ANNUAL REPORT

2014-15

CIRG

CIRG
1979
MATHURA

भा.कृ.अ.प.-केन्द्रीय बकरी अनुसंधान संस्थान

मखदूम, फरह-281122, मथुरा (उ.प्र.) भारत

ICAR-Central Institute for Research on Goats

(An ISO 9001:2008 Certified Organization)

Makhdoom, P.O. Farah-281122, Mathura (U.P.), India


NEW LABORATORY BLOCK
INAUGURATED BY
Dr. S. AYYAPPAN
Dr. K.M.L. PATHAK

Annual Report

2014-15

CIRG
1979
MATHURA

भा.कृ.अ.प.–केन्द्रीय बकरी अनुसंधान संस्थान
मखदूम, फरह–281122, मथुरा (उ.प्र.) भारत

ICAR-CENTRAL INSTITUTE FOR RESEARCH ON GOATS
(An ISO 9001:2008 Certified Organization)
Makhdoom, Farah, Mathura 281122, U.P.

भाकृअनुप
ICAR

Publisher:

Dr. S.K.Agarwal
Director,
CIRG, Makhdoom

Editorial Board:

Chairman
Dr. S.K. Jindal
Members
Dr. P.K. Rout
Dr. Ashok Kumar
Dr. S.D.Kharche
Dr. M.K.Tripathi
Dr. Vijay Kumar

Photography

Mr. Satish Chandra

ICAR-CENTRAL INSTITUTE FOR RESEARCH ON GOATS
(An ISO 9001:2008 Certified Organization)
Makhdoom, Farah, Mathura 281122, U.P.

Telephone No.	: 0565-2763380
Fax No.	: 0565-2763246
E-Mail	: director@cirg.res.in
Website	: http:// cirg.res.in
Helpline	: 0565-2763320

Printed by :
Yamuna Syndicate
Mathura
Tel. : 09456684421, email : ys9456684421@gmail.com

PREFACE

ICAR-Central Institute for Research on Goats is in the Service of Nation since 12th July, 1979. The Year 2014-2015 has proved to be a fruitful year for the Institute as the Institute was recommended for ISO 9001 : 2008 Certification dated 23rd March, 2015. The Institute has developed farmers friendly and commercially viable technologies for goat improvement. During the year we were able to transfer and commercialize six technologies to various industries in the country. These included Goat milk based soaps i.e. Ajas Beauty, Ajas Green and Ajas antiseptic soaps; Herbodin-herbal antidiarrheal formulation; Topivet G- herbal skin/ healing gel and Areamix-an area specific mineral mixture for goats.

The Institute is maintaining elite herd of Barbari, Jamunapari and Jakhrana goats and Muzaffarnagri sheep for their conservation, propagation and distribution for the genetic improvement of goats and sheep under field conditions in the country. The Institute during the year supplied 482 elite goats and 82 sheep to different SAUs, State Governments, NGOs and farmers for genetic improvement of their goats and sheep. The mortality rate of goats and sheep flocks maintained in the Institute have been below 5% during the year which is mainly due to effective health care and overall management of the livestock farms.

The scientists have worked on 19 institute funded and 18 out funded research projects. Seven new out funded research projects were awarded to scientists of the Institute during the year which reflects the research and academic environment in the Institute . Total 118 research papers have been published by the scientists in high impact International and National Journals.

The All India Coordinated Research Project on Goat Improvement (AICRP on goat improvement) with eighteen research centres all over the country is running at this institute. Out of eighteen, four new centres were added this year ie Changthangi goat unit at SKUAST, Kashmir; Andaman goat unit, Portblair; Uttarakhand goat unit, GBPUA&T, Pantnagar and Himalyan goat unit, IVRI, Mukteshwar.

Skill development, capacity building and transfer of technologies are strong and key features of the Institute activities. During this year, we imparted 16 trainings to veterinary professionals and other stakeholders. 26 episodes of the farm school on AIR on goat production were broadcasted on All India Radio, Mathura in addition 8 T.V. programmes

reflecting Institute contribution and achievements as well as on scientific goat farming were telecasted on DD National New Delhi. The Institute participated in eleven exhibitions and Kisan Melas at different places of the country to display its various technologies for the benefit of the goat farmers, professionals and other stakeholders. The Institute organized ten Camps, five Kisan Gosthis and ten Farmer 's scientists interaction in various villages. The Institute was able to establish active communication with goat farmers and stakeholders throughout the country through farmers help line, goat-net and dynamic website (www. Cirg.res.in).

Agro-forestry is another important section of the Institute which produced and supplied 10124 quintals of green fodder to different livestock units besides the dry fodder and grains.

We have conducted IRC, IMC, RAC and QRT meetings during the year for the guidance in research and development of the Institute. QRT has rated the achievement and progress of the Institute as very good.

The Institute scientists received different awards viz; Bioved Agri-Innovation Award-2015, Indian National Science Academy Award (INSA) - 2014, fellowship of different societies Best Paper Presentation Award at different seminar/ symposium, Member, management committee of Universities/ ICAR Institutes etc.

The infrastructure and research facilities developed in the Institute have been visited by our Hon'ble Union Agriculture Minister, Govt of India Sh. Radha Mohan Singh, parliamentarian Sh. Giri Raj Singh, Minister of State, MISME, Government of India, DG, DDG (AS), DDG (Fisheries) and many Directors of ICAR Institutes.

I express my sincere gratitude to Dr. S. Ayyappan, Secretary DARE, and Director General, ICAR, and Dr. KML Pathak, DDG (Animal Sciences)for their support for the development of the Institute. I am thankful to, Dr. B.S. Prakash, ADG (AN&P), Dr. Gaya Prasad, ADG (AH), Dr. Ravinder Singh Gandhi, ADG (AP&B), and other scientists of SMD for their ever encouraging support for the progress and overall development of the institute. Our thanks are also due to Chairman and members of QRT, RAC and IMC of the Institute for their valuable guidance and support. The editorial team needs appreciation for their untiring efforts for compiling and bringing out the Annual Report. I hope the annual report will be useful for scientists, administrators, entrepreneurs and stakeholders working in the field of goat production.

(S.K. Agarwal)
Director

CONTENTS

CERTIFICATE

TÜV NORD

Management system as per
ISO 9001 : 2008

In accordance with TÜV INDIA procedures, it is hereby certified that

ICAR - Central Institute for Research on Goats
Makhdoom, Farah - 281 122, Mathura,
India

applies a quality management system in line with the above standard for the following scope

Research & Development and Capacity Building for improving Goat productivity

Certificate Registration No. **QM 04 00356**
Audit Report No. **Q 6752/2015**

Valid until **31.03.2018**

S.K.Kulka

Certification Body
at TÜV INDIA PVT. LTD.

Issue **01.04.2015**
Place : **Mumbai**

This certification was conducted in accordance with the TÜV INDIA auditing and certification procedures and is subject to regular surveillance audits.

TUV India Pvt. Ltd., 801, Raheja Plaza – 1, L.B.S. Marg, Ghatkopar (W), Mumbai - 400 086, India www.tuvindia.co.in

TUV INDIA NABCB QM 002

MEMBER OF MULTILATERAL RECOGNITION ARRANGEMENT IAF

EXECUTIVE SUMMARY

Goat, the poor man's cows, fit in amicably to achieve the inter-dependent objectives of poverty alleviation, availability of food, creation of employment and growth in rural income. The livelihood security of an incredibly large number of farm families is linked to livestock. Majority of small and marginal farmers derive their livelihood from goats. India with 135million goats is one of the largest goats owning country in the world and playing a significant role in livelihood and nutritional security as well as providing supplementary income to nearly 70 million farmers of over 5,00,000 remote villages. Goat meat production in the country has increased from 0.47 to 0.59 million tons during the last decade (2002 to 2011) with an annual growth rate of 2.4%. Similarly, goat milk production in the country has also increased from 3.6 to 4.7 million tons during the same period with an annual growth rate of 2.6 %. The country stands first in goat milk production and is the second largest in goat meat in the world by sharing 29% & 12% production, respectively.Goat meat (Chevon) is most preferred and widely consumed meat in the country. Since ancient times goat milk has traditionally been known for its medicinal properties and has recently gained importance in human health due to its proximity to human milk for easy digestibility and it's all round health promoting traits. The goat sector contributes 8.4 % to the India's livestock GDPie 38,590 crores through meat (Rs. 22,625 crores), milk (Rs. 9,564crores), skin (Rs. 1491crores), manure (Rs. 1,535 crores) and others Rs 3,360 crores. The goat husbandry also generates about 4.2% rural employment to the small, marginal farmers and landless laborers. Women are also benefitted by goat rearing being the main custodian in rural areas, especially in Bihar, Jharkhand, West Bengal, Rajasthan, NEH and many tribal regions of the country. In the recent years, commercial goat farms have emerged in different parts of the country providing substantial income to the progressive farmers.

Genetic Improvement Programme

Selective breeding in institutional farm and AICRP units is being carried out to increase the production performance and to fulfill the need of the good quality genetically potential bucks in their breeding tract. Selective breeding of Jamunapari, Barbari, Jakhrana goats and Muzaffarnagari sheep at the institute farm have shown significant improvement in body weights, milk yield and wool production. Overall body weights in Jamunapari goats improved to 3.29±0.04, 12.78±0.14, 18.12±0.30, 23.55±0.38 and 28.31±0.48 kg at birth, 3, 6, 9 and 12 month age and 90 and 140 days milk yield 78.078±2.376 and 110.676±3.789 litre. The average body weights in Barbari goats recorded to be 8.55±0.09, 13.40±0.16, 19.14±0.33 and 22.69±0.41 kg and 140 days milk yield 85.16±2.32 litre, respectively. The body weights in Jakhrana goats improved to 2.74±0.09, 9.93±0.56, 15.80±0.18, 20.24±0.69 and 22.75±0.75 kg at birth, 3, 6, 9 and 12 month. In Muzaffarnagari sheep, The body weights at 3, 6, 9 and 12 month age and annual wool production improved to 17.01±0.29, 26.75±0.43, 33.27±0.60 and 38.26±0.65 kg and 1293.40±21.55g, respectively. The institute supplied a total of 484 goats and 131 sheep for various stakeholders for breed improvement programme in field. The overall mortality in the institute flocks was recorded less than 4%, which was significantly lower than previous year. Four multiplier flocks of Barbari goats were established in Agra and Mathura district to increase the availability of Barbari bucks in the field for genetic improvement of the breed. The farm and field programme under AICRP is being carried out in 18 units across the country and significant improvement in body weight has been observed in different field flocks. These units are also rearing bucks and supplying to farmers for breed improvement programme.

Physiology, Reproduction and Shelter Management Programme

Semen of superior bucks of Barbari, Jamunapari, Sirohi and Jakhrana breed were cryopreserved for AI and other research purposes. The post thaw motility, live sperm count, acrosomal integrity and hypo osmotic swelling positive spermatozoa were significantly higher in Cholesterol Loaded Cyclodextrin (CLC-1mg%) and chloropromazine hydrochloride (20 mg%) fortified group. Progesterone hormone estimation and Ultrasonography revealed that uterine involution completed by day 45 post partum in Jakhrana goats.

Parthenogenetic Stem cells colonies were produced from 8-16cells ,morula and inner cell mass (Blastocyst) stage goat embryos. Karyotyping of fibroblast cells was standardized. The overall cleavage rate and blastocyst production in TRIS + Heparin (37.67% and 13.8%) were comparatively higher as compared to sperm capacitated in TALP + Heparin (35.07% and 10.07%). The overall cleavage rate, morula and blastocyst production in mCR2aa and mCR2aa+cysteamine were 36.39, 21.62 and 4.95% and 31.72, 30.89 and 8.98%, respectively. Chemical activation of intra-cytoplasmic sperm injected in vitro matured goat oocytes showed significantly higher cleavage rate as compared to non activated oocytes. The percentage of embryonic cell colony formed was 32.35, 57.44 and 84.21% from 8-16 cell, morula and ICM of blastocyst stage derived embryos, respectively.

Comparison of biochemical and hormonal changes in goats kept in conventional soil floored houses with those kept in slatted floor indicated that the comfort level to the animals was similar in both types of flooring. Neck was observed as the most promising location for practical application of infrared method to measure body temperature.

Nutrition, Feed Resources and Products Technology Programme

Complete feed containing hay biomass of C. benghalensis (seasonal monsoon forbes), Setaria sp. and Lollium sp. (grass cultivated during the rabi season) with 50:50 of roughage and concentrate ratio in the form of complete feed pellets not only provided nutrient for the maintenance of goats but also supported production needs of the growing goat kids.

Brassica juncea green biomass was raised at institute and was supplemented ad lib to adult male goats along with pigeon pea straw and 200g of concentrate. Study demonstrated that the green biomass of Brassica juncea can be supplemented ad-libitum to goats as green fodder. Supplementation of fresh azolla improved the semen quality, whereas feeding of azolla in complete feed pellet did not improve lactation performance and milk constituents. Moringa, a multipurpose tree, which is fast growing and could grow as fodder tree with multi-cuttings during the year for the foliage biomass production, the foliage of moringa was evaluated for its suitability in goats feeding. Moringa Olifera biomass contains high protein content including all the essential amino acids, Moringa Olifera biomass based complete feed supported higher growth in growing goat kids.The assessment of methane production potential (MPP) of goat feed resources demonstrated that the MPP of Azolla was the lowest (1.52 ml / 100 mg truly digestible substrate), followed by mustard seeds (2.29 ml), gram straw (4.33 ml) and concentrate mixture (4.89 ml). Mustard cake inclusion in concentrate mixture reduced methane production by 21.09 %, whereas combination of guar korma and urea reduced methane by 4.83% in concentrate pellet. Feeding of these concentrate pellets improved milk production by 5.5 and 11.1 per cent respectively in comparison of control pellets

fed goats. Marua leaves inclusion in composite feed mixture (wheat straw: concentrate; 60:40) at 6 % reduced methane production by 12.6 %, while reducing ($p<0.05$) in-vitro dry matter and organic matter digestibility to the tune of 2 to 3 percent .A linear reduction in methane production was from 9.1 to 40.63% with 3 to 7 % KNO3 inclusion in concentrate mixture. Full fat mustard seed inclusion in a complete feed pellet (50:50) reduced methane production. Markers and strategies are being working out for adaptive capability of goat breeds to adverse climate and package of practice in terms of nutritional interventions to combat adverse climatic conditions to increase /sustain goat productivity are being formulating. Using recent molecular methods, 24 isolated of rumen bacteria were isolated from goats on straw based diets and submitted with GeneBank.

In increasing the functionality of goat products, plant ingredients such as Amla, Kiwi fruit peel, Moringa peel, pulp and flower can be used for the development of goat meat products with improved dietary fibre and antioxidants levels.

Low sodium goat meat pickles can be preserved and stored upto 60 days without the infestation of bacteria,yeast and moulds. National referral laboratory for testing of animal products was established and strengthened and rapid testing of pathogenic microorganisms and pesticide residue analysis in meat and meat products using GC/MS/MS was standardized. HACCP for goat meat and meat products has been designed with microbial and residue analysis. Microbial analysis of meat and meat products was carried out by manual as well as by TEMPO method.

Goat Health Programme

Five plants selected as prototype for development of herbal acaricide.

Zn-deficient animals vis a vis control animals showed up-regulation and down regulation of 3855 and 3819 genes in the liver.

During the year a therapeutic and preventive vaccine against incurable Johne's disease in domestic livestock has been licensed by Drug Controller of India and validated in field in all the farm domestic livestock species and commercialized.

Indigenous ELISA kit developed for diagnosis of Johnes disease in animals has been extensively validated in the available international tests and was given for commercialization to NRDC, New Delhi.

B. melitensis biovar 3 genome was sequenced and published. A sensitive and rapid Taqman probe based test has been developed for specific detection of B. melitensis. Studies showed Expression of TLR- 4 and 9 was more as compared to TLR 2 suggesting their role in innate response against brucellosis.

Indian breeds of goats were studied for phylogenetic correlation based on the full gene sequencing of their coding sequences.

Isolation of Rotavirus, from goats in India was reported. Confirmatory identification of Klebsiella pneumoniae associated with neonatal diarrhea was standardized targeting its fus A gene. A multiplex semi-nested RT-PCR assay for confirmatory detection of rotavirus from neonatal diarrhea was standardized targeting its VP1 gene.

An evidence was provided to prove that RTK signalling regulates replication of a Morbilli virus. A total of 8 cultures submitted to VTCC, Hisar for further characterization and accessioning. Supra-mammary lymph nodes followed by mammary gland elicited strong innate immune response by expressing higher levels of TLRs. PCR for detection of EPEC associated with neonatal diarrhea in goat-kids was developed. Estimation of beta- hydoxy butyrate in vitreous humor of eye was developed and standardized in goats died due to pregnancy toxaemia.

Extension Education and Socio-Economics Programme

During this year, we imparted 16 trainings to veterinary professionals and other stakeholders. 26 episodes of the farm school on Air were broadcasted on All India Radio, Mathura in addition 8 T.V. programmes telecasted on DD National New Delhi. The Institute participated in eleven exhibitions and Kisan Melas at different places of the country to display its various technologies for the benefit of the goat farmers, professionals and other stakeholders. The Institute organized ten

Camps, five Kisan Gosthis and ten Farmer 's scientists interaction in various villages. The Institute was able to establish active communication with goat farmers and stakeholders throughout the country through farmers help line, goat-net and dynamic website (www. Cirg.res.in).

One hundred and nine (109) technical letters were received and replied. Institute also entertained 2949 visitors from different parts of the country and received 2480 helpline calls and answered accordingly.

The All India Coordinated Research Project on Goat Improvement (A.I.C.R.P.) with eighteen research centres all over the country is running at this institute. These inclue four new centres i.e. Changthangi goat unit at SKUAST, Kashmir, Andaman goat unit, Port Blair, Uttarakhand goat unit, Pantnagar and Himalyan goat unit, IVRI, Mukteshwar started functioning this year.

The scientists have worked on 19 institute funded and 18 out funded research projects. Seven new out funded project awarded to scientists of the Institute during the year.

The revenue generation during the year was 105 lakhs. Institute scientists were awarded and recognized by various organizations for their contributions.

Three postgraduate students from IVRI completed thesis research work for M.V.Sc degree. Three students from GLA University Mathura are conducting research work for PhD degree under guidance of institute scientists. Three graduate students from GLAU, Mathura completed one month summer training and one PhD student from SHIAT, Allahabad, UP was given expert guidance on HPLC analysis of plant extract samples. One batch of BVSC and AH Students from College of Veterinary science and AH, Mathura completed training under internship programme. Students of different academic colleges and veterinary colleges visited the institute laboratory and livestock Units. The institute recently developed technologies for diagnostics of brucellosis & J.D. and vaccine against J.D. which are under process of commercialization.

The institute scientists published 118 research papers in various national and international journals, 33 popular articles, 68 research abstracts, 15 lead/invited papers, 44 books/chapters/bulletins/manuals and 28 radio talks/ and three TV programmes covered by the DD National

CIRG: AN INTRODUCTION

Considering the significance of goats in the agrarian economy of India, The Indian Council of Agricultural Research established a National Goat Research Centre at Makhdoom, Farah in Mathura district of Uttar Pradesh on 12th July, 1976. The centre got the status of a full fledged Institute on 12th July, 1979 and named as Central Institute for Research on Goats. The Institute is located almost at equi distance from two famous places – Mathura (22 Km), the birth place of Lord Krishna, and Agra (32 Km) the abode of world famous Taj Mahal. Director is the head of Institute and its apex body like IMC, RAC and QRT guide its research and other activities. Presently 39 Scientists, 58 technical and 35 administrative personnel share the responsibility to achieve mandate of the institute, which has four research divisions and one section including well equipped Library, ARIS cell, PME cell, Agricultural farm, IPR Cell, Livestock farm and Health Section. The Co-coordinating unit of All India Coordinated Research Project on goat improvement is also located at CIRG. The project aims at improving production performance of different breeds of goats distributed in different regions of the country under farm and field conditions. The Institute is well connected with modern information and communication facilities comprising landline phones 0565-2763380, 2763323 and helpline 0565-2763320. The profile of the Institute can be visited at www. cirg.res.in

Vision

To develop - the Goat- as a source of livelihood and nutritional security for future prosperity of India

MISSION

Improvement in productivity of goats through research, extension and HRD support.

MANDATE

To undertake research, training and extension education for improving milk, meat and fiber production of goats and to develop processing technology of goat products.

OBJECTIVES

- To undertake basic and applied research in all disciplines relating to goat production and products technology.
- To develop update and standardize area specific package of practices on breeding, feeding, management and prophylactic and curative health cover of goats.
- To impart National and International Trainings in specialized fields of goat research and development.
- To transfer technologies for improving milk, meat and fiber production and value addition of goat products.
- To provide referral and consultancy services on goat production and product technologies.

Highlights of Achievements

The institute has developed farmers' friendly and commercially viable technologies for goat improvement in the country. So far, 21 patents have been filed and the following technologies have been developed/ commercialized.

Commercialized

- Alquit - a green drug technology for control of ecto-parasites has been commercialized to M/S Natural Remedies Pvt. Ltd, Bangaluru.
- Areamix- An area specific mineral mixture, commercialized to M/S Girraj Industries, Sirsaganj, U.P.
- Herbodin - an anti-diarrhoeal formulation commercialized to M/S Girraj Industries, Sirsaganj, U.P.

- Topivet G - a skin gel commercialized to M/S Girraj Industries, Sirsaganj, U.P.
- Goat milk based soap (Ajas) - three variants of soap ie Ajas beauty, Aajas green and Ajas antiseptic soaps have been commercialized to M/S BVG Lifesciences , Pune (M.S.)

Under Commercialization

- BRUCHEK-Dot ELISA Kit for diagnostics for brucellosis in goats transferred to NRDC for commericaliation .
- ELISA KIT for JD transferred to NRDC for commericaliation
- A strain of Mycobacterium avium subspecies paratuberculosis genotype 'Indian Bison type' strain 'S 5' of goat origin has been transferred to M/S Biovet (P) Ltd, Bengaluru for development and commercialization of indigenous vaccine against John's Disease (J.D)
- Intra vaginal pessaries for oestrus synchronization.
- Modern goat appliances to reduce feed and water wastage
- Low cost complete feed pellet
- Cost-effective milk replacers for kids
- Goat meat Murukku: A crispy food product
- Goat meat Nimkee: A snack food
- Goat flavoured milk and whey drink

Awards and achievements

- ICAR's Sardar Patel Outstanding Institute Award-2010-In recognition of its meritorious scientific achievements and technology innovation
- ICAR-Rajshri Tandan Rajbhasha award for two successive year 2008 and 2009 - for significant achievement in popularization and progressive use of Rajbhasha (Hindi).
- ICAR-Rafi Ahmad Kidwai Award
- 1st Prize by Nagar Rajbhasha Karyanvayan Samiti, Deptt. of Official Languages, Ministry of Home Affairs, Govt. of India
- NRDC Award for development of ELISA kit for diagnosis of J.D.
- DBT Fellowship at Wisconsin-Madison, USA and Roslin Instiute, Edinburgh, U.K.
- Indian National Science Academy (INSA) award for young scientists.
- Ram Lal Agrawal Gold Medal award -2014
- Fellow, ISSAR. ISVM , ISAE and ISSGPU
- Member, Board of Management, NDRI, Karnal, NBAGR, Karnal, CARI, Izatnagar and MAFSU, Nagpur.
- Member of Selection Board, GADVASU, RAJUVAS, ASRB, NDRI, IVRI, PDC and JNU, New Delhi.
- Member, RAC, NRC Equines, Hisar
- President ISSAR and Vice – President, ISSGPU
- Best Paper Award at different Seminar/Symposium
- First, Second and Third prize at Kisan Mela at DUVASU, NDRI and IVRI

Some of the major achievements are as follows.

- Multiplication and conservation of elite germ plasm of Jamunapari, Barbari, Sirohi and Jakhrana breed of goat for genetic improvement of indigenous goats.
- Higher population growth in Jamunapari (94.65%) and Barbari (183%) goat flocks and positive genetic improvement trend in body weight at birth (0.12±0.03), at 3(0.59±0.12), 6(1.58±0.19), 9(2.66±0.28), and 12 (2.14±0.36) month of age in Jamunapari goats and at 9 month (0.999±0.213 kg) in Barbari goats.
- Significant improvement in milk yield in Jamunapari, Barbari and Jakhrana goats compared to their base population performance.
- AICRP on goat improvement through its eighteen centres carried out the genetic improvement of Barbari, Black Bengal, Ganjam, Jamunapari, Marwari, Malabari, Sirohi, Sangamneri and Surti breeds in their natural habitat
- Characterized heat stress tolerant genes i.e. AP-2 binding site in the promoter region of hsp70.1 gene, Melanocortin 1 receptor (MC1R) gene, Tyrosinase (TYR) gene and Signal transducer and activator of transcription 5 A (STAT5 A) gene to facilitate further studies on resilience of

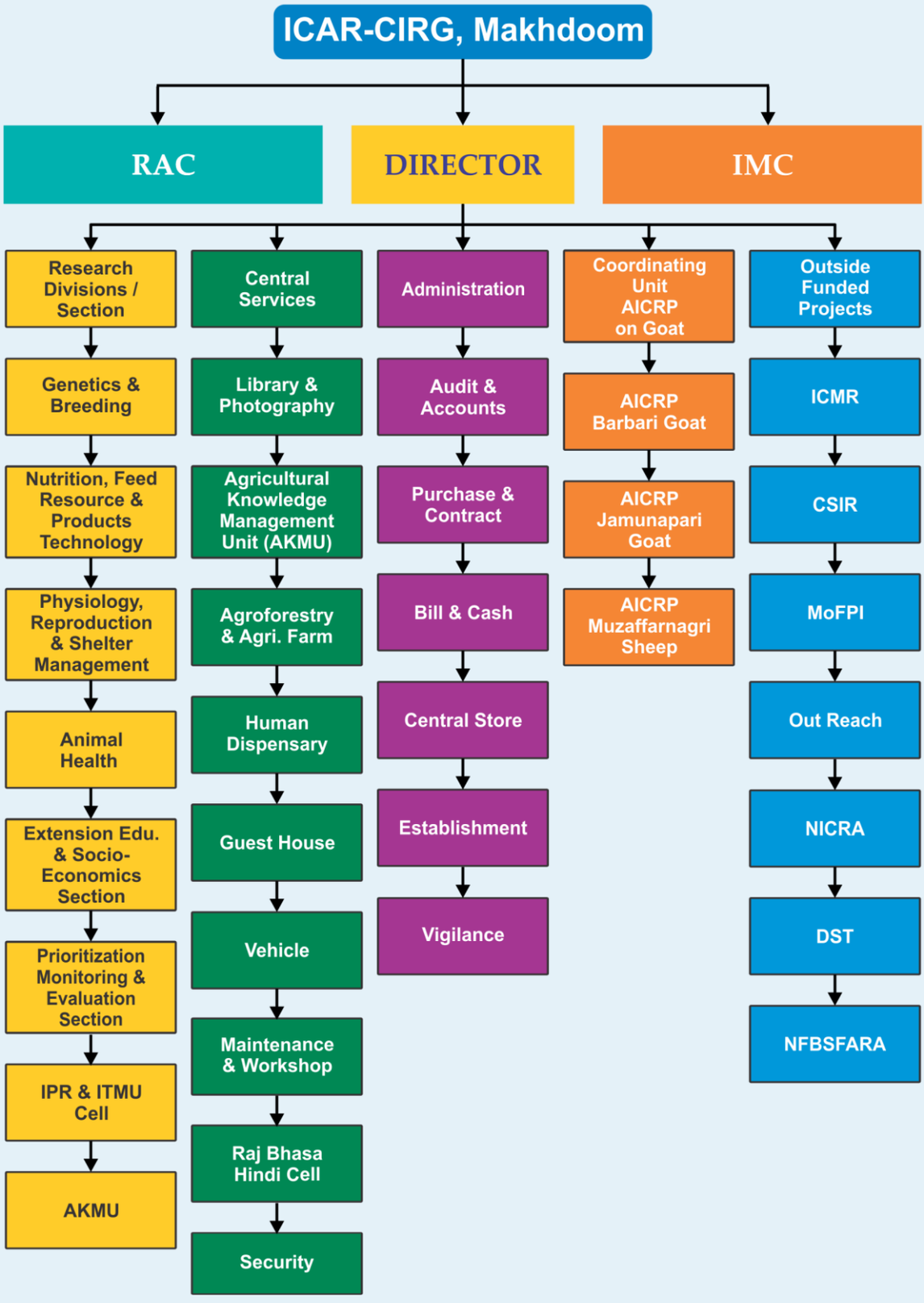
goat production system under changing climate.

- Established genetic origin of Indian goat breeds and genetic variation in Myf, leptin, Pit I, FecB, SCD gene and HSPgenes in Indian goats.Freezing of semen of Jamunapari, Barbari, Jakhrana and Sirohi breeds, and production of kids through AI in goats
- Standardized Embryo Transfer and IVF technology in goats and successful production of kids through above technologies.
- Developed complete feed pellet for efficient growth (80g/d) in finisher kids. Strategic supplementation of concentrate mixture @ 1.2 % of the body weight for better growth and meat quality of Barbari goats.
- Better dressing percentage and meat quality by supplementation of area specific mineral mixture under intensive goat rearing system.
- Identified anti-methanogenic feed resources for mitigation of methane production.
- Developed higher bio-mass producing fodder system (Guar+ Lobia + Sunhamp) for goats under rain fed conditions and Morus alba based cost-effective agro-forestry system for sustainable goat husbandry in semi-arid and rain fed areas
- Developed package of practices and dynamic health calendar for goat farmers.
- Determined fatty acids and mineral status of milk of different Indian goat breeds. Standardized process for preparation of herbal functional milk, whey drinks, goat milk and meat based biscuits, and low fat cheese.
- Developed low cost-protein and mineral enriched value added goat meat and milk products.

Impact of Research

- Improved, productivity and genetic potential of indigenous goats through supply of superior germ plasm from the institute to State Animal Husbandry Department, developmental agencies and goat farmers
    - Commercialized ectoparasitical drug-Alquit., Ajas Beauty soap, Ajas Green soap and Ajas antiseptic soap, Herbodin-herbal antidiarrheal formulation,;Topivet G- herbal skin/healing gel and Areamix- area specific mineral mixture for goats..
- Development of diagnostic kit for the diagnosis of Johne's Disease and Brucellosis in goat.
- Facilitated in establishment of several small & large commercial goat farms in different parts of the country through various trainings for capacity building to different stake holders, entrepreneurs. Established linkages with BAIF , ATMA, APEDA, DUVASU, IVRI, NDRI and other agencies for dissemination of technologies developed by the Institute.
- Improved body weights of Jamunapari (45.67%) , Barbari (31.96%) goats at 12 month age with kidding rate (1.4 in Jamunapari and 1.48 Barbari)
- Development of goat health calendar leading to over-all reduction in mortality.
- Development of suitable milk replacer for pre weaning kids.
- Developed complete pelleted feed, feed blocks and designing of low cost pelleting machine, being adopted by commercial goat farmers for intensive goat rearing

ORGANIZATIONAL SETUP



STAFF POSITION

Category	No. of post sanctioned	No. of post filled
Director	1	**1**
Scientific	50	**39**
Administrative Staff	33	**35**
Technical	72	**58**
Supporting	119	**89**
Temporary Status		**98**
Total	**260**	**320**

FINANCIAL STATEMENT (2014-15)

	Plan (Rs. lakh)		Non Plan (Rs.lakh)	
	Allocation	Expenditure	Allocation	**Expenditure**
A.Recurring				
Establishment charges	0.00	0.00	1530	1425
Wages	0.00	0.00	300	291
OTA	0.00	0.00	140	136
Overtime allowance	0.00	0.00	2.00	1.29
TA	9.00	9.00	3.00	3.00
Other charges	212	209	185	168
HRD	2.00	1.91	1.00	0.85
Total	223	220	2161	2027
B. Non-recurring				
Equipments	28	28	5.10	5.09
Furniture & Fixture	1.00	0.98	0.25	0.00
Library books & Journals	1.00	0.87	0.15	0.10
Livestock	0.00	0.00	0.00	0.00
Work	70.00	68.63	8.62	0.00
Others	0.00	0.00	0.00	**0.00**
Total	100	98	14	5
Grand Total (A+B)	325	318	2175	2032

REVENUE GENERATION

Particulars	Amount (in lakhs)
Sale of Farm Produce	56.08
Sale of Meat/Meat Products	1.97
Income from royalty/Sale of Publications and Advertisement	4.06
License Fee	8.61
Application fee from candidates	1.05
Income Earned from short term deposits	13.21
Income generated from Internal Resource Generation	5.52
Miscellaneous Receipts	15.00
Grand Total	105.51
Revenue Generation as per new guidelines	
Income from sale & Services	64.89
Income from fee/subscription	1.23
Income from royalty/ Publications	4.06
Grand Total	70.18

GOAT GENETICS AND BREEDING DIVISION

Improvement and sire evaluation of Jamunapari goats for milk production

P.K.Rout , Gopal Dass, Mahesh Dige ,N. Shivsaranappa, Vijay Kumar, H. A. Tewari and S. K.Singh

Jamunapari goat is one of the largest goat breeds of India, and is known as the best milch type goat in the subcontinent. Jamunapari is a tall, white and large sized goat of India and is commonly known as "Pari" in its home tract because of its majestic appearance. The natural habitat of this breed is the Chakarnagar area of Etawah district in Uttar Pradesh State. The breed is highly adapted to the ravines of Yamuna, Chambal and Kwari rivers, which have dense vegetation for browsing. The breed seems to be more adapted to particular vegetation as the breed is not seen in adjacent areas out of its specific home tract indicating the sensitiveness and adaptability of the breed to specific environmental conditions

Population growth:

The annual flock strength of Jamunapari goats for the year 2014-2015 showed opening balance of the flock was 741 and closing balance was 747. During the period 348 kids were born, in which 155 were males and 193 were females. The population growth of the flocks was 113.9% during the year. The overall mortality of the flock during the year 2014-15 was 3.94 % and annual culling rate was 3.12 %.(Table 1)

Table 1: Year-wise Overall Mortality in Jamunapari Goats

Year	2012-2013	2013-2014	2014-15
Flock Strength	1093	1112	1089
Goats Died	74	53	43
Mortality (%)	6.77	4.8	3.94

Production performance

The mean of body weights of kids at birth, 3, 6, 9 and 12 months of age during the year were 3.288kg, 12.770kg, 18.123kg, 23.548kg and 28.311 kg, respectively. Parity of dam had significant effect on kid's body weight and males had higher body weight than females at all the ages. The mean body weight under intensive management at 12 months of age was 45.705 kg and the highest vale was 52.0kg (Table 2). The average daily weight gain (ADG) of the kids under intensive management was 111.0, 115.3, 111.3, 119.9 and 111.5 g/day, respectively during 3-6, 3-9, 3-12, 6-9, and 6-12 month age group. The highest value of ADG was 152g/d during 6-9 months of age.

Table 2: Mean body weight at different ages in Feedlot experiment

	Number of observations	3 Month	6 Month	9 Month	12 Month
Mean weight	**22**	**15.659 ± 0.428**	**25.627 ± 0.580**	**36.418 ± 0.752**	**45.705 ± 0.838**
Range	**22**	**(11 – 20.2)**	**(18.5 – 29.8)**	**(28.4 – 42.0)**	**(38.8 - 52.0)**

Table 3: Least Squares Means of Body Weight Growth (Kg) in Jamunapari Goats

Factor	Weight at				
	Birth	3M	6M	9M	12M
Year of birth					
2010	3.137 ± 0.042 (270)	10.939 ± 0.159 (253)	15.264 ± 0.279 (223)	20.695 ± 0.352 (216)	26.639 ± 0.423 (206)
2011	3.231 ± 0.036 (466)	11.349 ± 0.137 (448)	15.398 ± 0.241 (426)	19.925 ± 0.308 (401)	24.013 ± 0.379 (347)
2012	3.232 ± 0.038 (347)	9.956 ± 0.146 (336)	13.494 ± 0.258 (290)	17.348 ± 0.337 (252)	21.970 ± 0.422 (215)
2013	3.262 ± 0.041 (279)	11.835 ± 0.158 (265)	17.045 ± .268 (257)	21.817 ± 0.339 (252)	27.786 ± 0.409 (245)
2014	3.288 ± 0.038 (466)	12.770 ± 0.144 (387)	18.123 ± 0.297 (219)	23.548 ± 0.381 (203)	28.311 ± 0.477 (161)
2015	3.302 ± 0.052 (161)				
Season of birth					
I	3.266 ± 0.038 (1161)	10.631 ± 0.123 (943)	15.403 ± 0.218 (867)	19.728 ± 0.278 (815)	25.017 ± 0.343 (701)
II	3.218 ± 0.040 (769)	12.108 ± 0.122 (746)	16.326 ± 0.228 (548)	21.606 ± 0.292 (509)	26.470 ± 0.360 (473)
Sex of kid					
Male	3.341 ± 0.040 (928)	11.829 ± 0.122 (816)	16.868 ± 0.220 (683)	22.575 ± 0.282 (625)	28.535 ± 0.349 (531)
Female	3.143 ± 0.037 (1002)	10.910 ± 0.121 (873)	14.861 ± 0.217 (732)	18.759 ± 0.277 (699)	22.953 ± 0.343 (643)
Type of birth					
Single	3.678 ± 0.026 (829)	12.439 ± 0.100 (750)	16.792 ± 0.183 (643)	21.708 ± 0.236 (607)	26.706 ± 0.292 (536)
Twin	3.210 ± 0.023 (1044)	10.977 ± 0.090 (886)	15.562 ± 0.165 (726)	20.401 ± 0.213 (674)	25.403 ± 0.262 (602)
Triplet	2.838 ± 0.073 (57)	10.693 ± 0.278 (53)	15.240 ± 0.485 (46)	19.891 ± 0.621 (43)	25.123 ± 0.773 (36)

Milk Production

Least squares means of part lactation milk yield in 90 days and 140 days were 78.07±2.37 and 110.67±3.78 liters, respectively during the year 2014-15(Table 4). Parity had significant effect on milk yield over the years. The doe, which had multiple births, produced more milk in comparison to doe having single kid.

Table 4: Lactation Performance of Jamunapari Goats

Factor	90 days milk (litres)	140 days milk (litres)
Year		
2010	**69.621 ± 2.537 (171)**	**97.880±4.076 (128)**
2011	**80.567 ± 2.315 (300)**	**114.306 ±3.621 (269)**
2012	**72.639 ± 2.403 (215)**	**107.272± 3.828 (178)**
2013	**71.756 ± 2.574 (177)**	**98.930 ±3.920 (160)**
2014	**78.078 ± 2.376 (250)**	**110.676 ± 3.789 (192)**
Season		
Mar-Apr	**74.245 ± 2.189 (579)**	**105.748 ± 3.491 (515)**
Oct-Nov	**74.819 ± 2.133 (534)**	**105.877 ± 3.517 (412)**
Parity		
1	**68.935 ± 2.232 (364)**	**99.556 ± 3.457 (322)**
2	**80.164 ± 2.289 (272)**	**114.728 ± 3.526 (235)**
3	**79.962 ± 2.472 (179)**	**113.512 ± 3.774 (145)**
4	**78.818 ± 2.537 (131)**	**114.924± 3.980 (101)**
5	**71.541 ± 3.018 (86)**	**105.283± 4.610 (64)**
6	**76.276 ± 3.611 (45)**	**106.790± 5.436 (37)**
7	**71.163 ± 4.945 (20)**	**96.651 ± 7.294 (15)**
8	**69.399 ± 5.707 (16)**	**95.059 ± 10.132 (8)**

Reproduction Parameter

During this year, a total of 233does kidded 348 kids, out of which single, twin and triplet born kids were 119,226 and 3 respectively. Reproductive performance of Jamunapari goats in terms of breeding efficiency and kidding percent on the basis of does selected for breeding were 84.69% and 118.3%, respectively. The kidding rate was 1.49.

Supply of Improved germplasm

Improved animals were supplied to various developmental agencies, farmers and state governments, Non-Government Organizations and progressive breeders for genetic improvement in the field conditions. During year, 224 improved animals were distributed to goat breeders for breed improvement of their flocks and 28 animals were transferred to other division for experimental use.

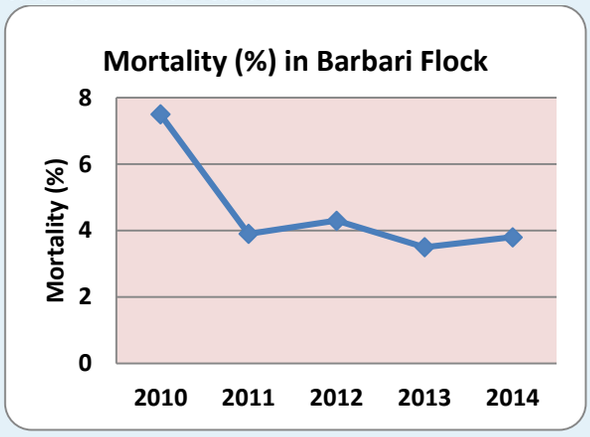
Genetic improvement of Barbari goats for meat and milk production

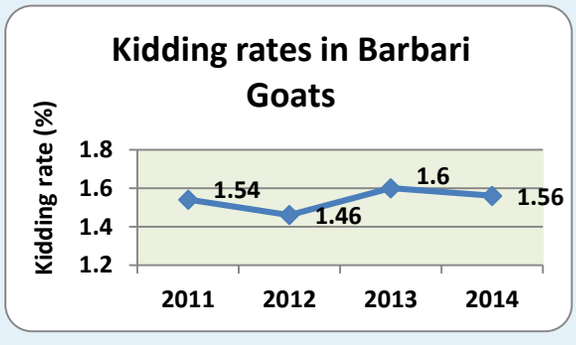
M.K. Singh, S. K. Singh, Mahesh Dige, A.K.Dixit, Nitika Sharma

Barbari a dual purpose goat breed. Lactation performance is almost similar to Indian dairy goat breeds. The breeding tract of the breed is Agra, Aligarh, Kanpur regions of Uttar Pradesh, and Bharatpur and Dholpur districts of Rajasthan. The Barbari farm unit of the Institute has been research units of All India Coordinated Research project on Goat Improvement from October, 1993 with prime aim to provide proven sires for breed improvement and conservation.

Flock Management

The goats are kept separately according to sex, age and production stages and maintained under semi-intensive management system. The breeding is carried out seasonally during April-May and Sept.-Oct. months of the year. Kids were weaned at 3 months of age. All the goats were vaccinated for PPR, ET, HS, FMD, Goat Pox and dewormed as per the goat health calendar of the Institute.





Flock population dynamics

The annual flock strength of Barbari goats for the year 2014-15 was 673 and 375 kids were born out of 240 goats. The population growth was 145% and overall mortality of the flock was 3.8%.

Growth performance (body weights)

The overall least squares means of body weight of kids at birth, 3, 6, 9, and 12 month of ages for the year 2014 were 1.54±0.02, 8.55±0.09, 13.40±0.16, 19.14±0.33 and 22.69±0.41 kg respectively (Table 2). Kids born during autumn season attained significantly higher body weight at 3, 6, 9 and 12 months of ages. Single born kids were significantly heavier than those born as multiple. Similarly males were significantly heavier than their counterpart's right from birth to 12 months of ages. The estimates of heritability (h^2) for body weight of kids at birth, 3, 6, 9, and 12 month of ages were 0.189±0.043, 0.231±0.048, 0.260±0.051, 0.494±0.074 and 0.655±0.088.

Lactation performance

The overall mean for 90 days milk yield, 140 days milk, total lactation yield, average daily milk yield and lactation length for the does kidded in 2014 were 57.56±1.15, 85.16±2.32, 67.94 ±1.54 liters, 519±9 ml and 126±1.56 days, respectively. Effect of year of kidding on different lactation traits was significant but amount of difference was quite low (3-10%). Does kidded during spring season performed significantly better for lactation traits than those which kidded in autumn season. Effect of parity and type of kidding were found non-significant on lactation traits (Table-3). The estimates of h^2 for MY 90, LMY and LL were 0.465±0.131, 0.483±0.133, 0.445±0.129 and 0.309±0.115 respectively (table 6). The genetic correlations among lactation traits were of high magnitude and positive in nature indicates part lactation yield of 90 days are reliable for constructing selection indices.

Reproductive & Breeding performance:

Overall mean for age and weight first mating, age and weight at first kidding, first kidding interval & gestation period were 341.4±10.4 days, 18.4±2.7kg, 475.5±7.4days, 21.9±4.6kg, 229.04±7.2 days and 144.1±2.3 days, respectively. Significant improvement in body weight at first mating with almost similar age at first mating over the years obtained. Breeding efficiency on the basis of does available and does tupped were 82.1 and 83.2%. Kidding % (tupped goat), kids with multiple birth and litter size (number) was 145.3, 68(%), and1.6, respectively.

Germ-plasm Supplied:

During this year 208 goats (162 male and 46 female) were supplied for breed improvement to farmers and various goat improvement & development agencies.

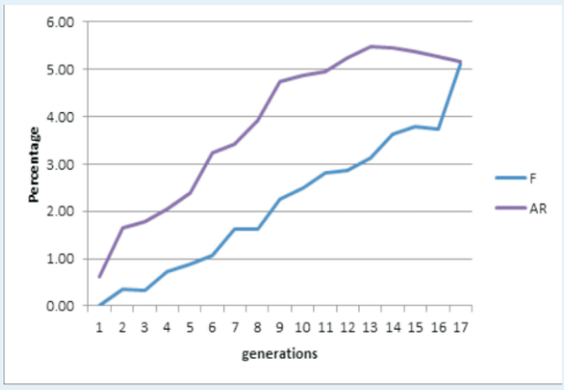
Multiplier Flocks:

Four multiplier flocks of Barbari goats were established, 2 at Mathura and one each at Agra and Dholpur (Rajasthan). One breeding buck, 6-12 kids of 3 months age and 3-6 adult females were provided to these flocks. Pooled body weight of male, female and overall at 6 months of age was 15.9±0.3, 12.7±0.2 and 14.2±0.2 kg respectively. Overall survivability at multiplier flocks was 93.3%. Multiplier flock initiated in Dholpur district has begun with intensive management system in the month of October, 2014. The composition of flock was: Adult breeding male- 55, adult castrated male- 30, adult female- 15 and kids (up to 6 months)- 10. The expenditure on shed construction (1200 sq. feet) was about Rs. 1.75 lacs. Per month wage rate for a labour was Rs. 5000.00. The average expenditure on feed per adult male and female was Rs.7.5 and Rs. 6 per day. The present value of the Barbari stock of khairagarh (Dholpur) is Rs.13.7 lacs. A low input based multiplier Barbari goat farm started in Farah with 3 adult female, 1 breeding buck and 6 weaned kids. The shed constructed with locally made material worth of Rs.10,000. Average grazing hours was 6-7 hours/day. Adult and weaned kids were supplemented with 150 gram of barley concentrate mixed with wheat straw.

Evaluation of flock health by employing Body Condition Scoring (BCS) Method:

A total of 573 goats of different age groups (20 breeding bucks, 48 bucks, 207 lactating does, 20 dry females, 133 kids (pre-weaned), 145 post weaned kids) were assessed for their nutritional and general health status by using BCS method. Various point systems were used to score the animals ranging from 1 to 5 (5-

excellent, 4- very good, 3- good, 2- average and 1-poor). Fat deposition at lumbar and sternal region was taken as an indicator of good scoring. Based on this, 3.84% (22/574) of animals showed BCS of 5 followed by 39.79% (228/573) with BCS - 4, 48.1% (276/573) with BCS-3 and 7.68% (44/573) of animals showed BCS of 2. This study revealed that the majority of the animals in the herd were in good nutritional and health status reflecting better management practices.



Population Structure and Pedigree Analysis: Genetic diversity of nucleus flock was estimated. The data on 10450 goats during 1985 to 2014 were used for pedigree analysis using ENDOG version 4.8. Effective number of founders was 53, representing 8.98% of the potential number of founders in population reference. The effective number of ancestors was 43 and the genetic contribution of the 16 most influent ancestors explained 50% of the genetic variability. The effective population size of founders was 73.16. The ratio fe/fa was 1.232 and the average relatedness among population was 4.09. The average inbreeding coefficient (fi) for the whole analyzed pedigree and for inbred animals was 2,27% and 4.4%, respectively. The (fi) increased with the addition of each generation to the pedigree. In the population, 7.53% individuals had more than 6.25% Fi. The average genetic conservation index (GCI) for the complete population was 6.52. Introduction of new sires with the lowest possible average relatedness coefficient are recommended to keep inbreeding at acceptable level.

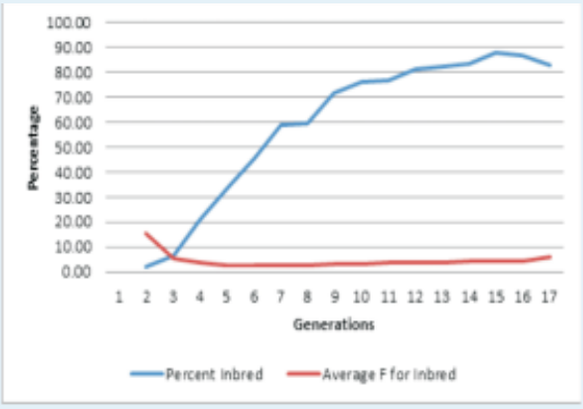


Table 1: Pedigree analysis and Inbreeding profile of Barbari flock

Size of population	10450
Number of ancestors in reference population	590
Average coefficient of inbreeding (fi)	2.27
Proportion of no inbred (fi-0)	39.43%
Proportion of low inbred (fi >0 to ≤ 6.25)	53.22%
Proportion of moderate inbred (f >6.25 to ≤ 12.5)	6.1%
Proportion of highly inbred (fi > 12.5)	2.9%
Average relatedness	4.09
Average fi for inbred goats	4.31

Table 2: Least squares mean of body weight growth (kg) in Barbari goats over the year

Year of birth	**	**	**	**	**
2011	1.85±0.016 (577)	7.81±0.09 (557)	11.66±0.014 (553)	15.97±0.20 (508)	18.99±0.25 (489)
2012	1.76±0.017 (443)	7.33±0.10 (398)	10.41±0.5 (361)	14.53±0.22 (327)	18.28±0.28 (288)
2013	1.68±0.018 (316)	8.41±0.10 (308)	12.53±0.5 (286)	16.91±0.22 (284)	21.73±0.27 (272)
2014	1.54±0.017 (397)	8.55±0.09 (386)	13.40±0.16 (268)	19.14±0.33 (115)	22.69±0.41 (101)
Season of birth	*				
March-April	1.72±0.016 (612)	7.93±0.09 (575)	11.83±0.13 (532)	15.94±0.20 (487)	20.01±0.25 (447)
Oct.-Nov.	1.68±0.01 (1121)	8.12±0.07(1072)	12.17±0.11 (914)	17.37±0.19 (747)	20.83±0.23 (703)
Sex of kid	**	**	**	**	**
Male	1.79±0.01 (897)	8.45±0.08 (848)	12.86±0.12 (732)	18.25±0.19 (622)	22.26±0.24 (568)
Female	1.62±0.01 (836)	7.60±0.08 (799)	11.14±0.12 (714)	15.07±0.19 (612)	18.59±0.24 (582)
Type of birth	**	**	*	*	
Single	2.01±0.014 (568)	9.39±0.08 (550)	13.57±0.12 (478)	18.42±0.18 (418)	22.13±0.22 (389)
Twin	1.75±0.010 (1080)	7.73±0.05 (1015)	11.95±0.08 (897)	16.65±0.13 (765)	20.32±0.16 (715)
Triplet	1.35±0.03 (85)	6.96±0.17 (82)	10.49±0.27 (71)	14.91±0.43 (51)	18.82±0.54 (46)

Values in parenthesis are number of observations

Table 3: Lactation Performance of Barbari Goats

Factor	90- d milk yield (l)	140dmilk yield (l)	Lactation length(d)	Daily milk yield (ml)	Total milk yield (l)
Year of kidding	*	*	*	*	*
2011	51.86±0.94 (332)	72.97±1.99 (120)	124.43±1.27(334)	488.08±7.69 (334)	60.84±1.28 (334)
2012	53.65±1.02 (289)	79.29±2.11 (100)	128.20±1.37 (295)	489.69±8.30 (295)	63.49±1.39 (295)
2013	59.60±1.15 (190)	81.33±1.92 (113)	134.06±1.55 (193)	526.84±9.41 (193)	70.84±1.57 (193)
2014	57.56±1.15 (231)	85.16±2.32 (94)	126.03±1.56 (231)	518.78±9.44 (231)	66.94±1.58 (231)

Table 4: Reproductive performance in Barbari goats over the years

S.No	Traits	2012-13	2013-14	2014-15
1	Age at first Service (days)	362.9±7.4(109)	354.7±6.4(97)	341.4±10.4(117)
2	Weight at first mating (kg)	14.44±3.2(109)	15.01±2.3(97)	18.4±2.7 (117)
3	Age at first kidding (days)	406.9±8.3(109)	422.3±5.2(102)	475.5±7.4 (111)
4	Weight at first kidding (kg)	16.23±3.3(109)	16.01±2.3(102)	21.9±4.6 (110)
5	First kidding interval (days)	219.07±6.2 (67)	221.04±7.2 (54)	229.04±7.2 (84)
6	Gestation period (days)	146.7±1.4 (307)	145.4±1.4 (204)	144.1±2.3 (240)
7	Breeding efficiency % (does tupped)	92.5	90.7	83.2
8	Kidding percentage (does tupped)	135.0	145.3	145.3
9	Kidding rate (litter size)	1.46	1.60	1.6

Genetic evaluation and improvement of jakhrana breed for milk and growth traits

Saket Bhusan, Gopal Dass, A. K. Mishra

Amongst Indian breed of goat, Jakhrana is a valuable breed of goat of Northwestern region of India and also used for meat due to its compact and large body size. It is a hardy breed and can be reared in low resources. The coat colour of the breed is black with white speckles on the ears. Teats and udder of the breed are long and heavier. It is found in a small breeding tract centered in Jakhrana and its nearby villages of Bahrod Tahseel in Alwar district of Rajasthan. Breed derives its name from the name of the village 'Jakhrana' Rajasthan. Small population of the breed and its grade are also reported in Narnaul, Gurgaon, Bhiwani and Rohtak districts of Harayana and adjoining areas of U.P. climate. Total population of Jakhrana goats in pure form is approximately 6,000. Due to some local constraints, population of the pure Jakhrana animals is reducing gradually. Since it is a highly valuable breed of India and has very less number of animals in pure form however there is a need to evaluate, conserve, multiply and improve the breed genetically. A small unit of Jakhrana goats is maintained at CIRG, Makhdoom for genetic improvement of goats for milk and meat production.

Population Dynamics:

Population strength of males and females of Jakhrana goats for 0-1, 1-3, 3-6, 6-12 months and Jakhrana adults on dated 1st April, 2014 and 31st March, 2015 are given below. Opening Balance on 1st April, 2014 is given in table 1.

Table 1: Opening Balance on 1st April, 2014

0-1 Month		1-3 Month		3-6 Month		6-12 Month		Adults		Total		GT
M	F	M	F	M	F	M	F	M	F	M	F	
11	08	11	11	36	29	0	02	43	116	101	166	267

One hundred six (106) kids were born in 76 kidding in 2014-15. Twenty (20) animals were culled on production ground and 12 animals on health ground and 13 animals were died. Thirty five (35) breeding males and 15 breeding does were sold to the farmers and other government and non-government agencies for breed improvement in 2014-15. Closing Balance on 31st March, 2015 is given in table 2.

Table 2: Closing Balance on 31st March, 2015

0-1 Month		1-3 Month		3-6 Month		6-12 Month		Adults		Total		GT
M	F	M	F	M	F	M	F	M	F	M	F	276
0	03	20	17	07	21	12	17	54	125	93	183	

At present flock have total 97 kids, 125 adult females and 54 adult males. Hence, there were total 276 animals in the farm on 31.03.15.

Selection and Breeding:

Adult females were selected on the basis of 90 days milk production and of 9 month body weight Kids were selected for future bucks and does on the basis of 9 months body weight to increase body weight of kids and 90 days milk production of their dam. Out crossing breeding method in Jakhrana flock was conducted. Kidding rate is also considered for selection the does and bucks for breeding. More than 5 percent animals are culled from the flock on the ground of health, low body weight or low milk production. Selective and controlled breeding was practiced in the flock. The does were bred during May-June and October-November only because more than 85 % does comes in heat in these two season followed by kidding in the months of October-November and March-April. After kidding, kid birth weight, sex and birth status of each kids are recorded then kids are weighted 15- day's interval from birth to weaning and thereafter at monthly interval up to 12 months of age. Weaning of kids is generally done at 3 months of age.

Housing and health management for breeding animals:

Three shades of 20 x 60 feet with 40x 60 feet corral were used to keep the Jakhrana flock. Animals were kept separately according to their reproductive and productive status like advance pregnant animas, breeding females, breeding bucks, sick animals, newly born kids and aged kids. One shed was divided into 5 compartments for the purpose. All the animals were housed in the shade from 6 pm to 8 am in the winter and 7 pm to 7 am in the summer. Regular treatment and prophylactic measures were adopted in terms of vaccination against all important diseases like PPR, enterotoxaemia and FMD and H. S. Deworming with different anthelmintic was done pre monsoon and post monsoon seasons. Dipping was done as per health calendar schedule.

Feeding practices of selected animals for future breeding:

Jakhrana goats are maintained under semi intensive system of management. Animals were allowed for grazing from 8 am to 4 pm. Green fodders which were produced at the institute and was supplied to the animals as per the rate of adlib, 2.5 kg, 3.5 kg, 4.0 kg and 5.0 kg per animal per day to the 1-4 months, 5-9 months, 9-12 months, 1-2 years and above 2 years age of animals respectively. Kid platted feed, kid mash feed and adult platted feed were procured from factory and provided to the animals according to their productive and reproductive status. For adult, concentrate ration was given for maintenance, advance pregnant does, lactating does and breeding bucks as per rate of 250 gm, 500 gm, 700 gm and 500 gm per day per animal respectively. For kids, concentrate ration for 1-3 months, 3-6 months, 6-9 months and 9-12 months age were given as per the rate of adlib, 300 gm, 350 gm, and 400 gm per kids per day, respectively. Three to four times milk was provided to the kids after birth to 15 days of age. After 15 days of age kids were provided only two times milk in the morning and evening. Every day fresh drinking water was provided adlib.

Kidding rate:

Total 106 kids were born from 76 kidding in the year 2014-15. Out of 106 kids, 44 kids (41.51 %) were male and 62 kids (58.49 %) were female. Out of 76 kidding, 48 does (63.16 %) gave single birth, 26 does (34.21 %) produced twins and 2 does (2.63 %) gave triplet births. Over all multiple births were 28 (36.84 %). The kidding rate of Jakhrana goats in 2014-15 was 1.39.

Production of breeding bucks for breed improvement in the field and farm.:

Male and female kids were selected on the basis of their 9 month body weight and 90 days milk yield of their mothers. Does were selected on the basis of 90 days milk yield. One hundred one (101) breeding bucks and 166 does were maintained at farm on 1st April, 2014. Total thirty five (35) breeding males and 15 breeding does were supplied to the farmers and other government and non-government agencies for breed improvement in 2014-15 and rest 97 kids, 54 bucks and 125 does were retained at farm for experiment

Growth performance of Jakhrana kids:

Least square means for birth weight, 3, 6, 9 and 12 month were calculated for 2013-14 to 2015-16 and presented in the table 3. Males are selected on the basis of 9 month body weight for selective breeding. Thirty males were transferred for feedlot and other experiment. Pooled average body weight at birth, 6, 9 and 9 months of Jakhrana kids born in 2014-15 were increased than kids born in 2013-14. Results indicated that selection of bucks at 9 month body weight also significantly effects the birth weight, 3 and 6 month body weight.

Table 3: Least Square Means of Body Weight of other than Feedlot Animal of Jakhrana Kids.

2013-14	Birth wt.	3 m wt	6 m wt	9 m wt	12 m wt
Pooled	2.61±0.04 (78)	10.30±0.27 (76)	13.58±0.37 (75)	17.91±0.47 (73)	22.40±0.53 (72)
Male	2.65±0.06 (29)	11.87±0.27 (29)	13.46±0.58 (28)	18.71±0.75 (27)	23.94±0.68 (27)
Female	2.58±0.09 (49)	11.54±0.29 (47)	13.42±0.64 (47)	17.53±0.55 (47)	21.48±0.79 (46)
Single	2.68±0.04 (31)	10.84±0.24 (31)	13.88±2.44 (31)	18.02±0.57 (31)	22.52±0.89 (31)
Multiple birth	2.56±0.07 (47)	09.94±0.15 (45)	13.15±0.80 (44)	17.90±0.49 (47)	22.29±0.59 (42)
2014-15	Birth wt.	3 m wt	6 m wt	9 m wt	12 m wt
Pooled	2.74±0.09 (104)	8.93±0.56 (93)	15.80±0.18 (33)	20.24±0.69 (29)	22.75±0.75 (27)
Male	2.87±0.08 (46)	9.48±0.42 (40)	16.79±0.43 (17)	21.31±0.79 (14)	24.5±0.58 (12)
Female	2.61±0.13 (58)	8.38±0.53 (53)	14.44±0.58 (16)	18.89±0.89 (15)	23.05±0.78 (15)
Single	2.85±0.08 (42)	9.03±0.46 (37)	15.47±0.59 (13)	19.4±0.81 (13)	23.3±0.88 (11)
Multiple birth	2.64±0.06 (62)	8.73±0.29 (56)	15.77±0.76 (20)	20.52±0.85 (16)	24.01±0.79 (16)
2015-16	Birth wt.	3 m wt	6 m wt	9 m wt	12 m wt
Pooled	2.74±0.29 (39)	-	-	-	-
Male	2.77±0.17 (20)	-	-	-	-
Female	2.71±0.20 (19)	-	-	-	-
Single	2.79±0.38 (20)	-	-	-	-
Multiple birth	2.69 ±0.32 (19)	-	-	-	-

Feedlot Experiment

Least square means of body weight of Jakhrana male kids under feedlot experiment are presented in table 4. Highest growth at 12 month of a particular kids was more than 50 kg.

Milk production of Jakhrana goats

Milk production of Jakhrana does was recorded in liter and average milk production for 2012-13 to 2014-15 is presented in Table 5. Females are selected on the basis of 90 days milk production for selective breeding. Therefore, on milk yield of 30, 60, 90, 120 and 150 days of does kidded in 2013-14 were increased. Milk production of 30, 60, 90, 120 and 150 days of does kidded in of 2014-15 little lower than milk production of 2013-14 due to including the more young does in the flock in this particular year. Results indicated that that parity of does a non-genetic factor had significantly effect on the 30, 60, 90, 120 and 150 days milk production however various genetic and non-genetic factors affected the milk production of does. Average lactation length of Jakhrana goats was 136.37±5.62 days and average lactation production was 174.61±09.46 liter. Average per day milk production of Jakhrana goats was 1.32 liter. Average peak yield of the flock was 1.97±0.87 liter and average time of peak yield in the flock was 14.12±7.37.

Table 4: Least Square Means of Body Weight of Feedlot Experiment of Jakhrana Male Kids.

2013-14	Birth wt.	3 m wt	6 m wt	9 m wt	12 m wt
Pooled	2.91±0.02 (30)	12.11±0.14 (30)	20.61±0.22 (29)	35.10±0.39 (29)	43.86±0.41 (59)
Single	3.21±0.04 (08)	12.50±0.32 (08)	21.22±0.42 (08)	35.78±0.43 (08)	44.36±0.73 (08)
Multiple birth	2.81±0.05 (23)	11.98±0.25 (23)	20.43±0.46 (22)	34.47±0.63 (22)	43.07±0.69 (22)

Table 5: Least Square Means of Milk Production (liter) of Jakhrana goats

Year	30 d	60 d	90 d	120 d	150 d
2012-13	45.91±1.18 (77)	83.32±1.99 (74)	113.01±3.20 (70)	146.26±4.28 (49)	165.14±11.22 (29)
2013-14	51.16±1.25 (71)	97.23±3.80 (48)	141.28±5.12 (39)	178.22±6.38 (35)	209.27±11.74 (16)
2014-15	51.24±1.18 (70)	96.76±2.26 (67)	136.37±4.65 (59)	169.96±4.42 (33)	203.83±10.77 (22)

Genetic evaluation and improvement in muzaffarnagari sheep for body weight.

Gopal Dass, Saket Bhusan, Souvik Paul and S.D. Kharche

Muzaffarnagari, the heaviest mutton producing sheep breed of the country, is mainly distributed in Muzaffarnagar and its adjoining districts of Western Uttar Pradesh viz. Meerut, Bulandshahar, Saharanpur and Bijnor. The breed is usually reared for mutton production. The institute has been maintaining a pure bred flock of Muzaffarnagari sheep under a "Network Project on Sheep improvement" since 1976. Presently the efforts are being made to improve the breed for higher mutton production through selective breeding.

Management of flocks

Flocks were maintained under semi-intensive system of feeding management with 6-7 hours grazing supplemented with 100-500 gm concentrate in various stage and age group of the animals. Dry and green fodder was also offered as per the requirement. Controlled breeding was practiced to improve the managemental efficiency. Ewes were bred during May-June and October-November followed by lambing in the months of October–November and March-April, respectively.

The opening balance of sheep was 590 which comprised of 197 males and 393 females and closing balance of 580 sheep had a stock of 151 males and 429 females. During this year a total of 225 lambs born and overall mortality was recorded 2.82%.

Production performance

The overall least-squares means of body weights of lambs at birth, 3, 6, 9 and 12 month age were 3.58±0.04, 17.01±0.29, 26.75±0.43, 33.27±0.60 and 38.26±0.65 kg, respectively. Sex and year of lambing had highly significant (P<0.01) influence on all body weights except non-significant effect of sex on birth weight. Male lambs gained higher weights as compared to female lambs at all growth stages. Body weights at 9 and 12 month age were significantly higher in year 2014 as compared to previous two years. The average daily gain of Muzaffarnagari lambs during 0-3, 3-6, 6-9, 9-12 and 3-12 months were 149.51±2.93, 103.33±2.70, 74.26±3.72, 55.75±3.37 and 78.76±2.15g under semi-intensive feeding management. The average adult body weights of males and females were respectively 50.0 and 41.8 kg.

The overall least squares means for lambs 1st and 2nd six monthly and adult annual clips were calculated to be 609.02±12.27, 565.40±11.31 and 1293.40±21.55g, respectively. The males produced significantly higher greasy fleece yield than females in all the clips which might be due to larger surface area for wool growth in males as compared to females.

Table 1: Growth performance of Muzaffarnagari lambs (kg).

Particulars	Birth Wt.	3M Wt.	6M Wt.	9M Wt.	12M Wt.
Overall mean	3.70±0.03 (635)	16.80±0.16 (602)	25.66±0.23 (483)	30.76±0.27 (378)	35.60±0.29 (359)
Sex	NS	**	**	**	**
Male	3.75±0.04 (309)	17.28±0.24 (294)	27.63±0.35 (225)	33.16±0.38 (191)	39.03±0.41 (180)
Female	3.65±0.04 (326)	16.31±0.23 (308)	23.69±0.32 (258)	28.35±0.37 (187)	32.18±0.39 (179)
Year	**	**	**	**	**
2012	3.75±0.05 (197)	15.19±0.30 (182)	22.04±0.41 (151)	27.44±0.42 (133)	32.23±0.46 (124)
2013	3.78±0.05 (228)	18.20±0.28 (216)	28.19±0.37 (190)	31.56±0.37 (179)	36.33±0.39 (174)
2014	3.58±0.04 (210)	17.01±0.29 (204)	26.75±0.43 (142)	33.27±0.60 (66)	38.26±0.65 (61)

Reproduction performance

The twinning rate in Muzaffarnagari sheep is comparatively low due to large body size. But due to the intensive breeding of those rams and ewes responsible for producing twins and triplets, the twinning rate improved tremendously. The annual tupping, lambing on available basis and lambing on bred basis were 97.3, 88.3 and 91.1%. These reproductive parameters in season first and second were respectively 80.0, 74.5, 90.2% and 78.1, 68.3, 92.3%. During this year, the twinning rate recorded to be 14.7, 20.6 and 17.2% respectively in first & second season and annual. The

twinning rate was found significantly higher than previous years. The overall replacement rate was calculated as 30.6%.

Semen collection and artificial insemination with liquid semen

Rams showing better libido and semen qualities in terms of volume, sperm concentration, mass motility etc. were finally selected and used for semen collection and AI using diluted liquid semen in the flocks. The semen was collected by AV in the shed and diluted in the ratio of 1:10 with Tris diluter supplemented with 1% bovine serum albumin. In two major breeding seasons (April-May:26 ewes and October-November:25 ewes) 51 ewes of Mujaffarnagari breed were inseminated only one time with diluted semen. Out of the total 26 inseminations at cervical oss were carried out in April-May, 16 ewes became pregnant (13-lambed, 2-aborted and 1-died) with a conception rate of 61.5% whereas 25 inseminations inseminations at cervical oss were carried out in October-November, 13 ewes became pregnant (10-lambed, 2-still birth and 1-aborted) with a conception rate of 52.0%. The vaginal AI was performed in standing as well as in dorsal posture. Thus, the overall CR using liquid semen was 56.86%.

Distribution of elite germplasm

A total of 131 elite animals (125 rams and 06 ewes) were supplied to various developmental agencies, Research organizations, Non-Government organizations and progressive farmers for genetic improvement of their flocks under field conditions.

PHYSIOLOGY, REPRODUCTION AND SHELTER MANAGEMENT DIVISION

Flagship project on artificial insemination in goats

S.K. Jindal, Satish Kumar, A.K. Goel, S.D. Kharche, Ravi Ranjan and Chetna Gangwar

Addition of Chloropromazine hydrochloride in semen diluter on post thaw quality of buck semen.

Chloropromazine hydrochloride as a sperm membrane stabilizer was added in semen dilutor (control, 10mg%, 20mg%, 30mg% and 40mg %) to find out the freezability of buck semen by conventional method of freezing. Post thaw motility, live sperm count, abnormalities, acrosomal integrity and hypo osmotic swelling test were performed to assess its effect on freezability. Analysis of data using SPSS 16 revealed that post thaw motility, live sperm count, acrosomal integrity and hypo osmotic swelling positive spermatozoa differed significantly (P<0.05) at different concentrations of Chlorpromazine HCl. The post thaw motility, live sperm count, acrosomal integrity and hypo osmotic swelling positive spermatozoa were significantly higher (P<0.05) with 20mg% Chloropromazine hydrochloride concentration in the diluter.

Chloropromazine hydrochloride Conc (mg%)	Motility%	Live %	Acrosomal integrity %	HOS %
0 (control)	30.00±2.88^{b}	42.12±3.21^{b}	53.88±4.84^{b}	40.75±3.6 ^{b}
10	30.00±2.04^{b}	41.43±2.31^{b}	50.15±2.01^{b}	40.29±4.82^{b}
20	45.00±4.08^{a}	54.05±0.95^{a}	69.08±1.86^{a}	55.53±2.30^{a}
30	33.75±2.39^{b}	43.72±3.74^{b}	47.80±3.25^{b}	40.37±4.10^{b}
40	28.75±2.39^{b}	39.49±5.02^{b}	49.54±4.36^{b}	42.06±6.43^{ab}
Fresh Semen	85.00±5.00	76.22±1.45	81.32±0.21	75.07±1.07

Effect of Cholesterol loaded cyclodextrin (CLC) in semen diluter on post thaw quality of buck semen.

Cholesterol loaded cyclodextrin (CLC) is a substance which protects the plasma membrane of spermatozoa during freezing process. In this experiment thirty five ejaculates from adult Sirohi bucks (3-5 years old) were used to find out the freezability of buck semen with different concentrations of CLC (Control, 1mg%, 2mg% and 3mg%) by conventional method of freezing. Post thaw motility, live sperm count, abnormalities, acrosomal integrity and hypo osmotic swelling test were performed to assess its effect on freezability. Analysis of data using SPSS 16 revealed that post thaw motility, live sperm count, abnormalities, acrosomal integrity and hypo osmotic swelling positive spermatozoa differed significantly (P<0.05) with different concentrations of CLC. The post thaw motility, live sperm count, acrosomal integrity and hypo osmotic swelling positive spermatozoa were significantly higher (P<0.05) with 1mg% CLC concentration in the diluter.

CLC Conc (mg%)	Motility%	Live %	Acrosomal integrity %	HOS %
0	38.33±0.98^{c}	56.42±1.41^{c}	76.83±1.37^{bc}	41.46±1.41^{c}
1	50.00±1.16^{a}	67.96±1.25^{a}	83.54±1.16^{a}	53.92±1.93^{a}
2	44.37±1.78^{b}	62.21±1.31^{b}	79.17±1.38^{b}	47.17±1.43^{b}
3	39.58±1.08^{c}	58.67±1.27^{bc}	74.79±1.59^{c}	42.12±1.80^{c}
Fresh Semen	83.96±1.12	89.33±0.89	91.62±0.81	75.29±0.98

Figures bearing different superscripts differ significantly (p<0.05)

Semen collection and cryopreservation

During the period under report, a total of 4792 semen doses of different breeds of goat (Jamunapari, Barbari, Jakhrana and Sirohi) were frozen. Out of the this 1780 frozen straws were used under different experiments, Artificial Insemination and demonstrations etc.

Artificial Insemination with Frozen Semen

In two major breeding season (May-June; 40 and October-November; 35) 75 goats of different breeds (Jamunapari, Barbari, Jakhrana and Sirohi) were inseminated with frozen semen. Out of total insemination carried out in goats, 6 inseminated goats were culled due to poor health and 2 goats fetus aborted during this period. A total 13 goats conceived by using frozen semen AI technology. A total 9 goats were kidded and 13 kids were born through this technology.

Hormone profile during different reproductive stages in goats

A. K. Goel, S. K. Jindal, Satish Kumar, S.D. Kharche and Ravi Ranjan

The gonadal hormones play a crucial role in reproduction and production in goats. Scanty information is available in Indian breed of goats before and after puberty and during peri-parturient period. Currently little information is available regarding regulatory mechanisms controlling post-partum oestrus period in goats with non-seasonal reproductive activity. It has been reported that suckling has a negative effect on re-establishment of post- partum ovarian activity in exotic goats. Information on basal concentration of gonadal hormones during different physiological stages of tropical goats is almost lacking. The study shall be useful in understanding the role of various hormones playing significant role in the normal reproductive process of goats. The outcome of the project shall be used to imply its influence in improving the reproductive efficiency for higher productivity from the goats.

Blood Sampling and Storage

Jakhrana goats (female, 6) were selected and grouped according to their physiological/ reproductive stages (Age: 8-12 months). 54 Blood samples (4 ml each) from 6 Jakhrana female goats at 8-12 months were collected at 15 days interval and serum samples after separation were stored at -200 C till assayed for progesterone hormone concentration.

Blood samples(30) from 6 Jakhrana does were collected at day 0,15,30,45 and 60 days post-partum and serum samples were stored and assayed for progesterone concentration in similar fashion as above.

Jamunapari goats (Male: 6, female: 6) were selected and grouped according to their physiological/ reproductive stages (Age: 13-18 months). 144 Blood samples (4 ml each) from 12 Jamunapari goats (six of each sex) at 8-12 were collected at 15 days interval and serum samples after separation were stored at -200 C till assayed for testosterone and progesterone hormone concentration.

Ultrasonography of Post-parturient Jakhrana Does to Assess Uterine Involution

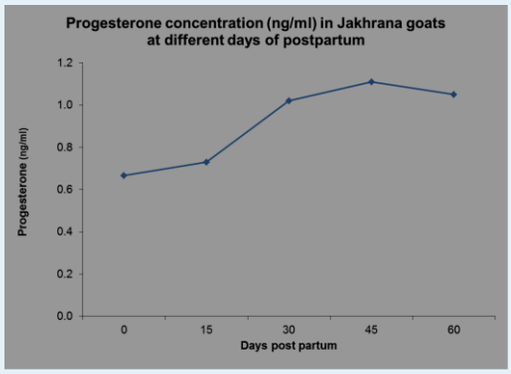
Post-parturient Jakhrana does (6) were subjected to trans rectal ultrasonographic examination using 5/ 7 MHz transducer at day 0,15,30,45 and 60 days post- partum (15 days interval) to assess the uterine horns and associated organs for their relative size for ascertaining post- partum uterine involution. Ultrasonographic examination revealed that pregnant uterus regained pre-gravid stage at day 45 post- partum.

Hormone Assay (Progesterone)

In 6 Jakhrana females (day 0,15,30,45 and 60 post- partum), 30 samples (6 for each female) in duplicate were processed by using DRG Diagnostics, Germany ELISA Kits. Results are summarized in following tables & graphs:-

Progesterone concentration (ng/ml) in Jakhrana goats at different days of Post partum

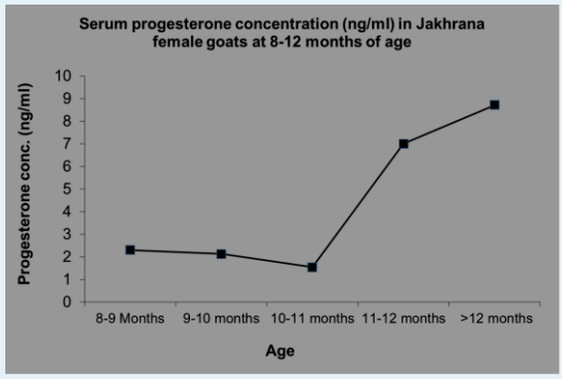
Days (Post Partum)	Mean (ng/ml)	SEM	Range (ng/ml)
0	**0.67**	**0.14**	0.50 – 1.08
15	**0.73**	**0.28**	0.50 - 0.78
30	**1.02**	**0.26**	0.50 -1.74
45	**1.11**	**0.28**	0.66- 1.90
60	1.05	0.26	0.58- 1.74



In 6 female goats (8-12 months of age), for progesterone assay, 54 samples (12 from each group in duplicate) were processed by using DRG Diagnostics, Germany ELISA Kits. Results are summarized in following tables & graphs:-

Progesterone Concentration (ng/ml) in Jakhrana Female Goats at 8-12 Months of Age

Age (In Months)	Mean (ng/ml)	SEM	Range (ng/ml)
8 – 9 Months	2.31	0.72	0.08 –2.66
9 – 10 Months	2.13	0.62	0.70 –0.57
10 – 11 Months	1.55	0.26	0.66 -3.20
11 – 12 Months	7.01	2.03	0.87- 10.66
>12 Months	**8.72**	**2.93**	1.25- 3.24



NFBSFARA Project : Development of parthenogenetic goat from embryonic stem cells

S.D. Kharche, Ravi Ranjan , A.K. Goel, S.K. Jindal and S. K. Agarwal

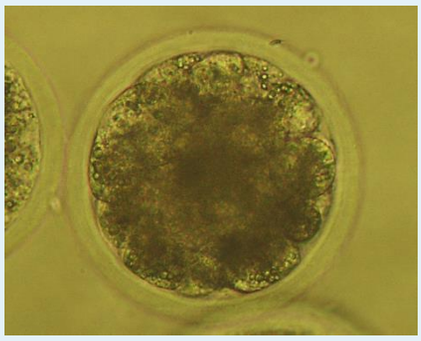
In vitro embryo production.

Effect of TALP and TRIS media for sperm capacitation and subsequent in vitro fertilization of in vitro matured Caprine oocytes

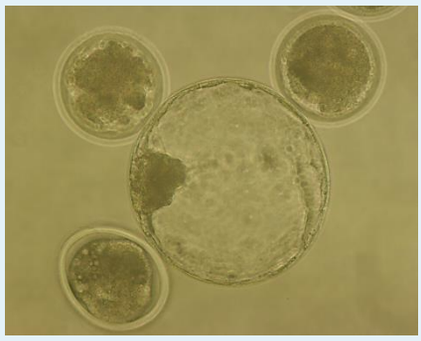
The overall cleavage rate and blastocyst production in TRIS + Heparin (37.67% and 13.8%) were comparatively higher as compared to sperm capacitated in TALP + Heparin (35.07% and 10.07%).

Effect of cysteamine on embryo development of in vitro fertilized Caprine oocytes

The overall cleavage rate, morula and blastocyst production in mCRaaa and mCRaaa+cysteamine were 36.39, 21.62 and 4.95% and 31.72, 30.89 and 8.98%, respectively.



Morula



Blastocyst

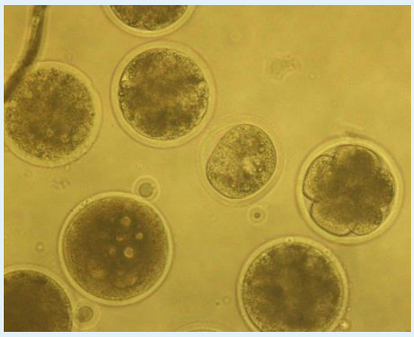
In vitro embryo production through ICSI

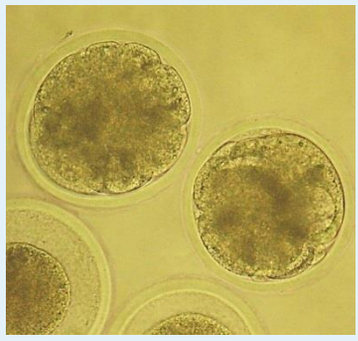
Cumulus oocyte complexes (COCs) were recovered by slicing the goat ovaries were matured in TCM199 supplemented with 10% fetal bovine serum (FBS) + 10% Follicular fluid + FSH(5µg/mL) + LH (5µg/mL) + Estradiol (1 µg/mL) + EGF (10ng/mL) + BSA (3mg/mL) for 27 hr in humidified atmosphere at 38.5°C with 5% CO_2 in CO_2 incubator. After 27h of culture, COCs (n=639) were separated from cumulus cells by treating with 0.1 % hyaluronidase enzyme and passing repeatedly through a fine pipette and randomly divided into three groups.

Group 1 (n=150) matured oocytes were given mechanical stimulation with injection micropipette for parthenogenetic activation without sperm injection.

Group 2 (n=135) capacited spermatozoa were injected in to cytoplasm of matured oocytes through injection micropipette.

Group 3 (n=354) capacited spermatozoa were injected in to cytoplasm of matured oocytes through injection micropipette and then activated with 5µM Ca ionophore for 5 min. The oocytes of all groups were then culture in RVCL media for embryo development. The cleavage rate was observed after 48 to 72 hr of injection. The cleavage rate in group 1, 2 and 3 were 0.00, 8.14 and 29.66%, respectively. The result indicated that mechanical activation failed to induce cleavage in in vitro matured goat oocytes whereas chemical activation of intracytoplasmic sperm injected in vitro matured goat oocytes showed significantly higher cleavage rate as compare to non activated oocytes.





Fertilized embryo produced through ICSI

Parthenogenetic embryo production

Effect of Ionomycin and Ca Ionophore Activation on parthenogenetic embryo production:

Recovery of oocytes and in vitro maturation (IVM)

The oocytes (7114) were collected from ovary (1224) in a petridish containing oocyte collection media (OCM) (Dulbecco's phosphate-buffered saline with 1mg/ml BSA, 50µg/ml streptomycin and 60µg/ml penicillin) by follicle puncture method using 18-G needle. Only grade A and B oocytes (Kharche et al.,

2008) were chosen as it has evenly granulated cytoplasm which represents its active physiological state with having bunch of compact cumulus cell mass around them. Selected oocytes (7114)) were washed two or three times in Oocyte Holding Medium (OHM) containing (TCM-199 with Hepes modification, EGS 10%, Sodium Pyruvate 0.25 mM, gentamycin 50 µg/ml, Glutamine 100 µg/ml, BSA 3 mg/ml) and subsequently two three times in oocyte maturation media (TCM-199 with 10% FBS, Sodium Pyruvate 0.25 mM, Glutamine 100 µg/ml, LH 5µg/ ml, FSH 5µg/ ml, EGF 10ng/ml, BSA 3mg/ml & Gentamycin 50µg/ml) and allowed for maturation in 50µl drop of IVM medium in 35mm×10mm Petri dishes for 27 hours in a CO_2 incubator maintained at 38.5º C, 5% CO_2 and 90% humidity.

Activation of oocytes

After maturation for 24–27 h, oocytes were stripped off their cumulus cells by treatment with 0.1% hyaluronidase and gentle pipetting for 5 min in mCR2aa handling medium The matured oocytes (1143) were activated 5 µM Ionomycin in mCR2aa medium for 5 min followed by treatment with 2.0 mM DMAP for 4 hr in mCR$_2$aa medium. After 4 hr, the oocytes were washed 5 to 10 times in the culture medium cultured in 50 µl drop of RVCL medium for 12 days. Similarly, The matured oocytes (5802) were activated 5 µM Calcium ionophore in mCR2aa medium for 5 min followed by treatment with 2.0 mM DMAP for 4 hr in mCR$_2$aa medium. After 4 hr, the oocytes were washed 5 to 10 times in the culture medium cultured in 50 µl drop of RVCL medium for 12 days.

In vitro culture of activated oocytes

After 48 hours of parthenogenetic activation treatment, caprine oocytes were examined for cleavage. Development of parthenogenetic embryos were observed at every 48h till day 12 post activation under inverted phase contrast microscope (200x, Nikon, Japan). The culture media was replaced with freshly prepared embryo culture media after every 48 h and observations were made for subsequent embryos development. The overall 2-cell, 4-cell, 8-16-cell, morula, blastocyst and hatched blastocyst production following activation were shown in Table 1.

Table 1: Parthenogenetic embryo development following two different activation treatments

S. No.	Treatment	2 cell (%)	4 cell (%)	8-16 cell (%)	Morula (%)	Blastocyst (%)	Hatched Blastocyst (%)
1.	5 µM Ionomycin	14.25	20.74	32.77	27.03	3.51	1.66
2.	5 µM Calcium ionophore	16.26	27.88	28.03	21.31	4.06	2.43

Diffèrent stages of Parthenogenetic goat embryos

Embryonic stem cell production

Goat fetal skin fibroblast cell monolayer preparation

Collection of fetus

The uterus containing 3-6 cm fetus was aseptically collected from local slaughter house and transported to laboratory within 1 hour. The whole organ was washed thoroughly in sterile normal saline solution (NSS) (38^{0}C) supplemented with gentamycin (50µg/ml). The fetus was swabbed with ethyl alcohol and then with the help of sterile forceps and scissors fetus was taken out and kept in a sterile beaker containing NSS. Finally skin sample was collected from fetus with the help of sterile forceps and scissors and washed in PBS (1X).

Determination of age of fetus

A total of 24 caprine foetuses of goat from Agra was collected from the abattoir for determination of age of foetus. Crown-rump length (from the forehead to base of the tail) of each foetus was measured and recorded for determination of age of foetus. The age of foetus was estimated as per method of Sivachelvan et al. (1996). The average crown rump length of below 6 week and 6 to 8 week fetuses were 4.40±0.34cm and 9.60±0.29cm, respectively.

Table 2. Determination of age of fetus.

S.No.	Crown Rump length (cm) of below 6 weeks foetuses	Crown Rump length (cm) of 6-8 weeks foetuses
1.	3.5 cm	**9.5**
2.	3.5 cm	**10 cm**
3.	4.5 cm	**8.5 cm**
4.	4 cm	**10 cm**
5.	6 cm	**10.5 cm**
6.	4.5 cm	**6.5 cm**
7.	2.5 cm	**10.4 cm**
8.	5 cm	**10 cm**
9.	5.5 cm	**9.5 cm**
10.	6 cm	**10 cm**
11.	3.5 cm	**10 cm**
12.		**10 cm**
13.		**10 cm**
Average	**4.40±0.34cm**	**9.60±0.29cm**

Isolation of fetal skin fibroblast cells:

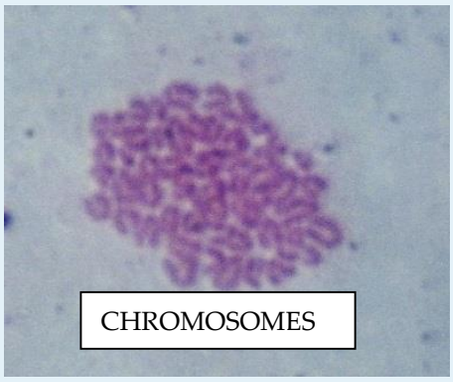
Fetal skin fibroblast cell monolayer preparation for ICM cell culture was done. In brief, collected fetal skin samples was chopped and trypsinised. Finally fibroblast cells were bathed with DMEM media and cultured in 25 cm^2 of tissue cell culture bottle at 37^{0}C, 5% CO_2 level and 90% relative humidity in CO_2 incubator. Media was changed in every 72 hours interval and subculture was made as per requirement.

Evaluation of Chromosomal Stability of Fibroblast cells

Cells are subjected to chromosomal analysis as per the method given below.

- Treat fibroblast cell with 80-90% confluency growing in DMEM culture medium with colcemid (100ng/ml) for 4 hrs.
- Wash the cells with ice chilled calcium and magnesium free DPBS for 5 min and make a single cell suspension by trypsinization of confluent monolayer.
- Add FBS containing cell culture medium to neutralize trypsin and remove traces of trypsin-EDTA by washing the cells through centrifugation (1500 X g, 5 min).
- Suspend the cell pellet in hypotonic solution (0.75 mM KCl) for 30 min at room temperature and centrifuge it (300Xg, 5min).

- Fix by resuspending in 10 ml of freshly prepared ice-chilled fixative (3:1Methanol/Glacial Acetic Acid) for 20 min at 4°C and pellet cell by centrifugation and remove supernatant.



- Resuspend the pellet in 2-3 ml of fresh chilled fixative so as to get sufficient no of cells.
- Prepare metaphase spreads (of the chromosomes) by dropping the cells suspension from 2-3 ft height onto the ice-cold glass slides.
- Allow the spreads to air dry for 5 min.
- Stain chromosomes with 10% Giemsa stain.
- Remove the stain and unwanted Debris with Trypsin EDTA.
- Observe under oil immersion (1000 X) using a compound microscope.

Development of embryonic stem cell colonies on goat fetal fibroblast monolayer:

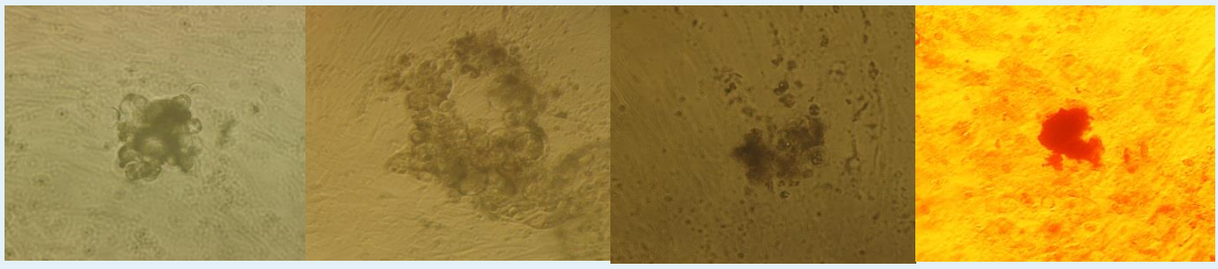
For derivation of embryonic stem cell colonies from blastomeres, blastomere of 8-16 cell and morula staged parthenogenetic embryos were removed from IVC drops and put into warm PBS for washing. After washing, embryos were shifted to proteinase-K (0.02%) drops and the thinning or dissolution of zona pellucida was observed under zoom stereo microscope. After thinning or dissolution of zona pellucida, the proteinase-K activity was neutralized by addition of media containing FBS (20% FBS in DMEM media). The clumped blastomere cells were washed in 4-5 drops of stem cell culture media and kept in CO_2 incubator for growth. The undissociated clumped blastomere were cultured in wells on mitomycin-C inactivated goat fetal fibroblast monolayer at 38.5^{0}C, 5% CO_2 and 90% relative humidity in CO_2 incubator in different media containing different growth factors.

For the derivation of parthengenetic embryonic stem cells, hatched blastocysts were washed in mCR2aa medium supplemented with 5% FBS and 0.3% BSA. Trophectoderm cells were removed from ICM using micro surgically blade. The inner cell mass of blastocyst was placed in the well of twelve well culture plate on a feeder layer of mitomycin C inactivated goat fibroblast cells. The inner cell mass gets attached to the feeder layer and get spread in the wells. Stem cell culture media was used for the culture of parthenogenetic stem cell. Half of the media of the culture well were replaced with fresh media at every 48 hr. interval. The ICM was mechanically isolated and placed on a fresh feeder layer and cultured for next 4-5 days. All the subsequent passages were made after 5-6 days in culture. For early passages, colonies were mechanically divided into clumps and re plated. Further passages of parthenogenetic stem cells were performed with trypsin-EDTA(%) and mechanical dissociation. The propagation of stem cells was performed at 38.5ºC, 5%CO_2 in humidified atmosphere. Total seven passages were done using the above protocol.

Parthenogenetic embryos of 8-16 cell (34), morula (47) and blastocyst/ICM (38) were used for embryonic cell colony formation. The time taken for their attachment on goat fetal fibroblast monolayer was 72-96 hrs. The percentage of embryonic cell colony formed was 32.35, 57.44 and 84.21% from 8-16 cell, morula and ICM of blastocyst stage derived embryos, respectively. There was no significant difference in the formation of embryonic cell colony between 8-16 cell and morula stage derived embryos on goat fetal fibroblast monolayer ($P<0.05$). Embryonic cell colonies were further passage up to five to seven passage on goat fetal fibroblast monolayer.

Table 2 Embryonic cell colony formation on goat fetal fibroblast monolayer in caprine.

Types of embryos	*Stage of embryos*	*No. of embryos used*	*No. of embryonic cell colony formed*	*Percentage of embryonic cell colony formed (%)*
Parthenogenetic	8-16 cell	34	11	32.35
	Morula	47	27	57.44
	ICM	38	32	84.21



Stem cells (Day 0) Stem cells (Day 5) Stem cells (P1) Alkaline Phosphatase staining

Parthenogenetic embryonic stem cell colony on goat fetal fibroblast monolayer during different days of culture in caprine

Tetraploid embryo production

Two cell stage were equilibrated through three washes of mCR2aa medium and three more washing in fusion medium and were placed in groups of five between the electrode wires of a microslide fusion chamber filled with fusion buffer that was connected to a BTX Electro cell Manipulator 2001. Embryos were aligned with a 7.0 V, 5 second alternating current pulse to orient the plane of contact between the blastomeres in parallel with the electrodes. 0.75 kV/cm direct current pulses of 80 µsec was used to fuse the blastomeres together. Embryos were then washed in mCR2aa medium and incubated for 1 h. Embryos that had only a single cell upon evaluation after 1 h were determined to have fused and were separated. Out of twenty 2 cell stage embryos, 8 embryos were fused 1 hr after electrofusion. The fusion rate of electrofused embryos were 40%.

To analyse genetic trait and expression analysis of goat ESR1 gene for buck fertility and sperm quality (DST)

Sonia Saraswat, S. D. Kharche, P. K. Rout

Male fertility is impaired through the lack of ESR1 (Estrogen Receptor 1) but little is known about the ESR1 roles in buck spermatogenesis and fertility. This study has analyzed the seminal attributes in Jamunapari and Barbari bucks from purebred. The genomic DNA was isolated from blood samples. The OD was checked through biophotometer which lies between 1.7 to 1.9. The PCR amplification was carried out by using following Forward primer ESR1-F (5′CAAGAACGTGGTGCCTC3′) and a reverse primer ESR1-R(5′ CCTGGAATCCCTTTGGCTGT 3′) in Jamunapari and Barbari breed. The product lengh 420bp was observed of amplified PCR products when resolved on 2% agarose gel. Further, RFLP was carried out with restriction enzyme (ALU1). Different pattern was observed at molecular characterization by PCR-RFLP. Genotyping of ESR1 was carried out by High Resolving Melting analysis technique (HRM) using Roche Light Cycler 480 system. Analysis showed different genotypes in all the analyzed samples which are indicated by the different color in different plot. The blue colored curves indicated the wild type genotypes and green, red, yellow, brown, violet indicated mutant type of genotype. Amplified PCR products were sequenced, sequenced

results confirmed 416bp of the buck ESR1 gene. Gene sequences were submitted to NCBI and ESR1 gene accession numbers were obtained for Barbari and Jamunapari breed (KJ938303, KJ938304).

Comparative study on different structures of goat shelters under farm conditions

N Ramachandran, S P Singh, M K Tripathi, Souvik Paul, B Rai and Saket Bhusan

The recording of growth pattern of 30 post weaned Jakhrana kids maintained under adlib feeding conditions, 15 each in slatted and soil floor from 3 to 12 months age indicated that the final body weight after 34 weeks post weaning or at 12 months age in slatted and kutcha floor is recorded to be 43.4 and 41.3 kg, respectively. The initial body weight was similar (10.2 kg) in both the groups. The total gain at 12 months of age in slatted floor was higher (31.5±0.97 kg) than the soil floor (29.2±0.75 kg; P=0.455). The average daily gain (ADG) also followed similar trend (131.71±4.06 and 121.96±3.12g). The live weight gain (LWG) of kids at 6-9 months was higher than at 9-12 and 3-6 months of age. The LWG at 3-6, 6-9 and 9-12 months of kids on slatted floor was 9.33, 4.58 and 9.24% higher than that under soil floor. The ADG at 3 stages of growing kids on slatted and soil floor were 114.8±3.91 and 104.1±2.67 g, 158.7±5.16 and 151.5±6.41 g, 119.8±6.11 and 108.8±5.33 g, respectively. The dry matter intake per kg gain was 6.05, 6.54 and 7.42 kg in kids on slatted floor at 3-6 and 9-12 months which is 10.3 and 9.4% lower than the kids on soil floor. The feed efficiency was calculated to be 16.5 and 14.9, 15.3 and 15.4, 13.5 and 12.3 % at 3-6, 6-9 and 9-12 months of kids on slatted and soil floor, respectively with the overall feed efficiency of 13.4 and 12.9%.

The assessment of kids comfort on different type of floors during peak summer in terms of physiological responses indicated that slatted and soil floor provided comfort equally to the kids. The overall RT, RR and HR of kids on slatted floor during morning and afternoon period were 38.6 and 39.2˚C, 32.9 and 61.5 breathe/min, 103.9 and 116.7 beats/min, respectively which were lower than the kids on soil floor. The body surface temperature at six body surfaces during morning and afternoon period during peak summer also showed that kids were equally comfortable on both floors studied.

The serum concentrations of GPT, GOT, AKP enzymes in kids on slatted floor were 26.43 IU/L, 122.60 IU/L, 63.78 KA units, respectively. These values in kids on soil floor were 16.65 IU/L, 98.01 IU/L and 39.87 KA units. No difference in the biochemical parameters like the total protein, albumin, total cholesterol, triglycerides and hormones like T3, T4, TSH and cortisol was observed between floor types.

Analysis of faecal samples for EPG/OPG during pre-summer (Mar-Apr) months showed considerable worm load in both the groups. Kids had considerable coccidial load, tapeworm infestations, although no strongyle eggs were seen in the faeces. Summer sampling (Jun-Jul) showed reduction in coccidial load in slatted floor kids; but, it was more or less unchanged in soil floor kids. The results indicated the beneficial effect of elevated flooring in reducing the worm load in kids. Pre-monsoon and monsoon sampling also showed similar trend as that of summer sampling.

Overview of the results suggest that the provision of slatted floor in goat shelters in semi-arid areas may not be beneficial in increasing growth and comfort level to the growing kids, however, the worm load especially coccidial load can be maintained to the minimum level in the kids reared under raised floor system. Moreover, the labor required for daily cleaning can be saved that provide economic benefit in large scale commercial goat production.

NUTRITION, FEED RESOURCES & PRODUCTION TECHNOLOGY DIVISION

Development of feed resources on poor lands for goats

Prabhat Tripathi, M.K. Tripathi, Ravindra Kumar, U.B. Chaudhary

Conservation and evaluation of Commelina benghalesis, *Setaria* sp. and *Lollium sp*. as goat feed

Seasonal monsoon forbes namely C. benghalensis, Setaria sp. were collected during the monsoon season and conserved as hay, However Lollium sp. of grass cultivated during the rabi season and after the harvesting it was also conserved in hay form. These biomass mass were converted in to complete feed pellets in a ratio of 50:50 of concentrate and roughage with the help of pelleting machine. These complete pellets were evaluated for their feeding value in growing kids. The crude protein contents of these pellets were 16.85, 17.38 and 15.34 percent in C. benghalensis, Lollium sp, and Setaria sp. based complete pelleted feed respectively. The total dry matter intakes were 3.30,3.72 and 3.57 percent of live body weight recorded with C. benghalensis, Lollium sp, and Setaria sp. based complete pelleted feed respectively. Dry matter digestibility was 55.73, 53.53 and 58.12 percent respectively. However CP digestibility were 65.61, 61.2 and 66.35 percent with C. benghalensis, Lollium sp, and Setaria sp. based complete pelleted feed respectively. However drymatter digestibility did not differ significantly under these complete feeds. Therefore it may be concluded that all the three types of complete feeds not only provide maintenance nutrient to goats but also support producion needs of the animals.

Supplementation of *Brassica* sp. green biomass to Goats:

Brassica juncea green biomass was raised at institute and was supplemented *ad lib* to adult male goats along with pigeon pea straw and 200g of concentrate and it was compared with adult male goats of Berseem group . The animals remains healthy during the course of investigation. It was inferred that *Brassica juncea* green biomass can be supplemented to goats.

Pruning management of *Morus alba* based silvipasture system

Stand of *Morus alba* was seeded with *Cenchrus ciliaris* and *C. setigerus* perennial grasses and during the dormancy period of silvipasture the *Morus alba* stand was severly attacked by the termites due to moisture stress etc. Therefore, Pruning managemt was adopted to study the effect of pruning. There were five treatment were laid out in morus alba stand these were namely 1- Pruning at ground level 2-Pruning at 2feet height from ground level 3-Pruning at 4 feet height from ground level 4-Pruning at 6 feet height from ground level 5-Contol (with out pruning). Pruning was done in the last week of January. Leaves were sprouted during the second week of February. Initiation of leaf sprouting starts first in control as well as in 6 feet pruning height.

Table : Chemical composition of C. benghalensis, Lollium sp, and Setaria sp. based complete pelleted feeds

Chemical composition (%)	Complete feeds		
	C. benghalensis	Lollium multiflorum	Setaria sp.
Crude protein	16.85	17.38	15.34
Ether extract	2.08	1.97	1.51
NDF	53.36	48.20	46.78
ADF	21.04	26.02	21.72
Cellulose	18.02	20.65	21.72
ADL	3.01	5.36	5.90
Ash	11.17	13.34	13.65
AIA	3.73	5.46	6.63
OM	88.8	86.65	86.34
Hemicellulose	32.32	22.18	25.05
Total carbohydrate	69.89	67.30	69.49
Na	0.029	0.041	0.051
ca	0.125	0.118	0.099
K	0.159	0.149	0.144

Network program on estimation of methane emission under different feeding systems and development of mitigation strategies

M.K. Tripathi, Prabhat Tripathi, Ravindra Kumar, U.B. Chaudhary and P.K. Rout

Methane production potential of bio-resources namely Azolla (*Azolla microphylla*), gram straw (*Cicer arietinum*), mustard seeds (*Brassica juncea*) and concentrate mixture were determined under *in-vitro* fermentation experiments for 24 h using goat rumen flora. Methane production potential of azolla was the lowest (1.52 ml/100 mg truly digested substrate) among bio-resources evaluated. Mustard seed also demonstrated a lower (2.29 ml/100 mg truly digested substrate) methane production potential in comparison of gram straw and concentrate mixture. Marua, sweet marjoram (*Majorana hortensis*) leaves were evaluated for methane mitigation with complete feed mixtures containing roughage and concentrate ratio 60:40 experiments. Marua leaves were included from 0.5 to 6 % in complete feed mixture and the inclusion levels were not having a definite trend, a lowest methane production was (3.32 ml/100 mg truly digested substrate) at 6 % inclusion. Methane mitigation was also attempted using different protein supplements and urea in goat feeds. Replacement of linseed cake by mustard cake reduced in-vitro methane production 21.09 %, whereas replacement by guar korma and urea reduced methane production by 4.83 %. Feeding of these concentrate pellets in goats improved milk production by 5.5 and 11.1 % respectively with mustard cake and guar korma plus urea included concentrate pellets fed groups. The KNO3 was used in concentrate mixture to replace urea for nitrogen and provide a source of alternate hydrogen sink for reducing methane production. Replacement of urea by KNO_3 changed pH, TVFA, NH_3-N and protozoa numbers of fermentation medium. Inclusion of KNO_3 from 3 to 7% in concentrate had a reduction of methane up to 44.65%. Use of concentrate mixture containing 6 % KNO_3 was having 34.84% methane reduction on unit digestible substrate, when used at 40 % in composite feed mixture. When composite feed mixture was having 50 % concentrate, the 3% KNO_3 included concentrate mixture was effective in reducing methane production upto 19%, at higher concentrate levels (60%) an inclusion of concentrate with 7 % KNO_3 reduced methane production by 40 %. Full fat mustard seeds were used in composite pellet feed (R:C; 50:50) at 0, 50 and 100g/kg diet. Increasing levels of mustard seed were having greater methane reduction, which were respectively 5.82 and 13.86% at 50 and 100g inclusion levels. Fermentation metabolites of fermentation medium viz., pH, NH_3-N and protozoa numbers were not affected, whereas TVFA levels reduced by mustard seed inclusions.

Methane production potential of different bio-resources

Azolla (*Azolla microphylla*), full fat mustard (*Brassica juncea*) seed, gram straw (*Cicer arietinum)* and concentrate mixture used for goat feeding were evaluated. The net gas production (ml/0.2g substrate) was the lowest in Azolla (11.33 ml), followed by mustard seeds (21.33 ml) and was the highest with concentrate mixture (44.0 ml), however concentration of methane in gas was almost similar among feed resources evaluated, which ranged from 18.7 to 20.2% (Table 1). The methane production (ml/ 0.2g substrate or ml/100 mg truly digestible substrate), in-vitro dry matter and organic digestibilities were different among feed resources. The Azolla produced lowest methane 1.52 ml / 100 mg truly digestible substrate, followed by mustard seeds (2.29 ml), gram straw (4.33 ml) and concentrate mixture (4.89 ml). The metabolites of fermentation medium pH, NH_3-N (mg/100ml), TVFA (meq/100 ml) and protozoa ($N\times10^4$/ml) were also different.

Methane mitigation:

Methane mitigation using different protein sources in concentrate pellet

Methane production potential of the three-concentrate pellet feed (16 % CP) was estimated in which different protein sources were used. The conventional protein supplement linseed cake was used at 25 % in control pellet feed (A), linseed cake was replaced (w/w) by mustard cake (B) and in another pellet feed (C) guar korma (5.7%) and urea (1.3%) were used for replacing cakes. The methane production of the three feed varied from 3.89 to 4.71 ml/ 100mg digestible DM (Table 2). Mustard cake inclusion reduced methane production by 21.09 %, whereas the concentrate pellet containing guar korma and urea produced 4.83 % less methane in comparison to linseed cake included pellets. These concentrate mixtures were fed to lactating goats for 60 days to assess the effect on different concentrates on milk production and performance of goats. Feeding of different concentrates did not affect the dry matter intake of roughage, green fodder and concentrate, whereas total dry matter intake was higher ($p<0.05$) in goats fed concentrate pellet (C), containing guar korma and urea. Dry matter intake was ranging from 3.3 to 3.8 % of live weight (Table 3). Digestibility of dry matter and organic matter were similar among three concentrate fed goats. Milk production was higher ($p<0.05$) in goats fed concentrate pellet B and C, and the improvement in milk production was 5.5 and 11.1 per cent respectively in comparison of control goats, which received A concentrate pellet.

Table 1. Methane production potential of goat feeds

	Concentrate	Azolla	Gram straw	Mustard seed
Methane production potential				
Net gas (ml/ 0.2 g substrate)	44.00	11.33	24.67	21.33
CH_4 (%) in gas	18.73	19.77	20.21	19.91
CH_4 (ml/0.2g substrate)	7.67	1.76	4.55	3.78
In-vitro digestibility (%)				
Dry matter	78.41	57.63	52.67	82.77
Organic matter	81.98	59.07	54.48	87.08
CH_4 (ml/100 mg truly digestible substrate)	4.89	1.52	4.33	2.29
Fermentation metabolites				
pH	6.45	6.59	6.60	6.61
NH_3-N (mg/100ml)	18.21	8.72	16.40	20.07
TVFA (Meq/100 ml)	5.73	6.40	5.80	5.57
Protozoa ($N\times10^4$/ml)	1.46	1.13	0.60	0.60

Table 2. Methane production of concentrate pellets with different protein sources

	Concentrate pellet*		
	A	B	C
Methane production potential			
Net gas (ml/ g substrate)	241.7	248.3	262.5
CH_4 (%) in gas	18.09	15.29	16.69
In-vitro DM digestibility (%)	79.2	78.0	81.8
CH_4 (ml/100 mg truly digestible substrate)	4.71	3.89	4.49
% CH_4 reduction	0	21.09	4.83
*pellet contained: A-25 % linseed cake,; B-25 % mustard cake; C-guar korma (5.7%) + urea (1.3%)			

Table 3. Performance of goats on feeding of above concentrates

	Goat feeding groups			SEM	P-values
	A	B	C		
Dry matter intake (DMI, g/d)					
Dry roughage	252.25	291.51	282.92	9.398	0.208
Green fodder	184.36	227.92	268.54	15.169	0.067
Concentrate	466.88	479.95	484.67	4.971	0.338
Total DMI	903.5b	999.36ab	1036.14a	22.908	0.039
DMI % live weight	3.28	3.79	3.81	0.135	0.210
Nutrient digestibility					
Dry matter	67.61	67.34	65.26	0.790	0.441
Organic matter	69.46	68.69	67.01	0.746	0.414
Performance					
Milk yield (ml/day)	754.6b	796.5a	838.5a	18.612	0.048
Change %	0	+5.5	+11.1		

Table 4. Effect of different levels of marua leaves on methane production potential and in-vitro fermentation characteristics of diet containing wheat straw (60) and concentrate (40)

	Marua leaves in diet (%)							SEM	p-value
	0.5	1.0	2.0	3.0	4.0	5.0	6.0		
Methane production potential									
Net gas (ml/ 0.2 g substrate)	32.33a	33.00a	27.33b	26.67bc	24.67c	25.67bc	25.0c	0.748	<0.001
CH_4 (%) in gas	15.34c	16.73abc	17.33ab	18.66a	17.13abc	16.73abc	16.90bc	0.279	0.046
CH_4 (ml/0.2g substrate)	5.00abc	5.65a	4.88abc	5.19ab	4.37bc	4.41bc	4.21c	0.134	0.014
In-vitro digestibility (%)									
Dry matter	64.66a	63.25ab	62.76bc	63.65ab	62.73bc	61.36c	62.79bc	0.265	0.019
Organic matter	65.80a	64.43b	63.76b	64.13b	63.43b	63.27b	63.40b	0.214	0.002
CH_4 (ml/100 mg truly digestible substrate)	3.80ab	4.38a	3.83abc	4.05ab	3.45bc	3.48bc	3.32c	0.102	0.033
Fermentation metabolites									
pH	6.67a	6.56ab	6.48b	6.49b	6.63ab	6.69a	6.66a	0.023	0.032
NH_3-N (mg/100ml)	15.7d	15.55d	17.10cd	17.71bc	18.74ab	18.17abc	19.51a	0.347	<0.001
TVFA (Meq/100 ml)	5.53b	5.88ab	6.65a	5.72b	6.25ab	5.95ab	5.60b	0.116	0.091
Protozoa ($N\times10^4$/ml	2.21b	2.16b	2.48b	2.27b	2.37a	2.97b	2.32b	0.074	0.037

Effect of different levels of marua leaves on methane production potential of composite feed mixture

Marua leaves were included at 0.5, 1.0, 2.0, 3.0, 4.0, 5.0 and 6 % in complete feed mixture, which was containing wheat straw and concentrate in a ration 60:40. The gas production was reduced from 2 to 6% inclusion levels, whereas proportion (%) of methane in total gas was not affected by marua leaves inclusions at either levels. The methane production (ml/ 0.2 g substrate) was the lowest (4.21 ml; $p<0.05$) at 6 % inclusion level. However, marua leaves inclusion reduced ($p<0.05$) in-vitro dry matter and organic matter digestibility to the tune of 2 to 3 percent among inclusion levels (Table 4). Marua leaves inclusion levels were not having a definite trend, however the lowest methane production was (3.32 ml/100 mg truly digested substrate) at 6 % inclusion. The pH of the fermentation was the lowest (6.48; $p<0.05$) and the TVFA were the highest (6.65 meq/100 ml; $p<0.05$) at 2 % level, whereas NH_3-N (mg/100 ml) was the highest (19.51 mg; $p<0.001$) at 6% inclusion level. The fermentation metabolites of fermentation medium did not show a definite trend for the inclusion levels of marua leaves.

Methane mitigation using different nitrogen sources in concentrate

Methane mitigation was attempted using alternate hydrogen sink for rumen methane production. Urea is used as nitrogen source in ruminant feeding, which is containing 46 % nitrogen. The potassium nitrate (KNO_3) is having 13 % nitrogen and can be used in ruminant feeding to supply nitrogen as well as a source of alternate hydrogen sink for reducing methane production. The urea was added in concentrate mixture at 1.5 % and the urea was replaced by KNO_3 at 0, 3, 4, 5, 6 and 7 %. The crude protein levels of concentrates were kept between 20 to 22 %. Replacement of urea by KNO_3 reduced ($P<0.001$) methane production (ml/100 mg truly digested substrate) among replacement levels. The lowest methane production (ml/100 mg truly digested substrate) was 2.12 ml in 7.0 % KNO_3 included concentrate feed followed by 2.82 ml in the combination of urea 0.75 and KNO_3 4% included concentrate (Table 5). The methane reduction was achieved upto 44.65 % in concentrate feed with 7.0 % KNO_3 inclusion. The inclusion of KNO_3 in concentrate mixture at 7 % level was accompanied by reduced ($p<0.05$) protozoa numbers, whereas pH, NH3-N and TVFA were affected by KNO_3 inclusion but were not having a definite trend. These concentrate mixture were used in composite feed mixture with wheat straw at R:C ratios of 60:40 (Table 6), 50:50 (Table 7) and 60:40 (Table 8) for the determination of methane production potential of KNO3 included concentrates. The composite feed mixture containing 40% concentrate with urea and KNO3 (0.25 and 6.0) produced lowest ($p<0.001$) methane 3.61 ml/ 100 mg truly digested substrate, which was having a 34.8 % reduction in comparison of control feed. The methane reduction was respectively 20.3, 25.27, 34.8 and 29.0 % at 3, 4, 5, 6 and 7 % KNO_3 inclusion levels (Table 6). Inclusion of KNO_3 in composite feed mixture (R;C; 60:40) did not affect the pH, whereas NH3-N increased ($p<0.001$) and TVFA decreased ($p<0.001$) in fermentation medium. Composite feed mixture with R:C; 50:50 with concentrate containing 3 % KNO_3 have the lowest ($p<0.05$) methane was 1.7 ml/ 100 mg truly digested substrate, which was having a 19.05 % reduction in comparison of control feed. However, metabolites of fermentation medium were different among KNO_3 inclusion levels but were having a definite trend. A reduction ($p<0.001$) of methane was upto 40.63 % in composite feed mixture with R;C; 40:60 having concentrate containing 7 % KNO_3. The lowest ($p<0.05$) methane was 3.58 ml/ 100 mg truly digested substrate with 7% KNO_3 inclusion in comparison of 6.03 ml of control feed (Table 8). A linear reduction in methane production was from 9.1 to 40.63% with 3 to 7 % KNO_3 inclusion in concentrate mixture. Results of KNO_3 inclusion demonstrated that the KNO_3 can reduce methane production in ruminant feeds from 5 to 44 %, however level of reduction could be associated with the level of feeding.

Table 5: Methane mitigation using Urea and KNO_3 in concentrate mixture (concentrate only): effect on fermentation

Concentrate containing	CH_4 (ml/ 100 mg) truly digested substrate	% CH_4 reduction	pH	NH_3-N (mg/100 ml)	TVFA (mEq/100 ml)	Protozoa (no 10^4/ml)
Urea + KNO_3 (1.5 + 0 %)	3.83[a]	0	6.03a	19.24b	6.03a	2.54ab
Urea + KNO_3 (1.25 + 1. 0 %)	3.76[a]	0	5.98ab	16.67c	5.88abc	2.05bc
Urea + KNO_3 (1.0 + 3.0 %)	3.62[ab]	5.48	5.86ab	19.28b	5.92ab	3.18a
Urea + KNO_3 (0.75 + 4.0 %)	2.82[c]	26.37	5.78b	20.95ab	5.70abc	2.59ab
Urea + KNO_3 (0.5 + 5.0 %)	3.21b[c]	16.18	5.84ab	21.78a	5.38c	2.43ab
Urea + KNO_3 (0.25 + 6.0 %)	3.13[c]	18.27	5.93ab	16.95c	5.51bc	1.84bc
Urea + KNO_3 (0.0 + 7. 0 %)	2.12[d]	44.65	5.97ab	17.29c	5.78abc	1.46c
SEM	0.133		0.032	0.683	0.217	0.143
Significance (P-value)	<0.001		0.032	<0.001	<0.001	0.002

Table 6: Methane mitigation using Urea and KNO_3 in concentrate mixture (complete feed (R:C 60:40; wheat straw: concentrate): effect on fermentation

Concentrate containing	CH_4 (ml/ 100 mg) truly digested substrate	% CH_4 reduction	pH	NH_3-N (mg/100 ml)	TVFA (mEq/100 ml)	Protozoa (no 10^4/ml)
Urea + KNO_3 (1.5 + 0 %)	5.40[a]	0	6.72	19.53b	6.43a	1.78
Urea + KNO_3 (1.25 + 1. 0 %)	5.54[a]	0	6.68	19.87ab	6.25b	1.57
Urea + KNO_3 (1.0 + 3.0 %)	4.41[b]	20.39	6.71	19.91ab	6.12c	1.57
Urea + KNO_3 (0.75 + 4.0 %)	4.14[b]	25.27	6.81	19.80ab	5.52e	1.67
Urea + KNO_3 (0.5 + 5.0 %)	3.99[b]	27.98	6.85	19.92ab	5.55e	1.94
Urea + KNO_3 (0.25 + 6.0 %)	3.61[b]	34.84	6.76	19.85ab	6.05c	1.51
Urea + KNO_3 (0.0 + 7. 0 %)	3.93[b]	29.06	6.79	20.76a	5.75d	1.56
SEM	0.174		0.032	0.413	0.158	0.373
Significance (P- value)	<0.001		0.143	<0.001	<0.001	0.125

Table 7: Methane mitigation using Urea and KNO_3 in concentrate mixture (complete feed (R:C 50:50; wheat straw: concentrate): effect on fermentation

Concentrate containing	CH_4 (ml/ 100 mg) truly digested substrate	% CH_4 reduction	pH	NH_3-N (mg/100 ml)	TVFA (mEq/100 ml)	Protozoa (no 10^4/ml)
Urea + KNO_3 (1.5 + 0 %)	2.10^{bc}	0	6.80ab	16.38b	7.03a	4.91
Urea + KNO_3 (1.25 + 1. 0 %)	1.92^{cd}	8.57	6.78abc	17.99ab	6.30c	3.45
Urea + KNO_3 (1.0 + 3.0 %)	1.70^{d}	19.05	6.66de	18.05ab	6.37c	2.97
Urea + KNO_3 (0.75 + 4.0 %)	2.10^{bc}	0	6.78abcd	18.91a	6.40c	3.72
Urea + KNO_3 (0.5 + 5.0 %)	2.48^{ab}	0	6.66cde	18.80a	6.43bc	2.86
Urea + KNO_3 (0.25 + 6.0 %)	2.40^{abc}	0	6.64e	17.99ab	6.57b	2.27
Urea + KNO_3 (0.0 + 7. 0 %)	2.80^{a}	0	6.70bcde	17.70ab	5.58b	3.83
SEM	0.114		0.018	0.360	0.209	0.283
Significance (P-value)	0.003		0.009	0.003	<0.001	0.152

Table 8 Methane mitigation using Urea and KNO_3 in concentrate mixture (complete feed (R:C 40:60; wheat straw: concentrate): effect on fermentation

Concentrate containing	CH_4 (ml/ 100 mg) truly digested substrate	% CH_4 reduction	pH	NH_3-N (mg/100 ml)	TVFA (mEq/100 ml)	Protozoa (no 10^4/ml)
Urea + KNO_3 (1.5 + 0 %)	6.03^{a}	0	6.69a	18.62d	6.70cd	5.13a
Urea + KNO_3 (1.25 + 1. 0 %)	6.06^{a}	0	6.67a	18.44d	7.05ab	4.43b
Urea + KNO_3 (1.0 + 3.0 %)	5.48^{ab}	9.12	6.53b	19.89cd	6.47de	4.21b
Urea + KNO_3 (0.75 + 4.0 %)	5.00^{b}	17.08	6.70a	20.58bc	7.10a	4.76b
Urea + KNO_3 (0.5 + 5.0 %)	4.02^{c}	33.33	6.70a	21.60ab	6.82bc	3.99c
Urea + KNO_3 (0.25 + 6.0 %)	3.65^{c}	39.47	6.66a	21.02abc	6.18f	4.10bc
Urea + KNO_3 (0.0 + 7. 0 %)	3.58^{c}	40.63	6.68a	22.35a	6.35ef	4.58b
SEM	0.235		0.017	0.303	0.225	0.229
Significance (P-value)	<0.001		0.037	<0.001	<0.001	0.008

Effect of different levels of mustard seed in goat diets on in-vitro methane production potential and milk production

Three complete diets were prepared with roughage (gram straw) and concentrate ratio (50:50), complete diets were containing whole mustard (*Brassica juncea*) seed at 0, 50 and 100 g per kg diet, as source of oil. Methane production potential, gas production attributes and fermentation characteristics were determined in a 24 h in-vitro fermentation study. An animal experiment was conducted on lactation Barabri goats for 70days to assess the influence of mustard seed supplementation on performance. Net gas and methane production (ml/ 0.2 g substrate) reduced linearly with increased mustard seed levels, whereas proportion of methane in gas was similar among three diets (Table 9). In-vitro dry matter digestibility (IVDMD) was not affected by mustard seed inclusion, whereas organic matter digestibility increased ($p<0.05$) by 3 to 4 % units. The lowest methane production (ml/100mg truly digested substrate) was 4.29 ml with 100g mustard seed included diet. The reduction in methane production on unit digestible substrate was 5.82 and 13.86 % respectively with 50 and 100g mustard seed inclusion in each kg diet. The metabolites of fermentation medium pH, NH_3-N and protozoa numbers were similar, whereas TVFA levels reduced ($p<0.001$) with mustard seed included diets. However, milk production of goats was not affected during 70 days feeding.

Table 9. Methane production potential of mustard seed included diets (R:C; 50:50)

	Level of mustard seed (g/kg) in diet			SEM	p-values
	0	50	100		
Methane production potential					
Net gas (ml/ 0.2 g substrate)	42.67a	38.0b	35.67b	1.102	0.002
CH_4 (%) in gas	17.62	18.96	18.43	0.349	0.167
CH_4 (ml/0.2g substrate)	6.85	6.65	5.96	0.191	0.067
In-vitro digestibility (%)					
Dry matter	68.9	71.61	69.51	0.635	0.105
Organic matter	70.61b	74.41a	73.32b	0.706	0.048
CH_4 (ml/100 mg truly digestible substrate)	4.98	4.68	4.29	0.148	0.078
% CH_4 reduction	0	5.82	13.86		
Fermentation metabolites					
pH	6.61	6.53	6.63	0.033	0.538
NH_3-N (mg/100ml)	15.96	17.15	16.36	0.260	0.163
TVFA (Meq/100 ml)	6.87a	6.08c	6.32b	0.117	<0.001
Protozoa (N×10^4/ml	0.91	1.35	1.13	0.108	0.295
Performance					
Milk yield (g/day)	938	953	854	28.152	0.109

Development of complete feed for environmentally and economically sustainable goat production

Ravindra Kumar, P. Tripathi, U. B. Chaudhary, R.B. Sharma and Chetna Gangwar

Feeding trial on lactating Barbari goats was conducted with iso nitrogenous azolla based complete pellet feed. Twelve Barbari goats in 2-3rd lactation at post weaning stage were divided into two groups (control and treatment) of six each as per completely randomized design. Control group of goats was fed with normal complete pellet while treatment group of goats

was fed with iso nitrogenous azolla based complete pellet. The duration of study was 6 weeks. Daily feed intake and milk production was recorded. Milk samples were analysed for different milk constituents. The feed intake and milk production was statistically similar in both the group. The different constituents of milk like fat, SNF, protein etc. were also similar in both the group (Table 1). Blood and rumen fluid was collected at the end of experimental feeding. No significant difference was observed in different hematological parameters studied. Ruminal pH, TVFA and various nitrogenous fractions (Ammonia-N, Total –N, TCA-ppt N and Non protein-N) were similar in control and treatment group of lactating goats. Digestion trial was conducted after 4weeks of experimental feeding. The digestibility of dry matter and organic matter was statistically similar in control (60.67 and 62.63) and treatment group (54.07and 56.48) of goats. The digestibility of other nutrients was statistically similar for both the group of goats. No adverse effect on hematology was reported.

Table 1: Milk production in experimental goats

	Control Gr.	Treatment Gr.
Feed intake (g/day)	1539.28±15.83	1708.92±16.47
Milk (ml/day)		
Morning	279.66±5.51	292.14±7.23
Evening	129.76±4.18	198.64±5.14
Total	409.43±8.67	490.78±9.95
Total solids (%)	14.27±0.15	13.26±0.18
Fat (%)	5.57±0.09	5.06±0.11
SNF (%)	8.69±0.08	8.20±0.09
Density (%)	28.09±0.31	26.62±0.32
Protein (%)	3.01±0.03	2.84±0.03
Lactose (%)	4.66±0.04	4.41±0.05
Salts (%)	0.67±0.00	0.64±0.00

National initiative on climate resilient agriculture (nicra) on assessing resilience of small ruminant production under changing climatic conditions in semi-arid zone

U.B.Chaudhary, Ashok Kumar, P. K. Rout, and N. Ramachandran

The project was initiated as a research unit of NICRA project at CIRG to undertake the research on adaptation strategies in goats to environmental stress through nutritional manipulation with the objectives to investigate the adaptive capability of goats to environmental stress based on growth, physiological, endocrine, biochemical and genetic parameters & to explore the feeding management strategies to combat environmental stress in goats, since the productive potential of goats under semiarid and arid reason is highly influenced by their exposure to harsh climatic conditions mainly high & low ambient temperature along with humidity. Under the research project activities related to evaluation of adaptive capability of different breeds of grazing & stall fed goats during hot (dry and humid) & cool period, application of different combination of protein, energy, micronutrient and herbal based feed additive to combat the climatic stress in goats & creation of awareness amongst goat farmers for making suitable strategies to combat the adverse effect of climate change through organization of farmers awareness programme shall be undertaken. Outcome of the proposed study under NICRA project will help to evaluate adaptive capability of goat breeds to

adverse climate and to formulation of package of practice in terms of nutritional intervention s to combat adverse climatic condition s so as to increase /sustain goat productivity

Net work programme on 'veterinary type culture' (rumen microbes)

U.B.Chaudhary, Ravindra Kumar and V.K.Gupta

Twenty four isolates of rumen bacteria, isolated from goats, were identified and characterized on the basis of 16S rRNA gene amplification using F -S*-univ-530a-S-16 and R-S*-univ-1392-a-A-15 primers and sequencing of the amplified product. The rumen liquor for identification of rumen bacteria was collected from the Male Barabri goats maintained under stall fed conditions and were fed basal diet of gram straw ,green fodder and concentrate mixture. Rumen Bacteria was cultivated & isolated on anaerobic non defined medium. Rumen liquor from goats was used for isolation & cultivation of rumen Bactria. Isolation and cultivation process was done under anaerobic chamber and hungate roll tubes. Pure cultures of different isolates of rumen bacteria were subjected for extraction of DNA. This DNA was used for PCR amplification using relevant primers and amplified products were subjected for sequencing of desired genes. Characterization of the of rumen bacteria was done on the basis of gene sequence.

Isolates of Rumen bacteria isolated from goats fed gram straw based diet.

Rumen bacteria	Isolates
Butyrivibrio fibrisolvens	10
Oribacterium sinus	01
Pseudobutyrivibrio xylanivorans	06
Selenomonas ruminantium	05
Succinivibrio dextrinosolvens	02
Total	24

Traceability, food safety standards and food chain evaluation (HACCP) pertaining to goat meat and value added products

V. Rajkumar, Arun K. Verma and Khushyal Singh

HACCP data for Goat meat and meat products:

Microbial analysis was carried out by manual as well as TEMPO method. Residue analyses are being carried out using GC MS/MS triple quadrupole and the results will be presented in the final report. That will modify critical limits for the chemical and other related residues. To identify critical control point's microbiological quality of the stages of nuggets processing including slaughter has been carried out. Similarly estimation of bacterial counts in the raw materials used in the formulation of Nugget has been done. After this complete analysis HACCP design has been prepared. Perusal of Table 1 reveals that slaughter house floor (log 5.01), wall (log 3.87), butcher's hand (log 3.90), bleeding knife (log 3.46) and carcass splitting chopper (log 3.95) had higher SPC. Similar counts were found in the instrumental (TEMPO) enumeration also. Regarding raw material like keema (log 4.41) and fat (log 3.93), if the initial counts can be reduced, fresh product count can also be reduced considerably.

Table 1. Standard plate counts by manual method and instrumental (TEMPO) method at various stages of Nugget and Nimkee processing including slaughter

S.No.	Place of sampling	Manual (log CFU10^{-1}sqcm)	Instrumental (logCFU10^{-1}sqcm)
1.	Slaughter house floor	5.01	5.04
2.	Slaughter house wall	3.87	3.73
3.	Bleeding knife (Iron)	3.27	3.28
4.	Dressing knife (Iron)	3.46	4.01
5.	Butcher's hand	3.90	4.05
6.	Carcass splitting chopper	4.01	3.89
7.	Deboning knife I (SS)	2.74	2.50
8.	Deboning knife II (SS)	2.63	2.10
9.	*Carcass surfaces*		
	a. Carcass neck portion	4.64	5.10
	b. Carcass – Loin cut	4.87	5.21
	c. Carcass – Leg cut	3.43	4.85
10.	Carcass cutting wood	3.61	4.03
11.	Deboning table	3.81	3.08
12.	Surface of meat mincer	2.01	2.24
13.	Surface of bowl chopper	1.02	<1.00
14.	Surface of SS Emulsion box	2.18	
15.	Surface of nuggets cutting plates	1.71	<1.00
16.	Surface of the murukku/nimkee making machine	1.09	<1.00
17.	Plates used for making	Nil	Nil
18.	Wooden frame and handle used	Nil	Nil

Table 2. Estimation of bacterial counts in the raw materials used in the formulation of goat meat nuggets/sausage and Murukku/Nimkee

S.No.	Raw materials	Manual (log CFU10^{-1}sqcm)	Instrumental (logCFU10^{-1}sqcm)
1.	Meat Keema	3.92	4.00
2.	Meat fat	4.06	4.69
3.	Maida	3.07	3.89
4.	Meat powder	1.86	2.00
5.	Murukku/nimkee powder	1.09	<1.00
6.	Oil	Nil	Nil
7.	Spices	2.04	1.59
8.	Condiments	1.03	<1.00

MoFPI (Externally) Funded Project
Setting up of National Referral Laboratory for Testing of Animal Products

V. Rajkumar and Arun K.Verma

Samples of meat and meat products were screened for pathogenic microorganisms using VIDAS (M/s BioMérieux, France) and general screening of microorganisms using TEMPO (M/s BioMérieux, France). Results are presented in tables. All the meat and meat products screened were not positive for any pathogenic organisms. Reference value and mean values are presented for all the pathogenic organisms which are against their respective standard (Table 3). Test values are actual detected values in the samples. If the test value is more than 0.04 than the mean standard value then the test is positive otherwise the sample is free from the respective pathogenic organism. Positive, negative and blank samples were detected properly. Staphylococcus enterotoxin II, *E.coli* 0157 and Salmonella in meat and meat products were screened as early as in two days of time (Table 4). Therefore, the laboratory is commercially capable to carry out the tests in meat and meat products.

Instrumental (TEMPO) enumerations of bacterial counts (log CFU/g) are presented in the table. A new Goat meat product named as goat meat spread had the higher Total Viable Count (4.69 log CFU/g) and it had the higher enterobacteriaceae count (4.56 log CFU/g) also (Table 5). Therefore, the laboratory is now commercially capable to carry out the enumeration of microorganisms in meat and meat products.

Table 3: Instrumental (VIDAS) screening of standards for pathogenic microorganisms

Sr. No.	Pathogenic microorganism	Reference value			Interpretation
		Sample1	Sample2	Mean	
1.	Staphylococcus enterotoxin II	3696	3751	3723	Positive
2.	E coli 0157	3883	3890	3886	Positive
3.	Salmonella	4552	4568	4560	Positive

Table 4: Instrumental (VIDAS) screening for Pathogenic microorganisms in meat & meat products

Sr. No.	Sample	Pathogenic microorganism	Reference value	Test value	Interpretation
1.	Fresh Meat	Staphylococcus enterotoxin II	3723	0.01	Negative
2.		E coli 0157	3886	0.01	Negative
3.		Salmonella	4560	0.00	Negative
4.	Goat meat spread -product	Staphylococcus enterotoxin II	3723	0.00	Negative
5.		E coli 0157	3886	0.01	Negative
6.		Salmonella	4560	0.00	Negative
7.	Goat meat Pickle -product	Staphylococcus enterotoxin II	3723	0.00	Negative
8.		E coli 0157	3886	0.00	Negative
9.		Salmonella	4560	0.00	Negative

Table 5: Instrumental (TEMPO) enumeration of bacterial counts (log CFU/g) in meat and meat products.

Sample	Total Viable Count	Total Coliforms	Escherichia Coli	Entero-bacteriaceae	Yeast and Mould
Meat	2.05	<1	<1	1.89	<1
Goat meat spread	4.69	<1	2.00	4.56	<1
Pickle	2.00	<1	<1	<1	<1

Screening and quantification of pesticide residues in meat and meat products

Analysis was conducted in Shimadzu GCMS-TQ8030 triple quadrupole GC/MS/MS. GCMS-TQ8030 was operated in the single ion monitoring (SIM) mode using optimised SIM and collision energies detailed in the Shimadzu GC/MS/MS pesticide database. Pesticides were identified and quantified by comparing their retention times with pesticide standards and were expressed in PPM. Pesticide residues in meat and meat products can be estimated using this method. Pesticide standard mix had 20 organo chlorine compounds and their RT were identified and quantified in the GC MS/MS in the split less mode. Initially 5 ppm standards mix was screened for identification (Fig 1 and Table 6). Except the 19th compound all other compounds were identified at parts per million (PPM) level. Their RT and mass by charge ratio (m/z) were obtained. In the next analysis the unknown sample were plotted against the linear graph obtained and it quantified the unknown sample mix of the standards which had the concentration ranged from 44 PPM to 67 PPM (Table 7). Similarly the quantification of meat and meat products can be carried out for pesticide residues.

Figure 1: Chromatogram of Organo Chlorine compound (5 PPM mix) by GC MS/MS Split less mode

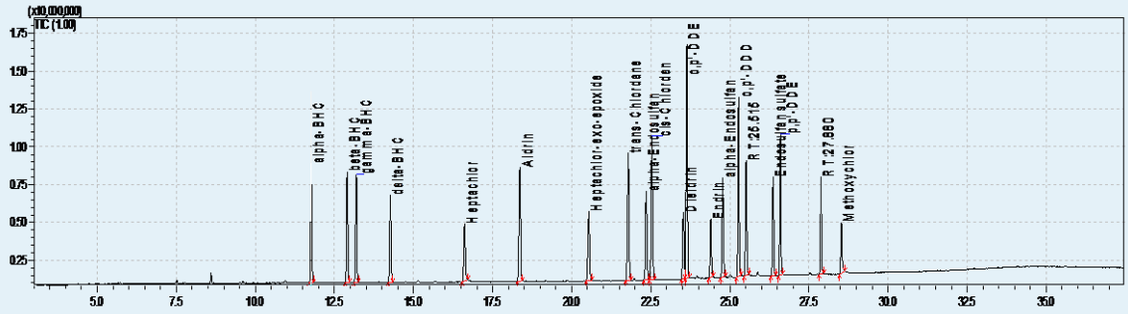


Table 6: Identification of Organo Chlorine compound (5 PPM standards mix) by GC MS/MS Split less mode

Sr No	Organo Chlorine compounds	Retention Time	m/z (Mass/Charge)	Unit
1	alpha-BHC	11.757	181.00	ppm
2	beta-BHC	12.889	181.00	ppm
3	gamma-BHC	13.173	183.00	ppm
4	delta-BHC	14.258	181.00	ppm
5	Heptachlor	16.597	266.00	ppm
6	Aldrin	18.342	66.00	ppm
7	Heptachlor-exo-epoxide	20.519	353.00	ppm
8	trans-Chlordane	21.772	373.00	ppm
9	alpha-Endosulfan	22.335	69.00	ppm
10	cis-Chlorden	22.518	373.00	ppm
11	Dieldrin	23.519	79.00	ppm
12	o,p'-DDE	23.623	246.00	ppm
13	RT:24.385	24.389	67.00	ppm
14	alpha-Endosulfan	24.766	69.00	ppm
15	o,p'-DDD	25.260	178.00	ppm
16	RT:25.495	25.499	67.00	ppm
17	Endosulfan sulfate	26.353	272.00	ppm
18	p,p'-DDE	26.589	246.00	ppm
19	RT:27.870	27.871	67.00	ppm
20	Methoxychlor	28.508	227.00	ppm

Table 7: Quantification of unknown standard sample mix of Organo Chlorine compounds by GC MS/MS Split less mode

Sr No	Organo Chlorine compounds	Retention Time	m/z (Mass/Charge)	Concentration	Unit
1	alpha-BHC	11.748	181.00	61.599	ppm
2	beta-BHC	12.880	181.00	62.110	ppm
3	gamma-BHC	13.165	183.00	59.942	ppm
4	delta-BHC	14.246	181.00	54.654	ppm
5	Heptachlor	16.586	266.00	63.114	ppm
6	Aldrin	18.333	66.00	66.813	ppm
7	Heptachlor-exo-epoxide	20.507	353.00	58.307	ppm
8	trans-Chlordane	21.762	373.00	64.311	ppm
9	alpha-Endosulfan	22.332	69.00	67.033	ppm
10	cis-Chlorden	22.512	373.00	63.308	ppm
11	Dieldrin	23.505	79.00	59.844	ppm
12	o,p'-DDE	23.612	246.00	61.803	ppm
13	Endrin	24.372	67.00	53.915	ppm
14	alpha-Endosulfan	24.750	69.00	61.803	ppm
15	o,p'-DDD	25.246	178.00	66.867	ppm
16	RT:25.495	25.485	67.00	58.818	ppm
17	Endosulfan sulfate	26.343	272.00	54.681	ppm
18	p,p'-DDE	26.571	246.00	62.871	ppm
19	RT:27.870	27.852	67.00	44.105	ppm
20	Methoxychlor	28.496	238.00	57.351	ppm

Value chain for the development of goat products with healthy traits

A K Verma and V Rajkumar

Physicochemical, colour and sensory characteristics of low sodium goat meat pickle

In the present study quality characteristics of low sodium goat meat pickles (Treatment I, II and III) having 50 percent less sodium chloride than the conventionally prepared goat meat pickles (Control) was evaluated. The half of the common salt in treated pickles was replaced by various combinations of KCl, $CaCl_2$ and sucrose. There were significant differences in the proximate principles of the products where the treatment III had the lowest moisture and highest protein content. Control and treatment III pickle had lowest water activity as compared to the other two products. The pH values of all the pickles were statistically similar.

Table 1: Physicochemical characteristics of low sodium goat meat pickle

Parameters	Control	Treatment I	Treatment II	Treatment III
Moisture (%)	40.83 ± 0.25^{b}	43.34 ± 0.46^{a}	41.47 ± 0.76^{b}	37.19 ± 0.53^{c}
Fat (%)	17.26±0.56	17.45±0.53	17.06±0.51	17.34±0.87
Protein (%)	36.55 ± 0.67^{b}	35.27 ± 0.66^{b}	36.98 ± 0.71^{b}	39.13 ± 0.60^{a}
Ash (%)	6.33 ± 0.11^{a}	4.89 ± 0.12^{b}	5.24 ± 0.14^{b}	6.12 ± 0.17^{a}
Water activity	0.90 ± 0.00^{c}	0.93 ± 0.00^{a}	0.91 ± 0.00^{b}	0.89 ± 0.00^{c}
pH	4.74±0.05	4.64±0.04	4.72±0.03	4.63±0.02

Evaluation of Hunter colour parameters revealed that control pickle had lower redness value as compared to treated pickles (Table 2). However, lightness and yellowness values of all the products did not differ significantly.

Table 2: Hunter colour characteristics of low sodium goat meat pickle

Parameters	Control	Treatment I	Treatment II	Treatment III
Lightness	27.59±0.83	28.17±0.40	27.87±0.83	27.07±0.76
Redness	2.65±1.30^{b}	4.13±0.92^{ab}	5.12±1.41^{ab}	7.42±1.24^{a}
Yellowness	9.44±0.72	10.12±0.83	10.02±1.10	10.05±1.19

Organoleptic evaluation of products showed no significant different in the various sensory parameters among all the products except saltiness score which was significantly higher in the treatment II (Table 3). Thus goat meat pickles with 50% less sodium chloride can be developed through use of different salt substitute blends without affecting their acceptability.

Table 3: Sensory characteristics of low sodium goat meat pickle

Parameters	Control	Treatment I	Treatment II	Treatment III
Appearance	6.72±0.22	6.77±0.18	6.95±0.12	6.75±0.28
Flavour	6.60±0.15	6.80±0.20	6.87±0.15	6.66±0.22
Texture	6.18±0.33	6.38±0.22	6.60±0.22	6.53±0.26
Saltiness	6.25±0.26^{b}	6.90±0.22^{ab}	6.98±0.19^{a}	6.48±0.25^{ab}
Sourness	6.36±0.28	6.55±0.29	6.78±0.23	6.51±0.23
Overall acceptability	6.58±0.20	6.80±0.17	7.08±0.16	6.53±0.26

Storage stability of low sodium goat meat pickle at ambient temperature

The treated low sodium goat meat pickles along with control were packed in polypropylene boxes and stored for 60 days at ambient temperature. Physicochemical and microbiological quality parameters of all the four products were monitored throughout the storage period at 15 day interval. Water activity and pH values of all the products did not reveal clear cut increasing or decreasing trends throughout the storage period (Table 4). Among products water activity was significantly higher for treatment II while treatment III had lowest value.

Table 4: Water activity and pH value of goat meat pickles during storage at ambient temperature

	Storage period (Days)				
Treatments	**0**	**15**	**30**	**45**	**60**
Water activity					
Control	0.91±0.00^{Bab}	0.90±0.00^{Cb}	0.91±0.00^{Ba}	0.91±0.00^{Ca}	0.90±0.00^{Cb}
Treat I	0.91±0.00^{Bc}	0.92±0.00^{Bb}	0.91±0.00^{ABb}	0.92±0.00^{Ba}	0.92±0.00^{Ba}
Treat II	0.93±0.00^{Ab}	0.93±0.00^{Abc}	0.93±0.00^{Ac}	0.93±0.00^{Aa}	0.93±0.00^{Aa}
Treat III	0.89±0.00^{Ca}	0.84±0.00^{Dc}	0.87±0.01^{Cb}	0.88±0.00^{Da}	0.89±0.00^{Da}
pH					
Control	4.66±0.03^{Aa}	4.50±0.02^{Ac}	4.69±0.02^{Aa}	4.64±0.02^{Aa}	4.58±0.01^{Bb}
Treat I	4.52±0.01^{Cb}	4.59±0.01^{Ba}	4.54±0.01^{Cb}	4.58±0.01^{Ba}	4.52±0.01^{Cb}
Treat II	4.68±0.01^{Aa}	4.67±0.01^{Aab}	4.61±0.03^{Bc}	4.62±0.01^{Abc}	4.62±0.01^{Ac}
Treat III	4.57±0.01^{Bb}	4.54±0.01^{Cc}	4.64±0.01^{ABa}	4.64±0.01^{Aa}	4.63±0.01^{Aa}

Hunter colour parameters of goat meat pickles also did not show any trend throughout the storage period (Table 5). Thus the effect of storage period on these parameters of control and low sodium goat meat pickles remained inconclusive. These inconsistent results of

water activity and pH could be attributed to the variability in the penetration of ingredients in the meat pieces. Proportion and distribution of meat pieces and non-meat ingredients particularly spice mix could be the main reason for inconsistent result of colour parameters.

Table 5: Hunter colour parameters of goat meat pickles during storage at ambient temperature

Storage period (Days)					
Treatments	0	15	30	45	60
Hunter colour lightness value					
Control	28.69±1.11	28.37±1.30^{B}	30.10±0.39	28.90±0.87	27.43±0.97
Treat I	27.93±0.70^{b}	31.00±0.72^{Aa}	27.50±0.37^{b}	28.97±0.58^{b}	28.93±0.73^{b}
Treat II	27.33±1.49^{ab}	30.17±0.32^{ABa}	30.68±1.76^{a}	28.27±0.37^{ab}	26.60±0.73^{b}
Treat III	25.74±0.75^{c}	29.71±0.41^{ABa}	28.58±1.02^{ab}	28.16±0.72^{abc}	26.34±1.21^{bc}
Hunter colour redness value					
Control	3.34±1.97	2.86±2.67	4.74±0.35	3.87±0.87	4.51±0.19
Treat I	4.68±1.35	2.59±1.61	4.22±0.74	4.60±1.24	6.15±0.73
Treat II	3.85±2.60	2.15±1.44	3.12±0.26	4.33±0.70	5.91±0.93
Treat III	9.10±1.74^{a}	2.63±1.32^{b}	3.16±0.84^{b}	3.29±0.74^{b}	3.80±2.09^{b}
Hunter colour yellowness value					
Control	10.15±1.31	9.83±1.43	11.69±0.30^{A}	12.06±0.25^{A}	11.93±0.77
Treat I	10.39±1.36	9.02±1.12	8.95±0.50^{B}	9.81±0.63^{B}	10.85±1.02
Treat II	8.93±2.15	8.35±0.88	10.70±0.64^{A}	10.50±0.71^{AB}	11.17±0.41
Treat III	12.74±0.82^{a}	8.93±0.55^{b}	10.17±0.64^{ABab}	10.74±0.67^{ABab}	10.39±1.72^{ab}

Evaluation of thiobarbituric acid reactive substances (TBARS) number showed gradual increase in the value throughout the storage period for all the products (Fig. 1). Except on the day zero, TBARS number for control pickle remained significantly lower than low sodium pickles throughout the storage period. TBARS number for treated pickles was significantly higher than control 15 day onwards. Among low sodium goat meat pickles, treatment I and treatment III had significantly higher value on day 60. Microbiological study of all the products revealed that bacteria and yeast and mould could not grow in any product even on 60th day of storage (data not presented) thus we could not get a single colony of total plate count, psychrotrophs and yeast and moulds.

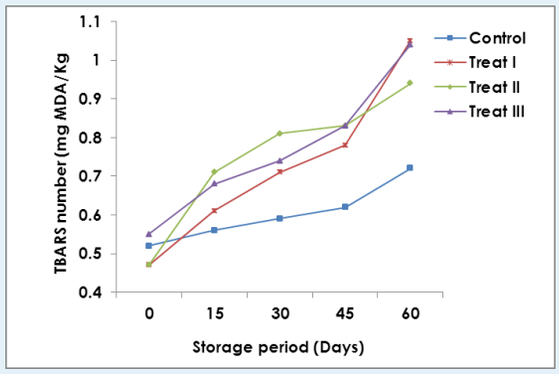


Fig. 1: TBARS number of low sodium goat meat pickle stored at ambient temperature

Quality characteristics and antioxidant potential of various fibre rich ingredients

In the present study different plant ingredients such as Amla, Kiwi fruit peel, Moringa peel, pulp and flower were screened for various physicochemical and technological characteristics so that they can be used directly or indirectly for the development of goat meat products dietary fibre and antioxidants. These ingredients were evaluated for water binding capacity (WBC), oil retention capacity (ORC), swelling capacity (SC), insoluble (IDF), soluble (SDF) and total dietary fibres (TDF) (Table 6) as well as total phenolics (Fig. 2).

Water binding capacity was highest for moringa pulp followed by amla, moringa flower, moringa peel, and KF peel. Oil

retention capacity was highest for moringa pulp while amla powder had lowest value. Swelling capacity for the moringa pulp was highest followed by moringa flower. Moringa peel, KF peel and amla had almost similar swelling capacity. The amount of total dietary fibre (TDF) and insoluble dietary fibre (IDF) was in the order of moringa peel> moringa pulp> moringa flower> KF peel> amla while order of soluble dietary fibre (SDF) was as moringa peel> moringa pulp> amla> KF peel> moringa flower. Total phenolics (mg Gallic acid equivalent/g) was highest in amla powder (101.09) followed by moringa flower (20.31), moringa peel (16.56), kiwi fruit peel (13.82) and moringa pulp powder (7.97).

Table 6: Quality characteristics of fibre rich ingredients

Sample	WBC	ORC	SC	IDF	SDF	TDF
Amla	6.69±0.09	2.24±0.05	7.00±0.22	27.83±0.27	8.65±0.33	36.48±0.36
KF Peel	4.73±0.04	2.98±0.05	6.92±0.24	32.42±0.18	8.41±0.20	40.82±0.26
Moringa Peel	5.08±0.03	3.98±0.07	7.00±0.22	64.14±0.54	12.71±0.39	76.85±0.78
Moringa pulp	7.11±0.03	5.14±0.03	10.25±0.17	51.32±0.94	10.62±0.46	61.94±0.57
Moringa flower	6.17±0.03	2.37±0.01	9.75±0.21	50.32±0.50	6.68±0.35	56.99±0.71

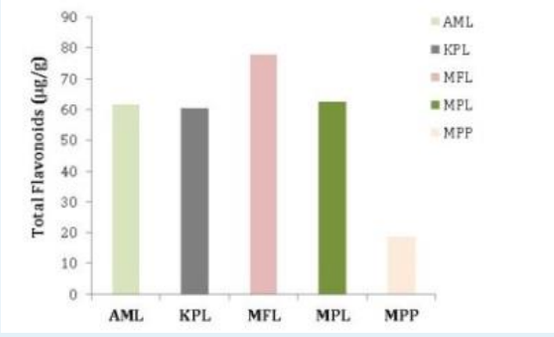


Fig. 2: Total phenolics (mgGAE/g) in five aqueous plant extracts

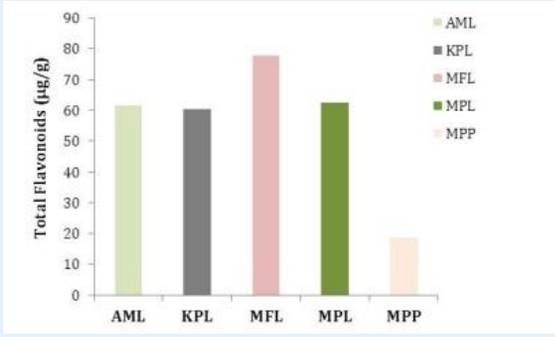


Fig. 3: Total flavonoids (µg CE/g) in five aqueous plant extracts

Fig.4: DPPH radical scavenging activity of aqueous AML extract

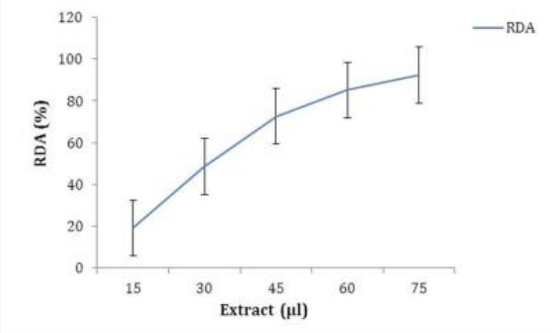


Fig.5: DPPH radical scavenging activity of aqueous KPL extract

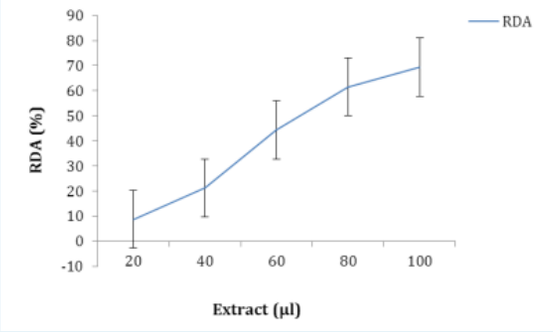


Fig.6: DPPH radical scavenging activity of aqueous MFL extract

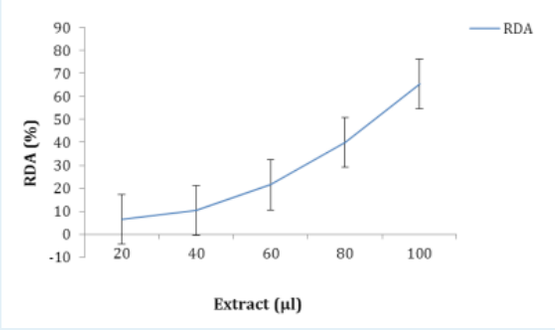


Fig.7: DPPH radical scavenging activity of aqueous MPL extract

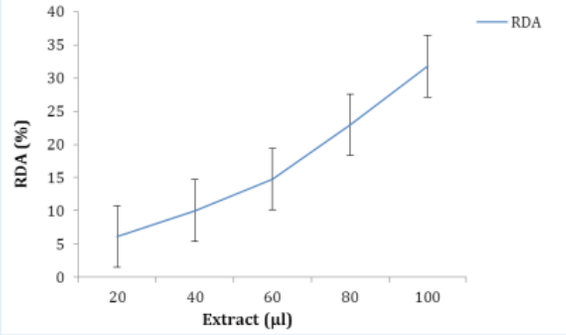
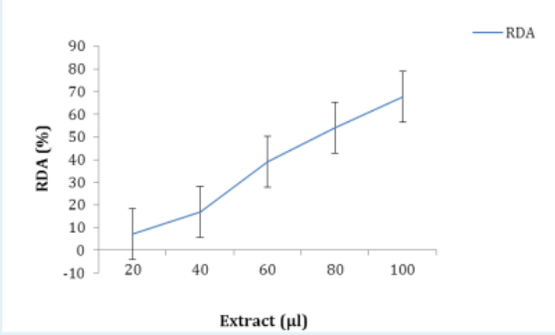


Fig.8: DPPH radical scavenging activity of aqueous MPP extract



A Pilot project on Moringa Olifera biomass based complete feed for goats

U.B.Chaudhary

In view of the shortage of feed and fodder in the country, challenge being caused by frequent change in climate and reduction in arable land, an study is being carried out to evaluate the cost effectiveness of Moringa Olifera biomass based complete feed for feeding of growing goats, since the leaves and twig portion of the Moringa tree contains a high protein content including all the essential amino acids. The biomass production of Moringa under cultivation is much higher than any other fodder crop and being grown in different parts of the word for human, livestock forage, medicine and for water purification. Under the present study, complete feed was prepared for feeding of goats using dry biomass of wild type Moringa tree (leaves and twig portion) and concentrate mixture. Six male Barbari kids weaned at 68 days of age and weighing average wt. of 8.50 kg were selected for study. These goats were maintained under stall fed conditions and were fed Moringa biomass based complete feed ad lib. for a period of 112 days and during this period observation in terms of body weight gain, dry matter intake, rumen fermentation pattern, antioxidant property in plasma hematological parameters of these animals were recorded. The initial observation recorded from experimental goats reveals an average gain of 6.5 kg /goat and consumed 57 kg of pelleted feed /goat during 112 days of study. The dry matter intake /100

kg body weight was ranging 2.5-8.0 kg/d. The concentration of volatile fatty acid and ammonia nitrogen in the rumen and values hematological parameters were in normal range. The units of antioxidant property of plasma and serum cholesterol level indicated higher & lower respectively in moringa biomass based pelleted feed group than the corresponding values observed in the group of goats fed traditional ration . The experiment is in its mid phase and more observation including observation related to carcass quality are to be collected in order to come out a meaning full conclusion. However, based on the preliminary studies conducted on growing goats, the feeding of moringa based complete feed to the goats, seems to be cost effective and cost effectiveness of feed is primarily depends upon the production cost of moringa biomass.

Chemical composition of Moringa biomass based comple

Parameters	Leaves	Stem	Leaves + stem	
Dry matter	39.12	30.6	30.75	
Crude protein		16.63	5.4	9.62
Ash		9.32	6.27	9.81
Ether extract		8.46	4.99	2.16
NDF		22.18	60.74	40.72
ADF		19.34	51.01	31.25
Gross energy Joule/gram		14484	17117	16408

GOAT HEALTH DIVISION

Patho-epidemiological studies on emerging and existing diseases of goats.

R.V.S. Pawaiya, S.V. Singh, D.K. Sharma, Ashok Kumar, V.K. Gupta, Naveen Kumar, K. Gururaj, Shivasharnappa N., A.K. Mishra, Nitika Sharma, Souvik Paul, H.A. Tiwari and V.K. Chaturvedi

A total of 1357 biosamples comprising of sera, swabs, faeces, pus, skinscrappings etc were collected from various locations/ states of the country. Laboratory tests revealed 171/274 (160.2%) sera and 249/766 (32.5%) faeces samples positive for JD, 5/31 (16.1%) sera positive for brucellosis and 8/17 (47.05%) pus positive for caseous lymphadenitis. Goat disease investigations were carried out for out breaks in various villages of U.P. viz. Saiyan (Agra), Bathi (Mathura), Hayatpur (Mathura), Turkiya (Agra), Sathia (Hathras), CIRG, Mathura, Hathras, Bhaisoda (Chandauli), Kagarol (Agra), and different samples were collected for laboratory investigations.

For animal health activities for the Institute animals during the year, a total of 6598 dwworming, 3932 dipping, 13340 vaccination (FMD, HS, ET, PPR, goat pox and sheep pox) and 4206 treatments for disease conditions were performed. A total of 203 necropsies (178 goats, 25 sheep) were conducted from 1.4.2014 to 31.3.2015 involving 45 (22.16%) animals from Animal Health Shed, 42 (20.68%) from Jamunapari unit, 33 (16.25%) from Barbari unit, 25 (12.31%) from Sheep unit, 23 (11.33%) from NFR&PT, 16 (7.88%) from PRSM, and 14 (6.89%) from Jakhrana unit.

The major causes of death diagnosed were pneumonia (28.57%), septicaemia (18.71%), enteritis (12.80%), toxaemia (10.34%), Autolysis (7.38%), inanition (3.94%), anemia/weakness, neurocysticercosis, predation & NSD (2.95% each), Hepatitis (2.46%), pregnancy toxaemia (1.47%), peritonitis (0.98%) and acidosis, asphyxiation & ruminal impaction (0.49% each). Age-wise, the mortality was highest (58.62%; 39M+80F) in adult animals, followed by 0-3m (18.74%; 22M+16F), 6-12m (11.82%; 16M+8F) and 3-6m (10.83%; 13M+9F) age groups.

Gross tissue specimens were collected for various pathological conditions and for microbiological isolation studies. 30 samples were processed for histopathological studies. Histopathological diagnosis revealed cases of granulomatous enteritis, acute serous pneumonia, suppurative pneumonia, bronchopneumonia, mycotic pneumonia, bronchioloalveolar proliferative changes etc.

More than 140 samples from goats and sheep were collected and processed for bacteriological isolation.The samples were comprised of blood, pus, milk, lung, liver, pleural fluid, nasal discharge, kidney, skin scrapings etc. The bacterial pathogens isolated and identified were Staphylococcus aureus, Coagulase Negative Staphylococci, Streptococcus, Bacillus, E. coli, Pasteurella multocida, and Pseudomonas aeruginosa. Screening of various pathogens such as Corynebacterium ovis from caseous lymphadenitis, Escherichia coli from neonatal diarrhea in kids, Brucella melitensis and Chlamydophila abortus from cases of abortions and still birth was performed.

A case of composite neoplasm of ovary in a goat having features of thecoma and metastatic adenocarcinoma:

On necropsy of an 8 year old female goat of non-descript breed, the pelvic cavity revealed presence of a large ovarian (left ovary) growth weighing about 1.5 kg and a dimension of 15.8 cmx11.9cm (LxB) sizes. The ovary was enlarged enormously with presence of hemorrhagic and necrotic foci on the surfaces as well as presence of uneven tumorous sub growths discernable on the surfaces (fig. 1). On cutting, it showed a rim of 3-4cm thickness of solid tissue encapsulating a deep red colored liquefied/gelatin like material (fig. 2). Histopathologically, ovarian parenchyma showed proliferation of cuboidal epithelial cells in the form of tubules, acini, cords and cell nests in the fibrous stroma (Fig. 3). The neoplastic cells evinced large oval to spherical vesicular nuclei having 2-3 large nucleoli and

abundant light pink cytoplasm. Mitotic figures were frequently present and many of them appeared abnormal (Fig. 4). Stromal fibrous tissue was composed of extensively proliferating fibroblasts and neovascularization associated with collagen fibers, which at places merged with the proliferating neoplastic epithelial cells giving rise to carcinosarcomatous as well as scirrhous character to the neoplastic tissue. In other areas, the neoplastic epithelial cells exhibited aggressive proliferation on the edges of fibrovascular connective tissue core in the form of papillary ingrowths in the lumen of variable sized glandular structures. These changes were characteristic to the adenocarcinoma of ovary. Often there were large areas of necrosis and hemorrhages with infiltration of macrophages and lymphocytes. Section from other portion of the tissue showed thecal neoplastic cells (Fig. 5) with dark blue stained small to medium sized elongated or oval or spherical, sometimes triangular, nuclei and vacuolated cytoplasm almost completely occupied by lipid vacuoles (Fig. 6). The solid sheets of neoplastic cells were intersected by thin fibrovascular stroma that had several ovarian follicles entrapped amongst the proliferating cells. There were several concentric layers of hyalinised or calcified tissue (psamoma bodies) present in the field (Fig. 6). These changes characterized the thecoma neoplastic condition of the ovary. The sections from regional lymph nodes revealed metastatic adenocarcinoma of ovary, showing about half of the lymphoid tissues replaced by proliferating cuboidal neoplastic epithelial cells in the form of variable sized acini, cords, cell nests and clusters in the fibrovascular connective tissue stroma, almost resembling the histological pattern seen in the primary adenocarcinoma of ovary (Fig. 7). It was concluded that this rare case of ovarian tumour in goat histologically composed of metastatic adenocarcinoma with psamoma bodies, thecoma and carcinosarcomatous changes.

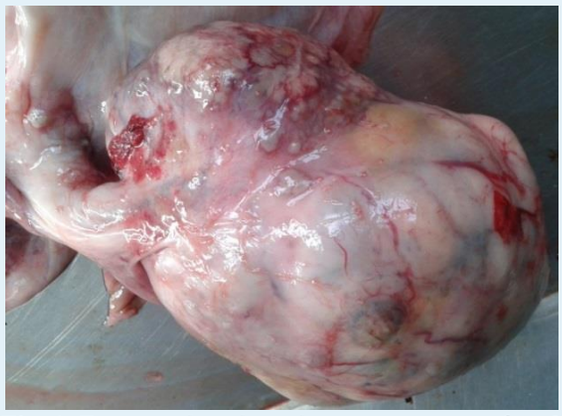


Fig. 1. Enormously enlarged tumorous ovary of an 8 year old female goat with presence of hemorrhagic and necrotic foci on the surface.

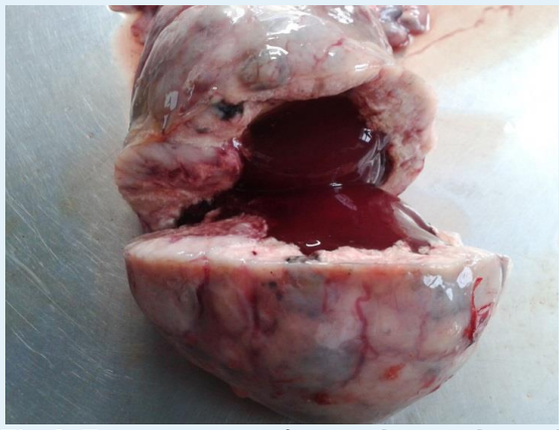


Fig. 2. Tumorous ovary of a goat showing deep red gelatin like content in the central cavity.

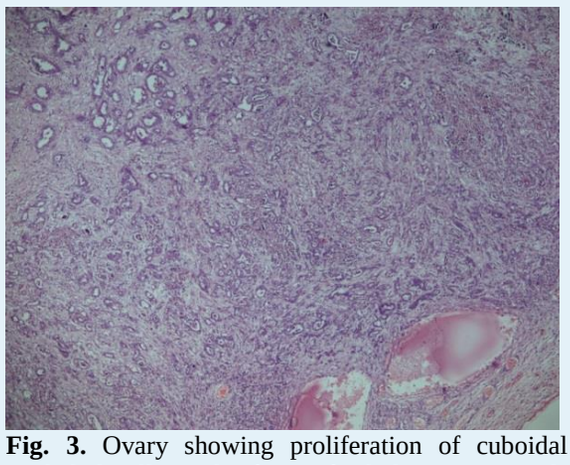


Fig. 3. Ovary showing proliferation of cuboidal epithelial cells in the form of tubules, acini, cords and cell nests in the fibrous stroma (adenocarcinomatous changes). H&E x100.

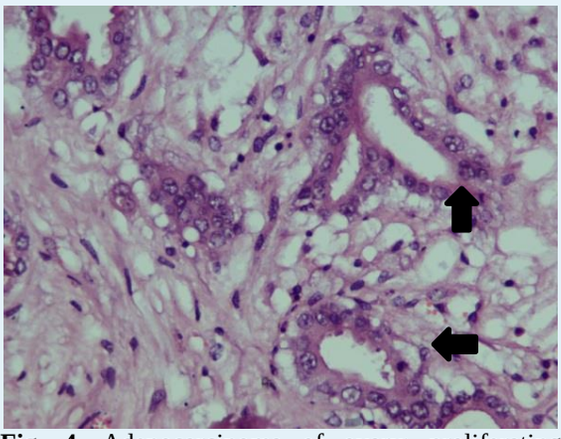


Fig. 4. Adenocarcinoma of ovary: proliferating neoplastic cells have large vesicular nuclei and abundant light pink cytoplasm with abnormal mitotic figures (arrows). H&E x400.

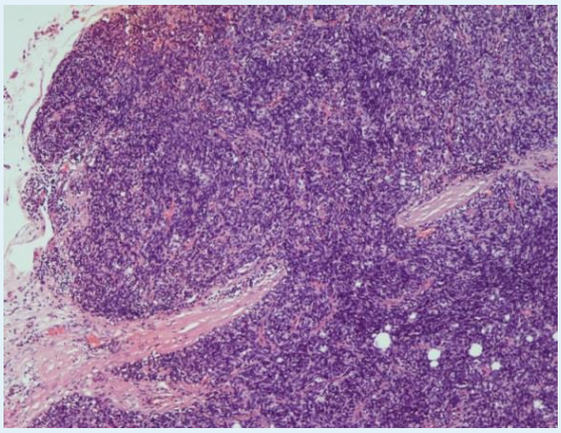


Fig. 5. Ovarian tumour section showing proliferating thecal neoplastic cells. H&E x100.

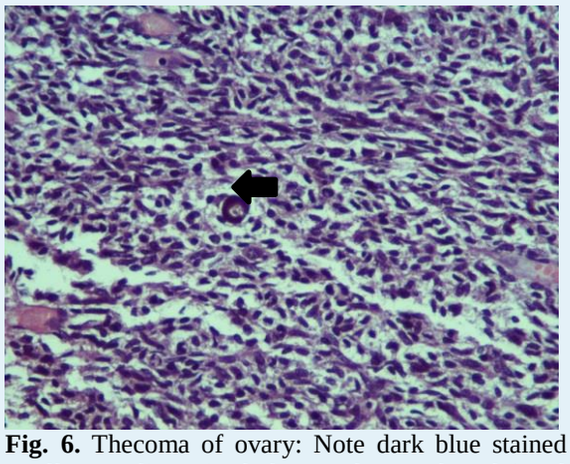


Fig. 6. Thecoma of ovary: Note dark blue stained small to medium sized elongated or oval nuclei and vacuolated cytoplasm almost completely occupied by lipid vacuoles. Note concentric layers of hyalinised or calcified tissue (psamoma body) in the centre (arrow) H&E x400.

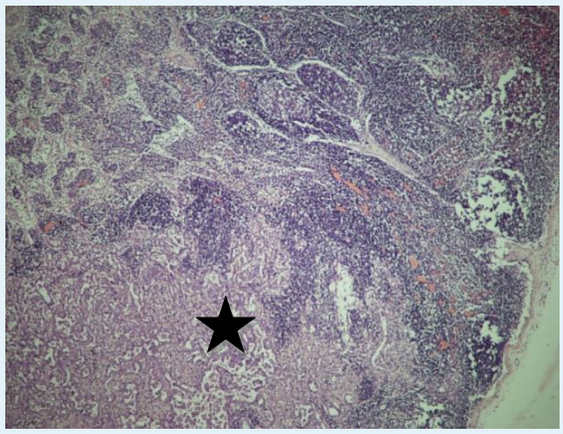


Fig. 7. Metastatic adenocarcinoma of ovary in regional lymphnode. About half of the lymphoid tissue is replaced by proliferating neoplastic epithelial cells in the form of variable sized acini, cords, cell nests and clusters resembling the histological pattern seen in the primary adenocarcinoma of ovary (asterisk) H&E x100.

Intestinal adenocarcinoma in a goat infected naturally with *Mycobacterium avium subsp. paratuberculosis*:

A four year old goat died of debility and anorexia, on necropsy revealed edematous, thickened and corrugated ileal wall (Fig. 8A). The mesenteric and ileocaecal lymph nodes were enlarged and their cut surfaces were edematous. Serosal surface of ileal wall was attached to a large nodular/tumerous mass of the tennis ball size with hard and gritty consistency (Fig. 8B). Impression smear from mucosa and MLN revealed numerous acid fast bacilli indistinguishable from *Mycobacteriam avium var paratuberculosis* (Fig. 8C). Histological sections revealed diffuse infiltration of epitheliod cells, macrophages, lymphocytes and giant cells in lamina propria of intestinal mucosa and MLN (Fig. 8D). In addition to this, the mucosa and sub mucosal layers of ileum showed proliferative adenocarcinomatous lesions penetrating deep into the serosal surface (Fig. 9A). The characteristic glandular pattern of adenocarcinoma consisting of proliferating epithelial crypts with inter connective tissue widely spread in to the all layers of ileum was observed (Fig. 9B). There was disruption of basement membrane due to penetration of proliferative epithelial cells (Fig. 9C). Necrosis and calcification was also noticed in submucosa and serosal layers (Fig. 9D). Elongated spindle shaped fibroblasts and osteocytes proliferation, metaplasia and ossification was observed in

serosal and submucosal region of the ileum (Fig. 9E). Tumor giant cells and fibro vascular proliferation with numerous mitotic figures were also evident (Fig. 9F). The cellular infiltrate comprised of numerous neutrophils, lymphocytes and eosinophils at many sites was observed in necrotic and calcified area of ileal mucosa.

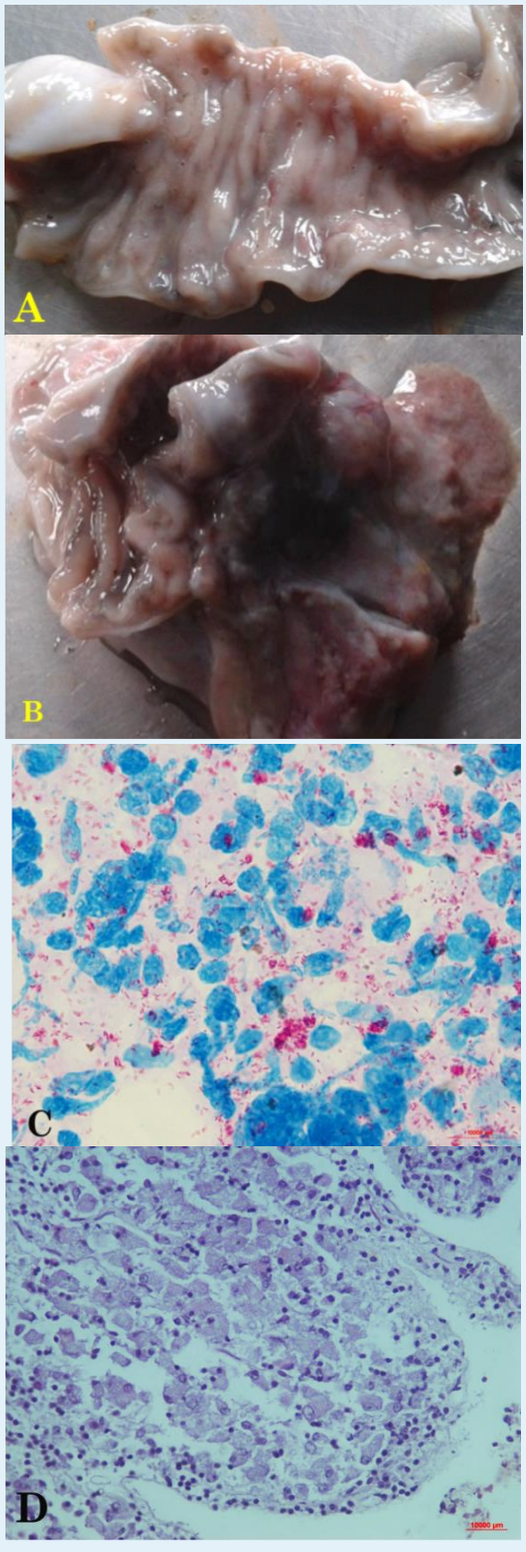
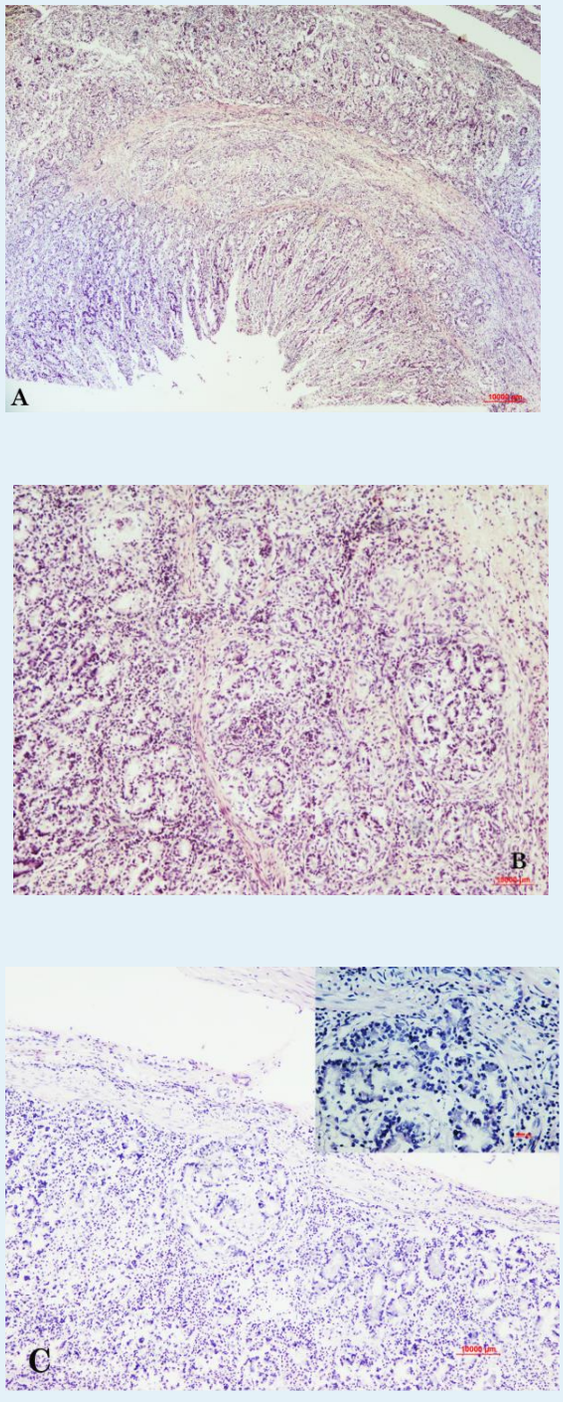
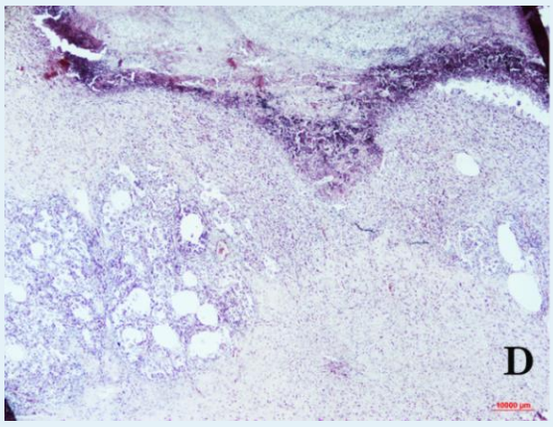
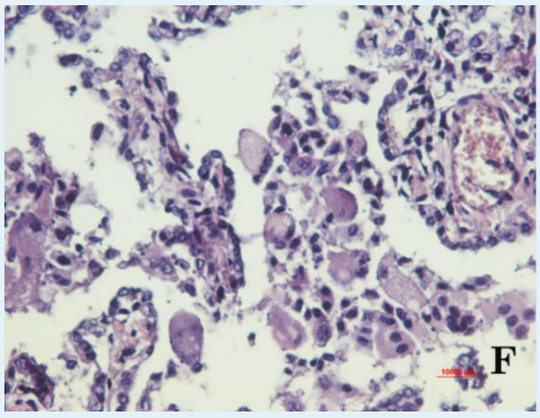


Fig. 8A. Thickening and corrugations of ileac mucosa; **B.** Serosal surface of ileum was attached to a large nodular/tumerous mass with hard, gritty consistency; **E.** Impression smear from mucosa and MLN stained with ZN/acid fast staining and revealed numerous acid fast bacilli indistinguishable from *Mycobacteriam avium var paratuberculosis* ZN x1000; **D.** Histological sections of ileum revealed diffuse infiltration of epitheliod cells, macrophages, lymphocytes and giant cells in lamina propria of intestinal mucosa. H&E x400.







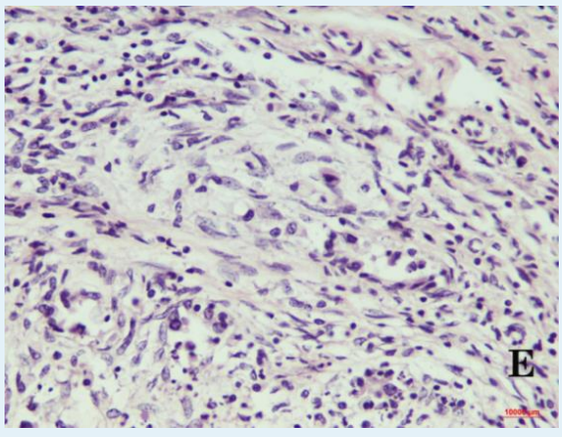


Fig. 9A. The mucosa and sub mucosal layers consisting of proliferative adenocarcinomatous lesions penetrating deep into the serosal surface H&E x40; **B.** The characteristic glandular pattern of adenocarcinoma consisting of proliferating epithelial crypts with inter connective tissue H&E x100.; **C.** Adenocarcinoma penetrating into the submucosa by disrupting basement membrane (inset) H&E x100.; **D.** Wide spread fibro adenomatous proliferative changes with necrosis and calcification of submucosa and serosal layers H&E x40.; **E.** Elongated spindle shaped fibroblasts and osteocytes proliferation, metaplasia and ossification was observed in serosal and submucosal region of the ileum H&E x400.; **F.** Tumor giant cells and fibro vascular proliferation with numerous mitotic figures in the ileum. H&E x400.

Toxemia in Goat:

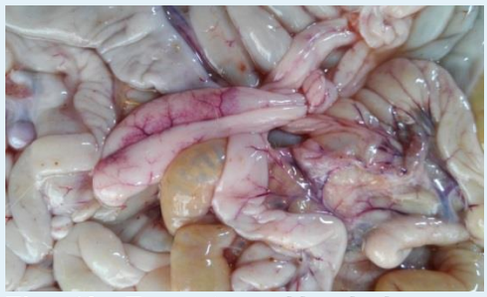


Fig. 10. Toxaemia: reddened, hyperaemic and congested small intestine in a goat kid.

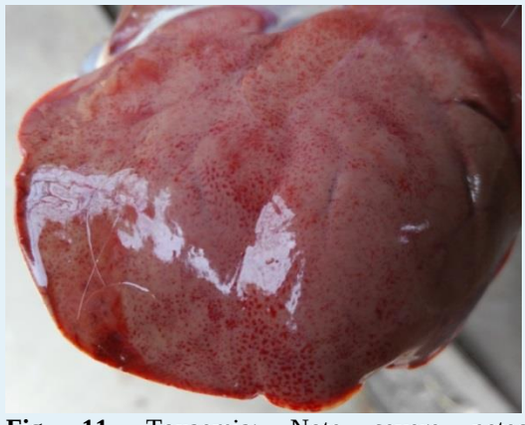


Fig. 11. Toxaemia: Note severe petechial haemorrhages on the surface of liver in a goat kid.

Fig. 12. Toxaemia: Note severe echymotic haemorrhages on the sub-capsular surface of kidney in a goat kid.

Disease outbreaks investigation in goats:

Outbreaks and disease investigations including screening of various pathogens such as *Corynebacterium ovis* from caseous lymphadenitis, *Escherichia coli* from neonatal diarrhoea in kids, *Brucella melitensis* and *Chlamydophila abortus* from cases of abortions and still birth.

Development of a Taqman probe based realtime PCR assay for quick detection of *Brucella melitensis* in clinical samples:

A Taqman probe based OMP-31gene realtime PCR assay has been developed for diagnosis of *Brucella melitensis* in various clinical samples like vaginal washings/swab, aborted contents, preputial swab, milk etc. The oligos and probes were designed in the coding region of the OMP31 gene specific to *B. melitensis*. The assay has a very high sensitivity that detects positive *B. melitensis* DNA spiked to clinical samples with concentration as low as 100 femtograms (fig. 13&14). The advantage of this assay is that it was specific to *B. melitensis*, which is the most common abortion causing agent in small ruminants including Goats and Sheep can be assayed approximately in 30 minutes duration using the suspected DNA sample. Based on this assay, many cases of abortion and bucks infected with *B. melitensis* could be effectively detected (fig. 15).

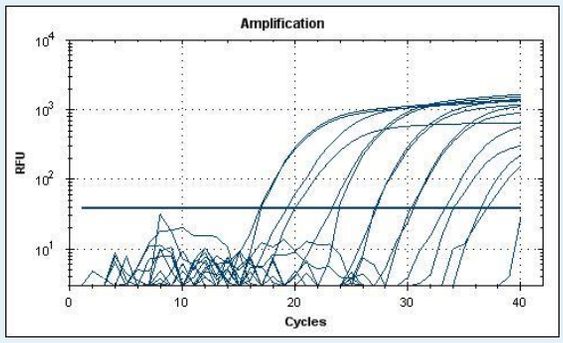


Fig.13. Ampification plot (log scale) showing the detection range of different concentrations of *Brucella melitensis* DNA spiked to milk samples using OMP31-Taqman® probe based realtime PCR assay.

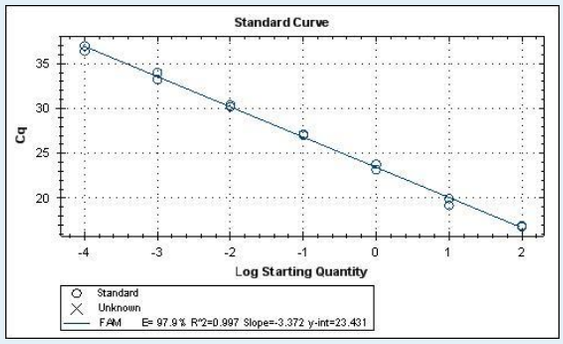


Fig. 14. Standard curve for Cq values versus DNA concentration showing 99.7 per cent regression and 98 per cent efficiency for detection of B. melitensis from clinical samples using OMP31-Taqman® probe based realtime PCR assay.

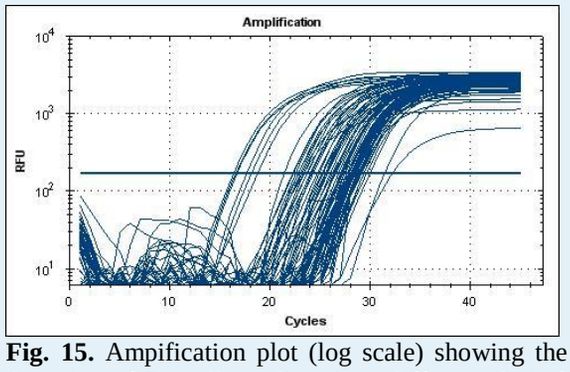


Fig. 15. Ampification plot (log scale) showing the detection of *Brucella melitensis* in different clinical samples like vaginal swab, aborted contents, aborted fetal abomassal fluid, preputial swab etc., using OMP31-Taqman® probe based realtime PCR assay.

Presence of Chlamydia as major cause of enzootic abortions in Goats negative to *Brucella* spp.:

Samples that were negative for *Brucella* spp in abortion cases were subjected to *Chlamydophila* spp specific 16srRNA PCR. Many samples that were negative for *Brucella* spp. came out as positive for chlamydia during the peak kidding season of August-october. During the study, about 28 vaginal swabs were collected from cases of abortions and DNA isolation was done to study the presence of Chlamydia. During the current study, none of the cases were found positive for *B. melitensis*. The aborted fetuses showed focal necrotic placentitis and congestion, which was reported to be a classical lesion in chlamydial abortions. The aborted cases were all found positive for *Chlamydophila abortus* using 16srRNA specific PCR, which corresponded to a product size of 276bp (fig. 16). The current study revealed that chlamydial abortions can occur suddenly in a herd causing outbreak which had a previous history of abortions due to *B. melitensis*. Moreover the abortion pattern observed was unusual with the chlamydia completely suppressing the Brucella infection and causing clinical abortions during the last trimester.

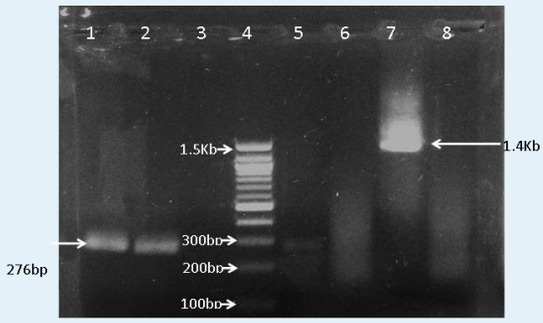


Fig. 16. Gel picture of PCR products from aborted sample showing presence of Chlamydophila abortus detected using 16srRNA specific PCR in most of the cases. All the cases were PCR negative when tested with Brucella specific 16srRNA. Gel legend : 1-3,5: Aborted samples/vaginal swabs tested for Chlamydia (276bp), 4 – 100bp ladder, 6, 8 Aborted sample tested for Brucella spp. using 16srRNA specific PCR, 7 – Positive DNA of Brucella melitensis.

Real time PCR detection of *Chlamydophila* spp.:

A SYBR-Green based realtime PCR assay was attempted to increase the sensitivity of detection of *Chlamydophila* spp in clinical samples. Some of the samples that came out negative in conventional PCR were effectively detected using realtime PCR (fig 17&18).

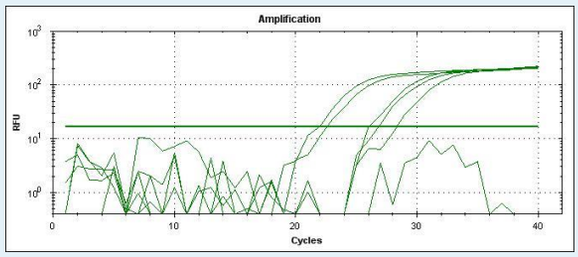


Fig. 17. Amplification plot (log scale) showing the Cq value for the unknown aborted samples suggestive of positive for Chlamydophila spp. using SYBR-green realtime PCR assay.

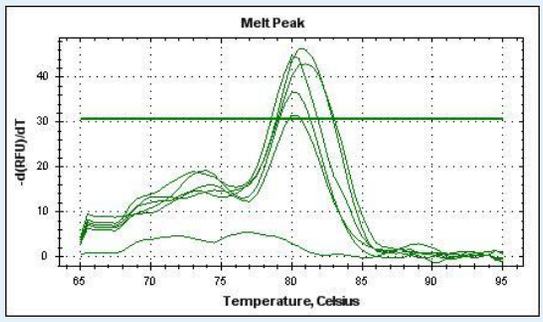
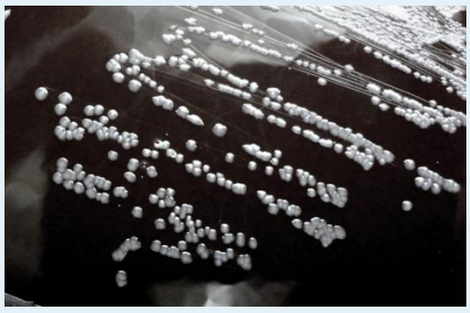
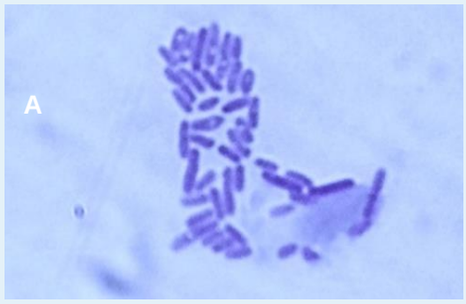


Fig. 18. Melting peak of 16srRNA amplification product for the unknown aborted samples suggestive of positive for *Chlamydophila* spp. using SYBR-green realtime PCR assay

Suppurative pneumonia and Caseous lymphadenitis (CL) outbreak in goats:

Caseous lymphadenitis or "Cheesy gland" is a chronic disease associated with abscess formation in lymph nodes of the body and internal organs. The herd in question suffering with CL has totally 65 goats showing sub-cutaneous abscessation. During general health examination about 17 animals were affected with a disease incidence of 26%. Multiple subcutaneous abscess in neck, shoulder regions were noticed. Bacterial examination was conducted to identify and characterize the predominant pathogen involved in the abscessation (fig 19A&B). Apart from these manifestation, systemic abcesses were also noticed in visceral organs like lungs, liver etc. (fig 19C&D).





C

Fig. 19A. Blood agar plate (5% defibrinated sheep blood) showing irregular to round, raised white to greyish smooth colonies of *Corynebacterium ovis*. B. Gram's stained smear of *C. ovis* colonies. C & D - Lung showing deep seated abcess with cheesy pus due to systemic CL caused by *C. ovis*.

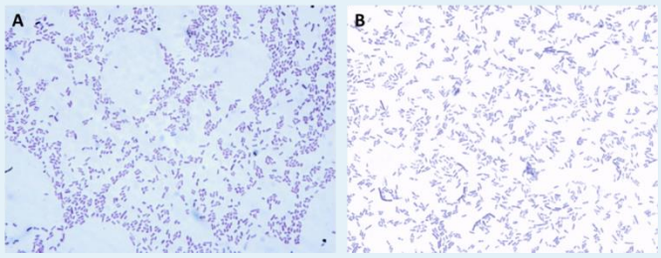


Fig. 20A. An isolate of *C. ovis* confirmed by 16srRNA PCR isolated from lung abscess. B. An isolate of *C. ovis* confirmed by 16srRNA PCR isolated from sub-cutaneous abscessation.

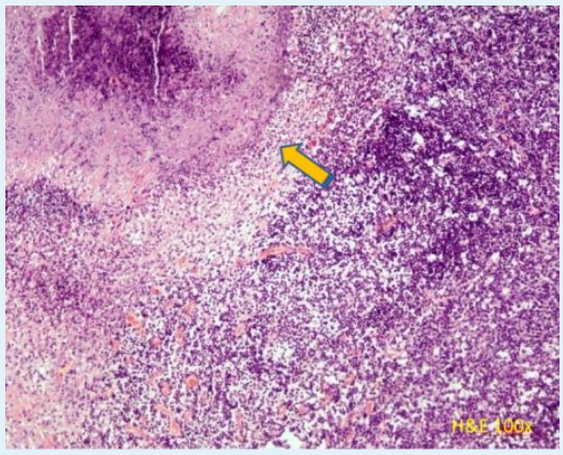


Fig. 21. Lung abscess showing dead and dying neutrophils and tissue debris surrounded by thick fibrous capsule (arrow) and inflammatory cells around it. H&E x100.

The isolate was subjected to staining (fig. 20A&B), histopathological examination (fig. 21) biochemical tests including sugar fermentation tests, CAMP test etc. Further confirmation was done by polymerase chain reaction (fig. 22 using 16srRNA primer sets specific to *C. ovis*. Out of 17 samples tested 8 samples were found positive for *C. ovis*, whereas by culture technique only 4 samples were found positive.

The isolate was subjected to biochemical tests including sugar fermentation tests, CAMP test etc. Further confirmation was done by polymerase chain reaction using 16srRNA primer sets specific to *C. ovis*. Out of 17 samples tested 8 samples were found positive for *C. ovis*, whereas by culture technique only 4 samples were found positive.

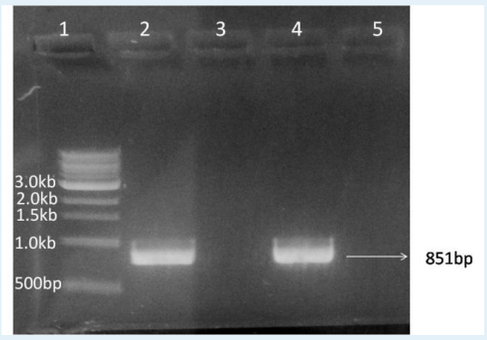


Fig. 22. Gel picture showing the amplification of 851bp 16srRNA of *C.ovis* in the pus samples collected from clinical cases of Caseous lymphadnitis. Gel legend: 1- 1kb ladder, 2- Positive control, 3 – 4 – Pus samples suspected of CL, 5 – No template control.

Effect of nutritional deficiency diseases on gene expression profiles in goats.

R.V.S. Pawaiya, U.B. Chaudhary, Nitika Sharma, Shivasharnappa N. and S.P. Singh

Gene Expression profiling Using Agilent Platform

RNA was isolated from blood and tissues for microarray analysis.

RNA Quality Control:

The RNA extraction from Goat Lung, Liver& uterus was performed using Trizol (Catalog: 15596018) method followed by DNAse treatment using Qiagen RNeasy Mini Kit (Catalog: 74106The RNA integrity of the extracted RNA were analysed on the Bioanalyzer (Agilent; 2100 expert).

Labeling and microarray hybridization:

The samples for Gene expression were labeled using Agilent Quick-Amp labeling Kit (p/n5190-0442) and converted to double stranded cDNA. cRNA was generated by and the dye Cy3 CTP(Agilent) was incorporated.

Hybridization and scanning:

Labeled cRNA sample were hybridized on to a Genotypic designed Goat gene expression Microarray 8x60K arrays. Hybridization was carried out in Agilent's Surehyb Chambers at 65º C..

Feature Extraction: Data extraction from Images was done using Feature Extraction software Version 11.5 of Agilent.

Microarray Data Analysis: Images were quantified using Feature Extraction Software (Version-11.5 Agilent). Feature extracted raw data was analyzed using GeneSpring GX software from Agilent. Significant genes up regulated fold> 0.6 (logbase2) and down regulated <-0.6 (logbase2) in the test samples with respect to control sample were identified. Statistical student T-test p-value among the replicates was calculated based on volcano plot algorithm. Differentially regulated genes were clustered using hierarchical clustering based on Pearson coefficient correlation algorithm to identify significant gene expression patterns. Pathway analysis for the differentially regulated genes was performed using Genotypic Biointerpreter-Biological Analysis Software. Genes were classified based on functional category and pathways using Biological Analysis tool DAVID (http://david.abcc.ncifcrf.gov/).

Results showed 3855 genes were upreguluaed and 3819 genes were down regulated in the Zn-deficient group animals when compared to the control group animals (Fig. 1). Significantly expressed/ downregulated genes and the molecular pathways of their involvements are given in table 1 & 2 below.

Table 1. Significantly upregulated genes and pathways of their involvement:

Molecular Pathway	Genes
P00031:Inflammation mediated by chemokine and cytokine signaling pathway	IFNAR2, PTGS2
P00005:Angiogenesis	PDGFB
P00047:PDGF signaling pathway	PDGFB
P00053:T cell activation	CD247
P00033:Insulin/IGF pathway-protein kinase B signaling cascade	IGF2
P00019:Endothelin signaling pathway	PTGS2
P00032:Insulin/IGF pathway-mitogen activated protein kinase kinase/MAP kinase cascade	IGF2
P00026:Heterotrimeric G-protein signaling pathway-Gi alpha and Gs alpha mediated pathway	ADORA3
P00011:Blood coagulation	SERPINC1
P00027:Heterotrimeric G-protein signaling pathway-Gq alpha and Go alpha mediated pathway	ADORA3
P02776:Serine glycine biosynthesis	SHMT1
P00029:Huntington disease	CAPN3
P00036:Interleukin signaling pathway	IL2RA
P00051:TCA cycle	IDH1
P00054:Toll receptor signaling pathway	PTGS2

Table 2. Significantly downregulated genes and pathways of their involvement:

Molecular Pathway	Genes
P00046:Oxidative stress response	TXN, MYC
P00034:Integrin signalling pathway	CAV1, ASPM
P05911:Angiotensin II-stimulated signaling through G proteins and beta-arrestin	AGTR1
P04398:p53 pathway feedback loops 2	MYC
P05917:Opioid proopiomelanocortin pathway	POMC
P04380:Cortocotropin releasing factor receptor signaling pathway	POMC
P00005:Angiogenesis	CRYAB
P00030:Hypoxia response via HIF activation	TXN
P00006:Apoptosis signaling pathway	BCL2L1
P00031:Inflammation mediated by chemokine and cytokine signaling pathway	CCR3
P00047:PDGF signaling pathway	MYC
P00036:Interleukin signaling pathway	MYC
P00026:Heterotrimeric G-protein signaling pathway-Gi alpha and Gs alpha mediated pathway	PYGL
P00057:Wnt signaling pathway	MYC

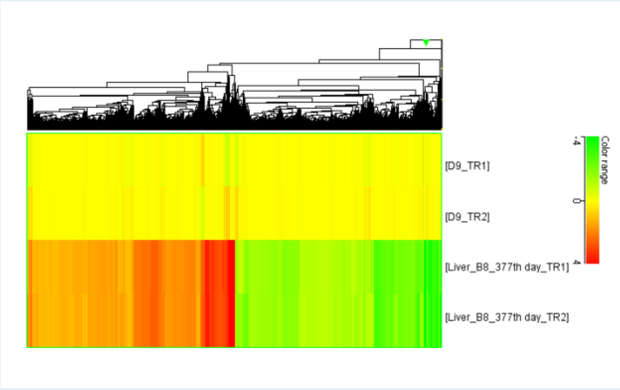


Fig. 1. Overview cluster of differentially expressed genes in Zn-deficient and control group animals. Red colour indicates upregulated genes; green colour indicates downregulated genes; yellow colour indicates control. Data analysis was done using GeneSpring GX version 12.6 and Microsoft Excel. Fold cut-off used: Up Regulation: Fold value >=1 Down Regulation: Fold value -<=-1.

Genetic resistance study in indian goats against gastrointestinal nematode, *haemonchus contortus* infection

D.K. Sharma , Souvik Paul, Naveen Kumar, PK Rout, VK Gupta (till Nov. 2014) and K Gururaj (From September 2014)

13 male goats were selected and raised in separate ward cleaned and infection free environments. These animals were selected down the line based on sire evaluation for faecal egg count (FEC) being high (susceptible) and low (resistant). Before putting to experiments the animals were de-wormed and made to rest for a month to ward off the effect of anthelmintic (Albendazole and Amprolium). All the experimental goats were then experimentally infected with 25,000 laboratory raised L3 larvae of *Haemonchus contortus*. Four successive blood collections from the animals were made at every 24 hrs post infection. The nematode infection in experimental animals was allowed for 6 weeks before being removed by de-worming of animals with anthelmintic. The infection of animals was, however monitored through faecal examination (FEC) till its patency. One animal however succumbed to infection during experiment. The remaining 12 animals were then grouped as resistant (showing continuously low EPG), susceptible (showing continuously high EPG), neutral(showing no definite EPG pattern) and control. Again after 6 weeks a second infection was given in animals with 30000 L3 larvae of *Haemonchus contortus* in a way that animals in resistant , susceptible and controlled groups were sacrificed after 72 hrs PI. At slaughter, collection of tissue sample like abomasal mucosa, abomasal lymph nodes and mesenteric lymph nodes was made. The collected blood and tissues samples were preserved at -20 C in RNA Latter. The neutral group was maintained on infection free house till infection reached its patency.

A total 45 blood (4 time from 12 animals) and 24 tissue samples were later processed for total RNA extraction and cDNA preparation through reverse transcription. .

Cytokine genes expression

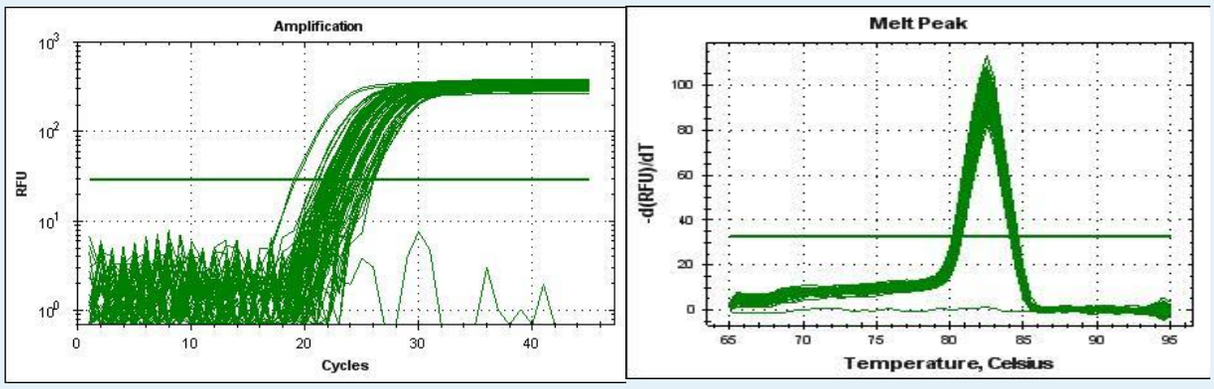
For blood samples, RNA extraction was done using spin column method (Qiaquick RNA extraction kit) after RBC lysis. The RNA was quantified using Bio photometer plus (eppendorf) and about 1 µg RNA was reverse transcribed to cDNA using Superscript® III first strand cDNA kit (Invitrogen). The cytokine genes taken for the current study included IFNβ, IFNγ, IL-1β, TNFα, TGFβ, IL4, IL6 and G6PDH as housekeeping gene.

Gene expression was studied using real-time SYBR green PCR assay with the respective primers used at 0.5 pmol final concentration, 05 µl of cDNA template equivalent to 50ng of total

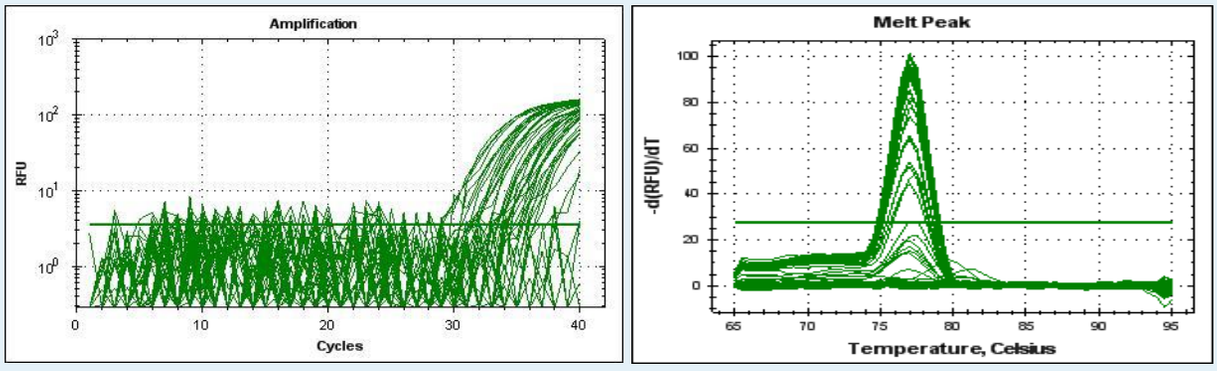
RNA, 1x Quantitect SYBR green master mix in a final reaction volume of 25µl in duplicates per sample per gene. The reaction condition has been followed as described by the manufacturer with the annealing temperature at 550C. Reaction controls like No template control (NTC) and No reverse transcription controls (NRT) has been kept

The gene expression was calculated using ΔΔ Ct method (Livak's method) with the uninfected control as calibrator. The cytokine genes IFNβ and TGFβ showed up regulation in samples 48 hours and 72 hours post-infection with L3 larvae respectively. The other cytokine gene TNFα showed higher expression post 96 hours infection. Data analysis is underway for assessing the overall effect of Haemonchus spp on transient cytokine pathways post infection. The Amplification plot and Tm calling of the cytokine genes studied are given below

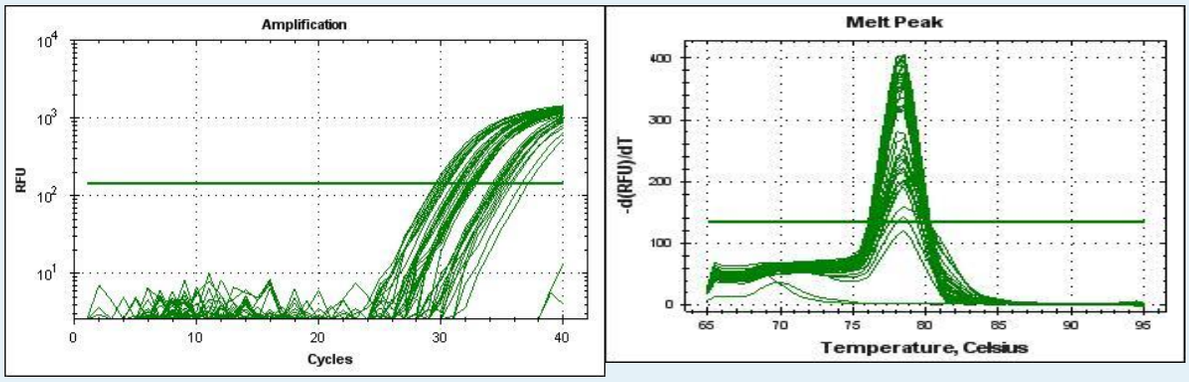
IFNβ



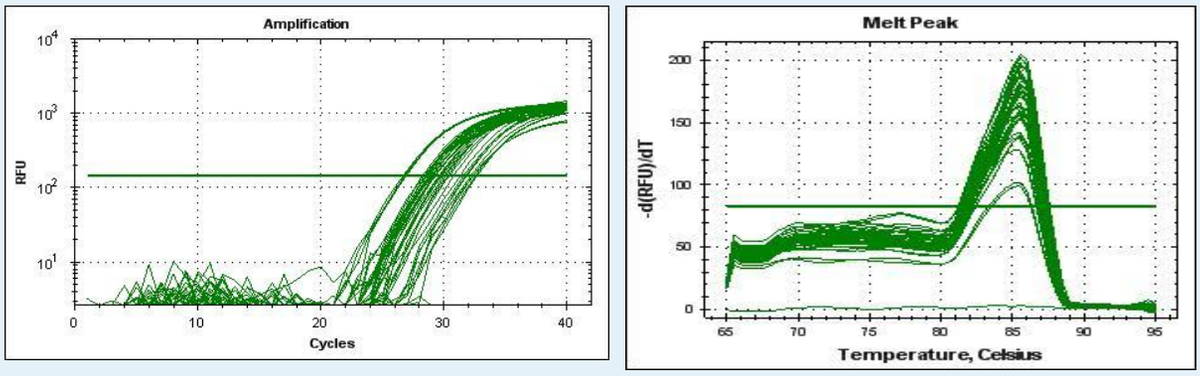
IFNγ



IL-1β



TGF-β



TNFα

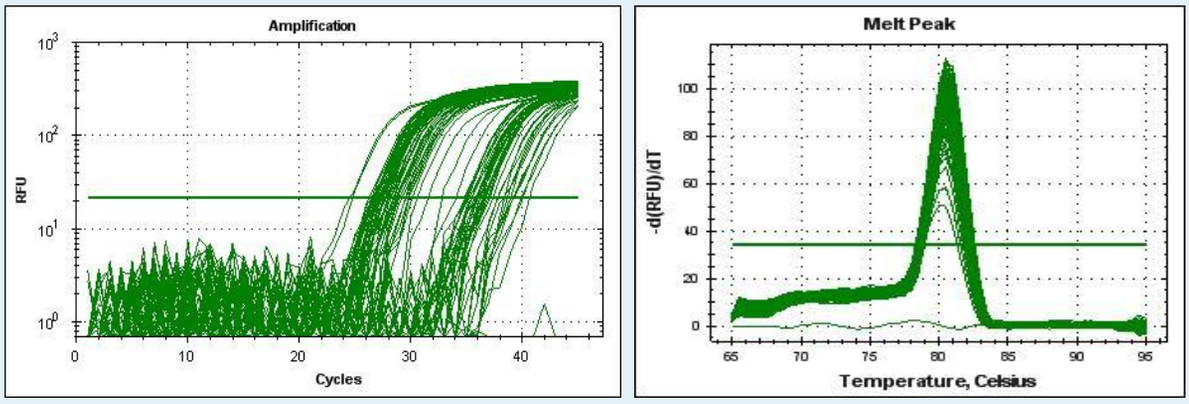


Figure 1. Exression of Cytokine genes in infected goats.

Likewise cDNA from tissue samples were processed for TLR genes expression through RT – PCR. During the reported period TLR 4 expression was considered. The expression of Cytokine and TLR genes in resistant and susceptible group was compared.

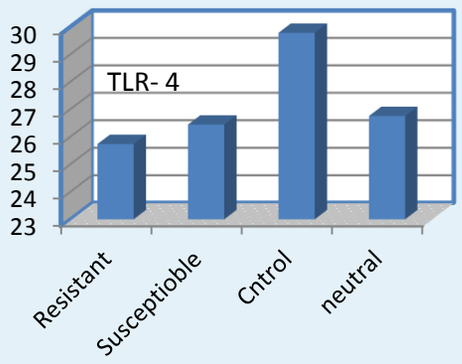


Figure 2. TLR-4 Expression in Abomasal mucosa of infected Goats.

Table 1: Gastrointestinal Parasites Incidence in faecal samples from Institute Goat Flocks.

Age of goats screened	Total No. of Samples screened	Incidence of infections			
		Coccidia	Strogyle	Moniezia	Strongyloides
Jamunapari Adult	121	27.27(33)	12.39(15)	8.26 (10)	0.82 (1)
3-6M	192	39.79(76)	2.61(5)	1.57(3)	1.04 (2)
Barbari	206				
3-6M	15	-	46.66(7)	13.33(2)	-
Adults	191	42.40(81)	17.80(34)	7.85(15)	15.18(29)
Jakhrana	157				
3-6M	87	77.01(67)	2.29(2)	9.19(8)	5.74(5)
Adults	70	67.14(47)	5.71(4)	4.28(3)	-
NFRPT	128				
3-6M	96	28.12(27)	-	10.41(10)	-
Adults	32	50.00(16)	-	-	-
Sheep	12				
3-6M		-	-	-	-
Adults	12	25.00(3)	58.33(7)	33.33(4)	-

All India Network Project on Neonatal Mortality in Farm animals

(Jan -March 15)

Ashok Kumar, R V S Pawaiya , Anil Kumar Mishra

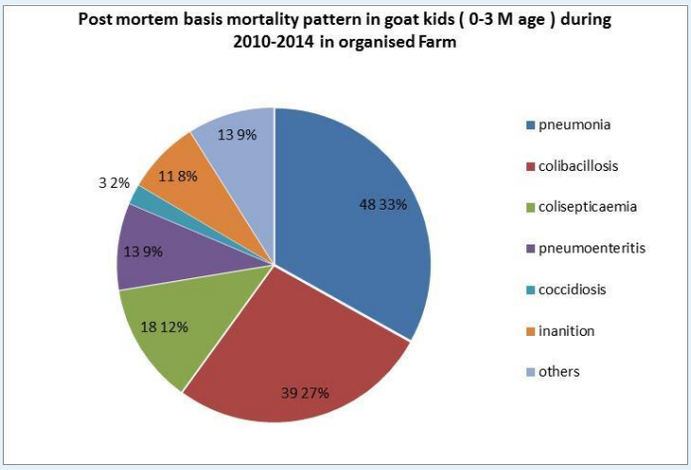
Epidemiological studies on goat kid mortality in organised farm:

A Survey on pattern of kid mortality was carried to assess the extent of economic losses in organized adopting scientific technologies . Five year data (Jan 2010- Dec 2014) on kid mortality of CIRG Institute flock was analysed. Post mortem was carried out by Veterinary Officers and/or Scientist. Young age (0-3 Month) was considered for this study. Three goat unit such as Jamunapari , Barbari and Jakharana are maintained by the institute by adopting scientific practices for optimum

production and health . In general, mortality is restricted to lowest level. Overall mortality during this five year period was ranged from 4.22 – 6.67 percent and kid mortality (0-3 Month) was ranged from 1.7-8.25 percent in three goat unit. The total death recorded was 235, 297 and 123 in Jamunapari , Barbari and Jhakarana goat breed flock during five years and total kid death recorded 49,82 and 14 respective Units. The proportional kid mortality was 20.85 and 27.67 and 11.38 percent in relation to total mortality with the average figure of 19.94 %.

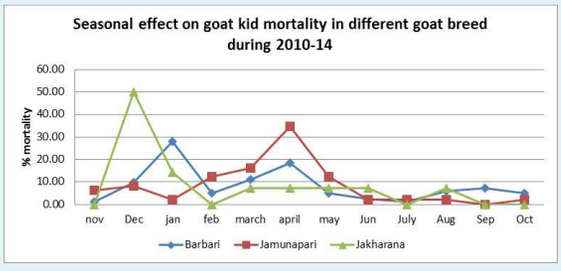
Main causes of mortality:

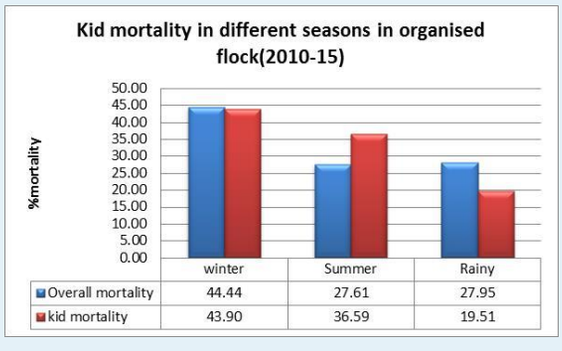
Major diseases causing mortality were Pneumonia, Colibacilllosis, Colisepticemia, Pneumo-enteritis, coccidiosis, Inanition (Poor mothering, weakness) and Others (tetanus, acute hepatitis, peritonitis) . The total number of death in these different diseases were 48,39,18,13,3,11 and 13 respectively and proportional mortality was 33.10, 26.90, 12.41, 8.97,2.07, 7.59 and 8.97 percent respectively. It indicated that pneumonia and colibacillosis are the major fatal threat to young kids, which attention of goat rears.



The effect of season on kid mortality :

The compiled data of three goat unit for five years on seasonal basis revealed that kid mortality is highest in winter season (43.90 %) followed by summer (36.59%) and lowest in rainy season (19.51%) , suggested that extreme low and high temperature is critical for kid . However, overall mortality was also highest in winter season (44.44%) and almost equal in both other Summer (27.61%) and Rainy season (27.95) . It indicated that kids need special care in extreme weather of cold and summer.The compiled data of mortality in monthly basis separately in three different breed indicated that December , January , March , April are the critical months for kid mortality , as shown in Table and figure given below.





Epidemiology of kid mortality in rural farmers flock:

The survey was conducted in representative villages of Uttar Pradesh Madhya Pradesh and Rajasthan. A questionnaire format was developed having questions Name of village, Address, number of goats reared, kid born, kid death, season of death, age of death and major causes of death. In Uttar Pradesh 10 villages were surveyed in Mathura District. Data collected from 100 families keeping 1543 goats. In Rajasthan three villages of Udaipur district were surveyed on 75 families rearing 1603 goats. Similarly, two villages were selected in MP in Indore district and 25 families were interviewed. The kid mortality was 49.34, 26.61 and 49.54 percent in representative area of UP, MP and Rajasthan respectively with an average figure of 41.83%. However, small areas were surveyed but mortality figures are very high resulting a huge economic losses to farmers.

Table : Kid mortality in farmers flock in three different state

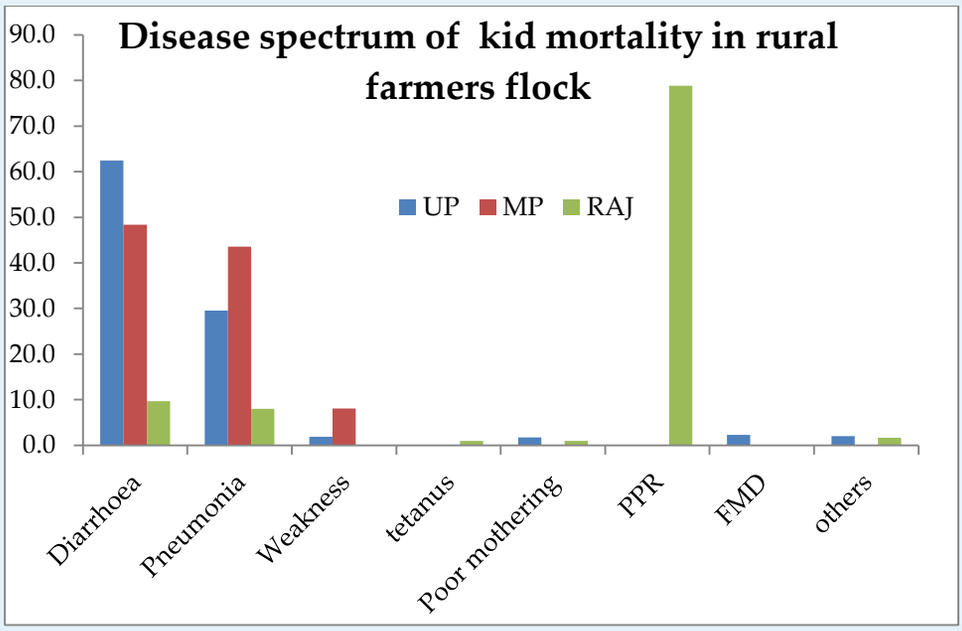
Parameters	UP	MP	Rajasthan	Overall
Total goat family	100	25	75	200
No of goat reared	1543	449	1603	3595
Breedable goat	972	242	785	1999
Total kid born	1518	233	1088	2839
Kidding rate	1.56	1.04	1.39	1.33
Total Kid Death	749	62	539	1350
Mortality Rate	49.34	26.61	49.54	41.83

Major causes of Kid Mortality in rural condition :

In survey in Mathura District of Uttar Pradesh revealed that Summer (31.33%) and winter season (67.82 %) are more vulnerable to kid mortality as compare to rainy season (1.07) . In representative area of MP, the highest mortality was recorded in winter season (72.58 %) followed by rainy (20.97%) and least in Summer (6.45%) . Also in Rajasthan area, the highest mortality in summer season (75.88 %) followed by winter (17.44 %) and lowest in Rainy Season (6.68%) . Overall figure on season basis inferred that Winter season (52.61 %) is most adverse to kids, followed by summer (37.81%) . In age wise, the highest mortality occurred at the age of 7-30 days (49.23%) followed by 1-3 Months (37.45%) and rest mortality at the age of 0-7 days (13.32%). This pattern is almost same in three different location studies. The compiled data on causes of death in kids revealed that diarrhea, pneumonia, PPR, weakness, tetanus, FMD, poor mothering and others (Inanition, trauma, injury, ecthyma, bloat, predation) in proportional percentage of 40.17, 27.01, 26.28, 3.31, 0.35, 0.76, 0.89 and 1.22 percent respectively. It inferred that diarrhea and Pneumonia are the biggest reason of death in young age.

Morbid sample Collection and analysis:

17 fecal samples were collected from rural area for analysis of bacterial , viral and protozoal infection .



Development of herbal anthelmintic and acaricidal formulations for goats

Ashok Kumar, D.K. Sharma, V.K. Gupta, U.B. Chaudhary, H.A. Tiwari and Vinay Chaturvedi

Plant selection and extract preparation:

Eleven plants were selected on the basis of literature possessing acaricidal activity on animal ticks. Finally 10 plants were coded as CIRG-1 to CIRG-10. The plants materials were collected from local area after due authentication and processed for drying . Methanolic extracts were prepared by soxhlet apparatus and dried under vacuum in rotary evaporator and extracts were kept under refrigeration for further use in different experiments.

Adult mortality assay :

Adult ticks were collected from animals as per standard technique without damaging the parasite . In triplicate experiment, the adult ticks (10 Each) were immersed for 2 minute in different concentration (200 , 100, 50, 25 , 12.5 mg/ml) and placed in petridish separately . The mortality were recorded at different time interval (1,2,4,6,12,24 hrs) . The mortality percent were recorded and LC 50 was calculated by probit analysis at 24 hours. In the results, CIRG-1, CIRG-3, CIRG-5 , CIRG-4 and CIRG-2 showed the lowest LC50 as 11.58, 29.84, 30.62, 43.66 and 52.14 mg/ml in their increasing order. The other five plant extracts showed higher concentration at the same time interval ranging from 171.10 t0 382.62 mg/ml.

Larval mortality assay:

Larva culture was done as per the method described and kept at optimum condition for experiments. The different concentration of extracts (200, 100, 50, 25, 12.5 mg/ml) was used and treated the larvae in triplicated design. Mortality were recorded at different interval of 1,2,4,6,12 and 24 hrs. The lowest LC50 was shown by CIRG-4 (0.62 mg/ml) and followed by CIRG-5 (0.32 mg/ml), CIRG-1 (0.62 mg/ml) , CIRG-3 (1.24mg/ml) and CIRG-7 (1.52mg/ml) ; however, other plant also possessed good antilarval acitivity ranging LC50 from 1.99 to 5.59 mg/ml at 24 hours.

Egg Hatch assay:

Experiment was designed to test egg laying and hatchability of female ticks after extract treatment. On the basis of reduction of hatching, LC50 was calculated. The maximum activity was showed by CIRG-1 (7.98 mg/ml) and followed by CIRG-5 (9.6mg/ml), CIRG-3

(10.73mg/ml), CIRG-3(12.75mg/ml) and CIRG-2 (14.23mg/ml). The plant extract were recorded higher LC50 value ranging from 35.49 to 60.34 mg/ml.

Fecundity Assay:

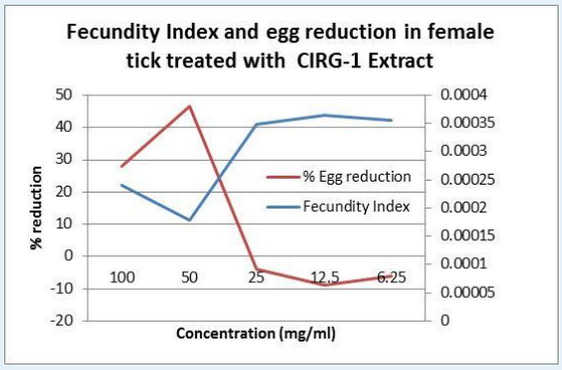
Fecundity was recorded after treatment of adult engorged female ticks at the concentration of 100,50,25,12.5 and 6.25 mg/ml. The control group was kept as untreated with plant extract. The plant Extract CIRG-1 and CIRG-5 was selected for this experiment on the basis of In vitro results. The Egg laying was weighed at 14 days interval. In both the plant extract, The fecundity Index (FI) was lowest at higher concentration (100 and 50 mg/ml) in comparison to other lower concentration . FI was calculated 0.00021 and 0.000179 for CIRG-1 and 0.000217; and 0.000144 for CIRG-5. The egg reduction was 28.05 % and 46.64% for CIRG-1; and 14.60 % and 43.50% for CIRG-5.

Chemical analysis and GC-MS finger print of plant Extract:

The qualitative analysis of plant extract was done for alkaloid , glycosides, proteins, triterpenoids and GC-MS analysis for done.

Prototype candidate for In vivo Experiments:

On the basis of results of In vitro studies on different stages of ticks, CIRG-1, CIRG-2, CIRG-3, CIRG-4 and CIRG-5 are the most effective candidates



.

Table : In vitro activity (LC_{50}) of plant extracts against different stages of ectoparasite (Ticks)

Sl No	Name of plant extract	Plant portion	Adult Ticks		Larval assay		Egg Hatch assay	
			LC_{50} (mg/ml)	**LC_{90} (mg/ml)**	**LC_{50} (mg/ml)**	**LC_{90} (mg/ml)**	**LC_{50} (mg/ml)**	**LC_{90} (mg/ml)**
1.	CIRG-1	Leaves	**11.58**	69.94	**0.62**	12.83	**7.98**	99.8
2.	CIRG-2	Leaves	**52.14**	1609.42	3.30	323.04	**14.23**	306.65
3.	CIRG-3	Leaves	**29.84**	852.35	**1.24**	91.86	**10.73**	195.91
4.	CIRG-4	Leaves	**43.66**	865.37	**0.12**	15.24	**12.75**	293.29
5.	CIRG-5	Leaves	**30.62**	391.78	**0.32**	75.26	**9.6**	162.37
6.	CIRG-6	Leaves	252.46	18140.74	2.82	588.97	60.34	1754.87
7.	CIRG-7	Leaves	382.61	8131.12	**1.52**	404.48	56.83	2006.66
8.	CIRG-8	Seed	215.07	1846.67	1.99	620.86	53.99	1656.86
9.	CIRG-0	Seed	132.97	1142.22	5.69	418.49	35.49	6476.51
10.	CIRG-10	Leaves	171.10	1512.19	3.51	711.13	47.88	2799.9

Outreach program on zoonotic diseases : Zoonotic potential of mycobacterium avium subspecies paratuberculosis, as the cause of inflammatory bowel (Crohn's disease) in human beings.

S. V. Singh and Naveen Kumar

Profile of human samples from pathology laboratories in Agra city:

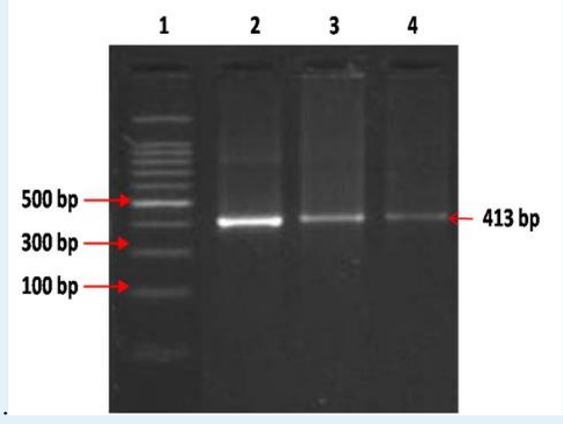
During the year, a total of 1594 samples (blood – 716, serum – 840 and stool - 38) from 840 human subjects were collected from 6 pathology laboratories in Agra city .

Screening of serum samples for infection against *Mycobacterium avium* subspecies *paratuberculosis* (MAP) by 'indigenous ELISA kit':

Of 711 serum samples collected in 380 days (1st Apr., 2014-15th April, 2015) were screened by 'Indigenous ELISA kit' and 4.2 and 42.8 percent were in strong positive and positive), respectively and were positive for MAP infection. Cumulatively, 47.1 percent human samples were positive for MAP infection from Agra and Mathura regiosn. Study showed association in 45.4, 55.2 and 38.1 percent cases of diabetes, hypo-thyroidism and others with MAP infection (Table 2).

Screening of cases of specific chronic illness for MAP infection:

ELISA and blood PCR



Screening of twenty two human patients suffering from different types of chronic illness for MAP infection by 'Indigenous ELISA kit' revealed that 9.0 and 36.0% samples were in strong positive and positive categories, respectively. However, cumulatively 45.4% human samples were positive for MAP infection. Screening of 22 blood samples of these patients by IS*900* blood PCR, 18.1% were positive for MAP infection. Of 18 stool samples screened by microscopy, 54.4% were positive for presence of acid fast bacilli indistinguishable to MAP. Shedding intensity of MAP was graded as +1, +2, +3 and +4. Comparatively stool microscopy was most sensitive followed by serum .

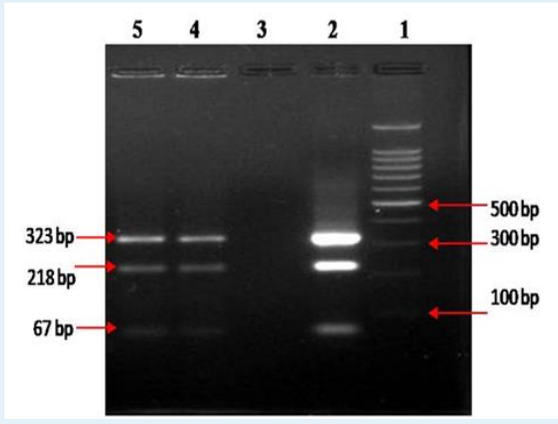
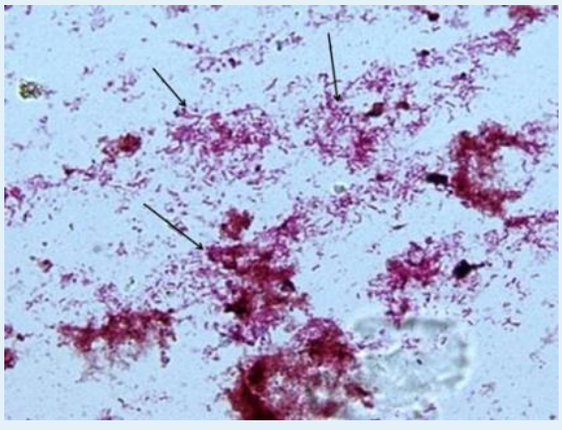
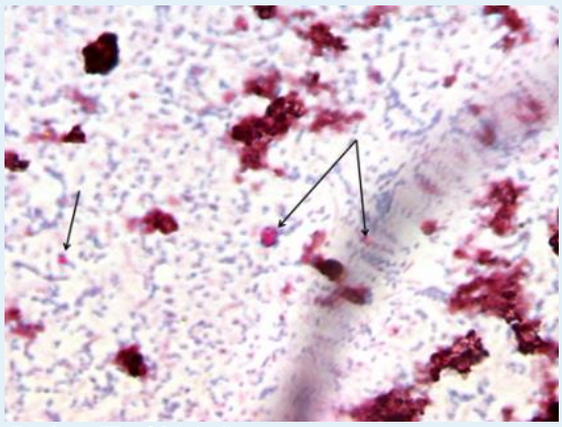


Fig 1

i. Characterization of MAP by IS900 PCR

ii. Bio-typing of MAP by IS 1311 PCR





Patient ID: 001 (+4)
Patient ID: 003 (+3)

Figure 2. Microscopy of stool samples by Ziehl Neelsen staining (100X)

Screening of human population for *Mycobacterium avium* subspecies *paratuberculosis* infection in a in a diabetes camp, Chattarpur, MP:

A total of 111 human samples (88 serum and 71 blood) were collected from a health camp organized by NGO and Gwalior Medical College, at Chattarpur district of Madhya Pradesh for screening of human population for diabetes. Of the 111 suspected human patients screened for diabetes, 20 (18.0%) were positive using commercial kits (ACCU-CHEK test strips). Of the 88 suspected diabetes patients, 3.4 and 35.2% were positive for MAP infection by ELISA kit. Of the 88 and 71 healthy suspects screened by ELISA kit and IS900 PCR, 38.6 and 39.4% were positive, respectively for MAP infection. And of 19 and 16 diabetes patients screened, by ELISA kit and IS900 PCR, 31.5 and 43.7% were positive, respectively for MAP infection. Comparative evaluation of two tests in 68 suspected human patients showed that 23.5% persons were positive for MAP infection by both the tests. However, 20.5 and 14.7% were positive in ELISA kit and IS900 PCR, respectively. Comparative evaluation of two tests in 15 diabetes patients, showed that 6.6% patients were positive for MAP infection by both the tests. However, 20.0 and 46.6% were positive in ELISA kit and IS900 PCR, respectively. In suspected and confirmed cases of diabetes, blood IS*900* PCR was more sensitive as compared to indigenous ELISA kit. Typing of IS*900* and IS*1311* PCR positive MAP DNA showed that human population was infected with 'Indian Bison Type' MAP, which is major bio-type infecting animals.

Co-infection of Cryptosporidia in cases of animals and human beings suspected and positive for *Mycobacterium avium* subspecies *paratuberculosis* infection: A new trend:

A new trend was noticed with emergence of Cryptosporidium in adult human and animal population with clinical disease in association with infection of MAP. Following fecal / stool samples from goats, cattle and human beings were routinely processed for the diagnosis and monitoring of MAP infection. The samples were processed for microscopy by routine method of concentration by centrifugation and acid fast staining of the smears and were examined under 100X of the microscope. Results show the increased presence of heavy (+4) infection of Cryptosporidium spp., singly or with MAP infection. These fecal samples were driven from goats (Etawah), cattle (Ludhiana) and human (Farah, Mathura) samples and were suspected for MAP infection and had symptoms of weakness, constipation, loss in body condition and diarrhoea. Present study revealed presence of heavy infection (+4) of Cryptosporidium spp. Cryptosporidium spp., a single cell parasite has been associated with cases of diarrhoea in young age in animals and has also been reported from young children (Zoonotic) has been found. However, we have reported two cases of Cryptosporidiosis in human beings, where patients suffered with symptoms of IBD. In case of a teenage girl (16 years) suffered with symptoms of IBD and was positive for MAP infection in ELISA, PCR and microscopy (+2). Whereas, an adult boy (22 years) suffered with chronic constipation for last one year was exclusively affected with Cryptosporidium.

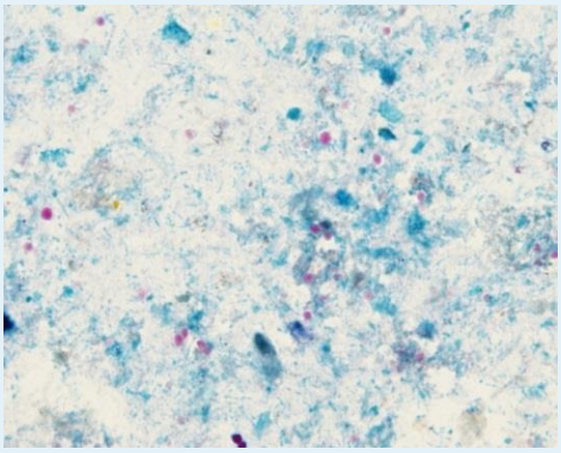


Fig 3: Patient id 374: 22 yrs/ Male, 24/03/2014

History: Constipation from one year, loss of appetite.

Results: Positive for Cyptosporidia

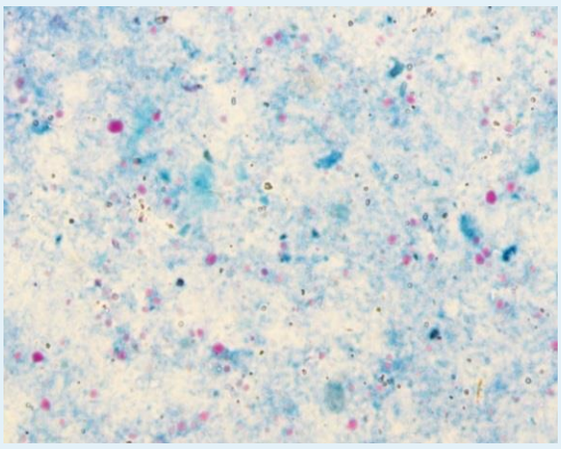


Fig 4: Patient ID 002, 16 years/ female, 17/05/13:

Patient is suffering from IBS from last 2 years, Gas formation, Mucous production, bowel movement, Crampy abdominal pain, skin rashes, loss of body weight, resemble with clinical cases of Bowel disease/Crohn's disease, Presently suffering from Loss of appetite, Weakness, tendency to get tired, Joint pain, skin rashes, Consulting Specialist: Dr. Rakesh Tandon, Professor & Head, Dept. of Gastroenterology, AIIMS, New Delhi, Treatment provided: Velgent (1 capsule/day) for 15 days, Zentel (400 mg/day) for 3 days, Results: Positive for Cyptosporidia and MAP (Positive in ELISA, IS900 PCR and Microscopy)

Screening of biopsies from chronic patients with 'Inflammatory Bowel Disease (Crohn's disease) for presence of MAP:

Of the 6 biopsies collected from chronic patients with 'Inflammatory Bowel Disease (Crohn's disease) processed for H & E staining (Histopathology), but results have been under process.

Screening of milk products (Paneer) for presence of MAP:

Of 24 paneer samples processed for the detection of MAP, 3 (12.5%) and 1 (4.2%) samples of paneer fat and sediment, were positive respectively in microscopic examination.

PCR standardization of five susceptibility gene for Crohn's Disease :

Five genes (MHC II DRB3- 911bp, **TLR 2-** 1371 bp, **TLR 4-** 1144 bp, **TLR 9-** 1504 bp, **NOD 2-** 1511 bp) were identified to study the polymorphism with respect to susceptibility and resistant to MAP infection. Wild-type NOD2 activates nuclear factor NF-kappaB, making it responsive to bacterial lipopolysaccharides; however, this induction was deficient in mutant NOD2. These results implicate NOD2 in susceptibility to Crohn's disease, and suggest a link between an innate immune response to bacterial components and development of disease (McGovern et al., 2001).

Protocol for C-DNA synthesis:

Genomic DNA was isolated from the white blood cell pack. Collect the blood (3.5 ml) in 2.7% EDTA. Blood was mixed with Histopaque (Sigma) and centrifuge at 2500 rpm for 45 min. To the buffy coat 13 ml PBS for washing. Centrifuge at 1000 rpm for 15 min and take the pellet. Add TRI reagent (Trizol, Sigma) to the pellet for RNA extraction. From RNA, then C-DNA synthesis using kit based method (Qiagen). This C-DNA was stored for PCR amplification of 5 susceptibility gene at different annealing temperatures.

Linkage developed with Medical Professionals for sampling of human patients with 'Inflammatory Bowel Disease (Crohn's disease):

Specific human patients with chronic health problems that were positive for MAP infection were followed with clinicians. Efforts to establish collaboration with human doctors are still on for collaboration. dsssFollowing gastero-entrologists were contacted for obtaining the samples of patients suffering with Inflammatory Bowel Disease (IBD) or Crohn's disease (CD).

Toll like receptors (TLRS) expression and characterization in different breeds of goats and their role in disease resistance with special reference to Brucellosis

V.K. Gupta, Shivasharanappa N., K. Gururaj, P.K. Rout and Ashok Kumar

Standardization of High-fidelity PCR amplification of the open reading frame of the genes viz., TLR4, TLR5 and TLR6:

The innate immune receptors including TLR 4, TLR5 and TLR6 has been amplified using in-house designed full CDS primers. The 5′ and 3′ flanking non-coding regions (NCR) of ORF were taken into consideration. The entire TLR4 with NCR has a size of 2136bp, followed by TLR5 with 2707bp and TLR6 with 2565bp. The *fig 9* shows the PCR standardization and the amplification products of TLR4,5 and 6.

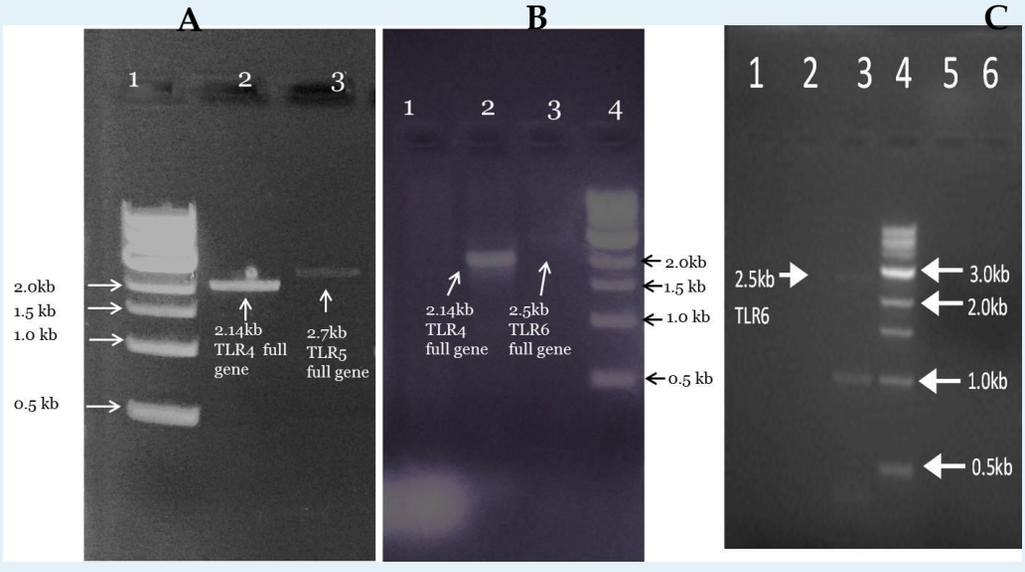


Fig.9. A – Shows the amplification of full gene of TLR4 (lane 2) and TLR5 (lane3). Full gene amplification of TLR 6(B-Lane 3 and C-Lane3) using Fidelitaq® enzyme (USB, Affymetrix)

PCR-RFLP analysis of TLR4 gene for possible variations/polymorphisms in the coding region :

First hand information on Novel SNPs has been found following the RFLP analysis of Barbari TLR4 with Pashmina TLR4, with the latter showing unusual restriction patterns when restriction digested using *Bgl*III. The Barbari breed showed four restricted products, while the Pashmina breed from the tibetan region showed three products suggestive of variations or polymorphisms in the coding region of TLR4.

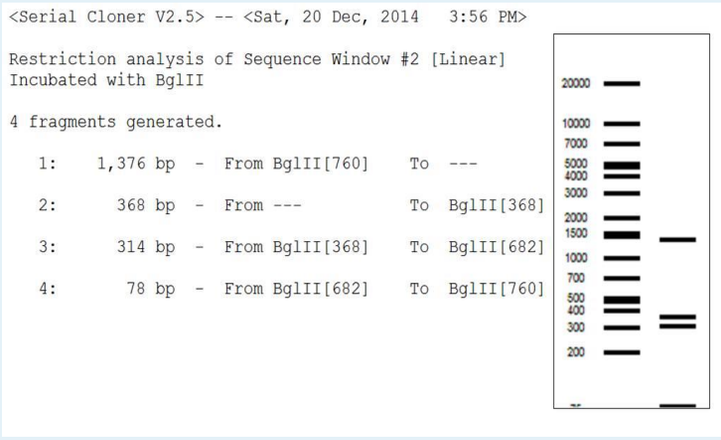


Fig. 11. An insilico restriction digestion using serial cloner shows four restriction products in the TLR coding region obtained by aligning coding sequences from multiple breeds

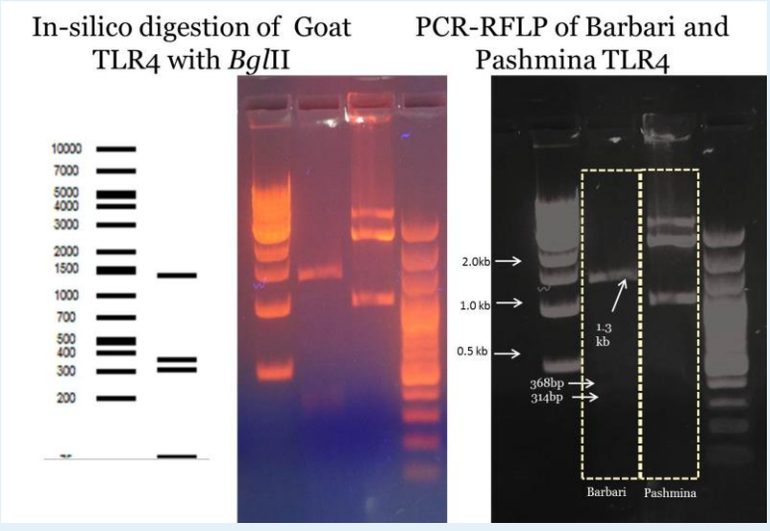


Fig. 12. The restriction patterns of the CDS of the TLR4 of Barbari showing four restriction products (as in insilico analysis) while Pashmina breed showed three restriction products.

Characterization of innate immune receptor following exposure to *peste des petits* ruminants virus

Naveen Kumar, S. V. Singh and A. K. Mishra

The main objective of this project is to characterize the innate immune receptors following exposure to PPRV with basic aim to understand host-pathogen interaction to improve the existing vaccine. Expression of various innate immune receptors viz; RIG-like receptors (RLRs), NOD-like receptors (NLRs) and Toll-like receptors (TLRs) in Vero cells following exposure to PPRV was determined by quantitation of the respective mRNA (TLRs/RLRs) by quantitative real-time PCR (q-RT-PCR).

Sequence alignments of innate immune genes (TLRs,RLRs and NLRs) form homosapiens, mice and bovine/caprine were performed to design the PCR primers (from conserved regions) for quantitation of the respective mRNA (gene expression) following exposure of PPRV to Vero cells. Protocol was standardized for amplification and quantitation of various innate immune genes from PPRV infected Vero cells.

Vero cells were infected with PPRV for 1 h followed by washing 3 times with PBS and addition of fresh DMEM. The cell lysates were prepared at indicated times to isolate the total RNA using TRI Reagent as per the instruction of manufacturer (Sigma, Steinheim, Germany). The mRNA of respective innate immune receptor were quantified by quantitative real-time RT-PCR as follows: The RNA was cleared of possible DNA contamination by incubation for 45 min at 37°C and 80°C for 20 min with DNAse I followed by reverse transcription. Briefly, 5 µl of the RNA was mixed with 200 ng of oligo dT primer and heated to 65°C for 5 min, after which it was cooled immediately on ice for 5 min and mixed subsequently with 4 µl of 5X RT buffer, 1 mM dNTPs, 40 U of RiboLock RNAse inhibitor and 200 U of Revert Aid H Minus Reverse Trasncriptase in a total reaction volume of 20 µl. The reaction mixture was incubated at 25°C for 10 min, 42°C for 1 h and 70°C for 10 min. The resulting cDNA was stored at −20°C until use. Real-time RT-PCR was carried out with a 20 µl reaction mixture containing gene specific primers and SYBR Green DNA dye (Promega, Madison, USA). β-actin was used as a house keeping control gene and was amplified using forward primer: 5′-CCC CAG CCA TGT ACG TTG CTA TCC -3′ and reverse primer: 5′- GCC TCA GGG CAG CGG AAC CGC TCA -3′). For PCR amplification of both innate immune genes and β-actin mRNA, following thermocycler conditions were used: An initial denaturation of 95°C for 5 min followed by 40 cycles of 95°C for 30 s, 52°C for 30 s and 72°C for 30 s.

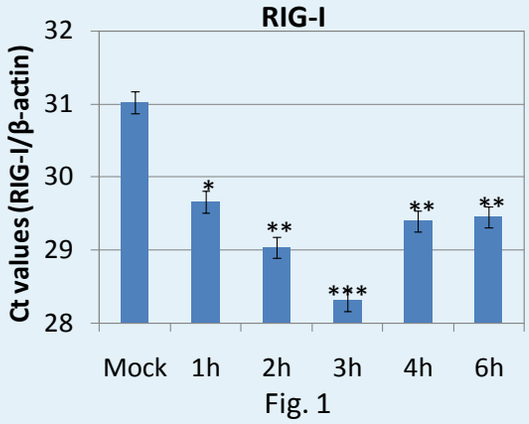


Fig. 1

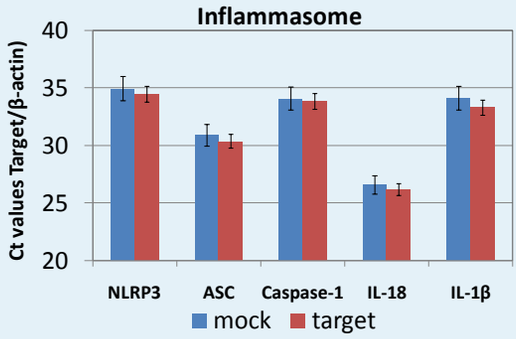


Fig. 2

A time-course experiment on expression of RLRs in PPRV-infected Vero cells was performed where highest expression of both RIG-I and MDA-5 was observed at 3 hpi (Fig. 1). At lower MOI, the induction of RLR expression significantly reduced. In a similar experiment *in vivo*, we observed down regulation of RIG-I in PBMCs at 2 days post-vaccination in goats. Preliminary data on expression of NLRs suggests that the PPRV does not seem to activate inflammasome (NLRP3, ASC, Caspase-1, IL-18 and IL-1β) (Fig. 2).

VTC-Veterinary microbes (CIRG-Unit)

VK Gupta (upto 25.02.15), K Gururaj (w.e.f. 26.2.15) A. K. Mishra and Naveen Kumar

As a part of the VTC-VM, routine samples screening was done at CIRG unit and the pathogens associated with different infections has been identified, isolated and submitted to VTCC, Hisar. *Salmonella Typhimurium* has been isolated from cases of neonatal diarrhoea and it has been characterized by culture, biochemical and molecular tests for confirmation. Cases of caseous lymphadenitis has been critically examined for the presence of *Corynebacterium ovis*, the principal pathogen being involved and it has been characterized by standard techniques for accession in VTCC, Hisar. Bacterial pneumonia has been a cause of concern due to mortality losses and hence pneumonic lungs were collected and *Pasteurella multocida* was isolated and further confirmed by staining, biochemical and molecular tests. Mastitis and sub-clinical mastitis has been studied in lactating does and found the presence of *Streptococcus agalactiae* and *S.*

dysgalactiae by isolation in blood agar and further confirmation done by staining, culture and biochemical tests. Silage fever caused by *Listeria monocytogenes* is also a cause of abortion in Goats and Sheep. The organism was isolated from brain and was cultured using enrichment with UVM and Palcam agar and was characterized by using virulent/biofilm forming genes and submitted to VTCC, Hisar

List of cultures submitted by CIRG-VM unit to VTCC, Hisar for accession

S.No.	Name of Bacterium	DID
1.	*Salmonella* Typhimurium	CIRG14-1
2.	*Salmonella*Typhimurium	CIRG14-2
3.	*Corynebacterium ovis*	CIRG14-3
4.	*Corynebacterium ovis*	CIRG14-4
5.	*Streptococcus agalactiae*	CIRG14-5
6.	*Streptococcus dysgalactiae*	CIRG14-6
7.	*Pasteurella multocida*	CIRG14-7
8.	*Listeria monocytogenes*	CIRG14-8
9.	*Staphylococcus aureus*	Indicator/host bacterium for phages
Virus (Phages)		
	Name of Phage	
10.	*Staphylococcus aureus* phage 1	CIRG14-9
11.	*Staphylococcus aureus* phage 2	CIRG14-10

Isolation, identification and characterization of major infectious agents associated with neonatal diarrhoea in kids

Anil Kumar Mishra, Naveen Kumar, K. Gururaj, Souvik Paul and Vinay Chaturvedi

PCR for confirmatory identification of *Klebsiella pneumoniae* associated with neonatal diarrhea was standardized targeting fus A gene, and the amplified PCR product was obtained as 238 bp. Molecular detection of *E.coli* isolated from diarrhea, mastitis and pneumonia affected goats was done using *usp*A gene of 844 bp. Thereafter, the *uspA* gene sequences were accessioned as KF765738, KF765739 and KF765740 respectively. The diarrheic *E. coli* (ECD1) showed significant variation in the nucleotide composition with the mastitic (ECM1) and pneumonic isolates (ECP) (Fig. 1 and 2). This is due to the fact that, the diarrhoeic isolate was in a different clade as compared to O157:H7 strain, which means it is not verotoxic but highly pathogenic as observed clinically and pathologically. Tajima's test of molecular hypothesis using Mega 6.0 software was conducted to identify evolutionary divergence in the *uspA* gene coding regions, and 756 identical sites were found among them. Significant differences were noticed with ECD1 showing 9 unique differences in the coding region, followed by ECM with 4 and ECP with 1 unique difference. The stx-1 gene sequence from a shiga toxin producing *E. coli* (CIRG-ECS1) isolated from diarrhoeic kid was accessioned as KF765741. Based on the maximum likelihood analysis, it was found that CIRG-ECS1 was in a different sub-clade as of other strains of *stx*1 producing *E.coli*, but it was very close to the verotoxic strains suggesting it might be having more pathogenic determinants for virulence in kids (Fig. 3). PCR for detection of EPEC associated with neonatal diarrhea in goat-kids was developed. A semi-nested RT-PCR for confirmatory detection of rotavirus from neonatal diarrhea targeting VP1 gene was standardized (Fig. 4).

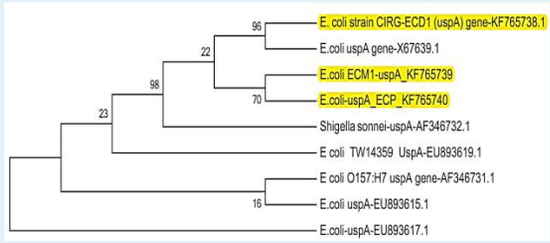


Fig.1: Phylogenetic tree constructed for universal stress protein based on the coding sequences by neighbour joining method

	1	2	3	4	5	6	7	8	9
1. E. coli strain CIRG-ECD1 (uspA) gene-KF765738.1									
2. E.coli ECM1-uspA_KF765739	0.014								
3. E.coli-uspA_ECP_KF765740	0.012	0.002							
4. E.coli uspA gene-X67639.1	0.012	0.021	0.019						
5. Shigella sonnei-uspA-AF346732.1	0.012	0.007	0.005	0.019					
6. E coli O157:H7 uspA gene-AF346731.1	0.019	0.014	0.012	0.026	0.012				
7. E coli TW14359 UspA-EU893619.1	0.019	0.014	0.012	0.026	0.012	0.000			
8. E.coli-uspA-EU893617.1	0.019	0.014	0.012	0.026	0.012	0.000	0.000		
9. E.coli uspA-EU893615.1	0.019	0.014	0.012	0.026	0.012	0.000	0.000	0.000	

Fig. 2: Pairwise distance matrix of diarrhoeic *E. coli* with the other isolates of *E. coli*

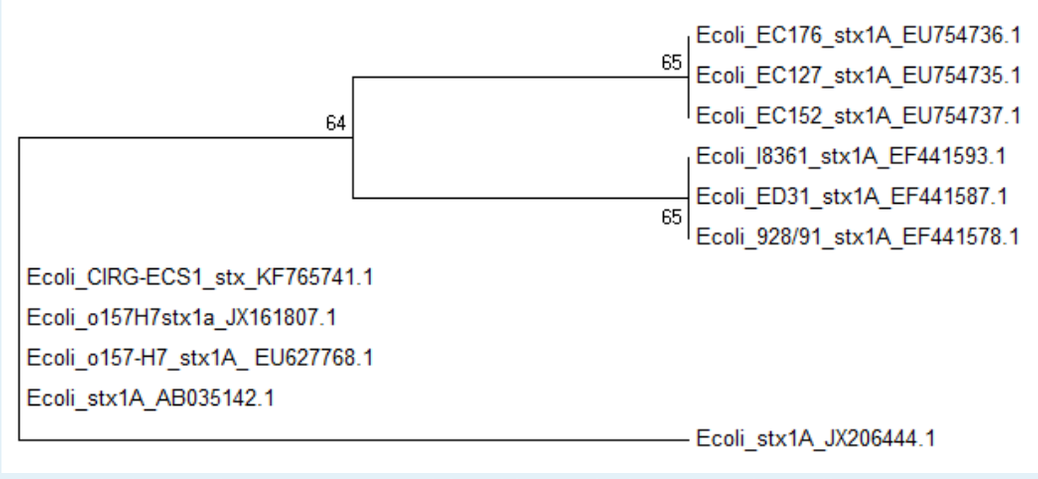
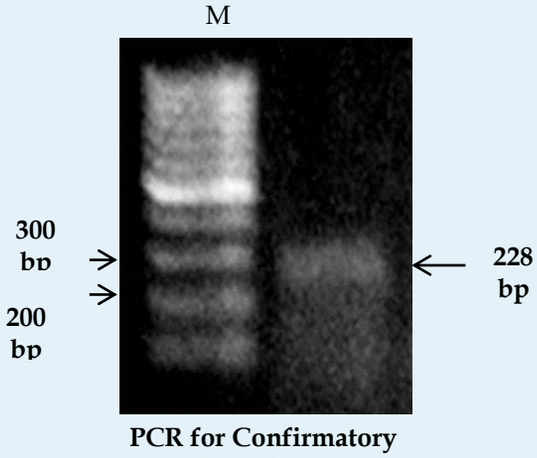


Fig. 3: Phylogenetic tree constructed for shiga toxin based on the coding sequence by neighbour joining method



PCR for Confirmatory Detection of Rotavirus

Development of diagnostic assay, molecular characterization and epidemiology of cryptosporidiosis in goats

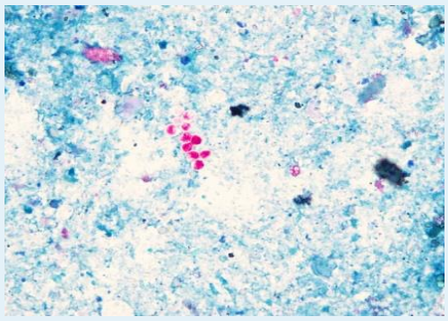
Souvik Paul

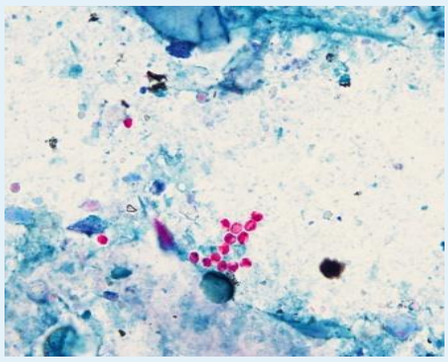
Cryptosporidiosis has emerged as one of the major health problems among neonatal goats kids. Apart from mortality (>40%) it accounts for diarrhea, decline in productivity, retarded growth, lowered feed efficiency, delayed maturity, loss of fertility and overall financial loss in the form of treatment of ailing animals. *Cryptosporidium parvum* and *Cryptosporidium xiaoi* are the two species involved in the causation of disease by faeco-oral route.

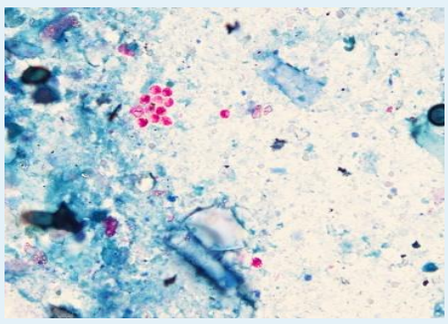
For proper control of cryptosporidiosis, knowledge of epidemiology and the disease pattern is an absolute necessity as there are no suitable vaccines or drugs are available against the disease.In the preliminary study about 100 faecal samples from diarrhoeic neonatal goats were collected and were screened for the presence of Rotavirus, E.coli (enterotoxigenic) and Cryptosporidium spp. The results revealed that E. coli and Cryptosporidium spp. were the major pathogens responsible for neonatal diarrhoea.

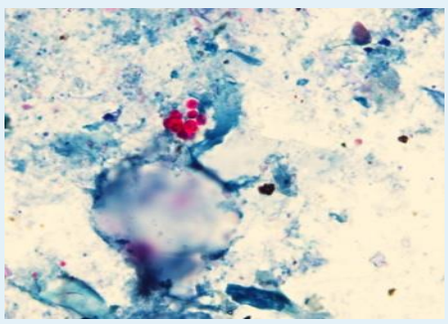
In the extensive study around 1039 faecal samples have been screened for the presence of *Cryptosporidium* oocysts, out of which 363 were found positive. A two stage stratified sampling was employed under which samples have been collected from both organized farms (Intensive/Semi-Intensive) and farmer's flocks (Extensive). It was found that the occurrence of the disease was found more in farmer's flocks which may be due to lack of hygiene in the premises. The prevalence of the infection was higher in 0-15 days old kids than 15-30 days old kids. Also, the incidence was high among twins or triplets. The prevalence of infection was greater during summer months than winter months. Sex or breed has no correlation with the occurrence of the disease. As transplacental route is not reported in cryptosporidiosis, other probable sources of infection were searched for the disease.

Finally, it was found that the infection was fomite borne. Being highly resistant to heat, cold, dryness due to its tough outer wall oocysts from one crop survives in the environment to act as a source of infection to next batch. The perianal regions and udders of the post-parted does were also a source of infection. The course of the disease varied from 5-10 days depending on severity of infection and concomitant stress. The predominant sign was profuse watery to mucoid diarrhea, sometimes bloody. Dehydration, unthriftiness, anorexia were the associated signs. Environmental stress, presence of other enteropathogens aggravated the condition. A positive correlation was found between rate of excretion of oocysts and the severity of diarrhea. *Cryptosporidium* oocysts were purified from faeces by modified Sheather's floatation and DNA was extracted from the purified oocysts both by commercial kit and Phenol-Chloroform method with minor modifications. Nested PCR amplification was done using primers directed towards the 18s SSU rRNA gene and a 834 bp amplicon confirmed the presence of Cryptosporidium spp. Restriction digestion of 834 bp nested product with *SSP* 1revealed 3 clear bands at 449 bp, 267 bp and 108 bp. RFLP with *Vsp I* showed 2 bands at 628 bp and 105 bp. This banding pattern suggested that the species was *Cryptosporidium parvum*. The RFLP pattern of the 18S ssu rRNA gene of the caprine isolate of *Cryptosporidium* spp. with *Mbo II* showed 2 clear bands at 771 bp and 70 bp, this banding pattern further confirmed that the species was *Cryptosporidium parvum*.

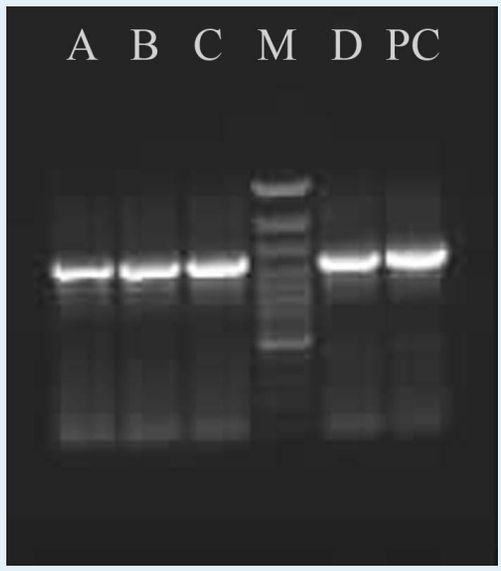


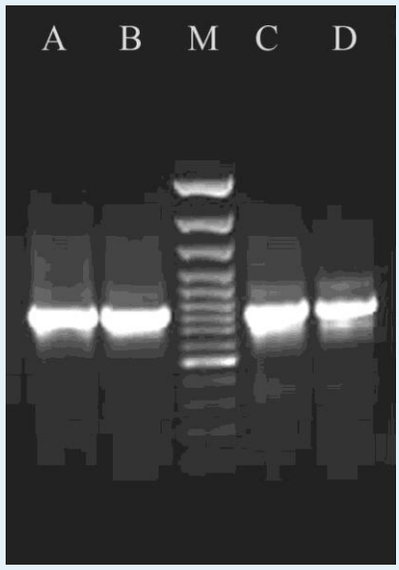






Modified ZN stained faecal smears showing Cryptosporidium oocysts (100X), as pink spheres against green background

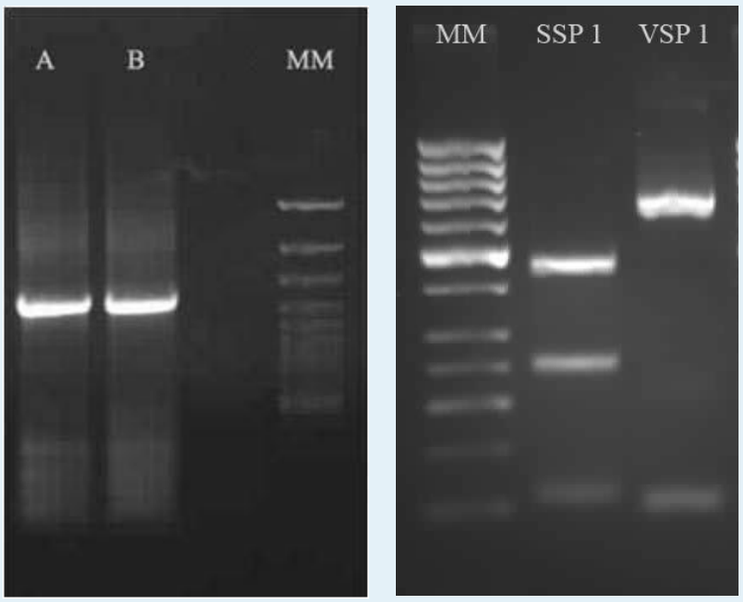




PRIMARY PCR

NESTED PCR

PCR-RFLP of 18S ssu rRNA gene and determination of the species of *Cryptosporidium* involved



SSP 1 RFLP showing 3 clear bands at 449 bp, 267 bp and 108 bp. **VSP 1** RFLP showing 2 bands at 628 bp and 105 bp.

Metabolic profiling for diagnosis and control of metabolic diseases in goats

Nitika Sharma, Ashok Kumar, Ravindra Kumar, R.V.S. Pawaiya and Vinay Chaturvedi

The metabolic profile of goats in various physiological states – dry, pregnant and lactating in healthy animals was established. Variations in energy related blood metabolites - -hydroxybutyrate (BHBA), non-esterified fatty acids (NEFA), glucose, total protein, albumin, blood urea nitrogen (BUN) and aspartate aminotransferase (AST) activity were studied in goats of different physiological states by colorimetric assays. Blood from the jugular vein was collected from eighteen does on days 180, 30, 14 and 7 before the expected kidding time and also on days 0, 7, 14, 30, 180 postpartum. The serum metabolites were measured over time hence a repeated measures approach using ANOVA with mixed linear models was used. The β-hydroxybutyrate level varied from 0.09-0.54 mmol/l in 15 animals expect in three does in which the concentration elevated above 1 mmol/l. NEFA concentration varied from 0.18-0.45 m mol/l. However, the number of does with abnormal non-esterified fatty acids concentrations (≥0.6 mmol/l) was eleven with aspartate aminotransferase concentrations greater than the threshold level. We conclude that negative energy balance (NEB) occurs in goats during the periparturient period. NEFA concentration reflected NEB better than other blood metabolites in goats.

The twin and triplet bearing does were found more inclined to the NEB than single kid bearing does. Epidemiological studies revealed that the prevalence of NEB increased with the parity. The does with poor body condition score and the over conditioned does were found more predisposed to NEB. The method for estimation of milk urea nitrogen (MUN) in goats was developed and standardized. The MUN varied from 27-45 mg/dl.

The variation of energy related metabolites in goats of different body condition scores (BCS) was investigated. The goats with high BCS had significantly higher levels of blood glucose concentration and lower levels of blood BHBA, NEFA and BUN. The goats with low BCS had significantly high levels of blood BHBA, NEFA and BUN.

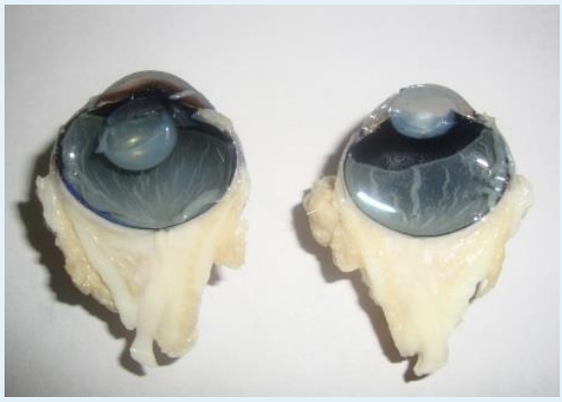


Fig: Collection of Vitreous humor from dead animal

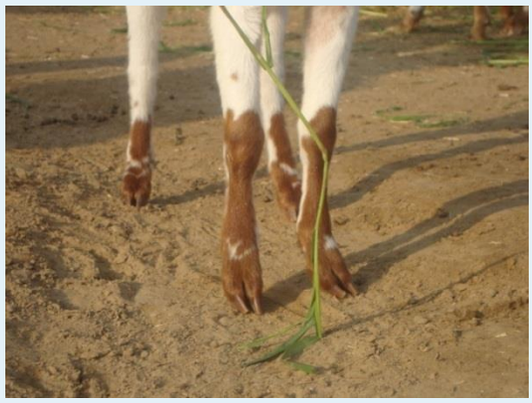


Fig: Angular limb deformities due to Calcium: Phosphorous imbalance

The method for confirmatory diagnosis of pregnancy toxaemia in dead goats by estimation of beta- hydoxy butyrate in vitreous humor of eye was developed and standardized. A total of twelve samples of vitreous humor were collected from PM cases for estimation of BHBA. The BHBA level was found to be elevated upto 5 times (normal 1mmol/L) in goats dead due to pregnancy toxaemia. BHBA was found to be an excellent indicator for the confirmatory diagnosis of pregnancy toxaemia and other metabolic disorders in goats. In order to detect the clinical and subclinical status of metabolic and deficiency diseases the morbidity and mortality records of CIRG goat farms were analyzed.

The investigation revealed that the major nutritional and metabolic diseases encountered in raising goats are pregnancy toxaemia, lactational ketosis, periparturient hypocalcaemia, rumen acidosis, polioencephalomalacia, osteo-skeltal deformities and urolithiasis. Angular limb deformities due to calcium phosphorus imbalances were observed in growing kids. The symptoms were more pronounced in males than female kids. The serum calcium, phosphorous and alkaline phosphatase level in affected animals was 8.98±0.68 mg/dl, 8.58±0.64 mg/dl and 203.18±0.37 U/L while, in the healthy group the level was 10.28±0.17 mg/dl, 5.28±0.27 mg/dl and 90.28±0.37 U/L respectively.

EXTENSION EDUCATION AND SOCIO-ECONOMICS SECTION

Extension approaches for dissemination of goat production technologies and impact assessment

Braj Mohan, A.K.Dixit, Khushyal Singh, Vijay Kumar , U.B.Chaudhary and Ashok Kumar

Village's Activities

Visit of villages: 28 visits of 08 adopted villages Nagla Phunisa, Daulatpur, Nagla Chandrabhan, Nagla Arma, Nagla Bhojpur, Nagla Girdhari, Girdharpur and Rawal (Hon'ble M. P's Adarash Adopted Village and CIRG) and Nagla Pola (Part of Rawal) of Farah, Mathura and Baldeo Block of Mathura District.

Pilot Survey and collection of basic information :

Conducted pilot survey and collected basic information in Nagla Bhojpur, Nagla Girdhari, Nagla Chandrabhan, Girdharpur, Daulatpur and Rawal (Hon'ble M.P's Adarash Adopted Village and CIRG)

Data collection on baseline, mortality, morbidity etc. :

Data collected from 100 goat farmers on baseline, mortality, morbidity etc., in adopted villages Nagla Bhojpur, Nagla Girdhari , Girdharpur and Daulatpur.

Organization of field days and extension education activities:

10 field days were organized in 08 adopted villages Nagla Phunsia, Daulatpur, Nagla Chandrabhan, Nagla Amra, Nagla Bhojpur, Nagla Girdhari, Girdharpur and Rawal (Hon'ble M.P's Adarash Adopted Village and CIRG), in which following extension education activities were conducted.

Arranged 05 group discussions in adopted villages Daulatpur, Nagla Phunsia, Girdharpur and Nagla Amra with 105 farmers and 10 farm women.

Advisory Services:

Provided advisory services on scientific goat farming and fishery to 55 goat farmers and 11 farm women on 14.01.2015 in Rawal (Hon'ble M.P's Adarash Adopted Village and CIRG) and Nagla Pola village (Part of Rawal) in collaboration with Regional Center Rohtak, Haryana of CIFE, Mumbai.

Provided door to door advisory services on scientific goat farming to 80 goat farmers and 26 farm women in Nagla Chandrabhan, Nagla Bhojpur, Nagla Girdhari, Girdharpur and Rawal (Hon'ble Adarash Adopted village and CIRG)

Provided advisory services on scientific goat farming to 118 farmers and 64 farm women in Nagla Amra, Nagla Bhojpur, Nagla Girdhari, Nagla Phunsia, Girdharpur and Daulatpur adopted villages.

Arranged a farmers- scientists interaction on mitigation on the effect of short rainfall on goat farming and its solution with 15 farmers and 05 farm women in Nagla Phunsia adopted village.

Conducted a farmers – scientists interaction with 15 farmers in Nagla Chandrabhan adopted village.

Organized extension education activities such as kisan gosthi, off – campus training, meeting and demonstration with 33 farmers in Rawal (Hon'ble M.P's Adarash Adopted Village and CIRG).

Distribution of mineral mixture

Mineral mixture was distributed to 137 goat farmers in Daulatpur, Girdharpur, Nagla Amra, Nagla Chandrabhan and Rawal (Hon'ble M.P's Adarash Adopted Village and CIRG).

Swachh Bharat Mission :

Awareness on cleanliness was provided in Girdharpur, Nagla Amra, Nagla Chandrabhan and Rawal (Hon'ble M.P's Adarash Adopted Village and CIRG) on 15.01.2015 , 17.01.2015 , 04.032015 and 28.03.2015 respectively.

Organization of health camps:

10 health camps were organized in 08 adopted villages Nagla Phunsia, Daulatpur, Nagla Chandrabhan, Nagla Amra, Nagla Bhojpur, Nagla Girdhari, Girdharpur and Rawal (Hon'ble M.P's Adarash Adopted Village and CIRG), in which 179 sick goats were treated for different clinical ailments. The major clinical conditions treated were cold, diarrhoea, fever, ecto-parasite infestation, mastitis, neonatal diarrhoea, anemia, infertility, mange, acariasis etc. Deworming was done of 396 goats, vaccinated 100 goats against PPR and drugs were given to 28 goats.

Research

78 goat farmers of four adopted villages having 459 goats were interviewed for baseline data. The respondents belonged to Scheduled caste (21.7%), Backward caste (41%) and Minority (37.3%). Out of 78 respondents 76.9% were landless, 20.5 % percent were marginal and 2.6% were small size land holders farmers. Majority of farmers (55%) belonged to middle age group (>30-50yrs), 9 % belonged to old age group (>50yrs) and 14% belonged to young age group (≤30yrs). Average age of respondents was 40.15±1.15 yrs and range varied from 16-65 yrs. There were 52.6 % respondents were illiterate, 19.2% were able to read or write only, 8.9% were primary and rests were middle and high school passed. Majority of farmers (50%) belonged to medium family size (6-8) followed by small (≤5) 34.6% and large (>8) 15.4% family. Average family size was 6.67 ±0.28 and range varied from 2-16. Majority of farmers (46.1%) farmers belonged to medium income group followed by low (42.3%) and high 11.6%. Average family income was Rs. 78 thousands. Further, majority of farmers (70.5%) had small flock size (≤5 goats) followed by medium 17.9% (6-10 goats) and large 11.4% (>10 goats). Average flock size was 5.9±0.6 goats and range varied from 1-31 goats. Grazing was important source of nutrition in the adopted villages. Vaccination and deworming practices were followed by 28.2 and 26.9 percent, respectively in adopted villages. The mortality was 20.6% at the time of intervention and major cause of mortality was related to alimentary system. Nearly, 42 percent of respondents followed middleman channel to sell their animals and rest followed direct channel. Minimum selling price of a goat was found Rs. 2400 and maximum Rs. 31000 whereas; average price of a goat was Rs. 8800 in adopted villages.

Assessment of economic losses due to diseases in goat production

A.K.Dixit, Braj Mohan, Khushyal Singh, Vijay Kumar, S.K.Singh and Ashok Kumar

A study has been conducted in the villages of Banda, Auraiya and Mathura districts of Uttar Pradesh where outbreak of *Peste des petits ruminants* (PPR) disease was reported. Data were collected from 54 goat farmers on viz. age, caste, occupation, and education status, and land holdings of goat farmer. Morbidity rate, mortality rate, case fatality rate and economic losses due to goat PPR were also estimated. Majority of the respondents belonged to middle age group (44 yrs) and scheduled caste (57%) social group. The average family size was 7 members. Moreover, goat farmers were landless and marginal farmers, illiterate with agriculture as well as animal husbandry occupation. The overall morbidity, mortality and case fatality rate due to goat PPR was found 58.5%, 41.5% and 71% respectively i.e. out of 1142 goats surveyed 668 fell ill and 474 goats died. The average flock size of goat was 21. The total economic loss per household due to PPR was Rs.17411. A disaggregated analysis of economic losses in PPR affected households revealed that mortality loss contribute maximum share (85%) followed by morbidity loss (10%) which include weight loss, reduction in market value etc. and milk loss due to reduction in yield (2.5%). The opportunity cost born by the goat farmer share 2.5% which include cost of extra labour to care ill goats and extra feed fed. Total economic loss per animal due to PPR was Rs.829. Considering 0.17 as frequency of occurrence of PPR, per household per year economic loss was estimated to be Rs.2960 (Rs. 140/goat/year). Furthermore, unavailability of timely veterinary services, medicines and vaccine, high cost medicines and poor knowledge of identification of diseases and their symptoms were to be found major constraints in goat rearing.

Economic losses due to goat PPR diseases in study households (Rs/HH)

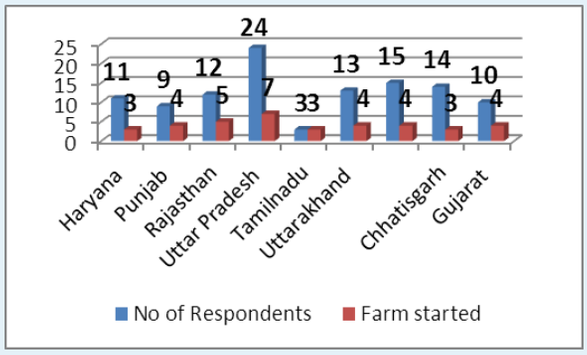
Particulars	Values
Mortality losses	
Number of study HHs	**54**
Number of goats in study HHs	**1142**
Average flock size	**21**
Number of animals infected	**668**
Number of animals died	**474**
Average loss per HH (Rs.)	**14,748.00**
Morbidity losses	
Milk loss due to reduction in yield	**456.00**
Losses due to weight loss, reduction in market value etc.	**1780.00**
Total morbidity losses	**2236.00**
Opportunity cost	
Expenses on veterinary care on survived goats	**172.00**
Extra labour charges	**148.00**
Other charges (extra feed etc.)	**107.00**
Total opportunity cost	**427.00**
Total losses due to disease	**17,411.00**
Per animal loss	**829.00**
Frequency of occurrence	**0.17**
Economic loss per HH per year	**2960**

Impact assessment of training programmes on scientific goat farming

Khushyal Singh, Braj Mohan, A.K. Dixit, Vijay Kumar

Data were collected from 111 trainees of 9 states namely, Haryana, Punjab, Rajasthan, Uttar Pradesh, Tamilnadu, Uttarakhand, Madhya Pradesh, Chhatisgarh and Gujarat to get feedback on performance of commercial goat farm, constraints in opening goat farms, knowledge, marketing channel, marketing problems, etc.

Figure 1: Number of Commercial Goat Farms



Out of 111, 37 trainees started commercial goat farms. Out of 37 trainees, from Haryana(3), Punjab(4), Rajasthan(5), Uttar Pradesh(7), Tamilnadu(3), Uttarakhand(4), Madhya Pradesh(4), Chhatisgarh(3) and Gujarat(4) started commercial goat farming with Non-Descript, Barbari, Sirohi, Salem black, Pallai, Tellicherry Kanni, Surti and Jamunapari breeds. The composition of flock mainly constituted with adult (62%) and kids/young stock (38%). The overall morbidity rate was 57.52% however, the rate was found slightly higher in young stock than adults. Mortality rate in goats in study was 26%. The kid mortality was particularly higher in all commercial goat farms. There were many constraints responsible for high mortality viz. low adoption of improved practices and preventive goat health calender, non-availability of critical inputs like vaccines, size of flock, type of housing, etc. Some problems of the commercial goat farming were also reported i.e. prevalent dystokia, abortion, stunted growth of kids.

Marketing of the animals was on the basis of estimate not on the weight basis. Middlemen and butchers mainly managed marketing of goats. Some of the commercial goat farmers were doing strategic marketing such as plan for Eid, Holi, Diwali and other local festival. They reared castrated male it gives better price to the farmers.

Result indicated highly varied level of adoption of technologies among the commercial goat farmers. Gap in knowledge and adoption of improved technologies was high due to inaccessible of critical inputs were the major factors responsible for low adoption. The level of adoption of these technologies was also not good. However there was a wide gap in the level of adoption and large proportion of the commercial farmers had not adopted the recommended technologies. The farmers realized remunerative price for pure breed animals as compared to non-descript goats

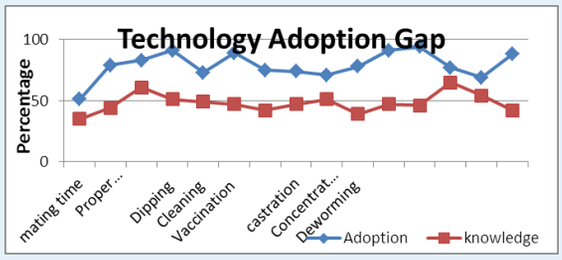


Figure 2: Technology Adoption Gap

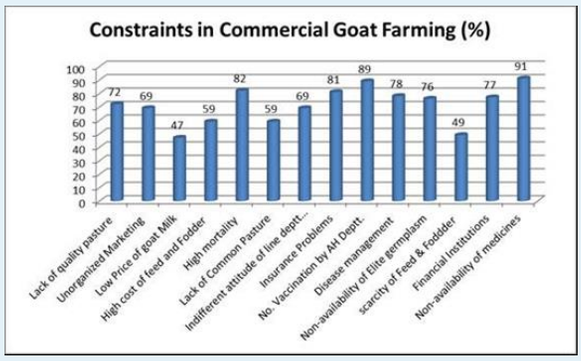


Figure 3: Constraints in Commercial Goat farming

The major constraints faced in the initial stage of goat farming were observed to be the high incidence of diseases and non-availability of vaccines, medicine and knowledgeable veterinarian, lack of elite germplasm and common pastures. Majority of these farmers struggled to sell their goats on live body weight basis and the price they realized ranged from Rs. 200 to Rs. 300 per kg of live body weight. The price was higher for castrated male for festive season. The farmers producing quality breeding-animals also got attractive prices from the goat breeders.

The majority of the farmers wanted to increase their flock size 200 – 1000 goats, but desired support in the form of technical knowledge and easy institutional finance, insurance are essentially needed for better flourishing the commercial goat farming in the country.

Break-even point varies from 22-30 months in different commercial goat farms. Sometimes spurious vaccines come in the market and it incurred heavy loss on commercial goat farms. It was reported by many commercial goat farmers.

AICRP ON GOAT IMPROVEMENT

S.K. Singh, M.S. Dige

All India Coordinated Research Project (AICRP) on Goat Improvement has been redesigned with modified objectives and technical programmes to accommodate farmers flock for long term genetic improvement under prevailing ecosystems. The project also enables conservation of goat genetic resources in their area of evolution and adaptation. The project explores genetic variations in local breeds through structured and systematic pedigree and performance recording of goats. Presently, fourteen goatbreeds are covered through eighteen centres located across the country which are coordinated through a Coordinating Unit located at CIRG, Makhdoom, Mathura. Three breeds i.e. Barbari, Jamunapari and Sirohi are being maintained under semi-intensive farming system with optimum feeding to explore their genetic potential in given environment. Other breeds viz. Assam Hill goat at Guwahati, Black Bengal at Kolkata and Ranchi, Gaddi at Palampur (HP), Marwari at Bikaner, Osmanabadi at Phaltan(Satara district of Maharashtra),Pantja at GBPUAT, Pantnagar, Sangamneri at Rahuri, Sirohi at Vallabhnagar (Udaipur), Ganjam at Bhuvaneshwar, Surti at Navsari and Malabari at Thrissurare being improved under farmer's flock in their respective home tract. Each field unit was persuaded to take up additional forth clusters as per revised technical programme of AICRP by the end of the year almost all units have adopted four clusters. A list of approved centre of AICRP on Goat improvement is shown in Table 1.Four units were persuaded to expand their area of coverage in Tribal areas under Tribal sub plan fund of the project. Assam hill goat unit is also operational in NEH region. In the XII plan from year 2014-15 Changthangi goat breed from Laddakh of region of J&K was added for conducting research on goats producing Pashmina under cold desert climate. The major thrust of the project is to build up long term capacity of goat keepers through technology demonstration, capacity building, application of health management practices andintroduction of genetically superior breeder goats for enhancing their production and reproduction potential.

The AICRP on Goat Improvement Centers

SN	Breed	Location of Centre	Type of Centre
	Project Coordinators Unit	CIRG, Makhdoom, Farah, Mathura 281122	Coordinating Unit
1	Assam Hill Goat Unit (NEH)	AAU, Khanpara Guwahati	Field
2	Barbari Unit	CIRG, Makhdoom	Farm
3	Bengal Goats (TSP)	BAU Ranchi	Field
4	Black Bengal (Partial TSP)	WBUV and FS, Kolkata	Field
5	Gaddi Field Unit(TSP)	HPKVV, Palampur (HP)	Field
6	Ganjam Field Unit	OUAT, Bhubaneswar	Field
7	Jamunapari Farm Unit	CIRG, Makhdoom	Farm
8	Malabari Field Unit	KV&ASU, Thrissur	Field
9	Marwari Field Unit	RAJUVAS, Bikaner	Field
10	Osmanabadi Unit	NARI, Phaltan (MH)	Field
11	Sirohi Field Unit (partial TSP)	RAJUVAS,VeterinaryCollegeVallabhnagar (Raj.)	Field
12	Surti Field Unit(TSP)	N.A.U., Navsari (Guj.)	Field
13	Sangamneri Field Unit	MPKV, Rahuri (MH)	Field

14	Sirohi Farm Unit	CSWRI, Avikanagar	Farm
15	Andamani Goats	CARI, Port Blair, Andman	Field
16	Himalayan Local Goats	IVRICampus,Mukteshwar	Field
17	Changthangi Goat Unit	SKUAST-K, Leh, J&K	Field
18	Uttarakhand Local Goats	GBPUA&T,Pantnagar	Field

Andaman Goat Unit, CIARI, Port Blair

Andaman local goat field unit was established during this year. Goat clusters wereadopted in Port Blair and Ferrargunj tehsils based on surveysconducted. Subsequently, farmers and their goats were registered.So far a total of 197 faremers have been resigetred under the projects. Mineral mixture powder were also distributed to the 120 farmers. A total of 8 elite Andaman local goat male bucks were purchased from the farmers field and is being reared at Institue farm for distribution to the farmers after attaiing the sexual maturity.A flock strength of 2649 goats have been recorded, of which 1656 were female and 993 male and adult does were 1033.During the period a total of 64 goats died and 93 were sold. The cause of death is mainly due to bloat, diarrhea, dog bite, accidents etc. A total 101 newborn kids were also observed. The average mean body weight at birth, 3, 6, 9 and 12 month of female goats was 1.71±1.23, 4.9±0.37, 8.49 ± 0.57, 11.15±0.97 and 15.11±0.73 and the respective weights of male goats were 1.99±0.15, 5.55±0.28, 10.19±0.73, 12.28±0.76 and 16.04±0.72. The overall chest girth (CG) for male goat at birth, 3, 6, 9 and 12 months was 25.9±2.18, 37.45±1.53, 47.25±3.51, 53.07±2.10, 60.12±1.89 respectively. Measurements for paunch girth (PG) at birth, 3, 6, 9 and 12 months were 26.19±3.02, 40.43±2.42, 53.42±5.01, 58.53±3.31, 64±2.62 respectively. Measurements for body length (BL) at birth, 3, 6, 9 and 12 months were 25.04±3.56, 36.02±1.45, 42.92±3.64, 46.76±2.67 and 49.25±2.25 respectively. Measurements for height at withers (HW) at birth, 3, 6, 9 and 12 months were 26.19±1.68, 36.07±2.91, 43.84±2.73, 49.35±1.47 and 53±1.56 respectively. Mean age and weight at first mating, age and weight at first kidding, service period, kidding interval and gestation period were 260±15.0 days, 8.49±0.89 kg, 420.0±12.0 days, 13.26±1.61kg, 101.20±11.23 days, 300.0±20.0 days and 147.0±2.0 days respectively . The kidding percentage on the basis of does kidded was 245.1 with a kidding rate of 1.07. Five awareness programmes on "Scientific rearing of goat for improving productivity" were conducted at Sippighat, New Bimblitan, Ranchi Basti, Calicut villages and one at Institute campus. In all, 211 farmers were trained.

Assam Hill Goat Unit, AAU Burnihat, Guwahati

The project is managed from the Goat Research Station, Burnihat, Kamrup campus of the university. There were 1980 goats from amongst 209 beneficiaries distributed in the four field clusters. The population growth was 104.23% during the year 2014-15. A total of 839 kids were born from 507 kidding with a kidding rateof 1.65. The highest kidding, 86 was observed in the month of October producing 152 kids. The twin and triplet kidding were 48.72 and 8.09 percent respectively during the year 2014-15 as against 39.80% and 8.6% in the previous year. The overall mortality rate was 6.82%. The major causes of mortality were pneumonia 21.63% followed by colibacillosis 19.29%. Predation by stray dogs and wild foxes was reported to be another important cause of mortality with 16.37%. The average morbidity was 15.88%. Dermatitis, itching 19.60% being one of the major cause of suffering followed by pneumonia 12.06%. During the period under report, 324 (12.93%) goats were sold and 31 (1.24%) were culled. The average family income from the goatery increased to Rs. 3525.12 from Rs. 3,461.72 recorded in the year 2013-14. The total income in the four field clusters were Rs. 7, 36,750.00. The Age and Weight at First Serviceand at First Kidding, Service Period, Kidding Interval and Gestation Period were 255.99±6.01 days, 10.12±0.33 Kg, 403.89±7.08 days, 13.56±0.32 Kg, 78.09±7.18 days, 225.13±6.16 days and 147.55 ± 0.66 days respectively. The mean weight of male and

female at birth were 1.41±0.09, 1.14±0.03; at 3 M 5.20±0.13, 4.96±0.07; at 6M 7.89±0.15, 7.53±0.18; at 9M 10.71±0.17, 9.87±0.16 and at 12M 13.68±0.49, 12.91±0.39 Kg respectively. To avoid inbreeding and to introduce genetic variability into the population, 16 superior bucks were distributed. Exchange of bucks between the field units to avoid inbreeding is also practiced on a regular basis.

Barbari Farm Unit, CIRG, Makhdoom, Farah, Mathura

Barbari, a dual purpose goat breed adopted for improvement and conservation of meat and milk production. A flock comprising of 977 goats were recorded at the institute during the year; 208 goats were sold for breed improvement to various agencies. A population growth of 145% were also recorded. Mortality as low as 3.8% was observed. Males and females for breeding were selected on the basis of prescribed index. During the year 377 kids were born from 240 doe @ 1.57 kid/doe. Population growth of flock was 147%. Incidences of Multiple born kids were 68% and 50% females delivered twin/triplet/Quadruplets births. Overall mortality for the year was 3.8%. Production performances for growth and lactation have significantly improved over the years. Three multiplier flock of Barbari goat has been established in Mathura, Agra and Dholpur district for the development of germ plasm resources, validation of technologies and development of model farm. Another 2 multiplier farms are in pipeline. Superior 208 germ-plasm of breed was distributed to goat keepers and development agencies for field improvement and conservation of Barbari goat.

Bengal Goat Unit , BAU , Ranchi

There were four center of AICRP on Goat improvement namely Beko (Jamshedpur), Palajori (Deoghar), Tiko (Lohardaga) and Chamguru of Ranchi districts they are functional. During the year 2014-15, 46 bucks from Beko,Palajori, Tiko and Chamguru centre were exchanged among the farmers after testing the semen quality. Local bucks and male kids were culled /castrated to prevent matting by them. During the reporting year a total of 886 kids were born. During the year 2014-15, a total of 345 kids were castrated at centres. All the goats of all centers were provided with timely health coverage like vaccination, Deworming and dipping and supplementary feeding. At the end of March 2015, there were 350, 669, 517 and 473 goats at Beko, Palajori, Tiko and Chamguru centres, respectively. The overall body weights were recorded at birth, 3 month, 6 month, 9 month and 12 month of age and are found to be 1.28±0.06,5.94±0.08, 9.15±0.15, 11.45±0.20 and 13.58±0.09 kg respectively. The kidding percentage based on does tupped and does available was 91.53 and 90.07 at Beko centre. The corresponding values for PalajoriTiko and Chamguru centre were 87.23% and 86.25%, 88.23 and 86.52, 90.54 and 89.12, 91.32 and 89.86 respectively. Kidding patterns single, twin, triplet and quadruplet were recorded as 55.51, 43.78, 2.59 and 0.70 %, for respectively at Beko centre 53.21, 43.75, 2.32 and 0.72% respectively at Palajori centre 52.94, 43.55, 2.82 and 0.69%, respectively, at Tiko center 53.00, 43.63, 2.82 and 0.55 %, respectively at Chamguru centres. Body weights at various stages have increased over the base population due to regular vaccination, deworming and dipping.Improved feeding practices have resulted in improved health status of the goats. Mortality was reduced up to 9 percent at the farmer flock. A five day farmers training programmes were organized during 9 to 13 March 2015 at Small Ruminant Instructional Farm, R.V.C Kanke for farmers of all the centers. Farmers started keeping goat in separate house Farmers have started selection of male and female and mating their goats with improved black Bengal Buck. Due to intervention of AICRP on goat farmers are raising more goats resulting more income from goats. Farmers of different centers earned Rs 985200/= 00 from sale of 349 goat during the reporting year. Two NGOs have purchased 13 breeding bucks from centers. 5 bucks have been sold to KVK, Jagarnathpur W. Singhbhum, Jharkhand. A number of goat breeder also purchased breeding bucks from our centers.

Black Bengal Goat Unit , WBUV&FS, Kolkata

During 2014-2015, a new village Beliapukur with 86 does in M-J Block of Murshidabad district was adopted in collaboration with KVK Digha. Another cluster in Jhargram Block of West Midnapur having tribal farmers at Lodhasuli (Dhangri, Ranidihi, Manapara and

Malapada villages) was added wherein 217 does were registered. The production performance of 638 does and 1285 kids born from 691 kidding were recorded. Twenty two bucks were purchased on basis of 6M body weight and prolificacy of their dams. Out of these 15 new bucks were distributed in the village units.The flock strength in the beginning was 1761and at the end of year was 2257. On the basis of initial doeannualpopulation growth was 57.93%. The average flock strength in the farmers flock increased to 5.94 from 4.50 in previous year. The initial flock strength per farmer was 2.53 in 2002-2003. Forty six percent farmers have had a flock of 1 to 4 goats, 35% had 5 to 8, 14% had between 9 to 12 and 4.4% had above 12 indicating that Black Bengal goat are reared by small flock size.The average body weight at birth, 3, 6 ,9and 12 M were 1.203 ± 0.005 kg, 4.998 ± 0.035 kg, 7.378 ± 0.048 kg, 9.845 ± 0.065 kg and 12.419 ± 0.101 kg respectively. Improvement in reproductive performances has also been noticed from previous year. During 2014-15 the average age at first service and kidding were recorded as 237.54 ± 5.07 days and 383.23 ± 5.31 days respectively; the respective values were 304.47 ± 23.77 days and 439.17±24.67 days in 2013-14.The average service period, gestation period and kidding interval was 91.94±3.06 days, 147.39±0.26 days and 237.79 ± 3.04 days in all village units during 2014-15. Maximum number of kiddings occurred between Augusts to February months, although hit was distributed throughout the year. The kidding rate was 1.86 %. Percent single, Twin and triplet kidding were 31.69, 52.82 and13.31.Few quadruplet kidding (2.17 %) were also observed. With the intervention of health care and preventive the kid mortality (upto 12 month) has been restricted to 6.01%with overall mortality of 6.19 %. In marginal (upto 20 katha land), small (20 - 40 katha land) and medium (above 40 katha land) farmer's annual income was around Rs. 4603.77±267.62, Rs. 4636.74±468.24, Rs. 5961.84±698.00 respectively. Amongst illiterate, partially literate (Class-I to IV) and moderately literate (Class-V to XII) annual income was around Rs. 4687.16±329.38, Rs. 4873.96 ± 395.35, Rs. 4881.58±428.21 Animals sold by the farmers are 23.14 % in 2014-15. The average annual income from a doe has substantially increased to Rs. 2790.00 in 2014-15. The average annual income of a farmer has been recorded as Rs. 4820.12±225.27 in 2014-15.

Changthangi Goat Unit, SKUAST-K, Leh

This is a newly established unit. Kharnak, Samad and Korzokvillages were adopted where in a 30 families were registered. The overall Changthangi goats from 30 registered families were 8400. In all 2750 breedable does and 70 breeding bucks were followed/ monitored. A farmer data register was issued to each family so that all the data related to goat production could be recorded by enumerators of the area from time to time. Health management issues were taken up. The major goat diseases observed were, FMD, CCPP, and contagious ecthyma, coccidiosis in kids, conjunctivitis, and abortion of unknown etiology. The endoparasitic diseases affecting the goats were liver fluke infestation, a flock of 20 Changthang does and 2 Changthangi breeding bucks were maintained as nucleus flock. The performance and pedigree recording is in progress.

Gaddi Field Unit, YSPHPKV, Palampur (HP)

The opening balance was 1197 goats including 646 breedable does. During the year, a total of 589 young kids were added in selected flocks by way of birth, 195 animals of different age groups died and 427 animals pertaining to different age groups were sold by the owners. The closing balance as on 31.03.2015 was 1164 animals under different age groups. For production of breeding bucks 25 male kids of 4-6 months age group were purchased on the basis of performance fromadopted farmers. These male kids were then transferred to Palampur center for subsequent rearing up to the age of sexual maturity, following all standard management practices. After final selection, a total of 16 males were finally distributed to 15 different farmers as a breeding input. In addition, 39 male kids were also purchased during March, 2015 for the distribution as breeding buck to the farmers during financial year 2015-16 and are being reared at Palampur center. All selected animals were provided health coverage under migratory field conditions viz. vaccination against PPR (1200 doses), de-worming against endo-parasites after fecal sample analysis (800

animals), periodic health check-ups etc. Strategic supplementary feeding was also provided in the form of mineral mixture (180 Kg) and concentrate feed (24 qtls.) supply. Collaboration with state Animal Husbandry Department was ensured while providing health coverage and other related activities. The overall population growth was observed to be 104.73%. The overall mortality incidence was found to be 10.92%. The incidence of twin birth was recorded 21.19%. The overall abortion incidence in the flocks was observed to be 6.58%. The kidding rate of the flocks was observed to be 1.21%. Maximum kidding was recorded in the month of November (187 kids) and December (148kids).

Ganjam Field Unit, OUAT, Bhubaneshwar

Three new villages Bharasa, D. Guhariapat and K. Guhariapat in the Khallikote cluster was adopted last year and 10 farmers were registered respectively belonging to the scheduled tribes(ST). All the breedable does of the newly adopted farmers were identified with poly urethane plastic tags.Action was initiated for starting a new cluster at Bhanjanagar and nearby area for taping the genetic variability of the Ganjam goats. Eleven young sleeted bucks were provided to three farmers. A total of 6500 dosages of Enterotoxaemia, 1500 dosages of PPR and 2000 dosages of goat pox vaccines were given to the goats. Deworming dosages distributed were 10,232 and number of goats treated 1562. The kid mortality always remained below 6 per cent over the year and whereas last year it was 10.47 per cent. This year there is substantial reduction in kid mortality which stands at less than 6.0 per cent. A total of 1351 goats were recorded for the growth traits and 184 recordings were done for the reproductive traits. Beside this 320 adult goats were recorded for the growth and morphometric traits as per their dentition groups.The overall means of body weights of goats were 2.40 ± 0.03, 7.51± 0.06, 9.88±0.06, 14.52± 0.10 and 18.44 ± 0.16 for birth,3 month, 6 month, 9 month and 12 month of age respectively. There has been improvement of 2.64 kg for the 9 month body weight till the current year as compared to the base year(2001) and improvement of more than 6.01 kg has been observed in the yearling body weight over the base year. A total of 21 progenies were recorded at recorded from the three breeding bucks distributed last year to the newly adopted farmers. The number of kids born were 2187 from 3456 breedable does from all the three centres of Chhatrapur, Rambha and Khallikote which is kidding percentage increased from 60.2 percent last year to 63 percent in the current year. A trial conducted on the comparative efficacy of anthelmintic on gastro-intestinal nematodes concluded that Ivermectin was most effective in reduction of Eggs per gram of faeces but closantel gave longer protection against reinfection beyond 14 days.

Himalayan Goat Unit, IVRI, Mukteshawar

All India Coordinated Research Project (AICRP) on"Himalayan goat unit" was initiated at Temperate Animal Husbandry division, Indian Veterinary Research Institute, Mukteswar campus on 14th June, 2014 with objective of Himalayan (Chaugarkha) goat improvement and enhance its productivity, which in turn to improve livelihood of local farmers as this goat adopted very well in Kumaon region based mid Himalayas of Uttarakhand. To map the breeding tract and distribution of Chaugarkha goats, surveys were conducted in various places of three districts, namely Dhol, Jhal Dungra (Lamgarha block), Khola, Gandhak, Mirtola (Dhauladevi block) of Almora district (original breeding track of Chaugarkha goats), Talle and MalleDeeni, pahadpani, Saspani (Dhari block), Supi, Bichgali (Ramgarh block) of Naintal district and Gangolihat (Gangolihat block) of Pithoragarh district. After survey, it has been found that Chaugarkha goats mainly distributed these areas, therefore, Khola, GandhakMirtola(Dhauladevi block) has been identified as one of the clusters. The survey results showed that the animals are mainly managed in unorganized system, feeding purely based on browsing in jungle bushes, tree fodders and agriculture wastes, barely animals get concentrates. Chaugarkha goats are small size breed reared mainly for meat purpose and the average herd size is 8 to 12 goats (herd size is varying from 2-6 to 25-30 goats). The colours of the breed are black, fawn and white with stripe on face, which run downwards from base

of horn to back of muzzle. Forehead is small to medium size, convex, tapering muzzle with alert eyes and Roman nose. Both male and female adult have straight horns (6-9 cm). The maturity age of female is 10-12 months and age at first kidding is 16-18 months. Majority of females deliver one kid per kidding twice a year, however, twinning also frequent in healthy goats. The adult body weight between 15-20 kgs. Four seventy six (476) faecal samples were collected for identification of parasitic infections. The qualitative, quantitative and culture analysis revealed that strongyles (Mainly *Haemonchuscontortus* and *Teladorsagiacircumcincta*), *Moniezia* and coccidia are common infection of these goats. The preventive health measures have been initiated to control parasitic infection.

Jamunapari Farm Unit, CIRG, Makhdoom, Farah, Mathura

The annual flock strength of Jamunapari goats for the year 2014-2015 showed opening balance of the flock was 741 and closing balance was 747. During the period 348 kids were born, in which 155 were males and 193 were females. The population growth of the flocks was 113.9% during the year. The overall mortality of the flock during the year 2014-15 was 3.94 % and annual culling rate was 3.12 %.The mean of body weights of kids at birth, 3, 6, 9 and 12 months of age during the year were 3.28, 12.77, 18.12, 23.55 and 28.311 kg, respectively. Parity of dam had significant effect on kid's body weight and males had higher body weight than females at all the ages. The mean body weight under intensive management at 12 months of age was 45.705 kg and the highest value was 52.0kg. The average daily weight gain (ADG) of the kids under intensive management was 111.0, 115.3, 11.3, 119.9 and 111.5 g/day, respectively during 3-6, 3-9, 3-12, 6-9, and 6-12 month age group. The highest value of ADG was 152g/d during 6-9 months of age. Least squares means of part lactation milk yield in 90 days and 140 days were 78.07±2.37 and 110.67±3.78 liters, respectively during the year 2014-15. Parity had significant effect on milk yield over the years. The doe, which had multiple births, produced more milk in comparison to doe having single kid. During this year, a total of 233does kidded 348 kids, out of which single, twin and triplet born kids were 119,226 and 3 respectively. Reproductive performance of Jamunapari goats in terms of breeding efficiency and kidding percent on the basis of does selected for breeding were 84.69% and 118.3%, respectively. The kidding rate was 1.49.Improved animals were supplied to various developmental agencies, farmers and state governments, Non-Government Organizations and progressive breeders for genetic improvement in the field conditions. During year, 224improved animals were distributed to goat breeders for breed improvement of their flocks and 28 animals were transferred to other division for experimental use.

Malabari Field Unit, KVA & S, Trissur Kerala

Malabari goat field unit started in April, 2001 with an objective to bring about the improvement in the farmers flock in its home tract. Project operates in six field centres viz. Thalassery, Badagara, Tanur, Perambra, Thalaiparamba and Kottakkal located in the North Kerala. Baseline information on production, reproduction and management practices were collected. Males selected from multiple births on the basis of body weight at 6/9 months of age and distributed to farmers. Breeding values were estimated by contemporary comparison for body weight at below one, three, six and nine months of age in different field centres. Health measures like periodical deworming, vaccination and supply of feed supplements were carried out. Total of 1336 animals from 335 farmers were registered and all adult females (1082) were provided with insurance coverage under the project. The participation of women was 66.50%. The overall population growth recorded was 87.47% with flock size of four to five. Majority of goat keepers (93.30%) in the project area had school education with land holding of below 25 cents. Average flock size was 3.70 adult female goats. The percentage of singles, twins, triplets and quadruplets were 44.31, 48.98, 6.41 and 0.30, respectively in the Malabari goat population. Mean average daily milk yield recorded was 0.86±0.04 litres. Body weight at one, three, six, nine and twelve months of age was 3.20±0.09, 8.65±0.20, 14.80±0.30, 19.45±0.54 and 21.80±0.90 kg, respectively. The mean of

age at first kidding and inter kidding interval were 396.20±11.30 and 277.50±14.20 days, respectively. The production economics was calculated under field conditions and the main source of income was from sale of kids. Enteritis was the major cause of morbidity followed by Pneumonia. Kid mortality was 4.7% in project area. During the year, 16 training sessions on goat rearing were conducted to 395 farmers. Intensive training on goat rearing with 2-4 days duration was imparted to 56 farmers. A Samagra goat village scheme has been launched in collaboration with self help groups to establish 20 elite Malabari breeding units in the home tract and five bucks were supplied in first phase.

Marwari Field Unit, RAJUV&AS, Bikaner

One new help centre of Marwari goat was established in Depalsar village of the Churu District of the Rajasthan, which is approximately 189 km away from the Marwari Unit head quarter. With addition to this cluster, the Marwari Field unit is having five clusters viz Bikaner (Deshnokh, Kalyansar-Raisar and Daiya), Jodhpur (Kan Singh Ki Sidd) and Churu district (Depalsar) from distant corners of breeding tract to explore maximum genetic variation available in the breeding tract. All the registered goats of new cluster and existing clusters were identified by plastic ear tag. Twenty superior Marwari bucks were disseminated free of cost to adopted flock and 10 bucks on cost basis to the other agencies for breeding purpose. The 28 male kids were selected for first stage of selection and are reared till the age of final selection for future buck. The 1307adult does of all adopted clusters under the project were recorded for growth, milk yield, reproduction and health parameter.The body weight at birth and 12 months of age was improved by 13.86 % and over the baseline performance (2.257 kg). The overall least square mean for body weights at birth, 3 month, 6 month, 9 month and 12 months of age were 2.57, 8.47, 14.01, 19.05 and 26.18 Kg, respectively. The birth weight was significantly influenced by cluster, sex of calf, single/twin kid and kidding month. This improvement is due to distribution of selected elite sires in farmers' flocks and effective health coverage. The test day milk yields of about 200 does were recorded fortnightly during the lactation. No special care to the dam or neonatal kid in the form of concentrate feeding is practiced. A total of 24133 animals of the flock were provided health coverage by way of vaccination against PPR, ET, dipping and de-worming besides strategic supplementary feeding in the form of mineral mixture. Reduction of the mortality rates in the farmers flock. Goat farmers were sensitized to form goat breeder/cooperative societies.

Osmanabadi Unit, NARI, Phaltan (MH)

The Osmanabadi Field unit works in four village clusters - Wadgaon in Satara district, Kamone in Solapur district and Sakat and Borla in Ahmednagar district. Total 605 adult does and their 1176 kids were recorded during 2014-15. The numbers of recorded goats were 125, 195 and 285 adult female goats in Satara, Solapur and Ahmednagar districts respectively, belonging to 188 goat keepers. The average number of goats per household was thus 3.22. All goats and kids were protected with vaccination as per schedule and deworming and spraying as required. About 90% of the does older than one year, kidded during the year. 15-20% of those kidded twice in the year. The average litter size from 698 kiddings during the year in the four villages was 1.69. The mortality among kids younger than 3 months was 6%. Overall mortality was 3.9%. 35% male and 22% female kids of the age of 3-6 months were sold in total from all villages. Out of the remaining kids, 65% males and 44% females were sold at the age of 6-12 months. This means that about 40% of the female kids were retained for breeding. Only about a third of these are needed as replacements. This means that the remaining two thirds of the kids contribute to increasing the number of adult goats reared for production. The 100-day milk yield of does (1077 records) that had given birth to single, twin and triplet kids was 64.0±1.9 kg, 97.8±1.6 kg and 131.4±3.3 kg. Goats from Kamone in Karmala taluka had 34% higher least-squares mean 100-day milk yield than those in Phaltan taluka. The overall least squares mean weight (total number of records 2068) was 2.4±0.06 kg at birth, 10.5±0.2 kg at 3 months, 15.7±0.6 kg at 6 months, and 22.7±1.9 kg at 9 months. The highest weight at 3-months

was 20.0 kg while the highest weight at 6 months was 30.8 kg. We have so far frozen 8419 semen doses of 30 Osmanabadi bucks in straws in the 'State of the Art Buck Semen Freezing and AI Centre set up with a grant from the Government of India. 4000 straws out of these were supplied to the Government of Maharashtra for their A.I. centres in five districts; 2124 straws were supplied to 22 Field AI technicians in Maharashtra (Aurangabad, Ahmednagar, Hingoli, Kolhapur, Nashik, Pune, Sangli, Satara and Solapur districts) and one distributor in Karnataka and there are 1291 straws in storage. We have thus given breeding support to non-adopted areas in the fulfilment of one of the important objectives of the AICRP on Goat Improvement. Two visits of 19 Pashumitra group members from Sakat and Borla were organized to NARI's livestock and fodder farms on 30 May and 16 September, 2014 respectively. We have finished refining and fine-tuning our MS Access database of the Osmanabadi field unit and putting it on the SQL platform for ease of data entry and data retrieval. Some enterprising goat keepers like Dattatray Jagtap of Wadgaon have benefited immensely from the Osmanabadi Field Unit. Dattatray had 3 goats when he joined the project in 2009 and now has 21 goats and earns almost Rs.300 per day from goat rearing (with help from his wife and father), in addition to income from cultivating his land.

Sangamneri Field Unit, MPKV, Rahuri

The programme was initiated by registering 500 does. However during year, 2014-15, 1348 breedable does were registered under 4 clusters i.e. Sangamner, Shrirampur,Rahuri and Belha located under 3 districts Ahmednagar, Nashik and Pune. Total 48 breeding bucks were rotated in the selected villages. 1909 progenies were generated in the field during the year. The overall least square means obtained for 1,3,6,9 & 12 month body weight 4.98±0.05(9782), 9.18±0.09(8420), 13.97±0.20(3198), 18.36±0.26(17.88) and 22.50±0.33 (1184) kg respectively. All the nongenetic factors i.e. villages cluster, year, season & type of birth and sex resulted significant influence up to 6 months body weight, however the season does not shows significant influence on the body weights at 9 and 12 months of age. The age at first conception and age at 1st kidding showed considerable improvement as the age at first conception and first kidding reduced i.e. 309.68±11.76, 407.65±12.09 days respectively. The kidding interval is also reduced from 266.36±9.45 days to 238.73±9.28 days. The numbers of kids per kidding were1.83 most of the reproductive traits were significantly influence by various non-genetic factors. The 90 days milk yield is increased by 6.09 lit. over the last year (92.69±1.90 to 97.56±1.83 lit). The Sangamneri field unit is working in two dimensions i.e. improvement through selective breeding and increasing of Sangamneri population by adopting up gradation through selective breeding accordingly. The Improvement in body weight at 1, 3, 6, 9 &12 months data was 1.84, 6.74, 10.43, 10.07 and 14.16 per cent respectively over the baseline performance. Similarly the milk yield also improved by 55.52 per cent over baseline data. ii The population of the Sangamneri goats increased by 52.90 percent over the last year in the registered cluster. However the population in the breeding tract increased by 399.52 percent i.e.3759 during 2006-07 to 15018 during 2014-15. During this year four KVKS (Babhaleswar , Naryangaon , Malegaon and Nashik)in the breeding tracts have been involved in improvement programme and 15 bucks were supplied to them to execute the programme Special goat training programme have been organized through the KVKS to create the awareness regarding conservation of Sangamneri goat. Five thousand frozen Semen doses of elite bucks have been prepared and will be submitted to NBAGR shortly. Fourteen elite female and 6 bucks were purchased. Prophylactic measures were carried out by vaccinating 4131 goats against ET and PPR and deworming of 3486 goats were done with the help of Department Animal Husbandry. The demand for Sangamneri bucks in increased accordingly during this year 45 bucks, & 34 were does sold to the goat keepers through revolving fund Project of the MPKV. The unit had been included women's self help groups through which Mrs. Surekha Subhash Shinde, at Gogalgaon Dist- Ahmednagar made victory by selling the 7 male kids of 4 months age at Rs.35000/-. Mrs. Latabai Haribhau Kadu, At/P-Gogalgaon Dist-Ahmednagar aban-doned

woman is self sustaining by Sangamneri goat keeping. Two heifers were purchased by Shri. Babasaheb Kashinath Gade A/P. - Jogeshwari Akhada, Tal. Rahuri are purchased by utilizing the income from the goats.

Sirohi Farm Unit, CSWRI, Avikanagar

The opening balance on 01.04.2014 was 211 males and 446 females totaling 657 animals. The additions during the year were due to birth of 144 male and 142 female kids. The reductions were due to death of 5 males and 10 females, culling of 12 males and 27 females, sale of 128 males and 89 females. The closing balance as on 31.03.2015 was 201 males and 462 females totaling 663. The overall least squares means (2010-11 to 2014-15 born animals) for live weights at birth, 3, 6, 9 and 12 months of age were 3.04, 11.93, 18.39, 24.46 and 29.26 kg, respectively. The growth rate in terms of per day average gain was 98.70 and 63.91 g from 0 to 3 months and 3 to 12 months of age, respectively. The overall least squares means (2009-10 to 2013-14 kidding) for milk yield at 90 days, 150 days, total lactation milk yield and lactation length were 74.64, 101.86 and 109.50 kg, and 182.87 days, respectively. During the year, out of 319 does available for breeding, 317 were tupped and 262 kidded with 21 giving birth to twins. The tupping percentage was 99.37. The breeding efficiency was 86.13 % on the basis of does available and 86.69 %, on the basis of does tupped. The kidding percentage was 91.29 and 91.88 on the basis of does available and does tupped, respectively. The litter size was 1:1.08. The overall mortality rate was 1.59 percent. A total of 217 animals comprising of 128 males and 89 females were sold to the progressive farmers, Government and Non-government agencies for improvement of their goats for meat and milk production. The total receipts from sale/transfer of live animals, sale of milk, culling etc. during the year was Rs 15,35,601.00.

Sirohi Field Unit, Veterinary Collage, Vallabhnagar

On-going AICRP on goat improvement (Sirohi field unit) came in to financial existence on 1st January 2001, with the main objective to bring about the improvement in the farmers flock. As per technical programme base line information on production and reproduction traits, managemental practices, production trend and disease pattern were recorded and analyzed. The registration of farmer's flock and the identification of animals were carried out in four clusters. The data on growth, lactation and reproductive performance of Sirohi goats under field conditions have been analyzed using least square techniques since 2009. The closing balance of the registered flock was 1652 animals including 1125 females. During report period, 488 kids were born out of which 256 were males. During report period population growth was 84.63% recorded. The least square means for body weight at birth, 3, 6, 9 and 12 months of ages were 2.24±0.03, 13.69±0.20, 18.07±0.33, 21.69±0.61 and 26.68±0.64 kg, respectively. The body weights increased over the years. Heritability of birth weight was found to be moderate. Year, season of birth, sex of kid and type of birth have significantly affected on the body weights. Kids born between months July-October had higher weights at birth and 9 months body weight whereas kid born between March to June had higher body weight at 3,6 and 12 months of age. Single born kids were significantly heavier than the multiple born kids at all the ages. Genetic parameters for growth, lactation and reproductive traits were estimated. Total 28 breeding bucks were distributed to registered farmers during the report period for further genetic improvement in the field. Additional three TSP centres are added and 18 bucks were distributed in TSP center. Kidding rate of 1.25 was observed during the period. The absolute selection differential of 4.89 kg for 3 months body weight and 9.75 lit for 90 days milk yield were observed for future set of bucks. Major diseases observed in the registered animals were enteritis and pneumonia.

Surti Field Unit, N.A.U, Navsari (Guj.)

During this year the unit had organized 14thAnnual review Meet of AICRP on Goat improvement between 29-30 September 2014 which was attended by Delegates from ICAR (ADG, Directors CIRG and NARI Phaltan) and Scientist from different SAUs (30 No) participated. In this review meet during inaugural programme two success stories of two goat farmers (Dipeshbhai Ahir & RaisinghbhaiVasava) were released. On the

second day field visit to Farmer Flocks and Buck show was organisedVill-Sukhesh (RamporeFalia), Taluka- Pardi, Distt-Valsad. Moreover, there was Consortium meet "GOAT MILK PROCESSING ON COOPERATIVE BASE IN GUJARAT" Jointly organized by AICRP on Goat Improvement- Surti Field Unit, BVG India Ltd, Boga Group & South Gujarat Goat Farmers Cooperative Union (SGGFCU). The review meet had come up with acknowledgement of phenomenal progress by Surti field unit during last three years along with future path to be followed. With continuous bilateral efforts from farmers and Surti field unit tribal farmers have started 14 notified village levels goat cooperatives out of which 3 had already been provided with accreditation of registered cooperatives by District Registrar. Eighteen (18) on campus, 21 FLD's (field visits and demonstrations), were organized by the unit.As an achievement a total of 8 Surti bucks had been supplied in field to minimize the problem of non-availability of Surti bucks. Additionally 20 bucks are ready for dissemination this year. In field a total of 08 new goats were registered and a closing balance of 535 white Surti goats was observed. Many of the progressive farmers had come forward and shown their commitment to retain Surti type goats in future after being taught about importance of this goat by AICRP Surti field unit staff. As an achievement continuously increasing trend in registered Surti goat population have been achieved under the project area during last six years.There was 16.71% increase in birth weight and 14.13% increase in total milk yield had been observed from 2009 to 2014 in adopted villages. During the current year the least square means for body weight at birth, 3, 6, 9 and 12 months of ages was 2.0±0.24 (518), 8.08±0.10 (335), 13.70±0.20 (247), 19.67±0.23 (208) and 23.19±0.32 (92) kg, respectively. Season of birth, sex of kid, breed, type of birth and clusters had significantly affected the body weights. Kids born between November and February months (winter) had higher birth weights at birth, 3, 6 and 9 months. Kids born during summer had shown highest body weight at 12 month of age. Single born kids were significantly heavier than the multiple born kids during first nine months, whereas differences get subsides as they approach 12 months of age. Kidding rate had been increased to 1.47 from 1.41 since 2009 justifying higher prolificacy in Surti Goats. Overall mortality in Surti flocks was 5.55%.

Two research papers & seven abstracts had been published and four research papers had been communicated for publication from the research work done on Surti goats under the scheme. Ten (09) Post Graduate and five (5) Departmental collaborative research works had also been undertaken in the scheme. Surti goat population need to be conserved and improved in time and it can pave the possibility of improving other non-descript breeds of the area through proper breeding plan. Overall there is a great scope of providing due importance to higher fecundity genes and milk producing ability of Surti goat breed.

Uttrakhand Goat Unit, GBPUA&T, Pantnagar

Uttarakhand Goat Unit was added from beginning of this year, however, it was launched at Department of Livestock Production Management, College of Veterinary and Animal Science, G.B.Pant University of Agriculture & Technology, Pantnagar on Aug. 29, 2014 with objective of improving uttarakhand local goats. A new breed named 'Pantja' goat registered through NBAR a national nodal agency to register new breeds. Since, a new breed got registered, work was focused to map the breeding tract and distribution of Pantja goats. Forrmats were prepared and surveys were conducted in these districts and adjoining areas, totaling about 39 villages. After survey, it was found that Pantja goats are mainly distributed in the areas, namely Bara, Kunda, Tilpuri and Bhimtal. Therefore, these areas were selected as clusters for further research and improvement work. The survey results showed that the goats are mainly managed in unorganized manner as subsistence farming and feeding was purely based on their browsing in fields bushes, tree lopping and agriculture wastes, without any provision of concentrates. Pantja are medium sized goats reared mainly for meat purpose with average flock size of 7±2. However, the flock sizes as big as 35 to 62 have also been observed. The composition of the flock for does, bucks and kids being 48, 1 and 51 per cent, respectively. Traditionally, buckling have

been castrated by incision method at about 10 days age and hence Pantja bucks were not commonly seen with small flocks. People consider meat of Pantja wethers as highly delicious. The colour of the goats is brown/ fawn, getting lighter ventrally with stripe on face. They are very active but docile and morphologically resemble with deer. Pantja have small sized horns (about 10 cm), which are triangular, twisted, pointed at tip and oriented slightly upwards and backwards. Their birth weight and yearling weight in male and female is 1.9±0.2, 1.7±0.2 and 21.1± 2.1, 17.5±1.7 kg, respectively. The age at sexual maturity of female ranged between 9 – 11 months and age at first kidding between 14-15 months. Majority of females deliver two kids (67%) per kidding, however, tripleting is also frequent in healthy goats. Being poor, the goat keepers maintain goats un-hygienically. Thus, a lot of these goats suffer from parasitism (external and internal), coccidiosis and PPR. Attempts have been initiated in preventive health care by supplying them with lime for its spray on the floor of the goat house, and mineral mixture, deworming and vaccine. Department is maintaining an elite flock of Pantja and a total of 9 bucks from this flock have been supplied to the farmers in the field for genetic improvement of the goats. Besides, 9 castrations have been performed in the field. A facility of natural service to the local goats has been created under the project.

METEOROLOGICAL OBSERVATIONS (2014-15)

N. Ramachandran & S.P.Singh

Months	Mean Max Temp. (°C)	Mean Min Temp. (°C)	Mean Daily Temp. (°C)	Mean Vapor Pressure (mmHg)	Mean RH (%)	Mean RainFall (mm) /WetDays	Sun Shine (hrs)
April 2014	39.55	20.42	29.98	11.99	31.49	3.40 (2)	286.40
May 2014	43.40	25.55	34.48	14.87	30.94	5.80(5)	316.60
June 2014	45.12	29.10	37.11	18.70	36.81	25.40(3)	245.70
July 2014	38.89	27.74	33.31	25.19	64.06	64.60(10)	159.50
August 2014	37.47	26.74	32.10	26.11	70.07	138.20(11)	212.60
September 2014	36.67	24.82	30.74	23.46	41.28	75.00(9)	236.10
October 2014	36.16	19.50	27.83	16.69	49.85	0.00(0)	232.20
November 2014	31.58	12.77	22.18	11.21	46.36	0.00(0)	189.50
December 2014	22.63	6.86	14.75	9.18	66.54	1.00(1)	138.80
January 2015	17.79	7.68	12.73	10.09	82.32	29.00(6)	84.10
February 2015	28.09	11.41	19.75	12.68	61.64	0.00(0)	212.20
March 2015	31.05	15.19	38.65	14.43	56.13	40.00(8)	246.80

Maximum temperature: 49.5 °C on 30.05.2014, 06.06.2014, 07.06.2014, 08.06.2014 and 09.06.2014.
Minimum temperature: 1°C on 28.12.2014.
Annual Rain Fall: 382.4.4 mm in 55 Days.
High sunshine: 11.7 hrs on 02.06.14.

Kiddings

Breed	Total
Barbari	**375**
Jamunapari	**348**
Jakhrana	**106**
Sheep	**225**
Total	**1054**

Milk production

Breed	Milk (in Kg.)
Barbari	**8107.50**
Jamunapari	**14723.75**
Jakhrana	**9596.75**
NFR&PT Experimental Shed	**6319.75**
PR&SM Experimental Shed	**3778.50**
Total	**42526.25**

TEACHING AND TRAINING

Teaching

Three postgraduate students from IVRI completed thesis research work for M.V.Sc degree. During the year five M.V.Sc. students (04 IVRI, 01 DUVASU) submitted thesis. During the year 7 M.V.Sc. (06 IVRI, 01 DUVASU) and 10 Ph.D. (04 DUVASU, 04 GLA, 01 IVRI and 01 MU) students are conducting research under different scientist
Teaching and Trainings of the Institute. Students of different academic colleges and veterinary colleges visited the institute laboratory and livestock Units.

Training

The following training programs were organized by the Institute during the year 2014-2015.

National Training

- Ten days 58th National Training Programme on Scientific Goat Farming on 21-30 May 2014. In this training programme 51 participants from 14 states were present.
- Ten days 59th National Training Programme on Scientific Goat Farming on 3-12 September 2014. In this training programme 64 participants from 12 states were present.
- Ten days 60th National Training Programme on Scientific Goat Farming on 9-18 October 2014. In this training programme 42 participants from 13 states were present.
- Ten days 61st National Training Programme on Scientific Goat Farming on 3-12 February 2015. In this training programme 62 participants from14 states were present.

Sponsored Training

- 5 days sponsored training programme on Scientific Goat Farming on 19-23 August 2014. In this training programme 5 VO and 23 farmers participated. Sponsored by Deputy Director, vet services Jaspur district of Chattisgarh under farmers' skill development programme.
- 5 days sponsored training programme on Scientific Goat Farming on 23-27 Sept. 2014. In this training programme 2 VO, 3 VAFO and 28 farmers total 33 participated. Sponsored by Deputy Director, vet services Jaspur district of Chattisgarh under farmers' skill development programme.
- 5 days sponsored training programme on Scientific Goat Farming on 27-31 October 2014. In this training programme 19 farmers and 6 farm women participated. Sponsored by Department of Irrigation and Water Resources, Hathras, Uttar Pradesh.
- Model Training Course (MTC) on Sustainable Development through Improved Goat Husbandry Practices on 14-21 November 2014 (8 days). 20 Assistant Directors and VOs from 7 states participated. Training was sponsored by Directorate of Extension, Ministry of Agriculture, Govt. of India, New Delhi.
- 5 days sponsored training programme on Scientific Goat Farming on 05-09 January 2015. In this training programme 23 farmers and 2 farm women (total 25) participated sponsored by ATMA, Madhubani, Bihar.
- 5 days sponsored training programme on Scientific Goat Farming on 16-20 February 2015. In this training programme 22 farmers and 3 farm women (total 25) participated sponsored by Department of Irrigation and Water Resources, Hathras, U.P.
- 5 days sponsored training programme on Scientific Goat Farming on 23-27 February 2015. In this training programme 21 farmers and 4 farm women (total 25) participated sponsored by Department of Irrigation and Water Resources, Hathras, U.P.
- 5 days sponsored training programme on Scientific Goat Farming on 9-13 March 2015. In this training programme 24 farmers were participated sponsored by Department of Land Development and Water Resources, Behjoi, District-Sambhal, U.P.

- 5 days sponsored training programme on Scientific Goat Farming on 17-21 March 2015. In this training programme 49 farmers were participated sponsored by Department of Irrigation and Water Resources, Firozabad, U.P.
- Advances in goat rearing to VOTI Bhuwaneshwar Odhisha 28 Feb to 3 March 2015.
- Advances in goat rearing to VOTI Bhuwaneshwar Odhisha 21 april Feb to 24 April 2015.

Technologies Exhibited at CIRG:

- Exhibited goat technologies on the occasion of visit of Hon'ble DG ICAR and Secretary DARE, DDG(AS) and ADG (AN&P) for the inauguration of newly constructed laboratory building at CIRG Makhdoom on 6-4-2014.
- Exhibited goat technologies on the occasion of Krihi Parivartan Yatra, NAIP, ICAR at CIRG Makhdoom on 17-05-2014.

Exhibition/ Technology Display /Kisan Mela

- Participated in 10th International Agriculture and Horti-Expo 2014 at Pragati Maidan, New Delhi on 25-27 July 2014.
- Exhibited goat technologies on the occasion of the visit of Hon'ble Union Agriculture Minister of India New Delhi Shri. Radha Mohan Singh Ji at CIRG, Makhdoom on 20-9-2014.
- Participated in Krishi Evam Gram Vikas Pradarshni at Pdt. Deen Dayal Dham, Nagla Chandra Bhan, Farah, Mathura (UP) on 20-22 September 2014. CIRG stall **won 2nd Prize.**
- Participated in Fodder Day cum Kisan Mela at IGFRI, Jhansi, Uttar Pradesh on 2nd November 2014.
- Participated in National Sheep and Wool Fair at CSWRI, Avikanagar, Rajasthan on 12 November 2014.
- Participated in Kisan Mela at office campus, Deputy Director Agriculture, Mathura 14th November 2014.
- Participated in ASC India Expo- 2015 on 3-6 February 2015 at NDRI, Karnal, Haryana.
- Participated in Brahad Pashudhan Evam Krishi Mela 2015 at UP Pt. DDUVASU, Mathura on 19 to 21 February 2015.
- Participated in Purvi Chetriya Mela at CPRI Regional Center, Patna, Bihar on 19-21 February, 2015.

- Participated in 21st Sarson Vigyan Mela evam Pradarshni at Directorate of Rapseed –Mustard Research, Bharatpur, Rajasthan on 24-26 February 2015.
- Participated in Kisan Gyan Ganga Mela at Pragati Maidan, New Delhi on 26-28 February 2015.
- Participated in Uttar Chetriya Anchalik Krishi Mela sponsored by Directorate of Extension, agricultural Ministry, GoI, New Delhi at IVRI, Izatnagar, Bareilly on 17-20 March 2015.

Technical Correspondence

Received and replied 109 letters (102 in Hindi and 7 in English) of different stakeholders on various aspects of goat production.

Visit Arrangement

2949 visitors were entertained and apprised with research, extension and development activities of the Institute during the year.

Helpline Calls

During the year 2480 calls received at CIRG Help line service regarding various aspects of goat farming, production, and elite germ plasm and training programmes etc and replied suitably.

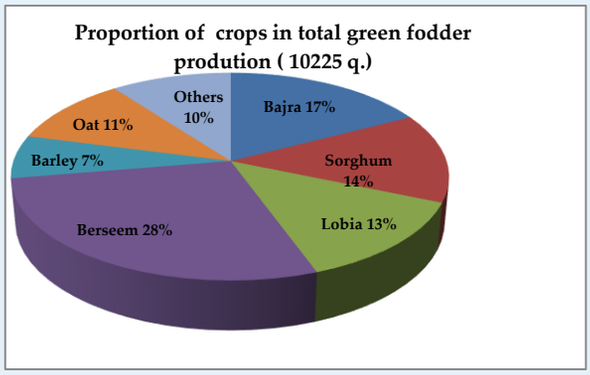
Training to Foreign delegates

- Training-cum-study visit of Seventeen Afro-Asian delegates coordinated by IIM, Lucknow
- Cooperative Group of farmers from France visited CIRG and apprised on Goat production in India

Agriculture Farm and Agroforestry Section

Prabhat Tripathi

Agriculture farm section is working with main objectives to produce nutritionally sound fodder for goats and sheep and to develop ravenous degraded land of institute in to a fodder production models through agroforestry or other agricultural interventions. During the year 2014-15 farm section supplied 10225 quintals of green fodder to different livestock units and produced approx.225-250 quintals barley& oat grains. A nursery of about 2000 seedlings of various fodder tree were raised and maintained. During the reported year about 25-30 quintals of *Brassica juncea* seed was produced under seed production programme of DRMR, Bharatpur.



Apart from its main objectives this section also supports horticulture, maintenance section and staff welfare club for various daily routine activities.

Fig: Mustard Seed Production

Success Story

Evaluation of herd health in Jamunapari animals by employing Body Condition Scoring (BCS) method

Shivasharanappa N*, Nitika Sharma, K Gururaj, A K Mishra and PK Rout

Body Condition Scoring (BCS) is an important method to evaluate the nutritional and general health status of the herd. A total of 301 goats of different age groups from AICRP Jamunapari unit were assessed for their nutritional and general health status by using BCS method. These animals included were 22 breeding bucks, 89 lactating, 89 dry females and 101 young (0-6M) animals. Various point systems were used to score the animals ranging from 1 to 5 (5-excellent, 4- very good, 3- good, 2-average and 1-poor). BCS is a good indicator of animal's fat and protein reserves. Fat deposition at sternal and lumbar region was taken as an indicator of good scoring. Based on this, 3.65% (11/301) of animals showed BCS of 5 followed by 32.5% (98/301) with BCS - 4, 49.8% (150/301) with BCS-3 and 13.9% (42/301) of animals showed BCS of 2. This study showed that the majority of the animals examined in the herd were in good nutritional as well as healthy status reflecting in better managemental practices.

Linkages and Collaborations

The institute has developed effective linkages with DUVASU, Mathura; IVRI, Izatnagar; NDRI, Karnal; IARI, New Delhi; CCS HAU, Hisar; Dr. B.R. Ambedkar University, Agra; CARI, Izatnagar; NIANP, Bangalore; IGNOU, New Delhi; CSWRI, Avikanagar; IGFRI, Jhansi and various Agricultural Universities and NGOs under AICRP programme. Institute is also running a project in collaboration with Biovet Pvt., Bengaluru under Public Private Partnership programme.

Technology Services

Goat Germ plasm supplied

CIRG Makhdoom supplied 482 goats and 82 sheep to the progressive farmers and various government agencies for breed improvement programmes.

Superior Animal Germplasm Supplied

Breed	Total
Jamunapari	**224**
Barbari	208
Jakhrana	50
Muzzaffarnagri	82
Total	564

Women's Complaint Committee

Women's Complaint Committee is ment to safe guard and promote well being of all women employees of an organization. It takes care of all complaints on sexual harassment of women at workplace and action taken for redressal of complaints. It also takes care of any act or conduct by a person in authority and belonging to one sex which denies equal opportunity in pursuit of carrier development or making the environment at workplace hostile or intimidating to a person belonging to other sex, only on the ground of sex. The Direct, ICAR-CIRG has constituted the committee with the following members .

Dr Nitika Sharma: Chair person
Dr Madhu Tiwari: 3rd Party Member
Rajesh Tomar: Member Secretary

A workshop on awareness programmes against sexual harassment was conducted on 27.3.15 for the betterment of the working atmosphere for the women employees.

AWARDS AND RECOGNITIONS

- Ist prize for carrying outstanding work in the use of Rajbhasha Hindi by Nagar Rajbhasha kriyanvan samiti, Mathura, Ministry of Home Affairs , Government of India.
- Bioved Agri-Innovation Award-2015 Indian National Science Academy Award (INSA)-2014
- Member, Board of Management, National Dairy Research Institute, Karnal.
- Member, Executive Council of Maharashtra Animal & Fishery Sciences University, Nagpur.
- Member, ARS Committee of ICAR, New Delhi.
- Vice President, Indian Society for Sheep and Goat Production and Utilization (ISSGPU) and ISSAR
- Guest of Honour at valedictory function of Northern Zone Regional Agriculture Fair at IVRI, Izatnagar
- Chief Guest at valedictory function of Short Training Course, CAFT in Animal Nutrition, IVRI, Izatnagar.
- Chief Guest at valedictory function of Games and Sports at DUVASU, Mathura
- Fellowship of Bioved Research Society (FBRS) was awarded to Dr Ashok Kumar
- Member of University Advisory Commmiitte of UP Pt Deen Dayal Upadhayaya Vet Sci University and cattle Resaerch Institute Mathura
- Chairman and Rapporteur; XXIII Annual Conference of Society of Animal Physiologists of India (SAPI)

- ISGBRD Fellowship-2015
- AJAS 2013 Best Reviewer Award
- Best oral presentation at different seminar /symposia
- Faculty fellow of INSA
- Fellowship by Animal Nutrition Association of India
- Elsevier Reviewer recognition for 2013-14
- Young scientist award in XXX annual convention of Indian Society for study of Animal reproduction (ISSAR)
- Ist prize in Kisan mela in Scientific knowledge dissemination held at U.P. Pt. Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwavidyalya evan Go-Anusandhan Sansthan, Mathura

- 1st prize Vrahad Pashudhan Evam Krishi Mela-2015 at Directorate of Extension, U.P. Pt. Deen Dayal Upadhyay Veterinary University and Cow Research Institute , Mathura, U.P.
- IInd prize in Krishi Evam Gramay Vikas Pradarshani at Pt. Deen Dayal Dham , Nagla Chandrabhan Farah, Mathura, U.P., on 20-22 September, 2014 (03 days).)

PUBLICATIONS

Research articles

Abhishek Mishra A K, Prakash C, Bhardwaj B, Asgola H S and Chander V, (2014). Prevalence of dermatophytoses in animals from Rohilkhand region of Uttar Pradesh, India. Indian Veterinary Journal 91 (10):99-103.

Agrawal N, Sharma DK, Mandal A, Rout PK, Kushwah YK (2015) Dynamics of faecal egg count in natural infection of Haemonchus Spp. in Indian goats, Veterinary World, 8(1): 38-41.

Banerjee, Dipak, Ramesh C. Upadhyay, Umesh B. Chaudhary, Ravindra Kumar, Sohanvir Singh, Jagan Mohanarao, Shamik Polley, Ayan Mukherjee, Tapan K. Das, and Sachinandan De. (2014) Seasonal variation in expression pattern of genes under HSP70. Cell Stress and Chaperones 19, no. 3 (2014): 401-408.

Bhusan, S. (2015) Influence of non-genetic factors on milk production of Jakhrana goats. Indian Journal of Small Ruminants 21, no. 1 (2015): 112-114.

Bhusan, Saket and Gopal Dass (2015). Influence of non genetic factors on body weights of Jakhrana kids. Indian Journal of Animal Sciences, 85: 60-63.

Chaudhary K., Chaubay, K.K., Singh, S.V. and Kumar, N. (2015). Receptor tyrosine kinase signaling regulates peste des petits ruminants virus replication. Acta Virologica, 59, 78-83.

Chaudhary U B, Tripathi M K, Tripathi Prabaht and Kumar Ravindra. (2015). Effect of strategic supplementation on growth performance and economics of Barbari goat kid production on rangelands. Indian Journal of Animal Science, 85: 67-72.

Dass, Gopal and Rout, P.K. (2014) Chayanit prajanan dwara Muzzafaranagari bhedo me anuvanshik sudhar Bhartiya Krishi Anusandhan Patrika (Research Journal of Agriculture and Animal Sciences), Vol. 29 (3) : 132-135.

Dass, Gopal, Ajoy Mandal and P.K. Rout (2014). Genetic and phenotypic parameters of growth traits in Muzaffarnagari sheep. Indian Journal of Animal Sciences, 84: 1328-1331.

Dass, Gopal, and P. K. Rout. (2014) Genetic improvement in production traits of muzaffarnagari sheep through selective breeding. Bhartiya Krishi Anusandhan Patrika 29, no. 3 (2014): 132-135.

Dixit, A. K., Mohan Braj, Singh K and Kumar Vijay. (2014). Impact of training programme on goat farmers and stakeholders: A study of CIRG training programmes. Indian Research Journal of Extension Education 14 (3):112-114

Dixit, A.K. and Singh M.K. (2014). Economic analysis of goat rearing under field conditions of Bundelkhand Region. The Indian Journal of Small Ruminants 20 (2): 165-168.

Dixit, A. K., B. S. Reddy, M. K. Singh, and N. Singh. (2014) Role of Financial Institution in Goat Trade: A Case Study of APMC-Gunj Goat Market of Gulbarga District in Karnataka. Agriculture Economics Research Review 27:217.

Dixit, A. K., and Braj Mohan. (2014) Economics of goat production in Mathura district of Uttar Pradesh. Indian Journal of Small Ruminants 20, no. 2 : 96-98.

Dixit, A. K., and M. K. Singh. (2014) Factors Determining Flock Size of Goats in Bundelkhand Region of Uttar Pradesh. Agricultural Economics Research Review 27, no. 2 : 315-318.

Durge, S. M., M. K. Tripathi, Prabhat Tripathi, Narayan Dutta, P. K. Rout, and U. B. Chaudhary. (2014) Intake, nutrient utilization, rumen fermentation, microbial hydrolytic enzymes and hemato-biochemical attributes of lactating goats fed concentrate containing Brassica juncea oil meal. Small Ruminant Research121, no. 2 (2014): 300-307.

Gadekar , Y. P., B. D. Sharma, A. K. Shinde, A. K. Verma, and S. K. Mendiratta. (2014) Effect of natural antioxidants on the quality of cured, restructured goat meat product during refrigerated storage (4±1° C). Small Ruminant Research 119, no. 1 : 72-80.

Gangwar Chetna, Ashok kumar, Alok kumar and Atul saxena. (2014) Post- partum uterine prolapse in a Murrah Buffalo- A case report. Buffalo Bulletin 33(2):146-148.

Gangwar, C., Ranjan, R., Kumar, S., Kharche, S D, Goel, A K., Ramachandran, N. and Jindal, S. K. (2014). Use of chelating agent for optimum post thaw quality of buck semen. Indian Journal of Animal Sciences 84 (8): 839–841.

Gangwar, Chetna, Alok Kumar and Atul Saxena. (2014) Pre-partum uterine prolapse in a Murrah buffalo- a case report. Polivet Intas vol (15).:

Gupta, Vivek Kumar, Shivasharanappa Nayakwadi, Amit Kumar, Kumaresan Gururaj, Ashok Kumar, and Rajveer Singh Pawaiya. (2014) Markers for the molecular diagnosis of

brucellosis in animals. Adv. Anim. Vet. Sci 2 : 31-39.

Heinz, Johanna FL, Shiva P. Singh, Ulrich Janowitz, Michael Hoelker, Dawit Tesfaye, Karl Schellander, and Helga Sauerwein. (2015) Characterization of adiponectin concentrations and molecular weight forms in serum, seminal plasma, and ovarian follicular fluid from cattle. Theriogenology 83, no. 3 (2015): 326-333.

Kadirve, G., Satish Kumar, S. K. Ghosh, and P. Perumal. (2014) Activity of antioxidative enzymes in fresh and frozen thawed buffalo (Bubalus bubalis) spermatozoa in relation to lipid peroxidation and semen quality. Asian Pacific Journal of Reproduction 3, no. 3 : 210-217.

Kashyap N., P. Kumar, B Deshmukh, M S Dige, M Sarkar, A Kumar, A Chauhan and G Singh. 2014. Influence of ambient temperature and humidity on ATP1A1 gene expression in Tharparkar and Vridavani cattle. Indian Journal of Animal Research, 48 (6): 541-544

Khandelwal, Nitin, Gurpreet Kaur, Kundan Kumar Chaubey, Pushpendra Singh, Shalini Sharma, Archana Tiwari, Shoor Vir Singh, and Naveen Kumar. (2014) Silver nanoparticles impair Peste des petits ruminants virus replication. Virus research 190 : 1-7.

Kharche, S. D., Goel, A.K., Jindal, S.K., Goel, P., Kouamo, J. and Saraswat, S. (2015). Effect of protein phosphorylation inhibitor on production of parthenogenetic caprine embryos. Indian Journal of Animal Sciences 85(2) 139-142.

Kharche, S. D., Goel, A.K., Jindal, S.K., Saraswat, S, Pathak, J. and Agarwal, S.K. (2015). In vitro maturation of nude caprine oocytes recovered during oocyte collection. Indian Journal of Animal Sciences 85(2) 135-138.

Kharche, S. D., S. K. Jindal, A. K. Goel, Satish Kumar, Chetna Gangwar and Sonia Saraswat (2015) Zona free hamster ova penetration test: fertility indicator of buck spermatozoa. Indian Journal of Small Ruminants 21, no. 1 : 118-121.

Kharche, Suresh Dinkar, Anil Kumar Goel, Satish Kumar Jindal, Ravi Ranjan, Pramod Kumar Rout, Sudhir Kumar Agarwal, Puja Goel et al. (2014) Development of parthenote following in vivo transfer of embryos in Capra hircus. In Vitro Cellular & Developmental Biology-Animal 50, no. 10 (2014): 893-898.

Kopp, C., S. P. Singh, P. Regenhard, H. Sauerwein and M. Mielenz. (2014) Trans-cinnamic acid increases adiponectin and the phosphorylation of AMP-activated protein kinase via G-protein coupled receptor 109A in 3T3-L1 adipocyte. International Journal of Molecular Sciences,. 15 (2014): 2906-2915.

Kopp, Christina, Afshin Hosseini, Shiva P. Singh, Petra Regenhard, Hamed Khalilvandi-Behroozyar, Helga Sauerwein, and Manfred Mielenz. (2014)Nicotinic Acid Increases Adiponectin Secretion from Differentiated Bovine Preadipocytes through G-Protein Coupled Receptor Signaling. International journal of Molecular Sciences 15, no. 11: 21401-21418.

Kouamo J and Kharche S D. (2014). An Overview of sex selection at conception in mammals. Ir. Journal of Applied Animal Sciences 4 (3):463-476.

Kouamo, J. and Kharche, S. D. (2014). Oestrus synchronization in small ruminants. A Review The Indian Journal of Small Ruminants, 20(2): 1-9.

Kouamo, J. and Kharche, S.D. (2014). Dose dependent effect of Pregnant mares serum gonadotropin and Human chorionic gonadotropin on in vitro maturation of goat oocytes. Indian Journal of Animal Sciences 84(4): 1040-1044.

Kumar Ashok , Sharma D K, Kumar Ravindra, Chaudhary U B (2014) Effect of feeding complete pellet containing herbal anticoccidial feed mix on the performance of Barbari goats The Indian Journal of Small Ruminants 20(1) 64-66

Kumar Ashok and Sharma D K Kumar Ravindra, Chaudhary U B (2014) Effect of herbal anticocccidial feed mix pellet on the growth, rumen fermentation and blood metabolites of Barbari goats Animal Nutrition and Feed Technology, 14(1)

Kumar M, Sharma B, Kumar A, Lal H P, Kumar V and Tripathi M K.(2014). Prevalence and Haemato-Biochemical Studies of Toxocara canis Infestation in Dogs and Risk Perception of Zooneses by Dog Owners in Mathura, India. Asian Journal of Animal and Veterinary Advances 9 (10): 653-663.

Kumar N, Chaubay, K.K., Singh, S.V., Gupta, S., Sharma, S., Sharma, D.K., Mishra, A.K. and Singh, M.K. (2014). Phylogenetic analysis of an orf virus from an outbreak in sheep at Makhdoom, India, Virus Genes, 48 : 312-319.

Kumar R, Singh B P, Kumar V., Bangar Y & Maousami. (2015). Adoption of health technologies among goat farmers in different agro-climatic zones of Bihar. Journal of Applied Animal Research 43(1): 46-51.

Kumar Ravindra, Chaudhary, U.B., Kumar, A. and Sharma, D.K., Tripathi, P and Tripathi M.K, (2014). Effect of feeding complete pellet

containing herbal anticoccidial feed mix on the performance of barbari goats.. The Indian journal of small ruminants. 20(1) 64-66.

Kumar Vijay and Singh B P. (2015). Adoption Level of Feeding Management Practices among Goat farmers in Semi-Arid zone of Uttar Pradesh. Indian Research Journal of Extension Education 15 (1): 46-48.

Kumar Vijay, Singh B P and Ramachandran N. (2014). Comparative study on bovine shelter management practices among rural and peri-urban dairy farmers. Indian Journal of Animal Production and Management 30(1- 2): 48 -50.

Kumar Vijay, Singh B P, Dutt T and Verma M.R. (2014). Adoption behaviour of kid management practices among goat farmers in Uttar Pradesh. Indian Journal of Small Ruminants 20 (2):169-171.

Kumar Vijay, Singh B P, Dutt T, Kumar R and Maousami. (2014). Perceived constraints and suggestions in adoption of goat husbandry technologies: a study in semi-arid zone of Uttar Pradesh. Indian Journal of Animal Sciences 80 (8): 897-902.

Kumar, Naveen, and Sunil Maherchandani. (2014) Targeting host cell factors for development of antiviral therapeutics. Adv. Anim. Vet. Sci. S 1 (2014): 37-41.

Kumar, M., T. K. Dutta, and M. K. Tripathi. (2014) Effect of Saccharomyces cerevisiae and Lactobacilli supplementation in diets with varying roughage and concentrate ratio on In vitro fermentation, protozoa population and methane production. Indian Journal of Small Ruminants (The) 20, no. 2 (2014): 38-44.

Kumar, N., Maherchandani, S., Kashyap, S. K., Singh, S. V., Sharma, S., Chaubey, K. K., & Ly, H. (2014). Peste des petits ruminants virus infection of small ruminants: A comprehensive review. Viruses, 6(6), 2287-2327.

Kumar, Naveen, Ashutosh Wadhwa, Kundan K. Chaubey, Shoor V. Singh, Sorabh Gupta, Shalini Sharma, Dinesh K. Sharma, Manoj K. Singh, and A. K. Mishra. (2014) Isolation and phylogenetic analysis of an orf virus from sheep in Makhdoom, India. Virus genes 48, no. 2 (2014): 312-319.

Kumar, Pradeep, Abhishake Saxena, S. K. Singh, R. K. Sharma, I. Singh, and S. K. Agarwal. (2014) Identification of pregnancy-associated glycoproteins by peptide mass fingerprinting in water buffalo (Bubalus bubalis). Indian journal of biochemistry & biophysics 51, no. 4 (2014): 326-330.

Kumar, R., B. P. Singh, V. Kumar, Y. Bangar, and Maousami. (2014) Perceived sustainability of health technologies by goat farmers in different agro-climatic zones of Bihar. Journal of Applied Animal Research 42, no. 2: 200-203.

Kumar, Ravindra, P. Tripathi, U. B. Chaudhary, and M. K. Tripathi. (2015) Nutrient composition, In vitro methane production and digestibility of azolla (Azolla microphylla) with rumen liquor of goat. Indian Journal of Small Ruminants 21, no. 1: 126-128.

Kumar, Ravindra, U. B. Chaudhary, Ashok Kumar, and D. K. Sharma. (2014) Effect of Herbal Anticoccidial Feed Mix Pellet on the Growth, Rumen Fermentation and Blood Metabolites of Barbari Goats. Animal Nutrition and Feed Technology 14, no. 1 : 101-108.

Kumar, V., Singh, B. P. and Ramachandran, N. (2014). Comparative study on bovine shelter management practices among rural and peri urban dairy farmers. Indian Journal of Animal Production and Management 30 (1-2): 48-50.

Kumar, Vijay, Braj Mohan, A. K. Dixit, Khushyal Singh, Ashok Kumar, U. B. Chaudhary, and A. K. Goel. (2015)Goat farming status: a benchmark survey in adopted villages of Mathura district of Uttar Pradesh. Indian Journal of Small Ruminants (The) 21, no. 1: 158-160.

Mamta, Dutta T K and Tripathi M K. (2015). Rumen fermentation of Barbari Kids at different physiological stages under semi-intensive system of production. Indian Journal of Animal Sciences, 85: 64-66.

Mandal, Ajoy, M. Karunakaran, P. K. Rout, and R. Roy. (2014) Conservation of threatened goat breeds in India. Animal Genetic Resources/Ressources génétiques animales/Recursos genéticos animales 55 (2014): 47-55.

Manjunatha Reddy G B, Kumari A, Mishra A K, Shivasharanappa N, Paul S, Gupta V K and Sharma D K. (2014). Prevalence of group A rotavirus in diarrheic goat kids from organized goat farms. Indian Journal of Comparative Microbiology, Immunology & Infectious Diseases 35 (1):9-12.

Manoj K, Dutta T K and Tripathi M K. (2014). Effect of Effect of Sacchromyces cereviesiae and Lactobacilli supplementation in diet with varying levels of roughage to concentrate ration on in-vitro fermentation, protozoa population and methane production. Indian Journal of Small Ruminant Research, 20: 38-44.

Maousami, Singh B P, Kumar, R and Kumar Vijay. (2014). Adoption analysis of scientific calf management practices among livestock owners. Indian Journal of Dairy Science 67 (4): 355-358.

Mishra A K, Shalini, Sharma N, Kumar A and Shivasharanappa N, (2014). Prevalence of subclinical mastitis in different breeds of goats. Veterinary Practitioner 15 (1):140-141.

Mishra A K, Sharma N, Kumar A, Kumar N, Manjunatha Reddy G B, Kumar S and Kumar N, (2014). Isolation, characterization and therapeutic potential assessment of bacteriophages virulent to Staphylococcus aureus associated with goat mastitis. Iranian Journal of Veterinary Research 15 (4):320-325.

Mukherjee Reena, R.K. Jadhav, Nitika Sharma, B.D. Sahu and U.K. De. (2014). Milk leukocyte adhesion molecules in response to Curcuma longa plus α -tocopherol and selenium in mastitic riverine buffaloes. Buffalo Bulletin,33(2): 215-220.

Niwas Ram, D. P. Singh, U. B. Chaudhary &Tarun Verma (2014).Impact of Different Herbal Drugs on Ruminal BacterialPopulation of Crossbred Calves. Environment & Ecology 32 (4): 1286—1290

Oakey, Jane, Lawrence Gavey, Shoor Vir Singh, Joanne Platell, and David Waltisbuhl. (2014) Variable-number tandem repeats genotyping used to aid and inform management strategies for a bovine Johne's disease incursion in tropical and subtropical Australia. Journal of Veterinary Diagnostic Investigation 26, no. 5 (2014): 651-657.

Pathak, A. K., Narayan Dutta, R. V. S. Pawaiya, and K. Sharma. (2014) Influence of condensed tannins containing leaf meal mixture on histopathological changes in Haemonchus contortus infected sheep. Indian Journal of Veterinary Pathology 38, no. 4 (2014): 231-234.

Paul S, Sharma DK, Boral R, Mishra AK, Shivsharanappa N, Banerjee PS and Pawaiya RVS (2014). Cryptosporidiosis in goats; a review. Adv. Anim. Vet. Sci. 2 (3S): 49 – 54.

Paul Souvik and Sharma D.K. Manjunatha Reddy, G.B, Shivasharanappa N, Mishra A.K. (2014) Pathomorphological and Histopathological Lesions in Naturally Occurring Caprine Paratuberculosis Indian J. Vet. Pathol. 36(2) 270-272.

Paul Souvik and Sharma D.K.(2014) Amprolium Resistant Eimeria spp. in Goats. Indian Veterinary Journal 91(3)89-90.

Pawaiya RVS, Shivasharanappa N, Sharma N, Mishra AK, Gururaj K, Paul S, Gupta VK, Kumar A, Sharma DK, Kumar N and Singh SV (2015). Patho-morphology study of a spontaneous case of mycotic pneumonia in Sheep. Indian J. Vet. Pathol., 39 (1): 78-80

Rajkumar, V., Arun K. Das, and Arun K. Verma. (2014) Effect of almond on technological, nutritional, textural and sensory characteristics of goat meat nuggets. Journal of Food Science and Technology 51, no. 11: 3277-3284.

Rajkumar, V., Gopal Dass, Arun K. Verma and Arun K. Das (2014). Slaughter weight effect on carcass and meat quality of Muzaffarnagari lambs in intensive production system. Indian Journal of Animal Sciences, 84: 569-574

Rajni, Kharche SD, Sinha NK, Goel AK, Jindal SK and Saraswat Sonia. (2014). Effect of vitrification and slow freezing on in-vitro matured prepubertal goat oocytes. Indian J. of Animal Sciences 84(3) 289-292.

Ramachandran , N., M. K. Tripathi, S. K. Singh, V. Rajkumar, and S. K. Jindal. (2015) Effect of curd as probiotic supplementation on growth of kids. Indian Journal of Small Ruminants (The) 21, no. 1 (2015): 37-39.

Ranjan R , Goel A K, Ramachandran N, Kharche S D and. Jindal S K. (2015). Effect of eggyolk levels and and equillibriation periods on frrezability of Jamunapari Buck Semen. The Indian Journal of Small Ruminants 2015, 21(1): 32-36.

Ranjan R, Singh Renu, Kumar Kuldeep, Sarkar M, Das B C and Sadhan Bag. (2014). Necdin and neuronatin genes expression among diploid parthenogenetic, IVF and in vivo derived female sexed embryos during preimplantation development in goat. Indian Journal of Animal Sciences 84 (8): 842–845.

Ranjan, R., A. K. Goel, S. D. Kharche, N. Ramachandran, Chetna Gangwar, and S. K. Jindal. (2014) Comparison of normal and dual staining techniques for evaluating viability and acrosome status in frozen thawed buck spermatozoa. Indian Journal of Small Ruminants (The) 20, no. 2 (2014): 50-53.

Rao, Sashi Bhushan, Vivek K. Gupta, Mukesh Kumar, Nagendra R. Hegde, Gary A. Splitter, Pallu Reddanna, and Girish K. Radhakrishnan. Draft genome sequence of the field isolate Brucella melitensis strain Bm IND1 from India.Genome announcements 2, no. 3 (2014): e00497-14.

Rashmi, Tiwari R, Roy R, Kumar Vijay. (2014). Scientific breeding practices followed by goat farmers in ravines areas of Uttar Pradesh. Indian Journal of Small Ruminants 20 (1):143-145.

Reddy, G. B., Archana Kumari, A. K. Mishra, N. Shivashanarappa, S. Paul, V. K. Gupta, and D. K. Sharma. (2014) Prevalence of groupa rotavirus in diarrhoeic goat kids from organized goat farms. Indian Journal of Comparative Microbiology, Immunology and Infectious Diseases 35, no. 1 (2014): 9-12.

Sachan , J., Kumar, Ravindra, Vaswani. S., Kumar V., Roy. D. (2014) Effect of addition of herbs on in vitro rumen fermentation and digestibility of feed. Indian Journal of Animal rResearch, 48(1): 91-93.

Saikia, P. P., P. K. Rout, and R. Nigam. (2014) Electrophoretic Separation Of Myofibrillar Protein Isoforms In Skeletal Muscle Of Indian Goats. Animal Science 8, no. 3 (2014).

Saraswat, S., S. D. Kharche, and S. K. Jindal. (2014) Impact of Reactive Oxygen Species on Spermatozoa: A Balancing Act between Beneficial and Detrimental Effects. Iranian Journal of Applied Animal Science 4, no. 2 (2014): 247-255.

Sharma D K , Tirpathi P, Paul Souvik, Tirpathi M K and Chaudhary U B (2014). Effect of Grazing on Gastrointestinal Parasitism in Goats. Indian Veterinary Journal, 91(10): 57-59

Sharma N, Reena Mukherjee and Anil Kumar Mishra. (2014).Comparative evaluation of Aloe vera and Glutaraldehyde teat antisepsis on somatic cell count in an organized dairy farm. Indian Veterinary Journal, Vol 91 (04): 40-41.

Sharma, A., Nayakwadi, S., Chandratre, G., Saini, M., Das, A., Raut, S., Swarup, D., and Somvanshi, R. (2014). Prevalence of Pathological Conditions in Zoo/Wild Animals in India: A Retrospective Study Based on Necropsy. Proceedings of the National Academy of Sciences, India Section B: Biological Sciences, 1-10.

Sharma, Nitika, Shivasharanappa Nayakwadi, Rajveer Singh Pawaiya, Surender Kumar, Waseem A. Tailie, Souvik Paul, Anil Kumar Mishra et al. (2014) Parasitic Encephalomyelitis in Goats due to Aberrant Infestation with Botfly Oestrous ovis Larvae. Advances in Animal and Veterinary Sciences 2, no. 3S (2014): 8-11.

Sharma, R. B., T. S. Raghuvanshi, Tahziba Hussain, and S. V. Singh. (2014) Immune activation in HIV-positive patients fed with goat milk before and after initiation of anti-retroviral therapy. Indian Journal of Small Ruminants (The) 20, no. 1: 67-70.

Sharma, S., and N. Kumar. (2015) Emerging role of regulatory T cells in heterologous infections. Adv. Anim. Vet. Sci 3, no. 2s (2015): 25-31.

Shivasharanappa N, Gupta V K, Sharma N, Mishra A K, Singh V K, Pawaiya R V S, Gururaj K, Sharma D K, Kumar A, Paul S, Kumar N and Singh S V, (2014). Rapid Detection of Fusobacterium necrophorum as a main causative agent of foot rot in small ruminants by polymerase chain reaction assay. Advances in Animal and Veterinary Sciences 2 (5): 302 – 304.

Shivasharanappa N., Singh R., Singh K.P., Singh R.P., Madhu B. P. (2014). Rabies virus induces expression of TLR-3 and its associated cytokines in Swiss albino mice. The Journal of Veterinary Science. Photon 115, 384-394.

Shome, Rajeswari, V. K. Gupta, K. Narayana Rao, B. R. Shome, M. Nagalingam, H. Rahman, and R. S. Pawaiya. (2014) Detection of Brucella Melitensis Rev–1 Vaccinal Antibodies in Sheep in India. Advances in Animal and Veterinary Sciences 2, no. 3S (2014): 19-22.

Shroff, S., B. S. Chandel, A. I. Dadawala, S. Gupta, K. K. Chaubey, and S. V. Singh. (2014) Incidence of Mycobacterium avium subspecies Paratuberculosis in Patanwadi sheep. Indian Journal of Small Ruminants (The) 20, no. 1 (2014): 54-58.

Singh , Tanuja, Vikas Pathak, Arun Verma, Rajkumar Vincentraju, Meena Goswami, and Veer Singh. (2014) Evaluation of color and textural properties of chicken meat momos. Nutrition & Food Science 44, no. 6 (2014): 474-482.

Singh, Shoor Vir, Vivek Kumar Gupta, Ashok Kumar, Saurabh Gupta, Ruchi Tiwari, Kuldeep Dhama, and N. Kumar. (2014) Therapeutic Management of Bovine Brucellosis in Endemically Infected Dairy Cattle Herd of Native Sahiwal Breed. Advances in Animal and Veterinary Sciences 2, no. 1S (2014): 32-36.

Singh, Narendra, A. K. Dikshit, B. S. Reddy, and Surendra B. Kuthe. (2014) Instability in Rice Production in Gujarat: A Decomposition Analysis. Asian Journal of Economics and Empirical Research 1, no. 1 (2014): 6-9.

Singh, S. V., N. D. Agrawal, Naveen Kumar, Saurabh Gupta, K. K. Chaubey, K. D. Rawat, Ruchi Tiwari et al. (2014) Screening of human population for Type 1 Diabetes and Mycobacterium avium subspecies paratuberculosis from Chattarpur district of Madhya Pradesh. Adv. Anim. Vet. Sci 2, no. 11: 612-619.

Singh, S. V., P. K. Singh, A. V. Singh, J. S. Sohal, N. Kumar, K. K. Chaubey, S. Gupta et al. (2014) Bio-Load and Bio-Type Profiles of Mycobacterium avium subspecies paratuberculosis Infection in the Domestic Livestock Population Endemic for Johne's Disease: A Survey of 28 years (1985–2013) in India. Transboundary and Emerging Diseases 61, no. s1 (2014): 43-55.

Singh, Shoor Vir, Saurabh Gupta, Kundan Kumar Chaubey, Naveen Kumar, Krishna Dutta Rawat, Ruchi Tiwari, Kuldeep Dhama, and N. Kumar. (2014) Dose Standardization Studies of

'Indigenous Vaccine'for the Control of Mycobacterium Avium Subspecies Paratuberculosis in Naturally Infected Goats. Advances in Animal and Veterinary Sciences 2, no. 1S (2014): 17-22.

Singh S.V., Kumar N., Sohal J.S., Singh A.V., Singh P.K., Agrawal N.D., Gupta S., Chaubey K.K., Rawat K.D., Deb R., Dhama K. (2014). First mass screening of the human population to estimate the bio-load of Mycobacterium avium subspecies paratuberculosis in North India. Journal of Biological Sciences, Vol. 14, Issue 4, pp. 237-247.

Singh S.V., Gupta, S., Chaubey, K.K., Singh, B., Kumar, A., (2014). Evaluation of microscopy as a field laboratory test for diagnosis of Johne's disease in farm animals. Intas Polivet, 15 (1).

Singh, Gitam, R. B. Sharma, and Ragini Mishra. (2014) Seasonal Variations in the Milk Minerals of Jakhrana Goats under Field and Farm Rearing Conditions. Journal of Community Mobilization and Sustainable Development 9, no. 2 (2014): 120-123.

Singh, Gitam, R. B. Sharma, Ragini Mishra, and Santosh Kumar Rajput. (2014) Effect of season on goat meat composition under field and farm rearing conditions. Indian Res. J. Genet. & Biotech. 6(2) : 451-456 (2014)

Singh, M. K., A. K. Dixit, A. K. Roy, and S. K. Singh. (2014) Analysis of prospects and problems of goat production in Bundelkhand region. Range Management and Agroforestry 35, no. 1 (2014): 163-168.

Singh, M. K., B. Rai, A. K. Dixit, Rustam Singh, and S. K. Singh. (2014) Management practices of goats in bundelkhand region. Indian Journal of Small Ruminants (The) 20, no. 2 (2014): 99-105.

Singh, Pallavi, M. K. Singh, and S. K. Singh. (2014) Genetic analysis of milk production traits in Jamunapari goats. Indian Journal of Small Ruminants 20, no. 1 (2014): 16-19.

Singh, Shoor Vir, Jagdip Singh Sohal, Naveen Kumar, Saurabh Gupta, Kundan Kumar Chaubey, K. D. Rawat, Sandip Chakraborty, Ruchi Tiwari, Kuldeep Dhama, and N. Kumar. (2014) Recent approaches in diagnosis and control of mycobacterial infections with special reference to Mycobacterium avium subspecies. Adv. Anim. Vet. Sci 2, no. 1S (2014): 1-11.

Sohal, J. S., S. V. Singh, B. Singh, S. Thakur, G. K. Aseri, N. Jain, S. Jayaraman et al. (2015) Control of para-tuberculosis: opinions and practices. Adv. Anim. Vet. Sci 3, no. 3: 156-163.

Tirpathi, M.K. and Chaudhary. U.B. Sharma D.K., Tirpathi P., Paul Souvik (2014) Effect of Grazing on Gastrointestinal Parasitism in Goats. Indian Veterinary Journal, 91(10): 57-59

Tiwari, K. P., M. I. Bhaiyat, A. Chikweto, R. N. Sharma, and R. V. S. Pawaiya. (2014) Immunohistochemical detection of c-Myc oncoprotein in round cell tumors of dogs in Grenada, West Indies. Indian Journal of Veterinary Pathology 38, no. 3 (2014): 153-157.

Tripathi M K. (2015). Comforts in quality of goat milk. Journal of Advances in Dairy Research, 3:1 doi:10.4172/2329-888X.1000e115.

Tripathi, M. K. (2014) Effect of nutrition on production, composition, fatty acids and nutraceutical properties of milk. J. Adv. Dairy Res. 2 (2014): 115.

Tripathi, P , Datta, T.K., Tripathi M.K, Chaudhary U.B , Kumar Ravindra (2014) Preparation of complete feed pellet from Monsoon herbages (Dactylonnium aegyptium, Cenchrus ciliaris and Tephrosia Purpurea) and its utilization in kids. Indian journal of Small Ruminants. 20(1) 31-36.

Umaraw, Pramila, V. Pathak, V. Rajkumar, Arun K. Verma, V. P. Singh, and Akhilesh K. Verma. (2015) Microbial quality, instrumental texture, and color profile evaluation of edible by-products obtained from Barbari goats. Veterinary World8, no. 1: 97-102.

Vaswani. S., Kumar, Ravindra, Kumar, V., Roy. D, and Kumar, M (2014). In vitro rumen fermentation and digestibility of different varieties of maize fodder in combination with wheat straw and concentrate using buffalo rumen liquor. The Indian Veterinary journal 91(10) 60-63.

Verma, Akhilesh Kumar, Veer Pal Singh, and Vikas Pathak. (2014) Effect of jackfruit supplement and ageing on the Physico-chemical, texture and sensory characteristics of Chevon patties. Journal of Applied Animal Research ahead-of-print (2014): 1-9.

Verma, Arun K. (2014) Slaughter weight effect on carcass and meat quality of Muzaffarnagari lambs in intensive production system. The Indian Journal of Animal Sciences 84 (2014): 569-574.

Waseem, A, Pawaiya, R.V.S., Singh, R, Gupta, V.K., Rajukumar, K, Mir, M.S. and Aamir, S (2015). Seroprevalence of caprine arthritis encephalitis virus infection (CAEV) in Indian goats Indian J Vet Pathol 39 (1): 15-19.

LEAD / INVITED PAPERS

- Agarwal S K, Kharche S D and Ramachandran N. 2014. Effect of thermal stress on Reproductive performance of Livestock. In: Advance short course on Fed safety and Nutritional Security under changing climatic scenario. Organized by Center of Advanced Faculty Training in Animal nutrition, IVRI, izatnagar, pp. 129-137.
- Ashok Kumar (2015) Ethnomedicine, scientific validation and herbal drug development in animal practice . National seminar on ehanobotany : concept and prospectives (March 21-22 2015) at BSA College Mathura .
- Ashok Kumar (2015) Technologies of CIRG for enhancing goat productivity in Asia and Africa.Training cum study Visit Programme to Afro-Asian delegates coordinated by IIM Lucknow , CIRG Makhddom 9-2-2015
- Ashok Kumar , V K Gupta , Ravindra Kumar and A K Dixit (2015) Innovative goatery technology for increasing rural employment . 17th Indian Agricultural Scientist and farmers congress on Agri innovation for enhancing production and rural employment (21-22 Feb , 2015) Allahabad
- Ashok Kumar , V K Gupta and R V S Pawaiya (2014) Status and management of goat disesaes in Uttar Pradesh . 2nd UP Agriculture Science Congress on" Technological and governance strategies for advancement of agricultural education , rresarch and extension in Uttar Pradesh. Organized by UPCAR Lucknow (14-16 June 2014)
- Ashok Kumar, V K Gupta , Ravindra kumar (2015) Scientific input in goat farming.Seminar and Livestock Expo 2015 organised by AH Punjab and Rural development and Panchayat department .8-12 Jan 2015
- Bhusan, S. (2014). Integrated genetic improvement and conservation of goats for increasing productivity for sustainable economic development of hill and tribal farmers. Proceeding of 7th National Extension Education Congress on "Translational Research-Extension for Sustainable Small Farm Development" will be held on 8-11 November, 2014 at ICAR Complex for NEH Region, Shillong (Meghalaya).
- Dixit A K, B Mohan and M K Singh. 2014. Trends in Goat Meat Production in India: Opportunities and Challenge, February 23-24, 2013 held at Janata College Bakewar and Published in proceeding of National Seminar on Value added functional foods: Prospects and Future challenges in April, 2014 pp: 74-85
- Dixit A K, M K Singh and B Rai. 2014. Goat Meat Production and Productivity Trends in India. Opportunities and Challenges. Published in compendium of National Seminar on Prospects and Challenges in Small Ruminants in India held at Sheep Breeding Research Station TANVASU, Sandynallah, The Nilgiri on 11-12 December, 2014. Page no 49-57.
- Gangwar Chetna, Kharche S.D. and Singh S.P. (2015). Use of Herbs and Spices in Animal Production. National Seminar on "Ethnobotany : Concept and Prospectives" organized by B.S.A College Mathura from March 21-22, 2015.
- Kumar, N. (2015). Paradigm shift in antiviral drug development. In, International Conference on Emerging trends in Biotechnology and Sciences with Especial Reference to Climate change" organized by Indian Society of Genetics, Biotechnology Research ad Development in collaboration with Krishi Vigyan Kendra (ICAR) Banasthali Vidyapith, Rajasthan from February 18-20, 2015.
- Kumar, N. (2015). Paradigm shift in antiviral drug development. In, International Conference on Emerging trends in Biotechnology and Sciences with Especial Reference to Climate change" organized by Indian Society of Genetics, Biotechnology Research ad Development in collaboration with Krishi Vigyan Kendra (ICAR) Banasthali Vidyapith, Rajasthan from February 18-20, 2015.
- Singh M K and S K Singh.2015. Goat Genetic Resources of India: Strategies for their Improvement and Conservation. International Symposium on" Sustainable Management of Animal Genetic Resources for Livelihood Security in Developing Countries. Society for Conservation of Domestic Animal Biodiversity (SOCDAB): 13-14 Feb, 2015, TANUVASU Chennai in collaboration with Animal Convention of Society for Conservation of Domestic Animal Biodiversity (SOCDAB). Published in Compendium Page 109-116
- Singh M K, S K Singh, A K Dixit, M S Dige and B Rai. 2015. Improvement and Conservation of Goat Breeds under Small-holder Production System in India. Published in compendium of ISAPM National Seminar on "Livestock Production Practices for Small Farms of Marginalized Groups and Communities in India" held during 28 – 30 January, 2015 at Aizawl, Mizoram.
- Tripathi M. K., Kumar Ravindra, Chaudhary, U.B. and Tripathi, P. (2015) Emerging nutritional approaches to manipulate ruminal efficiency In: eco-Responsive Feeding and Nutrition: Linking livestock and Livelihood: thematic papers. Proceedings of 9thBiennial Animal Nutrition Association Conference, January 22-24, 2015, Guwahati, India pp 181-190

POPULAR ARTICLES

- Bhaduria V PS, V K Gupta , Ashok Kumar (2014) Biomedical waste management . Agra Vet J 1:48
- Bhushan, Saket (2014-2015) Bakriyon ka prajanan prabhandhan Ajamukh 30: 4
- Bhusan, S. (2014). Role of Hindi Language in National Unity. Braj Rashmi, Nagar Rajbhasa Karyanvayan Samitee, Mathura Refinery (Mathura), p-21.
- Bhusan, S. (2014). Goat breeds for Braj area and their characteristics (hindi). Pashudhan Prakash, NBAGR, Karnal, Ank-5, p-23-25.
- Dixit, A.K., Braj Mohan, Khushiyal Singh, Vijay Kumar, U.C.Yadav and S.C.L.Gautam (2014) Rashtriya vyavasayik bakri palan parshishan karyakram ki badhti lokpriyata Ajamukh 29: 3
- Dixit, A.K., Mohan, B., Singh, K. and Kumar, V. (2014). Increasing Popularity of National Training Programme on Commercial Goat Farming: Some Glimpses. Submitted in ICAR- CIRG News Letter for publication.
- Dixit, A.K., Mohan, B., Singh, K. and Kumar, V. (2014). National Training Programme on Scientific Goat farming: Opening New Vista for Goat Farmers. ICAR-CIRG News Letter, volume – X, January – June, 2014, PP: 08.
- Gangwar C, Ranjan R and Kharche SD. 2014. Himkrat Virya dwara Bakarion me Krutrim Garbhdhan. Kheti Duniya Patiyala, pp 12.
- Gangwar Chetna and Jindal S.K. (2015). Virya Himikaran se uttpana shukranu vikritiyan avum unka nirakaran. Ajamukh 30 : 2
- Gangwar Chetna, Ravindra Kumar, Mahesh Dige, Ravi Ranjan and Satish Jindal.(2014) Prajanak Bakron Ka Chayan, Poshan Avum Rakhrakhaw. Kheti pp. 25-26.
- Gururaj. K and Gupta VK (2014) Transcriptional Profiling – A cutting edge tool for measuring host response to a disease condition, CIRG news Vol XI: July –December 2014
- Kharche, S D and Agarwal S K. 2014. Epigenetics: A Paradigm in Germ Cells Differentiation and In Vivo Development. Editor-in-Chief: Prof. N. K. Lohiya Editors: Dr. Dheer Singh & Dr. P. K. Mishra September, 2014, ISSRF News Letter 15:22-24.
- Kumar Vijay, Braj Mohan, A.K.Dixit, Khushiyal Singh, U.C.Yadav and S.C. Gautam (2014) Bakri palan hetu sarkari yojnaye Ajamukh 29 : 4
- Kumar Vijay, Braj Mohan, A.K.Dixit, Khushiyal Singh, U.C.Yadav and S.C. Gautam (2014) Bakri palan hetu sarkari yojnaye Ajamukh 29 : 4
- Kumar, Ravindra, Prabhat Tripathi, U.B.Chaudhary and Manoj Tripathi (2014) Krishi vaniki, bakri palan hetu Samarth chara strot. Ajamukh 29:8
- Kumar Ravindra, (2014) Azolla- a cheap nutrition for goat. CIRG NEWS (10) Jan-june 2014 Pp5
- Pawaiya R V S. 2014. A goat with ovarian tumour. CIRG News. Vol. X, January-June, 2014, pp.3
- Ranjan Ravi and Chetna Gangwar (2014) Nasal sudhar ke liye bakron ka chayan Ajamukh 29: 5
- Sharma N, Shivasharanappa N, Mishra A.K and Chaturvedi V. (2014). Pregnancy toxaemia. Ajmukh CIRG Newsletter (Hindi), July-Dec 2014.
- Sharma N, Shivasharanappa N, Mishra A.K and Chaturvedi V. (2014). Pregnancy toxaemia. Ajmukh CIRG Newsletter (Hindi), July-Dec 2014.
- Sharma N, Srivastava A, Mishra A K and Shivasharanappa N. (2014). Alternative therapies for mastitis in animals. Livestock Line 8 (4): 5-7.
- Sharma N., Kumar A., Mishra A.K and Shivsharanappa N. (2014). Metabolic Profiles-Indicators of Nutritional Status. CIRG Newsletter, Vol XI, July-Dec 2014. Page 2.
- Sharma, DK, Paul, S and Sharma, N. 2014. Twacha Myiasis: Bakriyon evam Bhedon mein prachalit ek ghatak rog. Ajamukh Jan-Jun 2014 29:5
- Sharma, Nitika, Anil Kumar Mishra, N.Shivasharanappa, and Vinay Chaturvedi (2014-2015) Garbhawastha Vishakta Ajamukh 30: 5
- Sharma Nitika, Naveen Kumar, S.V. Singh and M.K.Singh. 2014. Gai evam bhaison ka swasthaye prabhandan. Published by Y.K Graphics, Agra.
- Sikarwar Anuj Kumar, Gangwar Chetna, Ravi Ranjan and S.D.Kharche .(2014). Asadhya Rogon ke Upchar ki Sambhawanaon ko Talashti Vansh Koshikayen. Pashudhan Prakash (5): 114-116.
- Singh, M.K., Ajay Kumar Rai, Anupam Krishan Dixit and Naveen Kumar (2014-15) Bundelkhand khetra me Bakri evam pashupalan ke liye upukt fasle, faslo ki parjatiyan evam fasal chakra Ajamukh 30 : 3
- Tripathi, M. K., Tripathi P. Kumar Ravindra, and Chaudhary, U.B. (2014) Bio-resources that produce methane in goats. CIRG NEWS (10) Jan-june 2014 Pp5.
- Singh M.K., A.K. Dixit, N. Kumar, N. Ramachandran, S.K. Singh, S.V. Singh, A.K. Roy, J.S. Yadav, A.K. Singh, R. Singh and P. Singh. 2014. Goat – For nutritional and livelihood security in Bundelkhand Region. Indian Farming 63(10): 50-54.
- Singh, M.K., Mahesh Shivanand Dige and Anupam Krishan Dixit (2014) Dudharu bakri ki nai nasal ; Batisi Ajamukh 29 :11
- Singh, S.P. and N. Ramachandran (2014) Bakri hetu samayojya slatted farsh. Ajamukh 29 : 2
- Tripathi, Prabhat, M.K.Tripathi, Ravindra Kumar and Umesh Babu Chaudhary (2014-2015) Bakri palan hetu ber adharit krishi vaniki ka Prayog. Ajamukh 30: 8
- Verma, Arun Kumar and V.Raj Kumar (2014-15) Niman sodium yukt bakri mass achaar hridyay ke liye ek vikalp Ajamukh 30:9

RADIO TALK /TV PROGRAMME

- Agarwal, S.K. " Bhartiya paripeksh me bakri palan evam Kendriya Bakri anusandhan sansthan ki bhumika Radio talk from All India Radio Mathura under Farm School on Air Programme
- Agarwal, S.K. Shodh khetra me sansthan ki Uplabhiyan evam yogdan Radio talk In Mewat radio station Haryana.
- Bhushan Saket: "Selection of breeding buck and their management" Radio Talk on 06.08.14 from All India Radio, Mathura (UP).
- Chaudhary, U.B. Bakri poshan evam santulit aahar ki vyavastha avem prabhandhan Radio talk from All India Radio Mathura under Farm School on Air Programme
- Dass, Gopal Dugdh utpadit bakriyon ka chayan prajanan evam unka prabhandhan Radio talk from All India Radio Mathura under Farm School on Air Programme
- Dixit A.K. radio talk (Farm school on AIR) on Vyavsayik Bakri Palan, Arthiki evam Pariyojna Nirman on 24.10.2014 at Akashvani Mathura-
- Gangwar, Chetna Bakri Janan ki Aadhunik Janan taknikiyan on 5-09-2014 Radio talk In Krishi Jagat Prasaran.
- Gangwar, Chetna Bakri Janan se Sambandhit rog avum unke upchar. on 21-10-2014 Radio talk In Mewat radio station Haryana.
- Goel, A.K. Bakri Palan me janan sambhandi samasayay evam samadhan Radio talk from All India Radio Mathura under Farm School on Air Programme
- Gopal Dass. Dugdh Utpadak Bakrion Ka Chayan, Prajnan evam Pravandhan. At Mathura Akashvani on 21.07.2014.
- Gupta, V.K. Bakriyon ke vibhin tike evam swasthya prabhandan Radio talk from All India Radio Mathura under Farm School on Air Programme
- Gupta, V.K. Nasal Sudhar Radio talk In Mewat radio station Haryana.
- Jindal, S.K. "Bakri Vikas me Aadhunik Janan taknikiyan" on 5-09-2014 Radio talk from All India Radio Mathura under Farm School on Air Programme..
- Kharche, S.D. (2014) Bakriyon me rithchkra parikshan and prajanan . radio talk under Farm school on Air, from Aakash Vani Mathura on 27.8.2014
- Kumar, Ashok Mamno me rog , upchar evam bachav Radio talk from All India Radio Mathura under Farm School on Air Programme
- Kumar Ravindra Radio talk on Aaj ki Baat: Hare chhare hetu ghaas ugaye by , All India Radio,Prasar Bharti Mathura. Talk broadcasted on 25 June 2014
- Kumar Ravindra Farm School on Air: Unnat bakari utpadan hetu poshan ki Naveen prodhokiya. All India Radio, Prasar Bharti Mathura.
- Kumar Vijay Bakriyon ke sawadhanipurvak parivahan kaise karen? Radio talk on AIR, Mathura 08-12-2014.
- Mohan Braj Berojgar Yuvakon ke Liye Bakari Palan Ek Uttam Vyavsay Radio talk on 04.12.2014, at All India Radio, Mathura, U.P.-
- Pawaiya, R.V.S. Bakriyon ke sankramak rog aur unka bachav Radio talk from All India Radio Mathura under Farm School on Air Programme
- Rai, B. Bakri farm par hone wale parkukh prabhand karya Radio talk from All India Radio Mathura under Farm School on Air Programme
- Raj Kumar, V. Bakri mass utpad evam unka vipnan Radio talk from All India Radio Mathura under Farm School on Air Programme
- Ramachandran, N. (2014). Bakri aawas prabandhan kaise karen ? Talk delivered in Aakaswani, Mathura for ' Aakaswani par paatsala on Unnath tharike se bakri palan' the occasion of CIRG sthapana diwas-12th July, 2014.
- Rout, P.K. Grameen star par bakriyon ka nasal sudhar Radio talk from All India Radio Mathura under Farm School on Air Programme
- Sharma, D.K radio talk for farmer under "farm on air" programme for Control of Parasitic diseases in goat from Aakash Vani Mathura .
- Sharma, D.K. Bakri Palan Radio talk In Mewat radio station Haryana.
- Sharma, D.K. Thanela Radio talk In Mewat radio station Haryana
- Sharma, D.K. Galghotu Radio talk In Mewat radio station Haryana
- Sharma, Nitika . Radio talk on "General diseases of goats and their traditional treatment" in the Farm on AIR programme organized by CIRG.
- Sharma, R.B. Bakri dudh ka mehtab aur unka utpad Radio talk from All India Radio Mathura under Farm School on Air Programme
- Singh Khushyal Radio talk on Bakri Vipanan ke Vibhin Tarike At AIR, Mathura 08-12-2014.
- Singh, M.K. Mass utpadan hetu Bakriyon ka chayan evam parbhandhan Radio talk from All India Radio Mathura under Farm School on Air Programme
- Singh, S.K. Bakriyon ki vibhin nasle evam upyogita,Radio talk from All India Radio Mathura under Farm School on Air Programme
- Singh, S.V. Bakri me anton ke tb (john's disease) ki pehchan evam tike se bachav Radio talk from All India Radio Mathura under Farm School on Air Programme
- Singh, S.V. Bakri me anton ke tb (john's disease) Radio talk In Mewat radio station Haryana.
- Tripathi, Prabhat Bakri palan ke liye chare ka prabhand Radio talk from All India Radio Mathura under Farm School on Air Programme

BOOK /BULLETINS/MANUAL/CHAPTER/COMPENDIUM

Abhishek, Mishra A K, Gupta C and Agrawal R K (2014). Dermatophytosis: Trichophytosis. In: Bhushan B, Gaur G K, Sharma D, Mendiratta S K, Verma A K, Pawde A M, Singh M, Khan T A, Patel B H M, Pandey H O AND Panigrahi M (Eds.). Livestock Management. Indian Veterinary Research Institute, Izatnagar. pp. 298-300

Agarwal, S.K. and Kharche SD. 2014. Embryo transfer technology: A modern reproductive tool to augment productivity in goats. In : Model training course (MTC) on sustainable development through Improved goat husbandry practices' sponsored by Directorate of extension, Ministry of Agriculture, GOI from 14-21 November 2014

Agarwal, S.K., Kharche, S. D. and Ramachandran, N. (2014). Effect of thermal stress on reproductive performance of livestock. Chapter 20 : p127-137. In : Feed safety and nutritional security under changing climatic scenario Edited by Dutta, N., Pattanaik, A.K., Jadhav, S.E., Chaturvedi, V.B. and Verma, A.K. (Eds.), Centre of Advanced Faculty Training in Animal Nutrition, IVRI, Izatnagar, India, 238pp organised from June 3-23, 2014.

Banerjee, Rituparna, and Arun K. Verma. "Minimally Processed Meat and Fish Products." In Minimally Processed Foods, pp. 193-250. Springer International Publishing, 2015.

Chaturvedi Vinay, Nitika Sharma and Souvik Paul. (2014). Health parameters in Goats. In: Training Manual on "Advances in Goat Production and Health" held during 17-21 June, 2014 for Veterinary Officers of State AHD of UP under Trainer's Training Programme (Skill Development) Sponsored by Department of DADF, Ministry of Agriculture, Government of India. Chapter 11, Page no. 79-84.

Chaturvedi Vinay, Nitika Sharma and Souvik Paul. (2014). Health parameters in Goats. In: Training Manual on "Advances in Goat Production and Health" held during 17-21 June, 2014 for Veterinary Officers of State AHD of UP under Trainer's Training Programme (Skill Development) Sponsored by Department of DADF, Ministry of Agriculture, Government of India. Chapter 11, Page no. 79-84.

Dige, M.S., M.K.Singh, P.K. Rout, Chetna Gangwar and S.K.Singh. Record Keeping in Goat Farms Model Training Course on Sustainable Development through Improved Goat Husbandry Practices from 14-21 Nov, 2014 at CIRG.

Dixit, A.K. (2014). Economics of goat rearing: A techno-economic feasibility analysis published in training manual Advances in Goat Production and Health. Training held at CIRG and sponsored by Govt. of Uttar Pradesh.

Dixit, A.K. (2015). Economics of goat rearing : A techno-economic feasibility published in training manual Advances in Goat Rearing. Training held at CIRG on 28 February to 3 March, 2015. Sponsored by Veterinary Officer Training Institute, Bhubaneswar (Odisha).

Gupta VK,, Gururaj K, and Ashok Kumar 2014. Vaccine and Vaccination in Goats. In : Model training course (MTC) on "sustainable development through Improved goat husbandry practices" sponsored by Directorate of extension, Ministry of Agriculture, GOI from 14-21 November 2014

Gururaj K, Gupta V K, Shivasharanappa N, Ashok Kumar and PK Rout, 2014. Sequencing and phylogenetic analysis of TLR2 gene of four Indian Goat breeds. In: International conference on Host-pathogen interactions, held at NIAB, Hyderabad, India, published in the Nature India(Nature publishing group) ICHPI_PP1-104, pp 118

Gururaj K, Gupta V K, Shivasharanappa N, Ashok Kumar and PK Rout, 2014. Sequencing and phylogenetic analysis of TLR2 gene of four Indian Goat breeds. In: International conference on Host-pathogen interactions, held at NIAB, Hyderabad, India, published in the Nature India(Nature publishing group) ICHPI_PP1-104, pp 118

Gururaj K, Mishra A K, Gupta V K, Shivasharanappa N, Sharma N, Kumar A, Chaturvedi V, Paul S and Pawaiya RVS, 2015.Reports on chlamydial abortions in sheep and goats endemic to Brucella melitensis during peak kidding season. In: Souvenir of ISVM Seminar-2015 on 'New dimensions in veterinary medicine: Technology advances, one health concept and animal health concepts ' held at Kerala Veterinary and Animal Sciences University, Pookode,Wayanad,Kerala on Jan 22-24, 2015. Abstract OFI 5.33, pp.222.

Gururaj K, Mishra A K, Gupta V K, Shivasharanappa N, Sharma N, Kumar A, Chaturvedi V, Paul S and Pawaiya RVS, 2015.Reports on chlamydial abortions in sheep and goats endemic to Brucella melitensis

during peak kidding season. In: Souvenir of ISVM Seminar-2015 on 'New dimensions in veterinary medicine: Technology advances, one health concept and animal health concepts ' held at Kerala Veterinary and Animal Sciences University, Pookode,Wayanad,Kerala on Jan 22-24, 2015. Abstract OFI 5.33, pp.222.

Gururaj K. 2014. Collection and dispatch of morbid material for disease investigation. In : Model training course (MTC) on "sustainable development through Improved goat husbandry practices" sponsored by Directorate of extension, Ministry of Agriculture, GOI from 14-21 November 2014

Jakhmola R C, Tripathi M K and Tripathi Prabhat. 2014. Mitigation of enteric methane in relation to global warming. In: Recent Advances in Animal Nutrition (Eds. Bakshi, M.P.S. and Wadhwa, M). Satish Serial Publishing House, New Delhi, India. pp 19-39.

Jindal, S K, Rai, B., Kharche, S D, Ranjan, R. and Ramachandran, N. (2014). Goat housing and appliances. P 53-58. In : Training Manual on Advances in Goat Production and Health. Edited by Ashok Kumar, PK Rout, VK Gupta, RVS Pawaiya and Vijay Kumar. Pp 1-178 at CIRG, Makhdoom.

Kharche SD. 2014. Heat Detection and Oestrus synchronization methods. In : Model training course (MTC) on ,sustainable development through Improved goat husbandry practices' sponsored by Directorate of extension, Ministry of Agriculture, GOI from 14-21 November 2014.

Kumar Vijay, Dige M S, Ramachandran N, Rout P K and Kumar Ashok. 2014. Sustainable goat production through improved goat husbandry practices. Central Institute for Research on Goats, Makhdoom, Mathura, Uttar Pradesh, India - 281 122.

Kumar A, V. K. Gupta, K. Gururaj, Nitika Sharma, Shivasharanappa N and Vijay Kumar. (2014). Emerging Infectious Diseases and their Control in Goats. In: Training Manual on "Sustainable development through improved goat husbandry practices" held at CIRG, Makhdoom, Farah, Mathura (UP) on Nov 14-21, 2014 for veterinary officers; sponsored by directorate of extension, Ministry of Agriculture, Government of India. Chapter 15, pp. 105-112.

Kumar Ashok , Gupta VK, Gururaj K, Sharma N, Shivasharanappa N and Kumar V 2014. Emerging infectious diseases and their control in Goats. In : Model training course (MTC) on "sustainable development through Improved goat husbandry practices" sponsored by Directorate of extension, Ministry of Agriculture, GOI from 14-21 November 2014

Kumar Ashok, Gupta V K, Gururaj K, Sharma N, Shivashranappa N and Kumar Vijay. 2014. Emerging infectious diseases and their control in goats. Sustainabe goat production through improved goat husbandry practices, Central Institute for Research on Goats, Makhdoom, Mathura, India-281122, pp. 105-112.

Kumar Ashok, Rout P K, Gupta V K, Pawaiya R V S and Kumar Vijay. 2014. Advance in goat production and health. Central Institute for Research on Goats, Makhdoom, Mathura, Uttar Pradesh, India - 281 122.

Kumar Ravindra, Pankaj Kumar Singh and Avinash Kumar. (2015) Vitamin Supplementation in Livestock and Poultry. In: Feed supplement for livestock and poultry. Published by Daya publishing house, New Delhi. 258-277

Kumar Vijay and Dige M S. 2014. Use of computer in goat husbandry. Sustainable goat production through improved goat husbandry practices, Central Institute for Research on Goats, Makhdoom, Mathura, India-281122, pp. 142-146.

Kumar Vijay, Kumar Ashok and Ramachandran N. 2014. Transportation of sheep and goats: Important guidelines. Advances in goat production and health, Central Institute for Research on Goats, Makhdoom, Mathura, India-281122, pp. 173-178.

Kumar Vijay, M S Dige, N Ramachandran, P K Rout and Ashok Kumar Model Training Course manual on " Sustainable Development through improved Goat Husbandry Practices" Edited by and. 218pp organised from November 14-21, 2014 at CIRG, Makhdoom.

Kumar Vijay, M S Dige, N Ramachandran, P K Rout and Ashok Kumar Model Training Course manual on " Sustainable Development through improved Goat Husbandry Practices" Edited by and. 218pp organised from November 14-21, 2014 at CIRG, Makhdoom.

Kumar, V., Kumar, A. and Ramachandran, N. (2014). Transportation of Sheep and Goats: Important Guidelines. P 173-178. In : Training Manual on Advances in Goat Production and Health. Edited by Ashok Kumar, P K Rout, V K Gupta, RVS Pawaiya and Vijay Kumar. Pp 1-178 at CIRG, Makhdoom.

Kumar, V., Kumar, A. and Ramachandran, N. (2014). Transportation of Sheep and Goats: Important Guidelines. P 173-178. In : Training Manual on Advances in Goat Production and Health. Edited by Ashok Kumar, P K Rout, V K Gupta, RVS Pawaiya and Vijay Kumar. Pp 1-178 at CIRG, Makhdoom.

Mohan, B. and Singh, K.(2014). Goat Husbandry : A Tool to Augment Livelihood Security of Farmers. Submitted for Manual for Model Training Course (MTC) on "Sustainable Development through Improved Goat Husbandry Practices." Sponsored by Directorate of Extension , Ministry of Agriculture, Government of India, New Delhi on 14-21 November, 2014 (08 days) at ICAR-CIRG , Makhdoom.

Mohan, B. and Singh, K.(2014). Goat Husbandry : A Tool to Augment Livelihood Security of Farmers. Submitted for Manual for Model Training Course (MTC) on "Sustainable Development through Improved Goat Husbandry Practices." Sponsored by Directorate of Extension , Ministry of Agriculture, Government of India, New Delhi on 14-21 November, 2014 (08 days) at ICAR-CIRG , Makhdoom.

Paul Souvik, Shivasharanappa N, Nitika Sharma and D K Sharma.(2014) Collection and examination for ecto-parasites in goats Training manual on 'Advances in Goat Production and Health' organised for veterinary officers of state animal husbandry department of Uttar Pradesh, India. From 17th to 21st June, 2014

Paul Souvik, Shivasharanappa N, Nitika Sharma and D K Sharma.(2014) Collection and examination for ecto-parasites in goats Training manual on 'Advances in Goat Production and Health' organised for veterinary officers of state animal husbandry department of Uttar Pradesh, India. From 17th to 21st June, 2014

Rai, B., Singh, M K., Ramachandran, N. and Jindal, S K (2014). Goat production systems in India. P 1-7. In : Training Manual on Advances in Goat Production and Health. Edited by Ashok Kumar, PK Rout, VK Gupta, RVS Pawaiya and Vijay Kumar. Pp 1-178 at CIRG, Makhdoom.

Ramachandran, N., Singh, S. P. and Kumar, V. (2014). Farm operations including shelter and equipments. P 17-26. In : Model Training Course manual on " Sustainable Development through Improved Goat Husbandry Practices " Edited by Vijay Kumar, M S Dige, N Ramachandran, P K Rout and Ashok Kumar and. Pp 1-218 organised from November 14-21, 2014 at CIRG, Makhdoom.

Ranjan, R. and Ramachandran, N. (2014). Common practices in farm management. P 41-52. In : Training Manual on Advances in Goat Production and Health. Edited by Ashok Kumar, PK Rout, VK Gupta, RVS Pawaiya and Vijay Kumar. Pp 1-178 at CIRG, Makhdoom.

Reena Mukherjee and Nitika Sharma (2014). Dudaharu pashuyo mein thanela rog evam uski roktham. In: Parvatiye chetron mein aadhunik go palan. Pages 162-170 Edited by A.B.Pandey, Shashi Bhushan Sudhakar and Vishwanath Sahoo, 2014, Published by I.V.R.I, Mukteshwar, Uttarakhand.

Sahoo A and Tripathi M K. 2014. Feed resources management to maximize nutrient input for economic small ruminant Production. Proc. "National Seminar Prospects and challenges in small ruminant production in India", December 11-12, Sheep Breeding Station, Sandynallah, The Nilgiris (TNVASU), Tamil Nadu 643-237. pp 15-27.

Sharma D K, Souvik Paul, Shivasharanappa N, Nitika Sharma (2014) Endoparasitic spectrum, pathogenesis and strategic control in goats. Training manual on 'Advances in Goat Production and Health' organised for veterinary officers of state animal husbandry department of Uttar Pradesh, India. From 17th to 21st June, 2014

Sharma N, A Kumar, R Kumar, N Shivasharanappa, AKMishra, V Chaturvedi, M K Singh and RVS Pawaiya .2014. Changes in energy metabolism during peri-parturient period in goats. Published in Proceeding of Global Animal Nutrition Conference (Glance) Page:214

Sharma N, Kumar A, Mishra A K and Shivasharanappa N. (2014). Management of Production and Zoonotic Diseases. In: Training Manual on "Sustainable development through improved goat husbandry practices" held at CIRG, Makhdoom, Farah, Mathura (UP) on Nov 14-21, 2014 for veterinary officers; sponsored by directorate of extension, Ministry of Agriculture, Government of India.Chapter 19, pp. 132-141.

Sharma Nitika, Shivasharanappa N, AK Mishra, Vinay Chaturvedi and Surender Kumar. (2014). Control of important viral diseases of goats. In: Training Manual on "Advances in Goat Production and Health" held during 17-21 June, 2014 for Veterinary Officers of State AHD of UP under Trainer's Training Programme (Skill Development) Sponsored by Department of DADF, Ministry of Agriculture, Government of India. Chapter 13, Page no. 93-101.

Shivasharanappa N, Gupta V K, Gururaj K, and VK Singh, 2014. Overexpression of TLR-4 and -9in supramammary lymph nodes and mammary glands of Brucella infected goats. In: International conference on Host-pathogen interactions, held at NIAB, Hyderabad, India, published in the Nature India(Nature publishing group) ICHPI_PP1-103, pp 119.

Shivasharanappa N, Sharma N and Mishra A K, (2014). Herd Health: Monitoring and Regular

Activities. In: Training Manual on "Sustainable development through improved goat husbandry practices" held at CIRG, Makhdoom, Farah, Mathura (UP) on Nov 14-21, 2014 for veterinary officers; sponsored by directorate of extension, Ministry of Agriculture, Government of India.Chapter 13, pp. 94-96.

Singh M K and M S Dige 2014. Goat Management Systems/Models in Goat Production in India Model Training Course on "Sustainable Development through Improved Goat Husbandry Practices" November 14-21, 2014: Published by CIRG, Makhdoom pg 10-16.

Singh Pankaj Kumar and Ravindra Kumar (2015) Feed Supplements: An Overview. In: Feed supplement for livestock and poultry. Published by Daya publishing house, New Delhi pp 1-5

Singh Pankaj Kumar, Ravindra Kumar, Chandramoni and Kaushal Kumar (2015) Non Proteinous Nitrogen Supplementation in Ruminants In: Feed supplement for livestock and poultry. Published by Daya publishing house, New Delhi.68-84.

Singh S.V. and Sohal, J.S. Mycobacterium avium subspecies parartuberculosis in sheep and goats. A book on sheep and goat diseases

Singh, S. P., Ramachandran, N. and Jindal, S. K. (2014). Effect of different stresses on goat production and welfare. P 87-93. In : Training manual on "Advances in Goat Rearing" Edited by Vijay Kumar, P K Rout, Ashok Kumar and M S Dige. Pp 1-215 for training organised from Feb 28- March 03, 2015 at CIRG, Makhdoom. .

Swarup D, Dwivedi H.P and Nitika Sharma (2015). Recent trends in treatment of mastitis. In: Mastitis in dairy animals an update Pages 219-248 Edited by A.K. Srivastava, A. Kumaresan, and Manimaran, 2015, Published by Satish Serial Publishing House, Azadpur, Delhi.

Tripathi, M.K., Kumar Ravindra, Chaudhary, U.B. and Tripathi Prabhat. 2015. Emerging nutritional approached to manipulate rumen efficiency. In: Eco-Responsive Feeding and Nutrition: Linking Livestock and Livelihood (Eds. Pattaniak, A.K., Verma, A.K., Jadhav, S.E., Dutta, N. and Saikia, N.), Animal Nutrition Association, India (ISBN 978-81-908621-6-5), pp 181-190.

PAPERS PRESENTED IN NATIONAL AND INTERNATIONL CONFERENCES

Abhishek, Gupta S K, Prakash C, Mishra A K and Singh M, 2014. A study on occurrence of mycotic infections in diseased livestock, poultry, canines and equines: Isolation, and identification. In: Souvenir of IAVMI Conference-2014 on 'Challenges and opportunities in animal health at the face of globalization and climate change' held at DUVASU, Mathura on Oct 30-Nov 1, 2014. Abstract S11-O6, pp.182.

Abhishek, Rawat M, Gupta S K, Viswas K N, Anjay Mishra A K, Kumar B, Prakash C, Priydarshani, A and Kumar S,2014. Isolation and characterization of bacteriophages virulent to Salmonella abortus equi associated with equine infections. In: Souvenir of IAVMI Conference-2014 on 'Challenges and opportunities in animal health at the face of globalization and climate change' held at DUVASU, Mathura on Oct 30-Nov 1, 2014. Abstract S7-O4, pp.98.

Agarwal Surbhi, Sikarwar AKS, Sharma Juhi R, Kharche SD, Ranjan R, Goel AK, Jindal SK and Agarwal SK. Effect of Cysteamine supplementation on in vitro development of caprine embryos. National Symposium on "Research and Innovation toimprove Animal Fertility and fecundity and XXX annual convention of India society for study of animal reproduction" held on January 20-22 Nov., 2014 at DUVASU, Mathura.

Bhusan Saket and Aarti Sharma (2014). Genetic polymorphism in Jakhrana goats and their comparison with other Indian goat breeds through RAPD" Proceeding of the National seminar, "Prospects and challenge in small ruminant production in India" organized by ISSGPU, CSWRI, Avikanagar will be held on 11-12 December, 2014 at Ooty (Tamilnadu)..

Bhusan Saket and Tanvi Gupta (2014). Genetic relation at molecular level between three Indian dairy goat breeds of North western region. Proceeding of the National Symposium, "" organized by SOCDAB, NBAGR, Karnal which was held on 6-7 February, 2014 at NBAGR, Karnal.

Dass Gopal and P. K. Rout (2015). Evaluation of reproduction traits of Muzaffarnagari sheep. Published in the compendium of International Symposium on "Sustainable management of animal genetic resources for livelihood security in developing countries" organized by TANUVAS, Chennai and SOCDAB, NBAGR, Karnal from 13-14th Feb., 2015 at Madras Veterinary College, TANUVAS, Chennai, Page No. 62.

Dass Gopal, P. K. Rout and S. K. Singh (2014). Production performance of Muzaffarnagari sheep in organized flock. Published in the compendium of National Seminar on "Prospects and challenges in small ruminant production in India" held at Sheep Breeding Research Station, Sandynallah, The Nilgiris, Tamil Nadu from December 11-12, 2014, Page No.93.

Dass Gopal, P. K. Rout, Y. K. Kushwah and M. S. Dige (2015). Evaluation of production traits of Muzaffarnagari sheep. Published in the compendium of International Symposium on "Sustainable management of animal genetic resources for livelihood security in developing countries" organized by TANUVAS, Chennai and SOCDAB, NBAGR, Karnal from 13-14th Feb., 2015 at Madras Veterinary College, TANUVAS, Chennai, Page No. 61-62.

Dass Gopal, Souvik Paul and Vinay Chaturvedi (2014). Survivability of Muzaffarnagari sheep under semi arid climate of Uttar Pradesh. Published in the compendium of National Seminar on "Prospects and challenges in small ruminant production in India" held at Sheep Breeding Research Station, Sandynallah, The Nilgiris, Tamil Nadu from December 11-12, 2014, Page No. 210.

Dass Gopal, Souvik Paul, Vinay Chaturvedi and Nitika Sharma (2015). Survival rate of Muzaffarnagari sheep under organized farm. Published in the compendium of International Symposium on "Sustainable management of animal genetic resources for livelihood security in developing countries" organized by TANUVAS, Chennai and SOCDAB, NBAGR, Karnal from 13-14th Feb., 2015 at Madras Veterinary College, TANUVAS, Chennai, Page No. 62-63.

Dige M S, M K Singh, P K Rout and S K Singh. 2015. Population structure and pedigree analysis in Barbari goat. International Symposium on" Sustainable Management of Animal Genetic Resources for Livelihood Security in Developing Countries. 13-14 Feb, 2015, TANUVASU Chenni. Page-269

Dixit A K,Ashok Kumar , B Mohan (2014) Economic losses due to PPR disease in Goats: A case Study in Auriya District of Uttar Pradesh . national Symposium on " Livestock production practices for small farm of Marginalized group and communities in India " at CAU Aizwal 28-30 Jan 2015

Dixit A K, M K Singh and B Rai. 2014. Economic and Environmental contribution of goats in India with special reference to Mixed Farming System. Published in compendium of National Seminar on Prospects and Challenges in Small Ruminants in India held at Sheep Breeding Research Station TANVASU, Sandynallah, The Niligiri on 11-12 December, 2014. Page No 104.

Durge S M and Tripathi M K. 2014. Utilisation of Brassica juncea meal as an economic protein source in lactating Jamunapari goats feeding. Proc. of Global Animal Nutrition Conference 2014 on "Climate Resilient Livestock Feeding System for Global Food Security" from April 20-22, Bangalore, India. pp 222.

Durge S M, Tripathi M K, Uke S P and Gupta D L. 2015. Milk production increased by feeding of Brassica juncea meal in lactating goats. Proc. 9th Biennial Animal Nutrition Association conference on "Eco-responsive feeding and nutrition: Linking livestock and livelihood. January 22-24, 2015, Guwahati, India. pp 73.

Gangwar Chetna, B. Rai, S. K. Jindal and A. K. Dixit. Promotion of goat husbandry practices for livelihood empowerment of rural women in Barabanki district of Uttar Pradesh. National Seminar/Workshop on Gender Equity, Sensitization and Women Empowerment held on 11-12 March (2015) organized by Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut.

Gangwar Chetna, Ranjan R., Kharche S.D., Kumar Satish., Goel A.K.and Jindal S.K. (2014). Effect of Vitamin C (Ascorbic Acid) concentration in buck semen dilutor on quality of frozen semen. National Seminar on Prospects and Challenges in Small Ruminant Production in India held on 11-12 Dec ,2014 at Sheep Breeding Research Station, Sandynalla, Ooty.

Gangwar Chetna, Ravindra Kumar, Prabhat Tripathi, M.K. Tripathi and U.B. Chaudhary. (2014). Effects of azolla supplementation on Barbari buck semen quality. . XXX annual convention of Indian Society for study of Animal reproduction (ISSAR) and national Symposium on Research and innovation to improve Animal Fertility and Fecundity 20-22 November 2014.

Gupta G, Paul S, Sharma D K, Mishra A K, Shivasharanappa N and Sharma N, 2014. Epidemiology of caprine cryptosporidiosis in goats. In: Souvenir of IAVMI Conference-2014 on 'Challenges and opportunities in animal health at the face of globalization and climate change' held at DUVASU, Mathura on Oct 30-Nov 1, 2014. Abstract S10-P10, pp.160.

Gupta V. K., K Gururaj, Shivasaranappa N and Ashok Kumar (2015) Evaluation of recombinant outer membrane protein 28 of brucellamelitensis for diagnosis of caprine brucellosis- In: Souvenir of ISVM Seminar-2015 on 'New dimensions in veterinary medicine: Technology advances, one health concept and animal health concepts ' held at Kerala Veterinary and Animal Sciences University, Pookode,Wayanad,Kerala on Jan 22-24, 2015.

Gururaj K, Gupta V K, Shivasharanappa N, Ashok Kumar and PK Rout, 2014. Sequencing and phylogenetic analysis of TLR2 gene of four Indian Goat breeds. In: International conference on Host-pathogen interactions, held at NIAB, Hyderabad, India, published in the Nature India(Nature publishing group) ICHPI_PP1-104, pp 118

Gururaj K, Mishra A K, Gupta V K, Sharma N, Shivasharanappa N, Paul S, Kumar A, Pawaiya RVS, Sharma D K and Singh S V, 2014. Isolation and molecular characterization of Corynebacterium ovis from an outbreak of caseous lymphadenitis (CLA) in an organized goat farm. In: Souvenir of IAVMI Conference-2014 on 'Challenges and opportunities in animal health at the face of globalization and climate change' held at DUVASU, Mathura on Oct 30-Nov 1, 2014. Abstract S10-O2, pp.153.

Gururaj K, Mishra A K, Gupta V K, Shivasharanappa N, Sharma N, Kumar A, Chaturvedi V, Paul S and Pawaiya RVS, 2015.Reports on chlamydial abortions in sheep and goats endemic to Brucella melitensis during peak kidding season. In: Souvenir of ISVM Seminar-2015 on 'New dimensions in veterinary medicine: Technology advances, one health concept and animal health concepts ' held at Kerala Veterinary and Animal Sciences University, Pookode,Wayanad,Kerala on Jan 22-24, 2015. Abstract OFI 5.33, pp.222.

Kharche SD, Agarwal Surbhi, Sikarwar AKS, Sharma Juhi R, Gangwar Chetna, Ranjan R, Goel AK, Jindal SK, and Agarwal SK. 2015. Comparative study on TALP and TRIS media for sperm capacitation and subsequent in vitro fertilization of in vitro matured Caprine oocytes. In XII Agricultural Science Congress on Sustainable Livelihood Security for Small Holder Farmers, 3rd to 6th February, 2015 at NDRI, karnal, pp. 166.

Kharche SD, Sharma Juhi R, Agarwal Surbhi, Sikarwar AKS, Ranjan R, Goel AK, Jindal SK and Agarwal SK.. Effect of Calcium ionophore activation on cleavage rate of Intracytoplasmic Sperm Injected in vitro matured Caprine oocytes. International conference on Reproductive Health and 25th Annual meeting of the Indian Society for the study of Reproduction and Fertility from 14th to 17th February, 2015 organized by National Institute for Reproductive Health at Mumbai.

Kumar A., Sharma N., Sharma D.K, Gupta VK, Chaudhary M.K, Kishore V, Tiwari HA and Chaturvedi V. (2015). Brine shrimp lethality assay as simulation studies for in vitro ectoparasiticidal bioactivity in plant extracts. In: Souvenir of ISVM Seminar-2015 on 'New dimensions in veterinary medicine: Technology advances, one health concept and animal health concepts ' held at Kerala Veterinary and Animal Sciences University, Pookode,Wayanad,Kerala on Jan 22-24, 2015. Abstract OEV 4.24 pp.177-78.

Kumar Pradeep, Gangwar Chetna, Jindal SK, Kharche SD, Ranjan R, Goel AK, Satish Kumar and Agarwal SK. (2015). Optimization of Cholesterol loaded cyclodextrin (CLC) concentration in buck semen diluter. In XII Agricultural Science Congress on Sustainable Livelihood Security for Small Holder Farmers, 3rd to 6th February, 2015 at NDRI, karnal, pp. 167.

Kumar Ravindra, Chaudhary, U.B., Kumar, A. and Sharma, D.K. (2014) Evaluation of complete pellet containing herbal feed mix on Coccidiosis in growing barbari goats. In : International conference on "Challenges and opportunities in Animal Health at the face of Globalization and climate change held from 30 Oct-1st Nov 2014 at DUVASU, Mathura.

Kumar Ravindra, Tripathi, P , Chaudhary, U.B., and Tripathi M.K. and Sharma R.B. (2015). In vitro evaluation of complete feed having different azolla meal proportion with goat rumen microflora. In: Eco-Responsive Feeding and Nutrition: Linking livestock and Livelihood: Proceedings of 9thBiennial Animal Nutrition Association Conference, January 22-24, 2015, Guwahati, India

Kumar Ravindra, Tripathi, P , Chaudhary, U.B., Tripathi M.K. and Singh R.K. (2015). Effect of Azolla based complete pellet feed on growth, blood metabolites and rumen fermentation in barbari goats. In: Eco-Responsive Feeding and Nutrition: Linking livestock and Livelihood: Proceedings of 9thBiennial Animal Nutrition Association Conference, January 22-24, 2015, Guwahati, India

Kumar, R., Tripathi, P., Chaudhary, U. B. and Tripathi, M. K. (2014) Nutrient composition, in vitro methane production and digestibility of Azolla (Azolla microphylla) with rumen liquor of goats. In: Global Animal Nutrition Conference 2014 on Climate Resilient Livestock feeding systems for global food security held from 20-22 April 2014 at Bangalore.

Kumar Narendra, Gangwar Chetna*, Rai B., Kharche S.D., Bhusan Saket, Ramachandran N. and Jindal S.K. 2014) Relationship between testicular size on libido and semen quality in Jakhrana bucks. XXX annual convention of Indian Society for study of Animal reproduction (ISSAR) and national Symposium on Research and innovation to improve Animal Fertility and Fecundity 20-22 November 2014.

Kumar Pradeep., Gangwar Chetna*, Jindal S.K., Kharche S.D., Ranjan R., Goel A.K., Kumar Satish and Agarwal S.K. (2015) : Optimization of Cholesterol loaded Cyclodextrin (CLC) concentration in buck semen diluter. XII Agricultural Science Congress on Sustainable Livelihood Security for Smallholder Farmers held on 3-6 Feb 2015 at NDRI, Karnal, Haryana.

Kumar Vijay, S.P. Singh, M.M. Farooqui, Chetna Gangwar, Abhinov and Prabhakar Kumar.(2014). Role of Mono and Binucleate Trophoblast cells during different stages of pregnant goat. National Seminar on Prospects and Challenges in Small Ruminant Production in India held on 11-12 Dec ,2014 at Sheep Breeding Research Station, Sandynalla, Ooty.

Kumar Vijay, S.P.Singh, M.M.Farooqui, Chetna Gangwar, Abhinov and Prabhakar Kumar.(2014). Role of Mono and Binucleate Trophoblast cells during different stages of pregnant goat. National Seminar on Prospects and Challenges in Small Ruminant Production in India held on 11-12 Dec ,2014 at Sheep Breeding Research Station, Sandynalla, Ooty.

Kumar Vijay. 2014. Assessment of technology and training needs on ICAR foundation day 16 July 2014 at CIRG, Makhdoom.

Kumar, V., Mohan, B., Dixit, A.K., Singh, K., Kumar, A. and Chaudhary , U.B. (2014) . Angikrat Ganvon Mei Bakari Palkon Ki Samajik – Arthik Esthti. Hindi Shodh Patra Pratiyogita on 25.09.2014 at ICAR- CIRG, Makhdoom (Won II nd Prize).

Kumar, V., Singh, B.P., Mohan, B., Dixit, A.K. and Singh, K. (2014). Production Performance of Goat: A Field Study in Semi- Arid Zone of Uttar Pradesh, India. National ISSGPU seminar from 11-12 December, 2014 at Udhagamandalam (Otty), Tamilnadu.

Mohan, B., Dixit, A.K., Singh, K. and Kumar, V. (2014). Small Farm Goat Production in Semi-Arid Region of uttar Pradesh. Presented in 7th National Extension Education Congress- 2014 at ICAR- Research Complex For NEHR, Umiam , Meghalya on 08-11 November, 2014. Abstract printed in compendium , PP :50.

Narendra, K., Gangwar C, Rai, B., Kharche S.D., Bhusan, S., Ramachandran, N. and Jindal, S. K. (2014). Influence of rearing systems and seasons on sperm abnormalities in Jamunapari buck semen Abstract No. AIA-32. National Seminar on "Research and Innovations to Improve Animal Fertility and Fecundity" & XXX Annual Convention of ISSAR held on November 20 -22 at DUVASU, Mathura. P110.

Pawaiya RVS, Shivasharanappa N, Beena V, Sharma N, Gururaj K, Mishra A K, Gupta V K, Kumar A, Paul S, Kumar V, Dixit A K, Sharma D K, Kumar N, Gautam T K and Singh S V, 2014. Mortality in goats due to alimentary system diseases: A 25 year (1988-2012) study. In: Compendium of Veterinary Pathology Congress-2014 31st Annual Conference of IAVP and National symposium on 'impact of climate change on pathobiology of diseases of animals, poultry and fish' held at Anand Agricultural University, Anand on Nov 13-15, 2014. Abstract 15, pp. 101.

Pawaiya RVS, Shivasharanappa N, Beena V, Sharma N, Gururaj K, Mishra A K, Gupta VK, Kumar A, Paul S, Sharma D K and Singh S V, 2014. A case of composite neoplasm in a goat having histological features of thecoma and metastatic adenocarcinoma. In: Compendium of Veterinary Pathology Congress-2014, 31st Annual Conference of IAVP and National symposium on 'impact of climate change on pathobiology of diseases of animals, poultry and fish' held at Anand Agricultural University, Anand on Nov 13-15, 2014. Abstract 8, pp. 98.

Priyanka Raj and Ashok Kumar (2015) Antioxidant potential of synergistic combination of methanolic leave extracts of aegle marmelos and azadirachta indica against weaning stressed goat kids. In Souvenir of ISVM Seminar-2015 on 'New dimensions in veterinary medicine: Technology advances, one health concept and animal health concepts ' held at Kerala Veterinary and Animal Sciences University, Pookode,Wayanad,Kerala on Jan 22-24, 2015.

Rai B, M.K.Singh, A.K.Dixit and R B Rai 2015. Impact of improved goat based intervention on sustainable livelihood in disadvantaged districts of Uttar Pradesh" Published in compendium of ISAPM National Seminar on " Livestock Production Practices for Small Farms of Marginalized Groups and Communities in India" held during 28 – 30 January, 2015 at Aizawl, Mizoram.

Ramachandran, N., Singh, N. P., Ranjan R. and Goel, A. K. (2014). Assessment of nutrition and season interaction on semen freezability in Jamunapari buck semen Abstract No. AND-54. International Symposium on "Current challenges and Translational research to augment animal reproduction" jointly organized by TANUVAS and Washington University, USA on December 4-5 at TANUVAS, Chennai, Tamilnadu. P190-91.

Ramachandran, N., Singh, N. P., Shinde, A. K., Meena, R. and Jindal, S. K. (2014). Effect of seasons on nutrients intake and seminal traits in Jamunapari bucks Abstract No. SS III P-18. National Seminar on "Physiological Determinants of Climate Resilient and Sustainable Animal Production" & XXIII Annual Convention of SAPI held on November 27 -28 at CIRB, Hisar, Haryana. P161-62.

Ramachandran, N., Singh, N. P., Sikarwar A.K.S. and Jindal, S. K. (2014). Influence of rearing systems and seasons on sperm abnormalities in Jamunapari buck semen Abstract No. AIA-27. National Seminar on "Research and Innovations to Improve Animal Fertility and Fecundity" & XXX Annual Convention of ISSAR held on November 20 -22 at DUVASU, Mathura. P112-13.

Ranjan R, Singh Renu, Kumar Kuldeep, Sarkar M, Das B C and Sadhan Bag. (2014). Expression profile of P57KIP2 and Dlk1 genes among diploid parthenogenetic, female sexed IVF and in vivo derived embryos during preimplantation development in goat. National Seminar on "Prospects and challenges in small ruminant production in India" organized by TNVASU and ISSGPU at Ooty from 11-12 Dec, 2014. P-191

Ranjan R, Singh Renu, Kumar Kuldeep, Sarkar M, Das B C and Sadhan Bag. (2014). Comparative expression profile of maternally and paternally imprinted gene during preimplantation development in Capra hircus. Annual Conference of SAPI and National Symposium on "Physiological Determinants of Climate Resilient and Sustainable Animal Production"

organized by CIRB, Hisar and SAPI from Nov 27-28, 2014.p-94

Rout P K (2015). Goat –a key driver of inclusive growth and bringing equity in society, XII Agricultural science congress on sustainable livelihood security for small holder farmers,289, February 3-6,2015 , NDRI, Karnal

Rout, P. K., Gopal Dass and H. A. Tiwari (2015). Evaluation of production traits of Jamunapari goats. Published in the compendium of International Symposium on "Sustainable management of animal genetic resources for livelihood security in developing countries" organized by TANUVAS, Chennai and SOCDAB, NBAGR, Karnal from 13-14th Feb., 2015 at Madras Veterinary College, TANUVAS, Chennai, Page No. 69.

Sharma N, Kumar A, Chandresh, Shivasharanappa N, Mishra A K, Gururaj K and Chaudhary M K. 2014. Strong antimicrobial activity of methanolic extracts of *Holarrhaena antidysenterica*, *Aegles marmelos, Cordia myxa and Gloriosa superba* against uspA expressing multi-drug resistant *Escherichia coli* isolates recovered from neonatal diarrhoeic goat kids. In: Souvenir of IAVMI Conference-2014 on 'Challenges and opportunities in animal health at the face of globalization and climate change' held at DUVASU, Mathura on Oct 30-Nov 1, 2014. Abstract S7-O6, pp.99.

Sharma N, Kumar A, Kumar R, Shivasharanappa N, Mishra A K, Chaturvedi V, Pawaiya RVS and Singh MK, 2014. Changes in energy metabolite during periparturient period in goats. In: Compendium of GLANCE, 2014 on 'Climate resilient livestock feeding systems for global food security' held at Vivanta, Bengaluru, Karnataka on April 20-22, 2014. Abstract NRH-2, pp. 214.

Sharma N, Mukherjee R, Shivasharanappa N, Mishra A K and Paul S, 2014. Modulation of polymorphonuclear cell apoptosis by Staphylococcus aureus in mouse model mastitis. In: Souvenir of IAVMI Conference-2014 on 'Challenges and opportunities in animal health at the face of globalization and climate change' held at DUVASU, Mathura on Oct 30-Nov 1, 2014. Abstract S8-O4, pp.122.

Sharma, Nitika, Gopal Dass, Vinay Chaturvedi and Souvik Paul (2015). Normal biochemical values in different genetic lines of Muzaffarnagari ewes. Published in the compendium of International Symposium on "Sustainable management of animal genetic resources for livelihood security in developing countries" organized by TANUVAS, Chennai and SOCDAB, NBAGR, Karnal from 13-14th Feb., 2015 at Madras Veterinary College, TANUVAS, Chennai, Page No. 268.

Shivasharanappa N, Gupta V K, Gururaj K, and VK Singh, 2014. Overexpression of TLR-4 and -9in supramammary lymph nodes and mammary glands of Brucella infected goats. In: International conference on Host-pathogen interactions, held at NIAB, Hyderabad, India, published in the Nature India(Nature publishing group) ICHPI_PP1-103, pp 119.

Shivasharanappa N, Pawaiya RVS, Sharma N, Mishra A K, Gururaj K, Paul S, Gupta V K, Kumar A, Sharma D K, Kumar N, Gautam T K and Singh S V, 2014. Concurrence occurrence of adenocarcinoma of ileum and Johne's disease in a goat. In: Compendium of Veterinary Pathology Congress-2014 31st Annual Conference of IAVP and National symposium on 'impact of climate change on pathobiology of diseases of animals, poultry and fish' held at Anand Agricultural University, Anand on Nov 13-15, 2014. Abstract 9, pp. 98.

Shivasharanappa N, A K Sharma, V K Gupta, RVS Pawaiya, Nitika Sharma, R Singh, M Kataria, S Dandapat, A G Telang and A K Sharma. 2014. The effect of T-2 toxin in the feed on Heat Shock Proteins (HSPs) and oxidative stress in goats. In: Compendium of GLANCE, 2014 on 'Climate resilient livestock feeding systems for global food security' held at Vivanta, Bengaluru, Karnataka on April 20-22, 2014. Abstract NGE-14, pp. 67.

Sikarwar A.K.S., Sinha N.K., Kharche S.D., Ramachandran N., Ranjan R. and Agrawal S.K. (2014). Comparative Evaluation of Dimethyl Sulfoxide and Glycerol on freezability of Sirohi buck Semen Abstract No. AIA-045. National Seminar on "Research and Innovations to Improve Animal Fertility and Fecundity" & XXX Annual Convention of ISSAR held on November 20 -22 at DUVASU, Mathura. P118.

Sikarwar A.K.S., Sinha N.K., Kharche S.D., Ramachandran N., Ranjan R. and Agrawal S.K. (2014). Comparative Evaluation of Propylene Glycol and Glycerol on Freezability of Sirohi Buck Semen Abstract No. AIA-001. National Seminar on "Research and Innovations to Improve Animal Fertility and Fecundity" & XXX Annual Convention of ISSAR held on November 20 -22 at DUVASU, Mathura. P98.

Singh M K, S K Singh, P K Rout and M S Dige.2015. Role of Barbari Goat Nucleus Farm for field Improvement and Conservation. International Symposium on" Sustainable Management of Animal Genetic Resources for Livelihood Security in Developing Countries on 13-14 Feb, 2015, TANUVASU Chenni in collaboration

with Animal Convention of Society for Conservation of Domestic Animal Biodiversity (SOCDAB): Page 70

Singh R.K, R. Ranjan, Manish Kumar, Renu singh K.Kuldeep, B.C. Das, and Sadhan Bag. (2014). Effect Of Different Passages On Gene Expressions Of Caprine Mesenchymal Stem Cells. Annual Conference of SAPI and National Symposium on "Physiological Determinants of Climate Resilient and Sustainable Animal Production" organized by CIRB, Hisar and SAPI from Nov 27-28, 2014.p-111

Singh S K, M K Singh, P K Rout and M S Dige. Impact of Technologies and Skill Development in Goat Improvement. Published in XII Agriculture Science Congress on Sustainable Livelihood Security for smallholder farmers from 3-6 Feb 2014 at ICAR-NDRI, Karnal.pg 154

Singh, S. P., Jindal, S. K., Ramachandran, N. and Semar, A. (2014). Relationship of body surface temperature with physiological variables of goats in tropical condition Abstract No. SS III O -9. National Seminar on "Physiological Determinants of Climate Resilient and Sustainable Animal Production" & XXIII Annual Convention of SAPI held on November 27 -28 at CIRB, Hisar, Haryana. P147.

Singh, S. P., Ramachandran, N. and Jindal, S. K. (2014). Association of physiological variables with skin temperature in goat kids during tropical conditions Abstract No. SS1-18. National Seminar on "National Seminar on Prospects and Challenges in Small Ruminant Production in India" & Annual Convention of ISSGPU held on December 11 -12 at SBRS, Sandynallah,The Nilgiris, Tamilnadu. p79.

Tripahi M K, Tripathi Prabhat, Gupta D L, Kumar R and Chaudhary U B. 2015. Feeding of green Leucaena foliage has no deleterious effects on growth and health of goat kids. Proc. XII AGRICULTURAL SCIENCE CONGRESS, Sustainable Livelihood Security of Smallholder Farmers 3-6th February 2015, National Dairy Research Institute, Karnal.

Tripathi M K, Meena Ramkesh, Gupta Bhavna, Prabhat Tripathi, Kumar Ravindra and Chaudhary U B. 2014. Nutrient content and in-vitro methane production potential of different leaves by whole goat rumen flora. Proc. of Global Animal Nutrition Conference 2014 on "Climate Resilient Livestock Feeding System for Global Food Security" from April 20-22, Bangalore, India. pp 342.

Tripathi M K, Meena Ramkesh, Tripathi Prabhat, Gupta D L, Kumar Ravindra and Chaudhary U B. 2014. Methane production potential of subabool leaves, concentrate pellet and combinations of subabool leaves and concentrate. "National Seminar Prospects and challenges in small ruminant production in India", December 11-12, Sheep Breeding Station, Sandynallah, The Nilgiris (TNVASU), Tamil Nadu 643-237. pp 223-224.

Tripathi M K, Meena Ramkesh, Tripathi Prabhat, Kumar Ravindra and Chaudhary U B. 2014. In-vitro methane production potential of different tree foliage and weeds used in goat feeding. "National Seminar Prospects and challenges in small ruminant production in India", December 11-12, Sheep Breeding Station, Sandynallah, The Nilgiris (TNVASU), Tamil Nadu 643-237. pp 104.

Tripathi M K, Meena Ramkesh, Tripathi Prabhat, Kumar R and Chaudhary U B. 2015. Nutrient content, in-vitro fermentation and methane production potential of different bio-resources in goats. Proc. 9th Biennial Animal Nutrition Association conference on "Eco-responsive feeding and nutrition: Linking livestock and livelihood. January 22-24, 2015, Guwahati, India. pp 124.

Tripathi M K, Meena Ramkesh, Tripathi Prabhat, Kumar R and Chaudhary U B. 2015. In-vitro fermentation and methane production characteristics of concentrates replacing urea by potassium nitrate as source of nitrogen and alternate hydrogen sink. Proc. 9th Biennial Animal Nutrition Association conference on "Eco-responsive feeding and nutrition: Linking livestock and livelihood. January 22-24, 2015, Guwahati, India. pp 46.

Tripathi M K, Tripathi Prabhat and Chaudhary U B. 2014. Nutritional influence on composition and nutraceutical properties of milk. Proc. 2nd International Conference on Animal and Dairy Science, September 15-17, 2014, Hyderabad International Convention Centre, India. p80.

Tripathi M K, Tripathi Prabhat and Gupta D L. 2014. Effect of different protein sources on intake digestibility and milk production of lactating goats. Proc. of Global Animal Nutrition Conference 2014 on "Climate Resilient Livestock Feeding System for Global Food Security" from April 20-22, Bangalore, India. pp 54.

Tripathi M K, Tripathi Prabhat, Chaudhary U B, Kumar Ravindra and Gupta D L. 2014. Effect of different protein sources on milk production performance and milk constituents of lactating goats. Proc. 2nd International Conference on Animal and Dairy Science, September 15-17, 2014, Hyderabad International Convention Centre, India. p114.

Tripathi,P ,Datta, T.K., Tripathi M.K, Chaudhary U.B , Gupta, D.L. and Kumar Ravindra (2015)Rain fed Legumes as green fodder for goats in semi-arid region during early withdrawl of monsoon. In: Eco-Responsive Feeding and Nutrition: Linking livestock and Livelihood: Proceedings of 9thBiennial Animal Nutrition Association Conference, January 22-24, 2015, Guwahati, India.

Vaswani S., Ravindra Kumar, V.Kumar, D. Roy and M. Kumar (2014) In vitro evaluation of different varieties of maize fodder in combination with wheat straw and concentrate. In: Global Animal Nutrition Conference 2014 on Climate Resilient Livestock feeding systems for global food security held from 20-22 April 2014 at Bangalore

HUMAN RESOURCE DEVELOPMENT

Scientist deputed/Trained in India / Abroad

Dr R.Priyadharshini-ICAR International fellowship (continuing her Ph.D. programme in Germany)

Dr. S.K. Singh, ILRI workshop, Kandy, Sri Lanka 19-24 Nov., 2014

Dr. P.K.Rout, attended Workshop on "Priority setting, Monitoring and evaluation in National agricultural Research System status, experience and way forward at NASC complex , New Delhi during 27.05.2014 National Workshop

Dr. P.K.Rout attended Training on Internal auditor's Training programme on Quality management system as per ISO 9001:2008 by Quality growth services Pvt. Ltd., New Delhi on October 27,2014.

Training organized

Organized training for Scientists, Adm. & Finance staff by IBM on MIS/FMS

Scientists attended NARM Executive Training

Administrative/Finance personnel attended various trainings at ICAR, IASRI

Official language programmes

Hindi pakhwada was organized from 15.9.2014 to 29.9.2013 and several programme like Hindi Hastakshtra Pratiyogta, Hindi Anuprayog Pratiyogta, Hindi Sodh Patra Partiyogta, Sulekh Pratiyogta etc. were organized.

Quarterly meeting of Rajya Bhasha Karyanwan Samiti were organized on 28th June, 2014; 11th Sept. 2014, 5th December 2014 and27th February, 2015.

The Hindi Karyashalas were organized on 17.5.2014, 27.9.2014, 24.12.2014 and 10.3.2015 at CIRG and several programmes and guest lectures were organized.

Gene sequences published/ VTCC Accessions

- Capra hircus breed Barbari Toll-like receptor 3 (TLR3) gene complete cds.
- Capra hircus breed Jakhrana Toll-like receptor 1 (TLR1) gene partial cds.
- VTCCBAA784 (Escherichia coli)
- VTCCBAA785 (Pseudomonas aeruginosa)
- VTCCBAA786 (Klebsiella pneumoniae)
- ORFV/India/2013/CIRG
- GPV/Indiad/2012/Kakker
- PPRV/Shahjadpur/goat/India/2013 : KP745466 (M gene)
- PPRV/Nagaur/goat/India/2013 : KJ081283 (F gene)
- KP745467 (VP1 gene)
- KP757899 (5'UTR)
- KP757899 (B2 envelope glycoprotein)
- Capra hircus breed Sirohi 70 kDa heat shock protein (HSP70.3) gene, partial cds
- Capra hircus breed Jamunapari 70 kDa heat shock protein (HSP70.3) gene, partial cds
- Capra hircus breed Barbari ENOX2 (ENOX2) gene, 3' UTR
- Capra hircus breed Jakhrana ENOX2 (ENOX2) gene, 3' UTR
- Capra hircus breed Jamunapari ENOX2 (ENOX2) gene, 3' UTR
- Capra hircus breed Jakhrana 70 kDa heat shock protein (HSP70.3) gene, partial cds
- Capra hircus breed Barbari 70 kDa heat shock protein (HSP70.3) gene, partial cds
- Capra hircus breed Sirohi tyrosinase gene, partial cds
- Capra hircus breed Jamunapari tyrosinase gene, partial cds
- Capra hircus breed Jakhrana tyrosinase gene, partial cds
- Capra hircus breed Barbari tyrosinase (TYR) gene, partial cds
- Capra hircus breed Sirohi 70 kDa heat shock protein (HSP70-3) gene, partial cds
- Capra hircus breed Jamunapari genotype allele 1 70 kDa heat shock protein (HSP70-3) gene, partial cds
- Capra hircus breed Jamunapari 70 kDa heat shock protein (HSP70-3) gene, partial cds
- Capra hircus breed Barbari 70 kDa heat shock protein (HSP70-3) gene, partial cds
- Capra hircus breed Jamunapari genotype Allele 1 ATP1A1 (ATP1A1) gene, partial cds
- Capra hircus breed Jamunapari genotype Allele 1 ATP1A1 (ATP1A1) gene, partial cds
- Capra hircus breed Sirohi ATP1A1 (ATP1A1) gene, partial cds
- Capra hircus breed Jamunapari ATP1A1 (ATP1A1) gene, partial cds
- Capra hircus breed Jakharana ATP1A1 (ATP1A1) gene, partial cds
- Capra hircus breed Barbari ATP1A1 (ATP1A1) gene, partial cds

CONFERENCE/ SEMINAR/ SYMPOSIUM/WORKSHOP ATTENDED

11 th Conference of Association of public health veterinarian and national symposium on Food security and public health: Present status and future road map held at NASC Complex, Pusa, New Delhi from 24-25 November, 2014.(S.V. Singh)

12 th Agricultural Science Congress on Sustainable livelihood security for Small holder farmers held at ICAR, NDRI, Karnal, Haryana from 3-6 February, 2015.(U.B. Chaudhary, P.K. Rout, Ashok Kumar, M.K. Tripathi, S.D. Kharche, S.D. Kharche, Braj Mohan, A.K. Dixit and M.S. Dige, S.K. Singh.)

2 nd Advisory Committee Meeting of2 nd NFBSFARA projects "Development of Parthnogenetic Goat from embryonic stem cells" held on 3rd December 2014 at NDRI, Karnal.(S D Kharche)

2 nd International Conference on Animal & Dairy Sciences held at Hyderabad International Convention Centre (HICC) 15-17 September, 2014, Hyderabad. (R.V.S. Pawaiya, M.K. Tripathi)

2 nd UP Agriculture Science Congress on" Technological and governance strategies for advancement of agricultural education , rresarch and extension in Uttar Pradesh. Organized by UPCAR Lucknow (14-16 June 2014) (Ashok Kumar , V K Gupta and R V S Pawaiya)

22 nd National Conference of Indian Society of Virology on Virology Recent Trends in Virology Research Omics era organized by Indian Society of Virology at Tamilnadu Agriculture Uniersity, Coimbatore from 18-20 December, 2014. (S.V. Singh , Naveen Kumar)

23 rd Annual conference of SAPI and National Symposium on physiological determinants of climate resilient and sustainable animal production held at CIRB, Hisar from 27-28 November, 2014. (S.K. Jindal, Ravi Ranjan and S.P. Singh)

25 th Annual Meeting and International and Conference on Reproductive health held at NIRRH (ICMR) Mumbai from 14-17 February, 2015 (S.D. Kharche)

28 th Annual Convention of Indian association of Veterinary Microbiologists immunologists and specialist in infectious disease (IAVMI) and International Conference on Challenge and opportunities in Animal Health at the face of Globalization and climate change held at DUVASU, Mathura from 30th October to 1st November, 2014. (S.V. Singh, V.K. Gupta, Nitika Sharma, A.K. Mishra, K. Gururaj and Ravindra Kumar)

30 th Annual Convention of Indian Society for study of animal reproduction (ISSAR) and National Symposium on Research and innovations to improve animal fertility and fecundity held at DUVASU from 20-22 November, 2014.(S.D. Kharche and Chetna Gangwar)

31 st Annual Conference of India Association of Veterinary Pathologist and national symposium on impact of climate change on pathology of disease of Animals, Poultry and Fish organized jointly by IAVP and Department of Veterinary Pathology, College of Veterinary Sciences and Animal Husbandry, Anand Agricultural University, Anand from 13-15 November, 2014. (V.K. Gupta and Shivashrappan)

33 rd Annual Convention of ISVM and National Symposium on New Dimension in Veterinary Medicine: Technological Advances on health concept and Animal welfare concerns held at College of Veterinary and Animal Sciences, Pookode, Wayanan, Kerala from 22-24 January, 2015. (V.K. Gupta and K. Gururaj)

4 th Annual Review meeting of the NFBSFARA projects on February 10-12, 2015 at NASC Complex, Pusa, New Delhi 110012 (SD Kharche).

6 th Conference of Indian Meat Science Association (IMSCON-VI) and National Symposium on Sustainable meat production for nutrition security and consumer well-being: Challenges and strategies held at DUVASU, Mathura from 28-30 November, 2014. (R.B. Sharma)

7 th National Extension Education Congress on Translation Research Extension for sustainable small farm development held at ICAR Research Complex for NEH Region Shillong (Meghalaya) from 8-11 November, 2014. (Saket Bhushan, Braj Mohan and A.K. Dixit)

7 th PAC-Animal Science, Science and Engineering Research Board (SERB), Department of Science and Technology (DST), Govt. of India, held at North-Eastern Hill University, Shillong from September 27-28, 2014. Project presentation on "Targeting a host cell kinase for development

for development of antiviral therapeutics against PPR virus" .(Naveen Kumar)

9 th Biennial Conference of Animal Nutrition Association on Eco responsive feeding and nutrition: Linking livestock and Livelihood organized by College of Veterinary Sciences, Assam Agricultural University, Khanpara, Guwahati and Animal Nutrition Association, IVRI, Izatnagar from 22-25 January, 2015. (U.B. Chaudhary, M.K. Tripathi, Mr. D.L. Gupta and Mr. Ramkesh Meena, Ravindra Kumar.)

AICRP on Goat Improvement workshop, September 29-30 at NAVSARI, NAU, Gujarat (P.K.Rout)

Annual Conference on Leveraging Institutional Innovations for Agricultural Development from 18-20 November, 2014, Department of Agricultural Economics, University of Agricultural Sciences, Raichur, Karnataka (A.K. Dixit)

Annual Conference and National Symposium on Impact of Climate Change on Pathology of Disease of Animal, Poultry and Fish of IAVP-2014 held at Anand Agricultural University, Anand, Gujarat from 13-15 November, 2014. (R.V.S. Pawiaya)

Annual Convention and National Seminar on prospectus and challenges in small ruminant production in India organized by TNVASU and ISSGPU at Udhagamandlam (Ooty) Tamilnadu from 11-12 December, 2014. (Saket Bhushan, V. Rajkumar, N. Ramachandran, Ravi Ranjan and S.P. Singh, Khushyal Singh and Vijay Kumar, Chetna Gangwar)

Annual Review Meeting of "Net Work Project on Sheep Improvement" and "Mega Sheep Seed Project" held at NASC Complex, DPS Marg, New Delhi from, 29-30 October, 2014. (Gopal Das)

Brain Storming Session on Sheep and Goat Sector organized by Deptt. Of Animal Husbandry and HP Wool Federation Ltd. At Shimla on 28.7.2014 July, 2014. (N. Ramachandran)

DST Group Monitoring and Annual Workshop at GITAM University, Vishakapattanam during 23-24th September, 2014.(Souvik Pal)

First Convention of Association of Meat Scientists and Technologies (AMST) and National Seminar on Education and Research prospectus for current and future trends in the Indian Meat Industry organized by Department of Meat Science and Technology, Madras Veterinary College, Chennai at Taimilnadu from 15-16 December, 2014. (V. Rajkumar)

Global Animal Nutrition Conference Glance- 2014 organized by Animal Nutrition Society of Indian (ANSI) held from 20-22th April, 2014, Bangalore (U.B. Chaudhary, M.K. Tripathi)

IAVMI Conference-2014 on 'Challenges and Opportunities in Animal Health at the Face of Globalization and Climate Change' held at DUVASU, Mathura on Oct 30-Nov 1, 2014.(N. Shivasharanappa, K.Gururaj, Ravindra Kumar)

International Conference on Emerging trends in Biotechnology and Sciences with Especial Reference to Climate change" organized by Indian Society of Genetics, Biotechnology Research and Development in collaboration with Krishi Vigyan Kendra (ICAR) Banasthali Vidyapith, Rajasthan from February 18-20, 2015.(Naveen Kumar)

International Conference on Reproductive Health and 25th Annual Meeting of the Indian Society for the study of Reproduction and Fertility from 14th to 17th February, 2015 organized by National Institute for Reproductive Health at Mumbai. (S D Kharche)

International Symposium on "Sustainable Management of Animal Genetic Resources for Livelihood Security in Developing Countries" organized by TANUVAS, Chennai and SOCDAB, NBAGR, Karnal from 13-14th Feb., 2015 at Madras Veterinary College, TANUVAS, Chennai. (Gopal Das)

International Workshop on "Production Animal health and welfare research: Impact and opportunities" organized by Indian council of agricultural Research and Royal (dick) school of veterinary sciences and Roslin Institute , University of Edinburgh, Feb16-17,2015 at NASC complex , New Delhi (P.K.Rout)

National Seminar on "Ethnobotany : Concept and Prospectives" organized by B.S.A College Mathura from March 21-22, 2015 (Ashok Kumar , Chetna Gangwar)

National Symposium on "Research and Innovation to Improve Animal Fertility and Fecundity and XXX Annual Convention of India society for Study of Animal Reproduction" held on 20th to 22nd Nov., 2014 at DUVASU, Mathura. (S D Kharche)

National Symposium on Livestock Production Practices for Small Farms of Marginalized Groups and Communities in India and XXII Annual Convention of Indian Society of Animal Production and Management held at College of Veterinary Sciences and Animal Husbandry Selesh, Aizawal, Mizoram from 28-30 January, 2015 (M.K. Singh)

National Workshop on strengthening small ruminant based livelihood organized by Department of animal Husbandry, Dairying and Fisheries, Ministry of agriculture and SAPPLPP, New Delhi, January 16-17, 2015 at

UNDP conference room, New Delhi. (P.K.Rout)

Next Gen Genomics and Bioinformation Technologies (NGBT) Conference held at NIMHANS, Bengalure from 17-19, 2014. (V.K. Gupta)

Seminar and Livestock Expo 2015 organised by A H Punjab and Rural development and Panchayat Department .8-12 Jan 2015 (Ashok Kumar

Sustainable Genetic Improvement Utilization and Conservation of Indigenous Livestock Breeds; Conventional & Biotechnological Approaches' being organized by Gau seva & Gauchar Vikas Board, Gujarat at SGVP, Gurukul, Ahmedabad, Gujrat on 6th & 7th Sept., 2014 (S.V. Singh)

Workshop for HRD Nodal Officers at NAARM Hyderabad 26 th Feb 2015. (Ashok Kumar)

Workshop on "Priority setting, Monitoring and evaluation in National agricultural Research System status, experience and way forward at NASC complex , New Delhi during 27.05.2014National Workshop (P.K.Rout)

XI International National Symposium on "Sustainable Management of Animal Genetic Resources for Livelihood Security in Developing countries" organized by SOCDAB, NBAGR, Karnal & TANUVASU held on 13-14 February, 2015 at Madras Veterinary College, Chennai.(Saket Bhushan)

IMPORTANT MEETINGS

Composition of the Research Advisory Committee

Dr. A.K.Mishra, Vice Chancellor, MAFSU, Nagpur	Chairman
Dr. S.A.Ashokan, Dean, Madras Veterinary College, Chennai	Member
Dr. Mohammad Nadeem Feroz, Professor and Head, Livestock Products Technology Division, College of Veterinary Sciences, Hebbal, Bangalore	Member
Dr. R.K.Tanwar, former Director clinics, CVAS, Bikaner	Member
Mr. Ashok Kale, Maharashtra	Member
Mr. K. Venkatesh, Vijaya Farms, Villupuram, Tamil Nadu	Member
Dr. S.K.Agarwal, Director, CIRG, Makhdoom	Member
Dr. B.S.Prakash, ADG(AN&P),ICAR	Member
Dr.P.K.Rout, Principal Scientist, CIRG and Incharge, PME	Member Secretary

Composition of the Institute Management Committee

Dr. S.K.Agarwal	**Chairman**
Director, Animal Husbandry, Uttar Pradesh, Lucknow	Member
Director, Animal Husbandry, Uttrakhand	Member
Vice Chancellor, Pt. Deen Dayal Upadyay Pashu Chikitsa Vigyan Vishwavidyalaya evam go anunsandhan Sansthan, Mathura	Member
Shri, S.K.Pathak, DD(F-III), ICAR, Krishi Bhavan, New Delhi	Member
Dr. Sanjeev Kumar, Senior Scientist, NBAGR, Karnal	Member
Dr. Taru Sharma, PS & Head, Animal Physiology, IVRI, Izatnagar	Member
Dr. Dhirendra Singh, PS, Animal Health, CSWRI, Avikanagar	Member
Dr. S.K.Singh, PS, AG&B, CIRG,	Member
Shri Ashok R Kale, Ahmednagar, Maharastra	Member
Shri K Venketesh, Vellupuram, Tamil Nadu	Member
ADG(AN&P),ICAR	Member
Mr. R.K.Sharma, Senior Administrative Officer,CIRG	Member Secretary

Composition of Institute QRT

Dr.V.K.Singh, Ex-Director, CSWRI, Avikanagar	Chairman
Dr.G.Butchaiah	Member
Dr. A.S.R. Anjanaulu	Member
Dr. R.C.Jakhmola	Member
Dr. G.S.Dhaliwal	Member
Dr. J.R.Rao	Member
Dr.P.K.Rout, Principal Scientist, CIRG and Incharge, PME	Member Secretary

Institute Research Committee (IRC)

The annual and half yearly IRC of the Institute was held on 2nd and 12-13th May, 2015 and progress of all Institute and external funded projects was reviewed. The meeting was chaired by Dr. S.K.Agarwal, Director CIRG and attended by all the scientists of the Institute.

Institute Management Committee (IMC)

The Institute Management Committee meeting was held on 9.6.2014 and 19.12.2014. Director, CIRG Dr. S.K.Agarwal chaired the meeting. The meeting was attended by Dr. A.C.Varshney, VC, DUVASU, Mathura and member IMC, Dr. Dhirendra Singh, Principal Scientist, CSWRI and member RAC, Dr. Sanjeeva Kumar, NBAGR, Karnal and Dr. G.Taru Sharma, Head and Director, CAS, Physiology and Climatology Division, IVRI. The committee discussed various issues related to Institute and appreciated the achivements of the Institute scientist in the area of goat production and health management.

QRT

The QRT was constituted by Indian Council of Agricultural Research with Dr. V.K.Singh as Chairman and Dr's. G.Butchaiah, A.S.R. Anjanaulu,R.C. Jakhmola, G.S.Dhiliwal, and J.R.Rao as external members and Dr. P.K.Rout PS and I/c PME, CIRG as member secretary. The Chairman QRT visited the Institute on 21.7.2014 for preliminary discussion. Subsequently the QRT meeting was held on 4-5 September and 10-12th November, 2014 & 16-18th Dec, 2014 where all the HDs/Incharges, scientists, SAO and FAO attended. The committee after detailed discussion prepared its report and submitted it to Dr. S.Ayyapan, Secretary DARE and DG, ICAR in the presence of Dr. K.M.L.Pathak, DDG(AS) and Dr. S.K.Agarwal, Director, CIRG. The committee made valuable suggestions for growth and improvement in the functioning of CIRG in the years to come.

Research Advisory Committee (RAC)

The meeting of Research Advisory Committee (RAC) of CIRG was held on 21st August, 2014 under the chairmanship of Dr A.K.Mishra, members of RAC, Dr. B.S.Prakash, ADG (AN&P) and Dr S.K.Agarwal, Director, CIRG were present. The committee gave several recommendations on various projects being undertaken by scientists at this institute. Dr. A.K.Misra emphasized on dissemination of technologies developed by the Institute. He further empahsised that considering the importance of women in goat rearing, more training should be taken up by the Institute for women goat farmers.


पंचवार्षिक समीक्षा टीम
QUINQUENNIAL REVIEW TEAM (QRT)
अप्रेल 2009 – मार्च 2014
APRIL 2009 - MARCH 2014
भा.कृ.अ.प.– के.ब.अु.सं., मखदूम, फरह (मथुरा)
ICAR-CIRG, Makhdoom, Farah (Mathura)


20वीं शोध परामर्श समिति की बैठक
20th RESEARCH ADVISORY COMMITTEE MEETING
AUGUST 21, 2014

RESEARCH PROJECTS

List of Approved Institute Projects (2014-2015)

S.No.	Project Title	P.I.
1	Improvement of Jakhrana breed of goats for milk and meat production under farm and field conditions	Dr. Saket Bhusan
2	Extension Approaches for Dissemination of Goat Production Technologies and Impact Assessment	Dr. Braj Mohan
3	Economic Losses due to Important Diseases in Goat Production	Dr Anupam Krishna Dixit
4	A study on impact assessment of various training programmes	Dr. Khushyal Singh
5	Patho-Epidemiological Studies on Emerging and Existing Diseases of Goats	Dr. R.V.S. Pawaiya
6	Effect of Nutritional Deficiency Diseases on Gene Expression Profiles in Goats	Dr. R.V.S. Pawaiya
7	Genetic Marker study in Indian Goats for GI nematode Resistance with special reference to Haemonchus infection.	Dr. DK Sharma
8	Development of herbal anthelminitic and acaricidal formulation for goats	Dr. Ashok Kumar
9	Study on the molecular mechanism of resistance and susceptibility to PPR virus in goats	Dr. Naveen Kumar
10	Metabolic profiling for diagnosis and control of metabolic diseases of goats	Dr Nitika Sharma
11	Isolation, identification and characterization of major infectious agents associated with neonatal diarrhoea in kids	Dr. A.K. Mishra
12	Flagship project on articificial insemination in goats	Dr Satish Kumar Jindal
13	Hormone profile during different reproductive stages in goats	Dr AK Goel
14	Comparative Study on Different Structures of Goats Shelters under Farm Conditions	Dr. N Ramachandran
15	Traceability, food safety standards and food chain evaluation (HACCP) pertaining to goat meat and value added products	Dr. V. Rajkumar
16	Development of complete feed for environmentally and economically sustainable goat production	Dr. Ravindra Kumar
17	Value Chain for the Development of Goat Products with Healthy Traits	Dr. A.K. Verma
18	Development of feed resources on poor land for goats	Dr. P. Tripathi
19	Toll like receptors (TLRs) expression and characterization in different breeds of goats and their role in disease resistance with special reference to brucellosis	Dr. VK Gupta upto 25.2.2015 Dr. N.Shivasharappa from 26.2.2015

Out Funded Projects (2014-15)

S.No.		P.I.
1	AICRP on goat Improvement – Project coordinator Unit	Dr. S.K.Singh
	Improvement of Sire evaluation of Jamunapari goats for milk & meat production - AICRP Jamunapari Unit	Dr. PK Rout
	Genetic improvement of Barbari goats for meat and milk production-AICRP Barbari Unit	Dr. M.K.Singh
2	Network Project on Sheep Improvement – Muzaffarnagri Unit	Dr.Gopal Dass
3	ORP on Estimation of methane emission under different feeding systems and development of mitigation strategies	Dr. M.K. Trpathi
4	All India coordinated research project on Plasticulture engineering and technologies – Assessment of plastic based structures and shelters on goat production	Dr. S.K.Jindal
5	NICRA Project – Adaptation strategies in goats to environmental stress through nutritional manipulations	Dr. U.B. Chaudhary
6	NFBSFARA – Development of Parthenogenetic Goat from Embryonic Stem Cells	Dr S.D. Kharche
7	MOFPI – National Referral Laboratory for Testing of Animal Products	Dr. V. Rajkumar
8	Outreach Programme on Zoonotic Diseases	Dr S.V. Singh
9	VTCC – Veterinary Type Culture-Microbes in collaboration with NRCE, Hisar	Dr. K.Gururaj
10	VTCC – Veterinary Type Culture-Rumen Microbes in collaboration with NAINP, Bangalore.	Dr. U.B. Chaudhary
11	All India Network Project on Neonatal Mortality (AINP-NM) in Farm Animals (ICAR)	Dr. Ashok Kumar
12	Center for Agricultural Bioinformatics (CABin) project collaborating centre of IASRI	Dr. R.V.S.Pawaiyya
13	Development of Phage Therapeutic Preparation for Neonatal Colibacillosis in Goat-Kids (DST)	Dr. A.K.Mishra
14	Targetting a host cell protein kinase for development of antiviral therapeutics against PPR virus (DST)	Dr. Naveen Kumar
15	Development of nano-immuno rapid test for detection of MAP in milk samples (MOFPI)	Dr. S.V.Singh
16	Development and Characterization of an Indigenous Vaccine and Diagnosis for Johne's disease (CSIR and Biovet) NIMTLI upto Dec 2014	Dr. S.V. Singh
17	Development of diagnostic assay, Molecular characterization and epidemiology of cryptosporidiosis in goats (DST) upto 31st Jan, 2015	Dr. S. Paul
18	Crohn's disease in India: a multicenter study from a country where intestinal tuberculosis as well as John's disease is endemic (ICMR)	Dr. S.V. Singh

CONSULTANCY, PATENTS AND COMMERCIALIZATION OF TECHNOLOGIES

The following six technologies were commercialized during the year.

- Areamix- An area specific mineral mixture, commercialized to M/S Girraj Industries, Sirsaganj, U.P.
- Herbodin - an anti-diarrhoeal formulation, commercialized to M/S Girraj Industries, Sirsaganj, U.P.
- Topivet G -aherbal skin/ healing gel, commercialized to M/S Girraj Industries, Sirsaganj, U.P.
- Goat milk based soap (Ajas) -three variants of soap ie Ajas beauty, Aajas green and Ajas antiseptic soaps have been commercialized to M/S BVG Life sciences , Pune (M.S.)

The following patent applications were filed during 2014-2015.

Sr. No.	Title	Inventor Name
1.	AJAS green-Goat milk based natural herbal beauty soap.	Dr Ashok Kumar
2.	AJAS-Goat milk based natural beauty soap.	Dr P K Rout
3	AJAS antiseptic-Goat milk based natural herbal antiseptic soap	Dr P K Rout

DISTINGUISHED VISITORS

- Shri Radha Mohan Singh ,Union Agriculture Minister, Government of India visited the Institute on 20.9.2014

- Mr. Giriraj Singh, The then Member Parliament and now Minister of State for micro, small and medium enterprises , Government of India visited the Institute on 10.9.2014

- Dr. S. Ayyapan, DG & Secretory, ICAR 06.04.2014

- Dr. K.M.L.Pathak, DDG(AS), ICAR, New Delhi 6.4.2014, 19-02-2015
- Dr. B.S. Prakash, ADG (A N & P), Krishi Bhawan, New Delhi. 06.04.2014 and 21.08.2014
- Dr. Kusumakar Sharma, ADG (HRD), ICAR, New Delhi on 11.04.2014
- Dr. M.L.Mehrotra, former Joint Director, IVRI, Izatnagar on 11.04.2014
- Dr. Vinod Jindal, Deputy Director, A.H., Punjab, Chandigarh on 16.04.2014

- Dr. V.K.Singh, Ex-Director, CSWRI, Avikanagar. Member, QRT on 4.09.2014.
- Dr. M.C.Varshney, VC, Kaamdhenu University, Gujarat visited on 19.02.2015
- Dr. B.Meena Kumari, DDG (Fisheries) visited the Institute on 4.10.2014
- Dr. S.M.K.Naqvi, Director, CSWRI on 3.11.2014
- Dr. G. Butchaiah, Member , QRT visited on 4.09.2014.
- Dr. R.C.Jakhmola, Member, QRT on 4.09.2014.
- Dr. G.S.Dhaliwal, Member, QRT on 4.09.2014.
- Dr. A.S.R. Anjaneyulu, Member, QRT on 4.09.2014.
- Dr. Khub Singh, former Director, NIAN&P, Bengaluru 09.05.2014
- Dr. S.A.H.Abidi, Former Member, ASRB, on 23.05.2014
- Dr. Gajraj Singh, Ex Dean, COVSc & AH, Aizawal
- Dr. P.K.Ghosh, Director, IGFRI, Jhansi on 6.08.2014
- Dr.S.A.Asokan, Dean, Madras Veterinary College, Chennai on 22.8.2014
- Dr. A.K.Mishra, V.C., MAFSU, Nagpur, 22.08.2014.
- Dr. B.Pattnaik, Director, ICAR-PDFMD. Mukteshwar on 31.10.2014
- Dr. R.K.Singh, Director, IVRI, Izatnagar on 18.11.2014
- Col. Rajeshwar Singh, CO 56/APO on 12.09.2014
- Dr. K.Kulasekar, Prof & Head, ARGO, Madras Veterinary College, Chennai on 22.08.2014

PERSONNEL

Administration

Dr.S.K. Agarwal	Director
Dr.P.K.Rout	Scientific Secretary
Dr.A.K.Goel	VigilanceOfficer
Mr.R.K.Sharma	Senior Administrative Officer
Mr.P.K.Singh	Finance and Accounts Officer
Mr. Rajiv Kulshretha	Jr. Acc. Officer w.e.f. 3rd Dec,2014
Mr S.S.Gautam	Asstt.Admn.Officer
Mr. A.K.Sharma	Asstt.Admn. Officer
Mr. S.R.Achary	PS to Director upto 30.11.2014
Mr. Y.K.Gupta	PA to Director w.e.f.1.12.2014

Genetics and Breeding Division

Dr. S.K.Singh	**Principal Scientist and Head**
Dr. Saket Bhushan	Principal Scientist
Dr. P.K.Rout	Principal Scientist
Dr. Gopal Dass	Principal Scientist
Dr. M.K.Singh	Principal Scientist
Dr. M.S.Dighe	Scientist
Mr. Badan Singh	Technical OfficerT-5
Mr. A.S.Prajapati	Technical OfficerT-5
Mr. Vinod Kumar	Technical OfficerT-5
Mr. Gulzari Lal	Technical OfficerT-5
Mr. Rajendra Kumar	Technical OfficerT-5
Mr. M.P.Agarwal	Technical OfficerT-5

Physiology,Reproduction and Shelter Management Division

Dr.S.K.Jindal	**Principal Scientist and Head**
Dr. Satish Kumar	Principal Scientist
Dr. A.K.Goel	Principal Scientist
Dr. B.Rai	Principal Scientist
Dr. S.D.Kharche	Principal Scientist
Dr. N.Ramachandran	Scientist
Dr. S.P.Singh	Scientist
Dr. RaviRanjan	Scientist
Dr. R. Priyadharsini	Scientist (on study leave)
Dr. Chetna Gangwar	Scientist
Mr. H.K.Himkar	Technical OfficerT-5
Mr. Hari Om	Technical OfficerT-5
Mr. Dinesh Bhat	Technical OfficerT-5

Nutrition,Feed Resources and Products Technology Division

Dr. U.B.Chaudhary	Pr.Scientist and Head
Dr. M.K.Tripathi	Principal Scientist
Dr. R.B.Sharma	Principal Scientist
Dr. Prabhat Tripathi	Senior Scientist
Dr. Ravindra Kumar,	Senior Scientist
Dr. V.Rajkumar	Sr. Scientist
Dr. A.K.Verma	Scientist
Mr. Suresh Tewari	Asstt. Chief Technical OfficerT-7(7-8)
Mr. Dori Lal Gupta	Sr. Technical OfficerT-6
Mr. Raj Kumar Singh	Sr. Technical OfficerT-6
Mr. Suraj Pal	Technical OfficerT-5
Mr. Lal Singh	Technical OfficerT-5

Goat Health Division

Dr. S.V.Singh	Principal Scientist and Head
Dr. D.K.Sharma	Principal Scientist
Dr. Ashok Kumar	Principal Scientist
Dr. V.K.Gupta	Principal Scientist (upto 25.2.2015)
Dr. R.V.S.Pawaiya	Principal Scientist
Dr. Naveen Kumar	Senior Scientist
Dr. K.Gururaj	Scientist
Dr. Nikita Sharma	Scientist
Dr. Shivsharnappa	Scientist
Dr. A.K.Mishra	Scientist
Dr. Souvik Pal	Scientist
Dr. H.A.Tiwari	Chief Technical Officer (T-9)
Dr. Vinay Chaturvedi	Sr. Technical Officer (T-6)
Sr. Vijay Kishore	Technical OfficerT-5 (On study leave)
Sh. Chet Ram	Technical OfficerT-5
Sh. V.K.Gautam	Technical OfficerT-5
Sh. T.K.Gautam	Technical OfficerT-5
Sh. D.V.Sharma	Technical OfficerT-5

Extension Education and Socio-Economics Section

Dr. Braj Mohan	Pr.Scientist and I/c
Dr. A.K.Dixit	Senior Scientist
Dr. Khushyal Singh	Scientist (Sr. Scale)
Dr.Vijay Kumar	Scientist
Mr. S.C.L.Gautam	Technical OfficerT-5
Mr. U.C.Yadav	Technical OfficerT-5

AICRP on Goat Improvement

Dr. S.K. Singh	Principal Scientist and I/c
Dr. Shivanand Mahesh Dige,	Scientist
Mr. C.S.Sagar	Asstt.Admn. Officer

Network Project on Sheep

Dr. Gopal Dass	Principal Scientist

Priortization Monitoring and Evaluation Section

Dr. P.K.Rout	Pr. Scientist and I/c
Dr. Ashok Kumar	Principal Scientist
Dr. Souvik Paul	Scientist
Dr. Nitika Sharma	Scientist
Dr. Balraj Singh	Sr. Technical Officer T-6

IPR Cell

Dr V.K.Gupta	Principal Scientist and I/c Upto 25.2.2015
Dr. Ashok Kumar	Principal Scientist and I/c From 26.2.2015

RTI Cell

Dr. H.A.Tewari	Chief Technical Officer (T-9) and Chief PIO
Dr. Vijay Kumar	Scientist and APIO

Agriculture Knowledge Management Unit (AKMU)

Dr. R.V.S.Pavaiyya	Principal Scientist and I/c
Sh. Satish Chandra	Technical Officer T-5

Maintenance

Dr.U.B.Chaudhary	Principal Scientist and I/c
Sh. Jagdish Singh	Technical OfficerT-5
Sh. Ishwari Saran	Technical Officer T-5
Sh. Inder Pal	Technical OfficerT-5

Security Section

Mr. P.K.Sharma	Security Officer

Medical Section

Dr. Ashok Kumar	Principal Scientist and I/c
Mr. Mohan Lal	Technical Officer T-5

Library

Dr. A.K.Goel	Pr.Scientist and I/c
Dr. Pratap Singh	Chief Technical Officer,T-9

Agriculture Farm

Dr. Prabhat Tripathi	Sr.Scientist and I/c
Sh. Ram Kishan	**Technical OfficerT-5**

Horticulture Section

Dr. B.Rai	**Pr.Scientist and I/c**
Sh. Suraj	**Technical OfficerT-5**
Sh. Hukam Singh	**Technical OfficerT-5**

Transfer

Dr. V.K.Gupta,	Principal Scientist relieved on 25.2.2015 to Join as Joint Director, CADRAD, IVRI Izatnagar

Joining

Shri Rajiv Kulshretha	Jr. Acc. Officer 3 Dec,2014

Retirement

Sh. Vijay Singh	Temporary Status Worker retired on 31.07.2014
Sh. Guljari Lal	T-4, Retired on 30.11.2014
Mr. S.R.Achari	Private Secretary retired on 30.11.2014
Sh. Bhagwan Singh	Temporary Status Worker retired on 31.12.2014
Sh. Bhagwan Singh	Junior Clerk retired on 31.1.2015
Sh. Latur	Temporary Status Worker retired on 28.2.2015
Sh. Amar Singh	Temporary Status Worker retired 28.2.2015
Sh. Peetam	Temporary Status Worker retired on 31.03.2015

Death

Sh. Bhanwar Singh	Temporary Status Worker expired on 20.3.2015

Career Advancement/Promotion

Sh. Surj Pal	Promoted to Sr. Technical OfficerT-6
Shri Shyam Singh	Promoted to Technical Officer T-5
Shri Suraj Singh	Promoted to Technical Officer T-5
Shri Hukam Singh	Promoted to Technical Officer T-5
Shri D.V. Sharma	Promoted to Technical Officer T-5
Shri Prayag Narayan	Promoted to T-4
Sh. Shiv Charan	Promoted to T-4
Sh. Govind Prasad	Promoted to T-4
Sh. B.L.Tarkar	Promoted to T-3
Sh. Rajendra Singh	Promoted to T-3

Deputation abroad

Dr. R.Priyadarshini	Scientist on study leave for Ph.D. in Germany under ICAR International Fellowship

हर कदम, हर डगर
किसानों का हमसफर

भारतीय कृषि अनुसंधान परिषद

Agrisearch with a human touch


3

भा.कृ.अ.प.-केन्द्रीय बकरी अनुसंधान संस्थान

मखदूम, फरह-281122, मथुरा (उ.प्र.) भारत

ICAR-CENTRAL INSTITUTE FOR RESEARCH ON GOATS

(An ISO 9001:2008 Certified Organization)

Makhdoom, Farah-281 122, Mathura (U.P.)

Phone: +91-565-2763380, Fax: +91-565-2763246

E.mail: director@cirg.res.in

Web sites: http://www.cirg.res.in

Help line: 0565-2763320