CIRG

वार्षिक प्रतिवेदन

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CENTRAL INSTITUTE FOR RESEARCH ON GOATS

Makhdoom, Farah-281122, Mathura (UP) INDIA

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PREFACE

Under the changing agro-geo-climatic conditions and depleting resources for livelihood, the poor man's cow- The Goat has tremendous potential to be projected as the 'Future Animal' for rural prosperity. Goats being tolerant to harsher environmental conditions may provide amicable solutions to alleviate the vulnerability of the small and marginal farmers at the time of failure in food crop production due to adverse climatic conditions and limited availability of natural resources. Prevailing goat production system is all set to be changed in the coming years due to emerging market trends on account of strong consumer preferences towards quality animal foods. Goats provide a leaner meat in comparison to other domestic ruminants and their milk and milk products have several scientifically unexplored medicinal and health-promoting properties that need to be validated scientifically and promoted commercially.

Goat production is becoming an enterprise of repute not only for providing livelihood, but also lead to wider economic prosperity ranging from rural and tribal regions to urban economic empowerment. Low capital investment and lesser risk of failure in goat farming provide sizable economic return to the beneficiaries. Further, land degradation and uncertain monsoon have encouraged more and more farmers in most parts of the country to diversify into goat farming. The increasing popularity of goat keeping is evident by 4 per cent annual population growth of goats in the country. The technological dissemination from Central Institute for Research on Goats (CIRG) has been instrumental in

economic empowerment through goat production in disadvantageous location of the country. The institute is committed to develop complete package of practices for goat production system to optimize utilization of goat products and by-products for better economic returns to the clients, who in majority are poor farmers and landless labourers. Technologies on value added and organic goat products (milk and meat) and by-products (hide and manure) are being investigated and promoted for their adoption by the farmers.

Central Institute for Research on Goats (CIRG) endeavored several research and development successes during the year 2010-11. Significant progress was made in the area of goat product processing and value addition, genetic improvement of native goat germplasm, improvement in reproductive efficiency, abatement of biotic and abiotic stresses and improved health. Dissemination of knowledge was undertaken by organizing national training programmes on goat farming and through NAIP and TOT programmes. During the year, institute achieved success in IVF technology and produced twin IVF-ET

goat kids named *Ajat* and *Ajati*. For the first time, healthy triplet lambs were born in Muzaffarnagari sheep, which is a rare occurrence in this breed. Value added goat milk and milk products, developed at the institute in this year, included goat meat based functional products, and goat milk based biscuit, ice cream, low fat paneer, shrikhand and soap. A semen bank has been established, which at present preserves over four thousand frozen semen straw of elite Jamunapari, Barbari, Sirohi and Jakhrana bucks. Technologies developed for disease diagnosis (Brucheck) and prevention (JD vaccine) were cross-validated and being processed for commercialization. There was a significant improvement in body weight gain and milk yield at Barbari, Jakhrana and Jamunapari flocks. Mortality in goat and sheep units was brought down to less than five per cent. In comparison to previous year, there was a significant increase in fodder (35%) and feed grain (100%) production during the current year.

The institute submitted five new patent applications and four technologies are in the way of commercialization through NRDC. An Area Specific Mineral Mixture Technology was released by the Honorable Union Minister of Agriculture and Food Processing Industries, Shri Sharad Pawar during his visit to the institute on January 24, 2011. Institute also had proud privilege of welcoming Dr. S. Ayyappan, Secretary DARE and Director General, ICAR and Dr. K.M.L. Pathak, Deputy Director General (Animal Science), and also for hosting the first ever brain storming meeting of Directors of Animal Science Division of ICAR to discuss the XII Plan programmes.

All the achievements and activities of the Institute had the strong support and guidance from Dr. S. Ayyappan, Secretary DARE, and DG ICAR, Dr. K.M.L. Pathak, DDG (AS) and that of Dr. C.S. Prasad, ADG (Animal Nutrition and Physiology). I sincerely express my deep sense of gratitude to them. I am also grateful to Chairman RAC Dr. Arun Varma, Chairman QRT Dr. R.N. Srinivas Gowda and members of RAC, QRT and IMC for their unqualified support and guidance for over-all progress of the institute. Special thanks are due to Heads of Division, scientists, technical, administrative, finance and supporting staff of CIRG for their excellent cooperation and dedicated efforts. Dr. S.K. Jindal, Dr. A.K. Goel, Dr. P.K. Rout and other members of editorial board deserve appreciation and compliments for their splendid work of compilation, editing and in time publication of this Annual Report.

Although, Central Institute for Research on Goats has researched many results oriented and need based aspects of goat production system, still several challenges remain to be addressed during coming years for further enhancement of goat production in the country to ensure economic empowerment, livelihood and food security for economically weaker sections of the society. The emphasis has been on the use of multidisciplinary and inter-institutional approaches to improve eco-efficient rearing of goats and making goat farming a vibrant and viable enterprise, besides popularizing goat produce by value addition and making them attractive for industrial applications.

(D. Swarup)
Director

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EXECUTIVE SUMMARY

Goat farming is a sustainable livelihood option for poor farmers to face the adverse situation precipitated by declining return from farming in ecologically fragile areas. More and more farmers, especially small land holders and resource less rural people are adopting goat rearing, which today ensures income to over five million household in India. Over the years, the country has witnessed steady increase in goat population. Strong consumer preferences for quality animal foods especially from goat are likely to change the prevailing goat production scenario in the country during the coming years. Goats were among the first farm animals to be domesticated by man and have been in symbiotic association with man for nearly ten millennia. They provided edible products for human being and played a pivotal role in the Neolithic Agricultural Revolution. The origin of domestic goats remains uncertain and controversial; however the cradle of civilization, Fertile Crescent Region is one of the most probable centers. It has also been opined that goats have originated independently around 7000 BC in the Indus Basin near Mehragarh, Baluchistan, Pakistan.

The growth of world mammalian population since 1980 reflected the largest animal number increase for goat during last 30 years. According to FAO, the world population of goats and sheep was 861.9 million and 1078.2 million, respectively with a ratio of 1:1.25. However, the number of goats to sheep varies in different parts of the world. In India, despite highest slaughter rate, there are number of goats than sheep in a ratio of 1: 0.91. The country harbors around 125 million goats and 23 defined breeds adapted efficiently in different agro-climatic conditions all over the country. By virtue of its simplicity and usefulness the goat is always associated with landless, marginal and small farmers hence named as Poor Man's cow. Goat contributes significantly to total income of farmers and provides better nutrition for their family. In Himalayan region goats are especially important for fiber (pashmina), meat production and transportation. In other parts of the country, goats are reared for meat and milk production. The goat meat production in India has doubled (9.3% to 18.3%) during last decade. Similarly goat milk production has showed growth rate of 31.53% during last decade. In terms of goat milk production, India ranks first in the world with the total milk production of 4 million MT in 2008. Goat meat is widely consumed in developing countries. India is 2nd in total goat meat production. Over 47.8 million animals were slaughtered to produce 0.47 million MT meat with an average of 10 kg meat per animal.

Goat farming assumes special significance in extreme ecology, particularly in arid, semi arid and in dry land areas, where farming of other livestock species may not

be that profitable and sustainable. Worldwide goats and other small ruminants are among the most popular and beneficial livestock for people with very limited resources. Small scale goat production is of significant benefit to families all over the world living in a wide variety of climatic conditions. There goats have been found to be among the most adaptable animals. Helping the poor to successfully raise goats can have a very significant impact on their income, social status and even on the local environment. Constraints to livestock raising include the lack of good breeding stock, lack of veterinary and extension services, lack of credit and access to markets. Focusing more assistance on small holder farmers would improve impact on the poor. Value-based holistic community development with self-help groups may create a foundation for increasing farmer incomes by providing a forum for education, mutual support and developing markets. Constraints faced in the introduction and spread of goats and increasing their benefit to the small scale producers as well as success factors and best practices will be worked out and suitable frame work will be employed. The goat products are among the foods available with human health promoting characteristics.

Worldwide 100 million people in arid areas, have only possible source of livelihood by grazing small ruminants. Grazing goats can improve soil and vegetation cover and plant and animal biodiversity, for example by removing biomass, which otherwise might provide the fuel for bush fires, by controlling shrub growth and by dispersing seeds through their hoofs and manure, which can improve plant species composition. In addition, trampling can stimulate grass tillering, improve seed germination and break-up hard soil crusts. Other major benefits are the improved productivity of small farms by the incorporation of manure and the use of other farming practices such as the planting of trees and forages controlling soil erosion. Being handy to rear and due to short gestation, goats serve as a ready source of income for the farmers. Further, goats are intelligent, agile and resistant to many diseases including certain toxic chemicals and can look after themselves much better than other livestock species. However, importance of this valuable genetic resource is often neglected due to many social and environmental biases and mis-conceptions. To promote goat production among poor's for nutritional and livelihood security, holistic community development programs for education, improved goat breeds, agro-forestry pastoral system of common property resources, mutual support, assess credit and markets require for successful goat development programmes.

Central Institute for Research on Goats functions under aegies of Indian Council of Agricultural Research. Its research programmes are taken care of by four existing divisions. The extension education, socio-economic aspects of goat husbandry and training to various stake

holders are also under taken by the EE&SE section of the Institute.

Genetic Improvement Programmes

The major emphasis has been on selective breeding for improving production performance, conservation of goat breeds in their home tracts and gene marker studies for enhancing selection decision to increase productivity in goats. Selective breeding of Jamunapari, Barbari, Jakhrana goats and Muzaffarnagari sheep has established promising genetic progress in body growth, milk yield and twining ability over the years. During the year 2010-2011, a total of 424 animals of Jamunapari, Barbari, Jakhrana goats and Muzzafaranagri sheep were supplied to various agencies and goat breeders for conservation and genetic improvement. The mortality of the Jamunapari flock during the year 2010-11 was 4.22%.

The BLUP estimates of breeding values for Barbari were estimated using animal model and ASREML programme. Parameters for growth at different ages and milk yield at 90 days have been estimated in Barbari and Jamunapari goats. Genetic parameters for body growth, greasy fleece yield have been estimated in Muzaffaranagri sheep.

Genetic variation in SCD and FecB gene has been analyzed in different Indian goat breeds. Sequence variation analysis of SCD gene showed four SNP giving rise to protein variant. The SNP genotype in Leptin receptor gene explained 25.82% of the additive genetic variance for body weight at 9 months of age in Barbari goats.

Physiology, Reproduction and Shelter Management Programmes

During the year a frozen semen bank of goats of four breeds namely Jamunapari, Barbari, Sirohi and Jakhrana was developed.

Research on the adaptability of goats in changing environment due to climate stress was continued during this year. Sirohi goats were found to be more adapted as compared to Barbari under different shelter management conditions based on physiological reactions, feed and water intake and blood biochemical parameters.

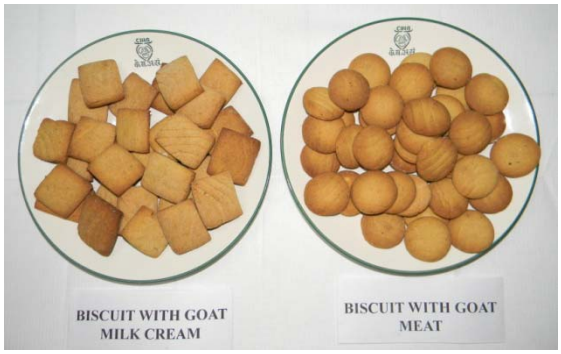
Work on Parthenogenetic production of goat embryos was carried out under a NAIP project. The cleavage rate and morula with parthenogenetic (ethanol) activation of matured oocytes were 24.31% and 23.03%, respectively. Production of twin IVM/IVF kids Ajat and Ajati was achieved at CIRG.

Nutrition, Feed Resources and Products Technology Programmes

An important research objective of the division is the development of feed resources for goats, development of feed technologies for improved goat productivity and post harvest evaluation of milk, meat and their products.

Feeding of grass based complete feed to finisher kids, yielded average daily gain of 65.0 g/d. Incorporation of goat faeces

reduces maturity time of vermin compost as compared with straw refusal alone. Earthworm multiplication rate was highest under goat faeces alone and in combination with Neem leaves.



Area specific mineral mixture was developed and was released by Hon'ble Minister of Agriculture Shri Sharad Pawarji at CIRG. Complete feed pellet with C:R (40:60) resulted economic growth (80g/d) in finisher kids. Meat from low value goat cuts goat meat can be successfully utilized for highly acceptable meat products. Bael fiber and drumstick fiber were established as a new source of dietary fiber in meat products. Development of herbal goat milk and meat biscuits, herbal goat milk ice cream and low fat paneer was carried out. Concentration of essential medium chain fatty acids was found high during early stage of lactation.

Goat Health Programmes

Goat health programmes are directed to conduct research on the development of various measures to prevent and control the various economically important goat diseases. Surveillance and monitoring of goat diseases revealed that PPR, goat pox, Enterotoxaemia were important infectious diseases in the field conditions. Final prototype consisting of two plant combinations having synergistic activity has been developed for the management of infectious diarrhea. Similarly, one prototype was also found effective for the control of coccidiosis in kids. ELISA and PCR based molecular tests were standardized for diagnosis of caprine brucellosis. Inactivated JD vaccine has shown good result in controlling the disease in ruminants.

Extension Education and Socio-Economics Programmes

Under extension education and socio-economics programmes, transfer of technologies developed by the Institute are being undertaken through group discussion and demonstrations in adopted villages. A total of 321 goats were vaccinated against ET. A reproduction health calendar was distributed to goat owners and a total of twenty three cases of specific reproductive ailments were diagnosed and appropriately treated.

Work to assess/study the impact of improved technologies and emerging market conditions on goat production system suggested the need for regulated marketing infrastructure. Survey was carried out to elicit information on goat rearing practices, level of awareness on improved goat rearing technologies. A study on impact of various training programmes on commercial goat farming was continued. Fifty farmers who started commercial goat farms after getting

training at CIRG were quizzed about their experience and problems faced. The major problems faced were high incidence of diseases and non-availability of vaccines, medicine and veterinary advice, lack of elite germplasm and common pastures and grazing lands.

Financial literacy programme was organized in adopted village in collaboration with NABARD.

Training Programmes and Other Activities

During this year, Institute organized 6 National training programmes of 10 days on "Commercial Goat Farming" for the development and encouragement of goat industry on commercial lines in the country. Four Training programmes on Scientific Goat Farming were organized during the year on special requests from various agencies like Agricultural Technology Management Agency (ATMA) Saharsa, Kisan Trust, New Delhi, Bihar Management and Extension Training Institute, Bihar. Consultancy services on goat production and utilization were provided to several national and international agencies. A large number of entrepreneurs, goat farmers, professionals, students and representatives of developmental agencies benefitted through advisory and consultancy services. Thirty radio talks were given by Institute scientists and broadcasted from All India Radio Station Agra for the benefit of goat farmers. The Institute participated in four Kisan Melas.

A dedicated Farmer Helpline No. 0565-2763320 is functioning at the Institute to answer to the queries of goat farmers, entrepreneurs, NGO etc from all parts of the country. This helpline has become very popular with 1829 queries received and appropriately answered during the year.

कार्यकारी सारांश

बकरी दूध, मांस, खाल, रेशा तथा खाद प्राप्ति का एक उत्तम साधन है। बकरी मानव जाति द्वारा पालतू बनाया गया पहला रोमान्थी पशु है। बकरी का उल्लेख आदिकाल से अनेक ग्रन्थों में पाया जाता है। बकरी से प्राप्त होने वाली खाल का उपयोग अनेक वाद्ययन्त्रों जैसे–तबला, ढ़ोल, मजीरा इत्यादि में किया जाता है। बकरी की खाल से बने हुये मस्क में पानी ले जाने के लिये उपयोग सदियों से होता रहा है। आज के समय में बकरी की खाल विशिष्ट जैकेट, पर्स इत्यादि बनाने में प्रयोग की जाती है। बकरी से प्राप्त पशमीना एक बहुत ही उत्तम किस्म का रेशा है जिससे बने शाल बहुत ही हल्के एवं गर्म होते हैं तथा पर्वतीय क्षेत्रों में रहने वालों के लिये बहुत ही उपयुक्त माने जाते हैं। बकरी से पाये जाने वाली खाद जमीन में कार्बन की क्षमता बढ़ाने में उपयागी है। इसकी बहुमुखी उपयोगिता तथा दुनिया भर में बकरियों की बढ़ती हुयी संख्या को देखते हुये बकरी को भविष्य का पशु कहा गया है। भविष्य में जहां मशीनीकरण से कई पशुओं की उपयोगिता निरन्तर कम होती जा रही है, बकरी की उपयोगिता उत्तरोत्तर बढ़ती जा रही है बकरी से प्राप्त नये–नये उत्पाद बकरी पालकों के लिये आय के नये स्रोतों का सूत्रधार कर रहे हैं। ऐसा कहना अतिशियोक्ति नहीं होगा कि भविष्य में बकरी पालकों के लिये नयी क्रांति का जनक बनेगी तथा देश के पिछड़े भूमिहीन सीमान्त किसानों के लिये एक वरदान सिद्ध होगी। बकरी के दूध तथा मांस से बनने वाले मूल्यवर्धित उत्पाद इस क्रांति के लाने में महत्वपूर्ण भूमिका निभायेगे। बकरी एक ऐसी प्रजाति है जो विश्व की सभी भौगोलिक परिस्थितियों में पाई जाती है, चाहे वह साइवेरिया के पहाड़ हों या अफ्रीका के मरूस्थल। प्राचीन काल से मानव और बकरी का घनिष्ठ सम्बन्ध रहा है, प्राचीन काल में जहॉ–जहॉ मानव रहता था उसके साथ बकरी अवश्य पाई जाती थी। मानव सभ्यता के समय से अब तक बकरी मनुष्य के लिए अत्यन्त ही उपयोगी रही है क्योंकि यह कृषि भूमि की उर्वरा शक्ति बढ़ाने एवं मनुष्यों के आर्थिक व सांस्कृतिक उत्तरदायित्व निभाने में सक्षम सिद्ध हुई है।

दुनिया भर में 80 करोड़ बकरियां पायी जाती हैं तथा इनमें अन्य पशुओं की तुलना सबसे ज्यादा अनुकूलता पायी जाती है। विश्व के आंकड़ों का अध्ययन करने से ज्ञात होता है कि पिछले 30 वर्षो में बकरियों की संख्या में सबसे अधिक वृद्धि हुई है। प्रतिवर्ष लगभग 40 प्रतिशत बकरियों का मानव उपयोग हेतु वध करने के उपरान्त भी हमारे देश में बकरियॉ 1.55 प्रतिशत की दर से बढ़ रही हैं। भारत में बकरी की 23 वर्णित नस्लें पाई जाती हैं जिनकी संख्या लगभग 12.5 करोड़ है। अन्य पशुपालन की अपेक्षाकृत बकरी पालन कम खर्च का व्यवसाय एवं आसान प्रबन्धन होने के कारण समाज के गरीब समुदाय के लोगों से जुड़ा हुआ व्यवसाय तथा यही कारण है कि इसको 'गरीब की गाय' कहते हैं। बकरी समाज के गरीब व मजदूर लोगों के लिए आय का मुख्य स्रोत है तथा उन्हें पौष्टिक आहार प्रदान करती है। हिमालय के क्षेत्रों में बकरी रेशा व मांस उत्पादन एवं यातायात के काम आती है। बकरी पालन की मुख्य विशेषता यह है कि यह देश की विषम परिस्थिति वाले क्षेत्रों, जैसे शुष्क, अर्द्ध शुष्क या फिर ऐसे स्थान जहॉ बड़े पशुओं को पालना सम्भव नहीं होता, में जीविका का एक मात्र साधन है। पिछले एक दशक में बकरी मांस उत्पादन में 9.3 से 18.3 प्रतिशत की वृद्धि हुई है जो कि लगभग दो गुनी वृद्धि है। न केवल मांस उत्पादन बल्कि दुग्ध उत्पादन में भी इस दशक में 31.53 प्रतिशत की वृद्धि दर्ज की गई है। दुग्ध एवं मांस के अतिरिक्त प्रतिवर्ष बकरियों से खाल तथा जमीन की उर्वता बढ़ाने में सक्षम मेंगनी भी प्राप्त होती है।

संगठनात्मक स्वरूप

यह संस्थान भारत सरकार के भारतीय कृषि अनुसंधान परिषद के अन्तर्गत कार्य करता है। इस संस्थान में सभी अनुसंधान एवं तकनीकी हस्तान्तरण कार्यक्रम चार विभाग एवं एक अनुभाग द्वारा सम्पादित किये जाते हैं।

अनुसंधान

पशु नस्ल सुधार कार्यक्रम

बकरियों के ग्रामीण क्षेत्रों में आनुवाशिंक सुधार एवं नस्ल संरक्षण के उद्देश्य से वर्ष 2010–11 में 424 श्रेष्ठ जानवरों को विभिन्न संस्थाओं के द्वारा वितरित किया। एक विशेष उपलब्धि के अन्तर्गत इस वर्ष जमुनापारी, बरबरी तथा मुजफ्फरनगरी भेड़ परियोजनाओं में मृत्यु दर 5.00 प्रतिशत से भी कम रही।

बकरियों की विभिन्न नस्लों विशेषकर जमुनापारी, बरबरी एवं जखराना में शारीरिक भार व दुग्ध उत्पादन के सुधार हेतु चयनधर्मी प्रक्रिया अत्यन्त लाभकारी सिद्ध हुई। प्रजनक बकरों के चयन के लिए उनके 9 माह के शारीरिक भार व 90 दिन के दुग्ध उत्पादन के आंकड़ों को प्रयोग किया गया। इस वर्ष बकरी एवं भेड़ के मांस उत्पादन, दुग्ध उत्पादन, ऊन उत्पादन एवं प्रजनन क्षमता में महत्वपूर्ण वृद्धि प्राप्त हुई। बकरों की आनुवाशिंक क्षमता को ज्ञात करने के लिए आधुनिक सांख्यकीय सूत्रों की सहयता ली गयी। जमुनापारी व बरबरी बकरियों में इस वर्ष एस.एन.पी. आनुवाशिकीय अध्ययन के अन्तर्गत लेप्टिन रिसेप्टर जीन्स से जनन भार में 25.52 प्रतिशत जैविक विविधता पायी गयी।

दैहिकी, जनन एवं आवास प्रबन्धन कार्यक्रम

बकरी में हिमीकृत वीर्य तकनीक को अधिक प्रभावी बनाने हेतु प्रयोग किये तथा चार महत्वपूर्ण बकरी की नस्लों जमुनापारी, बरबरी, जखराना तथा सिरोही का हिमशीतित वीर्य बैंक स्थापित किया गया।

बकरी के पार्थिजेनेसिस विधि द्वारा भ्रूण बनाने में सफलता पूर्वक कार्य सम्पादित किया गया तथा आई.वी.एफ.एम./एम. इ.टी. विधि द्वारा बकरी के जुड़वा बच्चे इनका नाम अजत एवं अजाति रखा गया है के उत्पन्न करने में सफलता प्राप्त की। बकरी की विभिन्न प्रकार की आवास व्यवस्थाओं का तुलनात्मक अध्ययन किया गया तथा पाया गया की बकरी की शारीरिक तथा जीव रासायनिक संरचना में अच्छा आवास देने से सकारात्मक प्रभाव पड़ता है।

एक और अध्ययन में बकरी के अनुकूलन एवं उत्पादन पर मौसम के बदलतेरूप का अध्ययन किया। बकरी के ऋतुकाल को समकालीकरण करने पर अध्ययन किया और इस कार्य के लिए संस्थान में ही विभिन्न आकार के स्पंज विकसित किये गये तथा इनके उत्साहवर्धक परिणाम प्राप्त हुए।

पशु पोषण एवं उत्पाद तकनीकी कार्यक्रम

बकरी के लिए सस्ती पोषण व्यवस्था विकसित करना संस्थान का महत्वपूर्ण उत्तरदायित्व है। इसी कार्यक्रम के तहत बकरी के लिए विभिन्न प्रकार का गोलीनुमा दाना, पिसा हुआ दाना एवं ईटनुमा सम्पूर्ण आहार का निर्माण किया गया। दाना बनाते समय दाने के अवयवों की कीमत का विशेष ध्यान दिया गया। चारा उत्पादन के क्षेत्र में पेड़ों एवं चारे की फसलों को मिश्रितरूप से तैयार किया गया। इसके अतिरिक्त क्षेत्र या स्थान विशेष आधारित बकरियों के लिए खनिज लवण मिश्रण (मिनरल मिक्चर) तैयार किये और जिसके प्रयोग से बकरी के उत्पादन में आशातीत सुधार पाया गया। विभाग द्वारा तैयार किया गया एरिया स्पेसिफिक लवण मिश्रण का लोकापर्ण माननीय कृषि मंत्री श्री शरद पवार जी द्वारा किया। पूर्व की भांति इस वर्ष भी

वर्मी कम्पोस्ट खाद का उत्पादन जारी रखा गया और पाया गया कि इसके निर्माण में बकरी की मैंगनी से खाद की गुणवत्ता में वृद्धि होती है। दुग्ध एवं मांस से निर्मित उत्पादों की आम आदमी में मांग एवं उपयोगिता को देखते हुए संस्थान ने इस वर्ष भी इनसे विभिन्न उत्पाद बनाने का कार्य जारी रखा गया। एक अध्ययन में बकरी की नस्ल एवं दुग्ध काल अवस्था के समय के प्रभाव को दुग्ध में उपस्थित वसा पर अध्ययन किया। बकरी के दूध में परमावश्यक मध्यम चैन फैटी अम्लों की मात्रा दूध श्रवण काल के

शुरूआत में ज्यादा पायी गयी। इस वर्ष बकरी के दूध से निर्मित आइसक्रीम, श्रीखण्ड तथा मांस आधारित बिस्कुट बनाने की प्रक्रिया कार्य किया गया।

बकरी स्वास्थ्य कार्यक्रम

आर्थिकरूप से महत्वपूर्ण बीमारियों की रोकथाम के लिए विभिन्न विधियों को विकसित करने की दशा में शोध कार्य किया गया। बकरी की महत्वपूर्ण बीमारियों जैसे पी.पी.आर., बकरी चेचक, नील जिव्हया (ब्लू टंग) आदि की देश में स्थिति पर संस्थान के वैज्ञानिकों द्वारा निरन्तर सर्वेक्षण कार्य जारी रखा गया। मेमनों में दस्तों के उपचार हेतु विभिन्न औषधीय पोधों के सतों का परीक्षण किया। इनमें से दो पौधों द्वारा निर्मित एक अन्तिम प्रोटोटाइप मेमनों के दस्त के उपचार में अत्यन्त ही प्रभावी पाया गया। इसी प्रकार मेंमनों में कोक्सीडियोसिस बीमारी से बचाव के लिए एक प्रोटोटाइप प्रभावी पाया गया। ब्रूसोलिसस बीमारी की पहचान करने हेतु एलीजा एवं पी0सी0आर आधारित आणविक परीक्षण तकनीक को विकसित किया। संस्थान द्वारा विकसित जोहनीज रोग के टीके का लघु रोमन्थी पशुओं में प्रयोग किया जिसके परिणाम सकारात्मक प्रभावी पाये गये।

प्रसार शिक्षा एवं सामाजिक अर्थशास्त्र कार्यक्रम

संस्थान द्वारा विकसित तकनीकों का समूह वार्ता एवं प्रदर्शन के माध्यम से अंगीकृत गाँवों में हस्तान्तरण किया गया। बकरी पालकों की पशु पालन में ज्ञान व रूचि के स्तर को ज्ञात करने हेतु विभिन्न टेस्ट व पैमानों को विकसित किया। बकरी उत्पादन तकनीकों के प्रभाव का आंकलन एवं मूल्यांकन किया तथा बकरी पालकों के लिए बकरी पालन के प्रशिक्षण की आवश्यकता का अध्ययन किया। बकरी एवं इसके उत्पादों के उचित विपणन–व्यवस्था से सम्बन्धित नीति बनाने पर भी वर्ष के दौरान कार्य हुआ ताकि यह क्षेत्र अछूता न रह जाये। पूर्व की भांति इस वर्ष भी संस्थान से उन्नत बकरी पालन पर विभिन्न बकरी पालकों द्वारा लिये गये प्रशिक्षण के प्रभाव का अध्ययन किया। किसानों द्वारा अपनी बकरी पालन से सम्बन्धित प्रमुख समस्याओं में रोगों से अधिक नुकसान होना, वैक्सीन, पशु चिकित्सा दवाओं व उपयुक्त परामर्श की अनुउपलब्धता उन्नत नस्लों के बकरों का न मिल पाना एवं सामुदायिक चरागाहों का अभाव पाया गया। वर्ष के दौरान संस्थान ने उन्नत बकरी पालन पर 6 राष्ट्रीय प्रशिक्षण कार्यक्रम तथा 4 अन्य संस्थाओं जैसे कि आत्मा, (बिहार), किसान ट्रस्ट, नई दिल्ली व बिहार मैनेजमेन्ट तथा प्रसार प्रशिक्षण संस्थान द्वारा प्रायोजित प्रशिक्षण आयोजित किये गये। संस्थान ने 4 किसान मेलों में सहभागिता की और ऑल इण्डिया रेडिया पर फार्म स्कूल आन एयर के अन्तर्गत 30 रेडियो वार्ताओं का सफल प्रसारण किया गया। संस्थान द्वारा संचालित किसान हैल्प लाइन पर 1829 प्रश्नावलियों का समुचित प्रत्युत्तर प्रदान करके समस्याओं का समाधान किया गया।

CIRG: AN INTRODUCTION

Considering the significance of goats in a 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 40 Scientists, 69 technical and 35 administrative personnel's share the responsibility to achieve mandate of the institute, which has 4 research divisions and one section including well equipped Library, ARIS cell, PME Cell, Agricultural Farm, IPR Cell, Livestock farm and Health Section. The Co-ordinating unit of All India Coordinated Research Project on Goat Improvement is also located at CIRG. The project aims at improving production performance of 13 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. The profile of the Institute can be visited at www.cirg.res.in.

VISION

Develop Poor Man's Cow- the Goat as a Source of Livelihood Security, Poverty Alleviation and Employment Generation for the Smallholders.

MISSION:

To enhance and then sustain goat productivity in respect of meat, milk and fiber through research, extension and HRD support.

MANDATE:

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

OBJECTIVES:

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

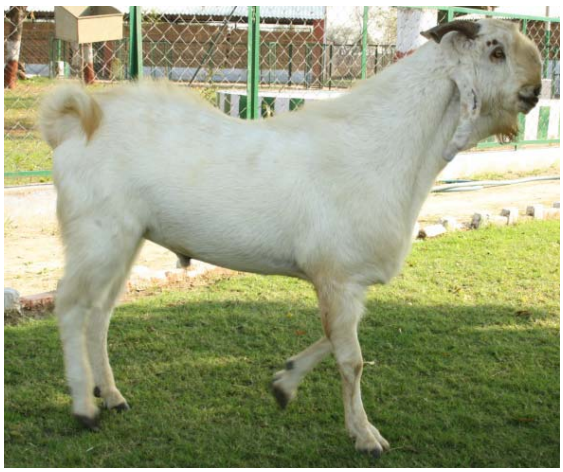
Past Achievements:

Research programmes at CIRG are flagged to provide cost effective scientific inputs that can easily be adopted by the weaker section of the society and to extend support to nutritional as well as the social security. The institute is contributing to high quality research output in the area of caprine ethology, husbandry, health, reproduction and production. It is committed to enhance the economic status of small farmers and to ensure their livelihood and food security. The emphasis has been on the use of multidisciplinary and interdisciplinary approaches to improve eco-efficient rearing of goats and making goat farming a vibrant and viable enterprise, besides popularising goat produce by value addition and making them attractive for industrial applications. The basic theme of research has been technological and institutional innovations to enhance the income of mainly poor goat farmers. We are trying to demonstrate the available improved technologies at the farmers' doorstep. A concerted approach has been adopted by the Institute in this direction. The dedicated helpline is working to address the goat farmer's problems.

Genetics and Breeding

- Characterization of leptin exon 2 and receptor genes has been carried out. Three genes of Y chromosome amelogenin gene (AMELY), sex determining gene (SRY) and Zinc finger gene (ZFY) were analyzed by sequencing in Jamunapari, Barbari, Black Bengal and local goats from Ladakh region.
- The genetic component of host resistance for controlling gastro intestinal nematode infections in goats in semi-arid climatic region has been carried out.

- DNA fingerprinting and Micro-satellite characterization has been carried out in Indian goat breeds.
- Micro-satellite characterization has been carried out in eight Indian goat breeds using 22 markers and best markers for breed differentiation have been reported.



- Sequencing of mitochondrial HVRI region was carried out in 10 goat breeds of different agro-climatic regions.
- Gene diversity in Indian goats and markers usefulness for breed differentiation has been established.
- The neighbor-joining tree of Indian goat breeds along with wild goats was constructed for the first time in

India. The Indian goats appear to cluster in three different groups *viz*. Group I- Jamunapari, Sirohi, Marwari, Changthangi, Chegu, Group II- Jakhrana, Black Bengal, Osmanabadi, Barbari and Kutchi and Group III- Local (non-descript) goats.

- Milk protein polymorphism has been studied in different Indian goat breeds.

  Kidding rate of 1.6 indicated higher population growth potential in Barbari breed goats.

- Selective breeding of Jamunapari, Barbari, Jakhrana goats and Muzaffarnagari sheep has established promising genetic progress in body growth, milk yield and twining ability over the years.

- Genetic parameters for body growth, greasy fleece yield have been estimated in Muzaffarnagari sheep and field survey has been carried out to highlight the status of sheep in field.

- The overall mortality of the flock during the year 2010-11 was below 5% in all the units.

- The BLUP estimates of breeding values for all animals were estimated using animal model and ASREML programme.

Nutrition, Feed Resources and Products Technology

- Several fodder tree leaves and cultivated leguminous fodders based complete feeds for different categories of goats as mesh, pellets and blocks were developed for economic goat meat and milk production.

- Supplementary feeding requirements of different categories of goats during different physiological stages have been worked out.

- Entrolobium tree leaves as defaunation agent improved feed intake, nutrient utilization and growth rate in goats.

- Subabool (*Leucaena leucocephala*) leaf meal could be incorporated up to 30% in the complete feeds for goats without any deleterious effect.

- Supplementation of 15 g common salt and 15 g mineral mixture daily in the feed of the adult goats improved protein and energy availability by about 16%.

- Milk replacers were developed and tested successfully in pre-weaning Barbari kids.

- Two and three-tier silvi-pasture models using several perennial grasses, legumes, fodder shrubs and trees were developed and evaluated for goats.

- A low cost Feed Pellet Making machine was developed for preparation of complete goat feeds in the form of pellets.

- A Complete Feed Block making machine was developed, tested and

used for making CFBs for different categories of goats.

- Technology for drying of rainy season herbage in the form of hay under Poly houses was perfected. Hay racks for drying the herbage have also been developed.
- Live animal traits, carcass and non-carcass component yield, cutability, carcass composition, fat partitioning and meat composition of goat carcasses of different breeds and age groups have been studied.
- Effects of age, system of feeding and management on quantity and quality of meat production have been studied.

Processing techniques for manufacture of value added products from spent goat meat have been developed and recipes viz. pickles, sausages, cubes, shami kebabs, samosas, patties, roll slices, cutlets, croquettes, meat balls, warm and serve meat curries and chevonettes have been standardized.

The quality attributes of value added meat products and their shelf-life have been evaluated.

- Effects of breed, season, time of milking, parity and stage of lactation on major milk constituents and paneer yield have been investigated.
- Keeping quality of Barbari and Jamunapari goat milk during summer, winter and rainy seasons at room temperature have been studied.
- Processing techniques for preparation of Paneer, a value added product using different coagulants have been developed and standardized.
- Quality and shelf-life of Khoa, Shrikhand, Channa, Mozzarella cheese, Whey drink and Dahi (curd) was studied.

Physiology, Reproduction and Management

- Work on standardization and preparation of hormone delivery system (sponges and injections) was carried out. The retention of sponges into vagina was 100%.
- Embryos were bisected through micro tools.
- Studies on adaptation of livestock to impending climate changes through

shelter management were carried out.

- Benefits of predominantly black/dark coat color commonly found in desert goats through energy economy have been worked out.
- The breed variation in sustaining water deprivation and effect on field application has been worked out.
- The package of management practices under both intensive and semi-intensive system has been developed.
- For ex-situ conservation of buck semen, efforts were made to further refine the freezing protocol using new cryoprotectants like dextran, addition of anti oxidants like vitamin, Vitamin C and glutathione and combination of cryo-protectants.
- Good quality embryos were successfully collected through non-surgical technique.
- Technologies have been perfected for collection and transfer of embryos for quick multiplication of superior goat germplasm.
- Thirty seven kids were born out of intra-cervical embryo transfer technique.
- Laparoscopic technique could be applied for oocyte recovery and application of collagenase enzyme proved to be beneficial in oocyte recovery.
- Caprine embryos could be successfully frozen at 4-12°C by vitrification technique.
- An eight cell *in vitro* fertilized (IVF) embryo was transferred to a local goat and a healthy kid was born of a surrogate mother for the first time in the country.
- Housing requirements for different categories of goats have been determined and shelter management techniques standardized.
- Sets of 11 Feeding and Watering devices suitable for Goat and Sheep Farms have been developed and/or modified. This technology has been adopted by several Commercial Goat Farmers in different parts of the country.

Goat Health

- PCR based diagnosis, directly from clinical material, serum and milk-ELISA diagnostic methodology has been developed.
- Several isolates of *Mycobacterium avium* Paratuberculosis (MAP) have been characterized in organized and farmer flocks.
- A comb based dot-ELISA kit and PCR based test has been developed for diagnosis of *Brucella melitensis* infection in goats and sheep. The dimension of caprine brucellosis disease has been studied in organized and unorganized farms.

- A prototype of DNA based vaccine against *Brucella melitensis* was developed.
- A latex agglutination test for quick and spot diagnosis of *M. Capri* infection has been developed.
- Pathogenic *E.coli* strains were isolated from the fecal samples and heart blood samples at autopsy of kids died of diarrhoea. About 200 doses of experimental polyvalent vaccine, incorporating six strains of various sero-types of entero-pathogenic *E.coli*, were used successfully in pregnant does to control the kid mortality.
- Outbreaks of PPR were investigated throughout the country. The disease appears to be endemic in goats and sheep in India and the outbreaks seem to spread steadily now in young animals all over with high mortality of 38.75 to 48.90% and morbidity of 19.34 to 46.66%.
- Epidemiology of important goat diseases like PPR, Goat Pox, Contagious Ecthyma, FMD, Haemonchosis, Colibacillosis was studied in changing climatic conditions in organized farms.
- Several medicinal plants were evaluated for the control of Haemonchosis in goats.
- Behaviour of blood biochemistry and Complete Blood Count (CBC) was studied in goat diseases for clinical diagnosis.
- Developed a herbal drug against ectoparasites with the trade name "**Alquit**". The drug is highly effective and is available commercially.
- Baseline information on epidemics of goat diseases at National level has been analyzed. Major diseases recorded were PPR, FMD, *E.coli* infection, contagious ecthyma, goat pox, gangrenous mastitis, Enterotoxaemia, Pasteurellosis etc.
- Monensin @ 40 mg/kid/day in premixed concentrate mixture was found to be effective in coccidiosis.
- The basic epidemiological information under field conditions on the common parasitic infestation and incidence of mortality has been studied.

Extension Education and Socio-economics

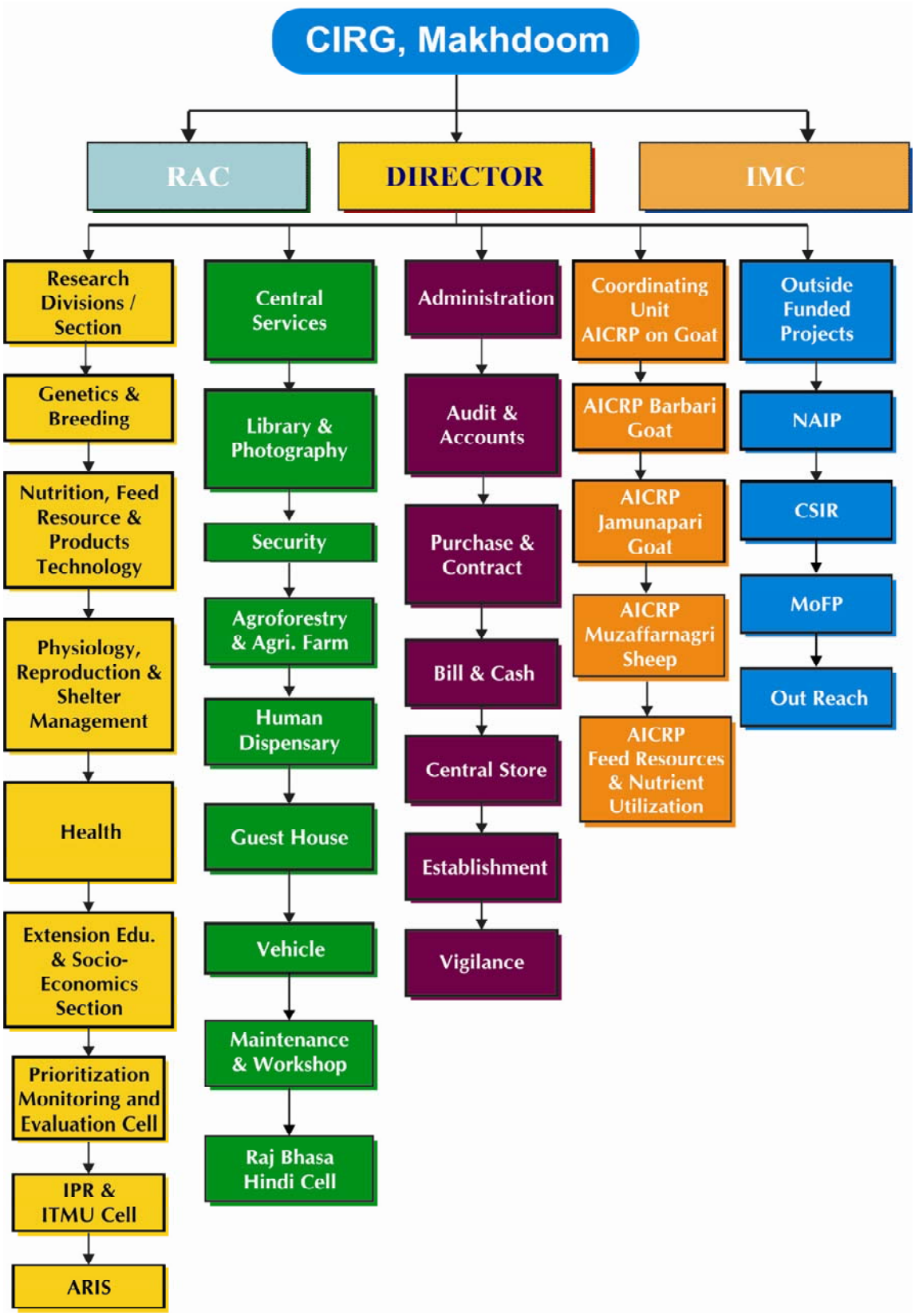
- Goat rearing has been found to be profitable under semi-intensive and extensive system of management under field conditions giving net profit of ₹0.76 per rupee of total input cost with a net income of ₹1300-1800/goat/annum.

- Several Extension Education Models in adopted villages and off and on-Campus training programmes have been studied. A Distant Extension Method for Commercial goat farming

has also been studied.

- Mortality and morbidity losses in goats under field conditions have been estimated to be ₹11,720 million/ annum at the National level and Prophylaxis measures may result in a net saving of ₹5,144 million/ annum.
- Basic information on goat production systems, marketing and ITK has been collected and analyzed.
- The constraint analysis of BPL farmers revealed that non-availability of medicines, vaccines, treatment, grazing, credit, proper market and feeds for goats were the major handicaps in successful goat rearing.
- The constraints in organization of Goat Cooperative Societies have also been studied.
- About 750 commercial goat farmers of 11 States were surveyed. About 25% farmers were undertaking goat rearing as their primary source of income and were fully dependent on it.
- The role of middlemen in goat marketing and exploitation of goat farmers by them was studied.
- About 52 ethno-veterinary herbal combinations were used by the goat farmers for treatment of 15 common diseases/ aliments of goats mostly due to resource crunch.
- The Agriculture Research Information System (ARIS) Cell was created during 1996. CIRG has established the first functional LAN of National Agriculture Research System of India. Subsequently, web site of the Institute was launched from the server located at CIRG. Thus, CIRG web site http://www.cirg.res.in was the first web site launched and hosted from Institute's own server and on OSS/FS software. The Institute has also launched Hindi version of the web site.
- The web-based email was created making the email of CIRG accessible from all over the world on Internet. The email conferencing systems generally known as Mailing Lists of List servers were created on 7 aspects of agriculture.
- The ARIS Cell organized 4 National and one International training programme on sustainable and affordable information system development using OSS/FS and Development of Internet and intranet using Linux Operating system. The Unit is advising Institutions and Universities in setting up their Internet.
- The Institute has entered into MOU with DUVSU, Mathura for collaboration in teaching and training to post graduate M.Sc., M.V.Sc. and Ph.D. students
- In addition to specialized training programmes for professionals and veterinarians in various areas of scientific goat rearing, the institute regularly organizes national training programmes on commercial goat farming for 10 days duration every quarter of the year, for farmers and entrepreneurs.

ORGANIZATIONAL SETUP



STAFF POSITION

Category	No. of post sanctioned	No. of post filled
RMP	1	1
Scientific	50	40
Administrative Staff	34	34
Technical	72	69
Supporting	104	93
Temporary Status		126
Total	261	364

FINANCIAL STATEMENT (2010-11)

	Plan (₹ lakh)		Non Plan (₹ lakh)	
	Allocation	Expenditure	Allocation	Expenditure
A. Recurring				
Establishment charges	0.00	0.00	979.00	978.17
Wages	0.00	0.00	195.60	178.43
OTA	0.00	0.00	1.00	1.00
TA	4.00	4.00	4.00	3.81
Other charges	157.00	149.60	173.40	152.42
HRD	4.00	2.29	0.00	0.00
Total	165.00	155.89	1353.00	1313.83
B. Non-recurring				
Equipments	30.00	23.26	2.24	1.86
Furniture	5.00	4.11	0.84	0.84
Library books & Journals	5.00	5.00	2.33	2.33
Livestock	0.00	0.00	0.00	0.00
Works	105.00	103.86	9.00	8.92
Other	5.00	2.77	0.59	0.56
Total	150.00	139.00	15.00	14.51
Grand Total (A+B)	315.00	294.89	1368.00	1328.34

REVENUE GENERATION (2010-11)

Target (₹ in lakh)	Achievement (₹ in lakh)
52.00	68.59

RESEARCH ACHIEVEMENTS

Genetics and Breeding Division

Physiology, Reproduction and Shelter Management Division

Nutrition, Feed Resources & Products Technology Division

Animal Health Division

Extension Education and Socio-Economics Section

AICRP on Goat Improvement

GENETICS AND BREEDING DIVISION

GGB-1.09: Improvement and sire evaluation of Jamunapari goats for milk production

R. Roy, Gopal Dass and H.A. Tiwari

The natural habitat of Jamunapari breed is ravines of Jamuna, Chambal and Kawari rivers of Chakarnagar district, Etawah (UP) and adjoining area of Bhind and Morena districts of M.P. where browse material is available in abundance. Jamunapari goats were brought to Central Institute for Research on Goats in 1982 and again added in 1988, 1997 and 2008. Since 1985 the project on genetic improvement of this breed has been in operation. In 1993 during VIIIth Five Year Plan, AICRP on Jamunapari unit was sanctioned vide letter F.No. 5 (1)/93 ASR II, dated 22.7.1993 for the period 1992-93 to 1996-97 and is continuing in IXth, Xth and XIth Plan. The project aims to improve the breed for milk production and body weight through use of selected bucks and production of elite germplasm for field improvement programmes.

Management practices of the flock in nucleus herd

Managemental practices: Goats are being maintained under semi-intensive system of management. Goats are sent out for 6 hrs grazing daily except rains and inclement weather and supplemented with recommended quantities of concentrate, seasonally available green and dry fodders. As a practice, after rainy and winter seasons 2" soil of all sheds was scratched, removed and refilled with fresh soil. Lime treatment after scratching the soil and before refilling of fresh soil was also practiced. White washing of sheds and burning of soil were done before kidding.

Housing management: The sheds have asbestos roof and kachcha floor. Goats are housed in the sheds during night particularly in winter and rainy seasons, whereas in summer season animal are kept in corrals. Various categories of goats are housed separately according to age, sex and physiological status viz., pregnant, milch and dry.

Feeding management: Goats remain on grazing for 6 hrs daily, therefore, supplementary feeding with recommended quantity of concentrate as well as seasonally available green and dry fodder are offered to the goats subject to availability of feed and fodder. Recommended quality of concentrated feed is offered in the morning and evening to avoid chances of over feeding in group feeding system. Dry fodder mainly gram and pegion-pea bhusa and seasonally available fodders are also provided to the goats. Newly born kids are kept with dams for 5 days, thereafter, shifted to kid nursery till weaning age and allowed to suckle their dam twice a day up to the weaning age.

Grazing management: Goats are allowed to grazes for 6 hrs in forest and consumes available grazing material. Pasture material is of poor to medium quality. From June to September grazing materials are found in abundance in the pasture, thereafter, availability reduces. During inclement weather such as rains, thunder, storms and other bad weather conditions goats are not allowed for grazing and fed dry and available green fodder in the shed. Sick, weak and advance pregnant goats are not sent for grazing. The quantity and quality of available grazing biomass depends on the season. Generally from June to September grazing materials are found in abundance and in better quality. During lean period tree loppings were provided.

Kid and adult feeding: The newly born kids are kept with dams in kidding sheds for 5-6 days. The kids are allowed to sucks colostrum within fifteen minutes of birth after dressing of navel cord, cleaning of nostrils and mouth etc, kids are allowed to suckle their dam according to their appetite as they remain with their dams for 5 days, thereafter twice daily till weaning. After 15 days of age tree leaves are provided for nibbling and creep mixture is also offered to them *ad lib*. Clean drinking water is also provided in the corrals.

Health management: All goat flocks are observed in morning and evening for any signs of illness before going out for grazing and after returning from grazing. The goats showing any symptom of disease or dullness are segregated from the flock for treatment. Dusting of floor and sheds with lime is done regularly and more frequently in rainy season.

Breeding management

The females are detected for oestrus twice daily in the morning and evening using aproned bucks and matings are done as per sire allocations through natural service. Since Jamunapari is seasonal breeder, therefore, sign of oestrus are exhibited mainly into two seasons viz., May-June and October-November and goats in oestrus are bred as per allocation. The kidding takes place in the months of October-November and February –March. The advance pregnant does before 3-4 days of their expected parturition were kept in kidding pens under close observation and proper care at the time of kidding.

Culling and disposal: A total of 72 goats comprising 29 males and 43 females of various age groups were culled on health and production ground during the year under report.

Flock statistics

Opening balance of the flock was 593 and closing balance was 735. The opening balance of breeding females was 268 and closing balance was 305. The population growth of the flocks was 59.70% and replacement rate of the does was 36.57%.

Mortality

The overall mortality of the flock during the year 2010-11 was computed as 4.22%. The mortality percentage of the animals in age group of 0-3, 3-6, 6-12, 12-18 months age groups and in adults were 2.77, 1.30, 2.00, 0.00 and 4.61%, respectively. The mortality rate was significantly lower than previous year in all age groups.

Growth performance

The overall least squares means of body weights of kids at birth, 3, 6, 9 and 12 months of age during the year 2010 were

3.28±0.02, 11.23±0.23, 15.78±0.20, 21.88±0.34 and 27.17±4.41kg, respectively. The body weights were significantly higher during this year. Various factors viz. year of birth, season of birth, type of birth and parity had significant influence on all the body weights except non-significant effect of year of birth and season of birth on birth weight. Male kids maintained higher weights at all growth stages. Kids born as single also showed significantly higher weights than those born as twins or triplets.

Feedlot performance

A total of 20 randomly selected male kids were kept under feedlot system where they were offered the concentrate, green & dry fodder *ad libitum*. These kids were kept in feedlot at 3 month of age. The overall mean of body weights were 19.31, 30.18 and 40.25 kg, respectively at 6, 9 and 12 month of age. As compared to semi-intensive feeding management, the kids under feedlot (intensive feeding system) were heavier by 3.07, 7.96 and 11.71 kg., respectively at 6, 9 and 12 month age. The average daily weight gain (ADG) of the kids under intensive management were 73.89, 120.78, 111.89 and 102.18 g/day, respectively during 3-6, 6-9, 9-12 and 3-12 month age group. Feedlot study indicated that breed has tremendous genetic potential which have been improved through selection.

Milk Yield Performance

Least squares means of part lactation milk yield in 90 days and 140 days were 72.92±1.8 and 104.74±2.64 liters, respectively. Season of kidding had highly significant ($P<0.01$) influence on both the milk yields. The milk production during this year was recorded to be significantly higher than previous year. Does kidded in Oct.-Nov. produced significantly higher milk in 90 and 140 days duration as compared to does kidded in Feb.- March season.

Reproductive Performance

Reproductive performance of Jamunapari goats in terms of tupping percentage, breeding efficiency and kidding per cent on the basis of does tupped were 89.7%, 87.07 & 120.40%, respectively. The kidding rate was 1.40. During this year, a total of 354 kids were born, out of which single born kids were 61.11%, twin born kids were 37.3%, triplet born kids were 1.58%.

Genetic parameters

Genetic parameters for body weights at various stages of growth and milk production traits were estimated. The heritability estimates for body weights at birth, 3, 6, 9 and 12 month age were 0.14±0.04, 0.19±0.04, 0.25±0.06, 11.04±0.04 and 0.18±0.06, respectively. The h^2 estimates of daily weight gain during 0-3, 3-6, 6-9 and 9-12 months of age were 0.23±0.05, 0.32±0.07, 0.13±0.06 and 0.25±0.07, respectively. All the h^2 estimates were medium except the estimate for 9 month body weight and daily weight gain during 6-9 month of age. The genetic trends for the body weight at birth, 3, 6, 9 and 12 month age were 0.12±0.03, 0.59±0.12, 1.58±0.19, 2.66±0.28 and 2.14±0.36 kg, respectively. The heritability estimates for peak milk yield, 90 day and 140 day were 0.25±0.08, 0.27±0.08 and 0.29±0.10, respectively. The h^2 estimates for milk yield traits were moderate. Selection of breeding individuals on the basis of body weight at 6 month and 90 days milk yield may be practiced for improvement.

Sire evaluation

Ranking of sires was done on the basis of breeding value estimates obtained as BLUP estimates. The top ten bucks were utilized for producing next generation progeny.

Supply of elite germplasm

Elite breeding bucks were supplied to various developmental agencies, research organizations, Non-Government Organizations and progressive breeders for genetic improvement in the field conditions. During year 2010-2011, 65 males and 34 females were distributed to goat breeders for breed improvement of their flocks.

Table 1: Least Squares Means of Body Weight Growth (kg) in Jamunapari Goats

	Birth Wt.	3M Wt.	6M Wt.	9M Wt.	12M Wt.
Year of birth	NS	**	**	**	**
2007	3.25±0.02 (247)	11.85±0.24 (211)	16.27±0.21 (185)	19.90±0.27 (176)	24.27±3.38 (171)
2008	3.30±0.01 (326)	10.49±0.22 (289)	13.55±0.18 (278)	18.35±0.24 (261)	23.09±3.02 (241)
2009	3.24±0.01 (188)	11.50±0.27 (162)	16.44±0.22 (152)	22.00±0.29 (142)	28.11±4.06 (106)
2010	3.28±0.02 (235)	11.23±0.23 (216)	15.78±0.20 (188)	21.88±0.34 (126)	27.17±4.41 (112)
Season of birth	NS	**	**	**	**
March-April	3.27±0.01 (594)	10.86±0.18 (536)	14.94±0.15 (476)	19.26±0.20 (440)	24.56±2.65(369)
Oct. - Nov.	3.27±0.01 (402)	11.67±0.19 (342)	16.08±0.15 (327)	21.81±0.24 (265)	26.76±2.94 (261)
	**	**	**	**	**
Male	3.43±0.01 (480)	11.73±0.17 (417)	16.25±0.09 (369)	21.98±0.21 (269)	28.13±2.86 (476)
Female	3.11±0.01 (516)	10.82±0.20 (461)	14.77±0.10 (434)	19.08±0.20 (361)	23.19±2.50 (559)
Type of birth	**	**	**	**	**
Single	3.54±0.01 (432)	12.40±0.17 (394)	16.48±0.16 (356)	21.81±0.23 (313)	26.75±2.92 (287)
Twin	2.99±0.01 (564)	10.14±0.18 (484)	14.54±0.14 (447)	19.08±0.20 (392)	24.57±2.59 (343)
Parity	**	*	*	*	*
1	3.16±0.04 (363)	11.25±0.23 (325)	15.61±0.17 (292)	20.15±0.23 (271)	25.46±2.96 (242)
2	3.28±0.04 (233)	11.94±0.26 (200)	16.06±0.19 (183)	21.10±0.26 (166)	26.47±3.36 (148)
3	3.33±0.05 (171)	11.39±0.35 (157)	15.65±0.22 (146)	20.57±0.30 (121)	25.68±3.89 (111)
4	3.36±0.07 (102)	11.16±0.43 (86)	15.57±0.30 (77)	21.07±0.42 (62)	26.29±5.53 (54)
5	3.38±0.07 (63)	10.48±0.41 (56)	14.54±0.36 (52)	19.55±0.49 (45)	24.61±6.41 (40)
6	3.09±0.01 (64)	11.41±0.01 (54)	15.62±0.36 (53)	20.76±0.52 (40)	25.45±6.84 (35)

Table 2: Comparative growth performance of Jamunapari male kids under different management system

Traits	Semi-intensive management	Intensive management
Body weight (kg) at		
Birth	3.49 (109)	**3.49 (20)**
3 month	10.68 (75)	**12.66 (20)**
6 month	16.07 (55)	**19.31 (20)**
9 month	21.39 (52)	**30.18 (20)**
12 month	27.35 (52)	**40.25 (20)**
Average daily weight gain (g/day) during		
3-6 month	59.89 (55)	**73.89 (20)**
6-9 month	52.11 (52)	**120.78 (20)**
9-12 month	66.22 (52)	**111.89 (20)**
3-12 month	61.74 (52)	**102.18 (20)**

Table 3: Heritability estimates for milk production & growth traits

Traits	Observation	Estimates
Birth weight	3527	0.14±0.04
3 month weight	2950	0.19±0.04
6 month weight	2034	0.25±0.06
9 month weight	1709	0.11±0.04
12 month weight	1438	0.18±0.06
ADG (0-3M)	2948	0.23±0.05
ADG (3-6M)	1933	0.32±0.07
ADG (6-9M)	1649	0.13±0.06
ADG (9-12M)	1402	0.25±0.07
Peak day yield	1243	0.25±0.18
90 day milk yield	1224	0.27±0.08
140 day milk yield	856	0.29±0.10

GGB 1.10: Genetic improvement of Barbari goats for meat and milk production

S.K. Singh, P.K. Rout and N. Shivasharanappa

Genetic improvement programme for meat and milk in Barbari goats at institutional farm continued during the financial year 2010-11. On 1st April, 2010, 785 Barbari goats were available under breed improvement programme. Out of this 338 were adult females and 85 were bucks. Two hundred forty nine genetically superior, does and bucks each, were sold for grading up, conservation and genetic improvement of farmers flock during the year and 100 were available for sale. Four bucks were distributed in Hyyatpur Village of Mathura district for technology testing. In all 482 kids born at the farm during the year wherein 249 were males. Overall mortality was 4.34% which was one of the lowest at this farm. At the end of the financial year 2010-11, 871 goats were available out of this 100 were for sale on account of breed improvement purpose. The population growth during the year was 149%.

Data on adult body weight for birth, 3, 6, 9 and 12 months of age from year 2006 to 2010 were analyzed using least square method (LSMLMW/PC2 version). The fixed effects included in the analysis were year and season of birth, sex of kids and type of birth while weight of dam at kidding were taken as regression. The overall least squares mean for body weight at birth, 3, 6, 9 and 12 months of ages were 1.77±0.01, 7.85±0.05, 11.32±0.08, 15.27±0.08 and 19.14±0.17 kg respectively. The respective body weight during the year 2009-10 born kids completing performance in the year under report were 1.82±0.02, 7.14±0.09, 10.69±0.12, 14.23±0.18 and 18.95±0.25 kg respectively. Single born kids were significantly heavier than that of twin or triple (Table 1) up to 9 months of age.

The lactation performance of the Barbari goats for milk yield over 90, 140 days and Lactation Milk Yield (LMY) and Lactation Length (LL) were also analyzed using least squares technique and are shown in (Table 2). Factors included in statistical analysis model were year and season of kidding and parity of dam. Overall least squares mean were 53.82±0.68, 77.53±2.01, 57.98±0.80 liters and 114.10±0.79 days. Goats kidding during March -April season produced significantly higher milk than does kidded during October- November season. The order of kidding (Parity of dam) did influence lactational traits significantly. Highest milk production was observed in 4th and 5th parities. The higher selection intensity indicates that intense selection pressure was applied for genetic selection in Barbari Goats.

Age and weight at first kidding, kidding interval, service period and gestation period are shown in Table 3. Considering the reproductive parameters it can be concluded that Barbari goats have early sexual maturity, and therefore, relatively lower age at first mating and kidding, making the breed highly suitable for meat production.

Table 1: Least Square Means of Body Weight Growth (kg) in Barbari Goats

Factor	Weight at				
	Birth	3M	6M	9M	12M
Year of birth					
2006	1.72±0.02 (395)	7.78±0.08 (347)	11.92±0.14 (303)	17.01±0.18 (282)	20.97±0.21 (277)
2007	1.79±0.01 (636)	8.39±0.10 (567)	12.85±0.12 (529)	16.21±0.16 (468)	20.99±0.19 (414)
2008	1.79±0.01 (413)	7.13±0.08 (307)	10.68±0.16 (248)	14.26±0.27 (117)	16.34±0.41 (65)
2009	1.82±0.02 (503)	7.14±0.09 (474)	10.69±0.12 (439)	14.23±0.18 (324)	18.95±0.25 (206)
2010	1.71±0.02 (378)	7.47±0.06 (367)	10.46±0.15 (325)	14.62±0.29 (114)	18.46±0.40 (73)
Sex of kid					
Male	1.85±0.01 (1173)	7.94±0.06 (1035)	12.05±0.09 (907)	16.39±0.15 (597)	20.72±0.19 (476)
Female	1.69±0.01 (1152)	7.22±0.07 (1027)	10.59±0.10 (937)	14.15±0.15 (708)	17.56±0.19 (559)
Type of birth					
Single	2.05±0.01 (797)	8.92±0.07 (717)	12.36±0.10 (635)	16.18±0.15 (447)	19.94±0.21 (341)
Twin	1.79±0.01 (1368)	7.37±0.05 (1206)	11.31±0.07 (1084)	15.43±0.12 (771)	19.32±0.15 (617)
Triplet	1.46±0.02 (160)	6.45±1.36 (139)	10.30±0.21 (125)	14.18±0.31 (87)	18.16±0.37 (77)

**P<0.01, *P<0.05

Table 2: Lactation Performance of Barbari Goats

Factor	90 days milk (liters)	140 days milk (liters)	Lactation yield (liters)	Lactation length (days)
Year of kidding				
2006	55.65±1.23 (176)	-	55.54±1.39 (216)	97.83±1.37 (216)
2007	59.73±0.99 (328)	90.20±3.66 (68)	64.66±1.20 (349)	113.70±1.17 (349)
2008	52.28±1.19 (206)	79.21±5.18 (16)	53.59±1.37 (248)	102.63±1.34 (248)
2009	51.64±1.20 (187)	71.81±3.24 (87)	59.57±1.43 (208)	131.53±1.39 (208)
2010	49.80±1.38 (145)	68.90±3.56 (41)	56.55±1.66 (153)	124.79±1.62 (153)
Lactation order				
1	49.41±0.99 (367)	63.25±3.16 (53)	52.64±1.14 (432)	111.69±1.11 (432)
2	52.03±1.01 (246)	70.54±2.93 (61)	56.41±1.21 (265)	115.40±1.18 (265)
3	53.96±1.29 (140)	78.594±3.59 (33)	57.31±1.52 (157)	113.50±1.49 (157)
4	54.41±1.62 (94)	83.39±4.92 (17)	58.68±1.91 (105)	115.14±1.87 (105)
5	57.99±1.95 (69)	88.30±5.30 (17)	64.27±2.30 (77)	116.70±2.25 (77)
6	55.14±1.70 (126)	81.14±4.37 (31)	58.60±2.03 (138)	112.15±1.98 (138)

Table 3: Mean Reproductive Traits in Barbari Goats Over the Years

S.No	Traits	2006-07	2007-08	2008-09	2009-10	2010-11
1	Age at first mating (days)	215.1±1.6 (42)	230.4±5.6 (54)	253.2±5.6 (56)	227.9±7.2 (55)	291.7±7.6 (64)
2	Weight at first mating (kg)	15.40±0.1 (42)	19.3±0.6 (54)	20.7±0.6 (56)	15.73±2.6 (46)	14.54±1.06 (84)
3	Age at first kidding (days)	371.0±4.1 (31)	358.0±6.1 (37)	397.7±4.1 (56)	411.2±1.7 (62)	425.2±6.1 (47)
4	Weight at first kidding (kg)	20.14±0.2 (41)	18.23±0.7 (37)	21.2±0.2 (56)	18.4±1.4 (46)	16.23±2.1 (47)
5	First kidding interval (days)	217.5±4.1 (27)	237.6±7.1 (25)	229.4±7.1 (34)	217.5±5.7 (29)	219.6±7.1 (37)
6	Service period (days)	221.51±4.6 (39)	224.31±5.4 (39)	215.3±5.4 (46)	219.40±4.1 (55)	232.41±5.4 (37)
7	Gestation period	142.4±0.1 (241)	143.1±0.1 (206)	144.4±0.1 (260)	142.5±1.2 (266)	144.8±0.5 (216)

The breeding efficiency on the basis of does available was 118% and on the basis of does tupped was 79% during the year 2010-11 while respective values for the year 2009-10 were 104 and 83.5 per cent. Kidding rate was 1.52. Of the 319 kiddings, 154 (48.2%) were single, 160 (50.16%) twin and 5 (1,5%) were triplet. Age and weight at first mating and at kidding, first kidding interval, service period and gestation period are shown in Table 4. Mean age at first mating ranged between 215 to 291 days and weight at mating 14.54 to 20.7 kg. The mean over years for first interkiding interval ranged between 217 to 229 days. Culling on health and production grounds were 0.06 and 2.76 per cent, respectively.

GGB 1.12: Improvement of Jakhrana breed of goat (Capra hircus) for milk and meat production under farm and field conditions

Saket Bhusan, U.B. Chaudhary, Gopal Dass and A.K. Mishra

Jakhrana is a valuable milch breed and also used for meat due to its compact and large size body. It is a hardy breed and can be reared in poor resources. The coat colour of the breed is black with white speckles on the ears. The breed derives its name from the name of village "Jakhrana" where it is found in most pure form. A small unit of Jakhrana goats is maintained at CIRG, Makhdoom for genetic improvement of goats for milk and meat production.

Housing Facility

Three shades of 20 x 60 feet with 40x60 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 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. During harsh winter season all the windows of the shade covered with moonj tatia or plastic sheet.

Feeding Practices

Jakhrana goats are maintained under semi intensive system of management. Animals were allowed for grazing from 8 am to 4 pm. Green fodder which produced at the

institute was supplied to the animals *adlib*. Kid pelleted feed, kid mash feed and adult pelleted feed were also 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 at the 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 at the rate of 300 gm, 350 gm, and 400 gm per kids per day, respectively. Milk was provided to kids after birth to 15 days of age at the interval of 6-8 hrs. After 15 days kids were provided only two times milk in the morning and evening. Every day fresh drinking water was provided *ad lib*.

Kidding and reproduction traits

In the year 2010 -11, out of 62 kidding 88 kids were born. Out of 88 kids, 49 kids (55.68%) were male and 39 kids (44.32%) were female. Out of 62 kidding, 41 does (66.13%) gave single birth, 16 does (25.81%) produced twins and 5 does (8.06%) gave triplet births. Over all multiple births were 21 (33.87%). The kidding rate of Jakhrana goats was 1.42. Gestation period, kidding interval and dry period of Jakhrana goats were 151.73±0.48, 293.19±0.56 and 146.46±0.36 (Table 1). 35 breeding males were supplied to the farmers, government and non-government agencies for genetic improvement of breed.

Table 1: Kidding and Reproduction Traits of Jakhrana Goats

No of kidding	Total kids produced	Male kids	Female kids
62	**88**	**39 (44.32%)**	**49 (55.68%)**
Single Birth	Multiple Birth	Twins Birth	**Triplets Birth**
41 (66.13%)	**21 (33.87%)**	**16 (25.81%)**	**5 (8.06%)**
Kidding Rate	Gestation Period	Kidding Interval	**Dry Period**
1.42	**151.73±0.48**	**293.19±0.56**	**146.46±0.36**

Growth performance of Jakhrana kids

Fortnightly body weight of kids, were recorded in kg. Least squares means±SE of body weight (kg) at different ages of Jakhrana kids are presented in Table 3.

Milk production: Milk production of Jakhrana does was recorded in liter. Least squares means of milk production are presented in Table 4.

Table 2: Least Squares Means of Body Weight of Jakhrana Kids

2008-09	Birth wt.	3 m wt	6 m wt	9 m wt	12 m wt
Pooled	2.966±0.061 (143)	8.300±0.171 (117)	10.521±2.258 (79)	15.282±0.143 (44)	19.353±0.529 (43)
Male	3.106±0.081 (78)	8.568±0.253 (61)	11.123±0.350 (43)	16.648±0.432 (25)	21.258±0.503 (23)
Female	2.814±0.089 (66)	8.041±0.224 (56)	9.878±0.347 (37)	13.484±0.553 (19)	16.947±0.723 (19)
Single birth	3.379±0.157 (28)	8.811±0.377 (26)	10.822±0.184 (18)	16.043±1.380 (7)	21.429±1.645 (7)
Multiple birth	2.866±0.062 (116)	8.154±0.190 (91)	10.782±0.283 (51)	15.138±0.426 (37)	18.950±0.535 (36)
2009-10	Birth wt.	3 m wt	6 m wt	9 m wt	12 m wt
Pooled	2.761±0.441 (123)	7.669±0.131 (108)	10.370±0.212 (87)	14.338±0.363 (58)	19.550±0.548 (42)

Male	2.800±0.049 (68)	7.977±0.200 (61)	10.888±0.320 (49)	14.891±0.575 (37)	20.812±0.653 (33)
Female	2.628±0.064 (55)	7.270±0.132 (47)	9.703±0.224 (38)	13.355±0.186 (27)	17.321±0.388 (24)
Single birth	2.898±0.076 (50)	7.855±0.265 (42)	10.689±0.350 (36)	14.352±0.438 (25)	19.723±0.636 (22)
Multiple birth	2.667±0.055 (72)	7.551±0.033 (66)	10.145±0.218 (51)	14.174±0.399 (39)	19.103±0.478 (35)
2010-11	Birth wt.	3 m wt	6 m wt	9 m wt	12 m wt
Pooled	2.61±0.03 (88)	8.994±0.285 (35)	10.025±0.6.374 (4)	14.900±0.950 (4)	-
Male	2.72±0.04 (49)	9.463±0.423 (19)	9.803±0.134 (2)	14.802±0.073 (2)	-
Female	2.47±0.46 (39)	8.445±0.302 (16)	9.964±0.323 (2)	15.043±0.474 (2)	-
Single birth	2.70±0.04 (41)	8.834±0.234 (18)	9.203±0.674 (2)	14.023±0.332 (2)	-
Multiple birth	2.536±0.464 (47)	9.193±0.395 (16)	10.367±0.245 (2)	15.533±0.297 (2)	-
Season-1 (April - Sept.)	2.475±0.935 (8)	7.062±0.256 (8)	10.025±0.6.37 (4)	14.900±0.950 (4)	-
Season-2 (Oct.-March)	2.622±0.036 (80)	9.567±0.267 (27)	-	-	-

Table 3: Least Squares Means of Milk Production of Jakhrana goats

Year/ Days	30 d	60 d	90 d	150 d
2007-08	35.752±1.776 (92)	75.795±2.934 (92)	109.873±3.992 (92)	**176.882±6.624 (68)**
2008-09	41.368±1.287 (69)	83.119±2.957 (69)	106.748±4.314 (62)	**128.717±6.326 (58)**
2009-10	37.021±1.174 (83)	72.203±2.698 (83)	98.002±3.933 (78)	**125.038±5.768 (67)**
2010-11	**38.633±1.831 (34)**	**74.873±3.810 (34)**	**105.681±6.681 (31)**	**159.635±10.374 (23)**

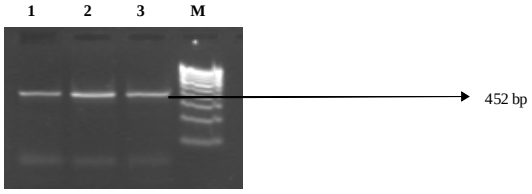
GGB 2.01: Molecular analysis of major genes and quantitative trait loci influencing growth, reproduction and disease resistance traits in Indian goats

P.K. Rout, A.K. Das, S.K. Singh and R. Roy

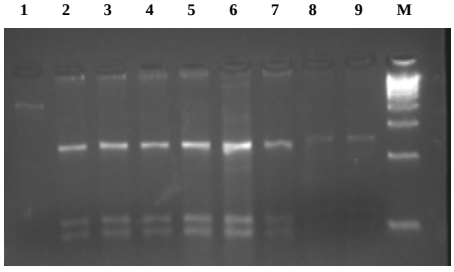
Molecular genetic approaches play an important role in the genetic improvement of the goat productivity. These molecular genetic approaches include: (1) Genetic diversity detection- using microsatellite markers and mtDNA D-loop- which shed light on the genetic variability within and between breeds, as it is fundamental for the choice of population to be conserved with high priority and for breed improvement (2) Genetic polymorphism analysis- using RFLP and SSCP- for genes whose products are key enzymes in the metabolic pathways of important physiological processes and for candidate genes of quantitative traits. (3) DNA sequencing among individuals representing different ecotypes to detect

the single nucleotide polymorphism (SNP) which is associated with the analyzed quantitative traits gene as a unique localization on the DNA.

The major focus of this project is to identify and characterize genetic variation underlying economically important traits in Indian goats. During the domestication, the goat has undergone intense natural selection pressure for various phenotypes. Selection in this species has led to distinct phenotypes associated with meat, milk, fibre production thriving in tropical environments in some part and tolerating specific pathogens. These selective pressures have differentiated sub-populations and produced phenotypes according to the need of the region. Therefore, it is necessary to utilize molecular markers to select high performance individuals for suitable environment for enhancing productivity and sustainability in goat production. It is necessary to combine molecular markers and production traits in an efficient manner for attaining higher productivity. DNA marker information, which identifies important allelic variation within the genome, could be incorporated into genetic evaluations to provide producers with selection tools that increase the rate of genetic improvement for lowly heritable traits.



PCR amplification of SCD gene in Indian goats with 100 bp marker.



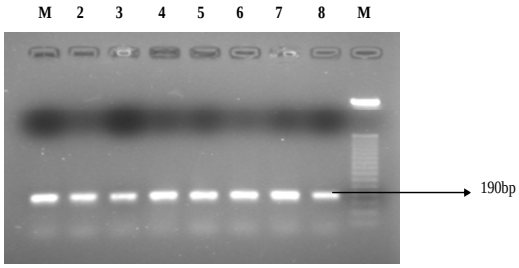
Rsa I -RFLP genotyping of SCD gene in different goat breeds.

Characterization of Stearoyl coenzyme A desaturase (SCD) gene in goats

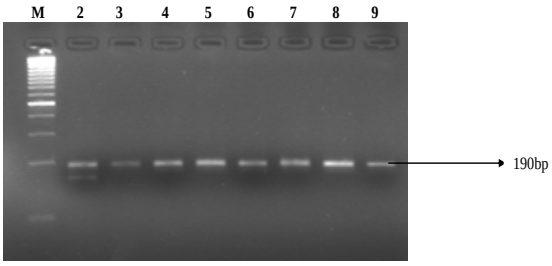
Mammary enzyme stearoyl coenzyme A desaturase (SCD) is an iron containing enzyme involved in the biosynthesis of monounsaturated fatty acids. Ruminants have relatively higher ratios of saturated to monosaturated fatty acids in their lipids, which are consumed by human beings as milk and meat. It is important to increase the proportion of unsaturated fatty acids in animal produce to make healthier designer products for the consumption of human beings. The SCD gene is a prime candidate gene for this purpose. Genetic variation was analyzed in goat stearoyl coenzyme A desaturase (SCD) gene in Sirohi (30), Jamunapari (30), Jakhrana (22), Barbari (40) and Marwari (25) goat breeds.

The amplified product was observed as 452bp. Polymorphic pattern was analyzed by PCR-RFLP with RsaI enzyme. Three different allelic combinations 228+110+86, 338+228+110+86 and 338+86 were observed. Genotypic frequency of GG, GT and TT was 89.01%, 4.39% and 6.59%, respectively. Polymorphic pattern showing 240 bp, 118 bp and 98bp was observed in 31.35% population over the breed, which needs further characterization.

Sequence analysis and genetic variation in SCD gene were analyzed in different goat breeds. Nucleotide diversity 1.000±0.038. The average nucleotide diversity, π, was 30.545 and the expected proportion of polymorphic site, θs, was 57.358. Out of



PCR amplification of FecB1 gene in Indian goats with 50 bp marker.



AvaII –RFLP genotyping of FecB1 gene in Indian goats.

total substitutions, transversion substitutions were more prevalent (67.85%) and transition was 32.14%. Haplotype analysis was carried out by ARLEQUIN () and unique haplotypes were observed. SCD haplotype was submitted to NCBI and accession number was obtained (Accession number: JF 508845).

Sequence analysis was carried out in 11 samples of different breeds and sequence length varies from 424 bp to 513bp.A total of 13 polymorphism were identified in the analyzed sequence. Mostly the polymorphism was observed in the region from 1 to 30bp and 355 to 381bp region. Mostly A to C and A to G were observed in the analyzed population.

Caprine SCD gene (JF 508845) showed significant sequence alignment with human SCD gene (complete cds; AF 097514) followed by Bos Taurus SCD gene (complete cds, AF481915S4), *Bos taurus* SCD gene 5′ UTR exon and with Ovies aries SCD gene (FJ513370.1). Further, efforts are needed to evaluate the potential use of identified SNP as markers for fat content and fatty acid composition.

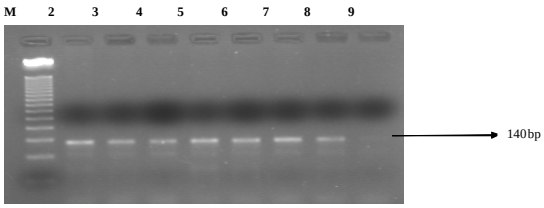
Genetic variation in FecB gene in different goat breeds

Reproductive success is critical for efficient livestock production and profitability. The research in ruminants has contributed significantly to define the effect of genotype and environmental factors on reproduction. Higher kidding rate is required for multiplication of farm animals in a short period of time to increase the profitability. Major genes controlling the reproduction are Booroola, Inverdale, Hanna, Belclare, Galway, Woodlands, Lacune, Thoka, Olkuska and Belle-Ile in sheep.

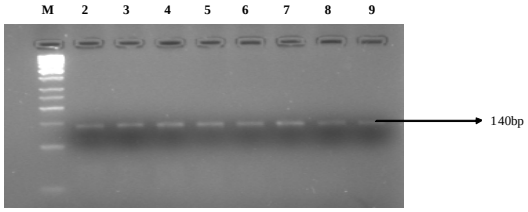
Genotyping of FecB1 and FecB2 gene was carried out in Jamunapari, Barbari, Black Bengal and Jakhrana goats by Forced PCR-RFLP method. Garole sheep was used as control animal in this population. The amplified product of FecB1 locus was observed as 190bp. The Forced PCR-RFLP pattern showed 190 bp in all the analyzed goat samples indicating the presence of homozygous non-carrier (FecB++) gene in goats. However, three Garole sheep samples exhibited 160bp indicating the presence of homozygous (FecB/FecB) and one sample showed 160 and 190bp indicating the presence of heterozygous carrier. Genotyping of Garole, Black Bengal and Barbari was carried out to observe FecB2 mutation by Forced PCR-RFLP method. The size of the amplified product of FecB2 locus was observed as 140bp. Genotyping of FecB2 locus in Jamunapari, Barbari, Black Bengal and Jakhrana goats showed 140bp by RFLP analysis indicating the presence of homozygous non-carrier (FecB++) in all the goat breeds. Similarly Garole sheep showed homozygous carrier (110bp) and heterozygous carrier (140bp) in the entire analyzed sample.

Association of Leptin receptor exon 4 polymorphism with body growth

The DNA region of leptin receptor gene was genotyped in Barbari half sib family in 89 kids. Standard records such as sire, date of birth, sex, birth type were recorded and phenotypic data on body weight and milk yield were recorded. Complete pedigree information was available for all animals with phenotypic records.



Forced-PCR amplification of FecB2 gene in Indian goats (M= 50 bp marker)



***AvaII* –RFLP genotyping of FecB2 gene in Indian goats (M=50bp marker)**

The significant fixed effects and covariates were included in mixed model association to determine the effect of SNP on body growth. We obtained three classes 1==AA, 2= AB and 3=BB genotype were fitted as fixed effects separately. An animal model was fitted using ASReml (Gilmour et al. 2002) to analyze all available animal phenotypic data and pedigree information for 89 animals.

Prediction and SNP genotype effects

Predicted trait values for each genotypic class either SNP including (Co) variances for the prediction and standard errors of differences (SED) for contrasts were obtained from ASReml analyzes. The predicted trait values were used to estimate additive and dominance effects on traits for each SNP, and the proportion of additive genetic variance (VA) for each trait accounted for the SNPs. The equation used were: additive effect, a= (AA-BB)/2; dominance effect, d=AB- (AA+AB)/2 and% Va due to SNP = 2pq (a+d (q-p)2, where AA,AB and BB were the predicted trait values for each genotype class, p and q were the allelic frequencies at SNP locus and Va was the additive genetic variance of the trait obtained from an animal model analysis ignoring SNP effects. Standard errors of the additive and dominance effects were constructed from the variance-covariance matrix of the predicted genotype class, as were the SED for pair wise contrasts of the SNP genotype classes.

Allele frequency at SNP locus in Barbari goat breed was 0.77 and 0.23. The A allele was segregating at higher frequencies (more than 0.7) and the B alleles was segregating at lower (less than 0.3) frequencies in Barbari population.

Mean, SD and range of 9 month body weight analyzed in the Barbari kids. The direct genetic heritability for 9 month body weight was moderate (0.305±0.085). Least squares analysis was performed to analyze the association of genotypes with 9 month body weight and milk yield at 90 days. When the complete data set was used, and an animal model was used including ungenotyped animals, the significant effect on body weight was observed. The predicted values of SNP genotype was shown in Table 1. Significant difference was observed between AA and BB genotype, but no difference was observed between AA and AB genotype.

Estimation using the predicted trait values for each SNP genotype showed that that the A allele had an additive effect of 1.987

on body weight. Based on the estimated allelic effects and the allelic frequencies observed in the sample at each locus, the proportion of additive genetic variance attributed to the SNP genotype at each SNP locus was determined for 9 month body weight. The AA SNP genotype explained 25.82% of the additive genetic variance for body weight attributed at 9 months of age.

Table 1: Predicted value of 9 month body weight with standard error of the leptin receptor genotype, gene frequency of Leptin receptor SNP and heritability of body growth at 9 months of age

Geno-type	Predicted value of 9 month body weight with SE	Gene frequency of leptin receptor allele	Heri-tability
AA	18.51±0.843	A=0.77 B=0.23	Heritability of 9 month body weight= 0.305±0.085
AB	18.91±1.00		
BB	14.94±2.28		

GGB 2.10: Genetic evaluation and improvement in Muzaffarnagari sheep for body weight and wool yield

Gopal Dass, S.D. Kharche and A.K. Das

Muzaffarnagari, the best mutton breed, is the heaviest and tallest among all sheep breeds of India. The animals are widely distributed in Muzaffarnagar, Meerut, Bulandshahar, Saharanpur and Bijnore of western Uttar Pradesh and also in some of the parts of Delhi and Haryana. This breed is considered as less known genotype exhibiting better growth and good adaptability than other Indian sheep breeds. The institute is maintaining a pure bred flock of Muzaffarnagari sheep under the *Network Project on Sheep Improvement*. The research work was initiated on this breed in year 1976 with main objective to improve the body weights through crossbreeding of local Muzaffarnagari sheep with exotic mutton breeds viz. Dorset and Suffolk. Later, in year 1992, the programme was modified to Network Project on Sheep Improvement on Muzaffarnagri sheep with the aim to improve the breed for mutton and carpet wool through selective breeding. Presently the efforts are being made to improve the animals for higher mutton production.

Management practices

Flocks were maintained under semi-intensive system of feeding management. However, some of the lambs at their weaning age (2 month) were put under the intensive system of feeding up to 6 and 9 month of age. During intensive feeding, they were provided with *ad libitum* growth ration daily, consisting of 72% TDN and 16% DCP. The ingredients of ration were maize (15%), barley (20%), ground nut cake (35%), wheat bran (20%), molasses (7%), mineral mixture (1.5%) and salt (1.5%). Dry and green fodders were given *ad libitum* and the lambs were not allowed to graze. The remaining animals were maintained under the semi-intensive system where they were provided 400 g of growth ration, 6-7 hrs grazing and dry and green fodders. Ewes of 100 days onwards pregnancy and during lactation were provided supplementary ration, where as dry ewes were fed only maintenance ration.

Controlled breeding was practiced to improve the managemental efficiency. The ewes were bred during May-June and October-November followed by lambing

in the months of October–November and March-April, respectively. The lambs were weaned at 2 months of age due to poor milk production as well short lactation period of their dams.

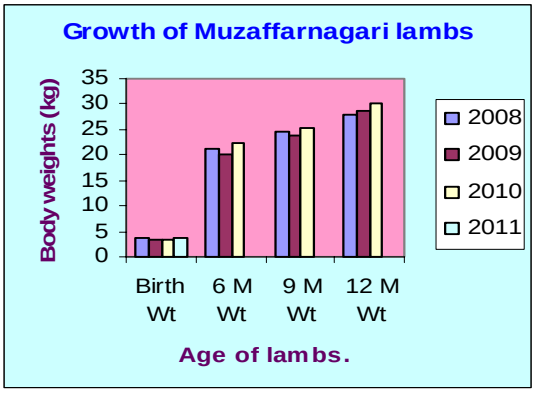
All the sheds and corrals were disinfected frequently with lime. Regular treatment and strict prophylactic measures were practiced for vaccination against Enterotoxaemia, Foot and Mouth Disease, Sheep Pox, HS, PPR. De-worming with different anthelmintic was practiced at pre-monsoon and post monsoon seasons and as and when required. Dipping was done after 15-20 days of each shearing.

Flock statistics

Flock strength of Muzaffarnagari sheep as on 01.04.2010 was 485 sheep (153 male and 332 female, out of witch breedable ewes were 253). The closing balance on last day of the year *i.e.* 31.03.2011 was 536 which comprised 150 male and 386 females component having 286 adult females. The addition was due to birth of 219 lambs (109 males and 110 females) while the reduction was due to death, culling and slaughter of male lambs. In the end of the year there were around 40 surplus breeding rams in the project for supply to the field.

Growth performance

The overall least-squares means of body weights of lambs at birth, 3, 6, 9 and 12 month age were 3.49±0.05, 13.80±0.33, 22.48±0.47, 25.40±0.45 and 30.23±0.67 kg, respectively during the year under report. The effect of sex and year of lambing was highly significant (P<0.01) on all body weights except sex and year effect on 3 month weight and year effect on 9 month body weight. Male lambs gained higher weights as compared to female lambs at all growth stages. On comparison body weights in different years, it was found that birth, 6, 9 and 12 month weights were significantly higher in year 2010 as compared to previous two years weights up to 3 month age were almost similar in different years. The overall least-squares means of birth weight of lambs born in first season of year 2011 was 3.71±0.06 kg.



Culling and mortality

The overall culling in 0-3, 3-6, 6-12 month age and in adults was 1.73, 7.90, 9.13 and 4.84%, respectively. The overall culling in respect of sex and age groups was 8.38%. The mortality was recorded to be 3.46, 3.95, 0.00 and 2.99% in the 0-3, 3-6, 6-12 month age group and in adults, respectively. The overall mortality was 4.26%. The overall mortality and culling were significantly lower than the norms decided by Network Project on Sheep Improvement (NWPSI). The overall culling on health ground was 0.99%. Post mortem findings indicated that maximum (43.3%) deaths were related to the problems in respiratory system (Pneumonia) and followed by Hemonchosis and Enteritis (13.3% each).

Average daily weight gain (ADG) and meat quality attributes

The average daily gain of Muzaffarnagari lambs during 0-3, 3-6, 6-9, 9-12 and 3-12

months were 113.49±3.35, 90.64±3.48, 47.30±3.43, 54.10±3.91 and 58.61±2.09 g under semi-intensive feeding management. Sex and year of lambing showed highly significant (P<0.01) effect on all average daily gains except effect of sex on ADG during 0-3 and 9-12 month and effect of year on ADG during 0-3 and 6-9 month. Similar to body weights, all average daily gains were found higher in males as compared to females.

Average monthly weights of adults

The overall average monthly body weights of adult males and females were 46.2 and 36.4 kg, respectively. The weights of rams were ranged from 40.5 kg in January to 50.0 kg in the month of October and in females it varied from 34.2 kg in June to 39.3 kg in the month of December. The overall average of monthly body weights were observed to be higher in pregnant (38.6kg) as compared to non-pregnant ewes (34.9kg). The higher weights of pregnant ewes might be due to additional weights of fetus and placenta. The monthly weights in all 12 months were higher in males as compared to females.

Carcass characteristics

A total of 15 male lambs maintained under semi-intensive feeding management were slaughtered to study various carcass characteristics of Muzaffarnagari sheep. The average age of the lambs at slaughter was 338 days (6-12 month age group). In sheep, the animals are slaughtered at any time after six month age, hence, this age group was selected for study.

The overall mean for carcass traits viz. weight at slaughter, empty body weight, carcass weight, dressing per cent (slaughter weight basis), dressing per cent (empty body weight basis), fore quarter weight and hind quarter weight were 26.953g, 20.932kg, 11.063kg, 40.86%, 52.66%, 5.844kg and 5.218kg, respectively. The average values for non-carcass traits like blood, head, skin, liver, kidney and GI tract (full) were respectively 1.587kg, 1.891kg, 2.068kg, 428g, 75g and 8.343kg.

Reproductive performance

Tupping, lambing on ewes available and lambing on ewes bred basis were respectively 52.9, 48.7, 90.6% and 77.7, 69.6, 91.2% in first and second season. The annual tupping, lambing on available basis and lambing on bred basis were 97.0, 88.9 and 91.9. The overall twinning during the year of report was recorded 10.9%. Tupping, lambing and twinning significantly improved during this year as compared to previous years. Ewe No. 6288 gave birth to triplet healthy lambs weighing 7.3 kg., which was for the first time in this breed and project since its inception. The averages for weight at first service, age at first service, age at first lambing and ewes' weight at lambing were 31.1 kg, 423 days, 590 days and 35.3 kg, respectively.

Greasy fleece yield

The overall least squares means for lambs 1st and 2nd six monthly and adult annual clips were calculated to be 478.46±11.81, 507.41±14.25 and 1132.32±18.37 g, respectively. Sex and year of lambing had highly significant (P<0.01) influence on lambs first and adult clip. 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.

Genetic and phenotypic parameters

The h2 estimates of birth, 3, 6, 9, 12 month body weights and first six monthly clip were 0.137±0.069, 0.091±0.061, 0.322±0.101, 0.292±0.096, 0.295±0.096 and 0.530±0.131, respectively. The h^2 estimates of birth and 3 month weights were low which were might be because of great influence of maternal and other environmental factors on the growth of lambs. All the genetic and phenotypic correlations of body weights and greasy fleece weights were positive. The genetic correlations between and among body weights were relatively higher as compared to phenotypic correlations. In general, the phenotypic and genetic correlations of body weight with body weights and fleece yield with body weights decreased with the increase in age.

Replacement rate

The replacement rate for the breeding ewes was calculated as: A*100/B

Where, A= No. of ewes added during the year (2010-2011)

B= Ewes available on first day of the year (01.04.2010)

The overall replacement rate was = 60*100/ 253= 23.7%

Selection of rams

Male lambs born in March-April, 2008 were ranked on the basis of their 6 month body weight and out of total top 9 were selected for breeding purpose. The selection differential for the trait under selection was 7.4 kg (2010-11). The population mean and the average of sire selected was 25.2 & 32.6 kg, respectively. The selection differential for 6 month body weight was 5.2, 5.5 and 7.7 kg, respectively for the year 2007-08, 2008-09 and 2009-10.

Breeding rams were selected based on their 6 month body weight and then evaluated for various semen characteristics before using in breeding programme. Rams showing better libido and semen qualities in terms of volume, sperm concentration, mass motility etc. were finally selected and used as breeding rams in the flocks. Out of 10 rams, 9 donated semen from 0.5 to 1.0 ml. The colour of the semen was creamy and consistency was thick. The mass motility of the breeding rams varied from +3.5 to +5.0.

Distribution of elite animals

A total of 35 breeding rams and 02 ewes were supplied to Animal Husbandry Department, Uttar Pradesh and progressive farmers around the CIRG, Makhdoom for genetic improvement of the breed under field conditions.

NAIP: Goat husbandry based integrated approach for livelihood security in disadvantaged districts of Bundelkhand region

M.K. Singh, Saket Bhusan (upto 15 Sept, 2010), A.K. Goel, S.V. Singh, R.B. Sharma, A.K. Roy, Deepak Sharma, Hritick Biswas, S. Chakravorty, K. Ram, Shikha Shakya, V.B. Jaiswal

To systematically address the problems of 16 adopted villages, a subjective and objective survey was carried out of each villages covering physical, natural, social, human and financial assets (Table 1-3). The salient features of survey findings about adopted villages are:

Human population of village varies from 825 (Parthania) to 12000 (Behooni) with an average of 4050 human being.

Population is predominated by marginal farmers (>40%), landless people (29%) and small farmer (21%). Land size has no definite association with family income unless land has irrigation facility.

Average family size in adopted village is 6.2.

Education level is low, most of literate people (>91%) have education up to primary level. About 37% male and 46% female are illiterate.

Infrastructure (link road connectivity is good, electric supply is highly inadequate and irregular (4-6 hrs/d). Primary schools are available in almost all adopted villages. Primary health centre and veterinary dispensary are available in 4 and 2 villages, respectively. There is no agri-based or other kind industry in this region to provide employment. There is scarcity of water for human beings and livestock.

Major source of income in adopted villages is agriculture, wages (both migratory and village based) and livestock rearing.

Agriculture is single (Rabi) crop/season based with about 115% cropping intensity. Agriculture is mainly rain fed with substantially low yield and quite often with negative realized income.

Rain is highly erratic and short duration (20-30 d) and irregular making area quite often as draught prone. Amount of rainwater varies from 350-700 mm/year. Gram, Lentil, Mustard and Wheat are main crops of Rabi season whereas, Sesame, Green gram, Black gram and Pigeon pea are major crops of Kharif season.

Net sown area in Kharif is 33% in Hamirpur and 25% in Mahoba. About 60% crops in Kharif and 30% in Rabi lost in want of irrigation and disease control measures.

Soil has poor fertility and productivity due to deficient in organic content and prone to water and wind erosion. Major soil types are sandy, sandy loam, black and Red rocker. Soils have poor water retention capacity; moreover maximum amount of rain water drained due to very-very poor vegetation cover.

Dug well is main source of irrigation but most of them are in non-functional. Tube-well and canal are important sources of irrigation. As per government records canal is main source but effective canal network is available only in 3 out of 16 villages. Efficiency of available irrigation resources is very poor due huge depth of ground water and their low charging.

Livestock (goat, cow and buffaloes) is important source of livelihood and

become life saving in case of persistent draughts but their productivity is low due to their poor genetic makeup, lack of feed and health care. Bullocks are available in good number with small and marginal farmers for agriculture operations. Farm machines (tractors hardly 1% of population and tube wells with about 10% of population) were quite less.

Backyard poultry, piggery, sheep rearing is meager and only about 2-3% families keeping them as livelihood resource. Average flock size/ herd size of goat, cow and buffaloes were 4.2, 2.7 and 1.8, respectively. Cattle and goat are mainly kept on range grazing. Livestock and agricultural products are sold mostly in village and in local town mandies. Due to above mentioned conditions/ reasons about 38% population of Mahoba and 21% of Hamirpur compelled to leave their villages/ families as migratory labour to sustain their life.Poverty in this region is due to lack of irrigation resources, lack of mechanism to conserve water, lack of awareness on improved agricultural practices/ undeveloped infrastructure and lack of employment avenues.

Activities Performed

Forty Barbari goats were distributed to 8 beneficiaries of 2 adopted villages. Improved feeding devices were provided to goat farmers to popularize feeds utilization. About 2700 goats vaccinated against PPR and 642 animals were treated for various diseases through conducting health camps once in a month in each village.

Fourteen self-help groups were formed mostly involving woman, landless people, marginal and small farmers to promote integrated farming.

To increase livestock productivity, fodder cultivation was promoted by conducting demonstrations of fodder crops with improved varieties in 13 villages at 153 plots. Horti-silvipasture units were also planted in 8 villages at 22 plots.

Demonstrations of integrated insect/pest and disease control for major crops were carried out in 68 acres of land belonging to 62 farmers. IPM resulted in about 15% increase in crop yield and becoming popular among farmers.

About 8400 crossbred strains of poultry with high growth rate were made available to 338 resources poor farmers of adopted villages to provide additional income, employment and nutrition.

Group discussions (64) were conducted with the farmers on improved crop and livestock husbandry practices, IPM, fodder conservation and their utilization. 64 demonstrations were conducted for Paneer preparation (value addition of milk).

Table 1: Baseline information on Adopted Villages of Hamirpur and Mahoba districts

S. No.	Name of adopted villages	Hamirpur	Mahoba
		Behooni, Sarsai, Bakrai, Etaura, Aonta, Chilli, Etkor, Barel	Parthania, Bharwara Aari, Budhwara, Sudamapuri, Bamhori, Mahoobkanth, Tikariya
1.	Human Population	37927	26825
2.	Cattle population	11700	6010
3.	Buffalo population	8695	5208
4.	Goat population	12510	9830
5.	Total area (ha)	5663.3	5298.5

6.	Irrigated area (ha)	2910.0 (51.3%)	1629 (30.74%)
7.	Rain fed area (ha)	2753.3 (48.62%)	3669.4 (69.26%)
8.	Human Migration of village population	20.6%	38.33%
9.	**Sources of irrigation**		
i.	Dug well	34%	52%
ii.	Tube well	38%	30%
iii.	Canal	26.5%	14%
iv.	Ponds	1.5%	4%
10.	Efficiency of irrigation resources	65%	45%
11.	**Major sources of income**		
i.	Agriculture	52.32%	34.7%
ii.	Labour	36.03%	53.3%
iii.	Livestock	11.66%	11.9%
iv.	**Net sown area**		
v.	Rabi (h)	5267 (93%)	4398 (83%)
vi.	Kharif (h)	1817 (33%)	1325 (25%)
vii.	Zaid (h)	142 (2.5%	(2%)
viii.	**Area under major crops**	**% sown area**	
ix.	Gram	28.8%	35.9%
x.	Lentil	21.7%	31.85
xi.	Wheat	18.6%	9.7%
xii.	Mustard (50% as inter crop)	9.6%	5.6%
xiii.	Green gram	19.2%	17.2%
xiv.	Sesame	23.2%	29.0%
xv.	Black gram	29.7%	35.4%
xvi.	Arhar	14.3%	9.4%
xvii.	Jwar/ Bajra (Mainly intercrop)	11.0%	5.6%

Table 2: Yield of major crops in adopted villages

S. No.	Crops	Hamirpur (Y/h-Q)		Mahoba (Y/h-Q)	
		Irrigated	**Rain-fed**	**Irrigated**	**Rain-fed**
1.	Gram	16.5	6.2	15.4	5.7
2.	Wheat	32.0	-	30.0	-
3.	Lentil	14.0	5.0	13.6	4.7
4.	Pea	16	5.0	15.0	5.2
5.	Mustard	8.0	3.0	7.0	3.4
6.	Sesame	-	4.0	-	5.0
7.	Black gram	11.0	4.0	10.6	4.2
8.	Green gram	11.0	4.0	11.2	4.0
9.	Arhar	9.0	4.0	8.5	3.5
10.	Crops lost due to frost draught, & disease (Rabi)	20-30% of sown area		30-40% of sown area	
11.	Crops lost due to frost draught, & disease (Kharif)	30-40% of sown area		40-50% of sown area	

Table 3: Production Performance of major livestock species in adopted villages

Attribute	Optimum feeding conditions	Poor feeding conditions
Cow Milk yield (L/D)	4	1.7
Buffalo Milk yield (L/D)	5.5	3.0
Goat Milk yield (L/D)	0.5	0.3
goats body weight at 12 month (kg)	22	15
Kids mortality < 3 M	8	15
Adult mortality in goats	4	10

NAIP: Bioprospecting of genes and allele mining for abiotic stress tolerance

P.K. Rout, S.K. Jindal and N. Ramachandran

1) Establishing the physiological indicators for heat stress in semiarid region

Heat stress affects animal bioenergetics, and has negative impact on animal performance and well being. The objective was to assess the heat tolerance of goats in semi arid region by analyzing physiological response in different environmental condition. The investigation has been carried out in Jakhrana, Sirohi, Jamunapari and Barbari goats. The dynamic physiological response of goats such as core body temperature (RT), respiration rate (RR) and heart rate (HR) was evaluated in different environmental conditions during hot dry period (May-June), comfortable period (November) and cool dry period (December-January). Study included three large size breeds and one medium size breed. Similarly contrasting coat colour was included such as Jamunapari (white colour), Jakhrana (black colour) Sirohi (brown colour) and Barbari (dark brown spotted) in the study.

Core body temperature (RT) varies from 38.06 to 39.61°C in different breeds. During heat stress period, Jakhrana breed had highest core body temperature (RT) as well as highest respiratory rate (RR) and heart rate (HR). Core body temperature (RT) of Sirohi breed was lowest and also the respiratory rate (RR) and heart rate (HR) were lowest during heat stress.

Breed, sex and age had significant ($P<0.01$) effect on rectal temperature (RT), respiratory rate (RR) and heart rate (HR). Sirohi goats had lowest HR as compared to Barbari and Jakhrana. Respiration rate was higher in Jakhrana goat than Barbari and Sirohi. Sirohi goat breed had lowest HR and RR as compared to other two breeds during hot dry period. Jakhrana goat showed highest rectal temperature (RT), respiratory rate (RR) and heart rate (HR) during hot dry period.

Females had higher core body temperature (RT) than male in all the breeds. However heart rate (HR) was showing variable trend within breeds. Males had significantly higher respiration rate than females in all the breeds. There was no significant difference ($P>0.01$) was observed in heart rate between male and female except Sirohi.

Similarly age had significant effect on Respiratory rate (RR) and Heart rate (HR).

Kids had significantly (P<0.01) higher heart rate than adult in all the three breeds during hot dry period. Kids had significantly (P<0.01) lower respiration rate than adults in Sirohi and Barbari goats however similar trend was not observed in Jakhrana goats.

2) Determination of various biomarkers during heat stress in different goat breed

In the present study enzymes/hormones with log exposure to heat stress were analysed. The analysis was carried out with Alkaline phosphatase (ALP), Alanine transminase (ALT), Aspartate aminotransferase (AST), Growth hormone (GH), Follicular stimulating hormone (FSH), Luteinizing hormone (LH), Thyroxine (T3), Triiodothyronine (T4).

Breed had significant effect (P<0.01) on FSH and ALT. Barbari breed had highest ALT level than other two breed. FSH and GH showed higher value 36.15mIU/ml and 10.93ng/ml, respectively in Jakhrana goats. ALT was also variable among the breed. Sex and age group had no significant effect on different biomarkers analyzed in three breeds. Jakhrana breed had significantly higher FSH and GH values than Barbari and Sirohi goats during hot dry period (Table 4). Barbari goats had significantly higher ALT and LH values than Jakhrana and Sirohi goats during hot dry period. Sirohi goats had highest T3 and T4 level than Jakhrana and Barbari goats. GH, T3 and ALT biomarkers are showing significant difference between heat stress tolerant and susceptible individuals. FSH, Prolactin, LH and AST were not showing any difference between heat stress tolerant and susceptible individuals. Therefore these enzymes and hormones *e.g.* GH, T3 and ALT can be used for accessing heat stress tolerant and susceptible genotype.

Identification of heat stress tolerant and susceptible phenotype

It was also observed that respiration rate and heart rate can be used as stress indicator for identifying genotypes. Two contrasting genotype *i.e.* low stress susceptible genotype and high stress susceptible genotype were identified. Least square analysis was carried out to observe the factors such as breed, age group and genotype affecting the biomarkers in three different goat breeds. Genotype had significant effect on biomarker.

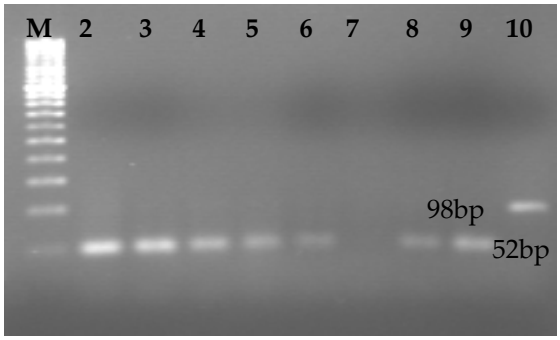
3) Characterization of candidate genes in heat stress regulation pathways with adaptive significance in goats and the expression analysis with respect to heat stress susceptible and heat stress tolerant phenotype

1) Characterization of AP-2 binding site in the promoter region of hsp70.1 gene.

The promoter variant of Hsp70.1 gene AP-2 binding was analyzed in four different goat breeds. First Hsp70.1 gene specific DNA fragment was generated. The size was amplified product was observed as 640 bp in goats. The generated PCR products were used in a second PCR for diagnostic amplification of the polymorphic site using modified primers. The diagnostic PCR amplification of the polymorphic site showed 98 bp.

The amplified product was subjected for RFLP analysis with ScrF1 enzyme. PCR RFLP pattern showed all mutant allele in all the analyzed samples. The result showed the presence of homozygous TT individuals indicating 50 and 52 bp in all

the samples. The population did not exhibit any wild type (CC) homozygous wild type allele in the analyzed samples. The further sequencing of the PCR product is in progress for further characterization.

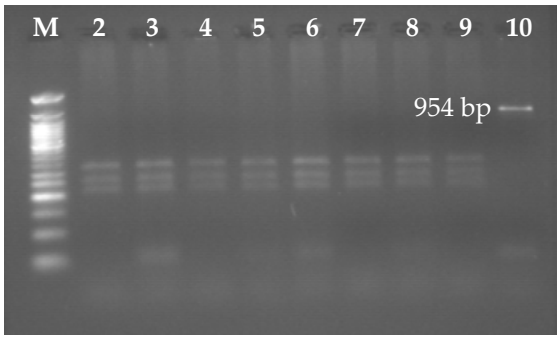


ScrF1-RFLP genotyping of Hsp70.1 gene in different goat (M= 50 bp marker)

4) Characterization of Melanocortin 1 receptor (MC1R) gene and Tyrosinase (TYR) gene in Indian goat breeds

Coat color is a trait that is easily observable and often serves to rapidly distinguish individuals, strains and breeds in many mammalian species. Mammalian pigmentation is controlled by the concerned action of TYR, TYRP1 and DCT in producing eumelanin and phaeomelanin in melanocytes. The ratio of these two pigments is determined by the agonist α-melanocyte stimulating hormone and the antagonist signaling protein (ASP) acting on the melanocortin-1 receptor gene (MC1R). The MC1R encoded by the extension (E) locus that corresponds to the melanocyte stimulating hormone receptor gene. The MC1R gene was analyzed in four different goat breeds. The size of the amplified product was observed as 954 bp in goats which was similar to wild type allele in cattle.

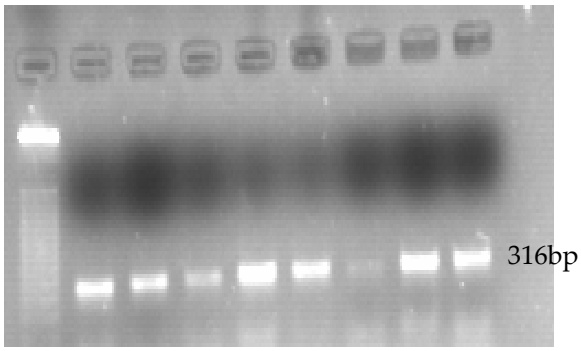
The PCR product of 954bp was digested with *Msp1* restriction enzyme. The polymorphic pattern showed two SNP on the locus. MC1R genotypic pattern was similar to wild type allele in the entire breed and the pattern was different for cattle. The sequencing of the product is in progress.



Msp1-RFLP genotyping of MC1R gene in different goat breeds (M= 50 bp marker)

The TYR gene was analyzed in four different goat breeds. The size of the amplified product was observed as 680 bp in Indian goats. Further it is necessary to sequence and analyze variation between heat stress susceptible and tolerant genotype.

3) Characterization of Signal transducer and activator of transcription 5 A (STAT5 A) gene in Indian goat breeds.



PCR amplification of STAT5A gene in Indian goats (M= 50 bp marker)

STAT 5A gene plays an important role in growth, cell proliferation and cell cycle progression. STAT5 A was a key intracellular mediator of prolactin signaling and also known as main

mediator of growth hormone action on target gene. Genotyping of STAT5A gene carried out on goats for the presence of different alleles by PCR-RFLP methods. The amplified PCR product was observed as 316bp. This gene plays major role in regulating heat stress.

The PCR product of 316bp was digested with *Ava I* restriction enzyme. The polymorphic pattern revealed two genotypes, CT (198 bp+118bp+ 212bp+ 94bp) and CC (198bp+118bp). The present analysis showed two SNP in this gene and need to further characterization with heat stress susceptible and tolerant genotype. The sequence variation has been analyzed in two different breeds.

Birth of triplet lambs in Muzaffarnagari sheep

Muzaffarnagari sheep is one of the tallest and heaviest mutton breed of the country. The breed has derived its name from its native tract- Muzaffarnagar district of Western Uttar Pradesh. The breed is highly adaptable to semi-arid region and known for its faster growth. Muzaffarnagari sheep is purely mutton producing breed. Being large sized breed, these sheep are genetically capable of producing single lamb and only 5% female give birth to twin lambs. Birth to triplet lambs is a rare occurrence and so far no case of triplet lambs has been recorded in Muzaffarnagari sheep in the country. The selective breeding, being undertaken in the Muzaffarnagari Sheep Unit of AICRP on Sheep for Mutton Production at Central Institute for Research on Goats, has improved the twinning rate to around 14.0% in this breed. This year, for the first time since the inception of the project in 1976, a sheep (ID 6698) produced triplet lambs. Generally the birth weight in single born lambs ranges from 3.4 to 3.7 kg, whereas in this particular case the total birth weight of the three lambs was 7.3 kg. The total weight of these triplets at 2 month age was 20.8 kg against 12.5 kg in single born lambs. The higher litter weight of triplet lambs than single born lamb indicated that the multiple births in this breed will help in the enhancement of mutton production in the country.

PHYSIOLOGY, REPRODUCTION AND SHELTER MANAGEMENT DIVISION

XI/PRSM-1.01: Studies on refinement of frozen semen technology and strengthening of goat semen bank

S.K. Jindal, A.K. Goel, S.D. Kharche, N. Ramachandran and R. Priyadharshini

Strengthening of semen bank

Elite bucks of four goat breeds viz. Barbari, Jamunapari, Jhakrana and Sirohi with good semen freezability were selected and semen was collected from each buck twice a week routinely. Cryopreservation of semen of all four breeds of goats were carried out in such a way that atleast 1000 doses of good quality semen straws were preserved.

Goat Breed	No. of semen doses available
Barbari	840
Jamunapari	934
Jakhrana	1062
Sirohi	1226
Total	**4062**

Antioxidant fortification on DNA integrity

Addition of antioxidants on the DNA integrity of the cryopreserved buck semen was studied. DNA integrity was assessed by RAPD assay. DNA isolated from 43 diluted (fresh) and post-thaw antioxidants fortified (reduced glutathione 7mM; ascorbic acid 9mM and α-tocopherol 4.5mM) semen samples and the two random primers OPM-5 and OPM-12 were used for amplification. The salient findings of the study were: all the samples showed amplification in the PCR reaction and the size of amplification products ranged from 190-1900bp. When total numbers of bands were counted, in all the three antioxidants, natural antioxidants ascorbic acid and α-tocopherol did not show more number of bands after post thaw.

Lipid peroxidation during cryopreservation

As a continuation of the study on effect of antioxidant fortification on improving post thaw seminal parameter, a study on measuring the level of lipid peroxidation occurring during freezing process was conducted. The oxidative stress associated with the cryopreservation process is known to be minimized by the addition of antioxidant in the extender media. In the same context whether the lipid peroxidation levels can be controlled by the addition of antioxidants like glutathione, Vitamin C and Vitamin E was also studied by measuring malanaldehyde level in semen.

Computer Assisted Semen Analysis

Automated analysis of sperm characteristics by image capture and computer processing (CASA) is based upon the relative importance of sperm motility and morphology. CASA improves the objectivity, accuracy and efficiency of the evaluation of sperm motion and has been increasingly used for assessment of sperm motility patterns. The Hamilton-Throne sperm analyzer (HTM –IVOS version 12.0) has nine sperm motion parameters; percentage of motile sperm, progressive motility, average path velocity (VAP), progressive velocity (VSL), track

speed (VCL), lateral amplitude (ALH), beat frequency (BCF), straightness (STR) and linearity (LIN). The sperm velocity parameters of each goat breed are being recorded by the use of HTM –IVOS system.

XI/PRSM-1.02: Augmentation of prolificacy by using biotechnological tools in goats

S.D. Kharche, A.K. Goel, S.K. Jindal and R Priyadharshini

1. Standardization and preparation of hormone delivery system (sponges and injections)

Sponges and injections preparation were standardized in the laboratory. The cylindrical shaped sponges with a diameter of 25mm were prepared and tied with one feet long thread. Sponges were washed and autoclaved for sterilization. Subsequently they were impregnated with hormone and dried in a oven at 37°C. Similarly, 1ml injection containing hormone was prepared in oil and filtered through 0.22µ filter to sterilize. Thus a total of 150 intra vaginal sponges and injections were prepared. Out of these 100 sponges and injections were given to Department of AR, Post graduate Institute of Veterinary and Animal Science Krishi Nagar, Akola for validation of the technology.

Induction of oestrus using intravaginal pessaries/ injection with hormones (eCG/PMSG)

Thirteen Sirohi goats were regularly checked for oestrus at 12 hourly interval by an aproned buck for 30 minutes. Animals were considered in oestrus only if they stood to be mounted by the aproned buck (standing oestrus). The other symptoms of behavioural oestrus were vulvar oedema and hyperaemia, mucus discharge, mounting behaviour over other oestrus and non-oestrus females in the flock, restlessness and wagging of tail from side to side and up and down.

a) Treatment of Goats

Thirteen Sirohi goats were inserted with indigenously prepared intravaginal pessaries for 10 days. At the time of insertion, 1ml injection was injected intramascularly. Similarly, 400IU Pregnant Mare's Serum Goandotropin (now eCG) was injected 24hr before the withdrawal of sponge and 1 ml of PF2α (Clostenol, Sarabhai) at the time of withdrawal of sponge. The intravaginal pessaries were removed 10 days after their insertion. The does were observed for the onset of estrus by the aproned buck daily in morning and evening. The oestrus response, onset of oestrus and duration of oestrus following use of intra vaginal pessaries for induction of oestrus were 62.00%, 66.00±4.53 and 37.50±5.28 hours, respectively.

b) Blood Sample Collection and Determination of Progesterone

Blood sample of experimental goats were collected before the insertion of sponges and on different days after the insertion of sponges from jugular vein. After collecting blood, the serum was separated out by centrifugation at 4000 rpm for 20 minutes and aliquots were stored at -40°C until assayed for progesterone.

Table 1: Retention of intravaginal pessaries in goats

Type of sponge	Total goats	Sponge retained	Sponge lost	Retention (%)
Cylindrical (25 mm)	13	13	Nil	100%

Table 2: Oestrus response following the use of intra vaginal pessaries in Sirohi goats

Oestrus response within 96 hr (%)	Onset of oestrus (hr)	Duration of synchronised oestrus (hr)
62.00%	66.00±4.53	37.50±5.28

c) Estimation of progesterone in blood

The progesterone concentration in serum on different days after sponge insertion was estimated by ELISA technique using commercially available EIA kits–Pathozyme Progesterone (Omega Diagnostics Limited, United Kingdom). A sample volume of 25 µl serum was used in the assay. The concentrations of standard progesterone used to plot a standard a curve were 0, 0.5, 3.0, 10.0, 25.0 and 50.0 ng/ml. A point to point standard curve was constructed by plotting the mean absorbance obtained for each standard against its concentration in ng/ml on a linear-linear graph paper with absorbance values on the vertical (Y-axis) and concentration on the horizontal (X-axis).Mean absorbance values for each specimen were used to determine the corresponding concentrations of progesterone in ng/ ml from the standard concentrations of test samples were within the range of standard concentrations. The absorbance was measured spectrophotometrically at 450 nm (ELISA reader). The detection limit of the assay was 0.05 ng/ml.

Induction of oestrus during low breeding activity in acyclic goat

The experiment was conducted with an objective to study the induction of oestrus in acyclic goats during low breeding activity without equine chorionic gonadotropin (eCG) using the intravaginal pessaries. Ten acyclic Sirohi goats were inserted with intravaginal pessaries for 16 days. At the time of insertion, 1ml injection was injected intramascularly. The intravaginal pessaries were removed 16 days after insertion without an injection of eCG. The acyclic does were observed for the onset of oestrus by the aproned buck daily in morning and evening. None of the acyclic does inserted with intravaginal sponges without eCG came into oestrus. This indicated that in acyclic does an injection of eCG along with intravaginal pessaries is required for follicular development and induction of oestrus.

Table 3: Serum progesterone (ng/ml) concentration during intra-vaginal passaries in goats

Days of sponge insertation	Progesterone concentration (ng/ml)	
	Mean ±SEM	Range
0	2.77±0.49	1.00 – 4.00
1	3.45±0.91	1.20 – 8.50
4	3.20±0.98	1.00 – 8.50
8	1.92±0.39	1.00 – 4.00
9	1.74±0.42	1.00 – 4.00

Technique for visualization of follicles/ corpus luteum and pregnancy diagnosis using ultrasonography in goats

Twenty five does were scanned by employing curvilinear trans-rectal (TR) scanner of variable frequency ranging between 3 to 7 MHz. The does were kept off feed 12 hour prior to scanning. The examinations were carried out in standing posture after proper restraining. After evacuating the rectum with fingers, a small amount of ultrasound gel was infused in to the rectum to get distinct image. After proper restraining of the animal, the gel lubricated scanner was introduced in to the rectum and urinary

bladder was located as non-echoic black area. The scanning surface of probe was rotated ventrally and laterally and advanced slowly for locating ovary. The uterus was located to detect pregnancies.

In vitro embryo production and transfer

i) Collection of oestrus goat serum

Goats were observed for the occurrence of oestrus daily twice at 12 hr intervals in the experimental herd. Estrous serum from these goats was collected 12 hr following the onset of oestrus and filtered through 0.22 µm millipore syringe filter. The estrus goat serum was heat inactivated at 56°C for 30 min. in a water bath, dispensed in to 1 ml and 10 ml aliquots and stored at -20°C until used.

ii) Oocyte collection

Oocytes were recovered by follicle puncture technique for *in vitro* maturation, fertilization and culture from goat ovaries collected from slaughter house located at Agra. A total of 712 out of 942 goat ovaries were used for recovery of oocytes using follicle puncture technique for IVMFC. The recovery of oocytes using follicle puncture was 2.35 per ovary.

iii) *In vitro* maturation of goat oocytes

Oocytes from 2-5 mm follicle (tertiary) of goat ovaries were collected by puncturing the follicles with a 18 gauge needle and placed in modified phosphate buffered saline containing sodium pyruvate (36 mg/l), glucose (1gm/l), penicillin (60 mg/l) and streptomycin (50 mg/l). The oocytes surrounded by compact cumulus mass with an evenly granulated cytoplasm were selected under stereozoom microscope.

The oocytes collected from goat ovaries were cultured in tissue culture medium (TCM-199) containing 20% EGS or 10% NCS with FSH, LH and bovine serum albumin, (pH: 7.2-7.4) in 50 µl drops of maturation medium covered with mineral oil. The cumulus oocyte complexes (COCs) were cultured for 27h at 38.5°C and 5% CO_2 in humidified air.

iv) *In vitro* fertilization of *in vitro* matured goat oocytes

The matured oocytes were separated from cumulus cells by treating them with PBS containing 0.1% hyaluronidase and by passing through a fine pipette and kept for fertilization in 50µl fertilization drop.

Fresh semen samples were collected in an artificial vagina from a fertile purebred Sirohi bucks. The capacitation medium for spermatozoa consisted of TALP medium supplemented with heparin, BSA or 10% or 20% EGS and antibiotics. First and second ejaculates were virtually examined for volume, colour, consistency and gross motility, then 50 µl of neat semen was diluted with 5 ml of capacitation medium and wash by centrifugation at 1800 rpm for 5 min. The supernatant was discarded and the pellet again washed with 5 ml of medium and the supernatant was discarded. The pellet was diluted with 5 ml of medium and kept for incubation at 38.5°C in a CO_2 incubator for 30 minutes. After incubation sperm suspension was centrifuged and 50 µl of sperm pellet was diluted with 750 µl of fertilization medium. Fertilization drop containing oocytes were inseminated with 25 to 50 µl of final diluted semen (1x106 sperm/ ml). The oocytes were washed after 18-24 hr of co-incubation with spermatozoa at 38.5°C in an atmosphere of 5% CO_2 in humidified air. The overall cleavage rate of 30.00% was obtained.

v) *In vitro* culture of *in vitro* fertilized goat oocytes

Following 18-24 hr of co-incubation with spermatozoa at 38.5°C in an atmosphere of 5% CO_2 in humidified air, oocytes were washed in culture medium (EDM). The oocytes were culture in culture medium KSOM/TCM-199 for embryo development. The overall percentage of 2-cell, 4-cell, 8-cell, 16-cell to morula and blastocyst were 13.96%, 30.39%, 23.81, 30.18% and 1.64%, respectively.

In vitro produced embryo transfer

Thirty *in vitro* produced embryos of 8-16 cell and morulla stage were transferred in to five naturally synchronized recipients on day 3 or 4 post oestrous surgically at tip of the uterine horn of the genital organs. The recipients were monitored for the oestrus/ pregnancy. Following transfer, pregnancy was detected by using ultrasound scanner at 8 weeks. These goats could not sustain pregnancy.

XI/PRSM 2.03: Economic managemental interventions for augmenting growth in kids

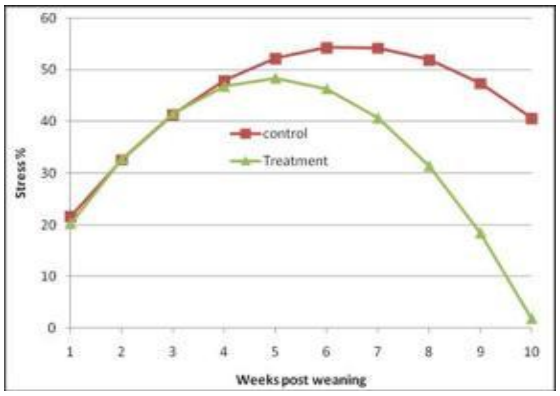
N. Ramachandran, S.K. Singh, M.K. Tripathi, V. Raj Kumar and T.K. Dutta

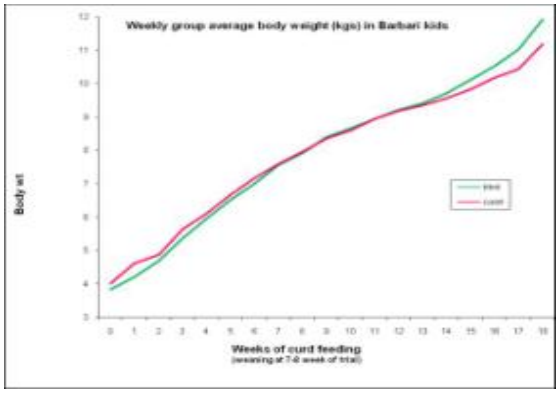
Based on the initial favorable observation of effect of curd feeding as a natural, easily available probiotic supplement on growth of kids after weaning, a pilot trial on Barbari kids (20 kids in treatment and 20 kids in control group) was initiated on pre weaned Barbari kids at the age of 1.5 months during November 2010. Kids were grouped to have uniform body weight, age, sex and type of birth. These kids were maintained under group feeding management in two groups of 20 each, with suckling, other routine kid rearing practices were followed similar to the rearing practices for other contemporary kids in the Barbari farm unit. The fresh curd was prepared daily from goat milk and 15 ml curd was fed orally every morning using syringe to individual kids of treatment group.

The body weight was recorded at weekly intervals for two consecutive days to monitor the daily gain in kids. Animals were also observed for the incidence of diarrhea and other illness, if any. The milk intake during the pre weaning phase in kids was also recorded at weekly intervals for two consecutive days. The difference of weight of kids before and after suckling was considered as milk intake and the daily milk intake was calculated by adding morning as well as evening milk intake. The milk samples were assessed for chemical constituents at fortnightly intervals. Since the beginning of experiment, the group feed intake (mash/kid pellet, bhusa, green fodders/tree leaves) is being recorded daily. The feed samples were collected at fortnightly intervals for estimation of dry matter and proximate composition. The blood samples were collected at monthly intervals to assess hematology and serum samples were being stored for biochemical assays.

The initial body weight of pre weaner kids was 3.83 and 4.01 kg of treatment and control groups, respectively. The kids of both groups had similar body weight and ADG at weaning, which was respectively 7.55 kg and 74.38 g in treatment, and 7.59kg and 71.50g in control kids. Results indicate that curd feeding as a probiotic supplement during pre weaning phase of growth may not be beneficial to the kids. The mean average body weight of kids

received curd as a natural probiotic supplement showed superiority over control group kids in terms of daily weight gain from weaning onwards. The mean ADG after weaning in curd fed kids was higher (56.54g) than the control kids (46.61 g). This could be attributed to the positive effect of natural probiotic supplement in alleviating the weaning stress in kids. The weaning causes stress to the kids which reduces the weight gain during post weaning transition stage.





The weaning stress (%) was assessed by calculating the decrease in weekly ADG against pre-weaning ADG in both groups. Though the stress due to weaning persisted in both the groups and increased from 20% in first week to 40-50% in 4th week post weaning. The reduction in stress level in curd fed kids was significantly higher and reached to a level of less than 5% at 10th week post weaning. However, kids which did not receive natural probiotics in their diet showed increasing stress level up to 7th week post weaning and even at 10th week, stress level was above 40%. This indicates that supplementation of curd may be an economic probiotic after weaning for reducing the weaning stress in kids that helps in higher daily weight gain.

Though the existence of weaning stress in kids reflected in the weight gain, the stress level in both groups will be further compared after analyzing the immunoglobulin levels in stored serum samples. The haematological parameters, nutrient intake through feed and milk in kids will be compared after carrying out the proximate composition of stored feed samples.

Developmental potency of parthenogenetic goat embryos (NAIP Component IV)

S.D. Kharche, A.K. Goel and S.K. Jindal

The cleavage rate for selected IVF oocytes was 40.00% and Morula was 23.00%. The cleavage rate for selected parthenogenetically activated oocytes with different concentrations of ethanol was 24.31% and Morula was 22.03%. IVP embryos of 4-8 cell stage were transferred surgically in to two recipients and IVP embryos of 8-16 to Morula stage were transferred surgically in to six recipients.

USG examination revealed two goats pregnant through transfer of IVP embryos at day 35 post transfer. However, one goat was found non-pregnant on day 60 and another goat delivered twin kids after 142 days of gestation.

Five goats were superovulated with 6mg of pure FSH (Sigma, USA) in decreasing dose for three days. *In vivo* produced

embryos were transferred into one naturally synchronized goat at the tip of uterine horn. Following transfer, pregnancy was initially confirmed at day 38 by ultrasonography. However, recipient repeated oestrus on day 60. Fifty goats were managed for estrus synchronization and embryo transfer study.

Network Project on adaptation of livestock to impending climatic changes trough shelter management

S.K. Jindal, N. Ramachandran and R. Priyadharshini

In the natural ecosystem goats are an efficient and sustainable means to produce high-quality protein with minimal environmental impacts. However, goat productivity in India varies greatly in all respects in different agro-climatic zones and often found lower as compared to global standards. To enhance productivity, it is equally important to give greater attention to the biological attributes of indigenous breeds and the need to exploit them for local advantage and future global application. The productivity of different goat breeds in different production systems is illustrative of their importance. It is thus imperative to evaluate the performance of different breeds in different production systems in relation to available feed resources. Measurement of physiological responses *i.e.* RT, RR, HR, feed and water consumption, Biochemical parameters (Enzymatic & Hormonal) of two breed under different housing system (Thatch, Asbestos and Open) in three seasons like hot humid period (July-Sept. 2010), comfortable period (Oct. - Nov. 2010 and Cool period (Dec.-Jan 2011) were carried out. A study was conducted to evaluate and compare the physiological responses in two goat breeds (Sirohi and Barbari) of India maintained under thatch or asbestos housing as compared to being kept in open just like under extensive system. The experiment was conducted during comfortable weather condition *i.e.* October-November. Twenty four Sirohi and Twenty four Barbari female adult goats were randomly selected according to their age (4-5 years old) and body weight and maintained under thatch housing system (TH), Asbestos housing system (AH) & Open housing system (OH). Sirohi and Barbari goats (eight each) were assigned under each housing system (TH, AH and OH), respectively and their physiological responses were recorded. While rectal temperature did not differ significantly with respect to different housing conditions, the Barbari breed was more affected as compared to Sirohi as shown by changes in respiration and pulse rate under open housing system. The dry matter intake also decreased when the animals of both the breeds were exposed to open weather conditions. The water intake was also less in animals exposed to open housing system as compared to goats provided with either thatch or asbestos housing.

It could be concluded that Sirohi and Barbari goat breeds differed in their responses to different housing systems with respect to pulse and respiration rates. The Sirohi goats exhibited less discomfort as indicated by lower respiratory activity under open housing system and also better water conservation mechanisms. The thatch or asbestos housing system did not differ in creating distress to both breeds of goats and therefore, it is inferred that housing either thatch or asbestos is better than to keep the goats in open

environment even under comfortable weather conditions.

Serum samples of selected animals (Sirohi & Barbari) were analyzed for thyroid hormones (T_3 and T_4) and blood samples were collected one time in a fortnight. The analysis of variance indicated the T_3 hormone concentration was not significantly different ($P<0.05$) between both Sirohi and Barbari goat breed under different housing systems. The mean value of T_3 concentration was higher in both breed Sirohi and Barbari goats in Thatch shed *i.e.* 1.18±0.14, 1.0±0.19, respectively as compare to Asbestos and Open shed. Thyroxine (T4) was not significantly different ($P<0.05$) with respect to different shelters (Thatch and Asbestos) between both goat breeds but thyroxine (T4) concentration was increased under Open shed as compared to Thatch and Asbestos in both Sirohi and Barbari goat breeds. The mean values of Thyroxine (T4) under open shed were 150.62±10.12, 141.22±9.92. The highest concentration of T3 was found in thatch of both goat breeds due to higher metabolic rate and T4 concentration was higher in open shed.

Table 1: Physiological responses of Sirohi and Barbari goats under different housing systems (Mean±S.E.)

Traits	Sirohi			Barbari		
	Thatch (N=96)	Asbestos (N=96)	Open (N=96)	Thatch (N=96)	Asbestos (N=96)	Open (N=96)
Rectal temp. (°C)	38.61^{a}±0.13	38.86^{b}±0.05	38.77^{ab}±0.06	38.45^{a}±0.07	38.65^{b}±0.07	38.73^{b}±0.05
Respiration rate (min^{-1})	34.71^{b}±1.49	29.15^{a}±1.19	28.81^{a}±1.02	36.99^{ab}±2.17	34.65^{a}±1.69	40.63^{b}±1.56
Heart rate (min^{-1})	95.53^{a}±2.00	90.23^{a}±1.95	93.10^{a}±1.70	92.97^{a}±2.08	99.22^{b}±1.82	106.68^{c}±1.94

Values bearing different superscripts in the same row differed significantly ($p<0.05$)

Table 2: Feed and Water consumption of Sirohi and Barbari goats under different housing system (Mean±S.E.)

	Traits	Sirohi			Barbari		
		Thatch (N=48)	Asbestos (N=48)	Open (N=48)	Thatch (N=48)	Asbestos (N=48)	Open (N=48)
1.	Dry matter Intake (g/day)	1138.66^{b} ±31.18	1283.72^{c} ±28.48	1026.70^{a} ±41.68	1103.34^{b} ±14.93	1029.42^{a} ±22.83	1025.97^{a} ±30.23
2.	Dry matter Intake (g/kg body wt.)	25.89^{a} ±0.78	26.50^{a} ±0.79	25.45^{a} ±1.07	39.14^{c} ±0.81	36.41^{b} ±0.95	28.05^{a} ±1.02
3.	Dry matter Intake/metabolic body wt.	66.51^{a} ±1.84	69.85^{a} ±1.93	64.09^{a} ±2.62	89.97^{c} ±1.47	83.77^{b} ±1.97	68.78^{a} ±2.27
4.	Water Intake (drunk)(lit./Day)	1.88^{a} ±0.12	2.70^{b} ±0.13	1.63^{a} ±0.11	1.50^{a} ±0.06	1.59^{a} ±0.10	1.47^{a} ±0.10
5.	Water intake though feed (lit./day)	0.96^{b} ±0.03	0.91^{b} ±0.04	0.48^{a} ±0.04	0.78^{a} ±0.04	0.77^{a} ±0.04	0.73^{a} ±0.04
6.	Total Water Intake (lit./Day)	2.84^{b} ±0.14	3.16^{c} ±0.13	2.11^{a} ±0.13	2.28^{a} ±0.08	2.36^{a} ±0.13	2.21^{a} ±0.11
7.	Total water intake/ kg DMI	2.53^{b} ±0.13	2.86^{b} ±0.11	2.10^{a} ±0.14	2.06^{a} ±0.06	2.29^{a} ±0.11	2.18^{a} ±0.10

Values bearing different superscripts in the same raw differed significantly ($p<0.05$)

Holistic Approach for improving Livelihood Security through Livestock based Farming System in Barabanki and Raebareli districts of U.P. (NAIP Component III)

B. Rai, Ashok Kumar and M.K. Singh

Data were collected from 8 villages belonging to Saraini and Lalganj blocks of Raebareli district and 9 villages of Hydergarh and Triveniganj of Barabanki district. A total of 147 households keeping goats were surveyed. Almost all the goat keepers (90%) belong to socio-economically backward (SC, Muslims, OBC) communities with their major source of income as labour. Goats are mainly managed by women and children in the families. Goats with them were non-descript and maintained on grazing crop residues. Most of goat keepers keep 3-6 goats with an average flock size of 3.2 in Barabanki and 2.8 in Raebareli district. Housing space for goats was highly inadequate and kept in human dwellings. The awareness and adoption level about improved goat rearing interventions/ practices such as strategic supplementary feeding, deworming and vaccination was almost negligible as shown in Table 1. Under extensive management system goat keepers are earning ₹800-1500 per goat/year and mostly sold their goats at the doorstep through middleman. Males are mostly castrated as they get better price and could be managed easily in group grazing and housing. The details about goat performance in these adopted villages are shown in Table 2 and 3.

Distribution of Barbari and Sirohi Goats

To improve the sustainable livelihood of these people 100 Barbari females and 10 bucks were provided to the beneficiaries of each district. Deworming at regular intervals and curative measures were also extended to the beneficiaries. Farmers were motivated for improved goat rearing practices through training and camps. Beside this 100 Sirohi female and 10 bucks were distributed to the beneficiaries of Barabanki district in 2009-10. Preliminary results indicated 32% twinning rate and 18 kg body weight of kids at 9 months of age, which ranged from 14-24 kg. Males were sold @ ₹3000-4000/ goat in local market. Sirohi crossbred kids produced at farmers flock are getting higher price due to their demands in breeding flocks.

Table 1: Level of Awareness and adoption of improved practices of goat rearing

S. No	Improved Practices/ Technologies/ Interventions	Area/ Districts			
		Barabanki		Raebareli	
		Aw	Ad	Aw	Ad
1.	Concentrate Feeding	90	8	80	7
2.	Green Fodder	85	3	70	2
3.	Straw Feeding	96	30	87	26
4.	Mineral Mixture	20	1	10	0
5.	Feeding Devices	20	5	45	4
6.	Deworming	35	0	25	0
7.	Vaccination	30	0	15	0
8.	Buck selection& utilization	30	5	30	5
9.	Breeding Practices	45	20	50	22
10.	Goat housing & Sanitation	30	5	35	5

Aw- Awareness level, Ad-Adoption level of farmers

Table 2: Marketing attributes of goats in Barabanki & Raebareli districts

Name of District	No. of adopted villages surveyed	Average family size	Average flock size	Price of adult goat		Income/ goat
				Male (1-24)	Female (1-24)	
Barabanki	8	4.7	3.2	2500-3000	2000-3000	1000-1500
Raebareli	7	4.3	2.8	2000-2600	2000-2500	1000-1200

Table 3: Performance attributes of goats in Barabanki & Raebareli districts

Name of District	Average AFK (Month)	Average daily Milk yield (ml)	Body weight at 12 months (kg)	Twins (%)	Kids mortality (<3M) (%)	Adult mortality (%)
Barabanki	16.2 (14-20)	600	16.6	38	12.5	6.7
Raebareli	16.6 (14-20)	550	15.7	32	14.2	6.4

CIRG achieves significant improvement in milk production performance of Jakhrana goats

Jakhrana is one of the best milk producing goats of India and the breed derives the name from its native tract village "Jakhrana" in Alwar district of Rajasthan. The coat colour of the breed is black with white speckles in the ears. As the population is decreasing in its home tract, CIRG took initiative to establish a nucleus flock for increasing production performance as well as conserving the breed during 2005.The production performance is being improved through selection in the nucleus flock. Breeding bucks were selected on the basis of 9 months body weight and production record of collateral relatives. Does were selected on the basis of production record of collateral relatives and 90 days milk yield. The technological interventions have resulted in remarkable improvement in milk production with 27.53% of does having the peak yield above 2litres of milk per day.

NUTRITION, FEED RESOURCES AND PRODUCTS TECHNOLOGY DIVISION

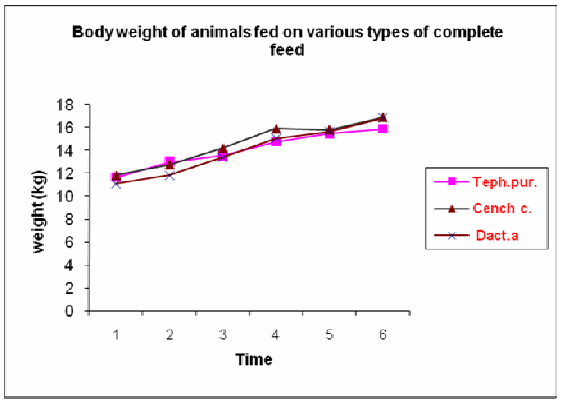
Project No. XI-NFR&PT-1: Development of fodder production, conservation and processing technologies for small holders and commercial goat farmers

Prabhat Tripathi and T.K. Dutta

Grazing studies under various pastures

Under grazing studies three types of pastures namely *Zizyphus* based silvipasture, *Cenchrus ciliaris* pasture and natural pastures were evaluated with six male Barbari animals aging 10-11 month in each pasture.

The average body weight of animals under all the groups namely *Zizyphus* based silvipasture, *Cenchrus ciliaris* and natural increased over the time, whereas maximum average body weight of 29.13 kg was recorded in *Zyziphus* based silvipasture system followed by 24. 21 kg in *Cenchrus ciliaris* pasture and 19.12 kg in natural pasture.



Evaluation of Monsoon herbage based complete Feed

Three plant species were selected on the basis of their availability and their green foliage biomass was collected for complete feed pellets preparation and evaluation. Three types of complete feeds were prepared with 60% plant foliage biomass and 40% concentrate (60:40). These complete feed were offered to six Barbari male kids aging 6-7 months in each group separately. The initial average body weight of animals were 11.66, 11.86 and 11.12 kg under complete feeds groups based on *Tephrosia* purpurea, *Cenchrus ciliaris* and *Dactylotennium aegypticum* respectively. Prepared complete feed was offered *ad lib* to these animals for a period of 72 days.

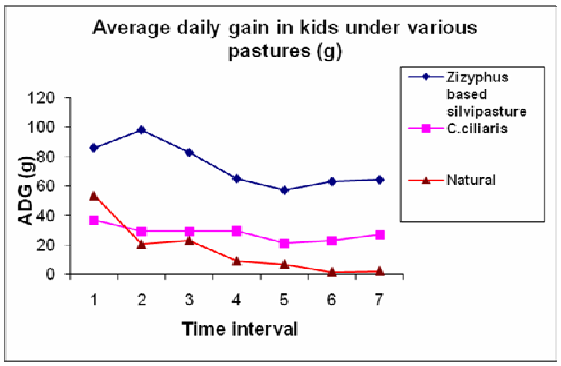


Table 1: Digestibility (%) of various nutrients in different pastures

Parameters	Ber based silvipasture	*Cenchrus ciliaris* Pasture	Natural Pasture
Dry matter	65.61±2.95	58.09±2.97	52.71±1.71
Crude Protein	57.08±5.10	58.71±4.88	50.87±2.49
Organic matter	68.75±2.63	60.41±2.70	55.25±1.72
NDF	66.19±3.15	58.54±2.68	48.07±1.88
ADF	53.92±5.91	51.65±2.84	45.12±1.92
Cellulose	61.05±6.28	48.78±4.78	56.68±2.66
Hemi-cellulose	69.02±3.18	66.64±2.82	65.79±2.80

Table 2: Rumen parameters of grazing animals under various pastures

Rumen parameters	Ber based silvipasture	*Cenchrus ciliaris* Pasture	Natural Pasture
pH	6.28±0.07	6.77±0.02	6.65±0.05
TVFA (m mol/dl)	14.99±0.53	11.72±0.40	10.01±0.41
Ammonia –N (mg/dl)	33.71±1.62	30.1±2.41	29.54±1.04
Total –N (mg/dl)	92.4±1.61	82.6±3.59	92.4±1.97
NPN (mg/dl)	53.2±1.91	45.73±1.56	59.92±2.59
TCA-ppt N (mg/dl)	39.2±2.16	36.86±2.44	32.48±1.89

Table 3: Performance and intake of goats on different types of complete feed

Parameters	Complete feeds		
	Tephrosia purpurea	*Cenchrus ciliaris*	*Dactylotennium aegypticum*
Initial body weight (kg)	11.66±0.52	11.86±0.89	11.12±1.19
Final body weight (kg)	15.88±0.93	16.9±0.72	16.82±1.68
Weight gain (kg)	4.21±0.56	5.033±0.30	5.70±0.57
Average daily gain (g)	58.56±7.81	69.90±4.22	79.16±7.96
DMI/100kg body weight (kg)	4.34±0.28	4.75±0.21	5.07±0.24
DMIg/kg $W^{0.75}$	85.66±5.30	94.94±4.53	100.05±3.14
Water Intake (ml)/animal	2227.11±93.22	2372.11±122.19	2998.95±161.77
Water intake (ml)/DMI (kg)	3421.83±303.80	3110.07±111.21	3823.19±112.72
Water intake (ml)/ kg $W^{0.75}$	285.83±10.32	293.29±9.70	382.52±15.74
Water intake (ml)/ body weight (kg)	145.00±7.03	146.94±5.26	194.26±11.85

Table 4: Haemetology of animals fed on various monsoon herbage based complete feed

Blood parameters	Complete feed		
	Tephrosia purpurea	*Cenchrus ciliaris*	*Dactylotennium aegypticum*
HB (g/dl)	8.75±0.49	8.88±0.70	8.36±0.32
HCT %	26.48±1.93	27.08±2.15	25.76±1.08
RBC (10^6/µl)	17.27±1.38	19.04±0.88	16.86±1.52
WBC (10^3/µl)	25.11±5.43	22.3±5.52	22.14±5.07
MCV	27.93±0.91	25.80±1.33	26.04±1.09
MCH (pg)	9.43±0.344	8.73±0.41	8.96±0.48
MCHC (g/dl)	33.08±0.70	32.8±0.56	32.46±0.72
PLT(10^3/µl)	1654.0±530.36	1913.5±530.6	2133.6±332.54

Project No. XI/NFR&PT-2: Development of feeding strategies for goats under intensive and semi-intensive system

T.K. Dutta and A.K. Das

Experiment 1: Effect of supplementation of different level of concentrate mixture on growth, rumen fermentation, and carcass traits in finished kids reared under semi-intensive system

Treatment groups: 21 weaned Barbari kids (5 months old) were divided into three equal groups.

T_1: Grazing (5-6 hours) + gram straw *ad lib.* + Limited green fodder + Conc. Mix. @ 0.8% of BW

T_2: Grazing (5-6 hours) + gram straw *ad lib.* + Limited green fodder+Conc.Mix. @ 1.0% of BW

T_3: Grazing (5-6 hours) + gram straw *ad lib.* + Limited green fodder + Conc. Mix. @ 1.2% of BW

The final body weight of weaned Barbari kids increased by 3.68 and 4.77 kg due to concentrate mixture supplementation @ 1.0 (T_2) and 1.2% (T_3) of the body weight respectively when compared with the control kids (T_1, Conc. Mix. 0.8% of BW) when reared under semi-intensive system of management (Table 1). Similarly, weigh gain and ADG were also increased by 2.98 and 4.19 kg; and 10.26 and 14.43 g in T_2 and T_3 than T_1, respectively. However, the differences were found statistically non-significant. The growth pattern of kids (Fig. 1) under T, T_2 and T_3 presented.

Table 1: Growth performance and rumen fermentation pattern in weaned finisher Barbari kids under different level of supplementation

Parameter	T_1	T_2	T_3	Significance
Birth weight (kg)	1.79±0.09	1.87±0.13	1.87±0.07	NS
Initial weight (kg)	10.21±0.66	10.91±0.73	10.79±0.66	NS
Final weight (kg)	19.80±2.33	23.48±2.40	24.57±2.13	NS
Weight Gain (kg)	9.59±1.76	12.57±1.90	13.78±2.00	NS
ADG (g)	32.94±6.04	43.20±6.53	47.37±6.86	NS

Rumen fermentation				
pH	6.30±0.04	6.28±0.03	6.34±0.03	NS
TVFA (mmol/dl)	10.91±0.22	11.51±0.57	12.00±0.40	NS
Total-N (mg/dl)	93.97±1.43	95.17±1.26	96.80±0.89	NS
NH_3-N (mg/dl)	28.33±1.37	28.10±0.77	27.80±0.82	NS
TCA-ppt-N (mg/dl)	41.17±3.25	41.97±2.84	42.80±2.11	NS
NPN (mg/dl)	52.80±3.20	53.20±2.73	54.00±2.57	NS

Rumen fermentation pattern

Rumen fermentation pattern of kids presented in the Table 1. Total VFA concentration tended to increase due to higher supplementation of concentrate mixture in T_2 and T_3 groups than T_1; however, pH, TVFA and nitrogen fractions were not statistically different among three treatment groups. This could be due to marginal variation of supplementation among groups.

Carcass characteristics

Detail study has been conducted to evaluate the carcass traits of male goats under three treatment groups (Table 2). Dressing percentage increased by 4 per cent in the T_3 (44.15%) than T_1 (40.36%), although the difference was non-significant. Fat depot (cod, omental and kidney fat) was found numerically higher in T_2 and T_3 than T_1, but meat fat percentage was not changed due to supplementation in male goats reared under semi-intensive system. About 2 kg higher hot carcass weight was obtained in T_2 and T_3 than control T_1. Meat protein, total ash and cholesterol percentages were statistically similar among four treatment groups. Therefore, supplementation of higher level of concentrate mixture did not have negative impact on meat composition.

Table 2: Effect of supplementation in weaned Barbari kids reared under semi-intensive system

Traits	T_1	T_2	T_3
Slaughter weight (kg)	21.53±3.35	27.40±2.18	26.73±1.87
Carcass loin width (cm)	60.50±3.52	61.80±0.97	64.75±1.48
Chest circumference (cm)	18.92±7.43	14.70±2.87	17.42±3.61
Leg circumference (mm)	26.00±1.29	25.00±3.35	22.75±3.19
GR measurement (mm)#	1.16±0.31	1.19±0.28	1.16±0.17
Back fat (mm)	0.85±0.15	0.71±0.14	1.12±0.27
Breast fat (cm)	15.84±2.33	20.46±1.34	21.61±0.74
Carcass traits			
Empty body weight (kg)	17.28±2.91	22.47±1.78	22.24±1.78
Hot carcass weight (kg)	9.03±1.71	12.08±1.13	11.95±1.21
Dressing percentage	40.36±2.12	43.91±1.23	44.15±1.87
Fore quarter (kg)	3.79±0.73	5.10±0.45	4.91±0.46
Hind quarter (kg)	5.23±0.99	6.98±0.69	7.04±0.76
Fat (g)			
Cod fat	28.33±11.08	36.00±9.27	44.17±7.35
Omental fat	60.00±19.83	86.00±20.64	120.83±9.70
Kidney fat	45.83±12.94	78.00±11.47	87.83±8.57
Mesenteric fat	85.33±25.53	85.20±27.68	78.83±30.46

No significant difference between treatments (P>0.05)

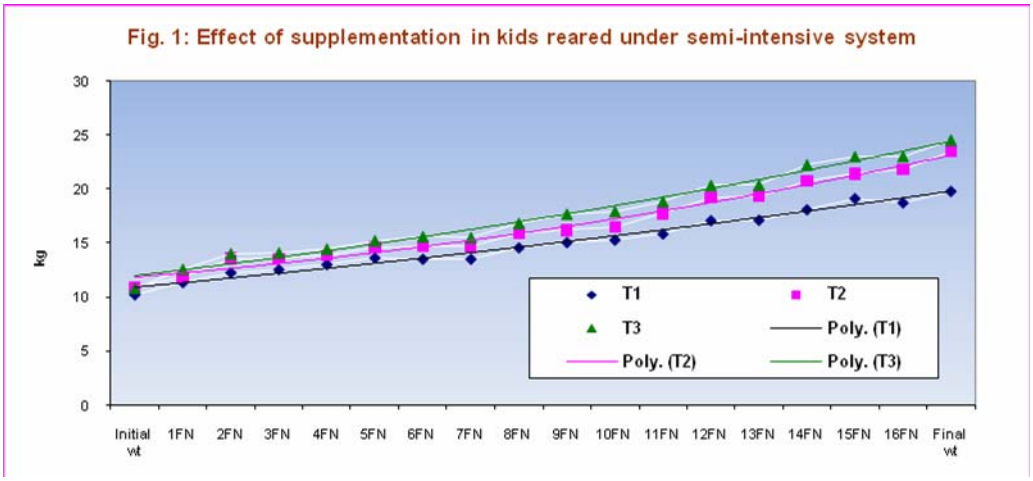
Table 3: Chemical composition of longisimus dorsi muscle as affected by dietary treatments

Traits	T_1	T_2	T_3
Meat chemical composition*			
Moisture	74.26±0.56	75.86±0.84	74.82±0.49
Protein	20.05±0.42	20.42±0.65	20.42±0.51
Fat	2.21±0.21	2.56±0.11	2.34±0.44
Ash	1.13±0.03	1.06±0.21	1.21±0.31
Total cholesterol (mg/100g)	61.23±2.10	62.64±1.21	63.05±1.44

*Chemical composition expressed as percentage of fresh muscle weight; **Nine samples from each treatment were analyzed; No significant difference between treatments (P>0.05)

Therefore, it may be concluded that supplementation of concentrate mixture @ 1.2% of the body weight of male Barbari kids increased growth performance and carcass traits under semi-intensive system of management against the supplementation of concentrate mixture @ 0.8% of the body weight.

Fig. 1: Effect of supplementation in kids reared under semi-intensive system



AICRP on improvement of feed resources and nutrient utilization in grazing animal production

U.B. Chaudhary, T.K. Dutta, A.K. Das, Ashok Kumar and M.K. Tripathi

Effect of inorganic minerals (Cu and Zn) and chelated minerals (Cu and Zn) on immunity, blood chemistry, semen quality and nutrient utilization in Barbari goats was studied. Thirty goats were divided into three groups of ten animals each. Group A or control group was fed with concentrate mixture @ 1.5% of b.wt. (devoid of Cu & Zn), Berseem (1 kg/goat) and Gram straw *ad libitum*. For group B and C the feeding was same but inorganic and organic Cu and Zn was added in their conc. mixture, respectively. The ADG (g) was highest in group B (111.0) as compared to group A (88.40) and group C (84.00). The DMI (g/d/goat) was 1134.59, 1197.98 and 1231.40 in group A,B and C group of goats respectively. The DMI (g/kg $W^{0.75}$) was highest in group C (100.17) followed by group B (98.21) and group A (92.99).

Blood parameters like RBC count, WBC count, Hemoglobin, PLT and HCT were also recorded and presented in Table 1. The experiment is continuing and recording of other observations on semen quality evaluation and blood chemistry is going on.

Table 1: Effect of mineral supplementation in Barbari goats

Parameters	Group A	Group B	Group C
Initial wt (kg)	25.45	25.41	25.47
Age (days)	476.8	475.9	475.9
Wt. After 60 days	31.64	33.18	31.35
ADG (g)	88.40	111.00	84.00
DMI (g/d/goat)	1134.59	1197.98	1231.40
DMI (g/100 kg BW)	4.04	4.26	4.34
DMI (g/kg W0.75)	92.99	98.21	100.17
RBC (10^6/µL)	15.36	16.35	16.46
WBC (10^3/ µL)	20.02	21.76	20.7
HGB (g/dl)	7.04	7.42	6.97
PLT (10^3/ µL)	1003.9	622.6	843.4
HCT (%)	22.47	23.3	22.34

Project No. XI/NFR&PT-3.1: Studies on nutritional value of goat milk

R.B. Sharma and A.K. Das

Effect of breeds on goat milk composition

A total of 945 pooled milk samples were collected from the different goats units of the Institute to study the effect of breed on goat milk composition. Higher fat, S.N.F., T.S., protein and lactose content was in Barbari goats maintained at Nutrition experimental shed in comparison to Barbari Unit animals may be due to composition of female flock and/or feeding management of the animals (Table 1). All the above constituents were also found in lower concentration in Barbari Unit goat milk in comparison to Jamunapari, Jakhrana and mixed milk of Sirohi and Barbari goats. There was no significant breed difference in ash content of goat milk. The yield of paneer obtained from pooled goat milk was 12.58%.

Table 1: Effect of different breeds on goat milk composition

	Breed	Fat (%)	S.N.F. (%)	T.S. (%)	Protein (%)	Lactose (%)	Ash (%)
1.	Barbari (189)	3.84^{a} ±0.03	7.10^{a} ±0.06	10.87^{a} ±0.09	2.53^{a} ±0.02	3.78^{a} ±0.03	0.61 ±0.03
2.	Jamunapari (189)	4.10^{b} ±0.03	7.72^{b} ±0.04	11.75^{b} ±0.07	2.80^{b} ±0.04	4.22^{b} ±0.03	0.63 ±0.01
3.	Jakhrana (189)	4.25^{c} ±0.04	7.63^{bc} ±0.05	11.80^{bc} ±0.09	2.72^{c} ±0.02	4.14^{c} ±0.03	0.62 ±0.01
4.	Barbari (Nutrition Shed) (189)	4.32^{cd} ±0.04	7.85^{d} ±0.04	12.06^{d} ±0.09	2.79^{bc} ±0.02	4.27^{b} ±0.02	0.63 ±0.01
5.	Sirohi+Barbari (PR&SM Shed) (189)	4.19^{bc} ±0.03	7.77^{bd} ±0.04	11.95^{bcd} ±0.06	2.76^{bc} ±0.02	4.24^{b} ±0.02	0.63 ±0.01
	Overall Mean	4.14 ±0.02	7.61 ±0.02	11.68 ±0.04	2.72 ±0.01	4.13 ±0.01	0.62 ±0.01

Variation in pooled goat milk composition during different months

Pooled goat milk samples were collected during different months to study the milk composition. A wide variation was observed in fat, S.N.F., T.S., protein and lactose content of goat milk. Fat (4.38± 0.08) S.N.F. (7.85±0.10), T.S. (12.23±0.16), protein (2.95±0.11) content was observed to be higher during the month of April. Lowest values were found for S.N.F. during May, June and July. Protein content was lower in goat milk during July month. However, lactose content was observed higher in February and lower in June and July. Goat milk produced during January month showed higher values for ash content and lower values were obtained during June and July month.

Effect of seasons on goat milk composition and paneer yield

Goat milk samples (pooled) were collected to investigate the influence of different seasons on its composition. Fat content was observed to be higher during rainy and winter season and lower during summer. However, S.N.F. content was higher in winter and lower in summer and rainy season. No significant difference was noticed in Total solids and ash content of goat milk during different seasons of the year. Protein content was lower in rainy season in comparison to summer and winter season. Lactose was found higher in winter and lower in summer and rainy seasons.

Table 2: Effect of the different seasons on goat milk constituents

Season	Fat (%)	S.N.F. (%)	T.S. (%)	Protein (%)	Lactose (%)	Ash (%)
Summer	4.04^{a}±0.02	7.56^{a}±0.04	11.61±0.06	2.73^{a}±0.03	4.10^{a}±0.02	0.61±0.00
Rainy	4.18^{b}±0.03	7.57^{a}±0.03	11.72±0.03	2.66^{b}±0.01	4.08^{a}±0.02	0.61±0.00
Winter	4.16^{b}±0.03	7.70^{b}±0.04	11.69±0.09	2.79^{a}±0.02	4.20^{b}±0.02	0.65±0.02

Effect of stage of lactation on mineral content in goat milk

Forty milk samples of Jamunapari goats and 30 milk samples of Jakhrana goats were collected during different stages of lactation and analyzed for mineral content by Atomic Absorption Photometer (AAS). Calcium content was observed higher (137.78±1.67) in Jamunapari goat milk in comparison to Jakhrana goat milk (133.89±1.49). No significant breed and stage of lactation difference was observed in respect of Iron, copper and Zinc content in goat milk. However, milk collected during early stage of lactation showed higher values for calcium content.

Table 4: Mineral content (mg/100 ml) in Jamunapari goat milk during different stages of lactation

Stages	Ca	Fe	Cu	Zn
Early (15)	143.88 ±3.30	0.037 ±0.001	0.034 ±0.002	0.24 ±0.013
Middle (15)	134.82 ±2.07	0.033 ±0.002	0.036 ±0.002	0.24 ±0.021
Late (10)	133.08 ±1.70	0.029 ±0.003	0.030 ±0.003	0.23 ±0.015
Mean	137.78 ±1.67	0.033 ±0.001	0.034 ±0.001	0.24 ±0.010

Table 5: Mineral content (mg/100 ml) in Jakhrana goat milk during different stages of lactation

Stages	Ca	Fe	Cu	Zn
Early (10)	135.06 ±2.15	0.037 ±0.003	0.037 ±0.002	0.26 ±0.016
Middle (10)	135.32 ±3.33	0.036 ±0.004	0.033 ±0.003	0.23 ±0.015
Late (10)	131.28 ±2.16	0.032 ±0.002	0.036 ±0.002	0.22 ±0.013
Mean	133.89 ±1.49	0.035 ±0.002	0.035 ±0.001	0.24 ±0.009

Effect of stage of lactation on Selenium content in goat milk

Goat milk samples were collected from Jamunapari (30) and Jakhrana (30) breed to observe the effect of breed and stage of lactation on selenium content. Breeds of goat did not affect selenium content of goat milk. However, its content was also noticed higher during early stage of lactation like other above minerals.

Table 6: Selenium content (ppm) in goat milk during different stages of lactation

Stages	Jamunapari (30)	Jakhrana (30)
Early (10)	4.62±0.26	4.65±0.55
Middle (10)	4.62±0.32	4.42±0.48
Late (10)	4.38±0.26	4.58±0.35
Mean	4.54±0.16	4.55±0.26

Effect of stage of lactation on fatty acids profile of goat milk

Fatty acid contents of goat milk collected from Jamunapari and Jakhrana breeds during different stages of lactation were determined. Significant differences between the breeds and stages of lactation were found for the components analyzed. The most abundant fatty acids in the milk of both the breeds were C18:1, C16:0, C18:0, C14:0 and C10:0. Fatty acids C6:0 (Caproic), C8:0 (Caprylic) and C10:0 (Capric) were present at significantly higher amounts in milk from early stage of lactation followed by middle and late stage of lactation. Among monoun-saturated fatty acids (MUFA), palmitoleic acid (C16:1) also showed a significantly higher concentration in milk from early stage of lactation than in milk from middle and late stage of lactation.

The content of omega 6 fatty acids (PUFA) viz. linoleic acid (C18:2) and linolenic acid (C18:3) was observed significantly higher in the milk of late stage of lactation followed by middle and early stage of lactation in both the breeds.

Table 7: Fatty acid composition (mg FA $100g^{-1}$ milk) of Jamunapari milk during different stages of lactation

Fatty acid	Early	Middle	Late
C4:0 (Butyric)	124±4.77	107±2.25	110±2.72
C6:0 (Caproic)	99±2.92	73±2.25	68±2.63
C8:0 (Caprylic)	102±3.44	87±1.61	86±3.22
C10:0 (Capric)	247±4.17	231±5.08	220±3.51
C12:0 (Lauric)	118±2.11	120±2.72	128±3.06
C14:0 (Myristic)	307±2.74	322±2.63	330±3.85
C16:0 (Palmitic)	896±4.50	911±2.92	893±3.87
C18:0 (Stearic)	425±4.51	442±6.63	464±4.22
C16:1(Palmitoleic)	79±2.46	63±3.53	67±2.74
C18:1 (Oleic)	961±9.74	971±8.53	983±3.53
C18:2 (Linoleic)	98±2.63	116±1.72	121±2.92
C18:3 (Linolic & other)	32±2.11	45±2.36	50±2.22

Table 8: Fatty acid composition (mg FA $100g^{-1}$ milk) of Jakhrana milk during different stages of lactation

Fatty acid	Early	Middle	Late
C4:0 (Butyric)	135±5.50	108±2.63	101±2.92
C6:0 (Caproic)	97±4.73	79±2.46	68±3.06
C8:0 (Caprylic)	100±2.72	78±4.10	77±2.25
C10:0 (Capric)	247±4.46	229±6.56	229±3.67
C12:0 (Lauric)	108±2.63	124±2.33	127±2.74
C14:0 (Myristic)	312±2.63	321±2.92	327±4.98
C16:0 (Palmitic)	897±4.17	908±3.44	902±2.11
C18:0 (Stearic)	422±3.06	433±8.17	456±5.26
C16:1(Palmitoleic)	78±2.63	70±2.72	59±2.46
C18:1 (Oleic)	960±5.88	978±8.29	984±3.22
C18:2 (Linoleic)	97±3.16	110±3.14	125±2.36
C18:3 (Linolic & other)	31±2.92	47±1.61	49±1.89

Variation in goat milk composition of Barbari breed during different months

Barbari goat milk samples were collected during different months and analyzed for proximate composition, density and temperature of milk.

Variation in goat milk composition of Jamunapari breed during different months

Jamunapari goat milk samples were collected during different months and analyzed for proximate composition, density and temperature of milk.

Variation in goat milk composition of Jakhrana breed during different months

Jakhrana goat milk samples were collected during different months and analyzed for proximate composition, density and temperature of milk.

Variation in goat milk composition of Barbari (Nutrition Experimental animals) breed during different months

Goat milk samples of Barbari breed maintained at Experimental shed of Nutrition Division were collected during different months and analyzed for proximate composition, density and temperature of milk.

Variation in goat milk composition of mixed milk of Barbari and Sirohi breed during different months

Goat milk samples (mixed) of Barbari + Sirohi breed maintained at Experimental shed of PR&SM Division were collected during different months and analyzed for proximate composition, density and temperature of milk.

Effect of the different seasons on Barbari milk composition

Goat milk samples of Barbari breed were collected during different seasons and analyzed for proximate composition.

Table 9: Effect of the different seasons on Barbari milk composition

Season	Fat (%)	S.N.F. (%)	T.S. (%)	Protein (%)	Lactose (%)	Ash (%)
Summer	3.89±0.06	7.38±0.13	11.2±0.19	2.62±0.04	3.91±0.08	0.59±0.01
Rainy	3.77±0.06	6.90±0.08	10.65±0.10	2.23±0.03	3.71±0.04	0.56±0.01
Winter	3.90±0.05	7.15±0.08	10.87±0.18	2.61±0.05	3.78±0.05	0.69±0.01

Effect of the different seasons on Jamunapari milk composition

Goat milk samples of Jamunapari breed were collected during different seasons and analyzed for proximate composition.

Effect of the different seasons on Jakhrana milk composition

Goat milk samples of Jakhrana breed were collected during different seasons and analyzed for proximate composition.

Table 10: Effect of the different seasons on Jamunapari milk composition

Season	Fat (%)	S.N.F. (%)	T.S. (%)	Protein (%)	Lactose (%)	Ash (%)
Summer	4.01±0.05	7.56±0.08	11.58±0.12	2.90±0.14	4.19±0.05	0.62±0.01
Rainy	4.16±0.04	7.66±0.06	11.82±0.10	2.68±0.03	4.15±0.04	0.62±0.00
Winter	4.08±0.05	7.89±0.08	11.79±0.17	2.89±0.05	4.33±0.05	0.64±0.00

Table 11: Effect of the different seasons on Jakhrana milk composition

Season	Fat (%)	S.N.F. (%)	T.S. (%)	Protein (%)	Lactose (%)	Ash (%)
Summer	4.13±0.05	7.51±0.08	11.65±0.11	2.69±0.04	4.04±0.05	0.61±0.01
Rainy	4.37±0.06	7.68±0.08	11.10±0.13	2.68±0.03	4.17±0.04	0.62±0.01
Winter	4.19±0.06	7.66±0.07	11.67±0.19	2.79±0.04	4.17±0.04	0.62±0.00

Project No. X1/NFR&PT3.2 MoFPI-Nutritional approach for designing goat meat based functional products

V. Rajkumar and A. K. Das

Standardization of the goat meat and milk herbal biscuits

Proximate composition and textural properties are presented in Table 1. Moisture, protein and ash contents were significantly different. Biscuits prepared out of goat meat II had significantly higher protein content than any other products. Control biscuits had the lowest protein content. Preparation of biscuits using goat milk had significantly higher moisture content than any other product. Control and goat meat I had similar moisture content.

Table 1: Proximate composition of goat meat and milk incorporated biscuits

Parameters	Control	Goat meat I	Goat meat II	Goat milk
Moisture	3.04 ±0.49b	3.03 ±0.27b	4.74 ±0.58a	5.00 ±0.48a
Fat	21.23 ±0.64	21.14 ±0.88	25.44 ±0.54	22.25 ±1.97
Protein	7.12 ±0.13a	7.82 ±0.19a	10.04 ±0.55b	7.59 ±0.86a
Ash	0.50 ±0.09b	0.96 ±0.10a	0.90 ±0.03a	0.86 ±0.02a
Water activity (a_w)	0.43 ±0.03	0.42 ±0.04	0.40 ±0.02	0.40 ±0.01
Yield	72.64 ±0.33	71.47 ±1.93	73.27 ±0.10	72.63 ±0.51
Cutting force (N)	62.71 ±10.19	68.81 ±3.74	59.01 ±4.79	74.84 ±5.42
Work of cutting(Ns)	4.91 ±1.06	4.53 ±0.86	3.07 ±0.33	5.82 ±0.76

Table 2: Fatty acid (mg/g) profile of goat meat and milk cream incorporated biscuits

Fatty acids	Control	Goat meat I	Goat meat II	Goat milk
Total SFA, %	19.69±0.33b	19.38±0.47b	19.30±0.61b	47.01±0.53a
Total MUFA, %	74.45±0.16a	73.65±0.27a	73.33±0.01a	27.33±1.89b
Total PUFA, %	5.86±0.29	6.98±0.20	7.37±0.62	25.67±2.39
Total MCT, %	4.38±0.03a	4.04±0.09a	4.11±0.12a	20.59±0.25b
% n3 PUFA	0.30±0.16	0.03±0.02	0.13±0.11	0.03±0.03
% n6 PUFA	0.89±0.22a	1.42±0.32a	1.65±0.47a	10.97±1.94b
SFA/MUFA	0.27±0.00a	0.27±0.01a	0.26±0.01a	1.74±0.10b
SAF/PUFA	3.38±0.23a	2.79±0.15ab	2.65±0.31b	1.89±0.20b
PUFA/SFA	0.30±0.02a	0.36±0.02a	0.39±0.05ab	0.55±0.06b

Biscuits prepared using goat milk required more cutting force than the other products. Goat meat had the lowest cutting force indicating its softness. Higher protein content may be a reason for such property. Similar trend was observed in the work of cutting.

Fatty acid profile of goat meat and milk herbal biscuits are presented in Table 2. Total saturated fatty acid (SFA) contents were significantly higher in the biscuits with goat milk. Total MUFA was the lowest and PUFA & MCT was the highest. As expected caproyic, caprylic and capric acid contents were significantly higher in biscuits prepared with goat milk. Among the above fatty acids the caprylic content were the highest. Similarly butyric acid contents were also high in goat milk biscuits. Preparation of goat meat biscuits will supply significantly more palmitic acid and linoleic acid. Linolenic acid was high in the goat milk biscuits. Similar trend was observed for nervoic acid. Ratio of SFA/MUFA was high in goat milk biscuits and PUFA/SFA ration was significantly high. SAF/PUFA ratio was significantly low than the control biscuits.

Significantly higher scores were received for flavor, texture in the biscuits prepared using goat meat. Non-significantly higher scores were also received for the above product. Overall goat milk biscuits received lower score and it is due to its hard texture.

Standardization of the formulation for dietary fibre enriched goat meat nuggets

Effect of addition of Moringa pod powder and lemon albido as a source of dietary fiber was carried out. Quality of goat meat nuggets due to addition of Moringa pod powder as dietary fiber is presented in Table 1. Addition of Moringa powder non-significantly increased the emulsion stability of the product. Similar trend was observed in the product yield. Moisture content of the product was significantly high due to addition of fiber as compared to the control. Other parameters were almost same.

Texture profile analysis was carried out in the nuggets added with Moringa pod powder. Significant differences were observed among the various parameters of textural profile. Addition of 1% moringa resulted in low hardness value than the other products. Similar trend was observed for the fracturability, adhesiveness and springiness. Cohesiveness and chewiness were also low than the control.

Sensory evaluation scores are presented in Table 2. Appearance scores and overall acceptability scores were significantly higher for Moringa pod powder added nuggets. All other parameters were non-significant. Addition of any fiber content in the meat products allows the product to withhold moisture and therefore, more acceptable and juicier.

Effect of addition of lemon albido fiber on the quality of goat meat nuggets aere presented in Table 3. Addition of lemon albido did not significantly increase the moisture or product yield. All the parameters except the protein content were non-significant in the product. No significant differences were observed in the product pH also.

Table 1: Effect of Moringa pod powder as dietary fibre inclusion on quality of goat meat emulsion and nuggets

Parameters	Control	0.5% Moringa	1.0% Moringa
pH emulsion	6.15±0.02	6.15±0.02	6.18±0.03
Emulsion stability	83.97±1.45	85.29±1.24	86.27±0.70
pH Nuggets	6.28±0.01	6.29±0.01	6.30±0.01
Product Yield, %	90.02±1.01	88.88±2.36	92.21±0.64
Nuggets Moisture, %	62.48±2.38a	66.31±0.86ab	68.19±0.32b
Nuggets Fat, %	10.24±0.47	9.28±0.94	9.31±0.27
Nuggets Ash, %	2.22±0.09a	2.50±0.06b	2.57±0.10b
Nuggets Protein, %	16.10±0.80	16.09±0.48	15.82±0.45

Table 2: Effect of Moringa pod powder as dietary fibre inclusion on sensory attributes of goat meat nuggets

Parameters	Control	0.5% Moringa	1.0% Moringa
Appearance	7.08±0.13a	7.17±0.12ab	6.69±0.18b
Flavour	7.03±0.25	6.81±0.23	6.67±0.22
Juiciness	6.47±0.19	6.50±0.26	6.36±0.25
Texture	6.50±0.20	6.81±0.23	6.22±0.22
Overall palatability	6.67±0.12a	7.42±0.13b	6.94±0.17a

Table 3: Effect of lemon albido on quality of goat meat nuggets

Parameters	Control	5% Albedo	10% Albedo
Emulsion pH	6.09±0.03	6.10±0.02	6.10±0.01
Emulsion stability, %	90.70±0.62	89.69±0.71	89.27±0.41
Product yield, %	92.54±0.25	92.86±0.21	93.08±0.27
Nugget pH	6.20±0.02	6.20±0.02	6.21±0.03
Nugget moisture, %	65.21±0.74	65.28±0.93	67.26±0.20
Nugget fat, %	10.67±0.51	10.84±0.38	10.32±0.56
Nugget protein, %	14.54±0.10b	14.89±0.06a	14.99±0.11a
Nugget ash, %	1.99±0.01	2.01±0.02	1.97±0.02

Similarly, the effect of addition of lemon albido fiber on the quality of goat meat nuggets was studied. Addition of fresh lemon albido fiber significantly affected the hardness of the product (Table 4). The same affected the springiness and therefore chewiness. All other parameters remained non-significant. The trend was different as compared to that of Moriga pods powder as fiber. In the later case the fiber was dry. This could be the reason for the difference in the quality parameters. There were differences in the texture profile; the panelists could not able to differentiate such minute variations. The overall acceptability rates declined as the percentage of addition of lemon albido increased in the composition.

Table 4: Effect of lemon albido on texture profile of goat meat nuggets

Parameters	Control	5% Albedo	10% Albedo
Hardness	116.20±5.76a	102.96±3.60b	102.26±2.92b
Fracturability	0.11±0.00	0.11±0.00	0.11±0.01
Adhesiveness	-0.03±0.01	-0.09±0.04	-0.03±0.01
Springiness	0.86±0.01a	0.85±0.01ab	0.82±0.01b
Cohesiveness	0.41±0.01	0.42±0.01	0.41±0.01
Gumminess	47.54±2.59	43.53±1.67	41.60±1.90
Chewiness	41.07±2.46a	36.94±1.58ab	34.26±1.83b

Studies on Almond Nut enriched goat meat nuggets

Almond nut was used to enrich the goat meat nuggets. Almond proximate and fatty acid composition (Table 1) was studied before using it for enrichment. Almond composed of 50% fat and 20% protein. Major fatty acids were oleic (68.67 mg/g) and linoleic acid (21.11 mg/g). Among the fatty acids MUFA percentage was high followed by PUFA and SFA. Effect of almond supplementation on quality of goat meat nuggets are presented in Table 2. Significant differences were observed in the emulsion characteristics. Addition of almond increases the emulsion pH, emulsion stability, protein and fat content. Moisture content decreases due to the addition of almond. Similar trend was observed in the product yield. Whereas, the moisture content of the product was different. The control product retained more water than the almond enriched product.

Non-significant differences were observed in the texture profile. Enrichment of almond nuts increases the hardness and fracturability. It may be due to the low moisture content in the product. Shear force and work of shearing were also non-significantly high. Effect of almond enrichment on the fatty acid profile of goat meat nuggets were evaluated (Table 3).

Linoleic acid and DHA contents were significantly higher than the control products. Similarly the nervoic acid content was significantly high in 2.5% almond enriched nuggets. Total per cent SFA were lower and MUFA were high. % n3 PUFA was significantly high in 2.5% almond enriched nuggets. N6/N3 PUFA ratio was significantly high in 5% almond enriched goat meat nuggets. SFA/MUFA ratio was non-significant. No significant differences were observed. Overall acceptability scores were rated as good.

Table 1: Proximate composition and major fatty acids of almond

Parameter	*Moisture*	*Fat*	*Protein*	*Ash*
Proximate composition	5.048±0.029	50.820±0.167	19.923±0.136	3.02±0.05
Major Fatty acids (mg/g)	Palmitic acid	Stearic acid	Oleic acid	Linoleic acid
	7.314±0.240	1.256±0.218	68.678±0.904	21.114±0.767
SFA (%)	MUFA (%)	PUFA (%)	n-3 PUFA(%)	n-6 PUFA (%)
8.951±0.449	69.479±0.880	21.570±0.799	0.231±0.028	21.229±0.777

Table 2: Effect of almond supplementation on quality of goat meat nuggets

Parameters	Control	2.5% Almond	5% Almond
Emulsion			
pH	6.22±0.03^{b}	6.32±0.03^{a}	6.34±0.01^{a}
Stability %	89.58±0.62^{c}	92.01±0.22^{b}	93.54±0.19^{a}
Moisture %	67.03±0.06^{a}	65.52±0.13^{b}	64.46±0.20^{c}
Protein %	9.56±0.29^{c}	11.73±0.68^{b}	14.09±0.36^{a}
Fat %	11.12±0.08^{c}	12.67±0.19^{b}	13.21±0.14^{a}
Ash %	2.33±0.01^{c}	2.38±0.01^{b}	2.61±0.02^{a}
Product			
Yield	95.36±0.31^{a}	97.46±0.43^{b}	95.72±0.17^{a}
pH	6.38±0.01^{b}	6.39±0.01^{b}	6.43±0.01^{a}
Moisture %	66.44±0.29^{a}	65.47±0.58^{a}	63.82±0.40^{b}
Protein %	10.97±0.50^{c}	13.62±0.24^{b}	15.74±0.71^{a}
Fat %	13.45±0.20^{c}	14.38±0.29^{b}	15.36±0.14^{a}
Ash %	2.36±0.02^{b}	2.39±0.02^{b}	2.51±0.03^{c}
Expressible water %	10.33±0.40^{a}	8.58±0.76^{b}	10.68±0.20^{a}

Table 3: Effect of almond supplementation on fatty acid profile of goat meat nuggets

Fatty acids	Control	2.5 %	5.0%
SFA (%)	25.71±2.02	24.42±2.43	22.85±1.66
MUFA (%)	31.93±1.88a	37.35±1.07a	43.74±2.46b
PUFA (%)	36.89±3.81	32.73±4.10	26.51±2.12
n-3 PUFA (%)	16.70±3.54a	15.28±2.27a	6.39±1.55b
n-6 PUFA (%)	20.01±1.76	15.64±1.37	18.19±1.28
SFA/MUFA	0.82±0.09a	0.65±0.07ab	0.54±0.06b
SAF/PUFA	0.73±0.08	0.87±0.22	0.89±0.12
PUFA/SFA	1.46±0.16	1.47±0.28	1.19±0.13
n-6/n-3 PUFA	1.42±0.18a	1.22±0.32a	4.06±1.31b

Standardization of the formulation for herbal based goat meat nuggets and shelf life evaluation

Formulation for the herbal based goat meat nuggets were standardized using the following herbs (CIRG-GPT Herb or CGH 1, 2 and 3). Proximate composition is presented in Table 1. No significant differences were observed among the different treatments due to addition of herbs. All the products were packed aerobically and under vacuum and were kept under refrigeration at 4±1°C. All the products including the control were not spoiled till 14 days of storage. Standardization of the formulation for herbal goat milk Kulfi (Indian Ice cream).

Standardization of the process of preparation of herbal goat milk kulfi (Indian Ice cream)

With the available facilities in the laboratory, overall sensory evaluation scores were studied. The product was rated as "Good".

Table 1: Proximate composition of different herbs based goat meat nuggets

Parameters	Control	0.25 % CGH 2	0.5% CGH 2	0.25 % CGH 3	CGH 1
pH	6.28±0.02	6.32±0.01	6.27±0.03	6.29±0.02	6.25±0.04
Yiled (%)	92.45±0.52	91.52±0.68	91.87±0.72	92.36±1.02	91.78±1.06
Moisture(%)	68.46±0.23	69.89±0.52	68.85±0.41	68.67±0.39	69.53±0.47
Protein(%)	13.74±0.18	14.44±0.12	14.76±0.14	14.08±0.21	14.57±0.26
Fat(%)	8.88±0.08	8.35±0.11	9.18±0.12	9.07±0.09	8.82±0.06
Ash(%)	2.26±0.06	2.18±0.02	2.09±0.04	2.32±0.03	2.30±0.04

CGH: CIRG-GPT Herb (*Coded*)

XI/NFR&PT-3-2: Evaluation of carcass traits, meat quality and products from goat meats

A.K. Das, V. Rajkumar, A.K. Verma and R.B. Sharma

Quality evaluation of fresh meat from low (neck and shoulder) and high value (leg) cuts

In this study, the analysis of physicochemical quality and fatty acid profile of fresh goat meat obtained from low value (neck and shoulder) and high value (leg) cuts was tried in order to observe the differences and effect of these differences on the quality and acceptability of goat meat product. There were no significant differences in pH, moisture, protein, water holding capacity, cooking loss and total pigment of goat meat from low and high value cuts. Meat from low value cuts showed non-significantly lower moisture and higher protein content. Meat from neck and shoulder had higher total meat pigment than meat from leg. Meat from neck and shoulder showed higher water holding capacity (less water extracted upon pressure applied) and hence lower cooking loss during cooking. Meat from neck and shoulder had significantly higher fat content than meat from leg cut. A 100 gm meat from leg cut had 132.62 Kcal/100g energy and meat from neck and shoulder cut had 145.15 Kcal/100g energy. From this study, it is concluded that there is non-significant differences in the meat quality between meat from high value and low value cuts.

Fatty acid profile of meat revealed no significant differences between high and low value cuts. Meat from neck and shoulder had higher percentage of saturated fatty acid than meat from leg cut. But total mono-unsaturated and polyunsaturated fatty acids were found high in meat from leg cut. Non-significantly higher content of omega 3 fatty acids were present in meat from neck and shoulder cut, whereas, leg cut contained higher amount of omega 6 fatty acids. Considering individual fatty acids composition, meat from neck and shoulder had high amount of myristic acid, palmitic acid and low amount of

stearic acid and oleic acid. Meat from leg cut had high linoleic acid and ecospentrionic acid. Fatty acids profile of these meats showed little variation.

Quality of goat meat nuggets prepared from meat of low and high value cuts

After analysis of physicochemical and fatty acid profile of meat from low and high value cuts, was utilized into product formulation in order to observe the impact of utilizing such meat components on the end product quality. There were no significant difference in pH, emulsion stability and moisture of raw emulsion prepared from high and low value cuts. Meat emulsions from low value cut had significantly higher fat and ash content. Goat meat nuggets from high value cut had higher yield than product from low value cut. Nuggets from low value cut had higher moisture content than from high value cut. Protein, fat and ash percentage in meat nuggets were not significantly different from low and high value cuts. Textural analysis of nugget from low and high value cuts is presented in Table 2. Results showed that there were no significance differences between nuggets from low and high value cuts. Nuggets from low value cut had higher hardness, springiness and chewiness than nuggets from high value cut.

Table 1: Quality characteristics of meat from high and low value cuts.

Parameters	High value	Low value
pH	5.67±0.07	5.78±0.06
Moisture (%)	76.43±0.26	74.83±0.30
Protein (%)	20.18±0.26	20.78±0.27
Fat (%)	1.38±0.06[b]	2.05±0.26[a]
Ash (%)	1.12±0.06	1.06±0.050
Water holding capacity	68.42±1.55	66.53±0.89
Cooking loss (%)	34.25±0.36	32.87±0.24
Total pigments (ppm)	122.57±6.56	132.82±9.11
Energy (Kcal/100g)	132.62±4.13	145.15±3.86

(*$p<0.05$)

Table 2: Fatty acid* profile (Mean±SE) of meat from high and low value cuts

Fatty acids	High value	Low value
% Saturated fatty acids (SFA)	46.27±3.26	49.95±3.24
% Monounsaturated fatty acids (MUFA)	32.41±3.07	30.49±3.13
% Polyunsaturated fatty acids (PUFA)	21.24±2.41	19.57±3.89
%n3 PUFA	4.09±0.84	9.59±4.50
%n6 PUFA	16.15±1.95	10.64±1.25
SFA/MUFA	3.17±0.90	2.44±0.78
SAF/PUFA	3.16±0.46	3.71±0.49
PUFA/SFA	0.46±0.27	0.39±0.16
n-6/n-3 ratio	3.95±0.75	1.11±0.83

*Percentage of total fatty acids

Table 3: Chemical composition of nuggets with meat from high and low value cut

Parameters	High value	Low value
Emulsion		
pH	6.12±0.04	6.18±0.02
Stability (%)	86.71±1.81	86.24±1.62
Moisture (%)	69.27±0.25	68.48±0.36
Protein (%)	13.83±0.37	13.45±0.17
Fat (%)	9.69±0.22[b]	10.41±0.43[a]
Ash (%)	2.18±0.07[b]	2.24±0.06[a]
Nuggets		
Yield (%)	94.15±0.60	93.59±0.74
pH	6.22±0.02	6.30±0.03
Moisture (%)	67.11±0.23[b]	68.38±0.44[a]
Protein (%)	13.85±0.22	14.79±0.36
Fat (%)	10.89±0.18	11.13±0.39
Ash (%)	2.18±0.03	2.20±0.04

(*p<0.05)

Textural studies showed that product prepared with meat from different cuts had little influence on final texture of the products. Sensory evaluation panel could not differentiate the nuggets prepared from high value and low value cuts. But the nuggets prepared from high value cuts received non-significantly higher scores than from low value cuts. Overall acceptability scores for the nuggets from high and low value cuts were rated as very good with 7.24 and 7.10 scores, respectively for high and low value cuts.

Bael extract residue as a novel source of dietary fibre in goat meat nuggets

In this study, incorporation of bael pulp extract as a novel source of dietary fibre in meat products was attempted. First of all, fibres present in the bael pulp extract residue were analyze (Table 1). Results showed that bael pulp extract residues had 32.11% neutral detergent fibre, 25.35% acid detergent fibre and 6.76% of hemicelluloses.

Effect of bael pulp extract residue as source of dietary fibre at 0.25% and 0.5% levels on quality of goat meat emulsion and nuggets (Table 2). There were significant differences in pH, emulsion stability of control and bael pulp extract residue incorporated goat meat emulsion. Emulsion without bael fibre had significantly lower pH value than emulsion with 0.5% bael pulp fibre. But pH of control emulsion and emulsion with 0.25% bael fibre did not differ significantly. Bael pulp extract residue as a new source of dietary fibre significantly improved the emulsion stability probably due to water binding capacity. Emulsion without bael fibre had lowest emulsion stability.

Table 1: NDF, ADF and Hemicellulose of bael extract residue

Parameters	Values
Neutral detergent fibre (%)	32.11±0.34
Acid detergent fibre (%)	25.35±0.18
Hemicelluloses (%)	6.76±0.26

Results indicated that addition of bael fibre significantly improved the cooking yield of nuggets. Though there were no significance difference in pH, moisture, protein, fat and ash percentage between control and treated nuggets, but nuggets with bael fibre showed higher protein percentage than control. Higher expressible water means lower water holding capacity during centrifugation. Nuggets with 0.5% bael fibre had significantly higher water holding capacity than control and 0.25% bael fibre incorporated nuggets. This might be due to water retention capacity of bael fibre incorporated nuggets. Bael fibre addition improved tenderness of goat meat nuggets. Goat meat nuggets with 0.5% bael dietary fibre had significantly lower hardness as compared to control nuggets. Nuggets with 0.25% bael fibre though had lower hardness compared to control sample but it was not significant different. Goat meat nuggets with bael fibre had non-significantly lower gumminess and chewiness than control nuggets. It was observed that addition of bael fibre did not significantly affect the sensory scores of the product upto 0.5% dried powder incorporation level. Increase in the incorporation level of bael fibre in the goat meat nuggets from 0.25% to 0.5%, non-significantly increased the flavour and texture scores indicating that addition of fibre increases the water retaining capacity and improves the flavour due to its natural characteristics. As compared to the control nuggets, addition of bael fibre non-significantly increased the sensory scores indicating that bael fibre can be a good source of unconventional dietary fibre.

Table 2: Effect of bael extract residue as new source of dietary fibre on quality of goat meat emulsion and nuggets

Parameters	Control	0.25%	0.5%
Emulsion			
pH	6.26±0.01^{b}	6.27±0.01^{ab}	6.29±0.01^{a}
Stability (%)	83.59±0.32^{b}	85.02±0.49^{a}	85.69±0.45^{a}
Moisture (%)	66.20±0.74	66.32±0.17	67.01±0.92
Protein (%)	13.86±0.021	14.52±0.018	14.49±0.25
Fat (%)	9.36±0.16	9.75±0.27	9.24±0.20
Ash (%)	1.92±0.003	1.95±0.008	1.93±0.009
Nuggets			
Yield (%)	91.48±0.55^{b}	93.52±0.67^{a}	93.87±0.83^{a}
pH	6.36±0.01	6.37±0.01	6.38±0.01
Moisture (%)	61.28±0.57	61.86±0.56	62.78±0.31
Protein (%)	14.56±0.31	15.29±0.44	15.25±0.11
Fat (%)	11.22±0.31	10.46±0.11	10.85±0.12
Ash (%)	2.08±0.005	2.17±0.002	2.16±0.004
Expressible water (%)	16.67±1.16^{a}	15.34±0.52^{a}	12.26±0.73^{b}

Mean bearing different superscripts in a row differ significantly.

Table 3: Effect of bael extract residue as source of dietary fibre on texture profile of goat meat nuggets

Parameters	Control	0.25%	0.5%
Hardness	89.36±2.98[a]	81.27±40.9[ab]	76.34±2.26[b]
Fracturability	0.11±0.003	0.12±0.005	0.12±0.007
Adhesiveness	-0.04±0.01	-0.03±0.01	-0.02±0.01
Springiness	0.77±0.01	0.75±0.03	0.72±0.02
Cohesiveness	0.359±0.02	0.336±0.02	0.338±0.02
Gumminess	32.22±1.60	27.24±1.32	25.86±0.98
Chewiness	24.70±1.44	20.61±1.40	18.57±0.87

Mean bearing different superscripts in a row differ significantly.

Pilot Project: Nutritional quality evaluation of full fat and low fat goat milk paneer

A.K. Verma, A.K. Das and V. Rajkumar

Chemical composition of fresh and skimmed Barbari milk was studied with the aim of developing low fat goat milk paneer. As expected there was a significant difference in the fat and total solids (TS) content. Skimmed milk had significantly lower fat (0.57%) and TS (8.72%) content. In this experiment by centrifugation the fat content was reduced up to 4%. Fresh milk had 4.56, 8.65, 13.21, 3.04, 4.71 and 0.68% fat, SNF, TS, protein, lactose and ash content respectively. Both the milk were used for the preparation of goat milk paneer as per the standard procedure.

Proximate composition of low fat and full fat paneer is presented in Table 1. It has been observed that proximate composition was significantly different in these products. Significantly high moisture, protein and ash contents were recorded in the low fat paneer as it suitably suggests its character in the name. Texture profile scores of low fat and full fat paneer are presented in Table 2 and as per expectation low fat goat milk paneer had significantly higher hardness than full fat paneer because the fat in product is responsible for the smoothness or tenderness. Fat is responsible for the oiliness and therefore the mouth coating. Accumulation of casein micelles is responsible for the firm texture of low fat paneer. In case of full fat paneer fat globules prevent this accumulation and thus improve product texture. Other textural parameters like adhesiveness, gumminess and chewiness were also significantly higher in low fat paneer.

Perusal of individual fatty acid contents revealed that full fat paneer had significantly high Caproic, Caprylic, Capric, Undecanoic, Lauric, Tridecanoic, Myristic, Heptadecanoic, Tricosanoic, Lignoceric, Cis-10-Pentadecanoic, Cis-10-Heptadecanoic, Arachidonic, Eicosapentaenoic and Cis-Eicosatrienoic acids (Table 3). All other fatty acids were non-significantly high in the full fat paneer.

Total fatty acids contents were significantly different. Full fat paneer had 146 mg fatty acids per gram of Paneer, which is almost five times higher than the low fat paneer. Cream separation by

centrifugation and further processing in to paneer leads to loss of Saturated Fatty acids (SFA) up to 21% in Barbari goat milk. Full fat paneer had 103 mg/g of SFA whereas; low fat paneer had 20 mg/g. On the other hand MCT loss was 5.5%. Full fat paneer had 61 mg/g of MCT whereas; low fat paneer had only 9 mg/g. MUFA loss was 2% and loss of PUFA was up to 0.12%. Of the total fatty acid content of fresh Barbari goat milk paneer, MCT content was 41%. As usual the full fat paneer had significantly high content of omega 3 fatty acids and similar trend was observed for the omega 6 fatty acids also (Table 4). Eicosatrienoic Acid content was high (3.84 mg/g) in the full fat paneer among the omega 3 fatty acids. Eicosadienoic Acid was high (0.79 mg/g) in the full fat paneer among the omega 6 fatty acids.

Table 1: Proximate composition of low fat and full fat Barbari goat milk paneer

Parameters	Low fat paneer	Full fat paneer
Moisture (%)	52.80±0.26^{a}	43.79±0.30^{b}
Fat (%)	1.01±0.10^{b}	27.91±0.24^{a}
Protein (%)	42.33±1.46^{a}	20.64±1.60^{b}
Ash (%)	2.86±0.10^{a}	1.73±0.03^{b}
Energy (Kcal/100g)	233.80±2.77^{b}	390.21±1.84^{a}

(*p,0.05; **p<0.01)

Table 2: Textural properties of low fat goat milk paneer

Parameters	Low fat paneer	Full fat paneer
Hardness	88.02±3.93^{a}	25.99±0.72^{b}
Fracturability	0.11±0.01	0.12±0.00
Adhesiveness	-0.05±0.01^{a}	-0.19±0.05^{b}
Springiness	0.87±0.00	0.86±0.00
Cohesiveness	0.75±0.01	0.69±0.01
Gumminess	65.69±3.15^{a}	17.89±0.64^{b}
Chewiness	57.26±2.76^{a}	15.31±0.59^{b}
Shear force	16.88±1.51^{a}	5.00±0.30^{b}
Work	9.75±0.90^{a}	3.35±0.19^{b}

(*p,0.05; **p<0.01)

Table 3: Fatty acids (mg/g) # profile of low fat and full fat goat milk paneer

Parameters	Low fat paneer	Full fat paneer
Butyric acid (C4:0)	1.79±0.21	6.00±2.64
Caproic Acid (C6:0)	0.81±0.09^{b}	6.25±0.47^{a}
Caprylic Acid (C8:0)	1.20±0.26^{b}	9.08±0.77^{a}
Capric Acid (C10:0)	3.80±0.96^{b}	30.29±2.90^{a}
Undecanoic Acid (C11:0)	0.03±0.01^{b}	0.33±0.08^{a}
Lauric Acid (C12:0)	1.47±0.40^{b}	8.74±2.33^{a}
Tridecanoic Acid (C13:0)	0.02±0.01^{b}	0.18±0.02^{a}

Myristic Acid (C14:0)	3.14±0.94[b]	17.70±4.41[a]
Pentadecanoic Acid (C15:0)	0.21±0.06	5.63±3.99
Palmitic Acid (C16:0)	5.68±2.53	14.43±5.56
Heptadecanoic Acid (C17:0)	0.23±0.06[b]	0.65±0.11[a]
Stearic Acid (C18:0)	2.27±0.50	2.38±1.67
Tricosanoic Acid (C23:0)	0.01±0.00[b]	0.15±0.04[a]
Lignoceric Acid (C24:0)	0.04±0.02[b]	0.43±0.08[a]
Myristoleic Acid (C14:1)	0.21±0.06	5.63±3.99
Cis-10-Pentadecanoic Acid (C15:1)	0.07±0.02[b]	0.62±0.07[a]
Pamitolic Acid (16:1)	0.33±0.10	0.63±0.15
Cis-10-Heptadecanoic Acid (C17:1)	0.10±0.04[b]	1.19±0.22[a]
Oleic Acid (18:1n9c)	5.48±2.56	14.96±4.97
Linoleic Acid (C18:2n6)	0.73±0.26	0.48±0.10
Alpha-Linolenic Acid (C18:3n3)	0.02±0.01	0.49±0.36
Eicosadienoic Acid (C20:2n6)	0.02±0.00	0.79±0.48
Arachidonic Acid (C20:4n6)	0.13±0.04[b]	0.67±0.13[a]
Docosadienoic Acid (C22:2)	0.07±0.07	0.18±0.09
Eicosapentaenoic Acid (C20:5n3)	0.15±0.11[b]	3.87±0.45[a]
Cis-Eicosatrienoic Acid (C20:3n3)	0.07±0.02[b]	0.69±0.23[a]
Docosahexaenoic Acid (C22:6n3)	0.03±0.02	0.15±0.03
Total Fatty acids (FA)	28.63±8.41[b]	145.58±16.19[a]
SFA	20.88±5.23[b]	103.06±±10.89[a]
MUFA	6.25±2.74[b]	33.55±8.83[a]
PUFA	1.31±0.45[b]	9.19±1.70[a]
MCT	9.09±1.57[b]	60.69±6.57[a]

#Milligrams per gram of goat milk paneer (*p<0.05; **p<0.01)

Table 4: Different omega fatty acids (mg/g) profile of low fat and full fat goat milk paneer

Parameters	Low fat paneer	Full fat paneer
Omega 3 fatty acids		
Alpha-Linolenic Acid (C18:3n3)	0.02±0.01	0.49±0.36
Eicosapentaenoic Acid (C20:5n3)	0.07±0.02[b]	0.69±0.23[a]
Cis-Eicosatrienoic Acid (C20:3n3)	0.15±0.11[b]	3.87±0.45[a]
Docosahexaenoic Acid (C22:6n3)	0.03±0.02[b]	0.15±0.03[a]
Omega 6 fatty acid		
Linoleic Acid (C18:2n6)	0.73±0.26	0.48±0.10
Linolenic Acid (18:3n6)	0.04±0.01	0.14±0.10
Eicosadienoic Acid (C20:2n6)	0.02±0.00	0.79±0.48
Arachidonic Acid (C20:4n6)	0.13±0.04[b]	0.67±0.13[a]

#Milligrams per gram of goat milk paneer (*p<0.05; **p<0.01)

Network Programme on Veterinary type culture–Rumen microbes

U.B. Chaudhary, T.K. Dutta and V.K. Gupta

Research project at CIRG, Makhdoom with its lead center at Veterinary type culture institute Hisar (Haryana) was sanctioned by the ICAR with the aim to act as a national repository of microorganisms including recombinant cultures and plasmids Identification, characterization and documentation of animal microbes and conservation, maintenance surveillance and utilization for R&D. CIRG unit is mainly emphasizing upon isolation of the anaerobic cellulose degrading bacteria from the rumen of goat fed high roughage diet using selective medium for cellulose degradation, microscopic and biochemical characterization and enzyme profile isolated microbes and effect of selected isolates on *in vitro* feed degradation. Rumen liquor from grazing goats maintained under intensive systems of feeding management and feaces from Blue bulls were collected for identification of fiber degrading bacteria. The isolates of microcrystalline cellulose degrading bacteria from these two breeds were cultivated and isolated. Enzyme profile of these isolates with respect of Microcrystaline cellulase and Avicelase has been studied. DNA of all the isolates has been extracted and PCR for amplification of specific gene using specific primers is in progress for identification and Characterization of isolates at molecular level.

Cultivation of Microcrystalline Cellulose Degrading Bacteria

For isolation of Microcrystalline cellulose degrading bacteria in the rumen liquor samples of goats, maintained under semi intensive system of feeding management, Anaerobic culture medium was used for cultivation of fiber degrading bacteria. Preparation of growth media and incubation was done under anaerobic condition (Carbon dioxide and Nitrogen). Total nineteen isolates of microcrystalline cellulose degrading bacteria were isolated from rumen of goats maintained under semi intensive system of feeding management. Culture of these isolates is being maintained for its further characterization at molecular level. Carboxy methylcellulase (n mol/min/ml) and avicelase activity (n mol/min/ml) exhibited by these isolates were estimated using biochemical analysis. Results indicated a range of 33.33-128.71 (n mol/min/ml) of carboxy methyl cellulase and 3.70-109.26 (n mol/min/ml) avielase in the culture supernatant of thee isolates. Isolate MCB-10, isolated from goat rumen was found most efficient, exhibiting, 128.71 and 100.00 units of Carboxy methylcellulase and avicelase respectively.

Four isolates of microcrystalline degrading bacteria were isolated from the faeces of Blue bulls. Carboxy methyl-cellulase activity of these isolates ranging 38.89-66.67 (n mol/min/ml). Correspond-ing values in case of avicelase were ranged from 32.87-33.76 (n mol/min/ml).

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

U.B. Chaudhary and M.K. Tripathi

Determination of *in vitro* methane production at t½ of different feeds and their combinations

A number of feed resources like crop residues (gram straw, arhar straw, wheat straw, lobia straw and guar straw), top feeds (peepal leaves, neem leaves, ber leaves, siris leaves, subabool leaves, remja leaves, chonkra leaves, sahtoot leaves and mixed leaves), energy and protein supplements (barley grains, bajra grain, wheat bran), compound feed (concentrate pellet) and their different combinations which were tested previously for determination of their t½, dry matter and organic matter digestibility in this project were tested for methane production (ml/g dry matter) at their corresponding t½ using *in vitro* gas production test. Among straw, highest methane production (ml/g DM) was observed with arhar straw (24.63) while lowest was observed with guar straw (4.2). In case of leaves, methane production (ml/g DM) at their corresponding $t^{1/2}$ varied from 1.65 to 7.18. The methane production (ml/g DM) of barley grains, bajra grain and wheat bran was 14.18, 15.71 and 1.45 respectively. The pelleted feed produced 2.7 (ml/g DM) methane at their corresponding $t^{1/2}$ period. The methane production (ml/g DM) varied from 1.32-12.08 in different combination of feeds. The estimation of methane production of other feeds and their combination which are being used as favourite goat feed are in progress.

ANIMAL HEALTH DIVISION

XI/GH-1 Monitoring and surveillance of important goat diseases in India

D.K. Sharma, V.K. Gupta, Ashok Kumar, V.S. Vihan, K. Gururaj (up to Sept. 2010), N. Shivasaranappa, M.N. Reddy and A.K. Misra

During the period under report, visits were made to state animal disease monitoring agency *i.e.* Animal Husbandry Directorates along with the AICRP goat centers. Information were however collected from Jharkhand, West Bengal, Kerala and Karnataka from secondary and primary sources. The faecal samples were also collected and laboratory examination was conducted for diagnosis of the parasitic infections.

West Bengal

A total of 15 million goats of 19 districts of West Bengal make 40.28% of the total livestock of the state. Of the noticeable prevalent diseases in country the diseases like PPR, Caprine pox, Blue tongue, FMD are reported on routine basis.

FMD- For last 3 years *i.e.* 2007-2010 a total of 561 outbreaks of FMD were reported in West Bengal (WB). Most of these outbreaks were however from bovine. The separate data for goats have not been recorded. The common serotypes were 'O' (72.65%), 'Asia-1' (0.19%) and 'A' (0.19%). Of the 19 total districts of WB 17 reported outbreaks of FMD. The morbidity and mortality during outbreaks ranged 3.71-7.20 and 0.01-0.05%, respectively. Of the total 32 samples of blood sera collected from WB (district-Nadia) 12.5 per cent were found to be sero-positive for the presence of the antibodies against FMD virus. The vaccination of goats for FMD was however a regular feature showing increase in coverage *i.e.* from 4.32% in 2006-07 to 8.65% in 2009-10.

PPR- A total 363 outbreaks of PPR were reported over last 3 years (2007-2010) in 14 districts in WB. Malda and Purulia districts were observed with highest number of outbreaks *i.e.* 59 and 50, respectively during this period. The disease outbreaks were observed throughout the year however, they were more frequent in April to June, the highest being in June 2009-10. The highest mortality of 10.23 per cent was in Murshidabad where morbidity was 50.00 per cent. The highest number of outbreak was reported from Malda district followed by Burdhman, 24 Dakshin Parganas, Dinajpur and Birbhum districts. Surprisingly no PPR incidence was reported from Purbi Midinipur, South 24 parganas, Uttar Dinajpur and Coochbehar districts for consecutive 3 years. A total of 32 samples collected from WB and result is awaited. During current year, a total of 11 outbreaks of PPR were reported from 5 districts during month of October 2010.

Goat Pox- In all 154 outbreaks of goat pox were reported from WB during last 3 years period *i.e.* from 2007-10. Information collected during this period revealed the morbidity and mortality ranged 6.09-8.21 and 0.48-0.92 per cent, respectively. Most of the outbreaks observed during last 5 years were from 5-6 districts. Month-wise observations revealed that most of the outbreaks (10) in 2009-10 were in the month of February followed by December (9), May (7) and October (7). During

current year *i.e.* 2010-11, 4 outbreaks of goat pox were reported from Hooghly and Birbhum district. The disease was however seems to be endemic to some district and/or under reported.

Blue tongue- The secondary data on disease from WB also revealed that 59.22 per cent (128/225) samples were sero-positive for Blue tongue virus antibodies. The results of serum samples collected from AICRP field unit are however, awaited.

Brucellosis- State of WB animal disease monitoring agency is not regular in monitoring caprice brucellosis. Out of 32 samples collected from the state, however, showed that 21.8 per cent were sero-positive for Brucella anti bodies.

Jharkhand

In Jharkhand, the state animal disease monitoring was very poor and almost no reporting was done. The goats were vaccinated for some diseases. However, reporting of any outbreak was not there. The serum samples collected from AICRP Black Bengal goat unit at Bainko village in Singhbhum district were tested for goat diseases viz., PPR, FMD, Caprine pox, Blue tongue. During screening 22.2% samples were found sero-positive for Brucella antibodies. A total of 17 serum and 20 faecal samples were tested for various diseases including parasitic infection.

Kerala

Personal visit to AICRP centre at Tiruchy, Kerala resulted in collection of 30 sera and 12 faecal samples. Serological investigations of the samples revealed that 6 samples were positive for Brucella antibodies showing sero-prevalence of 20 per cent. Common ailments reported by the farmers were diarrhea, maggot wound and bloat. The samples (sera) were also tested for antibodies against FMD virus, however, they were negative.

Karnataka

A total of 20 serum samples (16 goat and 4 sheep) were tested for serum antibodies against FMD virus and Brucella. Two samples of goats were found positive for FMD virus antibodies. These antibodies, however, were not because of vaccination. The testing of samples for Brucella showed that 3 of the 16 goat's samples (18.75%) were positive for Brucella antibodies. The results of PPR, goat pox and Blue tongue testing are however, awaited.

Outbreaks

Total 6 outbreaks were attended in local area in villages like Lohara, Oochagaon, Hayatpur, Pingri, Chiravalli and Sadabad. The sero-prevalence of FMD virus in samples in Lohara and Hayatpur in sheep and goat respectively was 20 and 10 and 50 and 6.1 per cent. The serum samples so obtained were also screened for Brucella antibodies by SAT. The sero-prevalence of Brucella in was 18.36 per cent in Hayatpur, 20% in Lohara, 25% in Oochagaon and 31.1 in Naussera village while sero-prevalence in sheep was nil in Hayatpur, 20% in Lohara and 37.5% in Oochagaon.

Table 1: Brucella screening of samples collected/ received

	Place	Samples tested	Sero- positive
1.	Kerala	30	20.00 (06)
2.	Mandya,	16 (Goats)	18.75 (03)
	Karnataka	04 (Sheep)	Nil
3.	Jhkarkhand	18 Goats	22.22 (04)
4.	Kolkata	32 Goats	21.87 (07)
5.	Mathura		
	• Hayatpur	49 (Goats)	18.36 (09)
		02 (Sheep)	Nil
	• Lohara	10 (Goats)	20.00 (02)
		15 (sheep)	20.00 (03)
	• Oonchgaon	8 (Goats)	25.00 (02)
		8 (Sheep)	37.50
6.	Naussera	45 (Goats)	31.11 (14)

Table 2: Parasitic incidence in faecal samples collected from field

Place	Total samples	Coccidiosis	Bursate
Kumher (Rajasthan)	6		
Hayatpur	18	72.2 (13)	33.33 (6)
Oonchagaon	15	93.3 (14)	6.4 (1)
Chirawali	10	70.0 (7)	-
Kerala	11		
Ranchi (Bainko	17	47.05 (8)	11.76 (2)
West Bengal	22	95.45 (21)	22.72 (5)

Table 3: Parasitic infections in different goat breeds flocks in Institute

Units	Samples examined	Parasitic incidence		
		Coccidiosis	Bursate	Moniezia
Jamunapari	196	65.85 (129)	42.34 (83)	1.02 (2)
Jakhrana	178	83.70 (149)	42.69 (76)	1.12 (2)
Barbari	108	61.11 (66)	26.85 (29)	5.55 (6)
Sheep	14	100.00 (14)	7.14 (1)	-
Goat Health	17	76.47 (13)	94.11 (16)	-

Table 4: Age-wise parasitic infestations in Institute flocks

Age	Jamunapari			Jakhrana			Barbari		
	Total Samples examined	Coccidia positive	Bursate Positive	Total Samples examined	Coccidia positive	Bursate Positive	Total Samples examined	Coccidia positive	Bursate Positive
0-3M	12	83.33 (10)	0.00	2	100.00 (2)	100.00 (2)	34	64.70 (22)	14.70 (5)
>3-6M	12	91.66 (11)	0.00	48	66.66 (32)	77.08 (37)	32	65.62 (21)	31.25 (10)
>6-12M	-	-	-	-	-	-	4	100.00 (4)	100.00 (4)
>12M	172	62.79 (108)	48.25 (83)	106	68.86 (73)	53.77 (57)	38	81.57 (31)	21.05 (8)

GH.3.1: Modulation of caprine coccidiosis through herbal therapy

D.K. Sharma and Ashok Kumar

Under *in-vivo* trials the prepared 2 prototypes CIRG-11 and CIRG-12 were tested for their *in vivo* efficacy in goats suffering from the coccidian infection in natural condition. A total of 17 animals infected with coccidian infection were identified and selected for in- vivo trial for CIRG-11 and 18 kids for CIRG-12. Their faecal samples were examined for initial OPG. The faecal OPG count was also recorded post treatment. The result of the trials has been shown in Table 1 and 2.

Table 1: Faecal OPG count in animals treated with CIRG-11 Prototype

S.N.	Initial OPG	12 day PT OPG	26 Day PT OPG
1	-	43	-
2	54	-	-
3	-	25	-
4	24	6	-
5	231	24	-
6	271	70	-
7	70	3	-
8	61	4	-
9	91	10	-
10	58	-	-
11	123	12	-
12	79	19	3
13	69	38	-
14	50	7	5
15	78	4	-
16	260	45	4
17	38	3	-
18	52	-	1

Both the prototypes were administered in same doses. The prototype CIRG-12 was quite effective in lowering down the OPG count on 12 day PT, however, it was for a while and the OPG picked up again to show higher value on 26th day PT. Contrary to it prototype CIRG-11 was quite effective to lower down the OPG count on 12th day. On 26th day all the animal with initial coccidian oocyst showed nil OPG count.

Further the phytochemical properties of these extracts were also made to know the various active constituents present in the extracts. Analysis showed that Benedict test was positive in the entire analyzed sample except in CIRG-1 and CIRG-9. It confirmed the poor state of carbohydrate in these two extracts. On the other hand Biuret test was negative in the entire sample except CIRG-5.

Table 2: Faecal OPG count in animals treated with CIRG-12 Prototype

Ani. No.	Initial OPG	12 day PT OPG	26 day PT OPG
1	50	-	562
2	27	-	4
3	180	21	2
4	101	1	623
5	203	244	252
6	281	-	120
7	179	-	314
8	10	4	31
9	19	-	6
10	22	-	60
11	57	12	48
12	17	-	23
13	23	-	40
14	67	3	23
15	28	-	17
16	37	4	10
17	15	-	8

Table 3: Chemical profile of different plants extracts

S. No.	Plant extract	Glycosides (legal test)	Alkaloids			Flavonoids Alkaline Reagent	Tannins Phenolic FeCl3	Carbohydrate		Proteins		Steroids& (R+) Y+) Salkowaski Triterpenoids
			Mayer	Hegar	Dragndroff's			Benedicts	Fehling	Ninhydrin	Biuret	
1	*CIRG-5*	+	+	+	-	+	+	+	+	-	+	*Y+*
2.	*CIRG-4*	+	-	+	-	+	-	+	-	+	-	-
3.	*CIRG-6*	+	-	-	-	+	+	+	+	+	-	-
4.	*CIRG-10*	-	-	-	-	-	+	+	+	+	-	-
5.	*CIRG-1*	+	-	-	+		-	-	+	-	-	*Y+*
6.	*CIRG-3*	+	+	+	-	+	+	+	+	-	-	*Y+*
7.	*CIRG-9*	-	+	+	-	-	-	-	+	-	-	*Y+*

GH: XI/GH-2.2: Development of herbal antidiarrhoeal drug for goats

Ashok Kumar, V.K. Gupta, K. Gururaj (upto Sept 2010) and V.S. Vihan

1. Extract preparation of selected plants and chemical analysis

Coded plants as CIRG-1 (leaves), CIRG –2A (Leaves), CIRG-2B (Bark), CIRG –3A (Leaves), CIRG-3 B (Bark), CIRG-4 (leaves), CIRG-5 (leaves) and CIRG-6 (leaves) were finally selected and tested for bioactivity as antibacterial. Only two prototypes were finalized for clinical trials after studying the chemical compatibility. Extracts were prepared by Soxhlet extraction under low temperature (25-30°C) for up to 24 cycles. The recovery of solvent was done by rotatory vacuum evaporator (Heidolph, Germany) under reduced pressure and temperature (4°C). The concentrated extracts were air dried and stored at 4°C. The selected and effective plants extract under methanolic solvents were studied for antibacterial activity. Some of the plants were fractioned by the solvents to improve the bioactivity. Solvent-solvent fractionation was done in following solvents, in the order given below; Petroleum ether Ethyl acetate, Chloroform, Ethyl methyl ketone, Water.

The per cent yield was calculated on as such basis and their physical characteristics were also noted. Qualitative chemical analysis was conducted to verify the chemical constituents for the presences of mainly flavonoids, alkaloids, saponins, Carbohydrates, glycosides, steroids, tannins and phenolic compounds and protein and amino acids by standard methods.

2. Isolation and characterization of *E.coli*

E.coli was isolated from faecal samples of Barbari and Jamunapari goat breeds showing clinical signs of diarrhea and mastitis were collected from Institute organized flocks. These isolates were characterized by using morphological, biochemical and molecular (PCR) methods. Besides, reference strains of *Escherichia coli* MTCC code 3381 were also used for the antibacterial study. Characterized isolates were subjected to *in vitro* antibiotic sensitivity as per the disc susceptibility method in order to find out the susceptibility and resistance profiles.

A total of 18 antibiotics (antibiotic discs from HiMedia) from 9 different groups were used. Cephalosporins (Cephalexin, Cephadroxil, Ceftriaxone), Penicillins (Penicillin G, Amoxicillin, Amoxyclav), Quinolones (Ciprofloxacin, Norfloxacin, Enrofloxacin) Aminoglycosides (Amikacin, Kanamycin, Gentamicin), Macrolids (Roxithromycin, Erythromycin), Tetracyclines (Oxytetracycline), Nitrofurans (Furazolidone), Chloramphenicols (Chloramphenicol) and Sulphonamides (Co-Trimoxazole). The isolates were showed resistance with commonly used antibiotic as Ciprofloxacin, Norfloxacin, Amikacin, Kanamycin, Oxytetracycline, Furazolidone, Chloramphenicol, Ceftriaxone,

3. Synergistic studies

The individual extracts were evaluated for their *in vitro* antibacterial potential by disc susceptibility method and by broth dilution method in concentration of 50 mg/ml, 25 mg/ml, 12.5 mg/ml, 6.25 mg/ml and 3.12 mg/ml. MIC were measured for both single and combination. The combination of extracts was assessed for anti-bacterial activity in the same way as employed for the evaluation of individual extracts. On the basis of activity the combinations were recoded for the purpose of patents as CIRG comb A, CIRG comb B, CIRG comb C and CIRG comb D.

The enhancement in the antibacterial activity due to component synergy, in terms of their MIC for bacterial growth, was evaluated using the calculation of the fractional effect (FE) of two extracts. The interpretation of FE index was made by using the standard method. Paired t-test analysis was done to prove the broad spectrum anti-bacterial effects of the preparation. The fractional effect (FE) of two extracts X and Y for antibacterial studies, in terms of their MIC for bacterial growth was evaluated by using following way as suggested by Schelz *et al.*, (2006). The sum of the two fractional effects called as FE index was calculated for the combination. The interpretation of FE index was made. FE index ≤1.0 (Synergistic); FE index = 1.0 (Additive) and FE index ≥1.0 (Antagonistic). Combinations of plants were studied for synergetic activity between plants. Only four combinations were shown the enhanced activity, which were further coded as CIRG comb 1 to 4.

In CIRG comb 1 in a definite proportion to yield a final effective concentration of as minimum as 1.56 mg/ml of combination, in comparison to MIC of both individual extracts of 3.12 and 12.25 mg/ml. This concentration was found to be capable of inhibiting a $1x10^8$ CFU/ml bacterial population of MDR (multi-drug resistant) *E.coli* by disc susceptibility and broth dilution methods. The preparation exhibited a strong synergy possessing the Mean FE Indices±SE of 0.62±0 for *E.coli*. In CIRG comb 2, definite proportion to yield a final effective concentration of as minimum as 1.0 mg/ml of combination, capable of inhibiting a 1x108 CFU/ml bacterial population of *E. coli*. The preparation exhibited a strong synergy possessing the Mean FE Indices±SE of 0.96±0 for *E. coli*. In CIRG comb 3, an effective concentration of as minimum as 1.0 mg/ml were calculated in a definite ratio of two combinations. This concentration inhibited 1x108 CFU/ml bacterial population of *E.coli* and *S. aureus* isolates of goat, as evaluated by disc susceptibility and broth dilution methods. The preparation is strongly synergistic

possessing the Mean FE Indices±SE of 0.96±0. In CIRG comb 4, minimum effective concentration of 1.0 mg/ml was capable of inhibiting a 1x108 CFU/ml bacterial population of *E.coli* isolates of goat, as evaluated by disc susceptibility and broth dilution methods. The preparation is strongly synergistic possessing the Mean FE Indices±SE of 0.96±0 for *E.coli* isolates. In all cases Paired t-test analysis resulted in the t-value of 0.00 indicating the broad-spectrum anti-bacterial effect of the preparation.

This same study was also conducted for isolated *Staphylococcus aureus*.

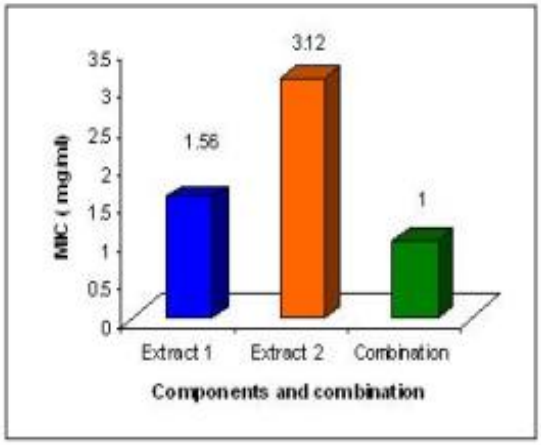
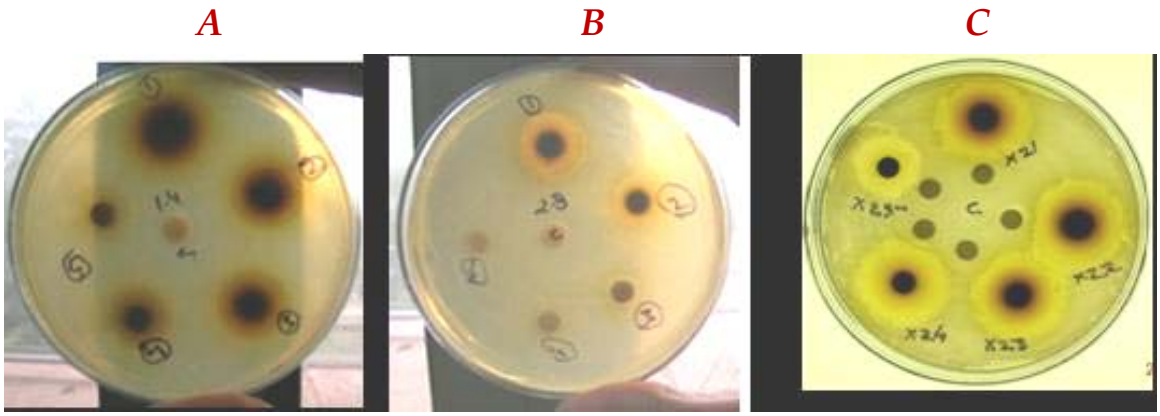


Table 1: Fractional Effect (FE) Indices of the effective synergistic combinations against *E.coli*.

Combinations (coded) Vs	Mean Fractional Effect (FE) Indices			Inference
	FE Index (I)	FE Index (II)	Mean FE Index±SE	
CIRG comb 1	0.62	0.62	0.62±0	Synergistic
CIRG comb 2	0.96	0.96	0.96±0	Synergistic
CIRG comb 3	0.96	0.96	0.96±0	Synergistic
CIRG comb 4	0.96	0.96	0.96±0	Synergistic



Antibacterial effect of individual (A & B) and combined preparation of CIRG 2 (C) combination against E.coli showing synergistic activity

4. Clinical trails of drug powder

The selected prototypes were mixed with gum acacia powder to prepare pulverized powder and tested in clinical cases of diarrhoea kids and goats at the dose rate of 10 mg/kg bwt for 1- 2 days orally and observed degree of recovery (score) and recovery days. In clinical trials, pretreatment values of appetite (Good 1, Low 2, No appetite 3), fecal consistency (Watery 1, Semi solid 2, Loose ball 3, Normal 4) and dehydration (+1, +2, +3, +4) were recorded on score basis. Rectal temperature was recorded in both the

groups. Recovery score recorded as (Poor 1, Partial 2, Moderate 3, and Complete 4. In spontaneous non-specific clinical diarrhea in different age group were treated with antidiarrhoeal formulation with or without antibacterial drug for 1-3 days duration depending upon recovery. In 0-1 Month kid (35), Average recovery percent, Average Recovery days and Average recovery score was 91.0%, 1.2 days, 3.0 respectively; whereas in 1-3 Months kids (22), 86%,1.5 days, 4.0; 3-6 Month kids (5),100%, 2.0 days, 4.0 and in Adult goats (16), it was 87%, 1.5 days and 4.0 respectively. The average recovery per cent was 91.0%, recovery per cent 91.0%, recovery days 1.55 days, with recovery score 3.75.

G.H. 2.1 Control of Brucellosis in goats by Molecular Diagnosis and Epidemiology

V.K. Gupta, S.V. Singh and V.S. Vihan

Isolation of *Brucella* from specimens (Continued activity from previous years)

The following specimens were used for isolation of *Brucella* sp.

Table 1: Isolation of Brucella isolates from different source of goat origin

Specimen	No.	No. of suspected *Brucella* isolates
Milk	15	03
Fetal stomach contents	02	02
Supramammary lymph nodes	02	nil
Total	19	05

A total of 19 suspected *Brucella* isolates were isolated. Theses isolates were further subjected to identification and characterization.

Identification of *Brucella* organisms

PCR-RFLP for molecular typing of *Brucella* culture

A molecular approach, which utilizes DNA polymorphism was utilized. This is the PCR-RFLP analysis of *Brucella omp2* gene. The omp2 gene as a locus of two nearly homologous repeated copies that differ slightly among *Brucella* species and biotypes in presence or absence of the *Pst 1* site to differentiate between them. A total of 19 samples were processed for isolation of *Brucella*. Out of this a total of 05 suspected *Brucella* isolates were isolated. Theses isolates were further subjected to identification and characterization (Table 1).

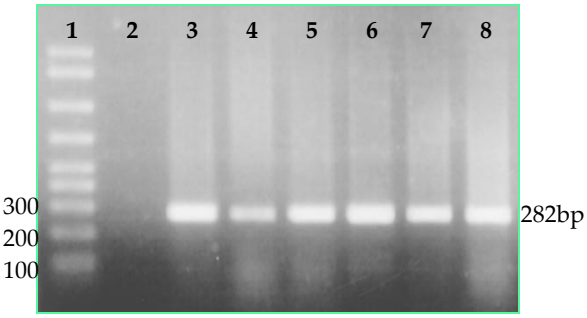


Fig. 1: Agarose gel electrophoresis of PCR-amplified omp2 gene fragments from isolated Brucella strains. The figure shows a single band, a 282-bp DNA fragment. Lanes 1: M, molecular size ladder (in base pairs); 2, negative control; 3 & 4, B. melitensis strain 16M; 5,6,7 & 8, B.melitensis biovar 3

Identification of *Brucella* organisms

Suspected *Brucella* colonies which were close to colonies of contaminants were picked and restreaked on *Brucella* agar medium. After incubation for 4-5 days, the plates were examined for colonial morphology. There Several types of suspected Brucella isolates colonies were seen. Representative colonies of each isolates were selected for further characterization. In most of the cases the

growth was smooth, clear, pale honey-colored appearance. The colonies producing haemolysis on blood agar or lactose fermentation on Mac Conkey agar were eliminated from further consideration as *Brucella*.

Biotyping of *Brucella* cultures

After it was established that out of 05 suspected *Brucella* isolates, only 2 were identified as genus *Brucella* For characterizing the *Brucella* at the biovar level four tests were used: carbon dioxide (CO_2) requirement, production of hydrogen sulphide (H_2S), dye (thionine and basic fuchsine) sensitivity, and agglutination with monospecific A and M antisera. Results are shown in Table 2.

Table 2: Species and biovar differentiation of the species of the genus *Brucella* isolated from goats

Suspected *Brucella* isolates	Source	Growth characteristics					Monospecific sera					Phage typing					Interpretation
		Urea	H_2S	CO_2	BF	TH	A	M	R	Ac	Tb	Wb	BK_2	Fi	Iz	R/C	
PM1	Milk	++	-	-	+	+	-	+			NL	NL	CL	NL	PL	NL	*Brucella melitensis* 16M
PS2	Stomach content	++	-	-	+	+	+	+			NL	NL	CL	NL	PL	NL	*Brucella melitensis* biovar 3

BF = Basic fuchsin at 20µl/ml (1/50,000 w/v); TH = Thionin at 20µl/ml (1/50,000 w/v); Ac = 0.1% acriflavin; CL = Confluent Lysis; PL = Partial lysis; NL = No lysis; Plq = Plaques; NL Some lytic activity observed, but not considered true lysis

Molecular typing

The *Pst*I digestion pattern of the *omp2* amplified gene fragments resembled that of strain 16M, the prototype strain for virulent *B. melitensis* biovar 1, and that of the vaccine strain Rev.1 (Fig. 2). In contrast, the *Pst*I digestion profile of the *omp2a* gene amplified fragments from all other isolates, depicted a reproducible and conserved pattern that was different from that shown for strains 16M and Rev.1 (Fig. 2). It that a genetic link might be established between the prototype strain 16M and the vaccine strain Rev.1.

A total of 05 suspected *Brucella* isolates were isolated and on morphological, biochemical and molecular characterization it was found that the 01 isolates identified as *B.melitensis* 16M strain and 01 isolates were identified as *Brucella melitensis* biovar 3.

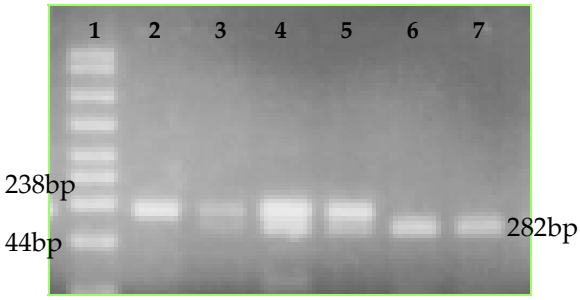


Fig. 2: Agarose gel electrophoresis of restriction digested (Pst I) omp2 PCR product fragments from isolated Brucella strains. Lanes 1: M, molecular size ladder (in base pairs); 2.B. melitensis strain 16M (uncut); 3, 4 & 5, B. melitensis 16M; 6 & 7, B. melitensis biovar 3

Comparison of molecular method (PCR) developed and standardized and compared with the other serological tests available standardization of PCR using different *Brucella melitensis* genes and oligonucleotide primers (Contd. from previous year).

Table 3: Different *Brucella melitensis* genes amplified and their cycle conditions

Cycling condition						
OMP2b	35 cycle	95°C/3min	95°C/20sec	60°C/1min	72°C/1min	72°C/7min
OMP-31	35 cycle	94°C/5min	94°C/1min	58°C/1min	72°C/2min	72°C/2min
BP26	30cycle	94°C/5min	94°C/1min	58°C/1min	70°C/30sec	70°C/10min

Table 4: Genes of *Brucella melitensis* amplified along with the size of PCR product

1.	**OMP2b**	**282bp**
2.	OMP-31	**720bp**
3.	**BP26**	**1029bp**

Table 5: Detection of *B. melitensis* antibodies by serology in goat samples

Location of goats	No. of goats tested	Number of goats positive in				
		m-ELISA	serum-ELISA	SAT	RBPT	Isolation
Field	792	75	69	32	48	ND
Organized farm	224	37	32	16	22	23
Total	**1016**	**112**	**101**	**48**	**70**	**23**

Table 6: Comparative result of serology and milk-PCR in infected (culture positive) and non-infected (culture negative) goats

Goats	m-ELISA			Serum-ELISA			SAT			RBPT			Milk-PCR		
	No.	Sensi-tivity	Speci-ficity	No.	Sensi-tivity	Speci-ficity	No.	Sensi-tivity	Speci-ficity	No.	Sensi-tivity	Speci-ficity	No.	Sensi-tivity	Speci-ficity
Naturally infected goats	21/22	95.45		20/22	90.9		12/22	54.54		15/22	68.18		20/22	90	
Brucella free Goats	1/22		95.5	2/22		90.1	5/22		77.28	4/22		81.82	22/22		100

G.H. 2.3 Development and characterization of indigenous vaccine and diagnostics for Johne's disease

S.V. Singh

Strain: Following studies were carried out with the strain 'S 5' of MAP (Indian Bison Type) of goat origin and maintained at CIRG, Makhdoom. MAP 'S 5' is under continuous passage on HEY medium with mycobactin J, has been cultured to make sufficient quantities of 'Indigenous ELISA kits' and 'Indigenous Vaccine' against Johne's disease. MAP 'S 5' culture was also adopted on Middlebrook 7H12 agar base without Malachite green at six monthly interval. Efforts are on to adopt MAP 'S 5' to Middlebrook 7H9 medium with OADC supplement.

I. IS*900* DNA Sequences Analysis: Amplified products obtained from specific IS*900* PCR of blood samples of cows from Swadeshi Goshala, Singhna, Agra collected before and after vaccination of cows with 'Indigenous Johne's disease Vaccine', were sequenced and analyzed using NCBI Global Blast Search tool. On alignment of IS*900* sequences from DNA of MAP from present study with standard 'S 5' strain of Indian Bison Type' MAP,

95% homology was recorded. However, when compared with fully sequenced 'K 10' strain following results were obtained.

i. **IS*900* Sequence I (cow): This is IS*900* sequence, 100% identical to MAP K10.**

ii. **IS*900* Sequence II (cow): This is IS*900* sequence, 99% identical to MAP K10**

iii. IS*900* Sequence III (cow): This is IS*900* sequence, 98% identical to MAP K10.

iv. IS*900* Sequence IV (cow): This is IS*900* sequence, 99% identical to MAP K10

v. IS*900* Sequence V (cow): This is IS*900* sequence, 100% identical to MAP K10

vi. IS*900* Sequence VI (cow): This is IS*900* sequence, 99% identical to MAP K10

vii. IS*900* Sequence VII (cow): This is IS*900* sequence, 99% identical to MAP K10

viii. IS*900* Sequence VIII (cow): This is IS*900* sequence, 99% identical to MAP K10

ix. IS*900* Sequence IX (cow): This is IS*900* sequence, 99% identical to MAP K10, this isolate represents deletion polymorphisms (SNP) with respect to MAP K10 (in red font). However, this isolate is least polymorphic than all other polymorphic study isolates with respect to MAP K10. It is interesting observation, since IS*900* is highly conserved (variations are very less). It will be interesting to analyze other genomic locations of this isolate also and we may stumble upon interesting polymorphisms.

II. Screening of goats for Johne's disease: Clinically 107 goats (suspected for Johne's disease) from livestock farms of CIRG, Makhdoom, were screened by microscopy for MAP infection and 18 (16.8) goats found positive in microscopy were culled from herd. Breed-wise prevalence of JD was 24.4, 12.5 and 25.0% in the Barbari, Jamunapari and Sirohi breeds of goats located at CIRG, Makhdoom. None of the goats from Jakhrana, Non-descript and Marwari herds were positive for JD, though showing clinical symptoms of JD using microscopic examination. Jamunapari, Jakhrana and Sirohi herds were vaccinated against Johne's disease in 2007. Sex-wise prevalence of JD was 37.5 and 13.1% in male and female goats located in farm herds of CIRG, Makhdoom. Thirty goats were transferred (suspected JD) from livestock herds of CIRG to the experimental shed of Goat Health Division. Screening of these goats by fecal microscopy and serum ELISA, 46.6 and 86.6% goats were positive, respectively. However, in IS*900* blood PCR, none of the goat was positive. Screening of 46 representative goats (Sirohi type) purchased from Nagaur and nearby regions in Rajasthan, 18.7 and 12.5% goats were positive, respectively. None of the goat was positive in blood PCR.

III. Indigenous Johne's Disease Vaccine trials: Of the 9 trials, 8 (6 cattle, 1 goat and 1 sheep) were conducted on 'spontaneous cases of JD (50-75%). Major concern was nutritional status of animals in the trial and animals were under nutritional stress (low to severe).

A. Trials in goats (under low plane of nutrition)

1. Mehsana goats (250) were vaccinated for Johne's disease. All goats above 3 months of age and kids born to vaccinated goats were vaccinated. Of 250 goats, representative 52 (male-15, female-37)

were selected randomly for regular monitoring (vaccinated =37 and control =15) of vaccination response (immune response and body weights gained) and sampled at monthly interval. Vaccinated and control goats were administered one milliliter of Ivermectin (USA) at zero day. Physical condition of goats was poor before start of vaccination trial. Goats were screened by microscopy, indigenous ELISA and blood PCR and 28.0, 43.3 and 7.6% were positive for MAP infection.

Monitoring of goats for vaccine response by microscopy showed that there was gradual reduction in MAP shedders in vaccinated goats as compared to controls where number of goats shedding MAP increased at the end of 5 months. Improvement in shedding status took more time as compared to other parameters recorded for improvement due to vaccination. Therefore shedding status was recorded six months post vaccination. Trend in reduction of shedders was visible before 6 months.

Antibody titer of vaccinated group was up-regulated after vaccination and peaked at 60 DPV and afterwards declined slightly but was still significantly above control group titer. Titer of control group also raised simultaneously with vaccinated group however, it was significantly lower than vaccinated goats at each post vaccination sampling intervals. Up-regulation in control group may be due to injection of Ivermectin in both groups at the time of vaccination. Ivermectin is known for improving immune response (non-specific immuno-stimulator), therefore naturally infected goats after improvements in immune system developed antibody faster resulting rise of MAP antibodies levels. Indigenous ELISA kit used for monitoring do not discriminate between infected and vaccinated goats therefore, assessment of vaccine mediated immune response in already infected goat may be random or unpredictable (Fig. 1).

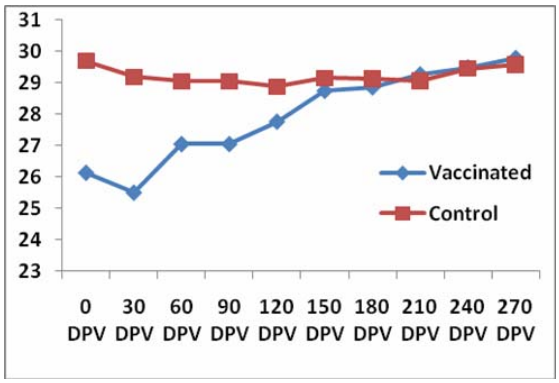


Fig. 1: Average body weights at monthly intervals (0 to 240 DPV)

Body weight is important parameter for recording improvement and evaluating efficacy of the vaccine. Monthly body weights (0 to 270 days post vaccination at monthly intervals) of both vaccinated and control groups were recorded and compared. Statistical analysis of average body weights gained showed gain within 5 months) in vaccinated and control goats were statistically analyzed using unpaired 't Test' with Welch correction by GraphPad InStat 3.0 software. Results showed that vaccinated goats gained significantly higher weights (p=0.038) as compared to controls. Numeric value also indicated that only vaccinated groups gained weight (2.81±0.37kg) while goats in control group lost weight (-0.62±1.69 kg) as compared to body weights on the day of vaccination (Fig. 1).

Physical condition of goats improved after vaccination. Positive effect of vaccine was recorded within 5 months of vaccination using different monitoring parameters. Vaccine was safe as no un-towards reaction was seen in any of the vaccinated

goats. 'Take' was seen as dispersed swelling at the site of injection (neck) and size was large as compared to other goat trials.

Vaccination of new kids and kids born to vaccinated Mehsana goats: Status (physical) of goat kids (born to vaccinated and non-vaccinated goats) before vaccination was not good and many kids were weak. Screening of 64 kid by microscopy, blood PCR and ELISA showed 28.1, 3.1 and 29.6% kids were positive for MAP infection**.** Average body weights of 51 vaccinated and 13 control group kids was 22.49±1.21 & 25.14±1.34 kg before vaccination.

B. Trials in sheep flocks

i. Bharat Merino breed: SRC, CSWRI, Mannavanur, TN: Sheep were given concentrate and 6 hours grazing. Sheep were in good body conditions in general except cases of diarrhea due to JD (confirmed by TANUVAS, Chennai). Sheep (Avikalin and Bharat Merino) were vaccinated in 2008. New Bharat Merino sheep transferred from CSWRI, Avikanagar and next generation (II) of lambs, were also vaccinated. Lambs born to generation II vaccinated ewes were vaccinated in III year of trial (generation III lambs vaccinated).

New lambs (138) were vaccinated in 2010-2011 at SRC, Mannavanur. Vaccination and monitoring of Bharat Merino sheep flock continued by monitoring earlier vaccinated sheep (97 vaccinated, 30 controls) and new sheep (145 vaccinated and 39 control = 184 under experiment) vaccinated on 11-14, Nov., 2010. There was all round improvement (diarrhoea stopped, mortality and morbidity reduced, tupping 100%, fecal shedding reduced). Vaccinated sheep sero-converted and no animal was reported sick. Body weights of sheep showed increasing trend. 'Indigenous vaccine' against JD was 'therapeutic' as clinically sick sheep were cured of JD.

Fecal samples profile for shedding of MAP at zero and 618 DPV showed reduction in shedders both in vaccinated and control groups (trend was better in vaccination group). Improvement in control group was due to reduced contamination of environment (soil and pasture). Control sheep also improved as daily dose of MAP reduced. Reduced shedding by vaccinated sheep helped to reduce environmental contamination and of sheep in control group.

Average body weights gained (within a year of vaccination) in vaccinated and control groups were statistically analyzed. Though difference was not significant however, vaccinated sheep gained more weight as compared to control. Mean of weight gained over one year in vaccinated and control groups were 4.44±0.50 and 3.91±0.85, respectively.

Typing of the MAP using IS*1311* PCR-RE, from Bharat Merino sheep, wild animals (bison) and other domestic ruminants (goats and cow) at Mannavanur showed that all of these animals were infected with 'Indian Bison Type' genotype, which also justified use of 'indigenous vaccine' based on 'S 5' strain of MAP. Of the total flock of 500 sheep, only 13 sheep died of suspected JD in last 4 years and deaths due to other diseases also reduced. JD existed in the flock however incidence was under control due to JD vaccination in last four years. Similarly, morbidity due to JD was also reduced drastically after vaccination. Both the 'Vaccines strain' and MAP genotype prevalent at Mannavanur

and Bharat Merino sheep were homologous, along with better nutrition status of flock may be reasons for 'long time effect of the vaccine'. The 'Indigenous Vaccine' made from strain of goat origin was equally effective in sheep flock also that located in Kodai hills of Tamil Nadu. The positive effect of vaccine was seen up to the 1 year and beyond.

2. Vaccination of new flock of Patanwadi sheep at Dantiwada, Gujarat: Age and sex-wise profile of Patanwadi sheep at Sheep and Goat Research Unit, SDAU, Dantiwada is 132 sheep under different age groups. Sheep flock (132) at Dantiwada was taken under vaccination programme. Screening by microscopy, ELISA and blood PCR revealed, 25.5, 23.3 & 9.7% sheep positive, respectively. Average body weights of **s**heep were, 27.23±1.2 and 28.49±1.78 kg in 112 vaccinated and 22 control groups, respectively at zero DPV.

C. Vaccination trials in cattle (private cow shelters' or goshalas)

i. Golo Gausala: First trial of 'Indigenous vaccine' in 'cattle' was started on 19 cows and calves, of Golo Gaushala. Cows in age groups of 6 months to 5 years (males and females) were suffering from clinical to advance clinical JD. Many cows were suffering from non-treatable diarrhea for more than year. Of the 19 cows, 14 were vaccinated and 5 were in-contact controls. Nine animals were sampled every month for monitoring of vaccine response. Cows were chronic cases of weakness, weight loss, diarrhoea and were also positive for MAP infection. Vaccinated and control cows were mixed and kept under similar management conditions. In microscopy all the animals were shedding MAP in feces. In blood PCR and ELISA, 31.5% cows were positive. Screening of representative cows by 3 tests exhibited that none of the cow was negative in all 3 tests and was also showing clinical symptoms of disease.

There was marked overall improvement in body condition of cows 4-5 months after vaccination as compared to controls. With improvement in physical condition and cows were relieved of their clinical symptoms (loose feces, diarrhoea and weakness). Body coat regained luster, shining, pliability, regeneration of hairs and eyes were shining bright in vaccinated cows. All the vaccinated animals developed good 'take' of the vaccine and was retained up to 360 days.

Humoral immune response was measured using indigenous ELISA kit on the serum samples collected from nine representative animals (7 vaccinated and 2 control) before and every one month post vaccination. In vaccinated group peak titer was achieved around 90 days post vaccination in majority of sheep, which declines afterwards. In control group, slight increase in antibodies titer was also seen (Fig. 2) Ability of the peripheral blood mononuclear cells (PBMCs) to recognize and respond to MAP antigen was investigated up to 4 months post vaccination. PBMCs of vaccinated group had greater "Stimulative Index" (SI) when pulsed with protoplasmic antigen from native MAP strain than 'Control' group.

Indigenous Vaccine' was 'therapeutic' having effect upto 10 months at dose rate of 2 ml per cow. Effect of vaccine was not sustained after 10 months. Dose of vaccine 2 ml was not sufficient for cows in advance stages of JD. Good 'take' shown by cows proved MAP infection and was retained by all of the cows till 12 MPV. Of

the 9 cows monitored for vaccine response, six cows had infection with 'Indian Bison Type', genotype, which justified use of 'Indigenous Vaccine' of goat origin for control of JD in cows. Despite lower dose of vaccine, it was effective and was 'therapeutic'. After giving booster vaccine, 3 of the 4 positive cows became negative in blood PCR within 60 days. The status of two earlier vaccinated cows remained same for next 60 days which were not given booster. The two control cows maintained same status (one each negative and positive) for next 60 days. All the 4 cows given booster, exhibited rise in s/p ratio in ELISA (increase in titer or sero-conversion), which was slow and cows retain same category for next 60 days in s/p ratio except one cow, which became strong positive (SP) from positive category (sero-converted). Status of 2 earlier vaccinated and not given booster remained same. One cow showed slight increase in titer. Of the two control cows, titer remained same in these 60 days. Of the 4 cows given booster, all showed decrease in shedding rate for next 60 days, whereas, 2 earlier vaccinated cows maintained similar status (one shedder and one non-shedder). Two control cows maintained same status (both shedder, +1 and +2). There was no change in status of 3 cows given booster (one each, +2, +3 and negative) and two control cows (one each, +2 and negative) in 60 days post vaccination. Of 3 vaccinated cows, 2 retained similar status in blood PCR (one negative and one positive) and only one cow became negative in 60 DPV. Control cows also retained same status in blood PCR (one positive and one negative) for next 60 DPV. The vaccinated cows (two positives and one low positive) and control (one positive and one low positive), retained similar status for next 60 DPV.

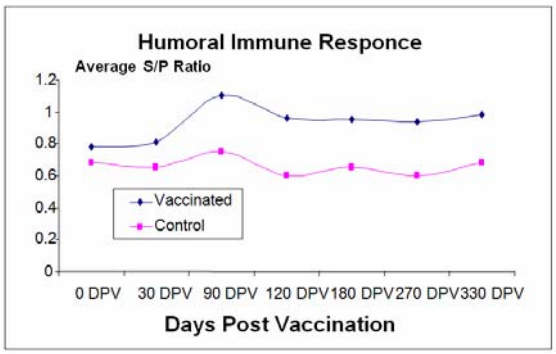


Fig2: Humoral immune response of representative animals pre and post vaccination

2: Swadeshi gaushala: The 158 cows of both sexes from Swadeshi gaushala (cow herd), Sighna were included in Vaccine Trial II. Cows suffered from JD (sub-clinical to clinical) and were on sub-optimal or low plane of nutrition (grazing in waste land with little concentrate and wheat straw). Of 158 cows, 38 were calves (3 months to 1year) and 120 were adults (>1year of age). Cows were divided in vaccinated and control groups. Of the 158 cows, 128 (35 calf and 93 adult) were vaccinated with 'Indigenous JD Vaccine' and 30 (3 calf and 27 adult) were kept as controls. Vaccinated and control cows were kept together.

Body condition and physical appearance of vaccinated animals improved as compared to controls. Microscopy of fecal samples from representative vaccinated cows (calf-5, adult- 22) and controls (calf-3, adult-4) was done before and after vaccination at monthly interval. Microscopy of representative 43 (27 vaccinated and 7 control), before vaccination revealed, 61.7% cows positive and were shedding MAP (Clinical shedders) in feces, confirming existence of clinical JD and in other stages. Cows

positive for MAP at zero day were higher in vaccinated group (62.9%) as compared to controls (57.1%). After 5 months of vaccination, there was reduction in shedding of MAP in vaccinated cows (33.3%). In controls number shedders increased (85.7%).

In 'Bovine trial II, 5 calves died (2 vaccinated and 3 controls) in beginning of experiment, had marked lesions (corrugation in small intestine mainly at ileocaecal junction and enlargement and edema mesenteric lymph nodes) suggestive of JD. Typical AF bacilli indistinguishable from MAP were demonstrated in impression smears of lesions. Microscopic lesions of intestine were desquamation, sloughing, marked fusion degeneration and necrosis of the intestinal villi with proliferation of mucosal glands. Infilteration of lymphocytes was also observed frequently. **P**resence of MAP was confirmed by tissue PCR and all five ca;ves were positive when intestinal tissues were screened by IS*900* PCR.

Govind Gaushala: The 680 cows of Govind Gaushala, Akrur, Vrindavan were included in the vaccine study. Body condition was variable (healthy to weak, debilitated and emaciated). Physically majority of cows were sub-clinical to clinical JD. Cows **(**total 680: 41 calves and 639 adult**)** were randomly divided in vaccinated and control groups. Of 680 cows, 532 (31 calves and 501 adults) were vaccinated (indigenous vaccine) and 148 (10 calves and 138 adults) were controls. Representative cows were regular monitoring and sampled. Cows under trial were ear tagged for identification. Body conditions of cows monitored and samples was noted on zero, 30 and 90 days post vaccination (DPV). Fecal and blood samples were collected at zero day and screened by microscopy, blood PCR and indigenous ELISA kit for monitoring of MAP status. At 30 DPV only ELISA and at 90 DPV ELISA and Blood PCR were done. Of 121 blood, 63 serum and 103 fecal samples screening at zero day, 42.2, 54.0 and 28.2% was prevalence of MAP by microscopy, ELISA and blood PCR, respectively.

Schedule for monitoring MAP shedding in feces was fixed at six months post vaccination. ELISA was performed at 30 and 90 DPV. Blood-PCR was done at 90 DPV. Comparison of ELISA titer at 0, 30 and 90 DPV, vaccine mediated immune response peaked at 90 DPV, whereas at 30 DPV there was no difference. Both vaccinated and control cows had up-regulated anti-MAP antibodies level as compared to titer at 0 DPV. Results of blood-PCR showed possible restriction of MAP presence in main blood stream. About 7.8% reductions were recorded in vaccinated cows, whereas there was slight increase of MAP bacterimia after vaccination (at 90 DPV) in control cows.

Vaishnav Gaushala: Of 28 vaccinated, 23 and 5 were cows and calves (all females), respectively. The 8 control included 5 cows and 3 calves. In total, there were 28 cows and 8 calves (5 males and 31 females). There was significant reduction in shedders in vaccinated animals as compared to control group. All vaccinated cows became negative in blood PCR within 120 days of vaccination and were negative for next 90 DPV. The control animals maintained similar status. Initially vaccinated cows sero-converted within 120 DPV but the titer of the vaccine slightly decreased at 210 DPV. In control

gropus the status of ELISA titer remained same.

Validation of 'Indigenous ELISA kit' for the diagnosis of Ovine Johne's disease: The 'indigenous ELISA kit' was validated for screening of sheep against Ovine Johne's disease. Wherein, 15 sheep were monitored clinically (fecal microscopy, blood PCR and ELISA) and at necropsy (microscopy and PCR of MLN and intestine). Results show perfect correlation of 'Indigenous ELISA test with status of Johne's disease in sheep.

ICAR-Network project-Veterinary type culture-veterinary microbes

V.K. Gupta, K. Gururaj (upto Sept 2010), and Manjunath Reddy, G.B. (w.e.f. Sept 2010)

Isolation of *Staphylococcus* spp. from cases of clinical and sub-clinical mastitis

In the study a four month period of lactation was selected and milk samples were collected for screening Intra-mammary infection in different dairy goats. During the four month period, different does were selected randomly and collected milk to check the presence of subclinical mastitis using direct microscopic Somatic cell count (SCC). Direct Microscopic SCC was taken as an indicator of mastitis along with the presence of pathogenic microbes in the milk. During this study 14 different isolates belonging to various groups of *Staphylococcus* spp. were isolated and characterized. All these isolates of *Staphylococcus* spp. were characterized using certain biochemical tests like Modified oxidase test and O-F test for glucose to differentiate with similar Micrococcus spp. and Slide coagulase test with Rabbit plasma, Hemolysis test on 5% sheep blood agar and growth on Mannitol salt agar. After screening with Biochemical tests, the isolates were confirmed using genus specific marker gene of region of Elongation factor (Tu) "T*uf*" gene, to obtain a PCR amplicons of size 370 bp. Based on the biochemical and molecular tests, the isolates were classified as *Staphylococcus aureus.*

Staphylococcus spp – Coagulase positive

Coagulase negative *Staphylococcus* spp. (CNS)

Isolation of *E.coli* from a clinical case of neonatal diarrhea

Fecal swab was collected from a kid suffering with acute neonatal diarrhea. Primary culture was done on Blood agar and macConkey's agar simultaneously. The colonies were circular, pink, convex, mucoid and medium to large in size. The lactose fermenting colonies, were tested for Nitrate reduction, oxidase and catalase tests. Microscopically on Grams staining, it appeared as gram negative cocco-bacilli. On EMB it appeared as colonies with "metallic sheen.'Biochemical tests like IMViC tests and TSI tests were also done. It was positive for Indole production and methyl red tests, whereas negative for Voges proskauer and Citrate utilization, and TSI gave acid butt acid slant with gas production. Sugar fermentation tests were done, and it fermented, Mannitol, Arabinose, Salicin, Sorbitol, Glucose with gas and Rhamnose.

Molecular characterization was done primarily by using species specific marker, Universal stress protein A gene (*usp*A), which produced an amplified product of size 884 bp. Later it was tested for enteropathogenicity by using the

Bundle forming pilus gene (*bfp*A), by using PCR amplification which generated a 326 bp product.

Classical biotyping of *Brucella* cultures

It is important to establish species and biovar of *Brucella* isolates. Species identification was done based on two main sets of properties: lysis by phages and oxidative Metabolic profile on selected amino acid and carbohydrate substrates. For characterizing the *Brucella* at the biovar level four (04) main tests were used: carbon di oxide (CO_2) requirement, production of hydrogen sulphide (H_2S), dye (thionine and basic fuchsine) sensitivity, and agglutination with monospecific A and M antisera.

The characteristics of *Brucella* isolates as revealed by the routine typing tests are presented in Table 1. There are a large number of bacteriophages active upon members of the genus *Brucella*, that have not been shown to lyse bacteria of other genera and thus are of taxonomical value for identification at both genus and species level. In present study important phages like Tb, Wb, Bk2, Fi, Iz were used for phage typing (Table 1).

Table 1: Biochemical characteristics of the *Staphylococcus* spp. isolates obtained from lactating does

S. No.	Isolate No.	Species	Slide Coagulase test	O-F test for Glucose	Hemolysis	Colony pigment
1	St/2A/CIRG	*Staphylococcus* spp.	Negative	F	NH	Yellow
2	St/2B/CIRG	*Staphylococcus* spp.	Negative	F	NH	Yellow
3	St/2C/CIRG	*Staphylococcus aureus*	Positive	F	α	Yellow
4	St/2E/CIRG	*Staphylococcus aureus*	Positive	F	β	Yellow
5	St/29A/CIRG	*Staphylococcus* spp.	Negative	F	NH	Yellow
6	St/82C/CIRG	*Staphylococcus* spp.	Negative	F	NH	White
7	St/84B/CIRG	*Staphylococcus aureus*	Positive	F	NH	Yellow
8	St/195D/CIRG	*Staphylococcus* spp.	Negative	F	β	Yellow
9	St/198A/CIRG	*Staphylococcus* spp.	Positive	F	β	White
10	St/249A/CIRG	*Staphylococcus aureus*	Positive	F	α	Yellow
11	St/249B/CIRG	*Staphylococcus aureus*	Positive	F	α	Yellow
12	St/276C/CIRG	*Staphylococcus aureus*	Positive	F	β	Yellow
13	St/345B/CIRG	*Staphylococcus aureus*	Positive	F	NH	Yellow
14	St/345C/CIRG	*Staphylococcus aureus*	Positive	F	NH	Yellow

Molecular typing: The *Pst*I digestion pattern of the *omp2* amplified gene fragments resembled that of strain 16M, the prototype strain for virulent *B. melitensis* biovar 1, and that of the vaccine strain Rev.1 (Fig.). In contrast, the *Pst*I digestion profile of the *omp2a* gene amplified fragments from all other isolates, depicted a reproducible and conserved pattern that was different from that shown for strains 16M and Rev.1 (Fig.). This suggests that a genetic link might be established between the prototype strain 16M and the vaccine strain Rev.1.

Omp2 gene was used as a locus of two nearly homologous repeated copies that

differ slightly among *Brucella* species and biotypes in presence or absence of the *Pst 1* site to differentiate between them. The PCR test was performed with all 06 *B. melitensis* biovars isolated from goats. The PCR technique has increasingly been used as a supplementary method in *Brucella* diagnosis. We have used a molecular biotyping approach which has been proposed on the basis of restriction endonuclease polymorphism in the genes encoding the major 25- and 36- KDa outer membrane proteins of *Brucella i.e.* omp2.

The PCR was first performed to test the specificity by *Brucella* species. A single band with the expected size of 282 bp was obtained only when *Brucella* DNA was used as a template. All other bacterial strains and a water sample failed to produce an amplified fragment (data not shown). The *omp 2* gene exists as a locus of two nearly homologous repeated copies (*omp2a* and *omp2b*) that differ slightly among *Brucella* spp. The information was used to design specific primers that amplify a 282-bp fragment (Fig. 1), flanking upstream sequences of the 5 terminus of the two genes (*omp2a* and *omp2b*) and expanding downstream of the *Pst I* sites. Moreover, because of the existing *Pst I* site polymorphism between brucella strains, the test distinguishes between the strains of *Brucella melitensis*. The results revealed that DNA fragments obtained from two isolates from goats identified as *B. melitensis* 16M strain which produce three bands, an intact 282-bp fragment from the amplified *omp2a* gene that lacks the *Pst I* site and two smaller fragments of 238 and 44 bp, the product obtained from digestion of the omp2b amplified fragment.

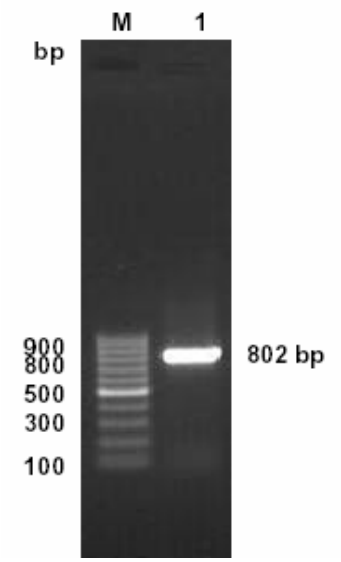


Fig. 1: Amplification of lysin (endolysin) gene of Staphylococcus aureus phage: Lane M: 100 bp DNA ladder, Lane 1: Lysin gene

The results obtained from these tests showed that one isolate identified as *B.melitensis* biovar1 and 01 isolates were identified as *Brucella melitensis* biovar 3 on the basis of classical and molecular biotyping. The profiles of the digested PCR products DNA were analyzed by agarose gel electrophoresis (Fig. 2).

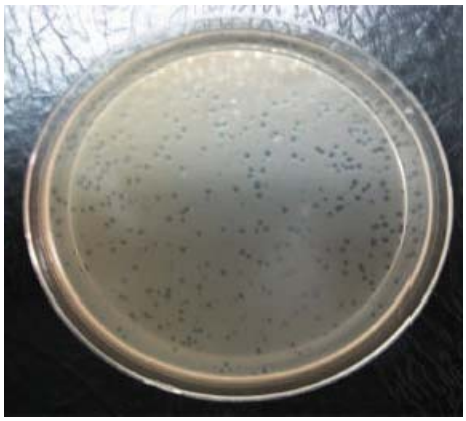


Fig. 2: Plaques produced by Staphylococcus aureus phage against indicator Staphylococcus aureus

Isolation of bacteriophage *of Staphylococcus aureus*

100 ml of sterilized BHI broth in flat bottom flask is inoculated with 5 ml of 18 hr pure broth culture of indicator

Staphylococcus aureus isolate and incubated at 37°C for 3hr. To flask containing the young culture, sufficient quantity of the stock suspension of *Staphylococcus aureus* phage (1ml) was inoculated. The phage bacteria mixture is incubated at 37°C with vigorous intermittent shaking until complete lysis (approximately 3 hr) was observed. The bacterial lysate of the phage is filtered through 0.22 µ membrane filter (Millipore) and collected aseptically in sterile bottle. The stock is stored at 4°C for 1 month to eliminate residual lytic activity attributed to phage-induced enzymes.

Propagation of *Staphylococcus aureus* phage by soft agar wash method

Confluent lysis by phage is obtained in soft (0.70% agar with 0.098% $MgSO_4$ heptahydrate) nutrient agar overlayon hardened nutrient agar plate. 10 µl of the phage stock is mixed with 200 µl of 16 hr incubated pure *Staphylococcus aureus* broth culture in 3 ml of molten soft agar. The phage-bacteria mixture is vortexed and content immediately poured on plate containing hardened Nutrient agar plate. After overnight incubation at 37°C, there will be complete lysis. The phage is harvested with SM diluent (2 ml/plate), gross agar shreds are removed by slow speed centrifugation and the supernatant is filtered through 0.22 micron membrane filter. The phage suspension could be kept at 4°C for longer duration (years together). The lytic activity of the phage can be shown by spot inoculation test. 3 µl of the bacteriophage suspension is put on the lawn culture of the test organism and kept at 37°C.After 4-6 hr of incubation, the lysis will be observed indicating *in vitro* lytic activity.

Fig. 3: Lysis of indicator Staphylococcus aureus by Staphylococcus aureus phage

Propagation of *Staphylococcus aureus* phage by conventional liquid culture method

100 ml of sterilized BHI broth in flat bottom flask is inoculated with 5 ml of 18 hr pure broth culture of indicator *Staphylococcus aureus* isolate and incubated at 37°C for 3hr. To flask containing the young culture, sufficient quantity of the stock suspension of *Staphylococcus aureus* phage (1ml) was inoculated. The phage bacteria mixture is incubated at 37°C with vigorous intermittent shaking until complete lysis (approximately 3 hr) was observed. The bacterial lysate of the phage is filtered through 0.22 µ membrane filter (Millipore) and collected aseptically in sterile bottle. The stock is stored at 4°C for 1 month to eliminate residual lytic activity attributed to phage-induced enzymes.

Propagation of *Staphylococcus aureus* phage by soft agar wash method

Confluent lysis by phage is obtained in soft (0.70% agar with 0.098% $MgSO_4$ heptahydrate) nutrient agar overlay on hardened nutrient agar plate. 10 µl of the phage stock is mixed with 200 µl of 16 hr incubated pure *Staphylococcus aureus* broth culture in 3 ml of molten soft agar. The phage-bacteria mixture is vortexed and content immediately poured on plate

containing hardened Nutrient agar plate. After overnight incubation at 37°C, there will be complete lysis. The phage is harvested with SM diluent (2 ml/plate), gross agar shreds are removed by slow speed centrifugation and the supernatant is filtered through 0.22 micron membrane filter. The phage suspension could be kept at 4°C for longer duration (years together). The lytic activity of the phage can be shown by spot inoculation test. 3 µl of the bacteriophage suspension is put on the lawn culture of the test organism and kept at 37°C. After 4-6 hr of incubation, the lysis will be observed indicating *in vitro* lytic activity.

Table 2: The Protocol (cycles) used for amplification of "T*uf*" gene-primer

Step's	Stage	Cycles	Temperature	Time
1st step	Initial denaturation	One cycle	94°C	5 min
2nd step	Denaturation	34 cycles	94°C	1min
3rd step	Annealing		62°C	2 min
4th step	Extension		72°C	2 min
5th step	Final extension	One cycle	72°C	10 min
6th step	Cooling	-	4°C	1hr.10min

5th step go to step 2nd 34 time.

Table 3: Species and biovar differentiation of the species of the genus *Brucella* isolated from goats

Suspected *Brucella* isolates	Source	Growth characteristics					Monospecific sera					Phage typing					Interpretation
		Urea	H_2S	CO_2	BF	TH	A	M	R	Ac	Tb	Wb	BK_2	Fi	Iz	R/C	
BME/3/ CIRG	Fetal membrane	++	-	-	+	+	-	+			NL	NL	CL	NL	PL	NL	*Brucella melitensis* biovar1
BME/4/ CIRG	Stomach content	++	-	-	+	+	+	+			NL	NL	CL	NL	PL	NL	*Brucella melitensis* biovar3
BME/5/ CIRG	Stomach content	++	-	-	+	+	-	+			NL	NL	CL	NL	PL	NL	*Brucella melitensis* biovar1
BME/6/ CIRG	Stomach content	++	-	-	+	+	-	+			NL	NL	CL	NL	PL	NL	*Brucella melitensis* biovar1

BF = Basic fuchsin at 20µl/ml (1/50,000 w/v); TH = Thionin at 20µl/ml (1/50,000 w/v); Ac = 0.1% acriflavin; CL = Confluent Lysis; PL = Partial lysis; NL = No lysis; Plq = Plaques; NL Some lytic activity observed, but not considered true lysis

Outreach programme on zoonotic diseases- Zoonotic potential of Mycobacterium avium subspecies paratuberculosis, as the cause of inflammatory bowel disease (Crohn's disease) in human beings

S.V. Singh

A. The strain: Following studies were carried out using the strain 'S 5' of *Mycobacterium avium* subspecies *paratuberculosis* ('Indian Bison Type') of goat origin maintained at CIRG, Makhdoom and used for making Indigenous 'ELISA kits' and vaccine.

i. **Maintenance and Passage**: *Mycobacterium avium* subspecies *paratuberculosis* (MAP) 'S 5' is under continuous passage on HEY medium with mycobactin J. MAP strain has been cultured to make sufficient quantities of 'Indigenous ELISA kits' and 'Indigenous Vaccine' against Johne's disease.

B. Screening of primates (monkeys) for the presence of MAP infection: Stool

samples of monkeys were collected in Nov, 2010 and Feb, 2011 from Vrindavan and Mathura, respectively. Monkeys in Vrindavan are reported to be suffering with chronic weakness, cough and emaciation. Of the 92 stool samples screened by microscopy, 30 (32.6%) were positive on +1 to +4 scale. Of the 19 positive stool samples processed by IS*900* PCR, 2 (6.6%) were positive for MAP. Further genotyping of MAP DNA by IS*1311* PCR_RE, revealed presence of 'Indian Bison Type' (a major genotype reported from animals), which indicated sharing of MAP between animals and non-human primates (Table 1 and 2).

Table 1: Screening of monkeys stool samples for presence of MAP

Place Mathura	Stool samples (*n*)	Microscopy	IS*900* PCR
		Positives *n* (%)	**Positives *n* (%)**
Vrindavan	43	19 (44.1)	2 (10.5)
Gaushala Nagar	44	11 (25.0)	Under Process
CIRG	5	0 (0)	0 (0)
Total	**92**	**30 (32.6)**	**2 (6.6)**

Table 2: Comparative status of stool samples in microscopy and IS900 PCR.

Status of MAP shedding	No. of Samples	IS*900*PCR
1+	18	0
2+	9	1
3+	2	1
4+	1	0
Negative	62	ND
Total	**92**	**2**

C. Profile of human samples: Randomly, 5051 human beings (Agra: 1882, Mathura: 3148) were screened for the presence of MAP infection. Of 5051 human beings, 5173 samples (2705 serum, 2438 blood and 30 stool samples were collected from Agra (serum 507, blood- 1437, stool – 23, Total, 1967) and Mathura (serum-2178, blood-1000, stool – 7, Total, 3185) in 105 visits to 17 diagnostic laboratories (Agra-11 and Mathura-6) between 23, Dec, 2010 and 12, April, 2011 (total 109 days). Human beings from Farah (14) and Varanasi (7) were also screened, wherein 21 serum, 20 blood and 1 stool samples were collected (Table 3).

Screening of human samples for the presence of MAP infection by IS*900* blood PCR and indigenous ELISA kit: Serum samples were screened by indigenous 'ELISA kit', wherein samples in positive and strong positive categories (S/P ratio) were considered positive. Sero-presence of MAP was recorded as 25.1% (681 positive of 2707 serum samples). Region wise sero-presence was, 15.7, 27.0, 53.8 and 85.7% in Agra, Mathura, Farah and Varanasi, regions, respectively. However, on the basis of screening of 657 blood samples by IS*900* PCR, 51 (7.7%) were positive for MAP infection. Screening of 415 and 241 blood samples, 34 (8.1%) and 17 (7.0%), were positive for presence of MAP from Agra and Mathura, respectively (Table 3).

Blood and serum samples collected from human beings usually belonged to different persons. However, in 159 cases,

both blood and serum were available. Screening of 159 serum revealed, 22.6% (Agra-21.4% and Mathura- 25.0%) sero-presence of MAP, whereas, of 65 blood samples, 7.6% were positive (Agra- 2.9% and Mathura- 14.2%), in IS*900* PCR (Table 4).

Table 3: Presence of MAP infection by IS*900* blood PCR and indigenous ELISA kit

District	Blood PCR*			Indigenous ELISA kit		
	Samples *n*	Samples processed	Positives *n* (%)	Samples *n*	Samples Processed	Positives ** *n* (%)
Agra	1437	415	34 (8.1)	507	507	80 (15.7)
Mathura	1000	241	17 (7.0)	2178	2178	588 (27.0)
Farah	1	1	0 (0)	13	13	7 (53.8)
Varanasi	0	0	0 (0)	7	7	6 (85.7)
Total	**2438**	**657**	**51 (7.7)**	**2705**	**2705**	**681 (25.1)**

*Expected presence of MAP in blood samples; **Strong positive and positive (S/P ratio) were taken as positive for MAP infection

Table 4: Screening of individuals for MAP infection both by blood PCR & indigenous ELISA kit

District	Persons sampled	Blood PCR		Serum ELISA	
		Samples Processed (*n*)	Positives *n* (%)	Samples processed (*n*)	Positives *n* (%)
Agra	107	37	1 (2.9)	107	23 (21.4)
Mathura	52	28	4 (14.2)	52	13 (25.0)
Total	**159**	**65**	**5 (7.6)**	**159**	**36 (22.6)**

Correlation between clinical profile and status of MAP in human samples: Correlation between clinical profile (infectious and non-infectious) for which samples were submitted and sero-statu of MAP was investigated. Besides Inflammatory Bowel Disease (IBD)/ Crohn's disease (CD), MAP was associated with other health problems, juvenile diabetes (Table 5) etc.

Correlation between profile of samples and status of MAP by PCR: Following Table (6) shows correlation between clinical profile (infectious and non-infectious) and status of MAP by PCR. MAP was found to be associated with diabetes (4.2%) and liver disorders (8%).

Age-wise presence of MAP: Correlation between age profiles and status of MAP showed that >40 yr age group was most sensitive to MAP Infection. Limited studies showed that except in 13 to 18 yr age group, moderate to higher level of MAP in all age groups (especially above 40) by ELISA and blood PCR Table (7).

Table 5: Age-wise presence of MAP

Age group (Yr)	ELISA kit		Blood PCR	
	Samples Processed (*n*)	Positives (*n*) (%)	Samples Processed (*n*)	Positives (*n*) (%)
0-12	4	1 (25.0)	41	2 (4.8)
13-18	6	1 (16.6)	16	0 (0.0)
19-40	91	13(14.2)	23	4 (17.3)
>40	21	8 (38.0)	70	3 (4.2)
Total	**122**	**23 (18.8)**	**150**	**9 (6.0)**

Screening of stool samples: Screening of stool by microscopy and IS*900* PCR, showed 2.9% were positive for acid fast bacilli indistinguishable to MAP.

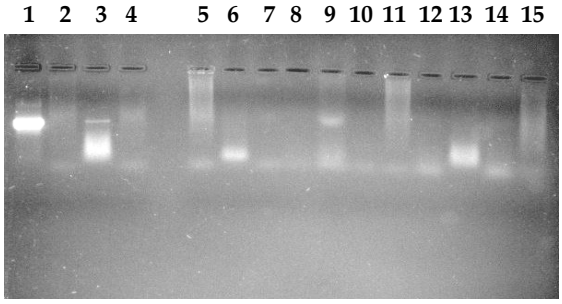
Table 6: Screening of stool by microscopy and IS*900* PCR

Region	Stool samples (n)	Positives n (%)	
		Microscopy	IS900 PCR
Agra	23	1 (4.3%)	Under Process
Mathura	11	0 (0%)	Under Process
Total	**34**	**1 (2.9)**	

Comparison of Indigenous ELISA kit and blood PCR: Comparison between ELISA and PCR, showed that of 65 humans screened by two tests, most (41.5) of the samples were positive by 'Indigenous ELISA'.

Genotyping of MAP DNA: Genotyping of 5 MAP DNA by IS*1311* PCR-RE showed the presence of 'Bison type' genotype, only.

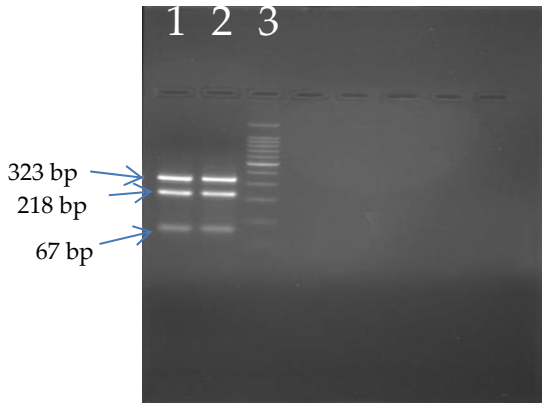
IS 900 PCR:



Lane 1: Positive control, Lane 2: 3714, Lane 3: 2989(+), Lane 4: 3001, Lane 5: 2983, Lane 6: 2992, Lane 7: 5090, Lane 8: 2345, Lane 9: 2062, Lane 10: 3363, Lane 11: 2991, Lane 12: 5091, Lane 13: 3005, Lane 14: 5087, lane 15: 3342

1.4. Screening of non-conventional hosts (Peacock, Horse and Rabbit) for the presence of MAP: Of 14 peacock and horse fecal samples screened, 42.8% and none were positive by microscopy and PCR, respectively. Of 53 rabbits at Mannavanur centre (TN) screened, 15.1 and 7.4% samples were positive in microscopy and IS*900* PCR.

Genotyping: *IS* 1311 REA



Lane 1: Sample No 2989, Lane 2: Positive Control, Lane 3: 50 bp mass ruler
Genotyping by PCR IS 1311-REA showed the presence of Indian Bison type genotype

Table 7: Detection of MAP in Rabbit fecal samples in year 2009, 2010 and 2011

Sampling *n*/ date	Positives	
	Microscopy	IS 900 PCR
24 Sept, 2009	1+ = 5	Negative
	2+ = 8	Positive (n = 1)
	3+ = 3	Negative
	4+ = 2	Positive (n = 1)
27 Nov, 2010	1+ = 0	Negative
	2+ = 1	Positive (n = 1)
	3+ = 0	Negative
	4+ = 1	Positive (n = 1)
26 March, 2011	1+ = 6	Positive (n = 2)
	2+ =0	Negative
	3+ =0	Negative
	4+ =0	Negative
77	26	Positive - 6

Screening of commercial pasteurized milk for the presence of MAP: Screening of 6 commercial pasteurized milk samples

(2 each from Amul, Vita and Mother dairy) collected on 2.11.2010 and 2.3.2010 from Faridabad, none of the sample was positive in microscopy, ELISA or IS*900* PCR.

Screening of Abiotic Environmental samples

Screening of water for presence of MAP: A total of 20 water samples were collected from river Yamuna and Chambal, from three districts (Etawah, Agra and Mathura) of North India and screened for the presence of MAP using microscopic examination and direct IS*900* PCR. Of 13 Yamuna water samples, 6 (30.0%) and 2 (10.0%) were positive for MAP by microscopy and IS*900* PCR, respectively. MAP present in the Yamuna river samples were genotyped as 'Indian Bison Type' using IS*1311* PCR–REA.

NAIP: Achieving improved livelihood security through Resource conservation and diversified farming system approach in Mewat

D.K. Sharma and P.K. Rout

Under the project, 50 farmers of 5 villages (Badarpur, Maroda, Singhalhedi, Jharpadi and Chhapera of Mewat region (Cluster II) were identified and selected for goat rearing. These selected farmers in village were distributed 3 goats each farmer along with 2 bucks of superior germplasm in each village. All the distributed goats and their offspring were vaccinated, dewormed and dipped for control of ectoparasite infestation before distribution. During year 2010-11, four animal camps were organized in adopted villages and operations like vaccination (95), deworming (63) and treatment (42) were conducted. The farmers were distributed supplementary ration (75 quintals) for the goat feeding. The data on production and reproduction of goats was recorded over the year. The population growth of goats varied from 28-42% during the year. The kidding rate of 1.05-1.375 per animal was observed. The recording of milk revealed that Jakhrana milk yield was unto 3 liter/day.

Pilot Project: Pathology of Neurological diseases in goats and sheep

Shivasharanappa N, V.K. Gupta and Ashok Kumar

A total of 52 goat and 32 sheep brain samples (84) collected from post-mortem cases and goats slaughtered in goat production technology laboratory during the period of May 2010 – March 2011. The objective of this project is to study the incidence and pathology of neurological diseases in goats and sheep. Gross examination of brain samples revealed lepto-meningeal congestion in majority of the cases 34 goat brains, 65.38%; 15 sheep brains, 46.87% one case of *Ostrus ovis* in Sirohi goat (1.19%) and other brain samples did not show any gross lesions. A total of 14 (11 goat and 3 sheep) brains were processed for histopathology to record the microscopic lesions at different neuro-anatomical sites in the brain such as thalamus, hypothalamus, cerebrum, hippocampus, cerebellum, medulla oblongata, pons, cerebral peduncles and spinal cord.

Out of 14 brain samples processed the prominent change in the goat brain was vascular congestion in the grey matter, followed by degenerative changes in the neurons at different anatomical sites. The less frequent lesions noticed were lepto-

meningitis, vascular wall thickening, and multifocal hemorrhages in the grey matter, focal to diffuse gliosis, perivascular infiltration of mononuclear cells and edema at many sites. One interesting case of parasitic encephalitis which was characterized by tubular hemorrhagic tracts with the severe necrosis of cerebral hemisphere was documented. This was further confirmed as *Oestrus ovis* larvae infection by the microscopic examination of larva which revealed characteristics of 'D' shaped, closed, dark black coloured, stigmal plates with radially arranged respiratory holes.

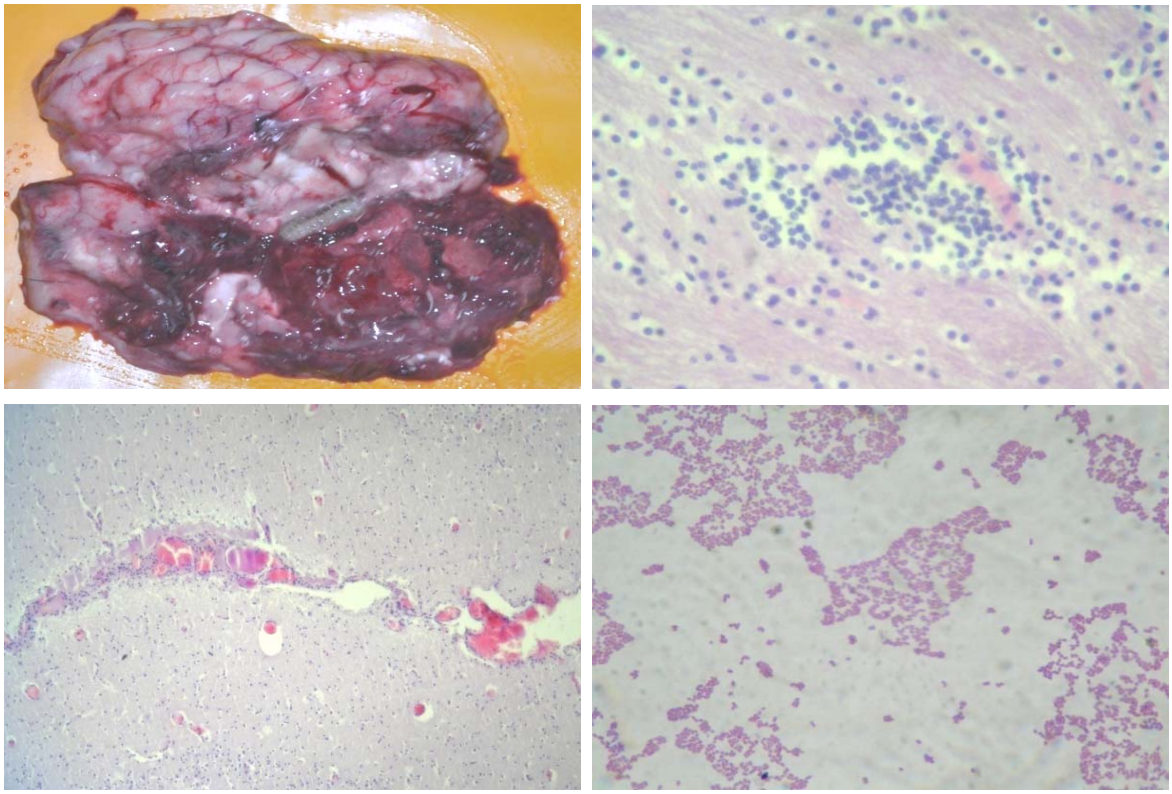


Fig. 1 to 4: Parasitic encephalitis caused by larvae of Oestrus ovis in goat, diffuse gliosis in brain, oedema and hemorrhage in the leptomeninges of brain and Listeria monocytogenes Gram's positive cocco-bacilli isolated from brain

The attempts were made to isolate listeria from above samples of brain, blood and veginal swabs by US Department of Agriculture (USDA), as described by McClain and Lee (1988) *i.e.*, UVM method of isolation. Among 24 blood and 14 vaginal swab samples from goats only one blood sample and among 21 brain samples from goats 6 were positive for listeria by their cultural and morphological characters. The characteristic black to grayish, small pointed, about 0.5mm diameter surrounded by black zones were observed on PALCAM agar after streaking of UVM enriched culture. These were further confirmed by Gram's staining which revealed Gram positive coco-bacilli. These samples were further confirmed at microbiology lab, ICAR Research complex, Goa as *L. monocytogens* and other species of listeria. The amplification of five virulence genes of listeria also tested.

EXTENSION EDUCATION AND SOCIO-ECONOMICS SECTION

EE&SE 1.03: Impact of Improved Technologies and Emerging Market Conditions on Goat Production System

M.K. Singh, Khushyal Singh, Vijay Kumar and Ashok Kumar

As per the objectives of the project observations were recorded from the goat farmers and State Animal Husbandry Department/Institute/Agencies working on Goat Development. Survey was carried out in five districts of Bundelkhand region (UP & MP) to elicit information on goat rearing practices, level of awareness, technologies being provided and adopted by farmers on improved goat rearing practices. Information was also collected on distribution of superior animals and their utilization/performance and goat marketing attributes in field.

Feedback obtained from VO, CVO's as well as observed in field indicated that level of awareness on improved goat husbandry practices/ interventions/ technologies is quite low (Table 1). It was also observed that poor economic status, illiteracy, lack of exposure and poor feeding resources of goat keepers also substantially account for low adoption of improved goat rearing practices/ technologies.

Observations collected from 472 goat keepers belonging to 28 villages of Hamirpur, Mahoba and Jalaun (U.P.), Chattarpur and Satna districts (M.P.) are summarized in Table 2.

Socio-economic attributes of goat keepers

Goats (2-5) are kept by more than 70% families in Bundelkhand irrespective of land size, caste and community as it's is critical in livelihood of people due to frequent draught, though very common among small, marginal farmers and landless labourers who do not go for migration to distant places. Goats are mostly looked after by farm women, children and aged person.

Goat type and Flock size

Goats available in Bundelkhand are of medium size, black in coat colour probably have blood of Beetal, Jakhrana and Gujarat goats. Presently these goats are called as 'Bundeli' and need to be characterized at phenotypic and molecular level. The average flock size was 4.9±0.3, 5.4±0.2, 3.8±0.3, 4.2±0.2 and 4.7±0.4, in Hamirpur, Mahoba, Jalaun, Chattarpur and Satna districts, respectively. About 90% goat keepers also keep cow and buffaloes and have land for crop production. However, flock size is large (15-50) with some goat keepers (5%). Bucks are maintained by large flock owner and selected from their own flock on the basis of growth rate and body size. Scarcity of quality buck observed as major constraint of goat farming. Bucks are kept for 5-6 years in same flock/ shared flock, thus building very high level of inbreeding. Since bucks are kept by few goat keepers so they were extensively and exhaustively utilized them. Females were bred at one year of age and mostly bred in April-May and October-November.

Feeding System

Goats are maintained on low energy diet such as grazing, crop residues etc., occasionally fed with small amount of grains. Biomass availability in range is meager and also utilized by cow and buffalo as grazing of large ruminant is common in Bundelkhand. Straw of Gram, Lentil, Moong, Black gram, Arhar is available in this region and fed to goats. Few flocks (4-5%) however, are maintained on semi-intensive feeding system.

Table 1: Level of awareness and adoption among goat farmers in Bundelkhand Region

S. No	Improved Practices/ Technologies/ Interventions	Area/ Districts									
		Hamirpur		Mahoba		Jalaun		Chattarpur		Satna	
		Aw	Ad	Aw	Ad	Aw	Ad	Aw	Ad	An	Ad
1	Concentrate Feeding	100	8	100	7	100	7	100	6	100	6
2	Green Fodder	100	3	100	2	100	4	100	3	100	2
3	Straw Feeding	100	40	100	36	100	42	100	28	100	26
4	Mineral Mixture	10	0	10	0	15	0	8	0	8	0
5	Feeding Devices	40	10	45	10	50	10	30	10	30	5
6	Deworming	25	0	25	0	40	0	15	0	15	0
7	Vaccination	20	0	15	0	25	0	15	0	15	0
8	Buck selection& utilization	25	5	30	5	30	6	25	5	25	5
9	Breed Identity	20	0	20	0	30	0	15	0	18	0
10	Breeding Practices	50	30	55	30	60	20	40	20	40	25
11	Goat housing & Sanitation	50	5	50	5	60	6	40	4	40	4
12	Kids Sanitation	30	2	30	3	40	4	30	2	20	2
13	Value added products	10	0	5	0	5	0	5	0	5	0
14	Sell/ marketing of goat	30	15	35	12	32	16	25	11	26	12

Aw: Awareness Level, Ad: Adoption Level among farmers

Table 2: Performance of goats under extensive system of management in Bundelkhand

Traits/ Attributes	Average	Range
Age at first kidding (M)	17	14-24
Milk yield/d (ml)	450	200-1000
Lactation length (M)	4.2	3-6
Multiple birth (%)	34	-
Body weight at 3 M (kg)	8.5	7-12
Body weight at 6 M (kg)	13.2	12-18
Body weight at 12 M (kg)	17.4	15-26
Kids mortality up to 3 M (%)	12	5-30
Adult mortality (%)	6	4-10
Income from adult goat/ year (₹)	1400	1000-2500

Bucks during breeding season are usually provided concentrates. Goat keepers with small flock (<10) also rears goats under contract system. Supplementation of cultivated green fodder, deworming, vaccination and drenching is not followed by the goat rearers of this region. Almost 90% males were castrated as farmers believe they grew faster and easily managed under field.

Production Performance

The average body weight at different age, reproductive traits, milk yield and survivability is shown in Table 2. Considering the very poor biomass for a limited period and inadequate care, the production performance of goat is not so bad indicating natural selection for harsh conditions. It could be substantially

increased by providing strategic inputs (green fodder, concentrates during harsh conditions, deworming and vaccinating goat against PPR). Higher kid mortality is attributed mainly to inadequate health care, inadequate housing & sanitation and poor feeding.

Goat marketing structure and practices

Survey carried out in Orai (Jalaun), Jhansi, Kanpur, Allahabad, Mahoba, Hamirpur, Banda and Chattarpur towns/ districts indicated that more than 90% goats are sold for meat by goat keepers at their village to the butcher (middleman). These middlemen move round the year in villages and further sold these goats to district level butcher/contractor. These district level contractors sold these animals to goat meat shopkeeper (retailer) in district towns and also send them to wholesale chevon traders of Kanpur, Kolkata or other big cities. District level contractors have a grip on goat meat marketing and play a major role in regulating the market price. Almost all of them belong to Muslim community. Village level contractor or middleman earns a profit of ₹250-350/ goat and district level contractor earns ₹150-250/ goat. Male up to 1.5 years of age get better price. At village level price of 20-25 kg male ranged from ₹2000- 2500. Whereas, females were mostly (>70%) sold at late age (>6 years) for ₹1500-2000. Price of goat for meat is determined by age and health of goat. The price of goat meat varies from ₹220-280/ kg over the towns and seasons in Uttar Pradesh and Madhya Pradesh. Skin and other non-edible portion is sold @ ₹150-250/ goat. Prices of breeding buck in Bundelkhand region varied from ₹3000 to 6000 and of female from ₹3000-5000. Price of buck is determined by its body size and health whereas in case of female by size, health, milk yield and prolificacy. Goat milk is commonly not sold because of non-availability of market for goat milk.

Technologies transferred to field

Breeding goats of both sex (370, Barbari, Jamunapari and Jakhrana were supplied by the institute to field mainly to State Animal Husbandry Departments and progressive farmers during 2010-11. Goats were mainly sold to Uttarakhand, Bihar, Chhattisgarh, Rajasthan, Uttar Pradesh, Haryana and Karnataka. Feedback obtained indicated that adaptability and survivability of supplied goats were moderate and satisfactory. Goat is predominant livestock species of Bundelkhand and maintained irrespective of caste, community and land size, it acts as life line during persistent draught. Therefore, goat rearers should be made knowledgeable for improved goat rearing practices. Some initiatives/ incentives may be given to goat keepers for their rapid adoption. Goat keepers of this region strongly felt need of cheap feed particularly during lean period (April-July). Regulated goat marketing infrastructure may be created in Bundelkhand to provide due benefits to goat keepers.

EESE 1.04: A study on impact of various training programmes on commercial goat farming

Khushyal Singh, Braj Mohan and Vijay Kumar

Data was collected from 200 trainees of 9 states namely, Uttar Pradesh, Haryana, Punjab, Bihar, Madhya Pradesh, Rajasthan, Chhattisgarh and Delhi to get feedback on performance of commercial

goat farms, constraints in opening goat farms, knowledge, marketing channels, marketing problems, etc. Fifty out of 200 trainees belonging to Haryana (20), Uttar Pradesh (14), Punjab (1), Bihar (5), Madhya Pradesh (4), Rajasthan (2), Chhattisgarh (1) and Delhi (2) have started commercial goat farming with local breed, Barbari, Sirohi and Jamunapari breeds.

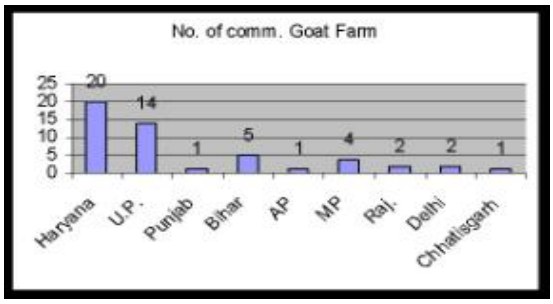


Fig. 1: Number of commercial goat Farms

As per the feedback, the survivability of adult goats in the commercial goat farms was good. However, kid mortality was higher in all commercial goat farms. There were many constraints responsible for high mortality viz. low adoption of improved practices and preventive goat health calendar, non-availability of critical inputs like vaccines, size of flock, type of housing, etc. Marketing of the animals was on the basis of estimate not on the weight basis. Some of the commercial goat farmers were doing strategic marketing such as plan for Eid, Holi, Diwali and other local festivals. They were rearing castrated male as it gives better price to the farmers. Some other problems of the commercial goat farming were also reported *i.e.* prevalent dystokia, abortion, stunted growth of kids.

The level of adoption of these technologies was moderate. There was a wide gap in the level of adoption and large proportion of the commercial farmers not adopted the recommended technologies. Gap in knowledge and adoption of improved technologies was high due to inaccessibility of critical inputs. Higher technology adoption at some commercial farms led to low mortality losses as compared to traditional flocks. The farmers realized remunerative price for pure breed animals as compared to non-descript goats.

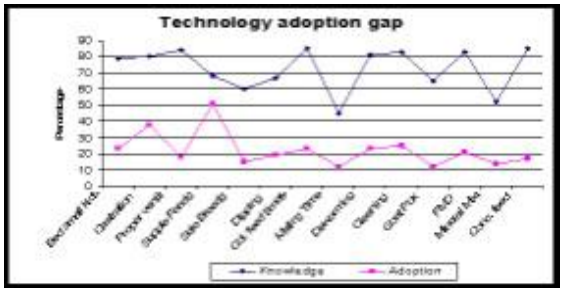


Fig. 2: Technology adoption gap in commercial goat farms

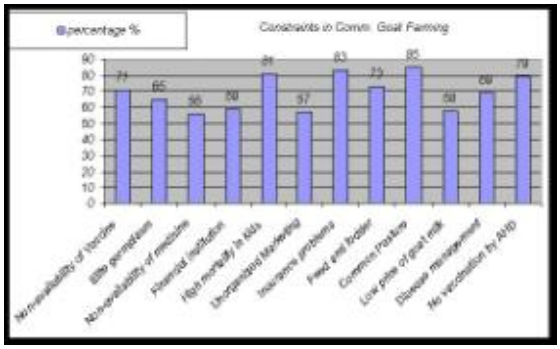


Fig. 3: Constraints in commercial goat farming

The major problems faced in the initial stage of goat farming were observed to be the high incidence of diseases and non-availability of vaccines, medicines, qualified 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 ₹90 to ₹120 per kg of live body weight. The price was higher for castrated male for festive sale. The farmers producing quality breeding-animals also got attractive prices from the goat breeders. The constraints in commercial goat farming are depicted in

Fig. 3. On an average a commercial farm had the total number of goats upto 321 The majority of the farmers wanted to increase their flock size up to 250 –1000 goats, but desired support in the form of technical knowledge and easy institutional finance, insurance is essentially needed.

EE&SE 8.15: Sustainable Livelihood through Goat Farming by Disseminating the Improved Goat Production Technologies

Braj Mohan, A.K. Goel, Ashok Kumar, Khushyal Singh, U.B. Chaudhary, R.B. Sharma, M.K. Singh, H.A. Tiwari,Vijay Kumar, N. Ramachandran, Anil Kumar (IASRI) (w.e.f. Oct., 2010)

Health Component

Interview schedule was developed, pre tested and standardized for studying the mortality status of goats in the adopted village. Data was collected to study the mortality status of goats in Hayatpur village. Method of data collection was personal interview. In total, 20 goat farmers were interviewed and having 234 goats. Maximum mortality was found in kid was 41.78% in the age group of 0-6 months. Details of mortality data are presented in the Table 1. In adult mortality percentage was 11.9 per cent (all these data are based on before intervention).

Maximum mortality occurred in the month of November to January. Problems related to Gastro Intestinal Tract (GIT) were the major (52%) cause of death. Animals were kept densely in the house so that hygienic and proper ventilation were major predisposing factors for occurrence of various diseases.

Table 1: Age group and mortality percentage

Age group	Mortality percentage (of total mortality)
< 15 Days	23.60
15- 30 Days	21.00
1-2 Months	42.00
2-3 Months	5.20
3- 6 Months	8.00

Reproduction Component

The programme is aimed to increase goat productivity, income, employment and socio-economic status of farmers through technological intervention. Under reproduction component study was undertaken to collect information on various reproductive parameters to assess the extent and nature of reproductive problems in villages, organization of village camps for different reproductive ailments and reproductive health care of affected animals. In order to achieve the targets under reproduction component, seven visits were undertaken in operational villages. In these visits 73 goat and sheep farmers were contacted and data on different production and reproduction was collected on prescribed schedule. Reproductive health care of affected goats of different adopted villages was undertaken. Round the year breeding is practiced by flock owners by using non-descript bucks. A reproduction health calendar was also distributed to goat owners. In total twenty three cases of specific reproductive ailments were diagnosed and appropriately treated in operational villages (Table 1). Caesarean sections in two goats were performed to relieve dystokia/ facilitate kidding. The incidence of various diseases was of moderate degree. During this period a total of 58 goats were screened for their gestational status. A total of 4 field days

were arranged at different occasions by organizing Animal Health Camps and Kisan Goshthies in Hayatpur village for creating awareness and motivation of goat farmers for goat rearing practices on scientific lines. In these field days a total of 321 goats were vaccinated against E.T. (initial and booster dose). Under reproduction component seven goats were treated for anoestrus condition and 21 were examined for pregnancy status. In Kishan Goshthies, Dr. Devendra Swarup, Director of the institute emphasized the need to adopt goat farming on scientific lines. Other subject matter specialists (SMS) also delivered talks and made interaction with farmers on various aspects of goat rearing. I also participated in interactive discussions and delivered a talk on Reproductive Management of Goats for increased production under village conditions. In another Animal Camp and Kishan Gosthi, NABARD, Mathura in collaboration with this institute and local NGO provided financial management solution and literacy for goat keepers and other farming community to enhance their socio-economic status besides vaccination and treatment of animals against various ailments.

Table 1: Occurrence of reproductive disorders in adopted villages

Disease/ condition	No.
Anoestrus	11
Ring Womb	07
Retention of Placenta	02
Dystokia	03
Total	**23**

Visits and advisory services

In all 29 visits made by the scientists and technical staff to adopted village Loh Karera and Nanau (Agra) and Hayatpur and Manoharpur (Mathura). In these visits individual contacts were made with about 356 goat farmers/ farm women at their home during the period under report. They were educated and motivated about the scientific/ commercial goat rearing and use elite Barbari breeding bucks.

Self-Help Groups

Extended support to Self-Help Groups (SHGs) of Hayatpur village for enhancing their livelihood through scientific goat farming.

Financial literacy campaign

Financial literacy campaign was organized in collaboration with NABARD through puppet show and interaction with Bank personnels. In this campaign, NABARD Personnels, Lead Bank Manager of Mathura, NGO, and more than 200 farmers/ farm women participated. This campaign helped the goat farmers about opening of account in bank, bank loan for goat project, procedure of bank loan and how to repay bank loan, etc.

Group Discussions

In all 3 group discussions were conducted on scientific goat rearing and management in the adopted villages on health care, kid management and care, and management of goats before during and after kidding.

Participatory Rural Appraisal

PRA was conducted to assess the village resources, resource mapping, time line, communication and constraints about agriculture in general and goat farming in particular in all four adopted villages.

Organization of On Campus Training

An on-campus training programme on

scientific goat rearing was organized on the occasion of the visit of Hon'ble Union Agriculture Minister Shri Sharad Pawarji at CIRG, Makhdoom on 24.01.2011 in which 27 goat farmers and 6 farm women attended and got benefitted.

Organization of Off-Campus Trainings

An off-campus training was organized on goat breeding management at Nanau (Agra) on 6.8.2010 in which 20 farmers attended and got benefitted.

An off-campus training was organized on 'Goat reproduction problems' at Hayatpur on 19.10.2010 in which 20 farmers were benefitted.

An off-campus training was organized on 'Goat reproduction problems' at Loh Karera on 26.10.2010 in which 25 farmers were benefitted.

An off-campus training was organized on 'Importance and utilization of goat milk' at Hayatpur on 12.11.2010 in which 23 farmers were benefitted.

An off-campus training was organized on 'Scientific goat management' at Hayatpur on 12.11.2010 in which 23 farmers were benefitte.

On 14.01.2011 an off-campus training was organized for 35 goat farmers on scientific goat management and hoof trimming.

An off-campus training was organized on 'Scientific goat management' on 20.1.2011 in which 25 goat farmers were benefitted.

Field Day

A Field Day including Kisan Gosthi and Animal Health Camp was organized on 28.11.2010 in adopted village Hayatpur. Besides Director of the Institute, scientists, technical staff, 60 goat farmers, 30 farmwomen and 53 trainees of 45th National Training Programme on Commercial Goat Farming were present.

On 8.1.2011 aother field day was organized in adopted village Hayatpur in which following transfer of technology programme were conducted.

Kisan Goshthi: Secretary DARE and Director General, ICAR Dr. S. Ayyappan, Dr K. M. L. Pathak DDG (AS) ICAR, Director, CIRG, I/C, EE&SE Section, two principal scientists, two senior scientists,

Participants of National Training Programme on Commercial Goat Farming along with Director and Scientists of CIRG

six scientist, two bank personnel, five technical assistants, and other dignitaries, staff, media persons, village Pradhan and 500 farmers and farm women were present.

Exhibition: An Exhibition of technologies was arranged for creating awareness among the goat farmers/ farmwomen.

Distribution of Barbari Bucks and feeders: Four elite Barbari breeding bucks were distributed by the Director General and Deputy Director General (AS) to the interested goat farmers for breed improvement in the village. Four feeders were also distributed to demonstrate the importance of avoiding wastage of feed and fodder which costs high in goat rearing.

Distribution of Pelleted Feed: Pelleted feed was distributed to demonstrate the importance of complete feed for commercial goat farming.

Health Care Activities

- A Health camp was organized at Hayatpur adopted village on 08.01.2011 during the visit of Dr. S. Ayyappan, Secretary DARE and Director General, ICAR. In this camp over 800 goats and sheep were vaccinated with PPR vaccine, 282 animals were treated for endoparasites and 65 animals were treated for other ailments.
- A Health camp was organized at Hayatpur adopted village on 09.03.2011 in which, 109 small animals were vaccinated against ET and 3 animals were treated for various other ailments including reproductive problems.
- A Health camp was organized at Hayatpur adopted village on 23.03.2011 in which, 235 small animals were vaccinated with ET vaccine and 12 animals were treated for various other ailments including reproductive disorders.
- Besides these health camps, 14 visits were made in all four villages for healthcare and other support. In these visits, animals were treated and suggestions were given to farmers for better heath management.
- Hoof trimming of 27 goats was done in Hayatpur village with the help of management scientist.

AICRP ON GOAT IMPROVEMENT

D. Swarup, B. Rai (upto 2.2.11) and S.K. Singh (wef 3.2.11)

All India Coordinated Research Project (AICRP) on Goat Improvement is a major long term programme focused to bring upon genetic improvement under prevailing ecosystems and also to conserve threatened goat breeds under their landscapes. Presently three breeds *i.e.* Barbari, Jamunapari and Sirohi are being improved under organised farming system where in efforts are made to provide controlled environment and optimum feeding so as to obtain maximum genetic gain. Other breeds viz. Assam Hill goat at Guwahati, Black Bengal at Kolkata and Ranchi, Gaddi at Palampur in HP, Marwari at Bikaner. Osmanabadi at Phaltan in Satara district of Maharashtra, Sangemneri at Rahuri, Sirohi at Vallabhnagar (Udaipur), Ganjam at Bhuvaneshwar, Surti at Navsari and Malabari at Trichur are being improved under farmer's flock having age old traditional but proven systems of farming. This project also implements modern animal husbandry and health technologies for testing and enhancing knowledge of farmers. Most units are practicing animal identification and performance under farmer's condition which is an essential requirement of any genetic improvement programme. At many locations farmers do not agree to get their animals tagged by any agency as it was not the traditional practice they inherited from their ancestors.

At Kolkata in Black Bengal breed three village clusters were adopted and 200 does per village were registered. Fifty male kids were purchased on the basis of 3 months body weight and reared at farmers' door. Out of these, 15 selected bucks were distributed in village clusters for breeding of 300 selected does in 2001-02. These bucks are replaced at regular intervals. In 995 kidding, 1889 kids were born of which twin born kids were the highest (54.42%), followed by triplet kids (24.93%), then by singlet kids (15.99%) and lastly by quadruplet kids (4.65%).

In Marwari Goat at Bikaner, a total of 150 young bucks of true to Marwari breed were distributed to registered breeder for breed improvement up to 2011. Out of these, the 17 bucks were distributed to the registered breeder of Kalyansar (05), Raisar (05) and Daiya centres (07), during this financial year. The average population growth was 97.62% among the registered goats' at all four field centers. The body weight at different stages of growth ranged from 2.47±0.02 to 2.67±0.01 kg (2.58±0.01kg) at birth, 12.53±0.23 to 15.57±0.24 kg (13.72±0.51 kg) for 3 Month, 17.57±0.2 to 18.84±0.18 kg (18.33±0.62 kg) for 6 Month, 16.79±1.08 to 30.18±1.93 kg (21.89±0.27 kg) for 12 month, 27.08±1.19 to 30.57±0.19 kg (29.14±0.32kg) for 18 month, 29.38±0.96 to 34.03±0.24 kg (32.37±0.28 kg) for 24 month, 30.47±0.89 to 36.25±0.26 kg (34.06±0.27 kg) for 30 M and 33.76±1.06 to 42.2±0.24 kg (38.51±0.3 kg) for adult animals. The average milk yield was 73.99±2.70 kg in first 30 days, 76.01±2.41kg in second 30 days, 70.89±2.2 kg in third 30 days and 54.49±1.83 kg in fourth 30 days of lactation. The reproductive performance of Marwari goats was evaluated on the basis of numbers of does

available for breeding purpose. The kidding interval ranged from 278.25±16.249 to 305.41±9.922 days (288.456±11.157 days). The overall kidding per cent was 91.18 % which may be due to adaptation of scientific managemental practice by the goat breeder and proper care of animals during the prevalent famine conditions.

At Osmanabadi Field unit of NARI, there were total 626 kiddings and 1026 kids were born, giving a combined average litter size of 1.64 for all six villages. Compared to 2009-10, there was a 5% increase in average litter size (1.49 to 1.56) of goats recorded under the project in Bibi and Wadgaon villages in Satara district. The average litter size of goats recorded under the project in Solapur and Osmanabad districts was 3.8% and 13% higher, respectively than goats recorded in Satara district (*i.e.* 1.62 and 1.77).

In Sangamneri field Unit at Rahuri, total of 642 breedable does in four clusters were registered and 33 elite bucks were rotated in the selected clusters. Population of Sangamneri goats was increased by 25.15 per cent over the last year in registered clusters, however the population in breeding tract was increased by 126 per cent. The overall superiority for body weights at 1, 3 and 6 months of age was 3.99, 7.27 and 6.98 per cent, respectively over the contemporaries. Overall economic gain was ₹62.00 and 98.00, respectively for 3 and 6 months weights. The improvement in milk yield over the baseline population was 21.42 per cent, with economic gain of ₹256.50. Farmers-Scientist forum of goat keepers is formulated for dissemination of new techniques of goat keeping. The same forum will be registered as Sangamneri goat breeders association. Five bucks are transferred to Frozen Semen Lab of Cattle Project, MPKV, Rahuri for semen preservation.

In Sirohi Farm Unit at Vallabhnagar, Rajasthan, total of 1313 goats were registered comprising of 1064 females. During the year, under report, 531 kids were born out of which 272 were males. Population growth of 73.10% was recorded. Total 243 males were sold out of which maximum 88 males were sold between 6-12 months of age. Since inception of the project 713, 1240, 716, 953 and 987 kids were born in 1^{st}, 2^{nd}, 3^{rd}, 4^{th} and 5^{th} generation, respectively. The least square means for body weight at birth, 3, 6, 9 and 12 months of ages were 2.47±0.03, 13.6±0.18, 17.30±0.25, 20.69±0.48 and 24.79±0.49 kg, respectively. The body weights increased over the years. Heritability of birth weight was found to be high. Year, season of birth, sex of kid and type of birth have significantly affected on the body weights. Kids born between November to February months had higher weights at 3 months age whereas, those born between July to October had higher weights at 6 and 12 months of ages due to better environment for gene expression of growth. Single born kids were significantly heavier than the multiple born kids at all the ages. The overall least square means for milk yield over 90 days, 150 days, lactational yield and lactational length were 69.50±3.73, 102.03±3.67, 102.45±4.66 lit and 151.59±0.37 days, respectively. The lactation length was significantly shorter than previous years. Season of kidding has significant effect on milk yield. The lactation order played a significant role in milk yield.

At Guwahati, to establish Assam Hill Goat

center, selection of two field units with 160 and 190 breedable goats respectively were completed. Initial data regarding the production performances like Body weight at different ages from the field unit is collected. Four Bucks of high genetic merit, two in each unit has been distributed. Training on "Scientific Management of Goats" and other necessary technical guidance is provided to the beneficiaries at regular interval.

Three centres of the Black Bengal in Jharkhand were established at Jamshedpur, Deoghar and Ranchi districts of Jharkhand. Data on growth at various stages and reproduction etc. were recorded and analyzed. The coat colour of the animals is brown, grey and black. Majority of animals (74 %) are black coat followed by brown (21 %), grey (4 %) and 1% white patches on black. Males are having generally beard and sometimes it is present in female also. The adult body weights of males and females are 13.90±1.24 and 12.74±0.97.

Survey results of Gaddi Home tract showed that breeding tract is distributed mainly in the pockets of Mandi, Kullu, Kangra and Chamba districts of Himanchal Pradesh. The average family size was 5.82 and land holdings 8.88 *bigha* per family. The animals are managed purely on transhumance (migratory) system of management, where no supplementary feeding is provided except common salt at weekly intervals. Natural service is the only method of breeding followed and one buck is kept per 50-75 breedable does. The main breeding season commences from April onwards and lasts up to June. The kidding starts from the month of October onwards and it occurs in the open. No special care to the dam or neonatal kid in the form of concentrate feeding, Thereafter three field units belonging to different migratory routes were established and 701 animals were registered and identified by ear tagging. A total of 452 young kids were born, 95 animals of different age groups died and 274 animals pertaining to different age groups were sold and 99.47% overall population growth and 6.24% overall mortality was recorded. The per cent of twin births and incidence of abortions was 18.32 and 7.32%, respectively. All the animals of the flock were provided health coverage by way of vaccination against PPR, dipping and de-worming besides strategic supplementary feeding in the form of mineral mixture and concentrate feed. The overall least square means for body weights at birth, 1 month and 3 months of age were 2.16, 8.66 and 15.71 kg, respectively wherein significant effects of sex of birth and field units were observed. The overall body length, body height and body girth at birth was 26.49, 33.90 and 31.29 cm, respectively. The corresponding figures at one month were 46.24, 49.40 and 49.30 cm, respectively and at three months 52.37, 53.94 and 57.65 cm, respectively.

At Navsari, Surti Field Unit, the closing balance of the registered flock was 957 animals including 749 females. Out of these animals 567 animals were Surti including 492 Surti females. Increased number of Surti females as compared to opening balance of 152 Surti females pertains to registration of 301 new Surti goats in newly added three clusters during the year 2009-10. During current year, 430 kids were born out of which 247 were males. Surti kids born during the year were 95 males and 61 females respectively. Major constraint faced

during the year again remained non availability of good quality Surti bucks. There is no appreciable trait or physical character in this breed that can be counted as defect. But negative selection pressure is operating on this breed at high intensity due to higher demand of white bucks during Id-ul-Fitar festival. Farmers raise white Surti type buck for sacrificial purpose on Id-ul-Fitar festival. This imparts high selection coefficient against this breed leading to genetic loss of almost entire elite Surti germplasm from male side in natural breeding tract of this breed. Closing balance for male Surti bucks remained only 10 due to sale of white coloured Surti bucks during Id-ul-Fitar festival as preferred by Muslims of South Gujarat region. Total 69 males were sold out of which maximum 40 males were sold at adult age. Overall population growth of 80.67% was recorded with the addition of 363 live kids. The least square means for body weight at birth, 3, 6, 9 and 12 months of ages were 1.72±0.02, 9.74±0.10, 16.39±0.12, 19.99±0.15 and 21.86±0.22 kg, respectively. The overall least square means for milk yield over 90 days, 150 days, lactational yield and lactational length was 102.32±2.19, 163.88±1.71, 169.47±2.47 lit and 160.88±1.58 days, respectively. Season of kidding has significant effect on milk yield and goat kidded during the July to October remained low producer throughout the lactation. Surti goats prove to be a very good milch breed with a range of 136-216 lit of milk in a complete lactation.

The Ganjam field unit located at Bhuvaneshwar had a closing balance of goats at Rambha, Khallikote and Chattarpur centres was 1870, 1698 and 2465, respectively. The overall average body weight at birth, 3, 6, 9 and 12 months of age were 2.31±0.06, 6.36±0.01, 9.46±0.03, 13.81±0.02 and 17.78±0.03 kg, respectively. There was a significant increase of the body weight at 9 and 12 months of age in comparison of base population average. The kidding percentage was 36.12 upto Sept. 2010. The average daily milk yield of Ganjam goats was 425.5±10.8 ml. Prophylactic measures were undertaken in the farmer's flock.

The farm units of Barbari, Jamunapari and Sirohi were able to generate genetic and phenotypic variance and covariance for economic traits. Generation wise means and BLUP estimates were recorded for animals used in the breeding programme. As such the project is contributing in genetic evaluation of local breeds, generation of genetic variances and covariance and in conservation of valuable germplasm.

Table: Ongoing units under AICRP on goat improvement during XI five year plan

Sl. No.	Name of the Unit	Location	Type of Centre
From X Plan			
1.	Jamunapari Farm Unit	CIRG, Makhdoom	ICAR based
2.	Barbari Farm Unit	CIRG, Makhdoom	ICAR based
3.	Sirohi Farm Unit	CSWRI, Avikanagar	ICAR based
4.	Marwari Field Unit	R.A.U. Bikaner	SAU based
5.	Black Bengal Field Unit	WBUVS & F, Kolkata	SAU based
6.	Ganjam Field Unit	OUA & T, Bhubaneshwar	SAU based
7.	Sangamneri Field Unit	MPKV, Rahuri	SAU based
8.	Surti Field Unit	N.A.U. Navsari	SAU based
9.	Malabari Field Unit	K.A.U. Trichur	SAU based
10.	Sirohi Field Unit	M.P.U.A & T., Udaipur	SAU based
New Units during XI Plan			
1.	Black Bengal Field Unit	BAU, Ranchi	SAU based
2.	Assam Hill Field Unit	A.A.U. Guwahati	SAU based
3.	Gaddi Field Unit	HPKV, Palampur (HP)	SAU based
4.	Osmanabadi Unit	NARI, Phaltan (MH)	Voluntary centre

EDUCATION AND TRAINING

Training Programmes Organized

1. Organized National Training Programme on Commercial Goat Farming from 6-15 April, 2010. In this training programme 20 veterinary officers participated.
2. Organized National Training Programme on Commercial Goat Farming from 11-20 May, 2010. In this training programme 46 farmers participated representing Araria (9), Gaya (10) Purnia (7), Katihar (10) and Supaul (10).
3. Organized National Training Programme on Commercial Goat Farming from 20-29th July, 2010. In this training course, 65 participants from 13 States *i.e.* from U.P. (30), Jharkhand (1), A.P. (1), M.P. (2) Haryana (19), Delhi (3), Maharashtra (1), Chhattisgarh (1), Gujarat (1), Punjab (3), Rajasthan (1), Orissa (1) and Uttarakhand participated.
4. Organized a 10 days 44th National Training Programme on Commercial Goat Farming from September 21-30, 2010. In this training course, in all 64 participants from 9 States *i.e.* from U.P. (30), Haryana (19), M.P. (3) Maharashtra (1), Rajasthan (4), Bihar (3), Jharkhand (1), Uttarakhand (1) and A.P. (2), participated.
5. Organized and conducted a 10 days 45th National Training Programme on Commercial Goat Farming from November 23—December 2, 2010. In this training course, in all 54 participants from 9 States *i.e.* from U.P. (27), Haryana (9), A.P. (5), M.P. (4), Delhi (3), Punjab (2), Bihar (2), Maharashtra (1) and Gujarat (1) participated.
6. Organized and conducted a five days training programme on scientific goat rearing from 6-10 December, 2010 to 23 progressive farmers sponsored by ATMA Sahrasa and Kosi Agro Foundation, Sahrasa, Bihar.
7. Organized and conducted a training programme on Scientific Goat Rearing to Farmers Sponsored by Bihar Agricultural Management and Extension, Training Institute, Bihar from 16-25 April, 2010. In this training programme 35 farmers from Muzaffarpur (10), Purbi Champaran (10), Pashchmi Champaran (5) and Bhagalpur (10) participated.
8. An exposure cum training programme was organized for 9 goat farmers (including two farm women) from ATMA, Munger, Bihar from 17 – 19 September, 2010
9. Organized and conducted one day training programme on Scientific goat rearing on 1.1.2011 to 128 progressive farmers sponsored by Kisan Trust, Tughlaq Road, New Delhi.
10. Organized and conducted a 10 days 46th National Training Programme on Commercial Goat Farming from February 22-March 3, 2011. In this training course, in all 68 participants from 13 States and Bangladesh *i.e.* from U.P. (23), Haryana (12), Bihar (7), Delhi (4), Rajasthan (4), M.P. (4), Uttarakhand (3), Karnataka (3), Jharkhand (2), Punjab (2), Tamilnadu NRI (1), Maharashtra (1),

Chhattisgarh (1) and Bangladesh (1) were present.

Participation in Exhibition/Kisan Mela

1. Participated in Krishi evam Gramya Vikas Pradarshani at Pt. Deen Dayal Dham, Nagla Chandrabhan, Farah, Mathura from 5-7 October, 2010.
2. Participated in Kisan Mela at IVRI, Izatnagar, Bareilly from 1-3 November, 2010 ***and third prize was awarded for Institute stall.***
3. Participated in Pusa Krishi Vigyan Mela at IARI, New Delhi from March 3-5, 2011
4. Participated in Bheda Mela from March 5, 2011 at CSWRI, Avikanagar (Rajasthan

Technical Correspondence

1. In all 134 inquiry letters (112 in Hindi, 21 in English and 1 in Telgu) were received from different categories of aspirants covering different of parts of country on various aspects of goat reproduction and production were suitably replied.

Visits

In all 1122 visitors were entertained and apprised with research, extension and development activities of the institute.

Helpline Services

The farmers help line initiated by the Institute has become immensely popular among the goat farmers, entrepreneurs and commercial goat farmers, and a large numbers of them are contacting the Institute for seeking information and knowledge on improved goat technologies. A large number of farmers/ entrepreneurs contacted the Institute on various aspects of goat production especially on the availability of superior germplasm, training and marketing of goats etc through the Help Line service and were suitably replied.

In all 1829 calls were received regarding various aspects of commercial goat farming, improved goat production technologies, elite germplasm and training programmes and replied suitably.

Farm School on AIR

The 30 radio talks were broadcasted from All India Radio Station, Agra from 20 September 2010 to 17 January, 2011. These radio talks covered all aspects of commercial goat production including goat breeds, breeding, feeding, management (shelter, kid and health) extension education socio-economic and marketing aspects.

IMPORTANT EVENTS

Hon'able Union Minister for Agriculture and Food Processing Industries, Shri Sharad Pawar visits CIRG

Calls for dissemination of scientific goat rearing to the farmers

Shri Sharad Pawarji, Union Minister for Agriculture and Food Processing Industries, Govt. of India visited Central Institute for Research on Goats on 24th January 2011. He took keen interest in goat development programmes being undertaken by CIRG and visited Jakhrana, Jamunapari and Barbari goat units and Muzaffarnagari Sheep units and also the rumen microbiology, feed processing, male reproduction and IVF laboratories of the Institute. He had an interactive meeting with the farmers and scientists and released the area specific mineral mixture technology developed by the institute. Shri Pawar expressed satisfaction on the quality animals being maintained by the Institute and suggested that knowledge sharing initiatives should be undertaken by CIRG to disseminate benefit of scientific goat rearing to the farmers. He told that good animals are available with the farmers but these are not properly utilized for breed improvement for want of proper recording of performance data. It is therefore crucial to register farmers for getting superior germplasm from field to experimental farms. He asked CIRG to prepare a road map for state governments for goat breed improvement programme and develop effective vaccines and disease diagnostic technologies for disease free flock at farmer's level to improve production in order to meet the domestic and export demands in terms of both quality and quantity of goat meat. He appreciated the CIRG technologies such as complete feed block, area specific mineral mixture, value added goat milk and meat products (Nimkee, Murukku and Pops), and herbal medicines and congratulated the scientists for producing IVF kids. While emphasizing needs to develop goat gene/semen bank, Shri Pawar demanded that scientists should find out solution to combat goat diseases at farmers' level. Shri Pawar advised scientists to standardize basic framework for Artificial Insemination in goat so that same can be adopted by State Governments in their AI programmes already in vogue for cattle and buffaloes. He called State Agriculture and Veterinary Universities and mass media to popularize goat breeding programmes. Shri Pawar was satisfied with the Kisan Help Line and the farmers training at the Institute but wanted vast coverage of such training programmes. He said that livestock production has become more knowledge-intensive, technology-led and demand-driven and asked the scientists to contribute accordingly. Shri Pawar was accompanied by Dr. S. Ayyappan, Secretary DARE and DG

ICAR, Dr. K.M.L. Pathak DDG (AS), and Dr. C.S. Prasad, ADG (ANP) and a host of dignitaries notably Dr. (Ms) Chanda Nimbkar from Phaltan and Ms. Kadirbai from Baramati, Maharashtra.

Dr. S. Ayyappan, Secretary DARE and DG, ICAR complimented the efforts made by the scientists of CIRG, and indicated that the council is considering initiating outreach programme on goat production and projected goat as the future animal. He said that invention of farmer- friendly technology would go a long way in sustainable livestock production and poverty alleviation. Dr. Devendra Swarup, Director, CIRG, informed that 18 patent applications have been filed by the Institute and many of these are in the final stage of award. He told that commercialization of technologies has been taken up on priority and a herbal drug- Alquit has already been commercialized and is available in the market. Four other technologies are in the pipeline for commercialization.

Speaking on the occasion, Dr. Chanda Nimbkar stressed the need to set up disease free multiplier flocks for production, maintenance and distribution of quality nucleus stock of improved goat breeds.

Republic Day Celebration

Institute celebrated 62nd Republic Day with devotion, sincerity and joy. Dr. Devendra Swarup, Director of the Institute in his inaugural address encouraged the staff to work hard with sincerity and devotion to enhance livelihood status of goat keepers. He put stress on maintaining discipline and feeling of brotherhood among the staff.

CIRG Participation in the ICAR-Industry Meet

CIRG team participated in the ICAR-Industry Meet organized by the Indian Council of Agricultural Research (ICAR) with theme, ICAR - A Destination for Innovative Agro-Industry and Entrepreneurs, and provides an opportunity to the Industry and Enterprises of getting a glimpse of the ICAR Technology profile and its Technology Transfer Pursuits on 28-29 July 2010. The CIRG, Makhdoom was the special invitee for this meet to showcase their technologies. The concurrent exhibition showcases the potential technologies under four themes: Seed and Planting Material; Diagnostics, Vaccines and Biotechnological Products; Farm Implements and Machinery; and Post-Harvest Engineering and Value Addition. The Meet enhanced the learning experience and mutual trust and developed a better understanding among the innovators and industry for the future participatory or collaborative endeavours. About 300 representatives from companies, federations, organizations and scientists from ICAR institutes participated in the Meet.

While inaugurating the two-day ICAR-Industry Meet 2010 as Chief Guest, Pawar emphasized the important role of such partnerships that will result in development of rural entrepreneurship and provide an enormous employment potential leading to improved farm earnings. Concerted efforts are needed to move forward and work towards partnership for knowledge, prosperity and social good, he added. India's National Policy on Agriculture recognizes the role of private sector in critical areas of agricultural research and human resource development. While appreciating the organization of the ICAR-Industry Meet, he called it a welcome step in right direction at the right time. CIRG showcased the important technologies developed by the Institute during the meet which were highly appreciated by the Honorable Agriculture Minister Shri Sharad Pawarji and other dignitaries during their visit to CIRG stall.

Brain Storming Meeting of Directors of ICAR Animal Science

Brain Storming Meeting of Directors of ICAR Animal Science Division Institutes was organized at Central Institute for Research on Goats, Makhdoom from January 30-31, 2011. All Directors, Joint Directors and Heads of Regional Stations of the ICAR Animal Science Institutes and ADGs, Principal Scientists and DS (AS) from SMD attended the Meeting, which was Chaired by Dr. K.M.L. Pathak, DDG (AS) ICAR. The meeting was to sensitize the Institutes in preparing the XII Plan EFC document and identify few flagship programs and thematic areas to be addressed during XII plan. For the first time incharges of various regional stations were involved for providing inputs. The interaction was very useful and few programs on genomics, stem cell research, nanotechnology, molecular diagnostics and vaccines, biogeography of rumen and nutrition and reproduction interaction were prioritized for drawing focused research activities.

Brain Storming Session on Field Data Recording and Information

Brain storming session on field data recording and information was held at CIRG on 30th August, 2010. Director Dr. D. Swarup welcomed all the delegates

including Dr. C.S. Prasad, ADG (AN&P), Dr. B.K. Joshi, Director, NBAGR and Dr. Chanda Nimbkar, NARI, Phaltan. He stressed for developing a uniform pattern of data recording for AICRP of Goat improvement programme. Dr. B.K. Joshi in his address explained the need for animal characterization and conservation of breeds with sustainable utilization in future. Dr. C.S. Prasad said that field data recording is very important aspect of breed improvement programme. Dr. Nimbkar stressed to develop a reporting format for better output and suggested uniform data treatment and analysis for all the AICRP units and to follow a common protocol In the technical session six presentations of different aspects of data recording and existing formats developed by CIRG were discussed at length by all the participants.

ARIS Cell

Two servers were maintained in Open source Software/Free Software Operating system called Ubuntu Linux and one using Redhat Enterprise Linux to work as Internet Gateways for the Institute. The following operating systems were installed.

1. Server-I:
   (a Ubuntu Linux 10.04 LTS: This server is configured for a proxy server using squid as a software for proxy.
   (b) The E.mail server are based on postfix and squirrel mail.
   (c) The virus protection using ClaimAV antivirus server, SpaM Assassign software.
   (d) Spam control using Spam Assassin.
   (e) DNS Servers- to maintain institute host name "www.cirg.res.in"
2. Server-II: Host name "goat.cirg.res.in"
   (a) This server acts as a backup server/ secondary name server having Ubuntu operating system.
3. Operating System:
   (a) Having installed with Ubuntu 10.04 LTS server and upgraded to 10.04.
   (b) All above utilities were also being used configured on Server-II
   (c) Instead of send mail post fixed is being used as MTA and to control the viruses, Amavis D and ClaimAV.

Web Site

The complete website of the institute **www.cirg.res.in** was redesigned and reprogrammed from sketch which was in order to incorporate to maintain web-programming language. Such as php, CSS2, Javascript, ASP

Goat-net mailing list server

- A mailing list server was created named "goat-net@cirg.res.in". This mailing list server is operation for discussion and dissemination of information on goat husbandry.
- Several other mailing lists were created on Agricultural subjects they are available at http://cirg.res.in/cgi-bin/mailman/listinfo
- An information system for scientific data base was prepared and made available at http://cirg.res.in:8080/. This system is used to upgraded the biodata of scientists.
- The CIRG gate way of 2 MBPS leased line was taken from BSNL, Mathura. Thus, the intranet speed was enhanced.
- Statistical Software were developed and are in use.

- Most open source software *i.e.* Open Office, Sribus DTP editor, Bind, Clam Av are in use and Institute is taking lead in demonstrating use of OSS/FS.

Agriculture Farm and Agro-forestry Section

- The Agricultural Farm and Agro-forestry Section is the Central Service Facility of the Institute. The main objectives of the section are to cultivate fodder crops for the goats and sheep in the Institute for maintaining the nutritional level and to develop the poor degraded soil of the Institute through agro-forestry/silvi-pasture. A well maintained crop rotation was followed in three seasons (summer, kharif and rabi) with legume (berseem, Lucerne, cowpea, guar, mung) and non-legume (barley, oats, pearl millet, sorghum, maize) to supply quality green fodders and hay to the livestock in the Institute on day-to-day basis. During the year under report the farm section has produced and supplied 9291.65 quintals green biomass in the form of fodder, hay and tree loppings. Total grain production (barley and oats) was about 500 quintals. The section has also developed following area of land with different models agro-forestry system/ silvi-pasture with proper protective fencing.

Development of plots under agro-forestry/silvi-pasture plantations

a.	Mulberry plantation:	2.50 acres
b.	Neem plantation:	2.50 acres
c.	Ber plantation:	3.50 acres
d.	Mixed plantation:	3.50 acres
e.	Amla plantation:	1.50 acres
f.	Guava+Jamun plantation:	0.75 acres
g.	Nursery:	0.50 acres
h.	Neem/Gular/ Ornamental plantation:	2.00 acres

The section is maintaining 1711 plants (1-7 years old) of different fodder tree species (neem, mulberry, lasora, ber, subabool, pakar, gular, pepal, bargad, amla etc) and 185 perennial ornamental plants in the above plots. The section is also maintaining a nursery with about 2250 saplings of different species for the use of the Institute. Apart from these the section is also engaged regularly for the upkeep and maintenance of all farm roads and drinking water supply to the entire Institute.

Vermicompost from goat faeces

Goat rearing is primarily associated with resource poor farmers in developing countries. In general, goat keepers are not much aware or interested to know about economic importance of goat faeces. Dumping of goat faeces in an open area for use as manure under natural

decomposition is a common practice resulting loss of nutrients due to direct exposure of to sunlight, temperature and rainfall. The practice created foul smell and provides favorable conditions to various insect and pests growth. In this process decomposition also takes long time to mineralize nutrients for conversion into manure. Goat keepers may enhance their income by making vermicompost from goat faeces. This can be marketed for organic crop, vegetable or ornamental plant productions. Goat producers can also use vermicompost for their own farms, which has better nutrient densities because of reduced nutrient losses due to lowered decomposition time and fasten mineralization process. Plant material *i.e. Saccharum munja, Calitropis* sp. *Azadirachta indica, Ficus benghalensis* and grasses can be mixed with goat faeces. A special kind of earth worms easily convert these in to vermicompost in a very short time. While sole plant material as such are not ingested by earthworm and took months together for conversions into vermicompost.

LINKAGES AND COLLABORATIONS

The institute has developed effective linkages with DUVASU, Mathura; IVRI, Izatnagar; NDRI, Karnal; IARI, New Delhi; CCS HAU, Hisar; 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.

The Institute is hosting a study centre for Diploma in Meat Technology of Indira Gandhi National Open University. Dr. R.B. Sharma, Senior Scientist is acting as a co-ordinator for Diploma in Meat Technology programme at the study centre. Nine students were enrolled for this diploma course during the year 2010-2011.

राजभाषा प्रकोष्ठ

संस्थान में वर्ष 2010–2011 के दौरान राजभाषा से सम्बन्धित कार्यकलापों का विवरण निम्न प्रकार है

(1) हिन्दी पखवाड़े का आयोजन

दिनांक 14.09.2010 को एक विचार संगोष्ठी का आयोजन किया गया जिसमें संस्थान के विभिन्न वैज्ञानिकों, अधिकारियों, कर्मचारियों व आमंत्रित अतिथियों द्वारा 'संस्थान में राजभाषा हिन्दी के प्रगामी प्रयोग व बढ़ते कदम एवं सुधार हेतु सुझाव' पर अपने विचार प्रकट किये गये तथा अन्त में संस्थान के निदेशक द्वारा अपने उद्‌बोधन में हिन्दी को अपने देश की एकता को जोड़ने वाली एक कड़ी तथा पहचान बताते हुए संस्थान के सभी कर्मियों को शत–प्रतिशत हिन्दी में कार्य करने हेतु आह्‌वान किया गया।

- दिनांक 15.9.2010 को हिन्दी श्रुतलेख प्रतियोगिता का आयोजन संस्थान के दो वर्गों में की गयी, जिसमें प्रथम वर्ग में संस्थान के समस्त कर्मचारी एवं द्वितीय वर्ग में संस्थान की समस्त छात्राओं ने भाग लिया। प्रथम वर्ग में श्री विजय किशोर, प्रथम, श्री बदन सिंह, द्वितीय, डा. गोपाल दास, तृतीय एवं श्री राजकुमार सिंह, तृतीय तथा द्वितीय वर्ग में कु. पल्लवी सिंह, प्रथम, कु. प्रिंयका शर्मा, द्वितीय एवं कु. प्रियंका राज, तृतीय स्थान पर रहे।
- दिनांक 16 सितम्बर, 2010 को हिन्दी हस्ताक्षर प्रतियोगिता का आयोजन किया गया जिसमें संस्थान के 139 वैज्ञानिकों, अधिकारियों, कर्मचारियों एवं छात्र/छात्राओं द्वारा हिन्दी में अपने हस्ताक्षर किये गये तथा मूल्यांकन के पश्चात् सर्वश्रेष्ठ तीन हस्ताक्षर करने वाले श्री निरंजन प्रसाद, श्री बदन सिंह एवं श्री गंगादत्त क्रमशः प्रथम, द्वितीय व तृतीय स्थान पर रहे।
- दिनांक 18.9.2010 को हिन्दी अनुप्रयोग प्रतियोगिता का आयोजन किया गया जिसमें श्री विजय किशोर, श्री देवकी नन्दन उप्रेती एवं डा0 अनिल कुमार गोयल क्रमशः प्रथम, द्वितीय एवं तृतीय स्थान पर रहे।
- दिनांक 20.9.2010 को आओ बताओ ईनाम पाओ प्रतियोगिता का आयोजन किया गया जिसमें 205 वैज्ञानिकों, अधिकारियों, कर्मचारियों, बच्चों एवं महिलाओं ने सहभागिता की। इस प्रतियोगिता में सहभागिओं से राजभाषा एवं सामान्य ज्ञान से सम्बन्धित 100 प्रश्न पूछे गये तथा सही उत्तर देने वाले 100 सफल प्रतियोगिओं को तत्काल पुरस्कृत किया गया।
- दिनांक 21.9.2010 को हिन्दी श्रुतलेख प्रतियोगिता का आयोजन बच्चों के प्रौढ़ वर्ग एवं बाल वर्ग के लिए अलग–अलग किया गया। प्रौढ़ वर्ग में कु. भारती शर्मा, कु. पिंकी एवं मि. हिमांशु क्रमशः प्रथम, द्वितीय एवं तृतीय स्थान पर रहे एवं बाल वर्ग में कु. नीतू, कु. प्रतिष्ठा एवं मि.योगेश क्रमशः प्रथम, द्वितीय एवं तृतीय स्थान पर रहे।
- दिनांक 22.9.2010 को संस्थान के समस्त कर्मचारियों एवं छात्र/छात्राओं के लिए हिन्दी अनुवाद प्रतियोगिता का आयोजन किया गया जिसमें डा. अनिल कुमार गोयल, कु. भव्या पाठक एवं श्री राजकुमार शर्मा दास क्रमशः प्रथम, द्वितीय एवं तृतीय स्थान पर रहे।
- दिनांक 23.9.2010 को संस्थान के वैज्ञानिकों, वरिष्ठ तकनीकी अधिकारियों के लिए एक हिन्दी शोध पत्र प्रतियोगिता का आयोजन किया गया। वैज्ञानिक एवं तकनीकी वर्ग में डा0 अनिल कुमार गोयल, डा0 गोपाल दास एवं डा0 बृजमोहन क्रमशः प्रथम, द्वितीय एवं तृतीय स्थान पर रहे।
- दिनांक 24.9.2010 को राजभाषा से सम्बन्धित वृत्तचित्र, सेतु व हिन्दी गांधी और गुलामी का चलचित्र प्रदर्शन समस्त कर्मचारियों के लिए संस्थान में किया गया।
- दिनांक 25.9.2010 को राजभाषा से सम्बन्धित वृत्तचित्र

कलमकारी व गौपुरम का चलचित्र प्रदर्शन समस्त कर्मचारियों के लिए संस्थान में किया गया।

- दिनांक 27.09.2010 को राजभाषा कार्यशाला का आयोजन किया गया, जिसमें संस्थान के समस्त वैज्ञानिकों, तकनीकी अधिकारी व कर्मचारी, प्रशासनिक अधिकारी व कर्मचारियों ने सहभागिता निभायी जिसमें डा. शीलेन्द्र वशिष्ठ, वरिष्ठ प्रबन्धक (राजभाषा),पंजाब नेशनल बैंक, क्षेत्रीय कार्यालय, आगरा द्वारा 'प्रशासनिक शब्दावली एवं अनुवाद' पर एक व्याख्यान दिया गया।

- दिनांक 14 सितम्बर, 2010 से प्रारम्भ हुए इस हिन्दी पखवाड़े के दौरान समस्त सफल प्रतिभागियों को संस्थान निदेशक एवं अध्यक्ष राजभाषा कार्यान्वयन समिति द्वारा पुरस्कृत किया गया। इस अवसर पर निदेशक महोदय ने अपने उद्‌बोधन में कहा कि किसी भी देश की एकता एवं विकास के लिए उस देश की राष्ट्रभाषा का समृद्ध होना अति आवश्यक है। अतः हम सभी का कर्तव्य है कि हिन्दी को राष्ट्रभाषा के पद पर आसीन करने के लिए हर सम्भव प्रयास करें तथा संस्थान मे निर्धारित लक्ष्यों के अनुरूप हिन्दी में कार्य करते हुए हिन्दी के कार्यान्वयन को आगे बढ़ाना सुनिश्चित करें। हमेशायाद रखें कि दैनिक व्यवहार में हिन्दी भाषा का प्रयोग हीनता नहीं बल्कि गौरव का प्रतीक है।

(2) संस्थान समाचार पत्र अजामुख का प्रकाशन

संस्थान में एक त्रैमासिक हिन्दी समाचार पत्र 'अजामुख' नियमितरूप से प्रकाशित किया जा रहा है जिसमें हिन्दी में बकरी पालन व्यवसाय के विभिन्न पहलुओं एवं क्षेत्रों जैसे बकरी प्रजनन, आनुवांशिकी, स्वास्थ्य, आवास प्रबन्धन, जनन, पोषण, चारा स्रोत एवं उत्पाद प्रौद्योगिकी, परियोजना निर्माण तथा बकरी पालन व्यवसाय इत्यादि पर सरल एवं सुगम भाषा में वैज्ञानिकों के लेख प्रकाशित किये जाते हैं। इस पत्रिका को समस्त प्रशिक्षण प्राप्त बकरी पालकों, संस्थानों, विश्वविद्यालयों, कृषि विज्ञान केन्द्रों व गैर सरकारी संगठनों को नियमितरूप से उपलब्ध कराया जा रहा है जिसके माध्यम से ज्ञान अर्जित करते हुए ग्रामीण किसान व बकरी पालक लाभान्वित हो रहे हैं।

(3) व्यावसायिक बकरी पालन पर राष्ट्रीय प्रशिक्षण का आयोजन

संस्थान में बकरी पालकों को बकरी पालन व्यवसाय पर राष्ट्रीय प्रशिक्षण देने के उद्‌देश्य से वर्ष के दौरान व्यावसायिक बकरी पालन पर चार राष्ट्रीय प्रशिक्षण आयोजित किये गये जिसमें वर्ष 2010 के दौरान देश के विभिन्न राज्यों से कुल 238 बकरी पालक किसानों, भूमिहीन कृषकों, शिक्षित बेरोजगारों, व्यवसायियों व सेवा निवृत्त अधिकारियों/कर्मचारियों व सेना के कई व्यक्तियों ने प्रशिक्षणार्थियों केरूप में सहभागिता की। इस प्रशिक्षण के दौरान संस्थान के वैज्ञानिकों व वरिष्ठ तकनीकी अधिकारियों द्वारा राजभाषा हिन्दी में व्याख्यान, प्रदर्शन, प्रयोगात्मक प्रशिक्षण व भ्रमण के माध्यम से बकरी पालन से सम्बन्धित विभिन्न आधुनिक अनुसंधान तकनीकों के बारे में सहभागियों को जानकारी प्रदान की गई तथा उन्हें प्रेरणा लेते हुए अपना बकरी पालन व्यवसाय आरम्भ करने हेतु प्रोत्साहित किया गया।

(4) रेडियो कृषि पाठशाला (फार्म स्कूल ऑन एयर)

संस्थान द्वारा किसानों को बकरी पालन व्यवसाय अपनाने हेतु प्रोत्साहित करने के उद्देश्य से सितम्बर, 2010 की अवधि के दौरान एक कृषक रेडियो पाठशाला का आयोजन आकाशवाणी, आगरा की सहायता से किया गया जिसमें उन्नत बकरी पालन व्यवसाय हेतु संस्थान द्वारा विकसित की गयी नवीनतम वैज्ञानिक तकनीकों से सम्बन्धित 30 कड़ियों का प्रसारण संस्थान के 30 वैज्ञानिकों द्वारा किया गया। इन प्रसारणों के अन्त में प्रत्येक कड़ी में प्रसारण से सम्बन्धित तीन प्रश्न पूछे गये, जिनका उत्तर बकरी पालक किसानों के द्वारा लिखितरूप में डाक द्वारा संस्थान को भेजा गया। इस प्रक्रिया में 15 बकरी पालकों ने सहभागिता की जिसमें उत्तर प्रदेश व राजस्थान के भरतपुर जनपद के किसानों ने भाग लिया तथा पूछे गये प्रश्नों के उत्तर लिखितरूप में संस्थान में भेजे जिनका मूल्याकंन करने के

पश्चात् कुल 12 किसानों को पुरस्कृत किये जाने का प्रावधान रखा गया।

(5) संस्थान की हेल्पलाइन के माध्यम से पशु पालक किसानों की समस्याओं का समाधान

संस्थान द्वारा बकरी पालक किसानों की विभिन्न समस्याओं के त्वरित निवारण हेतु प्रारम्भ की हेल्पलाइन (दूरभाष संख्या 0565–2763320) की सहायता से वर्ष–2010 के दौरान बकरी पालन व्यवसाय से सम्बन्धित विभिन्न 481 प्रश्नों/समस्याओं का समाधान किया गया। उल्लेखनीय है कि इस हैल्प लाइन के अन्तर्गत किसानों द्वारा बकरी पालन से सम्बन्धित पूछे गये प्रश्नों का उत्तर संस्थान के वैज्ञानिकों द्वारा तत्काल दूरभाष के माध्यम से राजभाषा हिन्दी में प्रदान किया जाता है।

(6) बकरी पालक किसानों द्वारा भ्रमण

संस्थान में विभिन्न संस्थाओं जैसे कृषि विश्वविद्यालयों, कृषि विज्ञान केन्द्रों गैर सरकारी संगठनों द्वारा प्रायोजित किसान भ्रमण कार्यक्रमों के अन्तर्गत आने वाले 1032 बकरी पालक किसानों को वैज्ञानिकों द्वारा राजभाषा हिन्दी में संस्थान की बकरी पालन से सम्बन्धित विभिन्न गतिविधियों व नवीनतम अनुसंधान तकनीकों के विषय में जानकारी प्रदान की गई।

(7) राजभाषा प्रभावी क्रियान्वयन के अन्तर्गत अन्य गतिविधियॉ

- संस्थान परिसर में विभिन्न स्थानों पर संस्थान द्वारा विकसित की गई अनुसंधान सम्बन्धी तकनीकों/गतिविधियों राजभाषा हिन्दी में तैयार कराये गये डिस्प्ले बोर्ड के माध्यम से प्रदर्शन किया गया है तथा संस्थान में आने वाले बकरी पालक किसानों को सरल एवं सुगम हिन्दी भाषा के माध्यम से वांछित जानकारी उपलब्ध कराई जा रही है।
- संस्थान में आयोजित की गई चार हिन्दी कार्यशालाओं में संस्थान के समस्त वैज्ञानिकों, तकनीकी अधिकारी व कर्मचारियों एवं प्रशासनिक अधिकारी एवं कर्मचारियों को विषय संघ की राजभाषा नीति, नियम एवं प्रावधान, प्रशासनिक शब्दावली एवं अनुवाद, राजभाषा एवं हिन्दी संरचना से सम्बन्धित त्रुटियां व उपाय एवं हिन्दी भाषा व उसकी प्रयोगशीलता के विषय में प्रबुद्ध व्याख्यान कर्ता डा. रघुवीर शरण तिवारी, प्राध्यापक एवं सह–सचिव, नगर राजभाषा कार्यान्वय समिति, आगरा, श्रीमती रेसू अग्रवाल, शोध छात्रा द्वारा शोध कार्यों का हिन्दी में प्रस्तुतीकरण, डा0 शीलेन्द्र वशिष्ठ, वरिष्ठ प्रबन्धक (राजभाषा), पंजाब नेशनल बैंक, क्षेत्रीय कार्यालय, अगरा एवं श्री अशोक कुमार तनेजा, वरिष्ठ मुख्य प्रबन्धक (राजभाषा), सेन्ट्रल बैंक ऑफ इंडिया, संजय प्लेस, आगरा द्वारा व्याख्यान दिये गये। इन कार्यशलाओं में संस्थान के कुल 145 वैज्ञानिकों, अधिकारियों एवं कर्मचारियों ने सफलता पूर्वक सहभागिता की।
- संस्थान में दैनिक प्रयोग में आने वाले समस्त विभागीय प्रपत्र (प्रोफार्मा) जैसे अर्जित अवकाश, आकस्मिक अवकाश, कार्य आरम्भ रिपोर्ट, प्रस्थान रिपोर्ट, वाहन मांग पत्र, भण्डार मांग पत्र, तथा समस्त रजिस्टर, अनुबन्ध पत्र, निविदा पत्र व फाइलें इत्यादि द्विभाषी अथवा प्रकाशित कर विभागीय कार्य हेतु उपलब्ध करा दी गई हैं तथा उनमें अधिकांशतः हिन्दी में कार्य सम्पादित किया जा रहा है।
- संस्थान में समस्त सूचना पट, संकेतक, नाम पट्टिकाऐं, मुहरें इत्यादि राजभाषा हिन्दी में अथवा द्विभाषी करा दी गई हैं।
- संस्थान में कार्यरत कर्मचारियों में हिन्दी में कार्य करने हेतुरूचि उत्पन्न करने के उद्देश्य से राजभाषा अनुभाग द्वारा स्चागत–पटल पर लगाये गये सूचना पट पर प्रतिदिन एक नया हिन्दी का शब्द एवं राजभाषा हिन्दी को बढ़ावा देने वाली तथा ज्ञानवर्धक सूक्तियॉ, कविताऐं व दोहे नियमितरूप से लिखे जा रहे हैं।
- संस्थान भ्रमण के दौरान आने वाले वैज्ञानिकों, प्रसार अधिकारियों, व्यवसायियों व बकरी पालक किसानों को संस्थान की अनुसंधान से सम्बन्धित परियोजनाओं, गतिविधियों, उपलब्धियों व नवीन अनुसंधान तकनीकों के विषय में सुलभ जानकारी सुगमता से उपलब्ध कराने के उद्देश्य से पिछले 32 वर्षों की जानकारी को विस्तार पूर्वक द्विभाषीरूप में प्रदर्शित किया गया है तथा बकरी पालन से सम्बन्धित विभिन्न गतिविधियों पर आधारित प्रकाशित की गयी नवीन अनुसंधान तकनीकी से सम्बन्धित पुस्तिकाओं, पुस्तकों एवं फोल्डरों के माध्यम से जानकारी आने वाले आगन्तुकों को राजभाषा हिन्दी में निरन्तर उपलब्ध करायी जा रही है।
- संस्थान के अधिकारियों व कर्मचारियों को हिन्दी के प्रशिक्षण के अन्तर्गत डा. हरिऔध तिवारी, प्रभारी राजभाषा अनुभाग एवं डा. विजय कुमार, वैज्ञानिक ने

दिनांक 29 अक्टूबर, 2010 को राष्ट्रीय कृषि एवं प्रबन्धन अकादमी (नार्म), हैदराबाद में राजभाषा हिन्दी पर आयोजित कार्यशाला में सहभागिता की।

- संस्थान के समस्त वैज्ञानिकों, अधिकारियों एवं कर्मचारियों को अपना शत–प्रतिशत कार्य हिन्दी में करने के उद्देश्य से निदेशक द्वारा हस्ताक्षरित अक्षरशः आदेश जारी किये गये हैं।
- संस्थान के प्रसार शिक्षा एवं सामाजिक अर्थशास्त्र अनुभाग, स्थापना अनुभाग, केन्द्रीय क्रय एवं संविदा अनुभाग तथा बीजक एवं रोकड अनुभाग को अपना शत–प्रतिशत कार्य राजभाषा हिन्दी में सम्पादित करने हेतु निदेशक महोदय द्वारा आदेशित/नामित किया गया है।
- संस्थान के 15 विभागों/अनुभागों में प्रत्येक से 2 से 4 कर्मचारियों को अपना शत–प्रतिशत कार्य राजभाषा हिन्दी में सम्पादित करने हेतु निदेशक महोदय द्वारा अक्षरशः आदेश जारी किये गये हैं।
- बिहार सरकार के पशु पालन विभाग द्वारा आयोजित एवं भेजे गये 20 पशुचिकित्सा अधिकारियों को बकरी पालन के विभिन्न पहलुओं व विकसित की गयी नवीन अनुसंधान तकनीकों पर 6–15 अप्रैल, 2010 की अवधि के दौरान संस्थान वैज्ञानिकों द्वारा प्रशिक्षण द्विभाषीरूप में प्रदान किया गया।
- बिहार सरकार के 'बामेती', पटना द्वारा प्रायोजित बकरी पालन प्रशिक्षण के अन्तर्गत 16–25 अप्रैल, 2010 की अवधि में 35 किसानों, 11–20 मई, 2010 की अवधि में 46 किसानों व 'आत्मा' द्वारा प्रायोजित 23 किसानों को 6–10 दिसम्बर, 2010 की अवधि के दौरान उन्नत बकरी पालन का प्रशिक्षण पूर्णरूपेण राजभाषा हिन्दी में संस्थान के वैज्ञानिकों द्वारा प्रदान किया गया।
- संस्थान द्वारा अंगीकृत किये गये मथुरा जनपद के हयातपुर गांव में कुल 128 बकरी पालक किसानों को बकरी पालन से सम्बन्धित विभिन्न नवीन वैज्ञानिक अनुसंधान तकनीकों पर राजभाषा हिन्दी में प्रशिक्षण प्रसार विभाग के वैज्ञानिकों द्वारा माह फरवरी, 2010 से नवम्बर, 2010 के दौरान प्रदान किया गया।
- संस्थान में आने वाले बकरी पालक किसानों व विभिन्न आगन्तुकों को संस्थान द्वारा वर्ष 2010 के दौरान 755 किसानों को निःशुल्क परामर्श व 277 किसानों को सशुल्क परामर्श राजभाषा हिन्दी में प्रदान किया गया।
- संस्थान द्वारा पिछले 32 वर्षों के दौरान किये गये विभिन्न अनुसंधान कार्यों व विकसित की गयी नवीन अनुसंधान तकनीकों तथा संस्थान में किये विभिन्न विकास कार्यों की जानकारी संस्थान में आने वाले आगन्तुकों को देने के उद्देश्य से एक 10 मिनट की अवधि की वृत्तचित्र (डाक्यूमेन्ट्री फिल्म) पूर्णतया हिन्दी में तैयार करायी गयी है। जिसकी प्रशंसा परिषद स्तर पर भी की गयी है।
- संस्थान द्वारा वर्ष 2010 के दौरान संस्थान की अनुसंधान एवं विकास सम्बन्धी समस्त गतिविधियों को राजभाषा हिन्दी में जनसम्पर्क विभाग द्वारा क्षेत्र के समस्त एवं राष्ट्रीय समाचार पत्रों में प्रकाशित किया गया है।
- संस्थान में 30 अगस्त, 2010 को बकरियों के संरक्षण एवं उनके प्रबन्धन में आपेक्षित सुधार पर एक मस्तिष्क–मंथन (ब्रैन स्टारमिंग) बैठक का आयोजन संस्थान में किया गया जिसमें परिषद से उप–महानिदेशक, पशुविज्ञान, सहायक महानिदेशक एवं राष्ट्रीय पशु आनुवांशिकी ब्यूरो, करनाल के निदेशक की उपस्थिति में संस्थान के समस्त वैज्ञानिकों के भाग लिया तथा बैठक के दौरान समस्त विचार विमर्श व प्रदर्शन द्विभाषीरूप में किया गया।
- संस्थान के पुस्तकालय द्वारा राजभाषा हिन्दी के प्रगामी प्रयोग को बढ़ावा देने के उद्देश्य से कुल 388 राजभाषा हिन्दी की वैज्ञानिक, साहित्यक, सामाजिक व मनोरंजक पुस्तकें क्रय करते हुए पाठकों हेतु उपलब्ध कराई गयी हैं जिससे कि आम लोगों की राजभाषा हिन्दी के प्रतिरूचि जागृत हो सके।

(8) राजभाषा हिन्दी से सम्बन्धित त्रैमासिक बैठक

राजभाषा अधिनियम के अन्तर्गत संस्थान की राजभाषा कार्यान्वयन समिति की बैठकों का आयोजन क्रमशः दिनांक 25 मार्च, 2010, दिनांक 24 जून, 2010, दिनांक 10 सितम्बर, 2010 एवं दिनांक 16 दिसम्बर, 2010 को संस्थान निदेशक एवं अध्यक्ष संस्थान राजभाषा कार्यान्वयन समिति की अध्यक्षता में सम्पन्न हुयी। इन बैठकों में संस्थान के समस्त विभागाध्यक्ष, अनुभाग प्रभारी व संस्थान राजभाषा कार्यान्वयन समिति के सदस्यों ने सहभागिता की। बैठकों के दौरान संस्थान में हिन्दी के प्रगामी प्रयोग को बढ़ावा देने

हेतु किये गये कार्य कलापों पर गहन विचार–विमर्श किया गया तथा संस्थान निदेशक द्वारा समस्त वैज्ञानिकों, अधिकारियों व कर्मचारियों को संस्थान के 'क' क्षेत्र में स्थित होने के कारण अपना शत–प्रतिशत कार्य हिन्दी में करने हेतु निर्देशित किया गया तथा प्रशासनिक अधिकारी व प्रशासन के अन्य अधिकारियों एवं कर्मचारियों को प्रत्येक दशा मेंधारा 3(3) का अनुपालन करने के लिये निर्देशित किया गया। इसी दौरान राजभाषा अनुभाग को समस्त कर्मचारियों में राजभाषा हिन्दी के प्रति जागरूकता वरूचि जागृत करने के उद्देश्य से हिन्दी में उत्कृष्ठ कार्य करने के लिये कर्मचारियों को नियमानुसार नगद पुरस्कार प्रदान करने हेतु निर्देश जारी किया गया।

(9) हिन्दी कार्यशालाओं का आयोजन

1 जनवरी से 31 दिसम्बर, 2010 तक आयोजित त्रैमासिक हिन्दी कार्यशाला

1. दिनांक 31 मार्च, 2010 को चतुर्थ एक दिवसीय कार्यशाला का आयोजन संस्थान में किया गया। इस कार्यशाला में डा. रघुवीर शरण तिवारी, प्राध्यापक एवं सह–सचिव, नराकास, आगरा संघ की राजभाषा नीति, नियम एवं प्रावधान पर व्याख्यान दिया गया। इस कार्यशाला में संस्थान के समस्त वैज्ञानिक, तकनीकी अधिकारी, प्रशासनिक अधिकारी व कर्मचारियों ने सहभागिता की।

2. दिनांक 28 जून, 2010 को प्रथम त्रैमासिक एक दिवसीय कार्यशाला का आयोजन संस्थान के केन्द्रीय सभागार में किया गया। इस कार्यशाला में संस्थान के पशुस्वास्थ्य विभाग के शोध छात्र श्री दीपक द्विवेदी व पशु आनुवाशिकी एवं प्रजनन विभाग की शोध छात्रा रेसू अग्रवाल द्वारा अपने शोध पत्र द्विभाषी/हिन्दी में प्रस्तुत किये गये तथा प्रभारी, राजभाषा के द्वारा उपस्थित कर्मचारियों को राजभाषा अधिनियम व अनुपालन के विषय में विस्तृत जानकारी प्रदान की गयी। इस आयोजन में संस्थान के समस्त वैज्ञानिक, तकनीकी अधिकारी एवं कर्मचारियों ने सहभागिता की।

3. दिनांक 27.09.2010 को द्वितीय त्रैमासिक एक दिवसीय कार्यशाला का आयोजन किया गया, जिसमें संस्थान के समस्त वैज्ञानिकों, तकनीकी अधिकारी व कर्मचारी, प्रशासनिक अधिकारी व कर्मचारियों ने सहभागिता निभायी जिसमें डा. शीलेन्द्र वशिष्ठ, वरिष्ठ प्रबन्धक (राजभाषा),पंजाब नेशनल बैंक, क्षेत्रीय कार्यालय, आगरा द्वारा 'प्रशासनिक शब्दावली एवं अनुवाद' पर एक व्याख्यान दिया गया।

4. दिनांक 22 दिसम्बर, 2010 को तृतीस त्रैमासिक एक दिवसीय कार्यशाला का आयोजन संस्थान में किया गया। इस कार्यशाला में संस्थान के समस्त वैज्ञानिक, तकनीकी अधिकारी, प्रशासनिक अधिकारी, व कर्मचारियों एवं हाईस्कूल उत्तीर्ण कुशल सहा. कर्मचारियों ने सहभागिता की। इस कार्यशाला में श्री अशोक कुमार तनेजा, वरिष्ठ मुख्य प्रबन्धक (राजभाषा), सेन्ट्रल बैंक ऑफ इंडिया, संजय प्लेस, आगरा द्वारा राजभाषा हिन्दी के प्रगामी प्रयोग को बढ़ावा देने से सम्बन्धित अपने विचार व्यक्त किये।

(10) राजभाषा कार्यों हेतु उल्लेखनीय सम्मान/पुरस्कार

नगर राजभाषा कार्यान्वयन समिति (नराकास), मथुरा रिफाइनरी, मथुरा द्वारा आयोजित निबन्ध प्रतियोगिता में 55 सदस्य कार्यालयों अधिकारियों एवं कर्मचारियों की सहभागिता के समक्ष संस्थान के डा. अनिल कुमार गोयल, प्रधान वैज्ञानिक द्वारा प्रथम पुरस्कार प्राप्त किया गया।

दिनांक 28.10.2010 को श्री शैलेश कुमार सिंह, उप निदेशक (कार्यान्वयन) गृह मंत्रालय, राजभाषा विभाग, क्षेत्रीय कार्यान्वयन कार्यालय (उत्तर) गाजियाबाद के द्वारा संस्थान का भ्रमण किया गया तथा संस्थान के विभिन्न विभागों/अनुभागों में राजभाषा हिन्दी से सम्बन्धित किये जा रहे कार्य–कलापों का निरीक्षण तथा संतोष व्यक्त किया।

TECHNOLOGY AND CONSULTANCY SERVICES

Goat Germplasm supplied

CIRG Makhdoom supplied 424 superior animals of Barbari, Jamunapari and Jakhrana breeds to the progressive farmers and various government agencies for breed improvement programmes.

Diagnostic Services provided

For the screening of MAP infection, samples (serum, fecal) from Veterinary College, Mathura, Faizabad and Pondicherry and Regional Centres of CSWRI, Avikanagar (SRC, Kodai Kanal and WRCC, Bikaner) were received. These samples were screened by ELISA, microscopic examination, faecal culture and PCR.

AWARDS AND RECOGNITIONS

संस्थान को वर्ष 2009 का प्रतिष्ठित राजर्षि टंडन राजभाषा प्रथम पुरस्कार प्राप्त

संस्थान को वर्ष 2009 के दौरान सरकारी काम–काज हिन्दी के प्रयोग में उल्लेखनीययोगदान के लिये 'क' एवं 'ख' क्षेत्र के अन्य संस्थानों की श्रेणी में प्रथम पुरस्कार परिषद के द्वारा दिनांक 16 जुलाई, 2010 को भारतीय कृषि अनुसंधान परिषद, नई दिल्ली के स्थापना दिवस समारोह के अवसर पर श्री शरद पवार केन्दीय मंत्री, कृषि, उपभोक्ता मामले, खाद्य और सार्वजनिक वितरण मंत्री, भारत सरकार द्वारा संस्थान के निदेशक, डा. देवेन्द्र स्वरूप एवं डा. हरिऔध तिवारी, प्रभारी (राजभाषा प्रकोष्ठ) को प्रदान किया गया। इस अवधि के दौरान संस्थान के वैज्ञानिकों, अधिकारियों व कर्मचारियों द्वारा अधिकतम विभागीय कार्य राजभाषा हिन्दी में किया गया।

नगर राजभाषा विकास समिति (नराकास), मथुरा द्वारा संस्थान सम्मानित

संस्थान द्वारा वर्ष 2009–10 के दौरान विभागीय काम–काज उत्कृष्ठ स्तर पर राजभाषा हिन्दी किये जाने के उपलक्ष्य में केन्द्रीय गृह मंत्रालय के राजभाषा विभाग के अन्तर्गत कार्यरत नगर राज भाषा कार्यान्वयन समिति (नराकास), मथुरा द्वारा प्रथम पुरस्कार से सम्मानित किया गया।यह पुरस्कार दिनांक 28.10.10 को मथुरा, रिफाइनरी में आयोजित एक कार्यक्रम के दौरान श्री शैलेश कुमार सिंह, उप निदेशक (कार्यान्वयन) गृह मंत्रालय, राजभाषा विभाग, क्षेत्रीय कार्यान्वयन कार्यालय (उत्तर) गाजियाबाद के द्वारा संस्थान निदेशक डा. देवेन्द्र स्वरूप को एक चलवैजन्ती व प्रशस्ति पत्र प्रदान कर सम्मानित किया गया।

The Institute was awarded **Stall Award** during Krishi Mela, held at Indian Veterinary Research Institute, Izatnagar from November 1-3rd, 2010 for excellent Stall in the category of Institutes of Indian Council of Agricultural Research.

The Institute has been awarded Chal Vaijyanti Award from the Ministry of Home for work in the area of popularization of Hindi Rajbhasha.

Dr. S.V. Singh

- Best Oral Presentation award (II) at UP MICROCON, 2010 for article 'Genotypic profile of *Mycobacterium avium* subsp paratuberculosis in human beings in India' by Singh AV, Singh, SV. *et al*., at UP MICROCON 2010 held from 13-14 March 2010, 6th annual conference of Association of Medical Microbiologists UP chapter at NJIL-OMD (ICMR) Agra.

Dr. S.P. Singh

- Awarded ICAR International fellowship to work in Germany for a period of 3 years leading to the award of Ph.D.

Dr. M.K. Tripathi

- Awarded Endeavour Research award 2010-11, for a period of Six Months by Australian Government.

Dr. A.K. Goel

- Received First Prize in Hindi Sodh Patra Presentation Competition held at CIRG Makhdoom Farah (Mathura).
- Received First Prize in Hindi Translation Competition held during Hindi Pakhwara from 14-28 Sept., 2010 at CIRG Makhdoom Farah (Mathura).

- Received First Prize in Hindi Essay Competition arranged by Nagar Rajbhasha Karyanwan Samiti (NARAKAS) Mathura.

Dr. Gopal Dass

- Received Second Prize in Hindi Shodh Patra Pratiyogita during Hindi Pakhwada at CIRG, Makhdoom from 14-28 September, 2010.
- Received Third Prize in Hindi Hastakshar Pratiyogita during Hindi Pakhwada at CIRG, Makhdoom from 14-28 September, 2010.

Dr. Ravindra Kumar

- Best oral presentation award to paper co-authored by Dr. Ravindra Kumar in 7th Binnenial conference of ANA held in OUAT Bhubneswar from 17-19 Dec, 2010.

Dr. S.D. Kharche

- Special Recognition Award for meritorious contribution-2010 by KNP Vet. Alumni Association, KNP College of Vety. Science and A.H., Shirwal, Satara (MS).

Release of Area Specific Mineral Mixture Technology

An Area Specific Mineral Mixture Technology, developed by CIRG scientists under the AICRP programme, was released by the Hon'ble Union Minister of Agriculture and Food Processing Industries, Shri Sharad Pawar during his visit to the institute on January 24, 2011. The area specific mineral mixture was formulated on the basis of micronutrient status in soil, water, feed and fodder and animals of different livestock species in South- Western Semiarid, Central and Eastern Plain zones covering 30 districts of Uttar Pradesh. The use of the mineral mixture resulted in significant improvement in the fertility as well as productivity of different livestock species under field conditions. The commercialization of this technology is under process.

METEOROLOGICAL OBSERVATIONS

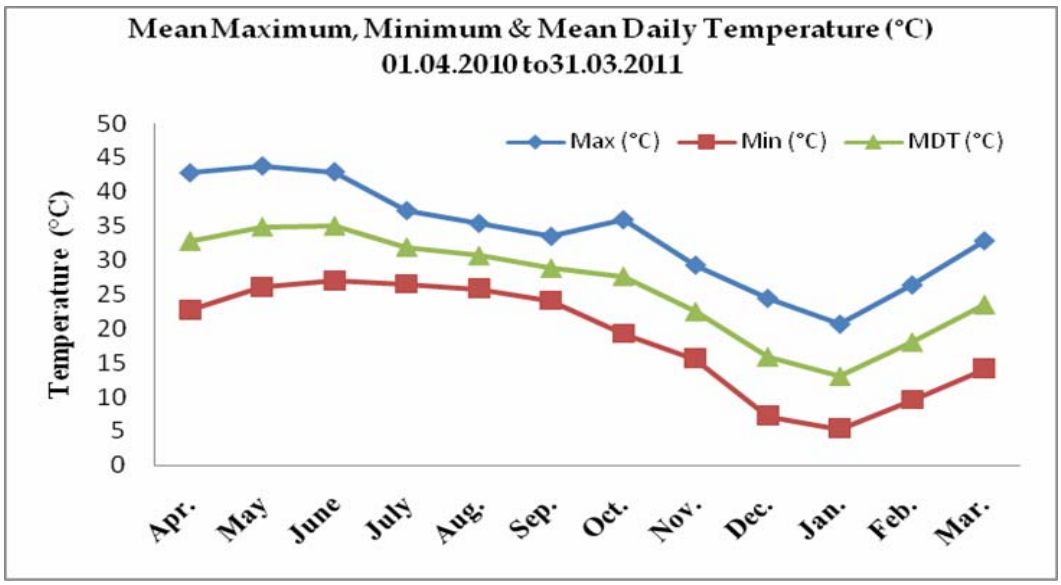
Months	Mean Max Temp. (°C)	Mean Min. Temp. (°C)	Mean Daily Temp. (°C)	Mean Vapor Pressure (mmHg)	Mean RH (%)	Mean Rain Fall (mm)/Wet Days	Sun Shine (hrs)
April 2010	42.82	22.73	32.78	10.54	22.18	1.2 (1)	281.3
May 2010	43.82	26.08	34.84	15.10	30.73	1 (1)	261.6
June 2010	42.97	27.03	35.00	19.36	39.60	18.2 (3)	224.9
July 2010	37.31	26.50	31.90	28.25	26.22	68.40 (8)	184.4
Aug. 2010	35.45	25.82	30.64	26.62	75.91	98.2 (13)	182
Sept. 2010	33.55	24.07	28.81	24.56	78.24	114.0 (13)	171.5
Oct. 2010	35.98	19.27	27.63	17.39	53.11	Nil	278.4
Nov. 2010	29.35	15.58	22.47	14.38	64.23	20 (5)	167.5
Dec. 2010	24.50	7.25	15.88	9.74	63.32	2 (2)	218.3
Jan. 2011	20.73	5.31	13.02	8.09	66.35	Nil	193.4
Feb. 2011	26.45	9.59	18.02	11.40	62.77	22.2 (3)	247.3
March 2011	**32.90**	**14.10**	**23.50**	**12.38**	**45.76**	**Nil**	**295.0**

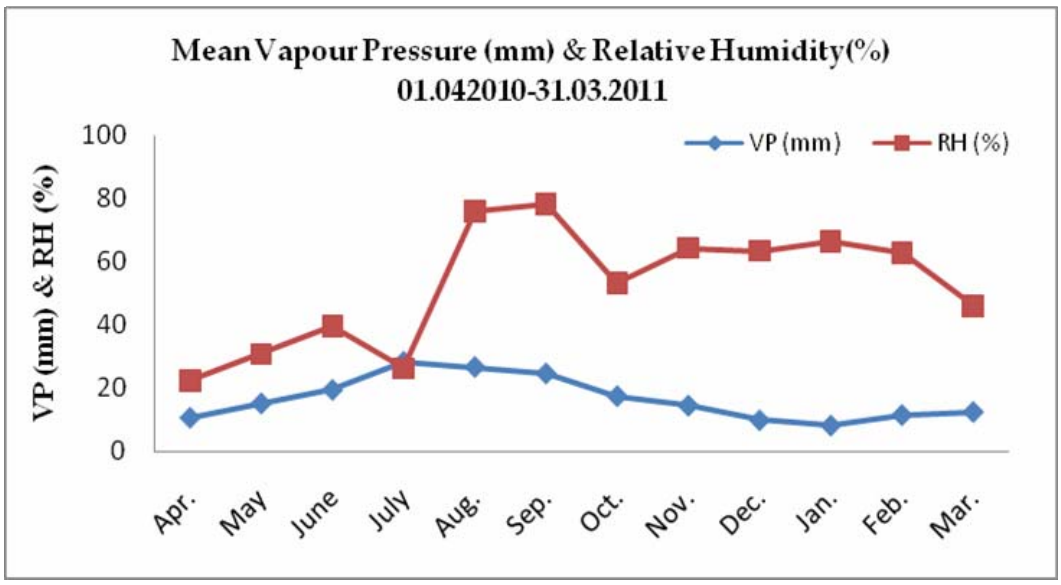
Maximum temperature: 48.0°C on 24.05.2010, 28.05.2010 and 22.06.2010

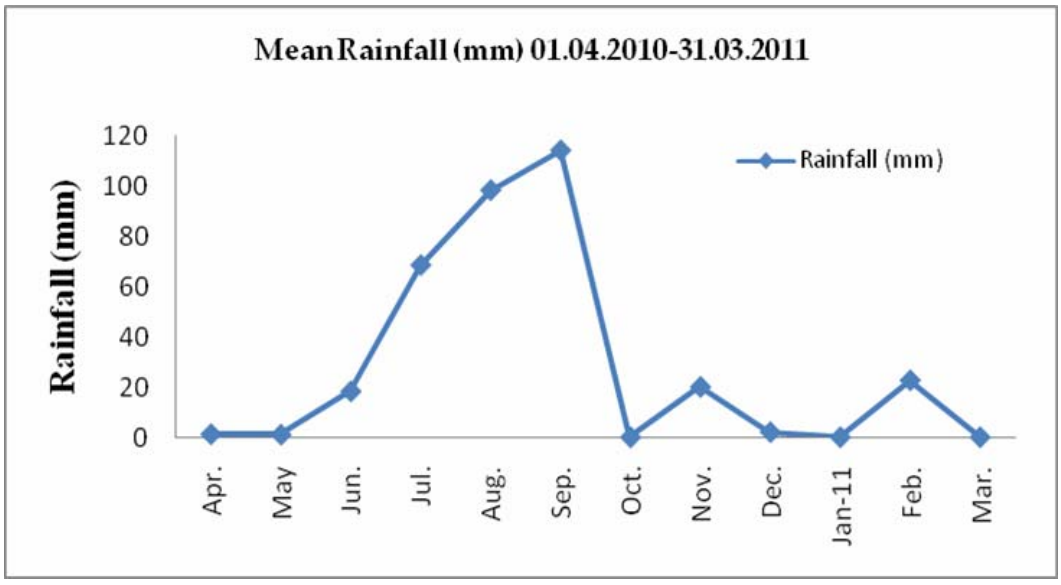
Minimum temperature: 2°C on 05.01.2011 and 11.01.2011

Annual Rain Fall: 345.6 mm in 49 Days

The average annual rainfall has decreased to 345.6 mm in 49 wet days during the last decade from 487.81 mm in 38.18 wet days during 1999. The maximum rainfall of 796.2 mm in 39 days was recorded at this place in 1992 and minimum rainfall of 252.7 mm in 39 days was recorded in 2001.


Mean Maximum, Minimum & Mean Daily Temperature (°C)
01.04.2010 to31.03.2011
Temperature (°C)
50
45
40
35
30
25
20
15
10
5
0
Max (°C)
Min (°C)
MDT (°C)
Apr.
May
June
July
Aug.
Sep.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.


Mean Vapour Pressure (mm) & Relative Humidity(%)
01.042010-31.03.2011
VP (mm) & RH (%)
100
80
60
40
20
0
VP (mm)
RH (%)
Apr.
May
June
July
Aug.
Sep.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.


Mean Rainfall (mm) 01.04.2010-31.03.2011
Rainfall (mm)
120
100
80
60
40
20
0
Rainfall (mm)
Apr.
May
Jun.
Jul.
Aug.
Sep.
Oct.
Nov.
Dec.
Jan-11
Feb.
Mar.

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Medicine (17-19 Feb. 2011) at MAFSU, Mumbai.

19. Raghavendra BS, Priyadharsini Raju, Ravindra JP, Reddy IJ, Agarwal SK and Selvaraju S. 2010. Expression of LH-R, IGF-IR, BMP-2, 3β-HSD and caspase-3 in buffalo corpus luteum. In: Proceedings of International Symposium on Biotechnologies for Optimization of Reproductive Efficiency of Farm & Companion Animals to Improve Global Food Security & Human Health, ISSAR at Department of Animal Reproduction, Gynaecology. & Obstetrics College of Veterinary and Animal Sciences G.B. Pant University of Agriculture & Technology Pantnagar, U.S. Nagar, Uttarakhand - 263 145 from 10 - 12 November 2010. pp. 121-122
20. Rai B, Singh, M K and Tiwari H A. (2010). Bundelkhand mein bakari utpadan barahne ke upayay. In Proceedings of National Agriculture Science Seminar in Hindi language held on 21-23 Jan, 2011 at NRC on Agro-Forestry, Jhansi.
21. Rai B, Singh MK and Ramachandran N. (2010). Management interventions for higher productivity of goats. In: National Symposium of ISAPM on Technology management, visioning and up scaling for accelerating livestock production at College of Veterinary science, Guwahati, Assam on 11-13th November, 2010. pp.186-194.
22. Rajkumar V and Das AK. (2010). Quality characteristics of goat meat patties. In: Compendium. 4th Convention of Indian Meat Science Association and National Symposium on "Strategies for Sustainable Meat Production and Processing for Nutritional Security and Employment Generation" held on November 19-20, 2010, IVRI Izatnagar, Bareilly. pp.131.
23. Singh AV, Singh SV, Singh PK and Sohal JS. 2010. Genotype profiles of *Mycobacterium avium* subsp. paratuberculosis recovered from inflammatory bowel disease patients, suspected Crohn's disease patients and healthy human beings in India. In: 6th Annual Conference of Association of Medical Microbiologists-UP Chapter, UP MICROCON 2010 & CME on "Newer Molecular tools for Diagnosis & Management of tuberculosis & other Mycobacterial disease on 13-14 Mar, 2010 at NJIL&MD, Tajganj Agra.pp.45. 206.
24. Singh SK. 2010. Livestock Genetic Resources in the Asia-Pacific Region. In: International Symposium on Sustainable Agricultural Development and Use of Agro biodiversity in the Asia-Pacific Region" Abstract & Programme Guide, Rural Development Administration Suwon, Korea 13-15 Oct., 2010 pp. 35.
25. Saraswat Sonia and Jindal SK. 2011. Effect of antioxidant fortification and post thaw sperm motility of the Sirohi buck semen. In: Compendium of 'Frontiers in Reproductive Biotechnology' and 21st Annual meeting of the Indian Society for the study of Reproduction and Fertility. pp. 249.
26. Saraswat Sonia, Jindal SK and Rout PK. 2011. Effect of antioxidant fortification on DNA integrity (DNA stability) of the Sirohi buck semen. In: Compendium of 'Frontiers in Reproductive Biotechnology' and 21st Annual meeting of the Indian Society for the study of Reproduction and Fertility. pp. 115.

27. Swarup D. (2010). Traditional and current uses of herbs and herbal preparations for management of animal diseases in India In: International Seminar on the Development of herb- medicinal products for animals and the promotion of their practical use. Seoul National University, (South Korea). December 6, 2010. Proc. (ppt. presentation) pp. 281-232.
28. Swarup D. (2010). Vaccines and vaccination in animals. In: Proceedings of Innovative Approaches in Livestock Development. Bihar Agricultural Management and Extension Education Training Institute Patna, July 2010. pp. 26-45.
29. Swarup D, Rout PK and Kumar V. (2010). Small ruminants as a source of rural livelihood security in India. In: National Seminar on Ensuring Productivity Enhancement in Livestock for Food Security, Income Generation and Self Employment. November 24, 2010. Souv. pp 26-32.
30. Chauhan Swati, Kumar Ashok and Vihan VS. (2011). Evaluation of successive extracts of *Punica granatum* (Peel) for antibacterial activity against MDR bacteria. In: Proceedings of 29th ISVM convention and National Symposium on "Recent Development in diagnostic and Therapeutics including applications of nano technology in Veterinary medicine (17-19 Feb 2011) at MAFSU, Mumbai.
31. Tripathi Prabhat and Dutta TK. 2010. Berseem (*Trifolium alexandrinum*) hay preparation using hay rack in poly houses and under direct sun. Range Management and Agroforestry Symposium Issue (A) pp. 103-104.
32. Tripathi Prabhat and Dutta TK. 2010. Response of natural and improved pasture on biomass yield and growth performance in Barbari Kids under semi arid region Range Management and Agroforestry Symposium Issue (A) pp. 47-48.
33. अनिल कुमार गोयल एवं सुरेश दिनकर खर्चे (2010)। बुन्देलखंड क्षेत्र की बकरियों के जनन अभिलक्षणों व रोगों का अध्ययन तथा उपचार। एक दिवसीय शोध पत्र प्रस्तुतिकरण सम्मेलन, केन्द्रीय बकरी अनुसंधान संस्थान, मखदूम, मथुरा सितम्बर 23, 2010।

Human Resource Development

Scientist Trained in India/ Abroad

Dr. A.K. Goel

- Specialized Training Programme on Agricultural Research Management (ARM): 15th Training Programme on "Management Development Programme in Agricultural Research" held at NAARM, Hyderabad from 2-7 Dec. 2010.

Dr. A.K. Das

- Attended 21 days Winter School on "Current Trends in Microbial Biotechnology: Genomics, Diversity and Gene Mining" at Central Institute on Fisheries Technology, Kochi, Kerala from 9-29th November 2010.

Dr. Manjunatha Reddy GB

- Training Programme for researchers in the usage of SAS' from 20 to 25th September/2010, organized by statistical computing hub at IVRI Izatnagar.
- Foundation course for Agricultural Research Scientist (90th FOCARS) training from April 20 to August 18, 2010 at NAARM, Hyderabad.

Dr. Vijay Kumar

- Participated in a Winter School on "Micro-enterprise promotion in

Agriculture at Indian Agricultural Research Institute, New Delhi from 1-21 December, 2010.

Training/Workshop Organized

- Brain Storming Meeting of Directors of ICAR Animal Science Division Institutes was organized at Central Institute for Research on Goats, Makhdoom from January 30-31, 2011. All Directors, Joint Directors and Heads of Regional Stations of the ICAR Animal Science Institutes and ADGs, Principal Scientists and DS (AS) from SMD attended the Meeting, which was Chaired by Dr. K.M.L. Pathak, DDG (AS) ICAR. The meeting was to sensitize the Institutes in preparing the XII Plan EFC document and identify few flagship programs and thematic areas to be addressed during XII plan.
- Brain storming session on field data recording and information was held at CIRG, Makhdoom on 30th August, 2010.
- Work-shop on "Goat husbandry based integrated approach for livelihood security in disadvantaged districts of Bundelkhand region" was organized at CIRG on 29-30 April, 2010.

Seminar/Symposia/Workshop etc. attended

Dr. A.K. Goel

1. Participated in Brain Storming Session organized on 30th August, 2010 under AICRP on Goat at CIRG, Makhdoom, Farah, Mathura, U.P.
2. International Symposium on "Biotechnologies for Optimization of Reproductive Efficiency of Farm Companion Animals to Improve Global Food Security and Human Health and 26th Annual Convention of ISSAR at GBPUAT, Pantnagar (Uttarakhand) from 11-12 Nov., 2010.
3. Workshop on Mintub Sperm Vision (Asia, Semen Processing & ETT, arranged by Chemtron Analytical Instruments, Pvt. Ltd., New Delhi & Minitub Gmb H, Germany at New Delhi on 17.12. 2010.
4. National Symposium on Prevention and Management of Companion Animal Diseases vis-vis Human Health and VIII Annual Congress of ISACP at SKUAT, RS Pura Jammu-181102 (JK) from 2 - 4 February 2011.
5. त्रैमासिक हिन्दी कार्यशालाः संस्थान द्वारा आयोजित त्रैमासिक हिन्दी कार्यशाला में भाग लिया 27.9.2010, 22.12.2010 |

Dr. Ashok Kumar

1. Participated in Brain Storming Session organized on 30th August, 2010 under AICRP on Goat at CIRG, Makhdoom, Farah, Mathura (U.P.)
2. X Agriculture Science Congress on Soil-Plant-Animal Health: Safety and Security by National academy of Agricultural sciences at National Bureau of Fish Genetic Resources, Lucknow UP (10-12 February 2011).

Dr. B. Rai

1. Participated in Brain Storming Session organized on 30th August, 2010 under AICRP on Goat at CIRG, Makhdoom, Farah, Mathura (U.P.)

Dr. Braj Mohan

1. On 23.9.2010 participated in Hindi Shodh Patra Pratiyogita at CIRG, Makhdoom.
2. On 27.9.2010 participated in Tritiya Trimasik Hindi Karyashala at CIRG, Makhdoom.
3. On 28.2.2011 attended a National

Science Day Programme at CIRG, Makhdoom.

Dr. Devendra Swarup

1. Review Meeting- NAIP (3) Project on "Goat husbandry based integrated approach for livelihood security in disadvantaged districts of Bundelkhand region" held on 04.09.2010 at CIRG, Makhdoom.
2. Attended the 20th Meeting of the ICAR Regional Committee No. IV Chaired by Honorable DG, ICAR and held from 7th-9th October, 2010 at Birsa Agricultural University, Ranchi.
3. Meetings of CPCSEA organized by the Ministry of Environment and Forests (MoEF), New Delhi.
4. Meeting of Expert Group on Animal Health (DAHD, Ministry of Agriculture), New Delhi.
5. Meeting of Scientific Advisory Committee of NCLAS, National Institute of Nutrition, Hyderabad.
6. Meeting of Thematic Expert Group on Animal Conservation and Welfare, MoEF, New Delhi.
7. Meetings of ICMR - ICAR Joint Working Group on Zoonosis at ICMR New Delhi.
8. CAC of NAIP on Development of Wireless sensor at NDRI Karnal.
9. Mid - term review of AICRP on goat improvement.
10. Interactive meeting of Director's with RAC Chairmen, chaired by DG.
11. Brain storming meeting of Directors' Animal Science Division on XII Plan priorities chaired by DDG (AS).
12. ICAR Directors' Meeting in July 2010, February 2011 and Interactive meeting of VCs and ICAR Directors in February 2011.

Chief Guest/ Guest of Honour

13. Xth Annual Conference and National Symposium on Recent Trends in Ethnopharmacology & Monitoring of Environmental and Food Toxicants held at College of Veterinary Science and Animal Husbandry Madhya Pradesh Pashu Chikitsa Vigyan Vishwa Vidyalaya, Jabalpur on December 3, 2010.
14. National Seminar on Frozen Semen Technology for Cattle Breed Improvement held at College of Veterinary Science and Animal Husbandry, DUVASU, Mathura on December 23, 2010

Guest speaker to deliver keynote address/ theme paper/ Lead papers/ Expert lectures at Workshop/ National Seminar/ Training Courses

15. Workshop on " Goat Rearing in Bihar" organized by Directorate of Animal Husbandry in Bihar Veterinary College, Patna on 29.3.2011.
16. Seminar on Innovative approaches in livestock development. Bihar Agricultural Management and Extension Education Training Institute Patna, July 2010.
17. National Seminar on Ensuring Productivity Enhancement in Livestock for Food Security, Income Generation and Self Employment Vet. College Durg November 24, 2010.
18. International Seminar on the Development of Herb - Medicinal Products for Animals and the Promotion of their Practical Use. Seoul National University, College of Veterinary Medicine (South Korea). Dec. 6, 2010. Proc. (ppt. presentation).

Dr. Gopal Dass

1. Participated in Brain Storming Session organized on 30th August, 2010 under AICRP on Goat at CIRG, Makhdoom, Farah, Mathura, U.P.
2. Participated in National Symposium on "Animal Genetic Resources for Sustainable Livestock Sector in India" held at OUAT, Bhubaneswar from February 18-19, 2011.

Dr. M.K. Singh

1. Attended the Review Meeting- NAIP (3) Project on "Goat Husbandry based integrated approach for livelihood security in disadvantaged districts of Bundelkhand region" held on 4.9.2010.
2. Participated in Brain Storming Session organized on 30th August, 2010 under AICRP on Goat at CIRG, Makhdoom, Farah, Mathura, U.P.

Dr. M.K. Tripathi

1. National Symposium on optimizing forage production from arable and non-arable lands for increasing livestock production November 12-14, 2010 at IGFRI, Jhansi.
2. 7th ANA Conference on "Animal Nutrition Strategies for Environmental Protection and Poverty Alleviation" from Dec. 17-19, 2010, OUAT, Bhubaneswar, India.

Dr. N. Ramachandran

1. Annual Review Meeting of the Network Project on "Adaptation of livestock to impending climatic changes through Shelter Management" held on 6th July, 2010 at NDRI, Karnal.
2. Hindi Workshop at CIRG Makhdoom, Farah (Mathura) UP.

Dr. R. Priyadharsini

1. International Conference on 'Frontiers in Reproductive Biotechnology' and 21st Annual meeting of the Indian Society for the Study of Reproduction and Fertility, Karnal, Feb 9-11, 2011.
2. Workshop on Minitub Sperm Vision (Asia, Semen Processing & ETT, arranged by Chemtron Analytical Instruments, Pvt. Ltd., New Delhi & Minitub Gmb H, Germany at New Delhi on 17.12. 2010.

Dr. P. Tripathi

1. Participated in workshop on Collaborative extension programme (NEP) at IARI, New Delhi 22-23 April 2010.

Dr. P.K. Rout

1. Participated in Brain Storming Session organized on 30th August, 2010 under AICRP on Goat at CIRG, Makhdoom, Farah, Mathura, U.P.

Dr. R.B. Sharma

1. Participated in Brain Storming Session organized on 30th Aug., 2010 under AICRP on Goat at CIRG, Makhdoom, Farah, Mathura, U.P.
2. National Conference on Newer Advances in Food Science and Technology, March 5-6, 2011, Faculty of Engineering and Technology, R.B.S. College, Bichpuri, Agra.

Dr. R. Roy

1. Participated in Brain Storming Session organized on 30th August, 2010 under AICRP on Goat at CIRG, Makhdoom, Farah, Mathura, U.P.
2. Participated in one day workshop on "Goat Rearing in Bihar" organized by Directorate of Animal Husbandry in Bihar Veterinary College, Patna on 29.3.2011.

Dr. Saket Bhushan

1. Participated in Brain Storming Session organized on 30th August, 2010 under

AICRP on Goat at CIRG, Makhdoom, Farah, Mathura, U.P.

2. Attended the Review Meeting- NAIP (3) Project on "Goat Husbandry based integrated approach for livelihood security in disadvantaged districts of Bundelkhand region" held on 4.9.2010.
3. Attended National Symposium on Animal Genetic Resources for Sustainable Livestock Sector in India held on 18-19 February, 20011 at Bhubaneswar (Orissa).

Dr. S.D. Kharche

1. Workshop on Computer Assisted Semen Analyzer 2010. Sponsored by Minitub India Pvt. Limited at New Delhi on 17.12.2010.
2. Annual Workshop of NAIP entitled: Developmental potency of parthenogenetic goat embryos" at NDRI, Karnal, Haryana from 1st to 2nd May, 2010.
3. Annual Workshop of NAIP entitled: Developmental potency of parthenogenetic goat embryos" at NDRI, Karnal, Haryana from 6 to 7th Feb., 2011.
4. International Conference on Frontiers in Reproductive Biotechnology and 21st Annual Meeting of The Indian Society for Study of Reproduction and Fertility, Jan. 9–11, 2011, NDRI, Karnal, Haryana.
5. Hindi Workshop at CIRG Makhdoom, Farah (Mathura) UP.
6. Attended the International Symposium on Biotechnologies for Optimization of Reproductive Efficiency of Farm and Companion Animals to Improve Global Food Security and Human Health and XXVI Annual Convention of ISSAR, November 10-12, GBPUAT, Pantnagar.

Dr. S.K. Jindal

1. Attended the 20th Meeting of the ICAR Regional Committee No IV Chaired by Honorable DG, ICAR and held from 7th -9th October, 2010 at Birsa Agricultural University, Ranchi.
2. Attended and Coordinated the Review Meeting- NAIP (3) Project on "Goat Husbandry based integrated approach for livelihood security in disadvantaged districts of Bundelkhand region" held on 4.9.2010.
3. Workshop on Minitub Sperm Vision (Asia, Semen Processing & ETT, arranged by Chemtron Analytical Instruments, Pvt. Ltd., New Delhi & Minitub Gmb H, Germany at New Delhi on 17.12. 2010.
4. Participated in Brain Storming Session organized on 30th August, 2010 under AICRP on Goat at CIRG, Makhdoom, Farah, Mathura, U.P.

Dr. S.K. Singh

1. Participated in Brain Storming Session organized on 30th August, 2010 under AICRP on Goat at CIRG, Makhdoom, Farah, Mathura, U.P.
2. Attended International Conferences on Sustainable Agricultural Development and Use of Agro biodiversity in the Asia-Pacific Region at Suwon city, South Korea and presented a lead paper entitled Livestock Genetics Resources in Asia-Pacific Region Technology Dissemination.
3. Attended Biodiversity Conference organized by ICAR at NASC Complex on 26-27 May, 2010.
4. Attended Workshop cum seminar Animal Biodiversity on 11-16 August, 2010 at Kullapptanam.

5. Attended a meeting of Planning Commission on XII Plan preparation with DDG (AS) ICAR, New Delhi on 28-29 September, 2010.

Dr. S.V. Singh

1. 6th Annual Conference of Association of Medical Microbiologists-UP Chapter, UP MICROCON 2010 & CME on 'Newer Molecular tools for Diagnosis & Management of tuberculosis & other Mycobacterial disease on 13-14 Mar, 2010 at NJIL&MD, Taj Ganj, Agra.
2. Attended Johne's disease Integrated Program conference at Denver, USA from 10 to 15 July, 2010 and presented three oral papers and one poster.

Dr. Vijay Kumar

1. Participated in Winter School on Micro Enterprise Promotion in Agriculture, Sponsored by ICAR, at CATAT, IARI, New Delhi.
2. Attended a scientific talk on traditional and current uses of herbs in herbal preparations for management of animal diseases in India delivered by Dr. Devendra Swarup, Director, CIRG, Makhdoom on 4.2.2011.
3. Attended National Science Day Programme at CIRG, Makhdoom on 28.2.2011.

Dr. V.K. Gupta

1. Participated in Brain Storming Session organized on 30th August, 2010 under AICRP on Goat at CIRG, Makhdoom, Farah, Mathura, U.P.
2. Participated in ICAR-Industry meet organized by ICAR at NASC complex, New Delhi 28-29th July, 2010.
3. Participated in Workshop organized by National Biosecurity Network organized by Ministry of Agriculture 22nd March, 2011.

Dr. V. Rajkumar

1. Attended 4th Convention of Indian Meat Science Association and National Symposium on Strategies for Sustainable Meat Production and Processing for Nutritional Security and Employment Generation held on November 19-20, 2010, at IVRI, Izatnagar, Bareilly (UP).

Dr. V.S. Vihan

1. Participated in Brain Storming Session organized on 30th August, 2010 under AICRP on Goat at CIRG, Makhdoom, Farah, Mathura, U.P.
2. Attended and Coordinated the Review Meeting- NAIP (3) Project on "Goat Husbandry based integrated approach for livelihood security in disadvantaged districts of Bundelkhand region" held on 4.9.2010.
3. Participated in one day workshop on " Goat Rearing in Bihar" organized by Directorate of Animal Husbandry in Bihar Veterinary College, Patna on 29.3.2011.

Dr. U.B. Chaudhary

1. Participated in Brain Storming Session organized on 30th August, 2010 under AICRP on Goat at CIRG, Makhdoom, Farah, Mathura, U.P.
2. Attended and Coordinated the Review Meeting- NAIP (3) Project on "Goat Husbandry based integrated approach for livelihood security in disadvantaged districts of Bundelkhand region" held on 4.9.2010.

IMPORTANT COMMITTEES AND MEETINGS

Quinquennial Review Team (QRT)

Position	Status	Name and Designation
An eminent retired ICAR Scientist nominated by DG, ICAR	Chairman	Dr. R.N. Sreenivas Gowda, Ex. Vice Chancellor, Karnataka Veterinary, Animal & Fisheries Science University (KVAFSU), Bidar
4-5 external members (including retired ADG, Director, Scientists representing the major areas of research and development programme of the institute nominated by DG, ICAR.	Member	1. Dr. B.U. Khan, Former Director, CSWRI, Avikanagar
		2. Dr. M.N. Razdan, Former Dean, HAU, Hisar
		3. Dr. A. Chakraborty, Director of Research, AAU, Khanapura
		4. Dr. J. Ramaprasad, Professor & Head (AN), SVVU, Tirupati
		5. Dr. P.K. Nagpaul, Former Head (LPM), NDRI, Karnal
	Member Secretary	6. Dr. A.K. Goel, Principal Scientist (Animal Reproduction)

Research Advisory Committee (RAC)

Position	Status	Name and Designation
An eminent retired ICAR Scientist nominated by DG, ICAR	Chairman	Dr. Arun Verma, Former ADG (AN&P), ICAR, New Delhi
4-5 external members (including retired ADG, Director, Scientists representing the major areas of research and development programme of the institute nominated by DG, ICAR.	Member	1. Dr. D.V. Rangnekar, former Vice President BAIF, Ahmadabad
		2. Dr. K.P. Agrawal, Former National Coordinator, NAIP, New Delhi
		3. Dr. V.K. Singh, Ex. Director, CSWRI Avikanagar, Jaipur
		4. Dr. S.K. Singh, Ranchi Veterinary College, Ranchi
		5. Director, CIRG, Makhdoom
		6. ADG (AN&P), ICAR, New Delhi
		7. Members to be nominated by President, ICAR on the IMC of CIRG, Makhdoom
	Member Secretary	8. Dr. S. K. Jindal, Principal Scientist, CIRG, Makhdoom

Institute Management Committee (IMC)

Position	Status	Name and Designation
Director, CIRG, Makhdoom	Chairman	Dr. Devendra Swarup
Members include ADG, Former Head, Principal Scientist, Finance Account Officer and Administrative Officer representing the major areas of research and development programme of the institute nominated by DG, ICAR.	Member	1. Dr. N.N. Pathak, Former Director, CIRB, Hisar
		2. Dr. H.N. Singh, Former Dean, Pt. Dean Dayal Upadhayay Pashu Chikitsa Vishwa Vidayalaya, Mathura
		3. Dr. Rupasi Tiwari, Scientist & OIC, ATIC, IVRI, Izatnagar
		4. Dr. Mahesh Kumar, Prof. & Head (VPM), GBPUAT, Pantnagar, Udham Singh Nagar
		5. Dr. C.S. Prasad, ADG (AN&P), ICAR, New Delhi
		6. Dr. S.K. Jindal, Principal Scientist, CIRG, Makhdoom
		7. Shri S. Philipose, FAO, CIRG, Makhdoom
	Member Secretary	8. Shri S.L.V. Prasad, Administrative Officer, CIRG, Makhdoom

MEETINGS

Institute Research Council (IRC)

Institute Research Council (IRC) meeting was held at the Institute from 8th to 10th June, 2010. The meeting aimed to review the progress made under different research projects and also to discuss and decide the technical programme to be undertaken during XII Five Year Plan period. The Chairman in his opening remarks appraised that keeping in view of the future thrust areas of research, the programmes have been modified by the Animal Science Division of ICAR New Delhi. The progress of the research projects for the year 2009-10 was reviewed. In total the progress of 16 major research projects was presented by the respective principal investigators and collaborators.

Six monthly Research Council (IRC) Meeting of the Institute was held from 23.10.2010 to 29.10.2010.

Institute Management Committee (IMC)

A meeting of the Institute Management Committee was held on 31st August, 2010 in the committee room of the Institute to discuss some urgent Agenda Items. Dr. Devendra Swarup, Director, CIRG and Chairman, Institute Management Committee welcomed the IMC members. The following were present.

1. Dr. C.S. Prasad, Assistant, Director General (AN&P), ICAR, Krishi Bhavan, New Delhi
2. Dr. N.N. Pathak, Former Director, CIRB
3. Dr. Mahesh Kumar, Prof. & Head (VPH), GBPUAT, Pantnagar
4. Dr. S.K. Jindal, Pr. Scientist and Head, PR&SM, CIRG (Special invitee)
5. Dr. U.B. Chaudhary, Pr. Scientist and Head, NFR&PT, CIRG (Special invitee)
6. Shri S. Philipose, Finance & Accounts Officer, CIRG
7. Shri S.L.V. Prasad, Administrative Officer, CIRG– Member Secretary

RESEARCH PROJECTS

INSTITUTE PROJECTS

Project No.	Project Title	Investigators	Date of start	Date of completion
GENETICS AND BREEDING DIVISION				
XI/GGB-1: Evaluation and improvement of growth, milk, meat and skin traits in Indian goat breeds (Jamunapari, Barbari, Jakhrana, Beetal and Bengal goats) through multi disciplinary approach.				
GGB-1.09	Improvement of sire evaluation of Jamunapari goats for milk & meat production (AICRP-Jamunapari).	R. Roy (P.I.), Gopal Dass and H.A. Tiwari	1997-98	**To continue**
GGB-1.10	Genetic improvement of Barbari goats for meat & milk production (AICRP-Barbari).	S.K. Singh (P.I.) and P.K. Rout	1997-98	**To continue**
XI/GGB-1.12	Improvement of Jakhrana breed of goats (*Capra hircus*) for milk and meat production under farm and field condition.	Saket Bhushan (PI). U.B.Chaudhary, Gopal Dass, A.K. Mishra	April, 2007	**March, 2012**
AICRP on sheep improvement				
CIRG-10.01	AICRP on sheep improvement.	Gopal Dass (P.I.) K.Gururaj (upto Sep, 2010), S.D. Kharche, N. Shivasharanappa A.K. Das	1997-98	**To continue**
XI/GGB- 2 Quantitative Trait Loci (QTL) mapping for production, reproduction and other traits in Indian goats				
XI/GGB-2.01	Molecular analysis of major genes and Quantitative Trait Loci (QTL) influencing growth, reproduction and disease resistance traits in Indian goats.	P.K. Rout (P.I.), A.K. Das, S.K. Singh and R. Roy	June, 2007	**March, 2012**
NUTRITION, FEED RESOURCES AND PRODUCTS TECHNOLOGY DIVISION				
XI/NFRPT-1. Development of technologies for improving feed & fodder resources for goats.				
XI/NFRPT-1.01	Development of fodder production, conservation and processing technologies for small holders and commercial goat farmers.	P. Tripathi (PI) T.K. Dutta	April, 2007	**March, 2012**
XI/NFRPT-1.02	Development of feeding strategies for goats under intensive and semi-intensive systems.	T.K. Dutta (PI) AK. Das	September, 2007	**March, 2012**
XI/NFRPT-2	**Development of value addition and marketing of goat products.**			
XI/NFRPT-2.01	Studies on nutritional value of goat milk.	R.B. Sharma (PI) A.K. Das	April, 2007	**March, 2012**
XI/NFRPT-2.02	Evaluation of carcass traits, meat quality and products from goat meat.	A.K. Das (PI) R.B. Sharma V. Rajkumar and A.K. Verma (w.e.f. 25.10.10)	April, 2007	**March, 2012**
PHYSIOLOGY, REPRODUCTION AND SHELTER MANAGEMENT DIVISION				
XI/PRSM-1: Improved productivity of goats through reproductive biotechnologies including refinement of frozen semen, strengthening of semen bank and augmentation of prolificacy.				
XI/PRSM-1.01	Studies on refinement of frozen semen technology and strengthening of goat	S.K. Jindal (PI) S.D. Kharche	April, 2007	**March, 2012**

	semen bank.	A.K. Goel and N. Ramachandran and Priyadharsini Raju		
XI/PRSM-1.02	Augmentation of prolificacy by using biotechnological tools in goats.	S.D. Kharche (PI) A.K. Goel, S.K. Jindal and Priyadharsini Raju	April, 2007	**March, 2012**
XI/PRSM-2: Development of model goat production system including adaptability and environmental aspects for integrated rural development based on goat farming.				
XI/PRSM-2.03	Economic managemental interventions for augmenting growth in kids	N. Ramachandran (PI), S.K. Singh, M.K. Tripathi, V. Rajkumar, Priyadharsini Raju and T.K.Dutta	June 2009	**May 2012**
GOAT HEALTH DIVISION				
XI/GH-01	Monitoring and surveillance of important goat diseases in India.	D.K. Sharma (PI), V.K. Gupta, Ashok Kumar, V.S. Vihan, N. Shivsharanappa, M.N. Reddy, A.K. Mishra	April, 2007	**March, 2012**
XI/GH-2: Development of diagnostic kits, reagent and prophylactics using frontier technologies.				
XI/GH-2.1	Control of brucellosis in goats by molecular diagnosis and epidemiology.	V.K. Gupta (PI) S.V. Singh, V.S. Vihan	July, 2007	**March, 2011**
XI/GH-3:Development of contemporary alternative medicines for selective diseases.				
XI/GH-3.01	Modulation of caprine coccidiosis through herbal therapy.	D.K. Sharma (PI), Ashok Kumar	April, 2007	**March, 2011**
XI/GH-3.02	Development of herbal anti-diarrheal drug for goat.	Ashok Kumar (PI) V.S. Vihan and V.K. Gupta	April, 2007	**March, 2011**
EXTENSION EDUCATION & SOCIO-ECONOMICS SECTION				
XI/EESE- 1: Transfer of Technology and its impact on improving goat production.				
XI/EESE-1.03	Impact of improved technologies and emerging market conditions on goat production system.	M.K. Singh (PI) Khushyal Singh Vijay Kumar, Ashok Kumar and Anil Kumar (IASRI)	April, 2007	**March, 2011**
XI/EESE-1.04	A study on impact of various training programmes	Khushyal Singh (PI) Braj Mohan, Vijay Kumar and Anil Kumar (IASRI)	April, 2007	**March, 2011**
XI/EESE-2: Organization of National and International training programmes and provision of consultancy services for improving goat production.				
EESE/8.15	TOT-Multidisciplinary Project for Sustainable livelihood through goat farming by disseminating the improved goat production technologies.	Braj Moan P.I, Ashok Kumar, Khushyal Singh, M.K. Singh, A.K. Goel, U.B. Chaudhary, R.B. Sharma, H. A. Tiwari, N. Ramachandran and Vijay Kumar	April 2009	**March, 2012**

EXTERNALLY FUNDED PROJECTS

FUNDING AGENCY	Project Title	Investigators	Date of start	Date of completion
ICAR	AICRP on "Improvement of feed resources and nutrient utilization in raising animal production".	U.B. Chaudhary T.K. Dutta, A.K. Das & Ashok Kumar, M.K. Tripathi	2004 and September 2008 with modified Tech. Prog.	**March 2012**
CSIR & DST (PPP mode)	Development and Characterization of an Indigenous vaccine and diagnosis for Johne's disease (Collaboration with Biovet Private Ltd. Bangalore)	S.V. Singh	April 2007	**March, 2010**
ICAR (NAIP)	Goat husbandry based integrated approach for livelihood security in disadvantaged districts of Bundelkhand region (Component-3)	M.K.Singh (Component-3)	April, 2008	**March,2012**
Ministry of Food Processing	Nutritional approach for designing goat meat based functional products. (Ministry of Food Processing)	V. Rajkumar A.K. Das	Feb.,2009	**2011**
ICAR (Net work Project)	Adaptation of livestock to impending climatic changes through shelter management.	S.K.Jindal, Priyadharsini Raju and N. Ramachandran	2008	**2012**
ICAR (Net work Project)	Estimation of Methane emission under different feeding systems and development of mitigation.	U.B. Chaudhary M.K.Tripathi	2008 (March)	**2012**
NAIP	Developmental potential of parthenogenetic goat embryos (NAIP Component -4)	S.D. Kharche A.K. Goel S.K. Jindal and Priyadharsini Raju	Jan, 2009	**2012**
NAIP	Holistic approach for improving livelihood security through livestock based farming system in Barabanki and Raibareilly districts of UP	B Rai, Ashok Kumar and M.K. Singh	2009-10	**2012-13**
NAIP	Bioprospecting of genes and allele mining for abiotic stress tolerance	P.K. Rout N.Ramachandran S.K.Jindal	April 2009	**2012**
ICAR	Outreach programme on zoonotic diseases	S.V. Singh	2009-10	**2012**
ICAR (Network Project)	1. Veterinary type cultures-Microbes	V.K. Gupta and G.B. Manjunatha Reddy	2009-10	**March 2012**
	2. Veterinary type culture-Rumen microbes	U.B. Chaudhary V.K. Gupta, T.K. Dutta	October 2009	**March 2012**
NAIP	Achieving improved livelihood security through resource conservation and diversified farming system approach in Mewat	D.K.Sharma and P.K. Rout	2009-2010	**2012**

CONSULTANCY, PATENTS AND TECHNOLOGY COMMERCIALIZATION

The Institute rendered consultancy services (paid/free) on establishment and management of commercial goat farms to 865 visitors from India and abroad who visited the Institute during this period.

During the year 5 patent applications of various technologies generated by different scientists of the institute has been filed with Controller of patents, New Delhi. Details are as follows:

List of Patents Registered

S.N.	Title	Patent registration numbers	Inventors
1.	Intravaginal pessaries for augmentation of reproduction in goats	1872/DEL/2010	Drs. S.D. Kharche, A.K. Goel, SK Jindal and M.C. Sharma
2.	A synergistic anti-bacterial herbal preparation for animals	2840/DEL/2010	Drs, Ashok Kumar, Deepak Dwivedi, V.K. Gupta, V.S. Vihan and Devendra Swarup
3.	A formulation having antibacterial herbal extract for animal use.	2842/DEL/2010	Drs, Ashok Kumar, Deepak Dwivedi, V.K. Gupta, V.S. Vihan and Devendra Swarup
4.	A herb based antibacterial preparation for veterinary use.	2841/DEL/2010	Drs, Ashok Kumar, Deepak Dwivedi, V.K. Gupta, V.S. Vihan and Devendra Swarup
5.	An antibacterial herbal composition for animals.	2839/DEL/2010	Drs, Ashok Kumar, Deepak Dwivedi, V.K. Gupta, V.S. Vihan and Devendra Swarup

Patents filed during the year by Dr. D. Swarup from his work at IVRI Izatnagar

1. Development of post milking teat dip based on a novel herbal formulation for the prevention of bovine subclinical mastitis. *Innovators:* Reena Mukherjee, **Devendra Swarup** and MC Sharma (Government of India Patent Office File No 937/DEL/2010, dated 19.04.2010).
2. Herbo-mineral acaricide formulations against *Boophilus microplus* ticks in cattle Innovators*:* Debabrata Mondal, Srikanta Ghosh, Shubhamitra Chaudhuri, Nityanand Pandey, **Devendra Swarup** and Mahesh Chandra Sharma (Filed on 26-6-2010).
3. IVRI Antidiarrhoeal herbal formulation Innovators: Nityanand Pandey, Debabrata Mondal, **Devendra Swarup**, Jawahar Lal Singh and M.C. Sharma (Filed on 30-7-2010).

CIRG Introduces Goat Milk Based Value Added Products

CIRG Scientists have been involved in extensive research to generate value added goat product technologies. In this direction, goat milk based biscuits, *shrikhand*, low fat *paneer*, goat milk herbal whey drink, ice-cream and moisturizer soap (named as *Ajas*) have been developed this year. The edible value added products are being tested further for their nutritive and aesthetic traits prior to their commercialization.

Goat milk and cream based biscuits were developed using pure goat milk, goat milk cream, herbs, plant fibers and grains. The product contains higher amount of medium chain fatty acids, which are known to be beneficial for human health. Organoleptic evaluation revealed that the product has the score of 7.5 out of 9 for various parameters under hedonic scale. Flavour and colour of the product was more appealing. Texture and hardness of the product was comparable with the existing commercial products. Goat milk ice-cream was developed using pure goat milk, herbs, nuts and plant fibers. The product has high meltability, natural homogenizing quality, smooth texture, good flavour and better taste and was highly acceptable by the consumers. Selected immune-modulatory herbs with refreshing properties were used to develop herbal goat milk whey drink. This product contained lactose and essential minerals and was processed from whey after *paneer* making. The herbs used in flavoured goat milk and whey dirk completely eliminated the objectionable goaty flavor. Goat *shrikhand* was produced by using pure goat milk containing 4% fat. No preservatives or chemical additives were used. The product had a shelf life under refrigeration conditions. It is expected that the goat milk shrikhand would be liked by the consumers due to beneficial properties of goat milk.

Ajas soap formulation has been developed by using pure goat milk and fatty acids. The soap has many distinctive advantages. Goat milk soap has pH similar to human skin and protects it from daily bacterial and chemical invasions. This soap was evaluated by 120 families for various parameters such as lather, moisturizing ability, fragrance and texture and more than 90% respondents have rated it very good with an average score of 7 out of 10 for various qualities.

Activities related to Commercialization of Technologies

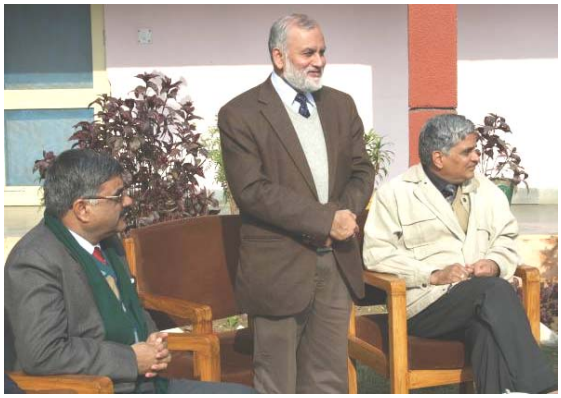
1. Institute participated in ICAR-industry meet held at NASC complex, New Delhi on 28-29th July 2010. In this meet institute showcased the technologies developed by the institute scientists before the industrialists.
2. Institute participated in business development meetings held at ZTMC-BPD, IVRI, Izatnagar.
3. One of the institute's technology named '**Areamix: mineral mixture**" was released by Hon'ble Agriculture Minister Shri Sharad Pawar on 24th Jan, 2011.
4. A Memorandum of Understanding (MOU) with the National Research Development Council (NRDC), New Delhi has been signed. The NRDC will help the institute in commercializing the technologies generated by the institute scientists. In first phase, two technologies viz., "Bruchek: A Dot Elisa Kit for detection of Brucellosis in goats and sheep" and Plate *ELISA* kit for diagnosis of Johne's disease has been transferred to NRDC for commercialization.

CIRG Produces Twin IVF Kids

A team of CIRG scientists has successfully produced twin *in vitro* fertilized (IVF) male and female kids on 3rd November 2010. The kids have been named as *Ajat* and *Ajati*. This is the second success in producing IVF kids at this Institute. The research work is a part of NAIP on *Developmental potency of parthenogenetic goat embryos*. The surrogate mother was of Sirohi breed. The kidding was normal with healthy offspring and occurred after 142 days following transfer of *in vitro* produced embryos. The birth weight of male kid was 2.4 kg and that of female was 2.6 kg. The weight of surrogate mother after parturition was 30 kg. IVF technique is an important method for improvement and conservation of goat breeds and opens new vistas for application of biotechnological tools for production of biopharmaceuticals through transgenic technology. The technique has applications in faster propagation of the genetic merit of the elite females and also to use non-descript goats as foster mothers for production of kids of superior genetic merit. This particular achievement is a step towards the high quality research output of the Institute in the area of reproductive biotechnology.

DISTINGUISHED VISITORS

- Dr. K.M.L. Pathak, Deputy Director General (AS) visited the Institute on 17-18 April, 2010 and 28 Aug., 2010.
- Dr. Arun Varma, Former ADG ICAR, and Chairman RAC visited the Institute on 01.05.2010.
- Dr. K.P. Agrawal, Former National Co-ordinator, NATP, Delhi visited the Institute on 07.06.2010.
- Dr. (Mrs.) Vandana Dwivedi, Joint Advisor (Agriculture), Planning Commission visited the Institute on 14-15th June, 2010.
- Dr. Arvind Kumar, DDG (Education) visited the Institute on 15th June & 28th Aug., 2010.
- Dr. P.N. Bhat, former DDG (AS), former AHC visited the Institute on 12th July, 2010.
- Dr. C.S. Prasad, ADG (ANP) visited the Institute on 30.08.2010.
- Dr. Chanda Nimbkar, Member Governing Body, ICAR and Incharge, Osmanabadi Field Unit, Phaltan visited the Institute on 30.08.2010.
- Dr. B.K. Joshi, Director, NBAGR visited the Institute on 30.8.2010.
- Dr. N.N. Pathak, former Director, CIRB visited the Institute on 31.8.2010.
- Dr. Bangalee Baboo, ND, NAIP, ICAR, New Delhi visited the Institute on 04.09.2010.
- Dr. O.P. Dhanda, former ADG (AN&P) visited the Institute on 30.10.2010.
- Dr. S. Ayyappan, DG (ICAR) and Dr. K.M.L. Pathak, DDG (AS) and Dr. C.S. Prasad, ADG (AN&P) visited the Institute on 8th January, 2011.
- Dr. N.V. Patil, Director, NRC on Camel, Bikaner visited the Institute on 15th Jan, 2011.
- Honorable Agriculture Minister Shri Sharad Pawar alongwith Dr. S. Ayyappan, DG, ICAR and Dr. K.M.L. Pathak DDG (AS) visited the Institute on 24th Jan., 2011.



- Dr. K.M.L. Pathak, DDG (AS), Dr. C.S. Prasad, ADG (ANP), Dr. S.C. Gupta, ADG (AG&B), Dr. Gaya Prasad, ADG (AH), Directors of All the Animal Science Institutes and Dr. Rajan Gupta, PS, Dr. Vineet Bhasin, PS, Dr. J. Misri, PS and Dr. Neelam Gupta, PS attended the Animal Science Directors Meeting at CIRG on 30th Jan. 2011.

- Dr. M.P. Yadav, Former VC, Meerut visited the Institute on 22.2.2011.
- A team of scientists from Ethiopia visited the Institute on 21.3.2011.

PERSONNEL

Administration	
Dr. D. Swarup	Director
Dr. A.K. Goel	Vigilance Officer
Dr. P.K. Rout	Scientific Secretary and I/C PME
Mr. R.N. Mallik	Administrative Officer (w.e.f. 14.02.11)
Mr.S.L.V.Prasad	Administrative Officer (upto 14.02.11)
Mr. S.Philipose	Finance and Accounts Officer (upto 23.2.11)
Mr. S.S. Gautam	Asstt. Admn. Officer
Mr. C.S. Sagar	Asstt. Admn. Officer
Mr. A.K. Sharma	Asstt. Admn. Officer
Mr. S.R. Achary	Private Secretary
Mr. Kailash Chandra	Jr. Finance and Accounts Officer

Genetics and Breeding Division	
Dr. R. Roy	Pr. Scientist and Head
Dr. S.K. Singh	Principal Scientist
Dr. Saket Bhushan	Principal Scientist
Dr. P.K. Rout	Principal Scientist
Dr. Gopal Dass	Sr. Scientist
Dr. M.K. Singh	Sr. Scientist

Physiology, Reproduction and Shelter Management Division	
Dr. R.P.Misra	Principal Scientist and Head (upto 31.7.2010)
Dr. S.K. Jindal	Principal Scientist and Head
Dr. A.K. Goel	Principal Scientist
Dr. Puneet Kumar	Principal Scientist (upto 10.4.2011)
Dr. B. Rai	Pr. Scientist (w.e.f. 2.2.11)
Dr. S.D. Kharche	Sr. Scientist
Dr. Neeru Bhushan	Sr. Scientist (On deputation)
Dr. N. Ramachandran	Scientist
Dr. Ravi Ranjan	Scientist (on study leave)
Dr. S.P. Singh	Scientist (on study leave)
Dr. Priyadharsini Raju	Scientist (w.e.f. 18.9.2010)
Dr. Balraj Singh	Technical Officer T-6
Mr. H.K. Himkar	Technical Officer T-5

Nutrition, Feed Resources and Products Technology Division	
Dr. U.B. Chaudhary	Pr. Scientist and Head
Dr. T.K. Dutta	Principal Scientist
Dr. M.K. Tripathi	Sr. Scientist
Dr. R.B. Sharma	Sr. Scientist
Dr. Prabhat Tripathi	Sr. Scientist
Dr. V. Rajkumar	Scientist (Sr.Scale)
Dr. A.K. Das	Scientist
Dr. A.K.Verma	Scientist (w.e.f.25.8.2010)
Mr. Suresh Tewari	Tech. Officer T-7-8
Mr. Dinesh Prasad	Technical Officer T-6
Mr. Dori Lal Gupta	Technical Officer T-5

Health Division	
Dr. V.S. Vihan	Pr. Scientist and Head
Dr. S.V. Singh	Principal Scientist
Dr. Ashok Kumar	Principal Scientist
Dr. D.K. Sharma	Principal Scientist
Dr. R.V.S. Pavaiwya	Principal Scientist (on deputation)
Dr. V.K. Gupta	Sr. Scientist
Dr. K. Gururaj	Scientist (On study leave)
Dr.Shivsharnappa	Scientist (21.4.2010)
Dr. Manjunatha Reddy	Scientist (w.e.f. 27.8.2010)
Dr. A.K.Mishra	Scientist (w.e.f. 28.8.2010)
Dr. Souvik Pal	Scientist (w.e.f. 10.1.2011)
Dr. Nikita Sharma	Scientist (w.e.f. 3.1.2011)
Dr. H.A. Tiwari	Senior Veterinary Officer

Extension Education and Socio-Economics Section	
Dr. Ashok Kumar	Principal Scientist and I/C (upto 2.4.2011)
Dr. Braj Mohan	Pr. Scientist and Incharge (w.e.f. 2.4.2011)
Dr. Khushyal Singh	Scientist (Sr.Scale)
Dr. Vijay Kumar	Scientist
Mr. U.C. Yadav	Technical Officer T-5
AICRP on Goat	
Dr. B.Rai	Pr.Scientist (upto 2.2.11)
Dr. S.K.Singh	Pr.Scientist (w.e.f. 3.2.11)
AICRP on Sheep	
Dr. Gopal Dass	Sr. Scientist
Prioritization Monitoring and Evaluation Section	
Dr. P.K.Rout	Pr. Scientist and I/C
Dr. H.S. Sisodiya	Technical Officer T 7-8
IPR Cell	
Dr. V.K.Gupta	Sr. Scientist and I/C
RTI Cell	
Dr. V.K.Gupta	Sr. Scientist and Transparency Officer
Dr.Vijay Kumar	Scientist and Sr. PIO
Dr. H.A. Tiwari	Sr.Vet. Officer and PIO
Agriculture Research Information Section	
Dr. S.K. Singh	Pr. Scientist and I/c
Mr. M.P. Agrawal	Technical Officer T-5
Maintenance	
Dr. D.K.Sharma	Pr. Scientist and I/c
Horticulture	
Dr.U.B.Chaudhary	Pr. Scientist and I/c
Security Section	
Dr. R.B. Sharma	Sr. Scientist and I/c
Mr. P.K. Sharma	Security Officer
Medical Section	
Dr. V.K. Gupta	Sr. Medical Officer
Mr. C.B. Pandey	Tech. Officer T-7-8
Mr. Mohan Lal	Technical Officer T-5
Library	
Dr. M.K.Tripathi	Sr. Scientist and I/c
Dr. Pratap Singh	Technical Officer, T-9
Agriculture Farm	
Dr. T.K. Dutta	Pr.Scientist and I/c
Mr. Inder Pal	Technical Officer T-6 (upto 31.12. 2010)
Mr. Bhagwan Singh	Technical Officer T-6
Transfer	
Dr. R.P. Misra	Principal Scientist transferred to NAIP, ICAR, New Delhi (relieved on 31.7.2010)
Dr. Puneet Kumar	Principal Scientist transferred to IVRI, Izatnagar (relieved on 10.4.2010)
Mr. S.L.V. Prasad	AO transferred to Nagpur (relieved on 22.2.2011)
Mr. S. Philipose	F&AO transferred as Sr.F&AO to NAARM, Hyderabad (relieved on 23.2.2011)
Mr. Ratan Singh	Promoted to AO, IARI and relieved on 23.2.2011
Joining	
Dr. Priyadarshini Raju	Scientist (w.e.f. 12.9.2010)
Dr. Shivsharnappa	Scientist (w.e.f. 21.4.2010)
Dr. A.K. Misra	Scientist (w.e.f. 28.8.2010)
Dr. A.K.Verma	Scientist (w.e.f. 25.8.2010)
Dr. Manjunatha Reddy	Scientist (w.e.f. 27.8.2010)
Dr. Souvik Pal	Scientist (w.e.f. 10.1.2011)
Dr. Nikita Sharma	Scientist (w.e.f. 3.1.2011)
Mr. Satish Chandra	T- 4 (ARIS Cell) (w.e.f. 19.10.2010)

Mr. R.N. Mallik	A.O. (w.e.f. 14.2.2011)
Mr. Suraj Pal	T-5 (Agri.Farm) (w.e.f. 8.1.2011)

Retirement

Mr. R.P. Gupta	Sanitary Inspector
Mr. Inderpal	Technical Officer T-6
Mr. V.P. Singh	Technical Officer T-5
Dr. Hari Prasad	Technical Officer T-7-8
Mr. Bhajan Lal	Skilled Supporting Staff
Mr. Kailash Chand	Skilled Supporting Staff

Career Advancement/Promotion/Selection

Dr. U.B. Chaudhary	Senior Scientist to Principal Scientist (w.e.f. 14.04.2008)
Dr. Braj Mohan	Sr.Scientist to Pr. Scientist (w.e.f. 15.11.2008)
Dr. Saket Bhushan	Sr.Scientist to Pr. Scientist (w.e.f. 27.7.2007)
Dr. D.K.Sharma	Sr.Scientist to Pr.Scientist (w.e.f. 5.10.2007)
Dr. Khushyal Singh	Scientist to Scientist (Sr. Scale) (w.e.f. 16.4.2007)
Dr. V.Rajkumar	Scientist to Scientist (Sr. Scale, w.e.f. 30.8.2007)
Mr. S.S. Gautam	Asstt. Promoted to AAO
Mr. C.S. Sagar	Asstt. Promoted to AAO
Mr. A.K. Sharma	Asstt. Promoted to AAO

Deputation Abroad

- Dr. R.V.S. Pawaiya, Principal Scientist (Veterinary Pathology) has been awarded visiting Professorship in West Indies.
- Dr. S.K. Singh, Principal Scientist (Animal Genetics and Breeding) visited Suwon, Republic of Korea from 13-15 October 2010 to present an invited lecture in International Symposium on Sustainable Agricultural Development and use of Agro biodiversity in the Asia-Pacific Region.
- Dr. D. Swarup, Director, Central Institute for Research on Goats visited Seol, South Korea from 6-8 December 2010 to deliver a lecture in International Symposium on Development of Herbal Medicine Products and their application in Veterinary Medicine.
- Dr. S.P. Singh, Scientist (Animal Physiology) awarded prestigious ICAR International Fellowship to pursue Doctoral Programme in Germany.