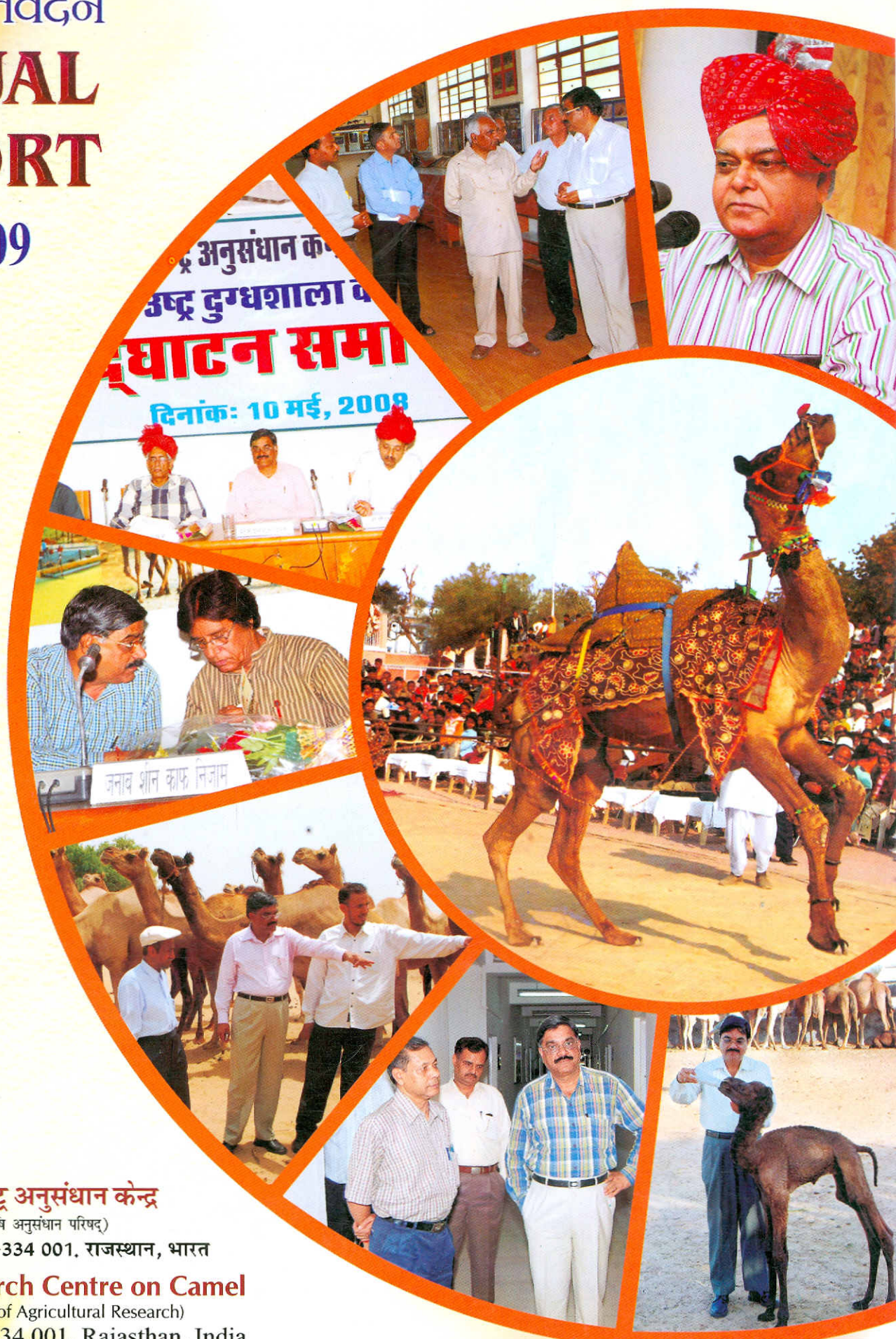


वार्षिक प्रतिवेदन  
**ANNUAL  
REPORT**

2008-09



**राष्ट्रीय ऊष्ट्र अनुसंधान केंद्र**

(भारतीय कृषि अनुसंधान परिषद्)

जोड़बीड़, बीकानेर-334 001, राजस्थान, भारत

**National Research Centre on Camel**

(Indian Council of Agricultural Research)

Jorbeer, Bikaner-334 001, Rajasthan, India



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**Published by**

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Director

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वार्षिक प्रतिवेदन

**ANNUAL REPORT**

**2008-2009**

निदेशक - प्रो. के.एम.एल. पाठक  
**Director - Prof. K.M.L. Pathak**



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## Preface



The camel is regarded as a heroic emblem of Rajasthan. It is also known as the *ship of the desert* due to its capability to survive under tough environmental conditions. The unique adaptability features make it far more superior to other livestock species in this region. Camels have great mobility on sandy terrain because of its body attributes such as height, shape, long legs and footpads. It is capable of sustaining on scarce vegetation and low water intake unlike other livestock species. Thousands of years of sustenance in harsh climatic conditions have made this animal very well adaptive to its ever changing natural habitat. Camels play a significant role in the rural economy and livelihood of many people in this region.

National Research Centre on Camel (NRCC) is a premier research institution responsible for the allround development and improvement of camels and socio-economic uplift of its keepers. The Centre made a modest beginning in July 1984 as a Project Directorate under ICAR and grew overtime into a full fledged Centre headed by a Director in 1995.

It gives me immense pleasure to present the Annual Report 2008-09 of this Centre before you. This Annual Report bears a special significance because it is being brought out in Silver Jubilee Year of the establishment of NRCC, Bikaner completing its glorious 25 years in July 2009.

The report highlights some of the glimpses of the research achievements made, new

methodologies developed, significant advisory and consultancy services offered by the Centre besides the dissemination of knowledge acquired by it. The scientists, technical personnel and other staff of the Centre have put up their best efforts to achieve the targets for this year.

The Centre has been conducting the studies based upon molecular biology to characterize different breeds of camel. The microsatellite primers known to be polymorphic in camelids were got synthesized and 40 microsatellite loci were successfully amplified by these primers. Maximum number of alleles were found in the Bikaneri followed by Jaisalmeri and Kachchhi breeds. An experiment was attempted to reduce the inter-calving period by mating she-camels during 30-70 days after calving in the same breeding season. The growth data was analysed from the year 2005-09 for the Bikaneri, Jaisalmeri, Kachchhi, Arab cross and Mewari breeds of Indian dromedary. The effect of breed and sex was largely non-significant. An attempt was made to study the effect of Lana (*Haloxylon salicornicum*) seed feeding to camel on palatability and nutrient utilization in arid region. It concluded that Lana seeds preferred in arid region by camel have shown fairly good digestibility and it may safely complement the conventional concentrate feed.

Out of the activities under report, the events organised for promotion of Rajbhasha need a special mention. Internationally acclaimed poet and critic Sheen Kaaf Nizam delivered a scintillating talk on quest of *Truth in Science*. His oratory and eloquence was spell binding and opened new vistas of thought and philosophy. On a similar occasion

Dr. A.K. Purohit, Professor of Plant Physiology and Director, Extension, RAU, Bikaner delivered a special lecture on the communicability of Hindi for scientific interactions. His talk was of bifold significance as the aspects of a biotic stress tolerance were synthesized with poetic portraits from Ramcharitmanas.

The establishment of first camel dairy of the country, as a symbol of transformation of camel from drought to dual purpose animal, is one of the prominent highlight of this year. It is coupled with the marketing of camel milk at Jaipur and Delhi under an MoU with RCDF. India Today group of publication in their famous weekly independent special August 25, 2008, page 72 has projected the achievement of NRCC and included in the list of *India's finest institution that make the nation work*. This is a great honour and recognition for NRC on Camel.

The year has witnessed an all time record growth in the number of foreign tourists,

underlining the realisation of vision of eco-tourism of NRCC, Bikaner

The growth and progress of NRCC would not have been possible without the constant support, guidance and blessings of Dr. Mangla Rai, Hon'ble Director General, ICAR and Secretary, DARE; Dr. K.M. Bujarbaruah, Deputy Director General (AS), Dr. C.S. Prasad, ADG (AN&P) and Dr. Lal Krishna, ADG (AH). NRCC family offer deep sense of gratitude to all of them.

The help rendered by Dr. Rajan Gupta, PS and Dr. Vineet Bhasin, PS is acknowledged with gratitude.

Hopefully the researchers, teachers, students, policy makers and other stake-holders will find this document interesting and useful.

**[Prof. K. M. L. Pathak]**  
**Director**

## विशिष्ट सारांश

भारतीय ऊँट की बीकानेरी, जैसलमेरी, कच्छी, अरब संकर एवं मेवाड़ी नस्लों के वर्ष 2005-09 के शारीरिक वृद्धि संबंधी आंकड़े विश्लेषित किए गए। इनमें नस्ल एवं लिंग का प्रभाव सांख्यिकी की दृष्टि से असार्थक था। संचयी वृद्धि विश्लेषण से ज्ञात हुआ है कि भारतीय उष्ट्र-नस्लों में करीब 22 वर्षों में लगभग 200 प्रतिशत समूह वृद्धि हुई तथा 100.95 प्रतिशत की वृद्धि अरब संकर के पशुओं में देखी गई। दुग्धकाल के माह से औसतन प्रतिदिन दुग्ध उत्पादन सार्थक रूप से भिन्न पाया गया। यह उत्पादन दुग्धकाल के तीसरे माह में उच्चतम (4783.54 मि.ली.) पाया गया। चौथे माह में दुग्ध उत्पादन तीसरे माह से कुछ कम तथा दूसरे माह से अधिक पाया गया। सामान्यतया सुबह के समय दुग्ध उत्पादन दोपहर एवं सायं की अपेक्षा अधिक आंका गया। दूध दुहने के सभी काल में पिछले थनों में आगे वाले थनों की अपेक्षा अधिक दुग्ध उत्पादन आंका गया। कैमेलिड के बहुरूपिक माइक्रोसैटेलाइट प्राइमर का संश्लेषण किया गया है। इन प्राइमरों को प्रयुक्त करते हुए 40 माइक्रोसैटेलाइट लॉकी का भारतीय उष्ट्र-नस्लों में सफलतापूर्वक परिवर्धन किया गया। इन पशुओं में 21 बहुरूपिक थे तथा शेष एकल रूपी के रूप में पहचाने गए। इन लॉकी में ऐलील की संख्या 2 से 7 थी। ये ऐलील बीकानेरी में सर्वाधिक (76) जबकि जैसलमेरी नस्ल में 74 तथा कच्छी नस्ल में 69 थे। बीकानेरी में प्रत्याशित विषमयुग्मजता विस्तार 0.18 से 0.815, जैसलमेरी में 0.31 से 0.816 तथा कच्छी में 0.15 से 0.796 था। उष्ट्र दूध से चीज उत्पाद बनाने के लिए प्रोटोकॉल मानकीकरण हेतु अनुसंधान किए गए।

बीकानेर जिले में सर्वेक्षण के दौरान यह ज्ञात हुआ कि अधिकांश ऊँट पालक (77.52 प्रतिशत) 4 साल की अवस्था में अपने पशु से काम लेना प्रारंभ करते हैं जबकि 22.

48 प्रतिशत उन्हें 3 वर्ष की आयु से भारवहन कार्य में प्रयुक्त करने लगते हैं। अधिकांश (76.82 प्रतिशत) नर ऊँटों को गाड़ा चलाने, खेती एवं अन्य कृषि कार्यों में प्रयुक्त किया जाता है जबकि 23.18 प्रतिशत मादाओं को भी इन कार्यों के निष्पादन हेतु काम में लगाया जाता है। ग्रामीण स्तर पर ऊँटों द्वारा गाड़ा चलाने से औसतन 350-450 रुपये प्रतिदिन की आय प्राप्त होती है परंतु यदि इन्हीं ऊँटों को शहर में गाड़ा चलाने हेतु प्रयुक्त किया जाए तो गांव की अपेक्षा अधिक आय प्राप्त होगी। ऊँटों के भारवाहक सामर्थ्य के आधार पर बिजली उत्पादित करने की ओर अनुसंधानिक प्रयास किए गए। इससे प्राप्त उत्साहवर्धक परिणाम को देखते हुए अपार संभावनाएं तलाशने हेतु प्रयास जारी हैं ताकि भविष्य में इस प्रजाति द्वारा आर्थिक सुधार लाने के साथ-साथ इसकी ऊर्जा का भी सदुपयोग किया जा सके। संसर्ग द्वारा मादाओं में त्वस-जनन अवधि के अंतराल को कम करने के प्रयोजन से त्वस-जनन पश्चात उसी प्रजनन ऋतु में 30-70 दिनों के दौरान संसर्गित करवाया गया। इस अनुसंधान से अभी तक प्राप्त परिणाम सकारात्मक एवं उत्साहजनक रहे हैं।

ऊँटों के बच्चों में पौष्टिक उपयोगिता, वृद्धि क्रिया एवं सीरम जैव रासायनिक रूपरेखा पर विभिन्न आहार प्रोटीन स्तर के प्रभावों का अध्ययन एक वर्ष तक किया गया। इस अनुसंधान में न केवल वृद्धि दर अधिक पाई गई बल्कि शुष्क पदार्थ, पचनीय प्रोटीन, एवं चयापचय ऊर्जा की आवश्यकताएं क्रमशः 40, 22 एवं 22 प्रतिशत तक कम हो गईं। ऊँटों के आधारभूत आहार के कुल नाइट्रोजन टीवीएफए, अमोनिया नाइट्रोजन एवं गैस उत्पादन इत्यादि प्राचल आंके गए जिसमें इनविट्रो गैस तकनीक के अन्तर्गत मक्की आहार को मानक के रूप में प्रयुक्त किया गया।

इनका 4,8,12,18,24 एवं 48 घंटे के समय-अंतराल पर उष्मायन से मानकीकरण किया गया। अध्ययन के भिन्न-2 समय अन्तरालों पर कुल नाइट्रोजन (मि.ग्रा. प्रतिशत) रूपरेखा अध्ययन में उष्मायन के 12 घंटे तक मोठ भूसे में मूंगफली भूसे की तुलना में अपेक्षाकृत उच्च नाइट्रोजन उत्पादन प्रदर्शित हुआ है। संपूर्ण नाइट्रोजन की मात्रा 8 व 12 घंटे के उष्मायन पश्चात मूंगफली भूसे की तुलना में सार्थक रूप से अधिक पाई गई। मोठ चारे में 48 घंटे तक का कुल गैस उत्पादन (मि.ली. प्रति 0.2 ग्राम) अभिलेखित किया गया। यह 4 घंटे में (13.58 मि.ली. प्रति 0.2 ग्राम डी. एम.) सार्थक रूप से उच्च पाया गया जबकि मूंगफली भूसे में उष्मायन के 8 एवं 12 घंटे पर यह महत्वपूर्ण रूप से उच्च था। शुष्क क्षेत्र में स्वाद एवं पौष्टिक उपयोगिता को ध्यान में रखते हुए ऊँटों को लाणा घास आहार के रूप में दी गई। अध्ययन से यह निष्कर्ष सामने आया कि लाणा घास को ऊँट चाव से खाते हैं। इसकी पचनीयता अच्छी है तथा यह परंपरागत सान्द्र आहार के स्थान पर सुरक्षित रूप से प्रयुक्त की जा सकती है।

जैसलमेरी ऊँटों में रक्त एवं शुक्रिय प्लाज्मा नमूनें द्वारा कैल्शियम, फॉस्फोरस, मैगनीशियम, सोडियम, पोटैशियम, कॉपर, जिंक, लोहा एवं मैगनीज जैसे विभिन्न घटकों के तुलनात्मक स्तर जानने हेतु अनुसंधान किए गए।

उष्ट्र प्रबन्धन की विभिन्न पालन पद्धतियों का अध्ययन कर ज्ञात हुआ है कि अर्द्ध गहन प्रबन्धन में औसतन वृद्धि दर गहन प्रबन्धन समूह की तुलना में सार्थक रूप से अधिक होती है। 180 दिनों बाद तुलनात्मक कुल शारीरिक भार प्राप्ति अर्द्ध गहन प्रबन्धन (56.23 किग्रा) में गहन प्रबन्धन (46.55 किग्रा) की अपेक्षा अधिक आंकी गई। अर्द्ध

गहन प्रबन्धन समूह में प्रथम समूह की तुलना में शारीरिक नाप संबंधी अवयवों में वृद्धि देखी गई।

फार्म क्षेत्र में 3 माह तक के नवजात उष्ट्र बछड़ों के रोग आपात, रूग्णता एवं मृत्यु दर आदि का रिकॉर्ड रखने हेतु एक अनुसंधान किया गया। इन उष्ट्र-बछड़ों में कुल 23.42 प्रतिशत मृत्यु दर आंकी गई जो मुख्यतः निमोनिया के कारण थी जबकि रूग्णता चीचड़ संक्रमण के कारण पाई गई।

ऊँटों में जीवाणु एवं फफूंद बीमारियों के सर्वेक्षण के अन्तर्गत कुल 78 जीवाणु प्रजातियां जिन्होंने त्वचा, स्तन, आंख, कान इत्यादि को संक्रमित किया था, में जीवाणु प्रतिरोधक परीक्षणों से पाया कि इनमें टेट्रासाइकलिन प्रतिजैविक सबसे अधिक (98.15 प्रतिशत) प्रभावी है। इसके उपरान्त को-ट्राइमोक्साजोल (78.20 प्रतिशत), सेफुक्साईम (58.97 प्रतिशत) फैलोक्साईम (53.85 प्रतिशत), लिंकोमाइसिन एवं क्लोक्सासिलीन (47.44 प्रतिशत) प्रभावशाली है।

राजस्थान के भिन्न-2 क्षेत्रों से रक्त नमूनें लेते हुए ट्रिपैनोसोमा इवान्सी रोग की रोकथाम हेतु पीसीआर आधारित रक्त लेप जांचें की गईं। केन्द्र द्वारा आयोजित विभिन्न स्वास्थ्य शिविरों में कोक्सीडियोसिस की जांच हेतु ऊँटों से मलीय नमूनें लिए गए। ऊँटों में खुजली रोग की रोकथाम हेतु विभिन्न गांवों के ऊँटों की त्वचा खुरचन जांची गई जिसमें मुख्यतः सारकोप्टिक स्केबाई का संक्रमण पाया गया। केन्द्र की चारा उत्पादन इकाई ने 11 हैक्टेयर फार्म क्षेत्र में 893 क्विंटल चारा उत्पादन किया है। लगभग 2500 चारा वृक्षों सहित कुल 4000 नए पौधे भी रोपित किए गए हैं। वर्ष भर में ग्रामना, धामण, मोठ, ग्वार व तारामीरा की बुवाई द्वारा लगभग 25 हैक्टेयर का चारागाह क्षेत्र केन्द्र के ऊँटों हेतु तैयार किया गया।



# 1

## Executive Summary

The growth data was analysed from the year 2005-09 for the Bikaneri, Jaisalmeri, Kachchhi, Arab cross and Mewari breeds of Indian dromedary. The effect of breed and sex was largely non-significant. The cumulative growth analysis indicated about 200 % herd growth in about 22 years in the Indian dromedary breeds except 100.95% growth in Arab-cross animals. The average daily milk production varied significantly with the month of lactation. Peak yield (4783.54 ml) was observed in the third month of lactation. Fourth month showed little decline from the peak yields followed by 2<sup>nd</sup> month. It was observed that the milk production from rear quarters remained higher during morning as well as evening. In general the production in morning was higher as compared to noon and evening and the production from rear teat was greater than front teat during all the times of milking. Microsatellite primers (43) known to be polymorphic in camelids were got synthesized. Using these primers, 40 microsatellite loci were successfully amplified in the Indian dromedary breeds. 21 were polymorphic and rests were monomorphic in the animals studied. Number of alleles at these loci ranged from 2 to 7. Maximum number of alleles were found in the Bikaneri (76) followed by Jaisalmeri (74) and Kachchhi (69) breeds. The expected heterozygosity ranged from 0.18 to 0.815 in Bikaneri, 0.31 to 0.816 in Jaisalmeri and 0.15 to 0.0.796 in Kachchhi. Experiments were conducted to standardize the protocol for making cheese from the camel milk.

A survey conducted in the Bikaner district has revealed that the most of the camel keepers (77.52 %) are putting their camels to work at an age of 4 years while only 22.48 % put them to work at 3 years of age. Mostly (76.82%) male camels are being used for carting, farming and other agriculture operations against 23.18% females being used for the same purpose. An average income of Rs. 350 - 450/- is generated per day from camels through carting at the village level. The per day income is more if the same camels for carting are made

to work in the city. The efforts to generate electricity through camel draught power have also been encouraging and thus continue to explore vast opportunities for viable and economically improved energy utilization from this species in future. An experiment was attempted to reduce the inter-calving period by mating she-camels during 30-70 days after calving in the same breeding season. The results have been encouraging so far.

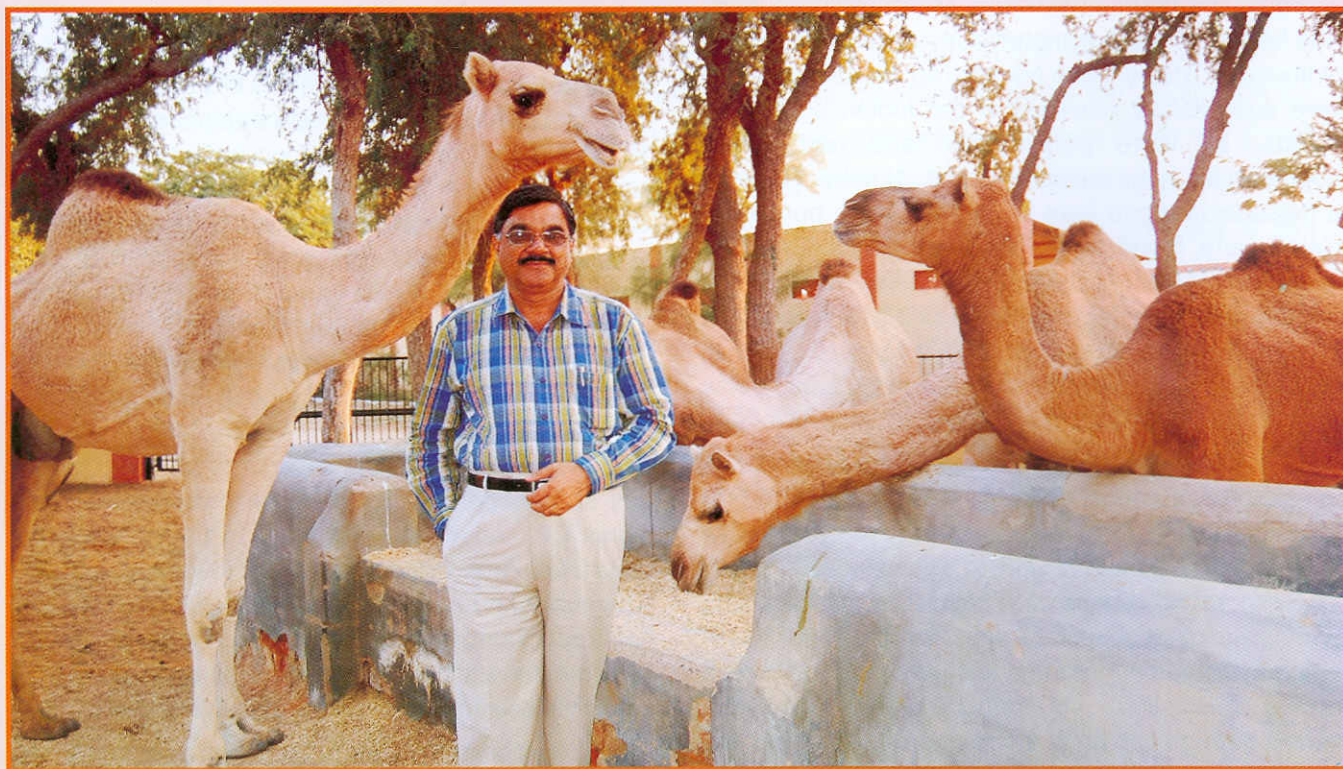
The effect of different dietary protein levels on nutrient utilization, growth performance and serum biochemical profile of camel calves was studied during a period of one year. Not only the growth rate was higher in this experiment, but the DM, DCP and ME requirements were also reduced by 40, 22 & 22 % respectively. Total N, TVFA, NH<sub>3</sub>-N and gas production etc. parameters in basal feed of camels were estimated by *in vitro* gas technique (IVGPT) fabricated with 50 ml saline bottle and three way cannula in quadruplicate with two set of blank and maize fodder as standard at 4, 8, 12, 18, 24 & 48 h time intervals of incubation. Total N was significantly higher ( $P < 0.01$  &  $0.05$ ) at 8 and 12 h in moth straw than the corresponding values of ground nut straw at same hrs. Total gas production (ml/0.2g DM) recorded up to 48 h was found to be significantly ( $P < 0.05$ ) higher at 4 h (13.58ml/0.2g DM) in moth straw while in ground nut straw it was significantly ( $P < 0.01$ ) higher at 8 & 12 h of incubation (14.40 & 6.81ml/0.2g). Result indicates that fermentation efficiency of moth straw is superior to groundnut straw due to its better *in vitro* characteristics, low fiber and higher CP. An attempt was made to study the effect of Lana (*Haloxylon salicornicum*) seed feeding to camel on palatability and nutrient utilization in arid region. The study concluded that Lana seeds preferred in arid region by camel have shown fairly good digestibility and it may safely replace the conventional concentrate feed.

Experiments were undertaken to compare the levels of various constituents in blood and seminal

plasma samples from the Jaisalmeri camels viz., Studies on camel rearing practices in different systems of management were undertaken. The average growth rate has significantly ( $P < 0.01$ ) increased in semi-intensive group ( $312.39 \pm 58.94$  gm / day) as compared to intensive management group ( $259.61 \pm 56.07$  gm / day). The comparative total body weight gain is found to be higher in semi-intensive management (56.23 kg) than intensive management (46.55 kg) after 180 days. The body length, heart girth, height at wither, hump circumference horizontal, neck length, leg length (front & hind) are significantly ( $P < 0.01$ ) increased in semi-intensive management group as compared to first group.

An experiment was conducted to record the disease incidence, morbidity and mortality occurring in neonatal camel calves till 3 months of age in the farm. A total of 23.42% mortality was noticed in camel calves below 3 months of age. Maximum mortality in neonatal camel calves (0-3 months) occurred due to pneumonia while morbidity was due to tick infestation. Antibiotic sensitivity of 78 bacterial isolates was observed from

skin, mammary gland, gastrointestinal tract, eye and ear infections which revealed an overall sensitivity of 98.15% against tetracycline, followed by co-trimoxazole (78.20%), cefuroxime (58.97%), cephaloxime (53.85%), lincomycin and cloxacillin (47.44% each) respectively. The blood samples of camels were collected from different areas of Rajasthan and examined for the prevalence of *Trypanosoma evansi* by blood smear and PCR based tests. Similarly faecal samples were collected from camels during health camps organized at different places to test the occurrence of coccidiosis. The skin scrapings were examined from camels of different villages to observe the prevalence of mange infection where *Sarcoptic scabei* mite was identified as the major cause of infection. The fodder production unit of the centre has produced about 893 quintals of green fodder from the farm area. About 4000 new plantations have been made including 2500 fodder trees. Gramana, dhaman, moth, guar and taramira was grown during the year to provide 25 h of grazing area for the camels of the centre.



# 2

## Introduction

### **Brief history**

On the recommendation of the National Commission of Agriculture (1976), the Government of India approved a Project Directorate on Camel under the auspices of ICAR during the last phase of VI Plan. The Project Directorate on camel started on 5<sup>th</sup> July, 1984 utilizing the physical facilities (149 camels of Bikaneri breed and around 824 ha land) of erstwhile camel breeding farm under the control of Sukhadia University, Udaipur. The physical facilities were transferred by Government of Rajasthan. Later on it was upgraded to National Research Centre on Camel (NRCC) on 20<sup>th</sup> September, 1995.



### **Location**

The Centre is located in the Jorbeer area of Bikaner city. The soil type is mostly loose and sandy. The climate is mostly dry and hot with an average annual rainfall of around 250 mm. The temperature ranges between 30 to 46 °C in summer and between 4 to 28 °C in winter season.

### **Mandate**

The Centre was started with the mandates of developing infrastructure and basic facilities for research on camel which were relevant for conservation and preservation of existing breeds of camel and generating baseline data. The existing modified mandates are,

- To undertake basic and applied research for improvement of camel.
- To provide leadership and coordinate camel research and training nationally and act as a national repository of information.
- To collaborate with national and international agencies for camel research and development.

The work of the Centre is being carried out by the camel breeding and genetics, physiology, biochemistry, reproduction, health, nutrition, management and extension, camel farming and agro-forestry units besides ARIS and PME cells.

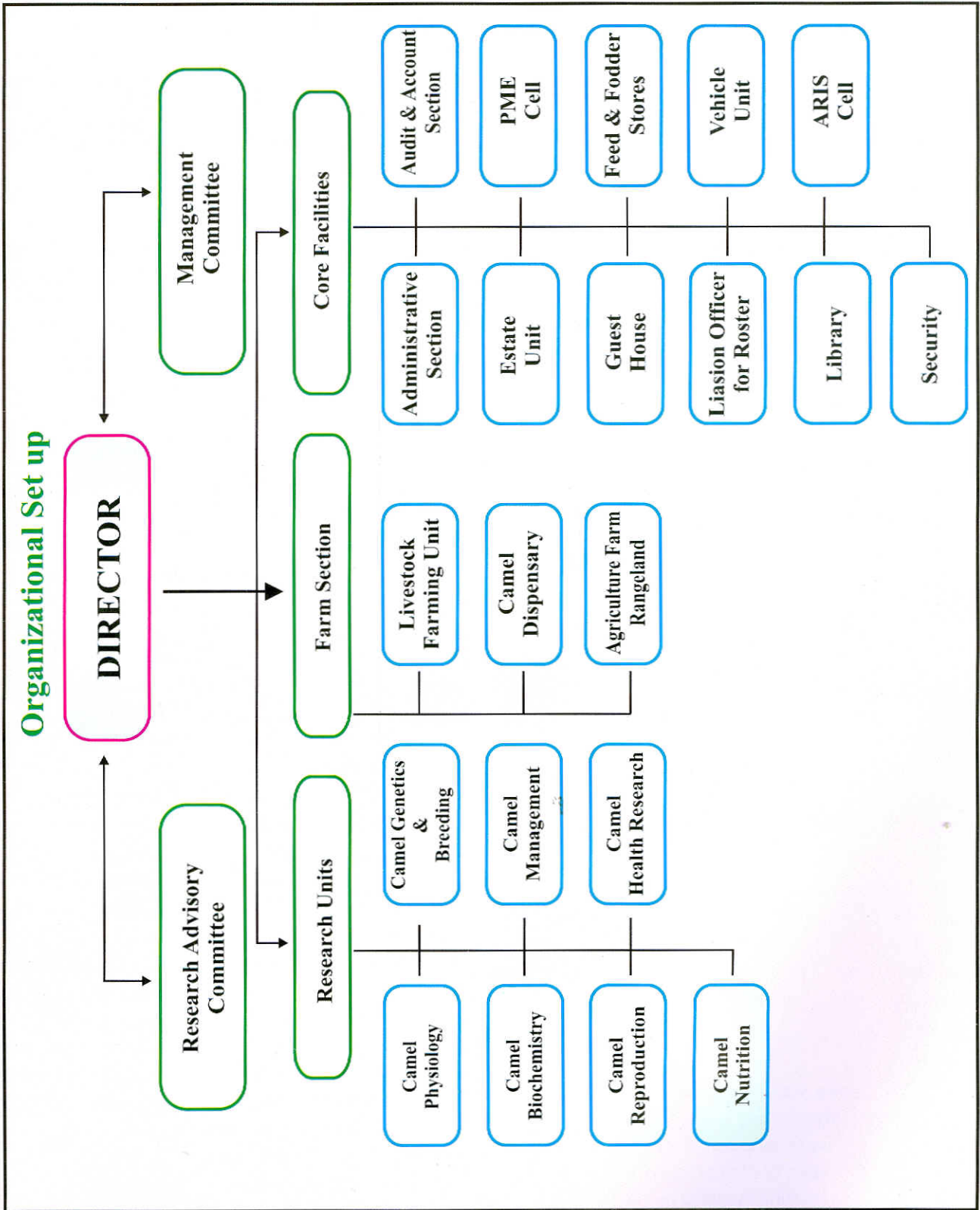
### **A unique institute**

Over the years, NRCC has developed excellent infrastructural facilities including modern laboratories and library.

The NRCC has modern laboratories situated in three complexes. The laboratories are fully equipped to handle modern research in the field of camel physiology, reproduction, biochemistry, genetics and breeding, health, nutrition, pathology and camel management.

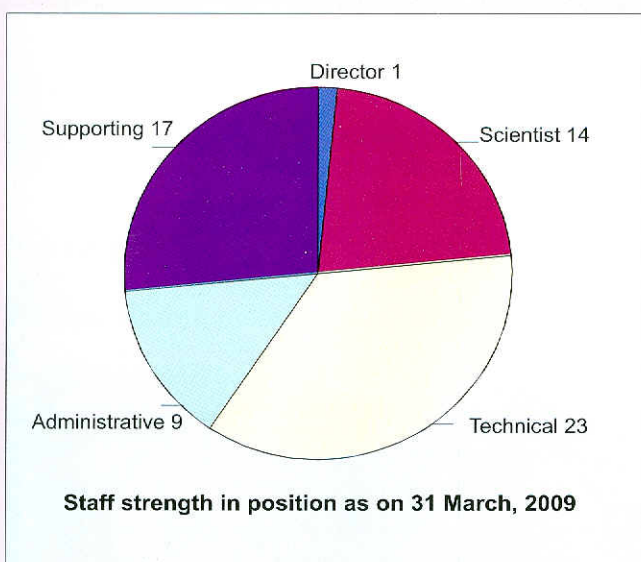
The Centre maintains an elite herd of about 270 camels comprising of bikaneri, Jaisalmeri and kachchi breeds. An area of about 650 ha of farm land has been fenced and 45 ha of land have been brought under perennial silvipasture comprising of grasses, shrubs and trees. The library subscribes to about 30 Indian and 10 foreign journals and has collection of 6742 reference books.

The Centre is recognized as one of the important tourist place of Rajasthan. The camel museum at the Centre depicts historical, cultural, social, economical and scientific aspects of camel and attracts the attention of researchers and tourists. The camel milk parlour at the Centre serve different products *i.e.* flavoured milk, lassi, kulfee, tea and coffee to the tourists.



**Staff position (as on 31<sup>st</sup> March, 2009)**

Cadre	Number of posts sanctioned	Number of post filled
Director	1	1
Scientific	20	14
Technical	23	23
Administrative	10	9
Supporting	19	17
Total	73	64

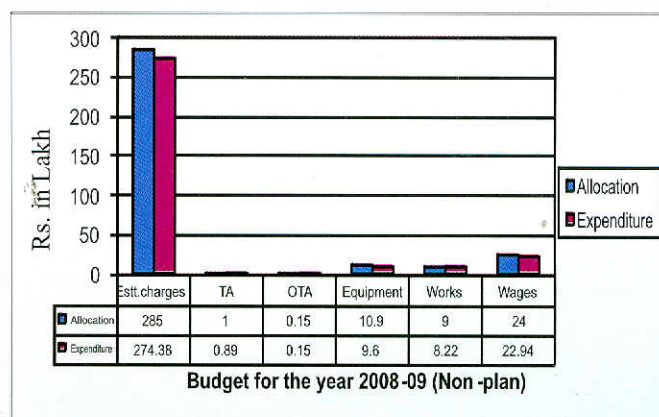
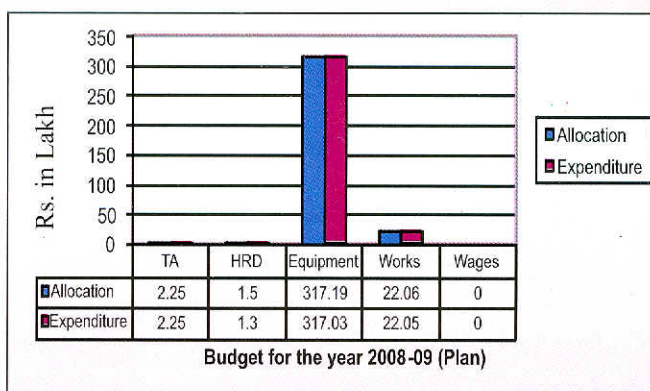


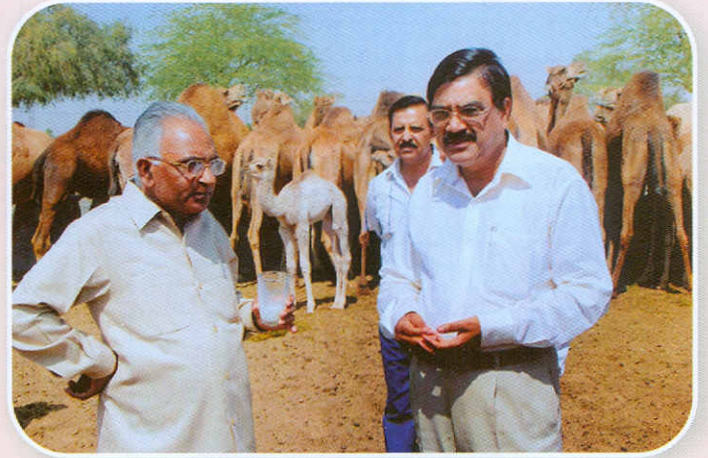
**Financial statement (2008-09)**

Through regular monitoring, the Centre was able to ensure optimal utilization of funds available in the budget. The actual utilization of the budget both under Plan and Non- Plan is furnished below:

(Rs.in Lakh)

Head of Account	Allocation		Expenditure	
	PLAN	NON-PLAN	PLAN	NON-PLAN
Pay & Allowances	-	285.00	-	274.38
Wages		24.00		22.94
T.A	2.25	1.00	2.25	0.89
O.T.A	-	0.15	-	0.15
H.R.D	1.50	-	1.30	-
Other charges including Equipment	317.19	10.9	317.03	9.60
Works	22.06	9.00	22.05	8.22
	<b>343.00</b>	<b>330.05</b>	<b>342.63</b>	<b>316.18</b>
Revenue receipt	17.5			





# 3

## Research Achievements

The research targets set by the Centre and discussed in the Research Advisory Committee (RAC) and Institute Research Committee (IRC) meeting were implemented by respective units of the Centre.

### Unit: Camel Genetics and Breeding

**AGB-1. Project : Studies on qualitative and quantitative genetic parameters in Indian Camel**

Project Leader : Dr. S. C. Mehta

Associate : Dr. U. K. Bissa

### Body weight and growth

The growth data was analysed from the year 2005-09 for the Bikaneri, Jaisalmeri, Kachchhi, Arab-cross and Mewari breeds of Indian dromedary. The effect of breed and sex was largely non-significant ( $P > 0.05$ ). The growth of camels in the current year was significantly higher ( $P < 0.01$ ) than the previous years at all the stages of growth studied (Table-1 & 2). The better growth of camels can be attributed to selective breeding and proper management of the herd.

Table-1. Growth performance of dromedary breeds at NRCC farm (2005-2009)

(Body weight in kg)

Classes	Birth	3 Months	6 Months	9 Months	12 Months	15 Months	18 Months
Pooled	38.67±0.65 (199)	75.73±3.09 (131)	143.88±9.52 (100)	198.57±8.59 (101)	238.63±8.47 (89)	261.60±6.67 (78)	298.35±8.36 (58)
Breed	NS	*	NS	NS	NS	NS	NS
Bikaneri	40.98±0.63 (70)	84.02±3.64 (47)	140.63±9.70 (38)	211.21±9.62 (35)	246.54±8.97 (34)	275.11±6.66 (33)	305.96±11.27 (22)
Jaisalmeri	39.30±0.64 (70)	85.06±3.65 (48)	154.36±9.06 (35)	212.19±8.13 (39)	244.33±8.16 (30)	256.17±7.77 (25)	294.24±10.20 (22)
Kachchhi	38.98±0.80 (46)	71.88±0.67 (30)	151.24±10.51 (24)	197.89±11.01 (23)	244.27±10.08 (22)	258.14±9.74 (17)	294.81±12.99 (14)
Arab cross	38.19±2.19 (6)	61.94±10.25 (6)	129.28±20.63 (3)	172.99±22.61 (4)	219.39±21.89 (3)	256.98±22.80 (3)	--
Mewari	35.90±2.13 (7)	-	-	-	-	-	-
Sex	NS	NS	NS	NS	NS	NS	NS
Male	39.33±0.71 (120)	74.83±3.52 (77)	147.13±9.97 (60)	199.82±9.50 (58)	241.12±9.39 (50)	262.66±7.37 (42)	295.91±8.59 (37)
Female	38.01±0.80 (79)	76.63±4.07 (54)	140.62±10.23 (40)	197.32±9.72 (43)	236.15±9.31 (39)	260.54±8.71 (36)	300.79±11.71 (21)
Year	*	NS	**	**	**	**	**
2005	36.19±1.07 (31)	68.92±5.05 (27)	123.44±7.42 (24)	163.96±25.72 (3)	204.31±26.26 (2)	233.77±9.81 (18)	263.58±8.81 (22)
2006	38.33±0.96 (50)	82.75±4.53 (43)	152.14±6.83 (42)	182.07±8.50 (38)	216.42±7.50 (39)	265.12±8.43 (37)	291.33±7.59 (32)
2007	39.03±1.00 (45)	74.22±4.87 (37)	140.16±7.49 (33)	206.32±9.17 (34)	248.42±8.47 (30)	285.91±9.85 (23)	340.14±21.46 (4)
2008	39.83±1.11 (29)	77.01±5.36 (24)	159.77±32.86 (1)	241.91±8.87 (26)	285.39±8.91 (18)	-	-
2009	39.96±0.93 (44)	-	-	-	-	-	-

\* $P < 0.05$ , \*\* $P < 0.01$ , NS : Non-significant

Table-2. Growth performance of dromedary breeds at NRCC farm (2005-2007)

Classes	(Body weight in kg)						
	21 Months	24 Months	27 Months	30 Months	33 Months	36 Months	48 Months
Pooled	319.99±9.20 (79)	346.83±10.48 (65)	366.91±6.35 (50)	370.12±13.07(17)	424.78±11.87 (45)	444.68±11.73 (40)	506.16±15.50 (17)
Breed	NS	NS	NS	NS	NS	NS	NS
Bikaneri	324.70±6.27 (30)	341.50±7.58 (26)	367.37±6.64 (19)	405.25±17.25 (7)	425.89±10.70 (16)	458.95±11.10 (14)	505.18±19.04 (7)
Jaisalmeri	324.22±6.30 (30)	353.61±7.92 (24)	356.10±9.75 (19)	375.85±16.73 (6)	424.98±10.34 (17)	443.36±10.95 (15)	461.46±17.24 (7)
Kachchhi	329.00±8.31 (18)	351.72±10.60 (14)	368.26±12.58 (12)	340.35±23.33 (3)	421.92±13.34 (11)	436.53±13.55 (10)	553.25±33.34 (2)
Arabcross	302.06±34.92 (1)	340.49±38.99 (1)	-	359.05±41.54 (1)	426.33±43.26 (1)	439.87±42.40 (1)	504.75±44.99 (1)
Sex	NS	NS	NS	NS	NS	**	NS
Male	321.44±9.52 (43)	349.61±10.77 (38)	367.43±8.09 (29)	388.07±15.60(8)	437.00±12.03 (26)	471.96±12.25 (23)	499.41±16.39(9)
Female	318.55±10.49 (36)	344.05±12.37 (27)	366.39±9.45 (21)	352.17±19.38(9)	412.55±14.76 (19)	417.39±14.78 (17)	512.91±24.72(8)
Year	**	**	**	-	**	**	-
2005	283.48±10.37 (22)	360.56±12.01 (18)	344.12±9.91 (19)	370.12±13.07 (17)	394.22±13.40 (17)	410.53±13.42 (15)	-
2006	314.22±10.73 (33)	361.01±12.00 (31)	389.71±7.66 (31)	NA	455.34±13.83 (28)	478.82±13.83 (25)	-
2007	362.28±11.24 (24)	371.92±13.76 (16)	-	-	-	-	-

\*P<0.05, \*\*P<0.01, NS :Non-significant

### Reproductive parameters

The conception rate was 57.75% as reflected from the reproductive performance of the camel herd. The calving (71.70%) was comparable with the performance of the herd in the previous five years (Table -3 & Fig.1)

### Mortality analysis

The records belonging to 1024 dromedary over a span of about 22 years (1986-2008) managed at the centre were analysed (Table 4&5). The differential breed mortality had occurred. The proportion that suffered death in this span was 0.6047 in arab-cross followed by 0.3594 in Kachchhi, 0.3177 in Jaisalmeri and 0.2891 in Bikaner. No preferential sex mortality was observed (P>0.05) with the proportion of males (0.3367) succumbing to death was almost equal to that of the females (0.3103). The mortality was maximum in adults above 3 years of age (0.2029) followed by 0-1 year (0.1943) and 1-3 years age group (0.0875). Since the stay in different age groups was for unequal period, the detailed analysis indicated that of the camels that suffered death, about 38.4% died in the first year of their life followed by 13.8% in 2<sup>nd</sup> year, 5.5, 5.5 and 5.2 %

respectively in the 3<sup>rd</sup> to 5<sup>th</sup> year and rest in the span of remaining 18 years with a reducing trend(Fig. 2). Of the camels that succumb to death in the first year 49.5% died in the first month of their life followed by 15.3 % in the 2<sup>nd</sup> month, 11.7 % in the 3<sup>rd</sup> and rest in the remaining 9 months with a reducing trend(Fig. 3).The mortality due to different systems differed significantly. Maximum mortality (41.39%) was due to the involvement of digestive system. Respiratory system was involved in 22.36% cases. The Nervous, Cardio-vascular, Urinary and peritoneum were involved in less than 5% of cases. Deaths in 23.26% cases were due to miscellaneous causes including heat stroke (8.76%), euthanasia due to incurable ailments (7.25%), poisoning (1.81 %) and other minor causes(Fig.4 & 5).

### Growth of herd

The growth of the herd due to natural causes was analysed for the period under study. The average birth rate on herd basis was observed to be 14.98% with non-significant effect of breed. The average death rate was 6.45% with significantly higher mortality in Arab-cross animals as compared to the Bikaneri, Jaisalmeri and Kachchhi camels. The average herd growth was



8.53 % with non significant variation among the breeds and with a maximum of 37.84%. The cumulative growth analysis indicated about 200 % herd growth in about 22 years in the Indian dromedary breeds except about 100.95% growth in arab-cross animals(Fig. 8)

camels and the closing balance was 310 camels (Table-6 & Fig.9). In order to strengthen the Mewari herd at the Centre 18 more camels of this breed were purchased. In addition to this 7 Jaisalmeri and 3 Bikaneri camels were also purchased. From March 1985 to March, 2009 this Centre has distributed 80 Bikaneri, 8 Jaisalmeri and 1 Kachchhi male for genetic improvement in the field.

**Field improvement**

The opening balance of Centre's herd was 272

**Table-3. Reproductive performance of the camel herd (2000-2008)**

Year	Traits	Bikaneri	Jaisalmeri	Kachchhi	Mewari	Pooled Breeds
2005	Mating	22	11	14		47
	Conception	18	11	11		40 (85.11%)
	Calving	15	11	9		35 (87.50%)
2006	Mating	16	12	6		34
	Conception	13	11	6		30 (88.24%)
	Calving	12	11	4		27 (90%)
2007	Mating	26	17	8		51
	Conception	19	14	6		39 (76.47%)
	Calving	14	14	5		33 (84.61%)
2008	Mating	30	16	18	3	67
	Conception	26	11	13	3	53 (79.10 %)
	Calving	18	7	10	3	38 (71.70%)
2009	Mating	23	23	15	13	74
	Conception	11	15	8	7	41 (57.75%)

\*2 calves of Jaisalmeri and 3 calves of Mewari breed have born out of the mating in the breeding tract.  
# 2 calves each of Bikaneri and Jaisalmeri have born out of reproduction experiment of Dr. Sumant Vyas.

**Table-4. Breed, sex, age and system wise mortality at NRCC farm (2008-09)**

Breed	Sex		Age group			Pooled
	M	F	0-12 Months	1-3 Years	Above 3 Years	
Bikaneri	1	-	1	-	-	1
Jaisalmeri	2	1	1	-	2	3
Kachchhi	2	2	-	1	3	4
Mewari	-	3	-	-	3	3
Total Mortality	5	6	2	1	8	11

**Table-5. Breed, sex and age wise mortality at NRCC farm (Jan., 1986 to March, 2008)**

System	Breed			Sex			Age group			Pooled
	Bikaneri	Jaisalmeri	Kachchhi	Arab cross	M	F	0-12 Months	1-3 Years	Above 3 Years	
Digestive	60	35	30	12	65	72	46	29	62	137
Respiratory	32	22	15	5	43	31	48	9	17	74
Cardio-vascular	4	2	4	1	3	8	3	2	6	11
Nervous	6	4	5	0	10	5	9	2	4	15
Urinary	3	1	0	0	1	3	1	0	3	4
Peritoneum	4	3	5	1	4	9	2	1	10	13
Others	39	21	10	7	43	34	41	13	23	77
Total Mortality	148	88	69	26	169	162	150	56	125	331
Chi-square	$\chi^2=19.594^{**}$ df-3, P<0.01			$\chi^2=0.8767$ df-1, P>0.05			$\chi^2=39.4574^{**}$ df-1, P<0.01			

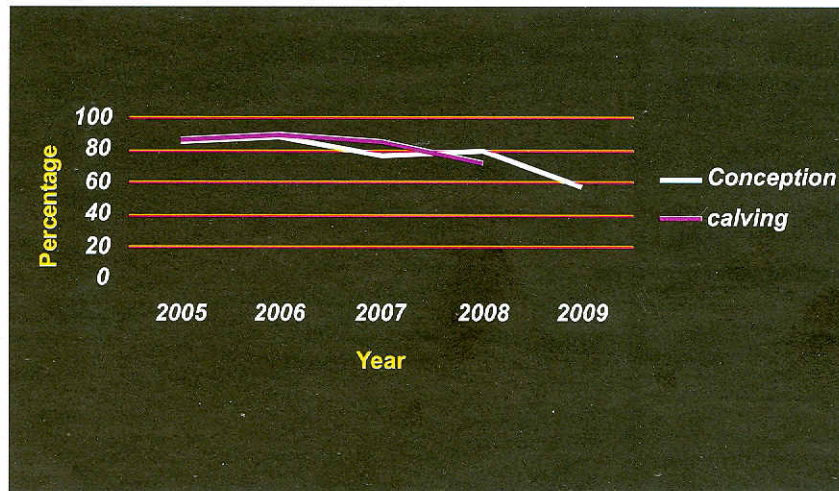


Fig.1 Reproductive performance of the NRCC camel herd(2005-2009)

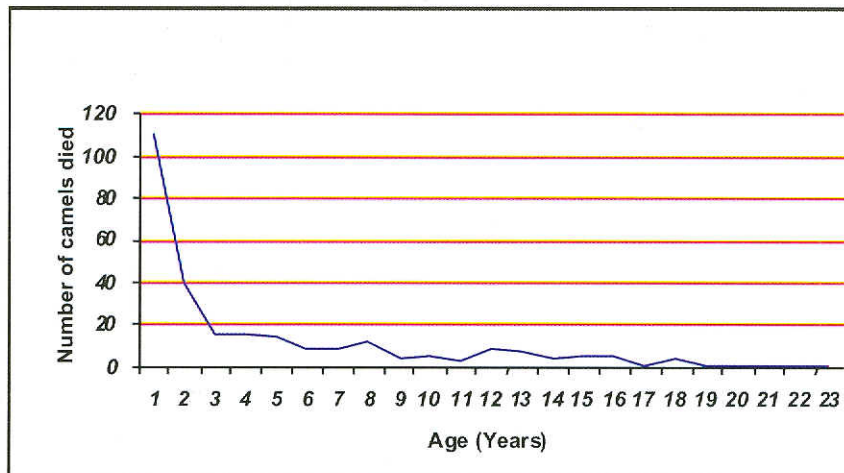


Fig.2 Mortality in Indian dromedary at NRCC farm

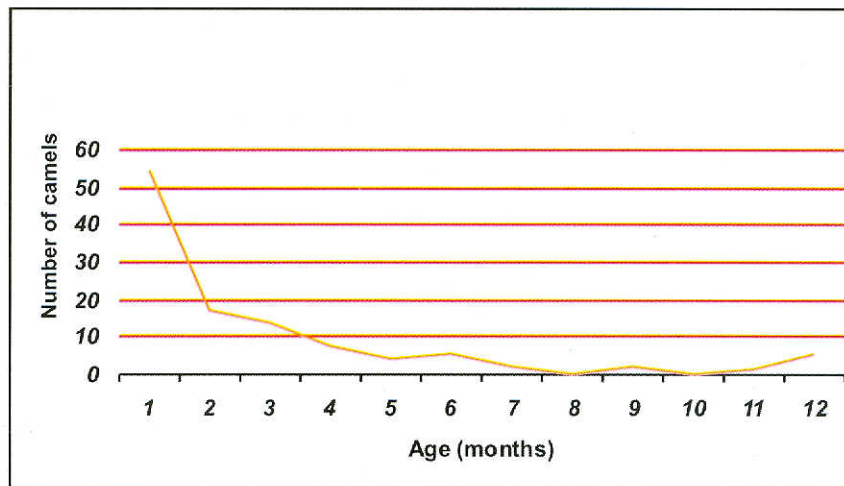


Fig.3 Mortality in Indian dromedary at NRCC farm in the first year of their life

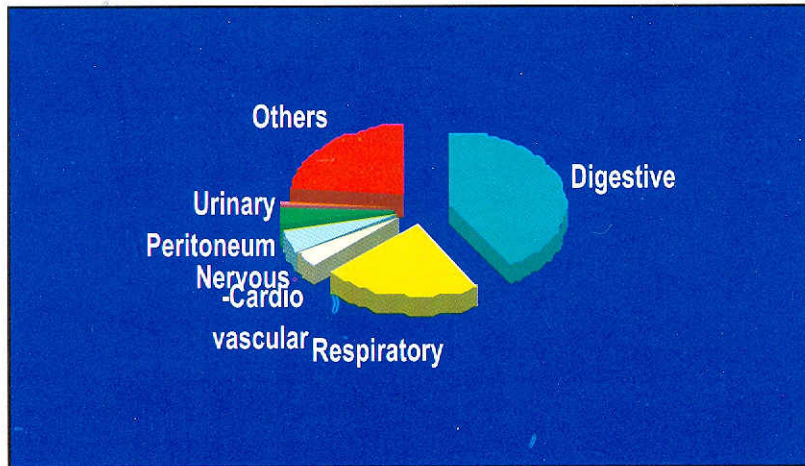


Fig. 4 Involvement of different systems in causing death in camel

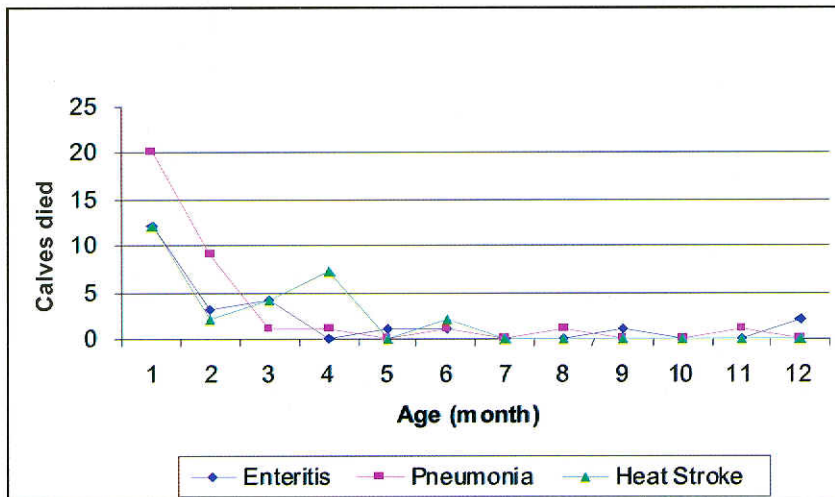


Fig. 5 Major threats to young camel calves born at NRCC farm

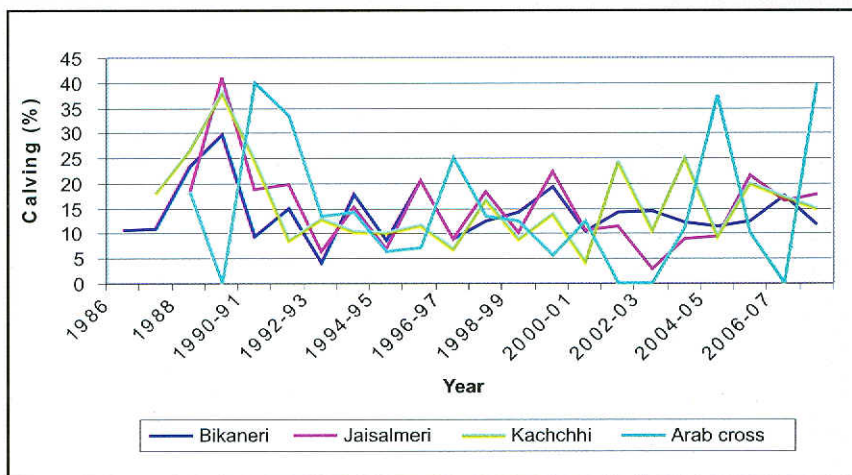


Fig.6 Calving in Indian dromedary breeds on herd basis

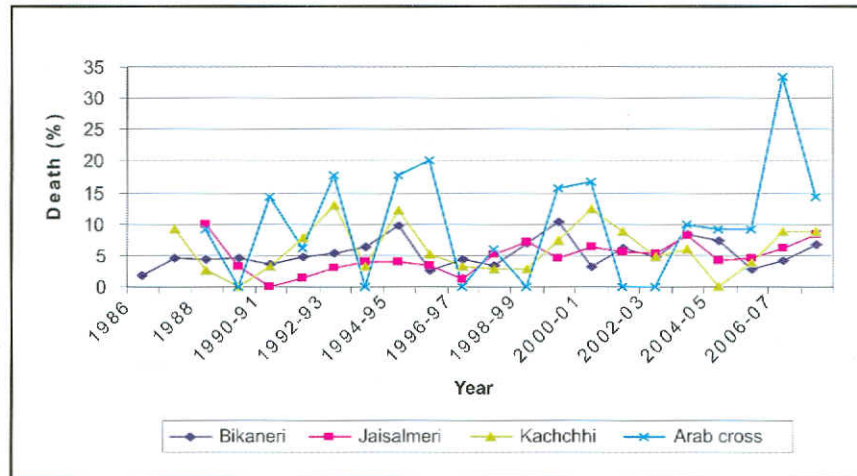


Fig.7 Death in Indian dromedary breeds on herd basis

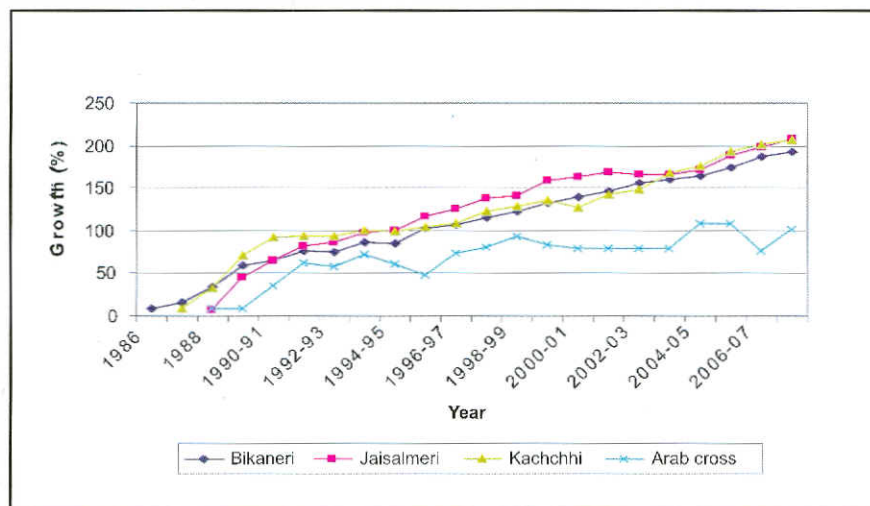


Fig.8 Growth of Indian dromedary herd

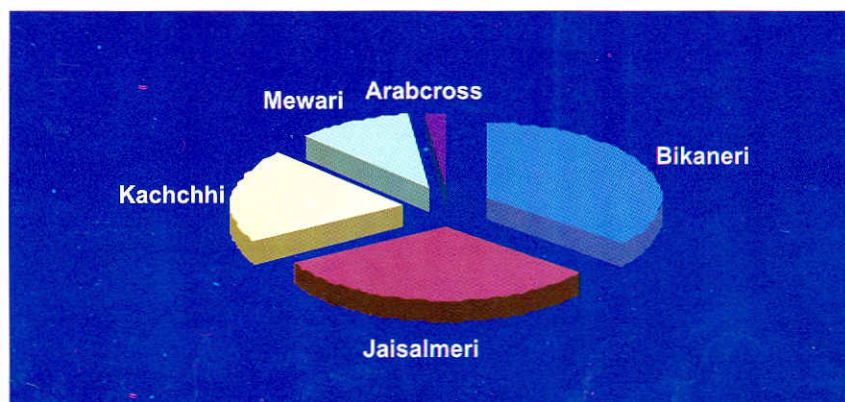


Fig.9 Composition of camel herd at NRCC Bikaner

**Table-6. Camel herd strength (2008-09)**

Breed Age	Opening 1-04-08		Calving		Purchased		Died		Auction		Raj. Govt.		Closing 31.03.09	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
<b>Bikaner</b>														
0-1 Yr	12	12	12	7			1	-					11	7
1-2 Yr	7	4							2	-			4	6
2-3 Yr	2	6											6	6
3-4 Yr	1	5							1	-	1		7	4
>4Yr	9	43			3	-			-	7			13	47
<b>Total</b>	<b>31</b>	<b>70</b>	<b>12</b>	<b>7</b>	<b>3</b>	<b>-</b>	<b>1</b>	<b>-</b>	<b>3</b>	<b>7</b>	<b>1</b>		<b>41</b>	<b>70</b>
<b>Jaisalmeri</b>														
0-1 Yr	15	8	7	4	1		1						8	4
1-2 Yr	6	5							-	1			7	4
2-3 Yr	5	3							1	-			8	4
3-4 Yr	4	3				1			2	-			5	4
>4Yr	15	29				5	1	1	6	2			14	38
<b>Total</b>	<b>45</b>	<b>48</b>	<b>7</b>	<b>4</b>	<b>1</b>	<b>6</b>	<b>2</b>	<b>1</b>	<b>9</b>	<b>3</b>			<b>42</b>	<b>54</b>
<b>Kachchhi</b>														
0-1 Yr	8	6	8	2									8	2
1-2 Yr	5	2					1		1	-			3	2
2-3 Yr	2	0											3	4
3-4 Yr	6	3											5	2
>4Yr	4	23					1	2	-	1			11	23
<b>Total</b>	<b>25</b>	<b>34</b>	<b>8</b>	<b>2</b>			<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>			<b>30</b>	<b>33</b>
<b>Mewari</b>														
0-1 Yr	0	1	3	3									3	3
1-2 Yr	0	0											0	0
2-3 Yr	0	0			1								0	1
3-4 Yr	0	2			1								1	0
>4Yr	2	8			-	16	-	3	-	-			3	23
<b>Total</b>	<b>2</b>	<b>11</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>16</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>			<b>7</b>	<b>27</b>
<b>A*B</b>														
0-1 Yr	0	2	-	1									0	0
1-2 Yr	0	0											0	3
2-3 Yr	1	0											0	0
3-4 Yr	0	0											0	0
>4Yr	0	3							-	1			1	2
<b>Total</b>	<b>1</b>	<b>5</b>	<b>-</b>	<b>1</b>					<b>-</b>	<b>1</b>			<b>1</b>	<b>5</b>
<b>Grand Total</b>	<b>104</b>	<b>168</b>	<b>30</b>	<b>17</b>	<b>6</b>	<b>22</b>	<b>5</b>	<b>6</b>	<b>13</b>	<b>12</b>	<b>1</b>		<b>121</b>	<b>189</b>

**AGB-4. Project : Selection for the improvement of draught ability of camel breeds**

**Project Leader :Dr. S. C. Mehta**

**Associates :Dr. A. K. Roy and Dr. U. K. Bissa**

Selection of males at 4 years of age is made mainly on the basis of body length and by fixing independent culling level for body height, heart girth and body weight for immediate use in selection. Use of selected animals in breeding ensure minimal inbreeding.

**Selection of Studs:**

Biometry of entire herd i.e. 210 camels was carried out in the month of September, 2008. The data

was analysed and selection of sires was done as per the laid down criteria. Breeding plan was prepared and individual information for mating each female was finalized (Table-7-8 & Fig.10a,b,c). The breeding has been accomplished. One Bikaneri (569) and two Jaisalmeri (167 and 349) were initially pregnant but did not calve and hence were made available for breeding in the breeding season. Three Jaisalmeri (219, 227, 229) and 9 Mewari females (19, 27, 29, 33, 35, 43, 45, 47, 51) were also available for breeding during the season. Five half-sib families were identified and accordingly 23 animals were selected for evaluation of draught potential by the physiologist.

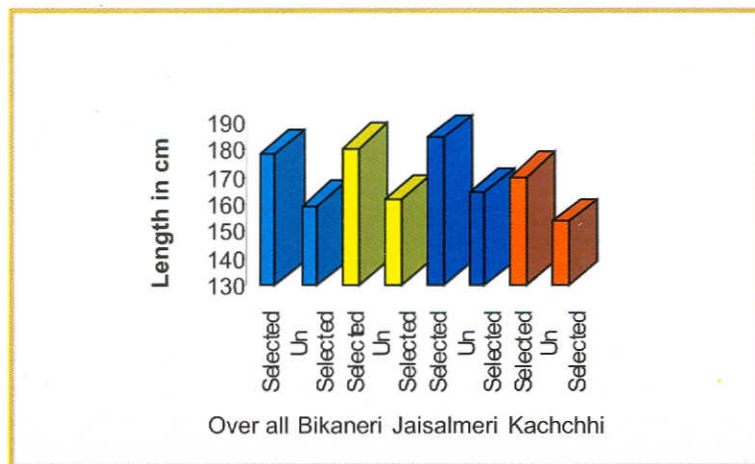


Fig. 10(a) Body Length of breedable males

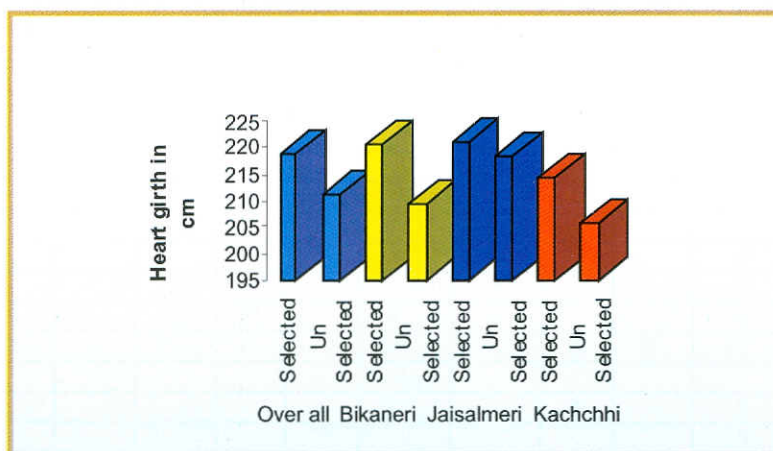


Fig.10(b) Heart Girth of breedable males

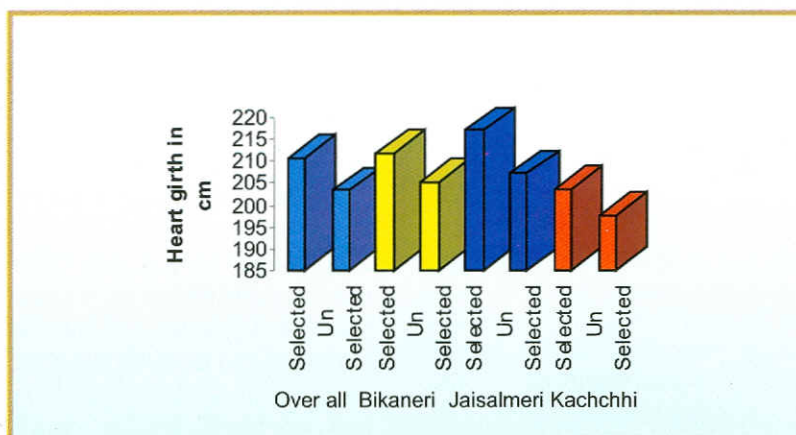


Fig.10(c) Height at wither of breedable males

**Table-7. Breeding plan for NRCC camel herd for the year 2008-09**

Breed	Available females (Approx)	Studs to be used for breeding	Sire	Dam	Females Bred
Bikaneri	22 + 1	620 Godu	Purchased		5
		622 Modu	Purchased		4
		600 Surja ka beta	418	255	7
		474 Sohanki ka beta	285	151	-
		480 Kajalki ka beta	47	78	-
		602 Cholaki ka beta	366	463	7
Jaisalmeri	18+5	228 Fatiya	Purchased		10
		218 Punia	Purchased		9
		232 Champia	Purchased		4
		230 Bhagat	Purchased		-
Kachchhi	15	166 Satiya	Purchased		6
		126 Dugli ka beta	72	107	7
		128 Madharki ka beta	72	101	-
		116 Ghantel	Purchased		-
Mewari	5 + 8	2 Partap	Purchased		6
		4 Peeliya	Purchased		5

**Table-8. Population mean and selection differential in adult camels**

Breed	Selection	Number of camels	Body Length (cms)	Heart Girth (cms)	Height At Wither (cms)
Overall	Selected	14	177.92	218.69	210.64
	Unselected	21	159.62	211.18	203.31
	Significance	35	**	NS	*
Bikaneri	Selected	6	180.00	220.83	211.67
	Unselected	4	161.50	209.25	205.25
Jaisalmeri	Selected	4	183.75	221.00	216.75
	Unselected	11	164.18	218.45	207.18
Kachchhi	Selected	4	170.00	214.25	203.50
	Unselected	6	153.17	205.83	197.50
Mewari	Selected	2	142.20	205.77	193.90

\*(P<0.05) ; \*\*(P<0.01); NS – Non-significant

**AGB-7.Project : Genetic improvement of milk production potential of Indian dromedary**

**Project Leader : Dr. S. C. Mehta**

**Associates : Dr. U. K. Bissa**

**Selection of females (2008-09):**

Six females each of Bikaneri and Kachchhi breed were selected. Three Bikaneri females were in 1<sup>st</sup> lactation and 3 in 2<sup>nd</sup> lactation. Of the 6 Kachchhi females four were in 4<sup>th</sup> lactation and 1 each was in 1<sup>st</sup> and 3<sup>rd</sup>

lactation. There was no choice to get the animals of same parity. K-129 died during parturition due to dystokia. The camel number K-111 was milked as per schedule only for 2 days, thereafter one teat was milked for subsequent 19 days and finally the animal got mastitis and has been discontinued (Table 9).

#### Milk Production : Breeds

Two teat milking was followed to allow proper let down of milk. Two teats (one front and one rear) were milked and the other two were left for the calf. The milking females were offered concentrate ration *i.e.* Saras Gold @ 3 kg / day. The recording commenced after 15 days of calving. Three times milking has been followed till the calf attains an age of 3 months. The average daily milk production was 3672.10±51.46 ml with 3642.41±198.62 ml in Bikaneri and 3701.79±297.60 ml in Kachchhi. However the effect of breed was non-significant. The highest milk production was 5878.41±249.03 ml of K-117, which was in 3<sup>rd</sup> parity. The average daily milk production of the individuals varied significantly (Table 10 & Fig.11-12

**Table-9. Female camels under milking (2008-09)**

Camel	Parity	Remarks
Bikaneri		
515	2	Two teat milking
523	2	Two teat milking
537	2	Two teat milking
541	1	Two teat milking
543	1	Two teat milking
545	1	Two teat milking
Kachchhi		
83	4	Two teat milking
103	4	Two teat milking
105	4	Two teat milking
111	4	First 2 days – Two teat milking Subsequent 19 days – One teat milking Milking stopped thereafter due to Mastitis
117	3	Three teats – Two teat milking
129	1	Died

#### Milk Production : Months

The average daily milk production varied

significantly with the month of lactation. Peak yield (4783.54 ml) was observed in the third month of lactation. Fourth month showed little decline from the peak yields followed by 2<sup>nd</sup> month. The production in different months has been summarized in Table- 11.

#### Milk Production : Lactations

Milk yields in different lactations was analysed (Table -12). Only 3 animals each were available in 1<sup>st</sup>, 2<sup>nd</sup> and 4<sup>th</sup> lactations. Only one animal was in its 3<sup>rd</sup> lactation, so the production figures for the same lactation may not be considered as a representative one. However, highest production was observed in 3<sup>rd</sup> lactation (5988.99±30.53 ml) followed by 4<sup>th</sup> (3900.69±56.33 ml), 1<sup>st</sup> (3275.54±22.33ml) and 2<sup>nd</sup> (3100.43±18.19ml) (Fig.14)

#### Milk production from quarters vs. left and right handedness of the milkmen

In order to remove the effect of milkman's left or right handedness on the production of different quarters, especially the front and rear quarters, this practice was followed. Usually the she camels were being milked from the left side by the milkmen, but they were asked to stand on the other side (right) of the she camel during milking in the month of November. The data so obtained were analysed to see the effect of milkmen's handedness on the production from front and rear quarters. It was observed that the production from rear quarters remained higher during morning as well as evening (Table-13). In general the production in morning was higher as compared to noon and evening and the production from rear teat was greater than front teat during all the times of milking. (Fig.13)

#### Growth of calves and dams

The body weight of calves of the she camels under milking was monitored along with their dams. The average values are quite comparable with the herd performance data (Table-14).

#### Selection of females (2009-10)

Tentatively 9 animals of Bikaneri, 8 of Kachchhi and 3 of Mewari breed were selected for the milking experiment based on their lactation and availability for the project. Finally 7 animals each of Bikaneri and Kachchhi and 3 of Mewari were retained for the project (Table-15). The initial production of these animals was analysed and is presented in (Table-16).



**Table-10. Leastsquares mean and analysis of variance : Average daily milk production among individuals and breeds**

(Two teat milking, milk yield in ml.)

Animal Number	Morning		Evening		Total
	Front	Rear	Front	Rear	
Pooled	919.94±14.29(4019)	1133.08±16.16(4019)	613.19±13.37(4000)	776.77±15.22(4000)	3672.10±51.46(3976)
Breed	NS	NS	NS	NS	NS
Bikaneri	914.63±55.20(2475)	1117.95±62.41(2475)	640.36±51.62(2467)	769.45±58.76(2467)	3642.41±198.62(2450)
Kachchhi	925.24±82.72(1544)	1148.20±93.52(1544)	586.03±77.34(1533)	784.09±88.05(1533)	3701.79±297.60(1526)
ID	**	**	**	**	**
K-83	1408.40±69.62(374)	1674.97±78.72(374)	1115.34±65.11(371)	1315.56±74.12(371)	5862.73±250.52(370)
K-103	842.06±69.66(360)	1013.52±78.76(360)	579.04±65.14(356)	667.06±74.16(356)	3332.93±250.65(355)
K-105	548.23±69.58(395)	715.87±78.67(395)	507.28±65.06(393)	610.24±74.07(393)	2520.56±250.38(388)
K-117	1565.21±69.21(415)	1823.72±78.25(415)	1010.40±64.72(413)	1175.31±73.68(413)	5878.41±249.03(413)
B-515	846.06±69.52(428)	1052.64±78.60(428)	484.32±65.00(426)	675.63±74.00(426)	3312.63±250.12(424)
B-523	796.36±69.57(411)	1030.79±78.65(411)	446.03±65.04(412)	638.45±74.05(412)	3098.04±250.33(403)
B-537	720.31±69.57(407)	913.25±78.66(407)	506.63±65.06(406)	675.68±74.06(406)	3000.52±250.32(406)
B-541	649.72±69.64(373)	865.92±78.74(373)	365.32±65.13(370)	540.07±74.14(370)	2607.48±250.60(369)
B-543	1003.42±69.19(427)	1210.14±78.23(427)	629.89±64.70(426)	794.42±73.65(426)	3881.00±248.95(422)
B-545	819.57±69.51(429)	1029.94±78.59(429)	487.68±65.00(427)	675.25±73.99(427)	3226.72±250.10(426)

\*\* P<0.01

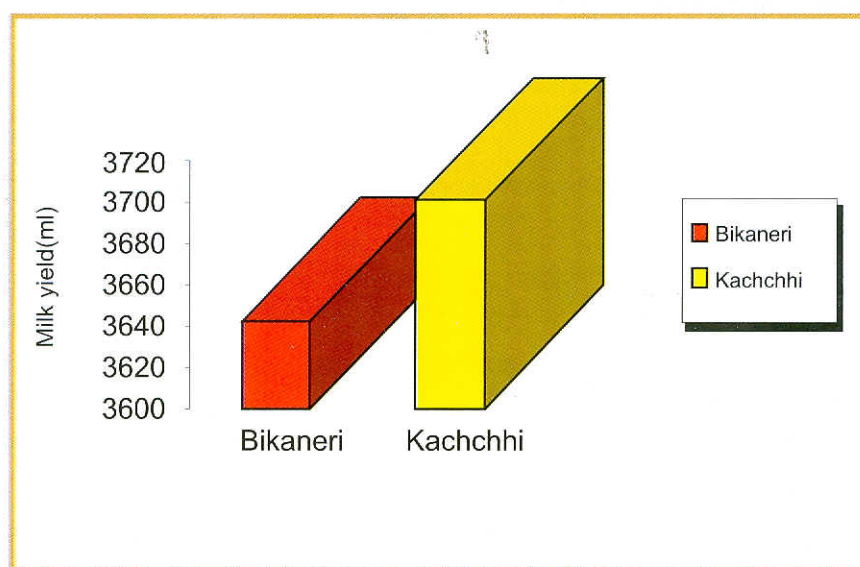


Fig-11 Milk production in dromedary breeds at NRCC farm

Table-11. Leastsquares mean and analysis of variance : Average daily milk production during different months

(Two teat milking, milk yield in ml)

Animal Number	Morning		Evening		Total
	Front	Rear	Front	Rear	
Month	**	**	**	**	**
1	649.13±17.78(298)	829.07±20.10(298)	437.28±16.60(300)	546.95±18.90(300)	3492.78±64.05(296)
2	826.43±17.76(300)	1062.19±20.08(300)	532.84±16.62(298)	686.25±18.93(298)	4335.80±63.97(298)
3	973.76±17.77(299)	1259.21±20.09(299)	667.93±16.68(293)	866.35±18.99(293)	4783.54±64.23(292)
4	1063.60±17.80(296)	1338.92±20.13(296)	926.25±16.73(289)	1130.48±19.05(289)	4536.79±64.51(286)
5	1048.06±17.80(296)	1311.67±20.13(296)	832.48±16.67(294)	1061.33±18.98(294)	4257.78±64.32(290)
6	1019.19±17.42(298)	1285.36±19.70(298)	725.34±16.30(297)	916.77±18.56(297)	3951.41±62.80(295)
7	955.80±17.82(295)	1205.31±20.14(295)	667.29±16.62(298)	840.43±18.93(298)	3667.16±64.19(293)
8	968.02±18.14(298)	1202.02±20.51(298)	690.50±16.96(298)	850.52±19.31(298)	3713.37±65.36(296)
9	991.06±17.76(300)	1191.02±20.08(300)	658.06±16.65(296)	808.89±18.95(296)	3656.72±64.06(296)
10	963.06±17.76(300)	1139.36±20.08(300)	618.56±16.64(297)	770.48±18.94(297)	3497.29±64.01(297)
11	974.57±17.77(299)	1152.07±20.09(299)	587.90±16.60(300)	746.13±18.90(300)	3465.42±63.92(299)
12	937.97±17.77(299)	1100.35±20.09(299)	539.95±16.61(299)	690.92±18.91(299)	3276.11±63.97(298)
13	926.30±18.67(240)	1077.99±21.10(240)	491.19±17.45(240)	628.57±19.87(240)	3139.59±67.16(240)
14	825.15±20.36(172)	987.60±23.02(172)	459.51±19.01(173)	598.41±20.64(173)	2890.93±73.26(172)
15	676.91±38.93(29)	853.99±44.01(29)	362.80±36.95(28)	509.03±42.67(28)	2416.85±142.18(28)

\*\* P&lt;0.01

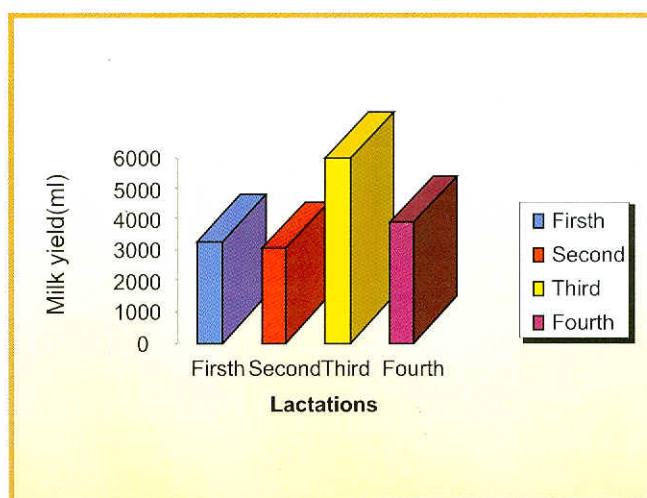


Fig-12 Average daily milk production in different lactations

**Table-12. Leastsquares mean and analysis of variance : Average daily milk production in different lactations**

(Two teat milking, milk yield in ml)

	Lactations			
	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>
Overall	3275.54±22.33(1217)	3100.43±18.19(1233)	5988.99±30.53(413)	3900.69±56.33(1113)
Month	**	**	**	**
1	2679.29±78.23(85)	2686.19±53.25(92)	5620.33±113.16(30)	4380.00±164.56(89)
2	3308.54±76.45(89)	3349.44±53.84(90)	6651.00±113.16(30)	5575.84±164.56(89)
3	3735.11±76.88(88)	4186.00±53.84(90)	8525.33±113.16(30)	5162.14±169.38(84)
4	3670.44±76.03(90)	3938.52±56.76(81)	8403.45±115.09(29)	4770.35±167.40(86)
5	3580.11±76.88(88)	3601.19±55.73(84)	7956.67±113.16(30)	4305.68±165.49(88)
6	3359.09±76.88(88)	3410.23±54.45(88)	6576.67±113.16(30)	4187.64±64.56(89)
7	3180.90±76.45(89)	3463.64±54.45(88)	5276.67±113.16(30)	3851.16±167.40(86)
8	3224.72±76.45(89)	3378.41±54.45(88)	6040.00±113.16(30)	3729.21±164.56(89)
9	3402.22±76.03(90)	3020.45±54.45(88)	5431.03±115.09(29)	3947.19±164.56(89)
10	3239.77±76.88(88)	2947.19±54.14(89)	4973.33±113.16(30)	3788.89±163.64(90)
11	3573.03±76.45(89)	2793.33±53.84(90)	5006.67±113.16(30)	3495.56±163.64(90)
12	3465.55±76.03(90)	2965.55±53.84(90)	4626.67±113.16(30)	2906.82±165.49(88)
13	3245.94±83.84(74)	2677.77±53.84(90)	4590.00±113.16(30)	2739.13±228.89(46)
14	3058.33±93.11(60)	2413.51±58.21(77)	4168.00±123.97(25)	-
15	2410.00±161.28(20)	1675.00±180.60(8)	-	-

\*\* P<0.01

**Table-13. Leastsquares mean and analysis of variance : Average daily milk production when opposite quarters milked**

(Two teat milking, milk yield in ml)

Month	Morning_FT	Morning_RT	Evening_FT	Evening_RT
Month	NS	NS	NS	NS
October (left side)	947.59±18.90	1153.45±20.34	624.83±16.29	761.72±17.59
November (right side)	954.70±18.65	1132.89±20.06	625.84±16.07	775.17±17.35
December (left side)	981.94±18.28	1163.87±19.67	628.39±15.76	778.71±17.01

Table -14. Body weight (kg) of calves and their dams under milking

Month	Calf	Dam
0	38.80	638.00
1	62.62	628.00
2	87.10	634.30
3	111.00	636.10
4	135.10	624.30
5	154.70	620.40
6	178.50	617.20
7	204.30	634.30
8	232.80	647.20
9	255.20	649.30
10	269.90	622.20
11	281.80	620.80
12	293.43	623.14

Table-16. Average daily production of milk during 2009-10

(Two teat milking, milk yield in ml)

	Effect of Breed	Pooled	Bikaneri	Kachchhi	Mewari
Number of animals		10	5	4	1
No. of records		180	130	37	13
Morning_FT	**	575.07	776.15	656.76	292.31
Morning_RT	**	708.21	932.31	800.00	392.31
Noon_FT	**	385.70	508.46	348.65	300.00
Noon_RT	**	519.56	676.15	459.46	423.08
Evening_FT	**	348.77	400.77	337.84	307.69
Evening_RT	**	465.96	549.23	448.65	400.00
Total	**	3003.27	3843.08	3051.35	2115.38

\*\*P&lt;0.01

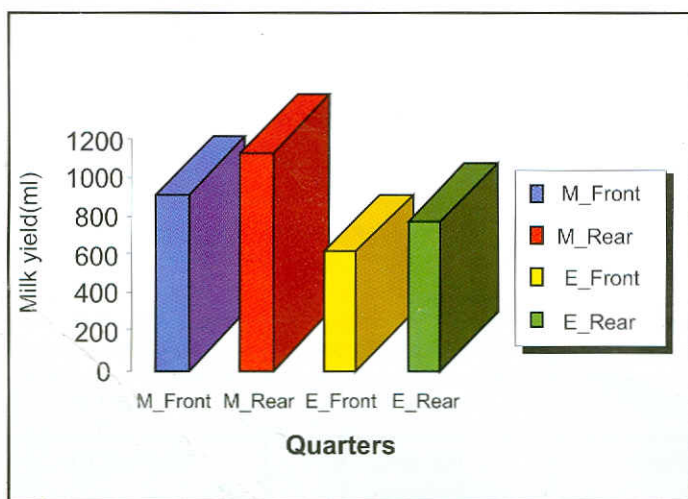


Fig-13 Milk production pattern at NRCC farm

Table-15. Selection of female camels for milking (2009-10)

S.No.	Animal No.	Parity	Status	Remarks
<b>Bikaneri</b>				
1	455	3		
2	473	3		
3	477	4		
4	481	2		Got injury during calving
5	483	3		Calf died
6	493	2		
7	497	2		
8	525	2		
9	529	3		
<b>Kachchhi</b>				
1	93	3		Died
2	109	2*	Purchased	
3	123	2		
4	125	2		
5	135	1		
6	153	1*	Purchased	
7	155	1*	Purchased	
8	159	1*	Purchased	
<b>Mewari</b>				
1	1	1*	Purchased	
2	5	1*	Purchased	
3	7	1*	Purchased	

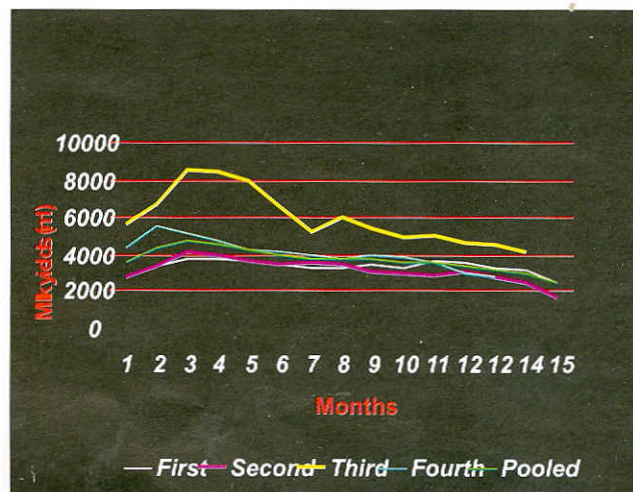


Fig-14 Lactation curve of Indian dromedary

**AGB-2. Project: Molecular genetic studies in Indian camel : Microsatellite markers for genetic characterisation of Bikaneri, Jaisalmeri and Kachchhi camel**

**Project Leader : Dr. S. C. Mehta**

Blood samples of Bikaneri, Jaisalmeri and Kachchhi breeds were collected from the farm as well as the breeding tract. A minimum of 50 randomly selected samples in each breed were analysed. 43 microsatellite primers known to be polymorphic either in the old & / or new world camelids were got synthesized. Using these primers, 40 microsatellite loci were successfully amplified in the Indian dromedary breeds. 21 were polymorphic and rests were monomorphic in the animals studied. Number of alleles at these loci ranged from 2 to 7. Maximum number of alleles were found in the Bikaneri (76) followed by Jaisalmeri (74) and Kachchhi (69) breeds. The expected heterozygosity ranged from 0.18 to 0.815 in Bikaneri, 0.31 to 0.816 in Jaisalmeri and 0.15 to 0.0.796 in Kachchhi. The polymorphic information content ranged from 0.175 to 0.789 in Bikaneri, 0.289 to 0.791 in Jaisalmeri and 0.136 to 0.765 in Kachchhi. Observation of monomorphic pattern at 19 microsatellite loci which are known to be polymorphic in new/old world camelids indicates existence of higher degree of genetic

homozygosity among and within the individuals of the Indian dromedary breeds. Phylip 3.6 was utilized to estimate the genetic distances among the camel breeds. Nei's, Reynold's and Chord distances were estimated (Table-17 to 21). The phylogenetic tree was constructed from all the three measures of the genetic distance using the UPGMA method of clustering by DRAWGRAM program of PHYLIP package. One thousand bootstrapping were also done and the consensus tree was constructed. The same tree topology was derived with the three measures.

**Conclusions**

- High degree of homozygosity exists between the Indian dromedary breeds.
- With in breed genetic variation was higher in Bikaneri and least in Kachchhi camels.
- The Jaisalmeri and Kachchhi breed formed one cluster and Bikaneri breed joined subsequently.
- The above 21 polymorphic loci can also be utilized in individual identification and parentage testing besides the identification of genetically distinct populations.
- Multiplex PCR utilizing above polymorphic primers may simplify the task of individual and parentage identification.

**Table-17. Amplification of microsatellite loci in Bikaneri breed of camel**

S.N.	Locus (5'-3')	Alleles(n)	Size (bp)	Temp (°C)	H <sub>o</sub>	H <sub>e</sub>	PIC
1.	VOLP-03	5	144-168	64	0.43	0.741	0.675
2.	VOLP-08	3	142-146	50	0.35	0.289	0.267
3.	VOLP-10	5	250-264	55	0.68	0.715	0.677
4.	VOLP-67	6	151-195	53	0.32	0.813	0.786
5.	YWLL-08	7	132-162	55	0.94	0.815	0.789
6.	YWLL-09	2	160-162	53	0.45	0.339	0.281
7.	YWLL-38	3	180-186	55	0.63	0.545	0.440
8.	YWLL-44	2	104-106	55	0.31	0.368	0.300
9.	YWLL-58	3	173-177	51	1.00	0.619	0.547
10.	YWLL-59	2	115-117	53	0.58	0.406	0.323
11.	LCA-56	2	134-138	55	0.46	0.403	0.322
12.	LCA-63	5	210-222	58	0.54	0.641	0.583
13.	LCA-66	3	234-238	58	0.26	0.642	0.570
14.	CVRL-01	3	208-240	58	0.42	0.64	0.517
15.	CVRL-03	5	182-215	58	0.79	0.55	0.518
16.	CVRL-04	3	180-194	54	0.58	0.68	0.552
17.	CVRL-05	4	155-174	59	0.55	0.68	0.611
18.	CVRL-07	3	284-304	59	0.60	0.67	0.554
19.	LCA-18	3	224-230	54	0.72	0.66	0.583
20.	LCA-22	4	170-180	60	0.45	0.64	0.579
21.	LCA-33	3	122-130	60	0.12	0.18	0.175

H<sub>o</sub> observed heterozygosity; H<sub>e</sub> expected heterozygosity

Table-18. Amplification of microsatellite loci in Jaisalmeri breed of camel

S.N.	Locus (5'-3')	Alleles(n)	Size (bp)	Temp (°C)	H <sub>o</sub>	H <sub>e</sub>	PIC
1.	VOLP-03	3	148-168	64	0.466	0.573	0.522
2.	VOLP-08	3	142-146	50	0.300	0.605	0.526
3.	VOLP-10	5	250-264	55	0.581	0.686	0.629
4.	VOLP-67	6	151-195	53	0.680	0.682	0.645
5.	YWLL-08	7	132-162	55	0.800	0.816	0.791
6.	YWLL-09	2	160-162	53	0.388	0.320	0.268
7.	YWLL-38	3	180-186	55	0.660	0.570	0.475
8.	YWLL-44	3	96-106	55	0.343	0.374	0.314
9.	YWLL-58	3	173-177	51	1.00	0.601	0.521
10.	YWLL-59	2	115-117	53	0.660	0.444	0.345
11.	LCA-56	2	134-138	55	0.400	0.385	0.311
12.	LCA-63	5	196-220	58	0.380	0.633	0.587
13.	LCA-66	3	234-238	58	0.480	0.635	0.558
14.	CVRL-01	3	208-240	58	0.37	0.57	0.449
15.	CVRL-03	4	182-215	58	0.40	0.64	0.577
16.	CVRL-04	3	180-194	54	0.48	0.64	0.501
17.	CVRL-05	4	155-174	59	0.57	0.54	0.432
18.	CVRL-07	3	284-304	59	0.39	0.60	0.499
19.	LCA-18	3	224-230	54	0.26	0.57	0.475
20.	LCA-22	4	170-180	60	0.73	0.62	0.544
21.	LCA-33	3	122-130	60	0.27	0.31	0.289

H<sub>o</sub> observed heterozygosity; H<sub>e</sub> expected heterozygosity

Table-19. Amplification of microsatellite loci in Kachchhi breed of camel

S.N.	Locus (5'-3')	Alleles (n)	Size (bp)	Temp (°C)	H <sub>o</sub>	H <sub>e</sub>	PIC
1.	VOLP-03	3	148-168	64	0.70	0.515	0.460
2.	VOLP-08	3	142-146	50	0.34	0.500	0.453
3.	VOLP-10	5	250-264	55	0.757	0.744	0.705
4.	VOLP-67	4	157-185	53	0.88	0.66	0.625
5.	YWLL-08	6	132-158	55	0.86	0.796	0.765
6.	YWLL-09	2	160-162	53	0.44	0.343	0.284
7.	YWLL-38	3	180-186	55	0.619	0.552	0.451
8.	YWLL-44	2	104-106	55	0.58	0.447	0.347
9.	YWLL-58	3	173-177	51	1.00	0.592	0.509
10.	YWLL-59	2	115-117	53	0.48	0.375	0.305
11.	LCA-56	2	134-138	55	0.42	0.332	0.277
12.	LCA-63	5	196-220	58	0.66	0.676	0.632
13.	LCA-66	3	234-238	58	0.56	0.535	0.478
14.	CVRL-01	3	208-240	58	0.42	0.64	0.517
15.	CVRL-03	5	182-215	58	0.73	0.73	0.686
16.	CVRL-04	3	180-194	54	0.58	0.68	0.552
17.	CVRL-05	3	155-174	59	0.62	0.52	0.404
18.	CVRL-07	3	284-304	59	0.60	0.67	0.554
19.	LCA-18	3	224-230	54	0.51	0.66	0.589
20.	LCA-22	4	170-180	60	0.66	0.62	0.538
21.	LCA-33	2	122-130	60	0.16	0.15	0.136

H<sub>o</sub> observed heterozygosity; H<sub>e</sub> expected heterozygosity

**Table-20. Monomorphic microsatellite loci in Indian dromedary breeds**

S.N.	Locus (5'-3')	Alleles (n)	Size (bp)	Temp (°C)
1.	YWLL-29	1	208	55
2.	YWLL-36	1	136	55
3.	YWLL-40	1	173	55
4.	YWLL-43	1	135	60
5.	YWLL-46	1	110	55
6.	CVRL - 02	1	205	53
7.	CVRL - 06	1	196	60
8.	CVRL - 08	1	205	55
9.	LCA - 08	1	230	58
10.	LCA - 19	1	100	58
11.	LCA - 24	1	110	58
12.	LCA - 30	1	230	60
13.	LCA - 36	1	209	61
14.	LCA - 65	1	170	58
15.	LCA - 68	1	200	61
16.	LCA - 05	1	202	55
17.	LCA - 37	1	148	64
18.	LCA - 77	1	235	55
19.	VOLP - 32	1	260	55

H<sub>o</sub>, observed heterozygosity; H<sub>e</sub>, expected heterozygosity

**Table-21. Genetic distance among Indian dromedary breeds**

Genetic Distance	Nei's distance (Ds)	Reynold's distance (Fst)	Cavalli-Sforza Chord distance (Dc)
Bikaneri- Jaisalmeri	0.097133	0.066832	0.074571
Bikaneri- Kachchhi	0.117586	0.080742	0.094219
Jaisalmeri- Kachchhi	0.091052	0.065436	0.063667

**Unit: Camel Physiology**

**AP-2.Project: Efficient utilization of camel energy during cart pulling and agricultural operations by camels**

(A Technical collaborative project with AICRP on Increased utilization of Animal energy with enhanced system efficiency, C.T.E. Udaipur)

**Project Leader :Dr. A. K. Roy**

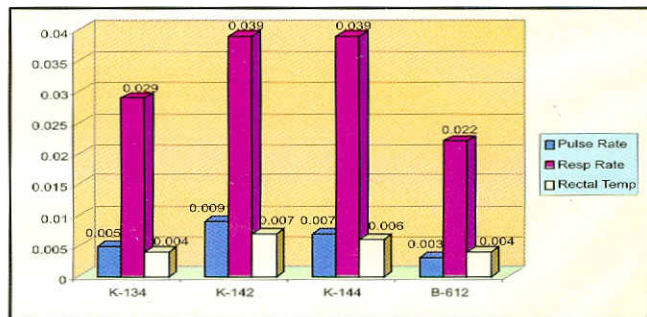
**Associates :Dr. A. K. Nagpal, Dr. C. Bhakat and Dr. G. S. Tiwari**

**Survey on the use of camels for draught:** A survey was carried out in seven tehsils of Bikaner district from 141 camel keepers. The transformation of camel use is investigated on pre-tested survey proforma by

participatory approach from villages of Bikaner district viz: Bachchhasar, Gadwala, Jasrasar, Udasar, 8KYDchalk, Khajuwala, Lunkaransar, Mahajan, Pugal, Nada, Seruna, Lakhmisar, Salasar, Kolayat.

The most of the camel keepers (77.52 %) are putting their camel to work at an age of 4 year whereas few (22.48 %) put them to work at 3 years of age. Mostly (76.82 %) male camels are being used for carting, farming and other agriculture operations where as only 23.18 % female are used for this purpose. An average income of Rs. 350 - 450/- income is generating per day from camel carting at the village level. But when they are using camels for carting in the city then per day income is more. Most of the farmers (42.55 %) are having single camel, 39.01 % with 2 to 4 camels whereas 18.44 % keep more than 4 camels in the areas under survey. The farmers rearing a single camel practise intensive system of management whereas those having more than 4 animals resort to the extensive system of management. The farmers having 2 to 4 camels rear them in semi-intensive system of management. The camel keepers prefer to rear their camels for the purpose of carting, farming work, pack loading, riding, safari and trading in the decreasing order. Where as the camel businessmen rear camels for trading, riding, carting, farming work and pack loading in the same order.

The trained camels were used to rotate the gear system of the rotary unit so as to charge a 12V180 Ah battery which got charged within 3 hours period. The camels were not fatigued during this time. The physiological responses of working camels were recorded before & after the work out at the rotary system. The percent changes observed in the rectal temperature, respiration and pulse rate are presented in the Fig.-15.



**Fig.15** Percent changes in the rectal temperature, respiration and pulse rate of camels before and after working on the rotary unit

**Camel Reproduction Unit**

**Research Programme : Camel reproduction and physiological efficiency improvement to support optimal production.**

**AR-6. Project : Role of sexual and bio-stimulation in camel reproduction**

**Project leader : Dr. Sumant Vyas**

**Associates : Dr. Gorakh Mal and Dr. U. K. Bissa**

**a) Collection and evaluation of poll gland secretion:**

Collection of poll gland secretion from adult male camels in natural, unhampered condition was attempted. It was revealed that there is individual variation in amount of secretion. The color was uniformly dark brown to black and a peculiar odor was common to all secretions. In all 12 samples from seven male camels have been collected and preserved at -20° C. Efforts are in progress for the evaluation of volatile compounds (pheromones) through GC-MS.

**b) Effect of Bio-stimulation on augmentation of rut in male camel:**

The breeding practice adopted at our farm in particular and camel farmer in general is to start breeding in first week of December. To study effect of bio-stimulatory measure in augmenting rutting behavior in male camels an experiment was started on 1<sup>st</sup> October 2008. The bio-stimulatory measure was applied early in the morning at 6-8 a.m. The males were tied near the corral where adult non-lactating non-pregnant female camels were kept and / or brought inside the corral for 15 minutes each on alternate days. There were three Bikaneri (B 622, 488, 620), four Jaisalmeri (J 218, 228, 230, 128), four Kachchi (K 126, 128, 116, 166) and one Mewari (M 02), totaling 12 camels. The camels were observed for the following behavioural signs:-

(i) grunting and gurgling sound, (ii) secretion of poll glands and salivary glands with frothing (iii) ejection of soft palate (iv) standing posture with hind limb wide apart (v) tail movements (up&down)(vi) micturition(vii) mounting (ix) copulation. The camel was considered to be in rut when it performed copulation successfully.(Table-22).

**Table-22. Effect of bio-stimulation in augmenting rut in male camels**

S. N.	Days after bio-stimulation	Camels achieved rut
1.	< 10 days	Two (B 622, 488)
2.	10-20	Four (K 126, 166, J 218, 228)
3.	20-30	Two (M 02, J 230)
4.	No rut	K 128, 116, B 620, J 128

Bio-stimulation or sexual stimulation has a positive effect on male reproduction and can be effectively used to augment rut in the month of October.

**AR-4. Project : Identification of factors responsible for reproductive disorders and development of technology for countering the same**

**Sub-project:** To study the reproductive status of female camels beyond the traditional limits of breeding season and during early post parturient period.

**Project leader : Dr. Sumant Vyas**

**Associate : Dr. U.K. Bissa**

The female camels which did not conceive in the breeding season 2007-08 and other non-pregnant female camels were examined in the month of September, 2008 and were mated when found with follicle during the months of October and November (Table-23).

**Table-23. Reproductive status of female camels prior to breeding season**

S. N.	Breed	No. of camels			Pregnant on	
		Examined	With follicle	Mated	10/1/09	18/3/09
1	Bikaneri	10	5	5	4	3
2.	Jaisalmeri	14	9	8	4	3
3.	Kachchi	12	9	9	2	2
4.	Mewari	3	2	2	-	-
	Total	39	24	24	10	8*

\*B 509 (Date of mating 10/11/08) and J 109 (Date of mating 4/11/08) repeated after two months



**Table-24. Females camels pregnant out of non-traditional breeding during the month of October and November, 2008**

S. N.	Female	Male	Date of mating	Pregnant On 10/1/09	Calving interval reduced in comparison to 10/12/08	
					18/3/09	
1	B 457	622	6/10/08	Yes	Yes	60 days
2	B 561	622	20/10	Yes	Yes	50
3	B 573	488	6/10	Yes	Yes	60
4	K 133	126	26/10	Yes	Yes	44
5	K 105	126	25/11	Yes	Yes	15
6	J 127	218	27/10	Yes	Yes	43
7	J 135	228	10/10	Yes	Yes	60
8	J 159	218	3/11 17/11	Yes	Yes	23
			Total		8	Mean – 44 days

There is a reduction of 44 days of calving interval in these eight camels, if compared to the 10th December, which is usual date of start of breeding at our farm (Table- 24). These camels will calve at the onset of next breeding season giving us more chance to rebreed them in the same breeding season .

**Post-parturient breeding:** This is non-traditional

**Table-25. The camels conceived in post-parturient breeding during 2008-09.**

S. N.	Camel No	Date of parturition	Date of service	Stud
1.	B 551	4/1/2009	5/2/09, 27/3/09	B 600
2.	B 483	21/1/2009	3/3/09	B 600
3.	B 439	2/2/2009	13/3/09	B 602
4.	B 467	20/2/2009	27/3/09	B 602
5.	J 389	7/1/2009	10/2/09, 13/3/09	J 228

breeding not practiced in the field as well as organized farms. The camels were mated during 30-70 days after calving in the same breeding season. A total of 20 camels were mated out of which 5 conceived (Table -25). There will be reduction of calving interval of 300 days in these she camels. The calving out of post parturient breeding(2007-08) and the lactation yield of such females is shown in Table- 26,27 and Fig.16.

**Table-26. Calving of the camels conceived in 2007-08 as a result of early post parturient breeding**

S.N.	Camel	Date of first parturition	Date of Conception	Date of second parturition	Calving interval (days)
1.	B 505	3/1/2008	19/3/2008	17/2/2009	411
2.	J 65	15/1/2008	10/3/2008	21/3/2009	431
3.	B 443	9/2/208	6/3/2008	23/3/2009	408
4.	J 85	3/2/2008	7/3/2008	26/3/2009	407
				Average	414

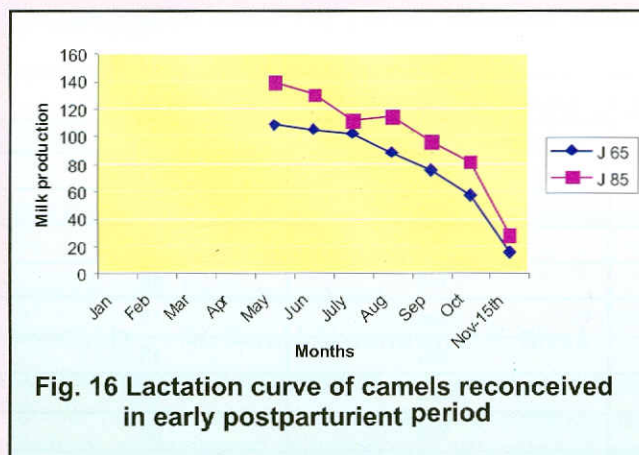
Average calving interval is 414 days.

**Table-27. Lactation yield (litres, two teat milking, twice a day) of two camels, which reconceived in the early post parturient period.**

Camel	Date of calving	Date of Conception	May	June	July	Aug	Sep	Oct	Nov
J 65	15/1/08	10/3/08	108.5	105.5	102.7	88.6	75.8	57.7	15.6
J 85	3/2/08	7/3/08	139.7	130.6	111.6	114.6	96.3	81.8	28.1

**Table-28. Trace mineral and biochemical profile (mean SE) of camels bred in early post parturient period**

Samples	Fe (ppm)	Zn (ppm)	Cu (ppm)	Mn (ppm)	Mg (mg%)	Ca (mg%)	P (mg%)	Total Protein
Pregnant (n=7)	39.46±3.29	1.61±0.19	0.93±0.07	0.9±0.04	3.43±0.08	9.61±0.45	3.72±0.44	5.72±0.47
Non Pregnant (n=20)	34.72±1.61	1.94±0.24	0.99±0.03	0.9±0.02	3.46±0.06	9.65±0.26	2.93±0.26	5.6±0.19
Overall	35.95±1.49	1.85±0.19	0.97±0.03	0.90±0.02	3.45±0.05	9.64±0.22	3.13±0.24	5.63±0.18



**Fig. 16 Lactation curve of camels reconceived in early postparturient period**

The trace mineral and biochemical profile of camels bred in early post parturient period were evaluated and t-test revealed no significant difference between camels conceived and not conceived during early post-parturient period in terms of serum Fe, Zn, Cu, Mn, Mg, Ca, P and total protein (Table- 28). These was wider Ca:P ratio in non-pregnant females.

**Use of hCG preparation in infertility treatment:** Camel is an induced ovulating species. Anovulation is one of the causes of repeat breeding in the organized farms where animals are mated under controlled condition. Inj Pubergen-HP 5000 IU (hCG) was tried in six camels at the time of fourth service in the last period of breeding season (March, 2009). One out of six camels conceived. The repeated trials are required in next breeding season.

**AR-5. Project : Improving the efficiency of artificial insemination in camel using existing and emerging technologies**

**Sub-project: To study the time of insemination in camel with use of hCG preparations**

**Project leader : Dr. Sumant Vyas**

**Associate : Dr.Gorakh Mal**

Female camels (n=15) were selected and were used for 30 inseminations in three groups. The male camels were selected and semen was collected not more than twice a week per male camel. The semen quality (thick gel at least 1.5 ml whole fresh ejaculate) and reproductive status of female (follicle size 1.0-2.5 cm diameter) insemination technique and site of deposition (uterine body) was same in each insemination. Ten inseminations (10 each) were carried after 24, 36 and 48 h of the administration of 4500 IU of

hCG (Inj. Chorulon) used as ovulation inducing measure. The blood was collected at 0, 7, 9, 15 and 30 days of hCG administration for progesterone assay. The pregnancy was checked by tail cocking method at 21 days and was further confirmed by rectal palpation at 45-60 days of insemination.

The results suggest that AI at 48h is not useful. More work is required for successful artificial inseminations at 24h and 36 h after hormonal treatment for ovulation. The progesterone estimation at 0, 7, 9, 15, 30 days post insemination will reveal more accurate information about ovulation, conception and early embryonic death.

### Camel Biochemistry Unit

**AP-3. Project: Processing, value addition and commercialization of different camel products and by-products**

**Project Leader : Dr. Gorakh Mal**

**Associates : Dr. C. Bhakat**

**: Dr.(Mrs.) D. Suchitra Sena**

Experiments were conducted to standardize the protocol for making cheese from the camel milk. The camel/cow milk was filtered and heated to 72°C/15sec. CaCl<sub>2</sub> (0.02%) or CaSO<sub>4</sub> (0.015%) was added with continuous shaking. Afterwards allowed cooling up to 40°C and 1% starter culture was added. The temperature was maintained between 35°C-40°C and after 30 min. different concentrations of rennet/ pepsin were used for the coagulation of milk but 600mg/L rennet/pepsin was found to be sufficient for the coagulation of camel milk. At this concentration, coagulation time was found to range between 1.5 - 2h for rennet and 10-15 minutes for pepsin (Fig.17). Further coagulated milk was kept for 2h at 40°C and afterwards cutting was done. After cutting the cheese curd, cooking was performed at 40°C till the whey gets separated (Fig. 18 and 19). Moisture, fat and yield of cheese was 38-45%, 18-22% and 7-9% respectively.

Sensory evaluation was carried out for the cheese prepared from camel milk+ rennet (type 1), camel milk+ pepsin (type 2) and cow milk + rennet (type 3). Smell, color, body taste and overall acceptability were found to be almost same in all the three types of cheese. However, the taste of camel milk cheese prepared using pepsin was significantly (P<0.05) better compared to other types of cheese (Table- 29).

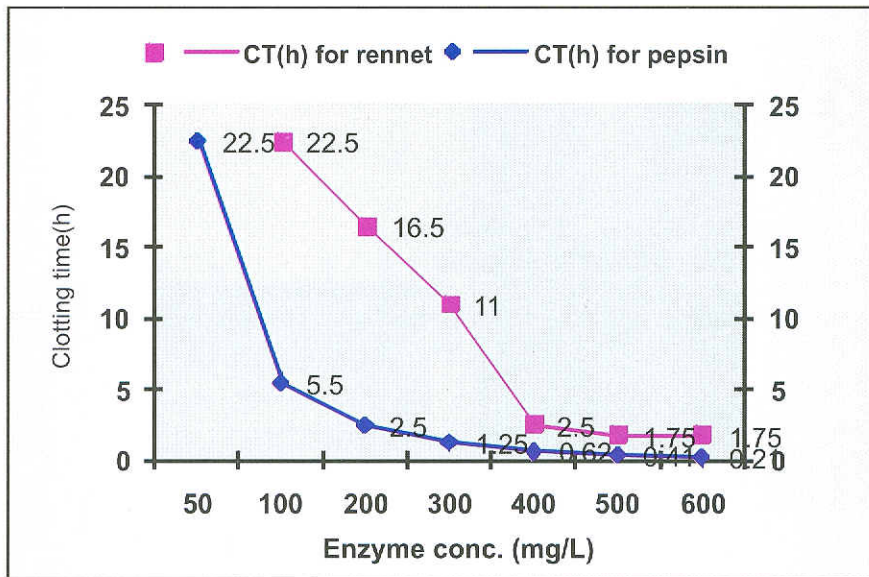
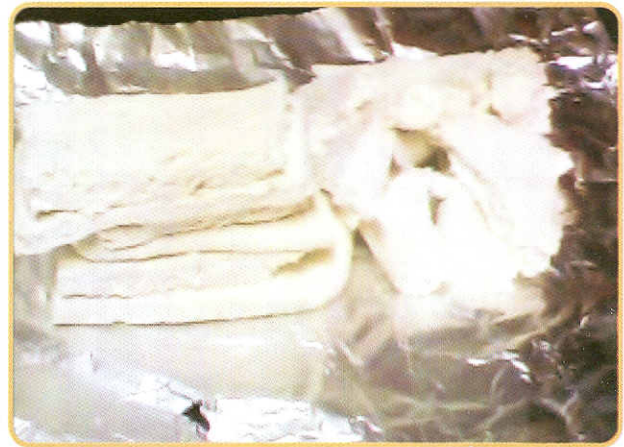


Fig. 17 Clotting time versus enzyme concentration



Fig.18 Camel milk after addition of rennet (R) and Pepsin (P),(2) Temperature monitoring,(3) after 5 min.,(4) after 10 min.,(5) Cutting and cooking of curd (6) Separation of whey



Camel milk cheese ( R )



Camel milk cheese(P)

Fig. 19 Camel milk cheese prepared with rennet (R) and pepsin (P)

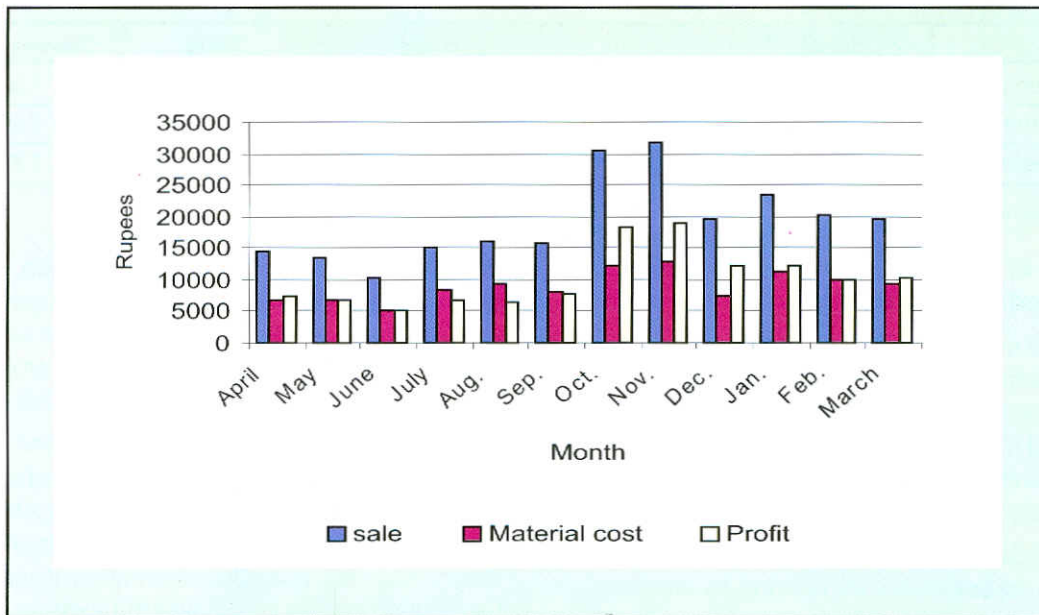


Fig. 20 : Month-wise sale, material cost and profit from camel milk parlour

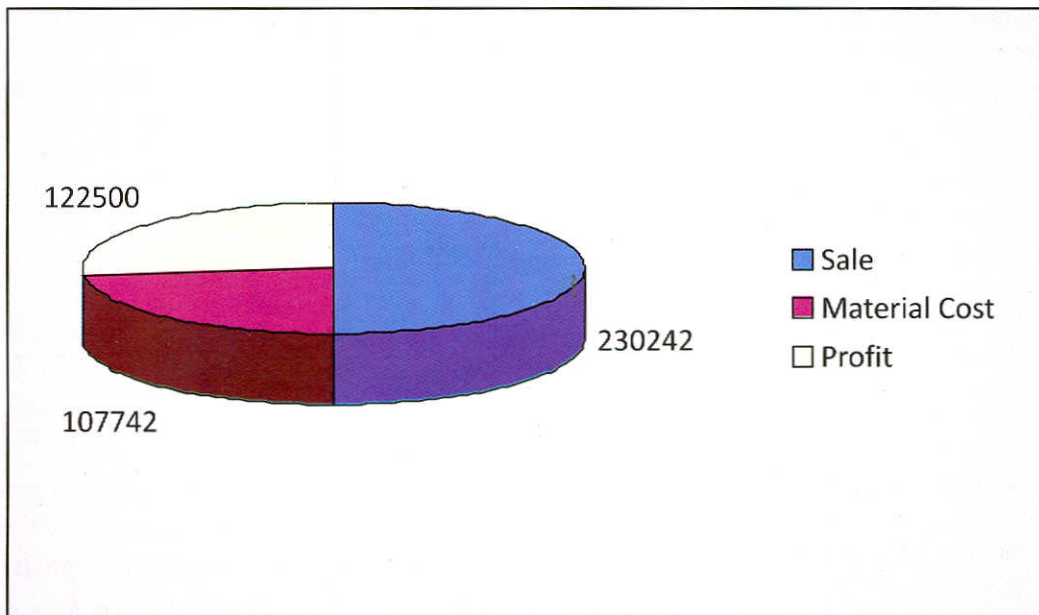


Fig. 21 : Net profit from camel milk and milk products from April 2008-March 2009 (Rupees)

**Table-29. Mean of sensory evaluation of cheese made from camel/cow milk using Hedonic scale (9: most desirable, 5: optimum, 1: most undesirable)**

Source	Smell	Color	Body	Taste	Overall acceptability
Camel milk + rennet	7.11±0.26	8.44±0.17	7.55±0.17	6.33a±0.37	7.30±0.16
Cow milk + rennet	7.55±0.44	8.11±0.31	7.67±0.17	6.89a±0.26	7.59±0.20
Camel milk + pepsin	7.44±0.44	8.55±0.24	7.89±0.26	7.44b±0.29	7.77±0.24

Values with different superscripts differ significantly ( $P < 0.05$ )

### Assessment of commercial viability of camel milk and its value added products

Camel milk and milk products viz., Kulfi, flavored milk, tea and coffee were prepared and sold in the camel milk parlour started by NRCC. Sale and profit from the camel milk and milk products was highest in October and November months (Fig. 20). Profit of Rs. 122500 was observed during the year (Fig. 21).

### AR-2. Project : Studies on the biochemical parameters of semen for increasing its efficacy

**Project leader : Dr. Gorakh Mal**

**Associates : Dr. Sumant Vyas**

**: Dr.(Mrs.) D. Suchitra Sena**

Experiments were undertaken to compare the levels of various constituents in blood and seminal plasma samples from the Jaisalmeri camels' viz., Calcium (Ca), Phosphorus (P), Magnesium (Mg), Sodium (Na), Potassium (K), Copper (Cu), Zinc (Zn), Iron (Fe) and Manganese (Mn). The concentrations of Ca, Zn and Fe were 1.9x, 6.11x and 20.14x higher in seminal plasma as compared to blood plasma. Almost same levels of P, Mg, Na, K, Cu and Mn were found in blood and seminal plasma samples (Table- 30). Higher levels of Ca, Zn and Fe might be playing an important role in the process of coagulation and liquefaction of camel semen. Therefore, a time course study was done for Ca, Zn and Fe in the fresh seminal plasma samples (0h) and aliquots taken at different time intervals (6h, 12h, 18h, 24h, 30h, 42h, 48h, 96h, 124h and 136h). The levels of Ca remain almost stable up to 18h and afterwards it starts to decline up to 48h. Further reduction was observed and the reduced levels were maintained up to 136h (Fig. 22). The levels of Fe remain stable up to 48h and afterwards reduced levels became almost static up to 136h (Fig. 23). The level of Zn remains stable during the period of study without any trend (Fig. 24).

Denaturing agents  $\beta$ - mercaptoethanol (5%) and

CTAB (Cetyltrimethylammonium Bromide, 2.5%) were used to disrupt the complexes of proteins.  $\beta$  mercaptoethanol was able to disrupt disulfide bridges of the seminal plasma proteins (Fig. 25) and complete loss of around ~100kDa protein band was observed after using CTAB (Fig. 26).

This study indicates that Ca and Fe might be playing role in coagulation/liquefaction of camel semen. Ca starts to act after 18h and Fe after 48h of storage. Interactions between proteins and minerals might be responsible for coagulum formation in camel semen. Denaturing agents could alter the expression pattern of seminal plasma proteins

**Table-30. Comparison of the levels of various parameters in camel blood plasma and seminal plasma samples (n=8)**

Parameter	Camel blood plasma Mean±S.E.	Camel seminal plasma Mean±S.E.
Ca (mmol/L)	2.40±0.19	4.56±0.07 (1.9x)
P (mmol/L)	1.53±0.10	1.58±0.08
Mg (mmol/L)	2.80±0.19	2.49±0.11
Na (mmol/L)	153.40±2.78	155.70±1.12
K (mmol/L)	8.35±0.18	12.82±0.79
Cu (ppm)	1.48±0.11	1.47±0.14
Zn (ppm)	1.59±0.14	9.72±0.92 (6.11x)
Fe (ppm)	2.81±0.25	56.62±3.51(20.14x)
Mn (ppm)	1.84±0.23	1.78±0.19

### AP-4. Project: Evaluation of anti-wrinkling property of camel milk cream in human

**Project Leader: Dr. K. M. L. Pathak and Dr. R.A. Bumb**

**Associates : Dr. Gorakh Mal, Dr. R. D. Mehta,**

**Dr. B. C. Ghyia and Dr.Ranu Jakar**

Camel milk cream prepared by NRCC was submitted to Department of Skin and V.D., S.P. Medical College, Bikaner for its evaluation as an anti-ageing agent. Study was conducted in 50 test group patients and 50 control group patients for 6 months. No significant

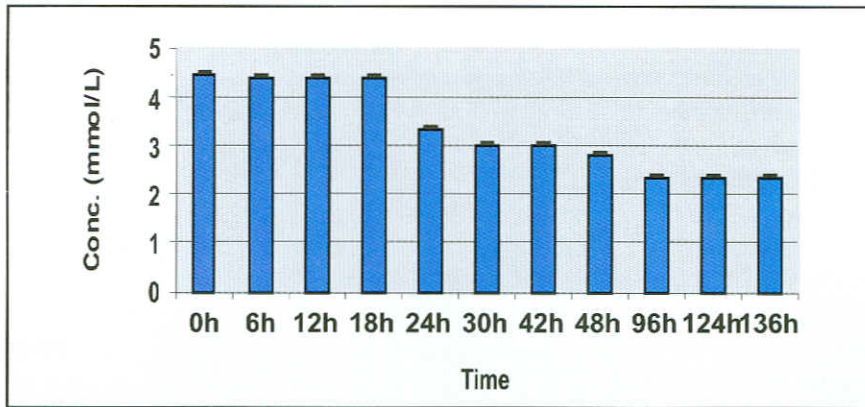


Fig.22 Conc. of Ca(mmol/l) in the fresh seminal plasma samples and aliquots taken at different time intervals

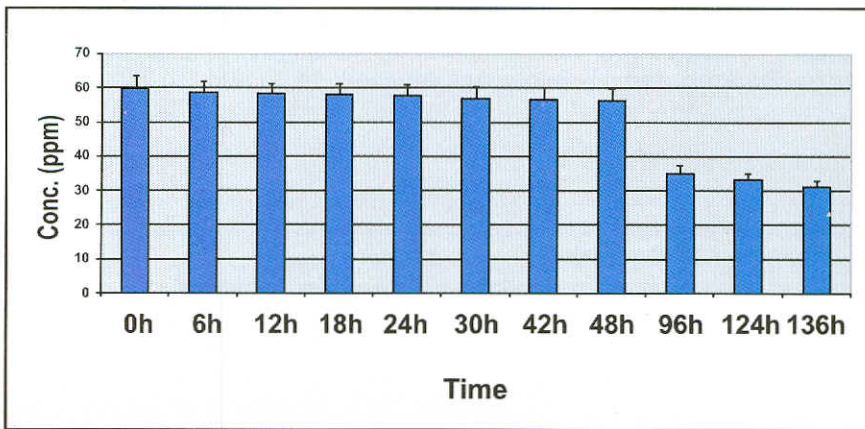


Fig.23 Conc. of Fe(ppm) in the fresh seminal plasma samples and aliquots taken at different time intervals

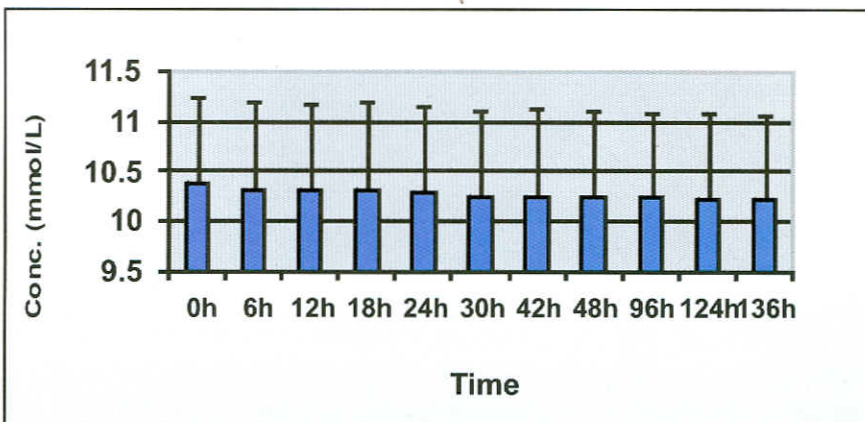


Fig.24 Conc. of Zn (ppm) in the fresh seminal plasma samples and aliquots taken at different time intervals

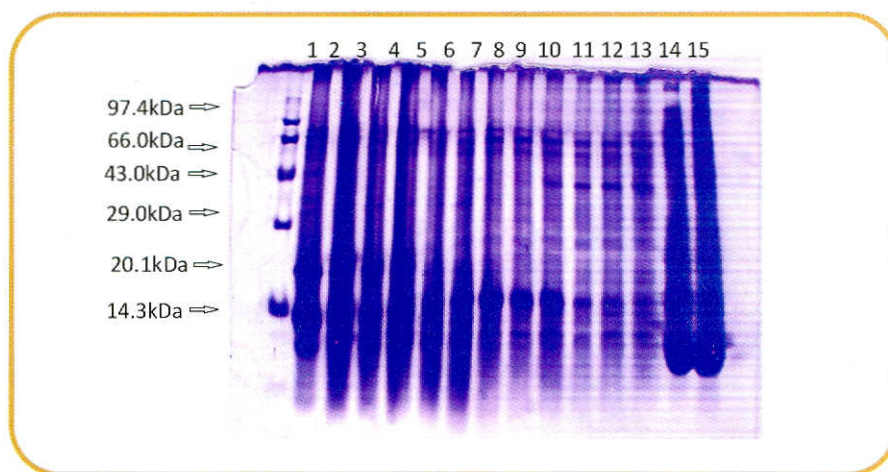


Fig.25 Seminal plasma sample of J-224 run on 15% gel. Lane-1, marker RPMW-M; 2, 0h; 3, 17h; 4, 22h; 5, 25h; 6, 41h; 7, 48h; 8, 65h; 9, 89h; 10, 96h; 11, 113h; 12, 120h; 13, 137h (2-13 reduced, 5%  $\beta$ -mercaptoethanol); 14, 0h and 15, 17h (14-15 unreduced).

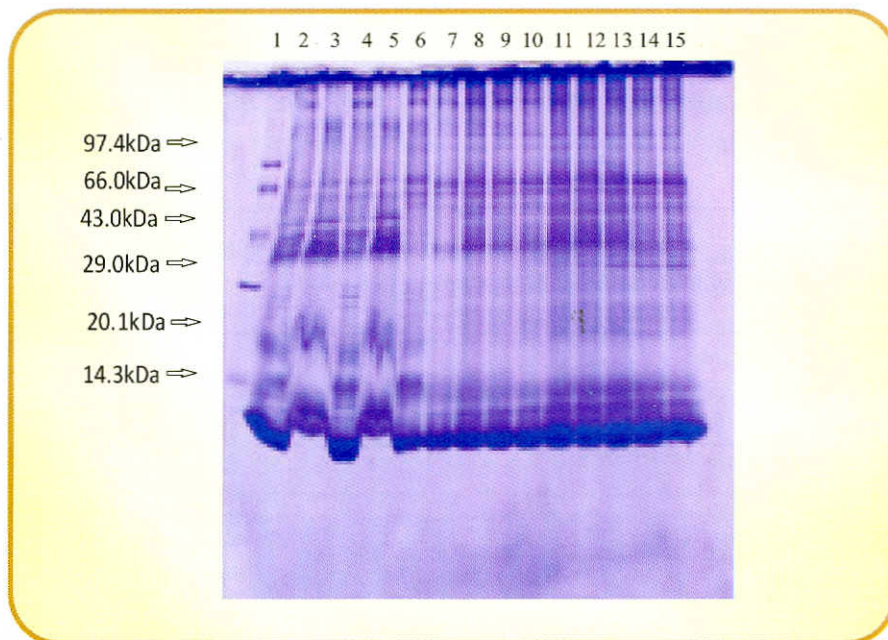


Fig. 26 Seminal plasma sample of J-120 /J-128 run on 15% gel. Lane-1, marker RPMW-M; 2, 0h; 3, 0h + CTAB ( Cetyltrimethylammonium Bromide ); 4, 40h; 5, 40h + CTAB (2-5 J-120); 6, 0h; 7, 16h; 8, 20h; 9, 23h; 10, 40h; 11, 44h; 12, 47h; 13, 64h; 14, 68h and 15, 72h (6-15j-1280).



difference was observed between these groups. This was concluded that camel milk cream could be used as an emollient agent. The claims for anti-ageing/ anti-wrinkling property of camel milk skin cream are still to be proved.

**Project : Identification, characterization and structural studies of proteins from camel milk**

**Sub-project : Structural and functional studies of camel Peptidoglycan Recognition Proteins**

**Project leaders: Prof. K.M.L. Pathak and Prof. T. P. Singh (AIIMS, New Delhi)**

**Associates : Dr. Gorakh Mal (NRCC), Mr. Pradeep Sharma (AIIMS), Dr. Sujata Sharma (AIIMS), Dr. P.Kaur (AIIMS), Dr. A.Srinivasan (AIIMS)**

The mammalian peptidoglycan recognition protein-S (PGRP-S) binds to peptidoglycans (PGNs), which are essential components of the cell wall of bacteria. The protein was isolated from the samples of milk obtained from the mastitis infected camels and purified to homogeneity. It was crystallized using 10% polyethylene glycol-3350 at pH 8.0 as the precipitating agent. The crystals belong to orthorhombic space group I222 with  $a = 87.0\text{\AA}$ ,  $b = 101.7\text{\AA}$  and  $c = 162.3\text{\AA}$  having four crystallographically independent molecules in the asymmetric unit. The structure has been determined using X-ray crystallographic data and refined to 1.8Å resolution. Overall, the structures of all the four crystallographically independent molecules are identical. The folding of PGRP-S consists of a central  $\beta$ -sheet with five  $\beta$ -strands, four parallel and one antiparallel and three  $\alpha$ -helices. This protein fold provides two functional site(Fig. 27). The first of these is the PGN-binding site, located on the groove that opens on the surface in the direction opposite to the location of the N-terminus. The second site is implicated to be involved in the binding of non-PGN molecules, it also include putative N-terminal segment residues, (1-31) and helix  $\alpha_2$  in the extended binding. The structure confirms that the two binding sites are spatially located on the opposite surfaces of the molecule. The structure reveals a novel arrangement of

PGRP-S molecules in which two pairs of molecules associate to form two independent dimers. The first dimer is formed by two molecules with N-terminal segments at the interface in which non-PGN binding sites are completely buried whereas the PGN- binding sites of two participating molecules are fully exposed at the opposite ends of the dimer. In the second dimer which is formed by another set of two molecules in which the PGN binding sites are buried at the interface while the non-PGN binding sites are located at the opposite surfaces of the dimer. This form of dimeric arrangement is unique and seems to be aimed at enhancing the capability of the protein against specific invading bacteria. This mode of functional dimerization enhances efficiency and specificity and is observed for the first time in the family of PGRP molecules.

**AP-5.Project : Evaluation of camel milk for its therapeutic value and its exploitation as functional food**

**Project leader : Dr. Gorakh Mal**

**Associate : Dr.(Mrs.) D. Suchitra Sena**

Camel milk samples were collected from 14 mid and late lactating camels belonging to three different breeds and 3 cow milk samples procured locally. Milk samples were heated at different temperatures (63°C, 70°C, 80°C, 90°C and boiled) for 30 minutes. Whey was separated from the heated/ boiled and raw milk samples. Simultaneously, whey from the cow milk was separated. Average whey proteins concentration in raw camel milk during mid and late lactation were 0.92±0.03, 1.23±0.01 and 0.96±0.01 percent and 1.00±0.06, 1.29±0.04 and 1.05±0.02 percent (Table-31) respectively in Bikaneri, Jaisalmeri and Kachchhi camels. In Kachchhi, Bikaneri and Jaisalmeri milk samples, whey proteins denaturation during mid and late lactation at 63°C was 7.29, 10.87 and 23.58%(Fig.28) and 10.48, 12.00 and 19.38% respectively (Fig. 29).

In boiled camel milk, average whey proteins concentration were 0.320.01, 0.600.02 and 0.430.01 percent and 0.280.04, 0.500.02 and 0.370.01 percent respectively in Bikaneri, Jaisalmeri and Kachchhi camels during mid and late lactation. Whey proteins denaturation during mid and late lactation in boiled camel milk was 55.20, 65.21 and 51.22% and 64.76, 72.00 and 61.24% respectively in Kachchhi, Bikaneri and Jaisalmeri camels.

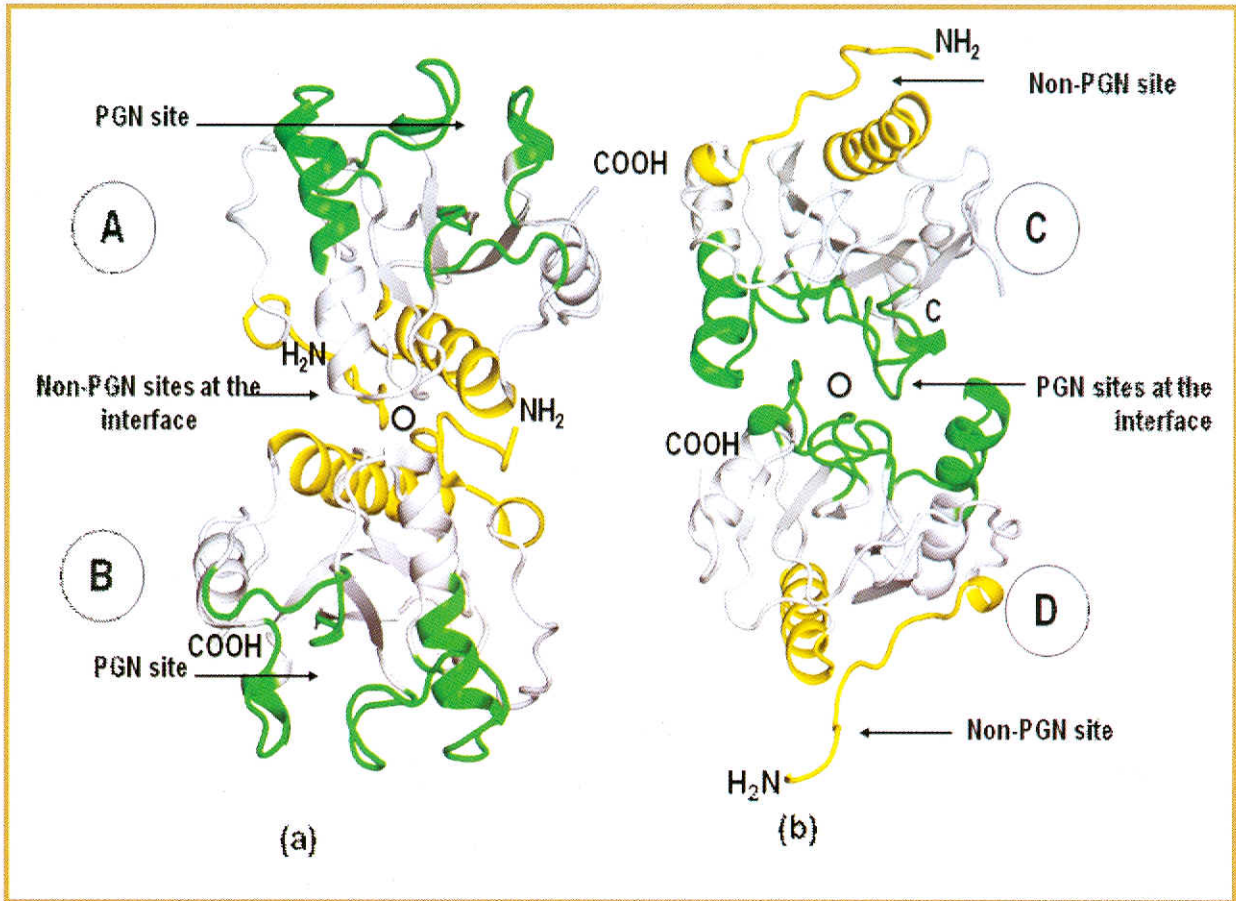


Fig. 27 The two dimers are drawn to indicate the PGN and non-PGN-binding sites.(a) In dimer 1,the two PGN-binding sites are indicated in green, while non - PGN-binding sites are buried at the interface in yellow (b) in dimer 2,the revers is the case. O indicates the position of the 2-fold axis perpendicular to the plane of the paper.

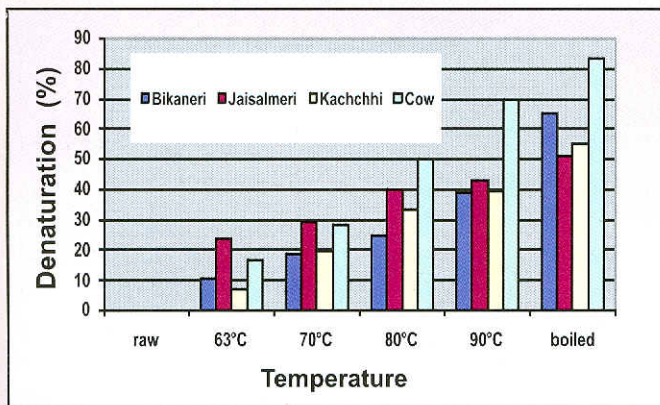


Fig.28 Whey proteins denaturation(%) during mid Lactation at different temperature

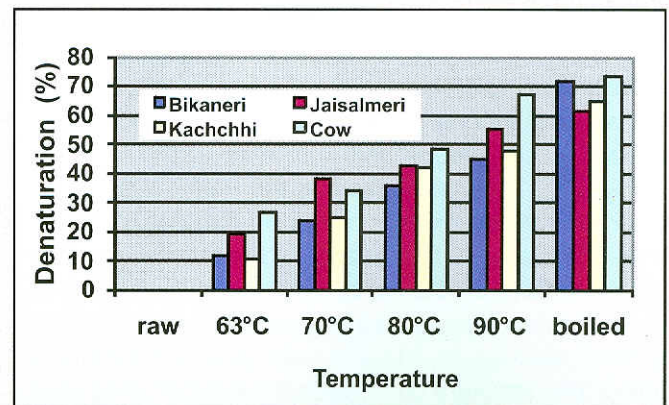


Fig. 29 Whey proteins denaturation(%) during late Lactation at different temperature

**Table-31. Whey proteins (%) in the mid and late lactation milk samples**

Temperature	Breeds during mid lactation				Breeds during late lactation			
	Bikaneri	Jaisalmeri	Kachchhi	Cow	Bikaneri	Jaisalmeri	Kachchhi	Cow
Raw	0.92±0.03	1.23±0.01	0.96±0.01	0.60±0.01	1.00±0.06	1.29±0.04	1.05±0.02	0.64±0.03
63°C	0.82±0.05	0.94±0.01	0.89±0.03	0.50±0.01	0.88±0.07	1.04±0.02	0.94±0.01	0.47±0.01
70°C	0.75±0.04	0.87±0.03	0.77±0.01	0.43±0.01	0.76±0.04	0.80±0.03	0.79±0.01	0.42±0.01
80°C	0.69±0.04	0.74±0.01	0.64±0.04	0.30±0.01	0.64±0.04	0.74±0.01	0.61±0.01	0.33±0.01
90°C	0.56±0.07	0.70±0.02	0.58±0.05	0.18±0.01	0.55±0.03	0.58±0.01	0.55±0.02	0.21±0.02
Boiled	0.32±0.01	0.60±0.02	0.43±0.01	0.10±0.02	0.28±0.04	0.50±0.02	0.37±0.01	0.17±0.01

**Unit: Camel Management**

**Programme: Developing camel management practices in present and impending climate change scenario.**

**LPM-1. Project: Studies on camel rearing practices in different system of management**

**Project leader: Dr. Champak Bhakat**

**Associates : Dr. (Mrs.) N. Saini and Prof. K. M. L. Pathak**

The eighteen camel calves at 15 – 20 months of age were divided into two groups of 9 animals each. Each of the group consisted of 4 Bikaneri, 3 Jaisalmeri, and 2 Kachchhi breed animals. There were 4 males and 5 females in both groups. Manger feeding of mungphali chara (*Arachis hypogaea*) + guar crop residue (*Cyamopsis tetragonoloba*) was provided. When one group is reared under intensive system of management and then the other group was reared under semi-intensive system of management.

The average growth rate increased significantly ( $P < 0.01$ ) in the semi-intensive group ( $312.39 \pm 58.94$  gm / day) as compared to intensive management group ( $259.61 \pm 56.07$  gm / day). The total body weight gain was found to be higher in semi-intensive management (56.23 kg) than that of intensive management (46.55 kg) after 180 days. The average fodder and water intake from manger is slightly higher in first group than the second group. The total dry matter intake was  $5.29 \pm 0.48$  kg /calf / day and the feed conversion efficiency was  $12.86 \pm 0.71$  for intensive management group.

The comparative biometrics of camel calves in different system of management reveals that body length, heart girth, height at wither, hump circumference horizontal, neck length, leg length (front & hind) are significantly ( $P < 0.01$ ) increased in semi-intensive management group as compared to the first group. Few

biometrical parameters viz. hump circumference vertical, footpad width (hind), foot pad length (front) varied significantly ( $P < 0.05$ ).

Serum biochemical attributes of calves in different systems of management are presented in Table-32. Total protein, globulin, calcium, phosphorus, zinc, manganese significantly ( $P < 0.05$ ) increased in semi-intensive management than intensive management group. The albumin, urea, magnesium, copper, iron varied non-significantly between groups.

The economic analysis of rearing camel calves in two systems of management has also been calculated. The total cost for per kg body weight gain is less (Rs 29.65) and economical for semi-intensive management as compared to the intensive management system costing Rs 48.31

**Table-32. Serum biochemical attributes of calf in different system of management**

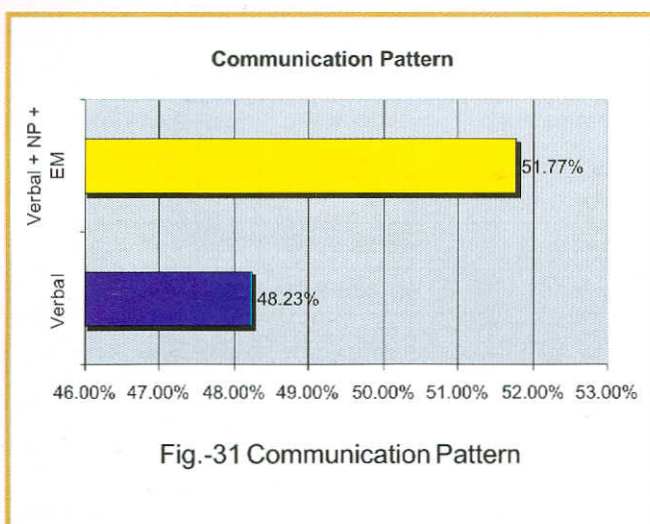
Parameters	Intensive system		Semi-intensive System
Total Protein (g %)	$4.97 \pm 0.21$	*	$6.12 \pm 0.39$
Albumin (g %)	$3.17 \pm 0.19$	NS	$3.05 \pm 0.12$
Globulin ((g %)	$1.80 \pm 0.14$	*	$3.07 \pm 0.28$
Urea (mg %)	$23.46 \pm 1.25$	NS	$22.18 \pm 1.99$
Calcium (mg %)	$8.94 \pm 0.26$	*	$10.10 \pm 0.34$
Magnesium (mg %)	$3.12 \pm 0.25$	NS	$3.16 \pm 0.29$
Phosphorus (mg %)	$4.85 \pm 0.53$	*	$5.59 \pm 0.49$
Copper (ppm)	$0.88 \pm 0.03$	NS	$0.94 \pm 0.07$
Zinc (ppm)	$0.96 \pm 0.05$	*	$1.31 \pm 0.08$
Iron (ppm)	$9.29 \pm 0.91$	NS	$10.20 \pm 0.83$
Manganese (ppm)	$0.28 \pm 0.03$	*	$0.39 \pm 0.04$

\* Significant at 5%, NS: Non-significant.

**Sub-Project : Studies on socio-economic scenario of camel husbandry at grass root level****Project leader :Dr. Champak Bhakat****Associate : Prof. K. M. L. Pathak**

The data was collected from 141 camel keepers on a survey proforma by participatory approach. The socio-economic aspects have been studied from 14 villages of Bikaner district viz: Bachchhasar, Gadwala, Jasrasar, Udasar, 8KYDchalk, Khajuwala, Lunkaransar, Mahajan, Pugal, Nada, Seruna, Lakhmisar, Salasar, Kolayat.

Maximum respondents (53.19 %) were having less than and equal to 8 members in their family. But 46.81 % of respondents are also having more than 8 members. The 50.35 % of camel keepers are less than and equal to 40 years of age group whereas 48.65 % of respondents are more than 40 years of age group. In this study area majority of respondents are illiterate i.e 63.83 % whereas 36.17 % of respondents are reported to be in a literate group. Most of the respondents (69.50 %) are having more involvement in different social activities but 30.50 % of them are having less involvement in different social activities. The Fig.31 reveals that some of the camel keepers are using only verbal means of communication whereas majority (51.77 %) are using multi communication channels like verbal + newspaper + radio + Television + other electronic media etc.



The small category of farmers mostly feed their camels by sending them out for grazing. But large category of farmers usually feed their camels at home and 55 % of the farmers from medium category follow a mixed practice of feeding management.

**Table-33. The extent of association of socio-personal parameters with sustainable livelihood of camel dairy**

	Family Size	Age	Education	Social Participation	Communication Pattern
	**	NS	NS	*	**
Sustainable livelihood of camel dairy	52.33	2.88	3.02	6.08	23.42

\*\* Significant at 1 %, \* Significant at 5 %,

NS: Non-significant.

**Sub-Project : Services of Extension, communication and human resource development****Project leader :Dr. Champak Bhakat****Associate : Prof. K. M. L. Pathak**

**Camps for Scientific Exhibitions:** During the reporting time period three exhibitions were organized viz. (1.) Veterinary college, RAU, Bikaner w.e.f. from 12.8.08 to 15.8.08 with a theme of "Recent advances of camel research and technical know-how" (2.) AKS, ATMA, Bikaner w.e.f. 21.10.08 to 25.10.08 with a theme - "Utilization of value added products and technology" (3.) Pushkar animal fair from 9.11.08 to 12.11.08 with a theme - "Camel products and technology". These are depicting latest technologies developed by centre & handouts are distributed at free of cost in these camps.

**A.T.M.A (NGO) Collaboration:** The farmers (326) from A.T.M.A, NGO were entertained and demonstrated practical training throughout the year and provided with educational information through extension literatures free of cost.

**Transfer of technical know how :** Efforts have been made to popularize the technical know how of preparation of camel milk products among common people, farmers and high official level to disseminate it.



Flavored milk, tea, coffee, kulfi of camel milk has been provided to various national and international visitors. Attempts are taken to transfer the technical know how of electricity generation by camel draughtability.

**Farmer's meet and kissan gosthi:** Two farmer's meet and gosthies were conducted at NRCC on 10.5.08 and Agricultural Khel stadium, RAU on 24.10.08. During the gosthi camel keepers were apprised about the camel diseases, modern management practices followed at an organized farm.

**Demonstrations and practical trainings :** The demonstrations and practical trainings were provided to various groups of farmers and students viz. 40 farmers from newly adopted village on 10.5.08, 35 farmers from Barmer on 8.7.08, 12 farmers from Punjab, T.I.S. & W on 19.2.09, 2194 school students from all over country, 200 scout guides and internee of Apollo college of veterinary medicine on 17.6.08 & 2.8.08.

**Collaboration :** The Centre is collaborating with NGO "Samvedana Sansthan", CSWRI, Avikanagar, URMUL Trust and dairy, KVK, Beechwal, LPPS Sadri, Pali, ATMA Jaipur and RAU, Bikaner for different extension activities. Efforts have been made to popularize the technologies of center through a holistic approach.

**Revenue generation programme :** Revenue collection has increased significantly in the present year as compared to the previous year. Attempts are being made to extend camel museum to look more scientific and informative so that it can attract large number of tourists and generate more revenue for the centre.

**Unit: Camel Health**

**VM-8. Project: Epidemiology of infectious diseases of camel**

**Project Leader: Prof. K. M. L. Pathak**

**(a)Sub-Project: Epidemiology of bacterial and fungal diseases of camels**

**Sub-Project Leader :Dr. F. C. Tuteja**

**Associate :Dr. S. K. Dixit**

Antibiotic sensitivity of 78 bacterial isolates from skin, mammary gland, gastrointestinal tract, eye and ear infections revealed an overall sensitivity of 96.15 percent against tetracycline, followed by cotrimoxazole (78.20%), cefuroxime (58.97%), cephaloxime (53.85%), lincomycin and cloxacillin (47.44% each), respectively (Table- 34). Different cases of fungal infection were reported from field (Fig. 31a,d).

**Table- 34. Antibiotic sensitivity of bacterial isolates**

Antibiotic	*Sensitivity	Organisms					Total (78)	Percent
		<i>Staph aureus</i> (20)	<i>Staph epidermidis</i> (28)	<i>Corynebacterium spp</i> (18)	<i>Bacillus spp</i> (10)	<i>Pseudomonas spp</i> (2)		
Tetracycline	S	19	28	17	10	1	75	96.15
	I	1	-	-	-	1	2	2.57
	R	-	-	1	-	-	1	1.28
Cotrimoxazole	S	12	26	14	8	1	61	78.20
	I	-	2	2	-	-	4	5.13
	R	8	-	2	2	1	13	16.67
Cloxacillin	S	6	14	9	7	1	37	47.44
	I	-	-	-	-	-	0	0
	R	14	14	9	3	1	41	52.56
Lincomycin	S	5	12	11	8	1	37	47.44
	I	-	-	-	-	-	0	0
	R	15	16	7	2	1	41	52.56
Cefuroxime	S	7	17	14	7	1	46	58.97
	I	2	6	-	-	-	8	10.26
	R	11	5	4	3	1	24	30.77
Cephaloxime	S	10	16	11	4	1	42	53.85
	I	8	12	-	5	1	26	33.33
	R	2	-	7	1	-	10	12.82

\*S- Sensitive, I- Intermediate and R-Resistant



Fig.31(a) Fungal thikria in camel calf



Fig.31(b) Weakness and emaciation of calf due to thikria



Fig.31(c) Fungal infection of udder



Fig.31(d) Fungal hyperkeratosis

**(b) Sub-Project: Epidemiology of major parasitic diseases of camel**

**Sub-Project Leader: Dr. S.K. Ghorui**

**Associates: Dr. G. Nagarajan and Dr. Sanjay Kumar**

Camel Health Camps at Jodhpur, Pali, Bikaner (Bajju, Phatuwala, Charanbala), Jaisalmer (Chandan, Dwara, Khetolai) and Udaipur (Dingri, Kejar, Sippur & Dunger) and Churu (Sardarsahar) were organized to collect different biological samples from camels. State animal fair of Gogamedi (Hanumangarh) and Nagaur have also been covered to have maximum number of samples. The herd size of camels have been observed

at 250- 375 heads in Bikaner and Jaisalmer districts. At other places the herd size is comprised of about 30 camels. In Churu district the camels are mostly reared in a group consisting of 1-5 animals. The prevalence of major diseases of camels encountered at different places have been presented in (Table-35 to 38 & Fig.-32-33) After microscopic examination of oocysts and amplification of DNA of coccidian oocysts with different primers, two genus of coccidia were identified i.e. *Eimeria* and *Isospora*. Few samples (9) from NRCC Farm and Bajju (Bikaner) were also found positive for *Balantidium* infection.

**Table-35. Collection of blood samples of camel from different area of Rajasthan and their examination for prevalence of *Trypanosoma evansi* by blood smear and PCR.**

S.N.	Name of places (District)	Total no. of samples collected	Total no. of positive sample (By blood smear examination)	Total no. of positive sample (By PCR)
1.	Bhajju & Phattubala (Bikaner)	58	2	7
2.	Gogamedi animal fair (Hanumangarh)	81	3	7
3.	Charanbala & Bhajju (Bikaner)	94	1	5
4.	Chandan, Dwara, Khetolai (Jaisalmer)	100	2	14
5.	Nagaur Animal Fair	40	0	2
6.	Jodhpur & Pali	50	2	6
7.	Sardarsahar (Churu)	23	0	2
8.	Dingri, Kejar, Sippur & Dunger (Udaipur)	105	5	11

**Table-36. Positive samples (%) as examined by blood smear and PCR based methods**

S.N.	Name of places (District)	Number of samples	Positive samples % (Blood smear test)	Positive samples % (PCR test)
1.	Bhajju & Phattubala (Bikaner)	58	3.45	12.07
2.	Gogamedi animal fair (Hanumangarh)	81	3.70	8.64
3.	Charanbala & Bhajju (Bikaner)	94	1.06	5.32
4.	Chandan, Dwara, Khetolai (Jaisalmer)	100	2.0	10.0
5.	Nagaur Animal Fair	40	0.0	5.0
6.	Jodhpur & Pali	50	4.0	8.0
7.	Sardarsahar (churu)	23	0.0	8.70
8.	Dingri, Kejar, Sippur & Dunger (Udaipur)	105	4.76	10.48

Table-37. Faecal samples examination for coccidia infection

Number of samples collected	Number of camels taken for faecal sample examination / Number of samples positive for coccidia infection			Place of sample collection	Month of collection
	< 1 year	1-3 years	>3 years		
80	28/5 28/2*	10/1 10/2*	42/0 42/1*	NRCC herd	Sep. 2008 Jan. 2009
68	4/1	6/1 6/2*	58/0 58/2*	Bajju & Phattubala (Bikaner)	Aug. 2008
90	0/0	13/0	77/0	Gogamedi (Hanumangarh)	Sept. 2008
78	0/0	11/1	67/0	Local area of Bikaner	Nov. 2008 Feb. 2009
55	16/2	7/1	32/1	Charanbala & Bajju (Bikaner)	Feb. 2009
32	0/0	4/0	28/0	Nagaur Animal Fair	Jan. 2009
102	4/1	19/0	79/3	Chandan, Dwara, Dimani & Khetolai (Jaisalmer)	Feb. 2009
23	0/0	5/0	18/0	Sardarshahar (Churu)	Mar. 2009
50	3/0	9/1	38/1	Jodhpur & Pali	Feb. 2009
106	12/1	20/1	74/2	Dingri, Kejar, Sippur, Dungari & Dunger (Udaipur)	Mar. 2009

\* +ve for *Balantidium*

Table-38. Prevalence of mange infection of camels in different area of Rajasthan

Number of samples collected	Number of camels taken for skin scrapping examination/Number of samples positive for mange			Place of sample collection	Month of sample collection
	< 1 year	1-3 years	>3 years		
20	13/0	2/0	5/0	NRCC, Farm	Sep.2008 Jan. 2009
16	3/0	4/2	9/2	Bajju & Phattubala (Bikaner)	Aug. 2008
15	6/2	3/2	6/1	Charanbala & Bajju (Bikaner)	Feb. 2009
34	4/1	11/7	19/8	Chandan, Dwara, Dimani & Khetolai (Jaisalmer)	Feb. 2009
3	0/0	0/0	3/2	Sardarshahar (churu)	Mar. 2009
35	6/1	10/4	19/5	Dingri, Kejar, Sippur, Dungari & Dunger (Udaipur)	Mar. 2009

Only *Sarcoptic scabei* was identified in the camels infected with mange**(c) Sub-Project - Epidemiology of viral diseases of camels**

Sub-Project Leader: Dr. G. Nagarajan

**I. Camel pox:** Blood samples and skin scabs were collected from the camels exhibiting the symptoms of camel pox. The following table gives the epidemiological data collected pertaining to the camel pox during the year 2008-09 (Table-39 & Fig.-33).

**II. Contagious ecthyma:** Scab Materials: In the first week of August 2008, Camel calves of 6-12 months of age in a Camel herd from Lawera village, Jodhpur district

Table-39. Epidemiology data on camel pox

Place	Date of collection	No. of Samples	Sex	Age (Years)
NRCC, Bikaner	Sept. 2008	10	Female	4-5
BSF, Delhi	01-01-2009	9	Male	< 4 years
BSF, Bikaner	25-04-2009	7	Male	< 4 years
BSF, Jaisalmer	24-04-2009	3	Male	< 4 years
Sardarshahar, Churu	20-03-2009	20	Males & Females	< 4 years





Fig.32 Camel showing nervous form of trypanosomiasis



Fig.33 Camel showing mange infection



Fig.34 Camel showing camelpox lesions

of Rajasthan were showing the symptoms of contagious ecthyma viral infection (Fig.-34). Scab materials were collected from the severely affected animals and subjected to polymerase chain reaction for the laboratory confirmation.



Fig.-34 Camel showing lesions of contagious ecthyma

**Polymerase Chain Reaction (PCR):** Skin scabs were collected from the suspected lesions of contagious ecthyma and stored at  $-20^{\circ}\text{C}$  until use. DNA was extracted from the skin scabs using GeneiUltrapure™ Mammalian Genomic DNA Purification Kit –Tissues (Bangalore GeNei Pvt.Ltd., India) according to the manufacturer's instructions. Nucleotide primers were designed using the sequence of the p37K ORFV

gene; forward primer (5' TTA ATT TAT TGG CTT GCA GAA CTC CGA GCG C 3'), reverse primer (5' ATG TGG CCG TTC TCC TCC ATC 3'). Reaction volumes of  $50\mu\text{l}$  (micro liter) were used and contained 5 l of 10 x buffer with 15  $\text{MgCl}_2$ , 10mM of each dNTP, 100pmol of each oligonucleotide primer, 100ng of DNA sample and 3U Taq DNA polymerase. The cyclic conditions for DNA amplification were set at  $94^{\circ}\text{C}$  for 5 min, and 35 cycles at  $94^{\circ}\text{C}$  for 1 min,  $55^{\circ}\text{C}$  for 1 min, and  $72^{\circ}\text{C}$  for 1 min. These were followed by a final extension period of 10 min at  $72^{\circ}\text{C}$ . Amplified PCR products were analysed on 1% agarose gel stained with ethidium bromide and visualized under UV light.

Viral DNA was extracted from the infected scabs and amplified using the sequence of the p37K ORFV gene. DNA fragment of expected size (1170 bp) was observed on agarose gel electrophoresis (Fig.35). There was no amplification in the PCR using the DNA isolated from the camel pox positive scab materials (negative control). The PCR technique could detect a few viral DNA and is found to be more efficient for the diagnosis of contagious ecthyma in camels.

The amplicon was cloned in p GEM-T vector and the recombinant clones were confirmed by *Eco RI* restriction enzyme digestion (Fig.-36) The recombinant clone was submitted for sequencing.

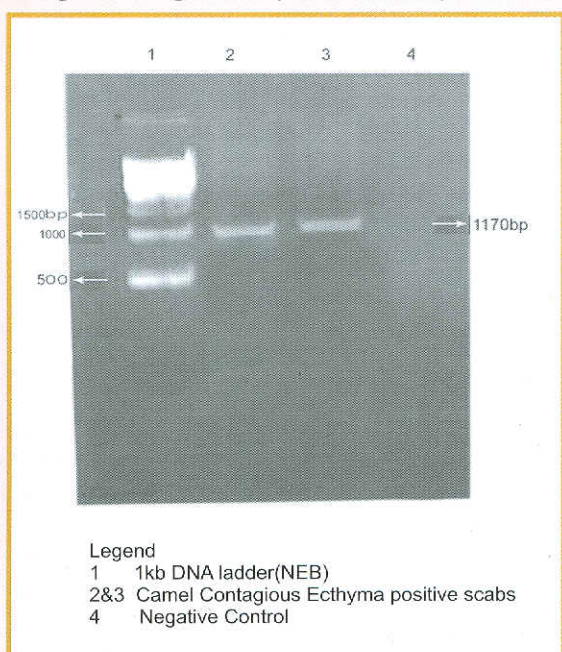


Fig.35 Amplification of Envelope Gene of Camel Contagious Ecthyma Virus

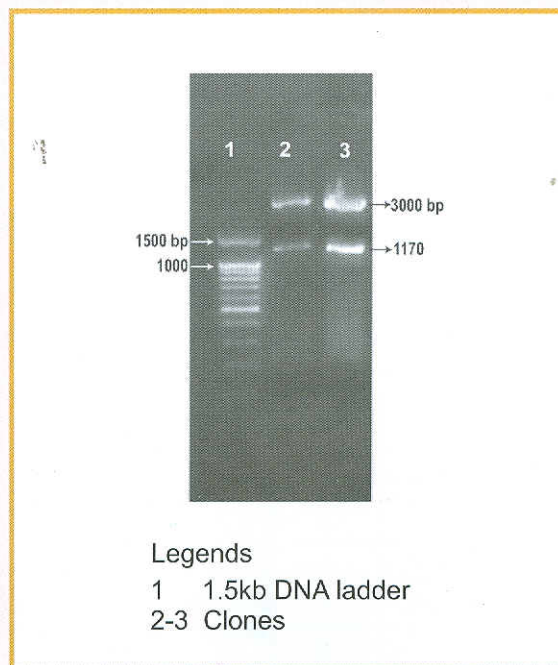


Fig.36 Cloning of envelope gene of Camel Contagious Ecthyma Virus

**VM-6. Project : Generation and validation of suitable formulation for the treatment of mastitis**

**Project Leader : Dr. F. C. Tuteja**

**Associate : Dr. S. K. Dixit**

**Minimum inhibitory concentration of methanol extract from effective plants:** Methanol extract of anar (*Punica granatum*), and pardesi kiker (*Prosopis juliflora*), were evaluated *in-vitro* for MIC against 8 isolates including *Staph. aureus* (5), *E.coli* (2) and *Pseudomonas* spp (1) in nutrient broth. MIC of anar varied from 3.75 to 10 µl/ml, whereas for pardesi kiker it varied from 1.25 to 8.75 µl/ml., for oxytetracycline it varied from <1.25 to 5.0 µg/ml.

**VM-5. Project: Evaluation and validation of ethno-veterinary practices against camel diseases**

**Project Leader : Dr. S. K. Dixit**

**Associate : Dr. F. C. Tuteja**

The information on ethno-veterinary practices was collected from camel keepers, farmers and NGOs located at Bikaner, Hanumangarh, Churu, Jodhpur, Pali, Sirohi, Barmer, Udaipur and Nagaur in Rajasthan. The names of places visited with the number of respondents are as follows: Bikaner- 25, Hanumangarh, Churu - 79, Jodhpur, Pali, Sirohi, Barmer - 50, Udaipur - 38 and Nagaur - 35.

Cold water, Tulsi, Mehandi, sulphur, Kala tel, leather ash mixed with ghee are used to cure Skin-ocular, naval and udder lesions, Mange, necrosis, ringworm, abscess, wound, saddle gall and tail gangrene in camels. Foot abrasion, abscess, wound and fractures are treated with sweet oil drops with candle, Phenyl liquid and coal made from kair roots. Similarly amla, har, baher, ajwain, bui root, extract of bajra, alum, meetha soda, patasa feed rice, khejari leaves, castor oil, magnesium sulphate, tumba, common salt, Kali Arandi and Aak milk are used to relieve from digestive problems, anorexia, dyspepsia, mouth lesions, impaction, tympany, diarrhoea, constipation and colic disorders. Nasal discharge and pneumonia is treated with the roots of babool, methi, sweet oil, ginger, onion, garlic, clove and roots of nimbu. The bamboo leaves, boiled pulses, uterotone and prajana are used to treat

reproductive problems. Vahvidang, neem oil, neem leaves, copper sulphate with tobacco, chiraita, datura seeds, aak leaves soaked in lassi in a matka for 2-3 days (maturation in dung) are used for deworming. Ethnomedicines against digestive & skin problems will be evaluated with the help of clinical trials at NRCC subject to the availability of appropriate animals.

**VM-10. Project: Epidemiology of deficiency/toxic and metabolic diseases in dromedary camel**

**Project Leader : Dr. S. K. Dixit**

**Associate : Dr. (Mrs.) D. Suchitra Sena**

A survey was undertaken on the designed format to collect samples and information from areas which are rich in camel population. The number of respondents at the places visited are as follows: Bikaner - 58, Hanumangarh, Churu - 66, Jodhpur, Pali, Sirohi, Barmer - 50, Udaipur - 106 and Nagaur - 41.

There was no occurrence of any metabolic disease at above places. The deficiency disease of Pica was reported from Nagaur (4), Jodhpur (2) and Hanumangarh (2).

**VM-3. Project : Therapeutic spectrum of selected herbs against dermatophytes / bacteria**

**Project Leader : Dr. S. K. Dixit**

**Associates : Dr. F. C. Tuteja**

**: Dr. (Mrs.) D. Suchitra Sena**

**: Dr. G. Nagarajan**

The samples (127) were collected from 210 animals during the period under report. The plants (67) were screened and 12 plants were used for the experimental trial.

Three herbal immuno-modulators were developed and evaluated in 18 experimental animals divided into 3 groups of 6 camels each. The dosage of the drug was 1g/10kg and 2g/10kg body weight respectively in group I and II. The results are presented in the Tables 40 and 41.

The globulin levels increased marginally after 30 days of treatment in group-I and II but decreased in group-III. IgG levels increased in group-II and III whereas it remained unchanged in the group-I.

Table-40. Globulin (g/dl) levels after 30 days of treatment

Camel Number	Group-I				Group II				Group III			
	0 day		30 days		0 day		30 days		0 day		30 days	
	Globulin	A:G	Globulin	A:G	Globulin	A:G	Globulin	A:G	Globulin	A:G	Globulin	A:G
1.	4.1	0.94	4.6	0.84	3.7	1.08	4.2	0.80	4.0	0.81	3.4	1.06
2.	3.3	1.18	3.7	1.11	3.8	1.01	4.0	0.81	4.3	0.69	3.8	0.93
3.	3.8	1.05	3.5	1.10	3.3	1.12	4.3	1.05	3.6	1.05	4.1	0.88
4.	3.5	1.02	3.4	1.06	3.0	1.30	3.6	1.14	3.8	1.05	4.2	0.90
5.	4.3	1.97	4.6	0.89	3.2	1.25	3.8	1.33	3.3	1.14	3.9	1.18
6.	4.1	1.04	3.7	1.12	3.6	1.16	3.3	0.74	4.5	1.33	3.9	0.95

Table-41. IgG (g/dl) levels after 30 days of treatment

Camel Number	Group-I		Group-II		Group-III	
	0 day	30 days	0 day	30 days	0 day	30 days
1.	0.222	0.198	0.210	0.837	0.113	0.721
2.	0.138	0.162	0.150	0.608	0.150	0.417
3.	0.174	0.174	0.125	0.777	0.186	0.777
4.	0.101	0.113	0.138	1.067	0.234	0.692
5.	0.234	0.210	0.174	1.018	0.150	0.958
6.	0.138	0.162	0.198	0.885	0.186	0.753

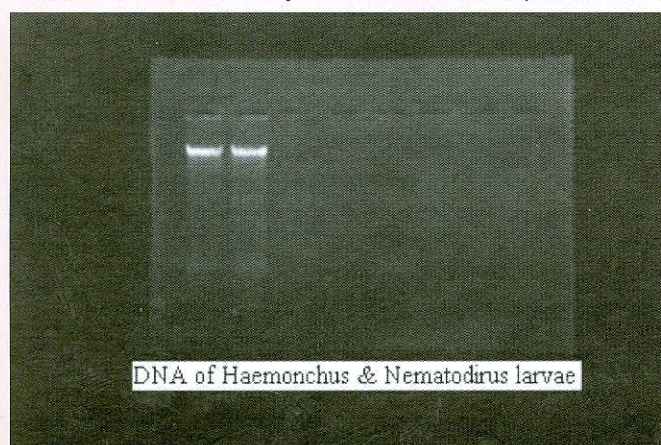
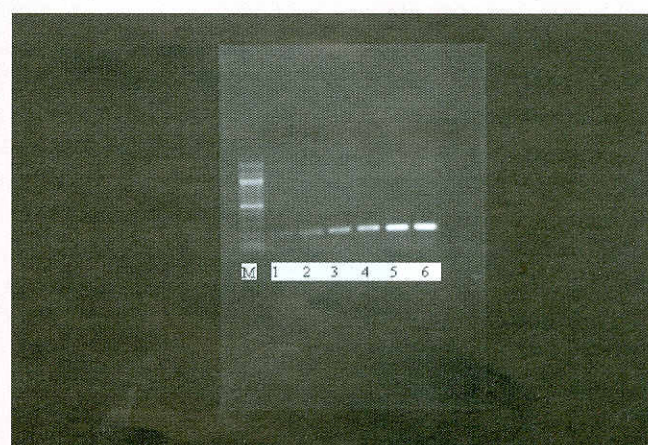
**VP-2. Project : Management of G. I. parasites in the camel herd and molecular characterization of anthelmintic resistant strains of parasites**

**Project Leader : Dr. Sanjay Kumar**

**Associates : Dr. S. K. Ghorui and Dr.G. Nagarajan**

Survey and sampling was undertaken for epidemiological studies of G. I. parasites. Camel faecal samples were collected during different seasons from arid and semi-arid areas. Samples were taken from different age groups (<1 year, 1-3 years, >3 years) of camels irrespective of the sex. The camel husbandry practices, grazing resources and de-worming schedule were recorded in the field and farm conditions. The incidence and intensity of different G. I. parasites in

selected herd were observed. Copro-culture of positive samples were done for the identification of the parasitic larvae by morphological characterization and PCR based methods. PCR primers were designed by using the existing sequences of ribosomal internal transcribed spacers (ITS) for identifying the genera of *Haemonchus* and *Nematodirus*. Pasture larvae were examined by collecting the herbage samples from various places of same grazing land to record the pasture larval burden. The camel faecal samples were also collected from Bikaner, Jaisalmer, Nagaur, Jodhpur, Pali, Udaipur and Hanumangarh district of Rajasthan and NRCC farm for epidemiological studies of G. I. Parasites in farm and field condition (Table-42). The copro-culture of positive faecal samples *Haemonchus* larvae were found in the highest concentration followed by *Nematodirus* and *Trichuris*. The mixed infection of G.I. parasites was observed in 13 % of the total positive samples. Only 5% of the samples at NRCC farm were found to be positive for *Nematodirus* infection. Specific amplification was found of target gene of *Haemonchus* and *Nematodirus* from the genomic DNA template by PCR using the specific ITS2 primers and the length of specific amplified products ranged from 210-350 bp for both the genera of parasites.(Fig.-37& 38)

Fig. 37 DNA of *Haemonchus* & *Nematodirus* larvaeFig.- 38 Amplification of *Haemonchus* DNA

**Table-42. Distribution of the faecal samples collected from different areas of Rajasthan**

Number of samples collected	Number of camels taken for faecal sample test / Number of samples (positive for G.I. Parasites)			Place of sample collection	Month of collection
	< 1 year	1-3 years	>3 years		
80	28/0	10/0	42/4	NRCC Farm	Sep. 2008 Jan. 2009
68	4/0	6/2	58/15	Bajju & Phattubala (Bikaner)	Aug. 2008
90	0/0	13/4	77/10	Gogamedi (Hanumangarh)	Sept. 2008
78	0/0	11/2	67/20	Local area of Bikaner	Nov. 2008 Feb. 2009
55	16/2	7/2	32/4	Charanbala & Bajju (Bikaner)	Feb. 2009
32	0/0	4/0	28/4	Nagaur Animal Fair	Jan. 2009
102	4/0	19/0	79/4	Chandan, Dwara, Dimani & Khetolai (Jaisalmer)	Feb. 2009
23	0/0	5/2	18/3	Sardarshahar (Churu)	Mar. 2009
50	3/0	9/1	38/2	Jodhpur & Pali	Feb. 2009
106	12/0	20/0	74/3	Dingri, Kejar, Sippur, Dungari & Dungeer (Udaipur)	Mar. 2009

**VM-4.Project : Immunity aspects in neonatal camel calves**

**Project leader: Dr.(Mrs.) D. Suchitra Sena**

**Studies in neonatal camel calves:** An experiment was conducted in 2008 to record the disease incidence, morbidity and mortality occurring in neonatal camel calves till 3 months of age (n=34) at the farm. The blood samples were collected in calves immediately after birth, 72 hours, 1 week, 2 week, 3 week, 4 week, 1.5 month, 2 month, 2.5 months and 3 months interval. In the dams the milk samples were collected immediately after parturition at the above-mentioned periods for whey protein and Ig estimation. The serum was separated for further biochemical estimations viz. immunoglobulin G, and protein profile. The body weight was recorded in calves immediately after birth and at fortnight intervals till 3 months of age.

A total of 23.42% mortality was noticed in camel calves below 3 months of age. The details of mortality among different breeds are shown in the Table- 43. Out of a total of 34 calving, one calf died due to the abnormal presentation (left lateral deviation of the head) and its dam due to dystokia, which might be due to profuse intra uterine bleeding. The causes for calf death revealed pneumonia (3), underweight (1), enteritis (1), encephalitis (1) and tetanus (1). The causes of morbidity (Table-44) revealed enteritis, constipation, pneumonia

and tick infestation with *Hyalomma* spp. Almost all the calves in mid-January showed tick infestation and were given Ivomec in 2 repeated doses at 2-week interval. The mean of body weight and average growth rate of the calves till 3 months are presented in Table -45.

**Table-43. Percent mortality in neonatal camel calves from 0-3 months of age (2008)**

Breed	Total pregnant camels	Number of calves		Per cent mortality
		Live	Died	
Bikaneri	14	10	4	28.57
Jaisalmeri	13	10	3	23.07
Kachchhi	5	4	1	20.00
Crossbred	2	2	0	0
Total	34	26	8	23.52

**Table-44. Percent morbidity in neonatal camel calves from 0-3 months of age (2008)**

S. N.	Disease	Number of calves	Number of infected calves	% morbidity
1.	Enteritis	34	5	14.70
2.	Constipation	34	3	8.82
3.	Pneumonia	34	3	8.82
4.	Tick infestation	34	10	29.41

**Table-45. Mean body weight and growth of camel calves till 3 months of age**

S.N.	Duration	Body weight (Kg)	AGR (Kg)
1.	Day 0	38.33±2.02	----
2.	Day 15	47.50±1.70	9.16±1.49
3.	1 month	55.16±1.30	7.66±2.06
4.	1.5 months	64.00±1.43	8.83±1.10
5.	2 months	74.83±1.47	10.83±1.19
6.	2.5 months	84.16±2.44	9.33±1.45
7.	3 months	97.16±2.00	13.00±1.15

Maximum mortality in neonatal camel calves (0-3 months) occurred due to pneumonia while morbidity was due to tick infestation. The highest AGR was seen in 2.5 - 3 months followed by 1.5 to 2 months. The serum Ig G concentration and the total protein profile till 3 months of age are presented in Table- 46. The whey protein and Ig levels of dams are presented in Table- 47.

Whey proteins and Ig levels are maximum of 0hr which decline continuously upto 3 months.

**Table-46. Mean Serum Ig G and protein profile of neonatal camel calves up to 3 months**

S.N.	Duration	Ig G (mg/ml)*	TP (g/dl)	TA (g/dl)	TG (g/dl)	A:G
1.	0 hrs	0.28±0.11	5.08±0.10	3.14±0.02	1.94±0.10	1.61±0.08
2.	72 hrs	10.68±0.30	6.00±0.08	2.93±0.12	3.07±0.15	0.95±0.09
3.	1 week	11.61±0.18	6.36±0.07	3.12±0.01	3.24±0.08	0.96±0.03
4.	2 week	12.92±0.34	6.55±0.08	3.21±0.03	3.34±0.09	0.96±0.03
5.	3 week	13.14±0.39	6.59±0.08	3.24±0.02	3.35±0.10	0.96±0.03
6.	4 week	13.65±0.29	6.69±0.08	3.25±0.01	3.37±0.08	0.96±0.02
7.	1.5 month	13.80±0.35	6.64±0.05	3.27±0.01	3.37±0.05	0.97±0.01
8.	2 month	14.09±0.42	6.68±0.04	3.32±0.02	3.36±0.04	0.98±0.01
9.	2.5 month	14.53±0.29	6.70±0.07	3.34±0.02	3.36±0.08	0.99±0.02
10.	3 month	15.27±0.36	6.72±0.06	3.35±0.02	3.37±0.06	0.99±0.02

\* Between days significant at 5%

**Table-47. Whey protein and Ig profile of dams**

S.N.	Duration	Whey Protein (g/dl)	Whey Ig (mg/ml)
1.	0 hr	6.31±0.31	17.40±0.69
2.	72 hr	2.16±0.35	12.62±0.95
3.	1 wk	2.29±0.46	10.37±0.85
4.	2 wk	1.81±0.45	8.83±0.88
5.	3 wk	1.79±0.31	7.88±0.98
6.	4 wk	1.31±0.21	7.59±0.39
7.	1.5 m	1.23±0.09	5.76±0.53
8.	2 m	1.21±0.24	5.40±0.76
9.	2.5 m	1.18±0.20	4.13±0.40
10.	3 m	1.15±0.03	4.02±0.77

**Raising of anti-sera in rabbits against camel Ig G:**  
The rabbit anti-camel immune-globulin G was produced and the cross reactivity was checked with double immune-diffusion and the protocol of SRID was standardized for the estimation of camel immunoglobulin which will be utilized in further experiments for Ig G estimations.

#### VM-7.Project : Investigations on digestion fermentation disorders with particular reference to indigestion and impaction

Project leader : Dr.(Mrs) D. Suchitra Sena

The rumen fluid samples collected from 3 healthy camels were subjected for total volatile fatty acid and nitrogen estimation. The fractionation of rumen fluid (CFRF- cell free rumen fluid, BRF and PRF- bacteria and protozoa rich fractions) was done and enzymatic estimations of fibre degrading enzymes (carboxymethyl cellulase, alpha amylase, alpha glucosidase, beta glucosidase) and protein & NPN degrading enzymes (urease, proteases, both transaminases *i.e.* GOT and GPT) were done. There was a postmortem case (animal 4 that died due to impaction) from where the rumen fluid was collected and subjected to the treatments as above. The total VFA (mEq/L) was 66, 72, 68 and 35 in the animal number 1, 2, 3 and 4 respectively. The total nitrogen (mg/dl) was 86, 94, 108 and 165 in the same sequence respectively. The results of enzymatic estimations are presented in the Table- 48



Fig. 39 a,b, Rumen fluid collection in camel by using rumen fluid extraction unit

**Table-48. Fibre, protein and NPN degrading enzymes of strained rumen liquor**

S. N.	Biochemical Attributes	Animal 1			Animal 2			Animal 3			Animal 4		
		CFRF	PRF	BRF	CFRF	PRF	BRF	CFRF	PRF	BRF	CFRF	PRF	BRF
1.	Carboxymethyl-cellulase (U/L)	30.6	117.97	467.4	28.68	106.96	519.06	33.52	138.48	477.95	43.5	98.34	282.31
2.	α-amylase (U/dl)	0.03	0.29	1.06	0.02	0.19	1.23	0.03	0.23	1.10	0.06	0.42	2.34
3.	α-glucosidase (U/dl)	1.75	8.58	12.16	1.56	7.42	17.22	1.62	7.75	18.17	2.80	9.12	10.35
4.	β-glucosidase (U/dl)	21.28	98.28	114.0	17.16	36.40	141.04	17.28	81.67	51.35	48.37	80.16	251.16
5.	Urease (U/dl)	1.26	6.00	71.44	1.04	7.80	51.66	1.17	8.20	39.5	1.96	0.97	23.46
6.	Protease (U/dl)	0.19	0.54	1.90	0.18	0.49	2.37	0.16	0.64	2.21	0.21	0.52	0.82
7.	GOT (U/dl)	39	152	13.5	42	164	12	33	158	9	12	68	15
8.	GPT (U/dl)	19	76	9	28	82	4	13	79	9	24	69	14

The rumen fluid was collected with the help of an extraction unit(Fig.-39 a,b) from four healthy camels in the age group of 2-4 years. The camels were maintained at the farm under normal feeding *i.e.*, guar phalgati and groundnut chara in the ratio of 1:1 approximately along with *ad lib* water consumption for more than a month. The physico-chemical and biochemical studies were undertaken immediately in the rumen fluid of these animals. All the samples were brownish grey, aromatic

and slightly viscous in consistency. The rumen fluid was fractionated and stored in different aliquots at -20°C for further biochemical studies. The blood samples were collected for haematological and serum biochemical profile. The results of physico-biochemical and microbial parameters of rumen fluid are shown in Table- 49. The haemato-biochemical parameters of the healthy camels are presented in Table- 50.

**Table-49. Physico-biochemical and microbial changes in the rumen fluid**

S.N.	Parameters	Animal 1	Animal 2	Animal 3	Animal 4
1.	Cellulose digestion Time (hrs)	<36	<36	<36	<36
2.	Sedimentation time (min.)	3	5	4	5
3.	Methylene blue reduction time (min.)	6	6	5	8
4.	Volume % (Solid/ liquid phase)	2.2/7.8	2.4/7.6	2.5/7.5	2.2/7.8
5.	pH	7.2	7.0	7.2	7.0
6.	Total acidity (Units)	38	40	44	52
7.	Motility of rumen protozoa	+++	+++	+++	+++
8.	Total protozoal count (x 10 <sup>5</sup> /ml)	2.10	2.06	1.98	1.84
9.	Iodophilic activity of rumen protozoa	+++	+++	+++	+++
10.	Total bacterial count (x 10 <sup>5</sup> /ml)	8.6	8.8	7.8	8.2

Table-50. Haemato-biochemical changes in healthy camels

S.N.	Parameters	Animal 1	Animal 2	Animal 3	Animal 4
A.	Haematology				
1.	PCV (%)	36	38	36	38
2.	Haemoglobin (g/dl)	12.4	12.2	13.2	11.8
3.	TLC (x10 <sup>3</sup> /cmm)	10.5	9.8	9.4	10.2
	DLC (%)				
4.	Neutrophils	55	54	50	52
5.	Eosinophils	8	6	6	8
6.	Basophils	0	0	1	0
7.	Lymphocytes	32	36	38	34
8.	Monocytes	5	4	5	6
B.	Biochemical				
1.	Glucose (mg/dl)	72.84	70.34	74.08	68.44
2.	Total Protein (g/dl)	7.06	6.68	6.56	6.88
3.	Albumin (g/dl)	3.41	3.26	3.2	3.36
4.	Globulin (g/dl)	3.65	3.42	3.36	3.52
5.	A:G ratio	0.93	0.95	0.95	0.95



Fig. 40 Camel calf showing symptoms of Thikria

**camel herd screening:** About 120 skin scrapings were collected and examined for ectoparasites especially mange but none were found positive. Few camel calves suffered from fungal infections (Fig.-40) (Local name: Thikria, etiology yet to be defined) were successfully treated with antifungal treatment. Mild level of infection was seen in the camel calves (72%) revealing eggs of *Strongyle spp.*, *Strongyloides spp.*, unsporulated oocysts of coccidian and *Trichuris spp.* In the lactating herd around 36% showed mild level of helminthic infection (*Strongyle spp.*, and *Nematodirus spp.*). The camels maintained under semi-intensive management had 22% of the cases positive for mild level of helminthic infection (*Strongyle spp.*, and *Nematodirus*

*spp.*). A total of 118 serum samples were screened for brucellosis by RBPT and STAT and found negative with titre ranging from 10 to 20 IU/ml of serum. Out of 30 milk samples from the lactating herd, none of the animals were indicative of positive reaction with ABR/MRT antigen. For conducting tuberculin test at Bikaner, PPD made from *M. bovis* AN5 and PPD *M. bovis* 3/86 were procured from IVRI, Izatnagar. 0.1ml of each PPD was injected intra-dermally on the left lateral side and middle of neck region with 3-5 cm apart. Skin thickness was measured using Vernier calipers before injecting PPD. Animals were observed after 24 h and 48 h for the occurrence of reaction. At 72 hrs the final reading i.e., skin thickness was recorded. Out of 157 camels tested a total of 37 (23.56%) were positive.

#### VM-11 Project : Capacity building for the molecular diagnosis of tuberculosis in camels

**Project leader :** Dr. Rishendra Verma,  
IVRI, Izatnagar

**Associate :** Dr. (Mrs.) D. Suchitra Sena,  
NRCC, Bikaner

The present work was undertaken with the objective of investigating camels for tuberculosis using conventional and molecular techniques.

#### Tuberculin testing of camels

All the camels subjected for the tuberculin test were first dewormed orally with Banminth @ 1 bolus/200



kg b.wt (Each bolus contains morantel as citrate 1.188 g). After deworming, camels were subjected to the tuberculin test (Fig.41 & 42). The source of PPDs utilised were a) PPD AN5 (Concentration 1mg/ml) from Division of Biological Products, IVRI, Izatnagar b) PPD 3/86 (Indigenous PPD) (Concentration 1mg/ml) through Dr. Rishendra Verma, Division of Biological Standardization, IVRI, Izatnagar.

The tuberculin test was conducted with 0.1 ml of PPDs AN5 and 3/86 inoculated intradermally into the middle of neck 3-5 cm apart. Skin thickness before and after injecting of PPDs was measured and skin thickness >5 mm was considered positive. Animals were observed after 24 h and 48 h for the occurrence of reaction however the final reading was recorded at 72 hrs. A total of 157 camels were screened and 37 (23.56%) cases were found positive.(Fig.43 & 44)

The serum lysozyme assay was conducted in twenty-three camels positive for tuberculin test using standard method and the specific activity levels ranged from 0.025-0.154 µgm/mg of protein with a mean of 0.101±0.007 µgm/mg of protein.

The gross pathological lesions revealed yellowish discolouration of sub-cutaneous fat, hard, highly calcified and multiple nodules on the lung tissue as well as granulomas on the spleen (Fig. 45 & 46).

The tissues samples (liver, spleen) were triturated, decontaminated and concentrated with H<sub>2</sub>SO<sub>4</sub> by the method of Marks (1972) for cultural examination. The

concentrated pellet was inoculated on to Lowenstein-Jensen medium. Tissues of liver, lung and spleen were fixed in 10% formalin for histopathological examination. Zeihl-Neilsen stained smear of the culture showed acid-fast bacilli (Fig. 47). The growth was very scanty inspite of long incubation (> 6 weeks) and a suspect of acid fast bacilli. Haematoxylin and Eosin staining of lung sections of a camel showing tubercle granulomas are characterized by caseation, presence of macrophages, lymphocytes, giant cells (inset) and fibroblasts (Fig. 48). The spleen section revealed caseo-calcified granuloma by H&E stain (Fig. 49) and presence of acid fast bacilli by ZN staining (Fig. 50).The research on cultivation of mycobacteria from samples will further be investigated.

**PCR Assay**

Isolation of DNA from the blood of 23 tuberculin reactor camels was done using a DNA isolation kit.

IS 6110-Oligonucleotide primers used for PCR amplification.

Primer	Sequences	Product size	Species specificity
Is6110	F5'-CTG GTC CAG CGC CGC TTC GG-3'	123 bp	M.tb complex
	R5'-CCT GCG AGC GTA GCC GTC GG-3'		

Presence of DNA was checked before PCR amplification. There was no amplification in DNA by PCR using IS6110 primer

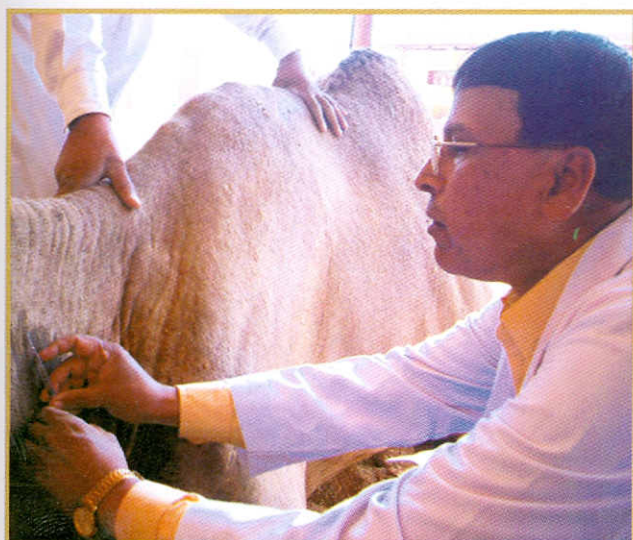


Fig.41 Injecting tuberculin intradermally



Fig.42 Tuberculin testing in camel measuring skin thickness after injection

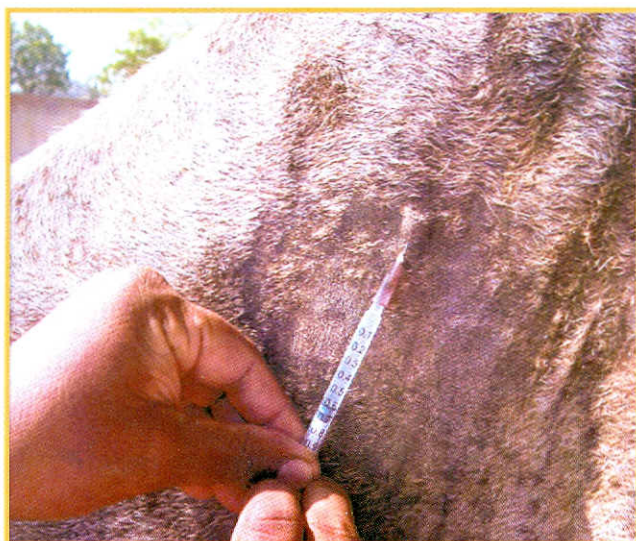


Fig. 43 & 44 Papule formation at the site of injection



Fig.45 Hard,highly calcified and multiple nodules on the lung tissue



Fig. 46 Granulomas on the spleen

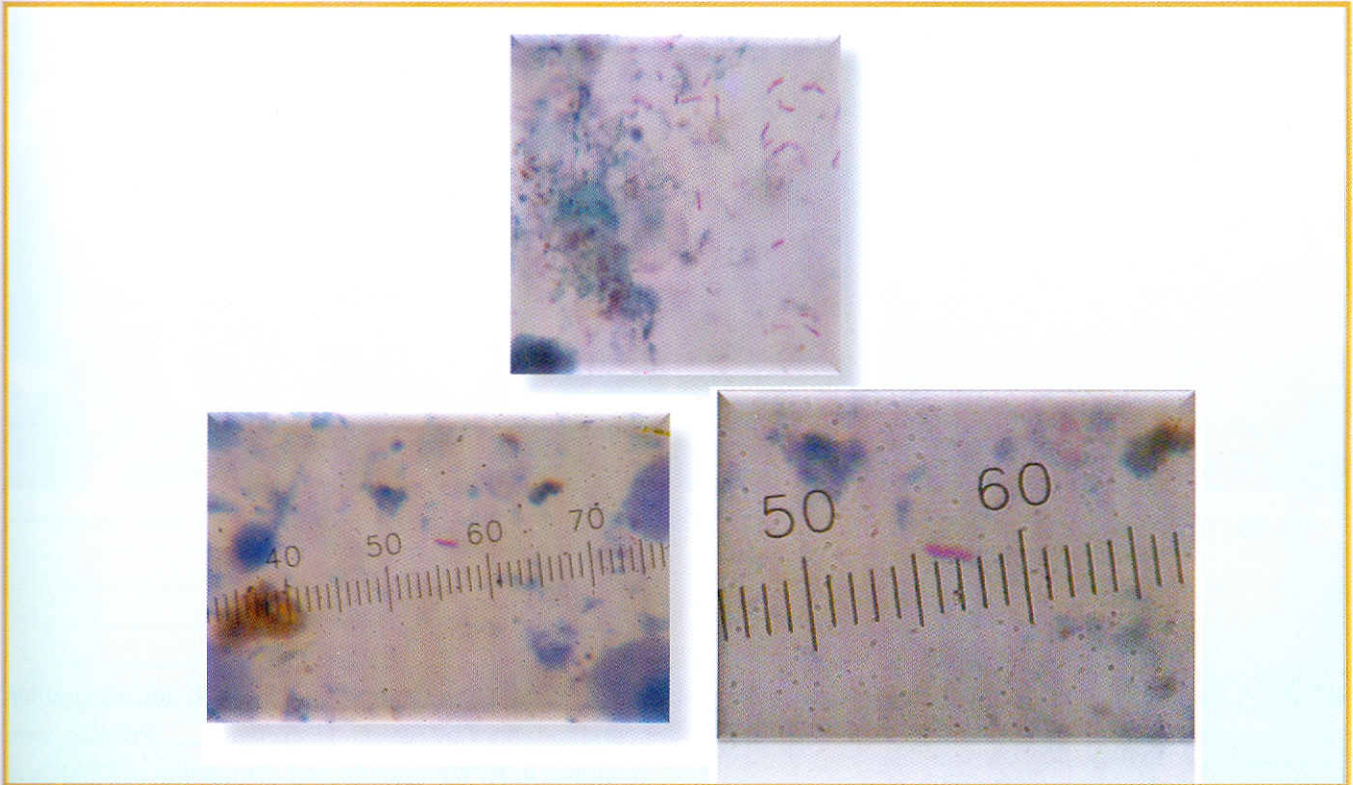


Fig. 47 Zeihl-Neelsen stained of the culture showing acid-fast bacilli

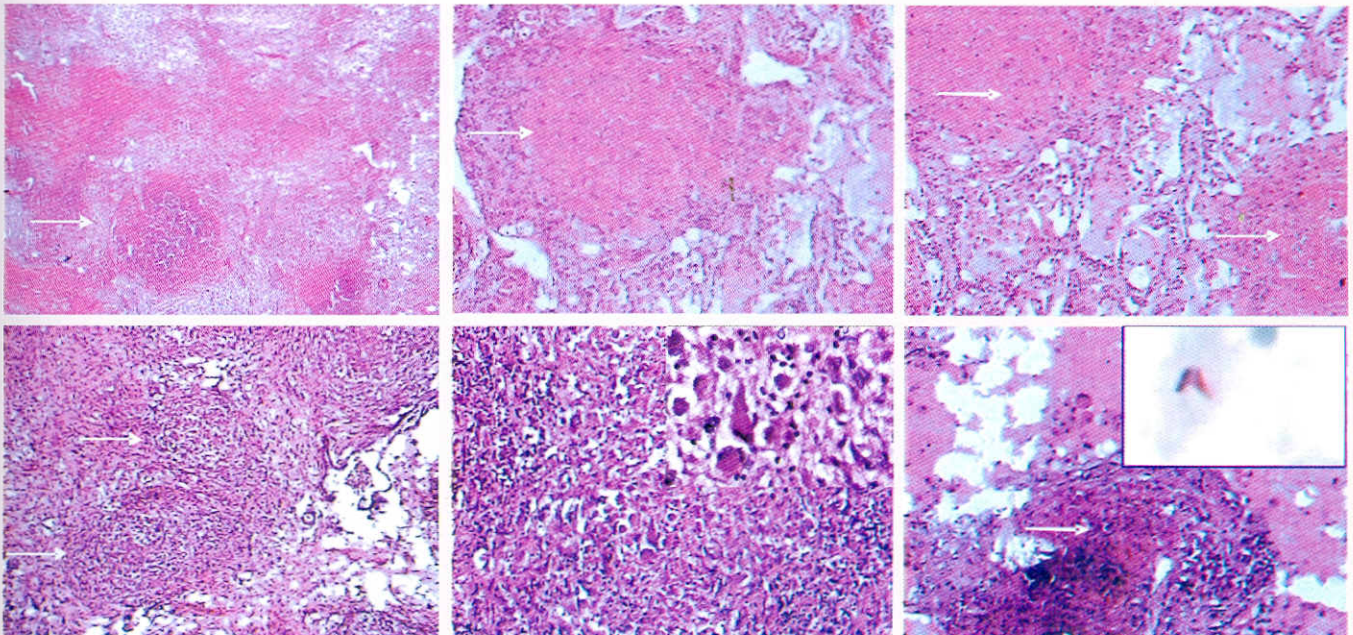


Fig. 48 H&E stained lung sections of a camel showing tubercle granulomas (arrows) characterized by presence of macrophages, lymphocytes, giant cells (inset) and fibroblasts.

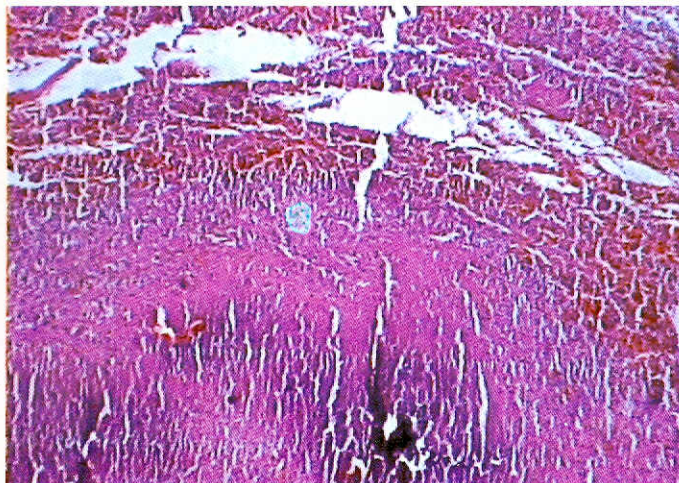


Fig. 49 : Caseo-calcified granuloma. H &amp; E. 40x

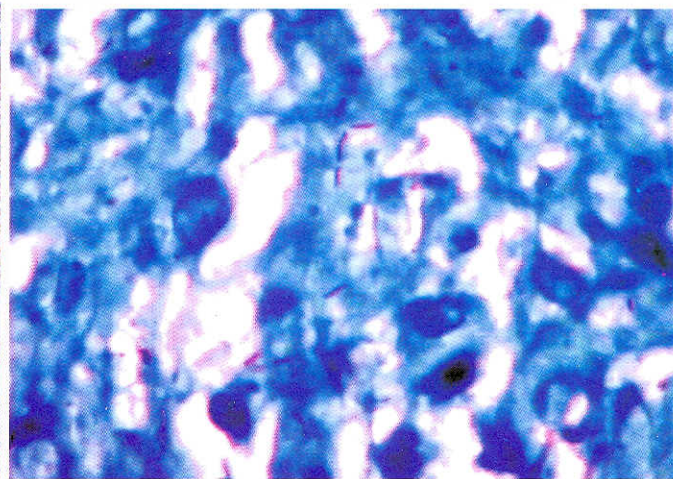


Fig. 50 : ZN stained section +ve for AFB. 1000x

**BT-AS-1.Project : Molecular cloning and characterization of cameline cytokine gene(s)**

**Project leader : Dr. G. Nagarajan**

**Associates : Prof. K. M. L. Pathak and  
: Dr. S. K. Ghorui**

The venous blood was collected with anticoagulant under aseptic conditions from healthy camels using vacutainers. Peripheral blood mononuclear

cells (PBMCs) were separated through density-gradient centrifugation by using Histopaque. PBMCs were cultured in RPMI medium and stimulation of PBMCs by Concanavalin A was standardized. Total RNA isolation from stimulated cells using Trizol reagent and RT-PCR for IL-2, IL-6 and TNF- $\alpha$  using the following set of primer was attempted. The cloning of IFN- Gamma gene fragment was also attempted.

IL-2 F	5'	CTC	AAC	TCC	TGC	CAC	AAT	GTA	CAA	GCT	GCA	3'
IL-2 R	5'	TCA	AGT	CAG	TGT	TGA	GTA	GAT	ACT	TTG	GCA	3'
TNF $\alpha$ F	5'	GA	CCC	TTC	TGA	AAA	AGA	CAC	CAT	GAG	CAC	3'
TNF $\alpha$ R	5'	GAA	GAT	GCA	TGT	CCT	GCA	CCC*	TCA	CAG	GGC	3'
IL-6-F	5'	GC	GG	GGA	TCC	ATG	AAC	TCG	CTC	TCC	ACA	3'
IL-6-R	5'	CGG	GAA	TTC	CTA	CAT	TAT	CCG	AAC	AGC		3'

**BT-AS-2. Project : Development of single domain antibodies for diagnosis/therapy -inter institutional project(with BARC,Mumbai)**

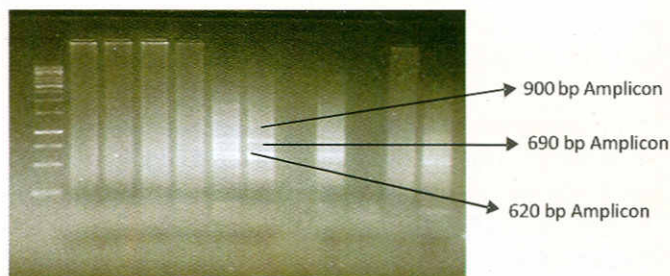
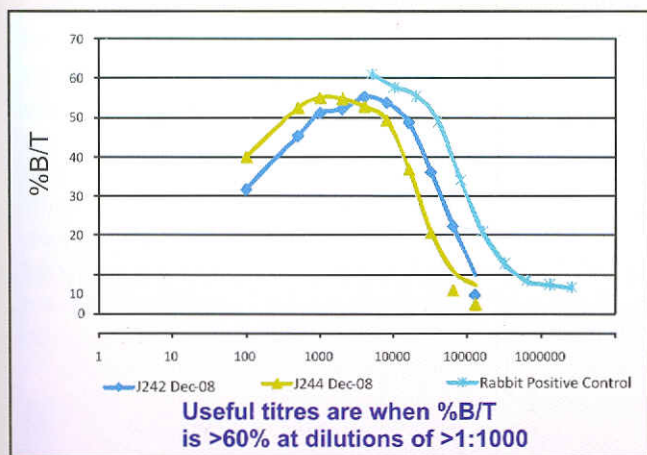
**Sub- Project : Status of Production of V<sub>H</sub>H against Thyroglobulin**

**Project-leader : Prof. K.M. L. Pathak and Dr. Y. Venugopal**

**Associates : Dr.S. K. Ghorui and Dr. G.Nagarajan**

Camel – J242,J44 Immunized with hTg

Fig.51 Tg -Ab Titer in Camel anti Tg Antiserum



1. 690 bp, 620 bp fragment corresponding to IgG 2 & IgG 3 heavy chain antibody were eluted
2. Using these amplicons V<sub>H</sub>H genes were amplified in the subsequent Nested-PCR



1. Peripheral Blood Mono-Nuclear Cells collected from immunized camels after sufficient antibody titre is seen.
2. Total RNA extracted from camel PBMNCs

3. cDNA Synthesized
4. Ig Specific cDNA were amplified using primers made with sequences from published literature

**Unit: Camel Nutrition**

**AN-3.Project : Studies on nutrient requirement and feed resource availability in camel for optimum production**

**Project leader : Dr. A. K. Nagpal**

**Associates : Dr. A. K. Roy, Dr. B. L. Chirania**

**Sub-project : Effect of variation in the dietary protein levels on growth, nutrient utilization and serum profile in camel calves**

The experiment was conducted to study the effect of different dietary protein levels on nutrient

utilization, growth performance and serum biochemical profile of camel calves for 367 days from July 16, 2007 to July 17, 2008. Fourteen healthy male camel calves of Bikaneri, Kutchchi and Jaisalmeri breeds (age 15 months; 291.00±7.64 kg body weight) were randomly allotted to 3 groups, 5 calves each in group I and II and 4 in group III and were fed feed blocks containing 9.5, 12.0 and 14.5% CP and similar TDN level. The dietary composition of group I animals was guar (*Cymopsis tetragonoloba*) phalgati 66.8, groundnut (*Arachis hypogea*) haulms 20, bajra (*Pennisetum typhoides*) 8, and guar churi 4, mineral mixture 0.2 and common salt 1.0%, that of group II was guar phalgati 58.8, groundnut

haulms 20, bajra 8, guar churi 12, mineral mixture 0.2 and common salt 1.0% and of III was guar phalgati 50.8, groundnut haulms 20, bajra 9, guar churi 19, mineral mixture 0.2 and common salt 1.0%. Chemical composition of diets given to 3 groups of camels is given in Table 51. The dry matter intake (DMI) kg/d or kg/100 kg body weight or g/kg metabolic body weight was  $6.09 \pm 0.26$ ,  $1.48 \pm 0.09$  and  $66.49 \pm 3.90$  in group I. These values were  $6.43 \pm 0.20$ ,  $1.55 \pm 0.02$  and  $69.87 \pm 0.83$  in group II and  $5.83 \pm 0.29$ ,  $1.38 \pm 0.05$  and  $62.39 \pm 0.05$  in group III respectively. (Table-52). Digestibility coefficients of DM, OM, EE, and CF were not significantly different among the groups. Crude protein digestibility increased ( $P < 0.05$ ) from group I to II and III due to higher dietary protein level. Significant ( $P < 0.01$ ) decrease in NFE digestibility observed from group I to II and III might be due to change in energy, protein ratio in the diet. The daily intake of DCP (g), TDN (g) and ME (MJ) /kg metabolic body weight was  $4.06 \pm 0.26$ ,  $43.06 \pm 2.73$  and  $0.65 \pm 0.04$  in group I;  $5.86 \pm 0.09$ ,  $45.14 \pm 0.61$ ,  $0.68 \pm 0.01$  in II and  $6.28 \pm 0.31$ ,  $39.62 \pm 1.94$  and  $0.60 \pm 0.03$  in III respectively. The initial body weights of group I, II and III animals were  $294.60 \pm 10.23$  kg,  $287.40 \pm 17.47$  kg and  $291.00 \pm 13.82$  kg respectively. The growth rates were  $0.349 \pm 0.02$ ,  $0.381 \pm 0.02$ , and  $0.392 \pm 0.01$  kg/d in group I, II and III, respectively. Dry matter intake kg/kg body weight gain did not differ

significantly among groups, it was minimum in group III (15.35) followed by 15.76 in II and maximum in I (16.80) indicating lower feed requirement per kg gain in live weight in III with increase in the level of protein. The average cost of rations increased from Rs.357.0/q in group I to Rs 441.0 /q due to incorporation of feed ingredients, and feed cost /kg gain worked out to be Rs 59.98, 63.04 and 67.70 in group I, II and III respectively.

While no significant difference among 3 groups for serum GPT, glucose, glycerides, cholesterol, total protein, albumin, calcium, phosphorus was observed serum GOT and chloride differed significantly ( $P < 0.05$ ) as seen in Table-53 The results of this study revealed that camel calves fed on diet containing 14.04 % crude protein and 63.43% TDN exhibited better growth rate and feed efficiency.

Comparing present results with nutrient requirements for growing camels recommended by Wardeh (1997) and ICAR (1985), it is seen that the daily intake of DM, DCP & ME are closer to recommendations made by Wardeh (1997) but variation was seen with respect to ICAR recommendations (Table 54). Not only the growth rate was higher in the present experiment, the DM, DCP and ME requirements were also reduced by 40, 22 & 22 % respectively. This highlights the point that ICAR recommendations for camels need to be revised.

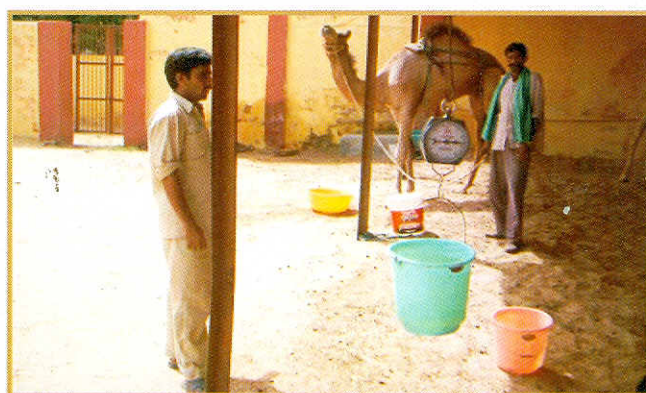


Table- 51. Chemical composition of experimental diets on DM (%) basis

Parameters	CP	EE	CF	NFE	Total ash
Guar phalgati	6.99	0.54	31.89	47.57	13.01
Ground-nut haulms	8.49	1.60	25.98	52.31	11.63
Bajra	14.21	5.55	2.81	74.68	2.80
Guar churi	40.58	3.92	17.43	32.40	5.67
Group 1	9.10	1.63	27.58	48.68	13.03
Group II	11.53	1.83	26.51	47.84	12.31
Group III	14.04	2.27	24.57	47.30	11.84

**Table-52. Feed intake, digestibility and growth performance of camel calves**

Particulars	Group I	Group II	Group III
Body weight (kg)	414.50 ± 10.02	416.00 ± 15.30	423.75 ± 11.66
DMI kg/d	6.09 ± 0.26	6.43 ± 0.20	5.83 ± 0.29
DMI kg/100 kg body weight	1.48 ± 0.09	1.55 ± 0.02	1.38 ± 0.05
Water intake L/d	23.33 ± 0.91	27.68 ± 2.78	25.38 ± 2.47
Water intake L/kg DMI	3.84 ± 0.09	4.27 ± 0.30	4.34 ± 0.28
<b>Digestibility (%)</b>			
DM	66.16 ± 1.81	63.79 ± 1.16	61.09 ± 1.26
OM	72.99 ± 1.11	72.32 ± 0.97	69.82 ± 0.65
CP*	67.16 ± 2.07	72.82 ± 1.18	71.69 ± 1.04
EE	60.46 ± 3.14	63.41 ± 2.44	63.49 ± 3.90
CF	62.62 ± 2.53	60.73 ± 2.22	59.12 ± 0.37
NFE**	80.42 ± 0.74	78.45 ± 0.45	75.27 ± 75.27
<b>Nutritive Value</b>			
CP%	9.10	11.53	14.04
DCP%	6.11	8.39	10.06
TDN%	64.73	64.62	63.43
ME MJ/kg	9.75	9.73	9.55
<b>Plane of Nutrition</b>			
DMI kg/d	6.09 ± 0.26	6.43 ± 0.20	5.83 ± 0.29
CPI g/d	948.80 ± 18.92	1094.63 ± 38.12	1264.83 ± 81.66
DCPI g/d	0.372 ± 0.02	0.540 ± 0.02	0.588 ± 0.04
TDNI kg/d	3.942 ± 0.19	4.159 ± 0.15	3.703 ± 0.22
MEI MJ/d	59.37 ± 2.82	62.65 ± 2.32	55.78 ± 3.29
DMI g/kg W <sup>0.75</sup>	66.49 ± 3.90	69.87 ± 0.83	62.39 ± 2.49
DCPI** g/kg W <sup>0.75</sup>	4.06 ± 0.26	5.86 ± 0.09	6.28 ± 0.31
TDNI g/kg W <sup>0.75</sup>	43.06 ± 2.73	45.14 ± 0.61	39.62 ± 1.94
MEI MJ / kg W <sup>0.75</sup>	0.65 ± 0.04	0.68 ± 0.01	0.60 ± 0.03
<b>Feed efficiency</b>			
Initial BW.kg.	294.60	287.40	291.00
Final BW.kg.	422.60	427.20	434.75
Gain .kg.	128.00 ± 6.32	139.80 ± 6.76	143.75 ± 3.75
ADG g/d	0.349 ± 0.02	0.381 ± 0.02	0.392 ± 0.01
Total DMI. kg	2129.2	2185.3	2202.0
DMI kg/ kg Gain	16.80 ± 0.88	15.76 ± 0.69	15.35 ± 0.36
Feed cost Rs./kg	357.0	400.0	441.0
Cost Rs./kg gain	59.98	63.04	67.70

Different superscripts in a row differ significantly \* = P<0.05, \*\* =P<0.01

Table-53. Serum biochemical values of growing camels given 3 diets

Parameters	Group I	Group II	Group III
GPT (IU/L)	4.66±0.23	4.64±0.45	5.93± 1.01
GOT** (IU/L)	73.67 <sup>b</sup> ±3.80	53.73 <sup>a</sup> ± 4.67	72.42 <sup>b</sup> ± 3.27
Glucose (mg/dl)	68.35 ± 3.90	62.49 ± 2.23	64.73 ± 1.41
Total protein (g/dl)	6.50 ± 0.10	6.06 ± 0.28	6.35 ± 0.11
Albumin (g/dl)	3.54 ± 0.07	3.42 ± 0.12	3.52 ± 0.07
Urea (mg/dl)	38.70 ± 3.49	31.53 ± 2.43	33.07 ± 3.22
Uric acid (mg/dl)	0.11 ± 0.02	0.17 ± 0.04	0.20 ± 0.04
Creatinine (mg/dl)	1.454 ± 0.06	1.539 ± 0.08	1.621 ± 0.07
TG (mg/dl)	23.69 ± 2.67	21.57 ± 1.68	22.04 ± 2.71
Cholesterol (mg/dl)	26.54 ± 4.97	24.83 ± 2.65	30.34 ± 3.68
Ca (mg/dl)	8.13 ± 0.84	9.63 ± 0.98	8.85 ± 1.13
P (mg/dl)	5.59 ± 0.17	5.11 ± 0.37	5.13 ± 0.23
Cl* (mmol/L)	75.66 <sup>a</sup> ± 1.81	87.45 <sup>a</sup> ± 3.09	81.53 <sup>b</sup> ± 2.82

\*P&lt;0.05 , \*\*P &lt;0.01

Table-54. Comparison of nutrient intakes with various feeding standards

Group	BW kg	Growth rate g/d	DM kg	CP g	DCP g	ME MJ
Gp I	412	349	6.1	949	372	59.4
Gp II	416	381	6.4	1095	540	62.6
Gp III	424	392	5.8	1265	588	55.8
Average	417	374	6.1	1103	500	59.27
Wardeh (1997)	400	400	6.79	-	401	60.42
ICAR (1985)	420	100	10.1	-	610	72.60

**Sub-project : Influence of different energy supplement levels on growth and nutrient utilization, growth and serum biochemical profile in camel calves between 2-3 years of age**

Three levels of energy supplement were given to camel calves to study nutrient utilization, growth performance and blood biochemical profile for 211 days from August 01, 2008 to February 27, 2009. Fourteen healthy male camel calves of Bikaneri, Kuchchhi and Jaisalmeri breeds of 2 years and 6 months of age were randomly allotted to 3 groups, 5 each in group I and II and 4 in group III. The groups were fed feed blocks containing 3 levels of bajra energy supplement levels @ 4, 12 and 20% keeping protein level around 11.50 %. The dry matter intake (DMI) kg/d or kg/100 kg body weight was 7.94 & 1.57 in group I. These values were 8.08 & 1.56 in group II and 8.10 & 1.63 in group III respectively (Table -55). Water intake l/kg DM intake did not show any significant variation and varied between

2.00 to 2.22. Digestibility coefficients of DM, CF and CP were not significantly different among the groups. Ether extract digestibility was similar between group I and II but significantly higher than group I. The daily intake of DM and DCP (g)/kg metabolic body weight were statistically similar among 3 groups and was 74.61 & 5.84 in group I; 74.36 & 6.18 in II and 76.97 & 6.23 in group III respectively. The initial body weights of group I, II and III animals were 439.00 ± 10.59 kg, 436.60 ± 16.66 kg and 433.75 ± 9.66 kg respectively. The growth rates of 0.313 & 0.338 kg/d in group I and III, respectively were similar but significantly (P<0.05) lower than 0.437 kg/d in group II. Similar trend was observed in DMI kg/kg gain. In terms of economics, the cost per kg gain was minimum at Rs.66.02 in group II followed by group I (Rs.80.63) and maximum of Rs.91.00 in group III. No significant variation among 3 groups for serum glucose, triglycerides, cholesterol, albumin, urea except total protein was observed (Table-56). The results of this study revealed that camel calves fed diet containing 8% bajra energy supplements and 11.62 % crude protein



exhibited better growth rate and feed efficiency and was economical. Further analysis of samples and data is in

progress for the complete interpretation of results(Fig 42).

**Table-55. Feed intake, digestibility and growth performance of camel calves**

Particulars	Group I	Group II	Group III
Body wt. Kg	504.75 ± 9.45	518.60 ± 9.45	497.00 ± 7.18
DMI kg/d	7.94 ± 0.25	8.08 ± 0.43	8.10 ± 0.08
DMI kg/100 kg B. Wt.	1.57 ± 0.06	1.56 ± 0.06	1.63 ± 0.01
Water intake l/d	17.60 ± 0.24	16.44 ± 2.94	17.55 ± 1.40
Water intake l/ kg DMI	2.22 ± 0.07	2.00 ± 0.25	2.17 ± 0.18
Feed Efficiency			
Initial BW.kg.	439.00 ± 10.59	436.60 ± 16.66	433.75 ± 9.66
Final BW.kg.	505.00 ± 10.46	528.80 ± 4.12	505.00 ± 6.79
Gain .kg.	66.00 ± 3.30	92.20 ± 8.58	71.25 ± 7.41
ADG* g/d	0.311 <sup>a</sup> ± 0.02	0.437 <sup>b</sup> ± 0.04	0.338 <sup>a</sup> ± 0.04
Total DMI. kg	1411.06 ± 22.86	1465.29 ± 38.92	1447.29 ± 11.09
DMI kg/ kg Gain*	21.57 <sup>b</sup> ± 1.00	16.27 <sup>a</sup> ± 1.03	21.02 <sup>b</sup> ± 2.28
Feed cost Rs./q	336.40	365.30	394.30
Cost Rs./kg gain	80.63	66.02	92.10

\*P<0.05 , \*\*P <0.01

**Table-56. Serum biochemical values of growing camels given 3 diets**

Particulars	Group I	Group II	Group III
Glucose (mg/dl)	114.58 ± 1.39	108.76 ± 1.56	111.90 ± 1.59
Total protein* (g/dl)	5.76 <sup>a</sup> ± 0.06	5.72 <sup>a</sup> ± 0.05	6.04 <sup>b</sup> ± 0.09
Albumin (g/dl)	3.09 ± 0.12	3.18 ± 0.12	3.03 ± 0.09
Urea (mg/dl)	26.25 ± 1.69	23.97 ± 0.97	25.60 ± 0.78
TG (mg/dl)	36.50 ± 2.42	31.75 ± 3.11	33.32 ± 1.31
Cholesterol (mg/dl)	31.92 ± 2.92	32.72 ± 2.32	40.24 ± 3.06

\*P<0.05

**AN-4.Project : Development of complete feed blocks for male breeding camels**

**Project Leader : Dr. A. K. Nagpal**

**Associates : Dr. U. K. Bissa and Dr. N. Sharma**

Eight healthy male breeding camels of Bikaneri and Jaisalmeri breeds of 10-14 years of age and 785.14 kg body weight were divided into 2 groups of 4 each. The 2 groups were offered feed blocks prepared on feed block making machine at 3500 psi. The dietary composition of group I Gp (O) animals was guar phalgati 61.8, groundnut haulms 20, guar churi 10, jaggery 5.0, groundnut oil 2.5, mineral mixture 0.2 and common salt 0.5 %, that of group Gp (B) was guar phalgati 57.3, groundnut haulms 20, bajra 15, guar churi 7, mineral mixture 0.2 and common salt 0.5%. The feed intake declined more in Gp (B) than in Gp (O) male camels during the experimental period. In case of Gp (B) daily feed intake was 6.2 kg in Dec.,2008, became lowest of

4.2 kg in Feb.2009 and rose again to 6.4 kg in March, 2009 . In case of Gp (O) daily feed intake was 7.1 kg in Dec. 2008 , it became lowest at 6.4 kg in March, 2009. The average daily feed intake was 5.73 ± 0.41 kg and lower in Gp (B) as compared to 7.32 ± 0.56 kg in Gp (O) camels. The average total feed intake /camel during the 111 days of feeding trial was also less in Gp (B) than in Gp (O) animals. Decline in feed intake was accompanied by decline in body weight of both the groups of male camels which was 121 kg and higher in Gp (B) group than 100 kg in Gp (O) animals over 111 days. The body weight declined from 781.25 on Dec.11, 2008 to 653.75 on 02 March,2009 and rose again to 660.75 kg on 31.03.09 in Gp (B) animals. The body weight loss was continuous in Gp (O) group. Further studies i.e. the digestibility trial and serum profile is scheduled in the month of April, 2009. The samples and data will be analyzed for compilation of results(Fig.52).

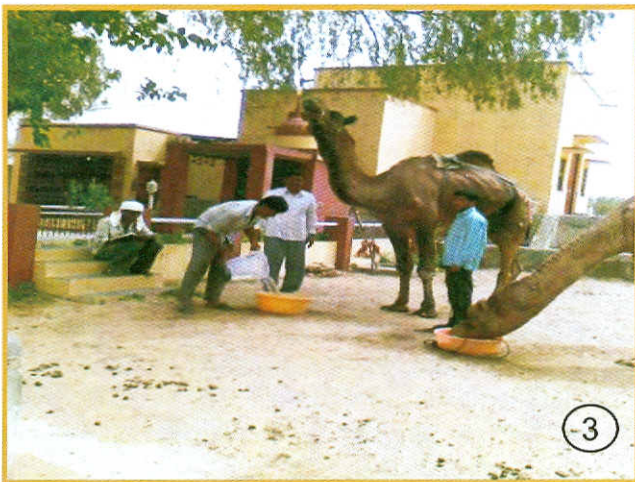
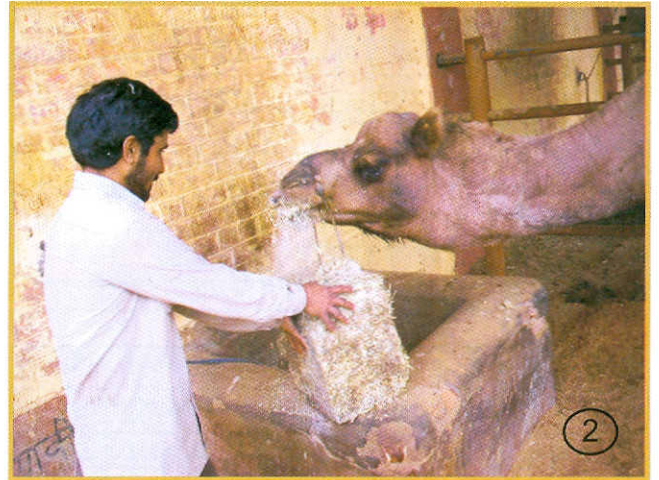


Fig. 52(1-4) Photographs depicting activities of nutrition experiment on male breeding camel

**AN-2. Project : Studies on digestive fermentation pattern in locally available camel feed and fodder**

**Project leader : Dr. (Mrs.) Nirmala Saini**

**Associate : Dr. Gorakh Mal**

**Value addition of poor quality feed resources to improve bioavailability of feed :**

Chemical composition of experimental feed (Table- 57) revealed that moth straw (*Phaseolus aconitifolius*) had significantly (P<0.01) higher protein, low NDF & ADF content than ground nut straw (*Arachis hypogea*), thus contained more fermentable carbohydrate in comparison to ground nut straw. Total N, TVFA, NH<sub>3</sub>-N and gas production etc. parameters of basal feed of camels was estimated by *in vitro* gas technique (IVGPT) fabricated (with the help of CSWRI, Regional station, Bikaner) from 50 ml saline bottle and three way cannula in quadruplicate with two set of blank and maize fodder as standard at 4, 8, 12, 18, 24 & 48 h time intervals of incubation is presented in Table- 58. Total N (mg/dl) profile study at different time intervals of incubation revealed comparatively higher nitrogen production in

moth straw compared to GN straw up to 12 h of incubation. Total N was significantly higher at 8 and 12 h in moth straw than the corresponding values of ground nut straw at same hrs. After that, total nitrogen values were significantly higher (P< 0.01) in ground nut straw compared to moth straw at 24 and 48h of incubation (Fig. 53.)

Initially, total VFA (mEq/100ml) production was although higher in GN straw compared to moth straw but value at 18 & 24 h were significantly higher in moth straw than ground nut straw. In ground nut straw significantly higher TVFA production were recorded at 48 h of incubation (Fig.54). Total gas production between both straws differed significantly up to 24 hrs of incubation (Fig. 55). The percentage of organic matter digestibility (OMD) at 24 h differed significantly between both straws at 24 h and values were 56.57± 0.60 & 51.06±1.08 in ground nut and moth straw respectively. Metabolizable energy (ME) calculated was 7.35±0.08 & 7.42±0.15 in groundnut and moth straw respectively (Table- 59). Results indicate that fermentation efficiency of moth straw is superior to ground nut straw due to its better *in vitro* characteristics and low fibre and higher CP .

**Table-57. Nutrient composition of experimental feeds (% DM)**

Straws	OM	CP**	NDF**	ADF**	HC	NFE
Groundnut	86.92±3.15	7.53±0.10	47.33±0.77	35.67±0.16	11.65±1.54	50.47
Moth	80.28±0.67	9.43±0.10	26.91±1.17	17.91±0.02	10.14±2.33	56.76

\*\* Significant at P<0.01 level

**Table-58. Rumen fermentation profile of conventional fodders of camel**

Attributes	Feed	4h	8h	12h	18h	24h	48h
Total N (mg/dl)	GN straw	20.21±0.71	15.48 <sup>a</sup> ±0.22	17.58 <sup>a</sup> ±0.56	27.21±0.97	27.56 <sup>a</sup> ±1.65	33.95 <sup>a</sup> ±0.51
	Moth straw	20.91±0.29	22.92 <sup>a</sup> ±0.30	25.81 <sup>a</sup> ±1.92	25.97±0.71	18.70 <sup>a</sup> ±0.60	20.38 <sup>a</sup> ±1.26
TVFA (mEq/100ml)	GN straw	3.52±0.43	3.97±0.41	4.20±0.11	3.86 <sup>a</sup> ±0.05	3.62 <sup>a</sup> ±0.12	4.21 <sup>a</sup> ±0.12
	Moth straw	2.87±0.077	3.90±0.14	4.07±0.075	4.81 <sup>a</sup> ±0.32	6.8 <sup>a</sup> ±0.34	3.56 <sup>a</sup> ±0.08
Gas production (ml/0.2g)	GN straw	4.52 <sup>a</sup> ±0.13	11.40 <sup>a</sup> ±0.13	6.81 <sup>a</sup> ±0.10	6.03 <sup>a</sup> ±0.07	4.39 <sup>a</sup> ±0.19	2.04±0.24
	Moth straw	13.58 <sup>a</sup> ±1.8	8.30 <sup>a</sup> ±0.15	4.75 <sup>a</sup> ±0.18	4.0	2.84 <sup>a</sup> ±0.16	2.0±0.10

Capital superscript differ significantly at P<0.01 level, & small superscript at P<0.05 level

**Table-59. Total gas production, % OMD and ME of feeds at 24 h**

Type of Straw	Net gas production (ml/0.2g)	%OMD**	ME (MJ/ Kg)	SCFA (mmol)
Groundnut	33.5±1.67	56.57±0.60	7.35±0.08	0.74±0.013
Moth	40±0.84	51.06±1.08	7.42±0.16	0.76±0.029

\*\* Significant at P<0.01 level

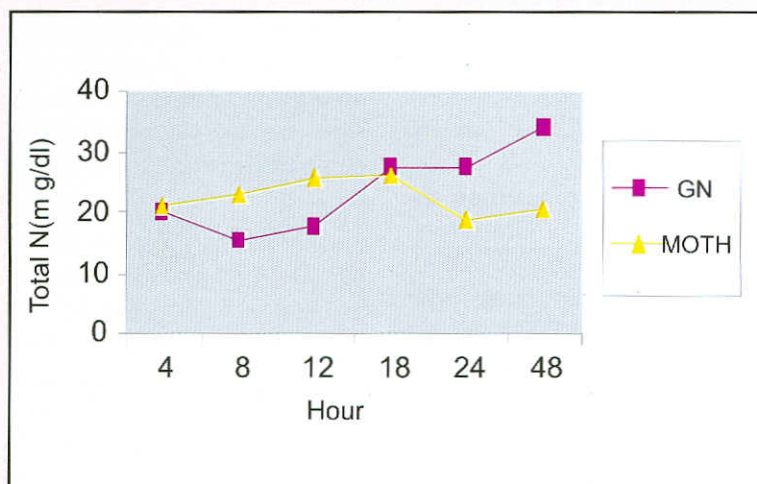


Fig. 53 Total N profile at different time intervals

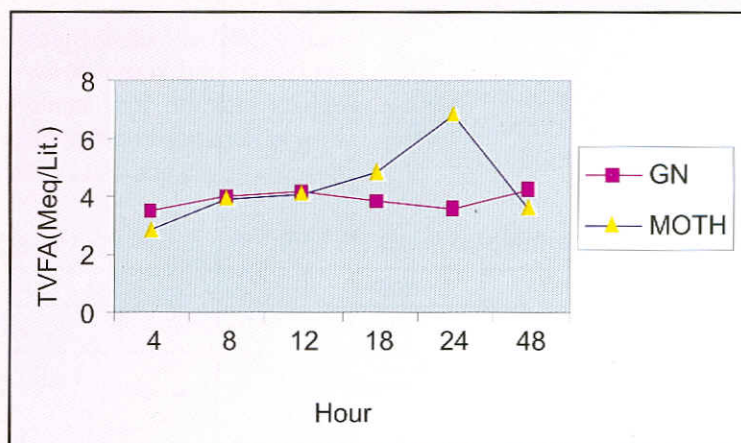


Fig. 54 TVFA production at different time intervals

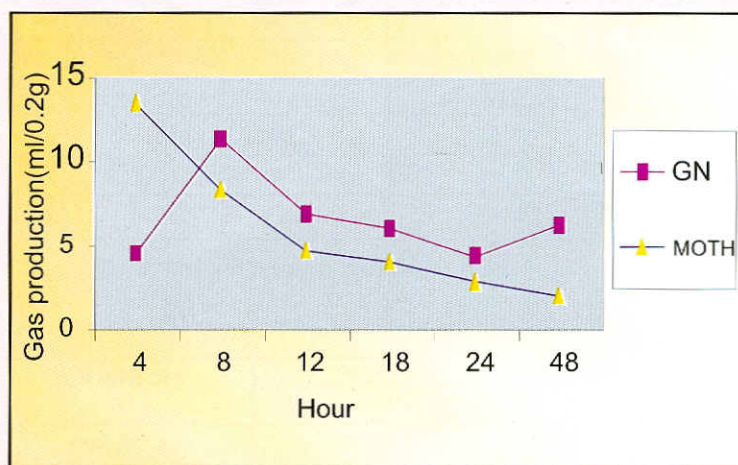


Fig. 55 Total gas production at different time intervals

**Sub-Project : Effect of Lana (*Haloxylon salicornicum*) seed feeding to camel on palatability and nutrient utilization in arid region**

(Collaborative Research Project with CAZRI, Bikaner)

Projectleader :Dr.(Mrs.) Nirmala Saini

Associates : Dr.B.K. Mathur, Dr.J.P. Singh,

Prof. K.M.L. Pathak and Dr. R.K. Beniwal

Lana desert plant preferred by camel was utilized as replacement of concentrate mixture. Eight growing male camels were divided randomly into two equal groups of 4 each, were taken for experiment forming control (T1) & treatment (T2) group respectively. Control groups animals were offered pelleted cattle feed @ of 1 kg each while in the T2 group 25% of pelleted cattle feed was replaced by Lana seeds on nitrogenous basis.

Both the group animals were offered guar (*Cyamopsis tetragonaloba*) phalgati *ad-libitum* and left over were measured daily.

The average initial and final body wt after 80 days of feeding trial were 361.1±25.5 & 359.62±17.22 kg; and 388.7±20.35 & 386.75±23.85kg respectively. There was non- significant difference in the gain and average body weight in both the groups (Table-61).

DM intake of the T1 and T2 was 5.41& 5.16 kg/day respectively. The digestibility coefficient of various nutrients of control and treatment groups has been given in the Table- 62 and 63. There was a non-significant difference in digestibility and intake of various nutrients. Effect of Lana feeding on blood biochemical & mineral attributes has been presented in Table- 64.

**Table-60. Chemical composition (%) of experimental feed**

Feeds	DM	CP	EE	CF	NFE	NDF	ADF	HC
Guar- phalgati	90.56	6.15	5.60	33.14	45.63	52.88	42.25	11.04
Concentrate	83.22	20.32	3.12	13.69	46.08	49.69	20.01	29.68
Lana seed	81.99	14.52	2.94	11.06	53.47	36.75	18.35	18.40

**Table-61. Body weight of experimental groups**

Body weights	Control group(T1)	Treatment group (T2)	SEM
Initial	361.12±25.52	359.62±17.22	9.12
After 27 days	377.50±24.74	384±20.37	4.48
After 80days	388.87±20.25	386.75±23.85	4.19
Wt gain at 27days	16.38±3.10	24.38±8.95	5.99
Wt gain at 80days	27.75±13.45	27.13±14.27	13.02

**Table-62. Percent digestibility of various nutrients in camels fed on Lana (*Haloxylon salicornicum*) seeds**

Nutrient	Group (T1)	Group (T2)	SEM
DM	68.97	70.08	1.87
OM	71.50	70.28	0.12
CP	66.05	63.77	1.44
EE	86.87	82.60	2.53
CF	65.68	72.73	1.33
NFE	62.63	63.96	1.54
NDF	62.20	61.10	1.28
ADF	63.12	63.32	1.55
HC	59.54	58.70	4.77

**Table-63. Intake of digestible nutrients in experimental camels**

Attributes	Group(T1)	Group(T2)	Group(T3)
DM Intake (kg)	5.41	5.16	0.26
DMI W g/kg 0.75	62.26	59.42	3.03
DCP(g/d)	163.59	176.99	22.97
TDN(kg/d)	3.61	3.66	0.33
ME(MJ/d)	53.63	54.27	4.90

**Table-64. Effect of Lana seed feeding on blood biochemical & mineral attributes**

Attributes	Group (T1)	Group (T2)	SEM
TP (g/dl)	5.63	5.32	0.36
Albumin (g/dl)	3.31	3.30	0.07
Globulin (g/dl)	2.32	2.01	0.50
Glucose (mg/dl)	125	124.5	16.80
Serum Urea (mg/dl)	24.11	22.42	0.35
Ca (mg/dl)*	10.60	11.24	0.20
P (mg/dl)	7.08	8.87	1.05
Na (meq/l)*	161.25	159.25	0.40
K (meq/l)	6.72	7.05	0.82
Mg (meq/l)	4.12	3.86	0.48
Zn (ppm)	1.12	1.27	0.18
Fe (ppm)	2.87	2.91	0.30
Mn (ppm)	1.12	0.97	0.37
Cu (ppm)	1.10	1.17	0.63

\* Significant (P<0.05)

The study concluded that Lana (*Haloxylon salicornicum*) seeds preferred in arid region by camel has shown fairly good digestibility and can safely replace partially conventional concentrate feed.

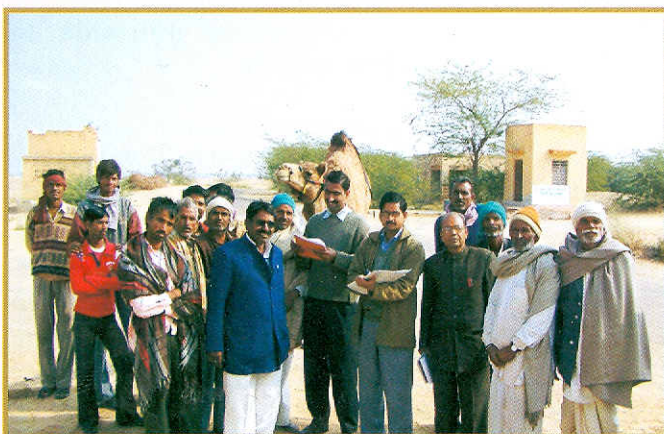
**AICRP Project : Improvement of feed resources and nutrient utilization in raising animal production**

**Project leader : Dr.(Mrs.) Nirmala Saini**

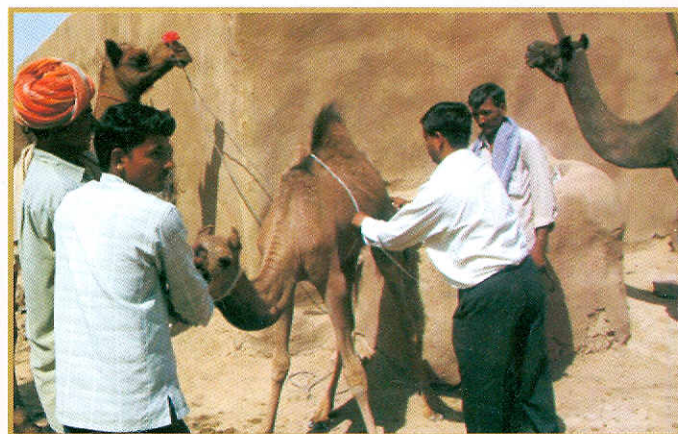
**Associates : Dr. S. Vyas, Dr. B.D. Kiradoo and Dr. Arjun Lukha**

**Effect of strategic supplementation through locally available feed on milk yield, composition, blood biochemical and growth of calves :** In adopted villages of Nokha (Morkhana, Beraser) and Kolayat (Hadala) tehsils of Bikaner, survey was made for socio economic status of camel owner and feeding practice prevailing at those places. The quantity and quality of milk produced by twelve multiparous camels of Nokha and eight camels of Kolayat tehsils were evaluated at field levels by introducing locally available supplementary feeds with in available management practices. In Nokha tehsil, camels were offered only ground nut straw(Gr.I), groundnut (*Arachis hypogia*) straw along with leaves of *Prosopis cineraria* (Gr.II) and straw and Mung churi (Gr. III) on iso-nitrogenous basis. In Hadala village, control group were offered guar phalgati (*Cymapsopsis tetragonoloba*) and supplemented group was fed with straw and barely grain. Blood and milk samples were taken along with data on biometry of calves at fortnightly intervals. The daily milk yield, feed intake and refusals were also recorded.

Blood biochemical and milk attributes estimated after 15 days intervals have been presented in Table- 65, 66, 67 & 68. After improved feeding, significant increase in albumin, globulin and calcium concentration was observed in camels of Hadala village. Total milk production of camels was higher in supplemented groups ( $5.31 \pm 0.39$  &  $6.04 \pm 0.51$  kg /d) than control ( $4.27 \pm 0.44$  kg/d) at Nokha tehsil. A significant difference (p<0.05) was observed between milk yield of Gr.II & Gr.III. However in Hadala village, milk production was 5.20 and 5.59 kg/d in Gr.I & Gr.II respectively. An attempt



Interaction of scientist with camel keepers at Morkhana village (Bikaner)



Sampling at village level

**Table-65. Blood biochemical parameters in experimental camels of Nokha tehsil**

Groups	TP (g/dl)	Albumin (g/dl)	Globulin (g/dl)	Glucose (mg/dl)	%Urea	%Ca	%P
<b>G1 group</b>							
Existing practice	6.68±0.24	3.28±0.30	3.24±0.46	28.31±4.20	17.89±2.10	8.15±0.34	5.27±0.85
Supple GN straw	7.20±0.18	3.47±0.24	3.56±0.28	36.25±5.0	28.75±3.44	8.21±0.56	5.69±0.83
<b>G2 group</b>							
Existing practice	6.64±0.38	3.80±0.69	2.69±0.22	39.94±4.95	19.41±1.94	8.46±0.22	5.14±1.08
GN +Khejri leaves	7.02±0.47	3.11±0.11	3.96±0.31	35.76±3.28	27.77±1.65	8.90±0.34	5.33±0.86
<b>G3 group</b>							
Existing practice	6.65±0.18	3.41±0.80	3.24±0.32	28.07±2.76	17.14±2.71	7.33±0.40	6.07±0.56
GN straw +Moong Churi	7.33±0.46	3.73±0.27	3.57±0.33	40.57±4.83	25.25±2.28	9.09±0.65	5.35±0.80

**Table-66. Blood biochemical parameters in experimental camels of Kolayat tehsil**

Parameters	Days	Group I	Group II
TP (g/dl)	Before	6.39±0.37	7.03 <sup>A</sup> ±0.11
	After	6.82±0.23	7.21 <sup>B</sup> ±0.11
Albumin (g/dl)	Before	4.06 <sup>A</sup> ±0.09	4.09 <sup>B</sup> ±0.08
	After	3.64±0.36	3.75±0.14
Globulin (g/dl)	Before	2.33±0.44	2.73 <sup>a</sup> ±0.31
	After	3.09±0.30	3.77 <sup>b</sup> ±0.13
Glucose (mg/dl)	Before	52.25±6.93	56.96±8.29
	After	56.47±9.80	63.30±4.32
Urea (mg/dl)	Before	30.50±1.73	53.30±5.86
	After	35.93±2.30	56.96±8.29
Ca (mg/dl)	Before	6.63±0.32 <sup>a</sup>	7.12±0.39 <sup>a</sup>
	After	8.41±0.60 <sup>b</sup>	8.0±0.37 <sup>b</sup>
P (mg/dl)	Before	4.23 <sup>a</sup> ±0.18	4.62 <sup>a</sup> ±0.62
	After	4.61±0.35	4.76±0.46

Different small and large superscript differ significantly p<0.05 & p<0.01.

**Table-67. Effect of improved feeding on milk composition (Nokha tehsil)**

Attributes	Fortnight intervals	Group I	Group II	Group III
% Fat	Start	2.97±0.27	3.08±0.07 <sup>a</sup>	2.55±0.10 <sup>b</sup>
	I	3.07±0.036	3.32±0.07	2.82±0.14
	II	3.02±0.30	3.55±0.32	3.07±0.20
	III	2.50±0.20 <sup>a</sup>	3.55±0.20 <sup>c</sup>	3.25±0.29 <sup>b</sup>
%SNF	Start	8.7±9±.052	7.90±0.47	7.90±0.38
	I	8.38±0.19	8.02±0.20	8.25±0.33
	II	8.72±0.36	8.46±0.43	8.29±0.18
	III	7.87±0.32	8.13±0.14	8.20±0.14
%Protein	Start	2.27±0.11	2.38±0.42	2.43±0.08
	I	2.28±0.19	2.45±0.17	2.41±0.12
	II	2.22±0.11	2.30±0.08	2.29±0.11

Different small superscript in the row differ significantly (P<0.05)

was also made to examine genital organs of the lactating female camels to rule out the pathological condition. There was no incidence of uterine discharge

or any abnormality. The owner was advised for early post parturient breeding but he was not ready for this practice. Experiment is still in progress.

**Table-68. Effect of improved feeding on milk composition (Kolayat tehsil)**

Parameters	Fortnight intervals	Group I	Group II
% Fat	I	2.53 ± 0.88 <sup>A</sup>	3.16 ± 0.28
	II	2.83 ± 0.20 <sup>B</sup>	3.26 ± 0.40
	III	3.66 ± 0.21 <sup>C</sup>	3.23 ± 0.45
%SNF	I	9.95 ± 0.50 <sup>a</sup>	8.46 ± 0.38
	II	9.45 ± 0.90 <sup>b</sup>	8.38 ± 0.27
	III	10.78 ± 0.29 <sup>c</sup>	8.10 ± 0.65
%Protein	I	2.25 ± 0.050	2.27 ± 0.17
	II	2.32 ± 0.20	2.27 ± 0.10 <sup>a</sup>
	III	2.26 ± 0.14	2.41 ± 0.11 <sup>b</sup>

#### Agro-forestry Unit

The forage production unit produced 893.3 quintals of green fodder from 11 ha of farm land. The grazing area (25.5 ha) was prepared with the cultivation of *grammna*, *dhamman*, *moth*, *guar*, *taramira* and oat. The production of seed and dry fodder respectively was

2.08 and 6.60 quintals in Guar where as 28.90 and 22.0 quintals in case of barley from a hectare of land. *Grammna* (10 Kg) and *Phog* (40 Kg) seed was also collected from the pasture area. About 4000 plants including 2500 fodder trees were planted in the farm area number -01. The landscaping work was undertaken at 5000 square meters of farm area.



Barley crop in Area No.01



Cutting of barley in Area No.01



## Technology Assessed and Transferred

### Gulab-jamun prepared from camel milk

The National Research Centre on Camel, Bikaner has launched Gulab-jamun as new value added product made out of camel milk on 15.4.09 by dignitaries namely, Dr. Nagendra Sharma, Ex-Vice Chancellor and Chairman, RAC of NRCC and Dr. C. S. Prasad, ADG (AN&P). In pursuings of transforming camel into a milch animal there had been continuous efforts in terms of selling camel milk as health drink, value added camel milk products like flavoured milk, tea, coffee and kulfi.

On the occasion of launching ceremony, Dr. Nagendra Sharma underlined that the preparation of sweet from camel milk is an important breakthrough in the post harvest processing technology and value addition of camel milk. He further expressed the hope that such technological advancement has commercial

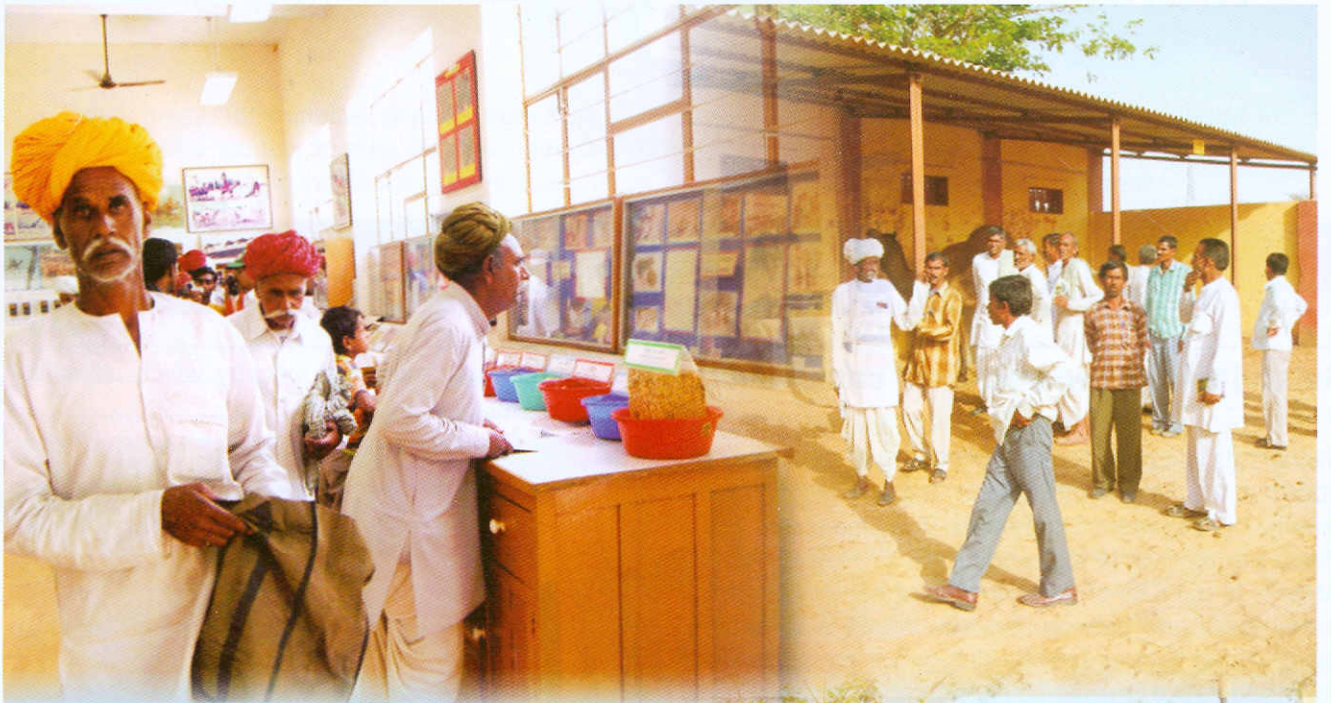
bearing on health and food industry which ultimately helps the camel owners.



*Gulab-jamun from camel milk*



*RAC members savoring Gulab-jamun*



## Education, Training and Awards

### Camps for Scientific Exhibitions

The exhibitions were organized on 9<sup>th</sup>-12<sup>th</sup> November, 2008 at the Pushkar Animal Fair, veterinary college, RAU (12<sup>th</sup>-15<sup>th</sup> August) and AKS, ATMA, (21<sup>th</sup>-25<sup>th</sup> August, 2008) Bikaner. These exhibitions depicted the latest technologies developed by the Centre & handouts were distributed free of cost in these camps.



**Farmer's meet or *Kissan Gosthi***

Farmer's meet or *gosthies* were organized at the Centre to update the camel keepers about their diseases and modern management practices being followed at an organized farm. The demonstrations and practical trainings were also provided to various groups of farmers and students from all over the country.



**FB fellow from USA completes his study at the Centre**

Mr. Henry Pederson spent the academic year 2008-09 at National Research Centre on Camel in Bikaner, Rajasthan, where he worked with the scientists and staff for learning about camel's care and the role it plays in *Rajasthani* culture and society.

### A.T.M.A (NGO) Collaboration

The farmers numbering 326 from A.T.M.A, NGO were provided with the demonstration and practical training during February and March 2009. They were also distributed extension literatures and booklets free of cost.

He got State Fulbright (FB) Grant from U.S. to use his education in genetics and environmental biology to learn the ways in which camels are managed and how these management practices have responded to recent changes in the economics, environment and culture of the Thar desert. He has learned about the camel reproductive system and research into Assisted Reproductive Technologies like Artificial Insemination in the camels. The nutrition unit introduced him to field work and the surrounding area, including the texture of life in the Thar Desert.



#### Recognition and Awards

- India Today group of publications in their famous weekly has projected the achievements of NRCC and included in the list of India's finest institutes that make the nation work. This is a great honour and recognition to NRCC, Bikaner.
- The Centre has got an appreciation certificate from Nagar Rajbhasha Karyanvayan Samiti for doing excellent work in Hindi at the centre.
- Dr Sumant Vyas, Dr (Mrs.) Nirmala Saini and Dr B. D. Kiradoo has won prizes by participating in the

competitions organized by Nagar Rajbhasha Karyanvayan Samiti Bikaner.

- The Centre has participated and won the award for camel milking competitions at the Camel Festival – 2009.
- Sh. Mohan Singh Chouhan, Technical Officer, won a Gold Medal in the Shot put event at the All India ICAR Zonal Championship organized at NAARM, Hyderabad from 17-20 Nov., 2008. He also received a Silver Medal in the event of Discus throw.



#### Internship programme for the veterinary students:

NRC on Camel organized a two months internship programme for the under graduate students (43) of Apollo Veterinary College, Jaipur w.e.f. 2<sup>nd</sup> April to 1<sup>st</sup> May 2009.

## 6

## Linkages and Collaborations

<b>Collaborative University/Institute</b>	<b>Programme</b>
Rajasthan Agricultural University, Bikaner	Research work of M.V.Sc. and Ph.D. student
Bikaner University, Bikaner	Research work of Ph.D. students
Maharana Pratap University of Agriculture and Technology, Udaipur	Camel drawn implements and electrical generation.
Sardar Patel Medical College, Bikaner	Development of anti-snake venom. Anti-wrinkling properties of camel milk cream based skin ointment.
Bhabha Atomic Research Centre, Mumbai	Development of single domain for diagnosis/ therapy
Indian Veterinary Research Institute, Mukteshwar	Development of a cell culture adapted live attenuated camel pox vaccine
Rajasthan Cooperative Dairy Federation(RCDF) and Urmul Dairy, Bikaner	Marketing of camel milk
Lokhit Pashupalak Sansthan, NGO at Sadri, Pali	Extension of camel husbandry practices, Training Demonstration
Central Arid Zone Research Institute, Jodhpur	Evaluation of nutritive value of Lama seed as feed resources in camel
National Research Centre on Equine, Bikaner	Studies on four MHC class II loci in donkey
ATMA(NGO), Jaipur	Transfer of Technology, Training , Demonstration
A.I.I.M.S. New Delhi	Identification ,characterization and structural studies of protein from camel with milk and seminal fluid



## List of Publications

### Research Papers

1. Bhakat Champak, Saini N and Pathak K M L (2008). Effect of management system on the performance of dromedary camel calves reared under organized farm condition. *Indian Journal of Animal Sciences*. 78(9): 1023-1027.
2. Bhakat, C. and Pathak, K.M.L. (2008). Socio-economic aspects of dromedary camel management in hot and desert system. *Indian Journal of Animal Sciences*, 79: 50-55.
3. Bhure, S.K., Mehta, S.C. and Singh, R. (2008). Comparative genomic organization of camel beta casein gene promoter: a computer aided gene regulation study. *Journal of Camel Research and Practice*. 15(1):25-33.
4. Dixit, S.K., F.C. Tuteja, A.P.Singh and D.S.Sena, (2008). Evaluation of oral formulation as humoral immune response modifier in dromedary camel, *Veterinary Practitioner* 9:161-163.
5. Dixit, S.K., F.C. Tuteja and D.S.Sena, (2008). Sarcopticosis in dromedary camel-clinical observations and its therapeutic management, *Indian Journal of Animal Sciences*, 79 :239-242.
6. Gorakh Mal and Aminu Deen (2008). Viability assessment of camel sperms using Hoechst 33258 stain, *Journal of Camel Practice and Research*, 15(1): 85-87
7. Gorakh Mal and Sena, D. Suchitra, (2008). Physical characterization, haematological and mineral profiles in bactrian camels. *Indian Vet. J.* 85(4): 408-410.
8. Mehta, S.C. (2008). Mathematical functions for the prediction of body weight gain in dromedary. *Journal of Camel Research and Practice*. 15 (2) : 239-244.
9. Mehta, S.C. and Sahani, M.S. (2009). Reproductive performance of Indian camel breeds. *Indian Journal of Animal Sciences*. 79 (2) 210-11.
10. Mehta, S.C., Pathak, K.M.L., Bhardwaj, B., Arora, S. and Bhatnagar, C.S. (2008). Camel dairying : an Indian perspective. *Indian Journal of Animal Sciences*, 79 : 454-456.
11. Mehta, S.C., Potdar, V.V. and Sahani, M.S. (2009). Amplification and RFLP of Exon 2 of MHC-DRB3 locus in livestock species. *Indian Veterinary Journal*. 86 (3) 250-254.
12. Saini, N., Bhati A.K. and Sahani, M.S. (2008) Plasma mineral profile of camels in different physiological states. *Indian Journal of Dairy Science* 61 : 1489-92.
13. Sena, D. Suchitra and Gorakh Mal, (2008). Effect on the growth rate and immune status in neonatal camel calves under different feeding practices, *Journal of Camel Practice and Research* 2008 15: 35-38.
14. Sena, D. Suchitra and Gorakh Mal, (2008). Studies on immunoglobulin and protein profile in pregnant camels, *Indian Vet. J.*, 85: 683-684.
15. Sena, D. Suchitra and Gorakh Mal, (2009). Macro mineral profile in pregnant camels and neonatal calves, *Indian Vet. J.*, 86:321-322
16. Sharma, K.K., Vyas Sumant, Kashyap, S.K. and Deen, A. (2008). Isolation and identification of Bacteria from lower genital tract of female dromedary camel. *Veterinary Practitioner* 9: 19-21.
17. Vyas, Sumant, Purohit, G.N. and Pareek, P.K. (2009). Efficacy of vaginal electrical resistance (VER) measurement for evaluation of follicular activity in *Camelus dromedarius*. *Indian Journal of Animal Science* 79: 147-150.

### Books, Booklets and Hand outs published in Hindi and English:

1. Pathak K. M. L. NRCC News Letter – July 2007 – June 2008
2. रॉय ए.के. (2008) करम-अंक 6 ; पृष्ठ 73 (सम्पादक) राष्ट्रीय उष्ट्र अनुसंधान केन्द्र, बीकानेर

3. Pathak K.M.L. and Roy A.K. (2008) "Sustainable camel farming". National Research Centre on Camel, Bikaner-334 001
4. रॉय ए.के. (2009) संवाद-वार्षिक हिन्दी प्रत्रिका ; पृष्ठ 53. (सह सम्पादक) नगर राजभाषा क्रियान्वयन समिति, बीकानेर.

### Abstracts / Papers presented / published in Seminar, Symposia, Conferences and Training

1. Ghorui, SK, Sanjay Kumar and Pathak K.M.L. (2009) Foresight of infectious Disease Management of Livestock in the Upfront of Climate Change. ASCAD Symposium on "Recent Scientific Trends in Animal Husbandry", pp.33-34, Mar.4-5, 2009, Bikaner.
2. Ghorui, SK, Sanjay Kumar, Md. Ashraf, Nagarajan, G and Pathak K.M.L. (2009) Abortion and neonatal mortality associated with Trypanosoma evansi infection in Indian camel. Proceedings of XIX Indian National Congress of Veterinary Parasitology and National Symposium on National Impact of Parasitic Diseases on Livestock Health and Production, Feb.3-5, 2009, Ludhiana.
3. Ghorui, SK, Sanjay Kumar, Md. Ashraf, Nagarajan, G and Pathak K.M.L. (2009) Using PCR for unraveling the cryptic epidemiology of trypanosomosis in parts of western Rajasthan, India. Proceedings of XIX Indian National Congress of Veterinary Parasitology and National Symposium on National Impact of Parasitic Diseases on Livestock Health and Production, Feb.3-5, 2009, Ludhiana.
4. Gorakh Mal and K.M.L. Pathak. Camel Milk- Properties and its products, 2<sup>nd</sup> conference of ISOCARD-2009 (pp: 59), Djerba, Tunisia during 12-14 March, 2009.
5. Gorakh Mal and K.M.L. Pathak. Effect of heat treatment on camel milk whey proteins, 2<sup>nd</sup> conference of ISOCARD-2009 (pp: 51), Djerba, Tunisia during 12-14 March, 2009.
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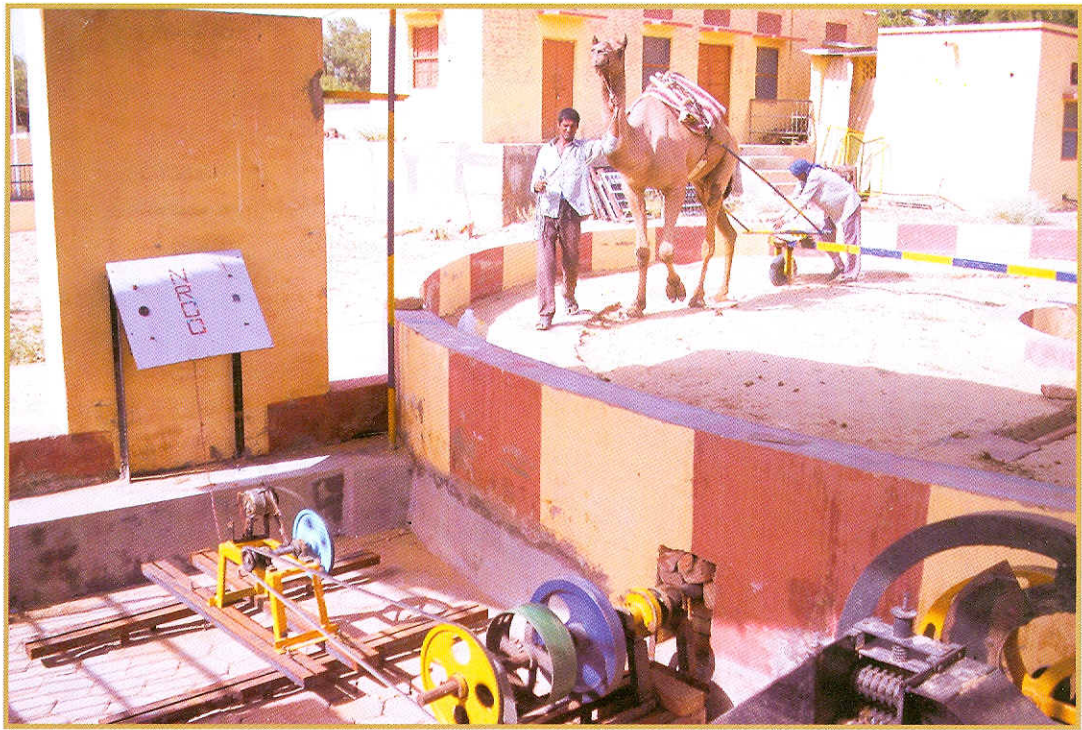
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## 8

## List of Ongoing Research Projects

S. No.	Name of Project	Code No.
	<b>Camel Breeding and Genetics</b>	
1.	Studies on qualitative and quantitative genetic parameters in Indian Camel	AGB-1
2.	Selection for the improvement of draughtability of camel breeds	AGB-4
3.	Genetic improvement of milk production potential of Indian dromedary	AGB-7
4.	Molecular genetic studies in Indian camel	AGB-2
	<i>Inter-Institutional</i>	
5.	Studies on four MHC class II loci in donkey. (with NRC on Equine)	
	<b>Camel Health</b>	
6.	Epidemiology of infectious diseases of camel.	VM -8
	<b>Sub projects:</b>	
	a. Epidemiology of bacterial and fungal diseases of camels	
	b. Epidemiology of major parasitic diseases of camels	
	c. Epidemiology of viral diseases of camels	
	d. Epidemiology of efficiency/Toxic and metabolic diseases of camels	
7.	Evaluation and validation of ethno-veterinary practices against camel diseases.	VM-10
8.	Therapeutic spectrum of selected herbs against dermatophytes / bacteria.	VM-5
9.	Generation and validation of suitable formulation for treatment of mastitis.	VM-3
10.	Investigations on digestion fermentation disorder with particular reference to indigestion and impaction	VM- 6. VM-7
11.	Immunity status in neonatal calves	VM-4
12.	Molecular cloning and characterization of cameline cytokine gene(s)	BT-AS-1
13.	Management of GI parasites in camel herd and molecular characterization of anthelmintic resistant strains of parasites	VP-2
	<i>Inter-institutional</i>	
14.	Development of a new camelid anti snake venom – (with SP Medical college, Bikaner)	VM- 9
15.	Development of single domain antibodies for diagnosis/therapy-inter institutional project with BARC, Mumbai	BT-AS-2
16.	Development of a cell culture adapted live attenuated camel pox vaccine (with IVRI, Mukteswar)	BT-AS-3
17.	Molecular Diagnosis of tuberculosis (with IVRI,Izatnagar)	VM-11

	<b>Camel Reproduction</b>	
18.	Identification of factors responsible for reproductive disorders and development of technology for countering the same	AR-4
19.	Improving the efficiency of artificial insemination in camel using existing and emerging technologies	AR-5
20.	Role of sexual and bio-stimulation in camel reproduction	AR-6
21.	Studies on biochemical parameters of semen for increasing its efficacy	AR-2
	<b>Camel Nutrition</b>	
22.	Studies on nutrient requirement and feed resource availability in camel for optimum production.	AN-3
23.	Development and testing of complete feed block for male breeding camels	AN-4
24.	Studies on digestive fermentation pattern in locally available camel feed and fodder	AN-2
25.	Improvement of feed resources and nutrient utilization in raising animal production.	AICRP
	<b>Livestock Production Management</b>	
26.	Developing camel management practices in present and impending climate change scenario	LPM-1
	<b>Camel Physiology</b>	
27.	Efficient utilization of camel energy during cart pulling and agricultural operations by camels.	AP-2
28.	Adaptation of camel to climatic changes in relation to temperature humidity index	AP-6
	<b>Camel Biochemistry</b>	
29.	Processing, value addition and commercialization of different camel Products and by-products	AP-3
30.	Evaluation of camel milk for its therapeutic value and its exploitation as functional food	AP-5
31.	Evaluation of anti-wrinkling property of camel milk cream in human - Inter-institutional project – SPMC, Bikaner	AP-4

## QRT, IMC, RAC, and IRC Meetings

### QRT visits the Centre

The Quinquennial Review Team (QRT) visited NRCC on 16<sup>th</sup> March 2009 under the chairmanship of Prof. M.P. Yadav, Hon'ble Vice Chancellor, SVBP University of Agriculture and Technology, Meerut and reviewed the research work carried out during 2002-07. Dr Arun Varma, former DDG (AS), ICAR, Dr R.J. Sharma, Former Dean, GBP U A & T, Pant Nagar, Dr M.C. Goel, former Professor Veterinary Immunology and Dean PGS, CCS HAU Hisar, Prof. S.B.S. Yadav, Director Research (VAS) RAU, Bikaner and Dr Sumant Vyas, Sr. Scientist participated in the deliberations of the meeting. Prof. K.M.L. Pathak, Director highlighted the various research and developmental activities of the Centre. The research activities and other administrative matters of the Centre were discussed at length. The subsequent meeting was held on 20.4.2009 at ICAR, New Delhi. The QRT appreciated the progress made in the areas of camel research and extension.



### RAC Meeting

The Research Advisory Committee Meeting was held on 15.4.2009 under the Chairmanship of Dr. Nagendra Sharma, Vice-Chancellor, SKAUST, Jammu. The other members of RAC who attended the meeting were Dr. C.S. Prasad, ADG (AN&P), Dr K.M.L. Pathak,,

Director, NRCC, Dr. N.D. Khanna, Ex-Director, NRCC, Dr. M.B. Chhabra, Ex-Professor of Parasitology, CCS HAU, Dr. Gaya Prasad, Professor Animal Biotechnology, CCSSHAU, Shri Shree Gopal Upadhyay, Ex-Sarpanch and Dr. Sumant Vyas, Senior Scientist, NRCC. The Committee visited the farm, laboratories and held discussions with the scientist and suggested recommendations after reviewing all the ongoing projects.



### Mid term Institute Research Council (IRC) meeting

Mid term IRC meeting was held on 24.12.2008 under the Chairmanship of Dr. K.M.L. Pathak. The



external experts including Dr. R.K. Tanwar, Head Preventive Medicine, CVAS, Bikaner, Dr. S.B.S. Yadav, Director Research (VAS), RAU, Bikaner, Dr. M.B. Chhabra, Former Professor of Parasitology, CCSHAU, Hisar and Dr. S.K. Kashyap, Head, Veterinary Microbiology, CVAS, Bikaner, reviewed the programs of various ongoing projects.

#### Annual Institute Research Council (IRC) meeting

Annual IRC meeting for the year 2008-09 was held on 23.5.2009. Project wise presentations were made by respective scientists. Dr. S. B. S. Yadav, Director Research (VAS), RAU, Bikaner, Dr. R. C. Jakhmola, Head, CSWRI Regional Station, Bikaner, Dr. M. B. Chhabra, former Prof. & Head, CCS HAU, Hisar, Prof. G. Prasad, Animal Biotechnology, CCSHAU, Hisar, Dr. Dharendra Singh, PS & Head CSWRI, Avikanagar, Dr. R.K. Tanwar, Head, CVAS, RAU, Bikaner, Dr. A.K.

Purohit, Director, Extension, RAU, Bikaner and Dr. Rishendra Varma, Head, IVRI, Izatnagar were invited as experts. The experts offered their valuable suggestions for the ongoing research programmes of the Centre. The Director who is also the Chairman of IRC, gave critical inputs on experimentation for obtaining realistic and reproducible results.

#### Institute Management Committee (IMC) meeting

The IMC meeting was held on 16.4.2009 under the Chairmanship of Prof. K.M.L. Pathak, Director along with Dr. C.S. Prasad, ADG (AN&P), Dr. S.B.S. Yadav, Director, Research (VAS) RAU, Bikaner, Dr. R.C. Sharma, Sr. Scientist, NRCE, Bikaner, Dr. Sailesh Sharma, Joint Director, Department of Animal Husbandry, Bikaner, Shri Shree Gopal Upadhyay, Ex- Sarpanch and Shri K.P. Sharma, AAO, NRCC, Bikaner. The Committee discussed and approved all the agenda items.



## Participation in Conferences, Meetings, Workshops and Symposia

Name and Designation	Meetings, Seminars, Workshops and Symposia	Date
Prof. K. M. L. Pathak, Director	EFC proposal presentation at Krishi Bhavan, New Delhi.	May 27, 2008
	AICRP Workshop held at Assam Agricultural University, Guwahati.	June 18-21, 2008
	IX Annual Conference and a National Symposium on Livestock genomics for productivity enhancement for food security, held at NASC, New Delhi.	July 3-4, 2008
	Conservation and use of farm animals microbial genomic resources", organized jointly by Indian Society for Genetics and Breeding and ICAR, New Delhi.	August 29-30, 2008
	Interactive Workshop on "Climate change and its impact on ecosystem, NDRI, held at Karnal.	Sept. 20 -21, 2008
	XIX National Congress of Veterinary Parasitology, held at GADVASU, Ludhiana.	Feb. 3-5, 2009
	Animal Nutrition Association World Conference 2009 held at NASC Complex, New Delhi.	Feb. 14-17, 2009
	ASCAD Symposium on "Recent Scientific Trends in Animal Husbandry, held at Bikaner.	March 4-5, 2009
Dr S. K. Ghorui, Sr. Scientist	Conservation and use of farm animals microbial genomic resources", organized jointly by Indian Society for Genetics and Breeding and ICAR, New Delhi.	August 29-30, 2008
	XIX National Congress of Veterinary Parasitology, held at GADVASU, Ludhiana.	Feb. 3-4, 2009
	ASCAD Symposium on "Recent Scientific Trends in Animal Husbandry, held at Bikaner.	March 4-5, 2009
Dr A. K. Nagpal, Sr. Scientist	Animal Nutrition Association World Conference 2009 held at NASC Complex, New Delhi	February 14, 2009
Dr A. K. Roy, Sr. Scientist	Animal Nutrition Association World Conference 2009 held at NASC Complex, New Delhi.	Feb. 14-17, 2009
	XI Coordination Committee Meeting of AICRP on Increased utilization of animal energy with enhanced system efficiency held at MPUA&T, Udaipur Rajasthan	June 15-16, 2009
Dr F. C. Tuteja Sr. Scientist	Conservation and use of farm animals microbial genomic resources", organized jointly by Indian Society for Genetics and Breeding and ICAR, New Delhi.	Aug., 29-30, 2008
	International Summit on 'Advancing Veterinary Medical Care: Challenges and Strategies' & 27th ISVM Convention. Satellite Seminars on Veterinary Internal Medicine, held at Tamilnadu Veterinary and Animal Sciences University, Chennai. Tamilnadu	Feb. 19-21, 2009

Dr Sumant Vyas, Sr. Scientist	Participatory lecture in Model training course on 'Improved equine production through cryopreservation of semen, A.I. and pregnancy diagnosis in equines at E.P.C., NRCE, Bikaner	March 23-30, 2009
Dr S. K. Dixit, Sr. Scientist	International Summit on 'Advancing Veterinary Medical Care: Challenges and Strategies' & 27th ISVM Convention. Satellite Seminars on Veterinary Internal Medicine, held at Tamilnadu Veterinary and Animal Sciences University, Chennai. Tamilnadu	Feb. 19-21, 2009
Dr Champak Bhakat, Sr. Scientist	International Seminar on Dairying organized during International Livestock and Dairy Expo, 2008. held at New Delhi.	Aug. 22-24, 2008
	Seminar on Double Humped Camel Production and Conservation organized by the Ladakh Autonomous Hill Development Council, Government of J&K, held at Leh-Laddakh.	March 7-8, 2009
Dr(Mrs.) D. Suchitra Sena, Sr. Scientist	International Summit on 'Advancing Veterinary Medical Care: Challenges and Strategies' & 27th ISVM Convention. Satellite Seminars on Veterinary Internal Medicine, held at Tamilnadu Veterinary and Animal Sciences University, Chennai.	Feb. 19-21, 2009
	National Conference on traditional knowledge systems, intellectual property rights and their relevance for sustainable development, held at NISCAIR, New Delhi.	Nov. 24-26, 2008
Dr Gorakh Mal, Sr. Scientist	International Seminar on Dairying organized during International Livestock and Dairy Expo, 2008. held at New Delhi.	Aug. 22-24, 2008
	कम्प्यूटर पर कुशल हिन्दी प्रयोग, सी-डैक, नई दिल्ली में आयोजित	फरवरी 9-13, 2009
	Seminar on Double Humped Camel Production and Conservation organized by the Ladakh Autonomous Hill Development Council, Government of J&K, held at Leh-Laddakh.	March 7-8, 2009
Dr Sanjay Kumar, Scientist	XIX National Congress of Veterinary Parasitology, held at GADVASU, Ludhiana.	Feb. 3-4, 2009
	ASCAD Symposium on "Recent Scientific Trends in Animal Husbandry, held at Bikaner.	March 7-8, 2009
Dr.(Mrs.)Nirmala Saini, Sr. Scientist	Animal Nutrition Association World Conference 2009 held at NASC Complex, New Delhi.	Feb.14, 2009
	Annual review meeting of AICRP on Improvement of feed resources and nutrient utilization in raising animal production, held at AAU, Guwahati.	June 19-20, 2008
	Mid annual review meeting of AICRP on Improvement of feed resources and nutrient utilization in raising animal production, held at NIANP, Adugodi, Bangalore.	Jan. 28, 2009
Dr S.C. Mehta, Sr. Scientist	"Conservation of Kachchhi breed of Camel" a meeting organized by the Department of Animal Husbandry, Dairying and Fisheries, Government of India at Krishi Bhavan, New Delhi.	December 22, 2008



Dr U. K. Bissa, Sr. V.O.	Conservation of Kachchhi breed of Camel" a meeting organized by the Department of Animal Husbandry, Dairying and Fisheries, Government of India at Krishi Bhavan, New Delhi.	December 22, 2008
Dr. N. Sharma, Technical Officer	International Summit on 'Advancing Veterinary Medical Care: Challenges and Strategies' & 27th ISVM Convention. Satellite Seminars on Veterinary Internal Medicine, held at Tamilnadu Veterinary and Animal Sciences University, Chennai. Tamilnadu	Feb. 19-21, 2009
Shri Dinesh Munjal, Technical Officer (T-6)	Workshop on Data Mining and Datahousing (DmDw'08) organized by The Centre for Soft Computing Research (CSCR) at Indian Statistical Institute, Kolkata under the scheme "National Training Programme for Scientists/ Technologists in Government Sector" of DST.	Sept.15-20, 2008
	International Convention on Automation of Libraries in Education and Research Institutions (CALIBER) 2009 held at Pondichery University, Puducherry.	Feb. 25-27, 2009
Shri Ram Dayal, Technical Officer (T-6)	International Convention on Automation of Libraries in Education and Research Institutions (CALIBER) 2009 held at Pondichery University, Puducherry.	Feb. 25-27, 2009
	SAU / DAU / ICAR Librarians' workshop on Digitization of Indian Agricultural dissertations (Krishi Prabha) hosted by Nehru Library, CCS Haryana Agricultural University, Hisar.	Nov. 14-15, 2008
Dr G. Nagarajan Scientist	National Conference on Ethical use of Animals in Research and Education and Dissemination of Norms and Guidelines of CPCSEA held at Dr. Marri Chenna Reddy Human Resource Development Institute, Hyderabad.	Jan.29-30,2009
Dr Arjun Lukkha, SRF	Animal Nutrition Association World Conference 2009 held at NASC Complex, New Delhi.	Feb.14, 2009



## Distinguished Visitors, Appreciation and Awards

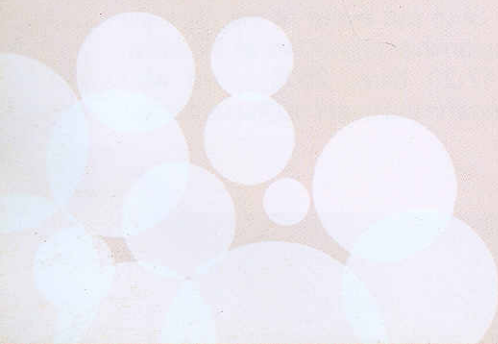
### Distinguished Visitors

- ❖ Sh. Rajender Singh Rajpurohit, Chairman, Rajasthan Gau Seva Ayog, Jaipur, visited on 03.07.2008
- ❖ Prof. Abdulah Alowaimer, College of Food Science and Agriculture, King Saud University, Saudi Arabia, visited on 09.07.2008
- ❖ Prof. Saeid Basmakil, College of Food Science and Agriculture, King Saud University, Saudi Arabia, visited on 09.07.2008
- ❖ Ms. Mira Mehrishi, IAS Principal Secretary, Tourism, Govt. of Rajasthan, visited on 24.7.08
- ❖ Ms Usha Sharma, IAS MD, Rajasthan Tourism Development Corporation, Jaipur, visited on 24.7.08
- ❖ Dr. D.C. Uprety, Emeritus Scientist, IARI, New Delhi, visited on 19.09.2008
- ❖ Shri Pritam Singh, Divisional Commissioner, Bikaner, visited on 06.10.2008
- ❖ Shri V. Srinivas, Secretary, Family Welfare & MD NRHM, Government of Rajasthan, Jaipur, visited on 31.10.2008
- ❖ Shri Prem Jauhar, US DA-ARS Northern Crop Research Institute Fargo, North Dakota, USA, visited on 18.11.2008.
- ❖ Shri Leeladhar Swani, District and Session Judge (Retd.) & Member Rajasthan Backward Cast Commission, Jaipur, visited on 26-12.2008.
- ❖ Shri Mahaveer Swami, RJS Hon'ble CJM, Bikaner, visited on 26.12.2008.

- ❖ Dr. Justice Vineet Kothari Hon'ble Judge, Rajasthan High Court, Jodhpur, visited on 03.01.2009
- ❖ Ms. Uttara Dasgupta, CGM & Principal State Bank Academy Gurgaon, visited on 03.02.2009
- ❖ Dr. B.K. Bansal, Professor Clinical Veterinary Medicine, GADVAGU, Ludhiana, visited on 13.02.2009.
- ❖ Maj. Gen. A.K. Gupta, SM, VSM, IG (Operations & Force) HQ NSG, New Delhi, visited on 17.02.2009.
- ❖ Shri Sagar Raika, Hon'ble Chairman, Central Sheep & Wool Board, visited on 02.03.2009.
- ❖ Mrs. Sreya Guha, I.A.S. Collector & District Magistrate, Bikaner, visited on 08.03.2009.
- ❖ Shri O.P. Saini, I.A.S, Principal Secretary Animal Husbandry Government of Rajasthan, Jaipur, visited on 25.03.2009.
- ❖ Dr. C.D. Mayee, Hon'ble Chairman, Agricultural Scientists Recruitment Board (ASRB), New Delhi, visited on 27<sup>th</sup> & 28<sup>th</sup> March, 2009.

### Appreciation and Awards:

- ❖ The centre has got an appreciation certificate from Nagar Rajbhasha Karyanvayan Samiti for doing excellent work in Hindi at the centre.
- ❖ The Centre has participated and won the award for camel milking competitions at the Camel Festival – 2009.
- ❖ Sh. Mohan Singh Chouhan, Technical Officer, won a Gold Medal in the Shot put event at the All India ICAR Zonal Championship organized at NAARM, Hyderabad from 17-20 Nov., 2008. He also received a Silver Medal in the event of Discus throw.



## Personnel

### Director

Prof. K.M.L. Pathak, Director

### Principal Scientist

Dr. Aminu Deen, Animal Physiology  
(under suspension-presently posted at CSWRI,Regional Station,Bikaner)

### Senior Scientist

Dr. A. K. Nagpal, Animal Nutrition  
Dr. S. K. Ghorui, Veterinary Parasitology  
Dr. S. K. Dixit, Veterinary Medicine  
Dr. A. K. Roy, Animal Physiology  
Dr. Sumant Vyas, Animal Reproduction  
Dr Raghvendra Singh (on deputation)  
Dr. S. C. Mehta, Animal Genetic and Breeding  
Dr. F. C. Tuteja, Veterinary Medicine  
Dr. Gorakh Mal, Animal Biochemistry  
Dr. C. Bhakat, Livestock Production Management  
Dr. (Mrs.) D. Suchitra Sena, Veterinary Medicine  
Dr.(Mrs.) Nirmala Saini, Animal Nutrition

### Scientist(Senior Scale)

Dr. G. Nagarajan, Animal Biotechnology

### Scientist

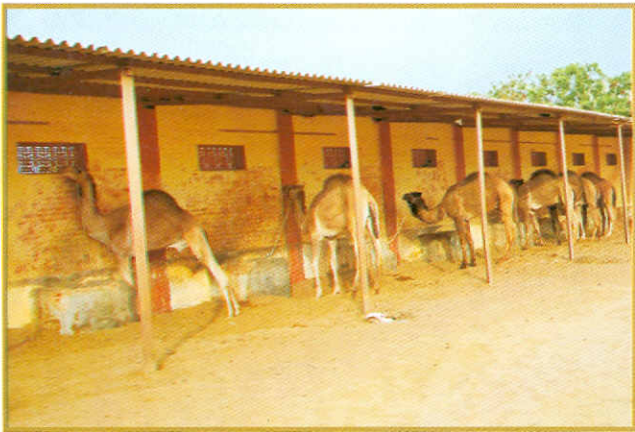
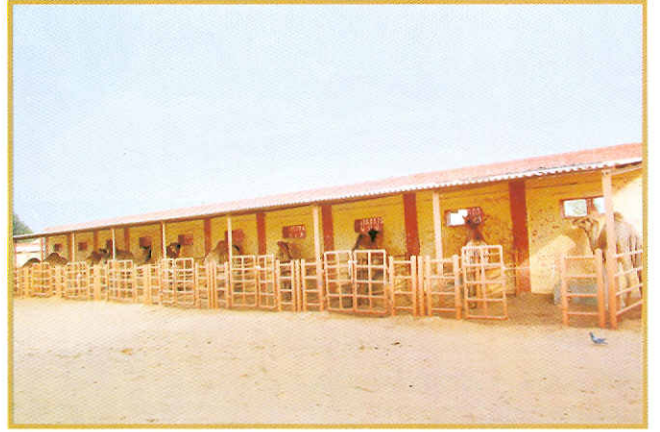
Dr.Sanjay Kumar, Veterinary Parasitology

### Technical

Dr. U. K. Bissa, Sr. Veterinary Officer, T-9  
Dr.N. Sharma, LSF, T-9  
Sh. Ram Kumar, Farm Manager, T-9  
Dr. B. L. Chirania, Veterinary Officer, T-7-8  
Sh. Ram Dayal, Technical Officer, T-6  
Sh. Dinesh Munjal, Technical Officer, T-6  
Sh. M. K. Rao, Technical Officer, T-5  
Sh. Nand Kishor, Technical Officer, T-5  
Sh. Mohan Singh, Technical Officer, T-5

### Administration

Sh. K. P. Sharma, Assistant Administrative Officer  
Sh. Raj Kumar, Assistant Finance & Accounts Officer

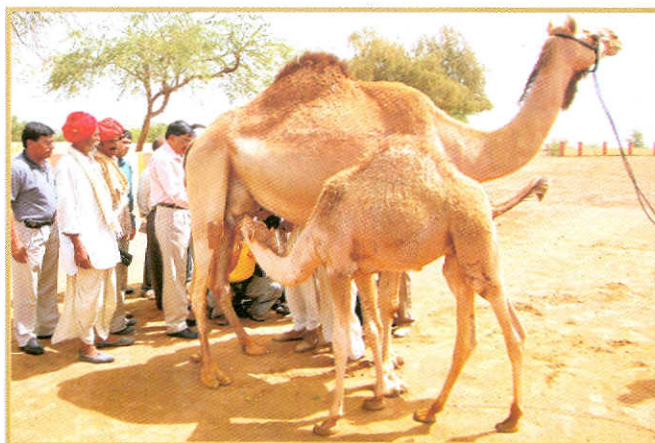
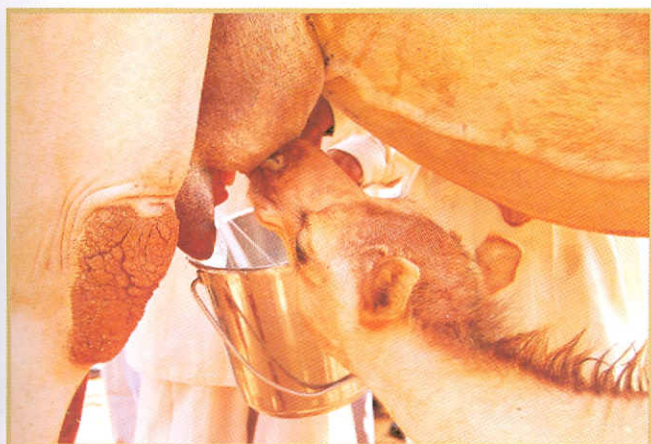


## Infrastructure Development

### Establishment of camel dairy

The camel dairy, first of its kind in India was inaugurated by Dr C. S. Prasad, ADG (AN&P) on 9<sup>th</sup> May, 2008. Dr Prasad underlined the importance of multiple role of camel in his speech at the occasion. He observed that the establishment of camel dairy at NRCC campus is a step forward to transform camel into a milch animal. He also expressed happiness over the MoU signed between NRCC and Rajasthan Cooperative Dairy

Federation for the promotion of camel milk sale and prospects of entrepreneurship through its products. Prof. K.M.L. Pathak Director NRCC stated that the camel milk has been accepted by the society as a healthy food drink. "The new role of the camel as a dairy animal will further strengthen the Raika community besides its traditional utility for draught purpose" he added further. The centre will organize the trainings for camel owners in the area of camel dairy and its products.





# हिन्दी चेतना मास



09 सितम्बर - 08 अक्टूबर, 2008

राष्ट्रीय उष्ट्र अनुसंधान केन्द्र, बीकानेर





## केन्द्र की राजभाषा संबंधी गतिविधियां

### हिन्दी चेतना मास : उद्घाटन समारोह

हिन्दी दिवस के शुभ उपलक्ष्य पर राष्ट्रीय उच्च अनुसंधान केन्द्र, बीकानेर में दिनांक 09 सितम्बर – 08 अक्टूबर, 2008 तक हिन्दी चेतना मास मनाए जाने की विधिवत् घोषणा केन्द्र निदेशक प्रो.कृष्ण मुरारी लाल पाठक द्वारा की गई।

इस अवसर पर प्रभारी राजभाषा डॉ. अश्विनी कुमार रॉय द्वारा हिन्दी दिवस को विधिवत् मनाए जाने व इस उपलक्ष्य में आयोज्य हिन्दी चेतना मास के कार्यक्रमों की जानकारी से सभाकक्ष को अवगत कराया।

हिन्दी चेतना मास के शुभारम्भ पर केन्द्र के निदेशक प्रो. के.एम.एल. पाठक ने सभाकक्ष को सम्बोधित करते हुए कहा कि हिन्दी दिवस को परंपरा के रूप में मनाना ही केवल हमारा उद्देश्य नहीं है अपितु 'क' क्षेत्र में स्थित होने के कारण हमारा दायित्व और भी अधिक बढ़ जाता है। प्रो.पाठक ने स्पष्ट किया कि हिन्दी चेतना मास के अन्तर्गत आयोज्य कार्यक्रमों एवं गतिविधियों में नगर स्तर के कार्यालयों व उपक्रमों को आमन्त्रित करने के पीछे यही लक्ष्य है कि राजभाषा का उत्तरोत्तर विकास हो तथा आयोज्य कार्यक्रम अपनी उपयोगिता व सार्थकता सिद्ध करें। हिन्दी चेतना मास के अन्तर्गत निम्नलिखित कार्यक्रमों का आयोजन हुआ : –

### हिन्दी में सामान्य ज्ञान प्रश्नोत्तरी प्रतियोगिता

प्रथम	श्री हरपाल सिंह कौण्डल	आशुलिपिक
द्वितीय	डॉ. सुमन्त व्यास	वरिष्ठ वैज्ञानिक
तृतीय	डॉ. अर्जुन कुमार लुखा	वरिष्ठ अनुसंधान अध्येता
प्रोत्साहन	1. डॉ. संजय कुमार	वैज्ञानिक
पारितोषिक	2. श्री अनिल कुमार	वरिष्ठ लिपिक

### हिन्दी में निबन्ध प्रतियोगिता

प्रथम	डॉ. सुमन्त व्यास	वरिष्ठ वैज्ञानिक
द्वितीय	डॉ. शरत् चन्द्र मेहता	वरिष्ठ वैज्ञानिक
तृतीय	श्री दिनेश कुमार मुंजाल	तकनीकी अधिकारी
प्रोत्साहन	1. डॉ. निर्मला सैनी	वरिष्ठ वैज्ञानिक
पारितोषिक	2. श्री मंजीत सिंह	कनिष्ठ अभियन्ता

### एक दिवसीय राजभाषा कार्यशाला

हिन्दी चेतना मास के अन्तर्गत आयोजित एक दिवसीय राजभाषा कार्यशाला में अतिथि वक्ता के रूप में पधारी डॉ. मधुलिका शर्मा, वरिष्ठ व्याख्याता, राजकीय डूंगर महाविद्यालय, बीकानेर ने अपने व्याख्यान "वर्तमान में हिन्दी की प्रासंगिकता" विषय में कहा कि हिन्दी भाषा सरल, उपयुक्त तथा एक समर्थ भाषा है। अतः इसे अपनाने हेतु हमें निःसंकोच आगे आना चाहिए। डॉ. शर्मा ने हिन्दी के सरलीकरण की बात पर जोर देते हुए अन्त में कहा कि हिन्दी हमारी मातृभाषा, राजभाषा एवं राष्ट्रभाषा है। अतः इसका अनादर न होने दें क्योंकि भाषा के माध्यम से ही हम न केवल अपना कल्याण करेंगे अपितु समाज का भी कल्याण कर सकेंगे।

कार्यशाला के 'नवीन क्षेत्रों में हिन्दी की संभावनाएं' विषयक दूसरे व्याख्यान हेतु डॉ. मदन केवलिया, पूर्व उप प्राचार्य एवं विभागाध्यक्ष (हिन्दी साहित्य) राजकीय डूंगर महाविद्यालय, बीकानेर को आमन्त्रित किया गया। डॉ. केवलिया ने अपने व्याख्यान में कहा कि वर्तमान परिदृश्य में यदि हम हिन्दी की संभावनाओं की बात करें तो इसका भविष्य अधिक सुनहरा है क्योंकि आज विधिक जैसे मामलों में भी हिन्दी की आवश्यकता महसूस की जा रही है। इस देश के जन साधारण की भाषा ही हिन्दी है। डॉ. केवलिया ने कहा कि फिल्मी जगत, दूरदर्शन, विज्ञापन आदि विभिन्न

क्षेत्रों में हिन्दी अपना परचम फहरा रही है जो कि किसी भी भाषा के लिए सुखद अनुभूति का द्योतक हो सकता है। उन्होंने हिन्दी में लगातार शोध की आवश्यकता भी जताई।

### सांस्कृतिक समारोह

केन्द्र में हिन्दी चेतना मास के समापन समारोह से पूर्व सांस्कृतिक समारोह का आयोजन मनोरम वातावरण में सम्पन्न हुआ। सांस्कृतिक समारोह में राजस्थान कला मन्दिर, बीकानेर के बाल कलाकारों द्वारा रंगारंग कार्यक्रम की प्रस्तुति दी गई।

### हिन्दी चेतना मास : समापन समारोह

राष्ट्रीय उष्ट्र अनुसंधान केन्द्र में हिन्दी चेतना मास का समापन समारोह उत्साही व मनोरम वातावरण में आयोजित हुआ। इस समारोह के मुख्य अतिथि के रूप में



उर्दू अदब के जाने माने शायर व साहित्यकार जनाब शीन काफ निजाम साहब को आमंत्रित किया गया। इस अवसर पर निजाम साहब ने अपने अभिभाषण में कहा कि साहित्य व विज्ञान में कोई दूरी नहीं है। दोनों ही नव सृजन कर अन्वेषण का कार्य करते हैं। जिस प्रकार से साहित्यकार भाषा में डूबता है उसी प्रकार वैज्ञानिक भी प्रयोगशाला में अपना अनुसंधान कार्य करता है। अनुसंधान के संप्रेषण का माध्यम भाषा बनती है। उन्होंने कहा कि यदि हम भाषाओं की तुलना करें तो हमें संवेदना के स्तर पर जाकर उनकी तुलना करनी चाहिए। निजाम साहब ने हिन्दी भाषा की आत्मसात् करने की क्षमता का विशेष जिक्र किया तथा कहा कि जिस प्रकार उर्दू आदि में अन्य भाषाओं के शब्द रच-बस

गए है, ठीक उसी तरह हिन्दी ने भी कई भाषाओं को अपने में समाहित कर लिया है।

समापन समारोह के विशिष्ट अतिथि के रूप में डॉ. ए. के. पुरोहित, निदेशक, अकादमिक कर्मचारी महाविद्यालय एवं दूरस्थ शिक्षा, राजस्थान कृषि विश्वविद्यालय, बीकानेर ने अपने उद्बोधन में कहा कि वैज्ञानिकों का अनुसंधान से तो सरोकार रहता है, पर साहित्य से नहीं। हमारे वैज्ञानिक चिन्तन एवं प्रतिदिन के वैज्ञानिक कार्य का हिन्दी में सम्प्रेषण कर सके, ऐसी चेतना जगाने की आवश्यकता है। उन्होंने



आगे कहा कि इस प्रकार के ऐतिहासिक आयोजन ऐसी भावना जगाते हैं। विशिष्ट अतिथि ने जनाब निजाम साहब की वैज्ञानिक सोच की सराहना करते हुए उनके एक शेर को प्रकाश संश्लेषण के सिद्धांत से जोड़कर प्रस्तुत किया।

समापन समारोह में अध्यक्ष के रूप में केन्द्र निदेशक प्रो.के.एम.एल.पाठक ने जनाब शीन काफ निजाम की उपस्थिति को प्रेरणादायक मानते हुए कहा कि विश्व में वैश्विक वातावरणीय गर्मी का प्रभाव हमारी खेती, मिट्टी और पशुओं के स्वास्थ्य पर स्पष्ट देखा जा सकता है। इसको जनसाधारण की भाषा में कृषकों, पशु पालकों तक पहुँचाने की आवश्यकता है। उन्होंने केन्द्र में राजभाषा प्रगति से मंचस्थ जनों को अवगत करवाते हुए कहा कि हमारा यह प्रयास रहता है कि राजभाषा में प्रकाशित सामग्री जन-जन तक पहुँचाई जाए ताकि उसकी सार्थकता सिद्ध हो।

### राजभाषा कार्यशाला

राष्ट्रीय उष्ट्र अनुसंधान केन्द्र, बीकानेर में दिनांक 26.03.2009 को एक दिवसीय राजभाषा कार्यशाला का आयोजन रखा गया। राजभाषा कार्यशाला में कुल दो

व्याख्यान रखे गए। व्याख्यान प्रस्तुतीकरण हेतु राजकीय डूंगर महाविद्यालय, बीकानेर के हिन्दी साहित्य के विभागाध्यक्ष डॉ. उमाकान्त गुप्त ने कार्यशाला के 'हिन्दी की ध्वनियां' विषयक प्रथम व्याख्यान पर बोलते हुए कहा कि हिन्दी भाषा हमारी अस्मिता से जुड़ी हुई है तथा हमारे होने का प्रमाण हमारी भाषा से जुड़ा है। उन्होंने व्याख्यान के विषय पर बोलते हुए कहा कि हिन्दी भाषा में ग्राह्यता, संग्रहण आदि की विशेषताएं विद्यमान हैं।

कार्यशाला के दूसरे व्याख्यान 'हिन्दी में टिप्पणी एवं प्रारूप लेखन' के सन्दर्भ में अतिथि वक्ता डॉ. उमाकान्त गुप्त ने कहा कि कार्यालय में प्रयुक्त भाषा में हम एकरूपता नहीं ला पाते जो कि बहुत ही आवश्यक है। विषय पर बोलते हुए उन्होंने कहा कि टिप्पणी आज के युग में महत्वपूर्ण प्रक्रिया है तर्क सम्मत पद्धति टिप्पणी कहलाती है।

### केन्द्र को राजभाषा सम्मान

नगर राजभाषा कार्यान्वयन समिति, बीकानेर द्वारा 31 मार्च, 2009 को समाप्त छःमाही बैठक के आयोजन के अवसर पर वर्ष 2008-09 के दौरान नराकास स्तर पर राजभाषा के उत्कृष्ट प्रयोग के लिए राष्ट्रीय उष्ट्र अनुसंधान केन्द्र, बीकानेर को श्री आलोक रंजन, अध्यक्ष नराकास एवं मंडल रेल प्रबंधक तथा श्री राम लाल शर्मा, सहायक निदेशक (रा.भा.), क्षेत्रीय कार्यालय, मध्य क्षेत्र, गृह मंत्रालय, भोपाल के कर कमलों द्वारा राजभाषा सम्मान प्रदान किया गया।



### राजभाषा पत्रिका 'करभ' का लोकार्पण

उष्ट्र दूध के प्रचार-प्रसार व इसकी लोकप्रियता के क्षेत्र में केन्द्र द्वारा नूतन पहल करते हुए दिनांक 10 मई, 2008 को "उष्ट्र डेयरी" की स्थापना की गई। इस ऐतिहासिक अवसर पर भारतीय कृषि अनुसंधान परिषद, नई दिल्ली से पधारे सहायक महानिदेशक (पशु पोषण एवं कार्यिकी) डॉ. सी.एस. प्रसाद के कर कमलों द्वारा केन्द्र की राजभाषा वार्षिक पत्रिका 'करभ' के पांचवे अंक का लोकार्पण किया गया।



कृषि वैज्ञानिक चयन आयोग, नई दिल्ली के माननीय अध्यक्ष डॉ. सी.डी. मायी दिनांक 28 मार्च, 2009 को अपने सरकारी दौरे के सिलसिले में केन्द्र पर पधारे। इस अवसर पर केन्द्र के सभागार में एक बैठक का भी आयोजन रखा गया।

इस अवसर पर डॉ. सी.डी. मायी के कर कमलों द्वारा केन्द्र की राजभाषा वार्षिक पत्रिका 'करभ' के छठे अंक का विमोचन किया गया।

### नराकास प्रतियोगिता में केन्द्र की सफल भागीदारी

नगर राजभाषा कार्यान्वयन समिति, बीकानेर की ओर से हिन्दी निबन्ध प्रतियोगिता एवं हिन्दी भाषण प्रतियोगिता क्रमशः 16.09.08, 11.11.08 आयोजित की गई। निबन्ध प्रतियोगिता डॉ. बलदेव दास किराडू को पुरस्कृत किया गया। भाषण प्रतियोगिता में डॉ. सुमन्त व्यास तथा डॉ. निर्मला सैनी द्वारा पुरस्कार अर्जित किए।

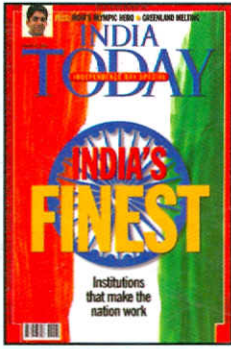


Dr. C. D. Mayee, Chairman, ASRB having a touch of camel safari at NRCC campus



Madam Mayee (second left) bottle feeding a camel sibling at NRCC campus





AUGUST 25, 2008

NATIONAL RESEARCH CENTRE ON CAMEL, BIKANER

## DESERT STORMTROOPER

If camel kulfi is becoming a fad among the tourists, the credit goes to the National Research Centre on Camel (NRCC), Bikaner. Just three years back, breeders, were selling camels to butchers because of the Indira Gandhi canal and the elimination of free grazing pastures, forcing people to question the existence of the NRCC. "From the basic work of conserving and improving the breed, we reoriented ourselves to making the camel attractive to owners," says Director K.M.L. Pathak. The change in approach began yielding results. The centre opened a milk parlor on its campus this year, selling Karabh Kulfi, a name for the camel in Sanskrit, flavoured milk, coffee and tea, all made of camel milk. Then the Rajasthan Cooperative Dairy Federation stepped in by marketing its products. The Centre is creating milk powder and cheese from camel milk and has already developed bitter cheese. Now, even private entrepreneurs are cashing in on the success story. Joru Ram Raika of Jhunjhunu district has set up a dairy in Bikaner where he sells milk for up to Rs. 22 a kg as against Rs. 16 by the cooperative. An NRI Arjun Batra, who is working for a firm which is into milk production, has asked the centre to help him identify land in Bikaner to set up a camel milk dairy. NRCC is also collaborating with the Bhabha Atomic Research Centre, to assess the therapeutic value of a camel antibodies. Camel are being used to make antidotes for snake venom and Dubai wants to collaborate on research in camel diseases. With a 700-hectare campus on the Bikaner-Jodhpur highway, and 300 camels from four pure single humped breeds, the institute has proved to be as hardy as the animal.

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