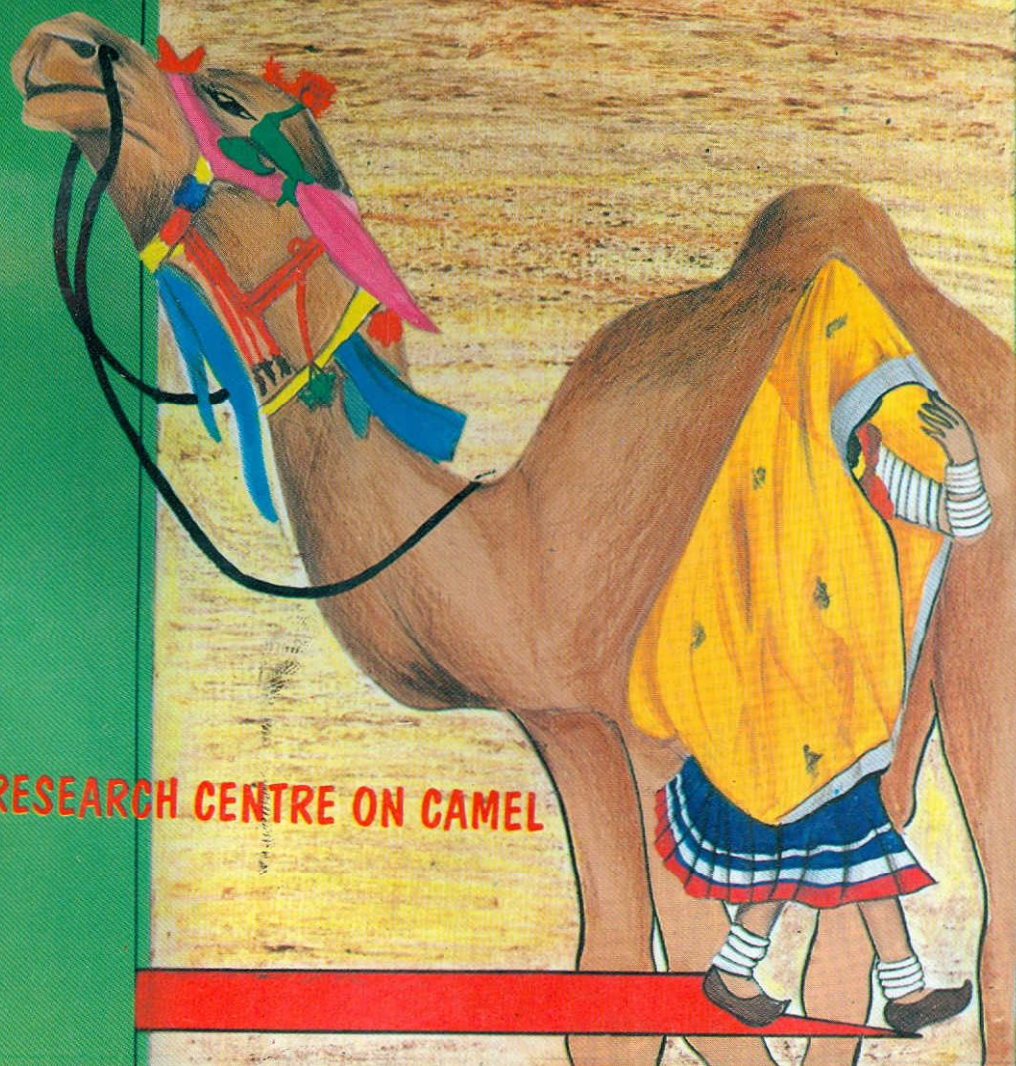




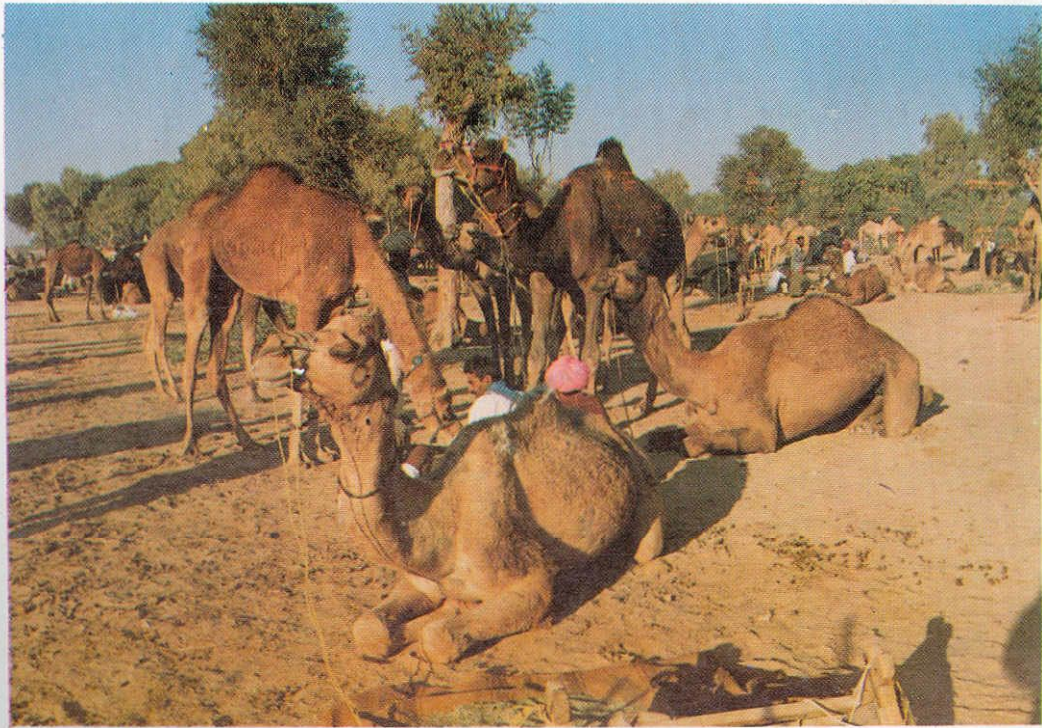
# ANNUAL REPORT 1995-96



**NATIONAL RESEARCH CENTRE ON CAMEL  
BIKANER**



Kisan Goshthi at Nagaur Cattle Fair.



Camel Section at Nagaur Cattle Fair.



## ANNUAL REPORT 1995-96



(Estd. 5th July, 1984)

DIRECTOR : DR. N.D. KHANNA

**NATIONAL RESEARCH CENTRE ON CAMEL  
BIKANER**

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## FROM DIRECTOR'S DESK

It gives me a great pleasure to be writing my last Annual Report as Director, National Research Centre on Camel (NRCC), Bikaner after having completed two tenures of five years each and more than two years of officiating charge with effect from April, 1984. I am particularly gratified to be able to do so because it gives me opportunity to thank all those with whom I was associated as founder Director of NRCC and who have made this period so memorable and delightful. My twelve and half years at this Institution from the beginning were very rewarding to me as these were the culmination of my career in fulfilling a very challenging and difficult task of establishing a new research centre.

I have this opportunity to provide an account of the birth pangs of 1984-85 and also insight of the development and execution of establishment process of NRCC and research programmes. The situation was very hard at the Jorbeer Camel Breeding Farm. Even minimal basic facilities were not available. There was no approach road for almost 4km from Bikaner city. Scientific, Technical or Administrative staff positions were not available during first year of establishment except eleven camel attendants to manage 150 camels and almost 2500 acres of undeveloped unfenced arid area. The animals were in very poor health condition with high rate of morbidity and mortality. From that unforgettable situation to the present NRCC with modern research laboratories, having fine infrastructural facilities is a journey of success. India holds third highest camel population of the world which reflects importance of camel in Animal Science field. It is gratifying that the NRC on Camel could fully recover from initial birth pangs. The run up-to realization of goal of setting up of NRCC was not easy. The staff of NRCC dedicatedly gave full cooperation and unending support at all stages and on all aspects of its development. The Animal Science Division at the headquarter of the Indian Council of Agricultural Research (ICAR), New Delhi and the Director General, ICAR, were in quite

sympathy with the difficulties faced by the NRCC and had provided full support in the establishment of this Centre.

The staff at NRC on Camel have acquired specialization in camel, indeed as they did, to meet future challenges for undertaking research and developmental programmes as envisaged in the 25 years Perspective and Strategic plan for camel improvement programmes. The future research programmes have been designed to emphasise immediate and long term impact on the problems faced by the target group, namely, camel breeders and camel keepers.

The NRCC Staff had conducted research programmes on camel draught, camel physiology, camel adaptability, camel genetics and breeding, camel nutrition, camel reproduction and camel management. The centre also conducted summer institutes and short courses on Camel Production and Management and had participated in the livestock fairs, exhibitions, kisan melas and kisan goshthies etc. The NRC on Camel provided research support to 17 Ph.D. and Masters students. The centre has published about 130 research/review/ popular articles and handouts/reports. NRC on Camel has currently five adhoc schemes from ICAR AP cess fund and Department of Biotechnology (DBT). The staff of NRC on Camel have participated in large number of National and International conferences and have also provided consultancy to the International organisations.

The Quinquennial Review Team (QRT) constituted by the ICAR had very extensively and elaborately reviewed year to year progress of this Centre and had remarked, "The QRT observed that inspite of staff limitation and the fact that centre was in its initial stages of establishment, very good and extensive research work was initiated". The QRT further strongly recommended that the NRCC be raised to the level of full fledged Institute. This and other recommendations of QRT have been accepted by the sub committee of the Governing Body of the ICAR, New Delhi.

Finally, I wish to use this occasion to thank each and all in our country and abroad with whom I had opportunity to interact and collaborate in connection with camel development programmes. I wish a very bright future to this Centre and look forward that it continues to further develop as Centre of excellence for camel research and will soon acquire status of a full fledged National Camel Research Institute.

**(N.D. Khanna)**

## 1. EXECUTIVE SUMMARY

During 1995-96, the staff strength of Centre was 60 consisting of one RMP, 9 Scientific, 10 Technical, 11 Administrative, 5 Auxiliary and 24 Supporting. The budget allocation under plan was Rs. 70 lakhs and under non-plan was Rs. 38 lakhs, which was fully utilized.

At the beginning and close of the year, the camel herd strength was 240 and 225 respectively, comprising mainly of Bikaneri, Jaisalmeri, Kachchhi and Crossbreds (Arab x Bikaneri). Six camel studs were distributed to the Panchyat Samities through State Animal Husbandry Department, Rajasthan under breed improvement programme and 26 Kachchhi camels were transferred to the Animal Husbandry Department, Government of Gujrat, Ahmedabad. Services of superior camel studs were made available to the Camel Breeders from nearby areas during breeding season.

Five Research Projects and five Research Schemes were carried out at the National Research Centre on Camel, Bikaner :

(a) Investigations on nutrient utilization of draught camel were carried out under "Switch over design". Three metabolism trials were conducted. The representative samples of feed, faeces and urine were analysed for proximate principles. The results indicated that the glucose level in serum declined, whereas, triglycerides, lactate, LDH and creatine kinase increased.

(b) Insulin response to glucose infusion in camel : Adult camels were injected 25% dextrose I/V @ 400 mg/kg b.wt. The insulin level increased from

6-8 IU/ml to 8-23.5 IU/ml in 2 hr and then gradually declined and reached initial levels after 24 hrs.

(c) Studies on birth weight of new born calves was significantly affected by breed, parity, year and sex. Bikaneri calves weighed heavier followed by Jaisalmeri and Kachchhi. Calves from 2nd parity were heavier than first parity. The study on biometry viz. body length, heart girth and height indicated significant contribution of age and sex. The average conception rate of herd during the year was 70.2%. The intercalving period vary from 709 to 731 days.

The milk production of Bikaneri and Kachchhi camels maintained on moth chara fodder indicated increasing trend upto 6 months of lactation and declined thereafter. The contribution of breed, parity and time of milking was significant on milk production. The average daily milk production was higher in Bikaneri than Kachchhi. The annual hair production was higher in Bikaneri camels as compared to other breeds. Qualitative and quantitative studies involving blood antigenic factors, blood proteins, blood enzymes and milk proteins were conducted to study genetic variability between camel breeds.

d) Bench mark survey was conducted in 4 villages of Bikaner district to study traditional camel management system. Data on marketing of camels at livestock fair at Pushkar 1995 revealed that out of 30,100 livestock brought for sale, 20,658 were camels (15,205 males and 5,652 females). Average cost of adult camel was Rs. 5,126, ranging from Rs. 2,000 to Rs. 20,000 resulting in total receipts amounting to almost 3 crores.

(e) Studies on nutrient intake of adult male camels fed on dry pala (*Zizyphus nummularia*) leaves indicated 67.1 g DM, 61 g DCP and 0.60 MJME/kg W<sup>0.75</sup>. The results of mineral investigations showed that absorption of Na, K, Ca, P and Mg from gastrointestinal tract was 92.9, 95.2, 45.2, 54.0 and 26.9% respectively. Ascorbic acid content in milk were assayed at different lactation stages which ranged from 3.5 mg/dl to 2.0 mg/dl.

(f) Studies on preservation of camel semen were conducted. The tris egg yolk and lactose extenders were compared. The results revealed that tris buffer was better than lactose buffer in preserving camel semen at 5-8°C. Biochemical studies of seminal plasma revealed wide animal to animal variation in aspartate transaminase, alanine transaminase, acid phosphatase, alkaline phosphatase, lactate dehydrogenase, total protein, calcium and ascorbic acid.

The folliculogenesis in an adult she camel was studied using ultrasound scanner during breeding and non breeding season. The number of follicles were less during non breeding season. It was also observed that only one follicle grew



at a time to mature and took almost 26-29 days to complete follicular cycle. Follicular cysts of approx. 6 cm were successfully treated in two camels using Receptal, 5 ml I/M, in a single dose.

A case study of bilateral cryptorchid in camel was investigated in details. The animal showed normal sexual behaviour but semen was azoospermic.

(g) Studies on poll glands of camel were conducted on histological, histochemical and ultra-structural aspects, were conducted on the biopsy samples of poll glands obtained from 4 camel studs. The histological observations of poll gland sections revealed suppressed activity of the gland during non breeding season. The histochemistry suggested that steroidogenic potential of the poll glands was drastically reduced during non breeding season. Ultra-structure exhibited well defined cellular organelles of the active secretory phase during breeding season. The total number of mitochondria per cell was  $66.4 \pm 1.39$ . During non breeding season the cellular organelles were lesser and the number of mitochondria reduced to  $35.55 \pm 1.53$ .

(h) In the blood groups and biochemical polymorphism studies efforts continued to develop hyper immune sera. Anti camel globulins in rabbit were successfully produced. Sixty five camels were tested against 4 camel blood typing reagents. Bio-chemical polymorphism was studied using 13 protein/enzyme systems. However, no variation was recorded. Studies on haemolytic complement activity through classical and alternate pathway was carried out. Through alternate pathway 75 camel samples were screened using cattle, buffalo, sheep, goats, rabbit and guinea pig as source of RBC's and VBS with or without  $Mg^{++}$ .

(i) Under the scheme on "Development of embryo transfer technology in camel" work on hormonal assay was carried out. Estimation of progesterone in breeding herd revealed that out of 18 animals, 3 (16.6%) had an anovulatory cycle, while 15 animals ovulated but of these 40% did not conceive. Pluriparous healthy adult she-camels selected as donor were treated with progesterone in oil (Duraprogen- Unichem) 100 mg I/M daily for 7 days followed by 3000 IU of eCG I/M (Trophovet, Indian Immunologicals). Inj. hCG 3000 IU (Chorulon, Intervet) was given alongwith mating to facilitate ovulation on the 6th day of superovulatory treatment. The superovulatory treatment resulted in multiple ovulation. Technique of embryo recovery is being standardised.

(j) Network programme on crop based animal production system was initiated. The forage yield of Sewan and Dhaman grasses was 69.0 and 53.0

g/na respectively. The yield of dry pala leaves was 0.76 kg/bush and of Acacia tortilis 6.7 kg/tree. Data was collected on grazing behaviour, growth, health, reproduction, soil composition and grass production parameters.

(k) Hormonal manipulations for improvement of reproduction in camel was continued. Studies on circulating LH in post mated camels revealed a preovulatory surge which appeared to be essential for ovulation and formation of active corpus luteum. camel semen contained testosterone and progesterone in the mean concentration of  $4.98 \pm 0.99$  ng/ml and  $0.53 \pm 0.08$  ng/ml, respectively, with significantly higher values during breeding than non-breeding season.

During the year 1995-96, 8 research articles were published and 15 papers were sent for publication to different journals.

The Centre conducted a short course on Camel Management and Health Control from 15th to 20th January, 1996, where 10 participants from Agriculture Universities, State Animal Husbandry Department, SSB, BSF and Army attended.

Fig. 2.1. Organisational chart



## 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 breed and about 2,060 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.

### **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 676 books and subscribed 29 journals.

### **2.5. Field :**

The NRC on Camel has 824 ha land. About 650 ha of area has been fenced and about 22,000 fodder trees have been planted in the area, 35 ha of land has been brought under perennial silvipasture comprising of grasses, shrubs and trees. Main grasses are sewan (*Lasiurus indicus*) and Blue panic (*Panicum antidotale*).

### **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.

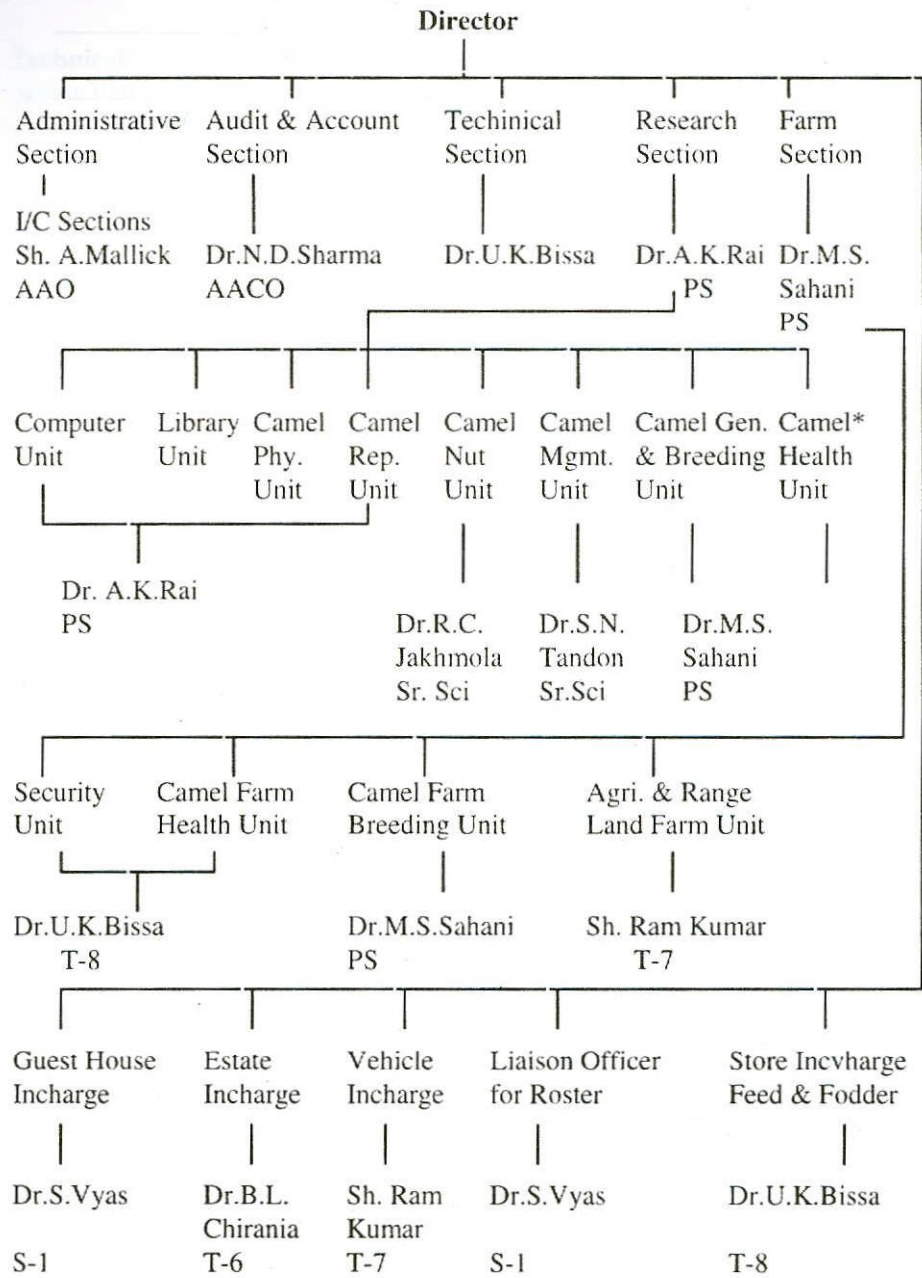
### **2.7. Camel Breeding Farm :**

The camel breeding farm has 240 camels comprising 99 Bikaneri, 73 Jaisalmeri, 52 Kachchhi, 2 Sanchori, 1 Marwari and 13 Crossbreds (Arabi x Bikaneri).

### **2.8. Staff position :**

The sanctioned strength in different categories at the centre was 60. All positions were filled up. Category wise staff position are shown in Table 2.1.

**Fig. 2.1. Organisational chart**



**Table 2.1.**  
**Staff position during 1994-95**

Staff categories	Positions		
	Sanctioned post	Filled	Vacant
R.M.P.	1	1	-
Scientific	9	9	-
Technical			
Category I	4	4	-
Category II	3	3	-
Category III	4	4	-
Administrative	10	10	-
Auxiliary	7	7	-
Supporting	22	22	-
<b>Total</b>	<b>60</b>	<b>60</b>	<b>-</b>

Names of the staff members in position during 1995-96 :

<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 (Animal Nutrition)	: Dr. R.C. Jakhmola
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

**Technical**

Senior Veterinary Officer, T-8	: Dr. U.K. Bissa
Farm Manager [Agril], T-7	: Sh. Ram Kumar
Live Stock Farm Superintendent, T-6	: Dr. N. Sharma
Veterinary Officer, T-6	: Dr. B.L.Chirania
Library Asstt., T-4	: Sh. Ram Dayal
Computer Operator, T-II-3	: Sh. Dinesh Munjal
Agricultural Asstt., T-II-3	: Sh. M.K. Rao
Livestock Asstt., T-1-3	: Sh. Mohan Singh
Livestock Asstt., T-1-3	: Sh. Ram Chandra Bheel
Lab. Tech., T-2	: Sh. Nand Kishore
Lab. Tech., T-1	: Sh. Rameshwar Vyas

**Administrative**

Asst. Fin. & Account Officer	: Dr. N.D. Sharma
Asstt. Adm. Officer	: Sh. A.K. Mallick
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

**Auxiliary**

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

**Supporting**

SSG I to IV	: 22
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### 3.

## FINANCIAL STATEMENT

During the year 1995-96, Rs. 70 lakhs were sanctioned under plan and Rs. 38 lakhs under non-plan. Full budget allocations were utilised. The details are provided in Table 3.1.

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

Sl. No.	Head of Account	1994-95				1995-96			
		PLAN		NON PLAN		PLAN		NON PLAN	
		Bdgt.	Exp.	Bdgt	Exp.	Bdgt	Exp.	Bdgt	Exp.
1.	Estt. Charges	-	-	28.19	27.48	0.50	0.46	35.60	36.37
2.	T.A.	0.20	0.10	0.40	0.40	0.30	0.30	0.40	0.40
3.	Other Charges (Including equipments)	44.80	53.76	3.41	4.11	40.00	49.78	2.00	1.23
4.	Works	45.00	36.12	-	-	29.20	19.46	-	-
		90.00	89.98	32.00	31.99	70.00	70.00	38.00	38.00



## 4.

### CAMEL HEALTH MANAGEMENT

#### 4.1. Clinical cases

During the period 204 cases belonging to camel farm of National Research Centre on Camel were treated for various ailments viz. digestive disorder (60), reproductive (9), respiratory (2), surgical affections including injuries and wound (69), skin affections including mange and dermatitis (47) and others (17). The age, sex and breed wise morbidity is presented in table 4.1.

#### 4.2. Prophylactic measures

(i) The animals and sheds were sprayed with insecticides twice a year for prevention and control of ectoparasites.

(ii) For control of internal parasites the camels were treated with broad spectrum anthelmintics twice a year in the months of August-September and February-March.

(iii) For prophylactic measures against trypanosomiasis (Surra), quinapyramine sulphate and chloride salts were injected twice a year in the months of August-September and February-March.

#### 4.3. Mortality

The specific death rate (SDR%) at the NRCC was 4.18% during the year. The breed wise mortality in Bikaneri, Jaisalmeri, Kachchhi and crossbred (Arab x Bikaneri) was 2.54%, 2.31%, 6.65% and 22.87% respectively. Age, sex and breed wise mortality per thousand camel days per day are presented in table 4.2 and table 4.3.

**Table 4.1.**  
**Age, Sex and Breed wise morbidity (1995-96)**

	Sex		Age			Breed				Total	Percent morbidity
	Male	Female	Birth to 90 days	91 days to 3 year	Above 3 years	Bikaneri	Jaisalmeri	Kachchhi	Cross bred		
1. Digestive System											
i) Enteritis	16	16	17	12	3	11	13	7	1	32	15.69
ii) Simple Indigestion	5	19	5	10	9	9	8	4	3	24	11.76
iii) Impaction	1	3	-	1	3	1	2	1	-	4	1.90
2. Respiratory System											
i) URI	1	1	1	1	-	1	-	1	-	2	0.98
3. Reproductive System											
i) Retention after birth	-	5	-	-	5	2	2	1	-	5	2.45
ii) Dystocia	-	1	-	-	1	-	-	-	1	1	0.49
iii) Abortion	-	3	-	-	3	2	1	-	-	3	1.47
4. Surgical affections											
i) Wounds & Injuries	7	3	-	2	8	2	5	2	1	10	4.90
ii) Fracture	2	1	-	1	2	2	1	-	-	3	1.47
iii) Sprain	1	4	-	2	3	2	1	1	1	5	2.45
iv) Maggot wounds	15	6	-	8	13	9	8	2	2	21	10.29
v) Castration	5	-	-	1	4	1	1	3	-	5	2.45
vi) Nasal wound	16	-	-	-	16	5	8	2	1	16	7.84
vii) Poll gland operation	2	-	-	-	2	1	-	1	-	2	0.98
viii) Camel bite	7	-	-	-	7	3	2	2	-	7	3.43
5. Skin affections											
i) Mange	18	12	5	14	11	8	14	6	2	30	14.71
ii) Dermatitis	9	8	4	4	9	5	6	4	2	17	8.33
6. Others											
i) Mastitis	-	3	-	-	3	1	2	-	-	3	1.47
ii) Agalactia	-	6	-	-	6	2	3	1	-	6	2.94
iii) Otitis media	1	1	-	1	1	-	1	1	-	2	0.98
iv) Pyrexia	-	6	-	-	6	2	3	1	-	6	2.94
	106	98	32	57	115	69	81	40	14	204	

**Table 4.2.**  
**Age and sex wise mortality during year 1995-96**

Age group	Sex	Camel days	No. of animals died	Mortality per 1000 camel days/day
Birth-90 days	M	1007	-	0.0000
	F	1053	-	0.0000
Pooled		2060	-	0.0000
91 days to 3 years	M	12227	3	0.2453
	F	6022	1	0.1661
Pooled		18249	4	0.2192
Above 3 years	M	25970	4	0.1540
	F	43630	3	0.0688
Pooled		69600	7	0.1006
Pooled	M	39204	7	0.1785
	F	50705	4	0.0789
Pooled		89909	11	0.1223

**Table 4.3.**  
**Breed wise mortality during year 1995-96**

Breeds	Camel days	No. of animals died	Mortality per 1000 camel days/day	SDR%
Bikaneri	43687	03	0.0687	2.54
Jaisalmeri	27149	02	0.0737	2.31
Kachchhi	14652	03	0.2047	6.65
Cross bred (Arabi x Bikaneri)	4421	03	0.6786	22.87
Pooled	89909	11	0.1223	4.18

Table 4.3  
Mortality during year 1995-96

Mortality per 1000 Camels	No. of animals died
0.0000	
0.0000	
0.0000	
0.0000	
0.0000	
0.0000	

## 5.

### RANGELAND MANAGEMENT

The farm area of the centre is spread over 824 ha sandy, undulating land divided in 7 sectors. The fencing of the farm is in progress and during the year 1995-96 approx. 2.5 km fencing was completed in sector 5 and 6. The farm roads were dressed up. The established Sevan pasture in about 22 ha and Blue panic in 3 ha were maintained. One hectare area was developed into three tier system of fodder production. Pala (*Zizyphus nummularia*) and Khejri (*Prosopis cineraria*) were planted and Blue panic (*Panicum antidotale*) was introduced through transplantation, while Sevan (*Lasirus indicus*) was broadcasted.

The plantation of 3000 plant seedlings were undertaken as gap filling in between 18000 plants of drought resistant varieties of trees and shrubs viz. *Albizia lebbek*, *Prosopis cineraria*, *Ailanthus excelsa*, *Azadirachta indica*, *Acacia tortilis* and *Zizyphus nummularia*. The landscaping components like *Bougainvillea* and *Nerium odorum* etc. were introduced in the office complex and already established species were maintained.

Guar (*Cyamopsis tetragonoloba*) was sown in about 40 ha as a rainfed crop. It was utilized for direct grazing. The farm also provided 350 quintals of green fodder from cutting of Blue panic pasture. About 65 quintals of dry leaf fodder (*Zizyphus nummularia*) was made available to camels from farm apart from support of 6 h regular grazing to a herd of 200 camels of the centre.

## 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

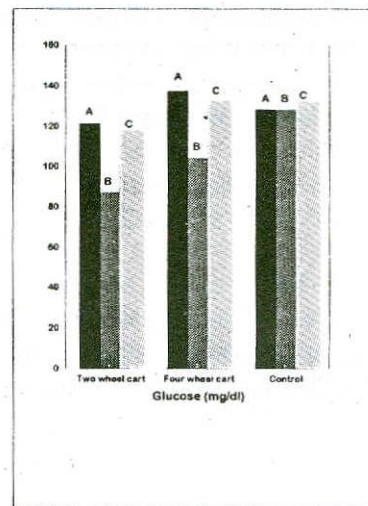
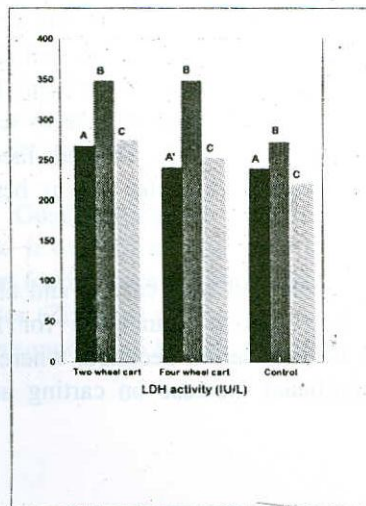
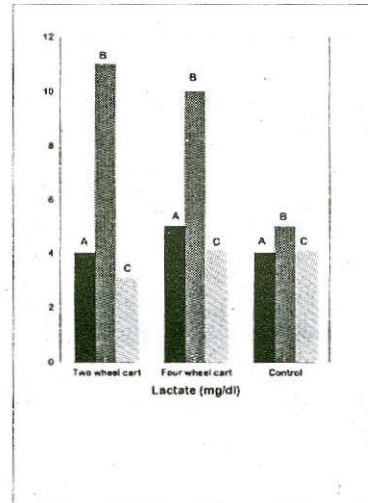
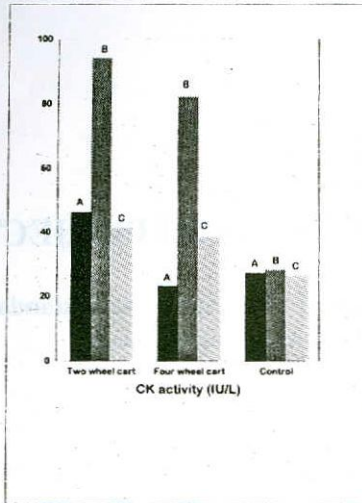
Associates : A.K. Nagpal  
: R. Singh  
: N.D. Khanna

#### 6.1.1. Investigations on nutrient utilization of draught camel :

Three adult male camels weighing  $682.7 \pm 40.16$  kg were used for study of nutrient requirement of draught camels. One camel was used on a two wheel cart, other on 4 wheel cart and the third served as control. The pay load on carts was @ 2.5 kg/kg body weight and the camels worked for 6 hr at a stretch. The experiment was conducted on switch over design. Three metabolism trials were conducted on the draught camels. The representative samples of feed, faeces and urine have been analysed for proximate principles and the data is being subjected to statistical analysis.

The blood samples were also collected before and after carting and after rest the next morning during the metabolism trial and analysed for the biochemical attributes in serum. The glucose level in serum declined, whereas, lactate, LDH and creatine kinase showed significant increase on carting and

**Fig. 6.1.1 Biochemical Changes on carting payload @ 2.5 kg/kg b.wt.**

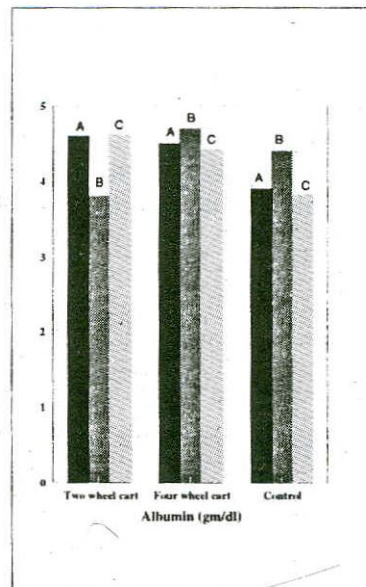
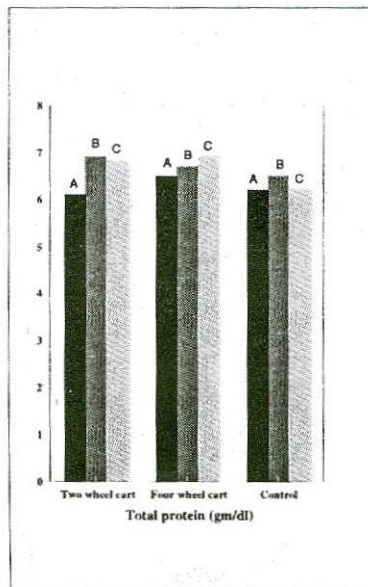
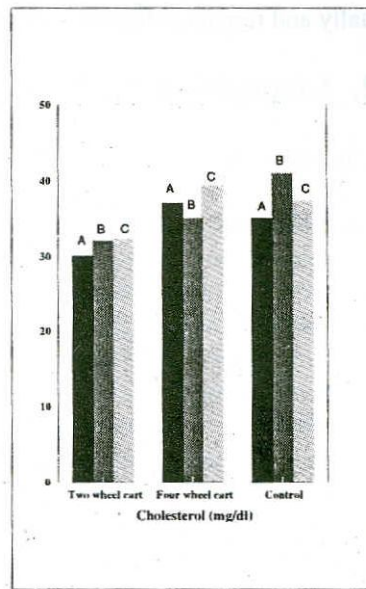
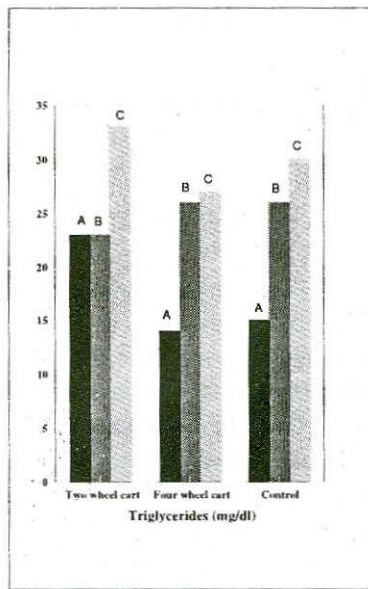


**A - Before carting**

**B - After carting**

**C - After rest**

Fig. 6.1.2 Biochemical Changes on carting payload @ 2.5 kg/kg b.wt.



A - Before carting

B - After carting

C - After rest

returned to initial levels after rest. The concentration of cholesterol, total protein and albumin did not exhibit marked variation. The triglycerides increased gradually and remained higher even after rest (Fig. 6.1.1 & 6.1.2).

### 6.1.2. Adaptation physiology :

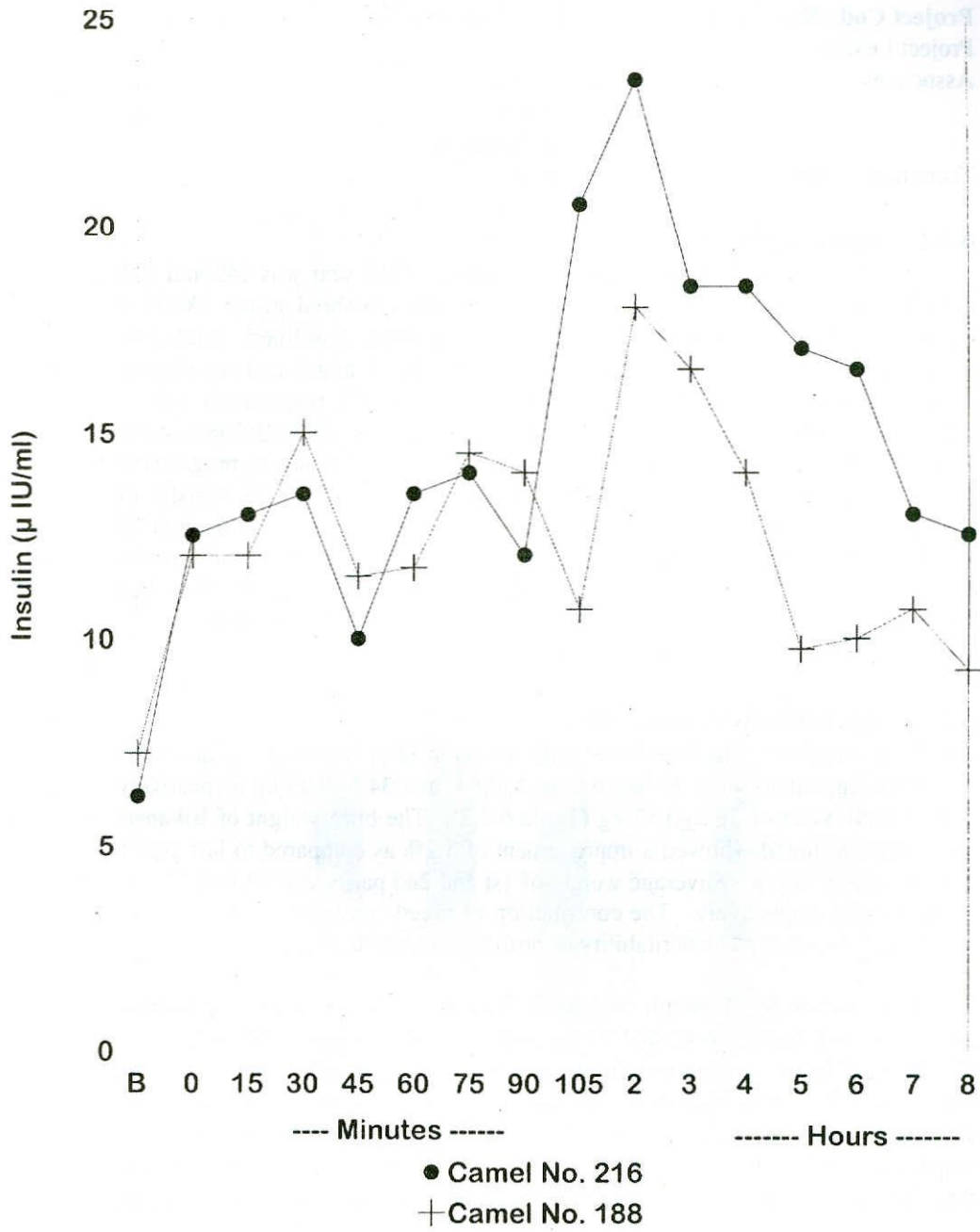
Insulin response to glucose infusion in camel :

A preliminary experiment was conducted to find insulin response to glucose infusion in camels. Two adult camels weighing 730 and 756 kg were fasted overnight. In the morning, blood sample was drawn from both the camels and then each animal was injected with 25% dextrose solution I/V @ 400 mg/kg b.wt. within a period of 15 minutes. The blood samples were collected from the jugular vein on the contralateral side of infusion at 0 hr (immediately after infusion) and then at an interval of 15 minutes up to 2 hr. Thereafter the time interval between samples was increased to 1 hr and sampling was continued upto 8 hr. The sera was separated in a refrigerated centrifuge and stored in a deep fridge (-80°C) until assayed. The insulin was estimated by RIA using Coat-A-Count RIA kit for human insulin supplied by Diagnostic Product Corporation, USA.

The preinfusion values of insulin (B) ranged between 6 and 8  $\mu$  IU/ml but registered an ascending trend upto two hours following dextrose infusion with a plateau at two hours in both the camels (Fig. 6.1.3). The peak levels in the two camels were 23.5 and 18.0  $\mu$  IU/ml respectively. The values started declining two hours onwards upto a period of 8 hours attaining values almost similar to 0 hours. The results suggest that camel responded to glucose infusion by elaborating insulin release from the Islets of Langerhans cells in the pancreas. In addition, it was also noticed that human insulin kit elicited cross reactivity with camel insulin and thus the same can be used for relative insulin studies in camel.



Fig. 6.1.3. Insulin response to glucose infusion @ 400 mg/kg weight in camels



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

Project Code No.	: P.I. 86/2-ICN/L-10/5220
Project Leader	: M.S. Sahani
Associates	: N.D. Khanna
	: S.N. Tandon
	: Raghvendra Singh
Technical Assistance	: U.K. Bissa

### 6.2.1. Herd strength

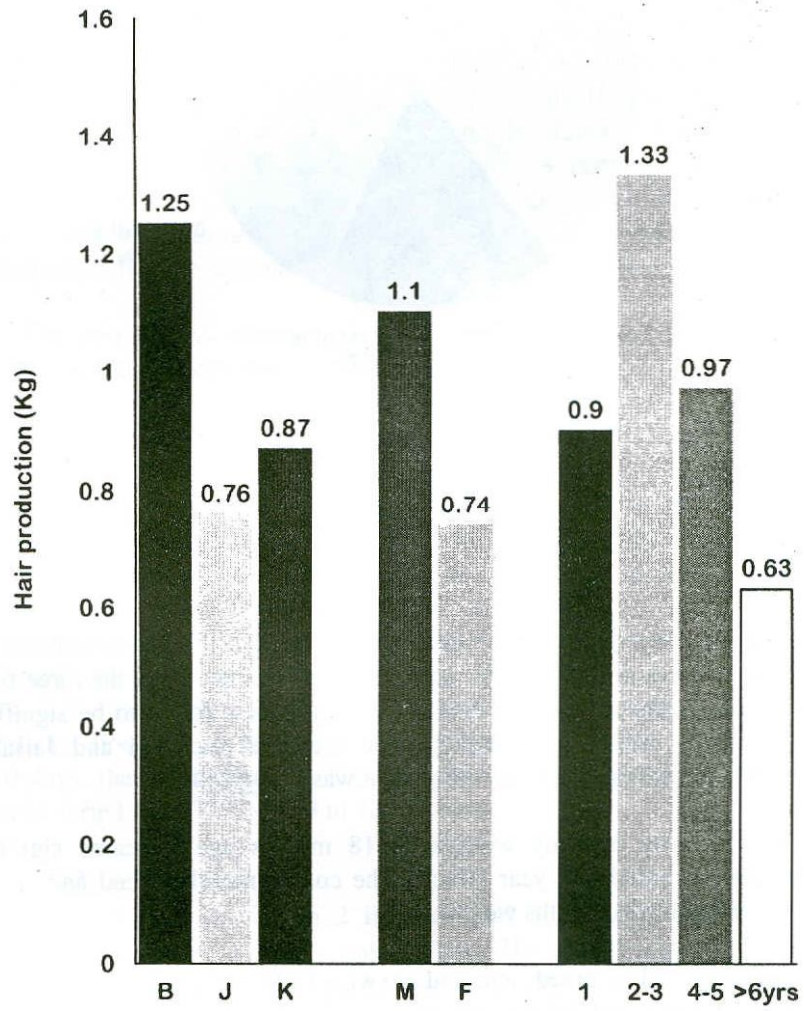
The herd strength at the beginning and close of the year was 240 and 225 camels, comprising of three indigenous breeds and crossbred group (Arabi x Bikaneri). The breedwise initial strength of Bikaneri, Jaisalmeri, Kachchhi, Crossbred, Marwari and Sanchori was 98, 73, 52, 14, 1 and 2 and the closing strength in the same order was 103, 79, 29, 12, 1 and 1 respectively (Table 6.2.1). The addition due to calving was 42 which consisted of 52.3% males and 47.6% female calves. The reduction due to distribution of males to progressive camel breeders through State Animal Husbandry Department was 6, transfer of Kachchhi camels to Animal Husbandry Department, Gujarat was 26, auction 12 and deaths 10 camels respectively. The overall percentage of male and females in the herd was 38.6% and 61.3% and the age-wise percentage of calves (1-3 months, 3-12 months), and adults (above 3 years) was 18.2, 5.7, 11.5 and 64.6% respectively (Fig. 6.2.1 & 6.2.2).

### 6.2.2. Quantitative parameters

(a) Body weights : The breedwise LSQ means at birth in Bikaneri, Jaisalmeri and Kachchhi calves were  $38.0 \pm 0.63$ ,  $36.2 \pm 0.84$  and  $34.5 \pm 0.85$  kg respectively with overall mean of  $36.2 \pm 0.57$  kg (Table 6.2.2). The birth weight of Bikaneri and Kachchhi breeds showed a improvement of 5.2% as compared to last year's weight. The parity wise average weight of 1st and 2nd parity was  $33.4 \pm 0.78$  and  $36.4 \pm 0.64$  kg respectively. The contribution of breed, year, parity and sex was significant ( $P < 0.01$ ). The heritability of birth weight was  $0.3 \pm 0.28$ .

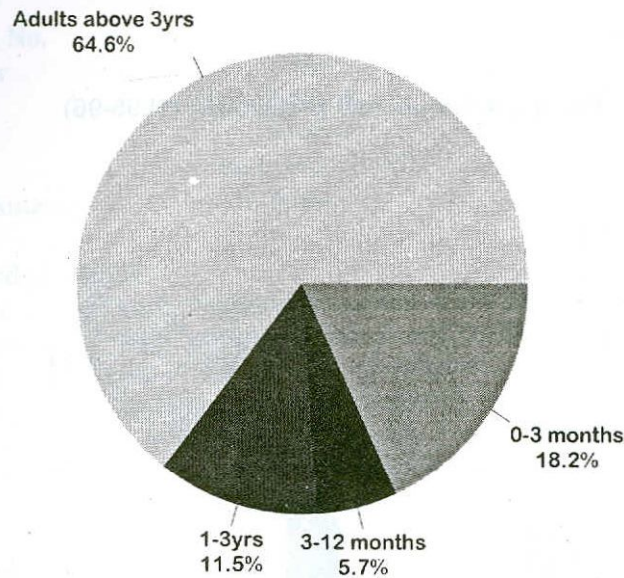
The LSQ means for 3 month weight in Bikaneri were  $93.7 \pm 4.07$ , Jaisalmeri  $88.2 \pm 1.76$  and Kachchhi  $91.4 \pm 1.97$  kg with over all weight of  $91.8 \pm 2.36$  kg. The heritability of 3 month weight was  $0.4 \pm 0.24$ . The contribution of year was significant ( $P < 0.01$ ). The 6 month weight in three breeds viz. Bikaneri, Jaisalmeri and Kachchhi was  $151.5 \pm 1.6$ ,  $145.7 \pm 1.34$  and  $145.8 \pm 1.68$  kg respectively with a over all average of  $148.0 \pm 1.60$  kg. The average weight was about 3.4 to 6.8% higher as compared to previous year's weight.

Fig. 6.2.4 Annual hair production (1995-96)



B - Bikaneri J - Jaisalmeri K - Kachchi M - Male F - Female

Fig. 6.2.2 Agewise percent composition of herd camel



The contribution of breed, year and sex was significant. The heritability of 6 month weight was  $0.3 \pm 0.21$ . The mean 12 month weight in all the three breeds showed similar trend and the contribution of year was found to be significant. Bikaneri calves weighed slightly heavier over the Kachchhi and Jaisalmeri calves. The heritability of 12 month weight was  $0.56 \pm 0.34$ .

The analysis of body weights at 18 months age indicated significant contribution of breed and year effect. The contribution of breed and sex was also significant on 24 months weight.

(b) Biometry : The breed, age and sexwise LSQ means of biometry (body length, heart girth and height) are presented in Table 6.2.3. The breed wise pooled body length in Bikaneri, Jaisalmeri and Kachchhi camels was  $156.4 \pm 2.15$ ,  $156.6 \pm 1.91$  and  $151.3 \pm 3.61$  cms respectively and the sex wise body length in same order for males was  $158.0 \pm 2.69$ ,  $157.6 \pm 2.42$ ,  $153.1 \pm 3.87$  cms

and in females  $154.9 \pm 2.41$ ,  $155.5 \pm 2.48$  and  $153.10 \pm 3.87$  cms respectively. Males had higher length as compared to females in all the breeds. The age wise LSQ means of body length (upto 1 year, 2-3 years, 4-6 years and above 7 years) was  $133.4 \pm 3.33$ ,  $137.3 \pm 3.8$ ,  $168.8 \pm 2.23$  and  $181.5 \pm 2.22$  cms respectively. The contribution of age was significant ( $P < 0.01$ ) in all the breeds.

The average heart girth in Bikaneri, Jaisalmeri and Kachchhi breeds was  $166.5 \pm 1.53$ ,  $164.3 \pm 1.72$  and  $160.7 \pm 2.89$  cms respectively. The LSQ means for heart girth for males in same order was  $168.6 \pm 2.16$ ,  $166.7 \pm 1.98$  and  $161.0 \pm 2.89$  cms and in females  $160.0 \pm 1.93$ ,  $164.3 \pm 1.93$  and  $154.5 \pm 3.98$  cms respectively. The contribution of sex was significant ( $P < 0.01$ ) in Bikaneri and Kachchhi breeds and the age effect was significant ( $P < 0.01$ ) in all the breeds. Bikaneri adult camels indicated higher heart girth followed by Jaisalmeri and Kachchhi camels. The LSQ means for height in Bikaneri, Jaisalmeri and Kachchhi camels was  $181.5 \pm 1.36$ ,  $182.0 \pm 1.21$  and  $175.6 \pm 2.29$  cms respectively. The contribution of breed was significant ( $P < 0.01$ ). Males had significantly higher height than females. Jaisalmeri camels were found to be taller followed by Bikaneri and Kachchi camels. The sex and age factors contributed significantly ( $P < 0.01$ ).

The correlations among body length, heart girth and height with body weights in all the breeds were significant ( $P < 0.01$ ).

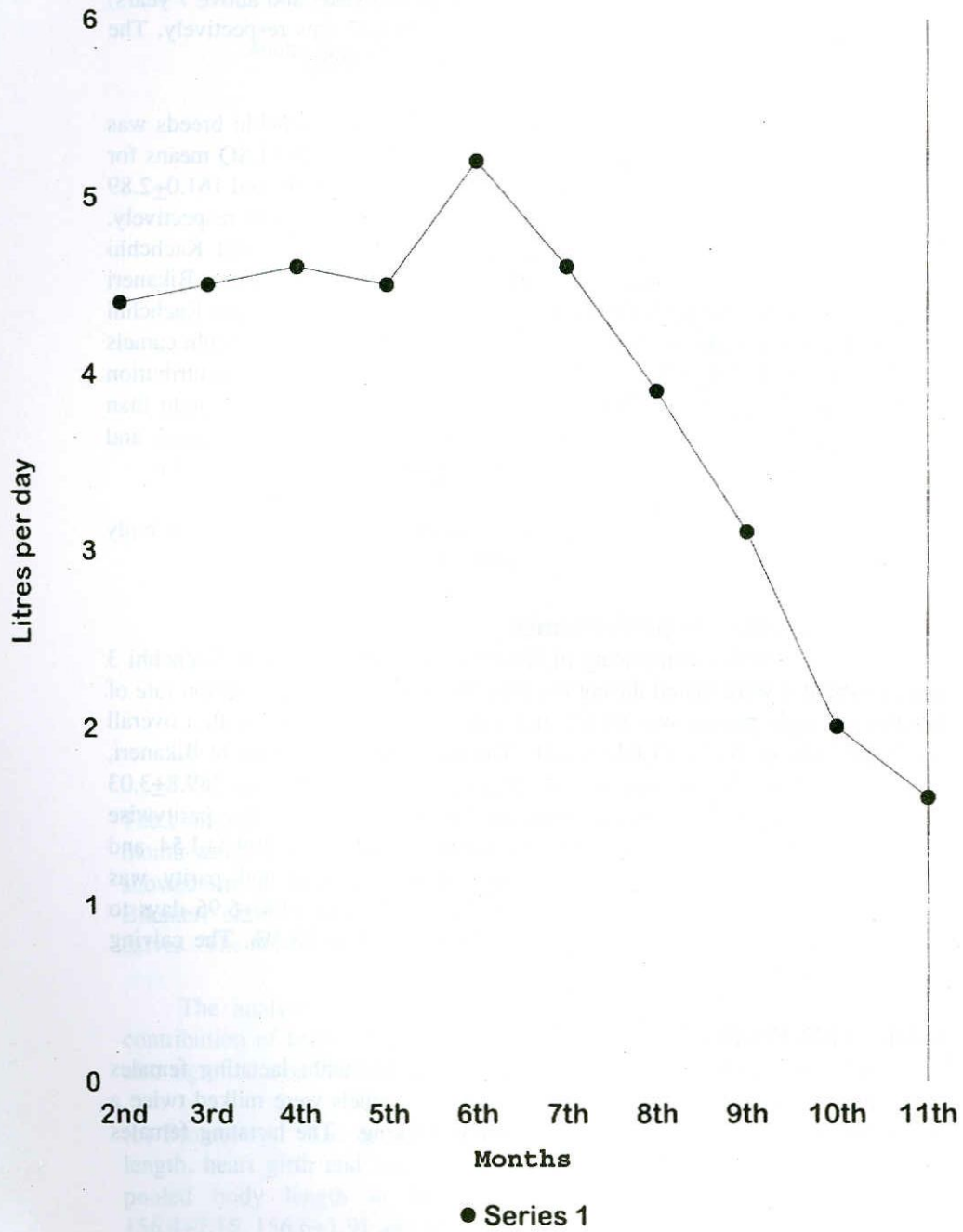
### **6.2.3. Reproductive performance**

In all 37 females comprising of Bikaneri, Jaisalmeri 15 each, Kachchhi 3 and crossbred 4 were mated during the breeding season. The conception rate of females in single mating was 84.6% and with two mating 62.5% with a overall conception rate of 70.2% (Table 6.2.4). The mean gestation length in Bikaneri, Jaisalmeri and Kachchhi camels was  $397.3 \pm 1.95$ ,  $396.5 \pm 2.72$  and  $389.8 \pm 3.03$  days respectively with overall average of  $394.5 \pm 2.06$  days. The paritywise gestation length for 1st parity and 2nd parity females was  $399.3 \pm 3.54$  and  $389.8 \pm 1.57$  days respectively. The contribution of breed and parity was significant ( $P < 0.01$ ). The age at first calving varied from  $1530 \pm 6.96$  days to 1810 days, the calving rate of herd varied from 46.6 to 58.3%. The calving interval varied from  $727.2 \pm 5.43$  to  $739.0 \pm 3.6$  days.

### **6.2.4. Milk Production :**

Daily milk production in 2 Bikaneri and 2 Kachchhi lactating females belonging to 4th and 2nd parity was studied. The camels were milked twice a day at an interval of 8 and 16 hrs by machine milking. The lactating females

**Fig. 6.2.3. Lactation curve of monthwise milk production in camels**



were maintained solely on moth chara (*Phaseolus aconitifolius*) with daily watering and without any supplementation. The average daily production in Bikaneri and Kachchhi camels was  $4.04 \pm 0.06$  and  $3.69 \pm 0.09$  litre/day (Table 6.2.5 and Fig. 6.2.3). The contribution of breed and parity was significant ( $P < 0.01$ ). The morning milk production during different months of lactation varied  $1.0 \pm 0.08$  to  $2.93 \pm 0.085$  litres/day and the evening milk from  $0.59 \pm 0.08$  to  $2.3 \pm 0.084$  litre/day. Morning milk production during different months of lactation was found to be 14.0 to 45.0% higher than evening milk production. The parity, breed and month of lactation contributed significantly on morning and evening production, except for breed effect on evening production. Milk production indicated increasing trend upto 6th month of lactation with average production of  $5.22 \pm 0.143$  and then it showed declining trend.

### 6.2.5. Hair production

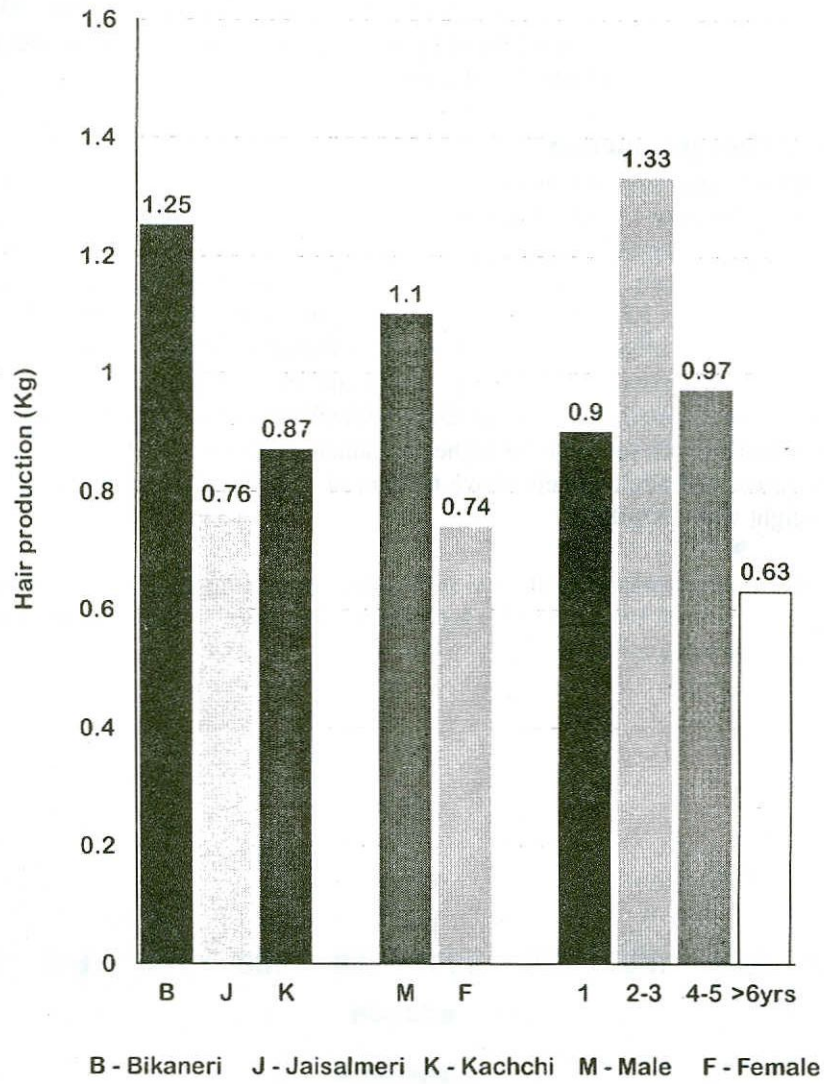
Breed, age and sex wise LSQ means for annual hair production in Bikaneri, Jaisalmeri and Kachchhi was  $1.252 \pm 0.137$ ,  $0.768 \pm 0.133$  and  $0.877 \pm 0.213$  kg respectively (Fig. 6.2.4) with overall production of  $0.965 \pm 0.11$  kg. Bikaneri camels produced heavier annual clip followed by Kachchhi and Jaisalmeri camels. The breed and sex effects were significant ( $P < 0.01$ ). Males produced heavier annual clip as compared to females. The age wise average production in one year, 2-3 years, 4-5 years and above 6 years age group was  $0.908 \pm 0.282$ ,  $1.336 \pm 0.211$ ,  $0.980 \pm 0.207$  and  $0.638 \pm 0.108$  kg respectively. The hair production was found to be higher in camels of 2-3 years followed by 4-5 years, 1 year and adult camels above 6 years of age. The heritability of annual hair weight was  $0.35 \pm 0.29$ .

Body colour pattern in the new born calves revealed mainly four prominent colours viz. - dark brown, brown, light brown and black. More data on colour inheritance is being collected.

Fig. 6.2.3 Lactation curves

which show (a) lactation curves of different breeds of goats and (b) lactation curves of different breeds of goats (Table 6.2.3). The lactation curves of different breeds of goats are given in Table 6.2.3. The lactation curves of different breeds of goats are given in Table 6.2.3.

Fig. 6.2.4 Annual hair production (1995-96)





**Table 6.2.1.**  
**Camel herd strength (1995-96)**

Breed/Age	Opening		Calving		Total		Deaths		Disposal		Closing	
	M	F	M	F	M	F	M	F	M	F	M	F
<b>Bikaneri</b>												
Upto 3 months	6	1	9	11	15	12	-	-	-	-	9	11
Upto 3 years	17	8	-	-	17	8	1Eu	1	3+1*	-	11	5
Above 3 years	16	50	-	-	16	50	-	1	4*	4	19	48
Total	39	59	9	11	48	70	1	2	8	4	39	64
Overall total	98		20		118		3		12		103	
<b>Jaisalmeri</b>												
Upto 3 months	3	1	7	8	10	9	-	-	-	-	6	8
Upto 3 years	13	7	-	-	13	7	1	-	1	1	9	6
Above 3 years	12	37	-	-	12	37	1+1Eu-	-	1*	3	15	35
Total	28	45	7	8	35	53	3	-	2	4	30	49
Overall total	73		15		88		3		6		79	
<b>Kachchi</b>												
Upto 3 months	3	1	3	3	6	4	-	-	-	-	3	3
Upto 3 years	7	4	-	-	7	4	-	-	4T	3T	3	2
Above 3 years	12	25	-	-	12	25	2	1	5T	14T	8	10
Total	22	30	3	3	25	33	2	1	9	17	14	15
Overall total	52		6		58		3		26		29	
<b>Crossbred (Arabi x Bikaneri)</b>												
Upto 3 months	-	-	1	-	1	-	-	-	-	-	1	-
Upto 3 years	1	3	-	-	1	3	1	-	-	-	-	2
Above 3 years	1	9	-	-	1	9	-	2	-	-	1	8
Total	2	12	1	-	3	12	1	2	-	-	2	10
Overall total	14		1		15		3		-		12	
<b>Marwari</b>												
Above 3 years	1	-	-	-	1	-	-	-	-	-	1	-
<b>Sanchori</b>												
Above 3 years	2	-	-	-	1	-	-	-	-	-	1	-
Grand Total	94	146	20	22	114	168	8	5	19	25	87	138
Overall total	240		42		282		13		44		225	

Note : \* - Male camels distributed to progressive camel breeders

T - Camels transferred to Animal Husbandry Department, Gujarat      Eu- Euthinised

**Table 6.2.2.**  
**L.S.Q. means of body weight (kg) of growing camels**

Age groups	Bikaneri	Jaisalmeri	Kachchhi	Sex		Overall
				M	F	
Birth weight	38.0±0.63 (87)	36.2±0.84 (42)	34.5±0.85 (33)	37.1±0.63 (86)	35.7±0.70 (76)	36.2±0.57 (162)
3 month	93.7±4.07 (76)	88.2±1.76 (37)	91.4±1.97 (32)	92.3±1.54 (77)	89.8±1.72 (68)	91.8±2.36 (145)
6 month	151.5±1.6 (59)	145.7±1.34 (37)	145.8±1.68 (32)	150.1±1.73 (69)	145.9±2.02 (59)	148.0±1.60 (128)
12 month	202.3±4.52 (56)	197.4±5.17 (33)	201.5±5.31 (29)	203.1±4.59 (54)	198.4±4.48 (64)	200.7±4.20 (118)
18 month	245.7±4.56 (51)	224.5±4.82 (31)	234.6±6.46 (26)	238.0±5.32 (48)	235.7±4.78 (60)	237.4±4.53 (108)
24 month	270.6±5.09 (46)	256.1±5.69 (29)	259.1±6.20 (23)	260.0±5.08 (41)	266.2±5.1 (57)	262.9±4.68 (98)

**Table 6.2.3.**  
**L.S.Q. means of body length, height and heart girth (cm)**  
**of camels of different breeds**

A. Body length		Bikaneri	Jaisalmeri	Kachchhi
Sex	Male	158.6±2.69 (28)	157.6±2.42 (22)	153.1±3.87 (10)
	Female	154.9±2.41 (54)	155.5±2.48 (39)	149.4±4.97 (12)
Age				
Upto 1 year		135.1±6.19 (3)	131.4±4.79 (5)	133.6±6.23 (3)
2 years		140.7±3.34 (11)	141.0±4.48 (6)	130.1±0.0 (1)
3 years		152.6±7.69 (2)	155.7±6.36 (3)	150.1±0.0 (1)
4-6 years		173.5±2.50 (19)	171.6±2.89 (14)	163.3±5.5 (4)
Above 6 years		184.3±1.72 (47)	178.9±1.95 (33)	181.1±3.13 (13)
Overall		156.4±2.15 (82)	156.5±1.91 (61)	151.3±3.61 (22)
B. Height (at withers)				
Sex	Male	186.7±1.71 (28)	183.6±1.57 (22)	180.5±2.46 (10)
	Female	176.8±1.53 (54)	179.8±1.53 (39)	168.7±3.16 (12)
Age				
Upto 1 year		161.0±3.93 (3)	160.4±3.04 (5)	159.9±3.96 (3)
2 years		171.0±2.12 (11)	178.2±2.84 (6)	168.1±0.0 (1)
3 years		180.4±4.88 (2)	179.0±4.04 (3)	174.1±0.0 (1)
4-6 years		195.9±1.59 (19)	194.5±1.83 (14)	182.8±3.49 (4)
Above 6 years		200.7±1.09 (47)	198.4±1.24 (33)	197.9±1.98 (13)
Overall		181.8±1.36 (82)	181.7±1.21 (61)	175.6±2.29 (22)
C. Heart girth				
Sex	Male	168.6±2.16 (28)	166.7±1.98 (22)	165.9±3.10 (10)
	Female	159.9±1.93 (54)	164.3±1.94 (39)	154.5±3.98 (12)
Age				
Upto 1 year		136.2±4.95 (3)	144.5±3.83 (5)	143.0±4.99 (3)
2 years		150.0±2.67 (11)	152.9±3.53 (6)	148.7±0.0 (1)
3 years		156.8±6.15 (2)	162.8±5.09 (3)	154.7±0.0 (1)
4-6 years		184.9±2.0 (19)	181.7±2.31 (14)	172.6±4.4 (4)
Above 6 years		193.5±1.38 (47)	190.8±1.56 (33)	192.3±2.50 (13)
Overall		165.5±1.72 (82)	166.5±1.63 (61)	160.7±2.89 (22)

**Table 6.2.4.**  
**Reproductive performance of farm herd**

Breed group	No. available & mated	No. conceived	conception %	Gestation length (days)	Calving interval (days)	Calving rate(%) (1994-95)
Bikaneri	15	12	80.0	397.3 $\pm$ 1.95 (20)	727.2 $\pm$ 5.43	55.5
Jaisalmeri	15	10	66.6	396.5 $\pm$ 2.72 (5)	732.5 $\pm$ 10.12	46.6
Kachchhi	3	2	66.6	389.8 $\pm$ 3.03 (7)	739.0 $\pm$ 3.60	58.3
Crossbred (Arabi x Bikaneri)	4	2	50.0	-	-	50.0

**Table 6.2.5.**  
**L.S.Q. means of daily milk production (Liters/day)**

	Morning	Evening	Average
<b>Breed</b>			
Bikaneri	2.37 $\pm$ 0.03	1.67 $\pm$ 0.36	4.04 $\pm$ 0.06
Kachchhi	2.11 $\pm$ 0.05	1.55 $\pm$ 0.05	3.69 $\pm$ 0.09
Overall	2.42 $\pm$ 0.02	1.62 $\pm$ 0.03	3.87 $\pm$ 0.04
<b>Parity</b>			
2nd	2.11 $\pm$ 0.05	1.44 $\pm$ 0.03	3.57 $\pm$ 0.06
4th	2.30 $\pm$ 0.05	1.80 $\pm$ 0.05	4.16 $\pm$ 0.09
<b>Month</b>			
2nd	2.49 $\pm$ 0.08	1.92 $\pm$ 0.08	4.41 $\pm$ 0.14
3rd	2.60 $\pm$ 0.08	1.98 $\pm$ 0.08	4.58 $\pm$ 0.14
4th	2.65 $\pm$ 0.08	1.95 $\pm$ 0.08	4.60 $\pm$ 0.14
5th	2.58 $\pm$ 0.08	1.91 $\pm$ 0.08	4.49 $\pm$ 0.14
6th	2.93 $\pm$ 0.08	2.29 $\pm$ 0.08	5.22 $\pm$ 0.14
7th	2.73 $\pm$ 0.08	1.90 $\pm$ 0.07	4.63 $\pm$ 0.14
8th	2.34 $\pm$ 0.08	1.62 $\pm$ 0.08	3.96 $\pm$ 0.14
9th	1.84 $\pm$ 0.08	1.30 $\pm$ 0.08	3.14 $\pm$ 0.14
10th	1.26 $\pm$ 0.08	0.78 $\pm$ 0.80	2.04 $\pm$ 0.14
11th	1.00 $\pm$ 0.08	0.59 $\pm$ 0.08	1.64 $\pm$ 0.14

Machine used for milking

### 6.2.6. Bio-chemical genetic studies

a) Breed differences in the milk proteins of three different genetic groups viz. Bikaneri, Jaisalmeri and Kachchhi were studied. Milk samples obtained from she camels in early lactation were used for determination of acid phosphatase, alkaline phosphatase, amylase, lactate dehydrogenase and total protein using standard techniques. The results indicated breed difference for acid phosphatase, alkaline phosphatase and amylase (Table 6.2.6). Further study is in progress.

The milk samples were also subjected to protein polymorphism viz. beta lactoglobulin, alpha, beta and kapa casein. No polymorphism was observed.

b) Genetic variability through polymorphism was studied in 118 blood samples collected from two different sources/farms viz. N.R.C. on Camel, Bikaner (90) and \* Cattle Breeding Farm, Palanpur (28). The systems studied were amylase, acid phosphatase, alkaline phosphatase, lactate dehydrogenase, malate dehydrogenase, phosphohexo isomerase, phospho glucomutase, estrases, albumin, haemoglobin and transferrin. No polymorphism was observed in any of the above systems.

c) The lactate dehydrogenase, amylase, alkaline phosphatase, acid phosphatase and total protein were determined in 50 serum samples. The average and the range were as under :

Acid phosphatase (IU/l)	-	7.89± 1.28	(5-12)
Alkaline phosphatase (IU/l)	-	110.62±19.20	(60-175)
Amylase (IU/l)	-	105.75±10.22	(60-130)
Lactate dehydrogenase (IU/l)	-	290.00±22.33	(230-350)
Total protein (gm/dl)	-	6.77± 0.22	(5-7)

\* Camels of Kachchhi breed were also maintained at this farm.

**Table 6.2.6.**  
**Protein and enzymes of camel milk**

Protein/enzymes	Bikaneri	Jaisalmeri	Kachchhi
Milk protein (g/dl)	3.9420	3.9054	4.0601
	$\pm 0.1616$	$\pm 0.3330$	$\pm 0.0866$
Alkaline phosphatase (IU/L)	50.7705	30.0122	9.3854
	$\pm 21.7958$	$\pm 11.0186$	$\pm 5.1035$
Acid phosphatase (IU/L)	6.5351	15.8370	9.6226
	$\pm 1.9150$	$\pm 7.7652$	$\pm 3.6764$
Amylase (IU/L)	39.3138	25.8246	7.8973
	$\pm 16.6102$	$\pm 13.4222$	$\pm 4.8316$
Lactate dehydrogenase (IU/L)	00.0478	00.0797	0.0285
	$\pm 0.0105$	$\pm 0.0254$	$\pm 0.0090$

### 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 extensive/ semi-intensive systems was extended to a few villages having livestock as main resource of livelihood. The bench mark survey on earlier developed performa was carried out in Kilchu, Kalyansar, Surdhana and Serara villages of Bikaner Tehsil (Table 6.3.1). These villages have limited transport facilities and are devoid of Human/Veterinary dispensary, post office, bank and facilities of education beyond primary level. The major population of these villages are labour class. The livestock wealth included sheep, goat, cattle and limited number of camels except for village Serara, where camel population was sizeable and it is the main source of livelihood. The camel population in village Serara was 240 followed by Kalyansar 70 and 60 each in village Kilchu and Surdhana. The camel to human ratio was 1:7 in village Serara, 1:23 in Kalyansar, 1:33 in Surdhana and 1:42 in Kilchu. The ratio of camel to other herbivora was higher in Serara-1:13 followed by Kalyansar 1:36, Surdhana 1:70 and Kilchu 1:94.

The camels were maintained only in the rangeland except when these were used for transportation of men and material or draught purposes. The fodder available in these area was moth chara. The fodder resources in the rangeland

are Pala leaves (*Zizypus mauritiana lank*), Khejari (*Prosopis cineraria*) and Jhal (*Salvadora oleoides decne*). The camels are watered once daily. The females are also used for draught. The breeding of she camel is normally not attempted sparing them for carting. People prefer purchasing camels than rearing. People treat the animals in traditional ways. Veterinary facilities are availed from Bikaner town if essential.

Another survey was conducted in village Gadwala on use of camels for draught. The analysis of the report is presented in table 6.3.2. Among the camels used in cart 71% were males and 29% females. More work is taken from male camels approximately 13 hours per day than females 11 hours per day. The average fodder eaten by males was 22 kg as against 20.7 kg by females. The average cost of camel was also higher for males over Rs. 10,000 as against females Rs. 8,000.

There are quite a few famous and important livestock fairs regularly/routinely organised by Govt. of Rajasthan namely Pushkar, Nagaur, Tilwara, Phalodi and Gogamedi. The transaction of animals may take place directly or through mediators. The details of marketing of camels at livestock fair Pushkar in year 1995 was as under :

Details of marketing of camel at livestock fair, Pushkar 1995 is as under:

Animals at the Pushkar Fair		30,093
Camels at the Fair	Male	15,205
	Female	5,653
Total no. of camels sold		5,790
Amount of business on camels		Rs. 2,96,839.00
Average cost of camel		Rs. 5,126.75
Highest cost of camel		Rs. 20,000.00
Lowest cost of camel calf		Rs. 200.00

In this fair, the demand for males was much more than the females.

The camels maintained at N.R.C. on Camel, Bikaner, under semi-intensive system were used to study genetic relationship between different bio-metrical parameters (Table 6.3.1 to 6.3.4).

Study was conducted on dentitation and ageing of camels. In all 42 camels, the different age groups were studied viz. 0-1 year - 9, 1-2 years - 15, 2-3 years - 2, 3-4 years - 2 and above 4 years - 14. The deciduous teeth erupt by 4 years and permanent teeth after 4 years of age. The two central deciduous incisors appear with in 3 to 12 days, however, some times it may be present at birth. Age wise eruption of teeth in camel was observed as under :

0-1 year 2[I 0/3 C 0/0 (Started erupting after 9 months of age) P 3/2]  
 1-2 years 2[I 0/3 C 1/1 (Erupted by the age of 18-20months) P 3/3]  
 2-3years 2[(I 0/3 C 1/1 P 3/3)  
 3-4 year s 2[I 0/3 C 1/1 (Start falling for replacement) P 3/3]  
 5-7 years 2[I 0/3 C 0/0 ( Under replacement) P 3/2 (One fall) M 3/3]  
 7-8 years 2[I 1/3 C 1/1 P 3/2 M 3/3]  
 above 9 years: Tushes and incisors get rounded due to wearing

Pre-parturition symptoms were also studied on 30 females during the year. The she camels were under observation at least for a week before actual calving. The observations revealed swelling of vulvar lips, redness of vulvar mucus membrane with occasional discharge, depression/concavity of pin bones, size of milk vein and general behaviour of sitting and standing posture.

**Table 6.3.1.**  
**The comparative analysis of sample survey in different villages**

	Kilchu	Kalyansar	Surdhana	Serara
Village population	2500	1600	2000	1700
Animal population				
(a) Camel	60	70	60	240
(b) Cow	600	500	1000	500
(c) Buffalo	20	30	200	70
(d) Sheep & Goat	5000	2000	3000	2500
Camel : other herbivora	1:93.7	1:36.1	1:70.0	1:12.8
Camel : Human ratio	1:41.7	1:22.9	1:33.3	1:7.1
Number of cattle per camel	10	7.1	16.7	2.1



**Table 6.3.2.**  
**Survey report of camels used for draught in village Gadwala**

1. Status	Owner 91.4%	Driving on hire 8.6%
2. Occupation	Earning through cart 2.9%	Agriculture 97.1%
3. Camel used in cart	Male 71.4%	Female 28.6%
4. Age groups of camels used in cart (%)		
(a) under 4 years	8.6	
(b) 4-6 years	14.3	
(c) 6-8 years	40.0	
(d) 8-10 years	25.7	
(e) above 10 years	11.4	
5. Working period	Male 12.8 hrs/day	Female 10.8 hrs/day
6. Average cost of camels as reported by cart owner	Male Rs.10,210/-	Female Rs.8,180/-
7. Quantity of fodder fed per day	Male 22 Kg	Female 20.7 kg

**Table 6.3.3.**  
**Phenotypic correlations between different bio-metrical parameters in female camels (post partum)**

	Leg length	Body length	Heart girth	Height at withers
Body weight	0.1268	0.6388	0.2100	0.3908
Leg length	-	0.2765	0.2058	0.2899
Body length	-	-	0.4190	0.4782
Heart girth	-	-	-	0.8725

**Table 6.3.4.**  
**Phenotypic correlations between different biometry of newly born calves**

	Leg length	Body length	Heart girth	Height at withers
Body weight	0.6909	0.3266	0.6847	0.3237
Leg length	-	0.3417	0.5990	0.2162
Body length	-	-	0.3426	0.1311
Heart girth	-	-	-	0.7059

## 6.4 Studies on Camel Nutrition

**Project Code No.** : P.I.-90/4-ICN/L-5220  
**Project Leader** : R.C. Jakhmola  
**Associates** : A.K. Nagpal  
: A.K. Roy

### 6.4.1. Utilization of Bui as feed for camel :

The Bui (*Aerva sativa*) even in green stage is not palatable by camel. In order to make it palatable, an attempt was made to process it as silage either alone or mixed with grasses like *Lasiurus indicus* (Sewan) or *Cenchrus ciliaris* (Dhaman). At the time of ensiling Bui, Sewan grass and Dhaman grass had a DM content of 36.6, 49.9 and 43.6% respectively. The D.M. content of silage premixes was adjusted between 30-40% by adding water. During preservation, premixes decomposed and resulted material had a pH in the range of 5.07 to 6.46 with  $\text{NH}_4\text{-N}$  content ranging from 1.36 to 7.64 g/kg DM. This material was poor quality silage. The low density and low soluble carbohydrate contents could be possible reason. The work will continue in this aspect.

### 6.4.2. Treatment of bajra straw for feeding to camel :

The bajra kadbi was treated with urea (4 kg/100 kg DM) in polythene bag. The treated material was removed from bag and was air dried and stored for feeding to camel. The animal experiment is in progress.

### 6.4.3. Vitamin-C content in milk during early part of lactation :

An experiment was conducted to determine ascorbic acid content in colostrum and milk during early part of lactation. The milk collected on day 1, 2 and 3 after parturition and then at weekly intervals upto 4 week, was analysed for ascorbic acid content (Table 6.4.1). Ascorbic acid content tended to rise from 1 to 3 days post partum in camel milk and subsequently declined to nearly a constant level in mature milk. Further work in respect of changes in vitamin-c content in blood, milk and urine with changing level of intake is needed.

**Table 6.4.1:**  
**Ascorbic acid content in milk (mg/dl)**

Period	n	Mean	S.D.
Day-1	12	2.781	1.677
Day-2	14	3.498	1.849
Day-3	12	2.857	1.256
Week-1	13	2.032	0.616
Week-2	13	2.101	0.624
Week-3	09	2.040	0.455
Week-4	06	2.677	1.591

#### 6.4.5. Mineral studies in camel

##### 6.4.5.1. Mineral absorption in camel calves given green Blue panic grass (*Panicum antidotale*):

Blue panic grass at the height of 1.5-2' was harvested as first cut and fed unchaffed to 3 young camel calves (328.3 kg) for a pre-experimental period of 21 days in June,95 and a 5 days digestibility trial was conducted. The chemical composition was 14.0% CP, 2.1% EE, 23.4% CF, 50.8% NFE, 9.7% total ash, 0.52 g/kg Na, 18.02 g/kg K, 6.01 g/kg Ca, 2.17 g/kg P and 2.92 g/kg Mg on DM basis. Drinking water contained 669.8 mg Na, 11.2 mg K, 68. mg Ca, 9.4 mg P and 75.3 mg Mg/l. The digestibility coefficients of OM, CP, EE, CF and NFE were 62.3, 57.1, 31.7, 55.1 and 65.4% respectively. The absorption of various mineral elements viz. Na, K, Ca, P and Mg from GI tract was 92.9, 95.2, 45.2, 54.0 and 26.9% respectively. The grass contained 8.0% DCP, 57.1% TDN and 18.7 MJ ME per kg DM and the mean intake of these nutrients was 28.4 g, 2.3 g and 0.29 MJ/kgw<sup>0.75</sup>/d respectively. The low % DMI (0.67 kg) indicated the need of feeding this grass in combination with other feeds.

##### 6.4.5.2. Nutritional evaluation of dry (*Zizyphus nummularia*)

###### Pala leaves in adult camels :

Three adult male camels (654.7 kg b.wt) were kept on sole roughage diet of dry Pala leaves (*Zizyphus nummularia*) for a period of 4 months and watered once daily. The proximate components of dry pala leaves on percent DM basis were 88.2 OM, 15.9 CP, 2.4 EE, 14.4 CF and 56.0 NFE. The digestibility coefficients of OM, CP, EE, CF and NFE were 66.0, 56.5, 21.3, 51.6 and 74.4 %

respectively. The nutrient intake of camels was 67.1 g DM, 6.1 g DCP and 0.60 MJ ME/kg  $W^{0.75}$  respectively. The average daily water intake was 25.6 l or 114.6 ml/kg  $W^{0.82}$ . The analysis of mineral elements viz. Na, K, Ca, P, Mg, Fe, Cu, Co, Zn, and Mn is being done.

## 6.5. Studies on camel reproduction

**Project code** : P.I.90/5-ICN/L-31/5220  
**Project leader** : A.K. Rai  
**Associates** : A.K. Roy  
: Sumant Vyas  
: N.D. Khanna

### 6.5.1. Male Reproduction

#### 6.5.1.1. Semen evaluation and preservation

(a) Breeding Season:

Three adult male camels belonging to herd of N.R.C. on Camel, Bikaner were used for the present study conducted during the months of January and February, 96. Bull artificial vagina was used for collecting the ejaculates. The inner temperature of A.V. was maintained at 40°C. A she camel restrained in sitting posture was used as dummy.

Eight ejaculates were collected from each bull at twice a week interval. The semen samples were evaluated for colour, volume, gel, pH, motility, sperm concentration, live sperm count and total sperm abnormalities. The semen was splitted into two parts and extended using two dilutors, as below in 1:3 ratio.

i). Tris egg yolk citrate glycerol extender.

Tris-hydroxy methyl amino methane	3.028 g
Citric acid monohydrate	1.675 g
Fructose	1.25 g
Glycerol	8.0 ml
D. water added to 100 ml	
Egg yolk	20 ml

Suitable antibiotics were added and pH was adjusted to 6.8.

ii) Lactose buffer (Sieme et al, 1990)

Lactose	11 g
Glycerol	8.0 g
D. water added to	100 ml
Egg yolk	20 ml

Suitable antibiotics were added and pH was adjusted to 6.8.

The extended semen samples were preserved in a refrigerator at 5°C. In all, 48 split semen samples were analysed for motility, live dead and sperm abnormalities at 0, 24, 48, 72 and 96 h of preservation at 5°C.

The colour of the semen varied from white to creamy white. The colours had no relation either with volume or the ejaculates. The semen volume varied from 2.78 to 7.5 ml. There were bull to bull and sample to sample variation in the ejaculates. The pH of the ejaculate varied from 7.87 to 8.10. Mild to thick gel was present in the ejaculates. The mean values for sperm concentration ( $\times 10^6/\text{ml}$ ) for the three bulls were 146.40, 68.53, and 127.35 respectively. These values were lesser than the values observed earlier where ejaculates were collected directly into tubes containing dilutor. In the present experiment sperm count was made in the neat semen. The possibility of spermatozoa being trapped in gel could be the reason for lower values of sperm concentration in the present experiment. The semen samples prepared for live dead count are being examined.

Out of 24 ejaculates the sperm motility varying from 20 to 50 percent was observed in only 10 samples. In isolated cases the motility was upto 80 percent.

The semen samples just after dilution with tris buffer showed sperm motility varying from 48 to 54 percent which declined to 22-24 and 11 percent respectively in semen from two bulls ( $B_2$  &  $B_3$ ) after 24 and 48 h of preservation at 6-8°C. In semen from third bull ( $B_3$ ) the motility was 41 and 33 percent after 24 and 48 h of preservation respectively.

The semen extended in lactose buffer showed initial motility varying from 27 to 34 percent which declined to 3-6 percent in semen from two bulls ( $B_1$  &  $B_2$ ) and 26 percent in the semen from third bull ( $B_3$ ) at 24 h of preservation. The result indicated that Tris-buffer was better than lactose buffer in preserving camel semen at refrigerated temperature.

(b) Non breeding (Hot humid) season:

Attempts were made for collection of semen in artificial vagina from five camel studs in month of July, 1995. The studs were reluctant to mount and did not exhibit normal sexual behaviour during semen collection. The volume of ejaculated semen was scanty ranging from 0.5 to 1.5 ml. The semen was viscid in consistency and gel was present in all samples. The microscopic examination revealed absence of spermatozoa in semen samples from three studs and non-motile dead sperms in semen samples from two studs.

(c) Biochemical characteristics of camel semen:

During the first half of the year under report i.e. April, 1995 to September, 1995, 56 attempts were made from five breeding camels to collect semen. The semen was less in quantity and also poor in quality. Hence only physical characteristics were evaluated (Table 6.5.1). The camels did not mount in 18 cases and 14 times no semen could be collected and there was no spermatozoa in 9 ejaculates during non breeding season. The semen could not be analysed for biochemical constituents. In the second half of the year semen samples were collected in the breeding season for the biochemical analysis of 8 different parameters (Table 6.5.2). There was a wide variation in these parameters from animal to animal. In some of the ejaculates, there was heavy gel formation and the gel did not dissolve even after two hours or more, so these samples were not utilized for biochemical analysis. An aliquot of each of these samples have been preserved for the quantitation of sodium, potassium and chloride.

### 6.5.1.2. Cryptorchidism in camel

Behavioural and seminal attributes of an adult cryptorchid camel was studied. The animal exhibited symptoms of rut viz. restlessness, aggressiveness, grinding of teeth, gurgling sound, ejection, blowing of soft palate and oozing of acrid dark brown secretion from the poll glands during breeding season and also mounted females for mating.

Attempts to collect semen in artificial vagina were successful. The camel exhibited normal libido. In all, 8 semen samples were collected the mean ejaculation time was  $4.0 \pm 0.5$  min. which was almost similar to ejaculation time reported earlier.

The volume of ejaculates varied from 3.7 to 4.0 ml. The semen was greyish in colour, thin viscid with mild gel. The pH varied from 8.0 to 8.5. The

**Table 6.5.1.**  
**Physical Characteristics of camel semen**

Camel No.	Mean Ejaculation Time (min.)	Mean Volume (ml)	Mean pH	Sperm Conc. $\times 10^6$	Live Sperms%
415 (15)*	4.0	3.0	8.33	320 $\times 10^6$	78
365 (12)	2.8	2.6	8.33	-	-
268 (14)	3.4	1.9	8.50	-	-
364 (8)	2.4	6.5	8.5	365 $\times 10^6$	85
373 (6)	4.0	3.0	8.0	-	-
273 (1)	1.0	-	-	-	-
Total (56)	3.3	3.14	-	-	-

\* Figures in parameter indicate number of attempts.

**Table 6.5.2.**  
**Biochemical characteristics of seminal plasma**

	Mean $\pm$ SE	Range
i) Aspartate Transaminase (u/lit)	6.92 $\pm$ 0.652 n = 19	4.72 - 11.92
ii) Alanine Transaminase (u/lit)	1.03 $\pm$ 0.167 n = 14	0.51 - 2.09
iii) Acid Phosphatase (u/lit)	85.27 $\pm$ 18.157 n = 9	49.96 - 221.70
iv) Alkaline Phosphatase (u/lit)	1020.82 $\pm$ 101.921 n = 15	88.50 - 1449.20
v) Lactate dehydrogenase (u/lit)	207.12 $\pm$ 22.891 n = 13	61.56 - 315.20
vi) Total protein (g/dl)	1.3998 $\pm$ 0.1416 n = 29	0.12 - 2.89
vii) Calcium (mg/dl)	6.385 $\pm$ 0.5147 n = 28	0.29 - 9.27
viii) Ascorbic acid (mg/dl)	0.333 $\pm$ 0.0926 n = 8	0.91 - 0.96



microscopic examination revealed azoospermia in all the samples. The semen was also collected during non-breeding season three times. The semen was azoospermic and volume was comparatively less than the breeding season (average 2.2 ml). The sexual behaviour was comparable to the behaviour of normal camel studs during non-breeding season.

#### **6.5.1.3. Histology of camel Testis and Epididymis**

An adult male camel (above 5 yr) and a camel calf (2 yr) were castrated using local anaesthesia during non breeding season. The testes and epididymis were collected and fixed immediately in Bouin's fluid, dehydrated in ethanol, and embedded in paraffin. Sections of 6  $\mu$ m thickness were stained in Harris haematoxylin and Eosin.

The testes of the calves and adults were in the process of differentiation of the seminiferous tubules. The basal lamina of seminiferous tubules were well organised and the spermatogonia were arranged close to the basal lamina. The nuclei of the spermatogonia were showing pycnosis and the cytoplasm was clear showing vacuolization. Sertoli cells were not differentiated. Other germinal cells viz. spermatocytes and spermatids were not differentiated. The seminiferous tubules were devoid of lumen. Interstitial cells were scattered in clusters in between the tubules and they had not formed any definite pattern.

Similarly, the epididymis of the calves showed disorganization. It has shown the tubular arrangement with a definite lumen. The epithelium was poorly differentiated and the appearance of the cell was not proper. The lumen contained phagocytes and undifferentiated cells.

However, the epididymis of the adult showed well differentiated tubular pattern with intertubular tissue. The epithelium was well organised and ciliated. Two types of cells viz. basal and principal cells, the typical cells of mammalian epididymis were observed. The lumen was devoid of spermatozoa.

The results suggested aspermatogenesis in calf and adult during non-breeding season. However, based on the structure of epididymis, it may be concluded that the arrangement of germinal cells in the testis may be due to early age in calf and the same in adult may be due to season.

## **6.5.2. Female Reproduction**

### **6.5.2.1. Studies on folliculogenesis**

The folliculogenesis was studied using annular array dual frequency, endovaginal probe of ultrasound scanner-200 (Pie Medicals) during breeding (February) and non-breeding (September) season. Adult she camel having normal genitalia and calved at least once was selected for daily scanning of both ovaries for a period of 30 days. The she camel was not mated during the experiment.

#### **(a) Non-breeding season**

**Left ovary :** On the first day of examination three follicles were present on left ovary. One of the follicle increased in size from 1.66 cm on subsequent examination and it continued to grow upto day 13th acquiring 4.3 cm size. The observations on 15th day onwards exhibited regression of the follicle which was traceable upto 24th day only. The other two follicles (size 1.15 & 0.4 cm) did not reveal any change in the size till 17th day of examination but a slight increase was noticed in one of three on day 20th.

**Right ovary :** One follicle (approximate size 0.6 cm) was present on right ovary on day 1<sup>st</sup> of examination. Subsequent examination revealed that the follicle did not grow and disappeared. This study revealed folliculogenesis during non-breeding season in she camels with follicular cycle in vogue.

#### **(b) Breeding season**

The experimental she camels used for ultrasound scanning during non-breeding season were not mated between September and February. The investigations on folliculogenesis revealed:

**Right ovary :** In all three follicles measuring more than 0.5 cm could be located on right ovary during ultrasonography. On day 1st of examination only one follicle was located on right ovary. The follicle measured 2.59 cm. A phase of gradual increase of this follicle started again on day 17th and it attained a size of 2.90 cm on day 26th. It declined thereafter reaching 2.22 cm on day 30th. The second follicle (0.8 cm) was found on day 6th of the examination. It did not change markedly upto day 24th and grew thereafter to 1.99 cm on day 30th. A third follicle (0.8 cm) was also observed between day 20th to day 27th.

**Left ovary :** On left ovary also 3 follicles (0.5 cm) could be found during this period. A mature follicle measuring 1.68 cm was present on first day of examination. It grew upto 4.0 cm on day 13th and then the follicle regressed upto day 17th. The follicle become atretic thereafter and could be traced only

upto day 27th. A small follicle was found between day 2nd to day 6th, but did not exceed beyond 1.0 cm. The third follicle was observed from day 11th to day 25th. This also did not grow beyond 1.30 cm during the period of observation. The results indicated that apart from breeding season folliculogenesis also occurred during non-breeding season. Follicular growth and regression is a gradual and sequential process in absence of ovulation. It was also observed that only one follicle grew at a time to mature, the growth of other follicles followed the process of regression of the matured follicle.

#### **6.5.2.2. Investigations on Camel Infertility problems**

Cystic ovarian disease in camel :

Two female camels aged 10-11 years belonging to herd of N.R.C. on Camel were observed to express abnormal sexual behaviour. They used to mount on other females and were difficult to restrain/manage for rectal palpation. The history revealed that the animals did not conceive during last breeding season. Rectal palpation revealed presence of single big follicular cyst in right ovary of both the animals. The cysts were thick walled and approximately 6 cm in diameter.

The animals were re-examined after two days, there was no change in the form of these cysts.

The animals were administered Inj. Receptal (Buserelin, Hoechst) 5 ml I/M. No cyst could be palpated after 3 days of the treatment.

## 7.

### ADHOC RESEARCH SCHEMES

#### 7.1. Studies on Poll glands of Camels

(Sponsored by ICAR AP cess fund)

Principal investigator : A.K. Rai  
Research Associate : B. Manivannan

Poll gland biopsy from 4 camel studs was obtained under local anaesthesia during non-breeding season ( May - September). For histological studies, the tissues were immediately fixed in Bouin's fluid, dehydrated in ethanol and embedded in paraffin wax as per standard procedure. The sections (6  $\mu$ m) were obtained and stained with Harris haematoxyline and eosin. For histochemical studies, the poll gland samples were brought in ice and immediately frozen to -70°C using cryospray. Fresh frozen sections were utilized for the localization of protein, glycogen, lipids, DNA, RNA, ATPase, LDH, G-6-PDH, 3  $\beta$  HSDH and 17  $\beta$  HSDH.

Histology of poll glands : The histological sections revealed that the alveoli of the poll glands were irregular in shape and size and total number of alveoli were reduced. The height of the epithelium was reduced, the nuclei had undergone pycnosis and the cytoplasm showed vacuolization. The results revealed suppressed activity of the gland during non-breeding season.

Histochemistry of the poll glands : The histochemistry of the poll glands showed presence of protein, glycogen, lipids, DNA (very feeble), RNA, LDH and G-6-PDH. The activities of ATPase, 3  $\beta$  HSDH and 17  $\beta$  HSDH were observed in traces. The histochemical findings of the poll glands during breeding season was compared with the results obtained during non-breeding season. As compared to breeding season, the levels of protein, glycogen and LDH activity were unaltered. Levels of Lipid and G-6-PDH activity were moderate. The DNA and ATPase were observed in traces and RNA did not

exhibit any change. The activities of 3  $\beta$  HSDH and 17  $\beta$  HSDH were also in traces/almost undetectable.

The results suggested that the metabolic activity of the poll gland was not affected, however, the steroidogenic potential of the poll glands during non-breeding season was drastically affected.

Biochemistry of poll gland secretion : Samples could not be collected due to scanty secretion during non-breeding season.

Ultrastructure of poll glands : The alveolar region of the poll gland was isolated from the biopsy material collected during breeding and non-breeding seasons. It was fixed in 2.5% glutaraldehyde in phosphate buffer (0.1 M : pH 7.4), post fixed in 1% osmium tetroxide, dehydrated in acetone and embedded in araldite. The ultrathin sections were collected on copper grid stained in uranyl acetate and lead citrate and observed under Philips EM 201 C electron microscope.

The poll glands during breeding season exhibited well defined cellular organelles of the active secretory phase. The epithelial cells were tall columnar or short cuboidal in shape with prominent ciliary structures at the apex facing the lumen. Plasma membrane of the adjacent cells had a straight profile. The nucleus appeared conspicuous with prominent chromatin material and one or two nucleoli. The nuclear envelope was well defined. Mitochondria, smooth endoplasmic reticulum and Golgi complex were well developed and scattered throughout the cytoplasm. The coated vesicles lied freely in the cytoplasm especially at the apex region. The free ribosomes and the glycogen granules in the cytoplasm were abundant. The electron dense secretory granules were numerous and found especially at the region of Golgi complex. The total number of mitochondria per cell was  $66.4 \pm 1.39$  (Fig. 7.1.1 - 7.1.4).

During non-breeding season, the poll gland cell exhibited sparsely distributed cellular organelles revealing the under activity of the cells characterized by the presence of larger vacuoles. The nucleus appeared with sparse chromatin material and at times showed nuclear inter digitation. The chromatin degeneration was evident in some of the cells. However, the nuclear envelope was prominent. The distribution of mitochondria, smooth endoplasmic reticulum, Golgi complex and free ribosomes were relatively poor as compared to breeding season. The secretory granules were poorly seen (Fig. 7.1.5 to 7.1.8). The total number of mitochondria per cell was reduced to  $35.66 \pm 1.53$ .

Figs. 7.1.1-7.1.4. Ultrastructure of the poll gland cells during breeding season.

Fig.7.1.1.The follicular epithelial cells x 3000.

The cells are short cuboidal. The cilia are prominent at the apex of the cells. The nucleus is conspicuous with patchy chromatin material.

Fig.7.1.2. The tall columnar cells x 10000.

The mitochondria are numerous. The smooth endoplasmic reticulum scattered in the cytoplasm. The plasma membrane has a straight profile.

Fig.7.1.3. The cytoplasmic area x 20000.

The secretory granules and coated vesicles are prominent. Anastomosed smooth endoplasmic reticulum, free ribosomes and glycogen particles are scattered in the cytoplasm.

Fig.7.1.4. The nuclear zone x 20000.

The nucleus enveloped by the prominent nuclear envelope. Secretory granules and coated vesicles are seen around the Golgi zone.

Abbreviations:PM - Plasma membrane; M - Mitochondria; N - nucleus; CI - cilia; SER : Smooth endoplasmic reticulum;G - Golgi complex; SG : Secretory granules; CV - coated vesicles; NE - nuclear envelope; Gly - Glycogen granules; R - Ribosomes.

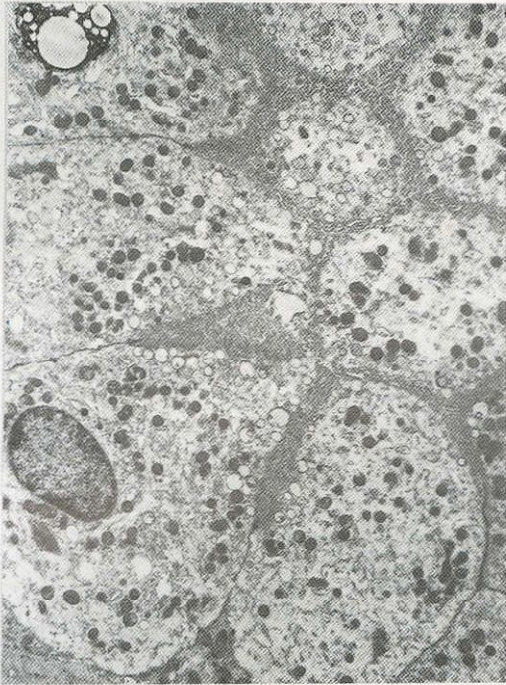


Fig. 7.1.1

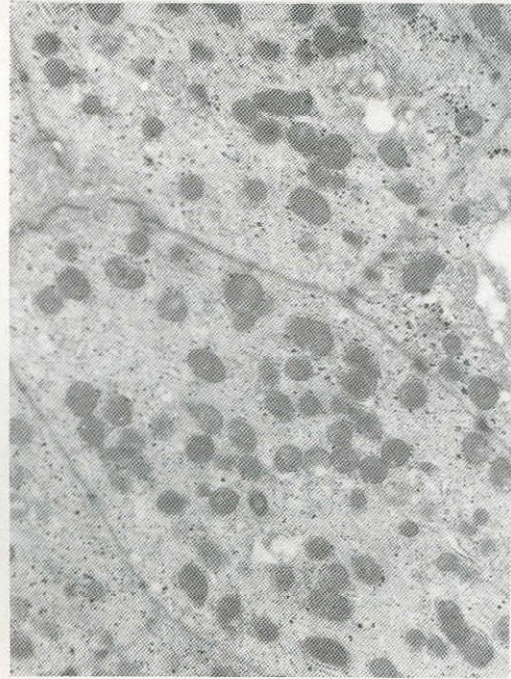


Fig. 7.1.2

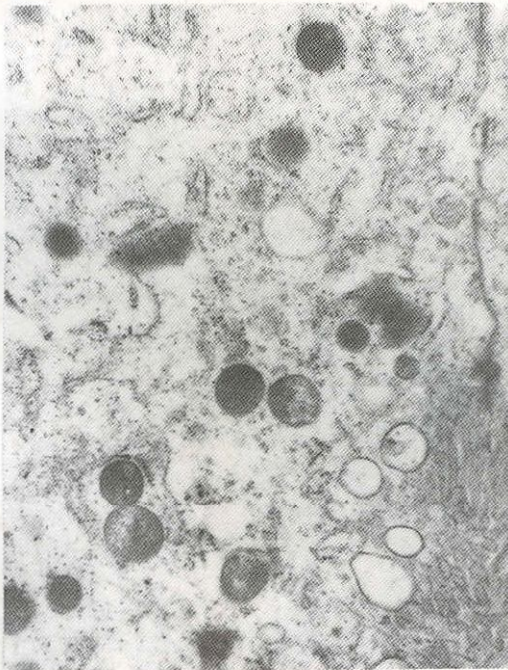


Fig. 7.1.3



Fig. 7.1.4

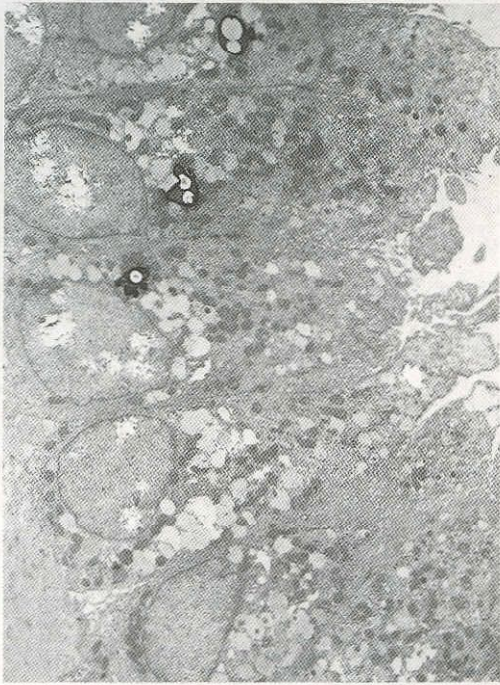


Fig. 7.1.5

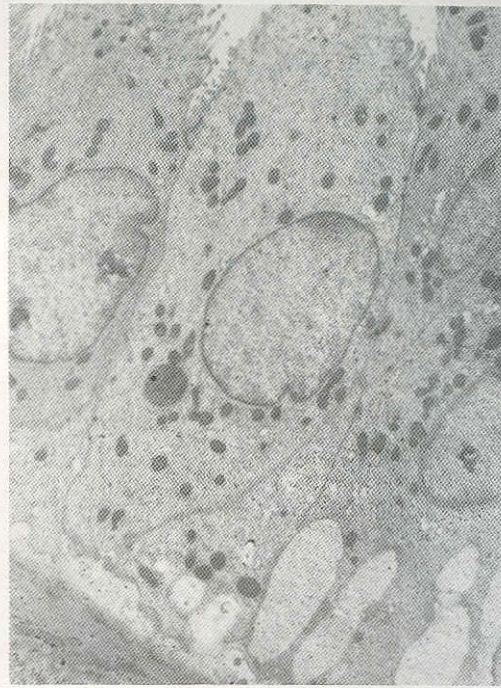


Fig. 7.1.6



Fig. 7.1.7

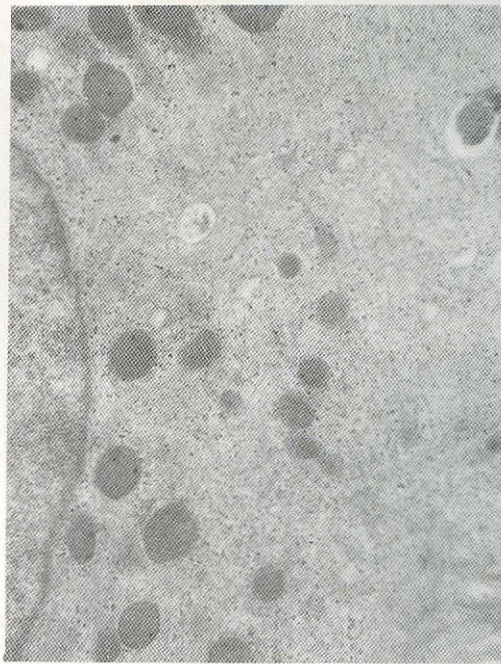


Fig 7.1.8



Figs.7.1.5-7.1.8. Ultrastructure of poll gland cells during non-breeding season.

Fig.7.1.5. The follicular epithelial cells showing vacuolization in the cytoplasm and in the nucleus x 3000.

Fig.7.1.6. The epithelial cells showing nuclear indentations and reduced number of mitochondria x 4500.

Fig.7.1.7. The nuclear zone showing sparse chromatin material in it x 20000.

Fig.7.1.8. The cytoplasmic zone showing sparse cellular organelles. The smooth endoplasmic reticulum is inconspicuous. Ribosomes and glycogen granules are scattered in the cytoplasm x 20000.

Abbreviations : As in previous legends.

## **7.2. Blood group and Bio-chemical polymorphism studies in Indian camel**

(Sponsored by ICAR AP cess fund)

Principal Investigator : N.D. Khanna  
Associates : S.N. Tandon  
: Raghvendra Singh  
: M. Kasturi  
: G. Raisinghani

To develop a battery of blood group reagents, isoimmunizations in 12 camel pairs of 2-3 years age group were carried out. Six immunizations at weekly interval were given. The recipient camels which were given immunizations earlier were also reimmunized with blood cells three times at weekly interval. The response in both cases was unsatisfactory.

Thirty seven blood samples belonging to N.R.C on Camel, Bikaner and 28 camel blood samples collected from Cattle Breeding Farm at Thara, Palanpur (Gujarat) were typed against 4 camel blood typing reagents produced through heteroimmunization of camel cells in sheep/ cattle/ goat. Nine horse typing reagents received from Sweden were also employed for typing of these blood samples.

Two camel blood antigenic factors were present in 64.9% samples collected from N.R.C. on Camel, Bikaner, while, other factors were not detectable on camel red cells. Inheritance studies on these blood antigenic factors was made in 16 sire-dam-offspring sets. The results revealed dominant inheritance pattern viz. it was present in the offspring only when it was present in either or both parents.

Studies on the haemolytic complement activity of camels through classical and alternate pathways were carried out. To study classical complement pathway, haemolysins were produced from different species (Table 7.2.1) The highest titre 1: 4096 was obtained with rabbit RBC sensitized with goat haemolysin. Haemolytic complement levels were determined in 120 camels of different age groups/physiological stages viz. upto 1 month, 1-3 months 1-2 years, 2-3 years, 3-4 years, and above 4 years. In pregnant and post partum females. The factors investigated were pH, ionic strength,  $Ca^{+2}$ ,  $Mg^{+2}$ , EDTA concentration, time of incubation and temperature. Seventy-five camels of different age groups were screened for the complement activity through alternate

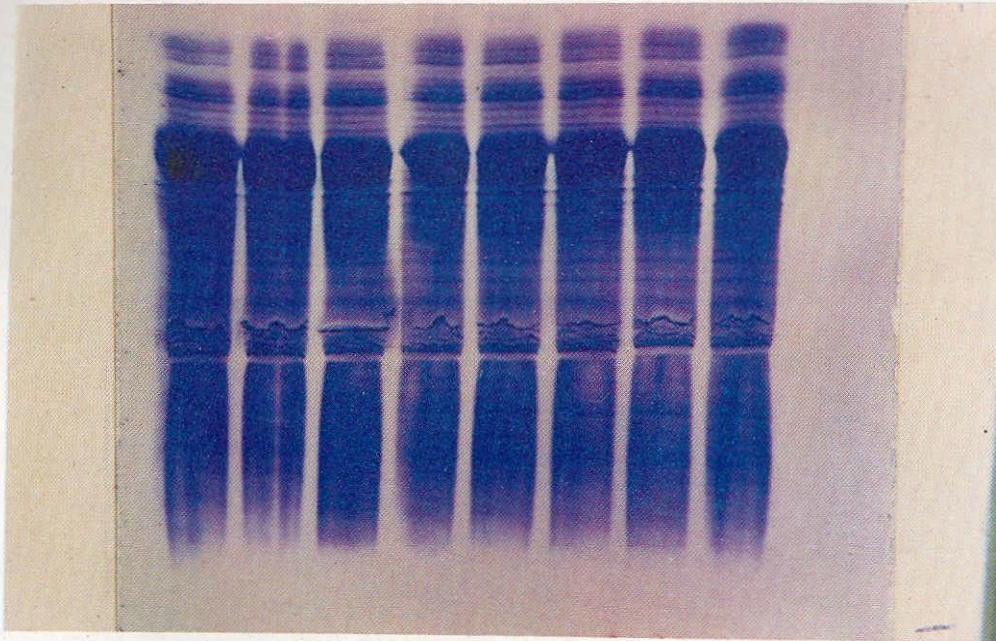


Fig. 7.2.1 IEF of serum protein on gradient gel (pH 3 to 10)

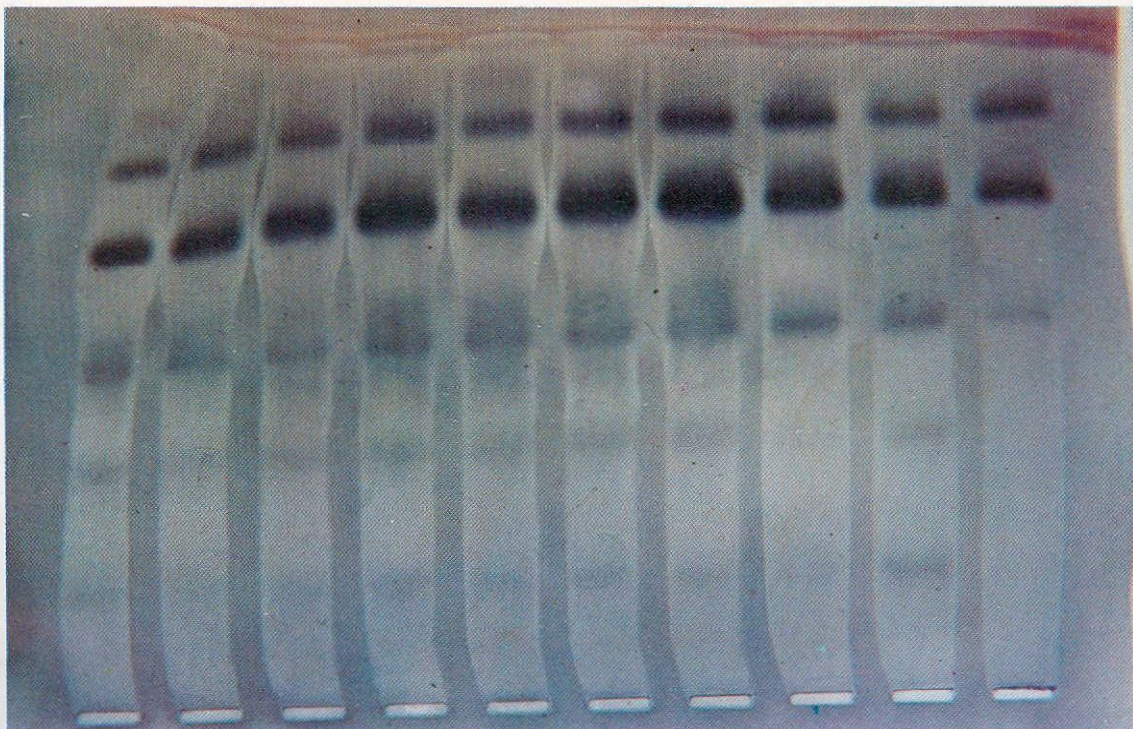


Fig. 7.2.2 Electrophoretogram of serum LDH

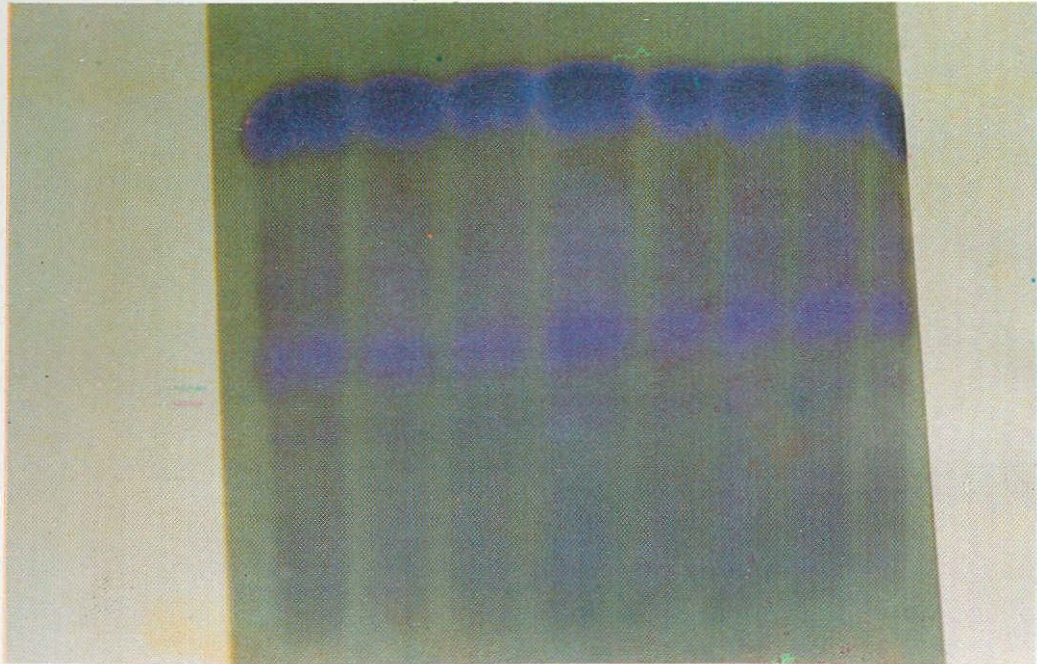


Fig . 7.2.3 Electrophoretogram of serum proteins on ACP (pH 8.6)

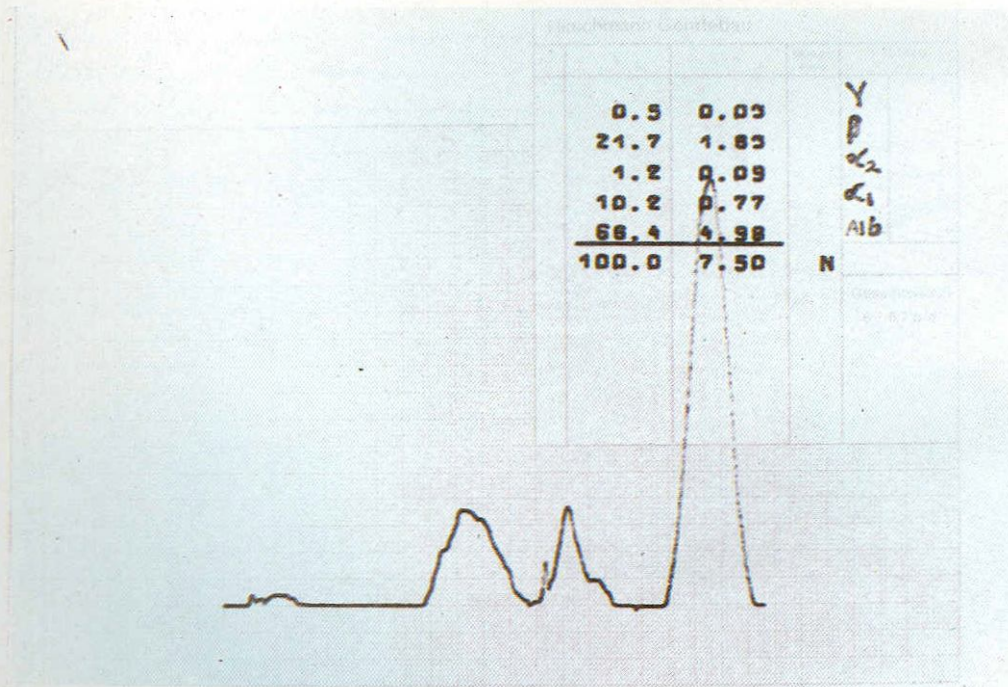


Fig. 7.2.4 Densitogram of serum proteins

pathway using cattle, buffalo, sheep, goat, rabbit and guinea pigs as source of RBC's and veronal buffer saline (VBS), veronal buffer saline - ethylene - glycol bis tetra acitic acid (VBS-EGTA) with and without  $Mg^{++}$  as diluents (Table 7.2.2). Cattle, buffalo, sheep and goat RBC's did not lyse with camel complement. The highest titre 1:64 was obtained with rabbit RBC's against unabsorbed camel serum. While, the  $CH_{50}$  titre was observed only in undiluted serum absorbed with rabbit RBC. Different concentration of  $Mg^{++}$  did not show any change (Table 7.2.3). Zymosan-A and heat treatment arrested the complement activity (Table 7.2.4 and 7.2.5). However, pH 7.4 was more affective in bringing titre  $CH_{50}$  in unabsorbed serum (Table 7.2.6).

Quantitative studies with respect to five biochemical factors, namely, acid phosphatase, alkaline phosphatase, lactate dehydrogenase, amylase and total protein were undertaken. Genetic variability between three camel breeds, namely, Bikaneri, Jaisalmeri, Kachchhi were carried out. Non significant results were obtained.

Biochemical polymorphism studies in respect of 11 systems in 118 blood samples were carried out. The systems were amylase, alkaline phosphatase, lactate dehydrogenase, melate dehydrogenase, esterases, albumin, haemoglobin, transferrin, acid phosphatase, phosphohexoisomerase and phosphoglucomutase. There was no genetic variability in all these systems. Breed variability was also not observed.

**Table 7.2.1.**  
**Haemolytic activity of dromedary complement with erythrocytes and haemolysins from different species**

Erythrocyte	Haemolysin	HA titre	$CH_{50}$ titre
Goat	Rabbit	1:64	4
Sheep	Rabbit	1:128	8
Guinea Pig	Rabbit	1:64	16
Chicken	Rabbit	1:32	32
Rabbit	Goat	1:4096	128
Camel	Cattle	1:64	4
Camel	Buffalo	1:32	2
Camel	Sheep	1:64	4
Camel	Goat	1:32	2
Camel	Camel	0	0
Camel	Rabbit	1:128	1

**Table 7.2.2.**  
**Alternate complement activity of camel serum in various age groups using different source of RBC.**

Age group	Source of RBC	CH <sub>50</sub> titre of serum			
		Unabsorbed serum		Absorbed serum	
		VBS	VBS-EGTA Mg+2	VBS	VBS-EGTA Mg+2
0-1 year	Rabbit	38.46±6.39	44.80±7.82	1	1
	Guinea pig	44.80±7.82	38.40±6.38	-	-
1-2 years	Rabbit	25.60±3.91	32.01±0.40	1	1
	Guinea pig	31.76±0.48	32.20±0.48	-	-
2-3 years	Rabbit	25.60±3.91	31.50±0.31	1	1
	Guinea pig	28.92±3.28	38.66±6.33	-	-
3-4 years	Rabbit	57.86±6.13	64.00±0.001	1	1
	Guinea pig	32.01±0.40	57.60±6.39	-	-
above 4 years	Rabbit	1.68±0.26	3.20±0.49	1	1
	Guinea pig	15.87±4.38	26.61±0.44	-	-

Cattle, buffalo, sheep and goat RBC's did not lyse with camel complement.  
 CH<sub>50</sub> titre : Reciprocal of highest serum dilution giving 50% haemolysis.

**Table 7.2.3.**  
**Effect of different concentrations of Mg<sup>+2</sup> on alternate complement activity in camel serum.**

Ionic strength of Mg <sup>+2</sup>	CH <sub>50</sub> titre
1 mM	0.000
4 mM	0.961
8 mM	1.041
12 mM	1.041
16 mM	1.041
20 mM	1.320

Source of RBC : Rabbit  
 Source of complement : Camel serum of 3-4 years age group after absorption (with Rabbit RBC).  
 Diluent : VBS - EGTA

**Table 7.2.4.**  
**Effect of Zymosan-A treatment on alternate complement activity of camel serum.**

Treatment	CH <sub>50</sub> titre
Absorbed serum treated with Zymosan-A	Nil
Unabsorbed serum treated with Zymosan-A	Nil
Control absorbed serum	1
Control unabsorbed serum	64

Source of RBC : Rabbit  
 Complement : Camel serum of 3-4 years age group  
 Diluent : VBS - EGTA Mg<sup>+2</sup>

**Table 7.2.5.**  
**Effect of heat treatment on alternate complement activity of camel serum.**

Treatment	CH <sub>50</sub> titre	
	absorbed serum	unabsorbed serum
50 <sup>0</sup> C for 20 minutes	0.961	1
50 <sup>0</sup> C for 60 minutes	Nil	Nil
56 <sup>0</sup> C for 60 minutes	Nil	Nil
4 <sup>0</sup> C for 60 minutes	1.000	64
37 <sup>0</sup> C for 60 minutes	1.000	64

Source of RBC : Rabbit  
 Complement : Camel serum of 3-4 years age group  
 Diluent : VBS - EGTA (Mg<sup>+2</sup>)

**Table 7.2.6.**  
**Effect of pH on alternate complement activity of camel serum**

pH	CH <sub>50</sub> titre	
	unabsorbed serum	absorbed serum
6.0	Nil	Nil
6.5	Nil	Nil
7.0	32	0.961
7.4	64	1.000
8.0	32	Nil
8.5	Nil	Nil

Source of RBC : Rabbit  
 Complement : Camel serum of 3-4 years of age group.  
 Diluent : VBS - EGTA.

### 7.3. Development of embryo transfer technology in camel

(Sponsored by Department of Biotechnology Govt. of India)

Principal investigator : A.K. Rai  
 Co-investigators : N.D. Khanna  
                               : S.P. Agarwal  
                               : Sumant Vyas

(a) Installation of equipments :

The following equipments procured during 94-95 were installed as follows :

- |   |          |
|---|----------|
| i) Stereozoom microscope with CCTV system and microphotographic attachment. | 26.04.95 |
| ii) Inverted microscope with micro manipulator                              | 25.04.95 |
| iii) Programmable freezer   | 14.07.95 |
| iv) CO <sub>2</sub> incubator   | 16.09.95 |

(b) Standardization of technique for collection of embryo :

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 trial was made on five adult she camels using locally available Foley's catheter (18 Fr 5 cc., 16" long). The modified Dulbecco's phosphate buffer saline was used as flushing medium. It was revealed that the Foley's catheter used was short in length in four out of five she camels. The process for procurement for long Foley's catheter (18 Fr 30 cc, 26" long) from USA, has been initiated and the trials with long catheter will be made in the ongoing breeding season.

(c) Incidence of anovulatory follicular cycles and failure of conception in camels :

It is well documented that the camels have relatively poor reproductive efficiency and the incidence of causes of failure of pregnancy is not known. Apparently there are three primary causes for failure of pregnancy namely failure of ovulation, failure of conception and early embryonic mortality. An effort was made to determine the incidence of these events in a breeding herd of camel through progesterone estimation. For this purpose the blood samples were collected from the female camels on day of mating followed by day 7, 14, 21, 30 and 45 post mating. The serum was separated and stored at  $-20^{\circ}\text{C}$ . Sera samples were analysed for progesterone concentration using RIA kits supplied by D.P.C., U.S.A. It was found that out of a total of 18 animals, 3 (16.6%) had an anovulatory cycle, of those which ovulated (15), 6 (40%) did not conceive either because of failure of fertilization/nidation. No case of early embryonic mortality between day 30 and 45 was detected in these animals. More data is being collected on these aspects.

(d) Superovulation and collection of embryo :

Superovulation and non-surgical embryo recovery was attempted on two she camels.

Pluriparous, healthy adult she camels were taken as donors. They were treated with progesterone in oil (Duraprogen - Unichem) 100 mg I/M daily for 7 days. On the last day of progesterone therapy, camels were given Inj 3000 IU eCG I/M (Trophovet, Indian Immunologicals). The ovarian response was assessed by ultrasound scanner on 5th and 6th day of eCG treatment to assess the optimum time for breeding.

As per the ovarian status, the donors were mated on 6th day and injection of 3000 I.U., I/M hCG (Chorulon, Intervet) was given to facilitate ovulation.

The camels were again mated after 12 hr.

A recipient was also similarly treated with 100mg of progesterone in oil for 7 days and ovulation was induced with 3000 IU hCG I/M (Chorulon, Intervet), on the day when donors were mated.

The day of mating was termed day 0. The embryo recovery was attempted on day 6th in one, day 7th in the other donor. The donors were restrained in sitting posture on an inclined plane so that hind quarters were on lower side. The animals were tranquilized with 6 ml of xylazine, I/V (Xylazine, Indian Immunologicals). After evacuation of rectum, 6 ml of 2% Xylocaine was administered in sacrococcygeal joint for epidural anaesthesia. For embryo flushing, Foley's catheter (26", 18 gauge, 30 c.c.) was used. The catheter was advanced through the vagina and guided to the middle of annular cervical ring with the help of index finger. The operator's hand was then placed in the rectum to direct the catheter into uterine body, and the bulb was inflated with about 25cc air to the tip of catheter just inside the uterine body. Both horns were flushed simultaneously with Dulbecco's phosphate buffer saline (GIBCO BRL, USA). One litre of DPBS was used for flushing in about 12-14 releases. Approximately 90% of the media was recovered and filtered through Emcon filter (75 u diameter). The filtrate was scanned under stereozoom microscope for the embryos. Lutalyse (Dinoprost Tromethamine, Up John), 10ml was injected I/M and Betadine 30 ml was infused intra-uterine after flushing.

The superovulatory treatment resulted in multiple ovulations as under:

Animal	CL ON OVARY		FOLLICLES > 4.0 cm		EMBRYO RECOVERY
	Right	Left	Right	Left	
06	1	4	1*	-	NIL
03	2	4	1	1	NIL

\* Did not ovulate

The first 200 ml media recovered was highly turbid rendering it difficult to scan. Subsequent recovery of media was clear. No embryo could be detected from two donors.

General observations :

- (1) The follicles above 4.0 cm did not always ovulate on administering eCG 3000 IU.
- (2) The turbidity in first 200 ml of the recovered media poses serious

problem for scanning. The she camels used were healthy and apparently free from uterine discharge/metritis.

(e) Investigations on ovulation in camels

Eleven she camels mated during second half of December 95 were used in the study of ovulation. The she camels were mated only once in 24 h and examined for the ovarian status using ultrasound scanner on the day before mating and were re-examined on 3rd/4th day and 6th day after mating. The observations were recorded on video cassette.

The blood samples were collected on day before mating (day -1), day of mating (day 0), 24 h (day  $\pm 1$ ), 32 h, 40 h, 48 h (day  $\pm 2$ ), 56 h, 64 h, 72 h (day  $\pm 3$ ), 96 h (day  $\pm 4$ ), 120 h (day  $\pm 5$ ), 144 h (day  $\pm 6$ ), 168 h (day  $\pm 7$ ), 192 h (day  $\pm 8$ ). The sera was separated in refrigerated centrifuge and preserved in deep fridge for estradiol and progesterone assay. The study is in progress.

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

(Sponsored by ICAR and Min. of Agril.)

Principal Investigator	: R.C. Jakhmola
Associates	: Ram Kumar, T-7
	: Raja Purohit, SRF
	: Renu Sharma, SRF

During the year under report, area was fenced. The pasture grasses like Sewan and Dhaman were sown and trees/bushes were planted/maintained. The green forage yield from Sewan pasture was  $169 \pm 13.3$  q/ha with a DM content of  $39.4 \pm 2.07\%$ . Newly established pasture of Dhaman yielded  $53.0 \pm 7.85$  q/ha fodder with  $30.3 \pm 1.07$  percent DM content. Average plant height was  $44.5 \pm 3.211$  cum during September '95. The bushes of *Zizyphus nummularia* (Pala) in pasture were ranging between 145-275 cm in height. Mean height and canopy diameter was  $195.3 \pm 8.87$  cm and  $207.7 \pm 9.22$  cm respectively. On lopping, yield of fodder including twigs and small branches was  $5.8 \pm 0.73$  kg/bush, with an average DM content of  $68.2 \pm 0.41\%$ . The yield of Pala (dry leaves of beri) was  $0.76 \pm 0.082$  kg/bush. Also from each bush on an average 3.2 kg dried twigs/small branches were also obtained. The trees of *Acacia tortilis*, had an average height of  $230.14 \pm 7.055$  cms with average canopy diameter of  $203.4 \pm 7.26$  cms. On lopping fresh yield including leaves, twigs/small branches

was  $6.7 \pm 0.811$  kg/tree with average 49.4% DM. On a DM basis each tree yielded  $0.57 \pm 0.038$  kg leaves and 2.74 kg dried twigs/small branches. The wood to leaf ratio in the harvest was 4.81:1.

The grazing behaviour of camels in pasture was also studied. The work is in progress.

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

(Scientist Emeritus, ICAR funded scheme)

Scientist Emeritus

Prof. S.P. Agarwal

#### **Augmentation of reproductive activity in prepubertal female camels :**

Twelve prepubertal female camels of two to two and a half years of age were divided into three groups. Group I and II (Treatment groups) were administered 250 mg Duraprogen (a progesterone derivative) intramuscularly for two consecutive days followed by 2000 IU Trophovet (a FSH predominant preparation) on the third day. The animals were periodically examined per rectum and those having mature follicles on their ovaries and expressing sexual interest were mated with a virile stud on two successive days. Following first mating, Group I and II were injected i.v. 3000 IU Chorulon (a hCG preparation) and 40 mcg Receptal (a GnRH analogue), respectively to ensure ovulation. Animals which failed to conceive were again mated and pursued for pregnancy. Periodical blood samples were collected and analysed for progesterone concentration by RIA. Animals in Group III were injected with sterile saline solution and served as control. All the animals in treated groups responded to treatment. A total of 10 follicles in Group I and 9 in Group II and 8 corpora lutea in each of these groups were detected indicating multiple ovulations but none of the animals conceived in the first service. In the subsequent service, one animal in each of these groups became pregnant. None of the animals in control group expressed any sexual activity. The results suggest that the reproductive activity in camel heifers can be augmented by hormonal treatment.

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

Five adult female camels expressing sexual interest were taken for this study during the month of December (Breeding season). The females were mated by a virile stud and blood samples were collected immediately after mating and then at two hourly interval for a total period of 10 hours. In all, six samples were collected from each animal. Sera were separated and analysed for

LH using double antibody RIA kits for human LH supplied by Diagnostic Products Corporation, U.S.A.

An LH peak was detected in four of the five animals with values ranging from 3.0 to 7.5 WHO 2nd IRP-HMG mIU/ml. The peak appeared earliest at two hours and latest by 8 hours after mating. Ovulation occurred in all those animals which exhibited a surge for LH and a well developed CL was also detected on day seven post-mating. In all these four animals, the blood progesterone level on day 7 post-mating was found to be more than 1.0 ng/ml. The animal missing LH peak did not ovulate. The results suggest that an LH surge following mating is essential for ovulation and formation of active corpus luteum.

### **Seasonal variations in the concentration of steroid hormones in seminal plasma of camel :**

Semen from seven camel studs was collected using artificial vagina in the early morning hours during breeding and non-breeding season. The number of semen samples collected from each bull varied from 2 to 7. After liquification of the gel, the seminal plasma was separated by centrifugation and analysed for testosterone and progesterone concentration using specific RIA kits for each hormone. The mean testosterone and progesterone concentration in the seminal plasma was found to be  $4.98 \pm 0.99$  and  $0.53 \pm 0.018$  ng/ml, respectively with significant variation between studs. The season had a significant effect on hormone concentration. The testosterone concentration during breeding and non-breeding season was  $7.78 \pm 1.40$  and  $1.66 \pm 0.37$  ng/ml, respectively. The corresponding values for progesterone during the two seasons were  $1.34 \pm 0.42$  and  $0.20 \pm 0.03$  ng/ml. The physiological significance of these hormones in semen warranted further investigations.

## 8. PUBLICATIONS

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

1. Agrawal, S.P. and Rai, A.K. 1995. Recent revelations about ovulation in camel : An updated review, Indian Vet. Med. J. 19:251-254.
2. Agarwal, S.P., Rai, A.K. and Khanna, N.D. 1995. Thyroid status of female camels following mating. Indian Vet. Journal, 72:591- 594.
3. Khanna, Deepti, Agarwal, S.P., Gupta, M.L., Rai, A.K., and Khanna, N.D. 1996. Effect of dehydration and rehydration on thyroid hormones in Indian camels. Indian Journal of Animal Sciences, 66 (3) 253-255
4. 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 Vet. Journal, 73:28-30.
5. Manivannan, B., Rai, A.K. and Khanna, N.D. 1996. A note on the structure of the skin of poll glands in the Indian camels (*Camelus dromedarius*). Indian Vet. Journal, 73, 365-367.
6. Rai, A.K., Nagpal, A.K. and Khanna, N.D. 1995. Effect of water restriction on nutrient utilization in pack camels under hot humid conditions. Indian J. Anim. Sciences, 65: 1256-1262.
7. Rai, A.K., Nagpal, A.K. and Khanna, N.D. 1995. Effect of water deprivation on nutrient utilization in Indian camels (*Camelus dromedarius*) during winter. Indian Journal of Animal Science, 65:565-570.
8. Rai, A.K., Sharma, N. and Khanna, N.D. 1995. Ovarian activity during breeding and non-breeding seasons in Indian camel (*Camelus dromedarius*). Indian J. Anim. Sci., 65 : 889-890.

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

1. Agarwal, S.P. and Khanna, N.D. 1995. Current status of camel hormones during reproductive cycle. International Journal of Animal Sciene (In press).
2. Agarwal, S.P., Rai, A.K. and Khanna, N.D. 1995. Seasonal variation in in the concentration of steroid hormones in seminal plasma of camel. Indian Vety. Journal (In press).
3. Agarwal, S.P., Rai, A.K. and Khanna, N.D. 1995. Induction of sexual activity in female camels during non-breeding season. Theriogenology (In press).
4. Agarwal, S.P., Rai, A.K., Vyas, Sumant and Khanna, N.D. 1996. Augumentation of early reproduction through hormonal therapy in camel heifers. International Journal of Animal Sciences (In press).
5. Khanna, N.D. 1995. Camel production in India, Prespective by 2001 AD. Indian Agriculture 2001 (In press).
6. खन्ना, न. द. एवं राय, अ. क. 1995. भारतीय शुष्क क्षेत्र में उष्ट्र पालन एवं उत्पादन कार्यक्रम की जीवीकोपार्जन के लिए सार्थकता, खेती (In press)
7. Khanna, N.D. and Rai, A.K. 1996. Economic analysis of draught as a source of livelihood at Bikaner. Draft Animal News (In press).
8. Khanna, N.D., Rai, A.K. and Sharma, N. 1996. Camel Safari. Draft Animal News (In press).
9. Manivannan, B., Rai, A.K. and Khanna, N.D. 1995. Histological and functional changes in the camel poll glands during breeding and non-breeding season. Indian Journal of Animal Sciences (In press).
10. Rai, A.K., Manivannan, B. and Khanna, N.D. 1995. Steroidogenesis in the poll glands of camel during rutting season. Indian Journal of Animal Science (In press).
11. Rai, A.K., Manivannan, B. and Khanna, N.D. 1996. Regional differences in the structure of camel skin (*Camelus dromedarius*) at differnt ages. Indian Journal of Animal Sciences (In press).
12. Rai, A.K., Sharma, N., Manivannan, B. and Khanna, N.D. 1995. Studies on camel semen during breeding and non-breeding season. Indian Journal of Animal Sciences (In press).
13. Rai, A.K., Singh, R. and Khanna, N.D. 1996. Investigations on fatigue index in Indian camels. Draft Animal News (In press).
14. Sahani, M.S., Nagpal, A.K., Rai, A.K. and Khanna, N.D. 1995. Milk production in Bikaneri camels managed under farm conditions. Indian Journal of Animal Sciences. Vol. No. 66 April, 1996 (In press).
15. Vyas, Sumant, Rai, A.K. and Khanna, N.,D. 1995. Case report of bilateral cryptorchidism in Bikaneri camel. Indian Veterinary Journal (In press).

## 9. OTHER ACTIVITIES

Dr. Raghvendra Singh, Scientist (Biochemistry) visited Department of Bio-Physics, All India Institute of Medical Sciences, New Delhi, from, 22nd to 27th April, 1995 to work on purification and separation of serum IgG and Hb.

Dr. U.K. Bissa, Sr. Veterinary Officer (T-8) attended a training in ELISA and serum monitoring work at AICRP on animal disease monitoring and surveillance, Institute of Animal Health and Veterinary Biologicals Campus, Hebbal, Bangalore from 25th to 30th September, 1995.

Sh. Ram Kumar, Farm Manager (T-7) attended UNESCO sponsored Regional Training cum Work Shop on Silvopastoral System in Arid and Semi Arid Ecosystem at Jodhpur from 15th November to 5th December, 1995.

Dr. Raghvendra Singh, Scientist (Biochemistry) visited Department of Microbiology, College of Veterinary Science, CCS, HAU, Hisar (Haryana) from 2nd to 8th Jan. 1996 to work on camel complement systems.

Dr. S.N. Tandon (Senior Scientist) attended a training course on Application of PCR and Nucleic Acid Hybridization for Detection of Animal Viruses at Indian Veterinary Research Institute, Bangalore Campus from February 5-23, 1996.

Sh. Dinesh Munjal, Computer Operator (T-II-3) attended a training on Computer Networking, E Mail and Microsoft Windows at National Informatics Centre, New Delhi, organised by ICAR from 8th to 12th Jan., 22nd to 26th Jan. and 12 to 16th Feb., 1996 respectively.



The Centre conducted a short course on Camel Management and Health from 15th to 20th January, 1996. Veterinarians from various Agriculture Universities, Animal Husbandry Department, SSB, BSF and Army participated in the course.

## 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. Islamuddin Gauri, S/o Late Sh. Naseeruddin<br>Sikar (Raj.)                          | Member   |
| ii) Sh. Jagdish Chaudhary, D-1, U.I.T. Colony, Bikaner  | Member   |
| 7. Finance & Accounts Officer, Central Sheep and Wool<br>Research Institute, Avikanagar (Raj) | 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. A.K. Nagpal, Scientist (Selection grade) N.R.C<br>on Camel Bikaner (Raj.)              | Member   |
| 9. Administrative Officer, N R C on Camel, Bikaner (Raj)<br>Secretary                         | Member   |

## 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.

### PEN SKETCH OF NEW ENTRANTS

Sh. Gorakhmal, Scientist

Born on 14th March, 1968 and completed his M.Sc. in Bio-chemistry from HPKV, Palampur (HP). He has joined N.R.C. on Camel, Bikaner as scientist (Bio-chemistry) on 24th August, 1995.

### **13. VISITORS**

The National Research Centre on Camel, Bikaner, received 7820 visitors. The visitors included Scientist, Educationists, Judges, Administrators, Defence Officers, Indian and Foreign tourists.

### **14. 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 and Dr. M.L. Madan, Deputy Director General, Animal Sciences, ICAR, New Delhi. The advise and valuable suggestions given by the Management Committee were of immense value in management of the centre. The centre also places on records sincere thanks to 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 1995-96 में केन्द्र में स्वीकृत पदों की संख्या 60 थी। जिसमें निदेशक, वैज्ञानिक (9), तकनीकी (10), प्रशासकीय (11), सहायक कर्मचारी-वाहन (5) व आधारी कर्मचारी-फार्म (24) कार्यरत रहे।

### आय-व्ययक

वित्तीय वर्ष 1995-96 में योजनामद में 70.00 लाख तथा गैर योजना मद में 38.00 लाख रुपये की धनराशि स्वीकृत की गई। सम्पूर्ण निर्धारित धनराशि उपयोग में लायी गई।

### उष्ट्र प्रक्षेत्र

वर्ष के प्रारम्भ में कुल 240, और अन्त में 225 बीकानेरी, जैसलमेरी, कच्छी, अरब X बीकानेरी, सांचोरी व मारवाड़ी नस्ल के ऊँट थे। समीपस्थ ग्रामीण क्षेत्रों से प्रजनन हेतु लायी गई ऊँटनियों को केन्द्र से उत्तम नस्ल के नर ऊँट उपलब्ध कराये गए। नस्ल सुधार हेतु 6 नर ऊँटों को राज्य सरकार के माध्यम से विभिन्न ग्राम पंचायतों को निःशुल्क वितरित किया गया। पशुपालन विभाग, गुजरात सरकार अहमदाबाद को केन्द्र द्वारा कच्छी नस्ल के 26 ऊँट भेजे गए। केन्द्र की 40 हेक्टेयर भूमि पर वर्षा आधारित ग्यार की खेती की गई। लगभग 3 हेक्टेयर भूमि में पास का प्रत्यारोपण कर चारागाह विकसित किया गया। वृक्षारोपण कार्यक्रम के अन्तर्गत 3 हजार नये पौधे लगाये गये तथा लगभग 20 हजार पौधों का रखरखाव किया गया।

## शोध कार्य

### परियोजनाएँ

#### परियोजना क्रमांक -1

ऊँट के कार्य प्रमाप तथा इन प्रमापों का भौतिक शारीरिक क्रियाओं तथा जैव रासायनिक सम्बन्धों पर अध्ययन

##### 1. बोझा ढोने वाले ऊँटों पर पोषण सम्बन्धित अध्ययन

दो पहिये एवं चार पहिये वाले गाड़ों पर 2.5 किग्रा./किग्रा शारीरिक भार के अनुरूप बोझ डालकर प्रतिदिन 6 घन्टे कार्य करने पर ऊँट की चारा खाने की क्षमता एवं पोषण तत्वों के चयापचय पर अध्ययन किया गया। रक्त जैव रसायनों के विशलेषण पर बोझा ढोने के उपरान्त ट्राईग्लिसराइड, लैक्टेट, लैक्टेट डिहाइड्रोजिनेस और क्रिएटिन काइनेज में वृद्धि पाई गई। विश्राम के उपरान्त ट्राईग्लिसराइड के अतिरिक्त अन्य सभी सामान्य स्तर पर पहुँच गये।

##### 2. ऊँट की शिरा में ग्लूकोज चढ़ाने पर इन्सुलिन प्रतिचार

400 मिली ग्राम/किग्रा की दर से 25 प्रतिशत ग्लूकोज चढ़ाने पर रक्त में इन्सुलिन की मात्रा 6-8 माइक्रो आई. यू./मिली लीटर से बढ़कर 2 घन्टे के पश्चात 18-23.5मममाइक्रो आई. यू./ मिली लीटर हो गई और 24 घन्टों में इसकी मात्रा सामान्य स्तर पर पहुँच गई।

मनुष्यों में इन्सुलिन के अध्ययन में प्रयुक्त होने वाली किट का उपयोग ऊँटों के लिए भी सम्भव प्रतीत होता है।

#### परियोजना क्रमांक -2

ऊँट की आनुवांशिकी विषयों का गुणात्मक एवं मात्रात्मक अध्ययन

1. वर्ष के अन्त में केन्द्र में ऊँटों की संख्या 225 थी, जिनमें बीकानेरी (103), जैसलमेरी (79), कच्छी (29), अरब X बीकानेरी (12), सांचोरी (1) और मारवाड़ी (1), नस्ल के ऊँट थे। ऊँटों के नवजात बच्चों का शारीरिक भार नस्ल वर्ष, ब्यांत और लिंग द्वारा प्रभावित पाया गया। बीकानेरी ऊँटों के बच्चों का जन्म भार जैसलमेरी और कच्छी की तुलना में अधिक पाया गया। ऊँटों की शारीरिक लम्बाई, सीने का घेरा और ऊँचाई पर किये गए शोध में उम्र व लिंग का प्रभाव देखा गया।

##### 2. प्रजनन सम्बंधी अध्ययन

ऊँटनियों में ग्याभिन दर 70.20 प्रतिशत तथा बच्चों के जन्म में 709.00 से 731.10 दिन का अन्तराल पाया गया। गर्भकाल नस्ल और ब्यांत से प्रभावित था।

##### 3. दुग्ध उत्पादन संबंधी अध्ययन

बीकानेरी एवं कच्छी नस्ल की ऊँटनियों को मोठ चारा खिलाकर मशीन द्वारा दुग्ध उत्पादन क्षमता पर अध्ययन किया गया। दोनों में प्रथम 5 से 6 माह तक दुग्ध उत्पादन बढ़ने के पश्चात घटने लगता है। दुग्ध उत्पादन पर नस्ल, ब्यांत और दूध निकालने के समय का प्रभाव पाया गया। बीकानेरी नस्ल में औसत दुग्ध उत्पादन कच्छी की अपेक्षा अधिक रहा।

#### 4. बाल उत्पादन संबंधी अध्ययन

नस्ल के आधार पर वार्षिक बाल उत्पादन क्षमता बीकानेरी ऊँटों में जैसलमेरी व कच्छी की तुलना में अधिक रहा। बाल का उत्पादन 2-3 वर्ष की आयु के ऊँटों में सर्वाधिक रहा।

#### 5. जैव रासायनिक अनुवांशिकी पर अध्ययन

ऊँटों के रक्त में लेक्टेट डिहाइड्रोजिनेज, एमाइलेज, एलकलीनफास्फेटेज, प्रोटीन एवं एल्ब्यूमिन का मात्रात्मक अध्ययन किया गया।

### परियोजना क्रमांक -3

ऊँटों में उचित रखरखाव एवं विकास कार्यों पर अध्ययन :

इस परियोजना के अन्तर्गत बीकानेर तहसील के चार गाँवों-किल्चू, कल्याणसर, सुरधना तथा शेरेरा में ऊँट पालकों से विचार विमर्श किया गया। इन गाँवों में सर्वेक्षण से पता चला कि स्थानीय गांव शेरेरा में ऊँटों की संख्या सर्वाधिक है, परन्तु यह संख्या गांव के अन्य चारा पोषित पशुओं से बहुत कम है। गांव गाढ़वाला में किए गए एक सर्वेक्षण से यह पता चला कि नर ऊँट औसतन 12.8 घन्टे प्रतिदिन और मादा ऊँट 10.8 घन्टे प्रतिदिन गाड़ा चलाने के लिए काम में लिए जाते हैं। उपलब्ध जानकारी द्वारा यह भी पता चला कि काम करने वाले नर ऊँट औसतन 22.00 किलो प्रतिदिन तथा मादा ऊँट 20.7 किलो प्रतिदिन चारे का उपभोग करते हैं।

पुष्कर पशु मेले, अजमेर में ऊँटों के क्रय-विक्रय सम्बन्धित आकड़े संकलित किये गए। मेले में कुल 30,093 पशुओं में से 20,858 ऊँट थे जिसमें से 15,205 नर तथा 5,653 मादा ऊँट थे। मेले में ऊँटों का औसत मूल्य 5,126 रुपये रहा तथा ऊँट का सर्वाधिक मूल्य 20,000 प्राप्त हुआ। सबसे कम मूल्य रुपये 200.00 में ऊँट का बच्चा बिका। मेले में ऊँटों का व्यापार करीब 2,96,839 रुपये का रहा।

ऊँट के दाँतों के निकलने, बढ़ने एवं गिरने से अनुमानित आयु पर अध्ययन किया गया तथा प्रसव पूर्व प्रदर्शित होने वाले लक्षणों पर भी अध्ययन किया गया।

### परियोजना क्रमांक - 4

#### ऊँट के पोषण पर अध्ययन

ऊँटनियों के दूध में ऐस्कॉरबिक अम्ल की मात्रा का परीक्षण किया गया। अध्ययन द्वारा पता चला कि ऐस्कॉरबिक अम्ल की मात्रा दूसरे दिन 3.5 मिली ग्राम प्रतिशत से घट कर तीसरे सप्ताह में 2.0 मिली ग्राम प्रतिशत हो गई। 3 वयस्क ऊँट के बच्चों में आहार नाल द्वारा सोडियम, पोटैसियम, कैल्सियम, फासफोरस एवं मैग्नीसियम धातुओं के शोषण पर भी अध्ययन किया गया। सूखे पाले की पोषण सम्बंधी उपयोगिता पर भी अध्ययन किया गया।

## परियोजना क्रमांक - 5

### जनन सम्बन्धी विषयों पर अध्ययन

#### 1. वीर्य का मूल्यांकन एवं परिरक्षण

ऊँटों के वीर्य को ट्रेस एग योक और लेक्टोस बफर माध्यमों में 1:3 के अनुपात में मिश्रित कर वीर्य परिरक्षण पर तुलनात्मक अध्ययन किया गया। वीर्य संग्रहण के विभिन्न समयों के आधार पर 5-8 °C पर मूल्यांकन द्वारा ट्रेस एग योक बफर माध्यम को लेक्टोस माध्यम से अधिक उपयुक्त पाया गया। अप्रजनन काल में ऊँटों ने यौन-व्यवहार नहीं दर्शाया तथा वीर्य की मात्रा भी कम रही।

#### 2. ऊँट के वीर्य में जैव रासायनिक अध्ययन :

ऊँट के वीर्य में एसपारटेट ट्रांसएमिनेज, ऐलेनीन ट्रांसएमिनेज, एसिड फॉस्फेटेज, ऐल्कलीन फास्फेटेज, लेकटेट डीहाइड्रोजिनेज, प्रोटीन कैल्शियम और एसकोरबिक अम्ल की मात्रा में अत्यधिक असमानता पाई गई।

#### 3. ऊँटों में क्रिप्टोओरकिडिस्म सम्बन्धी अध्ययन

एक द्विपार्श्व क्रिप्टोओरकिट ऊँट में सामान्य यौन-व्यवहार पाया गया। ऊँट प्रजनन हेतु मैथुन में भी सामान्य था, किन्तु कृत्रिम योनि में प्राप्त वीर्य शुक्राणु रहित था।

#### 4. मादा डिम्ब जनन सम्बन्धी अध्ययन

वयस्क मादा ऊँटों में अल्ट्रासाउंड-200 (पाई मेडिकल्स) के अन्तः योनि संवेदकों द्वारा प्रजनन काल व अप्रजनन काल में डिम्ब जनन पर अध्ययन किया गया। अप्रजनन काल में प्रजनन काल की तुलना में डिम्बकोषों की संख्या कम पाई गई। अध्ययन में पाया गया कि एक समय में केवल एक ही डिम्बकोष परिपक्व हो पाता है। अन्य डिम्बकोष तभी परिपक्व होना आरम्भ करते हैं, जब परिपक्व डिम्ब कोष के क्षय होने की प्रक्रिया प्रारम्भ हो जाती है।

#### 5. ऊँट में बाँझपन की समस्याओं पर अन्वेषण

अध्ययन के अन्तर्गत दो मादा ऊँटों में लगभग 6 से.मी. की डिम्ब कोष्ठिकाएं पाई गईं, जिनका रिसेप्टल की 5 मिली लीटर मांसपेसियों में सुई द्वारा देकर सफलता पूर्वक निदान किया गया।

### अनुसंधान योजनाएँ

#### 1. ऊँट की पोल ग्रंथियों पर अध्ययन

चार नर ऊँटों के पोल ग्रंथियों के जीविका प्रादर्श के आधार पर ऊतक विज्ञान, ऊतक रासायनिक एवं परासंरचना से सम्बन्धित बिन्दुओं पर शोध किया गया। ऊतकीय अध्ययन से यह ज्ञात होता है, कि अप्रजनन काल में ग्रंथि की क्रियाशीलता अत्यधिक कम हो जाती है। अप्रजनन काल में पोल ग्रंथि की स्टीरॉयड हॉर्मोन के संश्लेषण की क्षमता लगभग समाप्त हो जाती है। प्रजनन काल में परासंरचना सक्रिय स्त्रोवित दौर के स्पष्ट कोशीकीय अंगको को दर्शाता है प्रति कोशिका में माइटोकॉन्ड्रिया की संख्या  $66.4 \pm 1.39$  पाई गई। अप्रजनन काल में माइटोकॉन्ड्रिया की कुल संख्या  $35.55 \pm 1.53$  प्रति कोशिका रह गई।

## 2. ऊँटों के रक्त समूह व जैव-रासायनिक पररूपता पर अध्ययन

हाइपरइम्यून सीरा विकसित करने के लिए 12 जोड़ी ऊँटों का समजातीय टीकाकरण किया गया। ऊँटों में गाध, भैस व भेड़ की लाल रूधिर कणिकाओं के द्वारा विषमजातीय टीकाकरण किया गया।

अनुमापक परीक्षणों के द्वारा जॉचने पर कोई प्रक्रिया नहीं पाई गई। खरगोशों में एंटी उष्ट ग्लोब्यूलिन विकसित करने के प्रयास किये गए। 65 ऊँटों को चार ऊँट अभिकर्मक/कारक और अश्व समूह के कारकों द्वारा परीक्षित किया गया। 13 प्रोटीन/एन्जाइम तंत्र के आधार पर जैव रासायनिक पररूपता स्थापित करने के प्रयास किये गए। किसी भी तंत्र में कोई असमानता नहीं देखी गई। प्रतिष्ठित एवं वैकल्पिक पथमार्ग समपूरक, क्रियाओं पर अनुसंधान कार्य किया गया। लाल रूधिर कणिकाओं एवं हीमोलाइसिस जो कि विभिन्न जातियों के पशुओं से प्राप्त की गई थी। भैस, भेड़, बकरी, खरगोश एवं सारंग को स्रोत मानकर वैकल्पिक पथमार्ग द्वारा 65 ऊँटों के नमूनों को जाँचा गया।

## 3. ऊँटों में भ्रूण प्रत्यारोपण तकनीक का विकास

डिम्बविसर्जन रहित चक्र का घटनाक्रम एवं ऊँटनी द्वारा गर्भ धारण में विफलता प्रोजेस्ट्रोन के मात्रात्मक अध्ययन में पाया गया कि 16.60 प्रतिशत ऊँटनियों में ओव्यूलेशन नहीं हुआ और 33.30 प्रतिशत में गर्भाधान नहीं हुआ। प्रजनन के उपरान्त 30 से 45 दिनों में कोई भ्रूण क्षति नहीं हुई।

### बहुडिम्ब जनन एवं भ्रूण संग्रहण

एक या एक से अधिक बार गर्भ धारण करने वाली स्वस्थ व्यस्क मादा ऊँटों को भ्रूण दाता के रूप में चुना गया। प्रोजेस्ट्रोन (डयूराप्रोजेन युनीकेम) 100 मिग्रा सुई द्वारा मांस पेशियों में 7 दिनों तक तदुपरान्त 3000 आई.यू.इ.सी.जी. की खुराक दी गई। इस विधि द्वारा बहुस्त्री बीज जनन की क्रिया छठे दिन सफल पाई गई।

## 4. ऊँट में प्रजनन सुधार के लिए हॉर्मोन प्रस्तन

अध्ययन द्वारा यह पता चला कि में डिम्ब जनन तथा कारपस ल्युटियम बनने के लिए ऊँट के रक्त में एल.एच. जरूरी है। ऊँट के वीर्य में टेस्टोस्टीरोन की औसत मात्रा  $4.98 \pm 0.99$  एन. जी/मिली. तथा प्रोजेस्ट्रोन की मात्रा  $0.53 \pm 0.08$  एन.जी/मिली. पाई गई। प्रजनन काल में इन हॉर्मोनों की मात्रा अप्रजनन काल की तुलना में अधिक थी।

## 5. फसल सम्बन्धित पशु उत्पादन नेटवर्क कार्यक्रम

सेवन और धामन घास की उत्पन्नता करीब 169.0 और 53.0 ग्राम/एन.ए. रही। प्रति झाड़ी पाले की सूखी पत्तियाँ 0.76 किग्रा और प्रति वृक्ष बबूल की सूखी पत्तियाँ 0.57 किग्रा प्राप्त हुई। पशुओं के चरनें, बढ़ाव, स्वास्थ्य, प्रजनन आदि पर अध्ययन प्रगति पर है जो पूर्णतया घास पर निर्भर है।



### **उष्ट्र प्रबन्धन एवं स्वास्थ्य**

केन्द्र ने उष्ट्र प्रबन्धन एवं स्वास्थ्य पर संक्षिप्त अध्ययन क्रम (15 से 20 जनवरी 96) का आयोजन किया जिसमें विभिन्न कृषि विश्वविद्यालयों, राज्य पशु धन विभाग, एस.एस.बी., सीमा सुरक्षा बल एवं सेना के 10 अधिकारियों भाग लिया।

### **प्रकाशन**

वर्ष 1995-96 में 8 शोध पत्र प्रकाशित हुए तथा 15 शोध पत्र प्रकाशन हेतु विभिन्न शोध पत्रिकाओं को भेजे गये।

### **आगंतुक**

फार्म में कुल 7,820 आगन्तुक आए जिनमें वैज्ञानिक, शिक्षाविद्, प्रशासक, रक्षा अधिकारी तथा भारतीय एवं विदेशी सैलानी प्रमुख थे।

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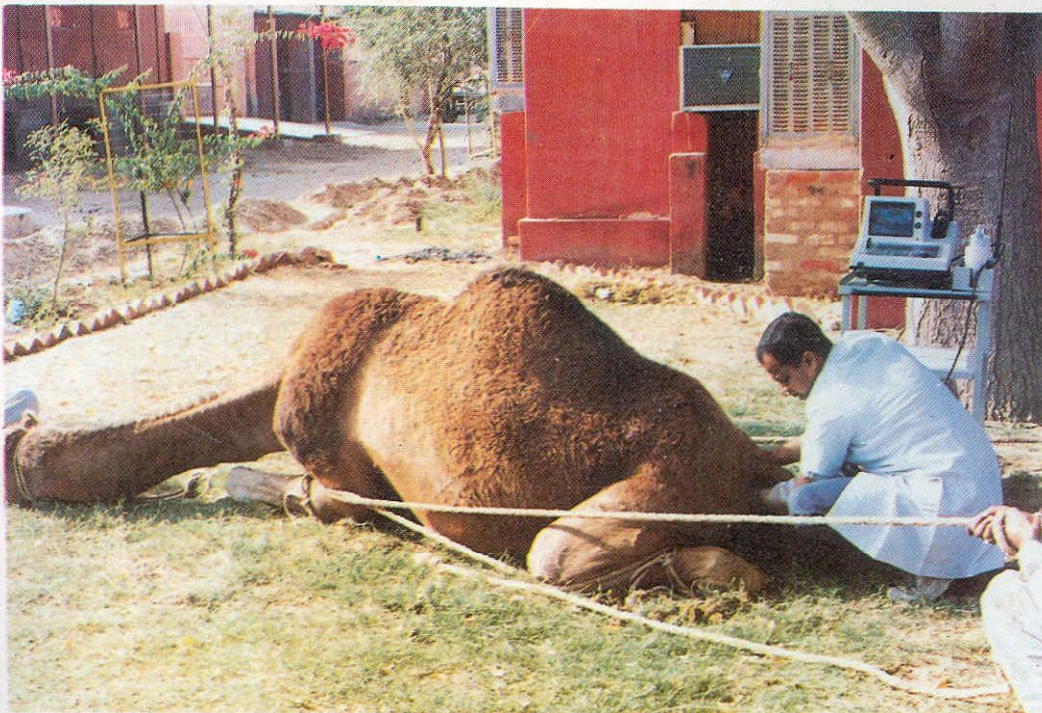
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