वार्षिक प्रतिवेदन

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CIRG
के.ब.अ.सं.

केन्द्रीय बकरी अनुसंधान संस्थान

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PREFACE

It gives me immense pleasure in presenting the Annual Report 2006-07 of the Institute. The Report contains a brief account of the salient research achievements made and training, extension and consultancy services provided by the Institute during the year. The Institute continued conducting basic and applied research on all aspects of goat production and utilization. Genetic improvement of Jamunapari, Barbari and Jakhrana at the Institute and Sirohi, Marwari, Surti, Black Bengal, Ganjam, Sangamneri and Malabari breeds under the AICRP was continued. Notable achievements were made in improving the productivity of these goat breeds located in different regions of the country in respect of population growth, milk and meat yield, reproduction and survivability. The Goat Semen Bank was further strengthened and an In-Vitro Fertilized kid was produced for the first time in the country. An area specific mineral mixture was developed and validated. A few very important transferable technologies were added to the list for enhancing milk and meat production of our goats. The herbal drug against acto-parasites developed by the Institute was launched for marketing by Natural Remedies International under the trade name 'ALQUIT'. A large number of elite breeding males and females of different breeds were provided to the State Animal Husbandry Departments, NGOs, Entrepreneurs and the Progressive goat farmers for breed improvement.

The success stories included establishment of several commercial goat farms around the country. The Institute imparted training to over 200 progressive farmers and entrepreneurs in commercial goat farming during the year. The human resource development and educational programmes offered by the Institute progressed successfully and several Ph.D. and M. Sc. dissertations were completed during the year. The Institute in collaboration with the Indian Society for Sheep and Goat Production and Utilization also organized a National Seminar on Emerging diseases of small ruminants and their containment during WTO regime during February, 2007. Several Technical Bulletins were published. Publication of the News Letter Ajamukh was continued. The Institute organized and participated in a number of Goat/ Farmer Fairs and Exhibitions. The RAC and IJSC meetings were held as scheduled. A large number of national and international visitors were attracted.

We are extremely grateful for the dynamic leadership, visionary guidance and constant support provided by Dr. Mangla Rai, Secretary DARE and DG, ICAR and Dr. K.M. Bujarbaruah, DDG (Animal Science), ICAR in perusing research and management activities of the Institute successfully. Our sincere thanks are due to Dr. Lal Krishna ADG (AH), Dr. T.J. Rasool ADG (AP&B), Dr. C.S. Prasad ADG (AN&P), Dr. Rajan Gupta Sr. Scientist (AN) and Dr. Vinit Bhasin Sr. Scientist (AG&B) of the SMD for coordinating and facilitating the Institute activities in a befitting manner. I am highly thankful to the scientific, technical, administrative and supporting staff of the Institute for their untiring efforts in most sincerely perusing the programmes and activities and significantly contributing towards the mandated goals of the Institute.

I am sure the information presented in this Annual Report will be useful to the scientists, extension workers, progressive farmers and all those interested in the welfare of goats and goat keepers across the country.

(N.P.Singh)
Director

CIRG: AN INTRODUCTION

Central Institute for Research on Goats is a premier Institute in the country engaged in research on goats. The Indian Council of Agricultural Research estashished a National Research Centre on Goats at Makhdoom village in Mathura district of Uttar Pradesh in the year 1975. This Centre was upgraded to the level of a full fledged Institute on July 12, 1979 and named as Central Institute for Research on Goats with a view to improve the productivity of goats and thereby socio-econmic status of the goat keepers in the country. The Institute is situated near Farah town (27.10ºN, 78.2ºE, 169.2 M above MSL) between Mathura and Agra cities on National Highway No.2.

The Institute has four Research Divisions and a Section. The Mandate of the Institute is to undertake research, training and extension education programmes for improving milk, meat and fibre production of goats and develop products processing technologies through the following objectives-

1. To undertake basic and applied research in all disciplines relating to goat production and product 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 fibre production and value addition of goat products.
5. To provide referral and consultancy services on goat production and product technologies.

कार्यकारी सारांश (अनुक्षेपण)

केन्द्रीय बकरी अनुसंधान संस्थान की स्थापना वर्ष 1979 में बकरी पालन की विभिन्न विधाओं में आधार एवं सारभूत तथा जनोपयोगी अनुसंधान हेतु हुयी। निदेशक संस्थान के सर्वोच्च अधिकारी है जो अनुसंधान सलाहकार समिति एवं संस्थान प्रबन्धन समिति की सलाहएवं मार्गदर्शन से कार्य करते हैं। संस्थान में वर्तमान में निदेशक सहित 38 वैज्ञानिक, 70 तकनीशियन, 38 प्रशासनिक एवं वित्त तथा 104 सहायक कर्मचारी हैं। वर्ष 2006-07 में संस्थान को आबंटित राशि रू0 141.05 लाख योजना मद तथा रू0 741.50 लाख गैरयोजनामद में प्राप्त हुयी। इस राशि में से संस्थान द्वारा रू0 139.05 लाख योजनामद तथा रू0 740.34 लाख गैरयोजनामद में व्यय किये गये।

बकरियों की संख्या वर्तमान दर से बढ़ती रही तो वर्ष 2010 तक यह लगभग 13.5 करोड़ तक पहुँच जायेगी। बकरी प्रतिवर्ष अपने विभिन्न उत्पाद जिसमें मांस (47.5 करोड कि0ग्राम), दुग्ध (276.0 करोड़ कि0ग्राम), खाल (13 करोड कि0ग्राम), पश्मीना (80 मी0 टन) तथा खाद (90 हजार मी0 टन) प्रमुख है, राष्ट्र की सेवा में समर्पित करती है। बकरी के उत्पादन को और प्रभावी बनाने के लिये केन्द्रीय बकरी अनुसंधान संस्थान अनवरत प्रयासरत है। संस्थान बकरी पालन की विभिन्न विधाओं जैसे पोषण, स्वास्थ्य, रखरखाव, जनन तथा प्रबन्ध इत्यादि में वैश्विक एवं राष्ट्रीय आवश्यकताओं कोध्यान में रखते हुये बहुआयामी शोध कार्य एवं प्रसार में संलग्न है। इसी कड़ी में संस्थान ने विगत वर्ष में निम्न उत्कर्ष शोध कार्यो को सम्पादित एवं प्रतिपादित किया है।

बकरियों की विभिन्न नस्लों विशेषकर जमुनापारी, बरबरी एवं जखराना के विकास के लिये चयनधर्मी प्रक्रिया का प्रयोग अत्यन्त लाभकारी सिद्ध हुआ है। इस प्रक्रिया से 90एवं 140 दिन के शरीर भार एवं दुग्ध उत्पादन में आशातीत वृद्धि पायी गयी है। आयु के 3, 6, 9 एवं 12 महीने पर जमुनापारी नस्ल में 2.75 ± 0.02, 13.16 ± 0.33 एवं 18.17 ± 0.45 कि0ग्रा0 भार वृद्धि पाई गयी है। बरबरी नस्ल में यह आंकड़ा 1.86 ± 0.1, 7.68 ± 0.05, 12.23 ± 0.19, 17.54 ± 0.11 एवं 21.63 ± 0.14 कि0ग्रा0 का था। जमुनापारीएवं बरबरी नस्ल में 90 दिन का औसत दुग्ध उत्पादन 80.86 ± 1.83 एवं 49.33 ± 2.30 लीटर दर्ज किया गया। इन दोनों नस्लों में दुग्ध अन्तराल 184.11 ± 3.91एवं 116.4 ± 1.4 दिन का देखा गया। जखराना नस्ल में जन्म, 3, 6, 9एवं 12 महीने में शरीर भार वृद्धि का औसत क्रमशः 2.76 ± 0.62 10.64 ± 0.32, 11.27 ± 0.73, 14.68 ± 2.68 एवं 20.04 ± 1.10 कि0ग्रा0 था।

इस नस्ल में 90 एवं 150 दिन का दुग्ध उत्पादन क्रमशः 90.91 ± 4.20 एवं 132.41 ± 10.73 लीटर मापा गया। जखराना नस्ल मेंएक से अधिक मेमने देने का प्रतिशत 34.07 रहा।

संस्थान द्वारा चयनधर्मी प्रक्रिया से उत्पादित जमुनापारी एवं बरबरी नस्ल के उन्नयत नर एवं मादा पशुओं को ग्रामीण एवं अन्य क्षेत्रों में नस्ल सुधार हेतु विभिन्न ग्रामीण एवं शहरी क्षेत्रों के बकरी पालकों, गैर सरकारी संगठनों, व्यवसायिक बकरी पालकों, राज्य कृषि विश्वविद्यालयों एवं शोध संस्थानों को दिया गया।

जैसा कि अनुभवों से सिद्ध हुआ है कि सामान्यरूप से एक बकरी कम मात्रा में भ्रूणों का उत्पादन करती है जबकि बकरी की शीघ्र वंश वृद्धि के लिये अधिक भ्रूणों की आवश्यकता होती है। संस्थान द्वारा विगत वर्ष परखनली निषेचन विधि सेएक मेंमने "कृष्णा" को सफल जन्म कराया गया। इस विशिष्ट विधि से उत्पादित यह परखनली मेंमना विश्व का प्रथम है। बकरी के हिमीकृत वीर्य से सफल निषेचन कराने हेतु विभिन्न कारकों का विश्लेषण किया गया है। प्रयोगों से ज्ञात हुआ है कि शुक्राणुओं की 80-100 मिलियन संख्या सफल निषेचन के लिए आवश्यक है। श्रवणातीत विधि द्वारा बकरी

में 4-5 सप्ताह के गर्भ का भी सफलतापूर्वक पता लगाया गया। इस विधि से बकरियों में 4-5 एवं 5-6 सप्ताह में गर्भ का पता लगाने के प्रयोग किये गये। इन प्रयोगों से यह पाया गया कि इस विधि से 4 से 5 सप्ताह के गर्भ का पता 80 प्रतिशत तक ठीक-ठीक लगाया जा सकता है। आंशिक आहार प्रतिबंधनएवं पुनः आहारीकरण पर किये जा रहे शोध सफलतापूर्वक सम्पन्न कर लिये गये तथा एक नयी प्रबन्धन व्यवस्था का विकास किया गया है। इन प्रयोगों को चार महीने के 30 मेमनों पर किया गया। इस दौरान इन मेमनों की वृद्धि, चारा-दाना ग्रहण दर तथा रक्त में होने वाले परिवर्तनों का अध्ययन किया गया। पुर्नआहारीकरण के 6 महीने बाद उच्चतम शरीर भार वृद्धि 21.88 ± 1.08 कि0ग्रा0एवं निम्नतम भार वृद्धि 19.42 ± 0.99 कि0ग्रा0 मापी गयी। इन प्रयोगों ने सिद्ध किया कि इस प्रकार दिये गये समय में कुल 1.77 कि0ग्रा0 शुष्क पदार्थ की बचत सम्भव है।

घटते हुये चारागाह तथा उपयोगी चारे की अनुपलब्धता बकरी के लियेएक समस्या कारूप लेती जा रही है। यह संस्थान उच्च वर्गीय चारे की उपलब्धता करने हेतु विभिन्न शोधों में तल्लीन है। बकरी के चारे को संचयित एवं सवंर्धित करने की दिशा में चल रहे प्रयत्न सफल हुये हैं। इन प्रयोगों से बकरी के अच्छे चारे को समय रहते ही कम लागत में सवंर्धित किया जा सकता है। इस दिशा में किये गये प्रयोगों से ऐसा ज्ञात हुआ है कि अरहर आधारित सम्पूर्ण आहार बकरियों द्वारा अधिक पसन्द किया जाता है। बकरियों के लिए अवास, चारा आपूर्ति के लिए वनचारागाह आधारित विभिन्न समरूपों का आंकलन किया गया है। ऐसा पाया गया कि सेन्करस सिलिऐरिस आधारित

वनचारागाह की ग्राहक क्षमता अत्यधिक पाई गयी जबकि गुणवत्ता की दृष्टि से सेन्करस सिलिऐरिस + टेफ्रोसिया आधारित मिश्रित चारागाह उत्तम पाया गया। उत्तर प्रदेश के विभिन्न भागों में चारे में विभिन्न खनिज लवणों की कमी पायी गयी है। उत्तर प्रदेश के पूर्वी भाग के विभिन्न गॉवों में पशुओं के चारे एवं मिट्टी में विभिन्न खनिज लवणों की तीव्र कमी पाई गयी। इस कोध्यान में रखते हुए संस्थान नेएक स्थान विशिष्ट खनिज लवण मिश्रण का विकास किया है। बकरियों में रेशों के पाचन के लिये रोमन्थी फफूंदियों का बड़ा ही योगदान पाया गया है। इन फफूंदियों का आणविक स्तर पर आंकलन किया गया है। विभिन्न जिलों में पाये जाने वाली बकरियों के दुग्ध का रासायनिक एवं खनिज तत्वों का आंकलन किया गया। इसमें पाया गया कि कुल ठोस पदार्थ, वसा तथा प्रोटीन की मात्रा क्रमशः 12.42 से 15.02, 3.50 से 6.90 एवं 3.44 से 4.05 प्रतिशत तक पाई गयी। आगरा एवं अलीगढ़ जिलों की बकरियों के दुग्ध में कैल्शियम की मात्रा अलवर जिला राजस्थान में पाई जाने वाली बकरियों से कम थी।

बकरियों के चारा संवर्धन के लिएएक कम मूल्य वाली मशीन का विकास किया गया

है। बकरी की प्रजाति का बकरी की दुग्ध संरचना में पड़ने वाले प्रभाव का अध्ययन किया गया। वसा रहित कुल ठोस एवं कुल ठोस की मात्रा जमुनापारी बकरी में अन्य बकरियों की प्रजातियों की तुलना में अधिक ($80.76 \pm 0.05\%$) पाई गयी। बकरियों के माँस के विभिन्न घटकों का विश्लेषण भी किया गया है।

नवागत मेंमनों में दस्तएक अत्यन्त गंभीर समस्या है। संस्थान द्वारा पादप निचोड़ों से इन दस्तों का कारगर उपचार ढूंढ़ा गया है। बकरियों में न्यूमोनिया करने वाले एक कारक माइकोप्लाज्मा की पहचान आणविक स्तर पर की गयी है। बाह्यपरजीवियों के विनाश के लिये विकसित जड़ी-बूटी आधारित दवा के विषाक्तता परीक्षण सम्पन्न हो चुके हैं। शीध्र ही यह दवा बाजार में उपलब्ध होगी। जॉहनी रोग के कारक का आणविक विश्लेषण किया गया तथा इस रोग के लिये विकसित टीके के परीक्षण जारी है।

संस्थान द्वारा गोद लिये गये चार गाँवों में बकरी पालकों के सामाजिक एवं आर्थिक सर्वेक्षण का कार्य सम्पन्न कर लिया गया है। संस्थान द्वारा विकसित उच्च तकनीकियाँ इन गाँवों में स्थानान्तरित की जा रही है। तकनीकी हस्तारंण

के कार्य को सुचारूएवं प्रभावीरूप में चलाने के लिये संस्थानएक विशेष कार्यक्रम चला रहा है।

बकरी पालन को अधिक से अधिक लोगों तक पहुँचाने के लिये संस्थान द्वारा विगत वर्ष 2006-07 में लगभग 10 राष्ट्रीय प्रशिक्षण कार्यक्रम चलाये गये तथा देशभर से आये 1048 प्रगतिशील बेरोजगार, युवाओं एवं महिलाओं को बकरी पालन से सम्बन्धित परामर्श दिया गया।

देश एवं विदेश के विभिन्न भागों से आये कृषकों, गैर सरकारी संगठनों के प्रतिनिधियों, व्यवसायिक बकरी पालकों एवं छात्रों के लिये संस्थान द्वारा विशेष परामर्श की भी व्यवस्था की गई। यह परामर्श विभिन्न वर्गो के लिये अत्यन्त लाभकारी सिद्ध हुआ।

EXECUTIVE SUMMARY

Central Institute for Research on Goats (CIRG) was established in 1979 to conduct basic, fundamental and applied research in all aspects of goat production. Director is the Head of the Organization assisted and guided by Research Advisory Committee (RAC) and Institute Management Committee (IMC). The Institute has 38 Scientists including Director, 70 Technical staff, 38 Administrative and 104 Supporting staff. The total budget allocated to the Institute in 2006-07 was Rs. 141.00 Lakh under plan and 741.50 under non-plan. Total expenditure was Rs. 139.05 Lakh in Plan and 740.34 Lakh in Non-Plan.

The goat population in the countrey is likely to reach a figure of 130 million by 2010. Goats contribute 475 million kg of meat, 2700 million kg of milk, 130 million of skins, 30 metric tones of Pashmina and 90 thousand metric tones of manure annually to the national economy. CIRG, Makhdoom is actively engaged in conducting research, training and extension activities on all aspects of goat production and utilization with a view to improve the productivity of goats in respect of milk, meat and fibre.

The selective breeding programme was executed in the nucleus flocks and also in their natural habitat involving farmers flocks. The criterion for selection of superior bucks was on the basis of index computed by taking account of 9 months body weight and 90 days milk yield of their dams. Top ranking bucks were used for producing superior progeny. Mean body weights of the kids at birth, 3, 6, 9 and 12 months of age were 2.75 ± 0.05, 9.89 ± 0.21, 13.16 ± 0.33, 18.97 ± 0.45 and 26.4 ± 0.57 kg in Jamunapari and 1.86 ± 0.01, 7.68 ± 0.05, 12.23 ± 0.19, 17.54 ± 0.11 and 21.63 ± 0.14 kg in Barbari respectively during the period under report. Average milk yield in the two breeds at 90 days was 80.86 ± 1.83 liters and 49.33 ± 2.30 liters respectively during the year. The average lactation length in Jamunapari was 184.11 ± 3.91 days and in Barbari 116.4 ± 1.4 days. Body weight at birth, 3, 6, 9 and 12 months age averaged 2.76 ± 0.62, 10.64 ± 0.32. 11.27 ± 0.73, 14.68 ± 2.68 and 20.04 ± 1.10 kg, respectively in Jakhrana kids during the reported period. The average milk production in Jakhrana was recorded to be 90.91 ± 4.20 and 132.41 ± 10.73 liters in 90 and 150 days, respectively. Multiple birth in the breed was 34.07% with kidding rate of 1.48. The elite germplasm of Jamunapari and Barbari breeds numbering 134 and 293 respectively was supplied to the farmers, SAUs, NGOs and other research institutions for improvement and conservation under field conditions.

In-vivo technique of embryo production has got limitations because it is expensive and produces less number of embryos per donor. However, a large number of embryos are required for the success of embryo transfer programme, which can be exploited through *In-vitro* technique of embryo production. A kid through in-vitro fertilization technique (IVF) was produced. Efforts were made on freezing of buck semen at different spermatozoal density for optimisation of sperm concentration per dose. Ultrasonographic Imaging Technique for early (4-5 weeks) pregnancy/non pregnancy determination in goats has been standardized. Trans-rectal ultrasound scanning of 23 pregnant goats at 4-5 and 5-6 weeks of gestation was observed. Over all, accuracy of scanning in prediction of foetal number at this stage was 80.00%. The optimal sperm concentration for higher post thaw motility was recorded with 80-100 millions spermatozoa per dose of 0.25ml. Studies on effect of dietary restriction and realimentation on growth and carcass characteristics in kids was completed and a suitable package has been developed. In this study four-month old 30 male kids of Barbari breed raised under uniform management and optimum feeding conditions were utilized. Observations on growth rate, feed intake and changes in blood metabolites were recorded. The final highest and lowest body weights recorded after 6 months of realimentation period were 21.88 ± 1.08 kg and 19.42 ± 0.99 kg in different groups. A saving of 1.77 kg dry matter for each kg gain in weight in treatment group as compared to control was obtained.

The feeds available to goats are poor in quantity and quality. The farmers are unaware about the balanced feeding of their animals. An experiment was conducted to study the processing effect on the complete feed manufacturing. Complete feed pellets, complete feed blocks and the total mixed ration (TMR) of the same composition with 50:50 straw and concentrate ratio were fed to three groups of growing animals. Higher ADG was observed in case of pellet fed group. Comparatively, arhar based complete feeds in different physical forms resulted in better intake in Barbari kids irrespective of sex than neem leaf based complete feeds. Various rainfed pastures such as *Cenchrus ciliaris*, *Cenchrus ciliaris* + *Tephrosea purpurea* and natural under semiarid condition were evaluated for goat production and carrying capacity. The carrying capacity of *Cenchrus ciliaris* + *Tephrosea purpurea* pasture was higher than the natural pasture. Maximum biomass production of 9.65 g/ha was associated with the *Cenchrus ciliaris* pasture. *Tephrosea purpurea* pasture was also observed as a potential pasture legume in semi arid condition. Different zones of the U.P. State were surveyed to study the status of different micro and macro minerals in feeds, fodders, soils, water and blood plasma of the animals. The results

indicated deficiency of most of the macro and micro minerals in cattle, buffalo, sheep and goats. Based on the deficiency of macro and micro minerals in the blood of cattle, buffaloes, sheep and goats, an area specific mineral mixture was formulated separately for South Western Semi-Arid Zone, Central Plain Zone and Eastern Plain Zone of Uttar Pradesh. For molecular characterization of rumen fungi, an ITS 1 & 2 region based PCR has been developed. Chemical composition and minerals (total solid, fat, SNF, protein, lactose, ash, Ca, Mg, Na, K, Fe, Cu, Mn, Zn and Co) in goat milk collected from different villages were estimated. Total solid, fat and protein percentage in the goat milk ranged from 12.42 to 15.02%; 3.50 to 6.90% and 3.44 to 4.05% in different villages, respectively. Ca concentration in goat milk of Aligarh and Agra districts was found to be lower compared to Alwar district. Fe content in milk collected from Aligarh district was lower than other two districts. Cu, Mn and Co in milk was found invariably lower in this semi-arid region.

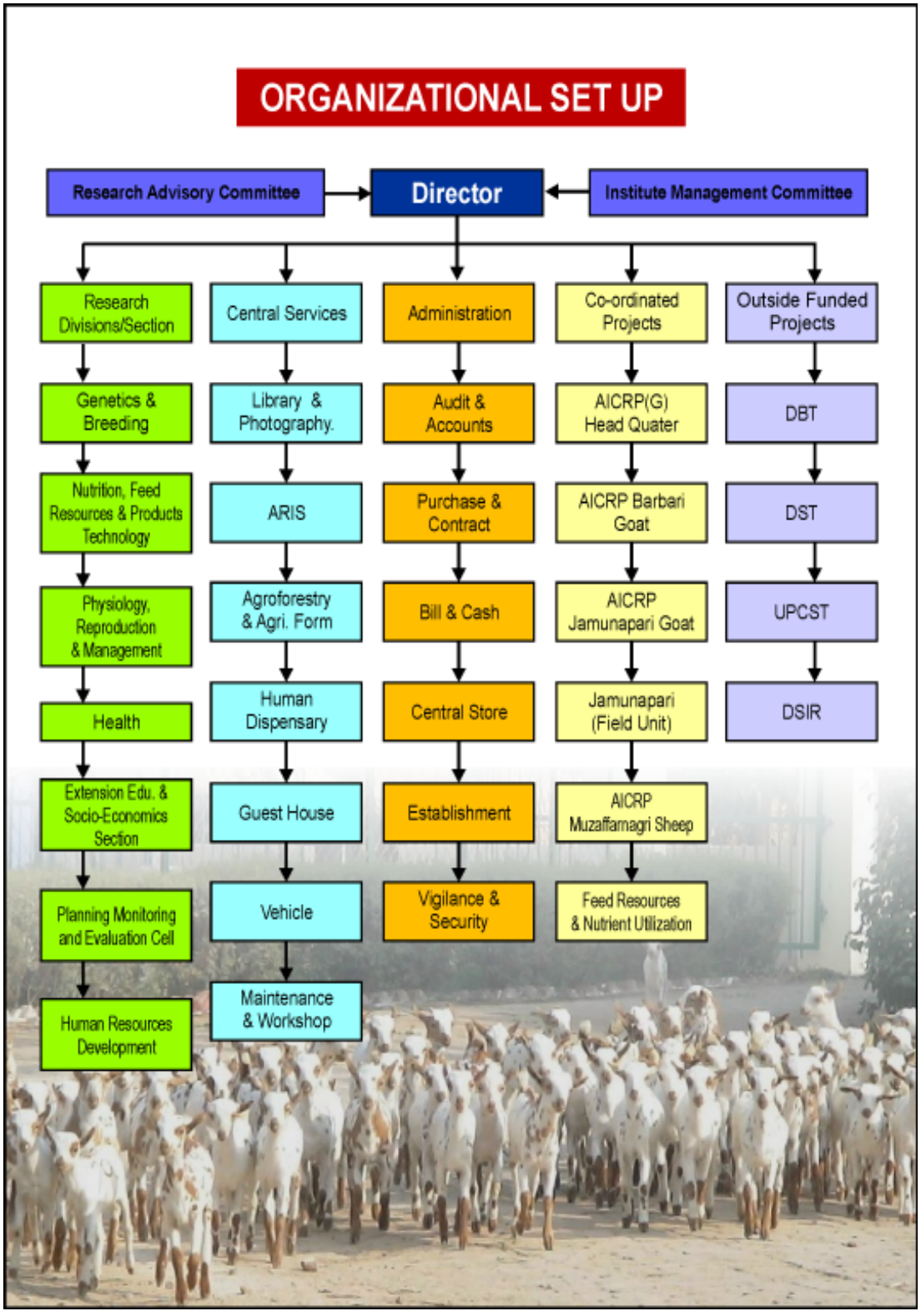
A cost effective design of machineries for fodder production, conservation and processing of feeds for commercial goat farming has been developed. The carcass characteristics of the male kids of different breeds maintained under different systems of feeding were evaluated. The effect of breed on goat milk composition was studied. The SNF and TS contents were observed to be higher in Jamunapari milk (8.76 ± 0.05 and $12.60 \pm 0.12\%$) as compared to Jakhrana (8.16 ± 0.07 and 12.54 ± 0.12), Sirohi (7.65 ± 0.05 and 10.97 ± 0.07), Barbari (7.76 ± 0.23 and 11.29 ± 0.24) and mixed milk (7.57 ± 0.08 and $10.99 \pm 0.17\%$), respectively. However, the fat content was observed significantly higher ($4.12 \pm 0.07\%$) in Jakhrana milk.

Diarrhoea in young kids is a serious problem. Antidiarrhoeal properties of selected plant extracts were evaluated. The results indicated that selected plant extracts showed anti-diarrhoeal activity in clinical cases of colibacillosis in kids with little variation. For the diagnosis of mycoplasmosis the work on development of PCR has been concluded. The safety trials of novel herbal ectoparasiticidal product for ticks in goats have been completed and industrial partner is going to launch the product in the market soon. Work on development of molecular diagnostic for the diagnosis of Johne's disease has been completed. The developed prototype of killed vaccine against Johne's disease is being tested in goats.

A rigrous Bench Mark Survey in four newly adopted villages was completed. The data collected will be used to work on the interventions to improve socio-economic condition of the farmers in general and goat keepers in particular. Technologies developed by the Institute are being transferred and evaluated at the farmer's door through the multi-disciplinary Project. Assessment of the impact of the improved technologies transferred in the field is in progress.

A total of ten training programmes on different aspects of scientific and commercial goat production were organized for the farmers, goat keepers, enterprenuers, extension workers and scientists sponsored by several State Animal Husbandry Departments, State Agricultural Universities, Dircetorates of Extension, Non-Governmental Organizations, Self Help Groups etc. Consultancy services on goat production and utilization were provided to several national and international agencies. A large number of elite males and females of the important goat breeds were distributed to the progressive goat farmers for breed improvement.

ORGANIZATIONAL SET UP



FINANCIAL POSITION

On March 31, 2007
(Rs. in Lakhs)

	Head	Plan		Non-Plan	
		Allocation	Expenditure	Allocation	Expenditure
1.	Establishment Charges	–	–	434.00	433.34
	OTA	–	–	0.35	0.35
	Wages	–	–	89.55	89.39
2.	T.A.	3.54	3.36	2.00	1.72
3.	HRD	2.16	2.15	-	-
4.	Other Charges including equipments	97.54	95.78	175.60	175.59
5.	Works	34.12	34.12-	40.00	39.95
6.	Land develoment	3.46	3.46	40.00	39.95
	TOTAL	**141.00**	**139.05**	**741.50**	**740.34**

STAFF POSITION

(on March 31, 2007)

Category	Sanctioned	Filled
Director	01	01
Scientific	50	37
Technical	72	70
Administrative including Non-Min. staff	39	38
Supporting	104	104
TOTAL	**266**	**250**

RESEARCH ACHIEVEMENTS

Goat Genetics and Breeding

GGB-1.09: Genetic Improvement and Sire Evaluation of Jamunapari Goats for Milk production (AICRP)

M.K. Singht and T.K. Dutta

Jamunapari is one of the important dual-purpose breeds of goats in India with greater recognition for milk yield. Efforts to improve productivity of Jamunapari goats through selection since 1985 have yielded designally and since then a large number of superior bucks and does have been distributed to improve in productivity through A.H. Deptt./NGOs and farmers.

Body Weights: Mean body weights of kids at birth, 3, 6, 9 and 12 months of age were 2.75 ± 0.049, 9.89 ± 0.21, 13.16 ± 0.33, 18.97 ± 0.45 and 26.04 ± 0.57 kg, respectively during 2006. Year, Season of kidding, type of birth, sex of kid and weight of dam at kidding have significantly influenced the body weights at all the ages.

Milk Yield: Average milk yield in 90 days, 140 days and total lactation was 80.86 ± 1.83, 111.15 ± 3.13 and 119.68 ± 4.20 liters, respectively of the does kidded during the year 2006. The average lactation length was 184.11 ± 3.91 days. Year, season of kidding, parity and dams weight at kidding showed significant influence on 90 days milk yield.

Reproductive Performance: Age at first kidding, weight at first kidding and kidding interval were 739 ± 29 kg, 34.2 ± 0.7 kg and 321 ± 13 days, respectively. Kidding percentage on the basis of does available and does tupped was 110.67 and 136.81% respectively. The multiple birth rate and litter size was 38.20% and 142%, respectively.

Genetic Parameters: The heritability estimates for body weight at birth, 3, 6, 9 and 12 months of age were 0.272 ± 0.068, 0.169 ± 0.076, 0.230 ± 0.064, 0.213 ± 0.003 and 0.327 ± 0.073, respectively. The genetic and phenotypic correlations amongst body weight traits were high. However, magnitude of estimate decreased with the increase of age as compared to adjacent body weight traits. The heritability estimates for 90 days, 140 days, total milk yield and lactation length were 0.077 ± 0.082, 0.113 ± 0.089, 0.112 ± 0.093 and 0.043 ± 0.079 respectively. Selection differential with respect to bucks selected for breeding were estimated. The ranking of sires on the basis of sire indices was computed by combining 9 months body weight and 90 days milk yield of their dams. Ten top ranking bucks were selected and allocated for breeding of the does. The average value of constructed sire indices was 16.44 and ranged from 15.04 to 21.38.

The average weight gain, dry matter intake, feed conversion ratio, slaughter weight and carcass weight of kids fed with pellet ration from 3 to 9 months of age were 16.42 ± 2.15 kg 891.85 ± 72.84 (g/d), 10.47 ± 0.60, 29.42 ± 2.34 kg and 14.07 ± 1.35 kg respectively. Corresponding values of kids fed on mash ration were 11.81 ± 0.56 kg, 663.04 ± 55.89 (g/d), 10.44 ± 1.06, 23.03 ± 1.22 kg and 10.07 ± 0.66 kg respectively. The overall

survivability of the flock was above 91%. A total of 134 goats (102 males and 32 females) were supplied to State Animal Husbandry Dept./NGOs and progressive farmers for conservation and improvement of goats during the year.

GG.B. 1.10: Genetic Improvement of Barbari Goats for Meat and Milk Production

S.K. Singh and P.K. Rout

Barbari is one of the dual purpose medium size breeds widely distributed and adapted around Agra, Aligarh, Etah, Etawah and Mainpuri districts of Uttar Pradesh having high fecundity, reproduction rate, moderate milk production and body growth.

The annual population growth in the flock was 154%. During the year, 293 goats were distributed to various agencies i.e. NGOs, Private breeders, Govt. Organizations for breed improvement and conservation.

Body Weight: Mean body weights of kids at birth, 3, 6, 9 and 12 months of age were 1.76 ± 0.02, 7.79 ± 0.09, 10.86 ± 0.20, 16.45 ± 0.25 and 20.48 ± 0.44 kg, respectively. Season of birth, type of birth and sex of kid significantly influenced the body weight at all the ages. At 12 months age single born kids were slightly heavier than those born as twins or triplets but the twin born kids did not differ significantly to those born as triplets indicating that the multiple birth should be preferred in the selection criteria.

Milk yield: The average milk yield in 90 days and daily milk yield were 49.33 ± 2.33 liters and 538.3 ± 20.3 ml, respectively with a lactation length of 87.01 ± 2.12 days. Season of kidding significantly influenced the milk production. Season –I (March-April) kidding has more milk yield than those kidding in Season-II (October-November). Type of kidding i.e. single, twin or triplet had no effect on lactational performance of goats.

Reproductive Performance: During the year 296 kiddings were observed. In all 395 kids were born with a kidding rate of 1.33. The percentage of single, twin and triplet kiddings was 53.4, 42.3 and 4.2 respectively. Tuppping was recorded as 142.3%. Fertility efficiency on the basis of does available and does tupped was 77.7 and 84.6% respectively.

GGB-1.11: Conservation and improvement of Jamunapari Goats in their Home Tract.

P.K. Rout, Saket Bhusan and R. Roy

Microsatellite analysis was carried out in Jamunapari goats to assess the genetic diversity and genetic consequence of population size reduction. As Jamunapari is endangered breed, it was necessary to characterize the population as well as to detect bottleneck in this population. Data were analysed with GENEPOP, AGARst software to analyze various diversity and bottleneck parameters.

The markers with their chromosome number, number of alleles identified and allele range are described in Table 1. Among the polymorphic markers, BM4621 and IDVGA7 showed highest 15 alleles at each locus. ILSTS005 marker showed 3 alleles and lowest number of alleles was observed at this locus. All other markers showed more than 6 alleles. The number of alleles varied from 3 to 15 across the microsatellite markers. The total number of alleles was observed as 153 over the loci. The highest number of allele was observed in BM4621 and IDVGA7 and lowest number of allele was observed in ILSTS005.

The mean number of allele per locus was 9.0. The average expected and observed heterozygosity was 0.769 and 0.386. The expected heterozygosity varied from 0.489 to 0.866. All the loci except ILSTS005 showed higher gene diversity in the analysed samples. The mean number of allele per locus and expected heterozygosity indicated that the overall gene diversity was high in the population. It was observed that the number of alleles in each microsatellite marker was more than 6 except ILSTS005. The rare alleles were observed in very low frequency at all the loci indicating that it was a population of constant size. Bottleneck detection in Jamunapari goat is presented in Table 1. The bottle neck analysis indicated that there was no mode-shift distortion and showed a normal 'L' shaped distribution. The heterozygosity excess method, which is more sensitive and robust in detecting historical bottleneck was carried out to analyse the population. Out of 17 loci, 7 showed heterozygosity excess and there was no significant departure from mutation drift equilibrium detected in the population. The analysis indicated that the population has not suffered any bottleneck recently and was a constant size population. The population was examined for allele frequency distribution for gaps. The average M ratio of the population was 0.815, which was significantly higher than critical value. The M ratio was less than 0.71 in ILSTS005, INRABERN192 and BM143. For all other markers in the population, it was very high and close to one indicating that it is a constant size population.

Population Dynamics: Migration in goat population in village flocks has been usual phenomenon due to frequent sale and purchase. Males were sold at all the age groups and 23.86% of males were sold during the period. Similarly 17.59% females were sold. All the available males were sold

Table 1: Genetic variability measure of polymorphic loci and Bottleneck detection in Jamunapari goats

Marker	Chromo-some No.	Observed No. of alleles	Effective No. of alleles	Allele range (bp)	Heq	(He-Heq) /SD	He excess	M ratio
BM4621	6	15	6.387	106-140	0.894	-1.825	+	0.833
NRAMP	2	9	4.864	224-248	0.834	-0.886	+	0.692
Oar AE101	6	8	4.906	92-108	0.787	0.337	-	0.889
IDVGA7	25	15	8.064	210-240	0.894	-0.436	+	0.938
ILST S005	10	3	1.963	178-188	0.441	0.364	-	0.364
BM6526	27	9	4.761	154-178	0.808	-0.244	+	0.692
ETH 225	14	6	3.523	140-152	0.714	-0.159	+	0.857
Oar HH 56	23	9	5.252	152-168	0.813	-0.007	+	0.857
INRABERN 192	7	10	5.010	178-208	0.833	-0.359	+	0.625
Oar FCB48	17	8	5.561	150-164	0.784	0.845	-	1.00
Oar HH62	20	5	3.429	108-118	0.653	0.672	-	0.833
TGLA 40		10	4.355	174-198	0.831	-1.275	+	0.769
BM 143	6	8	3.633	96-118	0.786	-0.934	+	0.667
SRCRSP 5	21	8	4.553	160-178	0.786	0.051	-	0.800
SRCRSP6	19	10	2.974	138-158	0.830	-4.182	+	0.909
SRCRSP 9		11	7.657	120-144	0.849	0.763	-	0.846
SRCRSP 10	8	9	5.630	260-276	0.813	0.393	-	1.000

in adult and 6-12 months of age group. The villagers purchased 10 animals from adjacent villages. The overall population remained minimum during May to September and thereafter increased due to kiddings.

Reproductive Performance: About 80 kids were born from 58 does during the year. The sex ratio was 46:54. The kidding rate was 1.38 and about 10 abortions were observed in the two villages. The multiple birth percentage was 55.0. The average fertility percentage was 75.5 during the year.

Production Performance:

Body Weights: The mean body weight during the year was 2.456 ± 0.07, 15.65 ± 0.26 and 19.93 ± 1.08 kg at birth, 3 month and 6 months of age, respectively. Sex had significant effect on body weight up to 9 months of age. Birth type had significant effect on body weight at birth, 3 months and 6 months of age.

Milk Yield: The average daily milk yield was about 1.11 ± 0.022 liter/day. The total milk yield at 30, 60 and 90 days was 32.22, 70.73 and 105.7 liters, respectively. Fortnight, year and type of birth had significant effect on total milk yield. The fortnightly milk yield showed consistent yield up to 6^{th} fortnight and highest yield was observed at 4th fortnight and thereafter it started to decline. Does, which produced twins and triplets, produced more milk in comparison to does having single kid. The milk yield up to fourth fortnight with respect to birth status was analysed and observed that it was 65.32, 69.45 and 77.39 liters in single kidded, twin kidded and triplet kidded does, respectively.

GG&B 1.16: Evaluation of Flock Dynamics, Production Performance and Management Systems of Gohilwadi and Zalawadi Goats in their Home Tract.

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

Gohilwadi is a medium size goat with black coat colour. Horns are spiraled, twisted with 1-3 folds. Ears are medium (14-18 cm), dropping and black in colour. The nose is slightly roman (convex). Udder is symmetrical and capacious with long and outward teats. The average body height, heart girth, body length and body weight of adult does were 30.79 ± 0.46 inch, 31.64 ± 0.27 inch, 32.31 ± 0.2 inch and 32.31 ± 0.80 kg respectively. The average milk yield was one litre/day and ranged from 0.5 to 2.5 litres. Multiple birth rate ranged from 45 to 65% with an average of 55% (Table 1). Gohilwadi goat is a native of Gohilwad province of Kathiawad (Saurashtra) now known as Bhavnagar in Gujarat. The traditional rearers of Zalawadi goats are Rabaries and Bharwads collectively known as Maldharies. These tribal goat keepers are pastoralists, illiterate and landless. The area is surrounded by sea and wastelands/rangelands are often flooded with the sea water. Goats (85%) were kept in closed enclosures made up of bushes. Goats were reared on range grazing in gaucher/barren lands and post-harvested lands without supplementary feeding. Some flocks (10-15%) migrate to Junagarh and Surendranagar during rainy season. Maximum goats ($>87\%$) were bred in summer on account of better grazing and browsing resources for pregnant does with onset of rain in June. Most of Maldhries practiced summer breeding. Buck scarcity is major constraint as single buck was used

Table 1: Production and reproductive performance of Gohilwadi goats under field conditions

S.No.	Traits	Mean	Range
1	Age at first kidding month	21	16-28
2	Multiple birth rate (%)	55	45-65
3	Milk Yield (lit.)	1.0	0.5-2.5
4	Lactation Length month	6	3-9
5	Kidding Interval month	12	6-18
6	Mortality in Kids %	15	10-25
7	Mortality in adults %	5	2-7

to provide service in the entire village having more than 100 females. On contarary to Zalawadi goat keepers, the rearers of Gohilwadi goats gave little weightage to maintain purity. Prophylactic measures were almost nil and most of the goat keepers used indigenous preparations for different ailments. Common goat diseases observed were FMD, PPR, Pneumonia, Blue tounge, Mycoplasmal mastitis, Enterotoxaemia and Contagious ecthyma.

GGB 1.17: Genetic Evaluation and Improvement of Jakhrana breed through Open Nucleus Breeding System (ONBS).

Saket Bhusan, S.K. Singh and B. Rai

Body Weight: Weekly body weight of kids and monthly body weight of adult males and females were recorded. Least square means of body weights in Jakhrana kids at various stages of growth are presented in Table 1. Results revealed increase in weights

Table 1: Least squares mean of body weight (kg) in Jakhrana kids

Factors	Age of kids				
	Birth	3M	6M	9M	12M
Overall mean	2.69±0.52 (133)	10.18±0.34 (97)	11.0±0.62 (40)	14.26±1.47 (24)	20.04±1.10 (19)
Year of birth					
2005	2.52±0.99 (28)	9.71±0.48 (27)	10.73±0.73 (23)	13.65±2.32 (20)	–
2006	2.76±0.62 (82)	10.64±0.32 (70)	11.27±0.73 (17)	14.68±2.68 (4)	–
Season of birth					
I	2.71±0.82 (41)	11.18±0.55 (14)	10.78±1.11 (03)	13.41±2.79 (3)	–
II	2.69±0.67 (92)	9.17±0.26 (83)	11.22±0.48 (37)	14.91±2.14 (21)	–
Sex of kid					
Male	2.83±0.63 (70)	10.87±0.39 (52)	11.39±0.69 (18)	14.40±1.68 (11)	21.85±3.15 (9)
Female	2.57±0.64 (63)	9.48±0.41 (45)	10.60±0.68 (22)	13.93±1.59 (13)	18.49±6.16 (10)
Type of birth					
Single	2.85±0.07 (55)	10.31±0.06 (43)	11.25±0.68 (18)	14.63±1.58 (11)	20.42±2.13 (10)
Twin	2.55±0.59 (78)	10.04±0.06 (54)	10.75±0.69 (22)	13.69±1.86 (13)	18.88±1.55 (9)

Season I: February –March, Season II: September –October birth.

Table 2: Least square analysis of variance of body weight

Source	Birth Wt.		3M Wt.		6M Wt.		9M Wt.	
	DF	MSS	DF	MSS	DF	MSS	DF	MSS
Year	2	0.66*	1	13.40*	1	1.54	1	0.70
Season	1	0.01	1	43.59**	1	0.45	1	1.50
Sex	1	2.20**	1	43.79**	1	5.57**	1	1.17
Type of Birth	2	2.53	2	1.56	2	2.39*	1	2.90*

****Significant at 1% level *Significant at 5% level**

Table 3: Least Square Means of Milk Production (lit) of Jakhrana goats

Factor	Number of days				
	30	60	90	120	150
Overall Mean	33.04±2.06	63.03±3.22	83.34±4.73	111.59±5.98	131.85±7.25
Year					
2005	26.25±3.11	55.79±4.88	75.77±7.22	103.93±9.0	131.29±13.32
2006	39.82±1.88	70.26±2.91	90.91±4.20	119.25±5.34	132.41±10.73
Season of kidding					
Season I (March-August)	24.84±3.14	52.57±4.89	73.40±7.12	106.93±9.06	139.76±14.13
Season II (Sep.-Feb.)	41.23±1.83	73.48±2.85	93.28±4.19	116.26±5.17	123.95±10.48
Type of birth					
Single	34.16±2.19	62.84±3.43	85.70±4.97	115.79±6.35	134.42±7.41
Twins	31.92±2.66	63.22±4.15	80.98±6.14	107.40±7.65	129.29±10.63

Table 4: Least square analysis of variance of milk production

Source	30 days		60 days		90 days		120 days		150 days	
	DF	MSS	DF	MSS	DF	MSS	DF	MSS	DF	MSS
Year	1	2238.80**	1	2450.94**	1	2591.89*	1	2565.20	1	3.12
Season	1	3275.17**	1	5230.12**	1	4720.06**	1	969.57	1	568.45
Type Birth	1	84.42	1	2.44	1	0.01	1	1068.76	1	195.30

****Significant at 1% level *Significant at 5% level**

at birth, 3, 6 and 9 months of age during 2006 as compared to 2005 by 0.24, 0.93, 0.54 and 1.03 kg, respectively. Seasonal variation in weights of kids at different ages was observed. Kids born in Season-I had heavier body weights at birth and 3 months than kids born in Season-II, whereas kids born in Season II weighed heavier at 6 and 9 months than the kids born in Season I. Weights of male kids at different ages were higher than weights of female kids by 0.26, 1.39, 0.79, 0.67 and 3.36 kg at birth, 3,6,9 and 12 months of age, respectively. Single born kids had higher body weight at different ages than the twins. Least square analysis of variance for different parameters is presented in Table 2.

Milk Production: Least square means of milk production are presented in Table 3. Milk production of does was increased during 2006 over 2005. Does which kidded during summer season produced more milk than the does which kidded during winter season kidding except 150 days milk production. Does having single kids produced more milk in each month than does having twins except 60 days milk production. Average lactation length was 162.08±4.85 days. Least square analysis of variance for various factors are presented in Table 4.

Reproductive Performance: Gestation period, kidding interval and dry period were151.33±1.48, 322.00±25.61 and

160.48 ± 17.24 days respectively. Multiple births observed in the breed were 34.07% while kidding rate was 1.48.

GGB 1.18: Study of Goat Production System in different Agro-climatic Regions of India.

B. Rai, M.K. Singh, R. Roy and N.P. Singh

Goat production system was studied in two states viz Assam and Uttar Pradesh.

Assam: The data collected on goat production system from two districts viz. Golaghat and Shibsagar revealed that goats found in this area are Bengal or Bengal type. A some places they are also called Assam hill goats since the goats are reared in upper Brahmputra valley zone of Eastern Himalayan region. The goats in the villages are reared by both Hindu and Muslim communities. The goats are raised in extensive system of grazing with little supplementation. The average flock size ranged between 2-10 goats in the villages. The grazing of goats is mostly done in the forests as well as in paddy fields. The local grasses available in this region are known as Dol, Dubari, Kuhiban and Murfula. The common fodder trees available in this region are Mango, Jackfruit and Bamboo. The average grazing time was 4-5 hours due to heavy rain fall in this area. The Assam hill goats are found in varying colours of white, black and brown. These goats are supposed to be a mixture of Bengal and local goats. The goats are small in size with short ears. The adult body weight ranged between 12-20 kg. The age at first kidding was 19 months with a service period of 14 months. The average lactation yield was only 65 liters in 120 days. The twinning was 30% with 65% single kiddings. The major goat diseases prevalent in this area were FMD, Diarrhoea, Tick infestation, Mange and diseases caused by internal parasites. The marketing of goats was unorganised and goats are mostly sold at the doorstep of the farmers. The selling price of the adult goat ranged between Rs.1000-1500. The role of women in goat rearing was also recorded. It was observed that women are involved in 90% activities of day to day management of goats like cleaning of sheds, milking, feeding, grazing and breeding etc.

Uttar Pradesh: Survey was conducted on goat production system in the Deoria district of Uttar Pradesh which is located in Northeastern plain zone of India. The information on goat production system was collected from two villages viz. Semari and Malghot from 20 goat keepers. The goats in this area are mostly reared by backward communities and most of them are landless. The goats are kept under extensive grazing system and grazed from dawn to dusk with an average grazing time of 6-7 hours. The average flock size ranged between 2-8 goats. The goats are grazed nearby the river, roadside and fields. The common fodder trees of this area are Banyan, Mahuva, Jackfruit and Peepal. Common grasses available in the grazing area are Dub, Motha, Patharchata and Gajarghas. The goats found in this area are mostly non-descript type. Some of the goats resembled to Black Bengal or Barbari. The coat colour of goats was black, white, and brown with white spots. The average adult body weight of goats was 12-15 kg. The average milk yield was 300-400 ml per day. The prolificacy was higher in goats with a twinning of 60-70%. The major goat diseases prevalent in this area were PPR, FMD, ET, Pneumonia and Parasitic infestations. The role of women in goat rearing was significant and they were actively involved in day-to-day management of goats.

Physiology, Reproduction and Management Division

PRSM 2.17: *In-vitro* production of caprine embryos and their survival following fresh and frozen embryo transfer.

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

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. The recovery of oocytes using follicle puncture was 1.71 per ovary.

***In-vitro* maturation of goat oocytes:** The oocytes collected from goat ovaries were cultured in tissue culture medium (TCM-199). The cumulus oocyte complexes (COCs) were cultured for 27 h at 38.5 ± 1^{0}C, 5% CO_2 in humidified air. The matured oocytes were separated from cumulus cells.

Table 1. Effect of different serum supplementation on in vitro maturation of goat oocytes

Serial No.	Serum	Total oocyte in maturation	Total oocyte matured	Maturation rate (%)
1	20% EGS	105	80^a	76.19
2	10% NCS + FSH + LH + E_2	450	288^b	64.00

Values in columns with different superscripts do not differ significantly (P > 0.05).

***In-vitro* fertilization of *in-vitro* matured goat oocytes and culture of fertilized goat oocytes:** An artificial vagina obtained fresh semen samples from a fertile purebred Sirohi buck were used. 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 examined for volume, colour, consistency and gross motility. Then 50 ul of neat semen was diluted with 5 ml of capacitation medium and washed 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^{0}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 (1x10^6 sperm/ml). The oocytes were washed after 18-24 hr of co-incubation with spermatozoa at 38.5^{0}C in an atmosphere of 5% CO_2 in humidified air.

Table 2. Cleavage rate of in vitro matured goat oocytes in different concentration of serum/fluid.

Serial No.	Serum	Total oocyte matured	Total oocyte cleaved	Cleavage rate (%)
1.	20% EGS	80	15^a	18.75
2.	10% NCS + FSH + LH + E2	145	18^b	12.41

Values in columns with different superscripts do not differ significantly (P > 0.05).

Following 18-24 hr of co-incubation with spermatozoa at 38.5^{0}C in an atmosphere of 5% CO_2 in humidified air, oocytes were washed in culture medium (EDM) and co culture with OEC or culture on the GCM for further development of in vitro fertilized oocytes. The oocytes were evaluated at 48-72 hour after insemination for cleavage rate and embryo development.

Birth of the first IVF-ET Kid: In vitro produced embryos of 8-16 cell stage were transferred in synchronized recipients on day 4 post-oestrous surgically in to the tip of the horn of the uterus. The recipient was

monitored for the oestrus/pregnancy. Following transfer, pregnancy was initially confirmed at day 28 and subsequently at day 56 by ultrasonography. On 17th August 2006, this surrogate goat of non-descript breed delivered normally a female kid weighing 3.15 kg after 146 days of gestation. The weight of surrogate goat after parturition was 42 kg. The kid was healthy and of brown color indicating inheritance of Sirohi. The mother was Black and White in color.

Frozen IVP Embryo Transfer: Fifty IVP frozen embryos at 2-16 cell stage were thawed. These embryos were transferred in to five synchronized recipients on day 2 or 3 post oestrous surgically in to the fallopian tube/tip of the uterine horn of the genital organ. The recipients were monitored for the oestrus/pregnancy. Two recipients missed two oestrous cycles but none of the goats were found pregnant.

Vitrification of IVP embryos: Vitrification of in vitro produced embryos at 2 to 4 cell stage was performed using ethylene glycol and glycerol as a cryoprotectant. Approximately 10 IVP embryos were used for freezing.

The first IVF-ET Kid born at CIRG, Makhdoom

PRSM 2.18: The effect of freeze-thawing of goat semen at different spermatozoal density on cell viability, keeping quality (storage), microbial contaminants and fertility.

N.K. Sinha, S.D. Kharche, V.K. Gupta and N. Ramachandran

A total of 270 semen collections from the bucks of different breeds viz. Sirohi (107), Marwari (63), Kutchi (48) and Jamunapari (52) having age group of 2-5 years were done. The semen was collected twice a week and only good quality (mass motility + 4 and above) semen was diluted in TEYCF diluter with the sperm concentration having 50, 100,150 and 200 sperms x 10^6/per insemination dose (0.25 ml French mini straw). Cooling from room temperature to 5°C was done in one hour period. The equilibration was done at 5°C for 3 hours and freezing was done in the biofreezer having a tested and set programme. The freezing was done at-160°C and then the frozen samples were shifted into semen storage container. After 24 hrs, two semen samples from each buck were thawed randomly at 40°C for 45 sec and examined for their post-thaw motility. Simultaneously, the slides were prepared for live and normal spermatozoal count. Post-thaw motility was affected by the number of spermatozoa/dose and it was high (> 50-60%) in semen having low number of sperms (50 & 100 million) as compared to higher concentration (150 and 200 millions/dose) irrespective of the breed. Fertility trial was conducted in Sirohi goats and fertility rate of 40.75% was achieved with deep cervical insemination technique. The Jamunapari bucks and Muzaffarnagari rams were screened for their breeding soundness, physical parameters, libido and seminal attributes before each breeding season in the Institutional flocks.

PRSM 2.20: Use of ultrasonography for ascertaining pregnancy related profiles in goats.

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

This Project was aimed to employ Real Time Ultrasonographic Imaging Technique (RTUI) for early (4-5 weeks) pregnancy/non pregnancy determination in goats, prediction of foetal counts and estimation of progesterone hormone (P4) at different stages of gestation and assessing the extent of embryonic mortality/fertilization failure upto 21 to 35 days after mating.

Imaging of non-pregnant and mated does by intra-rectal sonography: A total of 52 goats of different breeds (Jamunapari: 29, Sirohi: 11, Non-descript: 12) with previous kidding record and of known mating dates were taken for this study.

The scanning of non-pregnant uterus with the help of 7 mHz intra rectal transducer was done in the form of homogenous while coarsely granular echo immediately cranial to the urinary bladder (taken as a land mark for genital examinations). There was no accumulation of fluid in the non-pregnant genitalia of Jamunapari goats.

On 28 post-mating anechoic fluid pocket (black) with a white elongated streak extending more than half of foetal fluid was identified with a 7.00 MHz intra-rectal transducer. Two anechoic (Black) fluid pockets were also identified indicating the presence of multiple foetuses. Heart beat was not identified in any goat scanned at this stage of pregnancy. On day 35 post-mating using 5 and 7.00 mHz intra-rectal transducers, echo dense fetuses could be captured on a single ultrasonic image. On this day, foetal body was clearly imaged into two regions i.e. head and trunk. Foetal heart beat was visible in one of the part developing into trunk (50% animals). Amniotic membrane encircled the developing conceptus in the form of distinct hyper echoic dotted line in 65% animals. Developing placentomes which were half moon shaped (Saggital section) and ring shaped (horizontal section) were also scanned in some images.

Pregnancy determination by real time ultrasonography of goats at 4-5 week post breeding: Results of trans rectal ultrasound scanning of forty seven mated does at 4-5 weeks, post breeding are presented. Ultrasonographic scanning for detection of pregnancy did not indicate a pregnant doe as non-pregnant thus giving 100% accuracy. Similarly ultrasonographic scanning for non-pregnancy did not indicate a non-pregnant doe as pregnant thus giving 100% accuracy at this stage (Fig. 1).

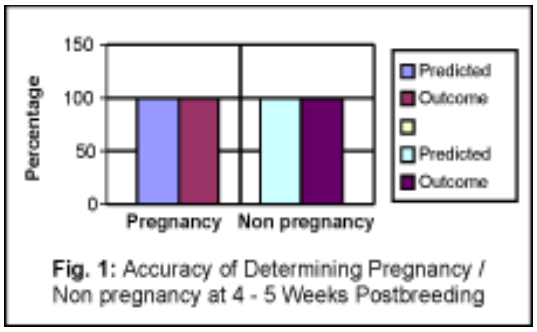


Fig. 1: Accuracy of Determining Pregnancy / Non pregnancy at 4 - 5 Weeks Postbreeding

Registration of foetal number through real time trans rectal ultrasonography: Results of trans-rectal ultrasound scanning of 23 pregnant goats at 4-5 and 5-6 week of gestation are summarized in Table 1.

a) Sensitivity at 4-5 week of gestation: Sensitivity of ultrasound scanning for singles and twins at this stage was 100% and 55.55%, respectively. The lower number of twin fetuses diagnosed at birth (5/9) was because

of under prediction of their number at this stage. However, the over all accuracy of scanning in prediction of foetal number at this stage was 80.00%.

b) Sensitivity at 5-6 week of gestation: Sensitivity of ultrasound scanning for singles and twins at this stage was 85.71% and 60.00%, respectively. During scanning, one animal was under predicted as single but actually kidded as twin and two animals were over predicted as twins but actually kidded with singles. However, the overall accuracy of scanning in prediction of foetal number at this stage was 75.00% (Fig. 2).

Table 1: Accuracy of determination of foetal number in pregnant does using trans rectal ultrasongoraphy

Sl. No.	Foetal Number	Scanning at 4-5 week post breeding	Scanning at 5-6 week post breeding
1.	Single[a]	11/11 = 100%	6/7 = 85.71%
2.	Twin[b]	5/9 = 55.55%	3/5 = 60.00%
3.	Overall	16/20 = 80.00%	9/12 = 75.00%

[a]Sensitivity of scanning for singles
No. diagnosed singles which kidded/No. actually predicted singles on Ultrasound scanning.
[b]Sensitivity of scanning for twins
No. diagnosed twins which kidded/No. actually predicted twins on Ultrasound scanning.

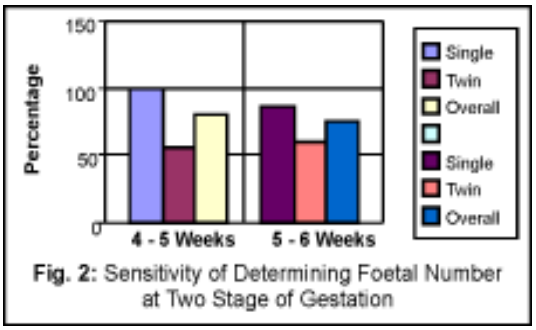


Fig. 2: Sensitivity of Determining Foetal Number at Two Stage of Gestation

Hormonal profile in goats:

Progesterone (p_4) estimation at different stages of gestation in Jamunapari goats: The level of pregnancy dependent hormone, progesterone (P4) was determined at different stages of gestation (day 21, 28, 35) in the serum samples of Jamunapari goats. Progesterone concentration in serum was estimated by ELISA technique. The mean serum progesterone level in Jamunapari does at three weeks of gestation was 24.44 ± 3.45 ng/ml (range: 8.60 to 40.00). It was slightly depressed at four weeks (20.24 ± 3.68 ng/ml) of gestation. As pregnancy advanced, it rose further and reached to a level of 29.22 ± 2.46 ng/ml (range: 9.2 to 40.00) showing increasing activity of corpus luteum for maintenance of pregnancy. Mean progesterone values among different days of gestation, however, did not differ significantly.

Progesterone profile (p_4) for assessing embryonic losses in goats: Blood samples of thirty one goats were collected at different periods after mating (21, 28 and 35 days) to assess the extent of embryonic mortality and fertilization failure by assaying progesterone hormone (P4). After serum separation, aliquots of all samples were stored under deep freezing condition at -40 °C until assayed. Serum samples were

Table 2: Serum progesterone (p_4) concentration (ng/ml) at different stages after mating in jakhrana goats

Sl. No.	Day 21 Post mating Mean ± SEM	Day 28 Post mating Mean ± SEM	Day 35 Post mating Mean ± SEM	Group
1.	17.48 ± 2.09 (10)	24.46 ± 2.45 (10)	25.47 ± 3.39 (10)	A Kidded
2.	23.96 (1)	29.00(1)	23.96 (1)	B Not Kidded
3.	0.396 ± 0.11 (3)	0.419 ± 0.15 (3)	1.11 ± 0.57 (3)	C Not Kidded

A: Normal Kidding
B: Embryonic loss at 5th week post-mating
C: Fertilization failure/embryonic losses within 3 weeks post-mating

subsequently processed for progesterone hormone (P4) by ELISA technique using commercially available assay kit. Pregnancy status of animals was based on real time ultrasonographic imaging. The detail analysis of assay results is shown in Table 2.

PRSM 2.21: Effect of Dietary Restriction on Growth and Carcass Characteristics in Kids.

Dharm Singh, N. Ramchandran, Puneet Kumar and R.B. Sharma

Four-month old 30 male kids of Barbari breed raised under uniform management and optimum feeding conditions were utilized. The kids were divided in to 3 groups of 10 kids each in such a way that the average age and initial body weights were almost identical in all the three groups. Kids were offered complete ration consisting of 50% concentrate mixture (Maize 25.0, Barley 20.0, Ground nut cake 25.0, Til cake 10.0, Wheat bran 17.0, Mineral Mixture 2.0 and Common salt 1.0%) and 50% Arhar/Gram bhusa as per schedule. Fresh water was offered twice daily at around 11 a.m. and 4 p.m. Observations on growth rate, feed intake and blood metabolites were recorded.

Growth: The body weight of the kids was recorded empty stomach in the morning at 10 days interval during dietary restriction period and thereafter at fortnightly interval up to 12 months of age. The least squares means of body weights are presented in Table 1. The least squares analysis of variance indicated relatively higher body weights in control group during entire dietary restriction period. However, the difference between control and treatment groups during first 30 days of dietary restriction period was statistically non-significant. But subsequently after 30th day the body weights in treatment groups became significantly ($P < 0.05$) lower than the control group. This trend continued until 60th day of realimentation period. Thereafter the difference between groups became statistically non-significant. The final body weight recorded after 6 months of realimentation period was highest (21.88 ± 1.08 kg) in group-3 and the lowest (19.42 ± 0.99 kg) in group-2. The average daily gain (ADG) during dietary restriction period was found to be negative (-4.2 g) in group-3 and 6.3 g in group-II as against 54.8 g in control group. During realimentation period a sharp increase in body weight was recorded in dietary restricted kids with overall ADG of 80.3 g in group-3, 62.6 g in group-2 and the lowest 59.2 g in control group.

Dry matter intake: The least squares means for dry matter intake in kids during different stages of feeding are presented in Table 2. The DMI/kid/d during dietary restriction period averaged 494.9, 268.7 and 222.3 g respectively in group-1, group-2 and group-3. The total DMI/kid during this period was recorded as 29.70, 16.13 and 13.34 kg respectively in group-1, group-2 and group-3. During realimentation period the DMI/kid/d ranged from 569.1 ± 5.8 to 723.7 ± 8.1g in control group, 371.7 ± 9.8 to 701.2 ± 8.1g in group-2 and 290.9 ± 9.8 to 719.6 ± 8.1g in group-3. Total DMI for entire experimental period of 235 days was recorded as 141.58, 119.0 and 119.0 kg respectively in Group-1, Group-2 and Group-3. The DMI/kid/d during different stages of growth except the period from 180-235 days remained significantly ($P < 0.01$) lower in dietary restricted kids.

Blood metabolites: The blood samples from individual kids were collected at periodic interval for estimation of Triiodothyronine (T3), Thyroxine (T4), Blood Glucose, Serum Creatinine and Urea. Their graphical presentation is shown in Fig. 1&2. During phase I i.e. dietary restriction period, the Triiodothyronine (T3) and Glucose level did not vary significantly between groups at different stages of growth whereas, Thyroxine (T4), Creatinine and Urea level varied significantly ($P<0.01$). The Triiodothyronine values on 10th day averaged 1.11 ± 0.15, 1.33 ± 0.15 and 1.13 ± 0.15 respectively in group 1, 2 and 3. In general, the T3 level during dietary restriction period was lower in treatment groups than in the control group.

The least squares means for Thyroxine (T4) level were 26.60 ± 3.72, 30.20 ± 3.72 and 28.60 ± 3.72 ng/ml respectively in group 1, 2 and 3 on 10th day and 51.60 ± 3.72, 54.00 ± 3.72 and 61.00 ± 3.72 ng/ml on 60th day. The glucose level (mg/100ml) ranging from 46.70 ± 1.27 to 67.60 ± 1.27 in group-1, 50.60 ± 1.27 to 63.20 ± 1.27 in group-2 and 48.70 ± 1.27 to 65.10 ± 1.27 in group-3 did not differ between groups at different stages of growth.

During second phase of the experiment i.e. realimentation period, the T3 level was relatively higher than in phase-I. The level of both T4 and creatinine rose sharply on realimentation and continued to increase gradually during entire phase. The difference in T4 level after 25th day became statistically non-significant between groups. The blood Urea level was found increasing with the increase in age and the difference between groups at different stages of growth was statistically significant ($P<0.01$).

Carcass Characteristics: After 6 months of realimentation period, 4 kids from group-1, 5 from group-2 and 6 from group-3 were slaughtered for carcass evaluation studies. The traits studied were empty live weight, carcass weight, dressing rate and meat yield. Least squares analysis of variance indicated

Table 1: Least Squares Means for body weight (kg) as affected by dietary restriction.

S.No.	Particulars	LSM ± SE			Remarks
		Group-I	Group-II	Group-III	
1.	Initial Body weight	8.08 ± 0.39	8.08 ± 0.39	8.08 ± 0.09	NS
2.	10-Day weight	8.48 ± 0.41	7.86 ± 00.41	8.04 ± 0.41	NS
3.	20-Day weight	9.21 ± 0.41	8.04 ± 0.41	8.11 ± 0.41	NS
4.	30-Day weight	9.48 ± 0.46	8.41 ± 0.46	8.13 ± 0.46	NS
5.	40-Day weight	9.98 ± 0.45	8.26 ± 0.45	8.17 ± 0.45	*
6.	50-Day weight	10.83 ± 0.46	8.36 ± 0.46	7.95 ± 0.46	**
7.	60-Day weight	11.37 ± 0.46	8.46 ± 0.46	7.83 ± 0.46	**
8.	75-Day weight	12.44 ± 0.51	9.23 ± 0.51	8.47 ± 0.51	**
9.	90-Day weight	12.99 ± 0.56	9.95 ± 0.56	9.23 ± 0.59	**
10.	105-Day weight	13.54 ± 0.57	10.49 ± 0.61	10.28 ± 0.61	**
11.	120-Day weight	14.55 ± 0.63	11.63 ± 0.75	11.55 ± 0.66	**
12.	180-Day weight	17.72 ± 0.96	15.57 ± 0.89	16.49 ± 0.83	NS
13.	235-Day weight	21.73 ± 0.99	19.42 ± 0.99	21.88 ± 1.08	NS

NS: Non-significant difference between LSM with in the rows.

* Indicates significant difference at $P<0.05$ and ** at $P<0.01$ with in the rows.

Table 2: Least Squares Means for dry matter intake (DMI) per kid/day (g) as affected by dietary restriction.

S.No.	Period	LSM ± SE		
		Group-I	Group-II	Group-III
1.	0-10 day	362.3 ± 9.3	252.0 ± 9.3	252.0 ± 9.3
2.	10-20 day	434.8 ± 6.5	251.9 ± 6.5	250.9 ± 6.5
3.	20-30 day	487.7 ± 5.4	309.6 ± 5.4	239.4 ± 5.4
4.	30-40 day	531.5 ± 4.1	265.9 ± 4.1	241.8 ± 4.1
5.	40-50 day	562.1 ± 4.3	264.5 ± 4.3	181.0 ± 4.3
6.	50-60 day	591.1 ± 3.2	268.3 ± 3.2	168.1 ± 3.2
7.	60-75 day	579.4 ± 9.8	371.7 ± 9.8	290.9 ± 9.8
8.	75-90 day	569.1 ± 5.8	441.2 ± 5.8	402.7 ± 5.8
9.	90-105 day	597.9 ± 5.5	468.9 ± 5.5	495.3 ± 5.5
10.	105-120 day	587.11 ± 0.3	541.2 ± 10.3	604.2 ± 10.3
11.	120-180 day	618.0 ± 5.1	616.1 ± 5.1	653.5 ± 5.1
12.	180-235 day	723.7 ± 8.1	702.0 ± 8.1	719.6 ± 8.1

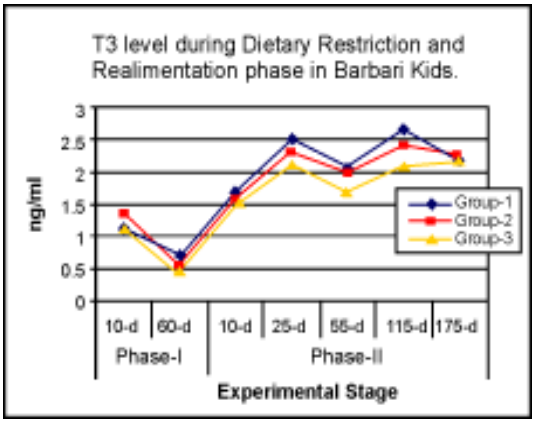
Table 3: Effect of dietary restriction on mean carcass characteristics of kids.

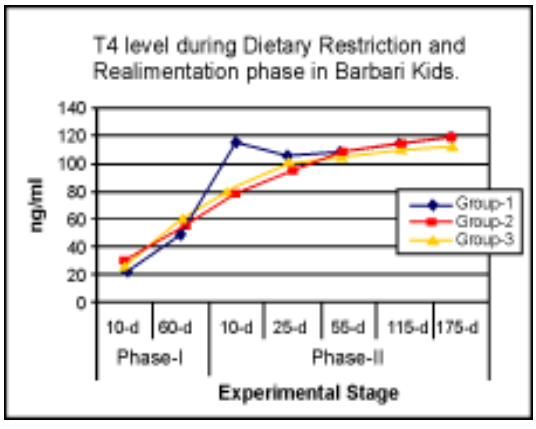
S.No.	Particulars	Group-I	Group-II	Group-III	Remarks
1.	Slaughter weight (kg)	20.75 ± 1.36	18.8 ± 61.21	20.02 ± 1.11	NS
2.	Empty live weight (kg)	17.82 ± 1.18	16.18 ± 1.06	17.26 ± 0.96	NS
3.	Carcass weight (kg)	9.90 ± 0.72	8.68 ± 0.64	9.45 ± 0.59	NS
4.	Dressing rate (%)				
	(i) On Live weight basis	47.53 ± 1.06	46.10 ± 0.95	47.19 ± 0.87	NS
	(ii) On Empty live weight basis	55.43 ± 0.87	53.71 ± 0.78	54.63 ± 0.71	NS

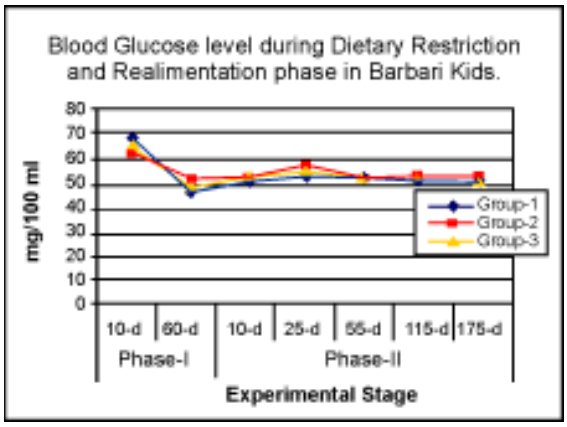
NS: Indicates non-significant difference between means within row.

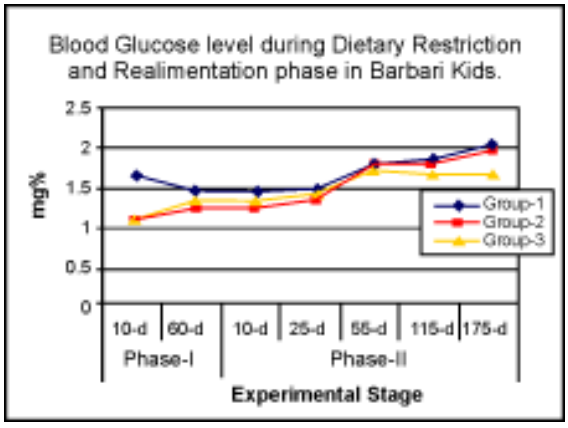
no significant difference for any of the carcass traits between groups. However, the dressing percentage on live weight basis was marginally higher in group-1 (47.52 ± 1.06%) and so was on empty live weight basis (Table 3). The highest meat yield (% of carcass weight) of 93.28 ± 0.82% was found in Group-II followed by group-I.

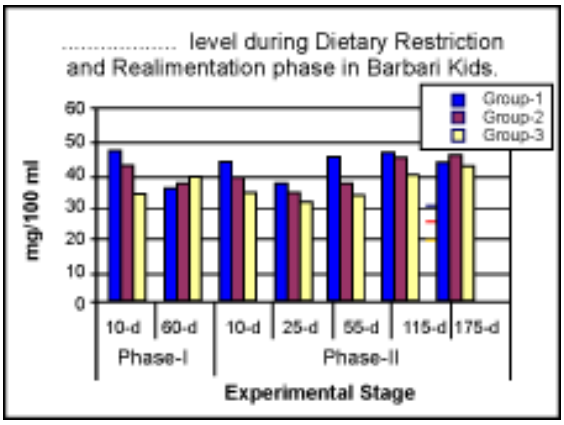
Effect of dietary restriction on cost of feeding: The details of cost of feeding worked out for control and treatment groups

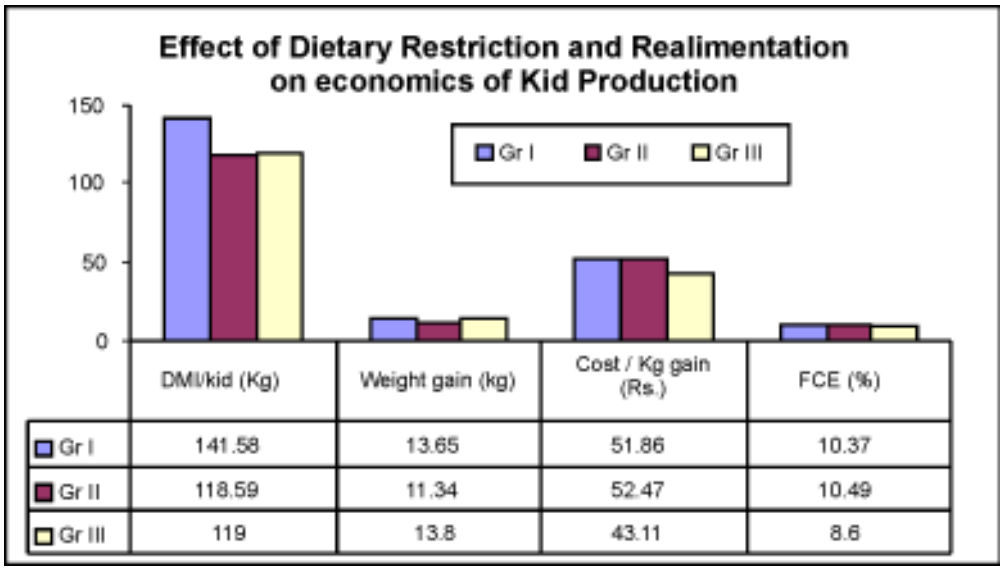












	DMI/kid (Kg)	Weight gain (kg)	Cost / Kg gain (Rs.)	FCE (%)
Gr I	141.58	13.65	51.86	10.37
Gr II	118.59	11.34	52.47	10.49
Gr III	119	13.8	43.11	8.6

Fig. 1: Effect of dietary restriction on economics of kid production in Barbari goats.

are presented in Fig. 3. Cost of feeding was worked out on the basis of total DMI, Cost of feed consumed and the total body weight gained. The total dry matter intake per kid remained as 141.58, 119.00 and 119.00 kg respectively in group-1, group-2 and 3. The feed cost per kg gain was worked out as Rs 51.86 in group-1 as against Rs 52.47 in group-2 and the lowest of Rs 43.11 in group-3. Compared to control group a saving of 1.77 kg dry matter for each kg gain in body weight was found in group-3.

Nutrition, Feed Resource and Product Technology Division

GN 4.14: Design and Development of machineries for fodder production, conservation and processing of feed for commercial goat farming

P.K. Sahoo, R.P. Misra and T.K. Dutta

Development and testing of low cost Feed Mixer: The prototype low cost animal feed mixer was designed and developed to mix the heterogeneous feed ingredients before preparation of complete feed pellets and complete feed blocks. The prime mover of the machine was a single-phase 2hp motor. The machine consisted of mixing chamber, T-shaped blades for mixing of the feed ingredients and opening flap. The speed reduction was done by belt and pulley sets. The feed ingredients consisting of 50% straw (*Cajanus Cajan)* and 50% concentrate with molasses was put in the mixing chamber and the T-shaped blades were activated to mix the highly heterogeneous substances. The blades moved spirally to have a uniform mixing. The samples were collected after 5, 10 and 15 minutes of operation and bulk density and moisture content were recorded. The bulk densities were found to be 75.46 ± 1.99, 77.09 ± 1.18 and 78.47 ± 1.38 Kg/m^3 respectively for mixing of 5 minutes, 10 minutes and 15 minutes. The corresponding moisture contents were recorded as 13.40 ± 0.52, 13.47 ± 0.26 and 13.80 ± 0.25% respectively. The bulk density and moisture content of the mixture were found to be 78.24 ± 1.55 Kg/m^3 and 13.45 ± 0.27% respectively by manually mixing for 25 minutes duration. It was observed that the mixing was more uniform with more time. But the output of the machine was reduced from 1.2q/h to 0.6q/h by mixing for 5 minutes to 15 minutes. Coefficient of Variation was considered as an index of uniformity in mixing. The CV was less than 5% for mixing 10 minutes and 15 minutes by the feed mixer. Hence, the performance of the machine can be rated as very good. The cost of the mixer was Rs. 20,000/-only.

Animal experimentation to study the processing effect: The animal experimentation was conducted to study the processing effect of the complete feed manufacturing. Complete feed pellets, complete feed blocks and the total mixed ration (TMR) of the same composition with 50:50 straw and concentrate ratio were fed to three groups of growing animals. Higher ADG was observed in case of pellet fed group. No significant differences were observed for dry matter intake for 100kg body weight, Kg metabolic body weight and feed conversion efficiency. However, metabolic trials were conducted to study the nutrient intake pattern and digestibility coefficients for arhar straw based complete feeds and neem leaf based complete feeds. It was observed that dry matter intake per 100 kg body weight ranged from 4.19 (TMR-male) to 5.53% (pellet-female) for Arhar straw based complete feed. The variation was found to be highly significant. Highest

Table 1: Digestibility coefficients of Arhar straw based complete feeds in different treatment groups

Parameters	Arhar Straw based complete feed					
	Pellet		Block		Mash	
	Female	Male	Female	Male	Female	Male
DM Digestibility, %	61.49 ± 1.08^{b}	59.8 ± 1.56^{ab}	60.69 ± 1.02^{ab}	55.94 ± 3.76^{a}	62.74 ± 0.98^{b}	57.77 ± 2.68^{ab}*
CP Digestibility, %	76.15 ± 0.79	73.54 ± 4.58	79.06 ± 2.35	71.34 ± 6.59	72.57 ± 4.0	71.15 ± 2.32^{NS}
EE Digestibility, %	68.19 ± 4.9	65.48 ± 5.3	54.88 ± 2.71	46.95 ± 10.68	64.11 ± 1.02	47.91 ± 8.21^{NS}
OM Digestibility, %	64.43 ± 1.18	62.8 ± 1.65	64.69 ± 0.86	60.46 ± 3.6	65.99 ± 1.11	61.08 ± 2.79^{NS}
ADF Digestibility, %	52.19 ± 0.62^{ab}	48.77 ± 3.17^{ab}	50.44 ± 1.04^{ab}	45.04 ± 3.16^{ab}	53.63 ± 3.04^{b}	44.28 ± 4.44^{a}**
NDF Digestibility, %	57.21 ± 2.34^{ab}	55.71 ± 2.33^{ab}	56.62 ± 2.35^{ab}	49.65 ± 4.23^{a}	59.77 ± 2.1^{b}	52.38 ± 4.24^{ab}*
TCOH Digestibility, %	62.25 ± 1.41	60.81 ± 1.42	61.73 ± 0.92	58.29 ± 3.15	64.28 ± 1.41	58.97 ± 3.64^{NS}

Table 2: Digestibility coefficients of Neem Leaf based complete feeds in different treatment groups

Parameters	Neem leaf based complete feed					
	Pellet		Block		Mash	
	Female	Male	Female	Male	Female	Male
DM Digestibility, %	58.17 ± 5.49^{ab}	51.14 ± 2.07^{a}	53.01 ± 4.02^{ab}	64.13 ± 2.3^{b}	57.29 ± 4.07^{a}	50.23 ± 1.5^{a}*
CP Digestibility, %	68.77 ± 4.43	60.35 ± 1.8	64.42 ± 9.69	75.67 ± 1.98	72.17 ± 2.13	62.54 ± 6.34^{NS}
EE Digestibility, %	79.75 ± 3.9	79.35 ± 1.63	66.83 ± 5.44	67.9 ± 7.06	77.39 ± 6.21	73.18 ± 5.32^{NS}
OM Digestibility, %	61.55 ± 4.93^{ab}	55.68 ± 1.68^{a}	55.33 ± 3.48^{a}	66.95 ± 2.15^{b}	60.51 ± 4.01^{ab}	53.89 ± 1.26^{a}*
ADF Digestibility, %	60.81 ± 6.8	49.76 ± 3.55	47.53 ± 6.56	61.69 ± 2.08	58.24 ± 5.02	47.41 ± 1.62^{NS}
NDF Digestibility, %	69.49 ± 5.5^{b}	60.97 ± 2.89^{b}	47.16 ± 4.82^{a}	61.16 ± 2.65^{b}	71.92 ± 3.38^{b}	64.72 ± 0.94^{b}*
TCOH Digestibility, %	59.21 ± 5.55^{ab}	53.59 ± 1.84^{a}	53.08 ± 2.5^{a}	65.14 ± 2.24^{b}	57.49 ± 4.91^{ab}	51.28 ± 0.75^{a}*

($P < 0.01$) DMI, DCP intake and TDN intake per Kg $W^{0.75}$ were recorded for pellet-female group. The values were 108.93, 10.82 and 63.85g respectively. The respective values pellet-male were statistically similar with the pellet-female group. The results showed that intakes of DM, DCP and TDN were similar among block and TMR fed groups irrespective of sex. DM digestibility was significantly ($P < 0.05$) higher in pellet-female and TMR-female groups (Table 1). OM, CP, EE and TCOH were similar among different treatment groups. Whereas, NDF digestibility followed the trend of DM digestibility in different treatment groups. ADF digestibility was significantly lower in TMR-female group. N-balance was similar in different treatment groups. In case of neem leaves based complete feeds DMI (kg)/100 kg body weight ranged from 2.22 (male-pellet) to 4.25 (male-block). However, the variation was found non-significant. Whereas, DCP intake/100 kg body weight was significantly higher in male-block group (470.12g) than other treatment groups. Similarly, TDN intake/ 100kg body weight was also higher in male-block group than other groups. The apparent digestibility coefficient of DM, OM, TCOH was significantly higher ($P < 0.05$) in male-block group than other groups (Table 2). The NDF digestibility reduced significantly due to neem leaf based block feeding in female kids. Nitrogen balance was estimated similar in different treatment groups. The results showed lower

intake pattern in Barbari kids due to neem leaf based complete feed in three-processed forms (pellet, block and TMR). But comparatively arhar based complete feeds in different physical forms resulted in better intake in Barbari kids irrespective of sex than neem leaf based complete feeds.

Drying studies of berseem fodder inside the poly-house: To achieve faster drying rate, the poly-house with natural ventilation was used for haymaking. The experiment was conducted to observe the drying rate of berseem fodder in the poly-house and in ambient conditions. The swath thickness was 2″ and 4″ and the average initial moisture content varied from 78% to 85% of the freshly cut fodder as per the stage of harvesting and ambient conditions. The moisture content was reduced to less than 10% within 32 hours of drying for 2″ and 4″ swath thickness (Fig. 1). However, for ambient solar drying, the drying duration was recorded higher for same swath thickness (Fig. 2). The drying rates were found higher inside the poly-house than the ambient solar drying. Therefore, it may be concluded that poly-house may be used for making good quality hay due to higher drying rate and less exposure.

GN 4.15: Nutritional Evaluation of common goat fees available in grazing area/rangeland with special reference to discount factors and rumen metabolism

R.S. Upadhyaya

Prediction of organic matter intake from faecal nitrogen excretion in goats: Observations on OMI (organic matter intake), DOMI (digestible organic matter intake) and FNE (faecal nitrogen excretion) from 5 different experiments were fitted to 3 regression models i.e. linear, quadratic and cubic in order to predict OMI and DOMI from FNE in Barbari bucks. The R^2 (coefficient of determination) values relating OMI and FNE by linear, quadratic and cubic models were 0.7068, 0.7119 and 0.7281 respectively. The corresponding R^2 values relating DOMI and FNE were 0.510, 0.5545 and 0.5563. The recalculation of linear regressions after omitting discordant data resulted in improvement of R^2 values in linear equations from 0.7068 to 0.8589 for OMI versus FNE and from 0.510 to 0.71 for DOMI versus FNE. It is concluded that regression equations developed in this study may be useful for prediction of OMI in goats maintained under similar feeding systems. However, it is preferable to have regressions specific to local feed stuffs given to goat population existing in a particular region for better accuracy of prediction.

GN 4.18: Studies on Silvipasture System for Sustainable Goat Production.

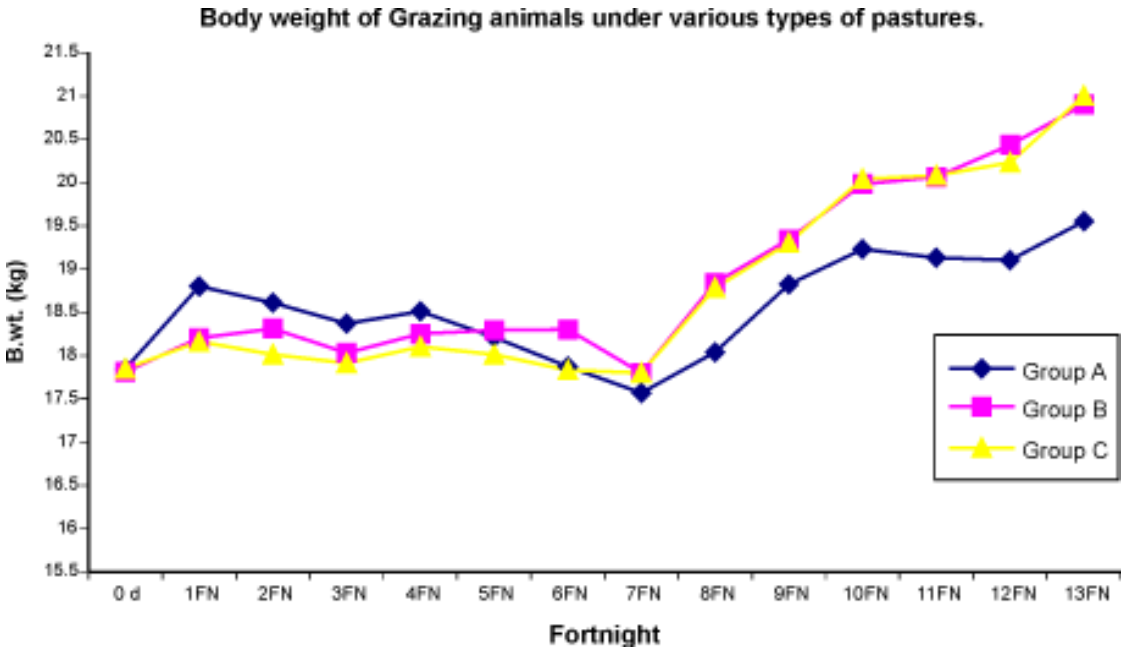
P.Tripathi, T.K. Dutta and R.S. Upadhayaya

Evaluation of primary productivity of pastures: Three pastures viz. Natural (A), *Cenchrus ciliaris* (B) and *Cenchrus ciliaris* + *Tephrosia purpurea* (GroupC) were rain-fed in loamy sand soil and evaluated for primary production, botanical composition and plant density. Though annual rainfall of the year 2006-2007 was less than the average annual rain fall, maximum green biomass observed was 6.25t/ha in natural, 9.65 t/ha in *Cenchrus ciliaris* and 8.40 t/ha in *Cenchrus* + *Tephrosia* pasture in September month. The major plant species in Natural pasture were *Achyranthes aspera, Tephrosia purpurea, Cenchrus ciliaris, Sida sp., Dichostachys bipinnata, Boervia diffusa, commelina sp. Tribulus terrestris* etc. Maximum plant density of 12.75/m^2 was observed in natural pasture. The hill diameter of *Cenchrus ciliaris* was

27.68 ± 2.32 cm in pure stand, which was higher than natural and *Cenchrus* + *Tephrosia* pasture. Proximate composition of various pasture species was done. Crude protein content was highest (19.65.24 ± 1.54) in *Tephrosia purpurea*.

Evaluation of *Tephrosia purpurea* as goat feed: *Tephrosia purpurea* is a leguminous plant in the Yamuna ravines as rain-fed feed resource. It is perennial in nature and can thrive well in poor soils with low rainfall. Flowering starts from September and matures at the end of October. Regeneration of this plant starts from March and remains green up to October. Six Barbari adult males having mean body weight of 23.27 ± 0.69 kg were selected to observe the suitability of *Tephrosia purpurea* as leguminous feed resource for goats. These animals were fed with *ad lib*. chaffed *Tephrosia purpurea*, collected from rain-fed grazing land for a period of 25 days as preliminary feeding. A metabolism trial was conducted. *Tephrosia purpurea* contained CP 22.05, OM 94.12, NDF 65.15, ADF 41.15, total carbohydrate 70.65, ash 5.87 and ether extract 1.41% respectively. Total DMI and DMI/kg $W^{0.75}$ were 736.46 ± 92.00 g and 70.43 ± 7.99 g respectively. DM, CP, OM, EE, NDF and ADF digestibilities were 66.67 ± 2.77, 74.63 ± 1.55, 67.82 ± 2.66, 66.68 ± 1.84, 61.89 ± 3.37 and 47.16 ± 4.90% respectively.Total TDN and TDN intake/kg $W^{0.75}$ were 490.24 ± 76.63 g and 46.82 ± 6.88 g. Total DCP and DCP/kg$W^{0.75}$ intakes were 128.10 g and 12.35 g respectively. TDN and DCP values in *Tephrosia purpurea* were estimated as 64.83 and 16.45%.

Grazing studies: Seven Barbari adult male were introduced in each type of pasture with initial body weight of 17.857 ± 0.69, 17.814 ± 0.69, 17.857 ± 0.71 kg in Group A, B and C respectively. These animals were allowed to graze for six hours a day in these pastures from September 2006 to mid



Group A-Natural pasture, Group B-*Cenchrus ciliaris* pasture, Group C-C. ciliaris + T. Purpurea

March, 2007. All the three groups of grazing animals were observed very near or below to initial body weight in the 7th fortnight of grazing. At this point all three groups were supplemented with concentrate pelleted feed @ 1% of their body weight.

At the end of grazing trial of 196 days average daily body weight gain was 8.64, 15.74 and 16.04 g in group A, B and C, respectively.

In the month of October grazing trial was conducted with faecal bags. Dry matter intake was calculated with acid insoluble content method. It was observed that DMI/ $w^{0.75}$ was 46.37 ± 7.28, 64.51 ± 7.02 and 80.07 ± 7.31g in Group A, B and C respectively. However, these values in March were 48.01 ± 2.91, 67.69 ± 10.39 and 44.60 ± 4.08 respectively where these animals were supplemented with pelleted concentrate feed. Dry matter digestibility in October was 68.69 ± 4.21, 64.97 ± 1.00 and 67.95 ± 1.12 % in GroupA, B and C respectively, while in March these values were 59.59 ± 1.65, 72.50 ± 0.75 and 61.19 ± 2.022% respectively.

AICRP On Improvement Of Feed Resources and Nutrient Utilization in raising Animal Production

U.B. Chaudhary, Nawab Singh and S.D. Kharche

Biological samples of soil, water, feed, fodder and blood of Cattle, Buffalo, Sheep and Goats were collected from Pratapgarh and Jaun Pur districs falling under Eastern plain zone and were analyzed for macro and micro minerals: Observations indicated that wheat straw, paddy straw, sorghum and grasses were the basal roughage for different livestock species in this zone. Macronutrient contents (calcium, phosphorus and magnesium) of these basal roughages were found low. The micro minerals (zinc, cobalt and manganese) were also found low. Wheat flour was found low in calcium, phosphorus, magnesium, cobalt and manganese, whereas, mustard and linseed cakes were found low in calcium magnesium, cobalt and manganese. The other components of concentrate mixture viz. Maize flour, Crushed wheat, Rice husk and Barley flour were not found balanced with micro and macro minerals. The concentration of different minerals in the top feeds (Table 1) of this zone was observed normal except for phosphorus, magnesium and manganese which was found low in some of the top feeds. Soil of this zone was found low in calcium, phosphorus, magnesium, copper, zinc, iron and manganese. Whereas, water samples collected from different sources indicated low concentration of calcium, magnesium, copper, zinc and iron. The concentration of cobalt and manganese could not be compared on account of non availability of the standard values with respect of these elements.

A total no of 205 blood samples from buffaloes and 95 from goats were collected from different villages and were analyzed for the concentration of different micronutrients. The results indicated deficiency of most of macro and micro minerals in the cattle, buffalo, sheep and goats. Based on the deficiency of macro and micro minerals in the blood of cattle, buffaloes, sheep and goats, an area specific mineral mixture was formulated separately for South Western Semi-Arid Zone, Central Plain Zone and Eastern Plain Zone of Uttar Pradesh. Area specific mineral mixture formulated for South Western Semi-arid zone is being tested in three adopted villages of Mathura district using cattle and buffaloes suffering from reproductive problems. Observations collected from

Table 1: Micro nutrient content of top feeds in Irrigated Semi Arid Zone (Eastern plain zone of UP)

Minerals Normal level	Ca 0.3	P 0.25	Mg 0.2	Cu 8.0	Zn 30	Fe 50	Mn 40
Acacia nilotica(Desi babool)	0.45	0.15	0.15	46.3	14.4	130	53.2
Ficus glomerata (Goolar)	0.04	0.16	0.1	47.1	69.2	649	58.4
Pongamiya pinnata(Kanji)	0.33	0.15	0.12	23.9	84.5	486	103.2
Emblica officinalis (Aonla)	0.65	0.2	0.14	10.3	71.3	243	7.4
Hibiscus spp.(Gurhal)	1.21	0.1	0.27	27	32.3	761	3.3
Leucaena leucocephala(Soobabool)	0.13	0.35	0.15	17.9	18.8	329	46.8
Sygium cummini (Jamun)	0.28	0.08	0.15	7.9	14.9	106	15.7
Reanus Communis (Caster)	0.05	0.25	0.15	16.4	22.7	127	65.5
Moringa Oliyavidus(Shahajan)	0.32	0.28	0.16	12.2	40.6	181	29.5
Calitropis spp.(Aak)	0.35	0.31	0.15	10.9	34.7	201	23.2
Zyzyphus Mauritiana (Ber)	0.14	0.27	0.14	24.2	0.0	288	46.0

Table 2: Usages pattern of feeds and fodder fed to different livestock in different agro climatic zones of UP

Feed & fodder	South western semiarid zone (Mathura & Etah District)	Central plain zone (Etawah & Unnao district)	Eastern plain zone (Pratpgarh district)
	Use by farmers (%)	Use by farmers (%)	Use by farmers (%)
Concentrate			
Mustard cake	97.56	77.08	12.5
Wheat bran	26.82	1.04	32.5
Rice bran	0	3.12	10
Chunies	7.31	3.12	0
Wheat flour	78.04	73.95	45
Pelleted feed	0	3.12	0
Mineral mixture	2.43	2.08	0
Common salt	57.31	38.54	2.5
Dry roughages			
Wheat straw	100	100	90
Paddy straw	0	1.04	15
Pearl millet stovers	2.43	1.04	0
Sorghum stovers	23.17	1.04	10
Green fodder			
Berseem	100	64.58	100
Lucerne	6.09	0	0
Sorghum	96.34	77.08	100
pearl millet	84.14	44.79	67.5
Grasses	19.51	71.87	32.5
Grazing	17.07	73.95	80
Tree leaves			
Accasia	17.07	45.83	32.5
Ficus	17.07	45.83	32.5

adopted villages indicated that out of 19 cattle and buffaloes suffering from anestrous or repeat breeding, 14 (74%) recovered and conceived within 36-96 days of feeding of area specific mineral mixture. Usage pattern feeding of feed fodder and concentrate to the live stock species was observed varying under three agro climatic zones of Uttar Pradesh (Table 2).

AP Cess Fund: Isolation and Identification of Efficient Exotic Fungi for Improvement of Pasture/Fiber Digestibility in Goats.

U.B. Chaudhary and V.K. Gupta

Comparative evaluation of fibrolytic enzyme activities: The faeces of Marwari goats collected from their native tract and CIRG, Makhdoom were used for cultivation of anaerobic fungus (*Piromyces* and *Orpinomyces*) and evaluation of enzymatic activities. The enzymatic activities of mixed culture of rumen fungus indicated comparatively higher activities of CMCase, Avicelase, α –amylase and Xylanase in the rumen of Marwari goats of its native tract than the same breed of goats being reared at CIRG, Makhdoom. However, in case of β –Glucosidase, the higher activities were observed in Marwari goats of CIRG, Makhdoom.

Fibrolytic enzyme activities of *Piromyces* species of fungus indicated higher concentration of CMCase, β–Glucosidase, α–amylase and xylanase in the rumen of Marwari goats of CIRG, Makhdoom as compared to the same breed of goats in their native tract. However, the activities of avicelase enzyme was observed higher in case of Marwari goats in the native tract than those at CIRG, Makhdoom.

In contrast to the *Piromyces* species the activities of different fibrolytic enzymes with respect of *Orpinomyces*, indicated elevated units of CMCase, Avicelae, α–amylase and Xylanase in the rumen of Marwari goats of native tract in comparison to CIRG, Makhdoom. However, the corresponding values of β–Glucosidase were observed higher in the goats of CIRG, Makhdoom than the same goat breed of the native tract. Higher enzymatic activities observed in mix culture and culture of Piromyces originated from the rumen of

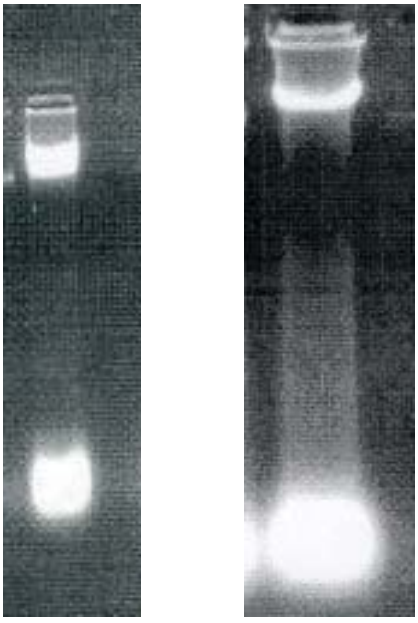


Fig. 1: Showing DNA extracted from *Piromyces* sp (a) and *Orpinomyces* sp (b)

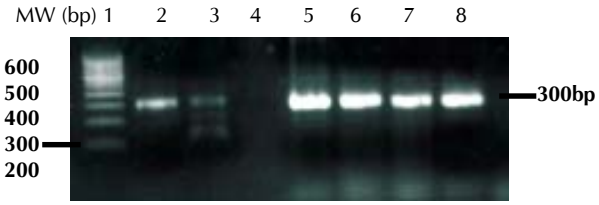


Fig. 2: Amplification of ITS 1 region of *Piromyces* and *Orpinomyces*. Black arrow indicates the 300bp PCR product.
Lane 1: Standard 100bp molecular weight marker.
Lane 2& 3: ITS 1 region of *Piromyces* (poor amplification due to low purity of DNA used)
Lane 4: Blank
Lane 5 & 6: ITS 1 region of *Piromyces*
Lane 7 & 8: ITS 1 region of *Orpinomyces*

Marwari goats of its native tract may be attributed to the adaptation of fungal species for digestion of structural carbohydrates of poor quality roughages on account of low intake of starchy diet by the goats. It was further confirmed that Marwari goats of native tract were fed either very low quantity or no concentrate. It is well documented that the feeding of soluble sugar/starchy diet reduces the cellulolytic activities of rumen microbes. In case of Marwari goats of CIRG, the animals were receiving sizable amount of concentrate mixture daily as per their requirement in addition to the green and dry fodder which may be resulting in lower fibrolytic activities exhibited by rumen fungus isolated from these animals. There is scope for transfer of efficient fungi of Marwari goats of the native tract to the same breed of goats being reared at CIRG, Makhdoom for improving the activities of fibrolytic enzymes.

Identification of rumen fungal species based on amplification of ITS 1 region: The ribosomal ITS 1 region defined by relevant primers was amplified from genomic DNA using PCR. The PCR was performed in a 50 ul volume containing (final concentration)

forward and reverse primers, 50 pmol each; 1X PCR master mix (Banglore Genei) having Taq DNA polymerase, dNTPs and reaction buffer with Mg_2 Cl at optimum concentration, 25 ul; template, 4 ul and sterile water, 17 ul. The temperature conditions were as follows:
Initial denaturation at 94 °C for 4 min, followed by 35 cycles of denaturation at 94 °C for 30 sec, annealing at 38°C for 30 sec and extension at 72°C for 1 min. Final extension at 72°C for 1 min. Final extension was at 72°C for 5 min. The amplified ITS1 region was got automated sequenced from commercial firm (Banglore Genei). As depicted in Fig. 2, the visibility of 300 bp (approximately) single band after PCR amplification of ITS 1 region of genomic DNA of *Orpinimyces* and *Piromyces* against specific primer confirms that amplified region incase of both the species was ITS 1 region. Sequencing (applied bio system) of amplified ITS products and blasting of sequenced base pair using ncbi website (www.ncbi.nln.nih. gov) further confirmed the amplified region as ITS 1region since blast results showed a high degree of similarity with *Piromyces* incase of isolates isolated from Nilgai whereas other isolates (isolated from goats) showed similarity with *Orpinomyces* sequence from gene bank.

AP-Cess Project: Development of Supplemen-tation Strategies for goats Under Field Conditions

T.K. Dutta, Prabhat Tripathi and Nawab Singh

In this Project, two Districts of semi-arid region of Rajasthan were selected for the survey works during the second year, namely Bharatpur and Alwar Districts. Twelve to fifteen goat farmers were interacted randomly in the selected villages of the two districts for the survey work. The chemical composition of goat feed resources collected from different districts were analyzed.

Goat Farmers' Profile and Animal Population: A total 25 goat farmers in two villages (Ramnagar and Sikrora-Sikrori) of Kumher block and 12 goat farmers in Nandera Bass village of Kaman block of Bharatpur District were interacted for evaluation of nutritional status of goats under field condition. Total 22 goat farmers in two villages (Dharampura and Madhogarh) in Umrain block and 27 farmers in two villages (Nagalheri and Bisa Ka bass) in Thanagazi block of Alwar District were also surveyed for the same purpose. The average goat population per family was 10.89 and 34.14 in Bharatpur and Alwar districts, respectively. The data regarding adult male and female ratio revealed that farmers in Alwar district maintained highest ratio (1:21.47) and lowest ratio was maintained in Aligarh district (1:3.12). Some goat farmers in all four districts reared other animals (cattle, buffalo and sheep) also in the mixed farming system. Buffalo population was found higher than cattle population reared by the goat farmers in the surveyed villages of the two districts. Landless and marginal farmers rear maximum number of goats as compared to other category farmers. Farmers in Alwar district reared highest number of goats per family. Positive relationship of family size and goat population was observed in these districts. Inverse relationship between family size and literacy percent and literacy percentage with goat population was observed in the two districts (Fig. 1). It was observed that association of children and ladies was found more for day-to-day activities in goat rearing as compared to adult males.

Feeding Practices for Goats under Village Condition: Goat farmers in Bharatpur and Alwar districts allow their goats for 5-7 hours and 7-10 hours for grazing, respectively. The grazing resource in Alwar was found abundant during monsoon season. Feed resources in the grazing fields were mainly mixed grasses. Mixed grasses available on road sides, bunds of cultivated fields and idle cultivated lands in Kumher block were mainly represented by Doob (*Cynodon dactylon*) along with other grasses like Sama (*Echinochloa colonum*) and Bathuva (*Chinopodium colonum*).The hilly region of Kaman block and two blocks of Alwar district have diversified biomass of grazing resources. Therefore, farmers in this region allow their goats maximum grazing. Goat keepers allowed newborn kids for colostrum feeding. Kids were allowed for milk feeding with their mother upto 2 to 3 months of age. In addition, farmers used to offer grain (wheat, barley, bazra or gram grain) and tree lopping to the kids during early stage of growth. Nearby grazing was also done by some of the goat farmers during early stage of growth of kids. Some farmers (40% in landless group to 100% in small farmer group) in Bharatpur district offer grain as supplement (50-300 g) to the growing kids and lactating goats.

Some goat farmers in Bharatpur district offer concentrate (50 to 300 g) in the form of home grown grain (barley, wheat, mustard cake, sorghum, bajra or gram) only to the male kids and lactating goats. In Alwar district goat farmers do not offer any concentrate under stall-feeding. Farmers in the Bharatpur district offer some straw also, like gram or guar or pigean pea straw to their goats.

Some farmers in Kaman block offer mustard oil occasionally to growing and lactating goats. The quantity of oil offered per animal is 50 to 100 ml. Some farmers have also reported to offer mustard oil to their goats before kidding.

No goat keeper in the surveyed districts of Rajasthan offer mineral mixture to the goats. But they offer common salt to through grain or water. In different villages, 50 to 92% farmers in Bharatpur and 50 to 100% in Alwar district were found offering common salt.

Farmers offer tree leaves of one or two species frequently to their goats *ad lib*. Tree leaves of *Ficus benghalensis* (Bargad), *Albizzia lebbeck* (Siras), *Zyzyplus mauritiana* (Ber), *Ficus glomerata* (Gular), *Morus alba* (Mulberry), *Azadirachta indica* (Neem), *Dalbergia sissoo* (Sheesam), *Acacia nilotica* (Desi babool), *Ficus riligiosa* (Peepal), *Cordia dichotoma* (Lahsora), *Ricinus cuminis* (Arndi), *Prosopis cineraria* (Chhonkra), *Zyzyplus* sp (Beri). *Sygium cumini* (Jamun) etc were used by the farmers as green fodder for feeding to the goats. Actual quantity of tree leaves offered was found variable among the farmers.

Reproductive disorders in goats under village conditions: Bharatpur district farmers recorded 2.17% in marginal farmers group to 9.68% in landless farmers group anoestrus in female goats, abortion were also recorded; which varied from 2.45 in marginal farmers group to 20% in small farmers group. Some farmers also observed repeat breeding in their goats. In Alwar district also some farmers reported these problems in female goats. Anestrus, abortion and repeat breeding in goats was observed in the range of 1.64 in medium farmers to 6.47% in marginal farmers, 1.09 in medium farmers to 9.23% in small farmers and 1.26 in landless group to 5.39% in marginal group, respectively. Although these reproductive problems in goats under

field conditions of the above region were not found alarming.

Chemical composition of feeds and fodders: The proximate and Van Soest composition of all goat feed resources collected during monsoon and winter seasons from Agra, Bharatpur Aligarh districts were analyzed. Average CP content of goat feed resources in Shamsabad block of Agra district ranged from 14.95 to 16.56% in grass and green fodder component, 15.60 to 17.31% in tree leaves and 12.24 to 12.65% in grains. NDF and ADF values in the respective feed ingredients varied from 64.03 to 68.69%, 48.32 to 50.58%, 40.38 to 48.68% for NDF and 39.11 to 39.85%, 36.15 to 37.96%, 5.97 to 6.06% for ADF. Almost similar composition were observed in Saiyan block of Agra district. Average CP in concentrate component, straw, grass, green fodder and tree leaves and shrubs were 16.82, 10.37, 13.95 and 13.78% in Ramnagar village. Whereas CP values were 9.97% in grains, 16.71% in grass and green fodders and 14.40% in tree leaves in Sikrora and Sikrori village. CP content in the grass component in hilly tract of Nandera Bass village was found lower. However, average CP content in tree leaves was estimated as 13.64%. It was observed that CP content in the mixed goat feed resources was sufficient to maintain production requirements in goats during winter season.

Fig. 1: Relationship between family size and goat population.

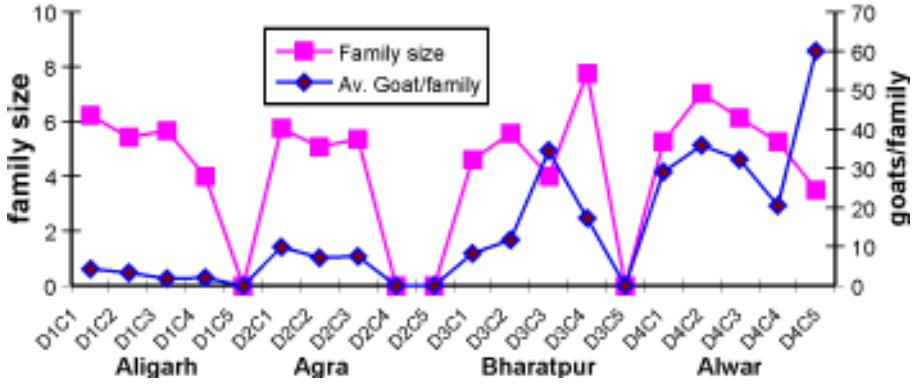
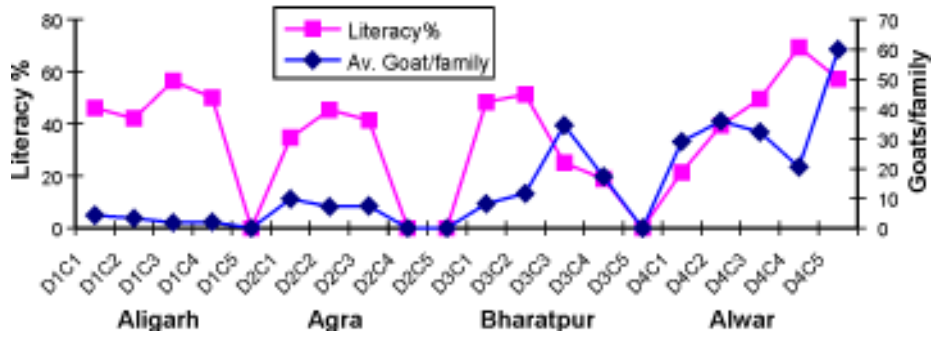


Fig. 2: Relationship between literacy and goat population



Mineral composition of feed resources in semi-arid region: Mineral composition (Ca, P, Mg, Na, K, Mn, Cu, Zn, Fe and Co) in the feed resources collected from different villages of Aligarh, Agra and Bharatpur districts was analyzed. Except tree leaves, Ca concentration was lower in goat feed resources. Concentration of P was found lower in feed and fodders in Gonda block collected during summer season, whereas, during rainy season P concentration was estimated higher in Akrabad block of the same district. Mn and Fe content in all feed resources appeared to be sufficient to maintain the production requirements of these minerals for goats. Co concentration in most of the surveyed districts was found lower. Therefore, this trace mineral needs to be supplemented to the goats in this region. Ca concentration in grasses and tree leaves collected from Bharatpur was found higher than Aligarh and Agra districts. Whereas, Cu and Co concentrations were estimated lower in different goat feeds in Bharatpur district.

Goat milk composition: Chemical composition and minerals (total solid, fat, SNF, protein, lactose, ash, Ca, Mg, Na, K, Fe, Cu, Mn, Zn and Co) in goat milk collected from different villages of the surveyed districts were estimated. Total solid, fat and protein in the goat milk ranged from 12.42 to 15.02%, 3.50 to 6.90% and 3.44 to 4.05% in different villages, respectively. Ca concentration in goat milk of Aligarh and Agra districts was found lower as compared to Alwar district. Fe content in milk collected from Aligarh district was estimated less than other two districts. Cu, Mn and Co in milk was found invariably lower in this semi-arid region.

Soil Composition: Organic carbon, P and K concentrations in the soils of grazing area of different districts were evaluated. Organic carbon in soil was lower in all the blocks except Akrabad. Low level of P in the soil of grazing area was observed in all three districts of the semi-arid region. Whereas, K was found optimum in the soil of this region ranging from 126.39 to 549.03 kg/ha.

GPT 6.04: Studies on milk composition of different Goat breeds and its utilization for paneer making.

R.B. Sharma

A total of 168 milk samples were collected to study the effect of breed on goat milk composition. The SNF and TS contents were observed to be higher in Jamunapari milk 8.76 ± 0.05 and 12.60 ± 0.12% as compared to Jakhrana (8.16 ± 0.07 and 12.54 ± 0.12), Sirohi (7.65 ± 0.05 and 10.97 ± 0.07), Barbari (7.76 ± 0.23 and 11.29 ± 0.24) and mixed milk (7.57 ± 0.08 and 10.99 ± 0.17%), respectively. However, the fat content was observed significantly higher (4.12 ± 0.07 %) in Jakhrana milk. There was no significance difference in fat content of Sirohi, Barbari and mixed milk

Effect of breed on goat milk Paneer: Paneer yield was Significantly higher (14.56 ± 0.19 %) in Jakhrana followed by Jamunapari (13.92 ± 0.19 %), mixed (12.24 ± 0.36 %) and Sirohi (11.70 ± 0.17%) milk. The higher paneer yield is attributed to the higher (4.42 ± 0.07 %) fat content in Jakhrana goat milk as compared to other breeds.

Effect of multiple births on goat milk composition: Milk samples (90) were collected from Jakhrana goats to study the effect of multiple births on goat milk composition. No significant difference was observed between single and twin births milk in respect of protein, casein, whey protein, fat, SNF, TS and ash content.

Effect of morning and evening milking on composition of goat milk: Total 92 batches of herd milk samples (46 morning and 46 evening) obtained from Jakhrana goats were analyzed for major milk constituents. Evening milk had significantly higher fat (5.35 ± 0.13 %), SNF (9.55 ± 0.26) and total solids (14.92 ± 0.27 %) as compared to morning milk (4.15 ± 0.09,8.63 ± 0.16 and 12.77 ± 0.14 %). However, protein content was observed significantly higher in morning milk.

Effect of morning and evening milking on paneer yield and composition in goats: Evening milk yielded significantly higher paneer (16.38 ± 0.53 %) than morning milk (14.10 ± 0.53 %). The protein and ash contents of paneer did not differ significantly between the milking timings. The paneer obtained from morning milk had higher fat (27.03 ± 0.32) than evening milk (23.70 ± 0.44). The moisture content was observed to be higher in paneer obtained from evening milk. The study indicated that goat milk composition is affected due to milking time that in turn affects paneer yield and quality.

Effect of stage of lactation on composition of goat milk: Total 43 samples on different stage of lactation (early-20, middle-9 and late-14) were analyzed to study the variation in milk composition of Jakhrana goat. The major milk constituents have shown a non-significant difference between stages of lactation.

Effect of season on milk composition of goats: Milk samples were collected from Jamunapari (69) and Jakhrana (74) goats to investigate the influence of winter and summer season on specific gravity, fat, SNF and TS contents of milk. Specific gravity, SNF and TS contents in Jamunapari milk were found significantly higher (1.030 ± 0.00, 8.76 ± 0.05 and 12.60 ± 0.12 %) during winter season as compared to summer (1.026 ± 0.00, 7.76 ± 0.15 and 11.28 ± 0.16 %). However, fat content did not show any significant difference during both the seasons. All the above constituents were observed significantly higher in Jakhrana milk also during winter season (1.027 ± 0.00, 4.42 ± 0.07, 8.16 ± 0.07 and 12.54 ± 0.12 %) as compared to summer (1.025 ± 0.00, 3.35 ± 0.06,7.54 ± 0.06 and 10.91 ± 0.10 %). It can be concluded that the quantum of goat milk constituents are higher during winter season as compared to summer.

Sensory quality of flavoured goat milk: A trial was conducted to standardize the technology of manufacture of flavoured goat milk. Jakhrana goat milk containing 3.4% fat was used. Different treatments were applied using 2, 2.5, 3 and 3.5% Strawberry flavour (Hershey's Brand-made in USA). The product was evaluated for organoleptic

Table 1: Effect of goat breeds on milk composition and paneer yield

Breed	Specific gravity	Fat	S.N.F.	Total Solids	Yield of Paneer
Jamunapari (46)	1.030 ± 0.00^{a}	3.84 ± 0.09^{a}	8.76 ± 0.05^{a}	12.60 ± 0.12^{a}	13.92 ± 0.19^{a}
Jakhrana (53)	1.027 ± 0.00^{b}	4.42 ± 0.07^{c}	8.16 ± 0.07^{c}	12.54 ± 0.12^{a}	14.56 ± 0.19^{a}
Sirohi (22)	1.027 ± 0.00^{b}	3.35 ± 0.04^{b}	7.65 ± 0.05^{b}	10.97 ± 0.07^{b}	11.70 ± 0.17^{b}
Mixed Milk (23)	1.025 ± 0.00^{b}	3.40 ± 0.12^{b}	7.57 ± 0.08^{b}	10.99 ± 0.17^{b}	12.24 ± 0.36^{b}
Barbari (24)	1.025 ± 0.00^{b}	3.46 ± 0.04^{b}	7.76 ± 0.23^{b}	11.29 ± 0.24^{b}	Not estimated
Over All (168)	1.027 ± 0.00	3.84 ± 0.05	8.12 ± 0.06	11.96 ± 0.09	13.55 ± 0.14

Table 2: Effect of multiple births on milk composition of Jakhrana Goats

Constituents	Single Kid (56)	Twins (34)
Protein	3.78 ± 0.05	3.81 ± 0.08
Casein	3.072 ± 0.04	3.09 ± 0.07
Whey Protein	0.71 ± 0.01	0.72 ± 0.02
Water	86.33 ± 0.28	86.19 ± 0.37
Total Solids	13.79 ± 0.25	13.97 ± 0.32
Solids-not-fat	9.02 ± 0.20	9.24 ± 0.28
Fat	4.77 ± 0.13	4.74 ± 0.17
Ash	0.74 ± 0.03	0.80 ± 0.03

Table 3: Effect of time of milking on milk composition of Jakhrana Goats

Constituents	Morning (46)	Evening (46)	Over All (92)
Protein	3.90 ± 0.07^{A}	3.70 ± 0.05^{B}	3.80 ± 0.04
Casein	3.17 ± 0.06^{A}	3.00 ± 0.04^{B}	3.09 ± 0.04
Whey Protein	0.74 ± 0.01^{A}	0.70 ± 0.01^{B}	0.72 ± 0.01
Water	87.33 ± 0.18^{a}	85.24 ± 0.34^{b}	86.29 ± 0.22
Total Solids	12.77 ± 0.14^{a}	14.92 ± 0.27^{b}	13.85 ± 0.19
Solids-not-fat	8.63 ± 0.16^{a}	9.54 ± 0.26^{b}	9.09 ± 0.16
Fat	4.15 ± 0.09^{a}	5.35 ± 0.13^{b}	4.75 ± 0.10
Ash	0.78 ± 0.03	0.73 ± 0.03	0.76 ± 0.02

A & B– Significant at 5%, a&b-Significant at 1%

Table 4: Effect of morning and evening milking on paneer yield and composition of Jakhrana goats

Constituents	Morning	Evening	Over All
Yield	14.10 ± 0.53^{a}	16.38 ± 0.49^{b}	15.24 ± 0.46
Moisture	41.85 ± 0.75^{a}	48.47 ± 0.81^{b}	45.09 ± 0.72
Fat	27.03 ± 0.32^{a}	23.70 ± 0.44^{b}	25.43 ± 0.36
Protein	$20.23 \pm 0.86^{*}$	$20.42 \pm 0.33^{*}$	20.34 ± 0.42
Ash	$3.40 \pm 0.21^{*}$	$3.74 \pm 0.41^{*}$	3.58 ± 0.23

Table 5: Effect of season on milk composition of Jamunapari goats

Season	Specific gravity	Fat	S.N.F.	Total Solids
Winter (46)	1.030 ± 0.00^{a}	3.84 ± 0.09	8.76 ± 0.05^{a}	12.60 ± 0.12^{a}
Summer (23)	1.026 ± 0.00^{b}	3.55 ± 0.05	7.76 ± 0.15^{b}	11.28 ± 0.16^{b}
Over All (69)	1.028 ± 0.00	3.74 ± 0.07	8.43 ± 0.08	12.16 ± 0.12

Table 6: Effect of stage of lactation on milk Composition of Jakhrana goat

Stages of lactation	Protein	Casein	Whey protein	Water	TS	SNF	Fat	Ash
Early (20)	4.02 ± 0.10	3.26 ± 0.08	0.76 ± 0.02	87.18 ± 0.22	12.79 ± 0.22	8.70 ± 0.30	4.14 ± 0.15	0.81 ± 0.05
Middle (9)	3.69 ± 0.15	3.00 ± 0.12	0.70 ± 0.03	86.94 ± 0.25	13.06 ± 0.25	8.59 ± 0.22	4.47 ± 0.20	0.64 ± 0.10
Late (14)	3.93 ± 0.12	3.19 ± 0.10	0.74 ± 0.02	87.78 ± 0.42	11.67 ± 0.93	7.95 ± 0.66	4.01 ± 0.15	0.79 ± 0.05
Over All(43)	3.92 ± 0.07	3.18 ± 0.06	0.74 ± 0.01	87.33 ± 0.18	12.48 ± 0.33	8.43 ± 0.26	4.17 ± 0.10	0.77 ± 0.04

Table 7: Sensory Score for Flavoured goat milk

Treatment	Appearance & Colour	Flavour	Sweetness	Over All Acceptability
T1	3.91	3.45	3.45	3.45 IV
T2	3.82	3.45	3.82	3.82 II
T3	4.08	3.58	3.92	4.08 I
T4	4.00	3.75	4.17	3.58 III

qualities i.e. appearance and colour, flavour, sweetness and overall acceptability by a panel of 12 Judges. The product containing 3% Strawberry flavour was liked most by the panelists and scored high as compared to other 3 treatments.

Goat Health Division

GH 15.24:Evaluation of medicinal plants for the control of neonatal diarrhoea in goats

Ashok kumar, R. Rana, V. S. Vihan and S. Barua (up to May, 2006)

Antibiogram of plant extracts: Antibiogram property of some new plant coded extracts (CIRG-35, 36, 37, 38, 39) were evaluated against isolated and characterized pathogenic ETEC *Escherichia coli*, along with other potential extracts at the concentration of 12.5, 6.24, 3.12, 1.56, 0.78 and 0.39 mg/disc by disc diffusion test. Result revealed that zone of inhibition of CIRG-35 (20, 18, 16, 10, 8, 6 mm), CIRG-2B (20, 18, 16, 12, 10 mm), CIRG-15 (18, 16, 12, 10, 8, 6 mm), CIRG-18 (15, 12, 6, 0, 0, 0 mm), CIRG-20 (18, 10, 6, 0, 0, 0 mm), CIRG-33A (18, 10, 6, 0, 0, 0 mm) and CIRG-36 (8, 6, 0, 0, 0, 0), rated good in activity in their chronological order at different concentrations. While, CIRG-37, 10B, 26,38,34,39 and 17B did not show activity at any concentration used by the same method (Fig 1).

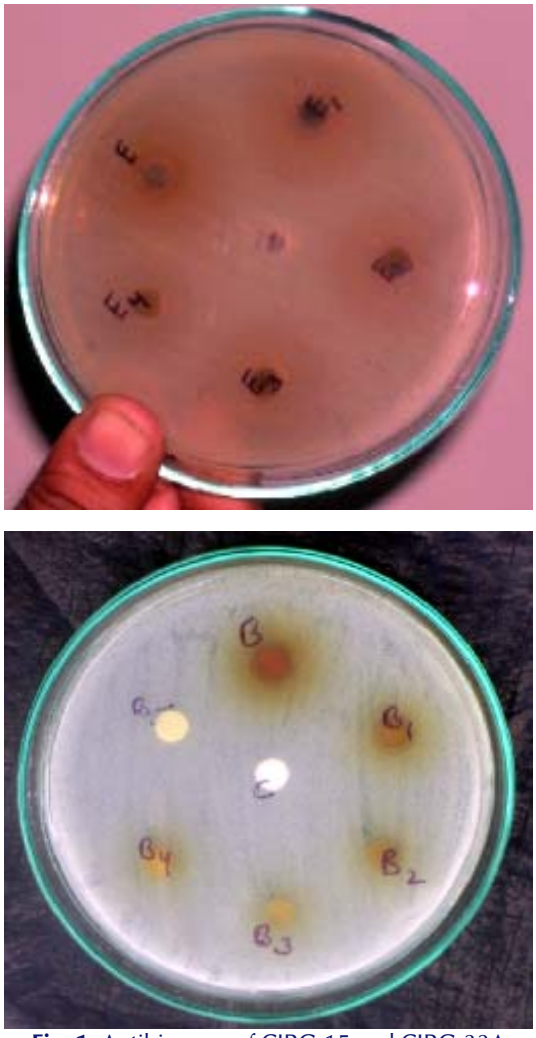


Fig. 1: Antibiogram of CIRG-15 and CIRG-33A

Antibacterial activity of fractioned plant extracts by bioautography: Test methanolic plant extract was dissolved in methanol and applied 5 μl on thin layer plate (Aluminum silica plate) at the concentration of 0.35 gm/ml and subjected to run in Toulene: Ethyl acetate (70:20) solvent system. Autoclaved Mueller Hinton agar was prepared and seeded for 24hrs. Broth culture of *E.coli* was incorporated with dehydrogenase-activity-detecting reagent (a tetrazolium salt). Seeded, incorporated MHA overlaid on developed TLC plate 24-36hr incubation was followed. Clear Zones of inhibition were obtained against a colored background of grown bacteria on TLC plate. After 36 hrs incubation, silica gel plate looked like pink due to reaction of tetrazolium blue with bacterial colonies *(E. coli)*. Result revealed that CIRG-19 did not show antibacterial activity in crude plant extract but on fractionation for both alkaloid and flavinoids resulted to five and two antibacterial spot respectively. Out of tested plant extracts by this method CIRG-19, CIRG-10A, CIRG-21 exhibited different spot of antibacterial activity in alkaloid and flavinoids, which further showed their potential as anti E coli activity (Fig 2). The potential candidates for further study were selected on the basis of three methods adopted for antidiarrhoeal

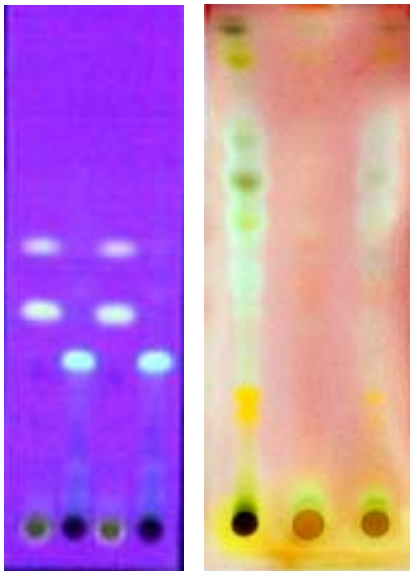


Fig. 2: Antibacterial activity of CIRG-19 (Flavinoid and alkaloids) by bioaotography

activity. Bio-autography was found better and suitable technique for antibacterial activity on crude and fractioned plant extract.

Antidiarrhoeal property of plant extracts in laboratory animals: Antidiarrhoeal properties of some selected plant extracts (CIRG-15, 22,2B, 17A, 25) were tested in castor oil (0.5 ml/kg body weight) induced diarrhoea in rats. The diarrhoeal episodes (fecal droppings) were observed at 1,2,3,4 and 5-hr interval in comparison to control group and standard drug therapy of diphenoxylate and atropine sulphate orally at the dose rate of 24 mg/kg body weight of rat. The tested plant extract was administered at two doses (100 and 200 mg/kg body weight). The average diarrhoeal episodes were 1.4 and 1.2 at 200 and 100 mg/kg body weight of extract concentration as compared to control (6.6) and standard drug group (0.8), indicated drug dependent anitidiarhoeal response in CIRG –15. In CIRG-22, fecal droppings were reduced to 1.8 and 3 at two doses in comparison to control (6) and standard (0.8). In CIRG-17A, the reading was 1.2 and 2.6 in comparision to control group (5.8) and standard drug group (1.0). In rest of the two plant extracts, CIRG-17A and CIRG-25, the readings were 2 and 2.8; 1.0 and 2.0 at two dose level respectively, in comparision to control (4.4, 5.4) and standard drug therapy (1.2, 1.0) respectively. The overall result suggested that CIRG-25, CIRG-2B and CIRG-15 showed higher efficacy as compared to CIRG-22 and 17 A. No mortality and side effect was observed during experiment in any group.

Clinical efficacy/safety trial: Therapeutic efficacy of the extracts was evaluated in clinical cases of diarrhoea (colibacillosis) in juvenile kids at the dose of 10 mg/kg bwt for 1-2 days orally and observed degree of recovery (score) and recovery days. However, before conducting *in vivo* efficacy, safety trials were done in 4 healthy kids below 1 month age at the same dose rate for two days. During experiment, no untoward toxic reaction was noticed in any kid and also no significant clinically important changes were observed in biochemical parameters (glucose, total protein, albumin, phosphorus, creatinine and AST) estimated 3 days post therapy. Plant extract appeared safe for further clinical trial. In clinical trials (6 kids), 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 on the basis of their severity. Rectal temperature was recorded in both the groups. Recovery score recorded as (Poor 1, Partial 2, Moderate 3, and Complete 4). In CIRG-35, mean recovery score was 3.8 ± 0.19 and

mean recovery days were 2.0±0.19 days, which indicated therapeutic effect. In CIRG-2B, on same dose rate mean recovery score was 3.8±0.19 and mean recovery days were 1.0±0.00. In CIRG-15, mean recovery score was 3.67±0.22 and mean recovery days were 1.67±0.22 at the similar dose rate for two days. In CIRG-22, mean recovery score was 3.33±0.35 and mean recovery days were 1.83±0.18, whereas in CIRG-25, mean recovery score was 3.00±0.48 and mean recovery days were 1.83±0.33 and in CIRG-17A, mean recovery score was 2.8±0.36 and mean recovery were 2.2±0.19 days. The results indicated that all plant extracts showed anti-diarrhoeal activity in clinical cases of colibacillosis in kids with little variation.

GH 15.25: Development of Molecular Diagnostic for the control of mycoplasmal mastitis/ agalactia in goats

Rajneesh Rana, V.S. Vihan, P.K. Rout, Ashok Kumar and S. Barua *(up to May, 2006)*

Processing of Milk samples, DNA extraction and PCR: Sixteen clinically suspected milk samples were inoculated in the above-mentioned liquid medium. From 16 samples, 06 Mycoplasma species could be isolated. As the direct inoculation/ isolation method is long and time consuming so to overcome the long incubation phases as well as other necessary steps involved viz. forward and reversal passages in liquid media for 14 days, the attempt was made to extract the microbial DNA directly from 118 milk samples as per Miserez *et al*. (1997) and Woubit et al. (2004) with some major modifications. Only 05 DNA extracts (using NEW protocol) exhibited PCR reaction.Out of 05 genomic DNA, one STANDARD exhibited an AMPLICON of 715 bp, which is a desired results, indicating the working ability of this newer protocol.Rest 04 genomic DNA exhibited the amplicons which were nearer to the size of the standard amplicon. The results were found to be encouraging but need further refinement.

Synthesis of Primers for "Cluster specific", *Mm*LC/capri specific and *M. putrefaciens* specific:

(a) Cluster specific:
F-REAP 5′-GAAACGAAAGATAATACCGCATGTAG-3′
R-REAP 5′-CCA CTT GTG CGG GTC CCC GTC-3′
Amplicon Length: 785 bp

(b) LC/*capri*:
MMMLC2-L 5′-CAATCCAGATCATAAAAAACC T-3′
MMMLC1-R 5′-CTCCTCATATTCCCCTAGAA-3′
Amplicon Length:1049 bp.

(c) *M. Putrefaciens*:
Mput F 5′-AAATTGTTGAAAAATTAGCGCGAC-3′
MputR5′-CATATCATCAACTAGATTAATAGTAGCACC-3′
Amplicon Length: 316 bp

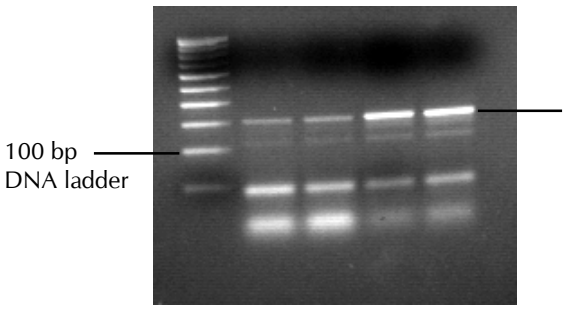


Fig 1: A PCR product of size 316 bp exhibiting an amplification of genomic DNA segment of *M. putrefaciens*

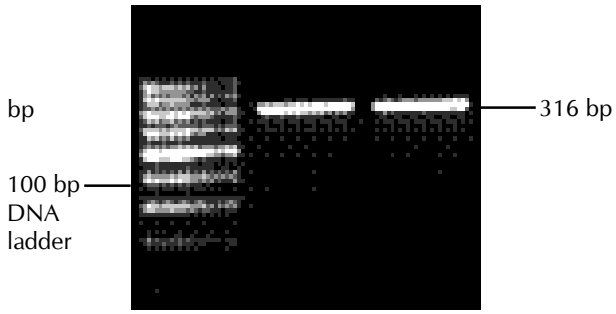


Fig. 2: Amplification of PCR product of size 785 bp exhibiting "Cluster specific" specificity of the *Mycoplasma* spp.

Preparation of PCR reaction mixture: For the specific detection, the reaction mixtures for all 3 sets of PCRs were prepared in a final volume of 50 µl. 2 µl of genomic DNA (80-100ng) was taken in PCR tube, under ice. Later master mixture was prepared adding all the reaction components and was added in PCR tubes. These PCR tubes were kept in a pre-programmed Thermocycler (MJ Research, USA) for amplification.

Amplified PCR products: 316 bp was observed in *M. putrefaciens* (Fig. 1) and 1048 bp was observed in LC/capri specific primers (Fig. 2). While application of various sets of primers viz. P4/P6, GPO & MGSO, Cluster specific F'REAP/R'REAP, Mput F'/ Mput R' and MMMLC L/MMMLC R, it was observed that:One isolate was confirmed as *M. mycoides* subsp *capri*.One isolate was confirmed as *M. mycoides* subsp *mycoides* LC.Two isolates were found to be positive for the "Cluster group".Two isolates do not belong to the cluster group of organisms.

DST Project: Development of novel herbal ectoparasiticidal product

V.S. Vihan, Amit Agarwal, Ashok Kumar, D.K. Sharma, M. Deepak, J. Joshua and K. Venkateshwarlu

In vivo evaluation of different prototypes in natural tick and lice infestation in different species of animals:

Evaluation on cow calves:

Prototypes 1-8: 8 coded prototypes (1 to 8) were tested on naturally tick *B. microplus* and *Hyalomma* spp. infested cow calves. Mortality was recorded at 30 minutes, 1, 2, 4, 6 hrs and 7 days post topical spray. Excellent ectoparsiticidal effect was noted in Prototype No. 1, 2 and 3. The average percent reduction ranged from 78.66-84.14 % at 30 minutes post application and 100 % at 2 hrs interval in sample No 1 and 3, however, in sample No. 2, it was also 98.86%. No adverse reaction on applied area was noticed in prototypes No. 1 and 2 but hyperemia was noted in prototypes No 3 immediately after application and persisted for 2-3 hours and disappeared within 4 hours. Prototypes No 1 and 2 stained greenish to skin, which was completely disappeared on next day observation. In Prototype No 4, 5, and 6, the ectoparsiticidal activity was very poor, as average percent reduction ranged from 2.90-6.03 % at 4 hours post application. Hyperemia was noticed in sample No. 6 and subsequently disappeared within 4 hours post application. Prototype No. 7 and 8 showed moderate activities against parasite, where mortality ranged from 59-74%.

Evaluation on cow calves:

Prototypes 1&2: The drug samples were sprayed over heavily infested area and percent reduction of ticks were recorded at 30 min, 1, 2, 4 hrs and 24 hrs respectively. In prototypes-1, mortality was 10 and 21% at 24 hrs in 50 and 100% concentrations respectively and prototypes-2 showed 100% mortality of ticks at 4 hrs in 100% concentration but resulted vesicular eruption in all animals, which was appeared prominently at 24 hrs, however subsides within 2-3 days but in lower concentration (50, 25 & 10%) of prototypes-2 did not exhibit any adverse skin reaction.

Prototype 18-23: Six prototypes (No. 18, 19, 20, 21, 22 & 23) were tested on tick infested cases of cow calves as single application therapy. Tick mortality was observed at 30 mts, 1 hr, 2 hr and 4 hrs intervals. Prototype 22 and 23 showed marked efficacy 53.0 and 57.25 % at 1 hr interval and further increased to 55.14 and

58.16 % at 4 hr interval. There was no staining and skin reaction observed during study. Prototype 22 and 23 also showed almost similar reduction percent in sheep (52.4 and 50.97%) and goats (41.01 and 44.33%) at 2 hrs interval, however stained greenish to skin.

Evaluation on Goat kids:

Prototypes 1&2: *In vivo* clinical trial of prototypes-2 was conducted on naturally lice infested kids of 2-4 months of age at four different concentrations (100, 50, 25, and 10%) as single application. Result showed that 100% mortality was observed at 100, 50, 25% concentrations at 30 minutes interval, however, at 10% concentration of drug exhibited 100% mortality at 4 hours interval. Adverse skin reaction was noted at two concentrations (100 and 50%) only in the form of vesicular eruptions (pustules) after 72 hrs of application. Average detachment time of lice population was 24 hrs and depolarization of skin took 24 hours.

***In vivo* evaluation of final (Alquit) prototype:** Prototype 26 (Aerosol spray NE/EP/03) was evaluated in clinically ticks infested dogs, which showed remarkable reduction percent at 1 hr (47.90%) and (69.33%) at 2 hrs interval without any skin reaction. However, prototype temporarily stained skin of white coat fur dogs which completely disappeared 2-4 hrs later. Similarly, this prototype also showed excellent reduction of 52.30, 70.50 and 94.80% ticks at 1, 2 and 4 hrs intervals respectively. Prototype also showed similar staining property in cow calves for few hours. A different prototype No 36 as scrub solution was evaluated in different species of dogs with tick infestation, as single application retained for 45 minutes and finally bath with plain water. This prototype showed moderate reduction efficacy at 4 hrs interval (24.0%) and maximum efficacy (41.5%) at 24 hrs intervals. As similar to all previous this also imparted greenish tinge to skin, which disappeared in later hours. No Skin reaction was observed (Table 1, 2 and Fig.1).

Toxicity studies:

Acute and chronic oral toxicity on albino rats: Oral toxicity was also performed to evaluate safety in laboratory animals at four different concentrations (100%, 50% 25% & 10%) in 3 rats in each group along with the control group. Results indicated that there were no symptoms of either acute or chronic toxicity by oral administration of prototype 2 on rats.

Dermal toxicity on albino rats: The dermal toxicity was observed in four different concentrations (100, 50, 25 and 10%) in three rats in each group. The result showed that the irritating index was 0.99 at 100% concentration, where vesicular erythema was observed 24 hrs post application. Other concentrations (50%, 25% & 10%) did not exhibit any skin reaction. The result indicated that the highest concentration is showing toxic effect to skin.

Dermal toxicity on adult goats: Dermal toxicity studies also conducted on adult goats by using four different concentrations (100, 50, 25 & 10%) of prototype-2. Skin reaction was also monitored as similar to laboratory animals. The calculated irritating index was 0.99. This reaction showed histamine like activity of prototype-2. The urticaria disappeared after 48 hrs of development. No skin reaction was noted in remaining three concentrations.

Dermal toxicity on kids: Similar experiment was also conducted on kids of (2-3 months). Vesicular eruptions were appeared at 24 hrs post application in 100% concentration. The irritating index was 0.99 on Driazy scale. No skin reaction was noted at (50, 25 & 10%) concentration. The results indicate that prototype-2 having counter irritant effect.

Testing for Histamine like activity: The test was performed to test the histamine like activity of plant extract in comparison to standard histamine. After 5 minute on histamine injected site, congestion was developed where as no congestion was noticed in drug injected area. This indicated that both drugs are not having histamine like activity and no blue spot was observed after 1-hour post injection at injected site.

Analytical chemistry of final product (drug):

ALQUIT: NR/EP/03: The raw materials of *Annona squamosa* (*A. squamosa*) and *Calotropis gigantea* (*C. gigantea*) were subjected for physicochemical and Thin Layer Chromatography (TLC) analysis. The tests such as thin layer chromatography and physiochemical analysis were performed. The result showed that it passes the identification test by thin layer chromatography. It possesses moisture content 8.4, total ash 6.19, acid insoluble ash 15.0, alchohal soluble extractive value 15.0 and water soluble extractive value 23.6 % w/w respectively. The TLC profile of sample is similar to that of standard.The result of physicochemical and Thin Layer Chromatography (TLC) analysis *of Calotropis gigantea* (*C. gigantea*) revealed that it passes the identification test by thin layer chromatography. It possesses moisture content 7.8, total ash 14.3, acid insoluble ash 1.8, alchohal soluble extractive value 17.2 and water soluble extractive value 31.9 % w/w respectively. The TLC profile of sample is similar to that of standard. The excipient used was Talc in the formulation of *A. squamosa* and *C. gigantea*. Analysis of Talc has been carried out as per IP. Extra parameters tested include untapped and tapped bulk density material passing through 30, 60 and 80 mesh.Based on the

Table 1: *In vivo* trial of prototype 26 (Aerosol spray) (NR/EP/03) in calves

Coat color	Total Tick count in marked area	% Reduction				Staining	Any adverse effect
		½ hr	1 hr	2 hrs	4 hrs		
Brown	22	12.00	40.00	50.00	80.00	+	-
Black	65	20.00	50.00	60.00	100.0	+	-
Brown	60	23.00	45.00	55.00	90.00	+	-
Brown	13	35.00	55.00	70.00	100.0	+	-
White	39	20.00	60.00	80.00	90.00	+	-
Brown	14	24.00	70.00	80.00	100.0	+	-
White	21	27.00	50.00	75.00	100.0	+	-
White	23	19.00	45.00	80.00	100.0	+	-
White	45	20.67	55.00	80.00	90.00	+	-
White	39	28.19	53.00	75.00	98.00	+	-
	Mean	**22.88 ± 1.98**	**52.30 ± 2.70**	**70.50 ± 3.61**	**94.80 ± 2.19**		

Table 2: Clinical trial of prototype 36 (Scrub solution) against tick infestation in Dogs.

Animal species	Coat colour	Total count in marked area	% Reduction						Staining	Any adverse effect
			½ hr	1 hr	2 hrs	4 hrs	6 hrs	24 hrs		
GSD	Brown	11	0.0	0.0	18.18	18.18	27.27	45.45	+	-
GSD	Brown	10	0.0	0.0	20.0	20.0	30.0	40.0	+	-
N D	Brown	12	0.0	0.0	0.0	16.67	16.67	33.33	+	-
N D	Brown	22	0.0	0.0	13.63	13.63	13.63	31.81	+	-
N D	Brown	7	0.0	0.0	0.0	42.85	42.85	57.14	+	-
N D	Yellow	22	0.0	0.0	0.0	18.18	18.18	36.35	+	-
Pom	White	8	0.0	0.0	0.0	25.0	25.0	37.50	+	-
Pom	White	9	0.0	0.0	0.0	22.22	22.22	33.33	+	-
Pom	White	6	0.0	0.0	16.67	33.33	50.0	50.0	+	-
Pom	White	10	0.0	20.0	30.0	30.0	50.0	50.0	+	-
Mean			0.0 ±0.0	2.0 ±0.61	9.84 ±3.53	24.0 ±2.84	29.6 ±4.27	41.5 ±2.74		

comparative thin layer chromatography, isolation of compounds unique to *A. squamosa* and *C. gigantea* is conducted for standardization of the formulation. Fingerprinting analysis of the methnolic extracts of *A. squamosa, C. gigantea* (NR/EP/03) extract and (NR/EP/03 5%) powder (final formulation) was done by infra red spectrum.

Conclusion: Ectoparasiticidal product **ALQUIT** for the control of ectoparasites (Ticks & lice) in the livestock has been developed and commercialized.The Trade Mark in the name of **ALQUIT** by industry M/S Natural Remedies Pvt. Ltd. Bangalore had applied. Further an application has been submitted to the department of AYUSH, Karnataka state for obtaining a manufacturing license. At first instance, the product (Alquit) was developed and commercialized for dog in view of the market demand. Two different formulations forms of the composition were developed keeping in mind that the pet owners generally bath their pets once in 10 or 15 days. The first one is a powder spray meant for daily application. This aerosol powder spray is perhaps the first of its kind in the country. The 2nd one is shampoo based liquid for the bath of the pets (Fig. 1). The product for other livestock (Cattle, Buffalo, Goat & Sheep) will be marketed by the company in due course of time after successful marketing of the product for pets. The IPR shall be owned by CIRG, Makhddom (IRI) and M/S Natural Remedies Pvt. Ltd. Bangalore (ICP) jointly. The income/royalty shall be shared by IRI/DST & ICP. The IRI and DST will share the money thus received in the ratio of 75:25, i.e. 75% to IRI and 25% to DST.

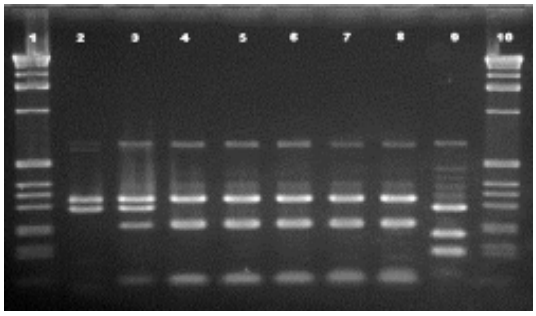


Fig. 1: Lane 1, 10: DNA ladder (1 Kb), Lane 2: Std. Ovine pattern (sheep isolate), Lane 3: Bovine pattern (Cattle isolate), Lane 4: Std. Bison pattern (Bison isolate), Lane 5,6: Bison pattern (Indian caprine isolate), Lane 7,8: Bison pattern (Indian ovine isolate), Lane 9. Std. *M. avium* pattern.

UP CST Project: Molecular Diagnosis of Johne's disease of Goats by PCR and DNA Probes

S.V. Singh

Characterization of minute colonies of Mycobacterium paratuberculosis by IS900 PCR (A new method): A new physical, easy, rapid, cost effective and non chemical method of DNA isolation and subsequent characterization by specific IS900 PCR was developed first time in India. This method successfully recovered DNA from even single tiny and stunted colony of Map (table 1).

Table 1: Comparison of two methods for recovery of DNA and subsequent IS 900 PCR

Concentration of total DNA recovered	DNA isolation	Range of DNA concentration	IS 900 PCR positives
New method	100% (20/20)	4.0-10.0 ng/μl	100% (20/20)
Classical DNA isolation Method*	15% (3/20)	2.5-4.0 ng/μl	15% (3/20)

*Van Soolingen *et al.* 1991.

Diagnosis of paratuberculosis in goat herds using PCR, culture and ELISA: The 51.7% goats were positive for Map by culture, whereas, ELISA and PCR detected 46.5% each. Prevalence in farmer's and farm goats was, 65.2 and 42.8%, respectively (Table 2). In farmer's herds, 47.8 and 34.8% animals were positive by culture of MLN and intestine, respectively. In farm herds, 34.8 and 31.4% goats were positive by culture of the MLN and intestinal tissues, respectively (Table 3). Using IS 900 PCR for JD diagnosis directly from tissues, 52.1 and 42.8% prevalence JD was seen in farmer's and farm herds, respectively. Detection of Map infection in tissues (MLN and intestine) by PCR showed 34.8 and 39.1% tissues positive for JD in farmer's herd and 28.6 and 22.8% in farm herds, respectively. On screening of the goats belonging to farmer's and farm herds by ELISA kit, the sero-prevalence was 65.2 and 34.3%, respectively. Comparative evaluation of direct tissue PCR with culture (Gold standard) exhibited 41.2% goats were

Table 2: Screening of goats by Tissues Culture, IS 900 PCR and ELISA kit for JD

Herds	Number of Samples	Positives		
		Tissues Culture	IS 900 PCR	ELISA kit
Farmer's	23	15 (65.2)	12 (52.1)	15 (65.2)
Farm	35	15 (42.8)	15 (42.8)	12 (34.2)
Total	58	30 (51.7)	27 (46.5)	27 (46.5)

Figures in parenthesis are percent

Table 3: Status of Map in target tissues (MLN & Intestine) of goats by Culture, IS 900 PCR and ELISA kit

Herds/Number of goats	Tissues	Number of samples tested	Positives		
			Tissues Culture	IS 900 PCR	ELISA kit
Farmer's-23	MLN	23	11	08	15
	Intestine	23	08	09	
	Total	46	19	17	15
Farm-35	MLN	35	10	10	12
	Intestine	35	11	08	
	Total	70	21	18	12
58		116	40	35	27

positive and 43.1% were negative (irrespective of farmer's and organized herd) by both test. While 16.3% goats were not detected by PCR, however 5.2% goats were detected as positive by PCR. Kappa statistics was applied to estimate agreement between 'Gold standard' culture test and direct PCR (from tissue). The agreement was almost perfect (kappa value = 0.69, proportion agreement = 0.84) between the 2 tests. Comparative evaluation of plate ELISA kit with culture of tissues exhibited the sensitivity and specificity of ELISA kit as 66.6 and 75.0%, respectively (Table 7). ELISA showed substantial agreement with tissue culture (kappa value = 0.415 and proportion agreement = 0.7). ELISA test also showed substantial agreement with PCR (kappa value = 0.514 and proportion agreement = 0.75) and showed better sensitivity and specificity as 74.0 and 74.0%, respectively.

Assessment of comparative efficacy of tissues with respect to Culture and ELISA for the diagnosis of Johne's disease in Sheep: Culture of MLN and intestine tissues revealed 33.3 and 35.9% prevalence of Map in farmer's flocks, respectively. PCR showed 30.8% prevalence in farmer's flocks for both target (MLN and intestine) tissues. Sero-prevalence of Map was 23.1% in ELISA kits. Sensitivity and specificity of ELISA with respect to tissues culture was 69.5 and 87.5%, respectively. Applying the kappa scores to estimate agreement between Gold standard culture method and direct PCR from tissue, Agreement was nearly, almost perfect category (kappa value-0.591, proportion agreement-0.79). ELISA kit showed substantial agreement with IS 900 PCR (kappa value = 0.229 and proportion agreement = 0.61) and showed 57.8% sensitivity and 65.0% specificity.

Diagnosis of Map in un-pasteurized raw milk and commercial pasteurized milk and milk products: Of 43 (16 un-pasteurized, and 18 pasteurized milk sample and 9 milk products) processed by culture, ELISA and PCR, 58.1, 04.6 and 23.2% were positive for presence of Map, respectively. Prevalence of Map in the un pasteurized and pasteurized milk samples (34) was 58.8, 5.8 and 50.0% using culture, ELISA and PCR, respectively. Whereas, in 9 milk products prevalence of Map was 55.5, 0.0 and 22.2% by culture, ELISA, and PCR, respectively. All Map cultures from un pasteurized, pasteurized milk and milk products were detected positive (confirmed as Map) by milk PCR. PCR was also performed for screening of decontaminated pellets (Fat and sediment) of milk.

Diagnosis of Map in cattle herds (feces and serum): Prevalence of Map was 20.8 and 28.3% by ELISA kit and fecal culture, respectively. Sensitive and specificity of ELISA kit was 50.0 and 90.6% respectively. Fecal culture was more sensitive than ELISA and all cultures were characterized as Map.

Screening of field samples for JD on payment: Diagnostic service was provided to outside agencies for screening of serum samples of goat, sheep, buffalo and cattle origin using ELISA kits developed at CIRG, Makhdoom.

Sero-prevalence of Map in serum samples of cattle and buffaloes using ELISA kit

Region	Herd	Species	Samples	Positive	Demanding Organization
Mathura UP	Farm	Cattle	120	20.8%	Dept. of Microbiology, Vet. Univ. Mathura
Bareilly UP	Farm	Cattle & buffaloes	40	30.0%	CADRAD, IVRI, Izatnagar, Bareilly

Characterization of most prevalent Indian isolates of MAP infecting animals: Of the17 DNA, 11 (64.7%) were amplified using specific IS 900 PCR. Map from Juvenile Capri Paratuberculosis (JCP), was characterized as 'Bison type' on the basis of IS 1311 PCR-REA, first time in India. In IS1311 PCR-REA Indian isolates appeared to be Map 'Bison type', but the genomic RLFP pattern were totally different from the 'Bison' isolates from Montana, USA and other isolates reported in other parts of world. The 12 Map isolates were processed for characterization and geno-typing.

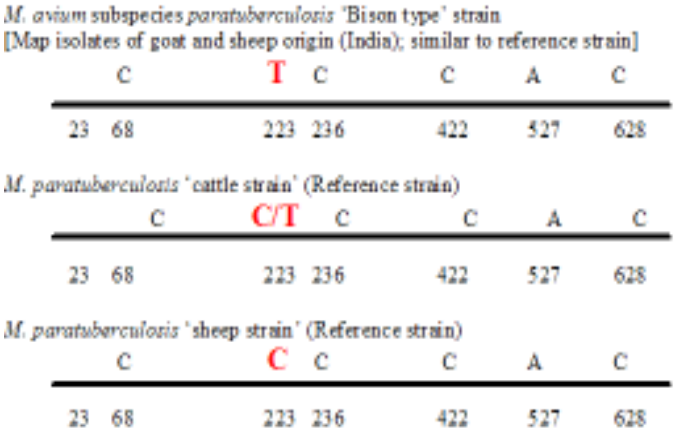


Fig. 2: Schematic diagram showing the location of C/T polymorphism at 223 bp in 'Bison type' isolates (most prevalent isolates of India) which is similar as reported by Whittington *et al.*, 2001 and different to other isolates (Cattle and Sheep isolate) Assessment of sensitivity and specificity of all diagnostic tools for diagnosis of Johne's disease in goats: field application

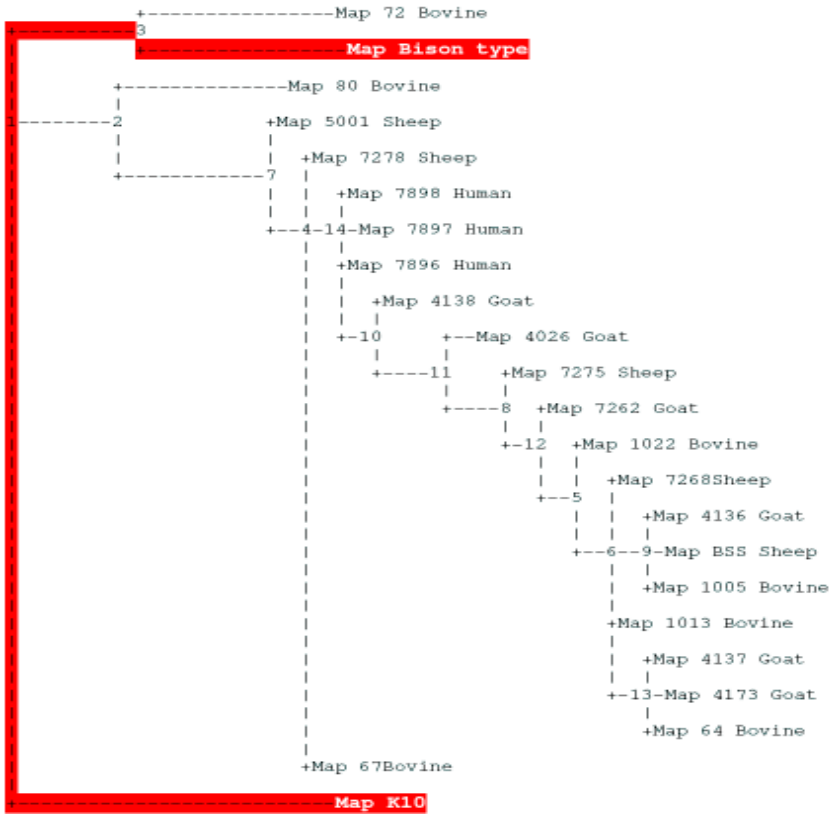


Fig. 3: Molecular phylogeny of Indian Map 'Bison type' isolate based on the G Repeat Analysis (DNA Parsimony algorithm, version 3.6a2.1)

Characterization of *M. avium paratuber-culosis* based on genome wide markers

Strain	IS 900	IS 1311	MAP 02	SSRs	LSPs
MAP K10 International fully sequenced reference train	17	7	6	Different repeat number for two strains	Same repeat number for two strains
MAP 'Bison type' Indigenous isolates	17	7	6		

All *Map* isolates from India were identified as 'Bison type' strains regardless of whether they were of bovine, ovine or caprine origin (Fig. 1). The DNA sequences obtained from the amplified products were matched exactly with those, reported earlier for 'Bison' strains. It was found that all Indian caprine and ovine PCR products sequence possessed a T in all copies at 223 positions (Fig. 2).

Accession with GenBank:

Sequencing of different loci of IS 900, IS 1311, MAP 02 and LSPs has been completed for some loci and 59 nucleotide sequences were submitted to NCBI GenBank.

1. Title: **Genetic Characterization of 'Bison type' S5 strain of *Mycobacterium avium* subsp. paratuberculosis of Indian Origin**

S. No.	Accessed Loci	Accession Number*	S. No.	Accessed Loci	Accession Number*
1	IS900 Locus 1	EF514818	22	IS1311 Locus 6	EF514839
2	IS900 Locus 2	EF514819	23	IS1311 Locus 7	EF514840
3	IS900 Locus 3	EF514820	24	ISMAP02 Locus 1	EF514841
4	IS900 Locus 4	EF514821	25	ISMAP02 Locus 2	EF514842
5	IS900 Locus 5	EF514822	26	ISMAP02 Locus 3	EF514843
6	IS900 Locus 7	EF514823	27	ISMAP02 Locus 4	EF514844
7	IS900 Locus 8	EF514824	28	ISMAP02 Locus 5	EF514845
8	IS900 Locus 9	EF514825	29	ISMAP02 Locus 6	EF514846
9	IS900 Locus 10	EF514826	30	G Repeat SSR	EF514847
10	IS900 Locus 11	EF514827	31	GGT Repeat SSR	EF514865
11	IS900 Locus 12	EF514828	32	LSP2 (5′ End)	EF514866
12	IS900 Locus 14	EF514829	33	LSP2 (3′ End)	EF514867
13	IS900 Locus 15	EF514830	34	LSP4 (5′ End)	EF514868
14	IS900 Locus 16	EF514831	35	LSP4 (3′ End)	EF514869
15	IS900 Locus 17	EF514832	36	LSP12 (5′ End)	EF514870
16	IS900 Locus 13	EF514833	37	LSP12 (3′ End)	EF514871
17	IS1311 Locus 1	EF514834	38	LSP15 (5′ End)	EF514872
18	IS1311 Locus 2	EF514835	39	LSP15 (3′ End)	EF514873
19	IS1311 Locus 3	EF514836	40	LSP^20 (5′ End)	EF514874
20	IS1311 Locus 4	EF514837	41	LSP^20 (3′ End)	EF514875
21	IS1311 Locus 5	EF514838	42	LSP^4II (Flanking Region)	EF514876

CIRG-DSIR: Collaborative Project: Development of inactivated vaccine using native isolate of *Mycobacterium avium* subspecies *paratuberculosis* against Johne's disease in goats and sheep

S.V. Singh and V.K. Gupta

Trial III: Kids (93) were distributed randomly into 3 groups belonging to farmers flocks(Rajasthan) and organized herds (CIRG, Makhdoom).

General Body Condition:

Physical Health: Appreciable improvement was observed in the health of vaccinated groups over the sham-immunized group after 1st and 2nd challenge.

Body Weights: Nine months post vaccination, there has been no significant difference in the live body weights between vaccinated (Bison and Gudair) and sham-immunized groups. After vaccination, goats were challenged on 75 DPV and 270 DPV. Body weights gained per animal was higher prior to challenge and decreased in post-challenged animals. In pre and post 1st challenged, the body weights gained per animal were higher in 'Bison group' and there was not much difference in Gudair and Sham-Immunized groups. But after 2nd challenged, the body weight gained in 'Bison' and 'Gudair' groups were similar but higher than in 'Sham Immunized' group (Table 1).

Table 1: Body weight gain during pre and post (I and II) challenge

Group	Pre-Challenged (Nov 05-Jan 06)	After Ist Infection (Feb 06-Aug 06)	After IInd Infection (Aug 06-Feb 07)
Bison	6.3±0.69	4.0±0.52	3.46±0.73
Gudair	5.37±0.58	3.28±0.41	2.72±0.72
Sham-Immunized	5.32±0.64	3.44±0.53	2.31±0.90

Body Weight (Sex and Breed-wise): Sex wise, the differences in body weights were observed in response to vaccination (Table 2). Body weights gained were higher in males and females of Bison group. The rate of body weights gained was considerably decreased in post challenge males. But the rate of body weight gain was increased in females of both vaccinated group (Bison and Gudair group), but the increase was less in Gudair group compared to Bison group. Barbari and cross Jakhrana males performed better in 'Bison' than 'Gudair' and 'Sham immunized' after 2nd challenged (Table 2).

Morbidity and Mortality in Goats

a. Morbidity: The number of animals in sick and treatment days were less in both vaccinated group than sham-immunized indicating better protection to disease in vaccinated group.

b. Mortality and causes of deaths: Mortality rate due to JD is significantly higher in sham-immunized groups of animals in comparison to both vaccinated group (X^2 = 6.659, df=1, p= 0.05). After second challenge, mortality increased in Gudair vaccinated group as well as in sham-immunized group whereas in bison group the rate was comparably low. Three animals (kids) were died at the first month of trial due to extreme cold temperature of environment. Bison vaccine very significantly support to reduce the mortality in comparison to sham-immunized group (X^2 = 6.249, df=1, p= 0.05). Although mortality due to JD in Gudair group is very low than sham-immunized but not significantly (X^2 = 2.865, df=1, p= 0.05).

Cellular Immune Response: At 0 DPV the stimulated indexes of PBMCs of animals from 3 groups were similar (Fig. 1) but after

Table 2: Sex and Breed-wise body weights gained pre challenge, after I[st] and II[nd] challenged

Pre-challenge (Nov 05-Jan 06)						
	Bison group		**Gudair group**		**Sham-Immunized**	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
Breed	Average wt gain/animal (kg) & No. of animals gained wt.		Average wt gain/animal (kg) & No. of animals gained wt.		Averagewt ain/animal (kg) & No. of animals gained wt.	
Jakhrana	**7.4** (2/2)	**5.4** (4/4)	**10.17** (3/3)	**4.5** (2/2)		**7.18** (4/4)
Cross Jakhrana	**9.54** (10/10)		**7.53** (8/8)		**8.09** (7/7)	
Barbari	**3.0** (6/6)	**2.67**(3/3)	**3.05** (4/4)	**2.56** (7/7)	**2.3** (4/4)	**1.48** (4/5)
Marwari		**6.0** (1/1)			**7.0** (1/1)	**2.8** (1/1)
Jamunapari			**6.8** (1/1)	**4.15** (2/2)	**7.3** (2/2)	
Sirohi						**6.6** (1/1)
After I[st] challenged (Feb 06-Aug 06)						
Breed	**Bison**		**Gudair**		**Sham-Immunized**	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
	Average wt gain/animal (kg) & No. of animals gained wt.		Average wt ain/animal (kg) & No. of animals gained wt.		Average wt gain/animal (kg) & No. of animals gained wt.	
Jakhrana	**4.5** (2/2)	**6.25** (4/4)	**4.33** (3/3)	**3.75** (2/2)		**6.25** (4/4)
CrossJakhrana	**3.0** (9/9)		**2.13** (6/8)		**2.93** (5 + 1*/7)	
Barbari	**1.5** (4 + 2*/6)	**5.16** (3/3)	**3.0** (4/4)	**3.71** (7/7)	**0.38** (2/4)	**2.5** (5/5)
Marwari		**11.5** (1/1)			**7.5** (1/1)	**4.0** (1/1)
Jamunapari			**6.0** (1/1)	**3.5** (2/2)	**4.75** (2/2)	
Sirohi						**8.5** (1/1)
After II[nd] challenged (Aug 06-Mar 07)						
Breed	**Bison group**		**Gudair group**		**Sham-Immunized**	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
	Average wt ain/animal (kg) & No. of animals gained wt.		Average wt gain/animal (kg) & No. of animals gained wt.		Average wt gain/animal (kg) & No. of animals gained wt.	
Jakhrana	**4.85** (2/2)	**2.5** (2/2)	**1** (1/2)	**3.9** (2/2)		**3.85**(3/4)
Cross Jakhrana	**5.11** (9/9)		**4.2** (7/7)		**4.66** (1/2)	
Barbari	**2.4** (4/5)	**4.2** (2/2)	**2.35** (4/4)	**3.15** (5/6)	**0.7** (3/3)	**0.66** (2/3)
Marwari		-1.8 (0/1)				2.4 (1/1)
Jamunapari			2.0 (1/1)	**-1.3** (1/2)	**0.**1 (2/2)	
Sirohi						**1.6** (1/1)

that PBMCs from vaccinated animals of two groups ('Bison type' and Gudair group) had greater stimulation to protoplasmic Map antigen than sham-immunized throughout trial. In case of sham-immunized group the response was always higher when the cells were stimulated with mitogen.

Humoral Immune Response: High rates of sero-conversion were observed in vaccinated goats (Bison and Gudair) as compared to sham-immunized (Table 4). All the animals in vaccinated groups became positive for anti-Map antibodies 2 months post vaccination. They retained high titer

Table 3: Morbidity rates in experiment III animals

Group	Total Animal	Animals sick	Number of treatment days				
			Total	Diarrhea/ Ani	Weakness/ Ani	Cold/ Ani.	Others/ Ani.*
Bison Type	30	15	35	11/4	5/2	12/4	7/5
Gudair	31	18	32	14/7	6/4	6/3	6/4
Sham Imm.	29	22	80	25/8	34/9	5/2	16/3

***Others diseases:** Pneumonia, fever, mange, lameness, wound and gid.

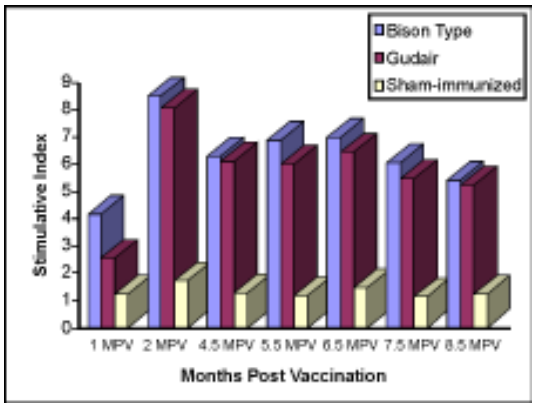


Fig.1: LTT for CMI response (Stimulation Index) in Bison, Gudair & Sham-Imm. groups

of antibodies till the vsccination trial. There was very low sero-conversion (40%) of sham-immunized animals even after the first experimental challenge when compared to vaccinated groups where all animals retained high antibodies titer. Sero-conversion rate again boost up at time of second experimental challenge in 2 vaccinated groups.

Determination of Map shedding by fecal culture: Fecal samples were collected at 6 months post vaccination (Three and half months post challenge) and were cultured

Table 4: Percent ELISA reactors at monthly intervals (pre and post challenged)

DPV	Percent ELISA Reactors		
	Sham Immunized	Bison Group	Gudair Group
Pre-Challenge			
O Day	0/25	0/30	0/30
1 Month	16. 0 (4/25)	80.0 (24/30)	73.3 (22/30)
2 Month	12. 0 (3/25)	100 (30/30)	100 (30/30)
After Ist Challenge			
3 Month	40.0 (10/25)	100 (30/30)	100 (30/30)
4 Month	40.0 (10/25)	100 (30/30)	100 (30/30)
5 Month	36.0 (9/25)	100 (30/30)	100 (30/30)
6 Month	48.0 (12/25)	100 (30/30)	100 (30/30)
7 Month	28.0 (7/25)	96.6 (29/30)	86.6 (26/30)
8 Month	32.0 (8/25)	100 (30/30)	86.6 (26/30)
9 Month	20.0 (5/25)	96.6 (29/30)	90.0 (27/30)
After IInd Challenge			
10 Month	28.0 (7/25)	100 (30/30)	100 (30/30)
11 Month	20.0 (5/25)	96.6 (29/30)	90.0 (27/30)
15 Month	20.0 (5/25)	90.0 (27/30)	80.0 (24/30)

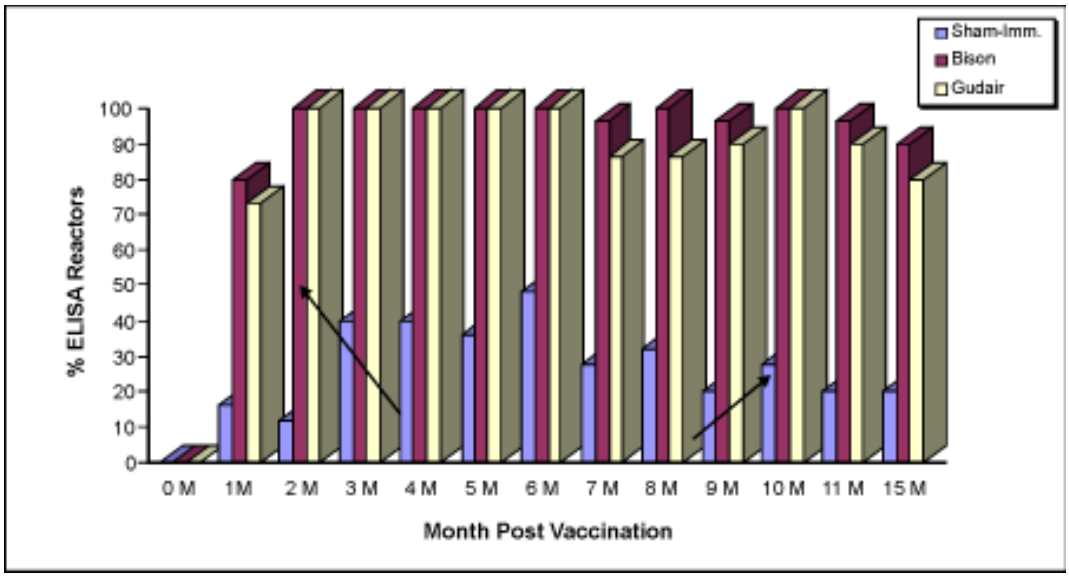


Fig.2: Humoral response (% positive reactors) for raised antibody specific to MAP

on HEYM to check the excretion of Map in feces. Fecal culture of animals from the 3 groups was performed three and half months post challenge. At the sampling time vaccination had a significant effect on the reduction of number of animals becoming positive for fecal shedding. Only 16.6% (5) and 26.6% (8) animals among the vaccinated animals of Bison and Gudair groups, respectively, became positive for Map fecal culture (Table 5). In the sham-immunized group 56% (14) animals became positive for the excretion of Map in feces. In the view of extent of the Map excretion in feces, none of animal among vaccinates yielded multi-bacillary culture, but 14.2% (2) animals of sham-immunized group yielded multi-bacillary culture.

Table 5: Animals screened for Map in fecal culture 3.6 months post challenge

Group	No. of Animals	Positive Animals	Pauci-bacillary	Multi-bacillary
Bison Type	30	5 (10.0%)	3 (100%)	Nil
Gudair	30	8 (26.6%)	8 (100%)	Nil
Sham-Immun.	25	14 (56.0%)	12 (85.7%)	2 (14.2%)

Carcass evaluation of the sacrificed animals: Body weight gain rate decreased after the challenge in all group of animals. However, even after the challenge (post = challenged) rate of body weight increase was still higher in 'Bison' group of vaccinated animals as compared to Gudair or sham Immunized groups.

Table 6: Comparisons of body weight gain in the sacrificed animals (200 DPV)

Groups	Av. wt. gain (kg) 0 DPV-0 DPI (75 DPV)	Av. wt. gain (kg) 0 DPI-125 DPI (4 months)
Bison type	7.5 ± 0.675	4.8 ± 0.553
Gudair	6.9 ± 0.872	3.0 ± 0.761
Sham-Immunized	7.7 ± 0.493	3.9 ± 0.342

DPV-days post vaccination DPI-days post infection or challenged

i. Statistical evaluation of data recorded from sacrificed animals: All parameters like external, physical and internal traits in terms

Table 7: Evaluation of different parameter concerning to sacrifice of experimental animals

S. N.	Parameter	One way Statistical analysis (ANOVA) in 3 groups for significance trait at 5% level of significance
1.	Leg circumference (Live)	Not significant (Bison group > Gudair group > Sham-Imm. group)
2.	Leg circumference (Carcass)	Not significant (Bison group > Gudair group > Sham-Imm. group)
3.	Loin Width (Live)	Significant Bison and Gudair groups > Sham-Imm. group
4.	Loin Width (Carcass)	Significant Bison > Gudair and Sham-Imm. groups
5.	Chest Circumference	No significance (Bison group > Gudair group > Sham-Imm. group)
6.	Loin Eye Area	Significant Bison and Gudair groups > Sham-Imm. Group
7.	Carcass Yield	Not significant (Bison group > Gudair group > Sham-Imm. group)
8.	Edible organ (Spleen, Kidney, Liver, Heart)	Not significant (Approximately equal)
9.	Cod fat	Significant Bison group > of Gudair and Sham-Imm. Groups
10.	Omental fat	Not significant (Bison group > Gudair group > Sham-Imm. group)
11.	Kidney fat	Not significant(Bison group > Gudair group > Sham-Imm. group)
12.	B.F.T (back fat thickness)	Significant Bison group > of Gudair and Sham-Imm. Groups
13.	Girth Measurement	Significant Bison and Gudair groups > Sham-Imm.group

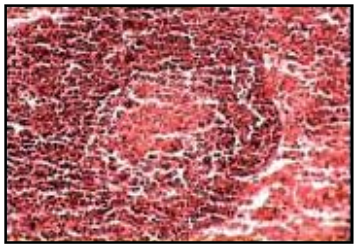
of body conformation, carcass characteristics, organs weight, body fat, body condition etc. were noted for comparative evaluation of animals sacrificed in the 3 groups (Table 7).

ii. Conclusion of Slaughter analysis: Loin width, Loin eye area, Cod fat, BFT and Girth measurements were significantly different in 3 groups (Table 7). Bison group was better in its effect on animal growth and other carcass components. In other carcass and non-carcass components were not significantly different among groups but Bison group showed improved performance than animals in other groups. Bison vaccine alleviate the factors responsible for positive impact on normal growth, muscling and optimum productivity.

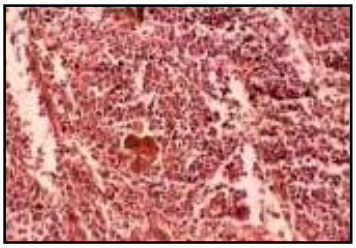
iii. Humoral immune response of sacrificed animals: Antibody titers were monitored in sacrificed animals pre and post challenged (Table 8). Greater sero-conversion rate was observed in 2 vaccinated groups than 'sham-immunized' throughout the trial period. 'Bison group' gained protective humoral response earlier than 'Gudair group'. At 90 dpv when all the animals were challenged, all sacrificed animals sero-converted to the positive. More animals of Bison group were in strong positive category than Gudair and sham-Immunized.

iv. Histopathogy, tissue culture and direct microscopic examination: Tissues (MLN & Intestine near ileo-cecal junction) were collected for histopathological study as well as for culture and its direct microscopic examination. Tissues were fixed in formalin then embedded in paraffin, sections were cut (13 animals), stained with H and E and Ziehl Neelsen. Histo-pathology

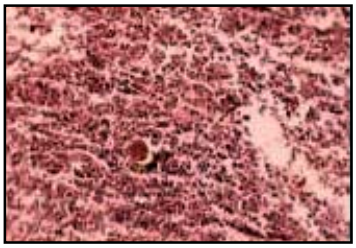
Histo-pathological lesions of tissues collected at the time of scarifying the goats of vaccinated group and



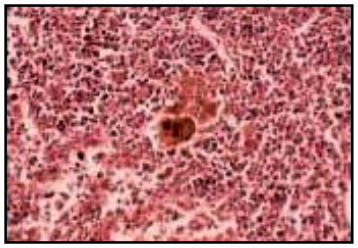
Normal germinal center



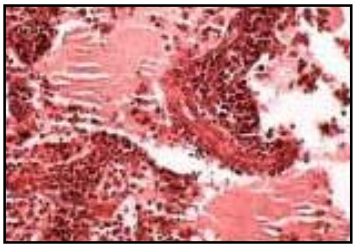
Typical granuloma



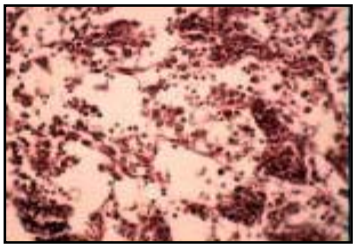
Typical giant cells



Fussed epitheloid cells



Excess edematous fluid



Earliest lesion

studies of Vaccination. Reduced the extension of lesions, limited the severity of lesions in intestine and mesenteric lymph nodes. Vaccinated goats showed normal histo-pathological picture of MLN and intestine. Modified lesions to regressive granulomatous to few epitheloid cells.

Microscopic Examination: Number of bacilli were less (MLN and Intestine) in Bison and Sham-Immunized groups than Gudair. The H/P methods and sampling techniques employed have showed a high efficiency to detect and to evaluate the initial and focal lesions.

Table 8a: Classification of lesions:

Lesion type	Lesion
Type 1	Focal lesions, small granulomas of epitheloid cells located only in the inter-follicular ares of Peyer's patches
Type 2	Small granulomas located in Peyer's patches and in mucosal lamina propria related
Type 3	Diffuse granulomatous lesions involving intestinal mucosa in different degrees

Table 8b: Extension of lesions after 1st challenged:

	Vaccinated goats and Challenged		Non-vaccinated Challenged	Non-vaccinated Non-Challenged
	Bison group	Gudair group	Sham Immunized	In contact Control
No lesions	3	2	0	0
Focal lesions	1	1	1	1
Diffused lesions	0	1	3	0

Table 8c: Individual animal –wise lesions in 3 groups

Goat no.	Tissues	Lesions in Sham Immunized group and in-contact control
K-15	MLN	Increased number of epitheloid cells in the medulla of lymph node Edema in the medullary part
	Intestine	Preponderance of epitheloid cells. Epitheloid cells in Peyer's patches
6857	MLN	Preponderance of epitheloid cells. Epitheloid cells in medullary region. Granulomas seen in medulla and less in cortex and edema also seen.
	Intestine	Chronic catarrhal enteritis, hyperplasia of goblet cells, mucinous denegation seen.
RJK 849	MLN	Collection of epitheloid cells at many places
	Intestine	Chronic catarrhal enteritis, hyperplasia of goblet cells,
6839	MLN	Heavy presence of epitheloid cells and edema seen
	Intestine	Granuloma present and epitheloid cells prepondernace
399	MLN	Epitheloid cells present
	Intestine	Epitheloid cells present
Animal no.	**Tissues**	**Lesions in Gudair group**
K 22	MLN	Edema and epitheloid cells present
	Intestine	Heavy accumulation of epitheloid cells
6723	MLN	Few epitheloid cells
	Intestine	Normal
Rjk 836	MLN	Normal and very few epitheloid cells
	Intestine	Few epitheloid cells in the wall of intestine
6859	MLN	Few granuloma
	Intestine	Normal
Animal no.	**Tissues**	**Lesions in Bison group**
GH 62	MLN	Normal but slight edema present
	Intestine	Normal
GH 64	MLN	Very few epitheloid cell
	Intestine	Normal
Rjk 825	MLN	Normal
	Intestine	Normal
K 37	MLN	Few granulomas seen
	Intestine	Few Epitheloid cells seen

Tissues culture of vaccinated and sham immunized groups, challenged and sacrificed

Tissues culture showed that vaccinated group had lowered rate of infection of tissues as compared to 'Sham immunized' and in vaccinated 'Bison group' had lowered rate of infection of tissues.

Table 8d: Colonies in MLN and Intestine of vaccinated, challenged and sacrifice goats

S.No.	Groups	No. of Colonies	
		MLN	Intestine
I	**Bison group**		
	1. K-37	No growth	No growth
	2.GH 64	No growth	1 Colony
	3.RJK 835	No growth	No growth
	4.GH 62	2 Colonies	No growth
II	**Gudair group**		
	1. K-22	No growth	2 Colonies
	2.B 6823	No growth	4 Colonies
	3.RJK 836	No growth	No growth
	4.B 6859		No growth
III	**Sham-Immunized**		
	1. K-15	3 Colonies	4 Colonies
	2.B 6839	6 Colonies	1 Colony
	3.RJK 849	No growth	4 Colonies
	4.B 6857	2 Colonies	3 Colonies

Table 9: Detection of AFB in tissues of sacrificed animals by direct microscopy.

Animals No.		AFB in Tested MLN	AFB in Tested Intestine
Bison Group			
K-37	By tissue impression	(+ +)	(+ +)
	By HPC treated tissue	(+ +)	(+ +)
GHB-64	By tissue impression	(+ + +)	(+ + +)
	By HPC treated tissue	(+ +)	(+ +)
RJK 835	By tissue impression	(+ +)	(+ +)
	By HPC treated tissue	(+ +)	(+ +)
GHB-62	By tissue impression	(+ +)	(+ +)
	By HPC treated tissue	(+ +)	(+ +)
Gudair Group			
K-22	By tissue impression	(+ +)	(+ +)
	By HPC treated tissue	(thick, atypical) (+ + + +)	(+ + + +)
B 6823	By tissue impression	-	-
	By HPC treated tissue	(+ +)	(+ +)
RJK 836	By tissue impression	(+ + +)	(+ + +)
	By HPC treated tissue	(+ + + +)	(+ + + +)
B 6859	By tissue impression	(+ + + +)	(+ +)
	By HPC treated tissue	(thick, atypical) (+ + + +)	(+ + +)
Sham-Immunized Group			
K-15	By tissue impression	ND	ND
	By HPC treated tissue	(+ +)	(+ + +)
B-6839	By tissue impression	ND	ND
	By HPC treated tissue	(+ + + +)	(+ +)
RJK-849	By tissue impression	(+ + + +)	(+ + +)
	By HPC treated tissue	(+ + +)	(+ + + +)
B-6857	By tissue impression	ND	ND
	By HPC treated tissue	(+ + +)	(+ + +)

*ND-Not Done, + +-Low Numbers of AFB, + + +-High Numbers of AFB + + + +-Very High Numbers of AFB

Extension Education and Socio Economic Section

TOT Project: Multi-Disciplinary Project on Transfer of Technology for sustainable goat production.

N.P.Singh (Co-ordinator)

Four villages namely Pohpa Burj, Pauri Shajadpur, Jalal and Barka Nagla were adopted under transfer of technology programme of this institute. On the basis of benchmark survey, the goat farmers were identified and the technologies developed and tested in the institute were transferred to the field to see the impact of various technologies of breeding, nutrition, reproduction, management and health. Scientists are visiting and interacting with the individual farmers regularly besides arranging the camps for awareness among the goat farmers for the adoption of new technologies. The institute is also providing the superior bucks to progressive goat breeders for breeding preventive and curative health care in terms of vaccination and deworming, demonstration for paneer preparation from goat milk, housing feeding practices etc. for development of a sustainable and economic viable goat production system.

1. Extension Education Component:

R.L.Sagar, Braj Mohan and Khushyal Singh

During the year 2006-07 the data were collected on the socio-economic aspects of goat farmers in all four adopted villages i.e. Pohpa Burj, Pauri Shahjadpur, Jalal and Barka Nagla. The data were coded, scored, compiled and tabulated.

It was observed that the highest number of goat farmers were marginal 77 (58.78%) followed by landless 50 (38.17 %) and small 4 (3.05%). The maximum goat farmers were found in Pauri Shahjadpur 45 followed by Pohpa Burj 32, Jalal 30 and Barka Nagla 24. It was revealed that backward castes (74.05%) were the prominent goat farmers followed by the scheduled castes (22.90%). The goat farmers of general caste were very less in number (3.05%). In case of villages, Pauri Shahjadpur had the maximum number of goat farmers (34.35%) followed by Pohpa Burj(24.43%), Jalal (22.90%) and Barka Nagla(18.32%). It was indicated that the majority of goat farmers in the adopted villages belonged to 31-40 years (42.75%) and 41-50 years (29.77%) of age groups. The goat farmers upto the age of 20 years were very few in number (1.53%). The age group of 21-30 years and above 51 years farmers were observed 12.21 and 13.74 %, respectively.

According to educational status of 131 goat farmers 53.43% were illiterate followed by primary (16.79%), middle school (14.50%), high school (10.69%), graduate(2.29%) and can read and write(1.54%). On the whole, it shows that the majority of goat farmers in the villages were illiterate. The prosperity of villagers can be partially assessed from its housing pattern in terms of material used for construction of the houses. In all 90 of the houses were pucca, 25 of mixed type and 13 were kutcha. Only three huts were found in all four adopted villages. Ninety-six houses had concrete roofs while 16 had thatched roofs, 14 mudded and 4 tiled roofs.

It was revealed that twenty-eight landless goat farmers families had pucca houses, 14 mixed typed, 5 kutcha houses and only 03 huts. More than 75 percent of the marginal category of the goat farmers had pucca houses, 11 mixed typed houses and 8 kutcha houses. All the four small category of goat farmers had pucca houses

Table 1: Family size of the goat farmers in the adopted villages

S. No.	Villages	No. of family	No. of members in the family	Children upto 4 years of age	Effective family size	Overall family size
1.	Pohpa Burj	32	181	03	5.65	5.75
2.	Pauri Shahjadpur	45	312	37	6.11	6.93
3.	Jalal	30	175	08	5.57	5.83
4.	Barka Nagla	24	167	22	6.04	6.96
	Total/Average	131	835	70	5.84	6.37

Table 2: Housing pattern of the goat farmers

S. No.	Village	Type of house				Type of roof			
		Pucca	Mixed	Kutcha	Hut	Concrete	Tile	Mud	Thatch
1.	Pohpa Burj N = 32	21(65.63)	9(28.13)	1(3.12)	1(3.12)	25(78.13)	2(6.25)	3(9.38)	2(6.25)
2.	Pauri Shahjadpur N = 45	33(73.33)	4(8.89)	8(17.78)	-	30(66.67)	1(2.22)	8(17.78)	6(13.33)
3.	Jalal N = 30	25(83.33)	2(6.67)	2(6.67)	1(3.33)	24(80.00)	-	4(13.33)	2(6.67)
4.	Barka Nagla N = 24	11(45.83)	10(41.67)	2(8.33)	1(4.17)	17(70.83)	1(4.17)	-	6(25.00)
	Total N = 131	90(68.70)	25(19.08)	13(9.92)	3(2.29)	96(73.28)	4(3.05)	15(11.45)	16(12.21)
	Percentage								

Figures in the parentheses indicate the percentage

Table3: Major job engagement of the goat farmers

S. No.	Occupation	Villages				Total	Per cent
		Pohpa Burj	Pauri Shahjadpur	Jalal	Barka Nagla		
1.	Goat Rearing	1	8	4	5	18	13.74
2.	Goat Rearing + Agril. Labour	4	10	9	11	34	25.95
3.	Goat Rearing + Agril labour + Farming	2	5	1	1	9	6.87
4.	Goat Rearing + Farming	22	14	16	4	56	42.75
5.	Goat Rearing + Service	1	1	-	2	4	3.05
6.	Goat rearing + Business	2	5	-	1	8	6.11
7.	Goat Rearing + Farming + Service + Business	-	2	-	-	2	1.53
	Total	**32**	**45**	**30**	**24**	**131**	**100.00**

in the adopted villages. In all 90 pucca houses followed by 25 mixed type, 13 kutcha houses and only 3 huts were found in all the four adopted villages. There were 16 material items indicated of which 9 material items were found to be in possession with the families of the goat farmers in all four adopted villages. Among these items, the number of bicycles were highest (106). It was also noticed that the maximum bicycles were found with marginal goat farmers (64) followed by landless (38) and small goat farmers (4). Only one kerosene stove which was

Table 4: Land distribution among the goat farmers in the adopted villages

S.No.	Villages	Land distribution (ha)		Total (ha)	Percentage of total land
		Irrigated	Non-irrigated		
1.	Pohpa Burj	13.34	-	13.34	33.59
2.	Pauri Shahjadpur	15.74	-	15.74	39.64
3.	Jalal	7.82	-	7.82	19.69
4.	Barka Nagla	2.81	-	2.81	7.08
	Total	**39.71**	**-**	**39.71**	**100.00**

Table 5: Goat farmers' category wise distribution of land in the villages

S.No.	Category	Land distribution (ha)		Total (ha)	Percentage of irrigated land	Percentage of total land
		Irrigated	Non-irrigated			
1.	Landless	-	-	-	-	-
2.	Marginal	34.00	-	34.00	100.00	85.62
3.	Small	5.71	-	5.71	100.00	14.38
	Total	**39.71**	**-**	**39.71**	**100.00**	**100.00**

Table 6: Income classifications of the goat farmers

S.No.	Category	Villages				Total	Per cent
		Pohpa Burj	Pauri Shahjadpur	Jalal	Barka Nagla		
1.	Rs. Up to 10000	3	9	6	-	18	13.74
2.	Rs. 10001-20000	13	19	17	12	61	46.56
3.	Rs. 20001-30000	12	5	5	7	29	22.14
4.	Rs. 30001-40000	3	4	1	-	8	6.11
5.	Rs. 40001-50000	1	-	-	-	1	0.76
6.	Rs.50000 and above	-	8	1	5	14	10.69
	Total	**32**	**45**	**30**	**24**	**131**	**100.00**

possessed by a marginal goat farmer. Further, 45 families of which 31 marginal 11 landless and 3 small were having hand pumps and 44 of which 32 marginal, 9 landless and 3 small goat farmers families had television sets. Seven marginal, one each landless and small goat farmers had 9 scooters/motor cycles. Out of 8 sewing machines in the villages 4 each were found with landless and marginal categories of goat farmers. It was taken into notice that 5 storage bins, 3 LPG (cooking gas) were found to be in possession with the marginal goat farmers. Radios/ transistors were possessed by 3 marginal and 1 landless goat farmer.

It was revealed that most of the goat farmers (42.75%) in the adopted villages reported that community hand pumps are available for drinking water. The remaining (34.35%) goat farmers had own hand pump and (22.90%) depended on community well for their drinking water requirements. It was further observed that majority (75.00%) of the small goat farmers followed by marginal 40.26% in the adopted villages had their own hand pump. Only one small goat farmer used community hand pump for his drinking water requirement, whereas 58.00 percent of the landless and 33.77 percent marginal goat keepers reported that

community hand pumps were available for drinking water. The rest of the landless 20 % and marginal 25.97 % were depended on community well.

It was observed that 65.63 percent goat farmers in Pohpa Burj village had electricity facility in their houses followed by Jalal (56.67%) and Barka Nagla (33.33%). The goat farmers of Pauri Shahjadpur had minimum electricity facility (24.44%) in their houses. Out of 131 goat farmers 57 had electricity facility in their houses. It was observed that small category of goat farmers had maximum (75.00 %) electricity facility in their houses followed by marginal (49.35 %) and landless (32.00%).

The major source of irrigation in all four adopted villages was diesel pump only. Diesel pump which alone provides water for 100% of the irrigated area. Diesel pump is the main source of irrigation in these villages. It is clear that marginal and small categories of goat farmers used diesel pump only for the irrigation of their crops.

2. Breeding and Management Component

M.K. Singh, B. Rai and D. Singh

More than fourty visits were performed to four adopted villages during the period from June, 2006 to July, 2007. Five Barbari breeding buck and 43 Barbari goats were provided to goat keepers of adopted villages. These bucks used to provide services to 34, 39, 28 and 31 goats in Pauri, Popha, Jalal and Bar Ka Nagla Villages. TOT team in each adopted village conducted eight health camps, two each for the vaccination of FMD, ET, PPR and HS. Free training cum awareness programmes of two days were conducted for the women of adopted villages in the institute. Goat Farmers from other villages, districts, states were also educated/aware about improved goat rearing practices. Effectiveness of TOT programmes motivated three new persons to set up commercial/goat farming in adopted villages and many others in surrounding villages of the institute. Some small goat farmers also have increased their flock size. The impact of buck distribution increased the percentage of Barbari/Barbari type young kids from 42% to 92.3% in Jalal, from 0 to 30.82% in Bar ka Nagla, from 22.7% to 72.7% in Popha Bhurj and from 31.6 to 72.4% in Pauri-Sahjadpur. The body weight of goats was recorded with respect to breed/type, type of birth, sex and management system. The overall body weight of goats belong to Jalal village was 2.63 ± 0.05, 8.03 ± 0.15, 14.90 ± 0.36, 16.89 ± 0.81, 19.43 ± 1.09 and 24.12 ± 0.51 kg at 3d, 3, 6,9,12 and >18 months of ages, respectively. The corresponding estimates in Bar-Ka-Nagla village were 2.90 ± 1.04,

Breed Composition and Impact of Buck Distribution

Attribute	Jalal	Bar Ka Nagla	Popha Bhurj	Pauri Sahjadpur
No of goat keepers	26	22	28	30
Average Flock size (Goats)	7.2	12.6	5.4	5.9
Range	1-72	1-80	1-12	1-14
Goats bred by Institute buck (No).	28	31	34	39
Breed Composition (%) before buck distribution to villages				
Barbari	-	-	-	4
Barbari type	52.3%	7.6	22.7	27.6
Non-descript	47.28%	92.4	72.3	68.4
Breed Composition (%) among kids after buck distribution				
Barbari			4.5	12.06
Barbari type	92.30%	30.82	68.2	60.34
Non-descript	7.69%	69.18	27.3	27.6

8.56±0.79, 13.83±0.99, 17.75±2.03, 23.33±180 and 28.45±0.89 kg, respectively. The corresponding estimates in Popha-Bhurj were 3.55±0.09, 8.86±0.24, 14.14±0.35, 17.95±0.91, 22.08±0.73 and 30.11±0.91 kg, respectively. The corresponding estimates in Pauri-Sahjadpur were 3.34±1.54, 8.73±0.92, 15.73±0.95, 22.51±1.27, 27.66±1.88 and 29.64±1.01 kg, respectively.

3. Health component

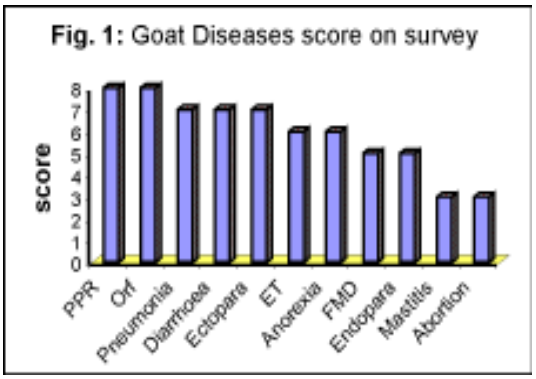
Ashok Kumar and H A Tiwari

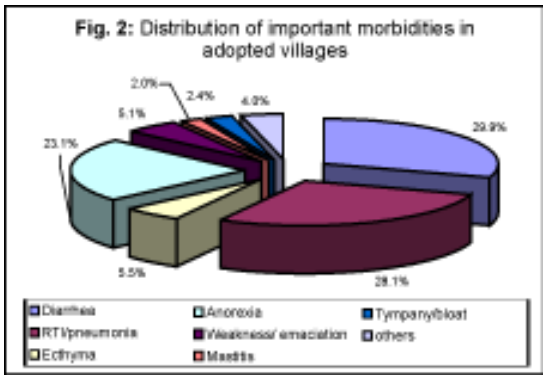
In a survey on morbidities and mortalities in goats on a prescribed format in all four adopted villages with the interaction of goat farmers revealed that diarrhoea, pneumonia, contagious ecthyma and ectoparasitic infestations in both adult and kid are important clinical conditions/ diseases and of economic importance. In increasing chronological orders higher mortalities (%) were due to PPR, ET, diarrhea, pneumonia and internal parasitic infestations; and morbidities were contagious ecthyma, ectoparasitic infestations, PPR, ET, Diarrhoea, pneumonia, FMD, anorexia, endoparasitic infestations, mastitis, abortion and other reproductive diseases (Fig. 1). In kids particular, major morbidities were due to dairrhoea (45.3%), pneumonia (37.3%), ecthyma(13%) and weakness(2.6%). Diarrhoea and pneumonia are important causes of mortality in kids. However, farmers have poor knowledge of actual name of diseases except FMD and ecto-endoparasitic infestations.

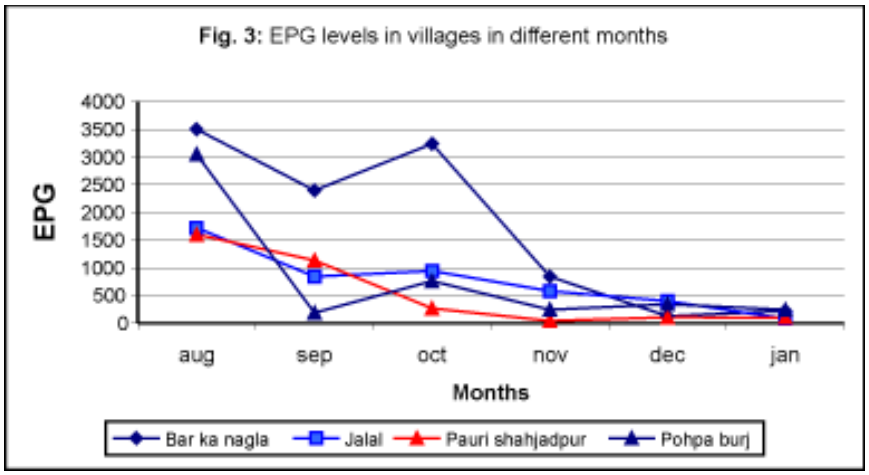
A total 455 clinical registries were recorded during the year for the treatment of different goat diseases. The proportional morbidities were highest (Fig. 2) in diarrhoea and followed by respiratory tract infection/pneumonia, anorexia, ecthyma, weakness/emaciation, tympany/bloat, mastitis and others (lameness, septic wounds, endoparasitic infestations, abortion, skin infections). These proportional morbidities were highest in the month of June (27.25), July(23.30), and August (25.70) and lower in September (6.81), October (1.76), November (3.30), December (1.98) and January (9.89), indicating the vulnerable periods for the goat diseases.

The Hemogram was studied in normal animals, which were in normal range of all figures.

The EPG levels revealed that August, September and October have higher EPG range (266-3500) in comparison to November to January (100-840), which indicated that rainy season is conducive for internal parasitic infections (Fig. 3). The behavior of EPG in adopted villages showed







that Bar Ka Nagla had comparatively higher level in comparision to three other villages, which was correlated with poor drinking water facility and management practices and were also communicated to the farmers to improve the system.

In all four villages, the goats were vaccinated and dewormed timely and stressed on the importance of the mass operation and health technologies. These goats were vaccinated against FMD, PPR and ET in Bar ka nagla (207, 242, 102), Jalal (84, 138, 166), Pauri shahzadpur (92, 94, 102) and Pohpa burz (68, 106, 100) respectively, which covered 80% population. Similarly, goats were dewormed with anthelmintic in Bar ka nagla (125), Jalal (94), Pauri shahzadpur (117) and Pohpa burz (92), covering 86.66% population. No outbreak was experienced during this period. Farmers cooperated in all mass operations.

4. Socio-economics component

Shalandar Kumar

In order to understand the goat production system, economics and marketing of goats in the adopted villages, an in-depth survey was conducted covering 41 goat farmers from the four villages namely, Jalal, Nagla Bar, Pohpa Burj and Pouri–Shahajadpur. The size of flock of breeding goats in different villages varied between 2 and 6 goats. However the distribution of breeding bucks was very skewed, even one of the villages had no buck (Table 1). Only 52 % of the goat keepers had agricultural land and all of them were marginal and small farmers. Majority of the goat keepers (71 %) were aged between 30-50 years. The young generation had little interest in goat rearing. Interestingly about 23 % farmers had taken goat rearing very recently in the last 5 years. Most of the farmers were illiterate. Goat rearing was mainly a subsidiary occupation; only 26 % farmers had adopted it as their main occupation. Goat rearing was the responsibility mainly (on 87 % households) of women and children in the family. The goats were better equitably distributed among different social groups as 95 % of the goat keepers belonged to OBC and SC category. The farmers have evolved a suitable feeding system using locally available resources. Among these practices, 84 % farmers sent their goats for grazing, 74 % used Saani (moist wheat straw + flour of wheat/barley/cake), 44 % used tree lopping and 48 % farmers fed their goats

Table 1: Flock Size of goats in adopted villages

Villages	Adult male	Adult female	Kids	Total flock size
Jalal	0.11	3.89	4.56	8.56
Nagla Bar	0.63	6.25	6.00	12.88
Pohpa Burj	0.00	2.33	2.33	4.66
Pouri-Shahajadpur	0.09	3.46	5.00	8.55
Pooled	0.23	4.16	4.87	9.26
Average market price	2057	1786		

Table 2: Total cost of goat rearing (Rs./annum/farmer)

Villages	Total fixed cost	Value of adult goat died	Cost of feeding	Total cost
Jalal	895	570	1570	3035
Nagla Bar	1408	1578	1530	4516
Pohpa Burj	687	—	1424	2111
Pouri-Shahajadpur	883	383	2108	3374
Overall	1003	598	1700	3301

Table 3: Returns from goat rearing (Rs./annum)

Villages	Value of sold/added kids	Value of milk	Value of manure	Gross returns	Net returns/ flock	Net returns/ goat
Jalal	4722	884	238	5844	2809	722
Nagla Bar	6738	2284	581	9603	5087	812
Pohpa Burj	3433	893	167	4493	2382	1022
Pouri-Shahajadpur	6155	1102	327	7584	4210	1217
Overall	5636	1324	351	7499	4198	1009

Table 4: Farmers' perceptions on prospects of commercial goat farming

Items	Particular	% Farmer
Adoption of commercial goat farming	Interested to increase the flock size	51.61
	Not interested	48.39
Support required	Easy access to credit at reasonable cost	48.39
	Prevention & control of diseases	19.35
	Market information and marketing	12.90
	Training on goat farming	9.68
	Superior breeding stock	6.45
Other constraints	Lack of space at proper place	3.23
	Social inhibitions	3.23
	Can not take high risk	3.23
	Present work of donkey rearing for draft purpose is more stable income source	3.23
	Satisfied as agricultural labour	3.23

mustard oil and salt. The major capital investment was made on purchasing the breeding stock (Rs. 6432) followed by value of shed (Rs. 423) and equipments (Rs. 102). The total fixed cost per annum was worked out to be Rs. 1003/farmer and Rs. 241 per goat. Moreover the mortality in adult goats was also considered as depreciation and was estimated to be Rs. 598/farmer/annum. Major component of the actual cost incurred by farmer was on feeding goats. That was worked out to be Rs. 1700/farmer/annum

and Rs. 409/goat. The total cost of rearing a goat was Rs. 794 per annum (Table 2). The net returns/goat/annum were estimated to be Rs. 1009. However the net returns from a goat varied from Rs. 722 (in Jalal village) to Rs. 1217 (in Pouri) (Table 3). Many farmers of Pouri village had higher awareness and followed the suggested marketing strategy. On our persuasion, 17 % farmers reared/fattened male kids for festive (Eid) sale and realized better prices. The net returns from goat rearing could be further increased simply by reducing mortality in goats, which caused losses to the tune of Rs. 1359/annum. It was observed that most of the farmers sold their live goats in the village itself to the traders/butchers and farmers. Though the farmers sold their animals as and when they need cash, however, majority of them sold their goats in winter season on account of better prices and feed scarcity. Fellow farmers and village traders were the major source of market information, however, the majority of goat keepers felt that lack of market information and distress sale are main reasons for low price of their goats. The reasons observed for sale of early age kids were risk of mortality, urgent cash needs and non-awareness of optimum age of sale. It was also observed that income from goats was mainly used to fulfill the family needs, replacing goats, etc. About 52 % goat farmers were interested to increase the flock size of goats to make it a self-sustaining unit (Table 4). However they needed support in the form of easy access to credit at reasonable cost, preventive and control of diseases in goats, access to market information, etc.

5. Animal Nutrition Component

R.S. Upadhyaya

All the goats are maintained on grazing land, the grazing period start at about 10 AM because it is believed that goats might suffer from a condition called "MOHMA" if they are allowed to graze in early morning hour when the plant biomass is covered with dewdrops. Goats are given Sani consisting of wheat straw mixed with wheat or barley flour and some amount of water. In none of the villages balanced concentrate mixture was being fed to the goats. On the other hand, goats are provided with home grown grains i.e. Bajra, Barley and Wheat, the amount of grain offered to goat may vary from 100 to 300g/h/d. All the goat farmers take due care that goat are given sand/soil free straw. One farmer in Jalal village was seen filtering Bajra *Kadbi* using a large size sieve. The growing kids suckle mother upto 3 months of age and goat milk usually is not collected for large scale human consumption. Some of the goat farmers feed about 50ml of mustured oil mixed with pinch of common salt and black salt at weekly interval. One lady told that wheat chapatti containing *Heeng* is good for curing Tympani in goats. The stall feeding of goats is practiced during rainy season and extreme winter, when it is not possible to allow goat in grazing area. Despite the fact that goats are not given balanced concentrate mixture in the four adopted villages almost all the goats appeared healthy. It was observed that farmers harvest grasses and dry them on cots, before feeding to goats. All the farmers were advised to feed common salt, mineral mixture and *Khadia* to goats. The preparation of balanced concentrate mixture was demonstrated in the village Jalal to a small group of farmers. The study reported above is not complete and greater efforts are required to rationalize the feeding system of goats in the villages.

A feeding trial was conducted for nutritional evaluation of *Sani* prepared from wheat straw, wheat bran and water

supplemented with 100g each of *Laha* cake and green grass (*Cenchrus ciliaris*). The DM intake (% body weight) was 2.58 ± 0.19 kg. and digestibility(%) of dry matter was 60.06 ± 1.19.

6. Products Technology Component

R.B. Sharma

Existing practices related to Goat milk adopted in the villages:

1. Unhygienic milk production: Existing goat genotype is low yielding type. The proportion of Barbari, Barbari type and Non-descript goats is around 25%, 25% and 50%, respectively in all the 4 villages. Inability to feed goat adequately throughout the year is a critical constraint for most of the goat farmers. System of management is mixed i.e. extensive and intensive type. Goats are allowed to breed as early as 5-6 months of age having lower body weight (10-12 kg). Goats are raised under zero or low input system. Farmers in all four adopted villages do not produce Goat milk hygienically. The utensils, hands of milker and teats of goats are also not washed properly before milking.

2. Consumption of goat milk: This is a common practice in all adopted villages to feed goat milk first to kids. Then the goats are milked after 2-3 months of kidding. The milk is utilised to make tea, drinking purpose and the milk is rarely available for processing.

3. Sale of goat milk: Only few farmers are selling goat milk @ Rs 8/-per litre either to villagers or to vendors. Vendors are mixing the goat milk with cow or buffalo milk and selling at a higher rate to consumers/dairies/Halwais.

4. Processing of goat milk: In general, hardly 1 litre of milk is available with one family during flush season for processing purpose. This milk is converted into kheer and khoa following traditional methods by most of the goat keepers. Some are making dahi also. Only 7 families occasionally make paneer from goat milk.

5. Work Carried Out:

1. Goat keepers were motivated regarding clean milk production, medicinal value of goat milk and goat milk processing.
2. Farmers were motivated and demonstrated paneer making technology from goat milk as the technology does not require much infrastructure and inputs. A total of 05 demonstrations were conducted in adopted villages.
3. Created awareness about Marketing of goat milk

7. Reproduction component

A.K. Goel

Services Provided in Terms of Reproductive Techniques:

Mating of Goats in Operational Area by Barbari Bucks: Farmers were emphasized to breed oestrous goats at appropriate stage of oestrus (heat) for increased pregnancy rate. A total of 134 goats were covered in different villages either by Institute Barbari buck (101) or village Buck (33).

Pregnancy Diagnosis in goats: Goats of different villages were diagnosed for their gestational stage by abdominal palpation around 2½ to 3 months of post mating. This was done for profitable goat production. In all 78 goats were screened for pregnancy status. Goat owners were taught for care and management of does before, during and after kidding and importance of timely feeding of colostrum.

Table 1: Occurrence of Reproductive Diseases in Adopted Villages

	Disease	No.
1.	Anoestrus	18
2.	Abortion (3-4 M)	9
3.	Abortion followed by Retention of Placenta	1
4.	Retention of Placenta	5
5.	Pre mature birth	2
6.	Parturition failure	5
7.	Dystocia	5
	Total	**45**

Diagnosis and Treatment of Reproductive Diseases in Goats:

Reproductive health care of affected goats of different adopted villages was undertaken. In total forty-five cases of specific reproductive ailments were diagnosed and appropriately treated in all four villages. Caesarean sections in three goats were performed to relieve dystocia/ facilitate kiddings. The incidence of various diseases was of moderate degree (Table 1).

Reproduction Rate and Multiple births in Village Goats: Kidding rate (litter size) is an important reproductive trait deciding the lifetime production in goats. Kidding rate is largely determined by ovulation rate but is also modified by fertilization and embryonic and foetal losses. In total 168 kiddings occurred in different adopted villages. The incidence of twinning was 42.85%, indicating good prolificacy. A few goats (2.38%) also kidded with triplets. Kidding rate in different villages ranged 1.36 to 1.47 (average: 1.41) as shown in Table 2.

8. Extension Education

Khusiyal Singh

Training programmes organized

On campus

1. An on campus training programme was organized on 2.5.2006 for the goat farmers of Pohpa Burj and Pauri Shahjadpur adopted villages. The goat farmers were educated through discussions and interaction. The farmers were suggested to adopt the tested technologies for higher productivity.
2. Another on campus training programme in scientific goat rearing was also organized on 12.5.2006 for the goat farmers of Barka Nagla and Jalal adopted villages. Lectures were delivered by the scientists and discussed the problems of the goat farmers and solved their problems.
3. Two days on campus training programme on scientific goat rearing was organized on 16-17.10.2006 for the goat farmers of Jalal adopted village. In this training 33 farmers and farmwomen participated and they

Table2: Kidding rate and multiple births in goats in adopted villages

	Village Name	Multiple Births		Total	Kids Born			Kidding
	Twin	Triplet	Kiddings	Male	Female	Total	rate	
1.	Pauri Shahjadpur	9	-	19	13	15	28	1.47
2.	Popha Burg	22	-	43	39	24	63	1.46
3.	Jalal	11	-	33	24	21	45	1.36
4.	Barka ka Nagla	30	4	73	58	43	101	1.38
	Total No.	**72**	**4**	**168**	**134**	**103**	**237**	**1.41**
	Per cent	**42.85**	**2.38**	**54.76**				

Number of kids born per doe per year: 1.41

weregiven exposure visit of the farmers.

Off campus

One day off campus training programme was organized on scientific goat rearing on 25.4.2006 at Pohpa Burj. In this training Director, CIRG, four HODS, nine scientists, one Senior Veterinary Officer, four Technical Officers, three Technical Assistants, one Stockman from Farah Veterinary hospital and about 100 goat farmers/farm women from Pohpa Burj and Pauri Shahjadpur participated in scientist farmers interaction.

Field day

A Field day cum health camp on 25.4.2006 was organized jointly in Pauri Shahjadpur and Pohpa Burj at Pohpa Burj. In this health camp about 200 goats were drenched and treated against various diseases.

Goat farmers visits:

1. A visit for the farmers/farmwomen of Pohpa Burj and Pauri Shahjadpur adopted villages was organized on 2.5.2006 to show research extension and development activities of the institute to make them aware of benefits of scientific goat rearing. In this visit, 13 goat farmers and 11 farmwomen were present.
2. Another visit-cum-on campus training programme on scientific goat rearing was also organized on 12.5.2006 for the goat farmers of Barka Nagla and Jalal adopted villages. In this visit, 31 farmers and farmwomen participated and were given exposure visit to the goat farms of the Institute besides interaction with the Scientists.

AP CESS Project: Commercialisation of Goat Farming and Marketing of Goats in India

Shalander Kumar

Commercial Goat Farmers: The goat farming using improved management practices undertaken for maximization of returns from the enterprise has been considered as 'commercial goat farming' in the present context. A detailed analysis was carried out of the data collected from 18 commercial goat farms spread over Uttar Pradesh, Rajasthan, Maharashtra and Madhya Pradesh. Preliminary data collected from another 6 goat farms from Tamilnadu, Bihar, West Bengal, Chhattisgarh and Haryana were also analyzed. The farmers have mainly adopted the breeds of goat, which are locally available in the tract of their goat farm. However the Sirohi, Barbari and Jamunapari have been widely reared by the farmers outside their home tract (Fig. 1). In farmers' perception the Sirohi breed has been the best adapted outside their home tract particularly in the semiarid regions of the country. To study the prospects and production system on commercial goat farms the efforts were made to analyze their initial and current flock size, capital investment, land holding size, occupation structure, type of goat production system adopted, educational status of entrepreneurs, social acceptability of goat enterprise, access to training on goat farming and problems faced by the commercial goat farmers in the initial stages. The major problem faced in the initial stages were Police harassment during transportation of breeding stock, huge losses due to sudden deaths and mortality on account of diseases in goats, difficulty in sourcing good quality breeding stock from reliable sources, non-availability of critical inputs like vaccines and feeds. Before

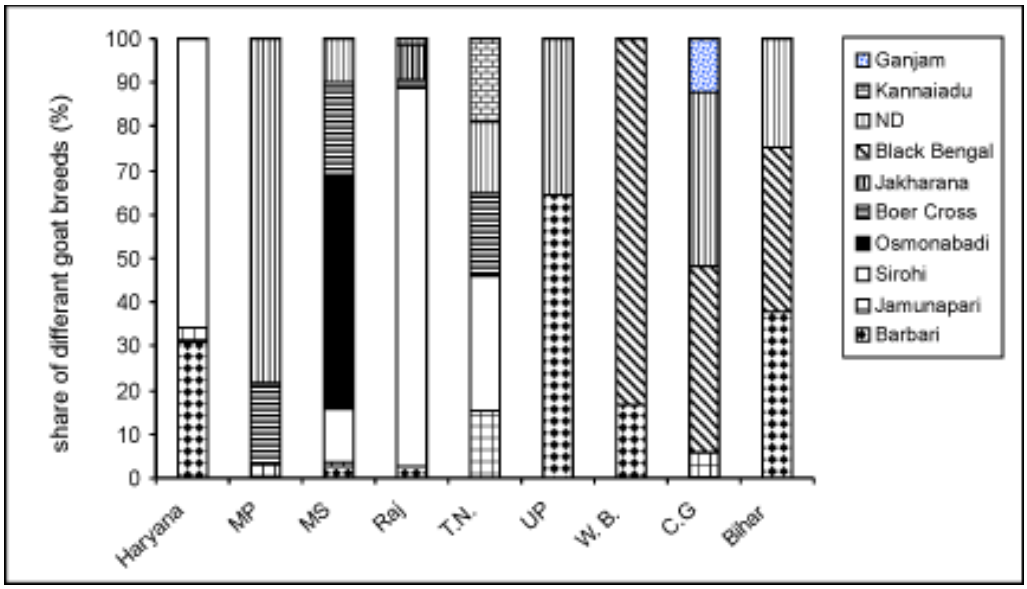


Fig. 1: Distribution of goat breeds on commercial farms in different states

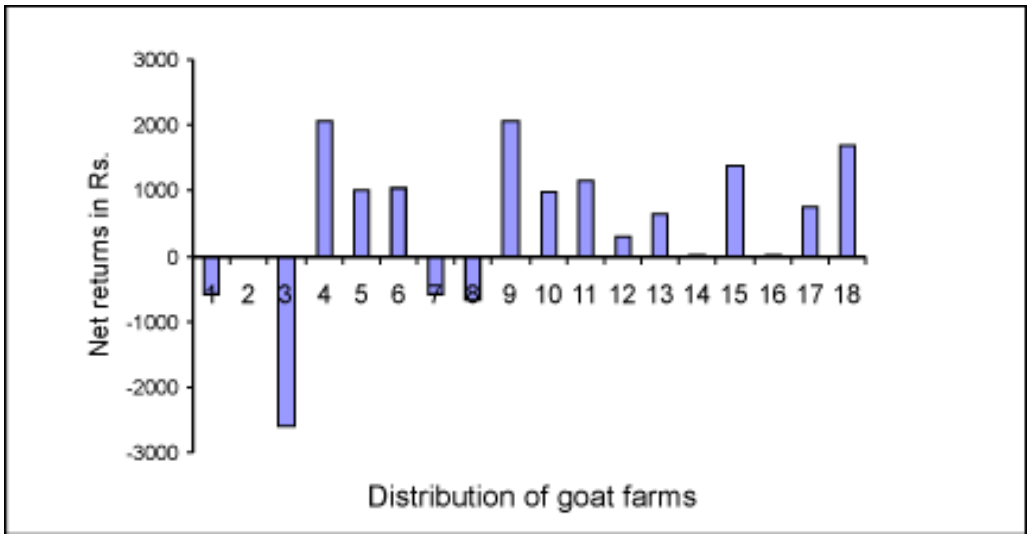


Fig. 2: Annual net returns per goat on commercial farms

building up reputation by the commercial goat farmer as a producer of quality animals, the butchers purchase animals on very low price that act as discouragement for a beginner.

The economics of goat production was worked out for each commercial goat farmer. The annual net returns per goat on each farm have been presented in Fig. 2. It was revealed that the 72 percent of the commercial goat breeders were earning positive net returns. The annual net returns per goat ranged from Rs. 8 to Rs. 2069. At the same time the 28 percent of the goat farms were in loss. The main causes of losses were high mortality in goats due to poor awareness and accessibility to vaccines, selection of poor breeding stock, negligence

in management and poor efforts for best marketing.

Marketing of goats: To study the goat marketing system followed by traditional goat farmers in Rajasthan, the data were collected from 120 traditional goat farmers from Jaipur and Ajmer districts of Eastern semiarid zone of Rajasthan. It was revealed that the farmers have poor awareness and no bargaining power on account of illiteracy, small scale of market surplus, poverty, lack of market information and unorganized nature of trade. For majority of the goat farmers in Rajasthan, the major objective of goat rearing was milk production. Most of the male kids are sold after weaning at the age of 2.5 to 3.5 months. The farmers get a price of Rs. 300 to 700 for each kid. The females are sold when they become old and unproductive. In this study, efforts were made to analyze the existing marketing system, sale pattern, marketing channels, price spread and constraints in marketing of live goats. As part of the broad study, the goat marketing system followed by traditional goat farmers in Uttar Pradesh was studied. In that order the data were collected from 120 traditional goat farmers from Agra and Mathura districts of southwestern semiarid zone of Uttar Pradesh. It was revealed that the middlemen cornered the major share of profit in the sale of goats. Farmers' poor awareness and bargaining power, illiteracy, poverty, lack of market information, distress sale and unorganized nature of trade are the main reasons for un-remunerative prices. The price of animals in Rajasthan was mostly decided through 'Under cover' method. However in Uttar Pradesh the 'Open auction' method of sale for deciding the price of goats was also adopted (Table 1).

The margin of the middlemen ranged from Rs. Rs. 118 to Rs.1000 per goat on each transaction. The existing marketing system, sale pattern, marketing channels, price spread and constraints in marketing of live goat were also analyzed.

Table 1: Method of price fixation

Methods of price fixation (%)	No. of market functionaries	
	Rajasthan	Uttar Pradesh
Open action	10	39.13
Under cover	90	60.87

AICRP on Goat Improvement

N.P. Singh and B.Rai

The AICRP on Goat Improvement programme is based on involving the flocks maintained at the Institutional farms (nucleus herd) and village flocks maintained by the farmers. The farm units consisting of Institutional flocks maintained under organized farm conditions include Jamunapari, Barbari and Sirohi breeds. Improvement was carried out in field units with active participation of the farmers under village management system in their native home tracts and included Jamunapari, Marwari, Sirohi, Sangamneri, Surti, Black Bengal, Malabari and Ganjam breeds. The results accrued from different Units during 2006-07 are summarized below.

Sirohi Goat Unit is located at CSWRI, Avikanagar, Rajsthan. The opening balance was 140 males and 392 females totalling 532 animals. The additions during the year were due to births of 94 males and 95 females. The closing balance was 154 males and 373 females totalling 527 animals. The body weight at birth, 3, 6, 9 and 12 months of age were 3.22 ± 0.04, 11.51 ± 0.38, 15.31 ± 0.29, 18.32 ± 0.27 and 23.02 ± 0.30 kg, respectively. Heritability of birth weight was found to be moderate. The milk yield of doe's of test progenies up to 90, 150 days and total lactation milk yield was

77.75±2.52, 101.84±2.05 and 102.19±1.98 lit respectively. The tupping and kidding percent on the basis of does available were 93.13 and 72.69%, respectively. Sirohi elite breeding bucks (48) and does (84) was supplied to the farmers and other agencies for genetic improvement of goats for meat and milk.

Black Bengal Goat Field Unit is located at WBUA&FS, Kolkata. Socio-economic survey, management practices and housing pattern were studied among adopted villages. The closing balance of Black Bengal goats including all centers was 1342, with a population growth of 50.14%. The body weights of Black Bengal goats at birth, 3, 6 and 9 month of age were 1.17±0.01, 5.28±0.06, 7.82±0.09 and 10.91±0.15 kg, respectively. The average weekly milk yields for first, second and fifth week were 1.58±0.13, 1.66±0.14 and 0.97±0.18 kg respectively. The parity-wise milk yield indicated that milk yield static up to 4th lactation. This breed is highly prolific and having 83.72% multiple birth. The kidding rate was 1.80, which is highest among all the goat breeds of the country. The age and weight at first kidding was 378±2.12 days and 13.52±0.22 kg. The overall mortality was 7.86% under field conditions. The Socio-economic studies revealed that in the Nadia district of West Bengal State, the goat rearing proved more beneficial to the goat keepers having basic knowledge of animal husbandry. The annual income of a family was Rs. 2384.06 from goat rearing.

Ganjam Goat Field Unit is located at OUA&T, Bhubaneshwar. The information regarding production and reproduction parameters were collected from 1453 goats in the adopted area. The average body weights of male kids at birth, 3, 6, 9 and 12 months of age were 2.93±0.05, 7.86±0.06, 10.82±0.18, 14.16±0.11 and 18.35±0.21 kg respectively. The average daily milk yield was 416 ml with total milk production of 75.01±3.22 ltrs in 180 days of lactation. The kidding percentage on the basis of does tupped was 73.18, which was higher than the previous year. The Socio-economic studies revealed that in the Ganjam district of Orissa state the goat is a primary source of income of tribals (Gola). The goat rearing contributed 61.54 percent of their annual income.

Sangamneri Goat Field Unit: As pre the technical programme baseline information on growth, production, reproduction and management practices were recorded. The overall least squares means for 1,2,3,9 and 12 months body weights were 4.89±0.06 (1014), 8.60±0.18 (927), 12.65±0.31 (266), 16.68±0.53 (145) and 19.71±0.95 (90) kg, respectively.The least squares means for milk yield in Sangamneri goats for morning, evening and daily milk yield were estimated for 90 days as 0.453±0.003 (731), 0.416±0.003 (731) and 0.869±0.0007 (731) lit., respectively. The least squares means for reproduction traits viz; age at estrus, age at first conception, age at first kidding, no. of kids/kidding, gestation period and kidding interval in Sangamneri goats under field condition were, 231.48±1.59 (219), 275.09±2.58 (224), 418.05±2.95 (214), 1.64±0.03 (890), 146.81±0.13 (526) and 269.81±1.80 (459) days, respectively.Economic gain through increase in body weight for 3 and 6 months of age were Rs. 42.40 and 30.40, respectively. Similarly economic gain through increase in milk production was Rs. 176.40 for 90 days estimated milk yield during 2006-07.

Surti Goat Field Unit is located at Navasari Agriculture University, Navsari (Gujarat). The survey work on the Surti goats was conducted in 3 centres of the Bharuch district. The closing balance was 145 during the year 2006-2007. The body weight at 3 and 6-month age was 9.79 ± 0.6 and 16.50 ± 0.00 kg for male kids respectively. The pooled milk yield for 90 and 120 days was 151.16 ± 6.79 and 213.22 ± 10.52 liters. The improvement of 15.10 percent was observed at 3 month body weight due to use of elite bucks under field condition.

Malabari Goat Field Unit is located at KAU, Trichur.In the three village centres 658 females were registered during 2006-2007. A total number of 18 bucks were selected from the population under recording during 2005-06. The average body weights of Malabari goats under field conditions are found to be 2.26 ± 0.11, 4.00 ± 0.28, 9.70 ± 0.42, 14.05 ± 0.86, 19.740.911 and 27.56 ± 1.42 Kg at birth, 1 month, three months, six months, nine months and one year of age respectively. The corresponding averages of the progeny are 2.447 ± 0.56, 4.88 ± 0.36, 9.85 ± 0.98, 17.35 ± 2.24, 23.06 ± 1.28 and 28.42 ± 1.28 Kg, respectively. The peak daily milk yield recorded was 850.80 ± 62.91 ml. The heritability of body weight at different ages was found to be 0.201 ± 0.182, 0.356 ± 0.223, 0.248 ± 0.187, 0.126 ± 0.200 0.242 ± 0.363 and 0.132 ± 0.296 at birth, one month, three months, six months, nine months and one year of age respectively. The average gestation length, age at first kidding and inter-kidding interval were found to be 149.34 ± 1.49, 381.36 ± 18.33 and 263.13 ± 15.62 days.

Sirohi Goat Field Unit is located at Livestock Research Station, Vallabhnagar, MPUA&T, Udaipur (Rajasthan). The population growth of the flock was 64.93% and total strength of Sirohi goat was 984 during 2006-07. The average least squares means for body weights at birth, 3, 6, and 9 month of age were 2.55 ± 0.05, 12.82 ± 0.33, 16.92 ± 0.49 and 22.90 ± 1.10 kg respectively. The milk yield of does at 90 and 150 days and total lactation yield was 61.30 ± 1.02, 90.12 ± 1.67 and 90.99 ± 1.78 lit, respectively. The age and weight at first kidding and kidding interval were 586.37 ± 19.07 d, 30.44 ± 0.28 kg and 361.26 ± 8.61 d respectively. The breeding efficiency on the basis of does kidded was 112.66 which was lower than previous year.

Marwari Goat Field Unit is located at Rajasthan Agriculture University, Bikaner. The overall means for body weight at birth 3, 6 and 12 months of age were 2.58 ± 0.011, 12.88 ± 0.12, 19.89 ± 0.42 and 26.81 ± 0.45 kg, respectively. Milk production for 30, 60 and 90 days was 43.00 ± 0.57, 92.84 ± 1.07 and 130.51 ± 1.52 lit., respectively under the field condition. The overall kidding percent was 75.25% along with a twinning percent of 5.54% in Marwari goats. Twenty five young bucks were selected, purchased and distributed to different centres for breeding. Two training camps of three days were organized in which 50 breeders/farmers participated. Under extension activities three field demonstrations and two Animal Health camps were organized.

AICRP on Sheep

Genetic Evaluation and Improvement in Muzaffarnagari Sheep for Meet and Wool Production.

Gopal Dass and Hari Prasad

Muzaffarnagari is one of the heaviest and largest sheep breeds of India and is widely distributed in semi-arid region of

western Uttar Pradesh near Muzaffarnagar, Meerut, Bulandshahar, Saharanpur and Bijnor and in the some parts of Delhi and Haryana. The breed is famous for good growth rate and adaptability than other Indian breeds. The Institute is maintaining a flock of Muzaffarnagari sheep under Network Project on Sheep Improvement on Muzaffarnagari sheep with the aim to improve the breed for mutton and carpet wool through selective breeding. Data on various parameters like growth, meat quality, reproduction, greasy fleece yield recorded in Muzaffarnagari sheep at institute flock as well as in its home tract were collected and analysed.

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 800 g of growth ration daily, consisting of 72% TDN and 16% DCP. Essential ingredients of this 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 under which they were provided 400 g of growth ration, 6 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. 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, H.S., PPR etc. De-worming with different anthelmintics was practiced at pre-monsoon and post monsoon seasons and as and when required. Dipping was done after 15-20 days of each shearing.

Growth performance: The overall least-squares means of body weights of lambs at birth, 3, 6, 9 and 12 month age were 3.20 ± 0.04, 14.81 ± 0.30, 19.76 ± 0.53, 22.79 ± 0.63 and 29.13 ± 0.89 kg, respectively during the year under report. The effect of sex was highly significant ($P < 0.01$) on all body weights. Male lambs gained higher weights as compared to female lambs at all stages. The low body weights at 6, 9 and 12 month age were due to outbreak of sheep pox disease which made animals off feed and under treatment for a longer period.

Average daily weight gain (ADG) and meat quality attributes: The average daily gain of Muzaffarnagari lambs during 0-3, 3-6 and 3-12 months were 128.18 ± 3.13, 59.26 ± 3.41 and 53.61 ± 2.52g under semi-intensive feeding management. Similar to body weights, male lambs showed higher ADG than female lambs for all age groups. The overall means of average daily gain and feed conversion efficiency were 168.97 and 18.86 up to 6 month age and 146.49g, 12.33% up to 9 month age in the male lambs maintained under intensive feeding management.

A total of 28 male lambs were slaughtered for analyzing meat attributes of

Muzaffarnagari sheep. Out of 28, 14 each were maintained under intensive and semi-intensive feeding management. Out of 14, 7 from each system were slaughtered at 6 month and remaining 7 at 9 month age. The overall mean for weight at slaughter, carcass weight, dressing on slaughter weight basis, dressing on empty weight basis, fat and bone were 35.27 kg, 15.78 kg, 44.75%, 54.38%, 3.54%, 28.02 % and 22.53kg, 9.11kg, 40.53%, 52.82%, 2.25%, 32.35% at 6 month age respectively in the lambs maintained in intensive and se-intensive system. The figures for these traits were 40.93kg, 19.33kg, 47.00%, 57.29%, 6.48%, 27.27% at 9 month age in the intensive system.

Reproductive performance: Tupping, lambing on ewes available basis and lambing on ewes bred basis were 74.5, 52.2, 76.2% and 73.9, 59.1, 82.2% in first and second season, respectively. The annual tupping, lambing on available basis, lambing on bred basis and twinning were 85.9, 66.8, 78.9 and 5.9%, respectively. The least squares means for weight at first service, age at first service, age at first lambing and ewes' weight at lambing were 32.88 ± 0.60 kg. 560.96 ± 15.89 days, 698.46 ± 13.94 days and 32.86 ± 0.45 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 409.15 ± 20.32, 444.54 ± 34.39 and 1128.75 ± 20.63g, respectively. The effect of sex was found highly significant ($P < 0.01$) on all lambs 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.

Culling and mortality: The overall culling on in lambs between 0-3 age group was nil, while in 3-6, 6-12 age groups and in adults it was 2.61, 4.13 and 25.29%. The overall culling in all age groups on health ground basis was 2.27%. The mortality was recorded to be 16.90, 16.01, 21.90 and 52.37% in the 0-3, 3-6, 6-12 and adults respectively. The overall culling and mortality was 19.49 and 53.80%. Heavy mortality during this year was mainly due to sheep pox outbreak in all the flocks. The overall culling on health ground was 2.21%.

Replacement rate: The replacement rate for the breeding ewes was 25.2%

Genetic and phenotypic parameters: The h^2 estimates of birth, 3, 6-month body weight and first six monthly clips were 0.179 ± 0.087, 0.269 ± 0.106, 0.482 ± 0.147 and 0.280 ± 0.108, respectively. The h^2 of body weights tended to increase with increase in age. All the genetic and phenotypic correlations of body weights and greasy fleece weight were positive. The genetic correlations between and among body weights were relatively higher as compared to phenotypic correlations. The phenotypic correlations of body weight with body weights and fleece yield with body weights decreased with the increase in age.

Selection of breeding rams: The selection of breeding rams was done on the basis of 6 months body weight and first 6 monthly greasy fleece yield. The selection differential for the traits under selection were 4.0kg and 120g. Ranking of rams for selection was carried out using the following index:

Index = 0.11029*6-Month body Weight + 0.00176 * First Shearing Wool Yield.

Distribution of rams: A total of 19 breeding rams were supplied to field for breed improvement in farmers flocks through State Agric. Univ., State Govt. farm and progressive farmers.

Field survey: Survey was conducted in the month of October, 2006 in the breeding tract of Muzaffarnagari sheep to record important traits of the breed. Muzaffarnagari sheep are generally reared by Pal/Gadaria and Khatik communities belonging to low-income group. Flocks are raised on extensive production system in which animals are grazed for 6-8 hours grazing on the common grazing land or on the road and canal sides with zero supplementary feeding. The animals are taken for grazing at 10.00-11.00 AM and return with sunset. The distance traveled for grazing varies 5-15 Km/day. In some cases, animals also get opportunity to graze on Partiland to consume post harvest crop residues. It was observed that grazing land is rapidly decreasing due to availability of irrigation facilities and practicing of intensive cropping system. In general the animals are kept in thatched sheds erected on Kuchcha floor and fenced with thorny/wooden materials and muddy walls. However, some breeders had sheds made up of bricks and cement along with Kuchcha/bricks flooring. Rams and ewes are grazed and housed together and usually one breeding ram is kept in a flock. The lambs below 2 months of age are kept loose with their dams during nights and left behind at the home during the daytime. The lambs are kept in house for about 15 days after birth and thereafter join the flock for grazing. The animals are generally brought to the water points (canal, ponds, tube wells) to drink water twice or thrice a day during the summer season.

Breeding takes place throughout the year as breeding rams stay with flock every time. However, majority falls in the month of April-June and September-November with lambing in September-November and February-April. Muzaffarnagari sheep is primarily maintained for mutton purpose, although it also produces fleece from 800-1000g/annum. The fleece of this breed is coarse hence not suitable for carpet manufacture. The price of wool varied from Rs. 15-25/kg. The shearing is conducted two times in a year in the months of October/November and May/June. Some of the farmers shear the animals thrice a year in the month of March, June and September. The shearing is carried out either by farmer's themselves or by their relatives and usually sold locally or to the traders of Panipat City. Sheep are vaccinated against Haemorrhagic septicemia and sheep pox through Department of Animal Husbandry of U.P. state. No de-worming is practiced in farmers' flock. Dipping in ordinary water is done twice a year. The medical cover is generally provided by Veterinary Hospital.

The overall least squares means of body length, height at withers, chest girth and tail length were 25.64 ± 1.46, 34.19 ± 0.85, 36.76 ± 0.65 and 22.45 ± 0.63 cm., respectively in the lambs of age group 0-1 month. The corresponding figures for these body measurements were 52.43 ± 0.91, 57.59 ± 0.87, 56.82 ± 0.96, 37.20 ± 0.92 cm in 1-3 month, 57.37 ± 0.82, 61.04 ± 0.86, 63.73 ± 0.66, 43.98 ± 0.58 cm in 3-6 month, 66.78 ± 1.10, 70.10 ± 1.06, 70.58 ± 1.09, 43.31 ± 1.11 cm in 6-9 month, 81.70 ± 0.95, 75.97 ± 0.86, 79.67 ± 0.62, 51.90 ± 0.88 cm in 9-12 month and 82.93 ± 0.46, 83.87 ± 0.42, 85.06 ± 0.49 and 53.29 ± 0.52cm in adult animals.

The overall least squares averages for body weights during 0-1, 1-3, 3-6, 6-9, 9-12 month and adult age groups were 6.18 ± 0.71, 14.61 ± 0.50, 19.58 ± 0.42, 22.73 ± 0.58, 25.58 ± 0.56 and 42.61 ± 0.82 kg, respectively. Sex showed highly significant ($P < 0.01$) influence on 1-3, 6-9, 9-12 month and adult age groups whereas it was found significant ($P < 0.05$) in 3-6 month age group. Results indicated that males gained about 3 (1-3 month), 2.5 (3-6 month), 3.6 (6-9 month), 5.6 (9-12 month) and 12 kg (adult group) more weight than females.

EDUCATION AND TRAINING

TRAINING PROGRAMMES ORGANIZED

The Institute imparts training on different aspects of goat rearing. The Institute can organize the following trainings for groups of clients supported by national or international organizations for the benefit of farmers, extension workers or those related to goat production work. The costs vary for each of these courses and Institute can provide details for the period during which training is requested by the sponsoring authorities.

National Training

1. Ten days National Training Programme on Commercial Goat Farming held from 03.07.2006 to 12.07.2006 and total 30 trainees participated.
2. Ten days National Training Programme on Commercial Goat Farming held from 04.10.2006 to 13.10.2006 and total 16 trainees participated.
3. Ten days National Training Programme on Commercial Goat Farming held from 15.01.2007 to 24.01.2007 and total 16 trainees participated.

Sponsored Training Porgrammes

1. Five days Sponsored Training Programme by UP Animal Husbandry Department, Etawah to 25 progressive goat farmers from 06.11.2006 to 10.11.2006.
2. Five days Sponsored Training Programme by UP Animal Husbandry Department, Kanpur to 25 progressive goat farmers of Kanpur rural from 20.11.2006 to 24.11.2006.

3. Five days Sponsored Training Programme by UP Animal Husbandry Department, Etah to 25 progressive goat farmers from 04.12.2006 to 08.12.2006.
4. Five days Sponsored Training Programme by UP Animal Husbandry Department, Mainpuri to 25 progressive goat farmers from 18.12.2006 to 22.12.2006.
5. Five days Sponsored Training Programme by UP Animal Husbandry Department, Auriya to 25 progressive goat farmers from 04.01.2007 to 08.01.2007.

6. Five days Sponsored Training Programme by UP Animal Husbandry Department, Deharadun to 25 progressive goat farmers from 12.03.2007 to 16.03.2007.

Teaching and Guidance: Besides training, Institute scientists guided and supervised Ph.D. and M.Sc. students in different disciplines through Dr. B.R. Ambedkar University, Agra and other Universities. During the year 26 students have been admitted under Post-Graduate and Ph.D. Programme in different disciplines of goat production.

M.Sc. - 12
Ph.D. - 14

Consultancy: Institute scientists also provided consultancy services for (1) Knowledge on scientific goat rearing (2) Preparation of Project Documents for developing commercial goat farms and (3) for monitoring of such projects.

SUCCESS STORIES

1. Birth of IVF kid

In-vivo technique of embryo production has got limitations because it is expensive and less number of embryo production per donor. However a large number of embryos are required for the success of embryo transfer programme which can be exploited through In-vitro technique of embryo production. Early stages of embryo are also required for micromanipulation/microinjection studies for the production of identical/transgenic/ sexed offspring. As the number of ova obtained by superovulation is limited and the response is unpredictable, the ability to utilized ovaries from slaughter house as a source of oocytes would greatly increased the in vitro production of embryo required for the biotechnological experiments such sexing, cloning and transgenesis.

Goat oocytes used in this technique were collected by follicle puncture method from the ovaries brought from an abattoir located at Agra. Recovered oocytes were subsequently cultured. Matured oocytes were then co-incubated for 18 hrs with spermatozoa collected from Sirohi buck Fertilized oocytes were finally transferred in to a surrogate goat of non-descript breed through surgical technique.

Following transfer, pregnancy was initially confirmed at day 28 and subsequently at day 56 by ultrasonography. On 17th August 2006, this surrogate goat of non-descript breed delivered normally a female kid weighing 3.15 kg after 146 days of gestation. The weight of surrogate goat after parturition was 42 kg. The kid was healthy and of brown color indicating inheritance of Sirohi. The mother was of Black and White in color. IVF technique will go a long way for improvement and conservation of goat breeds of India and has opened new vistas for application of biotechnological tools for improvement of domestic animal industry in the country in general and goats in particular.

2. Commercial Goat Farming

A farmer, Shri Rohan Singh resident of Salimpur village in Farah, Mathura, Uttar Pradesh, who has been raising traditional crops, was encouraged and inspired by the scientists of CIRG, Makhdoom to take up the goat farming activity for commercial production. Consequently he started a Goat Farm at his village in August 2006. Initially the farm started with 68 does and 2 bucks of Barbari breed. Later on, 33 does and 1 buck of same breed were added to the flock after 6 months. The objective of this goat-rearing project was to produce and market pure breed 'Barbari' animals. The initial investment made on purchasing of breeding stock and construction of sheds and equipment was estimated to be only Rs. 1.62 lakhs and another Rs. 10000 as working capital. The goats on this farm have

been maintained under semi-intensive system of management (with 5-6 hours of grazing per day in common lands) by the two unemployed youths of the family. Besides grazing, the animals were provided supplementary concentrate feeding, mineral mixture, tree leaves lopping and straw of guar. Total expenditure incurred on supplementary feeding of goats in a year was Rs. 10700. The prophylaxis schedule including vaccination of Enterotoxaemia, PPR and FMD and twice prevention against internal and external parasites was followed. The annual cost of prophylaxis for the whole flock was Rs. 2500 and Rs. 1000 for treatment. Thus the total recurring expenditure other than family labour for a flock of 104 goats was Rs. 14200.

During the last one-year 73 kids were born from 68 does. The present strength of the flock after sale of 50 grown up or adult goats and mortality, is 105 goats. The returns from sale of goats in one year were Rs. 75000. Moreover the goat manure valuing Rs. 4000 was produced and used in his own agricultural farm. Thus the annual net returns to the family labour from the goat farm were Rs. 64800. It is interesting to note that this farmer sold his almost all the surplus animals (pure Barbari goats) for breeding purpose to the goat farmers at the rate of Rs. 100 per kg live body weight. At the same time the other traditional farmers of this area maintaining non-descript goats get a market price of Rs. 60-65 per kg of live body weight for their goats sold mostly for meat purpose. Hence rearing of pure breed goats (Barbari or any other breed) always gets incentive through better market prices. Learning from his experiences and Transfer of Technology Programme of CIRG, the farmer is now able better manage his farm reflected through zero percent mortality in his goats over the last 6 months. Moreover he has taken superior bucks and does from CIRG for breed improvement and has established credibility of producing good quality pure breed Barbari goats. The farmer is happy to start the goat business and hopes to earn more profit in the future.

संस्थान द्वारा सम्पन्न राजभाषा कार्यक्रम

- वर्ष 2006 में दिनांक 5–6 मई की अवधि में संस्थान परिसर मेंएक दो दिवसीय हिन्दी कार्यशाला का आयोजन किया गया। नगर राजभाषा कार्यान्वयन समिति आगरा के सहयोग से सम्पन्न इस कार्यशाला का उद्देश्य केन्द्रीय बकरी अनुसंधान संस्थान के वैज्ञानिक एवं तकनीकी अधिकारियों को राजभाषा नीति, उसके वार्षिक लक्ष्यों, कार्यान्वयन एवं प्रतिवेदन पर विशेष जानकारी प्रदान करना था। कार्यशाला में वैज्ञानिकों एवं तकनीकी अधिकारियों को मिलाकर लगभग 70 लोगों ने सहभागिता की। दो दिन तक चली इस कार्यशाला का उद्घाटन केन्द्रीय बकरी अनुसंधान संस्थान निदेशक डा0 नरेन्द्र पाल सिंह की उपस्थिति में आयकर आयुक्तएवं अध्यक्ष नगर राजभाषा के कार्यान्वयन समिति, आगरा श्री दिग्विजय कुमार द्वारा किया गया।
- वर्ष 2006 में संस्थान समाचार 'अजामुख' के तीन अंकों का सफलतापूर्वक प्रकाशन किया गया। जिनमें बकरी पालन के विभिन्न विषयों से सम्बन्धित 19 लेखएवं 3 लोक गीतों को प्रकाशित किया।

- सितम्बर माह में दिनांक 14 से 28 तक संस्थान में हिन्दी पखवाड़े का आयोजन किया गया। इसके अन्तर्गत दिनांक 14 सितम्बर को 'भाषा सिर्फ अभिव्यक्ति का माध्यम ही नहीं राष्ट्रीयता और राष्ट्र निर्माण का मूलभूत तत्व है' विषय परएक विचार गोष्ठी का आयोजन किया गया।
- हिन्दी पखवाड़ा अन्तर्गत संस्थान में अनुभाग द्वारा दिनांक 23.09.2007 को एक दिवसीय हिन्दी शोध पत्र प्रस्तुतिकरण सम्मेलन का आयोजन किया गया जिसमें वैज्ञानिकों द्वारा कुल 9 शोध पत्र प्रस्तुत किये गये। यह सम्मेलन माननीय निदेशक की अध्यक्षता में आयोजित किया गया।
- अनुभाग द्वारा वर्ष अन्तर्गत संस्थान राजभाषा कार्यान्वयन समिति की 3 सफल त्रैमासिक बैठक आयोजित की गई। जिसमें संस्थान निदेशक एवं अध्यक्ष राजभाषा कार्यान्वयन समिति की उपस्थिति में प्रशासनिक/वैज्ञानिक कार्यो में हिन्दी के प्रगामी प्रयोग सम्बन्धी प्रगति का मूल्याकंन किया गया।
- हिन्दी अनुभाग प्रभारी डा0 दिनेश कुमार शर्मा एवं संस्थान राजभाषा कार्यान्वयन समिति सदस्य डा0 हरि प्रसाद द्वारा माह 31 जनवरी 2007 में नगर राजभाषा कार्यान्वयन समिति, मथुरा की त्रैमासिक बैठक में भागीदारी की गई और संस्थान की ओर से राजभाषा प्रगामी प्रयोग सम्बन्धी रपट प्रस्तुत की गई।

- हिन्दी पखवाड़ा कार्यक्रम अन्तर्गत संस्थान कर्मियों में हिन्दी के प्रति अभिरूचि पैदा करने एवं हिन्दी के प्रगामी प्रयोग को बढ़ाने हेतु हिन्दी की विभिन्न प्रतियोगिताऐं जैसे हिन्दी हस्ताक्षर, हिन्दी अनुप्रयोग, हिन्दी सुलेख, हिन्दी श्रतुलेख, हिन्दी अनुवाद जैसी प्रतियोगिताओं का सफलतापूर्वक आयोजन किया गया।
- अनुभाग द्वारा राजभाषा को लोकप्रिय बनाने एवं उसके प्रतिरूचि पैदा करने के लिए दिनांक 27 सितम्बर, 2006 कोएक स्थानीय कवि सम्मेलन का आयोजन भी किया गया।

AWARDS

Dr N.P. Singh

Life Time Achievement Award of the Bioved Research and Communication Centre, Allahabad.

Dr. S.D. Kharche

Gaon Gyan Paritoshik Award-2006 of the Indian Association for Advancement of Veterinary Research at College of Vety Sci & A. H, Bhubaneshwar, Orisa.

Best Poster Presentation Award:

1. Manish Dubey, D. Dwivedi, K. Mahour, Ashok Kumar, R. Rana and V.S. Vihan (2007). Evaluation of anti-microbial activity of some Indian plants against pathogenic *Escherichia coli* isolates of kids at National seminar on "Small ruminant, Emerging diseases, containment under WTO regime", Proceeding ISSGPU At CIRG, Makhdoom Mathura (3-5 Feb., 2007).
2. Ranjeeta Kumari and V.K. Gupta (2007). PCR-RFLP for detection of Brucella Melitensis from goat tissues at National seminar on "Small ruminant, Emerging diseases, containment under WTO regime", Proceeding ISSGPU At CIRG, Makhdoom Mathura (3-5 Feb., 2007).

METEOROLOGICAL OBSERVATIONS

(March, 2006 to February, 2007)

Month	Max. temp. (°C)	Min. temp. (°C)	Mean daily temp. (°C)	Vapour pressure (mmHg)	Relative humidity (%)	Rainfall (mm)/ wet days	Sun shine (hr)
April	39.83	22.13	30.98	14.19	33.89	1.00 (1)	227.0
May	42.22	27.53	34.88	19.73	41.69	21.4(4)	173.7
June	39.75	27.38	33.57	20.73	50.43	45(3)	107.1
July	34.52	27.94	31.23	25.77	76.63	143(11)	82.9
August	34.45	26.52	30.48	25.28	74.91	40(8)	175.3
September	35.88	24.57	30.23	22.41	62.98	23(5)	140.0
October	35.45	19.69	27.57	17.17	54.83	nil	272.3
November	29.6	13.08	21.34	13.19	56.54	nil	225.3
December	24.08	10.19	17.14	10.33	63.62	1.0(1)	218.4
January	21.90	8.53	15.22	9.03	61.04	nil	226.2
February	24.23	14.57	19.40	12.50	70.96	26.4(5)	189.4
March	30.73	14.21	22.47	13.21	53.94	27.6(4)	289.3

Max. Temp. 47.5 °C on May 7, 2006
Min. Temp. 2.0 °C on January 8 and 13, 2006
Annual Rainfall328.4 mm in 42 days

PUBLICATIONS

1. Arora N, Sharma SD, Vihan VS and Kumar Ashok (2006). Seasonal changes in gastro intestinal parasitic infection of goats reared at an organized farm in semiarid zone. *Indian Journal of small ruminants* 12:37-41.
2. Bhatta R, Vaithiyanathan S, Singh NP, Shinde AK and Verma DL (2005). Effect of feeding tree leaves as supplements on the nutrient digestion and rumen fermentatioNPattern in sheep grazing on semi-arid range of India-I. *Small ruminant Research* 60: 273-280.
3. Bhatta R, Vathiyanathan S, Singh NP, Shinde AK and Verma DL (2005). Effect of tree leaf as supplementation on nutrient digestion and rumen fermentatioNPattern in sheep grazing semi arid range of India-II. *Small Ruminant Research* 60:281-288.
4. Bhusan S, Kumar S, Rajkhowa C and Bujarbaruah K M. (2007). Status of the productive traits of four strains of mithun (Bos frontalis) and their correlation. *Indian Journal of Animal Sciences* 77 (1): 113-115.
5. Bhusan S, Rajkhowa C, Bujarbaruah K M and Kumar S (2006). Growth of four strains of mithun (Bos frontalis) calves up to twelve months of age. *Indian Journal of Animal Sciences* 76 (9): 770-772.
6. Bhusan S. (2006). Body weight changes of Jakhrana goats in farmers field. *Indian Journal of Small Ruminants* 12 (1): 124-127.
7. Chaturvedi O H, Bhatta R, Verma D L and Singh NP (2006). Effect of flushing on nutrient utilization and reproductive performance of ewes grazing on community rangeland. *Asian Australasian Journal of Animal Sciences* 19 (4): 521-525.
8. Goel A K, Kharche S D, Jindal S K, and Sinha N K (2006). Embryo production and kids born through embryo transfer in Jakhrana goats treated with p FSH. *Indian Journal of Animal Reproduction* 27 (1): 75-76.
9. Gupta V K, kumari Ranjeeta, Verma D K, Singh Kalpana and Singh SV (2006). Detection of *Brucella melitensis* from goat tissue employing PCR. *Indian Journal of Animal Sciences* 76:793-795.
10. Gupta V K, Verma D K, Rout P K, Singh SV and Vihan V S (2006). Polymerase chain reaction (PCR) for detection of *Brucella melitensis* in goat milk. *Small Ruminant Research*. 65:79-84.
11. Gupta V K, Verma D K, Singh K, Kumari R, Singh SV and Vihan V S (2006). Single-step PCR for detection of *Brucella melitensis* from tissue and blood of goats. *Small Ruminant Research*. 66:169-174.
12. Gupta Vinod, Kumar Ashok, Vihan V S, and Sharma S D (2006). Effect on milk yield in subclinical ketotic goats reared under semi intensive system management. *Veterinary Practitioner*, 7:110-111
13. Kharche S D, and Srivastava S K (2007). Fertility responses in repeat breeder dairy crossbred cows treated with human chorionic gonadotropin. *Indian J. Anim. Science 77 (4): 297-299.*
14. Kharche S D, Goel A K, Jindal S K and Sinha N K (2006). In vitro maturation of caprine oocytes in different concentrations of estrous goat serum. *Small Ruminant Research* 64 (1–2):186–189.
15. Kumar Ashok, Mahour Kanhiya, Gupta Vinod and Vihan V S (2006). Susceptibility and relative resistance in

tick population against cypermethrin in organized fram and field animals. *Veterinary Practitioner*. 7:41-43.

16. Kumar Shalander, Vaid R K And Sagar R L (2006). Contribution of goats to livelihood security of small ruminant farmers in semiarid region. *Indian Journal of Small Ruminants*. 12(1): 61-66.
17. Kumar P, Singh SV, Bhatiya A K, Sevilla I, Singh A V, Whittington R J, Juste R A, Gupta V K, Singh P K, Sohal J S and Vihan V S (2006). Juvenile Capri-Paratuberculosis in India; Incidence and characterization of by six diagnostic tests. *Small Ruminant Research*. 10. 023.
18. Kumar Shalander and Singh NP (2006). Privatization and regulation of veterinary services in India some issues and implications. *Indian Journal of Agricultural Economics*, 61(3) 560.
19. Kumar Shalander, Jain D K and Singh Rajvir (2006). Increasing income and employment through sustainable farming systems in water scares region of Uttar Pradesh. *Agricultural Economic Research Review*, 19(1): 145-157.
20. Kumar Shalander, Sagar R L and Vaid R K (2006). Harnessing production Potential of goats; a need for client oriented research. *Journal of Agril. Res. & Dev*. 2-7-14.
21. Kumar V, Bhatia A K and Singh SV (2006). Evaluation of efficacy of the species-specific antigens in the diagnosis of ovine and caprine paratuberculosis using plate ELISA. *Journal Immunol. and Immunopathol*. 8: 48-53.
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24. Nagpure N S, Kharche S D and Koul G L (2006). Comparative C-and G-banding studies in Hariana, Holstein Friesian and their crossbreds. *Indian Journal Anim. Sciences*. 76 (9): 652-774.
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26. Ramachandran N and Singh Dharm (2006). Study of relationships of wattles with body weights in kids. *Indian Journal of Small Ruminants*. 12(1): 117-18.
27. Ramachandran N, Prasad S and Raju S (2006). A study on mortality pattern in crossbred dairy goats in semiarid India. *Indian Journal of Animal Sciences*. 76(10): 843-846.
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29. Sharma G, Singh SV, Sevilla I, Singh A V, Whittington R J, Juste R A, Kumar S, Gupta V K, Singh P K, Sohal J S, Vihan V S (2006). Evaluation of indigenous milk ELISA with m-culture and m-PCR for the diagnosis of Bovine Johne's disease (BJD) in lactating Indian dairy cattle. *Res. Vet. Sci. doi*: 10.1016/j. rvsc.2007.03.014
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effect on dry matter intake and digestibility in sheep grazing on native ranges of semiarid region of Rajasthan. *Indian Journal Small Ruminants* 11(1): 37-42.

32. Singh NP and Prasad R (2005). Carcass characteristic of meat rabbits under farm feeding management. *Indian Journal Small Ruminants* 11(1): 58-61.
33. Singh S K and Sinha N K. (2006). Selection Indices for Genetic Improvement of body weight and wool yield in Muzaffarnagri Sheep *Indian Journal of Animal Sciences*. 76(6): 462-465.
34. Singh S K (2006). BRENDEX: A computer programme for estimation of general and restricted selection indices for genetic gain of individual traits. *Indian Journal of Animal Sciences* 76(7): 546-548.
35. Singh SV, Singh A V, Shukla N, Singh P K, Sohal J S, Gupta V K, Vihan V S (2006). Sero-prevalence of Johne's disease iNProspective young bulls of Haryana breed by indigenous ELISA kit, using protoplasmic antigen from 'Bison type' genotype of *Mycobacterium avium* subspecies *paratuberculosis* of goat origin. *Indian Journal of Animal Sciences*, 77(8): 7-9
36. Singh SV, Singh A V, Makharia G, Naser S A, Singh P K, Sohal J S, Gupta V K, Vihan V S (2006). Crohn's disease and Johne's disease: A comparison with reference to national and international perspective and public health significance. *Intas Polivet*. Vol. 7: 275-300.
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Popular article

1. Ajoy Mandal and Hari Prasad, (2006). Bakri utpandan evam unnatikaran ke kuch mahattopurna pehalu. Ajamukh, Aank: Astadasah.
2. Bhusan S.and Rai B. (2006). Study of first week milk production of Jakhrana goats (In Hindi). *Ajamukh*, Aank: Astadasah, p. 4.
3. Bhusan S. (2006). Development of Brahman cattle through Indigenous breed. *The Indian Cow* 3(10):7-10.
4. Bhusan S. (2006). Variations in the birth weights of Jakhrana kids (In Hindi). *Ajamukh*, Aank: Saptadasah, p. 4-5.
5. Brajmohan, Sagar R L, Singh K and Bhusan S. (2007). Breeding Management of the goats. Pashu Dhan 22(2): 5-7.
6. Goel A K (2006). Bakariyan mem madkal mahtva evem upyogita. Ajamukh Aank: Astadasah, p. 3.
7. Gopal Dass (2006). Pugal bhedon ki upyogita. *Ajamukh*, Aank: Saptadasah, p. 3-4.
8. Gupta Vinod, Kumar Ashok and Vihan V S (2006). Bakariyon mein swasthaya Prabhandhan. *Kheti* (February) 20-22.
9. Gupta Vinod, Kumar Ashok and Vihan, V S (2006) Bhed Bakariyon ko Antparjiviyon se Kese bachayein. *Kheti* (March, 2006).
10. Kharche S D and Goel A K (2006). Bakarion mein kritrim garbhadan kab, kyon aur kaise. Ajamukh Aank: Saptadasah, p. 8-9.

11. Sharma D K (2006). Bakariyon Ka Aakramak Vyavahar. *Ajamukh*, No. 18
12. Sharma D K (2006). Bakariyon MeiNParjivee Rog Ka Samakalit Prabandhan. *Ajamukh*, Aank: Astadasah.
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Lead Papers

1. Ashok Kumar and Vihan V S (2007). Alternative therapies for the treatment of animal diseases. Book on Small ruminant, Emerging diseases, containment under WTO regime Lead paper Proceeding ISSGPU seminar at CIRG, Makhdoom Mathura (3-5 Feb,2007) pp385
2. Goel A K (2006). Current Reproductive Technologies for Augmenting Fertility in Goats. National Seminar of ISSGPU on "Innovations and Recent Advances in Reproduction for Augmenting *Small Ruminant Production*. Dec. 28-30, 2006 at CSWRI Avikanagar (Rajasthan) pp. 85-95.
3. Dutta T K (2006). Nutrient requirement and forage availability for Jamunapari goats. pp 17.
4. Gupta V K (2007). Molecular approaches for diagnosis of infectious diseases. National Seminar on Emerging and reemerging diseases and their containment under WTO regime, ISSGPU, CIRG, Makhdoom, 3rd –5th Feb 2007.
5. Kharche S D (2006). Reproductive tools in conservation of Jamunapari goats. In a seminar on Conservation of threatened breed-jamunapari goat organized by Animal husbandary department of UP State from 27-28th September, 2006 at Lucknow.
6. Singh NP, Vihan V S and Ashok Kumar (2007). Nutriional disorders associated with macro and micro element in goats. Book on Small ruminant, Emerging diseases, containment under WTO regime, Lead paper Proceeding ISSGPU Seminar at CIRG, Makhdoom, Mathura (3-5 Feb,2007) pp 399.
7. Sharma D K (2007). Protozoan Diseases of Small Ruminants. Small Ruminant: Emerging Diseases, Containment Under WTO Regime, edited V.S.Vihan, Ashok Kumar, V K Gupta and NP Singh Published by Satish Serial Publishing House 403, Azadpur, Delhi.
8. Singh S K (2006). Role of Goats in sustainable livelihood of rural people in ASIA. In 30th Animal Husbandry Commissioners of Asia and Pacific of FAO (APHCA) meeting held at Lunag Prabang. Lao PDR. 24-25 Oct., 2006.
9. Singh S K and Singh NP (2006). Goat Genetic Resources in India and their Improvement. National Workshop on Biodiversity Awareness, Resource and Conservation at NBAGR Karnal, April, 22-23, 2006.
10. Sinha N K and Ramachandran N (2006). Cryopreservation of buck semen: Present status and future prospects. National Seminar on Innovations & recent advances in reproduction for augmenting Small Ruminant Production, held at CSWRI, Avikanagar on Dec. 28-30, 2006 Compendium pp. 114-119.
11. Vihan V S and Ashok Kumar (2007. Development and quality control of herbal veterinary formulations for effective health management. Book on "Small ruminant, Emerging diseases, containment under WTO regime Lead paper Proceeding ISSGPU seminar At CIRG, Makhdoom Mathura (3-5 Feb,2007) pp 91
12. Vihan V S and Ashok Kumar (2007). Poisoning and toxicity in small ruminants and their management. Lead

paper at Proceeding of National Symposium on Animal welfare and sustainable health through recent therapeutic and diseases management strategies at GBPAUT Pantnagar (26-28 Feb 2007)

13. Singh NP (2006). Goat Production in India –An Overview. Bioved Survey of Indian Agriculture 2006. Published by Bioved Research and Communication Centre, Allahabad (U.P.).
14. Singh NP (2006). Technological Advances in Goat production and Management for uplifting Socio-economic Status of Rural Poor in India. Lead Paper. Proceedings of the XV Annual Convention & National Symposium on Recent Technologies in Uplifting the Socio-economic Status of People through Livestock Production and Management organized by the Indian Society of Livestock Production and Management at GBPUA&T, Pantnagar on April 20-22, 2006.
15. Singh NP (2006). Diversity in Goat Genetic Resources and their Conservation. Lead Paper. Proceedings of the Biodiversity Awareness Workshop on Animal Genetic Resources and Conservation sponsored by National Biodiversity Authority and organized by National Bureau of Animal Genetic Resources at NBAGR, Karnal on April 22-23, 2006.
16. Singh NP and Rai B (2006). Goat Rearing for Meat and Milk Production: The Scenario of Eastern India. Lead Paper. Proceedings of the Interactive Meet oNPresent Status and Future Prospective of Sheep, Goat and Rabbit Production in Eastern India organized by OLDS and ISSGPU at OUAT, Bhuvaneswar on June 28, 2006.
17. Singh NP (2006). Ray of Hope for Weaker Sections. The Hindu Survey of *Indian Agriculture*. 164-167.
18. Singh NP (2006). Feeding Strategies for Sustainable Mixed Farming. Lead Paper. Proceedings of the VI Biennial Conference of Animal Nutrition Association held at Shere-e-Kashmir University of Agricultural Sciences and Technology, Jammu on September 15-17, 2006.
19. Singh NP (2006). Nutrition for Goat Health and Immunity. Compendium on Advanced Short Course on Clinical Nutrition of Livestock and Pets organized by the CAS in Animal Nutrition, IVRI, Izatnagar on November 03-23, 2006.
20. Singh NP (2006). Role of small ruminants in arid ecology. Lead Paper presented in the Indo-Afghanistan International Symposium organized by NAAS at New Delhi on November 19-22, 2006.
21. Singh NP and Jindal S K (2006). Nutrition in relation to reproduction in goats. Lead Paper presented in the National Seminar on Innovations and Recent Advances in Reproduction for Augmenting Small Ruminant Production organized by ISSGPU at CSWRI, Avikanagar on Dec. 28-30, 2006 Compendium pp 147-153.
22. Singh NP (2007). Goat Husbandry Perspective in India. Lead Paper presented in the 9th Indian Agricultural Scientists and Farmers Congress organized by Bioved Research and Communication Centre at Prayag, Allahabad on Jan. 29-30, 2007.
23. Singh NP and Kumar S. (2007). An alternative approach to research for harmessing productioNPotential of goats. Lead Paper presented in the 4th National Extension Education Congress-2005 organized by Society of Extension Education at JNKVV, Jabalpur on March 9-11, 2007.
24. Singh NP and Singh SV (2007). Johne's

Disease and Diagnostic Challenges. Lead Paper presented in the ASCAD Symposium on "Strengthening of Disease Diagnostic Facilities for Sustainable Livestock Development" held at Udaipur, Rajasthan on March, 10-11, 2007.

25. Singh NP (2007). Generic problems of grazing in forests: Goats the foe of the forest-Myth and realities. Lead Paper presented in the India-IIASA international Workshop on Economic, Societal and Environmental benefits provided by the Indian forests held at New Delhi on April 25-27, 2007.
26. Singh NP (2007). Vyabharic Bakari Palan.Souvenir of the Seminar on Conservation of Threatened Breed-Jamunapari Goat organized by the Deptt. of A.H. & Dairying, Govt. of India at CIRG, Makhdoom on February 28, 2007.
27. Srinivas B, Swain N and Singh NP (2006). Proceedings of the VI Biennial Conference of Animal Nutrition Association held at Shere-e-Kashmir University of Agricultural Sciences and Technology, Jammu on September 15-17, 2006.

Technical Folders

Editors: N.P. Singh & N.K. Sinha

1. चारा संरक्षण–"हे" बनाना –डा0 नरेन्द्र पाल सिंह
2. बकरियों में फैलने वाले जीवाणु जनित संक्रामक रोग–डा0एच0ऐ0 तिवारी, डा0 अशोक कुमार, डा0 वी0के0 गुप्ताएवं डा0 वी0एस0 विहान
3. बकरियों के विषाणु जनित रोगएवं उनसे बचाव–डा0 एच0ऐ0 तिवारी, डा0 अशोक कुमार, डा0 वी0के0 गुप्ताएवं डा0 वी0एस0 विहान
4. बकरी दुग्ध विकल्पएवं समूचित उपयोग–डा0 टी0के0 दत्ता, डा0 नवाव सिंहएवं डा0 पी0के0 साहू
5. उन्नत बकरी पोषण व्यवस्था–डा0 नवाव सिंह
6. नस्ल सुधार के लिये बकरियों में कृत्रिम गर्भाधान–डा0एन0के0 सिन्हा एवं डा0एन0पी0 सिंह
7. उन्नत बकरी पालन–कब क्या करें?–डा0 धर्म सिंह, डा0 हरि प्रसादएवं डा0 नरेन्द्र पाल सिंह
8. बकरियों में परजीवी रोग व उनसे बचाव–डा0एच0ऐ0 तिवारी, डा0 अशोक कुमार, डा0 वी0के0 गुप्ताएवं डा0 वी0एस0 विहान

Book/Book Chapter

1. Drs VS Vihan, Ashok Kumar, VK Gupta and NP Singh "Small Ruminant Emerging diseases, containment under WTO regime" published by Satish Serial Publishing House, New Delhi 2007, pp 410
2. Drs VK Gupta, VS Vihan and NP Singh "Laboratory Manual of molecular and immunological techniques" published by CIRG, makhdoom Mathura, 2007 pp126
3. Drs S Kumar and NP Singh. Marketing of goats and their products in India. A Chapter in the Book "Marketing of livestock and their products in India" published by ICFAI, University Press, Chennai, India, 2007.

Radio/TV Talk

1. Puneet Kumar: Delhi Doordarshan Channel 1 (DD1) recorded and telecasted a talk on the topic "Care and management of Goats in summer season " on May 11, 2006.
2. NK Sinha: Coordinated the Delhi Door Darshan Team (DD1) in shooting and recording the research activities of the Institute in May 2006, which was telecasted.
3. Ashok Kumar: Bakariyon ke rog and bachav-All India Radio Mathura July 2006.
4. R Rana: Barsat mein bakrion ki swasth

raksha-AIR Mathura, on 21.8.2006.

5. S Kumar: Krishi Jinson ki E-marketing on AIR, Mathura on 22.8.2006.
6. Goel AK: Krishi ke vividhikaran mein bakri palan ka vyavsayik Mahatva-on All India Radio, Mathura. Broadcasted on 15.09.2006.
7. Dharm Singh: Adarsh bakri farm ki sthapana-on All India Radio, Mathura. Recorded on 20.07.2006.
8. Dharm Singh: Vyavsayik bakri farm ki sthapana-on All India Radio, Mathura. Recorded on 25.10.2006.
9. R Rana: Krishi Vividikaran me bakri palan-AIR Mathura, on 25.12.2006.
10. VK Gupta: Delhi Doordarshan Channel 1 (DD1) recorded a talk on Biotechnological approaches for diagnosis of goat and sheep diseases. Recorded on 5th Feb 2007.

Foreign Visits

Dr. S.K. Singh, Senior Scientist attended 30th Animal Husbandry Commissioners of Asia and Pacific of FAO (APHCA) meeting at Luang Prabang Lao PDR from October 24-25, 2006.

Participation in Seminars/Symposia/ Conferences

A.K.Goel

National seminar on "Innovations and Recent Advances in Reproduction for Augmenting Small Ruminant Production from 28th-30th, December, 2006 at CSWRI, Avikanagar (Rajasthan).

National seminar on "Emerging Diseases of Small ruminants and their Containment under WTO regime" from 3rd-5th, February, 2007 at CIRG Makhdoom, Farah (Mathura) UP.

A.K. Das

National Symposium oNProspect and challenges in Indian meat Industry held at IVVC Chenai on 27-29 July, 2006.

National Symposium on Small Ruminant Production held at CSWRI, Avikanagar on 28-30 December, 2006.

A. Mandal

National seminar on "Emerging diseases of small ruminants and their containment under WTO regime" held at CIRG, Makhdoom, from 03-05 Feb., 2007.

National symposium on "Role of animal genetic resources in rural livelihood security" held at Ranchi College of Veterinary Science & Animal Husbandry, Birsa Agricultural University, Ranchi, from 08-09 February, 2007.

Ashok Kumar

National Seminar on emerging diseases of small ruminants and their containment under WTO regime, held at CIRG Makhdoom, w.e.f. Feb 3-5, 2007.

Hindi workshop held at CIRG, Makhdoom w.e.f. 5-6 May, 2006

National seminar on "Innovations and recent advances in reproduction for augmenting small ruminant productions" at CSWRI Avika nagar, 28-30 Dec., 2006

Bhagwan Singh

National seminar on "Emerging diseases of small ruminants and their containment under WTO regime" held at CIRG, Makhdoom, organized by Indian Society for Sheep and Goat Production and Utilization from 3-5 February, 2007.

Braj Mohan

Hindi Karyashala held at Central Institute for Research on Goats, Makhdoom on 5-6 May, 2006.

A National Seminar on Emerging Diseases of Small Ruminants and their containment under WTO Regime on February 3-6, 2007, held at CIRG, Makhdoom, Farah, Mathura.

Fourth National Extension Education Congress-2007 held at Jawahar Lal Nehru Krishi Vishwa Vidyalaya, Jabalpur, M.P. on March 9-11, 2007.

B. Rai

National Symposium ISAPM on Recent technologies in of rual peoples held at Pantnagar on 20-22 April, 2006.

National Symposium Small Ruminant production held at Avikanagar on 28-30 Dec., 2006.

National Seminar on Emerging diseases at CIRG, Makhdoom from 3-5 February, 2007.

D.K. Sharma

National Seminar on Emerging Diseases of Small Ruminants and Their Containment Under WTO Regime, held at CIRG, Makhdoom, Mathura UP on 3-5 February 2007.

Hindi workshop held at CIRG, Makhdoom on 5-6 May, 2006.

D.K. Nandy

National Seminar on "Emerging diseases of small ruminants and their containment under WTO regime" at Central Institute for Research on Goats, Makhdoom,Farah, Mathura, U.P. from February 3-5, 2007.

Dharm Singh

Hindi Workshop organized by Central Institute for Research on Goats, Makhdoom (Farah), Mathura on May 5-6, 2006.

XXXV Dairy Industry Conference held at Swabhmi, Kolkata (WB) on November 23-25, 2006.

National seminar on "Emerging diseases of small ruminants and their containment under WTO regime", held at C.I.R.G., Makhdoom (Mathura) on February, 3-7, 2007.

One-day Seminar on "Conservation of Jamunapari goats" organized by Department of Animal Husbandry, Govt of Uttar Pradesh in collaboration with C.I.R.G., Makhdoom at C.I.R.G., Makhdoom (Mathura) on Feb. 28, 2007.

Dori Lal Gupta

National Seminar on "Emerging diseases of small ruminants and their containment under WTO regime" at Central Institute for Research on Goats, Makhdoom,Farah, Mathura, U.P. from February 3-5, 2007.

Gopal Dass

National Seminar on Innovations and Recent Advances in Reproduction for Augmenting Small Ruminant Production held at CSWRI, Avikanagar organized by Indian Society for Sheep and Goat Production and Utilization December, 28-30, 2006.

National Seminar on emerging diseases of Small Ruminants and Their Containment Under WTO Regime" held at C.I.R.G, Makhdoom, Mathura, (U.P) organized by Indian Society for Sheep and Goat Production and Utilization February 3-5, 2007.

H.A. Tiwari

National Seminar on emerging diseases of small ruminants and their containment under WTO regime, held at CIRG Makhdoom, w.e.f. Feb 3-5, 2007.

Hari Prasad

National seminar on "Emerging diseases of small ruminants and their containment under WTO regime" held at CIRG, Makhdoom, organized by Indian Society for Sheep and Goat Production and Utilization from 3-5 February, 2007.

National Seminar on Innovations and Recent Advances in Reproduction for Augmenting Small Ruminant Production December, 28-30, 2006 CSWRI, Avikanagar organized by Indian Society for Sheep and Goat Production and Utilization.

Scientist Meet on Network Project on Sheep Improvement held at NTRS Gadsa of CSWRI between Sept. 11-12, 2006.

H.S. Sisodiya

Hindi Karyashala held at Central Institute for Research on Goats, Makhdoom on 5-6 May, 2006.

National seminar on "Emerging diseases of small ruminants and their containment under WTO regime", held at C.I.R.G., Makhdoom (Mathura) on February, 3-7, 2007.

H.K. Himkar

National Seminar on emerging diseases of small ruminants and their containment under WTO regime, held at CIRG Makhdoom, w.e.f. Feb 3-5, 2007.

Khushyal Singh

Hindi Karyashala held at Central Institute for Research on Goats, Makhdoom on 5-6 May 2006.

National Seminar on Innovation and recent Advances in Reproduction for Augmenting Small Ruminants Production on December 28-30, 2006 held at C.S.W.R.I., Avikanagar (Rajasthan).

A National Seminar on Emerging Diseases of Small Ruminants and their containment under WTO Regime on February 3-6, 2007, held at CIRG, Makhdoom, Farah, Mathura.

M.K. Singh

National Seminar on Innovations and Recent Advances in Reproduction for Augmenting Small Ruminant Production December, 28-30, 2006 CSWRI, Avikanagar organized by Indian Society for Sheep and Goat Production and Utilization.

National Seminar on emerging diseases of Small Ruminants and Their Containment Under WTO Regime" February 3-5, 2007. C.I.R.G, Makhdoom, Mathura, (U.P) organized by Indian Society for Sheep and Goat Production and Utilization.

National Symposium on ISAPM held at GB Pant University Pantnagar 20-22 April, 2006.

M.P. Agrawal

National seminar on "Emerging diseases of small ruminants and their containment under WTO regime" held at CIRG, Makhdoom, organized by Indian Society for Sheep and Goat Production and Utilization from 3-5 February, 2007.

N.K. Sinha

Hindi Workshop-Organized at CIRG, Makhdoom on May 5-6, 2006.

National Seminar Organized by ISBD (Indian Society for Buffalo Development) on Buffalo for rural upliftment held at Vet. College, Mumbai on May 27-30, 2006.

National Seminar on Innovations and Recent Advances in Reproduction for Augmenting Small Ruminant Production, held at CSWRI, Avikanagar on Dec. 28-30, 2006.

National Seminar on Emerging Diseases of Small Ruminants and their containment under WTO regime, held at CIRG, Makhdoom on Feb. 3-5, 2007, Organized by Indian Society for Sheep and Goat Production and Utilization.

Seminar on Conservation of Jamunapari breed-held at CIRG, Makhdoom on 28.02.2007.

N.P. Singh

Hindi Workshop-Organized at CIRG, Makhdoom on May 5-6, 2006.

National Symposium on Buffalo for Rural Upliftment and Annual Convention of Indian Society of Buffalo Development Board held at Bombay Veterinary College, Mumbai on May 27-30, 2006.

NAIP Workshop held at NDRI, Karnal on August 26, 2006.

Scientist Meet of AICRP on Sheep Improvement held at NTRS, Garsa (HP) on Sept. 11-12, 2006.

Seminar on Conservation of Threatened Breed-Jamunapari Goat in U.P. held at Lucknow on Sept. 27-28, 2006.

India-Afganistan International Symposium on Deserts and Desertification held at NASC on Nov. 20-21, 2006.

National Symposium on Innovations and recent advances in reproduction for augmenting small ruminant production held at CSWRI, Avikanagar on Dec. 28-30, 2006.

IX Indian Agricultural Scientists and Farmers Congress organized by Bioved Research and Communication Centre at Prayag, Allahabad on Jan. 29-30, 2007.

National Seminar on Emerging and re-emerging diseases of small ruminants and their containment under WTO regime organized by ISSGPU and CIRG at Makhdoom on Feb. 2-4, 2007.

ASCAD Symposium on strengthening disease diagnostic facilities for sustainable livestock and poultry development held at Udaipur on March 10-11, 2007.

3rd International Conference on linking markets and farmers organized by ISAP at New Delhi on March 12-13, 2007.

N. Ramachandran

National seminar on "Emerging diseases of small ruminants and their containment under WTO regime" held on February 3-7, 2007 at CIRG, Makhdoom.

P.K. Rout

Hindi workshop held during May 5-6, 2006 at CIRG, Makhdoom.

Workshop on "DNA sequencing and Real-time PCR technology", July 20-21, 2006, Applied Biosystem, Lab India, Gurgaon.

Refresher course on "Information technology in agriculture for effective decision support, October 4-24,2006, NAARM, Hyderabad.

National Seminar on Innovations and Recent Advances in Reproduction for Augmenting Small Ruminant Production held at CSWRI, Avikanagar organized by Indian Society for Sheep and Goat Production and Utilization on December, 28-30, 2006.

National Seminar on emerging diseases of Small Ruminants and Their Containment Under WTO Regime February 3-5, 2007 at C.I.R.G, Makhdoom, Mathura, (U.P) organized by Indian Society for Sheep and Goat Production and Utilization.

Seminar on "Improvement and conservation Jamunapari goat in its home tract" held on February 13, 2007, Etawah, UP.

Puneet Kumar

National Seminar on Innovations and Recent Advances in Reproduction for Augmenting Small Ruminant Production at Central Sheep and Wool Research Institute, Avikanagar, Via Jaipur Rajasthan-304 501 from 28-30 December 2006

National Seminar on "Emerging diseases of small ruminants and their containment under WTO regime" at Central Institute for Research on Goats, Makhdoom,Farah, Mathura, U.P. from February 3-5, 2007

P.K. Sahoo

Workshop on appication of MATLAB &

Teaching Research on April 29-30 at Hindustan College, Farah, Mathura.

6th Indian Veterinary Congress held OUAT, Bhubneshwar on 6-7th April, 2007.

6th Bienial Conference of Animal Nutrition Association from 15-17 September, 2006 held at Jammu.

National Symposium on Small Ruminant Production held at CSWRI, Avikanagar 28-30 December, 2006.

National Seminar on "Emerging diseases of small ruminants and their containment under WTO regime" at Central Institute for Research on Goats, Makhdoom,Farah, Mathura, U.P. from February 3-5, 2007.

Prabhat Tripathi

National Seminar on "Emerging diseases of small ruminants and their containment under WTO regime" at Central Institute for Research on Goats, Makhdoom,Farah, Mathura, U.P. from February 3-5, 2007.

R.L. Sagar

Hindi Karyashala held at Central Institute for Research on Goats, Makhdoom on 5-6 May, 2006.

A National Seminar on Emerging Diseases of Small Ruminants and their containment under WTO Regime on February 3-6, 2007, held at CIRG, Makhdoom, Farah, Mathura.

R. Rana

XIII annual conference of IAAVR, held at Orissa Veterinary College, Bhubaneshwar, Orissa w.e.f. 6-7 April, 2006.

Hindi workshop held at CIRG, Makhdoom w.e.f. 5-6 May, 2006.

National Seminar on emerging diseases of small ruminants and their containment under WTO regime, held at CIRG Makhdoom, w.e.f. Feb 3-5, 2007.

R. Roy

Hindi workshop held at CIRG, Makhdoom on 5-6 May, 2006.

National seminar on "Emerging diseases of small ruminants and their containment under WTO regime" held at CIRG, Makhdoom, organized by Indian Society for Sheep and Goat Production and Utilization from 3-5 February, 2007.

National symposium on "Role of animal genetic resources in rural livelihood security" held at Ranchi College of Veterinary Science & Animal Husbandry, Birsa Agricultural University, Ranchi, from 8-9 Feb., 2007.

R.P. Mishra

Hindi workshop held at CIRG, Makhdoom on 5-6 May, 2006.

National Seminar on "Emerging diseases of small ruminants and their containment under WTO regime" at Central Institute for Research on Goats, Makhdoom,Farah, Mathura, U.P. from February 3-5, 2007.

R.S. Upadhyaya

Hindi workshop held at CIRG, Makhdoom on 5-6 May, 2006.

6th Bienial Conference of Animal Nutrition Association from 15-17 September, 2006 held at Jammu.

National Seminar on "Emerging diseases of small ruminants and their containment under WTO regime" at Central Institute for Research on Goats, Makhdoom, Farah, Mathura from Feb. 3-5, 2007.

R.B. Sharma

Hindi workshop held at CIRG, Makhdoom on 5-6 May, 2006.

National Conference on Dairy Association at Calcutta on 23-25 November, 2006.

National Symposium on Small Ruminant Prodcution held at CSWRI, Avikanagar on 28-30 December, 2006.

National Seminar on "Emerging diseases of small ruminants and their containment under WTO regime" at Central Institute for Research on Goats, Makhdoom,Farah, Mathura, U.P. from February 3-5, 2007.

Saket Bhusan

Hindi workshop held at CIRG, Makhdoom on 5-6 May, 2006.

National seminar on "Emerging diseases of small ruminants and their containment under WTO regime", from February 3-5, 2007 at CIRG, Makhdoom organized by Indian Society for Sheep and Goat Production and Utilization.

Shalander Kumar

Hindi Karyashala held at Central Institute for Research on Goats, Makhdoom on 5-6 May, 2006.

National Seminar on Innovation and recent Advances in Reproduction for Augmenting Small Ruminants Production on December 28-30, 2006 held at C.S.W.R.I., Avikanagar (Rajasthan).

A National Seminar on Emerging Diseases of Small Ruminants and their containment under WTO Regime on February 3-6, 2007, held at CIRG, Makhdoom, Farah, Mathura.

S.D. Kharche

Hindi workshop held at CIRG, Makhdoom on 5-6 May, 2006.

Annual convention of ISBD and National symposium on Buffalo for Rural upliftment from 27th-30th May, 2006 at Bombay Veterinary college, Parel, Mumbai.

Seminar on "Conservation of threatened breed-jamunapari goat" organized by Animal husbandary department of UP State from 27-28th September, 2006 at Lucknow.

National seminar on "Innovations and Recent Advances in Reproduction for Augmenting Small Ruminant Production from 28th-30th, December, 2006 at CSWRI, Avikanagar.

National seminar on "Emerging Diseases of Small ruminants and their Containment under WTO regime" from 3rd-5th, February, 2007 at CIRG Makhdoom, Farah (Mathura) UP.

S.K. Jindal

Hindi workshop held at CIRG, Makhdoom on 5-6 May, 2006.

National seminar on "Innovations and Recent Advances in Reproduction for Augmenting Small Ruminant Production from 28th-30th, December, 2006 at CSWRI, Avikanagar (Rajasthan).

National seminar on "Emerging Diseases of Small ruminants and their Containment under WTO regime" from 3rd-5th, February, 2007 at CIRG Makhdoom, Farah (Mathura) UP.

S.K. Singh

Hindi workshop held at CIRG, Makhdoom on 5-6 May, 2006.

National Workshop on Biodiversity Awareness, Resource and Conservation at NBAGR Karnal, April 22-23, 2006.

Workshop on Application of MATLAB Techniques in Research. At Hindustan College of Science and Technology, Farah, Mathura, held on April. 29-30, 2006.

Scientist Meet on Network Project on Sheep Improvement held at NTRS Garsa of CSWRI, Sept. 11-12, 2006

30th Animal Husbandry Commissioners of Asia and Pacific of FAO meeting held at LAO, PDR, October 24-25, 2006.

S.V. Singh

Hindi workshop held at CIRG, Makhdoom on 5-6 May, 2006.

Seminar on Conservation threatened breed of Jamunapari from 27-29 September, 2006 at Lucknow.

National Seminar on emerging diseases of small ruminants and their containment under WTO regime, held at CIRG Makhdoom, w.e.f. Feb 3-5, 2007.

T.K. Dutta

Hindi workshop held at CIRG, Makhdoom on 5-6 May, 2006.

Seminar on Conservation threatened breed Jamuna-pari on 27-29 Sepetember, 2006 at Lucknow.

National Seminar on "Emerging diseases of small ruminants and their containment under WTO regime" at Central Institute for Research on Goats, Makhdoom,Farah, Mathura, U.P. from February 3-5, 2007.

V.K. Gupta

Hindi workshop held at CIRG, Makhdoom w.e.f. 5-6 May, 2006.

National Symposium on Buffalo for rural upliftment and Annual Convention of Indian Society of Buffalo Development. Bombay Veterinary College, 27th-30th May 2006.

National Seminar on Patenting in Biotechnology, NRDC, New Delhi 19th Oct 2006.

National seminar on " Innovations and recent advances in reproduction for augmenting small ruminant productions" at CSWRI Avikanagar, 28-30 Dec 2006.

National Seminar on emerging diseases of small ruminants and their containment under WTO regime, held at CIRG Makhdoom, w.e.f. Feb 3-5, 2007.

Vinod K.Gupta

Hindi workshop held at CIRG, Makhdoom on 5-6 May, 2006.

National Seminar on emerging diseases of small ruminants and their containment under WTO regime, held at CIRG Makhdoom, w.e.f. Feb 3-5, 2007.

V.S. Vihan

Hindi workshop held at CIRG, Makhdoom w.e.f. 5-6 May, 2006.

National seminar on "Innovations and recent advances in reproduction for augmenting small ruminant productions" at CSWRI Avika nagar, 28-30 Dec 2006.

National Seminar on emerging diseases of small ruminants and their containment under WTO regime, held at CIRG Makhdoom, w.e.f. Feb 3-5, 2007.

National Symposium on Management strategies held Pantnagar on 26-28 February, 2007.

U.B. Chaudhary

Hindi workshop held at CIRG, Makhdoom on 5-6 May, 2006.

National Seminar on "Emerging diseases of small ruminants and their containment under WTO regime" at Central Institute for Research on Goats, Makhdoom, Farah, Mathura (UP) from Feb. 3-5, 2007.

BULLETINS PUBLISHED

1. Singh SV and Singh NP. 2007. Diagnosis of Para tuberculosis ELISA KIT SERUM AND MILK for Goats, Sheep, Buffaloes and Human beings-a Bulletin.
2. Singh SV and Singh NP. 2007. Molecular diagnosis of Para tuberculosis CULTURE KIT (faeces, issues, milk, blood, vaginal secretions) Goats, Sheep, Cattle, Buffaloes, Blue Bulls and Human beings-a Bulletin.
3. Singh SV and Singh NP. 2007. Molecular Diagnosis of Mycobacterium avium subspecies Para tuberculosis (The cause of Johne's disease in animals and Crohn's disease in human beings) IS 900 PCR from: Faeces, Tissues, Milk, Culture, Vaginal Discharges and Serum-a Bulletin.

PROGRAMMES PROPOSED FOR XI PLAN

1. Evaluation, conservation and genetic improvement of goats through conventional and molecular approaches.
2. Development of resource based feeding systems for goats.
3. Improving productive and reproductive efficiency through physiological and nutritional interventions.
4. Management of goat diseases using state of the art technologies.
5. Facilitating adaptation of goat to impending climate change.
6. Post harvest processing, value addition and marketing of goat products.
7. Technology showcasing, dissemination and adoption.

RAC, IRC, QRT MEETINGS

RESEARCH ADVISORY COMMITTEE (RAC)

1.	Dr. A.T. Sherikar Vice Chancellor Maharastra Animal & Fishery Science University, Nagpur	Chairman
2.	Dr. H.N. Singh Ex. Dean, Pt. Deen Dayal UP. Pashu Chikitsa Vigyan Vishwa Vidhyalay Evam Go Anusandhan Mathura.	Member
3.	Dr. B.C. Pantnayak Ex. Director CSWRI, Avikanagar	Member
4.	Dr. P.S. Lonkar, Director (Extension) Maharastra Animal & Fishery Science University, Nagpur	Member
5.	ADG (AN&P) ICAR, Krishi Bhavan, New Delhi	Member
6.	Dr. B.U. Khan, Ex. Director CSWRI, Avikanagar	Member
7.	Shri Ashok Kale, Representative Agricultural/Rural Interest	Member
8.	Shri Sayaed G.H. Rizwi, Representative Agricultural/Rural Interest	Member
9.	Dr. N.P. Singh Director, CIRG, Makhdoom	Member
10.	Dr. N.K. Sinha PS & I/C PME Cell	Member Secretary

Fourteenth Research Advisory Committee meeting was held on Dec. 26-27, 2006 and several important decisions were taken. The RAC Meeting was held under the chairmanship of Dr. A.T. Sherikar, Chairman and other members including Dr. B.C. Patnayak, O.P. Dandha, H.N. Singh, Dr. P.S. Lonkar, Dr. B.U. Khan, Sh. Ashok Kale, Sayaed Garul Hassan Rizwi. Dr. N.P. Singh, Director CIRG and Dr. N.K.Sinha acted as Member Secretary. The valuable recommendations/suggestions to establishmrnt four Regional Research

Centres of the Institute to work on the goat breeds of different regions and a Model Goat Farm at the Institute where all the improved technologies developed by the Institute should be demonstrated. Research on evaluation of goat milk, meat and skin quality as affected by age, feed and breed and development of value added products may be continued at the Institute. Artificial insemination may be adopted as a routine practice for breeding the goats maintained under different Projects at the Institute.The Transfer of Technology programme of the Institute may be strengthened and a few Model Goat Villages may be developed by saturating with the technologies developed by the Institute.

INSTITUTE RESEARCH COMMITTEE (IRC)

The Annual SRC meeting for the year 2006-2007 was held to review the progress of ongoing research projects and discussion on proposed new projects on May14-19, 2007 under the Chairmanship of Dr. N.P.Singh, Director, CIRG. Dr. N.K. Sinha acted as the Member Secretary. All the Scientists and Technical Officers participated in the Meeting. The Chairman in his deliberation given valuable suggestions/recommendations on the ongoing Projects.The new Project Proposals for XI Plan were presented, discussed and approved. Suggestions were also given to modify some proposals in the light of discussion.

INSTITUTE MANAGEMENT COMMITTEE (IMC)

1.	Dr. N.P. Singh	Director and Chairman
2.	Shri Ashok Kale	External Member
3.	Shri Sayaed G.H. Rizwi	External Member
4.	Dr. S.K. Garg	Member (Ex. VC. Pt. Deen Dayal Upadhyay Pashu Vigyan Vishwa Vidhyalay Mathura.
5.	Dr. N.K. Sinha	Principal Scientist & I/C PME Section
6.	Dr. Dharm Singh	Principal Scientist
7.	Dr. N. Kondaiah	Director, NRC on Meat, Hyderabad
8.	Dr. A.L. Arora	Principal Scientist, CSWRI, Avikanagar
9.	Shri S. Philipose	F&AO, CIRG and Special Invitee
10.	Shri K.K.Hamza	F&AO, IASRI, New Delhi
11.	Director, Animal Husbandry Govt. of U.P., Lucknow	Member
12.	Director, Animal Husbandry Govt. of Uttaranchal	Member
13.	Shri Kumar Vivek	AO, CIRG & Member Secretary

The Institute Management Committee meeting was held on 27.01.2007. The meeting was attended by most of the Members of the IMC and Chaired by Dr. N.P. Singh, Director, CIRG. Several important decisions were taken at the meeting and to review the progress of ongoing projects and other important matters related to the development of the Institute. The meeting ended with a vote of thanks to the Chair.

PERSONNEL

Name	Designation
Dr. N.P. Singh	Director
Goat Genetics and Breeding Division	
Dr. R. Roy	Principal Scientist & I/C, Head
Dr. S.K. Singh	Sr. Scientist
Dr. Gopal Dass	Sr. Scientist
Dr. Saket Bhushan	Sr. Scientist
Dr. P.K. Rout	Sr. Scientist
Dr. M.K. Singh	Sr. Scientist
Dr. A. Mondal	Scientist (Sr. Scale)
Dr. B. Rai	Sr. Scientist
Shri Bhagwan Singh	Technical Officer T-6
Shri. M.P. Agarwal	Technical Officer T-5
AICRP on Goats	
Dr. S.K. Singh	Sr. Scientist (upto 11.02.2007)
Dr. B. Rai	Sr. Scientist (w.e.f.12.02.2007)
AICRP on Sheep	
Dr. Gopal Dass	Sr. Scientist
Dr. Hari Prasad	Technical Officer T7-8
Physiology, Reprolduction and Shelter Management	
Dr. S.K. Jindal	Principal Scientist & I/C, Head
Dr. R.P. Misra	Principal Scientist
Dr. N.K. Sinha	Principal Scientist
Dr. Dharm Singh	Principal Scientist
Dr. D.K. Nandy	Principal Scientist
Dr. A.K. Goel	Sr. Scientist
Dr. Puneet Kumar	Sr. Scientist
Dr. S.D. Kharche	Sr. Scientist
Mrs. Neeru (on deputation to UPCAR, Lucknow)	Scientist (Sr. Scale)
Dr. N. Ramachandran	Scientist
Mr. H.K. Himkar	Technical Officer T-5
Nutrition, Feed Resourfces and Product Technology Division	
Dr. Nawab Singh	Principal Scientist & I/C, Head (Superanuated on Dec.31, 2006)
Dr. R.S. Upadhayay	Principal Scientist & I/C, Head (wef Jan.1st, 2007)
Dr. M.K.Agnihotri	Sr. Scientist (on deputation to Min. of Agril.)
Dr. U.B. Chaudhary	Sr. Scientist
Dr. T.K. Dutta	Sr. Scientist

Dr. P.K. Sahoo	Sr. Scientist
Dr. R.B. Sharma	Sr. Scientist
Dr. Prabhat Tripathi	Scientist (Sr. Scale)
Dr. V. Rajkumar	Scientist (on study leave)
Dr. A.K. Dass	Scientist (FOCARS training from 1st Jan. 2007)
Mr. Dinesh Prasad	Technical Officer T-6

Goat Health Division

Dr. V.S. Vihan	Principal Scientist & I/C, Head
Dr. D.K. Sharma	Sr. Scientist
Dr. S.V. Singh	Sr. Scientist
Dr. V.K. Gupta	Sr. Scientist
Dr. Ashok Kumar	Sr. Scientist
Dr. Rajneesh Rana	Sr.Scientist
Dr. R.K. Vaid	Scientist (Sr. Scale) (Transferred to NRCVTC, HISSAR)
Dr. Sanjay Barua	Scientist (Sr. Scale) (Transferred to NRCVTC, HISSAR)
Dr. V.K. Gupta	Veterinary Officer T-7
Dr. H.A. Tiwari	Veterinary Officer T-7

Extension Education and Socio-Economics Section

Dr. R.L. Sagar	Principal Scientist & I/C
Dr. Braj Mohan	Sr. Scientist
Dr. Shalander Kumar	Sr. Scientist
Dr. Khushyal Singh	Scientist
Mr. Suresh Tiwari	Technical Officer T-6
Mr. U.C. Yadav	Technical Officer T-5

Education and Research Coordination Section

Dr. N.K. Sinha	Principal Scientist & I/C
Dr. H.S. Sisodiya	Technical Officer T7-8

Agriculture Research Information Section

Dr. S.K. Singh	Sr. Scientist & I/C
Mr. V.P. Singh	Technical Officer, T-5

Human Dispensary

Dr. V.K. Gupta	Sr. Medical Officer
Mr. C.B. Pandey	Technical Officer T-6

Library

Dr. Pratap Singh	Technical Officer T-7

Agri. Farm

Dr. T.K. Dutta	Sr. Scientist& I/C
Mr. Indra Pal	Technical Officer T-6

Administrative

Shri Kumar Vivek	Administrative Officer
Shri N.R. Verma	Asstt. Admn. Officer (Transferred to IGFRI, Jhansi)
Shri H.S. Sharma	Asstt. Admn. Officer
Shri Ratan Singh	Asstt. Admn. Officer
Shri S.R. Achary	Private Secretary

Audit & Accounts Section

Shri S. Philipose	Finance & AccountsOfficer

PERSONNELIA

Transfers:

1. Mr. N.R. Verma AAO was transferred on promotion to IGFRI Jhansi.
2. Mr. Patendeen Carpenter was transferred on request to IISR Luchnow.
3. Dr. R.K. Vaid Scientist was transferred to National Research Centre for Vety. Type Culture, Hissar.
4. Dr. Sanjay Barua Scientist was transferred to National Research Centre for Vety. Type Culture, Hissar.

Joinings:

1. Mr. Manik Pal joined as Jr. Engineer (Civil).
2. Mr. Pravesh Sethi joined as Jr. Computer Operator.
3. Mr. Pushpendra Kumar joined as Security Officer.
4. Mr. Bharat Rishi Kishore joined as Jr. Clerk.
5. Mr. Arun Kumar joined as Jr. Steno.
6. Mr. Gulab Singh joined as S.S.Gr.I.

Retirements:

1. Dr. Nawab Singh, Pri. Scientist retired on superannuation on 31.12.2006
2. Mr. Laxman Babu, T4 retired on superannuation on 31.01.2007.

Assessment Promotions:

1. Mr.Dori Lal Promoted from T4 to T5.
2. Mr. Jagdish Singh Promoted T4 to T5.

RESEARCH PROJECTS

Sl. No.	Proj. No.	Title of the Project	Investigators	Date of start	Date of completion
GENETICS & BREEDING DIVISION					
1.	GGB-1.09	Improvement of sire evaluation of Jamunapari goats for milk & meat production (AICRP-Jamunapari).	M.K. Singh and T.K.Dutta	1997-98	March 2002 (To continue)
2.	GGB-1.10	Genetic improvement of Barbari goats for meat & milk production (AICRP-Barbari)	S.K. Singh and P.K. Rout	1997-98	March 2002 (To continue)
3.	GGB-1.11	Conservation and improvement of Jamunapari goats in their home tract (AICRP-Field Unit).	P.K. Rout, S. Bhusan and R.Roy	1997-98	March 2002 (To continue)
4.	GGB-1.16	Evaluation of flock dynamics, Production performance and management systems of Gohillwadi and Zalawadi goats in their home tract	M..K. Singh, B. Rai, S.K. Singh, 16.. Kumar & M.B. Simariya	July 04	March,2007
5.	GGB-1.17	Genetic Evaluation and improvement of Jakhrana Breed through open Nucleus breeding system (ONBS)	S. Bhusan, S.K. Singh & B. Rai	June 2005	June 2010
6.	GGB-1.18	Study of goat production systems in different agro-climatic regions in India.	B. Rai, M.K. Singh, Units of AICRP (G), R. Roy.	Sept. 2005	Sept. 2009
7.	CIRG-2.10	AICRP on Sheep Improvement.	Gopal Das & Hari Prasad	1997-98	To continue
GOAT HEALTH DIVISION					
8.	GH-15.24	Evaluation of medicinal plants for the control of neonatal dirrhoea.	A. Kumar, R. Rana and V.S. Vihan	Nov. 04	Nov. 07
9.	DST	Development of a novel herbal ectoparasiticidal product.	V.S. Vihan, A. Kumar and D.K. Sharma.	Aug. 03	March 2007

10.	CST	Molecular Diagnosis of John's disease of Goats by PCR & DNA process.	S.V. Singh	Nov. 2003	Oct., 2006
11.	Collabo. CIRG-DSIR	Development of inactivated vaccine using native isolates of Mycobacterium avium subsp. Paratuberculosis against Johne's disease in goats and sheep.	S.V. Singh and V.K. Gupta	Jan.,2005	Sept.2007
12	GH-15.25	Development of Molecular Diagnostic for the control of Mycoplasmal Mastitis/Agalactia in Goats.	R. Rana, V. S. Vihan, P.K. Rout and A. Kumar.	July 2005	March. 2007
PHYSIOLOGY, REPRODUCTION AND SHELTER MANAGEMENT DIVISION.					
13.	PRSM-2.17	In-vitro production of caprine embryo their survival following fresh & frozen embryo transfer.	S.D. Kharche, A.K. Goel, S.K. Jindal and N.K. Sinha.	Oct. 2002	Sept. 2006
14.	PRSM-2.18	Effect of Freeze-thawing of goat semen at different spermatozoal density on cell viability, keeping quality (storage), microbial contaminants and fertility.	N.K. Sinha, S.D. Kharche, V.K. Gupta and N. Ramachandran.	Oct. 2003	March, 2007
15.	PRSM-2.20	Use of ultrasonography for ascertaining pregnancy related profiles in goats.	A.K. Goel, S.D. Kharche, S.K. Jindal & D.K. Nandy	Dec., 2004	March, 2007
16.	PRSM-2.21	Effect of dietary restriction and realimentation on growth and carcass characteristics in kids.	Dharm Singh, N. Ramchandran, Puneet Kumar and R. B. Sharma	March, 2005	Feb., 2008
NUTRITION, FEED RESOURCES AND PRODUCTS TECHNOLOGY DIVISION.					
17.	GN-4.14	Design and development of machineries for fodder production, conser-vation and processing of feed for commercial goat farming.	P.K. Sahoo, R.P. Misra & TK. Dutta	Sept. 2001	Sept. 2006

18.	GN-4.15	Nutritional evaluation of common goat feeds available in grazing area/range lands with special reference to discount factors and rumen metabolism.	R.S. Upadhyaya & P. Tripathi.	Dec. 2002	March 2007
19.	AP Cess Fund	Development of supplementation strategies for goats under field condition.	T.K. Dutta, P. Trapathi & Nawab Singh.	Apr., 2004	Aug. 2007
20.	AICRP	AICRP on "Improvement of feed resources and nutrient utilization in raising animal production".	U.B. Chaudhary, Nawab Singh and S.D. Kharche.	2004	Nov.2007
21.	AP Cess Fund	Isolation & identification of efficient exotic fungi for improvement of pasture/fibre digestibility in goats.	U.B. Chaudhary & V.K. Gupta	Nov., 2004	Oct., 2007 Extend.for one year
22.	GPT-6.04	Studies on milk composition in different breeds and its utilization for Paneer making.	R.B. Sharma & A.K.Das (6 Months)	July, 2005	March, 2007
23.	GN-4.18.	Studies on Agro-forestry system for sustainable goat production.	P. Tripathi, R.S. Upadhyaya & T.K. Dutta.	July 2005	March 2007
EXTENSION EDUCATION AND SOCIO ECONOMICS SECTION.					
24.	AP Cess fund	Commercialization of goat farming & marketing of goats in India.	Shalander Kumar & R.K. Vaid	Nov.,2004	March. 2007
25.	TOT Proj. EESE/ 8.14	Multi-disciplinary Project on Transfer of Technology for sustainable Goat Production System.	N. P. Singh, Shalender Kumar, M.K. Singh, Dharm Singh, A.K. Goel, R.S. Upadhyaya, R.B. Sharma, A. Kumar, B. Rai, H.A. Tewari and Khushyal Singh	July, 05	March, 2009