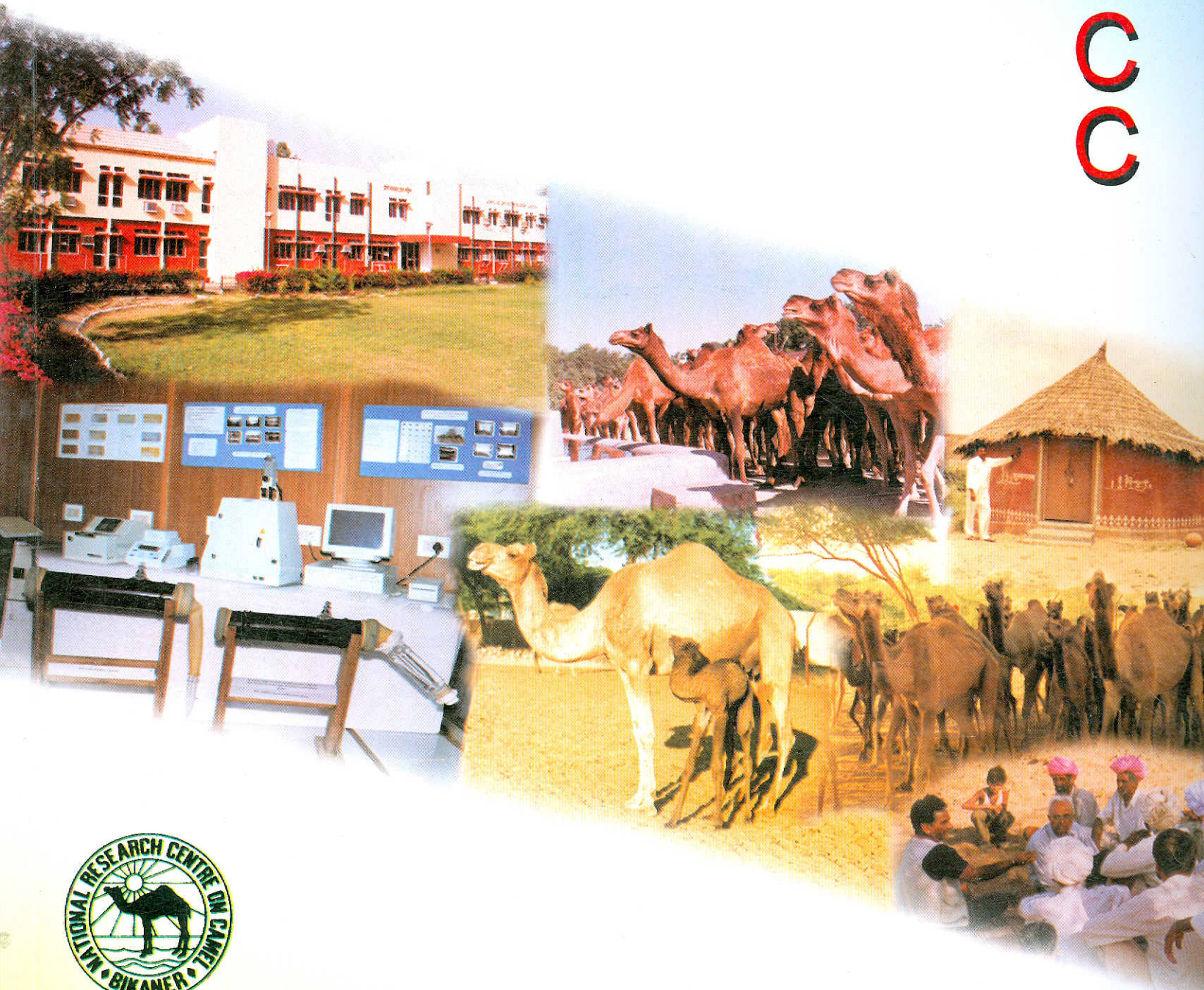




# वार्षिक प्रतिवेदन ANNUAL REPORT 2001-2002

N  
R  
C  
C  
C



राष्ट्रीय उष्ट्र अनुसंधान केन्द्र

जोरबीड़, बीकानेर-334 001(राज.)

**NATIONAL RESEARCH CENTRE ON CAMEL**

JORBEER, BIKANER-334 001(Raj.)

- Director** : **Dr. M.S. Sahani**  
National Research Centre on Camel  
Post Box – 07, Jorbeer.  
Bikaner – 334 001 (Rajasthan) India  
Phone : 0151-2230183, 2230858  
Fax : 0151-2230183  
E-mail : [nrccamel@hub.nic.in](mailto:nrccamel@hub.nic.in)  
Telegram : CAMCENTRE, BIKANER  
Web Site : [www.icar.org.in/nrccm/home.html](http://www.icar.org.in/nrccm/home.html)
- Published by** : Director, NRC on Camel, Bikaner
- Compilation Committee** : Dr. Aminu Deen, *Chairman*  
Dr. S.K. Ghorui, *Member*  
Dr. A.K. Roy, *Member*  
Dr. S.C. Mehta, *Member*  
Dr. Sumant Vyas, *Member Secretary*
- Hindi Abstract** : Sh. Nemi Chand
- Computer Assistance** : Sh. Dinesh Munjal  
Sh. Rajesh Kumar Sharma
- Printed by** : R.G. Associates,  
Tyagi Vatika, Jail Well,  
Bikaner-334 001  
Ph. : 0151-2527323



वार्षिक प्रतिवेदन  
**ANNUAL REPORT**

**2001-2002**

निदेशक : डा. एम.एस. साहनी  
Director : Dr. M.S. Sahani



राष्ट्रीय उष्ट्र अनुसंधान केन्द्र  
जोड़बीड़ , बीकानेर  
National Research Centre on Camel  
Jorbeer, BIKANER

## CONTENTS

1.	Preface	
2.	Executive Summary	1
3.	Introduction	6
4.	Research Achievement	10
5.	Technology Assessed and Transferred	70
6.	Education and Training	70
7.	Awards and Recognition	71
8.	Linkages and Collaborations	71
9.	AICRP/Coordination Unit/National Centres	76
<b>General / Miscellaneous</b>		
10.	List of Publications	77
11.	List of Approved on going Projects (IX Plan)	80
12.	RAC, Management Committee, SRC, QRT Meeting	81
13.	Participation of Scientists in Conferences, Meetings, Workshops, Symposia	82
14.	Workshops, Seminars, Summer Institutes, Farmer's Day etc	83
15.	Visit of Dignitaries	86
16.	Personnel	86
17.	Infrastructural Development	87
18.	सारांश	88

## PREFACE



Annual Report 2001-2002 of the NRCC is being presented highlighting research achievements under various projects/ad-hoc schemes along with important activities undertaken with regard to trainings, extension and infrastructure development.

As per the mandate of Centre priorities were given for the applied research especially under the changing ecosystem of North, West hot arid region for sustenance of camel and higher economic returns to camel keeper/farmers. Emphasis towards technology development included utility of camel milk and milk products in some of the camel rearing areas for promoting its utility.

Inter institutional collaboration both at National and International level were further strengthened in the field of post graduate studies, extension activities and products (milk and hair) their utilization with multi disciplinary approach. Human resource development formed one of the priority areas as per the guideline of council. Centre participated in various local and outside extension activities (Kissan gosthies, livestock fairs, exhibitions) for providing latest know-how information to camel keepers and extension agencies.

The infrastructure development included construction of new museum for tourist and other outside visitors highlighting centre's activities and economic utility of camel in order to promote revenue generation programme of the centre. The credit of all this goes to scientists, technical officers, administrative and supporting staff of centre and their team spirit and cooperation. I hope the publication will serve a useful source of information to various extension, research and development organizations and state Animal Husbandry Departments.

A handwritten signature in black ink, appearing to read 'M.S. Sahani', written in a cursive style.

**(M.S. Sahani)**

*Director*

## 2. EXECUTIVE SUMMARY

During the year 2001-02, the sanctioned staff strength under various categories was 72 and staff in position was 67 consisting of 1 RMP, 16 Scientific, 21 Technical, 10 Administrative and 19 Supporting staff. The budget allocation under Plan and Non-plan was 137.64 lakhs and 110.13 lakhs respectively.

The camel herd strength at the beginning and close of the year was 276 and 272 camels. The herd comprised mainly of three indigenous breeds Bikaneri, Jaisalmeri and Kachchhi.

Under infrastructural development, the library was further strengthened and the total number of books stands to be 1642. During the year 136 scientific and other books were procured.

The research agenda of National Research Centre on Camel, Bikaner, was pursued through institutional research projects, adhoc research schemes under NATP fund and collaborative research programmes.

### Research Highlights

#### Genetics and breeding

The microsatellite analysis of 30 unrelated individuals of Bikaneri and Jaisalmeri breeds using six primers was completed. All the six microsatellite primers used in the present investigation were found to be polymorphic. The observed and expected (Nei's) heterozygosity ranged from 0.3 to 1.00 and 0.32 to 0.65 in Jaisalmeri and 0.35 to 1.00 and 0.289 to 0.686 in Bikaneri breed. The polymorphic information content ranged from 0.268 to 0.588 in Jaisalmeri and 0.267 to 0.639 in Bikaneri breed. The number of alleles and heterozygosity was observed to be more in Jaisalmeri breed as compared to Bikaneri breed. The work for Kachchhi breed is in progress. The number of alleles and their size as resolved in 6 % urea polyacrylamide gel electrophoresis (Urea-PAGE) at microsatellite locus YWLL-44 and YWLL-58 in Jaisalmeri and Bikaneri breeds of camel, respectively.

#### Camel reproduction

Preservability of camel semen at refrigerator temperature in Tris and Biociphos (a commercial dilutor, IMV France) semen extenders revealed that out of 100 semen samples 46, 35, 18, 10 and 2 percent samples diluted in Tris extenders retained sperm motility for 24, 48, 72, 96 and 120 h, respectively, while none of the 28 semen samples extended in Biociphos could sustain sperm motility. Research on enhancing of preservability of diluted semen is in progress. A study on effect of carting on libido and semen ejaculation efficiency in breeding male camels revealed that carting had an inhibitory effect on libido and semen donation efficiency. Camels included in this trial, one exhibited complete loss of semen donation efficiency while other camel showed significant decline in copulation time and volume of semen. Modified artificial vagina (AV) in which rubber funnel of traditional AV was replaced by camel collection glass used for collection of camel semen to avoid semen contact with rubber funnel. Semen samples were collected from 6 male camels during rutting season alternately from each male with traditional and modified AV. Results of sperm motility

revealed that there were no differences in sperm motility of the samples collected by both the methods. Significance of gelation of semen is not known fully yet. Microscopic picture of semen gel gives an indication that spermatozoa are surrounded by long fiber like structure and they seem to be tightly packed and do not find space to move. Failure of conception in initial trials with diluted cooled liquid semen versus 40% conception in females inseminated with whole semen in an study at this centre also reflect the importance and gives an indication that gelation of semen is essential for fertility. Gelation appears to be useful as it allows the semen to get stucked with female genital tract. As observed in present study, a part of liquid diluted semen deposited into the uterus gets immediately drained out through vulva. Hence, if the camel semen is used in thin liquid form, a portion of it may drain out. Moreover, long fibers which surrounds the spermatozoa gets liquefied slowly and thus ensures prolonged maintenance of sperm bank in female genital tract.

### **Draught potential**

Potential of male camels to pull loaded cart on typical sandy desert track with a load equivalent to 300, 350 and 400% of their body weight was tested on 8 camels which were well trained in carting. Out of 8 camels, 5 successfully pulled load equivalent to 300% of their body weight for 20 km distance while 3 could not. Out of 4 camels tried with load equivalent to 350% of their body weight 2 could successfully pull it while none of the 4 camels tried with load equivalent to 400% of their body weight could pull the cart for 20 km. The distance covered with 400% load measured 8, 4, 4 and 1 km, respectively for 4 camels.

### **Milk and its products**

Camel milk is opaque white with salty sweet taste. Compared to cattle, it has lower percentage of fat, total protein and total solid while percentage of total salts, protective proteins, micro nutrients viz. iron, zinc and copper were higher. It contains about 22%, 8% and 85% sodium, calcium and magnesium in casein bound form. Camel milk was utilized successfully in preparation of tea and coffee. A study conducted on preservation of raw and pasteurized camel milk has revealed that the lactoperoxidase system is effective in preserving raw camel milk up to 18-20 h at 37°C. Similarly, sodium metabisulfite at the concentration of 50 ppm as a preservative increased the shelf life of raw and pasteurized camel milk upto 12 and 16 h, respectively.

Procedure of camel milk fermentation has been successfully standardized at the Centre. Under this fresh camel milk is boiled for 20-25 minutes, cooled at 30-37° C, starter culture added @ 2-4% and incubated for 20-22 hr at 37°C temperature. Chemical evaluation of fermented camel milk has revealed that it meets all the standards established by International Dairy Federation. Sensory evaluation of fermented milk product offered to tourists/visitors at the Centre revealed acceptability of 85%.

### **Camel health**

For confirmatory diagnosis the technique of polymerase chain reaction (PCR) amplification based detection has been standardized for diagnosis of camel trypanosomiasis. Using 21-mer sense and 22-mer

antisense primers, parasite specific amplification of 227 bp was observed. This will be advantageous due to its high specificity and sensitivity as it will enable to diagnose cases which remain undetected with other methods in epidemiological surveillance.

Two indigenous formulations comprising of locally available herbal ingredients were tried for their efficacy against camel mange, caused by *Sarcoptes scabiei*. Both herbal preparations were capable of relieving the experimental animals from symptoms of intense itching, scratching and biting, oozing of thick brown scabs in some cases, thickening and wrinkling of skin etc. Microscopic examination of skin scrappings were found negative for parasites (mites/eggs/larvae) between 10<sup>th</sup> - 15<sup>th</sup> day of its local application without any noticeable relapse even upto 30<sup>th</sup> day post treatment. Its promising results has encouraged to formulate the drug which is economic and at the same time effective also further research on this line is in progress.

Based on microbial culture and somatic cell counts in 282 milk samples from 71 camels, subclinical mastitis was suspected in 34.4% cases. *In vitro* chemotherapeutic sensitivity test on isolates from camel milk has revealed that chloramphenicol, cephalexin, amoxycillin gave 100 % results.

A total of 55 isolates of Staphylococci including 23 coagulase-positive isolates from camel intramammary infections were characterized by different biochemical tests. The different species of staphylococci identified were *Staphylococcus aureus* (30.9%), *Staphylococcus hyicus* (10.9%), *Staphylococcus intermedius* (7.3%), *Staphylococcus haemolyticus* (7.3%), *Staphylococcus auricularis* (7.3%), *Staphylococcus seiuri* (7.3%), *Staphylococcus hominis* (5.4%), *Staphylococcus epidermidis* (3.6%), *Staphylococcus capitis* (1.82%) and *Staphylococcus warneri* (1.8%). A randomised control trial (N=12) on camel milk as an alternative therapy in type-I diabetes was conducted at this centre in collaboration of S.P. Medical College Bikaner. The study revealed that after one month receiving of raw camel milk there was a significant improvement in fasting blood sugar and HbA<sub>1c</sub>; insulin requirement was also reduced. There was also overall improvement in satisfaction and positive impact of diabetes type-I on receiving the camel milk.

### Camel management

A comparative study on the farming use of camel and bullock system revealed that the Pay Back Period for investment on animal system is very less in camel than bullock. On the contrary the cost benefit ratio is high in camel system as compared to bullock system. The study indicated that due to higher cost benefit ratio and shorter pay back period the farming use of camel system is profitable and beneficial over the bullock system for small and marginal farmers.

A meticulous observation on behavioral parameters in Loose Housing Condition v/s Semi-Intensive Condition revealed that due to higher time involvement in feeding and other related activities and less time involvement in idling like activity, semi-intensive system is better than loose housing for camel users.

Analysis of hair production data (1998 to 2002) indicated that Bikaneri breed males of 2-3 year age group produced higher annual hair yield as compared to other age groups and breeds of camel.



Adaptation of improved management practices indicated an increasing trend in the body weight of camel calves of all breeds in 2, 3 and 4 year's weight inspite of continuous harsh conditions due to repeated droughts.

The socio-economic aspects were studied in the breeding tract of the Jaisalmeri camel. The average annual income of the camel keepers from all sources was Rs. 22712/- and an average family consisted of about 7 persons. The herd size ranged from 1 to 200 with an average of 2.4 camels per household. In all nine communities are involved in camel rearing in this tract. The average land holding is 96.9076 bighas of sandy soil with some hard pens and dependent mainly on rainwater. Mange was reported to be the major health problem (39.73%) followed by digestive disorders (33.69%). Of the 314 camel keepers, about 70% first prefer to go for local treatment followed by allopathic treatment (21.34%) and herbal treatment (8.59%).

### **Extension activities**

During breeding season free breeding input through superior quality Bikaneri studs was provided to she camels belonging to camel breeders of nearby villages. During the period the Centre has collaborated with various NGOs namely, Lokhit Pasu Palak Sansthan (A society for indigenous livestock research and development, Sadri, Pali) and URMUL trust, Bikaner. Efforts were made to popularise camel milk and hair products viz. curd, tea, utility aspects of camel etc. Scientists of the centre have gathered feed back information from camel keepers regarding camel management practices followed there. Centre also collaborated with Urmul Trust (Bikaner) in the field of popularisation of camel milk, hair etc with an objective of a wide utilisation of these products. In the form of tea and coffee the camel milk is provided to various national and international visitors at NRCC and gathered feedback indicated positive response. During the period five Kissan Gosthies were organised, three at the adopted village Gadwala (Bikaner Dist), one at the State Krishi Vigyan Mela (RAU), Bikaner and at the Jojavar (Pali dist). On these occasions the problems of camel management practices and diseases aspects were discussed. The farmers were apprised about advance management practices in the field of breeding, feeding, prevention of diseases and health care etc. Three scientific exhibitions were organised at National and International level highlighting the camel research achievement, husbandry practices and latest technology know-how, viz. Indian International Trade Fair - from 14 to 27<sup>th</sup> Nov- 2001, at Pragati Maidan, New Delhi, Camel Festival 2002 – from 22 to 30<sup>th</sup> Jan-2002, Bikaner, State Krishi Vigyan Mela, 2002 – on 24<sup>th</sup> March – 2002 at RAU, Bikaner. Live camel exhibition was organised during State Krishi Vigyan Mela on 24<sup>th</sup> March-2002 at RAU, Bikaner. To popularise and motivate the people regarding the benefits of camel milk, raw milk was also served among the various visitors, students, experts, farmers during the exhibition. Three elite camels also took part in the breed competitions, race, calf competition which are held in State Krishi Vigyan Mela on 24<sup>th</sup> March 2002 at RAU, Bikaner and won prizes. The Centre's camel have participated in various events viz. milking competition, newly born camel calf competition, camel hair clipping and decorations competition etc and won prizes in different events. Centre organised animal health camps at adopted village Gadwala (Bikaner, Dist). The health related problems were

discussed and remedies were provided by subject matter experts a substantial number of animals were also treated. Various students (from SAUs- Medical colleges, Veterinary colleges, schools, Universities), scientists, trainees, N.G.Os, farmers, farm women, youth, livestock owners, defense officers, administrators, field veterinarians, Indian and foreign educationists, journalists visited this Centre.

### **Infrastructure**

The development work includes construction of metallic road along with street light from Agricultural Farm office to Railway crossing (Block No. 1), two irrigation tanks each of 2.0 lacs liter capacity near Farm office in Block No. 1 and two VIP rooms in centre's Guest House and three residential quarters (type IV, type III and type II, one each).

---

### 3. INTRODUCTION

#### 3.1. History

The National Research Centre on Camel was established on 5<sup>th</sup> July 1984. Prior to this, the Centre was known as Camel Breeding Farm under the aegis of College of Veterinary and Animal Science, Rajasthan Agricultural University, Bikaner and before that with Department of Animal Husbandry, Government of Rajasthan. Over the years NRCC has developed modern laboratories with very good infrastructural facilities and a museum. The Centre has generated substantial scientific data on various aspects in Indian camels.

The National Research Centre on Camel, Bikaner is located in the Jorbeer area at a distance of about 10-km from Bikaner City. The geographical location is 28.3° North Latitude and 73.5° East Longitude at MSL of 234.84 m. The topography of the area is arid undulating desert with vast range of sand dunes. The soil type is mostly loose and sandy. The climate is mostly dry and hot with average annual rainfall of around 260-270 mm. The temperature ranges between 30°C to 45°C in summer season and between 4°C to 28°C in winter season. The Centre maintains a herd of about 270 camels of different age groups mainly belonging to three indigenous breeds Bikaneri, Jaisalmeri and Kachchhi.

#### 3.2. Past achievements

- ◆ NRC on Camel, Bikaner, has developed an elite camel herd consisting of Bikaneri, Jaisalmeri and Kachchhi breeds.
- ◆ Genetic parameters have been estimated for several traits viz. biometry, growth, milk and hair production.
- ◆ Reduction in early calf mortality from 20-30% under field conditions to around 5.0-7.0% under farm condition through improved management practices.
- ◆ Breeding efficiency of camel herd has been improved significantly in terms of mean conception, age at first calving and calving interval.
- ◆ Random amplification of polymorphic DNA technique showed genetic variability in Indian dromedary camel.
- ◆ Useful baseline data have been generated on draughtability, ploughing capacity and fatigue index of Indian camel.
- ◆ Camel milk as nutritional adjuvant indicated significant role in faster recovery of tuberculosis in human.
- ◆ Centre has produced 2 Embryo transplanted camel calves in year 1998-99.

#### 3.3. Mandate

- Undertake basic and applied research for improvement of camel.
- Provide leadership and co-ordinate camel research and training nationally and act as a national repository of information

- Collaborate with national and international agencies for camel research and development.

### 3.4 Infrastructure

The infrastructure facilities include a Livestock farming unit, Research Laboratories, Library, ARIS cell, Farm Rangeland, Residential complex and Guest House and Camel museum.

**Livestock farm:** The farm maintains a herd of about 270 camels mainly comprising of three indigenous breeds viz. Bikaneri, Jaisalmeri and Kachchhi camels. The unit is equipped with one Camel dispensary and a Disease Diagnostic Laboratory, 6 sheds, 3 camel boxes, 1 metabolic shed and a shed with provision of individual feeding. The farm also has fodder and feed godown and two weigh bridges, one mechanical and other electro-mechanical. Four camel corrals, camel dispensary, agriculture farm office and post mortem room & pit have been added in block no. 1 and 2 in farm area.

**Laboratories:** NRC on Camel has modern laboratories at 2 different complexes. One having laboratories for Camel Physiology, Camel Genetics, Camel Reproduction, Camel Health, ARIS cell and Administrative Wing and the other complex has Camel Nutrition and Camel Reproduction labs. The research unit has one seminar hall with 120-seat capacity. Recently Genetics laboratories have been renovated and modified.

**Library:** The library subscribes around 40 Indian journals and 6 foreign abstracting services. Subject-wise reference database has been created along with photocopying facility. In addition to research literature/books it has also been strengthened in Hindi books.

**Rangeland:** The NRC on Camel has 824 ha land partitioned in 5 blocks with 3 tube wells. About 650 ha of area has been fenced and 35 ha of land has been brought under perennial silvipasture comprising of grasses, shrubs and trees. Main grasses are sewan (*Lasiurus indicus*) and Blue panic (*Panicum antidotale*). Pasture development and large scale tree plantation has also been under taken in collaboration with state Forest Department and Network collaborative programme in Block No.1.

**Residential complex:** NRC on Camel has residential colony comprising 33 quarters including 2 type V, 4 type IV, 5 type III, 9 type II and 13 type I staff quarters.

**Guest House:** Centre has one small guesthouse with 4 rooms. The accommodation facilities has been further enhanced by addition of two VIP rooms and now it can accommodate 12 guests.

NATIONAL RESEARCH CENTRE ON CAMEL, BIKANER

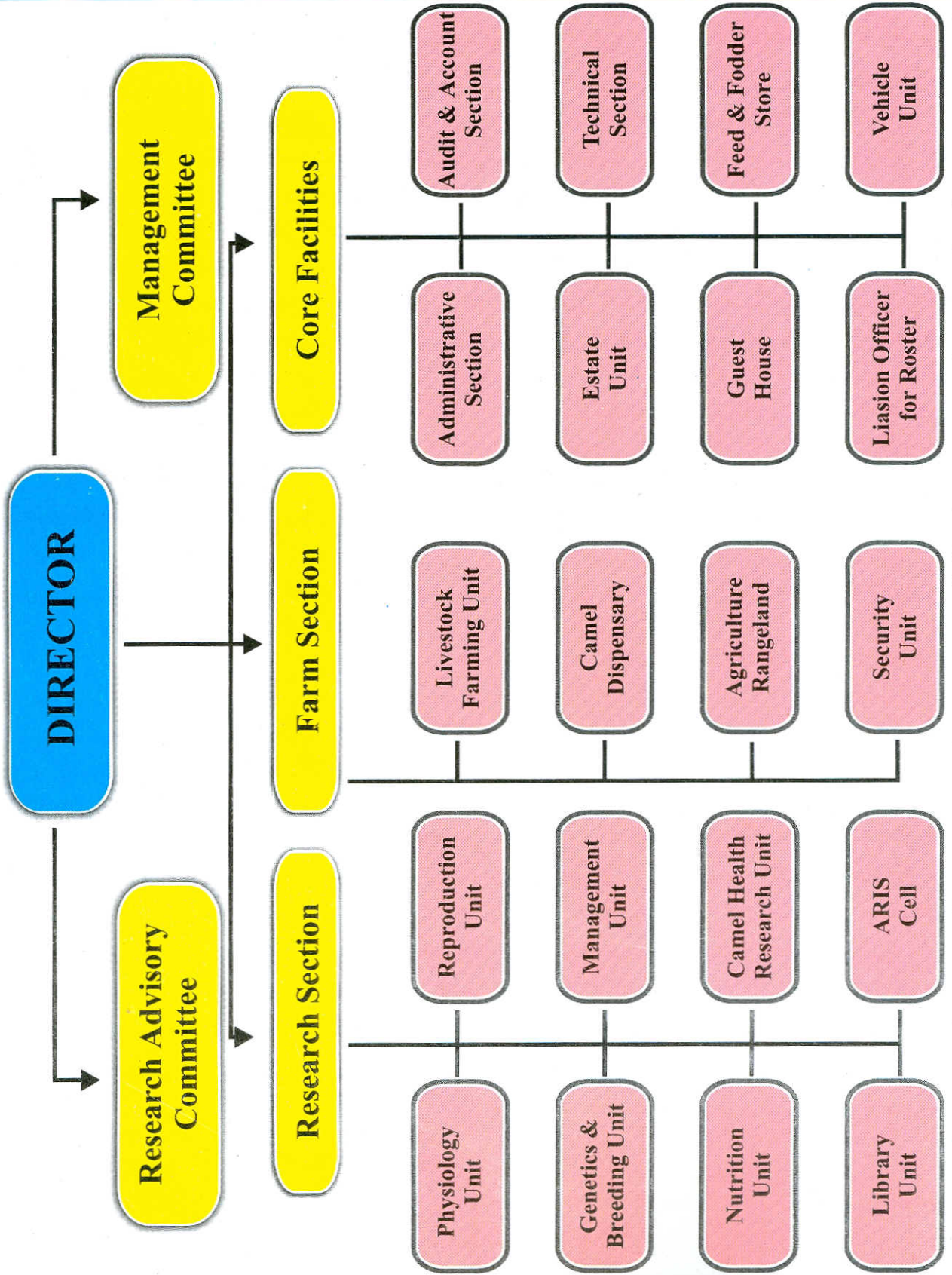


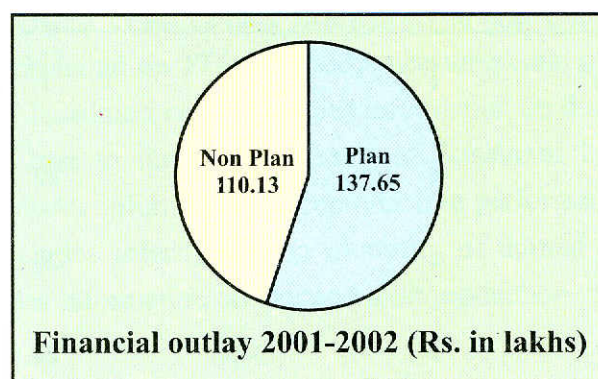
Fig. 3.5 ORGANOGRAM

## 3.6. Staff Position (2001-2002)

Cadre	Sanction	In position	Vacant
RMP	1	1	-
Scientific	20	16	4
Technical Category III	4	4	-
Category-II	3	2	1
Category-I	15	15	-
Administrative	10	10	-
Supporting	20	20	-
Total	73	68	5

## 3.7. Financial Statement and revenue receipt (2001-2002)

Head of account	Plan		Non plan	
	Budget	Expenditure	Budget	Expenditure
Estt. Charge	-	-	98.35	98.36
Wages	11.89	11.89	-	-
O.T.A.	-	-	0.20	0.19
T.A.	-	-	0.82	0.82
HRD	1.70	1.69	-	-
Other Charge including Equipment	8.39	8.39	0.10	0.10
Works	115.67	115.67	10.66	10.66
Total	137.65	137.64	110.13	110.13



## 4. RESEARCH ACHIEVEMENTS

### 4.1 Project Title : Improvement of working efficiency of camel under arid and semi-arid conditions

**Sub-project : Carting efficiency under variable energy protein ratio.**

Project leader : Aminu Deen

Associates : Raghvendar Singh and Gorakh Mal

A total of 8 male camels were divided into 2 groups of 4 each. Camels of Group A were fed 2-3 kg concentrate ration in addition to guar phalgati (*Cyamopsis tetragonoloba*) while camels of group B were fed guar phalgati alone. The animals were trained for carting over a period of 3 months before being put to pull loaded cart. After preliminary training, the camels were put to loaded cart for a to and fro journey of 20 km on sandy tract which was covered by camels in 3½ - 4 h.

The daily draught performance was scored (0-1 scale). Periodical heart beat and rectal temperature was recorded. Periodical monitoring of glucose, triglycerides, creatinine, creatine kinase, urea and LDH was undertaken at 0 h and end point of carting.

The draught performance of the 2 groups of camel did not differ. In a trial loading cart load equivalent to 300, 350 & 400% of body weight, it was observed that 6 of 8 camels successfully pulled cart load equivalent to 300% of their body wt. for 20km sandy tract while 2 could not. Of the 4 camels, which were put to a load of 350%, only 2 could successfully pull it to 20 km & none of them could pull cart load equivalent to 400% body weight for 20km. (Table 4.1.1).

**Table 4.1.1. Physical performance of 2 groups of camels on varying load (300, 350 and 400%) of body weight**

Camel No.	Group "A"			Camel No.	Group "B"		
	300%	350%	400%		300%	350%	400%
J-54	20	20	4	J-92	5	1	1
J-58	15	5	4	J-94	20	20	8
B-482	5	-	-	K-90	20	-	-
C-20	20	-	-	J-74	20	-	-

Heart beat and rectal temperature increased as a result of carting (Table 4.1.2).

**Table 4.1.2. Average clinical parameters at start and final stage of carting**

Groups	Rectal temperature (F)		Heart beat (per minute)	
	0 h	Final	0 h	Final
Group A	97.76 ± 0.10 (65)	103.55 ± 0.12 (61)	48.5 ± 0.83 (46)	73.29 ± 1.50 (37)
Group B	97.61 ± 0.08 (73)	103.71 ± 0.15 (74)	50.0 ± 0.89 (64)	73.45 ± 2.51 (35)

Biochemical parameters glucose, triglycerides, creatinine, creatine kinase, LDH and urea show significant changes at 0 h and end point samples except glucose but these changes cannot be utilized as fatigue index because these did not differ between animals fatigued in between the journey and those which completed journey normally.

During the experimentation, one animal of group A appeared to have developed muscular weakness due to overloading. The animal which developed muscular weakness exhibited rise in creatine kinase, creatinine and urea values.

#### **4.2 Project Title : Genetic characterisation, evaluation and conservation of indigenous camel breeds**

Project Leader : S.C. Mehta

Associates : M.S. Sahani, R. Singh, C. Bhakat, U.K. Bissa, B.L. Chirania

Inventory of the Centre's camel herd includes pedigree information on all available animals of Bikaneri, Jaisalmeri, Kachchhi and Arab cross camels maintained at the Centre's farm. Database on biometry of Centre's herd includes information on 17 traits (body measurements) of the camels maintained at the Centre. Breeding tract database on Jaisalmeri camel includes information on district, tehsil, village, camel breeder and biometry on 17 traits of true to the breed animals of Jaisalmeri breed as found in the breeding tract. Reproduction database includes information on reproductive performance of the Centre's herd from 1992 to 2002. Health database includes information on mortality of animal at NRCC farm since 1984 to 2001. Production database includes information on hair and milk production of camels of NRCC herd.



### Sub project 1: Studies on qualitative and quantitative genetic parameters in Indian camel

#### Body weights and growth

Body weight and growth database has been updated right from the inception of the Centre (year 1984) till date (year 2002) has been included and analysed for studying the effect of breed, sex and year (Table 4.2.1 and 2). The least-squares means of birth, 3,6,9,12,24,36 and 48 months weight were observed to be  $34.76 \pm 1.24$  (201),  $102.42 \pm 4.61$  (132),  $161.74 \pm 5.36$  (119),  $190.48 \pm 6.32$  (120),  $219.44 \pm 6.93$  (151),  $278.97 \pm 6.14$  (104),  $354.49 \pm 8.03$  (79) and  $448.19 \pm 15.44$  (78) kg, respectively. The effect of breed was found significant at various stages of growth phase. In contrast to most of the species the effect of sex was found non-significant at almost all stages of growth. The data analysed for year-to-year variation indicated significant effect of year from 1984 to 2002. It is also evident from the data that except initial decline for 2-3 years there has been an increasing trend in the body weight of camels of all breeds in 2,3 and 4 year's weight. This can be attributed to selection and improved management practices adopted at the Centre.

#### Reproductive parameters

The percent conception and calving, pooled over breeds and years (2001-2002), was 63.98% and 73.42%, respectively. Highest calving percentage was observed in Kachchhi (81.82%) followed by Bikaneri (72.22%) and Jaisalmeri (70.97%) breeds. This year there were three abortions (Table 4.2.3).

The data for gestation length was also analysed for the year 1992 to 2002. The effect of breed was found significant. The Bikaneri and Jaisalmeri females took  $390.04 \pm 0.73$  and  $389.54 \pm 1.12$  days, in contrast the Kachchhi females took only  $384.04 \pm 1.12$  days gestation. Such breed differences in the gestation period among breeds are rare. The calving interval, pooled over breeds, was  $715.50 \pm 8.46$  days. The year-to-year variation in the gestation length and calving interval was significant (Table 4.2.4).

#### Health performance

The mortality data for the period Jan. 1986 to March 2001 was analysed. In all 1824 records were studied. The mortality was highest in Arab cross (16.83 %) followed by Kachchhi (14.07 %), Bikaneri (10.35%) and Jaisalmeri (9.76 %) breed (Fig. 4.2.1). The mortality was significantly ( $P < 0.05$ ) higher in males (13.10 %) than the females (9.51%) (Fig. 4.2.2). The males had higher deaths than females in almost all systems. The mortality was maximum in adults above 3 years of age (21.57%) followed by 1-3 years age group (9.66%), 0-3 month age group (9.06 %) and 3-12 month age group (5.03 %) (Fig. 4.2.3). Chi-square variance test indicated highly significant effect ( $P < 0.01$ ) of age group on mortality. The mortality due to different systems differed significantly ( $P < 0.01$ ). Maximum mortality (48.78%) was due to the involvement of digestive system followed by respiratory system (17.56%) (Fig. 4.2.4).

Table 4.2.1 . Least-squares analysis of body weight (kg) of camel calves at birth and different months of age

Body Weight/ Effects	Birth	3M	6M	9M	12M	24M	36M	48M
<b>Pooled</b>	34.76±1.24 (201)	102.42±4.61 (132)	161.74±5.36 (119)	190.48±6.32 (120)	219.44±6.93 (151)	278.97±6.14 (104)	354.49±8.03 (79)	448.19±15.44 (78)
<b>Breed Effect</b>	**	**	*	*	NS	NS	NS	*
<b>Bikaneri</b>	38.30±0.57 (98)	97.18±2.34 (60)	156.11±3.08 (53)	186.35±3.77 (55)	213.07±3.67 (69)	273.44±6.09 (54)	338.37±7.51 (40)	404.21±9.17 (48)
<b>Jaisalmeri</b>	36.86±0.67 (79)	91.32±2.81 (57)	152.67±3.49 (50)	189.57±4.16 (50)	212.51±4.20 (63)	276.78±7.30 (39)	350.06±8.47 (31)	417.94±12.02 (24)
<b>Kachchhi</b>	35.80±1.09 (23)	93.14±4.68 (13)	144.63±5.46 (15)	169.22±6.69 (14)	204.74±6.30 (18)	286.69±12.73 (11)	375.05±17.39 (8)	395.46±24.60 (5)
<b>Sex Effect</b>	NS	NS	NS	NS	NS	NS	*	NS
<b>Male</b>	35.17±1.31 (88)	103.32±5.01 (53)	161.40±6.00 (50)	191.94±7.13 (47)	218.87±7.60 (66)	278.31±8.62 (31)	367.97±11.58 (28)	443.11±18.44 (23)
<b>Female</b>	34.35±1.28 (113)	101.53±4.64 (79)	162.08±5.35 (69)	189.01±6.19 (73)	220.00±6.93 (85)	279.63±6.33 (73)	341.01±7.28 (51)	453.28±15.55 (55)

Table 4.2.2. Least-squares analysis of body weight (kg) of camel calves at birth and different months of age

Year Effect	Body Weight/ Effects									
	Birth	3M	6M	9M	12M	24M	36M	48M		
	NS	**	*	**	**	**	**	**	**	**
1994	36.20±2.85	--	--	--	--	331.53±22.08	--	--	534.23±32.22	--
1985	31.87±3.38	68.14±14.84	172.29±13.64	208.60±15.58	245.80±18.31	339.87±26.61	403.60±28.61	460.23±32.22	568.90±37.55	--
1986	35.87±3.38	118.14±11.00	166.79±13.64	200.10±15.58	231.30±18.31	329.87±26.61	--	--	--	--
1987	35.37±3.38	96.14±9.38	165.29±18.47	213.60±21.11	212.80±18.31	284.87±22.08	380.60±24.00	460.23±32.22	--	--
1988	33.98±2.53	103.48±9.38	155.29±18.47	157.98±15.46	215.30±13.90	250.99±17.40	372.86±19.30	425.47±28.61	--	--
1989	32.47±2.31	108.66±8.37	155.03±10.28	195.25±10.78	204.19±11.72	247.57±16.51	310.87±17.14	408.28±29.16	--	--
1990	35.18±1.83	126.55±5.68	175.85±6.75	205.17±7.53	227.45±8.51	286.86±13.22	338.86±14.60	441.94±18.30	--	--
1991	41.97±2.85	122.03±8.35	177.87±10.32	206.44±11.62	222.67±12.64	245.06±17.24	337.60±20.64	376.03±36.91	--	--
1992	36.42±2.04	96.42±6.56	152.60±7.90	175.60±21.11	199.14±10.61	253.36±13.51	350.16±23.08	461.97±28.61	--	--
1993	26.67±3.35	102.14±14.84	144.35±13.37	163.52±15.27	--	--	345.28±27.54	401.33±50.44	--	--
1994	36.97±2.31	110.44±7.20	163.76±9.50	179.47±10.69	219.94±11.79	267.42±15.68	389.60±39.92	414.40±21.07	--	--
1995	34.76±2.54	100.96±9.23	171.38±11.21	--	238.59±12.41	273.52±26.44	321.16±13.64	408.92±23.40	--	--
1996	34.25±1.54	77.38±9.28	173.71±7.26	192.30±7.84	212.29±8.54	267.93±7.22	331.94±10.79	448.56±16.84	--	--
1997	36.68±1.96	101.91±6.83	154.79±8.24	184.65±9.41	215.18±9.22	243.46±16.84	338.66±15.40	453.09±22.65	--	--
1998	33.03±1.40	101.34±4.93	154.21±5.59	180.01±6.38	205.55±7.79	276.16±9.77	387.23±10.54	471.33±50.44	--	--
1999	35.55±1.73	110.07±10.91	143.00±9.26	176.38±21.13	214.48±8.80	286.10±15.26	--	--	--	--
2000	34.95±1.44	97.57±5.01	161.65±6.08	205.43±6.92	240.20±7.86	--	--	--	--	--
2001	34.28±1.30	99.82±4.91	--	203.17±8.30	206.13±25.23	--	--	--	--	--
2002	33.96±1.40	--	--	--	--	--	--	--	--	--

Table 4.2.3: Reproductive performance of the camel herd

Year	Traits	Bikaneri	Jaisalmeri	Kachchhi	Crossbred	Pooled
2001	Mating	35	25	17	-	77
	Conception	24 (68.57%)	19 (76.00%)	9 (52.94%)	-	52 (67.53%)
	Calving M	7	9	4	-	20
	F	9 (66.66%)	3 (63.15%)	3 (77.77%)	-	15 (67.30%)
2002	Mating	24	12	10		46
	Conception	16 (66.67%)	5 (41.67%)	3 (30.00%)		24 (52.17%)

- New born calf mortality – 2 (5.71%)
- Abortion – 3 (7.89%)
- No. of service per conception – Bikaneri - 2.00, Jaisalmeri – Herd Mating and Kachchhi – 1.50.

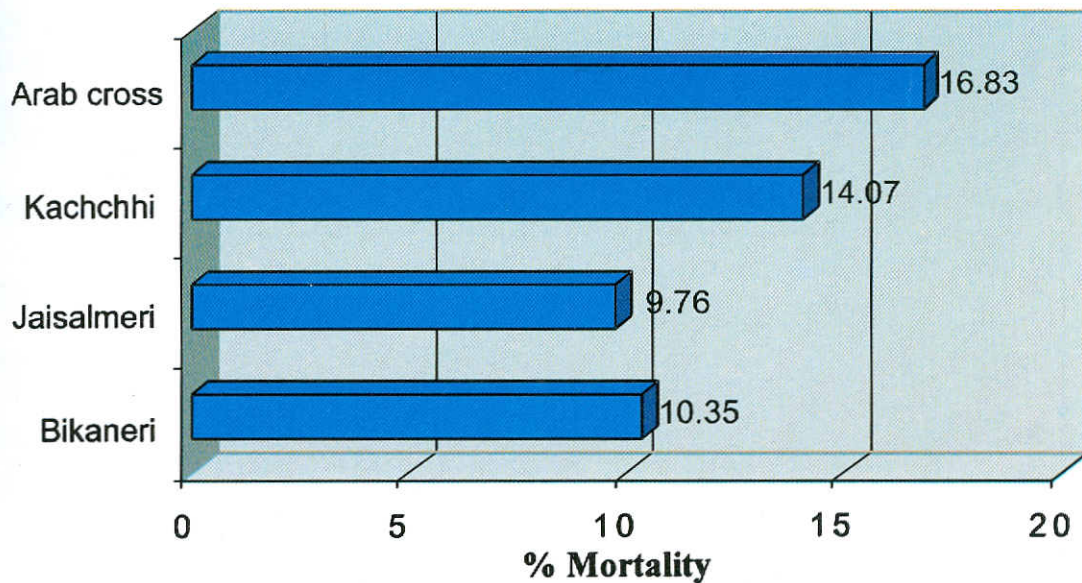
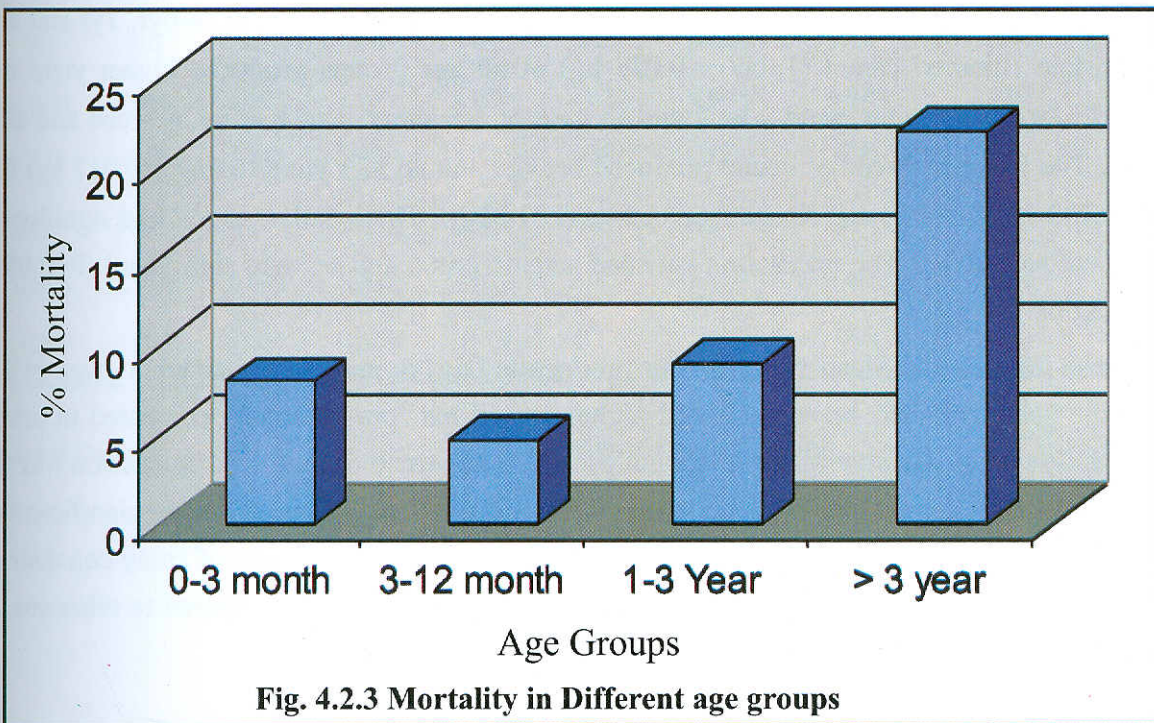
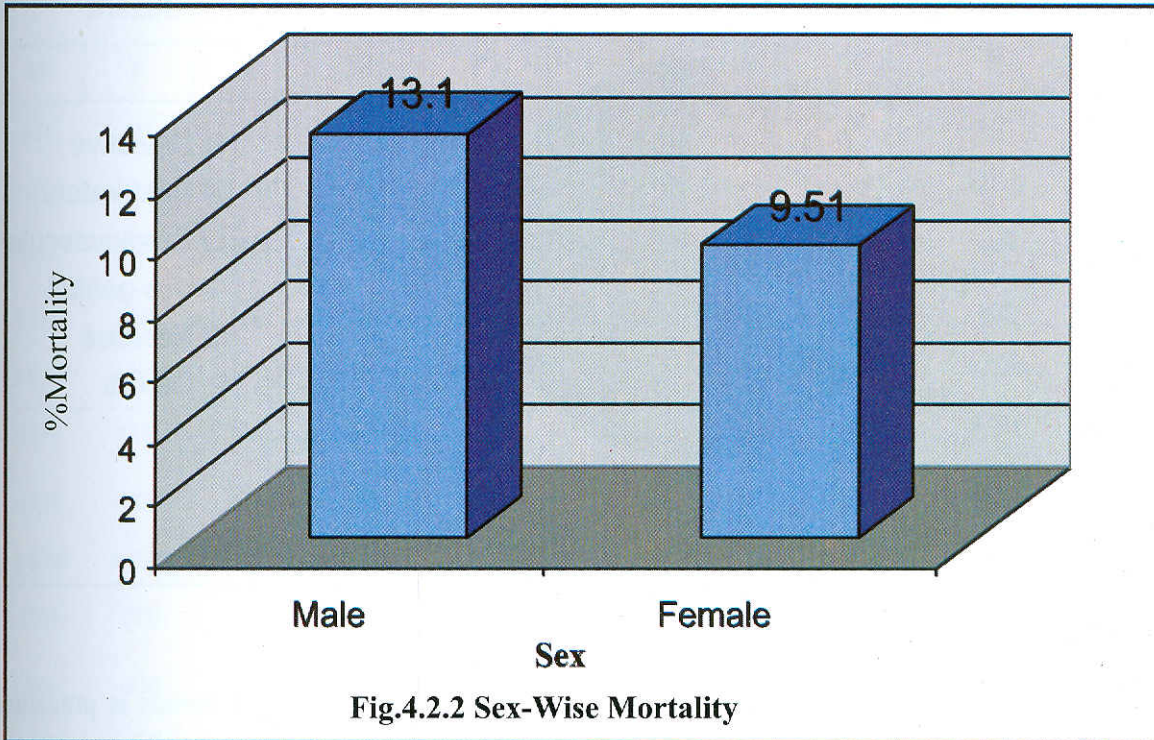


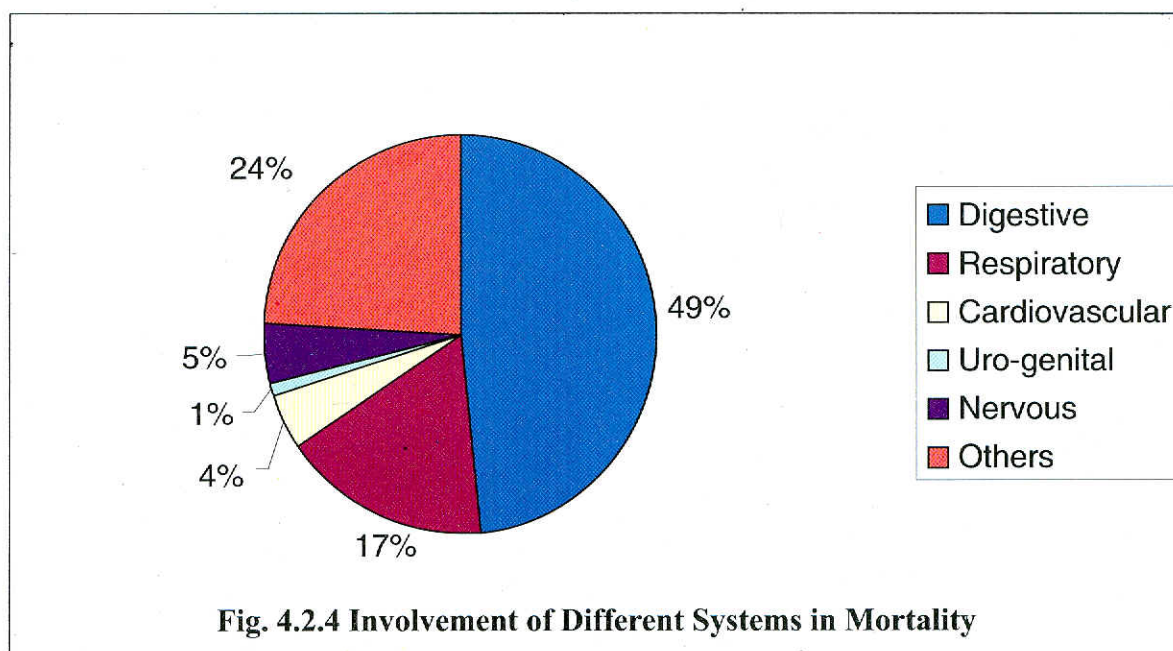
Fig. 4.2.1 Mortality in Different Breeds

Table 4.2.4. Least squares mean of reproductive traits in Indian camel breeds

Traits / Effects	Gestation Length	Calving Interval (in Days)
<b>Breed effect</b>	**	NS
<b>Pooled Breed</b>	387.87±0.56(232)	715.50±8.46(136)
Bikaneri	390.04±0.73(117)	715.81±10.26(74)
Jaisalmeri	389.54±0.96(69)	705.63±13.03(40)
Kachchhi	384.04±1.12(46)	725.05±17.33(22)
<b>Year Effect</b>	**	**
1992	385.25±1.55(24)	730.13±17.96(20)
1993	387.03±1.93(15)	694.09±27.48(8)
1994	388.54±1.40(29)	720.15±18.72(18)
1995	385.83±2.36(10)	726.41±44.89(3)
1996	391.43±1.39(30)	729.68±19.17(17)
1997	389.23±2.01(14)	731.69±29.12(7)
1998	390.99±1.57(23)	739.52±18.31(18)
1999	387.95±1.66(21)	730.03±24.53(10)
2000	385.45±1.29(35)	-
2001	382.77±2.07(14)	617.12±18.93(18)
2002	392.13±1.85(17)	736.17±19.37(17)

\*\* Significant ( $p < 0.01$ ), NS: Non significant





### Hair production

The least squares mean  $\pm$  SE for annual hair yield (Kg) of Indian camel breeds is presented in Table 4.2.5. Yearly hair production of camel of four different year (1998 to 2002) were recorded and subjected to analysis by applying mixed mode least square and maximum likelihood Computer Programme. 3 year age group produced maximum annual hair yield ( $1.076 \pm 0.025$  kg) followed by 2yr, 4-6yr, 1yr and above 6year age group. Male Bikaneri camel ( $1.057 \pm 0.026$  kg) of all age groups produced higher yield than female ( $0.877 \pm 0.022$  kg). A similar trend was found in case of Jaisalmeri and Kachchhi breed and all other age group cases. The Bikaneri breed of camel produced heavier annual hair yield ( $0.967 \pm 0.017$  kg) followed by Jaisalmeri ( $0.733 \pm 0.016$  kg) and Kachchhi ( $0.624 \pm 0.018$  kg). The breed, age, sex had significant ( $P < 0.01$ ) effect on annual hair yield. The interaction between genetic group and sex had significant ( $P < 0.05$ ) influence on hair production.

Year wise least square Mean  $\pm$  SE for hair production (Kg) in indigenous camel is given in Table 4.2.6. In all, over the years Bikaneri breed produced higher annual hair production as compared to other breed of Camel. It is followed by Jaisalmeri and Kachchhi camel. Same trend of total hair production was found in all four years. The overall annual hair production was  $0.778 \pm 0.011$  Kg. The breed factor significantly influence ( $P < 0.01$ ) total hair production but year had a non-significant effect. The results of study concludes that male Bikaneri breed of 2-3 year age group produced higher annual hair yield as compared to other sex, age group and breeds.

Table 4.2.5. Least square mean  $\pm$  SE for annual hair yield (gm) of Indian camel breeds

Age (Yr)	Bikaneri			Jaisalmeri			Kachchhi			Over all
	M	F	P	M	F	P	M	F	P	
1	804	711	758	639	575	607	634	505	569	630**
	$\pm 0.06$	$\pm 0.05$	$\pm 0.04$	$\pm 0.04$	$\pm 0.05$	$\pm 0.03$	$\pm 0.06$	$\pm 0.063$	$\pm 0.05$	$\pm 0.03$
	(20)	(23)	(43)	(25)	(18)	(43)	(8)	(10)	(18)	(104)
2	1318	1003	1161	884	754	819	674	644	659	902**
	$\pm 0.06$	$\pm 0.07$	$\pm 0.05$	$\pm 0.05$	$\pm 0.06$	$\pm 0.04$	$\pm 0.07$	$\pm 0.07$	$\pm 0.05$	$\pm 0.03$
	(19)	(18)	(37)	(23)	(16)	(39)	(8)	(9)	(17)	(93)
3	1548	1238	1394	1053	905	979	811	714	763	1076**
	$\pm 0.06$	$\pm 0.06$	$\pm 0.04$	$\pm 0.05$	$\pm 0.06$	$\pm 0.04$	$\pm 0.06$	$\pm 0.06$	$\pm 0.04$	$\pm 0.03$
	(19)	(25)	(44)	(24)	(14)	(38)	(11)	(13)	(24)	(106)
4-6	896	816	856	765	703	734	675	581	628	735**
	$\pm 0.06$	$\pm 0.04$	$\pm 0.04$	$\pm 0.04$	$\pm 0.05$	$\pm 0.03$	$\pm 0.06$	$\pm 0.05$	$\pm 0.04$	$\pm 0.02$
	(24)	(45)	(69)	(29)	(26)	(55)	(10)	(18)	(28)	(152)
>6	718	616	667	567	484	525	549	462	506	547**
	$\pm 0.04$	$\pm 0.03$	$\pm 0.03$	$\pm 0.04$	$\pm 0.02$	$\pm 0.22$	$\pm 0.06$	$\pm 0.04$	$\pm 0.03$	$\pm 0.02$
	(41)	(125)	(166)	(42)	(108)	(150)	(13)	(32)	(45)	(361)
Over all	1057**	877**	967**	781**	684**	733**	669**	581**	624**	778
	$\pm 0.03$	$\pm 0.02$	$\pm 0.02$	$\pm 0.02$	$\pm 0.02$	$\pm 0.02$	$\pm 0.03$	$\pm 0.02$	$\pm 0.02$	$\pm 0.01$
	(123)	(236)	(359)	(143)	(182)	(325)	(50)	(82)	(132)	(816)

\*\* - Significant at 1% level

(M-Male, F-Female P-Pooled)



Table 4.2.6. Year wise least square mean  $\pm$  SE for hair production (gm) in indigenous camel

Breed	1998 – 1999	1999 – 2000	2000 – 2001	2001 – 2002	Over all
<b>Bikaneri</b>	976 $\pm$ 0.03 (70)	898 $\pm$ 0.03 (94)	929 $\pm$ 0.03 (101)	952 $\pm$ 0.03 (94)	939 ** $\pm$ 0.02 (359)
<b>Jaisalmeri</b>	727 $\pm$ 0.03 (58)	716 $\pm$ 0.02 (80)	769 $\pm$ 0.03 (89)	769 $\pm$ 0.03 (98)	746 ** $\pm$ 0.02 (325)
<b>Kachchhi</b>	587 $\pm$ 0.05 (31)	581 $\pm$ 0.05 (30)	717 $\pm$ 0.04 (37)	707 $\pm$ 0.04 (34)	648 ** $\pm$ 0.03 (132)
<b>Overall</b>	763 $\pm$ 0.02 (159)	732 $\pm$ 0.02 (204)	805 $\pm$ 0.01 (227)	810 $\pm$ 0.02 (226)	778 $\pm$ 0.01 (816)

\*\* Significant at 1 % level

### Sub project 2: Selection for improvement of draughtability of camel breeds

#### Selection of Studs

Body measurements of complete NRCC herd were recorded in March-April, 2001. The effect of breed, age and sex on body measurements was given in the earlier report. The population mean, mean of the selected individuals and the selection differential have been presented in Table 4.2.7. Based on the literature that body length and related traits have significant effect on draughtability, 6, 5 and 3 males, respectively of Bikaneri, Jaisalmeri and Kachchhi breed were selected mainly on the basis of body length. Least-squares analysis of variance was also carried out to see the significance of difference in the two groups for body length, heart girth and height at wither. The selected group had significantly higher body length ( $P < 0.01$ ), heart girth ( $P < 0.05$ ) and height at wither ( $P < 0.01$ ).

#### Breeding Plan

After selection of breeding males of the three breeds, the pedigree of the breedable females was studied and farm born studs were not used on a female related to it either through sire or dam and the herd mating was avoided.

Table 4.2.7. Population mean and selection differential in adult camels (in cm)

Breed	Selection	N	Body length	Heart girth	Height at wither
<b>Group</b>			**	*	**
<b>Bikaneri</b>	Population	63	153.76±1.23	214.59±1.55	195.87±1.01
	Selected	6	169.83±3.97	229.33±5.01	203.33±3.28
	S.D.		16.07	14.74	7.46
<b>Jaisalmeri</b>	Population	59	150.20±1.27	209.02±1.60	195.36±1.04
	Selected	5	161.00±4.35	222.20±5.49	198.20±3.59
	S.D.		10.80	12.87	2.84
<b>Kachchhi</b>	Population	21	147.43±2.12	205.81±2.68	190.76±1.75
	Selected	2	160.67±5.62	216.33±7.09	203.00±4.63
	S.D.		13.24	10.52	12.24

\*(P<0.05) \*\*(P<0.01)

### Sub project 3: Molecular genetic studies in Indian camel

#### Characterisation of indigesous camel breeds using microsatellite markers

Blood samples of 55 unrelated camels of Bikaneri, Jaisalmeri and Kachchhi breeds were collected from the farm as well as breeding tract of the respective breed. Six microsatellite primers were utilised for characterisation. The microsatellite analysis of 30 samples of Bikaneri and Jaisalmeri breeds with six primers has been completed (Table 4.2.8 and 9). All the six microsatellite primers used in the present investigation were found to be

polymorphic. In Jaisalmeri breed 3 alleles in the size range of 143-146 bp, 5 alleles in the size range of 250-265 bp, 2 alleles in the size range of 160-162 bp, 5 alleles in the size range of 96-108 bp, 3 alleles in the size

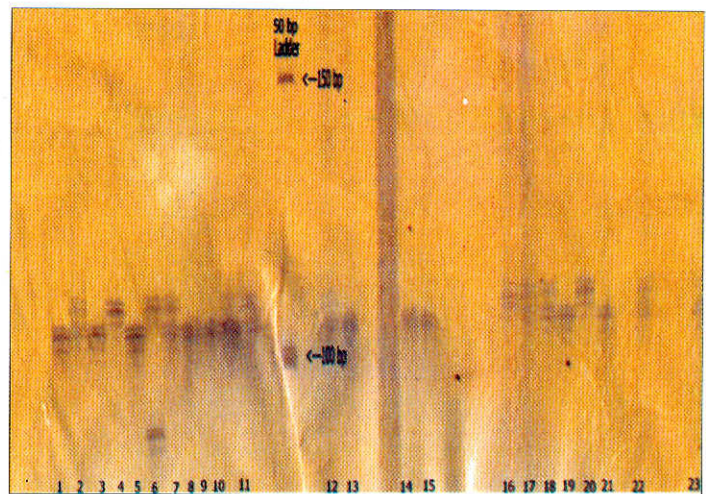


Fig.4.2.5 Photograph showing alleles at microsatellite locus (YWLL-44) in Jaisalmeri camels.

range of 173-176 bp and 2 alleles in the size range of 115-117 bp were resolved at microsatellite loci VOLP-08, VOLP-10, YWLL-09, YWLL-44, YWLL-58 and YWLL-59, respectively. Whereas in the Bikaneri breed 3 alleles in the size range of 143-146 bp, 5 alleles in the size range of 250-265 bp, 2 alleles in the size range of 160-162 bp, 4 alleles in the size range of 104-108 bp, 3 alleles in the size range of 173-176 bp and 2 alleles in the size range of 115-117 bp were resolved at microsatellite loci VOLP-08, VOLP-10, YWLL-09, YWLL-44, YWLL-58 and YWLL-59, respectively.

The observed and expected (Nei's) heterozygosity ranged from 0.3 to 1.00 and 0.32 to 0.65 in Jaisalmeri and 0.35 to 1.00 and 0.289 to 0.686 in Bikaneri breed. The polymorphic information content ranged from 0.268 to 0.588 in Jaisalmeri and 0.267 to 0.639 in Bikaneri breed. The number of alleles and heterozygosity was observed to be more in Jaisalmeri breed as compared to Bikaneri breed. The work on Kachchhi breed is in progress. Figure 4.2.5 to 8 presents the number of alleles and their size as resolved in 6 % urea polyacrylamide gel electrophoresis (Urea-PAGE) at microsatellite loci YWLL-44, YWLL-58, YWLL-09 and VOLP-10 in Jaisalmeri and Bikaneri breeds of camel.

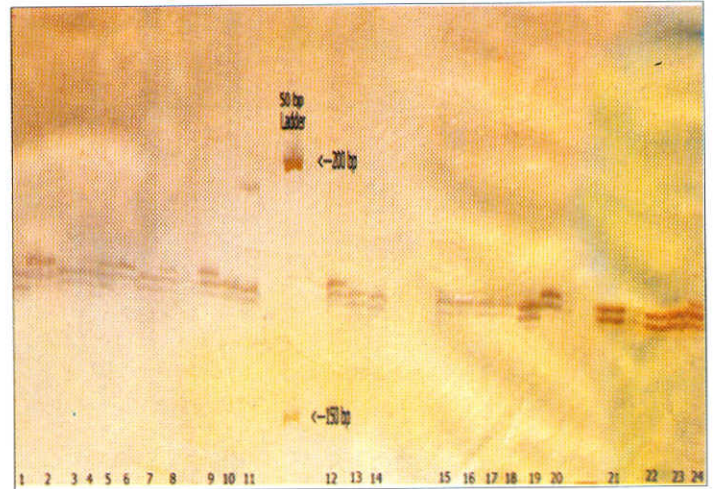


Fig. 4.2.6 Photograph showing alleles at microsatellite locus (YWLL-58) in Bikaneri camels

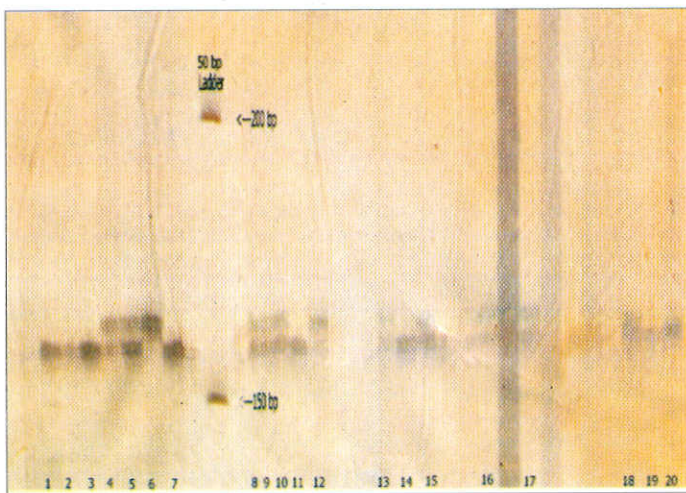


Fig. 4.2.7 Photograph showing alleles at microsatellite locus (YWLL-09) Bikaneri camels



Fig. 4.2.8 Photograph showing alleles at microsatellite locus (VOLP-10) in Jaisalmeri camels

**Table 4.2.8. Amplification of microsatellite loci in Jaisalmeri breed of camel (*Camelus dromedarius*) using New World Camelidae primers**

Locus	Primer 5' → 3'	Alleles (n)	Size (bp)	Temp (°C)	H <sub>o</sub>	H <sub>e</sub>	PIC
VOLP-08	CCATTCACCCCATCTCTC TCGCCAGTGACCTTATTTAGA	3	143-146	50	0.300	0.605	0.526
VOLP-10	CTTTCTCCTTCCTCCCTACT CGTCCACTTCCTTCATTC	5	250-265	55	0.630	0.651	0.588
YWLL-09	AAGTCTAGGAACCGGAATGC AGTCAATCTACACTCCTTGC	2	160-162	53	0.388	0.32	0.268
YWLL-44	CTCAACAATGCTAGACCTTGG GAGAACACAGGCTGGTGAATA	5	96-108	55	0.630	0.585	0.533
YWLL-58	GGCATCTCTTCCTCATCAAT GACATCTCCAACCTGGAATC	3	173-176	51	1.00	0.597	0.516
YWLL-59	TGTGCAGGAGTTAGGTGTA CCATGTCTCTGAAGCTCTGGA	2	115-117	53	0.660	0.444	0.345

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

**Table 4.2.9. Amplification of microsatellite loci in Bikaneri breed of camel (*Camelus dromedarius*) using New World Camelidae primers**

Locus	Primer 5' → 3'	Alleles (n)	Size (bp)	Temp (°C)	H <sub>o</sub>	H <sub>e</sub>	PIC
VOLP-08	CCATTCACCCCATCTCTC TCGCCAGTGACCTTATTTAGA	3	143-146	50	0.350	0.289	0.267
VOLP-10	CTTTCTCCTTTCTCCCTACT CGTCCACTTCCTTCATTTC	5	250-265	55	0.615	0.686	0.639
YWLL-09	AAGTCTAGGAACCGGAATGC AGTCAATCTACACTCCTTGC	2	160-162	53	0.450	0.339	0.281
YWLL-44	CTCAACAATGCTAGACCTTGG GAGAACACAGGCTGGTGAATA	4	104-108	55	0.400	0.655	0.590
YWLL-58	GGCATCTCTCCTCATCAAT GACATCTCCAACCTTGAATC	3	173-176	51	1.000	0.611	0.535
YWLL-59	TGTGCAGGAGTTAGGTGTA CCATGTCTCTGAAGCTCTGGA	2	115-117	53	0.583	0.406	0.323

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

## Molecular genetic studies on genes of economic importance

## (a) RFLP analysis of MHC-DRB3 fragment

MHC-Class I, Class II and Class III genes are associated with a number of diseases of economic importance such as mastitis, ketosis, retention of placenta in cattle; resistance or susceptibility to sarcoid tumour in equines; resistance to parasitic infection in sheep. Amplification of MHC-DRB3 locus was successfully attempted in cattle (BoLA), horse (ELA), donkey (ELA), sheep (OLA) and buffalo (BuLA). Amplification of this gene in camel could not be achieved using cattle primers. The fragment size observed in all species was 308 bp in 1 % agarose gel electrophoresis and 6% urea PAGE (Table 4.2.10 and Fig 4.2.9).

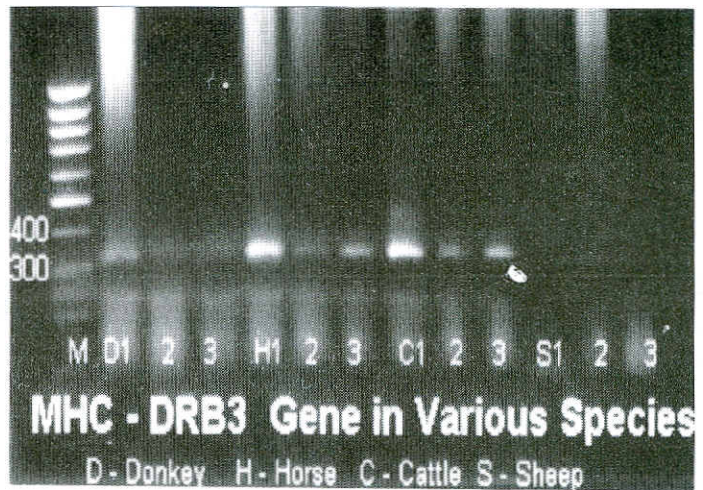


Fig 4.2.9

RFLP of MHC-DRB3 fragment with *HinfI*

The RFLP analysis of BoLA-DRB3 fragment with restriction enzyme *HinfI* revealed heterozygous status at this locus in all the animals. The molecular size of fragments was 261, 41 and 167, 94 and 47 bp. This indicates that one site for the restriction enzyme *HinfI* has been created possibly due to mutation. RFLP analysis of ELA and OLA DRB3 fragment revealed homozygous status at this locus in all the animals under investigation. In case of ELA-DRB3 the fragments were of 221 and 87 bp, whereas in sheep the fragments were of 212 and 96 bp. This indicates that at least one restriction site of *HinfI* enzyme was present in both the species at this locus (Table 4.2.11 and Fig. 4.2.10).

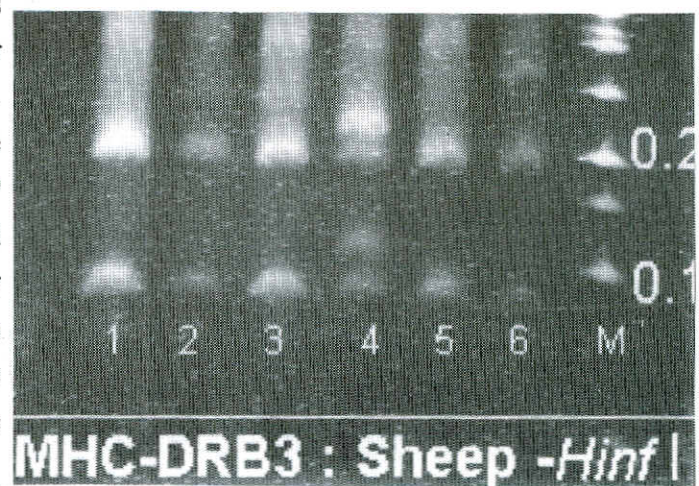


Fig. 4.2.10

RFLP of MHC-DRB3 fragment with *HaeIII*

ELA-DRB3 fragment was restriction digested with *HaeIII* in horse and donkey. All the animals were homozygous. However in horse at the annealing temperature of 58 °C the ELA-DRB3 fragment was amplified and subsequently digested with *HaeIII*. All the animals were heterozygous at this locus. The fragment

observed were of 221, 97 and 169, 139 bp, the two fragment, 169 and 139 bp, were common in donkey and horse indicating the similarity among the two species of equidae family, one additional restriction site was observed in horse (Fig.4.2.11).

**RFLP of MHC-DRB3 fragment with *RsaI***

The BoLA, OLA and ELA-DRB3 fragment were successfully digested with *RsaI*. This enzyme revealed heterozygous status in all three species. No intra-species variation was detected. The enzyme *RsaI* has two restriction sites in all the three species i.e. cattle, sheep and donkey. The fragment observed in cattle and sheep were of the same size indicating the genetic similarity in the two species. However the fragment were of different size in donkey as compare to cattle and sheep.

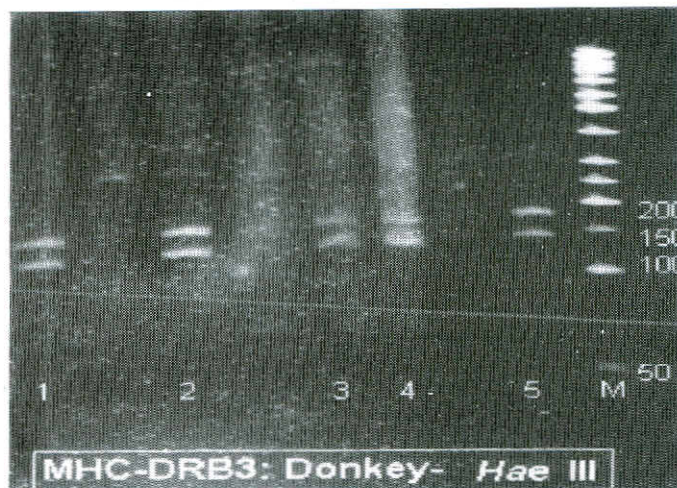


Fig. 4.2.11

The presence of restriction sites and RFLP patterns indicated the potential use of this technique for detecting, genotyping and screening the animals of different species for resistance or susceptibility to the diseases.

**Table 4.2.10. Amplification of exon 2 of MHC-DRB 3 locus in different livestock species**

Species	Sample Size (n)	Annealing Temperature (°C)	Molecular Size (bp)
Camel	4	-	-
Cattle	18	60	308
Sheep	15	60	308
Donkey	15	60	308
Horse	15	58	308
Buffalo	05	60	308

Table 4.2.11. PCR-RFLP pattern of MHC-DRB 3 locus in different livestock species

Restriction Enzyme	Species	MHC	Sample Size (n)	Status	Molecular Size(bp)
<i>Hinf I</i>	Cattle	BoLA	18	Heterozygous	261, 47 & 167,94,47
	Donkey	ELA	15	Homozygous	221, 87
	Sheep	OLA	15	Homozygous	212, 96
<i>HaeIII</i>	Donkey	ELA	15	Homozygous	169,139
	Horse	ELA	15	Heterozygous	221,87 & 169,139
<i>Rsa I</i>	Cattle	BoLA	12	Heterozygous	308 & 160,81,67
	Sheep	OLA	12	Heterozygous	308 & 160,81,67
	Donkey	ELA	12	Homozygous	138,85,85

#### (b) RFLP analysis of k-casein fragment

The B- variant of k-casein has been reported to be favourable for milk quality, as it is associated with highest protein percentage. The genotyping of animals at k-casein locus can be one among the selected criterias for selection of animals for dairy.

Using the primers, K1 and K2 reported for buffalo amplification of k-casein fragment was successfully done in cattle, buffalo and sheep, but this amplification could not achieved in camel. Fragment size observed in cattle, buffalo and sheep was 379 bp (Table 4.2.12 and Fig 4.2.12).

#### RFLP of k-casein fragment with *HinfI*

Digestion of k-casein fragment with *HinfI* in cattle and buffalo revealed heterozygous and homozygous status respectively. In cattle, the fragments were of

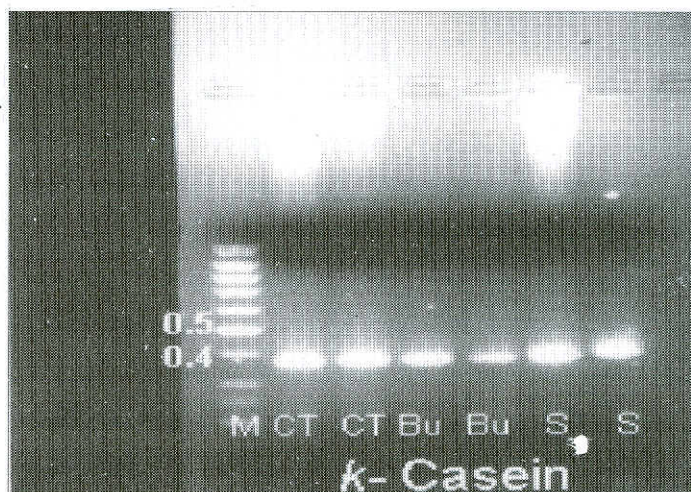


Fig. 4.2.12 PCR amplification of k-casein gene in cattle, buffalo and sheep



288, 91 and 153, 135, 91 bp, whereas the buffaloes were homozygous with the fragments of 288 and 91 bp. Since the B-variant of k-casein is favorable for milk quality, all the buffaloes in present investigation were of homozygous (BB) genotype, whereas all the cows in present investigation were heterozygous at this locus (Table 4.2.13 and Fig 4.2.13).

The k-casein fragment obtained by PCR amplification in sheep was also digested with *HinfI* to see the possible similarity or differences with cattle and buffalo at this locus. The restriction fragment length polymorphism indicated that the status at this locus in sheep is all together different from cattle and buffaloes because the fragments observed in sheep (174,123,82 bp) were all different from fragments observed in cattle and buffaloes. The same appears very relevant because the composition and properties of sheep milk is very much different from that of cattle and buffalo.

**RFLP of k-casein fragment with *Hind III***

The Polymerase Chain Reaction amplified fragment of k-Casein in cattle and buffaloes were analysed for restriction fragment length polymorphism pattern with *Hind III*. In cattle heterozygous status with fragments of 379 and 225, 154 bp were observed whereas in buffaloes homozygous status with fragments of 225, 154 bp was observed. All the buffaloes in present investigation were BB and hence are more suitable for the dairy. In cattle all animals were heterozygous as has been observed with *HinfI* digestion. This confirms that the animals (cattle) under investigation are heterozygous for most suitable 'B' allele (Fig 4.2.14).

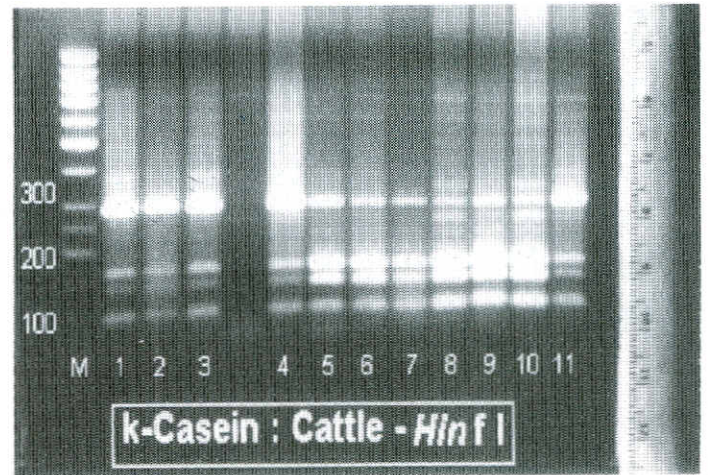


Fig. 4.2.13

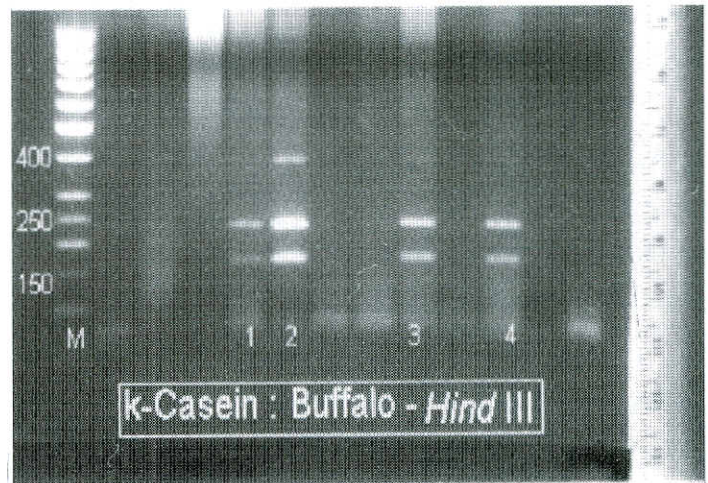


Fig. 4.2.14

Table 4.2.12. PCR-RFLP Pattern of k-casein locus in different livestock species.

Species	Sample Size (n)	Annealing Temperature (°C)	Molecular Size (bp)
Camel	4	-	-
Cattle	12	60	379
Buffalo	12	60	379
Sheep	12	60	379

Table 4.2.13. PCR-RFLP Pattern of k-casein locus in different animal species digested with *Hinf* I.

Restriction enzyme	Species	Sample Size (n)	Status	Molecular Size (bp)
<i>Hinf</i> I	Cattle	12	Heterozygous	288, 91 & 135, 91
	Buffalo	12	Homozygous	288, 91
	Sheep	12	Homozygous	174,123,82
<i>Hind</i> III	Cattle	12	Heterozygous	379 & 225,154
	Buffalo	12	Homozygous	225, 154

#### 4.3. Project Title: Improvement of reproductive efficiency and to study the causes of reproductive failures in camel

Project leader : Aminu Deen,

Associates : A. K. Roy, Sumant Vyas and M. S. Sahani

##### Sub project- 1: Collection of semen from camels- its evaluation, preservation and artificial insemination

a) A total of seven camels aged 9-12 yrs were used for collection of semen in morning using bovine artificial vagina during rutting season (December to March). The results indicated that camels donated semen in 70% of total attempts while no ejaculate was recorded in 30% attempts. 40% of the total ejaculates were thick highly concentrated while remaining 60% ejaculates were either of medium or poor sperm concentration. 50% of the ejaculates were graded to be of normal volume while remaining 50% were graded to be incomplete ejaculates. Copulation reaction was graded to be good in 30% while it was adjudged to be poor in 45% cases. It is therefore concluded that semen collection can be possible in camel, problems of no ejaculate, refractoriness of AV and incomplete ejaculates are there (Table 4.3.1).

b) Rutting activity is initiated in few but not all males during December month and the rutting activity is at peak in majority of males during later part of January and February. Some males loose libido during March, still others which maintain their libido and semen donation efficiency during March and April. By the end of May, majority of males loses their libido (Table 4.3.2).

c) The semen donation efficiency, copulation time and volume of ejaculates were compared for 2 male camels for 2 consecutive years. During first year the camels were kept solely for semen collection purposes while during 2<sup>nd</sup> year these camels were kept to regular carting of 20km on alternate days with full cartload. The semen donation efficiency, copulation times and volume of semen was significantly reduced in one camel while another exhibited complete loss of sexual activity (Table 4.3.3).

d) Semen was collected from six males on alternate occasions either with rubber funnel or camel collection glass AV to evaluate if contact of semen with rubber funnel had any adverse lethal effect on individual motility of spermatozoa. A total of 114 collections were obtained, the individual motility of each of them collected with rubber funnel (n=63) or camel collection glass (n=51) were recorded and compared by paired "t" test. The individual motility did not differ significantly, which indicated that either the contact of



Fig. 4.3.1 AV(s) with rubber funnel and camel collection glass

semen with rubber funnel had no adverse effect or camel collection has no beneficial effect over rubber funnel (Table 4.3.4 and 5).

**Table 4.3.1. Frequency of semen collection and its characteristics**

Camel No.	No. of Collection	Successful collections	No ejaculates	Volume (ml)		Consistency of ejaculates			Copulation Reaction			Copulation time (seconds)
				< 3	≥ 3	Thin	Medium	Thick	Good	Fair	Poor	
J-322	34	30	4	9	21	3	12	16	12	10	8	214.2 ± 21.68 (37-466)
B-346	29	27	2	16	11	14	10	3	17	5	7	178 ± 17.66 (55-358)
A-273	16	14	2	9	5	-	4	8	6	2	7	417.3 ± 76.68 (115-1206)
J-56	29	22	7	9	14	6	10	7	5	16	7	259.42 ± 18.75 (150-532)
J-321	29	14	15	11	3	4	4	6	4	2	20	150.95 ± 12.29 (68-248)
J-58	24	18	6	8	10	2	6	10	4	9	9	259.5 ± 26.91 (74-609)
J-54	16	0	16	-	-	-	-	-	-	-	16	167 ± 26.48 (87-328)

J- Jaisalmeri ; B – Bikaneri ; A – Arab x Bikaneri

**Table 4.3.2 Month wise grading of semen ejaculation reaction in AV**

Camel No	December			January			February			March			April		
	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor
A-273	-	-	1	3	-	1	2	-	2	1	1	1	-	1	2
	(Activity peaked during January & February)														
J-322	2	4	2	5	2	1	4	3	2	-	-	6	-	-	2
	(Activity peaked during January & February, declined during March and April) (Do not mount)														
B-346	7	-	1	5	2	-	1	1	2	2	-	2	2	1	1
	(Activity peaked during December & January, declined during February)														
J-321	1	-	6	-	-	7	2	-	2	-	-	5	-	1	4
	(Refractory to AV)														
J-58	3	-	3	1	2	3	-	-	2	4	-	1	1	2	1

J- Jaisalmeri ; B – Bikaneri ; A – Arab x Bikaneri

**Table 4.3.3. Effect of carting on libido, semen donation efficiency and semen volume**

Camel No	Year	Total attempts	No. of ejaculations	No ejaculations	Copulation time (seconds)	Volume (mL)	Gradation
J-58	Without carting in 2001	34	28 (82.4%)	6	365.9± 36.22	7.07 ± 0.85	Good
	With carting in 2001	24	18 (75%)	6	259.5± 26.9	3.66 ± 0.538	Fair
J-54	Without carting in 2002	30	24 (80%)	6	359.82 ± 0.47	3.78 ± 0.47	Good
	With carting in 2002	16	0	16	167 ± 26.48	-	Poor

J- Jaisalmeri

Table 4.3.4. Mean  $\pm$  S. E. of volume, motility and concentration of semen

Camel No	Volume (mL)	Sperm Motility (%)	Sperm Concentration ( $\times 10^6/\text{mm}^3/\text{mL}$ )	Total sperm count (in millions)
A-273	2.94 $\pm$ 0.711 (0.5-10 ml)	55.66 $\pm$ 6.85	214.83 $\pm$ 75.66 (43- 470)	404.83 $\pm$ 164.23 (86- 1100)
J-322	5.53 $\pm$ 0.62 (0.5 – 10 ml)	47.11 $\pm$ 6.14	340.80 $\pm$ 70.75 (93 – 690)	1034.00 $\pm$ 360.07 (420 – 3450)
B-346	2.48 $\pm$ 0.219 (1 – 5 ml)	43.27 $\pm$ 5.56	199.25 $\pm$ 82.24 (25- 650)	533.11 $\pm$ 220.28 (25- 1625)
J-321	2.03 $\pm$ 0.337 (1 – 5 ml)	54.16 $\pm$ 5.68	273.42 $\pm$ 90.08 (60 – 580)	392.85 $\pm$ 102.16 (110 – 680)
J-58	3.66 $\pm$ 0.538 (1 – 8 ml)	42.50 $\pm$ 5.06	272.88 $\pm$ 69.36 (12 – 570)	1116.5 $\pm$ 405.64 (60 – 2925)
J-56	3.91 $\pm$ 0.439 (1.5 – 10 ml)	42.38 $\pm$ 5.86	72.83 $\pm$ 20.63 (42 – 100)	281.00 $\pm$ 133.11 (84 – 459)

J- Jaisalmeri ; B – Bikaneri ; A – Arab x Bikaneri

**Sub project – 2: To examine the female camels for presence of ovarian activity during the month of November and study causes of infertility and ultrasonography for early pregnancy diagnosis**

(a) The ovarian activity in 26 female camels was observed by ultrasonography at weekly interval during the month of November. In six female camels (Group A) which were kept along with a male camel continuously in the rangeland, ovarian activity was observed in four female camels (66.7%) Out of these four, C.L., large follicle (>0.8 cm), small follicle (<0.8 cm) was observed in two, one and one female camels respectively. In one female camel having C.L., embryonic vesicle was also observed. No ovarian activity was observed in two female camels. In Group B camels (20) which were kept away from male camels, follicle (>0.8 cm) was observed only in two female camels and ovarian activity was not observed in rest of the 18 female camels. The results indicate that presence or absence of male camel in a camel herd can cause difference in the onset of ovarian activity in female camels.

Table 4.3.5. Comparison of sperm motility of camel semen collected by Rubber funnel and camel collection glass

Camel No.	Rubber funnel			Camel collection glass		
	Ejaculates	Actual motility (%)	Mean $\pm$ S. E.	Ejaculates	Actual motility (%)	Mean $\pm$ S. E.
A-273	7	20, 70, 80, 50, 70, 10, 60	51.42 $\pm$ 10.95	5	70, 60, 70, 80, 40	64.00 $\pm$ 7.58
J-322	14	50, 5, 2, 60, 55, 70, 70, 70, 90, 80, 90, 80, 20, 20	54.42 $\pm$ 8.5	12	50, 10, 10, 60, 10, 70, 30, 90, 70, 70, 0, 40	42.50 $\pm$ 9.12
B-346	11	5, 2, 40, 30, 70, 50, 70, 40, 50, 50, 90	45.18 $\pm$ 8.41	11	5, 20, 20, 50, 40, 70, 50, 80, 40, 70, 10	41.36 $\pm$ 8.07
J-321	10	50, 60, 70, 60, 70, 70, 50, 20, 0, 60	51.00 $\pm$ 7.76	5	50, 60, 80, 30, 30	50.00 $\pm$ 10.6
J-58	10	0, 30, 50, 60, 70, 70, 20, 50, 40, 40	43.00 $\pm$ 7.37	8	10, 50, 60, 40, 70, 40, 15, 50	41.87 $\pm$ 7.83
J-56	11	40, 0, 5, 70, 20, 60, 0, 50, 70, 70, 5	35.45 $\pm$ 9.50	10	50, 50, 40, 60, 0, 60, 70, 70, 50, 50	50.00 $\pm$ 6.66
<b>Overall</b>	63		46.80 $\pm$ 3.40	51		46.47 $\pm$ 3.35

J- Jaisalmeri ; B – Bikaneri ; A – Arab x Bikaneri

**(b) Use of ultrasonography for early pregnancy diagnosis:** The endo rectal linear array probe (5 MHZ) of Scanner-200 was used for the detection of early pregnancy in camels. Embryonic vesicle of 1.5-2.0 cm diameter was observed on day 17-18 post mating. Sometimes it appears to be compressed at the centre. Embryonic vesicle grew in size to 2.0 to 2.5 cm on day 23 post mating. Foetus as white echogenic spot could be observed in the embryonic vesicle at this stage. On day 30 post mating embryonic vesicle was > 3.0 cm size (fig 4.3.2.) and

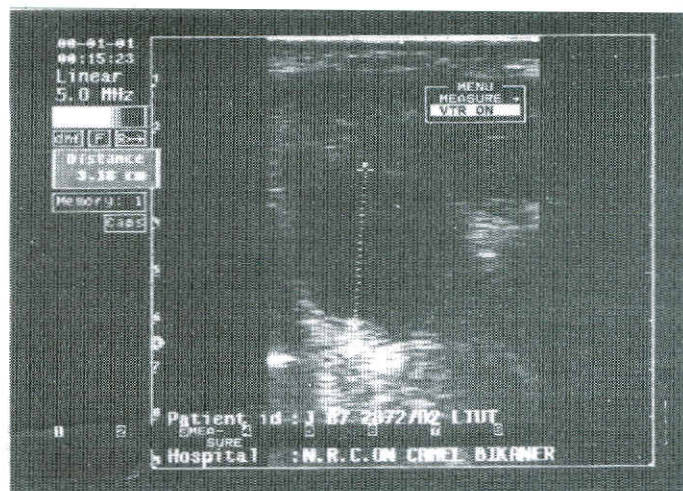


Fig. 4.3.2 Embryonic vesicle (>3.0 cm) on day 30 post mating

foetus could be distinctly seen as elongated white structure. On day 40 post mating, embryonic vesicle grew to 5.0 –5.5 cm diameter. Foetus appeared as thick white elongated band. (Fig 4.3.3) The optic area in the head region could also be observed. The allantoic fluid and amniotic fluid could also be distinctly visualized at this stage. On day 55 post mating, embryonic vesicle grew to 6.5 cm in diameter; foetus is elongated and appeared to be dividing the embryonic vesicle. The bulge in the left horn could also be observed at this stage. On day 60-65 post mating embryonic vesicle becomes large enough to be measured by transducer. Foetus appeared to be dividing the embryonic vesicle. Rectal palpation is also effective in pregnancy diagnosis at this stage.



Fig. 4.3.3 Fetus as white elongated band on day 40 post mating

In one female camel disappearance or complete resorption of embryonic fluid was observed on day 55 post mating indicating embryonic death. The results indicate that ultrasonography is useful in diagnosing pregnancy in female camels as early as day 18 after mating.

**(c) Causes of infertility:** Eleven female camels who could not get conceived by the last week of February 2002 were examined by rectal palpation and ultrasonography. Large follicle or ovarian cysts ((2.5-5.0 cm) was observed in three female camels. Metritis was observed in one female camel. On subsequent examination follicle of 1.0 to 2.0 cm diameter was observed in five out of remaining seven female camels. They were mated in the month of April with virile studs. One of them (483) is pregnant.

### Sub project-3 : To study the biochemical and endocrinological factors affecting puberty in male camels

The blood samples have been analyzed for serum biochemistry. The body weights and skin thickness have been recorded in the three groups of animals. The average body weights recorded at the beginning of the experiment were 637, 427 and 414 kg in adult, young and castrated animals respectively. The skin thickness was recorded from the three points located on the lateral side i.e. point 1 and 3 is an area just above the fore limb and hind limbs and the point 2 is located between the line joining 1 and 3. The skin thickness was 4.53, 5.93 and 4.53 mm; 3.03, 4.97 and 3.80 mm and 2.98, 4.50 and 3.50 mm respectively in the adult, young and castrated animals. The results on serum biochemistry are presented in the Table 4.3.6. The work will continue until these animals attain puberty and display rut symptoms like adults.



Table 4.3.6. Serum biochemistry of adult and pre-pubertal male camels

Parameters	Adult	Young	Castrated
Glucose (mg/dl)			
Rutting	115.25	115.73	125.51
Non-rutting	107.80	134.00	130.3
Cholesterol (mg/dl)			
Rutting	48.5	48.5	33.33
Non-rutting	16.2	36.27	26.63
Triglycerides (mg/dl)			
Rutting	26.37	41.97	21.73
Non-rutting	10.2	29.30	19.53
AST (I.U/L)			
Rutting	73.10	98.33	66.10
Non-rutting	37.73	44.26	31.68
ALT (I.U/L)			
Rutting	8.62	12.20	10.62
Non-rutting	6.80	7.12	5.62
LDH (I.U/L)			
Rutting	563.6	672.6	625.9
Non-rutting	188.4	176.6	149.4
ALP (I.U/L)			
Rutting	60.32	163.31	163.9
Non-rutting	62.26	194.69	172.0

#### 4.4 To study the economics of different camel management practices under arid and semi-arid eco-system

Project Leader: Champak Bhakat,

Associates : M. S. Sahani, N. Sharma

##### Sub Project 1: Studies on farming use of camel and bullock in irrigated and rainfed area

A study has been carried out on the farming use of camel (180 camel keepers) and bullock (164 bullock farmers) system in the different villages of Khajuwala tehsil (Bikaner Dist.). The mean  $\pm$  SE of various characteristic of farming use of camel and bullock systems are presented in Table 4.4.1. The data indicates that effective life period of camel is more as compared to bullock. Maximum 6-8 year age group of camel are being used under various farming operations. It is followed by 8-10 year, 4-6 year, more than 10 year and below 4-year age group. On the other hand maximum 4-6 year age group of bullock are being used for the same purpose. It is followed by 6-8 years, 8-10 years, below 4 years and more than 10 years age group. Annual average net income (Rs/ha) from Kharif season crop is more in camel system as compared to bullock system because mostly camel are used for cultivation of Groundnut (Kharif season crop) which is providing comparatively higher return per rupees invested than other Kharif season crop where bullocks are mostly used. Mostly male camels (90.34%) are used in various farming operation than female (9.56%). Maximum camel farmers (91.23%) involved themselves in farming operation but few large category farmers (8.77%) engage some hired person by which farming operations are done. Most of camel keepers (91%) purchased their camel on cash basis and it is followed by instalment (6%), loan (3%). A similar trend is found in case of bullock farmers. Influence of category of farmers on livestock management practices is given in Table 4.4.2. Overall Maximum intensive system is practiced for rearing of camel and bullock. It is mainly due to shrinkage of grazing land. The chi-square test shows a significant ( $P < 0.01$ ) influence of category of farmers on management practices of camel and bullock. Economic gain from agricultural land by using camel and bullock is presented in Table 4.4.3. Among the Kharif season crop Groundnut provides higher return per rupees invested followed by Guar, Cotton and moth where as among the rabi season crop mustard provides higher return per rupees invested followed by Gram and wheat. A detail economics of both type of farming system is analysed by using linear programming method. The analysis of fixed cost and variable cost are presented in Tables 4.4.4 (a) and (b), respectively. The detail Economic Estimate is presented in Table 4.4.5. The data indicates total expenditure is higher in bullock system as compared to camel system because a pair of bullock is involved in farming operations where as in camel system a single animal is involved for the same purpose. The average earning from selling of manure is more in bullock system because more manure is available from two bullocks at a time. The profit is quite high in camel system as compared to bullock system. The Pay Back Period (PBP) for investment on animal system is very short in camel than bullock system. On the contrary, the cost benefit Ratio (CBR) is high in camel system as compared to bullock system. The study

concludes that due to higher cost benefit ratio and shorter pay back period the farming use of camel system is profitable, beneficial over the bullock system for small and medium categories of farmer in the hot arid Thar region.

**Table 4.4.1. Mean  $\pm$  SE of different characteristic of farming use of camel & bullock system**

Parameter	Camel system (N = 180)	Bullock system (N = 164)
Ploughing of each Ac of land (Days)	1.12 $\pm$ 0.32	1.23 $\pm$ 0.37
Life period of animal (Year)	18.45 $\pm$ 0.89	14.79 $\pm$ 0.65
Life period of animal drawn Implements (Year)	11.56 $\pm$ 0.53	11.22 $\pm$ 0.51
Family labour employed / ha / day	2.16 $\pm$ 0.47	2.80 $\pm$ 0.48
Hired labour employed / ha / day	1.45 $\pm$ 0.31	1.57 $\pm$ 0.34
Cost of animal (Rs) Male -	9782 $\pm$ 14	5578 $\pm$ 10
Female -	8619 $\pm$ 11	
Age of animal used under farming system	6.43 $\pm$ 0.98	4.12 $\pm$ 0.76
Cost of animal drawn implements (Rs)	2014 $\pm$ 65	2089 $\pm$ 63
Working days / Year		
Agriculture Operation	130.11 $\pm$ 2.10	130.00 $\pm$ 2.24
Carting	234.89 $\pm$ 3.11	235.00 $\pm$ 3.72
Net income from Agriculture		
per year (Rs / ha) Kharif -	14821 $\pm$ 35	10590 $\pm$ 28
Rabi -	10200 $\pm$ 27	10220 $\pm$ 27
Working time of animal in farming		
operation (hrs / day) Rabi -	10.43 $\pm$ 0.32	10.52 $\pm$ 0.37
Kharif -	9.76 $\pm$ 0.29	9.87 $\pm$ 0.28

Table 4.4.2. Adaptation of different camel management systems by different category of camel keepers

Category	Camel (%)				Bullock (%)		
	Intensive	Semi-intensive	Extensive	Overall	Intensive	Semi-intensive	Overall
Small ≤ 6 ha	45.60	33.90	20.50	15.00	57.90	42.10	23.17
Medium 7 to 15 ha	56.80	23.40	19.80	61.67	62.90	37.10	55.49
Large ≥ 16 ha	60.50	21.50	18.00	23.33	79.10	20.90	21.34
Over all	55.56	24.44	20.00		65.24	34.76	
Chi-Square		1.91 **				4.43 **	

\* Significant at 1% level

Table 4.4.3. Average economic gain from agricultural land by using camel and bullock

Crop	Seasons	Avg production (Q / ha)	Avg cost of cultivation (Rs / ha)	Gross return (Rs / ha)	Net return (Rs / ha)	Return per Rs. invested (Rs)	By using
Cotton	K	16.60	5780	21580	15800	3.73	B-mostly C- rarely
Groundnut	K	31.40	9340	45530	36190	4.87	C-mostly B- rarely
Moth	K	5.60	2240	7000	4760	3.13	C / B
Guar	K	8.00	2256	10400	8144	4.60	C / B
Wheat	R	23.60	5460	15340	9880	2.81	C / B
Mustard	R	12.40	2348	14880	12532	6.34	C / B
Gram	R	10.00	3332	17000	13668	5.10	C / B

K-kharif, R-rabi, C-camel, B-bullock

Table 4.4.4. (a). Item wise comparison of expenditure (Rs) for camel v/s bullock carting

Expenditure (Rs)	Camel system (N = 180)	Bullock System (N = 164)
Interest on investment [@ 9 %]	1010	1192
Depreciation of implements [j.v @ 10 %]	157	168
Depreciation of animal [s. v @ 12 %]	438	663
Insurance on animal	483	582
Total fixed cost	2088	2605

Table 4.4.4. (b). Item wise comparison of expenditure (Rs) for camel v/s bullock carting

Expenditure / year (Rs)	Camel system (N = 180)	Bullock system (N = 164)
Hired labour	11310	12246
Family labour	11232	14560
Maintenance (mainly feeding) of animal	14600	29200
Repair & maintenance of animal drawn implements	100	100
Misc. / other expenditures	200	200
Total variable cost	37442	56306

Table 4.4.5. Economic analysis of camel v/s bullock carting

Factors	Camel System (N = 180)	Bullock system (N = 164)
Total expenditure (Rs)	39530	58911
Earning from different sources :		
Net income from agriculture per year (Rs / ha)	25021	20810
Sale of manure (@75 / q)	821	1600
Income from carting (Rs)	42300	39950
Profit (Rs)	28612	3449
P.B.P for investment on animal system (year)	0.39	3.84
Cost benefit ratio	1.72	1.05

#### 4.5 Project Title: Surveillance, monitoring and control of camel diseases

Project Leader :S.K. Ghorui

Associates :S.K. Dixit, R. Kumar, F.C. Tuteja, R.Singh, S.C. Mehta and N.Sharma

##### Sub Project 1: Comparative studies on the sensitivity of polymerase chain reaction (PCR) and serological tests for the diagnosis of camel Trypanosomosis

Camel blood samples (72) collected from both trypanosome endemic area and organised farm were subjected to parasitological and molecular detection of trypanosoma infection.

On parasitological examination – adopting wet smear, thin blood smears and thick blood smear examination none of the blood sample from camel detected trypanosomes (Table 4.5.1). However, 6 samples found positive on PCR amplification.

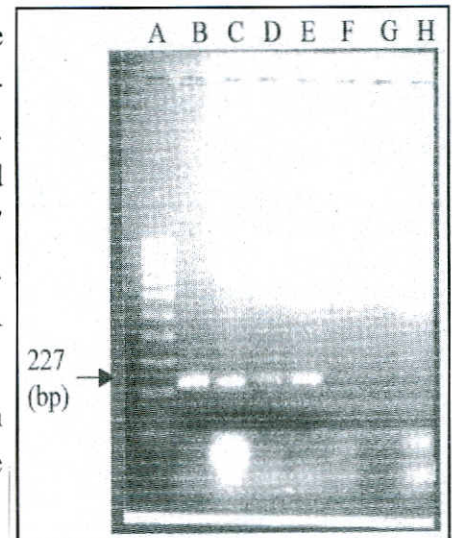
Table 4.5.1. Comparative performances of parasitological and DNA based diagnosis of Trypanosomosis in camel

A. Parasitological	sample examined	sample found positive
i. Wet film	72	None
ii. Thick smears	72	None
iii. Thin smears	72	None
B. DNA based	72	6 (8.3%)

Total un-cut DNA from separate *T.evansi* appeared as 23 Kbp. The same DNA when amplified as positive control, using a pair of primers (21-mer sense and 22-mer antisense) appeared as a single band of 227 bp. When DNA sample prepared from experimentally infected mice blood and subsequently amplified using the same primer set, same single band of 227 bp length appeared in 1.5% ethidium bromide stained agarose gel. Similarly, suspected camel blood also found 8.3% positive after DNA amplification using the same primer sets.

No amplifications have been recorded using DNA extracted from healthy mice blood and new born camel calf. This indicated that the amplified PCR product is parasite genome specific.

These result indicate clearly that PCR assay is much sensitive detector of *T.evansi* parasitaemia than microscopic examination of fresh blood. The work is under progress.



A : 100 bp ladder DNA  
 B-E: Positive *T.evansi* test samples  
 F,H : Negative *T.evansi* test samples

Fig. 4.5.1 : Amplification of *T.evansi* genomic DNA in Camel blood

### Sub Project 2 : Indigenous system of medicine against skin affections in camel mange

To popularise the ethno-veterinary practices among farmers after scientific evaluation and validation, two indigenous formulations were formulated and tried for their efficacy against naturally occurring most common skin disease “Mange” in camel. The constituents used are generally available at farmers doorstep. The experiment was conducted in two phases Phase I & II, with and without immuno modulator (Livamisole) and compared against commonly available allopathic drug fenvelerate 2080 (Neomax) at recommended dose schedule.

Both herbal preparations when applied once in a day locally and were repeated at 5 days interval, were found capable of relieving the experimental animals from symptoms of intense itching, scratching and biting, oozing of thick brown scab in some cases, thickening and wrinkling of skin, etc. Skin scrapings became negative for mites and egg between 10<sup>th</sup>- 15<sup>th</sup> day of its local application without any noticeable relapse even up to 30<sup>th</sup> day post treatment.

Hematological (Hb, DLC) and biochemical (AST, ALT and A/G ratio) parameters failed to yield any significant diagnostic contribution except eosinophilia and reverse trend in A/G ratio which however adopted a restoring trend during and after recovery in both the treated groups of animals.

These formulations were comparable to used allopathic drug in terms of clinical recovery when used alone or and in combination with immuno modulator (Livamisole).

### Sub Project 3 : Studies on prevalence, characterization and antibiotic sensitivity of intramammary infections in camel

To study prevalence of mastitis in camel, milk samples were collected from 282 quarters of 71 female camels and were subjected to microbial culture and somatic cell count test 39.72% samples were positive on microbial cut while 65.60% samples had somatic cell count more than 5 lac per ml of milk. Based on International Dairy Federation criteria adopted for cattle, 34.4 and 5.32% quarters were adjudged having sub clinical and latent mastitis respectively.

Amongst 115 isolates from 282 apparently healthy quarters examined including three quarters with mixed infections *Staphylococcus epidermidis* was the most predominant organism (27.83%) organism followed by unclassified streptococci (20.87%) *Staph. aureus* (20.0%), *Streptococcus agalactiae* (10.43%), *Str. dysgalactiae* (10.43%) *Corynebacterium* spp. (9.57% and *Bacillus* spp. (0.87%). Mixed infections were present in the following combinations *Staph. epidermidis* and unclassified streptococci (2); *Staph. aureus* and *Str. dysgalactiae* (1).

A total of 55 isolates of staphylococci including 23 coagulase + ve isolates from camel intramammary infections were characterized by different biochemical tests. The different species of staphylococci identified in order of their frequency were, *Staph. aureus* (30.91%), *Staph. hyicus* (10.91%), *Staph. intermedius* (7.27%), *Staph. haemolyticus* (7.27%), *Staph. auricularis* (7.27%), *Staph. sciuri* (7.27%), *Staph. hominis* (5.45%), *Staph. epidermidis* (3.64%), *Staph. capitis* (1.82%) and *Staph. warneri* (1.82%). Out of 55 isolates 9 isolates could not be identified with the present identification system used. A number of these species were associated with raised somatic cell count of milk. The non- typable isolates were: Coagulase- ve; novobiocin sensitive; DNase + ve; urease -ve; a- hemolytic; non pigment producing, mannitol -ve; maltose -ve; sucrose +ve; fructose +ve, lactose +ve; trehalose +ve.

In vitro chemotherapeutic sensitivity of the isolate from latent/ sub clinical intramammary infection : amongst *Staph. aureus* strains (23) tested, 100 per cent were sensitive to chloramphenicol, cephalixin, amoxycillin, amoxyclav, tetracycline, oxytetractline, cloxacillin, gentamycin followed by ciprofloxacin, kanamycin, neomycin (95.6% each), polymyxin-b (91.3%), lincomycin, penicillin, ampicillin (86.9% each), furazolidone (78.3%), nitrofurantion (73.9%) and spiramycin erythromycin (56.5% each).

Of the 32 *Staph. epidermidis* strains 100 per cent were sensitive to chloramphenicol, cephalixin, amoxycillin, amoxyclav, neomycin followed by tetracycline, oxytetracyclin, cloxacillin, ciprofloxacin (96.9% each), kanamycin (93.7%), gentamycin, polymyxin (90.6% each), lincomycin (81.2%) penicillin (78.1%), nitrofurantion, ampicillin spiramycin (71.9% each), furazolidine (68.7%) and erythromycin (62.5%).

Amongst *Str. agalactiae* strains (12) tested 100 per cent were sensitive chloramphenicol, cephalixin, amoxycillin amoxyclav, tetracycline, oxytetracycline, lincomycin, penicillin nitrofurantion, ampicillin,



erythromycin followed by cloxacillin, ciprofloxacin, polymyxin-b (91.7% each), gentamycin, kanamycin, spiramycin (83.3% each) and neomycin and furazolidine (66.7% each).

Of the 12 *Str. dysgalactiae* strains tested 100 percent were found sensitive to chloramphenicol, cephalixin, amoxicillin, amoxyclav, tetracycline, oxytetracycline, cloxacillin, gentamycin, licomycin, penicillin, nitrofurantion, ampicillin followed by ciprofloxacin, spiramycin (91.7% each), erythromycin (83.3%), kanamycin, polymyxin (75.0% each) and neomycin, furazolidine (50.0 % each).

24 unclassified streptococci strains tested were found 100 percent sensitive to chloramphenicol, cephalixin amoxycillin, amoxycl-av, tetracycline oxytetracycline cloxacillin lincomycin, penicillin followed by gentamycin, nitrofurantion spiramycin (95.8% each) polymyxin, ampicillin (91.7% each) crythromycin (87.5%), ciprofloxacin, kanamycin (83.3% each), furazolidine (75.0%) and neomycin (70.8%).

Of the 11 strains of *Corynebacterium* spp. tested, 100 per cent were sensitive to chloramphenicol, cephalixin, amoxicillin amoxyclav, tetracycline oxytetracycline, cloxacillin, gentamycin, penicillin neomycin spiramycin crythromycin furazolidine followed by ciprofloxacin, lincomycin, nitrofurantion (90.9% each) kanamycin, ampicillin (81.8% each) and polymyxin – b (72.7%).

As many as 114 isolates recovered from intramammary infections in camels were subjected to *in vitro* chemotherapeutic sensitivity testing by the disc-diffusion method using 19 antimicrobials. The isolates comprised of *Staph. aureus* (23), *Staph. epidermidis* (32), *Str. agalactiae* (12), *Str. dysgalactiae* (12), unclassified *streptococci* (24) and *Corynebacterium* spp. (11). Variable chemotherapeutic sensitivity pattern was observed for different species of organisms. In considering overall efficacy, irrespective of the species of the organisms, 100 per cent of the isolates were found sensitive to chloramphenicol, cephalixin, amoxycillin, and amoxyclav. More than 90 per cent were sensitive to tetracycline, oxytetracycline, cloxacillin, gentamycin, ciprofloxacin, lincomycin and penicillin. Sensitivity to kanamycin, polymyxin-b, nitrofurantoin, neomycin, ampicillin was more than 80 per cent. Whereas, 79.8, 76.3 and 72.8 per cent of the isolates were sensitive to spiramycin, erythromycin and furazolidone, respectively.

### **Sub Project : 4 : Effect of camel milk on glycemic control and diabetic quality off life in type-1 diabetes mellitus**

To evaluate the effect of camel milk on glycemic control and diabetic quality of life in type I diabetes mellitus. Study was carried in collaboration with S.P.Medical College, Bikaner. Twenty-four randomly selected type I diabetic patients were divided into two groups Group I (N=12) received usual care (diet, exercise and insulin). Group II recived 500 ml camel milk daily in addition to usual care. Frequent blood sugar monitoring was done to maintain euglycemia by titrating doses of insulin.

Baseline data of both the group were similar in demographic and clinical variables. After one month of trial significant improvement in fasting blood sugar ( $129 \pm 2.05$  to  $8.2 \pm 2.3$ ,  $P > 0.001$ ), was observed. Insulin

requirement was also significantly reduced in group II (mean doses of insulin 41.66 to 29.16 Vs 40.85 to 41.16,  $P < 0.003$ ). There was 30 per cent reduction in doses of insulin in 92 per cent of patients of group II. There was also improvement in satisfaction score ( $P > 0.001$ ), impact score ( $P < 0.001$ ), worry score ( $P < 0.001$ ) in patients receiving camel milk. Acceptability of camel milk was excellent. Study concludes that camel milk can serve as an alternate mode of treatment in type I diabetes as there was significant reduction in doses of insulin along with significant achievement in glycaemic control. There was marked improvement in diabetes quality of life score after one month.

### **Livestock Farming unit**

During the period opening balance of animals was 276 (104 males and 172 females) and closing balance was 272 (113 males and 159 females). The camel herd strength according to breed wise, age group wise, with addition and deletion are presented in table no.4.5.2.

### **Clinical cases**

During the period 227 camels were treated for various ailments viz. digestive disorders (28), respiratory disorders (19), reproductive disorders (6), cardiovascular (1), surgical affections including injuries and wounds (57), skin affections (87) and others (29). The age, sex, and breed wise morbidity is presented in table no.4.5.3.

### **Prophylactic measures-**

- (i) The animals and sheds were sprayed with insecticides twice a year for prevention and control of ectoparasites.
- (ii) For control of internal parasites the camels were treated with broad spectrum anthelmintics twice in a year before rains and after rains.
- (iii) For prophylactic measures against surra quinapyramine sulphate and chloride salts were injected twice a year in the month of August-September and March-April.
- (iv) Pregnant females and newborn camels were given Vitamin A as a prophylactic measure against hypo vitaminosis A.

Table 4.5.2 : Camel Herd Strength (2001-2002)

Breed/ Age	Opening		Calving		Purchase		Total		Death		Disposal		Closing	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
<b>Bikaneri</b>														
Up to 3 months	6	4	8	8	-	-	14	12	-	-	-	-	8	8
3-12 months	12	11	-	-	-	-	12	11					6	4
1-3 yrs	6	9	-	-	-	-	6	9	-	-	-	-	7	5
Above 3 yrs	16	49	-	-	-	-	16	49	2	4	4	6	21	52
Total	40	73	8	8	-	-	48	81	2	6	4	6	42	69
<b>Jaisalmeri</b>														
Up to 3 months	3	7	9	4	-	-	12	11	1	-	-	-	8	4
3-12 months	15	9	-	-	-	-	15	9	-	-	-	-	3	7
1-3 yrs	9	5	-	-	-	-	9	5	-	-	3	1	6	7
Above 3 yrs	22	39	-	-	6	-	28	39	2	4	2	5	39	36
Total	49	60	9	4	6	-	64	64	3	4	5	6	56	54
<b>Kachchi</b>														
Up to 3 months	-	2	4	5	-	-	4	7	1	-	-	-	3	3
3-12 months	5	3	-	-	-	-	5	3	-	-	-	-	-	2
1-3 yrs	2	2	-	-	-	-	2	2	1	-	-	2	2	3
Above 3 yrs	3	20	-	-	-	-	3	20	-	2	1	1	6	19
Total	10	27	4	5	-	-	14	32	2	2	1	3	11	27
<b>Arabx Bikaneri</b>														
Up to 3 months	1	-	-	-	-	-	1	-	-	-	-	-	-	-
3-12 months	-	-	-	-	-	-	-	-	-	-	-	-	1	-
1-3 yrs	-	4	-	-	-	-	-	4	-	-	-	1	-	-
Above 3 yrs	2	8	-	-	-	-	2	8	-	-	-	2	2	9
Total	3	12	-	-	-	-	3	12	-	-	-	3	3	9
<b>Marwari</b>														
	1	-	-	-	-	-	1	-	-	-	1	-	-	-
<b>Sanchori</b>														
	1	-	-	-	-	-	1	-	-	-	-	-	1	-
<b>Over all</b>	<b>104</b>	<b>172</b>	<b>21</b>	<b>17</b>	<b>6</b>	<b>-</b>	<b>131</b>	<b>189</b>	<b>7</b>	<b>12</b>	<b>11</b>	<b>18</b>	<b>113</b>	<b>159</b>

Table 4.5.3 : Age, Sex and Breed wise Morbidity (2001-2002)

Name of disease	Sex		Breed				Age group			Total
	M	F	B	J	K	AxB	0-3 M	3-36 M	Adult	
<b>Digestive System</b>										
Diarrhoea/Dysentery	5	11	5	5	5	1	13	1	2	16
Indigestion/Dyspepsia	3	3	4	1	1	-	-	2	4	06
Impaction	3	2	2	2	1	-	-	-	5	05
Abdominal pain	1	-	1	-	-	-	-	-	1	01
<b>Respiratory system</b>										
Pneumonia	3	3	2	2	2	-	3	1	2	06
URI	4	6	4	3	3	-	7	2	1	10
Aspiratory pneumonia	1	-	-	-	1	-	1	-	-	01
Multiple lung abscess	-	2	1	1	-	-	-	-	2	02
<b>Cardiovascular system</b>										
CHF (TP)	-	1	-	-	1	-	-	-	1	01
<b>Surgical Affections</b>										
Nasal wound	43	4	12	17	10	8	1	2	44	47
Abscess	3	-	2	-	1	-	-	-	3	03
Castration	3	-	2	1	-	-	-	-	3	03
Lameness	2	1	-	1	1	1	-	-	3	03
Chest pad inflammation	-	1	1	-	-	-	-	-	1	01
<b>Reproductive System</b>										
Prolapse of vagina	-	1	-	1	-	-	-	-	1	01
Metritis	-	3	2	1	-	-	-	-	3	03
Retained placenta	-	2	1	-	1	-	-	-	2	02
Vaginitis	-	-	-	-	-	-	-	-	-	-
<b>Others</b>										
Pyrexia	3	6	5	2	1	1	3	1	5	09
Debility	-	8	4	3	1	-	-	-	8	08
Fracture/Dislocation	3	3	1	4	1	-	1	-	5	06
Tetanus	-	1	-	-	1	-	-	-	1	01
Conjunctivitis	1	-	1	-	-	-	-	-	1	01
Rabies	1	-	-	-	1	-	-	-	1	01
Haematoma	1	-	1	-	-	-	-	-	1	01
Agalactia	-	2	1	-	1	-	-	-	2	02
Mange	28	59	31	37	17	2	-	42	45	87
Total	108	119	83	81	50	13	29	51	147	227

#### 4.6. RESEARCH SCHEMES UNDER NATP

##### 4.6.1. Improving the shelf life of milk and milk products of camel and goat

Project Investigator: Raghvendar Singh

Associates : Poonam Jayant

RA : Sanjay Shukla

##### **Chemical, physico-chemical and biochemical properties of camel milk at different stage of lactation**

Camel milk samples of the early, mid and late lactation were collected, processed and analyzed. The percent value of moisture, total solid, fat, SNF, protein, lactose, vitamin C, acidity, and pH ranged from 89-91, 8-11, 1.5-3.1, 7-8, 2.1-2.5, 3.8-4.3, 0.134-0.154, and 6.3-6.6 respectively (Figure 4.6.1.1). Higher percent acidity and lower percent fat were recorded in the milk of late lactation followed by the early and mid lactation respectively. These data will be helpful in standardization of milk product processing techniques.

##### **Mineral profile of camel milk**

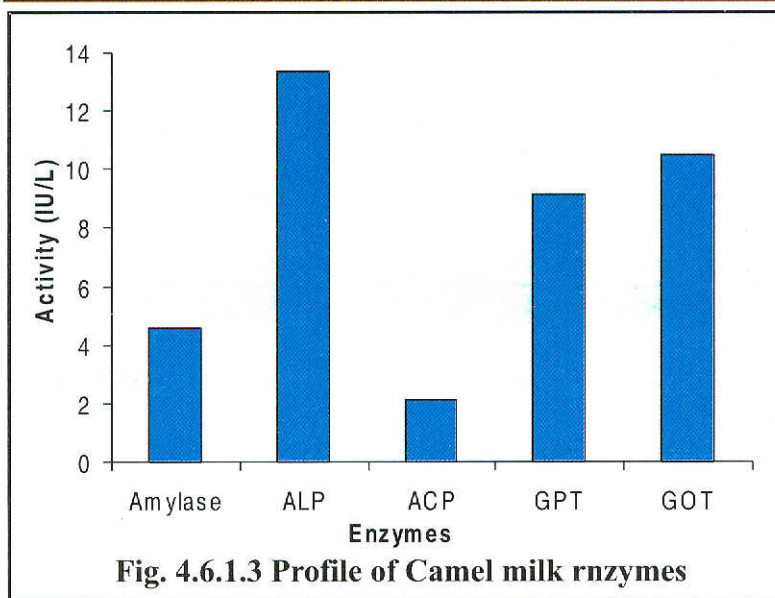
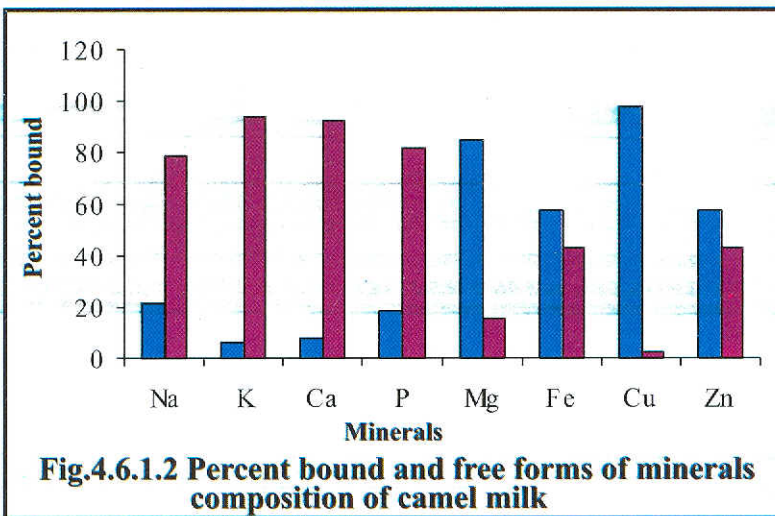
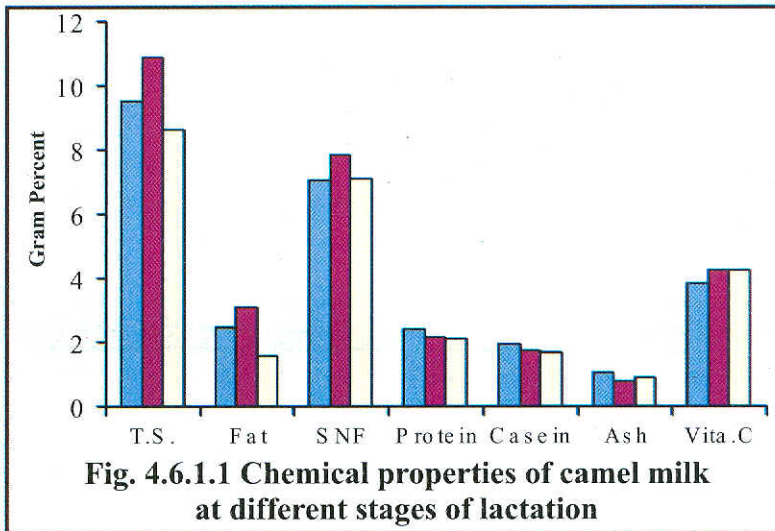
Milk samples from healthy lactating camels were collected in the 6-7<sup>th</sup> months of their lactation. Samples were processed for determination of their total, free and bound forms to assess quality of milk. Average values of Na, K, Ca, P, Mg, Fe, Zn, and Cu were  $46 \pm 0.39$ ,  $29 \pm 0.16$ ,  $84 \pm 1.99$ ,  $90 \pm 3.15$ ,  $4 \pm 1.22$ ,  $1 \pm 0.12$ ,  $2 \pm 0.02$ , and  $0.44 \pm 3.04$  mg/dl respectively. The percent bound and free forms of these minerals are presented in Fig. 4.6.1.2.

##### **Milk enzymes activity during late lactation**

Camel milk samples of late lactation period were collected from healthy lactating camels and were processed for the determination of different enzymes. The activity of GGT and LDH were  $241 \pm 13.55$  and  $140 \pm 1508$  IU/L respectively. The average activity of ALP, ACP, GOT and GPT are presented in Figure 4.6.1.3. Although milk enzymes represents less than one percent of total protein but enough to cause changes in quality of milk and milk products. The study on activity of lipase and cholinesterase also under process of the study.

##### **Immuno-proteins in camel milk**

Immuno-proteins IgG, IgA, IgM, C3, and C4 in blood serum, colostrum and milk were determined to study antibacterial factors. The values of these proteins in colostrum samples were  $8122 \pm 98.5$ ,  $2270 \pm 64.5$ ,  $210 \pm 12.5$ ,  $25 \pm 2.6$ ,  $25 \pm 2.6$  respectively which were found highest in comparison of respective blood and milk samples. The concentration of IgG in all the three samples viz blood serum, colostrum and milk were found highest followed by IgA, IgM, C3 and C4 respectively.



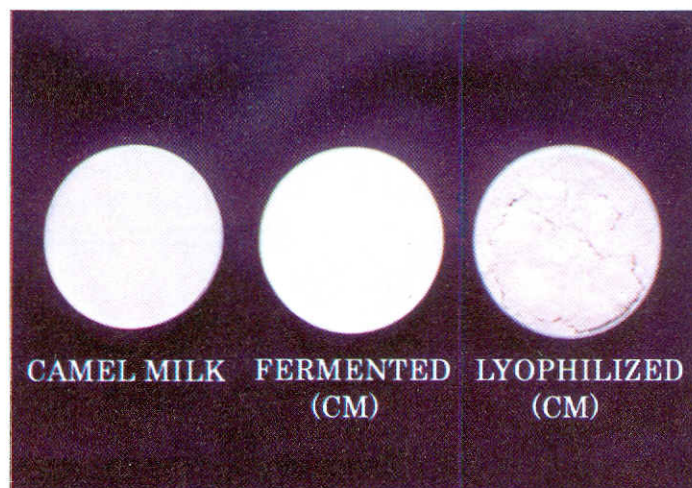
### Camel milk hormones

Camel milk samples of different stages of lactation were collected and processed for the determination of progesterone, prolactin, TSH, cortisol and insulin using radioimmunoassay method. The values of prolactin, insulin, TSH, progesterone and cortisol ranged from 8-11 ng/ml, 45-128 uU/ml, 0.12-0.15 uIU/ml, 0.35-0.1.40 ng/ml and 25-34 ng/ml respectively. These hormones play major role in regulation of mammary development.

### Camel fermented milk product

The process of camel milk fermentation has been standardized using different combinations of heat treatments, incubation and starter cultures and periodical changes in pH, acidity and DMC were recorded. The final process for preparation of fermented camel milk product (dahi) is given below.

The fresh whole filtered camel milk was taken and boiled for 15-20 minutes. The starter culture at the rate of 2-4% was added in the milk at the temperature of 30-37°C and incubated for 20-22 hour at 37°C. The prepared fermented milk product requires to be stored at 4-7°C to avoid further increase in the acidity.



Camel fermented milk Product

### Composition of fermented milk Product

Camel milk of pH, acidity and percent total solids ranged from 6.5 to 6.6, 0.138 to 0.145, and 8-10 respectively was processed for the fermentation. The prepared fermented milk (dahi) was chemically evaluated and results were closely related with International Dairy Federation standards. The values are given in Table 4.6.1.1.

**Table 4.6.1.1 Comparative evaluation of camel fermented milk**

Parameters (%)	Camel fermented milk	Standards of IDF
Water	83-84	82-86
Total Solids	16-17	14-18
Protein	4.1-4.8	4-6
Fat	3-3.3	1-10
Acidity	0.6-0.8	0.62-11

### Sensory Evaluation

The consistency of fermented milk is thin as compared to dahi prepared from cow/buffalo milk. It was served in three different manner viz. (i) addition of cumin and salt, (ii) rose with sugar and (iii) without any flavour to Indian and foreign citizens during their visit to Centre. Sensory evaluation test was carried out and 85 percent acceptability was recorded as normal or above the normal. The product indicated laxative effect.

### Evaluation of systems to improve shelf life of camel milk

#### (A) Sodium Metabisulphite ( $\text{Na}_2\text{S}_2\text{O}_5$ ) system

Salts of meta-bisulphite is decomposed by weak acids. The undissociated sulphurous acid molecules prevent the multiplication of yeast while the sulphurous acid ions inhibit the growth of bacteria. Camel raw and pasteurized milk samples were treated with sodium metabisulphite ( $\text{Na}_2\text{S}_2\text{O}_5$ ) at the concentration of 50 ppm and incubated at the  $37^\circ\text{C}$ . The acidity, COB and pH were recorded at four hour intervals up to 24 h. It was observed that raw and pasteurized milk with preservative increase the shelf life up to 12 and 16 h respectively.

#### (B) Lactoperoxidase system

LP-system in fresh camel raw milk was activated using of kscn (10 to 70 ppm) and  $\text{H}_2\text{O}_2$  (10 to 70 ppm) in different ratio. Periodical changes in acidity, alcohol test, COB test were recorded up to 24 hour at  $37^\circ\text{C}$ . The best lowest activation level 20:20 was evaluated which is effective in preserving raw camel milk up to 18-20 h at  $37^\circ\text{C}$ .

### 4.6.2 Characterisation and conservation of Jaisalmeri breed of camel

CCPI : S.C.Mehta

Associates : R.Goel, N.Sharma

JRF : S.R.Poonia, H.K.Bithu

The physical characterisation using biometry and other relevant information has been recorded for 3200 Jaisalmeri camels (Table 4.6.2.1 to 3). The effect of sex was significant in most of the traits except footpad length, face length and ear length. The male had higher dimensions indicating their suitability for riding and draught. The effect of age was significant in all traits because the data pertained to the growth phase. Adult animals were pooled in the group  $\geq 5$  years. The socio-economic aspects were paid attention. The average annual income of the camel keepers from all sources was Rs. 22712/- and an average family consisted of about 7 persons. The average herd size ranged from 1 to 200 with an average of 2.4 camels per household (Table 4.6.2.4). In all nine communities were involved in camel rearing in this tract. The average land holding was 96.9076 bighas of sandy soil with some hard pens and dependent mainly on rainwater.



The survey of health problems of the Jaisalmeri camel in the breeding tract indicated mange to be the major health problem (39.73%) followed by digestive disorders (33.69%) which included tympany, constipation, diarrhoea, abdominal pain and gastrointestinal obstruction. Trypanosomiasis (8.34%), wound / saddle gall (7.67%) and pneumonia (1.33%) were some other health problems. Among other health hazards retention of placenta, stillbirth, abortion, prolapse of uterus and mastitis were reported by the camel keepers. Of the 314 camel keepers, about 70% first prefer to go for local treatment followed by allopathic treatment (21.34%) and herbal treatment (8.59%) (Fig. 4.6.2.1).



Jaisalmeri herd in the breeding tract

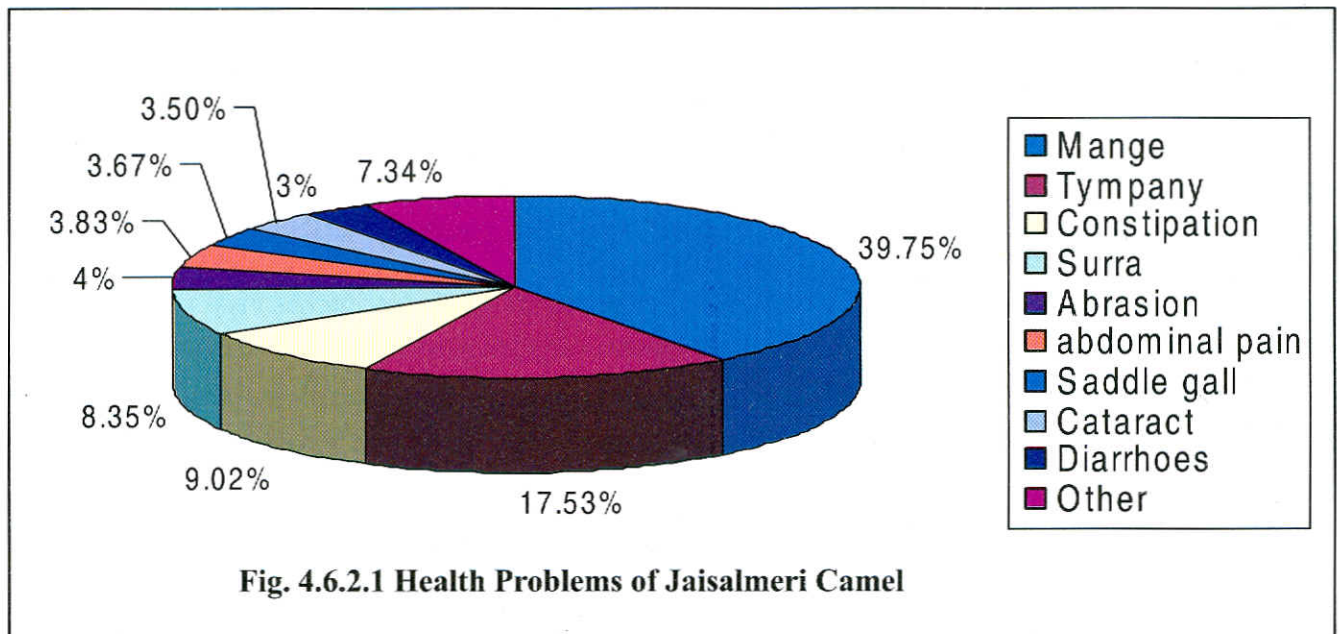


Table 4.6.2.1. Least squares mean±SE of body measurements (cm) in Jaisalmeri camels

Traits/ Effects	Body length	Heart girth	Height at withers	Neck length	Leg length (F)	Leg length (H)
Sex**	123.36±0.41 (1817)	172.18±0.49 (1817)	173.75±0.44 (1817)	94.21±0.36 (1817)	130.26±0.34 (1817)	136.69±0.33 (1817)
Male	124.48±0.47 (878)	173.88±0.56 (878)	175.32±0.50 (878)	94.94±0.41 (878)	131.11±0.39 (878)	137.59±0.37 (878)
Female	122.24±0.48 (939)	170.49±0.58 (939)	172.19±0.51 (939)	93.48±0.43 (939)	129.42±0.40 (939)	135.78±0.39 (939)
Age**	123.36±0.41 (1817)	172.18±0.49 (1817)	173.75±0.44 (1817)	94.21±0.36 (1817)	130.26±0.34 (1817)	136.69±0.33 (1817)
<1 Year	83.58±1.68 (37)	111.74±2.03 (37)	131.36±1.79 (37)	68.49±1.48 (37)	106.05±1.41 (37)	111.09±1.34 (37)
1 Year	106.76±1.19 (74)	152.73±1.44 (74)	163.18±1.27 (74)	89.19±1.05 (74)	124.04±1.00 (74)	129.79±0.95 (74)
2 Years	121.79±0.80 (166)	171.25±0.96 (166)	173.84±0.84 (166)	92.12±0.704 (166)	129.01±0.66 (166)	135.37±0.63 (166)
3 Years	132.26±0.75 (189)	186.93±0.90 (189)	183.73±0.79 (189)	101.44±0.65 (189)	136.29±0.62 (189)	142.89±0.59 (189)
4 Years	142.07±0.74 (194)	199.25±0.89 (194)	191.87±0.78 (194)	105.09±0.64 (194)	141.01±0.61 (194)	148.43±0.59 (194)
≥5 Years	153.69±0.30 (1157)	211.19±0.36 (1157)	198.55±0.32 (1157)	108.93±0.26 (1157)	145.17±0.25 (1157)	152.55±0.24 (1157)

\*\*(P&lt;0.01)

Table 4.6.2.2. Least squares mean±SE of body measurements (cm) in Jaisalmeri camels

Traits/ Effects	Foot pad length (F)	Foot pad width (F)	Foot pad length (H)	Foot pad width (H)	Hump circum (H)	Hump circum (V)
<b>Sex</b>	**	**	NS	*	**	**
	15.70±0.06 (1817)	14.78±0.06 (1817)	14.19±0.05 (1817)	13.22±0.06 (1817)	70.89±0.96 (1817)	30.10±0.47 (1817)
<b>Male</b>	15.70±0.07 (878)	14.79±0.06 (878)	14.18±0.06 (878)	13.22±0.06 (878)	73.22±1.09 (878)	31.20±0.53 (878)
<b>Female</b>	15.71±0.07 (939)	14.77±0.07 (939)	14.20±0.07 (939)	13.23±0.07 (939)	68.55±1.13 (939)	29.00±0.55 (939)
<b>Age**</b>	15.70±0.06 (1817)	14.78±0.06 (1817)	14.19±0.05 (1817)	13.22±0.06 (1817)	70.89±0.96 (1817)	30.10±0.47 (1817)
<b>&lt;1 Year</b>	10.57±0.25 (37)	9.97±0.23 (37)	9.46±0.23 (37)	8.70±0.23 (37)	37.33±3.92 (37)	15.28±1.92 (37)
<b>1 Year</b>	13.50±0.18 (74)	12.64±0.17 (74)	12.01±0.16 (74)	11.05±0.16 (74)	60.08±2.78 (74)	24.41±1.36 (74)
<b>2 Years</b>	15.59±0.12 (166)	14.61±0.11 (166)	14.07±0.11 (166)	13.05±0.11 (166)	73.58±1.85 (166)	31.11±0.91 (166)
<b>3 Years</b>	17.24±0.11 (189)	16.17±0.10 (189)	15.69±0.10 (189)	14.62±0.10 (189)	78.02±1.74 (189)	34.54±0.85 (189)
<b>4 Years</b>	18.02±0.11 (194)	16.96±0.10 (194)	16.28±0.10 (194)	15.29±0.10 (194)	82.63±1.71 (194)	34.62±0.84 (194)
<b>≥5 Years</b>	19.31±0.04 (1157)	18.32±0.04 (1157)	17.62±0.04 (1157)	16.60±0.04 (1157)	93.66±0.70 (1157)	40.64±0.34 (1157)

NS- Non-significant, \*(P&lt;0.05) and \*\*(P&lt;0.01)

Table 4.6.2.3. Least squares mean±SE of body measurements (cm) in Jaisalmeri camels

Traits/ effects	Face length	Distance between eyes	Distance between ears	Ear length	Tail length
Sex	NS	*	*	NS	*
	44.22 ±0.21 (1817)	18.69±0.09 (1817)	15.18±0.86 (1817)	10.82±0.06 (1817)	46.97±0.18 (1817)
Male	44.58±0.24 (878)	19.00±0.11 (878)	15.63±0.10 (878)	10.88±0.07 (878)	47.05±0.20 (878)
Female	43.85±0.25 (939)	18.38±0.11 (939)	14.74±0.10 (939)	10.76±0.07 (939)	46.89±0.21 (939)
Age**	44.22 ±0.21 (1817)	18.69±0.09 (1817)	15.18±0.86 (1817)	10.82±0.06 (1817)	46.97±0.18 (1817)
<1 Year	32.03±0.87 (37)	12.96±0.39 (37)	9.91±0.35 (37)	8.02±0.25 (37)	34.64±0.74 (37)
1 Year	40.39±0.61 (74)	16.71±0.27 (74)	13.90±0.25 (74)	9.79±0.18 (74)	42.90±0.52 (74)
2 Years	44.00±0.41 (166)	18.75±0.18 (166)	15.27±0.16 (166)	10.83±0.12 (166)	46.70±0.35 (166)
3 Years	47.27±0.38 (189)	19.81±0.17 (189)	16.29±0.15 (189)	11.39±0.11 (189)	50.20±0.33 (189)
4 Years	49.14±0.38 (194)	21.64±0.17 (194)	17.12±0.15 (194)	12.40±0.11 (194)	52.36±0.32 (194)
≥5 Years	52.45±0.16 (1157)	22.28±0.07 (1157)	18.61±0.06 (1157)	12.49±0.04 (1157)	55.02±.13 (1157)

NS- Non-significant, \*(P&lt;0.05) and \*\*(P&lt;0.01)

**Table 4.6.2.4. Average herd size socio-economic condition of the camel breeders in the breeding tract of Jaisalmeri breed**

District	Tehsil	Village	Farmer	Income/Farmer (Rs.)	Family size	Herd size
Jaisalmer	Pokran	5	14	31571.43	7.78	5.71
	Jaisalmer	20	116	18273.06	6.58	3.48
Barmer	Pachpadra	2	14	20706.34	8.35	7.71
	Barmer	4	41	29963.41	8.45	3.29
	Shiv	16	160	29111.21	7.76	1.25
	Chauhtan	30	298	19685.25	6.795	2.02
Total				Average		
Districts-2	Tehsils-6	77	643	22712.38	7.157	2.38

#### 4.6.3. Improving reproductive efficiency of sheep, camel, goat, cattle and buffalo

CCPI : Aminu Deen

Co-PI : Sumant Vyas

S.R.F. : Mamta Jain

(a) Preservability of camel semen at refrigerator temperature was studied in Tris and Biociphos extenders. A total of 28 semen samples split and extended in Tris and Biociphos extenders and another 72 samples extended in Tris were studied for preservation of motility at refrigerator temperature. Out of a total of 100 semen samples extended in Tris, motility was maintained in 46,33,18,10 and 2% samples for 24,48,72,96 and 120 h, respectively. However, in none of the 28 samples extended in Biociphos, motility could be maintained even for 24 hours. (Table-4.6.3.1 and 2)

(b) Artificial insemination was attempted in 10 female camels, which were induced to ovulate with hCG 5000 IU. Initially the inseminations were made with chilled and extended liquid semen deposited in uterus through a catheter, 36-48 h after the hCG injection. None of these females could be impregnated. This followed another trial using whole semen deposited into the uterus with the help of a disposable syringe passed into the uterus through transvaginal route. 4 out of 10 females could be

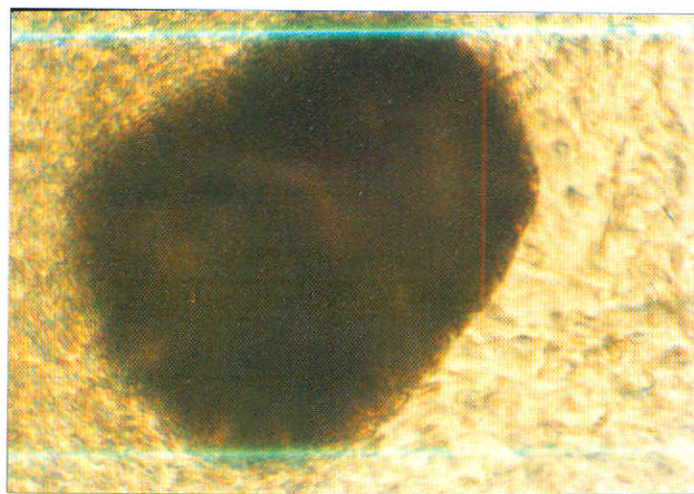


Fig.4.6.3.1 Spermatozoa densely packed in coagulum in camel semen

successfully impregnated. These results indicate that gelation of camel semen is important for optimum fertility of female camels. Probably it helps to form a sperm reservoir in female genital tract, from which sperms are released slowly over a prolonged period of time.

**Table 4.6.3.1. Sperm motility during different hours of preservation in Tris extender**

Camel No.	Number	Individual sperm motility				
		24	48	72	96	120
A-273	8	2	2	-	-	-
J-322	20	8	7	5	3	2
J-321	9	6	5	2	1	-
B-346	14	4	3	1	-	-
J-58	10	4	2	1	-	-
J-56	11	6	5	2	2	-
Total	72	30	24	11	6	2

A – Arab x Bikaneri; J – Jaisalmeri; B - Bikaneri

**Table 4.6.3.2. Hour wise comparison of semen preservability in Tris and Biociphos extenders**

Camel No	Number	Buffer	Sperm motility at 5°C			
			24	48	72	96
A-273	4	Tris	2	1	1	1
		Biociphos	0	0	0	0
J-322	4	Tris	3	2	1	1
		Biociphos	0	0	0	0
J-321	5	Tris	2	1	1	-
		Biociphos	0	0	0	0
B-346	7	Tris	4	3	1	1
		Biociphos	0	0	0	0
J-58	5	Tris	4	3	2	0
		Biociphos	0	0	0	0
J-56	3	Tris	1	1	1	1
		Biociphos	0	0	0	0
Total	28	Tris	16	11	7	4
		Biociphos	0	0	0	0

#### 4.6.4. Environmental stress and its amelioration through shelter management

CCPI : Champak Bhakat

Associates : N. Sharma.

SRF : D. Chaturvedi

##### Sub project 1: Studies on feeding behaviour of lactating camels and suckling behaviour of calves in different system of management

Behavioural parameters were recorded under Loose Housing Condition (L.H) / Intensive ( I ) and Semi-intensive condition (S I) were recorded using scientific coding method in seven adult female camels and their newly born calves from birth to 2 months of age. Mean  $\pm$  SE of different behavioural aspects of adult camel from birth to 24 hours are presented in Table 4.6.4.1. The total time spent in feed intake is more ( $327.53 \pm 2.92$  minutes) in SI condition than LH condition because camel were getting an opportunities of browsing and grazing. The time spent for feed intake was maximum during day as compared to night in both conditions. Number of rumination is higher in SI than LH group and nocturnal rumination time is maximum as compared to day rumination in both group. SI group indicated higher sleeping time (SP) than LH as camels were getting much more physical exercise in S I condition than L.H and to fulfill the normal physiological needs they devote more time in sleeping. The nocturnal sleeping was maximum as compared to daytime in both conditions. Since camels were getting much more open place in S I condition, Roaming/independent individual movement time is more in S I as compared to L H condition. In both situation roaming is maximum during day than night time. The total time for idling (ID) / no other activities is less in S I than L H condition because camels were



Fig. 4.6.4.1 Thatched roofed open type kachcha shelter



Fig. 4.6.4.2 Asbestos roofed close type concrete shelter

devoting much more time in feed intake, rumination and other related activities in S I condition. The frequency distribution of eliminative and other behaviour of adult camel and calf in 24 hours are given in Table 4.6.3.2 and 3 respectively. The data indicates that total frequency of defecation and Urination of adult and calf were more in night than daytime in both conditions. The total frequency of agonistic behaviour of adult and calf were less in S I than L H condition because camels were getting much more open space in SI condition. With advancement of age of young camel a hierarchy was formed among a group, which leads to reduction of the frequency of agonistic behaviour in S I condition. In L.H condition this frequency was maximum during group feeding when camels were competing with each other for taking feed from same manger at the same time.

The mean  $\pm$  SE of different behavioural pattern of camel calf during 24 h are presented in Table 4.6.4.4. The total time involved in milk suckling was reduced in S I than L.H condition because with advancement of age of calf, Grazing, Browsing, feed intake from manger behaviour developed which ultimately leads to more time involvement in feeding activity in LH condition. Rumination behaviour in

calves develop after the age of 30 days and nocturnal rumination was more than daytime. Sleeping time in calves was reduced in SI as compared to LH condition. This is mainly due to increment of age of calf. Nocturnal sleeping was more than day. The calf movement with mother (CMM) was reduced in S I than L.H condition but Roaming (RO) / independent individual movement time of calf increased in S I than L.H condition. Both kinds of movements were maximum during day than night time in each condition. The time involved in Idling was very less in S I as compared to LH condition. It is due to age factor and also calves were spending much more time in feed intake, rumination and other related activities in SI than LH conditions. A complete ethogram of adult camel and calf were presented in Fig 4.6.4.1 and 2, respectively. In LH and S'I conditions adult camels spent much time (%) in standing posture than Lying posture during day



Fig. 4.6.4.3 Loose housing (Tree shed) for camel



Fig. 4.6.4.4 Typical browsing behaviour in semi-intensive Condition



(6 AM to 6 PM) but this situation was almost reverse during night (6 PM to 6 AM). Similar trend was observed in camel calves under both conditions indicating that as the daylight disappears, camel has a tendency to go in lying posture.

The study concludes that due to higher time involvement in feeding and other related activities and less time involvement in idling like activity semi-intensive condition is better than intensive condition for calf and adult camel management.

**Table 4.6.4.1. Mean ± SE of different behavioural pattern of adult camels within 24 hours after parturition**

Type	Time	N	Standing posture				Lying posture			Total	
			TF	RU	ID	RO	RU	ID	SP	RU	ID
LH/I	Min / 24	49	IF= 290.55	102.46	282.37	60.40	320.32	287.05	98.75	422.78	569.42
	hr		± 2.26	± 1.54	± 2.85	± 1.86	± 2.73	± 2.04	± 0.84		
	(%)		(20.17)	(7.12)	(19.61)	(4.19)	(22.24)	(19.93)	(6.86)	(29.36)	(39.54)
	Min / Day	49	IF= 264.30	25.16	140.17	50.15	88.70	143.00	8.52	113.86	283.17
	(%)		± 2.01	± 0.47	± 1.49	± 1.00	± 1.12	± 1.05	± 0.63		
	(%)		(18.35)	(1.75)	(9.73)	(3.48)	(6.16)	(9.93)	(0.60)	(7.91)	(19.66)
	Min/Night	49	IF = 26.25	77.30	142.20	10.35	231.62	144.05	90.23	308.92	286.25
	(%)		± 0.31	± 1.22	± 1.51	± 0.92	± 2.54	± 1.26	± 0.75		
	(%)		(1.82)	(5.37)	(9.88)	(0.71)	(16.08)	(10.00)	(6.26)	(21.45)	(19.88)
SI	Min / 24	49	GR = 52.36	110.00	214.13	115.68	329.78	217.45	125.43	439.78	431.55
	hr		BR = 221.12	± 1.26	± 2.67	± 1.93	± 2.99	± 2.11	± 1.23		
	(%)		IF = 54.05	T=327.53±2.92	(7.64)	(14.87)	(8.03)	(22.90)	(15.10)	(8.71)	(30.54)
	Min / Day	49	GR = 52.36	27.50	95.46 ±	96.13	92.95	97.59	7.84	120.45	193.19
	(%)		BR = 221.12	± 1.01	0.72	± 1.74	± 0.48	± 0.46	± 0.12		
	(%)		IF = 29.05	T=302.53±1.62	(1.91)	(6.63)	(6.67)	(6.45)	(6.78)	(0.54)	(8.36)
	Min/Night	49	IF = 25.00	82.50	118.67	19.55	236.88	119.86	117.59	391.38	238.36
	(%)		± 0.28	± 0.23	± 2.00	± 0.27	± 2.76	± 2.03	± 1.10		
	(%)		(1.74)	(5.73)	(8.24)	(1.36)	(16.45)	(8.32)	(8.17)	(22.18)	(16.55)

TF- Total feeding, RU- Rumination, ID- Idling, RO- Roaming, SP-Sleeping, IF- Feed intake GR- Grazing, BR- Browsing LH/I- Loose Housing/Iractive, SI- Semi-intensive

Table 4.6.4.2. Frequency distribution of eliminative and other behaviour of camel calves in 24 hr of calving

System	Time	N	Eliminative		Attempt of drinking	Playing	Agonistic
			DE	UR			
Loose housing / Intensive	Total / 24hr.	49	5.16 ± 0.21	5.98 ± 0.23	1.32 ± 0.11	5.38 ± 0.12	4.32 ± 0.12
	Day	49	1.31 ± 0.13	1.55 ± 0.12	1.32 ± 0.11	3.51 ± 0.11	3.49 ± 0.09
	(%)		( 25.39 )	( 25.92 )		( 65.24 )	( 80.79 )
	Night	49	3.85 ± 0.12	4.43 ± 0.14		1.87 ± 0.10	0.83 ± 0.07
	(%)		( 74.61 )	( 74.08 )		(34.76)	(19.21)
Semi intensive	Total / 24hr.	49	6.74 ± 0.23	6.52 ± 0.25	2.86 ± 0.17	5.95 ± 0.13	3.56 ± 0.11
	Day	49	1.66 ± 0.12	1.57 ± 0.14	2.86 ± 0.17	4.05 ± 0.12	2.64 ± 0.08
	(%)		( 24.63 )	( 24.08 )		(68.07)	(74.16)
	Night	49	5.08 ± 0.13	4.95 ± 0.19		1.90 ± 0.10	0.92 ± 0.05
	(%)		( 75.37 )	(75.92)		(31.93)	(25.84)

DE- Frequency of defecation UR Frequency of urination

Table 4.6.4.3. Frequency distribution of eliminative and other behaviour of adult camel in 24 hour

System	Time	N	Eliminative		Attempt for drinking	Agonistic
			DE	UR		
Loose housing / intensive	Total / 24hr.	49	12.58 ± 0.23	12.47 ± 0.21	2.12 ± 0.19	2.09 ± 0.11
	Day	49	3.14 ± 0.12	3.00 ± 0.12	2.12 ± 0.19	1.58 ± 0.08
	(%)		(24.96)	(24.05)		(75.60)
	Night	49	9.44 ± 0.14	9.47 ± 0.13		0.51 ± 0.06
	(%)		(75.04%)	(75.95)		(24.40)
Semi intensive	Total / 24 hr.	49	13.12 ± 0.25	13.56 ± 0.22	2.78 ± 0.22	1.35 ± 0.12
	Day	49	3.28 ± 0.14	3.39 ± 0.12	2.78 ± 0.22	0.73 ± 0.07
	(%)		(25.00)	(25.00)		(54.07)
	Night	49	9.84 ± 0.19	10.17 ± 0.14		0.62 ± 0.05
	(%)		(75.00)	(75.00)		(45.93)

Table 4.6.4.4. Mean  $\pm$  SE of different behavioural pattern of camel calves in 24 hours after parturition

Type	Time	N	Standing posture					Lying posture			Total	
			TF	RU	CMM	RO	ID	RU	ID	SP	RU	ID
LH/I	Min / 24hr	49	MS = 65.72 $\pm$ 0.89 (4.56)	NF	54.55 $\pm$ 0.76 (3.79)	15.45 $\pm$ 0.61 (1.00)	504.63 $\pm$ 3.79 (35.04)	NF	549.66 $\pm$ 3.28 (38.17)	250.71 $\pm$ 2.63 (17.41)	NF	1054.29  (73.91)
	Min / Day	49	MS = 52.30 $\pm$ 0.71 (3.63)	NF	44.28 $\pm$ 0.52 (3.08)	14.21 $\pm$ 0.52 (0.99)	253.17 $\pm$ 2.88 (17.58)	NF	280.76 $\pm$ 2.53 (19.50)	75.28 $\pm$ 0.79 (5.23)	NF	533.93  (37.77)
	Min/Night	49	MS = 13.42 $\pm$ 0.15 (0.93)	NF	10.27 $\pm$ 0.29 (0.71)	1.24 $\pm$ 0.36 (0.10)	251.46 $\pm$ 1.73 (17.46)	NF	268.90 $\pm$ 1.95 (18.67)	175.43 $\pm$ 2.00 (12.18)	NF	520.36  (36.14)
SI	Min / 24hr	49	MS = 40.23 GR = 38.11 BR = 70.25 IF = 26.33 T = 174.92 $\pm$ 1.85 (12.15)	35.68 $\pm$ 0.47	21.67 $\pm$ 0.21 (1.50)	83.33 $\pm$ 1.56 (5.89)	433.96 $\pm$ 2.84 (30.14)	87.52 $\pm$ 0.93 (6.08)	427.92 $\pm$ 2.75 (29.72)	175.00 $\pm$ 1.85 (12.15)	123.20  (8.56)	861.88  (59.16)
	Min / Day	49	MS = 30.13 GR = 38.11 BR = 70.25 IF = 21.00 T = 159.49 $\pm$ 1.26 (11.07)	3.92 $\pm$ 0.38	19.80 $\pm$ 0.19 (1.37)	65.49 $\pm$ 1.23 (4.55)	220.03 $\pm$ 1.29 (15.29)	24.88 $\pm$ 0.34 (1.73)	211.99 $\pm$ 1.32 (14.72)	15.75 $\pm$ 0.39 (1.09)	28.80  (2.00)	432.02  (29.31)
	Min/Night	49	MS = 10.10 IF = 5.33 T = 15.43 $\pm$ 0.32 (1.08)	31.76 $\pm$ 0.41	1.87 $\pm$ 0.12 (0.13)	17.84 $\pm$ 0.39 (1.34)	213.93 $\pm$ 1.75 (14.85)	62.64 $\pm$ 0.75 (4.35)	215.93 $\pm$ 1.57 (15.00)	159.25 $\pm$ 1.63 (11.06)	94.40  (6.56)	429.86  (29.85)

LH-Loose housing, SI- semi-intensive, TF- Total Feeding, CMM- calf with mother, RO- Roaming, RU- Rumination, MS- Milk suckling

#### 4.6.5 Evaluation of locally available feed and fodder to improve and formulate economic rations with high roughage diets

C.C.P.I. : A. K. Nagpal

Associate : A.K. Roy

SRF : Manju Arora

#### Experiment 1. Utilization of guar phalgati and tree leaves (Ardu, Neem and Khejri) based complete diets in camel calves

Eleven camel calves comprising of Bikaneri (5), Jaisalmeri (5) and Kutchchi (1) breeds of 2 years age and average body weight of 291-344 kg were given *ad.lib.* complete rations formulated from guar phalgati, Ardu (*Ailanthus excelsa*), Neem (*Azadirachta indica*), Khejri (*Prosopis cineraria*) leaves and feed ingredients. Physical composition of control, CR I, CR II and CR III rations along with their cost (Rs./q) is given in Table 4.6.5.1.

It was revealed that the voluntary DM intake/ 100 kg body weight did not differ significantly among 4 treatments indicating even control diet of sole guar phalgati ration was capable to meet DM requirements of camels calves.

**Table 4.6.5.1. Physical composition (%) of complete feeds**

Parameter	Control	CR I	CR II	CR III
No. of calves	6	4	4	3
Guar phalgati	100	77	75	69
Tree leaves	-	8	10	16
Jaggery	-	4	4	4
Mineral Mixture	-	0.2	0.2	0.2
Common salt	-	0.8	0.8	0.8
Wheat bran	-	3	3	3
Guar churi	-	4	4	4
Broken rice	-	3	3	3
Cost Rs./q	167.00	270.65	277.30	297.28

Cost Rs./q: Guar phalgati- 167 , Tree leaves- 500 , Wheat bran- 450 , Guar churi- 530 ,

Broken rice- 485, Jaggery- 850 , Mineral mixture- 4000 and Common salt – 100 , Guar patha-500

### Experiment 2. Studies on utilization of guar phalgati and tree leaves based mixed rations in camel calves

Eleven male camel calves (2.3 years; 291-349 kg) were randomly distributed into 3 groups. Group MR 1 of 4 animals was given *ad.lib.*, mixed ration of guar phalgati and ardu tree leaves in the ratio of 84:16 (w/w). Group MR 2 having 4 animals was given *ad.lib.*, mixed ration of guar phalgati and neem leaves in the ratio of 80:20 (w/w) and MR 3 group of 3 animals was fed *ad.lib.*, mixed ration consisting of guar phalgati and khejri leaves in the ratio of 76:24 (w/w).

The DMI g/kg W<sup>0.75</sup> in group MR 3 was 78.73 and significantly (P<0.05) higher than other 2 groups.

Nutrient intake in term of DM / kg W<sup>0.75</sup> was higher (P<0.05) in MR 3 than MR1 and MR 2 groups and in terms of DCP and TDN it was similar among 3 groups.

Serum biochemical parameters did not differ significantly among three groups with the exception of cholesterol, which was found to be significantly (P<0.05) higher in MR 2 as compared to other 2 groups.

It was inferred that mixed ration MR 3 was better among 3 rations in terms of nutrient utilization and growth of camel calves (311.48 g/d).

### Experiment 3. Studies on utilization of moth chara, wheat straw and bui leaves based complete rations by camel calves

Eleven male camel calves of Bikaneri (5), Jaisalmeri (5) and Kutchchi (1) breeds (2 years age) were randomly divided into 3 groups. Group I (C) consisting of 3 camel calves was given control diet consisting of only moth chara. Group II had 4 camel calves and was given complete ration CR I and group III having 3 camel calves was given complete ration CR II (Table 4.6.5.2).

Table 4.6.5.2. Physical composition (%) of feeds given to 3 groups of camel calves

Parameter	C	CR I	CR II
Moth chara	100	47	27
Wheat straw	-	40	40
Bui	-	-	20
Jaggery	-	4	4
Wheat bran	-	3	3
Guar churi	-	5	5
Mineral mixture	-	0.2	0.2
Common salt	-	0.8	0.8
Cost Rs./q	280	264.79	218.19

Cost (Rs./q): Moth chara- 280, Wheat straw-150, Jaggery-800, Bui leaves-50, Wheat bran-425, Guar churi-392.86, Mineral mixture- 4000 and common salt- 100.

Looking to the overall picture of growth, feed efficiency, voluntary feed intake, digestibility of proximate and detergent fibre components, nutrient intakes (Table 4.6.5.3), it was concluded that the CR I ration was better than other three rations for growing camel calves.

**Table 4.6.5.3. Nutrient intake, digestibility and water intake of camel calves**

Parameter	Control	CR I	CR II
<b>No. of calves</b>	3	4	4
Initial Body Wt. Kg	342.67±7.69	336.75±10.86	335.25±9.89
Final Body Wt. Kg	360.00±6.51	367.00±10.12	359.75±10.18
ADG** g/d	161.99 <sup>A</sup> ±11.23	267.70 <sup>B</sup> ±6.64	216.81 <sup>A</sup> ±12.77
Total gain kg	17.33±1.20	30.25±0.75	24.50±1.44
Feed intake Kg.	656.77±17.82	735.17±16.67	681.30±15.04
Feed intake kg**/ kg gain	38.21 <sup>B</sup> ±2.45	24.39 <sup>A</sup> ±1.14	28.14 <sup>AB</sup> ±1.94
DMI kg/d	5.59±0.20	6.46±0.07	5.66±0.16
DMI** kg/100 kg B.Wt.	1.56 <sup>A</sup> ±0.08	1.81 <sup>AB</sup> ±0.03	1.59 <sup>A</sup> ±0.02
Water intake l/d	12.83±0.46	13.49±1.91	13.06±1.33
Water intake l/ kg DMI	2.29±0.03	2.08±0.28	2.32±0.26
<b>Digestibility %</b>			
DM**	63.53 <sup>C</sup> ±0.93	48.58 <sup>A</sup> ±1.64	55.51 <sup>B</sup> ±0.47
OM**	73.47 <sup>B</sup> ±0.33	65.87 <sup>A</sup> ±1.15	65.13 <sup>A</sup> ±0.63
CP	59.48±0.91	61.29±1.54	65.18±1.07
EE**	14.98 <sup>A</sup> ±2.91	28.91 <sup>A</sup> ±6.19	55.34 <sup>B</sup> ±2.60
CF	63.60±2.93	61.11±1.73	56.75±2.01
NFE**	82.03 <sup>B</sup> ±0.14	69.94 <sup>A</sup> ±1.14	68.55 <sup>A</sup> ±0.47
NDF**	59.73 <sup>B</sup> ±2.16	23.74 <sup>A</sup> ±4.02	45.03 <sup>B</sup> ±1.14
ADF**	46.14 <sup>C</sup> ±2.56	6.77 <sup>A</sup> ±4.85	27.86 <sup>BC</sup> ±1.55
<b>Plane of Nutrition</b>			
DCP g/d	364.51±12.09	389.83±8.41	378.97±15.01
TDN kg/d	3.39±0.11	3.60±0.10	3.19±0.07
DM** g/kg W <sup>0.75</sup>	67.85 <sup>A</sup> ±3.18	78.53 <sup>B</sup> ±0.87	69.23 <sup>A</sup> ±0.98
DCP g/kg W <sup>0.75</sup>	4.42±0.20	4.74±0.11	4.63±0.14
TDN* g/kg W <sup>0.75</sup>	41.17 <sup>a</sup> ±1.79	43.74 <sup>b</sup> ±0.89	39.06 <sup>a</sup> ±0.51

Small and big superscripts in a row differ significantly at \*=P<0.05 and at

\*\*= P<0.01 respectively.

**4.6.6. Study on the mineral status of feed and fodders in arid zone of Rajasthan, bio- availability and preparation of area specific mineral mixture for improved productivity in camel**

PI : G.P. Singh

Collected feed and fodders samples from randomly selected villages of Bikaner, Nagaur, Jaisalmer, Churu and Hanumangarh district of Rajasthan. Survey of villages of Bikaner district revealed that Sewan, Mothchara, Guar chara, Groundnut chara, Wheat straw, Chana khar, Cattle feed, Moth churi and Guar cake etc. are usually fed to the animals. Samples of feed and fodder were collected for analysis of trace mineral and toxic element.

Lactating buffalo and cattle are fed cattle feed, wheat straw, sewan straw but not according to their production level. Camels are mostly fed Guar chara, and Moth chara. These feeds are fed individually depending on the availability. Survey indicated that farmers do not feed mineral mixture to camels. Camels are not fed even common salt. Feeding of mineral mixture even to lactating animals is very uncommon. Some farmers fed salt to lactating animals.

Presently camels are used for carting only to bring the fuel wood, water and other items. Few farmers use for ploughing. Use of camel for earning is very limited in villages because farmer did not find remunerative. Camel milk is utilized in limited scale among Raika community.

**SCHEME**

**4.7. Network collaborative programme on crop based animal production system**

P.I. : M. S. Sahani

Project Associate : Nirmala Saini, Ram Kumar,

SRF : Raja Purohit, B.D. Kiradoo

**Exp. 1- Grazing behaviour and growth performance of camel calves under sewan and 3- tier silvipasture system**

Bikaneri camel calves aged 3-4 years were kept for 7 h grazing on sewan pasture (11 ha) and silvipasture (16 ha). Two camels were kept on Sewan pasture, three camels were left on silvipasture. Gain in body weight was higher (27 kg) in group grazed on sewan pasture in comparison to group grazed on silvipasture (21 kg). Average daily gain over 122 days was (0.221 & 0.172 kg/day) higher in sewan as compared to silvipasture.

Vegetative growth of sewan pasture was observed during rainy season under rainfed condition. Plant vigor study of sewan pasture revealed that it did not attain full growth due to low and erratic rainfall. Average plant height of sewan pasture during September month was 75.25 cm. The green fresh weight of sewan grass from (3×3 sqmt.) area is 4.5 kg with mean 3.6 kg.

8 h grazing behaviour studies of camel calves in quarter of winter (Oct.– Dec.) indicated that animals mostly spent their time only grazing & walking while grazing about (32.74%), followed by walking (18.64%), standing (15.48%) rumination (9.61%) browsing (8.48%) rumination while standing (5.84%) and rumination while sitting (4.77%).

### Grazing behaviour study of camel calves kept under 3-tier silvipasture system

In this study the complete behaviour of the animals were recorded from (9.00 am to 5.00 pm). It is evident that from April to June more time was spent in browsing (21.0–21.87%), walking while grazing (14.58%) and rumination (27.00%) and walking (14.58%).

Study from July to September 2001 indicated more time was spent in grazing and walking while grazing (39.57%), followed by browsing (15.62%), rumination while standing (12.50%) and walking (10.41%). Study from October to December 2001 indicated more time was spent in browsing (31.25%), followed by grazing & walking while grazing (17.70%), rumination while standing (13.54%), rumination while sitting (10.41%), walking (10.41%). Study from January 2002 to March 2002, the maximum time was spent in browsing activity (33.40%) followed by walking while grazing (22.30%), walking (13.60%), grazing (8.10%), rumination while standing (5.45%).

### Exp. 2 Growth performance of camels kept under common rangeland system

Twenty-Five animals of different age groups were taken for study on similar pattern as followed by camel keepers. During period of study (Nov.2001 to Mar.2002) body weight of camel calves were maintained, indicating that sufficient edible biomass was available for growth of camel calves through browsing/ grazing rangeland area.

Before grazing soil samples were analysed for various fertility parameters. Soil was observed to be alkaline in nature and deficit in nitrogen and phosphorus.



Fig.4.7.1 Phog – *Calligonum polygonoides*



Fig.4.7.2 Jal – *Salvadora oleoides*



The availability of vegetation (November to March) of rangeland was 38.50% Pala, 10.40% Phog, 4.30% Ker, 19.30% Jal, 18.70% Khejri and 8.80% Israeli babool.

### **Chemical composition of available vegetation of rangeland area**

The proximate chemical composition of trees and bushes in respect of DM, CP, CF, TA, NRE was studied in rangeland area. The % CP content in analysed tree leaves and bushes ranges from 13-18% and 13-20% respectively.

### **Vegetation preference study**

Choice of vegetation of camel in rangeland during different quarters was also recorded. In this study Oct to Dec. 2001 the maximum choice of vegetation was pala (50.35%), followed by Jal (17.20%), Khejri (15.40%), Phog (10.45%), Ker (6.63%).

In the month of Jan. to Mar. 2002, the maximum choice of vegetation was Phog (28.70%), Pala (23.80%) followed by Ker (20.10%), Khejri (18.90%), Ker (8.50%).

### **Grazing behaviour study of camels under rangeland area**

In this study 25 animals of different age groups were observed for the month-wise behaviour study from Nov.-March. In November, more time was spent in browsing activity (29.16%) followed by walking, grazing, walking while grazing, rumination while sitting, standing and sitting 21.87, 15.56, 14.17, 8.33, 4.20, 3.20% respectively.

In December, the maximum time was spent in browsing i.e., 30.31% followed by walking, grazing, walking while grazing, rumination while sitting, standing while rumination i.e., 20.83, 14.58, 7.29, 6.25, 4.10% respectively.

In month of Jan.2002 the maximum time was spent in browsing (24.40%), followed by walking (17.20%), walking while grazing (15.30%), grazing (8.30%), standing (10.35%), and sitting (8.10%).

In month of Feb. 2002, the maximum time was spent in browsing activity (26.50%), followed by walking (20.30%), walking while grazing (13.40%), standing (12.40%) and grazing (7.35%).

In month of Mar., 2002, the maximum time was spent in browsing i.e., 28.40% followed by walking, walking while grazing, and grazing i. e., 23.10, 15.30, 6.25% respectively.

**Table 4.6.7.1. Comparison of average body weight/daily gain (kg) in camel calves under different grazing**

Parameter	Sewan	Silvipasture
No.of camels	2	3
Initial B.wt. (kg.)	425.00	407.33
Final B.wt. (kg.)	452.00	428.00
Body wt. gain (kg)	27.00	21.00
Average daily gain (kg) (over 122 days)	0.221	0.172

#### 4.8 Agricultural farm unit

The farm activities performed during the year were confined in block no. 1& 2. The old trees and existing pasture (Gramna and Sewan) were renovated while performing requisite agricultural operations and applying farmyard manure. This year farm office came into existence and about three hundred trees and shrubs have been planted around the office and established lawn. The collaboration with Rajasthan Forest Department has been extended and 25000 tree saplings have been planted. The species comprises of *Acacia tortilis*, *Prosopis cineraria*, *Zizyphus nummularia* and *Tecomella undulata*.

Under the Net-work collaborative programme 4.5 ha blue panic grass pasture were renovated and tree saplings were introduced. Thorn fence was further strengthened around the area.

The 35 tree guards were fabricated and erected along with the roadside trees of Neem. The protection of trees with the help of tree guards remains quite useful for over all development of plants.

## 5. Technology Assessed and Transferred

1. Technology of preparation of tea and coffee from camel milk and fermented milk was successfully developed. The acceptability was about 85 percent.
2. Breeding efficiency of farm camel herd improved significantly in terms of percent conception through adoption of modified research techniques under natural breeding at farm conditions.

## 6. Education and Training

SCIENTISTS			
Name and Designation	Training	Place	Date
S. K. Ghorui (Sr. Scientist)	Training programme on Vigilance Awareness Training Programme	CIFE, Mumbai	Feb, 1-4, 2002
S. Vyas (Sci. Sr. Scale)	Winter school on biotechnological advances in aided reproductive technologies	NIANP, Bangalore	Dec, 4-24, 2001
R. Kumar (Scientist)	National Training Programme on "Taxonomy, Biology and Vector Potential of ticks"	AICRP on Blood Protista, CCS-HAU, Hisar	Nov 26 – Dec 1, 2001
	Training course on "Molecular Biology, Hybridoma and cell culture Techniques"	IVRI, Izatnagar	Feb 12- Mar 11, 2002
Gorakh Mal (Scientist)	Refresher course on faculty development programme in research management	CCSHAU, Hisar	Nov, 7 – Dec. 4, 2001
F. C. Tuteja (Scientist)	A Training course on "Molecular Biology, Hybridoma and Cell Culture Techniques	NBC, IVRI, Izatnagar	Feb 12 - Mar 11, 2002
ADMINISTRATIVE STAFF			
Ram Kumar (P.A.)	<i>Alpakalik gahan Hindi prashikshan</i>	Central Hindi Training Inst., Rajbhasa Vibhag, Delhi	Jan, 14-18, 2002
Harpal Singh Kaundal, (Jr. Steno)	Training course on "Web Designing"	IASRI, New Delhi	Oct, 15-20, 2001
Anil Jajoria, (Sr. Clerk)	Computer Application for Administrative and Financial Management	NAARM, Hydrabad	July, 17-27, 2001

## 7. Awards and recognition

Dr. Rajender Kumar, Scientist (Veterinary Parasitology) was awarded prestigious Jawahar Lal Nehru Award for outstanding Post Graduate Agricultural Research 2000 in the field of Veterinary Parasitology by Indian Council of Agricultural Research on July 16, 2001 at New Delhi.

## 8. Linkages and collaborations

### I National Level

- RAU, Bikaner : Research work of MVSc and Ph.D. students
- CCSHAU, Hissar(Haryana) : Research work of MVSc and Ph. D. students
- MAFSU, Nagpur (Maharashtra) : Research work of MVSc and Ph. D. students
- NDRI, Karnal (Haryana) : Camel milk analysis especially on protective proteins
- CSWRI, Avikanagar (Raj.) : Camel hair its utilization in form of blends
- CIAE, Bhopal ( M.P.) : Camel drawn implements & their performance.
- S. P. Medical College, Bikaner: Camel milk as nutritional adjuvant in treatment of Tuberculosis & type-II diabetes
- AIMS, New Delhi : Structure of protective proteins & its functional activity.

### II International level

- CIRAD-EMVT, France : Research and training

### Ph. D. Thesis

#### 1. Ultrasound scanning and serum progesterone profile for studying effect of photoperiodic control on female reproduction in *Camelus dromedarius*

Scholar : Sumant Vyas

Major Advisor: Prof. P.K. Pareek, RAU, Bikaner

#### Abstract

In all 184 ultrasonographic examinations were performed on 14 she camels for examination of ovarian status. There was absence of follicle and CL in ovaries of all she camels before the start of the experiment. The periodic ultrasonographic examination of the ovaries of seven she camels which were subjected to 'application of mask over eyes' revealed follicular growth sufficient to attain ovulatory size (>0.8 cm diam.) in six out of seven (85.7 %) she camels and therefore they were mated with virile studs. A measurable follicle

( $\geq 0.5$  cm diam.) could be observed in 57.1 and 100 percent masked she camels by the end of second and third weeks of the experiment respectively. Follicles of ovulating size ( $> 0.8$  cm diam.) could be observed in 14.3, 28.6, 14.3, 14.3 and 14.3 percent of masked she camels at third, fourth, fifth, sixth and seventh week of treatment respectively. Ovulation occurred in 50 and 100 percent of matings when follicle size ranged from 0.8-1.0 cm and 1.01-3.72 cm diam. respectively. Folliculogenesis of limited extent (follicle of 0.6 cm diam.) was observed only in 14.3 percent of she camels kept as control.

The ultrasonographic examination for early pregnancy diagnosis revealed three out of six she camels of the treatment group which responded to the treatment and were mated with virile studs, as pregnant. The conceptus could be recognized at day 18-20 post mating as discrete accumulation of fluid in the lumen of the left uterine horn. In all three cases, conceptus was found in left horn. The embryo proper or fetus was easily discernible by day 23-30 post mating as a small echogenic blob inside the conceptus. The amniotic (slightly echogenic) and allantoic (clear, anechoic) fluids could be easily recognized by day 40 post mating. The optic and cardiac regions could also be discerned by day 30 post mating as anechoic spot in the head and trunk region of fetus. The mean values of heartbeat on day 30 and 40 post mating were  $202.66 \pm 3.53$  and  $174.67 \pm 3.52$  beats/min respectively.

The mean serum progesterone concentration values remained 0.1-0.2 ng/ml before mating and in non-mated she camels during the experiment. The serum progesterone level increased after ovulation and remained higher than 1.0 ng/ml in pregnant she camel.

The use of 'Heat Detector' for measurement of vaginal electrical resistance (VER) did not give significantly different values under various utero-ovarian conditions viz. no follicle, follicles of 0.5, 0.5-0.79 and  $\geq 1.0$  cm diam., CL and early pregnancy in she camel.

The sexual behaviour 'rut' could be initiated in the male camels by parading them in front of the she camels during the present experiment. However it can be safely concluded by the observations made during the present experiment that sexual receptive behaviour in she camels is not always linked to presence of follicle measuring 0.84-3.72 cm diameter.

#### **M.V.Sc. Thesis**

##### **1. Microsatellite marker studies for genetic characterisation in Bikaneri camel**

M.V.Sc. Scholar : Kavita Tyagi  
Major Advisor : Dr.B.K.Beniwal, RAU, Bikaner  
Co- Advisor : Dr.S.C.Mehta

#### **Abstract**

The blood samples for isolation of genomic DNA were collected from NRCC, Bikaner and Field. The genomic DNA was isolated by phenol-chloroform extraction method with minor modification. The quality of genomic DNA was determined by spectrophotometer and agarose gel electrophoresis.

The polymerase chain reaction using eleven microsatellite primer pairs was done for amplification of microsatellite loci. The reaction volume was kept constant at 25 $\mu$ l in a 500  $\mu$ l GeneAmp tube. PCR amplification was carried out in a thermal cycler. The PCR products were electrophoresed in 1 % agarose gel in 1X TBE buffer system. DNA bands were visualised by ethidium bromide staining under UV Transluminator and documented. The PCR amplified products were separated by denaturing sequencing gel electrophoresis. The gel was stained with silver nitrate procedure and then dried under vacuum at 80°C for 45 minute to 1 hr. The conservation of camel microsatellite primer pairs were observed and recorded. Scoring of the allele was done manually. The allele frequency, expected heterozygosity and polymorphic information content were observed using the standard formula.

Six out of eleven microsatellite primer pairs were optimised. Primers VOLP-08, VOLP-10, YWLL-09, YWLL-44, YWLL-58 and YWLL-59 amplified the specific bands. Number of alleles ranged from two to five in Bikaneri camel at six microsatellite loci. The most polymorphic primer was VOLP-10 in which a total of 5 alleles were observed. The expected heterozygosity in Bikaneri camel ranged from 0.289 to 0.686. The expected heterozygosity was lowest at the locus VOLP-08 followed by YWLL-09 with the expectation of 0.339. Rest of the four microsatellite loci viz. VOLP-10, YWLL-44, YWLL-58 and YWLL-59 revealed more than 40% expected heterozygosity. This indicates that the above six primers can very well be utilised for further genetic studies which may include characterisation, conservation and production enhancement.

## 2. Genetic characterisation of Jaisalmeri camel using microsatellite markers

M.V.Sc. Scholar :	Lokesh Gautam
Major Advisor :	Dr.R.S.Gahlot, RAU, Bikaner
Co- Advisor :	Dr.S.C.Mehta

### Abstract

The genetic diversity of most livestock species is reducing and it is not possible to preserve all livestock breeds. In order to preserve as much of the genetic diversity as possible we must first have a robust method of measuring the genetic differences between breeds. Genetic characterisation of Jaisalmeri camel has long been a challenging issue due to lack of observable differences in cytogenetic and biochemical studies, despite existence of phenotypic distinctions among breeds. Microsatellites are considered the most powerful genetic markers for genetic characterisation of different breeds. The blood samples for isolation of genomic DNA were collected from NRCC, Bikaner and from field. The genomic DNA was isolated by phenol-chloroform extraction method with minor modification. The qualitative and quantitative estimation of genomic DNA was determined by spectrophotometer and agarose gel electrophoresis.

The six out of eleven microsatellite primer pairs were optimised. Primers VOLP-08, VOLP-10, YWLL-09, YWLL-44, YWLL-58 and YWLL-59 amplified the specific bands. Number of alleles ranged from two to five in Jaisalmeri camel at six microsatellite loci. The most polymorphic primers were VOLP-10 and YWLL-

44 in which a total of 5 alleles were observed at locus. The expected heterozygosity in Jaisalmeri camel ranged from 0.32 to 0.651. The expected heterozygosity was lowest at the locus YWLL-09 followed by YWLL-59 with the expectation of 0.444. Rest of the four microsatellite loci viz. VOLP-08, VOLP-10, YWLL-44 and YWLL-58 revealed more than 58% expected heterozygosity. This indicate that the above six primers can very well be utilized for further genetic studies which may include characterisation, conservation and production enhancement.

### 3. Genetic polymorphism of DRB3 locus in cattle and livestock species

M.V.Sc. Scholar : Potdar Vinod Vijayrao  
Major Advisor : Dr.A.D.Deshpande, MAFSU, Nagpur  
Co- Advisor : Dr.S.C.Mehta

#### Abstract

MHC-Class I, Class II and Class III genes are associated with a number of diseases of economic importance such as mastitis, ketosis, retention of placenta in cattle; resistance or susceptibility to sarcoid tumour in equines; resistance to parasitic infection in sheep. Amplification of MHC-DRB3 locus was successfully attempted in cattle (BoLA), horse (ELA), donkey (ELA), sheep (OLA) and buffalo (BuLA) using the primers, LA31 and LA32. The fragment size observed in all species was 308 bp in 1 % agarose gel and 6% urea PAGE.

The RFLP analysis of BoLA-DRB3 fragment with restriction enzyme *Hinf*I revealed heterozygous status at this locus in all the animals. The molecular size of fragments was 261, 41 and 167, 94 and 47 bp. This indicates that one site for the restriction enzyme *Hinf* I has been created possibly due to mutation. RFLP analysis of ELA and OLA DRB3 fragment revealed homozygous status at this locus in all the animals under investigation. In case of ELA-DRB3 the fragment were of 221 and 87 bp, where as in sheep the fragment were of 212 and 96 bp. This indicates that atleast one restriction site of *Hinf* I enzyme was present in both the species at this locus.

The BoLA, OLA and ELA-DRB3 fragment were successfully digested with *Rsa*I. This enzyme revealed heterozygous status in above species. No intraspecies variation was detected. The enzyme *Rsa*I has two restriction sites in all the three species i.e. cattle, sheep and donkey. The fragment observed in cattle and sheep were of the same size (308 & 160, 81,67 bp) indicating the genetic similarity in the two species. However the fragment were of different size in donkey (138,85,85bp) as compare to cattle and sheep.

The B- variant of k-casein has been reported to be favourable for milk quality, as it is associated with higher protein percentage. The genotyping of animals at k-casein locus can be one among the criteria for selection of animals for dairy. Using the primers, K1 and K2 reported for buffalo amplification of k-casein

fragment was successfully done in cattle, buffalo and sheep. Fragment size observed in cattle, buffalo and sheep was 379 bp.

Digestion of k-casein fragment with *HinfI* in cattle and buffalo revealed heterozygous and homozygous status respectively. In cattle the fragments were of 288, 91 and 153, 135, 91 bp, where as the buffaloes were homozygous with the fragments of 288 and 91 bp. Since the B-variant of k-casein is favorable for milk quality, all the buffaloes in present investigation were of homozygous (BB) genotype, whereas all the cows in present investigation were heterozygous at this locus.

The k-casein fragment obtained by PCR amplification in sheep was also digested with *HinfI* to see the possible similarity or differences with cattle and buffalo at this locus. The restriction fragment length polymorphism indicated that the status at this locus in sheep is altogether different from cattle and buffaloes because the fragments observed in sheep (174,123,82 bp) were all different from fragments observed in cattle and buffaloes. The same appears very relevant because the composition and properties of sheep milk is very much different from that of cattle and buffalo.

The Polymerase Chain Reaction amplified fragment of k-Casein in cattle and buffaloes were analysed for restriction fragment length polymorphism pattern with *Hind III*. In cattle heterozygous status with fragments of 379 and 225, 154 bp were observed whereas in buffaloes homozygous status with fragments of 225, 154 bp was observed. All the buffaloes in present investigation were BB and hence are more suitable for the dairy. In cattle all animals were heterozygous as has been observed with *HinfI* digestion. This confirms that the animals (cattle) under investigation are heterozygous for most suitable 'B' allele.

#### **4. Camel Lactoferrin, a Transferrin-cum-Lactoferrin: Crystal Structure of Camel Apolactoferrin at 2.6 Å Resolution and Structural Basis of its Dual Role**

Ph.D. Scholar : Javed A. Khan

Co-Advisor : Raghvendra S. Yadav

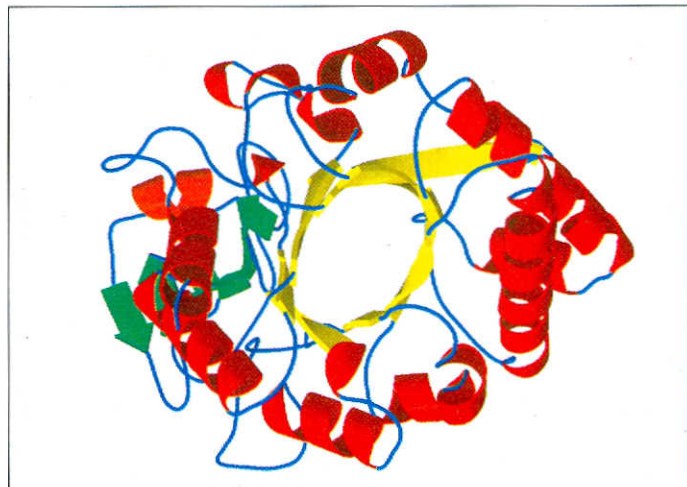
Major Advisor : Tej P. Singh, Dept. of Biophysics, AIIMS, New Delhi.

#### **Abstract**

Camel lactoferrin is the first protein from the transferrin superfamily that has been found to display the characteristic functions of iron binding and release of lactoferrin as well as transferrin simultaneously. It was remarkable to observe a wide pH demarcation in the release of iron from two lobes. It loses 50% iron at pH 6.5 and the remaining 50% iron is released only at pH values between 4.0 and 2.0. Furthermore, proteolytically generated N and C-lobes of camel lactoferrin showed that the C-lobe lost iron at pH 6.5, while



the N-lobe lost it only at pH less than 4.0. In order to establish the structural basis of this striking observation, the purified camel apolactoferrin was crystallized. The crystals belong to monoclinic space group C2 with unit cell dimensions  $a=175.8 \text{ \AA}$ ,  $b=80.9 \text{ \AA}$ ,  $c=56.4 \text{ \AA}$ ,  $\beta=92.4$  and  $Z=4$ . The structure has been determined by the molecular replacement method and refined to a  $R$ -factor of 0.198 ( $R$ -free=0.268) using all the data in the resolution range of 20.0-2.6  $\text{\AA}$ . The overall structure of camel apolactoferrin folds into two lobes which contain four distinct domains. Both lobes adopt open conformations indicating wide distances between the iron binding residues in the native iron-free form of lactoferrin. The dispositions of various residues of the iron binding pocket of the N-lobe of camel apolactoferrin are similar to those of the N-lobe in human apolactoferrin, while the corresponding residues in the C-lobe show a striking similarity with those in the C-lobes of duck and hen apo-ovotransferrins. These observations indicate that the N-lobe of camel apolactoferrin is structurally very similar to the N-lobe of human apolactoferrin and the structure of the C-lobe of camel apolactoferrin matches closely with those of the hen and duck apo-ovotransferrins. These observations suggest that the iron binding and releasing behaviour of the N-lobe of camel lactoferrin is similar to that of the N-lobe of human lactoferrin, whereas that of the C-lobe resembles those of the C-lobes of duck and hen apo-ovotransferrins. Hence, it correlates with the observation of the N-lobe of camel lactoferrin losing iron at a low pH (4.2-2.0) as in other lactoferrins. On the other hand, the C-lobe of camel lactoferrin loses iron at higher pH (7.06.0) like transferrins suggesting its functional similarity to that of transferrins. Thus, camel lactoferrin can be termed as half lactoferrin and half transferrin.



Picture of Camel lactoferrin crystal

## 9. AICRP/Coordination Unit/National Centres

### All India coordinated research project on “Increased system of animal energy with enhanced system efficiency”

Centre is collaborating with Deptt. Farm Machinery and Power Engineering, College of Technology and Agricultural Engineering, Maharana Pratap University of Agriculture and Technology, Udaipur, for their AICRP on “Increased system of animal energy with enhanced system efficiency”. The objectives of this programme are-

- 1 ORP trials on improved implements for camels.
- 2 Standardization of two- wheeled/four-wheeled camel cart.

- 3 Evaluation of camel based agro-processing complex including irrigation, thrashing, cleaning, and chap-cutting operation.
- 4 Effect of diets of varying energy-protein ratio on performance of draught animals.

The work was done under the experiment no. 4 at the centre with Dr. Aminudeen, as Principal investigator.

Eight adult draught camels were maintained under two dietary treatments T1- 3 kg concentration in addition to Guarphalgati, T-2 Guar phalgati alone. They were used in cart with load on a kuccha track for a total of 24.5 km. Comparison of average draught capacity of two groups shows that average performance of group T1 was better than group T2.

The biochemical profiles at the start and at the end of carting revealed that there was no significant change in plasma glucose whereas other profiles exhibited significant to highly significant changes (Table 9.1)

**Table 9.1 Biochemical profiles of camel**

Parameter	Group T1		Group T2	
	t value	D.f.	t value	d.f.
Glucose	0.2790	25	1.89	31
Triglyceride	4.83 **	23	6.85**	31
Creatinine	6.10**	24	3.30**	31
Creatinine Kinase	2.27**	25	4.11**	31
Lactate dehydrogenase	3.35**	25	1.483	31
Urea	4.91**	24	2.42**	31

## GENERAL / MISCELLANEOUS

### 10. List of Publications

#### I. Research Papers

1. Aminu Deen, Gorakh Mal and M. S. Sahani (2001): Applicability of commercial progesterone analysis kits standardized on human serum/ plasma for progesterone analysis in camel. *J. Camel Practice and Research* 8 (2): 221-26.
2. Bhakat,C., Mehta,S.C. and Sahani, M.S. (2002). Studies on hair production attribute in Indian dromedary camel managed in an organised farm. *The Indian Journal of Animal Sciences*.72(3) : 275-276.

3. Dixit, S.K., Qidwai, A.U. and Tuteja, F.C. (2001) Evaluation and Comparison of therapeutic values of coccidiostats. *Veterinary Practitioner*. 2:75-78
4. Mal, G., Sena Suchitra, D., and Kumar, R. (2001). Serum biochemical observations on mange in camels. *Indian Veterinary Journal*. 78:104-106.
5. Mal, G., Sena, Suchitra D., Kumar R. and Sahani, M.S. (2001). A note on haematological and mineral profile of bactrian and dromedary camel. *Indian Journal of Animal Sciences* 71:1162-63.
6. Nagpal, A.K. and M.S. Sahani (2001). Investigations on nutrient intake and utilization in adult male draft camels in Indian arid eco system. *Indian J. Anim. Prod. Magmt.* 17(1&2): 46-48.
7. Nagpal, A.K. and Arora M. (2002). Utilization of guar phalgati and groundnut haulms based complete feeds in camel calves. *Indian Journal of Animal Nutrition*, 19(1): 69-72.
8. Nagpal, A.K and M. S. Sahani. (2001). Improvement in nutrient utilization and growth of Bikaneri camel calves through dietary supplementation of urea molasses mineral blocks. *Indian J. Anim. Prod. Magmt.* 17(1&2): 14-16.
9. Sahani M.S and Bhakat Champak (2002). Camel – A source of livelihood of farmers in the hot arid region. *Agri Gold Swarna Sedyam*. 5 (3): 40 – 42.
10. Sena, Suchitra D, Mal, G., Kumar, R and Sahani, M.S. (2001). A preliminary study of prevalence of mastitis in camel. *Journal of Applied Animal Research* 20:27-31
11. Sena, Suchitra D., Mal, G., Kumar, R. and Sahani ,M.S. (2001) Clinical trial on mange in camels. *Pashu Dhan* 16:4 & 8.
12. Singh, A.P. Vashista, M.S., Dixit, S.K. and Gahlot, A.K. (2001). Role of minerals in Livestock-A review *Veterinary Practitioner* 2:1-16.
13. Tuteja, F.C., Sahani , M.S., Kumar, R., Ghorui, S.K. and Sharma, N. (2002). Tetanus in camel (*Camelus dromedarius*): A case report. *Indian Journal of Veterinary Medicine* 21(2): 112-113.
14. Vyas, S., Pareek, P.K., Purohit, G.N. and Sahani, M.S. (2001). Management practices for augmenting rut in male *Camelus dromedarius*. *Veterinary Practitioner*, 2 (2): 132-34.

### II. Papers presented in Symposium/Workshop/Conference/Seminar

1. Aminu Deen, Mal, G., and M.S. Sahani (2002): Muscular weakness and Anorexia due to overload exertion in a camel. National Symposium and XX ISVM convention, Bikaner, 2002.
2. Bhakat, C., Mehta S.C and Sahani M.S (2002). Factors affecting hair production attribute in Indian dromedary camel reared in an organised farm, National Conference on Agricultural heritage of India. 10 to 13 Feb - 02, RAU, Udaipur – 313001: 21.
3. Dixit, S.K., Singh, A.P., Tuteja, F.C., Kumar, R., Sharma, N. and Ghouri, S.K. (2002). Indigenous formulation against mange in dromedary camel- a preliminary trial. National Symposium on Recent

- Trends in Diagnostics and Therapeutics of Animal Diseases and XVIII Annual Convention ISVM. Feb. 14-16,2002. Bikaner.pp. 162.
4. Dongre, R.A. Singh, A.P., Dixit, S.K. and Mali, M.M. (2002). Haematological study in relation to trace mineral status in camels. National symposium on Recent Trends in Diagnostics and Therapeutics of Animal Diseases and XVIII Annual convention ISVM, Feb. 14-16, 2002 Bikaner.
  5. Duggal, G.P., Mehta, J.S., Aminudeen and Pareek, P.K. (2001). Effect of cryopreservation on seminal trials and enzyme leakage in relation to initial individual sperm motility in camel. XVII Annual Convention of ISSAR, Jodhpur, 6-8 Oct. pp. 51
  6. Ghorui, S.K and Kumar, R.(2001). Further immunochemical characterisation of isolates of *Trypanosoma evansi*. Abstract: XII<sup>th</sup> National Congress of Veterinary Parasitology and Annual Convection of IAAVP, August 25-27, 2001 held at Tirupati, pp 103.
  7. Kiradoo, B.D., Purohit, R., Saini, N. and Sahani, M.S. (2001). Grazing behaviour of growing camel calves under 3 tier silvipasture system. Proc. X Anim. Nutr. Cong., Karnal, pp. 284.
  8. Kiradoo, B.D., Purohit, R., Saini, N. and Sahani, M.S. (2001). Performance of camel calves kept on silvipastoral browsing/ grazing management system. Proc. X Anim. Nutr. Cong., Karnal, pp. 285.
  9. Kumar R., Sena, Suchitra D. Mal, G. and Sahani, M.S. 2001. Epizootiological, haemato-biochemical and therapeutic studies on gastro-intestinal nematodosis in Indian dromedary camel, International Twin Conference of Reproduction / Production in Camelids, Al Ain, U.A.E., Nov. 11-13, 2001.
  10. Mal, G., Sena, Suchitra D., Kumar R. and Sahani, M.S. 2001. A note on haematological and mineral profile of bactrian and dromedary camels . International Twin Conference of Reproduction / Production in Camelids, Al Ain, U.A.E., Nov. 11-13, 2001.
  11. Mehta, S.C., Bithu, H.K., Poonia, S.R., Rajender Kumar and M.S. Sahani. (2002). Health problems of Jaisalmeri camel in the breeding tract. Presented in National Symposium on Recent Trends in Diagnostics and Therapeutics of Animal Diseases and XVIII Annual Convention ISVM. Feb. 14-16,2002. Bikaner pp. 153.
  12. Nagpal, A.K. and M. Arora. (2001). Nutritional evaluation of guar phalgati and tree leaves based complete diets in camel calves. In: proceedings of X Animal Nutrition Conferences, NDRI, Karnal, Nov. 9-11, 2001, p 35.
  13. Nagpal, A.K., Roy, A.K. and Arora, M. (2001). Voluntary intake and utilization of guar phalgati based complete ration in camel calves. In: Proceedings of X Animal Nutrition Conference, NDRI Karnal, Nov. 9-11, 2001 p 34.
  14. Purohit, R., Kiradoo, B.D., Mal, G., Saini, N., Mehta, S.C. and Sahani, M.S. (2001). Effect of supplementation of green grass (*Panicum antidotale*) on milk production of Bikaneri camel. Presented in

X<sup>th</sup> Animal Nutrition Conference of Animal Nutrition Society of India N.D.R.I. Karnal, November 9-11, 2001. pp 281.

15. Purohit, R., Kiradoo, B.D., Saini, N. and Sahani, M.S. (2001) Feed preference and grazing behaviour of camel under rangeland condition. Proc. X Anim. Nutr. Cong. Karnal pp.34
16. Singh, G.P. (2001) Livestock production and environment protection-Lead paper. Proc. X Anim. Nutr. Cong., Karnal, pp. 211-221.
17. Singh, G.P. and Saini, N. (2001) Effect of weaning of camel calves on growth performance and their economics of feeding. Proc. X Anim. Nutr. Confr., Karnal, 281-282.
18. Singh, G.P. and Saini, N. (2001). Effect of groundnut chara on intake, digestibility and nitrogen recycling pattern in camel. Proc. X Anim. Nutr. Confr., Karnal, 283.
19. Singh, G.P. and Saini, N. (2001). Moth Chara as supplement in Guar chara based diet of camel. Proc. X Anim. Nutr. Confr., Karnal, 283.
20. Singh, G.R. and Saini, N. (2001). Effect of nitrogen source on the crude protein and fiber digestibility and cost of feeding of camel. Proc. X Amim. Nutr. Conf. Karnal 341:282.
21. Tuteja, F.C., Dixit, S.K., Kumar, R., Ghouri, S.K. and Sahani, M.S. (2002). Prevalence of non-clinical mastitis in camels. National Symposium on Recent Trends in Diagnostics and Therapeutics of Animal Diseases and XVIII Annual Convention ISVM. Feb. 14-16, 2002. Bikaner. pp 161.
22. Vyas, S. and Sahani, M.S. (2001). Use of Super-OV and Clomiphene citrate in augmentation of reproduction in camel heifers. In XVII Convention of Indian Society for the Study of Animal Reproduction, Jodhpur, 6-8 Oct. 2001. pp. 112.

### III. Popular articles

1. Bhakat C., Chaturvedi, D. and Sahani, M.S. (2002). *Utonh ka rakhrakhaw : Ak atiriket ai ka sadhan. Choki Kheti* 1(7) : 3.
2. Bhakat C., Chaturvedi, D., Sharma, N. and Sahani M.S (2001) *Utonh ka prashav samandhit mahatapurna jankaria abon rakhrakhaw prabhand*, Brochure, NRCC, Bikaner.
3. Tuteja, F.C. and Verma, R.K. (2001). *Pashuon mein thenella. Chara Patrika*, 3: 3-4.
4. Vyas, S. (2001). *Kritrim garbhadan- Ek takniki parichaya. Pashudhan*, September 2001. pp 2-4

## 11. List of approved on going projects (IX plan)

- 11.1 Genetic characterization, evaluation and conservation of indigenous camel breed.
- 11.2 Improvement of the working efficiency of camel under arid and semi arid conditions
- 11.3 Improvement of reproductive efficiency and to study the causes of reproductive failure in camels.
- 11.4 Studies on feed requirement and feed resources evaluation in camel for optimum production.
- 11.5 To study the economics of different camel management practices under arid and semi arid eco-system.
- 11.6 Surveillance, monitoring and control of camel diseases.

## 12. Management Committee, RAC , SRC Meetings

### I. Composition of I.M.C of NRCC, Bikaner

Dr. M.S. Sahani	:	Chairman
Director Animal Husbandry Dept. Raj.	:	Member
Director Animal Husbandry Dept. Gujarat	:	Member
Dr. Arun Varma ADG (AN&P), ICAR, New Delhi	:	Member
Dr. G. P. Singh, PS	:	Member
Dr. Raghvendra Singh, Sci. Sr. Scale	:	Member
Dr. A.K.Nagpal, Sr. Scientist	:	Member
Sh. A. K. Mallick, AAO	:	Member Secretary
AF&AO, CAZRI, Jodhpur	:	Member

The meeting of I.M.C. was held on 23.3.2002

Following decisions were taken

1. Purchase of certain miscellaneous item of E.F.C. equipment during the current financial year was approved.
2. Renovation of laboratories, conferance hall was approved.
3. Preparation of display board, renovation of residential quarters, purchase of tree guards, scrapper cum leveler, boring of new tubewell, 2 television air conditioners, shunt capacitor etc. were approved.

### II. RAC

New committee is under constitution.

### III. SRC meeting

Annual meeting of scientific research council was held on 11.6.2002 to discuss the research activities of the centre under the chairmanship of Director, NRCC, following subject matter experts participated :

1. Dr. G.R. Purohit, Professor & Head, Dept. of Animal Nutrition, CVAS, Bikaner
2. Dr. K.M.L. Pathak, Professor & Head, Dept. of Vet. Parasitology, CVAS, Bikaner
3. Dr. P.K. Pareek, Professor & Head, Dept. of Vet. Gynae. Obst. & Reprod., CVAS, Bikaner.

The research work carried during the year 2001-02 under the various approved research projects and schemes of the institute were thoroughly discussed.

### 13. Participation of scientist in conferences, meetings, workshops and symposia

<b>SCIENTISTS</b>			
<b>Name and Designation</b>	<b>Seminar/Symposium</b>	<b>Place</b>	<b>Date</b>
G. P. Singh (Pr. Scientist)	X <sup>th</sup> Animal Nutrition Conference	NDRI, Karnal	Nov 9-11, 2001
Aminu Deen (Pr. Scientist)	XVIII annual convention of Indian Society for Veterinary medicine	CVAS, Bikaner	Feb 14-16, 2002
A.K. Roy (Sr. Scientist)	X <sup>th</sup> Animal Nutrition Conference	NDRI, Karnal	Nov 9-11, 2001
S. K. Ghorui (Sr. Scientist)	XVIII annual convention of Indian Society for Veterinary medicine	CVAS, Bikaner	Feb, 14-16, 2002
S. K. Dixit (Sr. Scientist)	XVIII annual convention of Indian Society for Veterinary medicine	CVAS, Bikaner	Feb, 14-16, 2002
S. Vyas (Sci. Sr. Scale)	XVII convention of Indian Society for study of Animal Reproduction	Jodhpur	Oct, 6-8, 2001
S. C. Mehta (Scientist)	Internet engineering for Library and Information Centres.	Inflibnet Centre, Raj Univ., Jaipur	Feb, 14-16, 2002
R. Kumar (Scientist)	XII National Congress of Veterinary Parasitology	Tirupati, A. P.	Aug 25 - 27, 2001
<b>TECHNICAL STAFF</b>			
U. K. Bissa (Sr. VO, T-8)	XVII convention of Indian Society for study of Animal Reproduction	Jodhpur	Oct, 6-8, 2001
N. Sharma (LFST, T- 7)	XVII convention of Indian Society for study of Animal Reproduction	Jodhpur	Oct, 6-8, 2001
	XVIII Annual convention of Indian Society for Veterinary Medicine	CVAS, Bikaner	Feb, 14-16, 2002
B.L. Chirania (VO, T-6)	XVIII Annual convention of Indian Society for Veterinary Medicine	CVAS, Bikaner	Feb, 14-16, 2002
<b>ADMINISTRATIVE STAFF</b>			
Sh. Nemi Chand Barasa, (Hindi Translator, T II 3)	Hindi Karyashala	NAARM, Hydrabad	Nov, 6-9, 2001

## **14. Workshops, seminars, summer institutes and farmers' day etc.**

### **Computer training**

A training program on "**Advances in Information Technology and Database Management**" from February 6<sup>th</sup> to March 5<sup>th</sup>, 2002 was organised. This training programme exposed all the 44 in house participants, which includes 10 Scientist, 12 Technical, 9 Administrative and 13 SRF/ JRF/ RA/ Students, to the recent developments in the field of information technology, database management and bioinformatics. Subject matter specialists from different parts of country gave training to the participants. The Centre has published a compendium in the form of an edited book and released one CD prepared by Course Coordinator Dr. S.C. Mehta for future reference of the participants. This training programme was inaugurated by Dr. D. G. Dhandar, Director, Central Institute of Arid Horticulture, Bikaner and the honourable Vice-chancellor of Rajasthan Agricultural University, Bikaner Dr. C. P. S. Yadav chaired the valedictory function and appraised the trainees with the relationship between today's agricultural economy of the world and information technology. Sh. Dinesh Munjal, Technical Officer (T-5), has helped in conducting the course.

### **Extension activities**

#### **Service project on extension, communication and human resource development.**

Project leader : C. Bhakat

Associates : M.S.Sahani, N. Sharma, B.L. Chirania

### **Collaboration with NGO**

During the period the Centre has collaborated with various NGOs namely, Lokhit Pashu Palak Sansthan (A society for indigenous livestock research and development, Sadri, Pali). Scientists of the centre have gathered feed back information from camel keepers regarding camel management practices followed there. Centre also collaborated with Urmul Trust (Bikaner) in the field of popularisation of camel milk, hair, etc with an objective to create awarness and increase utility of these products. In the form of tea / coffee the camel milk is provided to various national and international visitors at NRCC and gathered feedback indicated positive response.



### Kissan Gosthi

During the period five Kissan gosthies, three at adopted village Gadwala, one each at State Krishi Vigyan Mela (RAU), Bikaner and at Jojavar (Pali) were organised. On these occasions the problems of camel management practices and disease aspects were discussed. About 25 camel keepers were apprised about advance management practices in the field of breeding, feeding, prevention of diseases and health care etc.

### Participation in Scientific Exhibitions:

Centre participated and organised exhibition in :

Indian International Trade Fair - from 14 to 27<sup>th</sup> Nov- 2001, at Pragati Maidan, New Delhi.

State Krishi Vigyan Mela, 2002 – on 24<sup>th</sup> March – 2002 at RAU, Bikaner.

The relevant literature in different disciplines was distributed among farmers, students and other visitors.

Live camel exhibition was also organised at the occasion of State Krishi Vigyan Mela on 24<sup>th</sup> March-2002 at RAU, Bikaner. The farmers were apprised of beneficial effects of camel milk. Camel milk tea, coffee was served among visitors.

Breeding inputs through superior elite studs of Bikaneri camels was provided to camel keepers of nearby villages during breeding season (Dec to Feb).

### Participation in camel festival (Jan 22-30, 2002) organised by RTDC and local administration, Bikaner

The Centre's camels participated in various events viz. milking competition, new born camel calf competition, camel hair clipping and decorations competition etc and won prizes in different events.

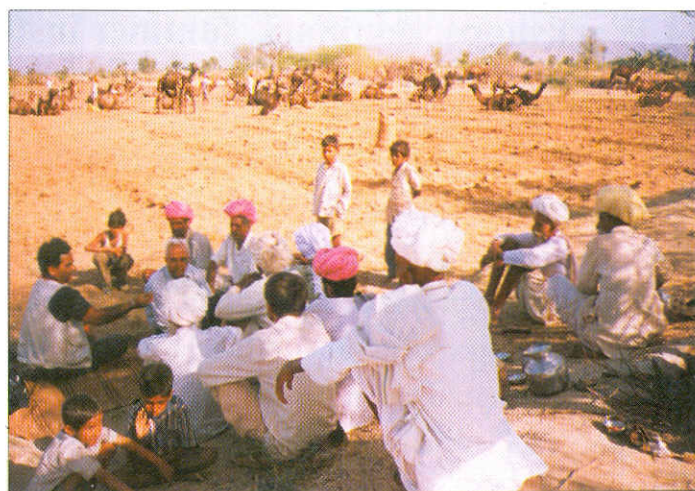


Fig. 13.1 : Dr. M.S. Sahani, director with camel farmers in Village Jojavar Dist. Pali



Fig. 13.2 : NRCC exhibition stall at India International Trade Fair, Pragati Maidan, New Delhi

### Animal Health Camp

Centre organised animal health camps at adopted village Gadwala (Bikaner). The health related problems were discussed and remedies were provided by subject matter experts. A substantial number of animals were also treated at these camps.

Efforts were made to achieve the revenue generation targets as per the instructions of council by providing camel safari, photography etc. The total revenue generation during the three months tourist season (Nov. 01 to Feb. 02) was Rs. 20,590.

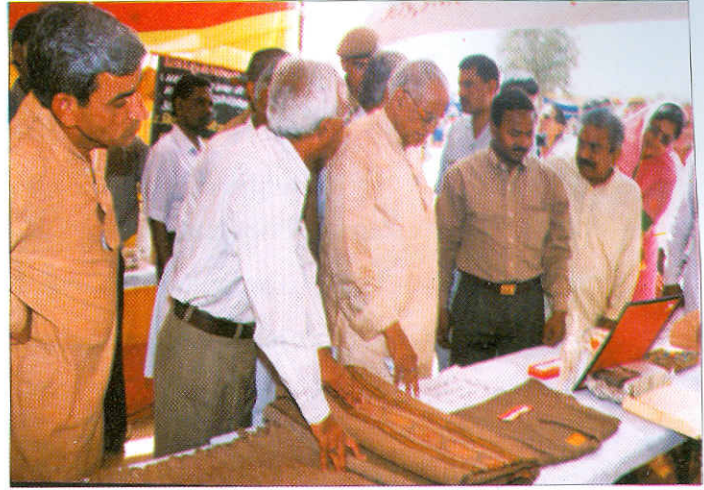


Fig.13.3 : Visit of Shri H.S. Kumher, State Minister, Animal Husbandry, in NRCC exhibition stall at State level

### हिन्दी सप्ताह, 2001

14 सितम्बर, हिन्दी दिवस के उपलक्ष पर केन्द्र में दिनांक 14-20 सितम्बर, 2001 तक हिन्दी सप्ताह आयोज्य रहा। इस अवधि के दौरान केन्द्र के अधिकारियों एवम् कर्मचारियों हेतु हिन्दी निबन्ध प्रतियोगिता, हिन्दी प्रश्नोत्तरी परीक्षा तथा साथ ही हिन्दी सप्ताह को और अधिक सक्रिय बनाने हेतु 'साक्षरता बनाम राष्ट्रीय विकास' विषयक हिन्दी में भाषण प्रतियोगिता भी आयोजित की गई। हिन्दी सप्ताह, 2001 के दौरान आयोजित प्रतियोगिताओं में डा. सुमन्त व्यास, श्री हरपाल सिंह, श्री रामेश्वर लाल ने प्रथम, श्री बलदेव किराडु, डा. अश्विनी रॉय व श्री अनिल कुमार ने द्वितीय स्थान प्राप्त किया। प्रतियोगिताओं में स्थान प्राप्त करने वालों को पुरस्कार व प्रशस्ति-पत्र प्रदान किए गए।

### हिन्दी कार्यशाला {21-22 मार्च, 2002}

राजभाषा कार्यान्वयन के अन्तर्गत केन्द्र में प्रथम बार दो दिवसीय {21-22 मार्च, 2002} हिन्दी कार्यशाला का आयोजन किया गया। दो दिवसीय कार्यशाला में कुल चार सत्र रखे गये जिसके अन्तर्गत विषय-विशेषज्ञों द्वारा विभिन्न शीर्षकों पर व्याख्यान दिये गए। केन्द्र में हिन्दी कार्यशाला के आयोजित किये जाने के पीछे मूल उद्देश्य केन्द्र के अधिकारियों एवम् कर्मचारियों को राजभाषा नीति सम्बन्धी जानकारी देना, दैनन्दिन कार्यों में हिन्दी के प्रयोग की ओर उन्मुख करना, हिन्दी के प्रयोग में आने वाली कठिनाइयों को दूर करने के साथ-साथ मसौदा/टिप्पणी लेखन के अतिरिक्त अन्य व्याकरण सम्बन्धी बाधाएं प्रस्तुत कर इनके निराकरण हेतु भी एक प्रयास रहा।



हिन्दी सप्ताह, 2001 में भाषण प्रतियोगिता में भाग लेते प्रतिभागी

अन्त में सदन के प्रति आभार व्यक्त करते हुए केन्द्र में आयोजित दो दिवसीय हिन्दी कार्यशाला का समापन हुआ।

## 15. Visits of dignitaries

Mr. H. K. Thakur, IRS, Joint Commissioner, Customs, Jaipur

Mr. S. Kapoor, DGIT (Inv.) Rajasthan, Jaipur

Mr. S. K. Gaur, G. M., Telcom, Bikaner

Prof. Dov. Pasternak, Principal Scientist, ICRISAT, Niasny, Niger.

Dr. G. Kalloo, DDG (Horticulture), ICAR, New Delhi.

Dignitaries were impressed with comprehensive approach, the quality of research work and detailed analysis/ examination being conducted at the centre on various aspects of camel. Mr. S. Kapoor appreciated the research work particularly in exploring the medicinal use of camel milk against human diseases and in improving the utility of camel breeds. Mr. H. K. Thakur opined that it is essential to explore the possibilities to diversify products out of camel husbandry which will help in self-employment of rural people. DDG (Horticulture) G. Kalloo expressed his views that it is an excellent centre for camel research and will serve the area by positive research on various aspects of camel.

A number of students from medical colleges, veterinary colleges, schools, universities, scientists, trainees, N.G.Os, farmers, farm women, youth, livestock owners, defence officers, administrators, field veterinarian, Indian and foreign educationists, journalists etc visited this Centre.

## 16. Personnel

Name of staff members (2001-2002)

Dr. M.S. Sahani

Director

### Scientific

Dr. G. P. Singh

Principal Scientist (Animal Nutrition)

Dr. Aminu Deen

Principal Scientist (Animal Reproduction)

Dr. A.K.Nagpal

Sr. Scientist (Animal Nutrition)

Dr. S. K. Ghorui

Sr. Scientist (Veterinary Parasitology)

Dr. S. K. Dixit

Sr. Scientist (Veterinary Medicine)

Dr. A. K. Roy

Scientist Sr. Scale (Animal Physiology)

Dr. Sumant Vyas

Scientist Sr. Scale (Animal Reproduction)

Dr. Raghvendar Singh

Scientist Sr. Scale (Animal Biochemistry)

Sh. Gorakh Mal

Scientist (Animal Biochemistry)

Dr. Rajender Kumar	Scientist (Veterinary Parasitology)
Dr. S.C. Mehta	Scientist (Animal Genetics & Breeding)
Dr. F.C. Tuteja	Scientist (Veterinary Medicine)
Mrs. Poonam Jayant	Scientist (Animal Biochemistry)
Dr. Champak Bhakat	Scientist (Livestock Production Mgmt.)
Dr. D. Suchitra Sena (On Study Leave from 08.09.2000)	Scientist (Veterinary Medicine)
Dr. Nirmala Saini (On Study Leave)	Scientist (Animal Nutrition )

### Technical

Dr. U. K. Bissa	Senior Veterinary Officer T-8
Dr. N. Sharma	Livestock Farm Superintendent, T-7
Sh. Ram Kumar	Farm Manager T-7
Dr. B.L. Chirania	Veterinary Officer, T-6
Sh. Dinesh Munjal (Promoted on 14.6.2001)	Technical Officer, T-5
Sh. M. K. Rao	Agricultural Assistant, T-4

### Administration

Sh. A. K. Mallick	Asstt. Admin. Officer
Dr. N. D. Sharma	Asstt. Fin. & Account Officer

## 17. Infrastructural development

The development work includes construction of metallic road from agricultural farm office to Railway crossing (Area No. 1), two irrigation tanks each of 2.0 lacs liter capacity near farm office in Block No. 1. Two VIP rooms were added in centre's Guest House and three residential quarters (type IV, type III and type II, one each) were completed.

## सारांश

### राष्ट्रीय उष्ट्र अनुसंधान केन्द्र : एक संक्षिप्त परिचय

पूर्व में उष्ट्र प्रजनन फार्म के नाम से जाना जाने वाला यह केन्द्र पशुपालन विभाग (राजस्थान सरकार) एवम् पशु चिकित्सा एवं पशु विज्ञान महाविद्यालय (राजस्थान कृषि विश्वविद्यालय) के अधीनस्थ रहा। शुष्क और अर्ध शुष्क भू-भागों के विकास में इस प्रजाति के महत्व को देखते हुए भा.कृ.अ.प. द्वारा जोड़बीड़, बीकानेर (राज.) में ऊँट से सम्बन्धित राष्ट्रीय उष्ट्र अनुसंधान केन्द्र की स्थापना 5 जुलाई, 1984 को की गयी। समय के साथ केन्द्र ने विगत वर्षों में अनुसंधान के क्षेत्र में राष्ट्रीय स्तर पर ही नहीं, अपितु विश्व-स्तर पर भी अपनी पहचान बनाई है। आज केन्द्र में आधुनिक प्रयोगशालाएँ तथा सभी आधारभूत सुविधाएँ उपलब्ध है। इस संपूर्ण अवधि के दौरान केन्द्र ने ऊँटों से सम्बन्धित विभिन्न पहलुओं पर ठोस वैज्ञानिक आँकड़े एकत्र किये हैं।

इस वर्ष के दौरान केन्द्र पर ऊँटों की कुल संख्या 270 थी। विभिन्न आयु वर्ग के इन सभी ऊँटों में मुख्यतः बीकानेरी, जैसलमेरी व कच्छी नस्ल के थे।

### विगत वर्षों में प्राप्त उपलब्धियाँ

- बीकानेरी, जैसलमेरी एवम् कच्छी नस्ल के ऊँट समूहों का विकास।
- शारीरिक माप, वृद्धि, दूध, बाल-उत्पादन जैसे महत्वपूर्ण अनुवांशिक गुणों के डेटा बेस का विकास।
- उचित प्रबन्धन द्वारा मृत्युदर को 20-30 प्रतिशत से 5 प्रतिशत कम करना।
- प्रथम ब्याँत तथा द्वितीय ब्याँत के अन्तराल को कम कर, औसत गर्भधारण संख्या बढ़ाकर प्रजनन क्षमता में सुधार।
- भारतीय ड्रोमेडेरी ऊँटों में जैवरसायनिक और रूधिर अध्ययन में अनुवांशिक विभिन्नता नगण्य/परन्तु आर.ए.पी.डी. तकनीक द्वारा विभिन्नता विद्यमान।
- बोझा ढोने, खेत जोतने की क्षमता, थकावट चिन्ह पर महत्वपूर्ण आधारभूत आँकड़े एकत्रित किये गये।
- प्रचलित औषधि के साथ ऊँट का दूध देने पर टी.बी. मरीज के स्वास्थ्य में तेजी से सुधार।
- भ्रूण प्रत्यारोपण तकनीक द्वारा दो बच्चों का जन्म।

## अधिदेश

- ऊँट सुधार पर आधारभूत व प्रायोगिक अनुसंधान करना।
- ऊँट अनुसंधान के लिए राष्ट्रीय स्तर पर सहयोग व नेतृत्व प्रदान करना तथा राष्ट्रीय सूचना ग्रहण केन्द्र की तरह कार्य करना।
- ऊँट अनुसंधान व विकास के लिए राष्ट्रीय एवम् अन्तर्राष्ट्रीय स्तर पर सहयोग देना।

## संगठनात्मक स्वरूप

केन्द्र में उष्ट्र फार्म इकाई, अनुसंधान प्रयोगशालाएं, चर भूमि, आवासीय खण्ड और अतिथि गृह सहित 824 हेक्टेयर भूमि है। वर्ष 2001-02 के दौरान विभिन्न वर्गों के अन्तर्गत स्वीकृत पदों की संख्या 72 थी। जिनमें निदेशक, 16 वैज्ञानिक, 21 तकनीकी, 10 प्रशासकीय तथा 19 सहायक कर्मचारीगण सहित 65 कर्मचारी कार्यरत रहे।

## बजट

वित्तीय वर्ष 2001-02 में योजनामद में 137.64 लाख व गैर योजनामद में 110.13 लाख रुपये की धनराशि स्वीकृत की गई।

अवसंरचनात्मक विकास के अन्तर्गत ही केन्द्र के पुस्तकालय को और अधिक सम्पन्न बनाया गया। वर्तमान में केन्द्र के पुस्तकालय में हिन्दी पुस्तकों सहित विभिन्न विषय-वस्तु की कुल 1642 पुस्तकें उपलब्ध हैं। इस वर्ष के दौरान कुल 136 पुस्तकों की खरीद की गई।

केन्द्र की स्वयं की अनुसंधान परियोजनाएं, रा.कृ.त.प. के फन्ड के अन्तर्गत तदर्थ अनुसंधान योजनाएं एवम् सहयोगिक अनुसंधान कार्यक्रम केन्द्र की कार्यसूची में रहे।

## शोध कार्यों का सारांश

### उष्ट्र वीर्य का संग्रहण मूल्यांकन, परिरक्षण तथा कृत्रिम गर्भाधान पर अध्ययन :

उष्ट्र-वीर्य के परीक्षण पर अध्ययन के अन्तर्गत वीर्य को रेफ्रीजरेटर तापमान पर ट्रिस एवं बायोसिफोस द्वारा परिरक्षित कर शुक्र गति पर प्रभाव का अध्ययन किया गया। जिनमें 100 से अधिक वीर्य नमूनें, जिन्हें ट्रिस विस्तारक में तनुकृत किया गया था। उनमें से 46,35,18,10 तथा 2 प्रतिशत नमूनों में प्रतिधारित शुक्राणु गतिशीलता क्रमशः 24,48,72,96 तथा 120 घंटे तक रही। जबकि बायोसिफोस में विस्तारित किए गए 28 वीर्य नमूने शुक्राणु गति नहीं रख पाये। तनुकृत वीर्य के परिरक्षण पर शोध जारी है। गाड़े में चलने वाले नर ऊँट का लेबिडो एवं वीर्य स्खलन की क्षमता पर पड़ने वाले प्रभाव में यह ज्ञात हुआ है कि गाड़े में चलने वाले ऊँट की वीर्य स्खलन क्षमता पर इससे प्रतिकूल प्रभाव पड़ता है। इस हेतु प्रयुक्त किये गये ऊँटों में से एक द्वारा वीर्य स्खलन क्षमता में पूर्णतया कमी पाई गई वहीं एक अन्य ऊँट में संगमन

समय तथा वीर्य की मात्रा में सार्थक ह्रास पाया गया। संशोधित कृत्रिम योनि जिसके अन्तर्गत परम्परागत कृत्रिम योनि – उष्ट्र वीर्य संग्रहण हेतु वीर्य रबर फनल प्रयुक्त किया जाता है, के स्थान पर वीर्य संग्रहण काँच को स्थापित किया गया जिसमें वीर्य को रबर फनल के सम्पर्क में लाये बिना एकत्रित किया गया। शुक्राणु गति का परिणाम यह प्रदर्शित करता है कि दोनों ही विधियों से लिये गये नमूनों में शुक्राणु गति में कोई भिन्नता नहीं देखी गई। वीर्य के जेलीकरण की सार्थकता को अभी पूर्णतया जाँचा नहीं जा सका है, परन्तु वीर्य जेल के सूक्ष्मदर्शी चित्र से यह ज्ञात हुआ है कि इसमें शुक्राणु लम्बे रेशों से घिरे रहते हैं तथा गति नहीं कर पाते हैं।

आरम्भिक प्रयासों में तनुकृत शीत तरल वीर्य के साथ गर्भधारण की असफलता के विपरीत 40 प्रतिशत मादाओं में सम्पूर्ण वीर्य के साथ गर्भ धारण के परिणाम इसके महत्व को प्रदर्शित करते हैं तथा यह संकेत देते हैं कि वीर्य का जेल बनना उर्वरता के लिए अत्यन्त आवश्यक है। जेलीकरण की संभावित उपयोगिता यह हो सकती है कि इससे वीर्य मादा जनन क्षेत्र से चिपक जाता होगा तथा ढलान के प्रवाह से बाहर निकलने से बच जाता होगा। जैसा वर्तमान अध्ययन में देखा गया है कि एक तरल तनुकृत वीर्य का कुछ भाग गर्भाशय में डाला गया, यह तुरन्त भग के द्वारा बाहर बह गया। अतः यदि उष्ट्र वीर्य पतले तरल रूप में प्रयुक्त किया जाये तो कुछ भाग बह सकता है। इसके अतिरिक्त, लम्बे तन्तु जो शुक्राणु को घेरे रहते हैं, धीरे-धीरे तरल होते हैं। इस प्रकार शुक्राणुओं की लम्बे समय तक मादा जननांगों में उपलब्धता सम्भव हो पाती है।

### परिवर्ती ऊर्जा प्रोटीन अनुपात के आधार पर ऊँटों द्वारा गाड़ा खिंचने की क्षमता पर अध्ययन

भारवहन सामर्थ्य के अन्तर्गत केन्द्र में 8 नर ऊँटों को कठिन रेतीले रेगिस्तानी रास्ते से उनके शारीरिक भार से 300, 350 तथा 400 प्रतिशत अधिक भारी गाड़ा खिंचवाया गया। इस हेतु प्रयुक्त ऊँट, गाड़ा चलाने में अच्छी तरह प्रशिक्षित थे। जिनमें 5 ऊँटों द्वारा 20 किलोमीटर दूरी तक शारीरिक भार से 300 प्रतिशत अधिक भार सफलतापूर्वक खींचा गया। जबकि 3 ऊँट नहीं खींच सके। 4 से अधिक ऊँट अपने शारीरिक भार से 350 प्रतिशत अधिक भार उठाने हेतु प्रयत्नशील रहे। जबकि 2 सफलतापूर्वक उठा सके जबकि उनमें से 4 ऊँट अपने शारीरिक भार से 400 प्रतिशत अधिक भार 20 किलोमीटर तक उठाने में प्रयत्नशील रहे।

### दुग्धकाल की विभिन्न अवस्थाओं में उष्ट्र दूध के रासायनिक, जैव रासायनिक व भौतिक रासायनिक गुणों का विश्लेषण

उष्ट्र-दूध के भौतिक एवं रासायनिक गुणों का विश्लेषण किया गया। ऊँट का दूध अपारदर्शी, श्वेत व स्वाद में नमकीन –मीठा होता है। अन्य पशुओं की तुलना में इसमें वसा, कुल प्रोटीन तथा कुल ठोस कम प्रतिशत में होता है। जबकि कुल लवण, रक्षा प्रोटीन, लोहा, जस्ता व ताँबे की मात्रा अधिक प्रतिशत में पायी जाती है। कैसीन में परिबंध रूप में 22, 8 तथा 85 प्रतिशत सोडियम, कैल्शियम व मैग्नीशियम रहा।

उष्ट्र दूध की और अधिक उपयोगिता बढ़ाने के क्षेत्र में चाय व काफी बनाने हेतु इसका अनुसंधान कर सफलतापूर्वक उपयोग किया गया। शोध करने पर यह ज्ञात हुआ है कि लेक्टोपरऑक्सीडेस प्रणाली परिरक्षित कच्चे उष्ट्र दूध में  $37^{\circ}$  से. तापमान पर 18-20 घंटों प्रभावी हैं। उसी प्रकार सोडियम मेटाबायसल्फाइड (50 पीपीएम) भी परिरक्षित रूप में कच्चे व पाश्चुरीकृत दूध के स्व:जीवन को 12 से 16 घंटों कमशः बढ़ाता है।

केन्द्र में उष्ट्र दूध में किण्वन की विधि का मानकीकरण किया गया, जिसके अन्तर्गत ऊँट के ताजे दूध को 20-25 मिनट तक उबाला गया। फिर  $30-37^{\circ}$  सेल्स. तक ठंडा करके 2-4 प्रतिशत की दर से जामन मिलाकर  $37^{\circ}$  सेल्स. तापमान पर 20-22 घंटों तक रखा गया जिसमें रासायनिक परिक्षण करने पर यह ज्ञात हुआ कि यह अन्तर्राष्ट्रीय डेयरी संघ द्वारा मानकीकृत मानकों के अनुरूप था। इसका इन्द्रीय परीक्षण केन्द्र भ्रमण हेतु आये पर्यटकों में स्वीकार्यता 85 प्रतिशत थी व पाचन क्रिया में उपयोगी पाया गया।

### पीसीआर की संवेदनशीलता पर तुलनात्मक अध्ययन व उष्ट्र ट्रिपैनोसोमोसिस के निदान हेतु सीरमीय परीक्षण

उष्ट्र ट्रिपैनोसोमोसिस के निदान हेतु पीसीआर प्रवर्धन आधारित संसूचन मानकीकृत किया गया। 21 मरसेन्स तथा 22 मरसेन्स एन्टीसेन्स प्राइमर के उपयोग से 227 बीपी का विशिष्ट परजीवी प्रवर्धन ज्ञात हुआ है। जानपदिक रोगविज्ञानीय चौकसी की अन्य विधियों द्वारा जिन प्रकरणों का संसूचन नहीं हो पाता था, यह विधि अत्यन्त विशिष्टता तथा संवेदनशीलता के कारण उपयोगी सिद्ध देखी गई।

### स्वदेशी सूत्र द्वारा निर्मित औषधियों से प्रभावित ऊँटों का उपचार

सारकोपिटज् स्केबिआई द्वारा होने वाली उष्ट्र खुजली में प्रभावित ऊँटों का दो देशी सूत्रों द्वारा उपचार किया गया। इन्हें स्थानीय स्तर पर उपलब्ध औषधियों से तैयार किया गया, जो अत्यन्त उपयोगी पायी गयी। ये दोनों औषधियां प्रायोगिक पशुओं में खुजली, कटाव, त्वचा प्रगाढन व वलीयन आदि रोगों में आराम दिलवाने में सक्षम है। प्रभावित स्थान पर इस औषधि के प्रयोग द्वारा अण्डें तथा लारवा केवल 10 से 15 दिन में नष्ट हो गये। औषधि के उपचार पश्चात 30 वे दिन तक उनका प्रभाव बना रहा। इसके उत्साहजनक परिणामों को देखते हुए इस में कम लागत की औषधि को तैयार करने के लिए अनुसंधान कार्य प्रगति पर है।

### ऊँटों में प्रायोभाव, अंतःस्तन संक्रमण के अभिलक्षण तथा प्रतिजैविक संवेदनशीलता पर अध्ययन

ऊँटनियों में अरोग लक्षण थनैला (स्तनकोप) पर अध्ययन के अन्तर्गत सूक्ष्म जैविक रोगाणवीय संवर्धन तथा कायिक कोशिका पर आधारित 71 ऊँटों से 282 दुग्ध नमूने लिये गये जिसमें 34.4 प्रतिशत प्रकरणों में सन्देहात्मक लक्षणहीन स्तनकोप रहा। जीवाणुओं के रसोचिकित्सीय पात्रे अध्ययन से यह ज्ञात हुआ कि 100 प्रतिशत जीवाणु क्लोरमफैनीकाल, सिफैलेक्सीन अमोक्सीसलीन, अमोक्सीक्लेबीन से संवेदनशील पाये गए।



कुल मिलाकर 55 प्रतिशत स्टैफाइलोकोकस आइसोलेटस् , जिनमें 23 कोएगुलेंस सकारात्मक आइसोलेटस् थे। इनको तरह-तरह के जैव रसायनिक से जाँच करने के बाद 10 तरह के जीवाणु पाए गए जो कि स्टैफाइलोकोकस ऑरियस, स्टैफाइलोकोकस हाईकस, स्टैफाइलोकोकस इन्टरमीडियस, स्टैफाइलोकोकस हीमोलाइटिकस, स्टैफाइलोकोकस ऑरिकुलेरिस, स्टैफाइलोकोकस एपिडर्मीडिस, स्टैफाइलोकोकस केपिटिस, स्टैफाइलोकोकस वारनेराइ, स्टैफाइलोकोकस होमीनिस, स्टैफाइलोकोकस सियूराई थे। तपेदिक बिमारी में ऊँटनी के दूध की उपयोगिता को देखते हुए केन्द्र व स्थानीय मेडीकल कॉलेज/सरकारी चिकित्सालय के तत्वाधान में Diabetes Type-I पर किये पर किये गये अनुसंधान से देखा गया कि जिन रोगीयो को ऊँटनी का कच्चा दूध 500 मि.लि. रोजाना दिया गया उनमें अन्य नियन्त्रित समूह की तुलना में 30-35 प्रतिशत इन्सुलिन की रोजाना की मात्रा में कमी देखी गयी व साथ ही इसके अलावा डायबिटीज रोगियों की जीवन गुणवत्ता पर डेटा प्राप्त किये गये तथा इसमें सुधार देखा गया।

### सिंचित व असिंचित क्षेत्रों में ऊँट गाड़ा व बैल गाड़ी का कृषि उपयोग पर अध्ययन

अध्ययन द्वारा यह ज्ञात हुआ है कि ऊँटों और बैलों में कृषि उपयोग हेतु जन्तुओं में निवेश की गई राशि की कार्य अदायगी बैलों की अपेक्षा ऊँटों में अपेक्षाकृत आसान है। तुलनात्मक दृष्टि से मूल्य लाभ अनुपात बैलों की अपेक्षा ऊँट गाड़ा में अधिक है। अध्ययन से यह स्पष्ट हुआ है कि अधिक मूल्य लाभ अनुपात व कम खर्च शीघ्र मुनाफा के कारण छोटे व सीमांत किसानों के खेती में उपयोग हेतु ऊँट गाड़ा बैल गाड़ी से लाभप्रद होने से अधिक श्रेष्ठ है।

उष्ट्र प्रबन्ध के खुले आवासन व अर्द्ध गहन पद्धति के अन्तर्गत आहार आचरण व दुग्ध स्तन्य-पान आचरण पर कार्य किया गया तथा स्पष्ट हुआ है कि दुग्ध स्तन्य-पान में अधिक समय तथा सम्बन्धित गतिविधियों के दौरान तथा धीमी गतिविधियों में कम समय लगना, उष्ट्र पालकों हेतु अर्द्ध गहन पद्धति खुले आवासन की अपेक्षा श्रेष्ठ है।

### भारतीय नस्ल के ऊँटों में गुणात्मक व मात्रात्मक आनुवंशिक प्राचल पर अध्ययन

केन्द्र में देशी ऊँटों में गुणात्मक व मात्रात्मक आनुवंशिक प्राचल के अन्तर्गत बाल-उत्पादन के आँकड़ों (1998-2002) का विश्लेषण करने पर यह पाया गया कि बीकानेरी ऊँट अन्य आयु (2-3 आयु वर्ग के) व नस्ल के ऊँटों की अपेक्षा वार्षिक बाल-उत्पादन अधिक करते हैं।

उष्ट्र बच्चों के चयन-अनुकूलन तथा रखरखाव-प्रबन्ध के अन्तर्गत सभी नस्लों के 2,3 तथा 4 वर्ष की आयु वर्ग के उष्ट्र बच्चों में बार-बार सूखे पड़ने की स्थिति में भी शारीरिक भार में वृद्धि देखी गई।

देशी नस्ल के बीकानेरी व जैसलमेरी ऊँटों में सूक्ष्म सैटेलाइट चिन्ह पर अध्ययन में बीकानेरी व जैसलमेरी ऊँटों में सूक्ष्म सैटेलाइट चिन्ह पर वर्तमान अन्वेषण के दौरान सभी 6 सूक्ष्म सैटेलाइट प्रारम्भक प्रयोग किए गए तथा बहुरूपी पाये गये।

जैसलमेरी में 0.3 से 1.00 व 0.32 से 0.65 विषमयुग्मजता अनुमानित देखी गई। बीकानेरी नस्ल में यह 0.35 से 1.00 व 0.686 आँकी गई। वहीं बहुरूपी सूचना अंशरेन्ज 0.268 से 0.588 जैसलमेरी व 0.267 से 0.639 बीकानेरी नस्ल में रही। विकल्पी संख्या व विषमयुग्मजता बीकानेरी नस्ल की अपेक्षा जैसलमेरी नस्ल में अधिक देखी गई। इसी सन्दर्भ में कच्छी नस्ल पर अनुसंधान जारी है। आकृति 1 व 2 विकल्पी संख्या व उनका आकार जैसा कि 6 प्रतिशत बहुएकालमाइड जेल विद्युत कण संचलन में वियोजित सूक्ष्मदर्शी विस्थल पर *ywll-44* व *ywll-58* जैसलमेरी व बीकानेरी नस्ल में क्रमशः प्रस्तुत करते हैं। अन्तर संस्थानीय सहयोग के अन्तर्गत इस वर्ष तीन स्नातकोत्तर छात्रों ने अनुवांशिकी प्रजनन आदि विषयों में एम.एस.सी./पी.एच.डी. हेतु शोध कार्य किया।

समाजार्थिक अभिमुखता के अन्तर्गत जैसलमेरी नस्ल के ऊँट के प्रजनन क्षेत्र पर अध्ययन किया गया। जिसमें ऊँट पालकों की वार्षिक औसत आय सभी स्रोतों से कुल 22,712 रु. व एक परिवार में औसत सदस्य 7 व्यक्ति है। ऊँटों के झुण्ड 1 से 200 तक में ऊँटों की औसत 2.4 ऊँट प्रति परिवार पाई गई। इसी अन्तर्गत कुल 9 समुदाय ऊँट के पालन – पोषण हेतु इस क्षेत्र में सम्मिलित किये गये।

इस हेतु कुछ कठिन टीब्यों सहित रेतिली मृदा औसतन 96.9076 बीघा भूमि जो मुख्यतया वर्षा के पानी पर निर्भर थी। खुजली स्वास्थ्य सम्बन्धित रोगों में प्रमुख आँकी (39.73 प्रतिशत) गई। जबकि इसी कम में पाचनता में खराबी 33.69 प्रतिशत पायी गई। ज्ञात हुआ है कि 314 उष्ट्र पालकों में 70 प्रतिशत स्थानीय उपचार को अपनाते हैं जबकि 21.34 प्रतिशत एलोपैथिक उपचार को और 8.59 प्रतिशत ने देशी उपचार को अपनाया।

**राजस्थान के शुष्क क्षेत्र में ऊँटों में आहार चारे के खनिज स्तर, जैव प्राप्यता तथा विशिष्ट खनिज मिश्रण को तैयार कर उत्पादकता के सुधार पर अध्ययन**

इसके अन्तर्गत राजस्थान के बीकानेर, नागौर, जैसलमेर, चुरू तथा हनुमान गढ़ जिलों में सर्वेक्षण का कार्य किया तथा यह ज्ञात हुआ है कि इन जिलों में सेवण, मोठचारा, ग्वार चारा, मूँगफली चारा, चना खार, पशु आहार, मोठ चूरी तथा ग्वार आदि पशुओं को मुख्यतः खिलाया जाता है। इसके साथ गत वर्षों में अकाल के कारण चरने की सुविधा में भी कमी आई है। बीकानेर के चारे में जस्ते और ताँबे की मात्रा में कमी पायी गयी।

**ऊँटों के बच्चों को संपूर्ण आहार आधारित ग्वार फलगटी व पेड़ों की पत्तियों के उपयोग पर अध्ययन**

इसके अन्तर्गत बीकानेरी, जैसलमेरी तथा कच्छी नस्ल के 2 वर्ष तक के 291-344 किलों शारीरिक भार वाले कुल 11 ऊँटों के बच्चों को ग्वार फलगटी, अरडू नीम, खेजड़ी की पत्तियों तथा आहार संघटक, संपूर्ण आहार के रूप में दिये गये।

**नर ऊँटों में प्रौढ़ता प्रभावित करने वाले जीव रसायन एवं हार्मोन्स का अध्ययन**

उक्त परियोजना में सीरम जीव रसायन घटकों हेतु रक्त नमूनों का परीक्षण किया गया। अनुसंधान योजना के अन्तर्गत नर ऊँटों में गौण लिंगी लक्षणों के प्रकटीकरण एवं नर लिंगी हार्मोनों के बीच परस्पर संबंधों का अध्ययन किया जा रहा है। इससे नर ऊँटों के विलम्ब से वयस्क होने के कारणों का पता लगाने में सहायता मिलेगी।

### फसल आधारित पशु उत्पादन नेटवर्क सहयोगिक योजना

इसके अन्तर्गत सेवण व 3-टायर सिल्वी पाश्चर पद्धति के द्वारा ऊँटों के बच्चों का चराई व्यवहार तथा वृद्धि क्षमता पर अध्ययन किया गया। सिल्वी पाश्चर में चरने वाले जानवरों का प्रतिदिन औसत भार सेवण की तुलना में अधिक पाया गया। चराई व्यवहार में यह पाया गया कि सभी ऋतुओं में चारण गतिविधि दूसरी अन्य गतिविधियों में अधिक पायी गयी।

### विस्तार कार्यक्रम

प्रजनन काल के दौरान पास के गांवों से आनेवाले उष्ट्रपालकों/किसानों को निशुल्क प्रजनन की सुविधा उत्तम नस्ल के बीकानेरी नर ऊँटों द्वारा प्रदान की गई। जिससे की स्थानीय बीकानेरी नस्ल के ऊँटों की उपयोगिता को बढ़ावा मिल सके।

### गैर सरकारी संगठनों के साथ समन्वय

इस दौरान केन्द्र द्वारा विभिन्न गैर-सरकारी लोकहित पशुपालक, संस्थाओं (देशी पशुधन अनुसंधान एवं विकास हेतु संस्था, सादड़ी, पाली) एवं उरमूल ट्रस्ट, बीकानेर से समन्वय स्थापित किया गया। जिसमें उष्ट्र दूध तथा बाल उत्पाद, दही, चाय, उष्ट्र की उपयोगिता पर विचार के साथ-साथ केन्द्र के वैज्ञानिकों द्वारा उष्ट्र पालकों से ऊँटों हेतु उनके द्वारा की जाने वाली रख-रखाव व उपयोगिता सम्बन्धी जानकारी प्राप्त की गई।

उष्ट्र दूध, बाल इत्यादि की अधिक उपयोगिता के ध्येय से केन्द्र द्वारा उरमूल ट्रस्ट, बीकानेर के साथ समन्वय स्थापित करते हुए इन उत्पादों की लोकप्रियता बढ़ाने के क्षेत्र में कार्य किया गया। ऊँटों के दूध से बनी चाय व कॉफी विभिन्न राष्ट्रीय व अन्तरराष्ट्रीय सैलानियों को उपलब्ध करवाई तथा जिसकी करीब 80 प्रतिशत सकारात्मक मान्यता देखी गई।

### किसान गोष्ठी

इस वर्ष के दौरान केन्द्र द्वारा पाँच किसान गोष्ठीयां आयोजित की गई। जिसमें तीन अंगीकृत गाँव गाढवाला (जिला - बीकानेर), एक राज्य कृषि विज्ञान मेला तथा एक जोजावर (पाली) में आयोज्य रही। इन अवसरों पर ऊँटों के रख-रखाव, बीमारियों की रोकथाम, प्रजनन, दूध की उपयोगिता आदि से सम्बन्धित विभिन्न पहलुओं पर विचार-विमर्श किया गया तथा पोषण इत्यादि रख-रखाव प्रबन्ध सम्बन्धी नवीनतम जानकारी प्रदान की गई।

### केन्द्र द्वारा वैज्ञानिक प्रदर्शनियों में भागीदारी

केन्द्र द्वारा राष्ट्रीय व अन्तरराष्ट्रीय स्तर पर तीन वैज्ञानिक प्रदर्शनियां आयोजित की गई। जिसमें उष्ट्र संबंधी अनुसंधान उपलब्धियां, उनके पालन-पोषण तथा नवीनतम प्रौद्योगिकी प्रस्तुत की गई तथा भारतीय अन्तरराष्ट्रीय व्यापार मेला- 14-27 नवम्बर, 2001 (प्रगति मैदान नई दिल्ली), उष्ट्र उत्सव, 2002 - 22 से 30 जनवरी, 2002 (बीकानेर),

राज्य कृषि विज्ञान मेला – 24 मार्च, 2002 (रा.कृ.वि. बीकानेर) आयोज्य रहे। एक सजीव उष्ट्र प्रदर्शनी, राज्य कृषि विज्ञान मेला– 24 मार्च, 2002 (रा. कृ . वि. बीकानेर) के दौरान आयोजित (रा. कृ . वि. बीकानेर) की गई। जिसमें उष्ट्र दूध के लाभ की सार्थकता के प्रति लोगों में लोकप्रियता बढ़ाने व इसे बढ़ावा देने हेतु कच्चा दूध विभिन्न सैलानियों, विद्यार्थियों, विशेषज्ञों, किसानों आदि को प्रदर्शनी के दौरान पिलाया गया। राजस्थान कृषि विश्वविद्यालय में 24 मार्च, 2002 को आयोजित राज्य कृषि विज्ञान मेला में केन्द्र के तीन उत्तम नस्ल के ऊँटों की नस्ल प्रतिस्पर्द्धा, उष्ट्र-दौड़, उष्ट्र – बच्चों की प्रतिस्पर्द्धाओं में भागीदारी रही तथा कई पुरस्कार प्राप्त किये।

### **उष्ट्र उत्सव– 2002**

राजस्थान पर्यटन विकास निगम , बीकानेर द्वारा आयोजित उष्ट्र उत्सव, 2002 में केन्द्र के ऊँटों ने विभिन्न गतिविधियों – दूध प्रतियोगिता, नवजात उष्ट्र बच्चों की प्रतियोगिता , उष्ट्र बालों की कटाई व साज-सज्जा प्रतियोगिता इत्यादि में भाग लिया व पुरस्कार भी प्राप्त किये।

### **पशु स्वास्थ्य शिविर**

केन्द्र द्वारा अंगीकृत गाँव गाढवाला में पशु स्वास्थ्य शिविर में स्वास्थ्य संबंधी समस्याओं पर विचार – विमर्श किया गया तथा विषय-विशेषज्ञों द्वारा उपचार संबंधी जानकारी के साथ पर्याप्त संख्या में उपचार किया गया।

### **केन्द्र भ्रमण**

प्रतिवर्ष की तरह ही इस वर्ष के दौरान भी विद्यार्थी, वैज्ञानिक, प्रशिक्षार्थी , गैर सरकारी संगठन, किसान, महिला किसान, युवा, पशुपालक, रक्षा अधिकारी, प्रशासनिक अधिकारी, फील्ड पशु चिकित्सक, भारतीय एवं विदेशी शिक्षाविद्, पत्रकार इत्यादि भारी संख्या में केन्द्र के भ्रमण हेतु आये।

### **हिन्दी सप्ताह, 2001**

14 सितम्बर, हिन्दी दिवस के उपलक्ष पर केन्द्र में दिनांक 14-20 सितम्बर, 2001 तक हिन्दी सप्ताह आयोज्य रहा। इस अवधि के दौरान केन्द्र के अधिकारियों एवम् कर्मचारियों हेतु हिन्दी निबन्ध प्रतियोगिता, हिन्दी प्रश्नोत्तरी परीक्षा तथा साथ ही हिन्दी सप्ताह को और अधिक सक्रिय बनाने हेतु ' साक्षरता बनाम राष्ट्रीय विकास' विषयक हिन्दी में भाषण प्रतियोगिता भी आयोजित की गई।

### **हिन्दी कार्यशाला { 21-22 मार्च, 2002 }**

राजभाषा कार्यान्वयन के अन्तर्गत केन्द्र में प्रथम बार दो दिवसीय { 21-22 मार्च, 2002 } हिन्दी कार्यशाला का आयोजन किया गया। दो दिवसीय कार्यशाला में कुल चार सत्र रखे गये जिसके अन्तर्गत विषय-विशेषज्ञों द्वारा विभिन्न शीर्षकों पर व्याख्यान दिये गए।

### कम्प्यूटर प्रशिक्षण

केन्द्र में दिनांक 6 फरवरी से 5 मार्च, 2002 के दौरान ' एडवान्स इन इनफोरमेशन टेक्नोलोजी एण्ड डाटाबेस मैनेजमेन्ट ' विषय कम्प्यूटर प्रशिक्षण कार्यक्रम का आयोजन किया गया जिसमें 44 प्रशिक्षार्थियों ने भाग लिया। जिसके अन्तर्गत विभिन्न विषय-विशेषज्ञों द्वारा कम्प्यूटर से सम्बन्धित नवीनतम जानकारी, डाटाबेस प्रबन्ध तथा कम्प्यूटर अनुप्रयोग संबंधी उपयोगी जानकारी प्रदान की गयी।

### अवसंरचनात्मक

केन्द्र में आधारभूत सुविधाओं के विकास के अन्तर्गत ही कृषि वानिकी इकाई से रेल्वे कौंसिंग तक पक्की सड़क (क्षेत्र एक में), फार्म कार्यालय तथा खंड 1 के पास 2.0 लाख लीटर क्षमता वाले दो सिंचाई टैंक, केन्द्र के अतिथि गृह में दो विशिष्ट अतिथि जन प्रकोष्ठ तथा तीन आवासीय क्वार्टर के निर्माण का कार्य किया गया।

आखिर क्या है इस ऊँट में

कुछ तो जरूर है इस ऊँट में  
जो दूसरों में अलग सा लगता है।  
पेट भर लेता है यह खाकर  
मरुभूमि की सूखी घास व झाड़ियां  
और रह लेता है कई दिन तक  
यह बिना पानी लिए हुए भी  
इसका बड़ा कूबड़ दूसरों में अलग सा लगता है।  
कुछ तो जरूर है इस ऊँट में  
जो दूसरों में अलग सा लगता है।  
बोझ ढो लेता है यह अपनी पीठ पर  
खींच सकता है गाड़े को गहरी रेत पर  
सह लेता है यह तपती धूप भी  
और दौड़ लेता है रेगिस्तान में दूर तक  
इसके गद्दीदार पांव अलग से लगते हैं  
कुछ तो जरूर है इस ऊँट में  
जो दूसरों में अलग सा लगता है।  
हल चला सकता है यह खेतों में भी  
और सिंचाई करने के भी काम आता है  
मरुस्थल की यह जीवन रेखा है  
क्या ऐसा कोई जीव आपने देखा है  
इसका गुणकारी दूध अलग सा लगता है  
कुछ तो जरूर है इस ऊँट में  
जो दूसरों में अलग सा लगता है।  
यह राजस्थानी लोक परम्परा की धरोहर है  
इसके बिना यहां जीवन अधूरा है  
काम आया है यह युद्ध और शान्ति में भी  
ऐतिहासिक कथाओं में इसका वर्णन है  
इसकी कहावतें दूसरों में अलग सी लगती हैं  
कुछ तो जरूर है इस ऊँट में  
जो दूसरों में अलग सा लगता है।

डा. अश्विनी कुमार रॉय  
वैज्ञानिक (शरीर क्रिया विज्ञान)



Feeds and fodders of arid region primarily utilized by camel



Camel milk products



**NATIONAL RESEARCH CENTRE ON CAMEL**  
**JORBEER, BIKANER-334 001(Raj.)**

Phone : 0151-2231213 (Director) 0151-2230070 (EPBX)  
Fax : 91-151-2230183 E-mail : [nrccamel@hub.nic.in](mailto:nrccamel@hub.nic.in)  
Website : [www.icar.org.in / nrccm/home.html](http://www.icar.org.in/nrccm/home.html)