ducks.

Major activities/Achievements

- Dr. P Kothandaraman memorial award for best paper presentation for the work entitled "Effect of dietary supplementation of Marigold petals, Red amaranth leaves, Curry leaves and Turmeric powder on egg yolk pigmentation in Native and White Leghorn layers" authored by Suja C. S., Binoj Chacko, P. Anitha and Greeshma Girijan during IPSACON 2016 held at AAU, Khanapara, Guwahati, Assam

Publications

- M Azhaguraja, S. Sankaralingam, P. Anitha, Binoj Chacko and T. V. Aravindakshan. 2017. Association of Prolactin gene polymorphism with production traits in White Leghorn-, *J. Indian Vet. Assoc.* **15** (2): 12-14.
- Nahal, M. S., Sankaralingam, S., Joseph, L., Anitha, P. and Dipu, M. T. 2016. Effect of switching from starter to finisher ration at different ages on growth performance of gramasree cockerels. *J. Indian Vet. Assoc*. **14** (1): 24-29.
- Afzal, A. M., Anitha, P., Joseph, L., Sankaralingam, S. and Anil, K. S. Evaluation of egg quality traits in four crossbred birds under backyard system a comparative study. *J. Indian Vet. Assoc.* **14** (1): 48-51.
- Greeshma, G., Sankaralingam, S., Jospeph, L. Anitha, P. and Aravindakshan, T. V. 2016. Association of SNP in the exon 2 of Ovocalyxin-32 gene with production traits in IWN strain of White Leghorn. *J. Indian Vet. Assoc.* **14** (2): 32-34.
- George, J., Joseph, L., Anitha, P., Sankaralingam, S., Mathew, D. K. M., Gleeja, V. L. Evaluation of dietary protein level for growth in Kuttanad ducks. *J. Vet. Anim. Sci*. **48** (1): 48-51.

Papers in conference proceedings

- Sankaralingam, S. 2016. Comparison of reproductive performance of different varieties of fancy chicken with the White Leghorn birds. In: *Proceedings of Kerala Veterinary Science Congress 2016*, held on 12th to 13, November, 2016 at Pattikad, Thrissur, Kerala, India, pp. 394-395.
- Binoj Chacko, C.S Suja and P. Anitha, Comparative production performance of long term selected pure White Leghorn strains., XXXIII Annual conference proceedings of Indian Poultry Science Association 2016-page no.148. (abstract)
- Binoj Chacko, C.S Suja and P. Anitha, Heritability and correlations for egg production and other traits in long term selected population of White Leghorn., XXXIII Annual conference proceedings of Indian Poultry Science Association 2016-page no.149. (abstract)
- C.S Suja, Binoj Chacko and P. Anitha, Effect of dietary supplementation of Marigold petals, Red amaranth leaves, curry leaves and turmeric powder on egg yolk pigmentation in native and white leghorn layers., XXXIII Annual conference proceedings of Indian Poultry Science Association 2016-page no.349-350 (Full article)

6. Centre for Advanced Studies in Animal Genetics and Breeding, Mannuthy

About the centre

The Department of Animal Breeding and Genetics of College of Veterinary and Animal Sciences was upgraded and given the status of Centre for Advanced Studies in Animal Genetics and Breeding (CASAGB) in 1986 as recognition for its contribution in various fields of activities.

The Department offers Under Graduate, Masters and Doctoral Programmes in Animal Genetics and Breeding. Courses offering at UG level include basic concepts of Biostatistics, Animal Genetics and Breeding with practical experience in solving problems. At post graduate level, courses on Population Genetics, Cytogenetics, Molecular Genetics, Immunogenetics, Conservation Genetics and Biometric Genetics are elaborated.

Post graduate students of Animal Genetics and Breeding and Animal Biotechnology are encouraged to undertake research activities on recent advancements of Animal Genetics, Breeding and Biotechnology. Further, the present research is more concentrated on the applications of Next Generation Sequencing technologies such as whole exome sequencing, metagenome analysis, transcriptome analysis and ddRAD sequencing. Learning support for the

department is also provided by a Bioinformatics lab, Computer lab with internet facilities and facilities for data analysis related to Animal Breeding.

Objectives

- Undergraduate, Master's and Doctorate studies and research on Animal Breeding and Genetics
- Improving the genetic potential of livestock for efficient growth and increased production
- Research in molecular genetics, genomics and animal breeding
- Conservation of native animal genetic resources and act as germplasm repository for domestic animals

Trainings conducted

- Training on Introduction to Bioinformatics Tools (3 days)-3
- Training on Basic Molecular Biology Techniques and Introduction to Bioinformatics Tools (10 days)- 2

Research Activities

i. KVASU Research projects.

25 Per cent of ongoing EAPs

- ICAR Field Progeny Testing Scheme- 16 lakhs
- AICRP on goat Improvement (Malabari)- 9 lakhs

Plan projects- CASAGB

- Establishment of a germplasm repository for domestic animal diversity of Kerala-10 Lakhs
- Modernization of Vechur Cattle Conservation Centre- 40 Lakhs
- Augmenting of biotechnology and molecular biology research in KVASU- 26 lakhs
- Strengthening of CAS AGB- 10 lakhs
- Strengthening of Rabbit Research Station Mannuthy- 25 lakhs
- Characterisation and SNP analysis of candidate genes for lean meat production ability in Murrah buffaloes- 5 lakhs
- Evaluation of lactation performance and establishment of system of milk recording in cross bred cows of Kerala for sire evaluation-5 lakhs

State Plan -AGB Department

Microsatellite markers for assessing genetic diversity and disease resistance among native goat breeds of Kerala	15,00,000	2017
Genomic Screening for structural variants associated with fertility in dairy cattle	4,50,000	2017

ii. Masters /Doctoral Research projects

M.V.Sc

Charlotte Coretta Rodricks	2017	Dr Thirupathy V.	Genetic Variability and expression profile of *GHRELIN* gene in goats
Silpa M.V	2017	Dr. Naicy Thomas	Molecular characterization and expression profiling of *Sirtuin3* gene in goats

Major activities/Achievements

1. Collaborations with external agencies
2. Collaborations in Goat improvement and rearing exist with
   i. Arya Vaidya Sala, Kottakkal
   ii. NABARD
   iii. Kerala State Animal Husbandry Department

Publications

- Manoj, M., Prasada Rao, GSLHV. and Aravindakshan, T.V. 2017. Seasonal influence on conception rate in Vechur and Kasargod dwarf cows. *J. Agromet.*, 19: 123-125.

- Naicy, T., Venkatachalapathy, R.T., Joseph Siju, J. and Aravindakshan, T.V; Kurian, E; Jose, J; Bosewell, A. and Silpa, M.V. 2017. Molecular characterization and differential expression patterns of the goat Nerve Growth Factor (NGF) gene during different growth stages. Mgene (doi:10.1016/j.mgene.2017.09.004.)

- Vishnurahav, R. B; Ajithkumar, S; Usha, N.P; Madhvan, U.N; John, M.K.D; Aravindakshan, T.V. and Sunanda, C. 2017. Haemato-biochemical changes associated

with dilated cardiomyopathy in dogs- A Retrospective study. *Int. J. Sci, Environ. Technol*, **6** (6): 3377 – 3381.

- Jain, K. J., Lakshmanan, B., Syamala K., Praveena, J. E., Aravindakshan T.V. 2017. High prevalence of small *Babesia* species in canines of Kerala, South India, *Vet. World*, **10** (11): 1319-1323.

- Abhilash, R.S., Joseph, M., Kurien, M. O; Harshan, H. M., Aravindakshan, T. V., Anil, K.S. and Gleeja, V. L. 2017. Impact of Trans-vaginal oocyte recovery on ovarian biometry and oocyte yield in crossbred cattle of Kerala. *Int. J. Sci. Environ. Technol.* **6** (5): 2766 – 2770.

- Jose, J., Lakshmanan, B., Aravindakshan, T.V., Hitaishi, V.N. and Mani, B.K. 2017. Evaluation of DNA extraction protocols from ixodid ticks. *Int. J. of Science, Environment.* **6** (3): 1912-1917.

- Thomas, N., Venkatachalapathy, R. T., Aravindakshan, T. V. and Kurien, E. 2017. Association of a Cac81 polymorphism in the IGF1 gene with growth traits in Indian goats. *Journal of Genetic Engineering and Biotechnology*. *http://dx.doi.org/10.1016/ j.jgeb. 2017.04.002*

- Naicy T., Venkatachalapathy, R.T., Aravindakshan T.V., Raghavan K. C., Mini M. and Shyama, K. 2017. Association of Novel SNPs at the exon-2 of IGF –I gene with phenotypic variants in goats. *Vet. Archiv*. 7: 457-472.

- Azhakuraja, M; Sankaralingam, S., Anitha, P; Chacko, B and Aravindakshan T.V 2017. Association of prolactin gene polymorphism with production traits in White Leghorn. *J. Ind. Vet. Assoc.* **15**:12-15.

- Naicy T., Venkatachalapathy T., Aravindakshan T.V., Raghavan, K. C., Mini, M. and Shyama, K. 2017. cDNA cloning, structural analysis, SNP detection and tissue expression profile of the *IGF1* gene in Malabari and Attappady Black goats of India. *J. Genet.* **96**: 307–312.

7. Centre for Animal Adaptation to Environment and Climate Change Studies

About the centre

About the centre: Foreseeing the risks the livestock sector would be facing in the changing climatic scenario, the Kerala Veterinary & Animal Sciences University (KVASU) has established 'Centre for Animal Adaptation to Environment and Climate Change Studies (CAADECCS) to excel in climate change education, research and extension in the field of Animal Agriculture under the Directorate of Academics and Research with ICAR special grant during XI Plan. The CAADECCS is the first of its kind among the State Veterinary Universities of the country which serves as the nodal agency dealing with research and capacity building on all the aspects of climate risk management in relation to animal agriculture including weather insurance and provide information to the planners/ policy makers for implementing strategies to mitigate the ill effects of climate change/variability so as to sustain and enhance the rural livelihoods through livestock production and management.

Trainings conducted

- Officers of the Animal Husbandry Department attended classes in CAADECCS on climate change and Animal Husbandry as a part of their three months training programme.
- One day workshop has been arranged on the functioning of Physiological Monitor on 27-08-16 to the faculty members of related departments. Mr Sumant Butt, Engineer, Ad Instruments, explained the details of the instrument with demonstration
- Nearly 70 progressive farmers participated in the farmers interface conducted by CAADECCS on "Impacts of Climate Change on Poultry Industry" at College of Avian Sciences and Management in collaboration with College of Avian Sciences and Management at Thiruvizhamkunnu on 17-06-16. A fruitful interaction occurred between farmers and scientists and classes were taken by different faculty members on weather based management of poultry and prevention of diseases.
- Farmer seminar on "Climate Change and Dairy Farming" at Cattle Breeding Farm, Thumburmuzhi, on 22-07-2016. More than 50 participants participated in the seminar. Classes were taken by the scientists of KVASU on summer management of cattle

Research Activities

i. KVASU Research projects

State Plan Projects

- Livestock Advisory based on weather forewarning: An amount of 5 lakhs has been given for providing livestock advisory services to farmers. The whole amount was spent for this purpose and also for improving the facilities of the centre for effective dissemination of information to the farmers. In collaboration with KAU weekly bulletins containing tips on animal husbandry practices being distributed to farmers of Thrissur, Palakkad and Ernakulam districts using messengers, online services like email and Whatsup. Farmer interfaces have been arranged at different milk societies for discussing the solutions and the precautions to be taken by them to counteract the weather based problems faced by them.
- Maintaining, Strengthening & Refurbishing CAADECCS for Climate Change Preparedness in Livestock Sector:- An amount of Rs 2 lakhs has been given to CAADECCS for Establishment of meteorological observatory and other expenses. An amount of Rs.149430/- (Rupees one lakh forty nine thousand and four thirty only) from the total allotment for this project has been transferred to the account of Executive Engineer, ID wing for the preparation of land for surface observatory and also for fencing the identified area. The remaining amount (Rs. 50,570/- Rupees fifty thousand five hundred and seventy only) has been utilised for the general maintenance and also for the maintenance of the equipments (including AMC) of the centre.

ii. Masters /Doctoral Research projects

- One Ph.D. student is on roll. The fourth semester is in progress. As a part of the PhD research programme, Physiological monitor (AD Instruments, Australia) has been standardised to measure the physiological parameters of cattle

Major activities/Achievements

- Contributed one chapter entitled “Nammude Kalavasthayum Mrigasamrakshanavum” in the book entitled “Kalavastha Vyathiyanavum Karshika Meghalayum” published by Farm Care Foundation.in January 2017. Authors: Dr. V. Beena and Dr. P. I. Geevarghese
- CAADECCS is also providing AWS data taken from the Automatic Weather Station of CAADECCS for the students and scientists of KVASU for research purpose

- Participated in Workshop on Climate Variability in Kerala: Climate Change Perspectives' held at Mascot Hotel Thiruvananthapuram on 21 November 2016.
- Participated in a detailed consultative meeting (full day session) of Stake holder departments and the experts in the field of climate change on the State Action Plan on Climate Change (SAPCC) 17th December 2016 at the Banquet Hall, Guest House, Thycaud, Thiruvananthapuram

Awards received by the students

- Best Paper Award for the paper entitled "Significance of metabolic response in livestock for adapting to heat stress challenges" under the theme Climate change and livestock, poultry and fisheries authored by J. Aleena, P. Pragna, P. R. Archana, V. Sejian, M. Bagath, G. Krishnan, A. Manimaran, V. Beena, E. K. Kurien, G. Varma and R. Bhatta. 2016. In: National Symposium on Climate driven food production systems: Agrometeorological interventions held at Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India between 20-22 December 2016.
- Best Paper Award for the poster entitled "Heat stress and dairy cow: Impact on both milk yield and composition" under the theme Climate change and livestock, poultry and fisheries authored by P. Pragna, P.R. Archana, J. Aleena, V.Sejian, G.Krishnan, M.Bagath, A. Manimaran, V.Beena, E.K. Kurien, G.Varma and R.Bhatta (2016). In: National Symposium on Climate driven food production systems: Agrometeorological interventions held at Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India between 20-22 December 2016.

Publications

Articles Published in Research Journals

- Joy Aleena, Prathap Pragna, P. R. Archana, Veerasamy Sejian, Madiajagan Bagath, Govindan Krishnan, A. Manimaran, V. Beena, E. K. Kurien, Girish Varma and Raghavendra Bhatta. "Significance of metabolic response in livestock for adapting to heat stress challenges" *Asian. J. Anim. Sci*. 2016. **10** (4-5) 224-234
- Prathap Pragna, P.R. Archana, Joy Aleena, Veerasamy Sejian, Govindan Krishnan, Madiajagan Bagath, A. Manimaran, V. Beena, E.K. Kurien, Girish Varma and Raghavendra Bhatta. 2016. "Heat Stress and Dairy Cow: Impact on Both Milk Yield and Composition". *Int. J. Dairy Sci.*1-11.

- Aziz Z., Varma G.G., Raji K., Beena V and Anil K.S. 2016. Haematological responses of Murrah buffalo calves to varying temperature humidity index. *Int. J. Innov. Res. Develop.* **5**:329-331
- Role of Heat Shock Proteins in Livestock Adaptation to Heat Stress. Archana P.R., Aleena J., Pregna P., Vidya M. K., Abdul Niyas PA., Bagath A., Krishnan G., manimarana., Beena V. Kurien E.K., Sejian V and Bhatta R. *J. Dairy Vet Anim Res* 2017, **5**(1): 1-8
- Behavioral Responses to Livestock Adaptation to Heat Stress Challenges. Athira P. Ratnakaran, V. Sejian, V. Sanjo Jose, Shalini Vaswani, M. Bagath, G. Krishnan, V. Beena, P. Indira Devi, Girish Varma and R. Bhatta. 2017. *Asian J. Anim. Sci*. **11**(1): 1-13
- Three volumes of books containing Automatic Weather Station Data with calculated THI have been published

  Volume 2 – AWS data from 01-07-2014 to 31-12-2014

  Volume 3- AWS data from 01-01-2015 to 31-12-2015

  Volume 4- AWS data from 01-01-2016 to 30-06-2016

8. Centre for Livestock Development and Policy Research, Thiruvananthapuram

About the centre

The CLPR had been set up as autonomous centres of the Kerala Veterinary and Animal Sciences University (KVASU) at Thiruvananthapuram in June 2013. The centres organize capacity building programmes for the various stakeholders of livestock sector, such as farmers and extension workers. Organise exhibitions and seminars on behalf of the University. Conduct need based researches in different fields. Provide consultancy services for farmers and entrepreneurs and sell publications of the University on request. Act as an intermediary between the headquarters of University and the Government departments at the Secretariat, Thiruvananthapuram

Trainings conducted


- Training Programme for Kudumbasree groups on scientific goat rearing at Venganoor Grama Panchayat Hall on 04.06.2016.
- Training Programme for Kudumbasree groups on scientific goat rearing at Aryanad Community Hall on 10.06.2016.
- Training Programme for Kudumbasree groups on Scientific Cattle Management at Vembayam Gram Panchayat Hall on 17.06.2016.
- Need based Training programme for Veterinary officers of the Department of Animal Husbandry at Kerala State Veterinary council Building, Peroorkada on the topic "Skill Development in Clinical Competencies" on 26.07.2016 and 27.07.2016.

Publications

- Training need analysis and job preference of students, *Imperial J. Interdisciplinary Res.*, **2**(8): 732-734
- Significance of adolescent growth in an individual's development, Imperial Journal of Interdisciplinary Research, **2**(8): 1251-1253
- Production statistics of meat in Kerala, *J. Dairy Vet. Anim. Res.*, **3**(4): 90

9. Centre for One Health Education Advocacy Research and Training, Pookode

About the centre

COHEART was established at KVASU in the year 2014 as per the decisions of the 10th Academic Council and 26th Board of Management. COHEART envision to be a Global Centre for Excellence in One Health Education, Advocacy, Research and Training. The centre aims to support in achieving sustainable health of man, animal and its surrounding environment through leadership, partnership, research and training in One Health domains. The objective of the centre is (1) *EDUCATION* of a new cadre of health professionals about One Health - the linkages between animal, human and environmental health. (2) *ADVOCACY* for collaboration as an encouragement for professionals to work together. (3)

Conducting *RESEARCH* to understand the health threats and disease processes that occur at the interface of human and animal activities and their effects on the environment. and (4) *TRAINING AND CAPACITY BUILDING* to improve community's preparedness and response to hazards affecting man, animal and the environment

Trainings conducted

- COHEART organized Training on Molecular Diagnostic protocol for Leptospira and *Vibrio cholera* on 19/08/2016. The sessions included theory of Gradient and Real time PCR and hands-on exposure on working with the instrument.
- COHEART organized seminar on Importance of Food safety standards for Hotel and restaurant owners and employees. The programme was attended by around 120 Hotel and restaurant owners/employees. The session proved very useful for the hotel owners as recorded from their feedback.
- COHEART organized One day National Seminar on '*Sustainable Rabies Control in Kerala"* at KVASU, Pookode to commemorate World Rabies Day- 2016 under the joint collaboration with Indian Veterinary Association (IVA) and Indian Veterinary Research Institute (IVRI).
- World milk day was celebrated by COHEART by organizing various programmes in association with the College of Dairy Science and Technology (CDST), Pookode. An interface meet on dairying as food business was convened. More than 70 members attended the programme. An essay competition on the topic 'Strength, Weakness and Challenges faced by Indian dairy industry, was also conducted and mementos and certificates were distributed to the winners of essay competition.
- COHEART organized an Environmental Health Educational week in association with Student's council, CVAS, Pookode. The event comprised of weeklong programme on Environmental Health Education under the theme "Thaleer- Go Green and Clean". The programme consists of planting more than 100 tree saplings on various locations of the college campus.
- COHEART celebrated World Zoonoses Day by conducting Zoonoses awareness camps at Sugandhagiri village. The houses were selected based on the pets and livestock they owned. The visit comprised of health appraisal, awareness class, water testing for potability etc.
- COHEART associated with Kerala Government Veterinary officers Association in commemorating World Veterinary Day- 2016 at Bolgatty Palace, Ernakulam. The

seminar was on the theme topic "Continuing Veterinary Education with a One Health Focus" on 30th April, 2016 at Bolgatty Palace Resorts, Ernakulam.

- COHEART organized One Day Interface meet on "Rain Water Harvesting and Water Conservation" held at Pookode. Mr. Fritz Poerschke, from WISY ACT (an Indo-German Trade name for Emerging / Modern Rainwater Harvesting Systems) was the resource person who has dedicated more than 30 years with Rain Water Harvesting Concepts from Germany.

Research Activities

i. KVASU Research projects

- Development of alternate extension model facility as preliminary step to undertake training in food safety and public health. Kerala Govt. State Plan-2015-16
- Developing Veterinary-Medical-Community partnerships for studying diseases of public health importance with special emphasis on Cholera and Leptospirosis. Kerala Govt. State Plan- 2015-16
- Interface of public health and food industry sector for student, health science graduates and faculties. Kerala Govt. State Plan- 2015-16

Major activities/Achievements

- COHEART participated in the Workshop on Zoonotic Disease and Pandemic Preparedness organized by CMDN in collaboration with the UC Davis One Health Institute and the Regional Environment, Science, Technology and Health (ESTH) office for South Asia (US State Department). The event was held from March 13 - March 15, 2017 at Nepal. Dr. Prejit spoke on "Roles and Responsibilities of Stakeholders in the Region".
- COHEART acted as Knowledge partner for CUROFY vet mobile app that offers doctors a spam-free and secure environment to communicate with each other. Doctors can provide referrals, share cases, call other doctors and have access to most recent, specialty-wise developments taking place in their field.
- Dr. Prejit from COHEART delivered a talk on "One Health-Vision for Future" for the 12th National Conference on 'One-health: Approaches towards practice and future challenges' at College of Veterinary Science & Animal Husbandry, Anjora, Durg (Chhattisgarh) during 2nd and 3rd December 2016

- Dr. Tessy D.L., PG Diploma student of One Health was honoured for her Best Dissertation with a cash award and citation. The award was received for PG Dissertation on "Evaluation of stability of Rabies Viral antigen for diagnosis in decomposing brain samples".

2. Publications

- S. Jayasree, H Shameem, V. L. Gleeja and K. Prejit. 2016. Effect of anthelmintic therapy on milk quality in bovine amphistomosis. *J. Indian Vet. Assoc., Kerala*.
- Raghunatha Reddy R, Prejit, Sunitha, R and Reem Rasheed. 2016. Detection of Escherichia coli O157:H7 and Staphylococcus aureus in broiler meat available in local markets of Wayanad, Kerala. *Int. J. Sci. Environ. Technol*. **5** (2): 599 – 604.

10. Centre for Pig Production and Research, Mannuthy

About the centre

The major objective of the centre is to conduct research on different aspects of pig production, to operate as an instructional farm to students, to function as a demonstration unit to farmers, to maintain purebred nuclear stock of animals for supply of quality piglets to farmers. Centre also conserves indigenous Ankamali pigs, to evaluate the performance of indigenous animals and their crosses with exotic pig breeds.

ICAR funded All India Coordinated Research Project has been under operation since 1993 to evaluate the performance of indigenous pigs and their crosses with exotic breeds. Mega seed project on pigs funded by ICAR has started functioning since 2015. The strategic breeding programmes for more than two decades evolved a new crosbred variety of pig with remarkable disease resistance, heat tolerance, lean meat production and feed conversion efficiency. The new pig variety Mannuthy white, with better adaptability and growth rate was developed and released from this centre. The three breed crosses of pigs with better growth rate and lean meat are also produced and distributed to farmers for fattening purpose. Ninety five M.V.Sc. and thirteen Ph.D. from different disciplines and various plan projects have been completed in this centre.

Training conducted

- With the collaboration of Kerala Livestock Farmers Association, the Centre has organized farmers meet and discussed the constraints and limitation of the pig farming in the state and remedial measures were evolved and the same has been submitted to the state government for necessary action through the association.
- Self employment training was given to unemployed women from weaker sections of the community for starting their own piggery units. Different units of Self Help (Kudumbashree) groups have undertaken short-term training on piggery for their better livelihood.
- The centre conducted a 'Farm Day'. Many progressive pig farmers participated and discussed the prospects and problems of pig rearing in Kerala and many of the pig farmers expressed their success stories.
- Hands-on practical training is provided to veterinary officers, farmers and self help groups. Faculty provides technical advice to pig farmers and helps in the preparation of project reports for the establishment of pig farms.

Research Activities

i. KVASU Research projects

Name of Project	Financial outlay (lakhs)
Artificial Insemination for improving reproductive efficiency in pigs	10.0
Conservation and maintenance of Ankamali pigs of Kerala	10.0
Effect of dietary supplementation of xylanase and β-glucanase on growth performance in weaned piglets	10.0
Evaluation of performance of crossbred pigs (25 Per cent share of AICRP on pigs)	20.0
Scaling up of production of piglets	80.0
Effect of different levels of energy supplementation on breeding performance in gilts	10.0
Strengthening of the Centre for Pig Production and Research	10.0
Waste water management for eco-friendly swine production	20.0
Total	**170**

EAPs	
AICRP on pigs	120.75
Mega seed project	48.00
Total	**168.75**

ii. Masters /Doctoral Research projects

- Nutritional management of early weaned Large White Yorkshire piglets by functional amino acid supplementation
- Effect of weaning age on performance of Large White Yorkshire pigs
- Evaluation of semen quality of liquid storage of specific fraction of LWY boar semen – ongoing

Major activities/Achievements

The Board of Management appreciated the Professor and Head and her team of scientists, staff and labourers for the commendable achievements and revenue generation at the Centre for Pig Production and Research, Mannuthy.

The strategic breeding programmes for more than two decades evolved a new crosbred variety of pig with remarkable disease resistance, heat tolerance, lean meat production and feed conversion efficiency. The new pig variety was released as 'Mannuthy white' by Dr. H. Rahman (Deputy Director General, ICAR) in presence of Dr. R. S. Gandhi, Assistant Director General, Dr. Vineet Bhasin, Principal Scientist and Dr. D.K. Sarma, Director ICAR NRC on Pig in this year

The center has distributed more than 5000 piglets (breeding and fattening) to farmers and has generated over 2 crores internal revenue during 2016-17. The centre distributed 150 piglets to 60 tribal families in Malakkappara and Varandarappilly tribal colonies utilizing the recurring contingency of Rs. five lakhs each in the projects AICRP on Pigs and Mega seed (TSP Component). The programme envisages the improvement of socio-economic status by enhancing the food security of tribal colonies

Publications

- Venketachalapathy, R, Usha, A.P., Benjamin, E.D. and Suraj, P.T. 2017. Ankamali Pigs- Monograph. Kerala Veterinary and Animal Sciences University.
- Usha, A.P., Benjamin, E.D. and Suraj, P.T. 2017. Mannuthy White – a new cross bred pig variety. Brochure. Kerala Veterinary and Animal Sciences University
- Suraj, P.T., Usha, A.P. and Benjamin, E.D. 2017. Waste management in pig farms. Brochure. Kerala Veterinary and Animal Sciences University
- Benjamin, E.D., Usha, A.P., Suraj, P.T. and Lali F Anand. 2017. Artificial insemination in pigs. Brochure. Kerala Veterinary and Animal Sciences University.

11. Centre for Wildlife Studies, Pookode

About the centre

KVASU Centre for Wildlife Studies, Pookode, was established in 2011 as a multidisciplinary station of the University. Here, intramural veterinary, wildlife biology and molecular biology experts work with extramural multidisciplinary subject area experts to train students who are passionate about conservation, in a truly interdisciplinary manner. The Centre runs the Master of Science (Wildlife Studies) course open for all bioscience graduates since 2011. Thirty six students have completed the course since its inception. There are currently forty three students. The alumni work in various organizations like Wildlife Institute of India – Dehradun, Kerala Forest Research Institute – Peechi, SACON-Coimbatore, Kerala State Forest Department, UNDP *etc*. Others pursue PhD/higher studies at reputed universities like KVASU, IIITM-K, IISER, Central University of Kerala & Tamil Nadu *etc*. The priority of the Centre is training and empowerment of all bioscience graduates, including veterinarians, for conservation action and research. Many of the alumni are recipients of national and international awards like Young Scientist award of KFRI/KSBB and fellowships like INSPIRE, Young Woman Scientist Award of DST, CSIR JRF *etc*. The Centre is also involved in social outreach activities aimed at the empowerment of youth from tribal and other socio-economically backward communities of Wayanad as well as helping farmers suffering from human-wildlife conflict.

Research Activities

i. Masters /Doctoral Research projects

A preliminary study on human-wildlife conflict in selected areas of wayanad indicated that respondents who had suffered from financial loss by crop damage or by livestock loss had negative attitudes towards co-existence. Positive attitude towards co-existence was marginally more significant among men than women. Diversity of ground dwelling spiders in south wayanad forest division recorded a total of 54 species belonging to 19 families were recorded. Among different spider species recorded, five were endemic to Western Ghats and six species endemic to South Asia. The study on spiders provided baseline information on spiders of the South Wayanad Forest Division and the influence of environmental factors on spider abundance which are essential for developing conservation plans. Population density, diversity and developmental stages of selected butterfly species at Chimmony Wildlife Sanctuary, Kerala, were studied. A total of 141 species of butterflies belonging to two orders, six families and 103 genera were recorded. Among different butterflies, 15 species were recorded as endemic and 20 species were reported under various schedules. Developmental stages of Grass Demon (*Udaspes folus*) and Nilgiri Grass Yellow (*Eurema nilgiriensis*) were studied. Nilgiri Grass Yellow butterfly eggs hatched on third day and there were two rapid growth phases with complete development taking 21 days. Development of Grass Demon was monitored in three different host plants - Red Ginger (*Alpinia purpurata*), Ginger (Zingiber officinale) and Turmeric (Curcuma longa).

KERALA VETERINARY AND ANIMAL SCIENCES UNIVERSITY

Pookode, Wayanad, Kerala