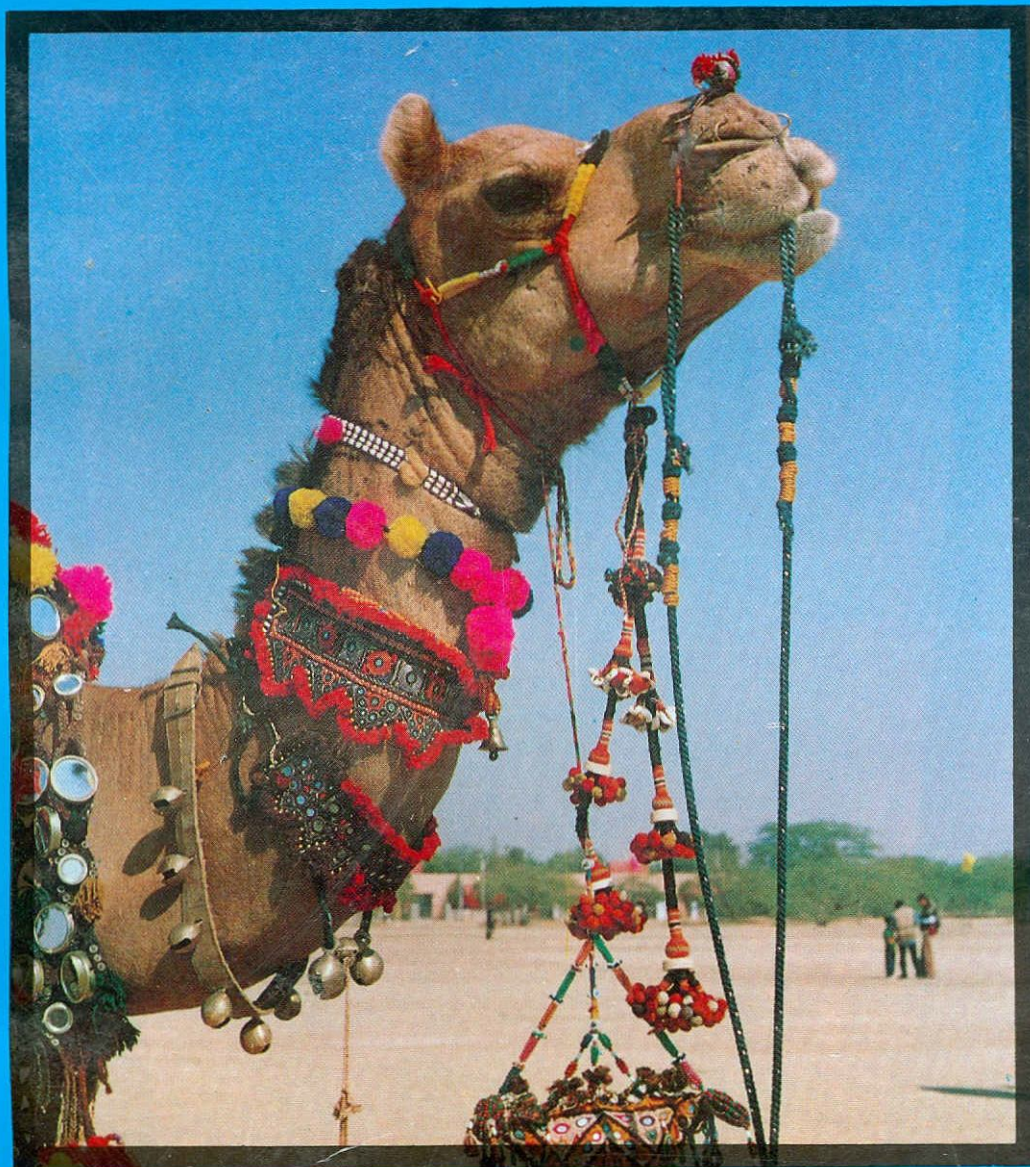




# ANNUAL REPORT 1996-97



**NATIONAL RESEARCH CENTRE ON CAMEL  
BIKANER**





Dr. R. S. Paroda, Director General, ICAR & Secretary DARE, inaugurating NRC on Camel Guest house on 25th Jan, 1997.



Short course on Camel Management and Health, February 1997.





## ANNUAL REPORT 1996-97



(Estd. 5th July, 1984)

DIRECTOR : DR. N.D. KHANNA

NATIONAL RESEARCH CENTRE ON CAMEL  
BIKANER

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सारांश (Saransh)



## FROM DIRECTOR'S DESK

For developing livelihood in the Indian dry land, it is important to prepare adaptive strategies which are socially acquired and are transformed for proper utilization of natural resources interfaced with environment so that these meet socio-ecological, cultural and biological needs of the area. The livestock production system in the dry land of India contribute most significantly for sustainable food security where the draught animals play an important role. The camel is very important component of livestock production in the arid zone. Amongst countries having highest camel population in the world (FAO, 1994), India stands third (1.5 million after Somalia (6.0 million) and Sudan (2.8 million). India has unequivocal opportunities to take leadership in Camel research, development and training. In the camel improvement research programmes undertaken by the National Research Centre on Camel, Bikaner, the concept of multi-disciplinary studies on camel production has been adopted for making camel more economically viable. The basic paradigm followed in developing programme for sustainable camel production is based on proper utilization of natural resources, carrying capacity and management of arid ecological environment. The research programmes which are currently in progress at this centre were developed to collect basic and applied information to answer some of the questions which are connected with developing need based transferable camel management technology suitable for Indian arid zone. The centre is also in the process of developing Perspective Plan for future research programmes upto year 2020 which will bring into sharp focus various camel improvement strategies to make camel production profitable in the Indian dry land.

N.D. Khanna  
Director



## 1. EXECUTIVE SUMMARY

During 1996-97 the staff strength of centre was 66 consisting of one RMP, 10 Scientific, 16 Technical, 10 Administrative, 7 Auxiliary and 22 Supporting. The budget allocation under plan was Rs. 75 lakhs and under non-plan was Rs. 44.15 lakhs, which was fully utilized.

During the year, the camel herd strength ranged from 225 to 234, comprising mainly of Bikaneri, Jaisalmeri, Kachchhi breeds and crossbreds (Arab x Bikaneri). Four camel studs were distributed to the Panchyat Samities through State Animal Husbandry Department, Rajasthan under breed improvement programme. Services of superior camel studs were made available to the Camel Breeders from near by areas during breeding season. Five research projects and five research schemes were carried to at the National Research Centre on Camel, Bikaner.

### Research Projects

i. Comparative study on riding performance of male and female camel was carried out after training for a period of 3 months. The riding performance, riding speed, cardinal physiological responses were recorded before and after riding performance. The result indicated increase in respiratory frequency, pulse rate, glucose level, serum lactate level, cortisol level and slight increase in level of triglyceride and did not decline even after 24 hr rest. Creatine kinase, LDH activity decreased significantly.

ii. Investigation on nutrient utilization of draught camel were carried out in adult draft camels during winter season. The carting stress resulted significant higher digestibility (%) of DM, CP, EE, CF and NFE. The Studies



on survey and nutritional evaluation of conventional and unconventional feed resources of camel was carried out. Twenty four plant samples of grasses, crops, creepers, shrubs/bushes and trees were collected and analysed for their proximate composition. In one experiment 20% of conventional moth chara was replaced with dry leaves of non convention shrub, bui (*Aerva tomentosa*). The result revealed no significant differences except decrease in serum glucose level when compared with the sole roughage diet moth chara. One study was conducted to know the oxalate contents and its removal in local shrub, crops, grasses trees. Lowest oxalate contents were found in *Heptadenia pyrotechnica* (Kheemp), *Cyamopsis tetragonaloba* (guar korma) i.e. 0.281, 0.450 per cent respectively while highest was found in *Lyceum barbarum* (Murali kalani). In another study treatment with water in ratio 1:20 lowered the oxalate content about 71.62% on *Lasiurus indicus* (Sewan grass).

No significant difference was observed between two stages of lactation (2-3 months and 13-14 months) for vitamin-C content in the blood serum as well as milk.

iii. Breed wise conception rate in Bikaneri, Jaisalmeri and Kachchhi breeds was 62.5, 66.6 and 72.4 percent with average 65.4 percent. Calving rate for the year (1996-97) varied from 46.6% in Jaisalmeri to 75 per cent in cross bred (Arabi x Bikaneri). In gestation length significant difference was found between breeds. The study on biometry body length, heart girth and height indicated significant contribution of age and sex. The intercalving period varied 706-729 days. The average calving rate was 53 per cent during the year 1996-97. The annual hair production was higher in Bikaneri breed as compare to Jaisalmeri and Kachchhi breeds. The contribution of sex was significant in hair production in Bikaneri and kachchhi camels. Age wise hair production was observed higher in 3-4 year age than 7-8 year age group. The average daily milk production was higher in third parity as compare to second parity.

The morning milk yield was observed 10-20 per cent higher than evening milk yield. The breed, month effects were significant. The protein and casien percentage indicated significant ( $P < 0.01$ ) variation due to breed and time of milking.

iv. Studies on male reproduction indicated initial motility in the semen samples was of oscillatory type. The concentration of sodium, potassium and



glucose was  $232.43 \pm 7.16$  meq/l  $156.0 \pm 11.612$  meq/l and  $3.73 \pm 0.71$  mg/dl. Sperm concentration was  $340-520 \times 10^6$ /ml. Other parameters like ejaculation time, ejaculate volume, sperm concentration, pH, live and dead spermatozoa, acrosomal damage etc were also studied.

The study was conducted for non-seasonal breeding under semi-intensive management system during the months of June to August, 96 level of progesterone in the serum indicated that ovulation occurred in all the she camels. Four she camels out of eight were found to be pregnant. Post partum ovarian status in female camels were studied with ultrasound scanner 40 to 60 days of parturition. Follicles of small size ( $<0.5$  mm) could be observed only in two animals up to 60 days post partum.

v. Investigations on camel management were studied under different management systems viz. intensive, semi intensive and extensive. The first two systems studies were conducted on camel at N.R.C. on Camel, Bikaner, while for study of third system experiences of camel breeders were taken into consideration. Under extensive management system, it has been found that farmers generally do not adopt any prophylactic measure for disease control and calf mortality is about 20-33% in the field.

vi. Studies on poll glands of camels were conducted and histochemical observation revealed presence of protein, glycogen, lipids, DNA, RNA, ATPase, LDH and G-6-PDH in both alveolar and skin regions. The alveolar region in addition exhibited  $3\beta$  and  $17\beta$  hydroxysteroid dehydrogenase. The poll gland secretion contained comparatively lower level of protein, albumin, glucose, calcium and urea than the serum level and relatively higher sodium levels. The testosterone was 16-20 times and progesterone and estradiol 6-8 times higher in the secretion of the poll glands than the serum level during breeding season. The secretory epithelium of the poll glands exhibited higher cellular activity during breeding season and relatively quiescent phase during non-breeding season. The seminal attributes indicated sperm production continued throughout the year with a subdued sexual behaviour. The present study on testis histology, ultrastructure and histochemistry does corroborate with the finding on poll glands during different season.

vii. Under the scheme of on "Development of Embryo Transfer Technology in camel" work on standardisation of technique for non-surgical collection of embryos was carried out. The two-way long Foley's catheter was used for collection of embryo. Protocols using various hormonal regimes

were tried for superovulation in she camels. Seven embryos were recorded with induced luteal phase prior to superovulatory protocol. Further trials are in progress.

viii. In the blood group and biochemical polymorphism studies in Indian camel efforts were made to standardise the techniques for separation of isocitrate dehydrogenase, hexokinase and glutathione reductase. The quantitative estimation of certain enzymes viz. amylase, alkaline phosphatase, LDH phosphatase was worked out in different seasons. The significant differences were observed due to reason of sex. In molecular genetic study simple modified technique for camel genomic DNA isolation was standardised. Camel genomic DNA from different breeds were analysed by hexacutter (*Bam HI*, *Bgl I*, *Hind III*) tetracutter (*Hae III*) restriction enzymes. *Hind III*, *Hae III* enzyme revealed 8 repetitive DNA bands ranging from 0.44 kb to 2.29 kb, two repetitive bands of 0.52 and 0.68 kb respectively. This analysis will further enumerate the organisation of repetitive DNA in camel and would help to locate satellite sequences on camel genomic DNA.

ix. Network programme on crop based production system was initiated. Comparative performance of camel calves kept in stall feeding with moth chara and sewan pasture grazing (continuous) management systems was studied. Growth of camel calves kept at stall was higher than those kept on sewan pasture. Stallfed calves spent less time in feeding as compare to sewan pasture fed calves. A 6 day digestibility trial was also conducted. The nutrient intake of DM, DCP and ME/kgW<sup>0.75</sup> was 79.04±1.51 g, 4.44±0.19 g and 0.678±0.03 MJ respectively. In another the growth rate of camel calves (427 g/d) in the stall fed group was found higher (P<0.01) than system (237 g/d). The 3-tier silvi pasture had both edible and non edible plant species. The nutritive value of groundnut crop studied and found that with the plant maturity the nutritional worth of plant declines.

x. Studies on evaluation and conservation of double humped camel in cold desert region was initiated. A preliminary survey was done in Partapur area of district Ladakh. Two research associates joined and the work was initiated to establish the laboratory.

### **Publications**

During the year 1996-97, 15 research articles were published and 19 articles were submitted for publication.



## 2.

### NATIONAL RESEARCH CENTRE ON CAMEL

The NRC on Camel came into existence on 5th July, 1984. The physical facilities available at the erstwhile Camel Breeding Farm, Bikaner consisting of 149 camels of Bikaneri breeds and about 2060 acres of land were transferred by the Govt. of Rajasthan to the ICAR for establishing N.R.C. on Camel.

The organisational chart of NRC on Camel is provided in fig. 2.1.

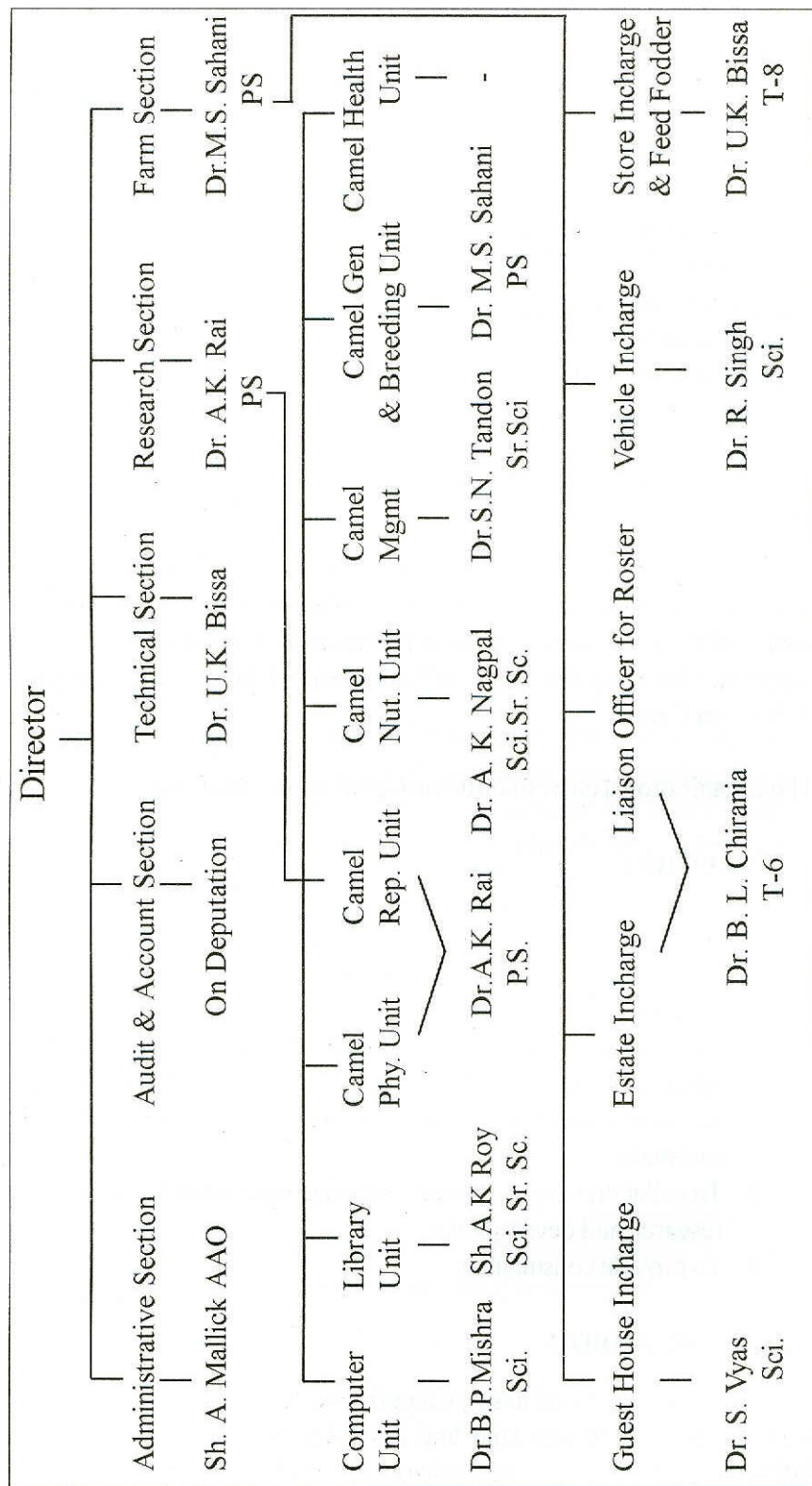
#### **2.1. Mandate :**

1. To undertake basic and applied research for improvement of camel.
2. To act as a repository of information on camel research and development.
3. To provide leadership and co-ordinate camel research with state agricultural universities for generating location specific technologies.
4. To act as a centre for training in research methodologies specific to camels.
5. To collaborate with national and international agencies for camel research and development.
6. To provide consultancy.

#### **2.2. Infrastructure :**

The NRC on Camel has (i) Camel breeding farm (ii) Research unit (iii) Library (iv) Range land and (v) Residential complex as a part of infrastructural facilities. The total area of NRCC campus is 824 ha.

Fig. 2.1. Organisational chart





### **2.3. Laboratories :**

NRC on Camel has modern laboratories. There are two laboratory complexes. In one complex there are laboratory rooms for camel physiology, camel genetics and breeding, camel management, camel reproduction, camel health and computer section. The other complex has camel nutrition and camel embryo transfer technology labs. There is one field diagnostic laboratory attached to camel dispensary. The research unit has one seminar hall with seating capacity 120.

### **2.4. Library :**

The library has 812 books and subscribed 35 journals.

### **2.5. Field :**

The NRC on Camel has 824 ha land. About 2500 tree seedlings have been planted in the area, 22 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*).

### **2.6. Buildings :**

There are two laboratory blocks and one camel dispensary cum disease diagnostic laboratory block. For housing camels, there are 6 open sheds, 6 roofed sheds, 3 camel boxes, one metabolic shed and one shed with provision for individual feeding of 8 camels. The farm has one fodder godown, one feed godown, two 35 KV generators, one open well and three tube wells.

NRC on Camel has residential colony comprising of 2 type V, 4 type IV, 5 type III, 9 type II and 13 type I staff quarters.

### **2.7. Camel Breeding Farm :**

The camel breeding farm has 234 camels comprising 105 Bikaneri, 82 Jaisalmeri, 30 Kachchhi, 1 Sanchori, 1 Marwari and 15 Crossbreds (Arabi x Bikaneri).

## 2.8. Staff position :

The sanctioned strength in different categories at the centre was 76. Category wise staff position are shown in Table 2.1.

**Table 2.1.**  
**Staff position during 1996-97**

Staff categories	Positions		
	sanctioned post	Filled	Vacant
R.M.P.	1	1	-
Scientific	20	10	10
Technical	Category I	4	-
	Category II	8	-
	Category III	4	-
Administrative	10	10	-
Auxiliary	7	7	-
Supporting	22	22	-
<b>Total</b>	<b>76</b>	<b>66</b>	<b>10</b>

### Names of the staff members in position during 1996-97

<b>Director</b>	:	Dr. N.D. Khanna
<b>Scientific</b>		
Principal Scientist (Animal Physiology)	:	Dr. A.K. Rai
Principal Scientist(Anim. Gen. & Breeding)	:	Dr. M.S. Sahani
Senior Scientist (Anim. Gen. & Breeding)	:	Dr. S.N. Tandon
Scientist Sr. Scale (Animal Nutrition)	:	Dr. A.K. Nagpal
Scientist Sr. Scale (Animal Physiology)	:	Sh. A.K. Roy
Scientist (Animal Reproduction)	:	Dr. Sumant Vyas
Scientist (Animal Biochemistry)	:	Dr. Raghvendar Singh
Scientist (Animal Biochemistry)	:	Sh. Gorakh Mal
Scientist (Veterinary Parasitology)	:	Dr. R. Kumar
Scientist (Animal Gen. & Breed.)	:	Dr. B.P. Mishra
<b>Technical</b>		
Senior Veterinary Officer, T-8	:	Dr. U.K. Bissa
Farm Manager [Agril], T-7	:	Sh. Ram Kumar



Live Stock Farm Superintendent, T-7	:	Dr. N. Sharma (on study leave)
Veterinary Officer, T-6	:	Dr. B.L.Chirania
Library Asstt., T-4	:	Sh. Ram Dayal
Computer Opt/Prog, T-4	:	Sh. Dinesh Munjal
Agricultural Asstt., T-II-3	:	Sh. M.K. Rao
Computer Opt/Prog, T-II-3	:	Sh. Vinod Kumar
Lab. Techn., T-II-3	:	Sh. Anand Kumar Bhati
Hindi Translator, T-II-3	:	Sh. Nemi Chand
Jr. Engineer, T-II-3	:	Sh. Manjit Singh
Livestock Asstt., T-1-3	:	Sh. Mohan Singh
Livestock Asstt., T-1-3	:	Sh. Ram Chandra Bheel
Lab. Tech., T-2	:	Sh. Nand Kishore
Live Stock Assistant, T-2	:	Sh. Radha Kishan
Lab. Tech., T-1	:	Sh. Rameshwar Vyas
<b>Administrative</b>		
Asstt. Adm. Officer	:	Sh. A.K. Mallick
Asstt. Finance & Accounts Officer	:	Sh. N.D. Sharma (On deputation)
Assistant	:	Sh. Kanwar Pal
Stenographer	:	Sh. Ram Kumar
Junior Stenographer	:	Sh. Harpal Singh
Senior Clerk	:	Sh. Ashok Yadav
Senior Clerk	:	Sh. Jamil Ahmed
Senior Clerk	:	Sh. Anil Kumar
Junior Clerk	:	Sh. Vishnu Kumar
Junior Clerk	:	Sh. K.K. Yadav
<b>Auxiliary</b>		
Driver	:	Sh. Shivji Ram
	:	Sh. Prabhu Dayal
	:	Sh. Mehboob Hussain
	:	Sh. Rafiq Alam
	:	Sh. Mani Lal
Tube Well Operator	:	Sh. Satnam Singh
	:	Sh. Suraj Bhan Singh
<b>Supporting</b>		
SSG I to IV	:	22

### 3.

## FINANCIAL STATEMENT

During the year 1996-97, Rs. 75 lakhs were sanctioned under plan and Rs. 44.15 lakhs under non-plan. Full budget allocations were utilised. The details are provided in Table 3.1.

**Table 3.1.**  
**Statement of expenditure**

S. Head of Account No.	<u>1995-96</u>				<u>1996-97</u>			
	PLAN		NON PLAN		PLAN		NON PLAN	
	Budget	Expdt.	Budget	Expdt.	Budget	Expdt.	Budget	Expdt.
1. Estt. charges	0.50	0.46	35.60	36.37	1.50	1.47	40.80	40.81
2. T.A.	0.30	0.30	0.40	0.40	0.50	0.34	0.60	0.57
3. Other charges (Including equipments)	40.00	49.78	2.00	1.23	59.75	59.95	4.00	2.77
4. Works	29.20	19.46	-	-	13.25	13.24	-	-
	70.00	70.00	38.00	38.00	75.00	75.00	45.40	44.15



## 4.

### CAMEL HEALTH AND FARM MANAGEMENT

#### 4.1. Clinical cases :

During the period 191 cases of different ailments were treated belonging to camel farm of National Reserch Centre on Camel. Among the systemic diseases 28 cases were of digestive diordurs 7 cases of resperatary disorders and others were of skin offections, surgical effections including retention after birth, ecthyine of the age, sex and breed wise marbidity is presented in table 4.1.

#### 4.2. Prophylactic measures :

##### 1. Control of trypanosomiasis :-

For prevention and control of trypanosomiasis chemoprophylaxis quinapyramine sulphate and chloride were injected twice in a year in the month of August-September and Feb.-March. No case of surra was found in the herd during the year 1996-97.

##### 2. Control of external parasites :-

The camels were sprayed with insecticides twice a year for prevention and control of ectoparasites before onset of rain after clipping of hairs in the month of March and second time after rains i.e. in the month of September-October. The sheds are also sprayed with insecticides.

##### 3. Control of internal parasites :-

The camels were given broad spectrum anthelmintics twice a year

**Table-4.1 : Age, Sex and Breed wise morbidity (1996-97)**

	Sex		Age group			Breed			Total	Percentage Morbidity	
	Male	Female	0-3 mths	3-36 mths	above 3 years	Bikaneri	Jaisalmeri	Kachchhi			Crossbred
<b>I. Digestive system</b>											
(i) Simple Indigestion	6	8	4	3	7	6	5	2	1	14	7.33
(ii) Enteritis	6	6	8	3	1	5	6	1	-	12	6.28
(iii) Impaction	1	1	-	-	2	1	1	-	-	2	1.05
<b>II. Respiratory system</b>											
(i) Pneumonia	1	1	2	-	-	1	1	-	-	2	1.05
(ii) Bronchopneumonia	2	3	3	2	-	2	2	1	-	5	2.62
<b>III. Reproductive system</b>											
(i) Retention after birth	-	1	-	-	1	-	-	1	-	1	0.52
<b>IV. Surgical affections</b>											
(i) Camel bite	8	-	-	3	5	3	3	2	-	8	4.19
(ii) Dog bite	-	2	1	-	1	-	-	2	-	2	1.05
(iii) Wounds & Injuries	47	13	-	15	45	24	27	7	2	60	31.41
(iv) Sprain	3	2	3	2	-	2	2	1	-	5	2.62
(v) Fracture	1	1	1	-	1	1	1	-	-	2	1.05
<b>V. Skin affections</b>											
(i) Mange	29	34	8	22	33	36	20	5	2	63	32.99
<b>VI. Others</b>											
(i) Debility	2	3	1	1	3	2	1	2	-	5	2.62
(ii) Pyrexia	2	1	2	-	1	1	2	-	-	3	1.57
(iii) Otitis media	1	-	1	-	-	-	-	1	-	1	0.52
(iv) Ecthyma	3	1	2	2	-	1	2	1	-	4	2.09
(v) Conjunctivitis	1	1	-	1	1	1	1	-	-	2	1.05
<b>Total</b>	<b>113</b>	<b>78</b>	<b>36</b>	<b>54</b>	<b>101</b>	<b>86</b>	<b>74</b>	<b>26</b>	<b>5</b>	<b>191</b>	



**Table 4.2**  
**Age and Sex wise mortality during year 1996-97**

Age-group	Sex	Camel Days	No. of animals died	Mortality per 1000 Camel days/day
Birth to 90 days	M	9125	-	0.0000
	F	12045	-	0.0000
Pooled		21,170	-	0.0000
91 days to 3 years	M	5967	2	0.3352
	F	4015	-	0.0000
Pooled		9982	2	0.2004
Above 3 years	M	18905	-	0.0000
	F	37714	2	0.0530
Pooled		56,619	2	0.0353
Overall	M	33997	2	0.0588
	F	53774	2	0.0372
Pooled		87,771	4	0.0456

**Table- 4.3**  
**Breed wise mortality during year 1996-97**

Breeds	Camel days	No. of animals died	Mortality/1000 camel days/day	SDR(%)
Bikaneri	40,616	4	0.0985	3.667
Kachchhi	11052	-	0.0000	0.0000
Jaisalmeri	30628	-	0.0000	0.0000
Cross breed (Arab x Bikaneri)	5475	-	0.0000	0.0000
Overall	87,771	4	0.0456	1.694



in the month of September-October and March-April. The worm load of the animals was within the safe limit.

#### 4.3. Camel Health Camps :

During the period two camps were organised at Bajju (Raikabas) and Gadwala village, where suspected camels were treated for trypanosomiasis and internal parasitic infestation. The camels suffering from mange were sprayed with insecticides by spray machine.

#### 4.4. Mortality :

The specific death rate (SDR %) at the NRC on Camel, Bikaner was 1.69% during the year. The breed wise mortality in Bikaneri breed was 3.66% whereas it was nil in Jaisalmeri, Kachchhi and crossbreed animals. The calf mortality was nil during the period. Age, sex and breed wise mortality per thousand camel days per day are presented in Table-4.2 and Table-4.3.

#### 4.5. Studies on parasitic diseases in camel

Investigator : Rajender Kumar

##### 4.5.1. Helminths :

The camel at NRCC farm were examined for helminthic infection in months of Feb. and March, 1997. 90/220 (40.9%) camels were found positive for *Nematodirella* sp., *Nematodirus* sp., *Haemonchus* sp. (Nematodes). Among these *Nematodirella* sp. was found predominant comparatively. 89/90 camels showed sub clinical form of infection. Faecal egg count was found less than 50 per gram of faeces.

Field survey of camels for parasitic infection was done in Nov., 96 around Indira Gandhi Canal area. 80.3% camels were found positive for mixed nematodal infections viz. *Haemonchus* spp. and *Strongyloides* spp. Faecal egg count was found between 50-100 per gram of faeces.

##### 4.5.2. Arthropods :

At NRCC farm 63/220 (28.6%) camels were found positive for

mange caused by *Sarcoptes scabiei* var. *cameli*. Intensity and incidence was higher in young ones as compare to adults. Due to severe itching in many cases secondary bacterial and parasitic (maggots) infections were also noticed at site of lesions.

In ticks, *Hyalomma dromedarii* was the only species recorded from camels of NRCC farm. Intensity of infestation was very very less due to regular acaricidal sprays.

Around Bikaner 250 camels were examined for different arthropods infestation. 83/250 (33.6%) animals were found positive for *Sarcoptes* mite and only one camel was found positive for *Psoroptes* mite. In ticks, *Hyalomma dromedarii* and *Hyalomma anatolicum anatolicum* were predominant species.

#### 4.5.3. Protozoa :

62 blood samples from NRCC farm and 28 blood samples from field (around Bikaner) of camels were tested for blood protozoa infection by blood smear examination after staining with Leishman's stain. All samples were found negative for any protozoan infection.



Nematode eggs in camel faeces



## 5.

### RANGELAND MANAGEMENT

The farm area of the centre is spread over in 824 ha sandy barren, undulated and terrain land. The fencing work of the farm area is in progress. The boundary roads were dressed up. About 2 ha area was brought under blue-panic (*Panicum antidotale*) and 2 ha area was sown with *Cenchrus ciliaris*. The work of gap filling with sewan grass was completed in established pasture of sewan grass in 22 ha. The requisite agricultural operations were performed, in one hectare pasture established with three tier system of fodder production and at various sites at the farm.

The work of plantation of 2500 tree seedlings were introduced in nearby farm area, adjacent to administrative office complex and as a gap filling in rows of old trees like *Prosopis cineraria*, *Acacia tortilis*, *Ailanthus excelsa*, *Salvadora oleoides* and *Zizyphus mummularia*. Lawn grass and other landscaping components were introduced inside and outside area of new rest house of the centre and in front of co-operative store. These components were maintained in nearby area of offices of the centre. Groundnut crop was cultivated in about 8 ha as a irrigated crop with the help of tubewells and about 10 ha guar as a rainfed crop, on contract basis. About 163 quintals dry fodder of groundnut was obtained and guar crop remained as a failure crop due to lack of rain. Guar crop was offered for camel grazing. About 1.5 ha area was sown with oat crop during winter for camel feeding and utilized the fodder as such. Farm area supported 6 hour regular grazing to a herd of 200 camels of the centre under semi-intensive management system.

## 6. RESEARCH PROJECTS

### 6.1. To study work standards in camel and to associate work standards with physical, physiological and biochemical parameters

Project Code no.	:	P.I.86/1-ICN/L-50 5220
Project leader	:	A. K. Rai
Associates	:	Raghvendar Singh
	:	A.K. Nagpal
	:	N.D. Khanna

#### 6.1.1. Comparative study on riding performance of male and female camel

The study was conducted on three male and three female camels aged 6 to 8 yr. weighing  $552 \pm 40.6$  Kg and  $495 \pm 10.5$  kg respectively. The camels were trained for riding for a period of three months. The riding performance was assessed on a 3.7 km. circular desert track. The average environmental temperature during the course of investigation was  $32.6 \pm 1.01$  degree centigrade and vapour pressure  $24.0 \pm 0.72$  mmHg. The riding speed was maintained at 8-9 Km per hour and experimental camels were targeted to complete 15 Km at a stretch. The cardinal physiological responses were recorded and blood sample collected before and after riding performance. The average respiratory frequency, pulse rate and rectal temperature before riding was 10 per min., 48 per min. and 36.8 de-



**Table 6.1.1**  
**Pulse, respiration rate and rectal temperature on riding performance of male and female camels\***

Sex	Body Weight(kg)	Pulse/min		Respiration/min		Rectal Temp. (°C)	
		Before	After	Before	After	Before	After
Male	552.00	47.00	81.00	10.00	25.00	37.00	39.40
	±40.65	±1.65	±3.93	±0.32	±2.44	±0.12	±0.36
Female	495.00	48.00	77.00	9.00	35.00	36.60	39.50
	±10.49	±1.93	±2.80	±0.45	±0.17	±0.17	±0.39

\* Average of six values ± S.E.

**Table 6.1.2**  
**Riding performance of male and female camels\***

SEX	Time taken/round (Minutes)				Speed/round (km/hr)			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Male	24.04 ±0.70	23.40 ±1.24	23.30 ±0.57	25.99 ±0.78	9.23 ±0.23	9.54 ±0.51	9.48 ±0.23	8.58 ±0.23
Female	23.94 ±0.08	25.23 ±0.31	28.60 ±0.76	28.37 ±0.93	9.31 ±0.37	8.76 ±0.11	7.73 ±0.20	7.81 ±0.25

\* Average of six values ± S.E.

a = One round equal to 3.7 Km circular desert track.



**Table 6.1.3**  
**Comparative study of biochemical performance of male and female camels**

PARAMETERS	0 hour		After 2 round		After 4 round		After 24 hr	
	M	F	M	F	M	F	M	F
Glucose (mg/dl)	66.52 +3.49	56.92 +6.06	97.76 +11.35	95.25 +1.76	112.78 +15.51	112.87 +4.41	63.44 +4.57	56.95 +1.29
Triglycerides (mg/dl)	25.84 +1.12	32.36 +3.11	33.84 +4.00	33.10 +3.18	32.45 +3.45	30.10 +4.13	17.17 +3.66	37.24 +1.04
CK (IU/L)	86.21 +20.97	75.89 +13.14	67.87 +16.94	55.50 +14.98	63.02 +12.32	55.27 +18.68	85.09 +18.21	76.88 +6.62
VGT (IU/L)	31.39 +1.63	28.02 +2.04	26.46 +2.45	24.42 +1.40	28.63 +2.26	24.27 +1.95	29.58 +9.27	28.69 +1.79
LDH (IU/L)	301.38 +8.12	368.68 +25.28	320.47 +6.00	385.66 +17.94	259.93 +7.22	267.43 +17.86	313.96 +11.09	402.50 +33.57
Lactate (mg/dl)	2.76 +0.53	4.04 +0.58	22.95 +3.32	15.07 +1.05	39.40 +3.96	32.62 +2.31	3.29 +0.55	4.07 +0.27
Cortisol	12.75 +1.33	11.50 +0.86	29.75 +4.82	21.16 +3.34	52.25 +7.49	31.67 +0.34	12.85 +1.94	12.25 +1.69

Average of six values  $\pm$  SE

gree centigrade respectively. The respiratory frequency after riding increased by 150% and 289% and pulse rate in male female camels 72% and 60% respectively. The increase in rectal temperature was 2.4 in male and 2.9 in females over normal rectal temperature. Gradual decrease was observed in the speed of camel with the increase in distance covered. (Table 6.1.1 and 6.1.2)

Data on glucose, triglycerides, creatine kinase,  $\gamma$  glutamyl transferase, lactate dehydrogenase, lactate and cortisol is given in table 6.1.3. The level of glucose increased on riding in both male female and reached initial level with in 24 hour rest. Slight increase was also observed in the level of triglycerides, however, it did not decline even after 24 hour rest. The creatine kinase activity decreased significantly on riding in both male and female, whereas, no significant change was observed in glutamyl transferase activity. The lactate dehydrogenase activity decreased in both male and female. There was significant increase in serum lactate level on riding. Cortisol increased significantly on riding in both male and female camels.

#### **6.1.2 Investigations on nutrient utilization in adult draft camels during winter season**

Three healthy adult male camels (7-11 years age) kept on sole roughage diet of dry moth chara (*Phaseolus aconitifolius*) were used for draft experiment in 3 x 3 switch over statistical design. One camel was kept at rest (control) while 2 others served as experimental animals. The 2nd camel was harnessed in 2 wheel cart with payload of 2.5 kg/kg body weight and pulled cart for 6 hrs continuously covering a distance of approximately 24 km. The 3rd camel was harnessed in 4 wheel cart with same pay-load and pulling cart for the same period as that of 2nd camel.

There was no significance difference among 3 groups in respect of average body weight, dry matter (DM), digestible crude protein (DCP), metabolisable energy (ME) and water intakes. The average daily DM intakes of experimental camels



**Table 6.1.4**  
**Average nutrients intake of adult draft camels during winter season**

Parameter	Body weight (Kg)	DM intake (kg/d)	H <sub>2</sub> OI (l/d)	DMI		MEI		H <sub>2</sub> OI	
				g/kgw <sup>0.75</sup>	DCPI	MJ/kgw <sup>0.75</sup>	MEI	MJ/kgw <sup>0.75</sup>	H <sub>2</sub> OI
Resting group	663.67	5.57	21.33	43.64	3.15	0.354	0.354	106.31	
	±36.29	±1.43	±6.17	±12.36	±0.95	±0.10	±0.10	±32.98	
2 Wheel carting	671.33	8.39	30.97	63.41	4.70	0.559	0.559	147.53	
	±37.21	±0.93	±6.93	±4.96	±0.49	±0.07	±0.07	±28.29	
4 Wheel carting	671.67	8.43	34.53	64.36	4.91	0.586	0.586	168.73	
	±30.34	±0.72	±6.10	±7.23	±0.44	±0.06	±0.06	±36.95	

**Table 6.1.5**  
**Digestibility (%) of nutrients in draft camels during winter season**

Camel group	DM	OM	CP	EE	CF	NFE
Resting group	57.17 ±0.96	63.64 ±1.11	58.90 ±0.45	16.04 ±5.65	40.41 ±8.81	74.99 <sup>a</sup> ±0.47
2 Wheel carting	61.34 ±2.20	68.02 ±3.41	60.91 ±3.73	20.65 ±3.91	53.97 ±11.94	77.35 <sup>ab</sup> ±1.65
4 Wheel carting	63.57 ±0.75	70.37 ±0.08	63.16 ±2.59	30.11 ±10.88	53.17 ±3.68	80.01 <sup>b</sup> ±0.56

a, b - P < 0.05



Table 6.1.6  
 Nitrogen balance and retention in draft camels during winter season

Camel group	N-intake (g/d)	N-voided (g/d)		N-balance (g/d)	%N retention of N-intake
		Faeces	Urine		
Resting group	108.88 ±29.11	45.49 ±12.38	42.94 ±16.43	20.45 ±4.83	21.39 ±5.64
2 Wheel carting	162.68 ±13.69	60.74 ±3.27	31.91 ±12.69	70.03 ±23.20	41.19 ±11.58
4 Wheel carting	163.48 ±9.14	64.20 ±4.63	54.03 ±15.35	45.26 ±16.22	28.02 ±9.75

put in 2 wheel and 4 wheel cart were  $8.39 \pm 0.93$  and  $8.43 \pm 0.72$  kg respectively which was about 50% higher than the control camels at rest ( $5.57 \pm 1.43$ ). Due to higher nutrient demand from work stress, the intakes of DCP (g) and ME (MJ)/kg metabolic body weight were higher by 49.2 and 57.9% respectively during 2 wheel carting and 55.9 and 65.5% respectively during 4 wheel carting by camels than at rest. (Table 6.1.4)

The carting stress also resulted in higher digestibility (%) of OM, CP, EE, CF and NFE in 2 wheel and 4 wheel carting camels by 4.46, 6.8, 2.0, 4.3, 4.6, 14.1, 13.6, 12.8 and 2.4, 5.0 units respectively (Table 6.1.5) than in control camels at rest. The NFE digestibility differed significantly ( $P < 0.05$ ) among 2 groups. The 2 wheel and 4 wheel carting was also observed to cause 50% higher N intake (g/d) than at rest (Table 6.1.6). However, there was no significant difference among 3 groups in respect of N retention. The results indicated that the draft camels require more nutrients than resign camels.

## 6.2. Studies on quantitative and qualitative genetic parameters in Indian camels

Project Code No.	:	P.I.86/2-ICN/L-10/5220
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### 6.2.1. Herd strength

The farm camel herd strength at the begin and at the end of the year was 225 and 234 camels, respectively, comprising mainly of three indigenous breeds and crossbred group (Arabi x Bikaneri). The breedwise initial strength of Bikaneri, Jaisalmeri, Kachchi, crossbreds, Marwari and Sanchori was 103, 79, 29, 12, 1 and 1, respectively, and at the end in the



**Table- 6.2.1**  
**Camel Herd Strength (1996-97)**

Breed/Age	Opening		Calving		Total		Deaths		Disposal		Closing		Total
	M	F	M	F	M	F	M	F	M	F	M	F	
<b>BIKANERI</b>													
Up to 3 months	4	9	3	6	7	15	-	-	-	-	3	5	8
3 to 12 months	5	2	-	-	5	2	2	-	-	-	7	12	19
1-3 Years	11	3	-	-	11	3	-	-	2	-	9	3	12
Above 3 Years	19	50	-	-	19	50	1(Eu)	2	-	-	18	48	66
Total	39	64	3	6	42	70	3	2	2	-	37	68	105
<b>JAISALMERI</b>													
Up to 3 months	5	6	4	2	9	8	-	-	-	-	4	2	6
3 to 12 months	1	2	-	-	1	2	1(Eu)	-	-	-	6	7	13
1-3 Years	6	6	-	-	6	6	-	-	2	-	4	6	10
Above 3 Years	18	35	-	-	18	35	-	-	-	-	18	35	53
Total	30	49	4	2	34	51	1	-	2	-	32	50	82
<b>KACHCHHI</b>													
Up to 3 months	0	2	1	1	1	3	-	-	-	-	1	1	2
3 to 12 months	3	1	-	-	3	1	-	-	-	-	3	3	6
1-3 Years	2	2	-	-	2	2	-	-	-	-	2	2	4
Above 3 Years	9	10	-	-	9	10	-	1(Eu)	-	-	9	9	18
Total	14	15	1	1	15	16	-	1	-	-	15	15	30
<b>(Arabi X Bikaneri)</b>													
Up to 3 months	1	-	0	3	1	3	-	-	-	-	-	3	03
3 to 12 months	-	-	-	-	-	-	-	-	-	-	1	-	01
1-3 Years	-	-	-	-	-	-	-	-	-	-	-	-	-
Above 3 Years	1	10	-	-	1	10	-	-	-	-	1	10	11
Total	2	10	-	3	2	13	-	-	-	-	2	13	15
MARWARI (ADULT) 1	-	-	-	-	1	-	-	-	-	-	1	-	01
SANCHORI (ADULT) 1	-	-	-	-	1	-	-	-	-	-	1	-	01
OVER ALL TOTAL	87	138	8	12	95	150	4	3	4	-	88	146	234

M-Male, F-Female, Eu -Euthanised

**Table 6.22 (a)**  
**Breed, Year and sexwise least-squares means of body weights (Kg) in indigenous camels.**

Breed group sex	Birth-wt	3 mth	6 mth	9 mth	12 mth	18 mth	24 mth	30 mth	36 mth	42 mth	48 mth
<b>BREED</b>											
Bikaneri	38.20±0.47 (106)	89.09±1.57 (94)	150.27±1.45 (58)	182.76±1.94 (54)	206.55±1.80 (102)	243.49±2.63 (76)	274.12±2.99 (72)	301.30±2.70 (61)	322.18±2.96 (56)	356.78±4.22 (47)	396.16±5.74 (42)
Jaisalmeri	36.47±0.61 (55)	87.17±1.81 (50)	146.22±1.69 (33)	179.91±2.39 (36)	199.37±2.49 (48)	227.90±3.95 (29)	265.97±3.85 (29)	288.23±4.30 (20)	319.19±5.02 (17)	352.53±6.25 (20)	379.96±9.74 (13)
Kachchhi	35.13±0.64 (40)	89.08±2.82 (23)	144.43±1.63 (38)	180.95±2.55 (35)	203.39±2.98 (40)	227.65±4.13 (33)	262.70±4.21 (35)	287.73±4.10 (30)	321.54±4.44 (28)	344.28±6.20 (24)	385.33±8.34 (23)
<b>YEAR</b>											
1988	34.10±1.06 (14)	77.28±6.41 (4)	141.08±1.95 (25)	173.73±3.81 (13)	189.94±3.65 (23)	221.75±5.55 (16)	257.71±3.80 (28)	285.95±4.27 (24)	312.79±8.43 (6)	342.55±14.39 (3)	373.94±7.16 (21)
1996	40.48±1.33 (9)	94.82±3.20 (16)	153.13±3.57 (7)	191.88±3.57 (15)	220.57±5.66 (9)	244.57±4.34 (30)	284.87±11.7 (3)	298.46±4.29 (27)	333.18±4.54 (26)	361.44±5.16 (28)	399.69±9.22 (12)
<b>SEX</b>											
Male	37.55±0.46 (103)	90.94±1.55 (85)	148.64±1.18 (69)	181.54±1.80 (65)	204.34±1.93 (88)	235.21±2.89 (59)	264.96±2.89 (56)	290.54±2.99 (49)	324.44±3.39 (45)	353.61±5.19 (33)	387.66±49 (28)
Female	35.65±0.47 (98)	85.96±1.68 (82)fm	145.31±1.32 (60)	180.87±1.91 (65)	201.87±1.84 (102)	230.81±2.64 (79)	270.23±3.12 (70)	294.30±2.79 (62)	317.49±3.19 (56)	348.78±4.09 (58)	386.64±5.56 (50)
Over all	36.60±0.36 (201)	88.45±1.28 (167)	146.97±0.92 (129)	181.21±1.41 (130)	203.10±1.42 (190)	233.01±2.04 (138)	267.60±2.41 (136)	292.42±2.22 (111)	320.97±2.60 (101)	351.20±3.84 (91)	387.15±5.43 (78)

Note - Figures in parentheses represent number of observations.

same order was 105, 82, 30, 15, 1 and 1 respectively. (Table 6.2.1). Addition due to calving was 20 calves, of which 40.0% were males and 60.0% females. The reduction, due to the distribution of superior quality studs to progressive camel breeders through State Animal Husbandry Department was 4, due to deaths and euthinisation was 4 and 3 camels, respectively. The overall survivability of herd was 98.3 per cent. The age wise composition (below 3 months, 3-12 months; 1-3 years and adults) was 8.0, 16.6, 11.1 and 64.1 percent, respectively.

### 6.2.2. Quantitative parameters

#### a. Body weights :

The breed, year and sexwise least squares means of body weights from birth to 48 months of age are presented in table 6.2.2 (a). The mean birth weight in Bikaneri, Jaisalmeri and Kachchhi calves were  $38.2 \pm 0.47$ ,  $36.4 \pm 0.61$  and  $35.1 \pm 0.64$  kg respectively, with overall weight of  $36.6 \pm 0.36$  kg. Over the years the birth weight varied from  $34.0 \pm 1.06$  to  $40.48 \pm 1.33$  kg. The contribution of breed, year and sex was significant ( $P < 0.01$ ). Bikaneri calves weighed heaviest followed by Jaisalmeri and Kachchhi calves. Male calves were superior to female calves. The average 3 months weight of Bikaneri, Jaisalmeri and Kachchhi were  $89.0 \pm 1.57$ ,  $87.17 \pm 1.81$  and  $89.08 \pm 2.82$  kg, respectively. The contribution of sex was found to be significant ( $P < 0.01$ ). The six monthly body weight in three breeds varied from  $144.4 \pm 1.63$  kg in Kachchhi to  $150.2 \pm 1.45$  kg in Bikaneri camels with overall weight of  $146.9 \pm 0.92$  kg. The breed, year and sex effects contributed significantly ( $P < 0.05$ ). The 12 months weight of Bikaneri, Jaisalmeri and Kachchhi camels was  $206.5 \pm 1.8$ ,  $199.3 \pm 2.49$  and  $203.3 \pm 2.98$  kg, respectively, with overall weight of  $203.1 \pm 1.42$  kg. The breed and year effects were found to be significant ( $P < 0.05$ ). The average weight at 24 months of age in Bikaneri, Jaisalmeri and Kachchhi was  $274.1 \pm 2.99$ ,  $265.9 \pm 3.85$  and  $262.7 \pm 4.21$  kg, respectively. The contribution of breed, year and sex effects was significant ( $P < 0.05$ ). The mean body weight at 36 months of age varied from  $319.1 \pm 5.02$  to  $322.1 \pm 2.96$  kg and the contribution of breed

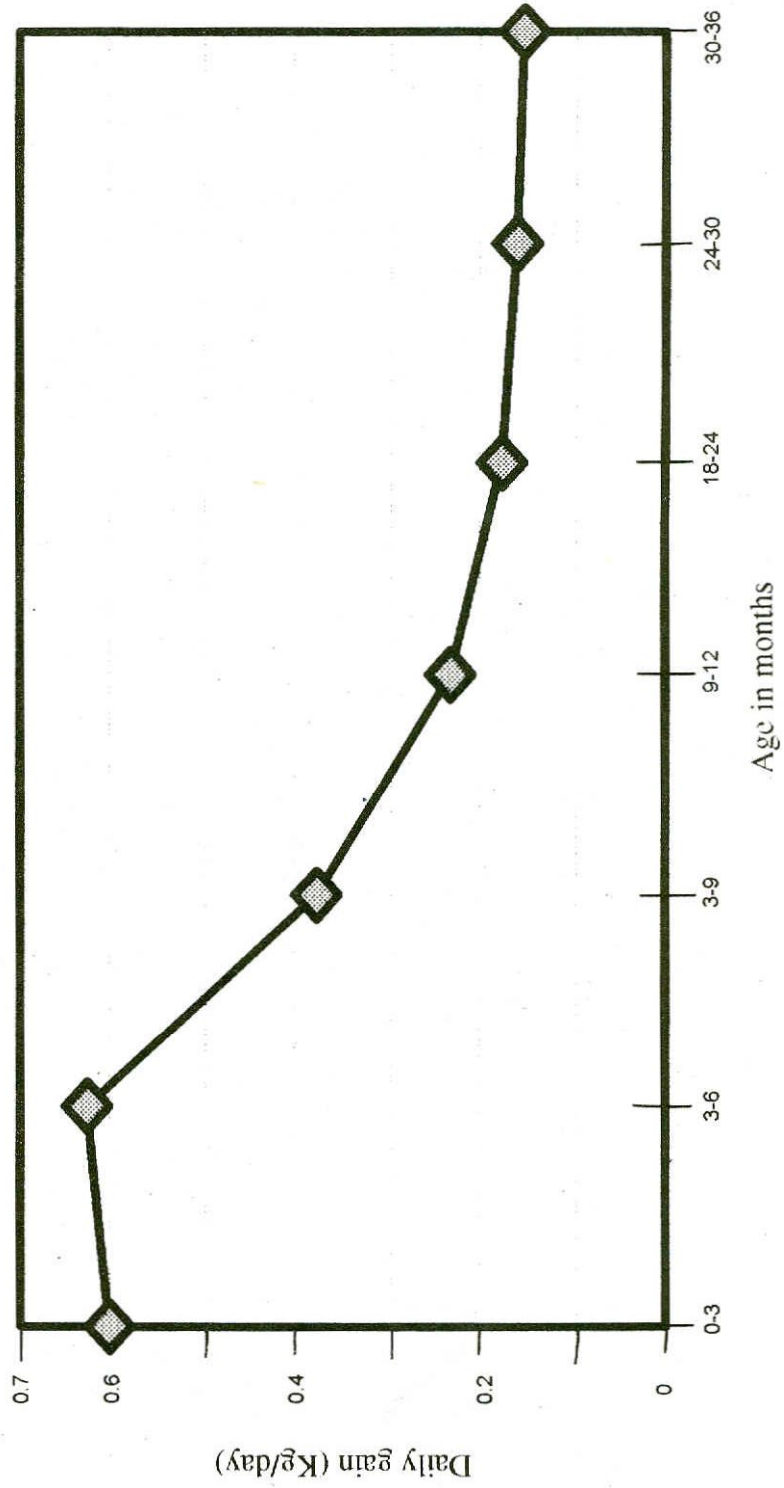


**Table-6.2.2 (b)**  
**Breed, year and sexwise least squares means of average**  
**daily gain (kg/day) along with standard error in indigenous camels**

Breed/Sex	0-3 mth	3-6 mth	6-9 mth	9-12 mth	18-24 mth	24-30 mth	30-36 mth
<b>Over all</b>	0.605±0.086 (125)	0.627±0.014 (93)	0.381±0.016 (82)	0.230±0.019 (114)	0.177±0.008 (120)	0.162±0.011 (109)	0.156±0.009 (97)
<b>BREED</b>							
<b>Bikaneri</b>	0.603±0.021 (69)	0.657±0.021 (44)	0.387±0.025 (33)	0.241±0.026 (52)	0.198±0.016 (63)	0.163±0.014 (57)	0.157±0.17 (53)
<b>Jaisalmeri</b>	0.583±0.025 (38)	0.648±0.031 (30)	0.355±0.031 (19)	0.208±0.030 (32)	0.160±0.11 (25)	0.157±0.016 (22)	0.123±0.010 (17)
<b>Kachchhi</b>	0.629±0.036 (18)	0.576±0.029 (19)	0.401±0.026 (30)	0.243±0.032 (30)	0.173±0.017 (32)	0.167±0.17 (20)	0.187±0.016 (27)
<b>YEAR</b>							
<b>1988</b>	0.594±0.027	0.567±0.024	0.338±0.049	0.175±0.108	0.111±0.015	0.107±0.016	0.132±0.015
<b>1996</b>	0.715±0.097	0.699±0.047	0.432±0.040	0.338±0.062	0.219±0.024	0.201±0.014	0.186±0.016
<b>SEX</b>							
<b>Male</b>	0.630±0.022 (65)	0.640±0.017 (53)	0.369±0.020 (44)	0.227±0.023 (54)	0.157±0.012 (54)	0.158±0.012 (50)	0.175±0.012 (43)
<b>Female</b>	0.579±0.022 (60)	0.617±0.020 (40)	0.393±0.023 (38)	0.234±0.025 (60)	0.196±0.011 (66)	0.166±0.013 (59)	0.136±0.11 (53)

Note - Figures in parentheses represent number of observations

**Fig 6.2.1**  
**Growth curve showing quarterly and six monthly overall average daily gain (kg/day) in indigenous camels.**



and sex effects were significant ( $P < 0.05$ ). Bikaneri calves were found to be heavier over the Jaisalmeri and Kachchhi calves.

#### b. Average daily gain

The least-squares means of quarterly average daily gain upto 12 months and 6 monthly average daily gain upto 36 months of age are presented Table 6.2.2 (b) and Fig 6.2.1 The average daily gain from birth to 3 months of age in Bikaneri Jaisalmeri and Kachchhi calves varied  $0.583 \pm 0.02$  in Jaisalmeri to  $0.629 \pm 0.03$  kg/day in Kachchhi with over all gain of  $0.605 \pm 0.18$  kg/day. The average daily gain in male and female calves was  $0.630 \pm 0.02$  and  $0.579 \pm 0.02$  kg/day, respectively, and the contribution of sex was significant ( $P < 0.05$ ). The average daily gain from 3 to 6 months of age in Bikaneri, Jaisalmeri and Kachchhi calves were  $0.657 \pm 0.02$ ,  $0.648 \pm 0.02$  and  $0.576 \pm 0.02$  kg/day, respectively, with over all gain of  $0.627 \pm 0.01$  kg/day. The breed and sex effects were found to be significant ( $P < 0.05$ ). The average daily gain form 6 to 9 months and 9 to 12 months of age varied from  $0.355 \pm 0.03$  to  $0.401 \pm 0.02$  and  $0.208 \pm 0.03$  to  $0.243 \pm 0.03$  kg/day. The average daily gain was higher in Bikaneri and Kachchhi camels as compared to jaisalmeri camels. The average daily gain from 18 to 24 months of age ranged from  $0.160 \pm 0.11$  to  $0.198 \pm 0.16$  with overall gain of  $0.177 \pm 0.08$  kg/day. The contribution of year and sex was observed to be significant ( $P < 0.01$ ,  $P < 0.05$ ). The average daily gain from 30th to 36 months of age in Bikaneri, Jaisalmeri and Kachchhi was  $0.157 \pm 0.17$ ,  $0.123 \pm 0.01$  and  $0.187 \pm 0.01$  g/day with overall gain of  $0.156 \pm 0.009$  kg/day. The breed and sex effects were significant ( $P < 0.01$ ,  $P < 0.05$ ). The average daily gain from birth to 36 months of age indicated increasing trend upto six months of age and then it started declining.

#### c. Biometry

The breed, sex and age-wise least-squares means of body length, height and heart girth are presented in Table 6.2.3. The breedwise pooled body length in Bikaneri, Jaisalmeri and Kachchhi camels was  $137.1 \pm 1.19$ ,  $141.0 \pm 1.38$  and  $136.9 \pm 2.11$  cm respectively, with overall average of  $138.3 \pm 1.03$



**Table 6.2.3**  
**Breed, Sex and agewise Least-squares means of body length, height and heart girth (Cm) of farm camels.**

<b>Breed Groups/ Sex/age</b>	<b>Body length</b>	<b>Height (at withers)</b>	<b>Heart girth</b>
Overall	138.39±1.03 (188)	177.30±0.93 (188)	182.95±1.43 (188)
<b><u>Breed</u></b>			
Bikaneri	137.15±1.19 (98)	177.94±1.07 (98)	182.18±1.66 (98)
Jaisalmeri	141.05±1.38 (66)	180.54±1.23 (66)	185.23±1.91 (66)
Kachchhi	136.97±2.11 (24)	173.42±1.89 (24)	181.44±2.93 (24)
<b><u>Sex</u></b>			
Male	142.31±1.36 (61)	180.87±1.22 (61)	188.13±1.89 (61)
Female	134.47±1.29 (127)	173.00±1.15 (127)	177.78±1.79 (127)
<b><u>Age (Years)</u></b>			
1	109.35±1.95 (27)	152.08±1.75 (27)	148.50±2.70 (27)
2	122.92±2.74 (13)	161.05±2.46 (13)	161.06±3.81 (13)
3	132.82±2.83 (13)	175.31±2.54 (13)	182.23±3.93 (13)
4	134.94±3.74 (7)	173.97±3.35 (7)	170.02±5.19 (7)
5	151.10±2.66 (14)	190.77±2.39 (14)	199.11±3.70 (14)
6-8	154.24±1.49 (48)	191.82±1.34 (48)	206.59±2.07 (48)
9 and above	163.35±1.45 (66)	196.11±1.30 (66)	213.18±2.01 (66)

Note :- Figures in parentheses represent number of observations.

cm. Jaisalmeri camels had higher body length followed by Bikaneri and Kachchhi camels. Males showed significantly ( $P<0.01$ ) higher body length as compared to females in all the groups with average of  $142.3 \pm 1.36$  and  $134.4 \pm 1.29$ , cm respectively. Age-wise least squares means at 1, 2, 3, 4, 5 years and 6-8 years of age was  $109.3 \pm 1.95$ ,  $122.9 \pm 2.74$ ,  $132.8 \pm 2.83$ ,  $139.9 \pm 3.74$ ,  $151.1 \pm 2.66$ ,  $154.2 \pm 1.49$  and  $163.3 \pm 1.45$  cm respectively, contribution of age was observed to be significant ( $P<0.01$ ). The heritability of body length in Bikaneri breed was  $0.6 \pm 0.37$ .

The least-squares means for height in the same order was  $177.9 \pm 1.07$ ,  $180.5 \pm 1.23$  and  $173.4 \pm 1.89$  cm, respectively, with overall mean  $177.3 \pm 0.92$  cm. The mean height in male and female camels was  $180.8 \pm 1.22$  and  $173.7 \pm 1.15$  cms, respectively, the contribution of sex was significant ( $P<0.01$ ). Age-wise height of camels in all the breeds varied from  $152.0 \pm 1.75$  cm at one year to  $196.1 \pm 1.3$  cm at 9 years and above age group. Age effect contributed significantly ( $P<0.01$ ). The heritability of height in Bikaneri breed was  $0.8 \pm 0.576$ .

The least-squares means for heart girth in Bikaneri, Jaisalmeri and Kachchhi camels was  $182.1 \pm 1.66$ ,  $185.2 \pm 1.91$  and  $181.4 \pm 2.93$  cm, respectively, with overall average of  $182.9 \pm 1.43$  cm. Males had significantly ( $P<0.01$ ) higher heart girth over the females with average of  $188.1 \pm 1.89$  and  $177.7 \pm 1.79$  cm, respectively. Age wise heart girth varied from  $148.5 \pm 2.7$  cm. at 1 year of age to  $213.1 \pm 2.01$  cm in 9 years and above age, contribution of age was found to be significant ( $P<0.01$ ) and the heritability was  $0.7 \pm 0.43$  in Bikaneri breed.

### 6.2.3. Reproductive Performance

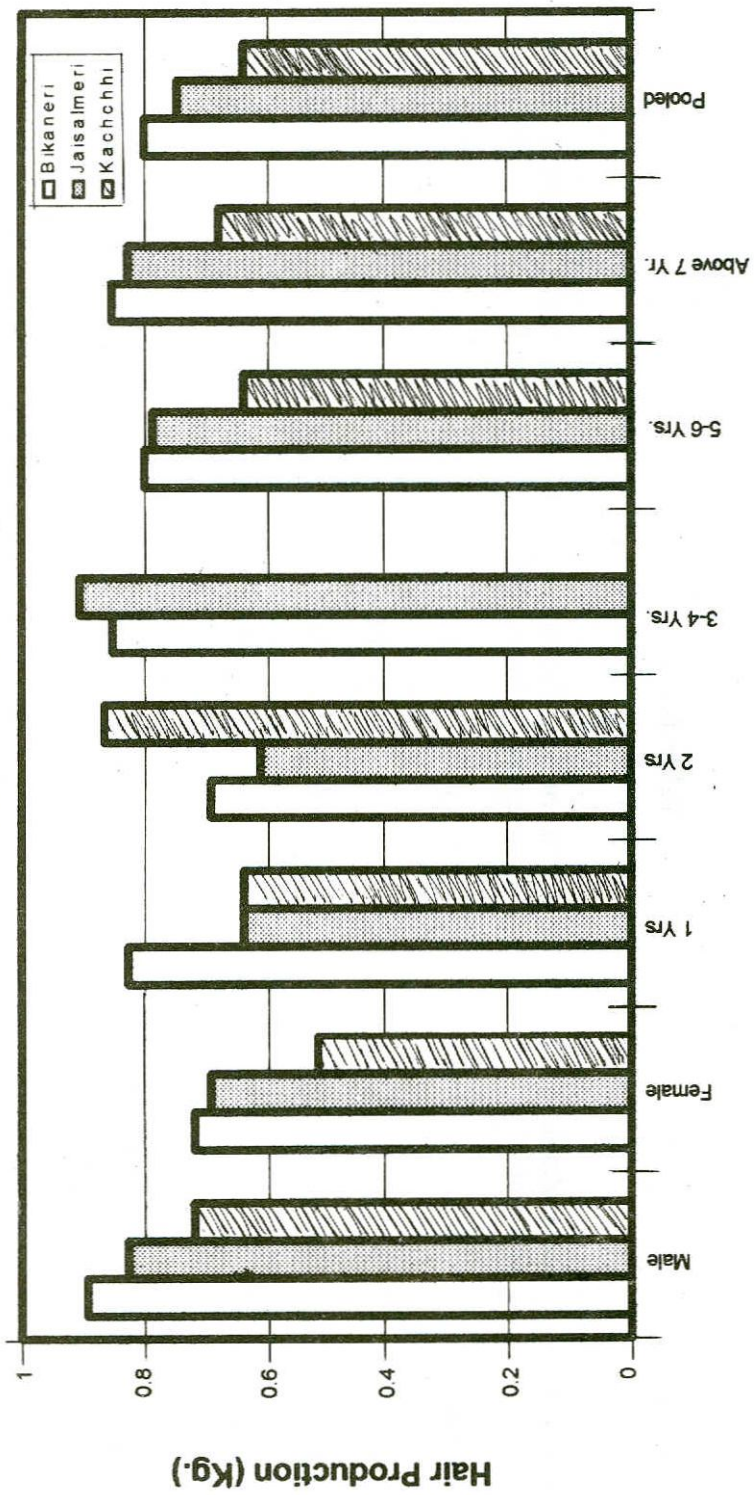
In all 55 she camels comprising of Bikaneri, Jaisalmeri and Kachchhi, breeds were available and mated by 3 sires each of Bikaneri, Jaisalmeri and one in Kachchhi during the breeding season. The breedwise conception in Bikaneri, Jaisalmeri and Kachchhi breed was 62.5, 66.6 and 72.4 per cent respectively with over all conception of 65.4 per cent. The mean gestation

**Table-6.2.4**  
**Reproductive performance of farm Camel Herd**

Breed	No. Available and mated	No. Conceived	Percent Conception	Calving rate Year (1996)	Gestation length (days)	Calving interval (days)
Bikaneri	24	15	62.5	53.3	392.5±1.25 (80)	729.8±19.03 (47)
Jaisalmeri	24	16	66.6	46.6	393.1±1.73 (39)	706.9±21.06 (21)
Kachchi	07	05	72.4	66.6	384.7±1.94 (32)	732.4±24.46 (61)
Overall	55	36	65.4	51.51	390.0±0.99 (151)	723.0±17.95 (84)



**Fig. 6.2.2**  
**Breed, sex and age wise annual hair production (Kg)**



length in Bikaneri, Jaisalmeri and Kachchhi breeds was  $392.5 \pm 1.25$ ,  $393.1 \pm 1.73$  and  $384.7 \pm 1.94$  days, respectively, with overall gestation of  $390.1 \pm 0.99$  days. (Table 6.2.4) The contribution of breed effect was observed to be significant ( $P < 0.01$ ). The heritability of gestation length in Bikaneri breed was  $0.2 \pm 0.37$ . The breed-wise least-squares means for calving interval in Bikaneri, Jaisalmeri and Kachchhi was  $729.8 \pm 19.03$ ,  $706.9 \pm 21.06$  and  $732.4 \pm 24.46$  days, respectively, with overall calving interval of  $723.0 \pm 17.93$  days. Over the years the calving rate in same order was 51.3, 54.1, 53.2 and 57.1 percent, respectively, with overall calving rate of 53.0 percent. The calving rate for the year (1996-97) varied from 46.6% in Jaisalmeri to 75.0 per cent in cross breeds (Arabi x Bikaneri) with overall calving rate of 54.0 percent.

#### **6.2.4. Hair production**

Breed, age and sexwise least-squares means for annual hair production in Bikaneri, Jaisalmeri and Kachchhi camels was  $0.806 \pm 0.057$ ,  $0.758 \pm 0.046$  and  $0.645 \pm 0.05$  kg, respectively. Bikaneri camels produced heavier annual clip followed by Jaisalmeri and Kachchhi camels. Males indicated higher production (ranging from  $0.772 \pm 0.06$  to  $0.895 \pm 0.061$  kg) and in females (ranging from  $0.520 \pm 0.06$  to  $0.717 \pm 0.065$  kg) in all the three breeds. The contribution of sex was significant ( $P < 0.01$ ) in Bikaneri and Kachchhi camels. Age-wise comparison of production was observed to be highest in Bikaneri camels followed by Jaisalmeri and Kachchhi camels. The age-wise hair production was observed to be higher at 3 to 4 years age and at 7 years above age group. (Fig. 6.2.2)

#### **6.2.5. Milk production**

Monthwise average daily milk production in 4 each lactating camels of Bikaneri and Kachchhi breeds belonging to second and third parity and 3 females of Jaisalmeri breed from third parity was studied. Three milking techniques, viz. 4 teat milking simultaneously, 2 teat milking along with calf suckling and machine milking were used. The camels were milked twice a

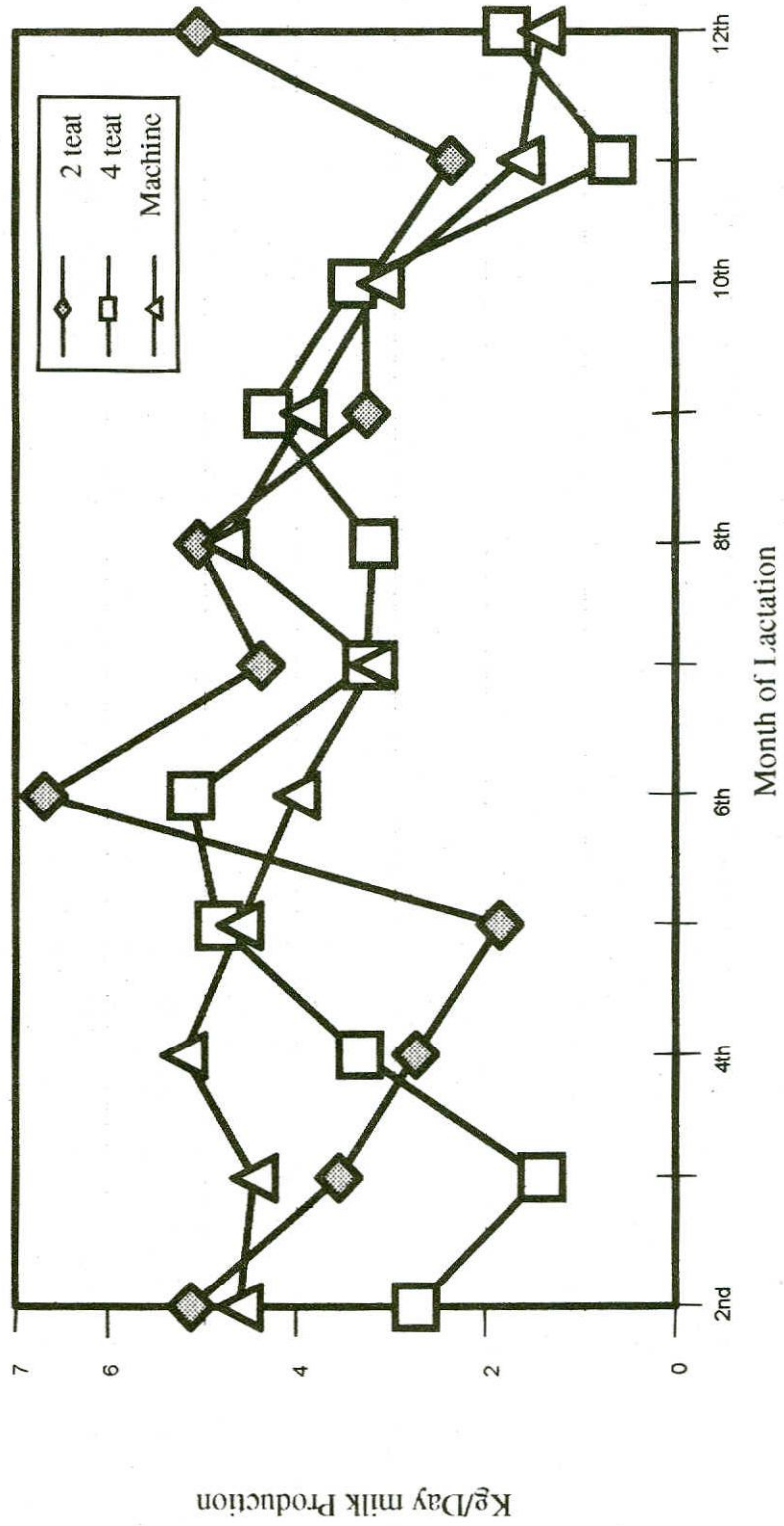
**Table-6.2.5 (A)**  
**Breed and milking Methodwise least-squares means of daily milk production (Kg/day)**  
**in 2nd & 3rd parity lactating camels**

	BREED			MILKING METHOD		
	Bikaneri	Jaisalmeri	Kachchi	2 teat	4 teat	Machine
<b>Parity II (M)</b>	1.58±0.09 (40)	-	1.83±0.09 (54)	2.13±0.12 (22)	1.60±0.08 (44)	1.39±0.11 (28)
<b>Parity III (M)</b>	2.05±0.07 (120)	1.69±0.06 (137)	2.56±0.12 (36)	2.57±0.07 (126)	1.98±0.07 (106)	1.76±0.10 (61)
<b>Parity II (E)</b>	1.37±0.08 (40)	-	1.57±0.08 (54)	1.84±0.12 (22)	1.41±0.08 (44)	1.16±0.10 (28)
<b>Parity III (E)</b>	1.76±0.06 (120)	1.41±0.05 (137)	2.24±0.11 (36)	2.23±0.07 (126)	1.71±0.06 (106)	1.47±0.09 (61)
<b>Parity II (P)</b>	2.95±0.17 (40)	-	3.41±0.17 (54)	3.97±0.25 (22)	3.02±0.16 (44)	2.56±0.22 (28)
<b>Parity III (P)</b>	3.82±0.13 (120)	3.11±0.12 (137)	4.81±0.23 (36)	4.80±0.14 (126)	3.70±0.14 (106)	3.23±0.19 (61)

M= morning, E=Evening, P=Pooled



**Fig 6.2.3**  
**Monthwise daily milk production (Kg./day)**  
**by different-milking methods**

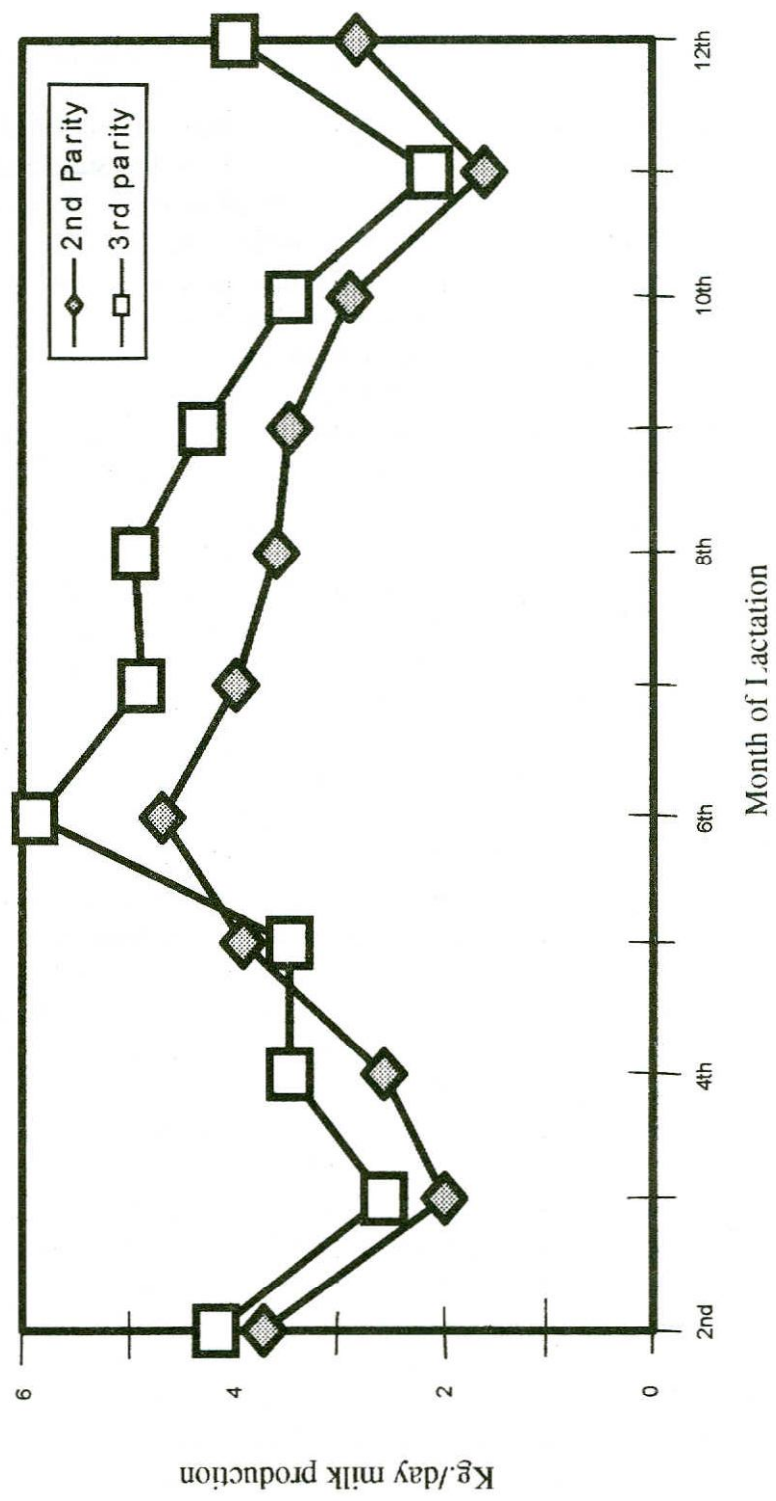


**Table-6.2.5 (B)**  
**Breed and Parity wise least square means of daily milk production (Kg/day) with**  
**different milking techniques in lactating camels.**

Milking Method	BREED				Parity		
	Bikaneri	Jaisalmeri	Kachchi		P-II	P-III	
<b>2 Teat (M)</b>	2.24±0.06 (88)	2.00±0.09 (60)	-		1.88±0.11 (22)	2.37±0.04 (126)	
<b>4 Teat (M)</b>	1.72±0.07 (44)	1.20±0.08 (51)	2.09±0.06 (55)		1.34±0.08 (44)	2.00±0.05 (106)	
<b>Machine (M)</b>	1.43±0.08 (28)	1.11±0.09 (26)	1.83±0.07 (35)		1.15±0.09 (28)	1.76±0.05 (61)	
<b>2 Teat (E)</b>	1.94±0.05 (88)	1.71±0.08 (60)	-		1.62±0.10 (22)	2.03±0.04 (126)	
<b>4 Teat (E)</b>	1.50±0.07 (44)	0.97±0.08 (51)	1.85±0.06 (55)		1.14±0.08 (44)	1.73±0.04 (106)	
<b>Machine (E)</b>	1.23±0.08 (28)	0.90±0.10 (26)	1.58±0.07 (35)		0.96±0.09 (28)	1.52±0.05 (61)	
<b>2 Teat (P)</b>	4.19±0.11 (88)	3.72±0.17 (60)	-		3.50±0.22 (22)	4.40±0.08 (126)	
<b>4 Teat (P)</b>	3.22±0.15 (44)	2.17±0.16 (51)	3.94±0.13 (55)		2.48±0.16 (44)	3.74±0.10 (106)	
<b>Machine (P)</b>	2.66±0.16 (28)	2.02±0.19 (26)	3.42±0.14 (35)		2.12±0.18 (28)	3.28±0.10 (61)	

M= morning, E=Evening, P=Pooled

**Fig. 6.2.4**  
**Monthwise average daily milk production (Kg/day)**  
**in 2nd and 3rd parity of lactation**





day at 12 hr interval (7 AM and 7 PM). The camels were maintained on dry moth chara *ad lib* (*Phaseolous aconitifolius*) with daily watering. The crushed guar (*Cyamopsis tetragonoloba*) was also supplemented @ 2.5 kg./camel for a period of 5 months. The average daily milk production during the lactation from second parity females of Bikaneri and Kachchhi camels was  $2.95 \pm 0.17$  and  $3.41 \pm 0.17$ , respectively kg/day and for third parity females in the same order was  $3.82 \pm 0.13$ ,  $4.81 \pm 0.23$  kg/day and for Jaisalmeri  $3.11 \pm 0.12$  kg/day (Table 6.2.5 A). The contribution of parity was significant ( $P < 0.01$ ). The average daily milk production of second parity females under 4-teat, 2-teat and machine milking was  $3.02 \pm 0.16$ ,  $3.97 \pm 0.25$  and  $2.56 \pm 0.22$  kg/day and for 3rd parity lactating camels in the same order was  $3.70 \pm 0.13$ ,  $4.80 \pm 0.14$  and  $3.23 \pm 0.19$  kg/day, respectively (Table 6.2.5 A and Fig 6.2.3) In second parity females the milking technique and month effect contributed significantly ( $P < 0.01$ ) and for 3rd parity females, contribution of breed, milking technique and month was significant ( $P < 0.01$ ). The monthwise daily production in second parity females varied from  $1.61 \pm 0.32$  to  $4.64 \pm 0.32$  kg/day and in third parity from  $2.13 \pm 0.25$  to  $5.86 \pm 0.25$  kg/day. The morning production was observed to be 10 to 21 per cent higher than evening production both in second and third parity females.

The breed and paritywise average daily production with 4 teat milking in second parity females of Bikaneri, Jaisalmeri and Kachchhi females was  $3.22 \pm 0.15$ ,  $2.17 \pm 0.16$  and  $3.94 \pm 0.13$  kg/day, respectively. The contribution of breed, parity and month was significant ( $P < 0.01$ ). The total lactation yield of 330 days was 1494.6 kg. The breedwise daily production in same order for 2nd parity females with 2 teat milking was  $4.19 \pm 0.1$ ,  $3.72 \pm 0.17$  kg/day and in second and third parity females  $3.5 \pm 0.22$  and  $4.40 \pm 0.08$  kg/day, respectively. The monthwise daily production varied from  $2.37 \pm 0.27$  to  $6.73 \pm 0.273$  kg/day. The breed, parity and month effects were significant ( $P < 0.01$ ). The total lactation yield of 330 days was 1630.2 litres. The average daily production with machine milking in the three breeds viz. Bikaneri, Jaisalmeri and

Kachchhi was  $2.66 \pm 0.16$ ,  $2.02 \pm 0.19$  and  $3.42 \pm 0.14$  kg/day and for 2nd and 3rd parity females  $2.12 \pm 0.18$  kg/day and  $3.28 \pm 0.108$  kg/day respectively. (Table 6.2.5 B) The monthwise average daily production varied from  $0.762 \pm 0.25$  to  $4.77 \pm 0.28$  kg/day. The contribution of breed, parity and month was found to be significant ( $P < 0.01$ ). The daily milk production was highest with 2 teat milking followed by 4 teat and machine milking. The paritywise daily milk production during different months is depicted in Fig. 6.2.4. The milk constituents viz. protein, casein, fat, ash, SNF etc. were estimated along with pH of milk. The protein and casein per-centage indicated significant ( $P < 0.01$ ) variation due to breed and timing of milking.

### **Bio-chemical genetic studies**

In all 169 blood/serum samples were collected from three farms/villages viz. NRCC-143, Gadwala-16 and Raikabas-10 belonging to four genetic groups/breeds viz. Bikaneri-75, Jaisalmeri-45, Kachchhi-37, and cross bred-12, Electrophoresis was performed for the separation of haemoglobin, albumin, transferrin, pre-albumin and amylase polymorphism. However, efforts were also made to standardise the techniques for the separation of isocitrate dehydrogenase, hexokinase and glutathione-reductase. The separation of hexokinase was established. No polymorphism was observed for any of the systems studied. Usual one band was observed for haemoglobin, albumin and pre-albumin. Amylase exhibited two bands while three bands were observed for transferrin polymorphism.

The quantitative estimation of certain enzymes was worked out in three seasons viz. summer, winter and spring. The enzymes assayed were amylase, alkaline phosphatase, acid phosphatase, lactate dehydrogenase and total protein (Table 1 & 2). The animals selected were on the basis of pedigree. The sexwise differences were observed for, lactate dehydrogenase in caives (Table 6.2.6 where as the sex wise differences were observed for all the five systems of adult animals (Table 6.2.7)



**Table-6.2.6**  
**Level of certain enzymes/proteins in camel calves (1996-97)**

	Male			Female		
	Summer	Winter	Spring	Summer	Winter	Spring
<b>Amylase</b>	161.48±0.46 (10)	159.78±0.73 (10)	161.5±0.93 (7)	160.61±0.51 (8)	160.22±1.15 (8)	160.64±0.97 (6)
<b>Alkaline phosphatase</b>	8.01±0.10 (10)	8.26±0.09 (10)	9.53±0.07 (7)	7.94±0.12 (8)	8.02±0.14 (8)	9.06±0.16 (6)
<b>Acid phosphatase</b>	4.23±0.13 (10)	4.37±0.11 (10)	4.77±0.18 (7)	4.31±0.19 (8)	4.46±0.17 (8)	4.52±0.13 (6)
<b>Total Protein</b>	6.02±0.12 (10)	6.09±0.14 (10)	6.47±0.17 (7)	6.15±0.15 (8)	6.33±0.15 (8)	6.67±0.14 (6)
<b>LDH</b>	520.28±24.89 (10)	493.67±40.32 (10)	554.76±75.39 (7)	533.44±32.27 (8)	455.83±71.88 (8)	554.33±38.00 (6)



**Table-6.2.7**  
**Level of certain enzymes/proteins in the blood of adult Indian camels (1996-97)**

	Male			Female		
	Summer	Winter	Spring	Summer	Winter	Spring
<b>Amylase</b>	130.62±0.75 (18)	130.62±0.75 (18)	141.25±1.08 (11)	115.95±0.84 (18)	115.64±0.86 (19)	120.21±1.59 (13)
<b>Alkaline phosphatase</b>	11.15±0.25 (17)	11.44±0.23 (18)	12.32±0.29 (11)	21.96±0.32 (19)	21.28±0.29 (19)	22.07±0.43 (13)
<b>Acid phosphatase</b>	2.88±0.06 (18)	2.97±0.05 (18)	3.42±0.06 (11)	3.09±0.05 (19)	3.07±0.05 (19)	3.61±0.07 (13)
<b>Total Protein</b>	5.95±0.06 (18)	6.09±0.05 (18)	6.67±0.05 (11)	6.53±0.08 (19)	6.55±0.11 (19)	6.94±0.12 (13)
<b>LDH</b>	255.63±9.39 (18)	253.59±20.5 (18)	350.51±48.79 (11)	412.15±12.31 (19)	378.06±35.58 (18)	463.78±36.98 (13)

### **6.3. To develop suitable management practices for rearing camels**

Project code	:	P.I.86/3-ICN/L-50/5220.
Project leader	:	S.N.Tandon
Associate	:	N.D.Khanna
Technical assistance	:	U.K.Bissa

Investigations on camel management under intensive/ semi-intensive and extensive systems were studied. Behavioural study was conducted in camels maintained under these three systems. The study was comprised of first two systems on camel maintained at N.R.C. on Camel, Bikaner while experiences of Camels breeders was recorded for the study of extensive system of management.

#### **Intensive system**

While recording observations on intensive system the camels were totally managed under farm conditions and allowed feeding watering etc. only in the farm and not allowed to go to the rangeland area. A group of approximately 25 camels were kept in shed/open bara. The observations were taken between 10 a.m. to 5 p.m. The observations made have been presented in Table-6.3.1. The period of watering was once every day. It was observed that there was no difference in time taken for feeding and sitting but the average period of watering was much higher in Jaisalmeri (animal no. 322) camel. The period of standing was much higher in Bikaneri animals i.e. animal no. 346 and 77. The period of walking was much higher in Kachchhi animal, regurgitation continued when camels were either standing or sitting.

#### **Semi-intensive system**

The study of semi-intensive system was conducted in two group viz non-pregnant and pregnant animals. The observations in the rangeland area (10 a.m. to 4 p.m.) have been recorded and presented in Table-6.3.2. The animals were offered feed at the rate of 10 kg per animal when they were kept in shed/bara from 5.00 p.m. to 9.00 a.m. The average grazing was higher in pregnant animals while standing period was higher in non-pregnant animals. The mother infant behaviour was also studied. It was observed that for the first few days (6-7 days) mother and calf moves very close and in early days

**Table 6.3.1.**  
**Observations made in intensive farming system**  
**(1996-97) percent time taken**

Traits	Breeds			
	Bikaneri		Jaisalmeri	Kachchhi
	346	77	322	72
Feeding	24.72	24.82	26.26	26.99
Watering	0.52	0.58	1.37	0.33
Standing	46.50	42.96	36.22	31.15
Sitting	12.96	13.19	16.66	14.41
Walking	15.30	18.45	19.49	27.12

**Table 6.3.2.**  
**Observations made in semi-intensive farming system**  
**(1996-97) per cent time taken**

Traits	Non-pregnant camels	Pregnant camels
Browsing	33.95	33.62
Grazing	33.65	45.15
Standing	14.69	5.28
Sitting	8.41	6.15
Watering	2.37	2.45
Walking	6.93	7.35



after calving, dam generally covers the calf but does not licks. No set pattern of sitting was noticed, many times calf sits on left side or right side of mother. The calf suckles the dam frequently in early days after birth i.e. the interval of suckling was 30-40 minutes but the interval increases regularly upto 2-3 hrs. The dam does not allow any other animal to come close to the calf like dogs etc. The calf also follows the mother even when dam in going for drinking water. The act of play with fellow calves was generally observed when calf was over 15 days.

### **Extensive management system**

Data on extensive management system was collected from village Gadwala and Raikabas. The farmers offer fodder to their she camels or male camels when animals are with them in the village for farm work/draft work, other wise whatever camel consumes in the rangeland is enough for the herd. Feeding of gour at the rate of 1/2 kg per day during winter to male animals is a common practice. Feeding of ghee or oil was also reported. Normally the herd is back to the village once in a week. The camels were taken to water point on alternate day. The breeding is within the herd but male is changed after every 4-5 years. The mortality rate in calf is reported to be 20-33%. No prophylactic measure are adopted by the farmer for any disease control. Surra is reported to be common and mange is an acute problem. Mortality due to Surra was also reported. Camel milk is generally consumed by the farmer and not sold or used for adulteration. Milk yield is reported to be 4-5 litres per day per camel but milking is as per need and camels are not offered special ration for milk production. The farmers allow the calf to suckle ad-lib and weaning is not practised.

The data on camel business (sale/purchase/price) was collected over a period of 5 years (1992-96) in different animal fairs arranged by Animal Husbandry Department of Rajasthan. The Rajasthan Govt. arranges in all 10 animal fairs annually. The data on 9 fair listed below was collected where camel is a component:-

- (1) Gogamedi (Sriganganagar).
- (2) Veer Tejajee (Parbatsar, Nagur).
- (3) Jasvant Exhibition (Bharatpur).
- (4) Kartika Mela (Pushkar, Ajmer).

**Fig- 6.3.1**  
**Camel business 1994-1996**

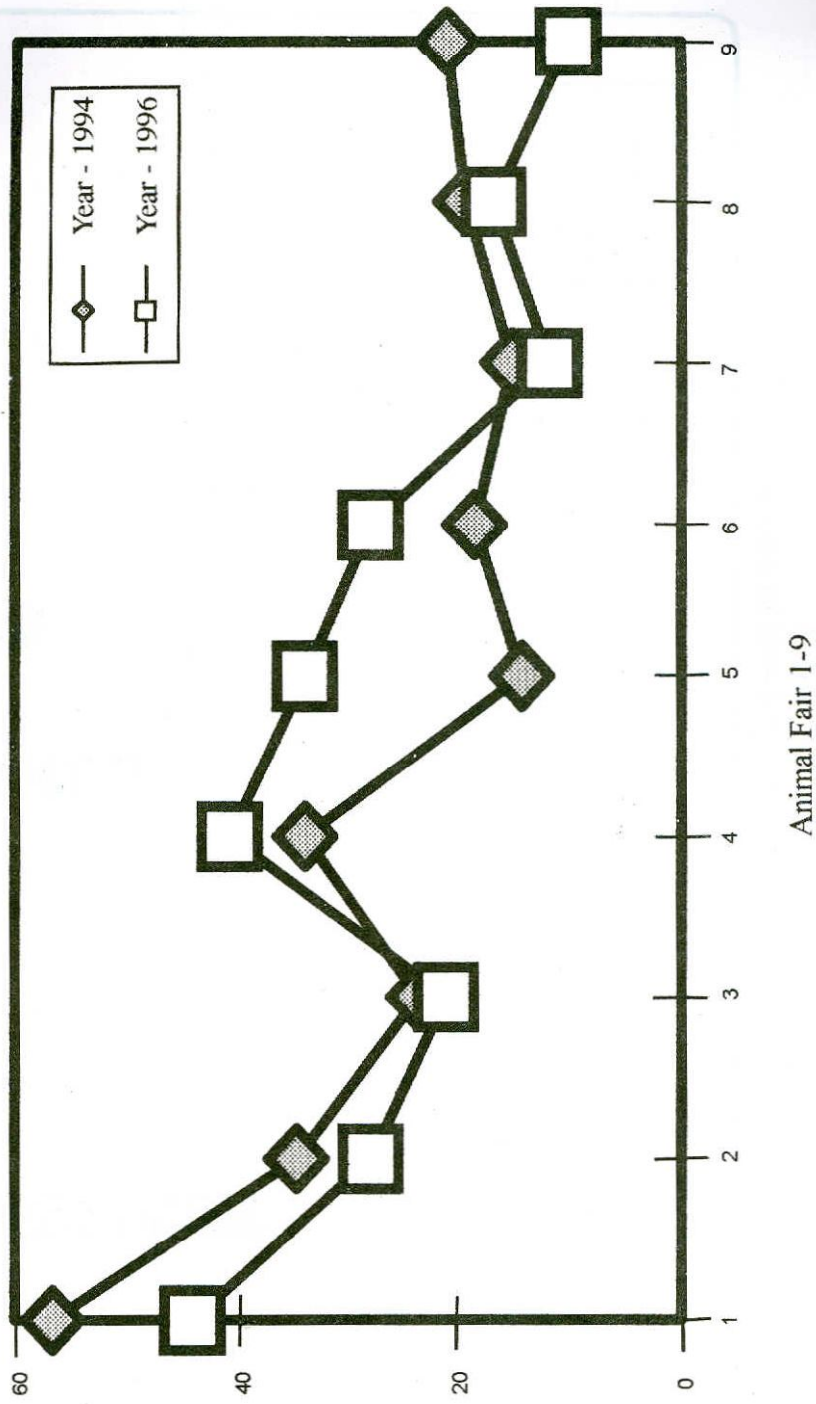
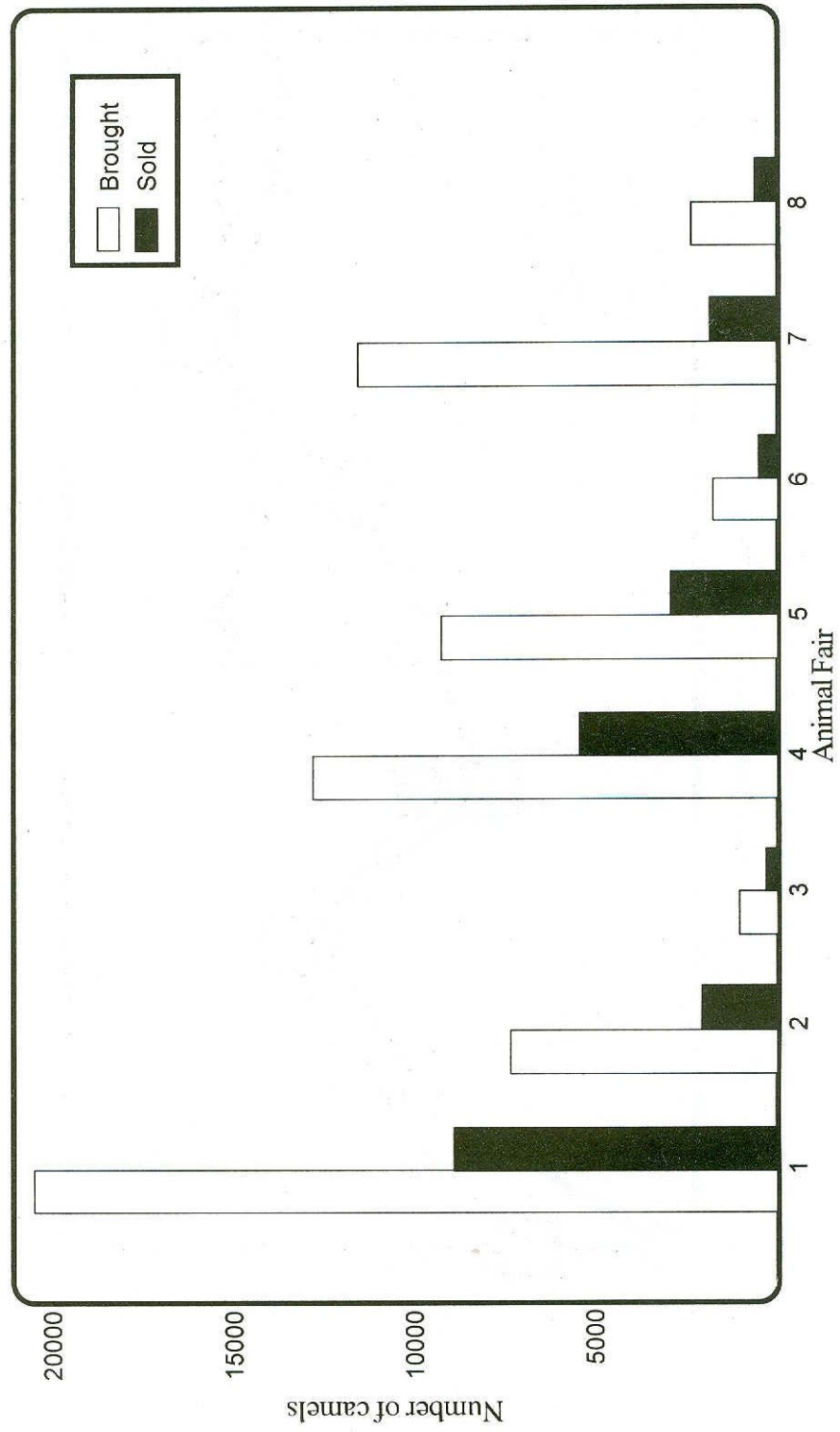


Fig- 6.3.2  
Camel brought and sold in animal fair 1996





**Table 6.3.3.**  
**Information about camel in animal fairs of Rajasthan 1996**

S.No.	Fair of Rajasthan	No. of total animal	No. of Camel brought	No. of Camel Sold	Highest price of camel (Rs)
1.	Gogamedi	21,930	20,346	8,899	17,000/-
2.	Parbatsar	37,146	7,427	2,053	21,000/-
3.	Bharatpur	8,913	1,222	257	10,000/-
4.	Pushkar	21,048	13,722	5,534	18,000/-
5.	Nagur	31,315	9,838	2,713	20,000/-
6.	Karoli	19,187	2,242	274	15,000/-
7.	Merata city	15,062	2,790	294	23,000/-
8.	Tilwara	42,424	12,073	2074	13,000/-

- (5) Chandrabhaga (Jhalawar)
- (6) Ramdev (Nagur)
- (7) Maha Shiva Ratri (Karoli, Sawai-Madhopur)
- (8) Malli Nath (Tilwara, Barmer)
- (9) Beldev (Merta City, Nagur)

The information on camel business in animal fair of Rajasthan is presented in Table 6.3.3. The maximum camel number is brought in Gogamedi followed by Pushkar and Tilwara in 1996. The highest price of camel sold in this year was Rs 23,000/- in Gogamedi. The percentage camel sold in 1994 and 1996 have been presented in Fig. 6.3.1. The number of camels brought and sold during 1996 during 1996 animal fair is presented in Fig. 6.3.2.

Sample survey of village Raikabas was conducted and observations on camel population, management systems, utility and production potential was recorded.

A three days training programme for teaching women camel farmers was conducted in village Gadwala to teach basics about camel management/breeds, nutrition, diseases and products technology. In all 40 women attended this course.

#### **6.4. Studies on Camel Nutrition**

Project Code : P.I.90/4-1CN/L-5220  
Project Leader : A.K. Nagpal  
Associate : Gorakhmal

##### **6.4.1 Survey and nutritional evaluation of conventional and unconventional feed resources of camel**

Twenty four plant samples of grasses (6), crops (3), creepers (2), shrubs/bushes (5) and trees (8) were collected from NRCC jurisdiction and analysed for their proximate composition (Table 6.4.1). The chemical analysis showed that grasses contained 29.3 - 46.6% DM with CP contents ranging from 5.9 to 10.2% except Blue Panic (*Panicum antidotale*) which had upto 15.6% CP contents. Among 3 leguminous crops

Groundnut (*Arachis hypogea*) had high feed value due to its high CP contents of 17.7-18.6%. Analysis of Blue Panic, Sewan grasses and Groundnut revealed that with plant maturity DM, CF and NFE % contents tended to increase and nutrients such as CP and EE decrease. Bakeria and Gokhru of creeper category have favourable CP contents of 12.7 and 19.1% respectively. The shrubs/bushes have high CP contents. Among these Murali, Kakani had CP contents to the tune of 23.4%. Kheemp due to its tough texture is not easily eaten by camels. Tree leaves had DM contents ranging from 30.1 to 50.6% and generally speaking CP contents were better ranging from 12.4 in Khejri (*P. cineraria*) leaves to 30.7% in Sirius (*A. lebbak*) leaves. Crude fibre contents were higher in grasses, followed by shrubs/bushes, creepers, crops and lower in tree leaves.

#### **6.4.2. Oxalate contents in plant species and its treatment**

A study was conducted to determine the oxalate contents in the local bushes/shrubs, crops, grasses and trees (Table 6.4.2). The lowest contents of oxalate among bushes/shrubs, crops, grasses, trees were 0.281, 0.450, 0.731, 0.450 in *Leptadenia pyrotechnica* (Kheemp), *Cyamopsis tetragonoloba* (Guar korma), *Andropogon lamiges* (Boor), *Salodora oleidius* (Jal) respectively, while the highest were 7.429, 1.293, 3.005, 1.574 in *Lyciam barbarcum* (Murali kakani), *Arachis hypogea* (Groundnut), *Panicum antidotales* (Grammna), *Prosopis cineraria* (Khejri) respectively.

In another study *Lasiurus indicus* (Sewan) grass in the mature stage was treated with water in different ratios (1:10, 1:15, 1:20) for 1 h and found that the treatment (1:20) lowered the oxalate contents upto 71.62%.

#### **6.4.3. Utilization of Bui (*Aerva tomentosa*) an unconventional plant resource as camel feed.**

Bui a wild shrub non-palatable to camel that grows luxuriously in desert tracts during short spells of rains in monsoon was harvested from NRCC jurisdiction. It was air-dried and



**Table 6.4.1.**  
**Proximate composition and oxalate contents of some feed resources of camel**

Plant	Stage	%DM	%CP	%EE	%CF	%TA	%NFE	Oxalate contents
<b>A. GRASSES</b>								
1. Gramma ( <i>Panicum antidotale</i> )	Flowering	22.82	15.63	4.8	23.25	13.05	43.29	3.005
	Seed stage	28.26	15.53	3.0	23.25	8.50	49.72	2.920
2. Sewan ( <i>Lasiurus sindicus</i> )	Veg.	30.58	9.40	1.40	33.25	9.40	46.55	2.181
	Postseed shedding	44.40	5.89	1.60	34.50	6.15	51.86	-
	Mature	52.68	8.76	1.52	33.25	7.38	49.09	-
	Mature	78.32	5.42	0.88	33.25	5.30	55.15	-
3. Dhaman ( <i>Cenchrus setigerus</i> )	Flowering	28.03	8.76	2.60	31.00	17.75	39.89	-
4. Boor ( <i>Andropogon lamiges</i> )	Flowering	33.94	7.33	2.76	32.00	7.50	50.41	0.731
5. Bhurut ( <i>Cenchrus biflorus</i> )	Flowering	29.29	10.19	2.60	20.25	15.50	51.46	1.960
6. Dachab ( <i>Cyperus rotundus</i> )	Veg.	46.61	7.73	1.80	30.05	20.50	39.92	0.734

(Cont. on page 59)

Plant	Stage	%DM	%CP	%EE	%CF	%TA	%NFE	Oxalate contents
<b>B. CROPS</b>								
1. Moth chara ( <i>Phaseolus aconitifolius</i> )	Mature	93.47	9.00	2.80	13.00	16.05	59.35	1.125
2. Guar phalgati ( <i>Cyamopsis tetragonoloba</i> )	Mature	93.47	6.81	0.59	28.21	9.40	54.99	-
3. Groundnut ( <i>Arachis-hypogea</i> )	Veg.	17.92	18.63	3.68	10.00	10.90	56.79	1.293
	Flowering	20.28	17.68	3.00	12.50	8.20	58.62	-
	Mature	29.59	12.27	1.80	14.00	10.75	61.18	-
<b>C. CREEPERS</b>								
1. Bakeria ( <i>Indigofera cordifolia</i> )	Flowering	32.16	12.74	1.60	10.40	22.85	52.41	-
2. Gokhru ( <i>Tribullus terrestris</i> )	Flowering	28.19	19.11	3.08	16.75	15.75	45.31	-
<b>D. BUSHES/SHRUBS</b>								
1. Pala ( <i>Zizyphus-nummularia</i> )	Veg.	53.20	14.33	3.12	18.55	15.17	48.83	0.731
	Flowering	55.37	13.70	3.80	16.50	10.80	55.20	2.533
2. Bui ( <i>Aerva-tomentosa</i> )	Veg.	27.08	16.56	2.80	14.50	15.10	51.04	1.29
	Flowering	33.90	13.85	1.50	18.50	13.70	52.44	-
3. Phog ( <i>Calligonum polygonoides</i> )	Veg.	25.92	10.59	1.60	21.75	9.50	56.56	5.681

(Cont. on page 60)

Plant	Stage	%DM	%CP	%EE	%CF	%TA	%NFE	Oxalate contents
4.Murali kakani ( <i>Lycium barbarum</i> linn)	Veg.	28.97	23.41	3.48	9.40	15.75	47.96	7.429
5.Kheemp ( <i>Leptadenia pyrotechnica</i> Forsk)	Veg.	30.28	10.51	-	19.10	20.95	-	0.281
<b>E. TREE LEAVES</b>								
1.Jal ( <i>Salvadora oleidius</i> )	Seed	30.05	15.77	2.00	8.15	27.50	46.58	0.450
2.Israeli babool ( <i>Acacia tortilis</i> )	Veg.	39.01	17.04	5.60	13.33	12.75	51.28	1.462
3.Khejri ( <i>Prosopis cineraria</i> )	Veg.	38.78	12.42	4.60	20.67	20.83	41.48	1.574
4.Parkin somia	Flowering	39.14	27.71	4.40	8.50	14.30	45.09	-
5.Ardu ( <i>Ailanthus excelsa</i> )	Veg.	30.61	22.61	5.00	16.75	12.00	43.64	-
6.Neem ( <i>Azadirachta indica</i> )	Veg.	36.76	19.43	3.60	13.63	8.65	54.69	-
7.Kikar ( <i>Acacia nilotica</i> )	Flowering	50.60	15.98	6.16	7.50	8.20	62.16	-
8.Sirus ( <i>Albizzia lebeck</i> )	Veg.	41.51	30.66	7.00	12.50	5.80	44.04	-



leaves separated. In the first phase a 6-day digestibility trial was conducted on 4 male camel calves kept on sole roughage diet of dry moth chara (*Phaseolus aconitifolius*). In the second phase 20% of conventional moth chara was replaced with dry leaves of Bui and given to camel calves for one month followed by 6 days digestibility trial. Blood samples were analysed to see any adverse effect. The results revealed no significant difference between 2 phases in respect of DM intake kg/d, DMI %, digestibility of proximate components, nutrients intake of DM, DCP and ME/kgW<sup>0.75</sup>, water intake (l/d or ml/kgW<sup>0.82</sup>) and Hb, serum values of total protein, albumin and cholesterol but for serum glucose which was significantly ( $P < 0.05$ ) low in 2nd phase (Table 6.4.3). The long term study is imperative.

#### 6.4.4. Studies on the Vitamin-C contents in serum and milk of lactating camels

Vitamin-C was estimated in the serum and milk of 6 lactating camels in the early and late stages of lactation (Table 6.4.4). No statistical significance was observed between two stages of lactation for Vitamin-C contents in the blood serum as well as milk.

**Table 6.4.2**  
**Oxalate contents after water treatments**

Treatment	Oxalate contents(%)	Reduction in oxalate contents(%)
1 : 10	0.956	56.17
1 : 15	0.731	66.49
1 : 20	0.619	71.62

**Table 6.4.3.**  
**Utilization of Bui (*Aerva Tomentosa*)**  
**leaves in the ration of camel calves**

Parameters	Phase I	Phase II
Feeding	Moth chara	Moth chara : Bui (81.34 : 18.66)
Body wt. kg	291.50	325.00
DMI kg/d	5.56	5.46
DMI %	1.92	1.69
<b>Digestibility %</b>		
OM	66.42	69.37
CP	49.70	54.21
EE	24.66	23.45
CF	63.26	67.99
NFE	73.57	75.56
<b>Nutrient intake/kg w<sup>0.75</sup></b>		
DM(g)	79.04	71.43
DCP(g)	4.44	4.08
ME(MJ)	0.67	0.63
Water intake(l/d)	13.54	12.33
Water intake (ml/kgW <sup>0.82</sup> )	129.16	107.75
<b>Blood Values</b>		
Haemoglobin(g/dl)	13.13	12.50
Serum glucose(mg/dl)	144.55 <sup>b</sup>	107.64 <sup>a</sup>
Serum total protein(mg/dl)	5.75	5.83
Serum albumin(mg/dl)	4.13	3.90
Serum cholesterol(mg/dl)	31.60	29.77

a, b - P < 0.05

**Table 6.4.4.**  
**Comparison of Vit-C (mg/dl) in serum and milk of camels**

Sample	Stage of lactation		t-test
	Early (2-2.5 months)	Late (13-14 months)	
Blood serum	0.284±0.025 (21)	0.237±0.018 (32)	N.S.
Milk	5.180±0.36 (21)	4.840±0.20 (36)	N.S.

N.S. - Non Significant

### 6.5. Studies on camel Reproduction

Project Code No. : P190 / SICN / L31/ 5220  
 Project Leader : A.K. Rai  
 Associates : A.K. Roy  
                   Sumant Vyas  
                   N.D. Khanna

#### 6.5.1. Male reproduction :

Studies on semen characteristics :  
 Semen samples (40) were collected twice in a week from 3 camel studs during breeding season. The samples were observed for macroscopic/microscopic and biochemical characteristics. The semen samples were divided into two parts each. First portion was utilised for microscopic examination. The other part was centrifuged for 15 minutes at 3000 rpm to obtain seminal plasma for the study of biochemical characteristics. The samples were analysed for sodium, potassium and glucose. The physical characteristics viz. ejaculation time, volume, initial motility, pH, live and abnormal spermatozoal percentage and acrosomal damage are presented in table 1. The initial motility in the semen samples was of oscillatory type. It was observed on a 0 to 5 scale. When 80 to 100%



of the spermatozoa in a microscopic field had oscillatory movements, the motility was recorded as +5 and when the movement was restricted in about 20% of the sperms it was rated as +1. Only 14 semen samples out of 40 i.e. 35% had an initial motility. The size of spermatozoa was measured with the help of rotary micrometer in the microscope. The dimensional characteristics of spermatozoa are presented in table 2. The samples with the gel were not used for studying biochemical characteristics. The concentration of sodium and potassium (mEq/l) was  $232.43 \pm 7.166$  (n=14) and  $156.0 \pm 11.612$  (n=12) respectively. The glucose concentration (mg/dl) in seminal plasma was  $3.73 \pm 0.714$  (n=12).

**Table 6.5.1.**  
**Physical Characteristics of Camel Semen**

S.N.	Seminal characteristics	Mean±S.E.(n*)	Range
1.	Ejaculation time	4.34±0.377 (40)	1-12 min
2.	Ejaculate volume	3.50±0.643 (40)	0.5-25 ml
3.	pH	8.50±0.00 (40)	8.50
4.	Motility	65.00±5.79 (14)	30-90%
5.	Sperm concentration	440.83±9.167 (24)	340-520x10 <sup>6</sup>
6.	Live spermatozoa	87.56±0.545 (25)	85-92%
7.	Abnormal spermatozoa	1.28±0.116 (25)	0.5-2.5%
8.	Acrosomal damage	8.33±0.705 (19)	5-16%

\* Number within brackets indicate the number of observations.

**Table 6.5.2.**  
**Spermatozoal measurement in  $\mu$  ( $10^{-3}$  mm)**

Camel Number	Head Length	Head Width	Middle Piece Length	Tail Length	Full Length	Range
268	7.129 $\pm 0.172$	3.800 $\pm 0.095$	7.100 $\pm 0.133$	36.800 $\pm 0.930$	50.410 $\pm 1.046$	47-55
273	6.87 $\pm 0.196$	3.80 $\pm 0.077$	6.63 $\pm 0.245$	37.55 $\pm 1.101$	51.05 $\pm 1.249$	46-55
153	6.93 $\pm 0.144$	3.68 $\pm 0.130$	6.93 $\pm 0.174$	37.52 $\pm 0.624$	51.38 $\pm 0.676$	49-54
K-66	7.09 $\pm 0.104$	3.68 $\pm 0.060$	6.90 $\pm 0.037$	36.03 $\pm 0.492$	50.04 $\pm 0.406$	48-51

## 6.5.2. Female reproduction

### 6.5.2.1. Non Seasonal Breeding Under Semi intensive Management

The study was conducted for the non-seasonal breeding under semi intensive management system during the months of June to August 96. No exogenous hormones were used to induce sexual activity.

She camels aged 8 to 10 years were screened for the ovarian status examined per rectum and with the help of ultrasound scanner. Eight she camels possessing follicles > 15 mm and exhibiting sexual behaviour were selected for non seasonal breeding. The camel studs were tied near females in early morning for 2 h daily for a week. The studs exhibiting symptoms of rut were used for breeding. The she camels were mated early in the morning and after 12 h. To facilitate ovulation Buserelin 0.04 mg (Receptal 10 ml) was administered i.m. shortly after first mating. The blood samples were collected, processed and preserved for the progesterone profile on the day of mating (day 0), and 7, 20 and 40 days post mating. The progesterone was assayed using RIA kit supplied by D.P.C., U.S.A. The level of progesterone in the serum (Table 6.5.3.) indicated that the ovulation occurred in all the she camels. Four she camels (50%) out of eight were found to be pregnant, where two conceived by first service and the other two conceived on subsequent mating.

### 6.5.2.2. Post partum ovarian status in female camels

Eleven she camels having post parturient period of 40 to 60 days were selected for the study. The ultrasound scanner- 200 with dual frequency endovaginal probe was used to examine the ovaries. The scanning was repeated after three days.

Follicles of very small size (< 0.5mm) could be observed only in two animals. These were not of sufficient size suitable for breeding. No follicular activity was observed in ovaries of rest of the female camels upto 60 days post partum.



**Table 6.5.3.**  
**Progesterone profile of she camels used for**  
**nonseasonal breeding**

Serum Progesterone Concentration (ng/ml)						
Camel No	day 0	day 7 p.m.	day 20 p.m.	day 40 p.m.	Ovulation	Pregnancy
1	0.9	1.0	7.5	6.8	Y	Y
2	0.5	5.5	8.5	17.0	Y	Y
3	0.3	7.5	10.5	9.5	Y	Y
4	0.2	5.7	5.7	0.3	Y	(EED)N
5	0.2	3.1	0.2	0.8	Y	N
6	0.2	4.6	0.2	0.8	Y	N
7	0.1	4.8	8.2	6.8	Y	Y
8	0.2	3.2	0.2	ND	Y	N

p.m. - post mating , Y- Yes , N- No , EED- Early Embryonic Death ND- Not Detectable

**ADHOC RESEARCH SCHEMES****7.1. Studies on poll glands of camels**

(Sponsored by ICAR AP cess fund)

Principal investigator	:	A.K. Rai
Co-investigator	:	N.D. Khanna
Research Associate(s)	:	B. Manivannan
	:	Swati Ojha

Poll glands, the unique glands of the male camels are the paired, tubulo-alveolar cutaneous glands. They secrete a profuse, dark brownish odorous secretion, akin to pheromone during breeding season, especially when the males are in rut. Investigations on the behavioural, morphological, structural and functional aspects of these glands, through histological, histochemical, biochemical and hormonal studies were carried out. The results revealed that the poll gland secretion contains approximately 6 times higher amount of androgens than the serum level. Hence, the relative structural and functional aspects of the testis, the next alternative source for steroid biosynthesis and the semen production and evaluation were also studied.

The poll glands have two well defined regions i.e. skin and alveolar region. The skin region resembles the typical mammalian skin containing epidermis and dermis having hair follicles, sebaceous and sweat glands. The alveolar region consists of large number of alveoli with secretory epithelium exhibiting seasonality.

The histochemical observations revealed the presence of protein, glycogen, lipids, DNA, RNA, ATPase, LDH and G-6-PDII the active metabolite in both the regions. The alveolar region in addition exhibited presence of 3  $\beta$  Hydroxy steroid dehydrogenase (3  $\beta$  HSDH) and 17  $\beta$  Hydroxysteroid dehydrogenase (17  $\beta$  HSDH) activities, the active marker enzymes of steroidogenesis. The secretion of poll glands contained comparatively lower level of protein, albumin, glucose. Calcium and urea than the serum level and relatively higher sodium and potassium levels. The testosterone was 16-20 times and progesterone and estradiol 6-8 times higher in the secretion of the poll glands than the serum levels during breeding season.

Isoelectric focusing revealed the presence of several polypeptides having acidic properties in the poll gland secretion during breeding season. The isoelectric point ranged from 3.5-4.7. During non breeding season it was rather difficult to obtain secretion from the poll glands.

Ultrastructural studies revealed the presence prominent nucleus and well developed mitochondria, golgi complex, smooth endoplasmic reticulum and abundant secretory granules revealing the active secretory phase, during breeding season. During non breeding season these cellular organelles appeared sparse and the nucleus had undergone pycnosis revealing cellular under activity.

The libido of camels varied during breeding and non breeding season. During breeding season, the libido was exhibited by restlessness, loss of appetite, grinding teeth, blowing soft palate, copious poll gland secretion and gurgling sound. In non breeding season, these behavioural signs appeared in subdued form in several cases. The studs, however, exhibited willingness for mating and the normal coital behaviour such as biting, fondling salivary frothing and jerking movements etc. The camel donated semen in all the season except for one or two occasions during non-breeding season.

Camel semen production, evaluation and observations on seminal attributes during breeding and non-breeding (hot dry and hot humid) seasons revealed that there were no variations in the colour and consistency of the semen. The sperm abnormalities increased during non breeding season. The most predominant abnormalities were found in the mid-piece. Gel formation occurred immediately after ejaculation, which liquefied with in 2 hr when kept at 37°C.



Histochemical analysis revealed high intensity for the presence of protein, glycogen, lipids, DNA, ATPase, LDH, G-6 PDH, 3 $\beta$ -HSDH and 17 $\beta$  HSDH in the head and mid piece of the spermatozoa. Majority of these parameters were at the acrosomal envelope of the head region.

Ultrastructure of the spermatozoa showed the head with a prominent nucleus, an elongated acrosome and acrosomal envelope. It connected the neck with proximal and distal centrioles and the tail, made up of axoneme containing 9+2 pattern of microtubules at various intensities in the above three regions. Acrosomal vacuolization, nuclear degeneration, neck abnormalities and mitochondrial swelling in the mid piece have also been observed.

The testis of camel consisted of seminiferous tubules and intertubular elements, the former containing sertoli cells, spermatogonia, spermatocytes, and few spermatids while the latter head leydig cells, macrophages and blood vessels. At sub cellular level the sertoli cells showed vacuolization and contained prominent mitochondria, golgi complex, granular endoplasmic reticulum, free ribosomes and glycogen particles exhibiting moderate secretory phase. The spermatogonia and spermatocytes appeared normal while the spermatid showed degenerated nucleus vacuolated mitochondria and cytoplasm. Leydig cells exhibited poor secretory phase showing vacuolization around the nucleus and in the cytoplasm absence of cellular organelles, particularly the smooth endoplasmic reticulum. Thus revealing poor steroidogenesis in the testis during breeding season.

Histochemical observation revealed the presence of intense protein, glycogen and DNA in the sertoli cells, germ cells and Leyding cells, lipids, LDH, G-6-PDH, 3 $\beta$ -HSDH and 17 $\beta$  HSDH were appeared moderate in the Leydig cells and thus corroborate the findings at ultra-structural levels.

It is concluded that the secretory epithelium of the poll glands exhibited higher cellular activity during breeding season and relatively quiescent phase during non breeding season. The general metabolism of the gland is not affected through out the year reflected by the presence of protein, glycogen, lipids, DNA, RNA, ATPase, LDH and G-6-PDH in the alveolar region. The steroidogenic potential of the gland is drastically reduced during non-breeding season as indicated by the absence of 3 $\beta$  Hydroxysteroid dehydrogenase and 17 $\beta$  Hydroxysteroid dehydrogenase activities. The significant feature of the poll gland is that its secretion contains 6 times higher amount of testosterone

than that of serum level. The secretion attributes to sexual behaviour and pheromone like activity during breeding season. Although under stress the poll glands secretion may be observed it is not associated with sexual/reproductive behaviour.

In the present investigation, the seminal attributes indicated sperm production, continued through out the year with a subdued sexual behaviour. Incidentally, the animals which were used for testicular histology, ultrastructure and histochemistry were not used for breeding in the current year and hence spermatogenic involution might have taken place. The present study on testis histology, ultrastructure and histochemistry does not corroborate with the finding on poll glands during different seasons. Further studies are certainly needed to substantiate the relation between poll glands and testis particularly towards steroidogenesis in the regularly breeding male camels.

## **7.2. Blood groups and bio-chemical polymorphism studies in Indian camel**

(Sponsored by ICAR AP cess fund)

Principal Investigator	:	N.D. Khanna
Associates	:	S.N. Tandon
	:	Raghvender Singh
	:	B.P. Mishra
	:	Deepika Mohan
	:	Sahi Ram

Thirty nine blood samples from different breeds of camel were screened to record the presence of human blood group factors in camel. The antigens used were human Anti-A, Anti-B, Anti-AB, O and also RH-antigen. None of the factors were present in camel, indicating no possibility of using human blood group factors for camel. These sample were also screened against 4 blood group factors developed for camel using hetero-immunization technique. The results indicated that the factor was present in offspring if it was present in either of the parent.

### **Molecular genetic studies**

**Isolation of genomic DNA** :- Thirty eight blood samples were collected and camel genomic DNA was isolated using standard technique. The



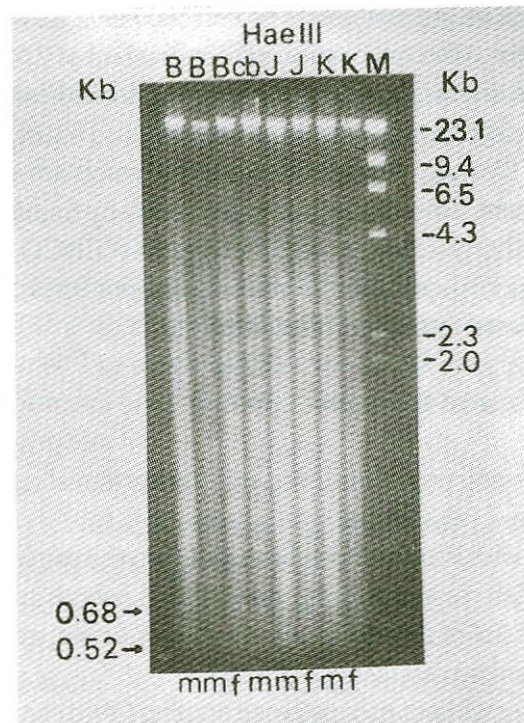
samples were checked for purity. The PCR technique was carried out for random amplification of polymorphic DNA. In all 18 primers were tried out of them two primers were found informative in camels. Genetic variation between and within breeds was observed.

The purity of sample DNA was checked by spectrophotometry which revealed O.D. 260 to O.D. 280 ratio between 1.7 to 1.9. Integrity of sample genomic DNA was checked on 0.7% agarose gels which showed clean single intact genomic DNA band.

### **Restriction enzyme cleavage profile and repetitive DNA analysis**

Camel genomic DNA from Bikaneri, Jaisalmeri, Arab x Bikaneri cross bred and Kachchhi breeds of camel were analysed by hexacutter (*BamHI*, *BglI*, *HindIII*) and tetracutter (*HaeIII*) restriction enzymes. Restriction enzyme digestion was carried out at 37°C overnight with 5 to 10 fold enzymes. Restriction enzyme digested genomic DNA samples were electrophoresed on 0.8% agarose gels in TBE buffer system for 24 h/36 h. Gels were stained with ethidium bromide (0.5 g/ml), visualized and photographed on UV transilluminator. Known molecular weight DNA marker viz. Lambda phage DNA-*HindIII* digest was run in parallel to digested samples for estimation of molecular length of repetitive DNA bands. Repetitive DNA bands in different restriction enzyme cleavage profile were identified and molecular length was estimated. *BamHI* and *BglI* did not revealed any clear repetitive DNA bands. However, *HindIII* enzyme revealed as many as 8 repetitive DNA bands ranging from 0.44 kb to 2.29 kb. Comparison of the camel breeds revealed no intra or inter breed differences in *HindIII*. Close observation of molecular length of *HindIII* repetitive DNA bands indicated the presence of a periodicity spanning approximately 20-30 bp. Similarly periodicity on repetitive DNA has been reported on other animal species. Similarly tetracutter *HaeIII* restriction enzyme revealed two distinct repetitive DNA bands across all the samples of 0.52 kb and 0.68 kb respectively. Apart from these two bands less distinct bands were also observed on gel above 0.68 kb. No genetic polymorphism with respect to *HaeIII* repetitive DNA bands was observed among different camel breeds. Repetitive DNA analysis will further enumerate the organization of repetitive DNA in camel and would help to locate satellite sequences on camel genomic DNA.





*HaellI* restriction enzyme cleavage profile of camel genomic DNA showing repetitive DNA bands. B-Bikaneri, J-Jaisalmeri, K-Kachchhi and cb-Arab x Bikaneri cross bred; m-male, f-female, M-Lambda phage DNA *HindIII* marker.

### 7.3. Development of Embryo Transfer Technology in Camel

(Sponsored by Department of Biotechnology, Ministry of Science and Technology, Govt. of India)

P.I. : A.K.Rai  
 Associates : N.D.Khanna  
 : Sumant Vyas

#### 1. Standardization of technique for nonsurgical collection of embryos.

First step towards standardisation of the technique of embryo transfer in a species is to develop a suitable method for embryo recovery. Camel being a large ruminant attempts were made towards development of technique for embryo recovery by non surgical methods.

The experimental she camels were restrained after administration of

Xylazine 4-6 ml, in sitting posture on an inclined plane, so that hind quarters were on lower side. After evacuation of rectum, 6ml of 2% Xylocaine was administered in sacrococcygeal joint for epidural anaesthesia.

The two way Long Foley's catheter (26", 18 gauge, 30 c.c.) was used for embryo flushing. The uterine horns in camels are almost T-shaped therefore both horns were flushed simultaneously by fixing the air bulb just inside the uterine body. One litre of DPBS media (GIBCO BRL, USA) was used for flushings in about 20 to 25 releases. About 95% of the media was recovered and filtered through Emcon filter.

## 2. Protocols used for superovulation

The following protocols using various hormonal regimes were tried for superovulation in she camels.

- i. eCG with Progesterone priming (Two she camels).  
Ovarian response was good (2-3 C.L. in both animals). First 200 to 250 ml of flushed media was highly turbid, making it opaque and embryo could not be found.
- ii. Mating without progesterone priming (Two she camels).  
Only one C.L. was found in both animals. However recovered fluid was free from any turbidity, and no embryo could be found.
- iii. eCG without progesterone priming (Two she camels)  
There was no ovarian response to the treatment. The flushed fluid was free from turbidity, but no embryo could be found.
- iv. Induced luteal phase prior to superovulatory treatment.



Camel Embryo



- Day 0 - Inj. hCG 3000 i.u., if a mature follicle is present on any of the ovaries.
- Day 6 to 10 - Inj. F.S.H.-P, 50 mg in divided doses.
- Day 12 & 13 - Mating three times at 12 h interval. Inj. hCG 3000 i.u. at the first mating.
- Day 20 - Flushing.

This protocol was used in eight she camels. A total of seven embryos were recovered. One good quality morula was transferred in a synchronised recipient she camel. The blood samples were collected, processed and sera preserved for hormonal assay. Further trials on day of flushing with the same protocol are in progress.

#### **7.4. Net work collaborative programme on crop based animal production system**

(Sponsored by ICAR and Min. of Agril.)

- Project Leader : Dr.A.K.Nagpal, Scientist, Sr.Scale.
- Associates : Dr.N.D.Khanna, Director.
- : Sh.Gorakh Mal, Scientist
- : Sh.Ram Kumar, Farm Manager
- : Sh.Raja Purohit, SRF
- : Mrs.Renu Sharma, SRF(19.11.95-29.6.96)
- : Sh.Baldev Kiradu, SRF(7.8.96-cont.)

Two experiments as proposed in the technical programme were conducted in the year 1996-97.

#### **Experiment.1.**

#### **Comparative performance of camel calves kept in stall feeding and sewan pasture grazing (continuous) management systems**

An experiment was conducted from Aug.96 to Nov.96 on two groups of camel calves ( 1.5-3.0 ys). Group 1 of 7 calves was kept at stall on *ad.lib.* ration of dry moth chara (*Phaseolus aconitifolius*) while the group 2 was kept in Sewan (*Lasiurus indicus*) grass pasture for all the 24 hrs.

Growth of camel calves kept at stall was (354 g/d) higher than those kept in sewan pasture (310 g/d) because of the availability of more nutrients



from dry moth chara than sewan (Table 7.4.1). The blood picture revealed little variation between two groups in respect of haemoglobin and cholesterol. The blood glucose and TG were higher and total protein, albumin, BUN lower ( $P < 0.01$ ) in stall-fed calves than sewan pasture group. The serum enzymes of Transaminases and ALP matched the blood picture observations.

**Table 7.4.1.**  
**Growth performance and serum biochemicals in camel calves kept on two feeding systems**

Parameters	Stall-fed group	Sewan-pasture group	
NO. of camels	7	21	
Growth			
Initial B. Wt. kg	261.71±11.43	271.05±8.68	
Final B. Wt. kg	296.43±11.29	300.90±9.60	
Body Wt. gain. kg	34.71±4.79	30.24±2.44	
Average daily gain kg. (over 98 days)	0.354±0.05	0.310±0.03	
Serum Biochemicals			
Haemoglobin (g/dl)	12.81±0.31	12.73±0.19	
Glucose (g/dl)	140.60±5.95	127.09±3.74	
Total protein (g/dl)	5.96±0.20	6.87±0.09	**
Albumin (g/dl)	3.97±0.17	4.47±0.11	*
Blood urea (g/dl)	29.13±1.01	41.83±1.69	**
BUN (g/dl)	13.61±0.47	19.54±0.79	**
Triglycerides (g/dl)	38.94±5.53	26.04±2.95	*
Cholesterol (g/dl)	29.20±1.49	31.61±1.53	
Serum Enzymes			
Alanine Transaminase (IU/L)	3.04±0.44	5.00±0.38	**
Aspartate Transaminase (IU/L)	35.86±1.95	39.25±2.58	
Creatine Kinase (IU/L)	73.29±5.50	120.74±3.31	**
Alkaline Phosphatase (IU/L)	171.11±14.65	90.50±7.44	**

\*  $P < 0.05$  \*\*  $P < 0.01$

It was observed that during 9 h study (8.30 am -5.30 pm) stall -fed camel calves spent 30% of their time in feeding against 65% time spent by sewan pasture group calves. Stall-fed calves spent more time in rumination (22%) than the sewan pasture calves (12%). The calves spent 4-15 minutes for drinking water.

The chemical characteristics of available water to both the experimental groups were within the limits and was fit for consumption without the presence of any incriminating substance.

A 6 d digestibility trial on 4 stall-fed male camel calves was conducted in Oct./Nov.96 given dry moth chara *ad.lib*.

The nutritive value of dry moth chara was 5.67% DCP, 56.82% TDN and 8.559 MJ ME/kg DM. The average daily DM intake was  $5.561 \text{ kg} \pm 0.14 \text{ kg}$  or  $1.92 \pm 0.01 \text{ DMI} \%$ . The nutrient intake of DM, DCP and ME/kg  $W^{0.75}$  was  $79.04 \pm 1.51 \text{ g}$ ,  $4.44 \pm 0.19 \text{ g}$  and  $0.678 \pm 0.03 \text{ MJ}$  respectively. The mean daily water intake was 13.54 l/d or  $129.16 \pm 2.78 \text{ ml/kg } W^{0.82}$ .

The study on plant vigour and proximate composition was also done in respect of Sewan grass (Table 7.4.2). As the grass matured, its nutrients decline.

**Table 7.4.2.**  
**Plant vigour, chemical composition of Sewan**  
**(*Lasiurus indicus*) grass**

Date	Height ft.	Diameter ft.	DM -----	CP %	EE -----	CF -----	TA -----	NFE -----
23.7.96	3.5	2.5	30.58	9.40	1.40	33.25	9.40	46.55
23.8.96	3.3	5.0	44.40	5.89	1.60	34.50	6.15	51.86
28.9.96	3.0	2.0	52.68	8.76	1.52	33.25	7.38	49.09
28.10.96	4.0	2.5	78.32	5.42	0.88	33.25	5.30	55.15

### Carrying capacity

On 15.10.96 the average fresh yield of Sewan from 3x3 meter taken from 8 different areas was 5.50 kg with DM contents of 70.50%.

The DM yield of Sewan was  
 $= (10000/9) * (5.5 * 0.705) = 4308.33 \text{ kg}$   
or 43.08 quintals/ha

Assumption : Maximum DM intake of adult camel is 2.0 kg per 100 kg body weight.

Therefore annual sustainability of Sewan pasture for adult camel weighing 500 kg having an intake of 2% DMI or 10 kg/d is  
 $= 4308 / 365 * 10 = 1.18$  hectares.

The effect of camel calves grazing on soil fertility was observed to be positive. The camel grazing was found to enhance the soil fertility by increasing % carbon, available phosphate and potash.

### Experiment 2.

#### **Comparative performance of camel calves kept under stall and 3-tier silvi-pasture feeding management systems**

The same camels as in experiment 1 were used for this experiment also. The observations on growth, digestibility trial, carrying capacity, soil fertility and botanical composition were made. This experiment was conducted from the month of Dec. 96 to March, 97. In this experiment the stall-fed calves were given dry moth chara/ground-nut guna or chara while the 3-tier silvi-pasture calves were grazed for 7 h (9.30 am-4.30 pm) plus groundnut chara supplementation.

**Growth** : The growth rate of camel calves (427 g/d) in the stall-fed group was higher ( $P < 0.01$ ) than those kept in 3-tier silvi-pasture system (237 g/d) which had continuous access to better feed throughout (Table 7.4.3).



**Table 7.4.3.**  
**Growth performance of camel calves kept**  
**on two feeding systems**

Parameters	Stall-fed group	3-tier grazing group
No. of calves	6	17
Growth		
Initial B. Wt. kg.	312.00±11.60	283.88±10.04
Final B. Wt. kg.	362.33±12.37	311.88±11.12
Body Wt. change kg	50.33± 3.63	28.00± 3.21**
Average daily gain kg. (over 118 days)	0.427±0.03	0.237±0.03**
	* *	P<0.01

In the month of Feb.97 a 6-d digestibility trial was conducted on 3 stall-fed male camel calves given ad. lib. dry groundnut (*Arachis hypogea*) guna and in March,97 a 6-d digestibility trial was conducted on 4 stall-fed calves given dry Ground-nut chara (Table 7.4.4).

**Table 7.4.4.**  
**Proximate composition and digestibility coefficients of**  
**Groundnut guna and chara given to stall-fed calves**

Parameters	Composition %		Digestibility %	
	G.N.guna	G.N.chara	G.N.guna	G.N.Chara
DM	87.69	91.02	59.32	58.21
OM	90.93	83.37	63.09	63.80
CP	5.89	8.76	48.87	43.27
EE	0.79	2.66	33.19	42.92
CF	35.04	23.87	59.07	60.29
NFE	49.21	52.08	68.19	69.91

The nutritive value of G.N. guna was 2.89% DCP, 57.87% TDN and 8.717 MJ ME/kg DM. The average daily DM intake was 6.79±0.39 kg or 1.96 %DMI. The mean intake of DM, DCP and ME/ kgW<sup>0.75</sup> was

84.17±2.37 g, 2.43 ±0.09 g and 0.73 MJ respectively. The mean daily water intake was 12.66 l or 105.61 ml/kg W<sup>0.82</sup>.

The nutritive value of G.N. chara was 3.77% DCP, 57.11% TDN and 8.603 MJ ME /kg DM. The average daily DM intake was 7.307±0.46 kg or 2.08%DMI. The mean intake of DM, DCP and ME/kg W<sup>0.75</sup> were 89.71, 3.39 g and 0.773 MJ respectively. The mean daily water intake was 16.49 l or 151.03 ml/kg W<sup>0.82</sup>.

The plant vigour study and proximate analysis of groundnut crop was done (Table 7.4.5). It is seen again that with plant maturity the nutritional worth of plant declines.

**Table 7.4.5.**  
**Plant vigour and composition of Ground-nut**  
**(*Arachis hypogea*) crop at different growth stages**

Date	Stage	Ht. ft.	Diam- eter ft.	DM	CP	EE	CF	TA	NFE
						-----%-----			
24.07.96	Veg.	1.0	2.0	17.92	18.63	3.68	10.00	10.90	56.79
23.08.96	Flowering	1.3	2.8	20.28	17.68	3.00	12.50	8.20	58.62
30.11.96	Post-Flow.	1.0	4.0	29.59	12.27	1.80	14.00	10.70	61.18

**Carrying capacity**

Dry yield of Ground-nut guna = 91.20 q\*.8769=79.97q  
 Dry yield of Ground-nut chara = 71.75 q\*.9102=65.31q

Total=145.28 q

Total area under Ground-nut crop cultivation = 11.25 hectares.  
 Dry Matter yield of Ground-nut crop q/h = 12.91  
 DM intake of camel calves/adult camels @ (1.96 + 2.08%)/2=2.02%  
 for 500kg body weight=2.02\*5=10.10 kg

Carrying capacity or the sustainability of Ground-nut crop area/year  
 = (Ground-nut DM yield kg/DMI kg)/365 days  
 = (1291/10.10)/365 =0.35 adult camel unit /hectare  
 or 1/0.35 =2.86 hectares for one adult camel unit

The soil samples of ground-nut crop were tested for the fertility status. It was observed that cultivation of crop depleted the soil of its available phosphate and potash while increasing the carbon contents.

The 3-tier silvi-pasture had both edible and non-edible plant species in an area of 18.3 hectares. The edible plant species of Jal, Kikar, Israeli babool, Pala Phog, Murali kakani and Ker accounted for 50.40% and non-edible plant species of Kheemp, Bui, Pardeshi babool and Shinio accounted for rest 49.60% of total plant bio mass. The ground cover consisted of grass species of Boor, Bhurut, Dhaman and Dachab.

### **7.5. Evaluation and Conservation of Double Humped Camel in Cold Desert Region**

Principal investigator : Dr. M.S. Sahani  
Co - investigator : Dr. N.D. Khanna  
Dr. A.K. Nagpal  
Dr. Raghvendra Singh  
Dr. U.K. Bissa

Preliminary survey of double humped camel available in Partapur area of district of Ladakh (J&K) was conducted. A meeting was also arranged with staff of Field Research Laboratory, Leh during August, 1996. At present there are about 76 bactrian camels.

#### **(a) Recruitment of staff**

As per the provision of the staff under the scheme two research associates were appointed. One research associate Shri M. Rathinasabapathy joined on 23.12.1996 and the other Shri Banamali Yadav joined on 27.02.1997.

#### **(b) Training of staff**

The two research associates were deputed for 3 months initial training at NRC on Camel. The training covered various aspects viz. physical and biochemical aspects of blood, camel nutrition, reproduction, camel health, genetics and breeding and camel products (milk and hair) production etc.



### **(c) Procurement of equipment/glasswares**

The glassware and chemicals have been procured and action for purchase of various other equipment and construction of animal shed at Partapur (Leh) were initiated for the implementation of scheme.

### **7.6 Hormonal manipulations for improvement of reproduction in camel.**

(Scientist Emeritus, ICAR funded scheme)

Scientist Emeritus : Prof. S.P. Agarwal

#### **Off season breeding in camel by photoperiodic control**

After 20 to 25 days, the treated animals started expressing mild sexual interest with small to medium follicles on their ovaries. Thereafter, the mask was not applied and all the camels (treated as well as control) were let loose in a paddock with a stud. Within a week, all the treated animals developed an urge of intense heat, presented themselves to the male and were mated successfully on two consecutive days. Curiously, the stud also became virile with vigorous symptoms of rut, like loud gurgling sound, expulsion of soft palate, frothing at the mouth and adoption of peculiar postures. The control animals neither exhibited sexual interest nor allowed mating. The progesterone levels of these animals revealed that two animals conceived of which one suffered from embryonic mortality and the other carried pregnancy successfully. The results suggest that the photoperiodism plays some role in the seasonal breeding behaviour of camels.

#### **Preovulatory LH surge in female camels**

An LH peak was detected in four out of five camels. The value and time of LH peak varied considerably among the animals. The LH peak ranged between 3.0 and 7.5 WHO 2nd IRP HMG mIU/ml. The peak appeared earliest at 2 hour and latest by 8 hour after mating. In general, only one peak was observed in each animal at a specific time which disappeared within next two hours. However, in one case the higher LH peak persisted for six hours.

below. Ovulation occurred in all those animals in which the LH surge was observed. A well developed corpus luteum was also detected in all these four animals on day 7 post mating and the peripheral progesterone levels were found to be more than 1 ng/ml. The animal missing the LH peak neither ovulated nor showed the presence of corpus luteum. The results suggest the significance of LH surge following mating in effecting ovulation and formation of active corpus luteum. The findings may also be of diagnostic importance in predicting ovulatory behaviour of the camel.

### **Early pregnancy diagnosis in female camels**

The progesterone concentration and the ovarian status of each individual camel was studied on day 7 in 11 out of 12 camels suggesting ovulation and formation of functional corpus-luteum. This was confirmed by the presence of corpus luteum in the ovary by rectal examination. Only seven animals maintained higher progesterone levels by day 20 indicating successful conception. These animals revealed that six animals continued pregnancy and one animal suffered early embryonic death between day 20 and 40 post mating. This was confirmed by regression of CL by day 40 Post-mating on transrectal examination. Thus the pregnancy diagnosis was found to be correct in 86% of the camels by day 20 post mating.

The data also gave an insight in to the causes to pregnancy failure. It was observed that out of 12 camels. One (8.3%) did not ovulate, four (33.3%) failed to conceive and one suffered from early embryonic death.

### **Ovario-pituitary response to exogenous hormones in postpartum female camel**

All the six camels expressed a psychological heat and allowed mating, although no external signs of heat could be observed in any of these animals. Rectal palpation on day 8 post mating revealed fully developed corporalutea in two animals hard button like structure in two camels and no structures in the remain in two animals.

The progesterone profiles of these animals revealed high concentration of progesterone (1.7 and 6.5 ng/ml) on day 8 post mating in two camels which declined to basal values (less than 1 ng/ml) by day 17 post mating suggesting ovulation and formation of active corporalutea of short duration. The remaining four animals exhibited only basal levels of progesterone at all

the stages of the cycle indicating that the two animals which had revealed corpus luteum like structure on their ovaries were not functioned CL but either bulging of ovarian tissue or corpus-albicans. The remaining two animals did not respond to mating. The results indicated that although the ovaries were responsive to exogenous LH immediately after involution of uterus, the pituitary gland was refractory to exogenous stimuli of mating and GnRH. Thus pituitary refractoriness appeared to be the main cause of poor fertility in post-partum female camels.



## 8. PUBLICATIONS

### 8.1. List of articles published during the year

1. Agarwal, S.P., Rai, A.K., Vyas, Sumant and Khanna, N.D. 1996. Augmentation of early reproduction through hormonal therapy in camel heifers. *International Journal of Animal Sciences*, 11:361-363.
2. Jakhmola, R.C. and Roy, A.K. 1996. Effect of feeding moth chara (*Phaseolus aconitifolius*) supplemented with concentrate and stage of pregnancy on certain blood metabolism in camel. *Indian Journal of Animal Science*, 66: 68-73.
3. Kumar, P, Agarwal, V.K., Agarwal, S. P., Rai, A.K. and Khanna, N.D. 1996. Concentration of steroid hormones in the poll gland secretion of Indian camel. *Indian Vety. Journal*, 73:28-30.
4. Khanna, Deepti, Agarwal, S.P., Gupta, M.L., Rai, A.K. and Khanna, N.D. 1996. Effect of water deprivation during summer and winter on thyroid hormones concentration in the Indian camel. *Indian Journal of Animal Science*, 66:253-255.
5. Khanna, N.D., Uppal, P.K., Sharma, N. and Tripathi, B.N. 1996. Occurrence of pox infection in camel. *Indian Veterinary. Journal*, 73 : 813-817.
6. Khanna, N.D., Rai, A.K. and Sharma, N. 1996. Camel Safari. *Draft Animal News No. 24*, pp. 13-14.
7. Khanna, N.D. and Rai, A.K. 1996. An economic analysis of draught as a source of livelihood at Bikaner. *Draft Animal News No. 24*, pp. 15-16.

8. Manivannan, B., Rai, A.K. and Khanna, N.D. 1996. Histological and functional changes in the camel poll glands during breeding and non-breeding season. *Indian Journal of Animal Sciences*, 66 : 709-712.
9. Manivannan, B., Rai, A.K. and Khanna, N.D. 1996. A note on structure of the poll glands in the Indian camels (*Camelus dromedarius*). *Indian Vety. Journal*, 73:365-367.
10. Singh., R., Raisinghani, G., Kasturi, M., Tandon, S.N. and Khanna, N.D. 1996. Comparative study on blood serum enzymes in Indian camel. *International Journal of animal Sciences*, 11:357-359.
11. Rai, A.K., Manivannan, B. and Khanna, N.D. 1996. Sexual behaviour of camels and poll glands secretion during breeding and non-breeding seasons. *Indian Journal of Animal Science*, 66 : 325-329.
12. Rai, A.K. and Khanna, N.D. 1996. Training of camel for work and description of traditional camel harnesses used in Thar desert of India. *Draught Animal News* No. 25, pp. 8-11.
13. Sahani, M.S., Sharma, N. and Khanna, N.D. 1996. Hair production in Indian camels (*Camelus dromedarius*) managed under farm conditions. *Indian Veterinary journal*. 73 : 531-533.
14. Sahani, M.S., Nagpal, A.K., Rai, A.K. and Khanna, N.D. 1996. Milk production in Bikaneri camels managed under farm conditions. *Indian Journal of Animal Science*, 66 : 415-417.
15. Vyas, Sumant, Rai, A.K. and Khanna, N.,D. 1996. Case report of bilateral cryptorchidism in Bikaneri camel. *Indian Veterinary Journal*, 73 : 1080-1081.

## 8.2. List of articles submitted for publication during the year

1. Agarwal, S.P. and Khanna, N.D. 1996. Current status of camel hormones during reproductive cycle. *International Journal of Animal Sciences*, (Submitted).
2. Agarwal, S.P. and Khanna, N.D. 1996. Preovulatory LH surge in female camels (*Camelus dromedarius*) and its association with subsequent ovarian events. *Indian Veterinary Journal* (Submitted).
3. Agarwal, S.P. and Khanna, N.D. 1996. Early pregnancy diagnosis through serum progesterone estimation in camels (*Camelus dromedarius*). *Indian Veterinary Journal* (Submitted).



4. Agarwal, S.P. and Khanna, N.D. 1997. Off season breeding in camel by photoperiodic control. International Journal of Animal Sciences (Submitted).
5. Kasturi, M., Singh, R., Tandon, S.N., Raisinghani G. and Khanna, N.D. 1996. Studies on haemolytic complement activity of camel (*Camelus dromedarius*) through alternate pathway. International Journal of Animal Science. (Submitted).
6. Khanna, N.D. and Bissa, U.K. 1997. Indian camel pastoral production system and their indigenous knowledge, Indian farming (Submitted).
7. Khanna, N.D. and Bissa, U.K. 1996. Camel production and utility scenario in Indian dry land. Indian farming (Submitted).
8. Khanna, N.D. and Rai, A.K. 1996. Relevance of sustainable camel production programme in the Indian dry lands. Cartman, Bangalore.
9. Khanna, N.D. and Rai, A.K. 1996. Relevance of sustainable camel production programme in the Indian dry lands. Camel News Letter (ACSAD), Syria.
10. Khanna, N.D. and Rai, A.K. 1996. Relevance of sustainable camel production programme in the Indian dry lands. AGRO India, New Delhi.
11. Khanna, N.D. and Rai, A.K. Camel draught power in Indian drylands - Some key issues. Indian farming (Submitted).
12. Khanna, N.D. and Rai, A.K. 1997. Bhartiya kshetra main ustra palan avam utpadan karyakram ki jivikoparjan ke liye sarthakta (Hindi), Sujas (Submitted).
13. Rai, A.K., Sharma, N., Manivannan, B. and Khanna, N.D. 1996. Studies on camel semen during breeding and non breeding seasons. Indian Journal of Animal Science (Submitted).
14. Roy, A.K. 1996. Oonto main kritrim garbadhan (Hindi). Krishi Chaynika (Submitted).
15. Sahani, M.S. and Bissa, U.K. 1997. Camel husbandry practices in Kachchh region of Gujarat, Indian farming (Submitted).
16. Sahani, M.S., Kumar R., and Bissa, U.K. 1997. Oonto ka pramukh rog-surra (Tibersa rog) (Hindi), Krishi Chyanika (Submitted).
17. Tandon, S.N. and Khanna, N.D. 1996. Milk protein polymorphism in Indian buffaloes. Indian Journal of Animal Sciences. (Submitted).



18. Tandon, S.N. and Khanna, N.D. 1996. Genetic divergence between buffalo populations using electrophoretic variability at blood and milk proteins. *Indian Journal of Animal Sciences*. (Submitted).
19. Tandon, S.N. and Khanna, N.D. 1996. Phosphohexose isomerase polymorphism in Indian buffaloes. *Indian Journal of Animal Sciences*. (Submitted).

9.

## **OTHER ACTIVITIES**

Sh. Dinesh Munjal, T-4, (Computer Op/Prog), Sh. Ashok Yadav (Sr. Clerk) and Sh. Jamil Ahmed (Sr. Clerk) attended a Training cum Workshop Programme for ARFIS (On Regional Basis) at CAZRI, Jodhpur from September 24-25, 1996.

Dr. Sumant Vyas, Scientist (Animal Reproduction) attended short term training course on "In vitro fertilization, embryoculture and associated techniques in farm animals" at National Dairy Research Institute, Karnal from January 27th to February 8th, 1997.

Dr. B.P. Mishra, Scientist (Animal Genetics and Breeding) participated in short term training course on "Application of Biotechnology in Animal Health Management" at Indian Veterinary Research Institute from February 20th to March 12th, 1997.

Dr. Raghvendra Singh, Scientist (Biochemistry) attended National training program on "DNA fingers-printing in Farm Animals" at National Dairy Research Institute, Karnal from February, 25th to March, 14, 1997.

Sh. Gorakh Mal, Scientist (Biochemistry) attended short term course on "Digestive Physiology and Bio energetic" at Indian Veterinary Research Institute, Izatnagar from March 3-15, 1997.

Dr. Rajender Kumar, Scientist (Parasitology) attended international course on "Advances in vaccine technologies and veterinary applications" at Punjab Agricultural University, Ludhiana from March, 4-9, 1997.

The Centre conducted a short course on Camel Management and Health from 12-21 February, 1997. Veterinarians from various Animal Husbandry Departments, Agriculture Universities and Army officers participated in the course.

### **Sports**

The Badminton team of the centre under the captainship of Dr. Raghvendar Singh was awarded runner's up trophy in the ICAR Zonal Tournament held at CSSRI (Karnal) from 8th to 14th December, 1996.



10.

**MANAGEMENT COMMITTEE OF NATIONAL  
RESEARCH CENTRE ON CAMEL, BIKANER**

- |    |   |                     |
|----|---|---------------------|
| 1. | Director, N.R.C. on Camel, Bikaner  | Chairman            |
| 2. | Director, Animal Husbandry Deptt., Govt. of Rajasthan<br>Jaipur (Raj.)                  | Member              |
| 3. | Director, Animal Husbandry Deptt., Govt. of Gujarat<br>Ahmedabad (Gujarat)              | Member              |
| 4. | Dean, College of Vet & Animal Sciences, RAU, Bikaner                                    | Member              |
| 5. | Dr. Kiran Singh, Asstt. Director General (AN&P)<br>ICAR, Krishi Bhawan, New Delhi.      | Member              |
| 6. | i) Sh. Syed Mujahid Ali Naqui,<br>152-53, Amarnath Ji Ki Bagechi, Adarsh Nagar, Jaipur  | Member              |
|    | ii) Sh. Tara Singh, CPI Office, Jaipur  | Member              |
| 7. | Finance & Accounts Officer, Central Institute for<br>Research on Goats, Makhddom (U.P.) | Member              |
| 8. | 1) Dr. A.K. Rai, Principal Scientist N.R.C. on Camel,<br>Bikaner (Raj.)                 | Member              |
|    | 2) Dr. M.S. Sahani, Principal Scientist N.R.C. on Camel,<br>Bikaner (Raj.)              | Member              |
|    | 3) Dr. S.N. Tandon, Senior Scientist N.R.C. on Camel,<br>Bikaner (Raj.)                 | Member              |
|    | 4) Dr. Sumant Vyas, Scientist N.R.C. on Camel, Bikaner                                  | Member              |
| 9. | Administrative Officer, N.R.C. on Camel, Bikaner (Raj)                                  | Member<br>Secretary |

11.

### SCIENTIFIC RESEARCH COUNCIL

- |                     |   |   |
|---------------------|---|---|
| 1. Chairman         | : | Director, NRCC  |
| 2. Out side member  | : | Brig. N.M. Singhvi, E.B.S., Babugarh.<br>Prof. M.C. Goel, HAU, Hisar.   |
| 3. Members          | : | All Scientific staff members of the centre  |
| 4. Special invitees | : | Prof. K.P. Pant, RAU, Bikaner<br>Prof. G.R. Purohit, RAU, Bikaner<br>Prof. K.M.L. Pathak, RAU, Bikaner<br>Dr. V.K. Singh, C.S.W.R.I, Bikaner<br>Dr. M.H. Patel, Gujarat State Animal<br>Husbandry Department.<br>Dr. R.C. Patel, Gujarat State Animal<br>Husbandry Department, Ahemdabad. |

12.

### RESEARCH ADVISORY COMMITTEE

- |                          |   |                  |
|--------------------------|---|------------------|
| 1. Dr. R.M. Acharya      | - | Chairman         |
| 2. Dr. N.K. Bhattacharya | - | Member           |
| 3. Dr. S.S. Rathore      | - | Member           |
| 4. Dr. D.D. Sharma       | - | Member           |
| 5. Dr. J.N. Pandey       | - | Member           |
| 6. Dr. A.K. Rai          | - | Member Secretary |

### 13.

## PEN SKETCH OF NEW ENTRANTS

#### 1. Dr. Rajender Kumar, Scientist

Born on August 2nd, 1968, Village Pabnawa, Disttt. Kaithal, Haryana, Passed B.V.Sc. & A.H. from College of Veterinary Sciences, Hisar in 1991 and M.V.Sc. (Vet. Parasitology) from same college in 1993. He served as Veterinary Assistant Surgeon, Govt. of Rajasthan, for 9 months, qualified for Agricultural Research Services and joined ICAR on March, 22nd, 1996. On completion of foundation course for Agricultural Service from National Institute of Agricultural Research Management, Hyderabad, he joined National Research Centre on Camel, Bikaner on 2nd September, 1996.

#### 2. Dr. B.P. Mishra, Scientist

Born on January, 26th, 1963. Passed B.V.Sc. & A.H. from Orissa Veterinary College in 1986 and M.V.Sc. & Ph.D (Animal Genetics & Breeding) from Indian Veterinary Research Institute in 1989, 1996 respectively. He served as Technical Officer (T-6) for 7 years at IVRI, Izatnagar in PGET (Bio Tech), qualified for Agricultural Services and joined National Research Centre on Camel, Bikaner on 10.12.96.

#### 3. Sh. Vinod Kumar, T-II-3 (Computer Opt./Prog.)

Born on 15, February, 1976. Completed his B.E. (Computer Science and Engineering) in August 1996 from M.B.M. Enginnering College, J.N.V. University, Jodhpur. Joined National Research Centre on Camel, Bikaner on 06.03.97.



14.  
**VISITORS**

The National Research Centre on Camel, Bikaner, received 8913 visitors. The visitors included Scientist, Educationists, Administrators, Defence Officers, Indian and Foreign tourists.

15.  
**ACKNOWLEDGEMENTS**

The centre gratefully acknowledges the financial support and scientific guidance provided by Dr. R.S. Paroda, Secretary, DARE, Govt. of India, Director General, Indian Council of Agricultural Research (ICAR), New Delhi, Dr. M.L. Madan, Deputy Director General, Animal Sciences and Dr. Arun Varma, Assistant Director General (AN&P) ICAR, New Delhi. The advice and valuable suggestions given by the Management Committee and Research Advisory Committee were of immense value in management of the centre. The centre also places on records sincere thanks to Dr. R.M. Acharya, Dr. N.K. Bhattacharya, Dr. S.S. Rathore, Dr. D.D. Sharma, Dr. J.N. Pandey, who served as member of Research Advisory Committee. Brig. N.M. Singhvi, Remount Veterinary Corps and Prof. M.C. Goel, Haryana Agricultural University, who served as members of Scientific Research Council of Centre.

## सारांश

### कर्मचारी वर्ग

वर्ष 1996-97 में केन्द्र में स्वीकृत पदों की संख्या 65 थी। जिसमें निदेशक, वैज्ञानिक (9) तकनीकी (16) प्रशासकीय (10) सहायक वाहन (5) व आधारी कर्मचारी-फार्म (24) कार्यरत रहे।

### आय व्ययक

वित्तीय वर्ष 1996-97 में योजना मद 75.00 लाख तथा गैर योजना मद 44.15 लाख रुपये की धनराशि स्वीकृत की गई। सम्पूर्ण धनराशि उपयोग में लायी गई।

### उष्ट्र प्रक्षेत्र

वर्ष के प्रारम्भ में कुल 225 और अन्त में 234 बीकानेरी, जैसलमेरी, कच्छी, अरब बीकानेरी सांचोरी व मारवाड़ी नस्ल के ऊँट थे। समीपस्थ ग्रामीण क्षेत्रों से प्रजनन हेतु लायी गयी ऊँटनियों को केन्द्र के उत्तम नस्ल के नर ऊँट उपलब्ध कराये गये। नस्ल सुधार हेतु 4 नर ऊँटों को राज्य सरकार के माध्यम से विभिन्न ग्राम पंचायतों को निःशुल्क वितरित किया गया। केन्द्र के फार्म क्षेत्र में वृक्षारोपण के अन्तर्गत 2500 पेड़ों का बीजारोपण किये गये। ठेके के द्वारा मूँगफली की फसल को 8 हैक्टर में उगाया तथा सिंचाई की गई तथा साथ ही 10 हैक्टर ग्वार की फसल को वर्षाधारित क्षेत्र में लगाया गया। शीत ऋतु में ऊँटों के खाने के लिए 1.5 हैक्टर में जई की बुवाई की गई अर्ध गहन प्रबन्ध के अन्तर्गत केन्द्र के 200 ऊँटों के समूह को रोजाना 6 घण्टे प्रति दिन फार्म में चराने के लिए छोड़ा गया।

### शोध कार्य

1. ऊँट के कार्य प्रमाण तथा इन प्रमाणों का भौतिक शारीरिक क्रियाओं तथा जैव रासायनिक सम्बन्धों पर अध्ययन :-

सवारी ढोने की सामर्थ्यता का तुलनात्मक अध्ययन नर और मादा ऊँटों को तीन माह के अभ्यास के अन्तराल के बाद किया गया। सवारी ढोने की सामर्थ्यता, सवारी ढोने की गति, हृदय

कार्यकी का प्रभाव देखा गया। इनके परिणाम स्वरूप श्वसन दर, स्पन्दन दर, ग्लूकोज स्तर, सीरम लेक्टेट स्तर, कॉर्टिसोल स्तर में बढ़ोतरी देखी गयी तथा कुछ मात्रा में ट्राइग्लिसराइड में भी बढ़ोतरी देखी गयी और 24 घंटे के आराम के बाद भी उनके स्तर में कमी पायी गयी। क्रिएटिन काइनेज, एल डी एच क्रियाशीलता में अभिप्राय पूर्ण कमी देखी गई।

## 2. ऊँटों के पोषण पर अध्ययन

शीत ऋतु में व्यस्क बोझा ढोने वाले ऊँटों में पोषक पदार्थों के उपयोग के बारे में अन्वेषण किया गया। ऊँट गाड़ी खिंचाव के परिणाम स्वरूप डी एस, सी जी ई ई, सी एफ की पाचक क्षमता (प्रतिशत) में महत्वपूर्ण वृद्धि हुई है। ऊँट के आवश्यक तथा अनावश्यक भोज्य संसाधन का अध्ययन निरीक्षण तथा पोषक मुल्यांकन के द्वारा किया गया। 24 पादप नमूने घास, फसलें, बेल, झाड़ी/क्षुप तथा पेड़ों का संग्रहण एवं परीक्षण किया गया तथा उनके प्रारम्भिक संगठन का अध्ययन किया गया। एक प्रयोग में 20 प्रतिशत संरक्षी मोठ चारा का परिवर्तन बुई असंरक्षी झाड़ियों की शुष्क पत्तियों के द्वारा किया गया एवं अध्ययन के परिणाम स्वरूप दोनों समूहों के ऊँटों के ग्लूकोज स्तर में कोई भिन्नता नहीं देखी गई। ओक्सलेट संघटक को एक अध्ययन द्वारा जाना गया तथा स्थानीय झाड़ियों, फसलें, घास और पेड़ों से उसे पृथक किया। सबसे कम आक्सलेट संघटक हिपेटेडिनियां पाइरोटेकिनका (खीप) साइमोपिसन टेट्रोगोना में पाया जो क्रमशः 0.281, 0.450 प्रतिशत था जबकि सबसे अधिक ओक्सलेट संघटक लाएसियम बारबरम (मुरेली कलानी) में था। एक-दूसरे अध्ययन में पानी (1 : 20) के उपचार में सेवन घास में ओक्सलेट की मात्रा 71.62 प्रतिशत कम रही। दुग्ध स्त्राव की दोनों अवस्था 2.0–2.5 महीने और 13–14 महीने पर दुग्ध और रक्त सीरम के विटामिन-सी की मात्रा में कोई विशेष अन्तर नहीं पाया गया।

## 3. ऊँट की आनुवांशिकी विषयों का गुणात्मक एवं मात्रात्मक अध्ययन

विभिन्न नस्लों बीकानेरी, जैसलमेरी और कच्छी में ग्याभिन दर 62.5, 66.6 और 72.4 प्रतिशत देखी गयी तथा औसत 65.6 प्रतिशत पाया गया। जन्म दर में इस वर्ष (1996–97) विभिन्नतार्ये जैसलमेरी में 46.6 प्रतिशत तथा अरब बीकानेरी में 75 प्रतिशत देखी गयी। विभिन्न नस्लों में गर्भधारण के समय में भी विभिन्नता पायी गयी। ऊँटों की शारीरिक लम्बाई, सीने का घेरा और ऊँचाई पर किये गये अध्ययन में उम्र व लिंग का प्रभाव देखा गया। 1996–97 के दौरान ऊँटनियों की ग्याभिन दर 53 प्रतिशत तथा बच्चे के जन्म में 706 से 729 दिन का अन्तराल पाया गया। नस्ल के आधार पर वार्षिक बाल उत्पादन क्षमता बीकानेरी ऊँटों में जैसलमेरी व कच्छी की तुलना में अधिक रहा। बीकानेरी और कच्छी ऊँटों के बाल उत्पादन में लिंग का महत्वपूर्ण योगदान रहा। बाल का उत्पादन 7 से 8 वर्ष की आयु की अपेक्षा 3–4 वर्ष की आयु के ऊँटों में सर्वाधिक रहा। औसत दुग्ध उत्पादन क्षमता दूसरी ब्याँत की अपेक्षा तीसरी ब्याँत पर अधिक रही। सायंकाल की अपेक्षा दुग्ध उत्पादन क्षमता प्रातःकाल दस से बीस प्रतिशत अधिक रही। दुग्ध उत्पादन पर नस्ल व माह का भी प्रभाव देखा गया। प्रोटिन व केसीन की प्रतिशतता पर नस्ल व दुग्ध निकालने के समय में महत्वपूर्ण विभिन्नताओं ( $P < 0.01$ ) का प्रभाव पाया गया।

## 4. जनन सम्बन्धी विषयों पर अध्ययन

नर जनन में नर के वीर्य नमूने की प्रारम्भिक गतिशीलता में अस्थिरता देखी गयी। सोडियम, पोटेशियम और ग्लूकोज की सान्द्रता क्रमशः 232.43+7.16 एम ई क्यू प्रति लीटर



156.0±0.71 मिली ग्राम प्रति लीटर पायी गई। वीर्य सान्द्रता 340–520 x 10<sup>6</sup> प्रति मिली लीटर थी अन्य नमूनों का भी अध्ययन किया गया जिनमें इजेक्यूलेसन समय, इजेक्यूलेसन आयतन, वीर्य सान्द्रता, जीवित व अजीवित शुक्राणु एक्रोसोमल क्षति आदि। अर्ध गहन प्रबंध (सेमी इन्टैनएक्रोसोमल मेनेजमेंट) तन्त्र के द्वारा अप्रजनन काल (जून से अगस्त) में सीरम में प्रोजेस्ट्रोन की मात्रा के अध्ययन से पाया कि अण्डोत्सर्जन हर मादा ऊँट में हुआ है। आठ मादा ऊँटनियों में से चार ग्याभिन्न पायी गई वयस्क मादा ऊँट में अल्ट्रा साऊण्ड स्कैनर के द्वारा प्रसव के 40–50 दिन बाद डिम्ब का अध्ययन किया गया। केवल दो मादा ऊँटों में छोटे डिम्ब कोष (<0.5 मी. मी.) ब्याँने के 60 दिन बाद पाये गये।

### 5. ऊँट की पोल ग्रन्थियों पर अध्ययन

नर ऊँट की पोल ग्रन्थि के उत्तक रासायनिक आधार पर अध्ययन किया गया और त्वचीय क्षेत्र में प्रोटीन ग्लाइकोजन, लिपिड, डी एन ए, एटीपेज, एल. डी. एच. तथा ग्लूकोज 6 पी डी एच पाये गये। वायवीय क्षेत्र में 3 बीटा, 17 बीटा हाइड्रोक्सी स्टीरॉइड डीहाइड्रोजेनेस भी पाये गये। पोल ग्रन्थि में सीरम की अपेक्षा ग्रन्थि के स्त्रावि पदार्थ प्रोटीन एलब्यूमिन, ग्लूकोज, कैल्सियम एवम् यूरिया की मात्रा कम होती है जबकि सोडियम अधिक मात्रा में मिलता है। प्रजनन काल के दौरान सीरम स्तर की तुलना में पोल ग्रन्थि में टेस्टोस्टीरॉन 16 से 20 गुना प्रोजेस्ट्रॉन एवम् एस्ट्रॉडिऑल 6 से 8 गुना अधिक स्त्रावित होता है। प्रजनन काल के दौरान पोल ग्रन्थि की एपीथिलियल कोशिकायें अधिक कोशिकीय क्रियायें करती हैं जबकि अप्रजनन काल में अक्रियता प्रदर्शित करती है। वीर्य परीक्षण प्रदर्शित करता है के वर्ष भर शुक्राणु उत्पादन होता है तथा शिथिल लैंगिक व्यवहार भी दर्शाता है हाल ही कि अध्ययन द्वारा विभिन्न काल में पोल ग्रन्थि व वृषण की उत्तकीय परासंरचना, उत्तक रासायनिक अध्ययन में पाया कि इन दोनों में काफी समानता देखी गयी।

### 6. ऊँटों में भ्रूण प्रत्यारोपण तकनीक का विकास

ऊँटों में भ्रूण प्रत्यारोपण विकास योजना के अध्ययन के दौरान मानकीकरण तकनीकी द्वारा बिना चीर-फाड़ के भ्रूण का एकत्रीकरण किया गया। भ्रूण को एकत्र करने के लिए दो मार्गी लम्बी फोली की नली का उपयोग किया गया। बहुस्त्री बीज संग्रहण के तरीके से सात भ्रूण प्रेरित ल्यूटियल अवस्था में पाये गये तथा आगे कार्य प्रगति पर है।

### 7. ऊँटों के रक्त व जैव रासायनिक पर-रूपता पर अध्ययन

भारतीय ऊँट के रक्त समूह एवम जैव रासायनिक पररूपता के अध्ययन के दौरान मानकीकरण तकनीकी के द्वारा आइसोसिट्रेट, डिहाइडोजेनेज, हैक्सोकाइनेज और ग्लूटैथिओन रिडेक्टैज का पृथक्करण किया गया विभिन्न कालों में कुछ एन्जाइमों जैसे एमाइलेज, इल्केलाइन फोस्फेटैज, एल डी एच फास्फेटैज के मात्रात्मक परीक्षण किये गये। लिंग में विभिन्नता के कारण भी महत्वपूर्ण विभिन्नता देखी गई। आणविक आनुवांशिकी के अध्ययन द्वारा जीनोमिक डी. एन. ए. के पृथक्करण के लिए सरल रूपान्तरित तकनीकी विकसित की गई। ऊँटों में आनुवांशिकी डी. एन. ए. के अध्ययन के लिए हैक्सा कटर (बी जी एल, हिन्द 3) टेड्राक्टर एन्जाइम (एच ए ई 3) काम में लिये गये हिन्द 3, एच ए ई 3 एन्जाइमों में 8 रिपीटेटिव डी. एन. ए. बैड औसतन 0.44 किलो बाइट से 2.29 किलो बाइट तथा दो रिपीटेटिव क्रमशः 0.52 किलो बाइट व 0.68 किलो

बाइट पाये गये। यह अध्ययन आगे रिपीटेडि व डी. एन. ए. संगठन तथा डी. एन. ए. क्रम को दर्शाने में मदद करेगा।

#### **8. फसल सम्बन्धित पशु उत्पादन नेटवर्क कार्यक्रम**

फसल सम्बन्धित पशु उत्पादन नेटवर्क कार्यक्रम के अन्तर्गत विभिन्न अध्ययन किये गये। ऊँट के बच्चे को मोठ चारा खूँटे पर तथा सेवन घास चरागाह में खिलाकर दोनों का तुलनात्मक अध्ययन किया गया। सेवन चारे की अपेक्षा खूँटे पर दिये गये मोठ चारा खाने वाले ऊँट के बच्चे में वृद्धि दर अधिक पायी गई। सेवन चारा खाने वाले बच्चों की तुलना में खूँटे पर चरने वाले बच्चे खाने में कम समय लगाते हैं। छः दिन पाचन क्षमता का अध्ययन भी किया गया। पोषक तत्व क्रमशः डी एम, डी सी पी तथा एम ई प्रति किलोग्राम भार 0.75, 79.4±0.19 ग्राम तथा 0.678±0.03 मिली ग्राम लिया गया। ऊँट के बच्चे में अन्य तन्त्रों 237 ग्राम प्रति दिन। इस दूसरे प्रयोग में खूँटे में चरने वाले ऊँटों के समूह में वृद्धि दर अधिक पायी गयी। तीन प्रकार के सिल्वी पास्चर प्रणाली में खाने योग्य व न खाने योग्य पौधों की प्रजातियां पायी गयी। मूँगफली की पोषकता के अध्ययन में पाया कि उसकी पोषक दर पौधे की वृद्धि के साथ कम होती जाती है।

#### **9. ठण्डे मरुस्थल में दो कूबड़ वाले ऊँटों का मूल्यांकन व संरक्षण योजना**

दो कूबड़ वाले ऊँटों का मूल्यांकन करना व संरक्षण का अध्ययन शुरू किया गया है। शीत मरुस्थल परतापुर (जिला लद्दाख) में प्रारम्भिक सर्वेक्षण किया गया। दो रिसर्च ऐसोसिएट नियुक्त किये गये तथा प्रयोगशाला व्यवस्थित करने के लिए कार्यक्रम प्रारम्भ किया गया।

केन्द्र ने उष्ट्र प्रबंधन एवं स्वास्थ्य पर संक्षिप्त अध्ययन क्रम (12 फरवरी से 21 फरवरी 1997) का आयोजन किया जिसमें विभिन्न राज्यों के पशुधन विभाग, कृषि विश्वविद्यालय, एस एस बी के 15 अधिकारियों ने भाग लिया।

#### **आगंतुक**

फार्म में कुल 8913 आगन्तुक आये जिनमें वैज्ञानिक, शिक्षाविद, प्रशासक, रक्षा अधिकारी तथा भारतीय एवं विदेशी सैलानी प्रमुख थे।

#### **प्रकाशन**

वर्ष के दौरान 15 शोध लेख प्रकाशित हुए तथा 19 शोध लेख प्रकाशन हेतु विभिन्न पत्रिकाओं को भिजवाए गये हैं।



## National Research Centre on Camel

The National Research Centre on Camel, Bikaner is located in the Jorbeer area at a distance of about 10 km. from Bikaner city. The area is arid, undulating desert with vast ranges of sand dunes. The soil is mostly loose and sandy. The climate is dry and hot. The average rainfall is around 26-27 cm. in a year. The average summer temperature ranges between 30<sup>o</sup> C and 45<sup>o</sup> C and winter temperature between 4<sup>o</sup> C and 28<sup>o</sup> C. The geographical location of the area is 28.3<sup>o</sup> North latitude and 73.5<sup>o</sup> East longitude at 234.84 m MSL.

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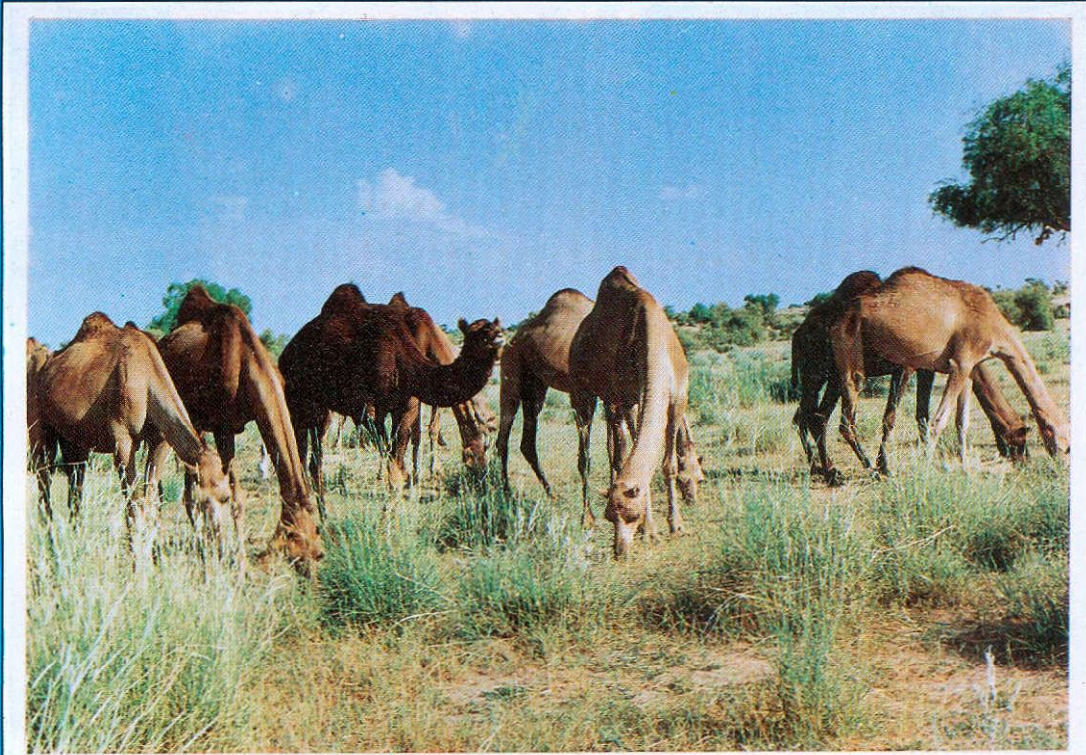
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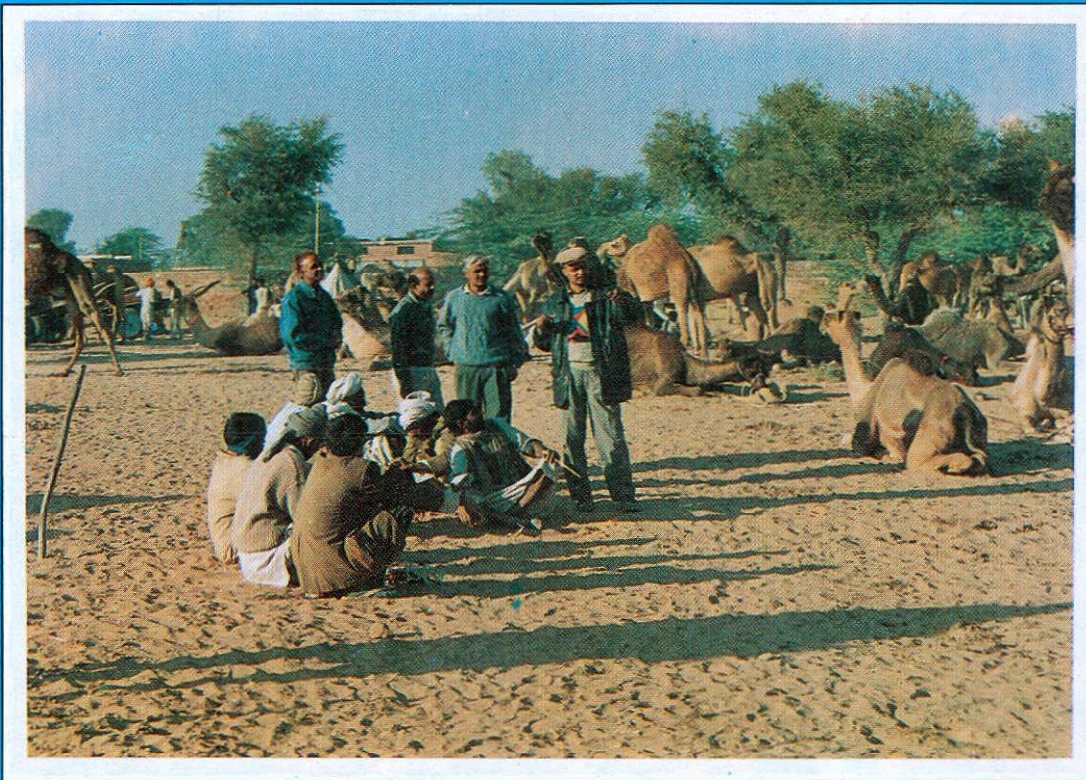
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Range land of NRC on Camel



Camel section at Nagaur Animal Fair



