



# ANNUAL REPORT 1986



**NATIONAL RESEARCH CENTRE ON CAMEL  
BIKANER**



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(Estd. 5th July, 1984)

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## BRIEF BACKGROUND AND OBJECTIVES

The National Research Centre on Camel (NRCC) was approved during the last phase of 6th Five Year Plan. The Centre came into existence on 5th July, 1984, when physical facilities, land and animals available at the former Camel Breeding Farm, Jorbeer, Bikaner were transferred by the Animal Husbandry Department of Government of Rajasthan to the Indian Council of Agricultural Research, New Delhi.

The camel is an important component of the desert ecosystem. It is a multipurpose animal, the principal use being draft, transport and agricultural operations. The other areas of camel utility are milk, hide, hair and meat. The camel is also utilized by the Border Security Force in the desert part of the border areas.

The camel utilizes its various adaptive mechanisms most suited to the life in the desert. It can survive in extreme hot climate under scarcity of fodder and water and can sustain on coarse fodder. It plays a significant role in the economic development and uplift of marginal and small farmers and other weaker sections of the society. In fact, the camel has been an important animal in the economy of Northern India for many centuries and continues to be so particularly in the North-Western part of the country, where almost all camel population of India is found.

Of the estimated 17.20 million world population, India has about 1.05 million camels. About 98.5% of world camel population is found in the developing countries. The Indian camels are also in

demand abroad and have been brought under the purview of export control policy of Government of India.

Although, the camel is important to the agrarian society of the North West India, this species remained sorely neglected and received less attention with the result that there has been little impact of the developmental efforts for its improvement. There is also dearth of accurate information in terms of research for improvement of its potentials.

Having recognized the economic and social importance of camel in development of rural India in the arid and semi-arid zones, a need was felt to optimise its productivity and working capacity and to develop package of innovations to introduce ideal management practices appropriate to desert ecosystem for economic maintenance. The National Research Centre on Camel has been, therefore, established to undertake research programmes with following objectives:-

- i) To establish work standards for riding and baggage camels.
- ii) To study and associate the work standards with physical, physiological and biochemical parameters.
- iii) To develop suitable selection criteria on the basis of established standards for improvement of work capacity.
- iv) To develop suitable management practices for rearing camels.
- v) To conduct basic and applied research for camel improvement.



## 2.

### CAMEL STRENGTH

There were 158 animals at the beginning of the year consisting of 157 animals of Bikaneri breed and 1 camel of Arab Origin (Table 1). The ratio of males and females was 38:62. There were 45.2% breedable females, 41.4% growing animals (between 0 to 3 years), 7.0% studs and 6.3% adult males used for traction and riding purposes.

During the period under report 2 Bikaneri males and 1 male each of Jaisalmeri and Kutchi breeds were added. Twenty seven

animals (3 males and 24 females) of Kutchi breed were received from the Animal Husbandry Department, Government of Gujarat, on returnable basis for developing Kutchi herd at Bikaner. These animals were kept in quarantine for about 3 weeks before mixing with the rest of the herd. The Kutchies and Bikaneries did not socialize readily and moved, ate or rested in separate groups. This behaviour continued even after 4 months of their stay at Bikaner.

## 3.

### CAMEL HEALTH

#### 3.1. Clinical cases:

During the year, 42 clinical cases were treated which consisted of 17 digestive disorders, 2 respiratory infections, 6 reproductive disorders, 4 vitamin deficiencies, 1 snake bite and 12 pyrexia of unspecified etiology. Cases of digestive disorders and vitamin A deficiency were mostly observed in the camel calves below 1 year of age. In addition, 31 cases of mange and 47 minor surgical cases were also attended to.

No major infectious disease outbreak occurred at the farm during 1986.

#### 3.2. Abortions:

Six cases of abortions were recorded. No specific cause responsible for abortions could

be identified either infective or otherwise. It was noticed that the cases of abortions mostly occurred after rains. 3 cases of premature births/still births were also recorded.

#### 3.3. Prophylactic measures:

i) **Ectoparasites:** All animals and sheds were sprayed with the insecticides, atleast twice a year.

ii) **Internal parasites:** Faecal samples were examined at regular intervals for internal worm load. Out of the 601 samples examined, 22.3% samples were positive for parasitic infestations and 77.7% were apparently negative. *Strongyles*, *Trichuris* and *Balantidium* were found to be major infestations. Preventive anthelmintics were

TABLE : 1  
CAMEL STRENGTH

Breed	Age group	Opening balance (1.1.86)						Additions						Deductions						Closing balance (31.12.86)	
		Calving		Internal Tran- sfer due to change in age groups		Purchased/ external transfer		Death		Internal Tran- sfer due to change in age groups		Disposal		Closing balance							
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F				
Bikaneri	0-3 months	6	9	6	11	-	-	-	-	1	1	11	19	-	-	-	-	-	-		
	3-12 months	14	3	-	-	11	19	-	-	-	-	20	12	1	-	4	10	-	-		
	1-3 years	18	15	-	-	20	12	-	-	1	-	5	5	19	-	13	22	-	-		
	3-15 years	19	56	-	-	5	5	2	-	-	-	-	-	8	4	18	57	-	-		
	above 15 years	2	15	-	-	-	-	-	-	-	-	-	-	-	4	2	11	-	-		
Kutchi	1-3 years	-	-	-	-	-	-	3	3	-	-	-	-	-	-	3	3	-	-		
	3-15 years	-	-	-	-	-	-	1	21	-	-	-	-	-	-	1	21	-	-		
Arab Bikaneri crosses	0-3 months	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-		
	3-12 months	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-		
Arab	3-15 years	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-		
Jaisalmeri	3-15 years	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-		
TOTAL		60	98	7	11	37	36	7	24	2	1	37	36	28	8	44	124	-	-		

administered twice a year.

**iii) Trypanosomiasis:** As a preventive measure against the occurrence of surra, chemoprophylactic agents were administered to the whole herd. The first dose was given before rains and the second during November - December.

**iv) Testing for infectious diseases:** The herd was negative for Tuberculosis, Johne's disease and Brucellosis.

### 3.4. Mortality

Due to proper management practices and health cover, the mortality rate during the year was only 0.04 per 1000 camel days per day. The details of age groupwise mortality rate is presented in Table 2.

TABLE : 2

**POOLED MORTALITY IN BIKANERI  
CAMEL 1975-85 & 1986  
(Per 1000 camel days per day)**

Sl.No.	Age group	Camel days		Mortality	
		1975-85	86	1975-86	86
1.	0-3 months	21867	2524	1.42	0.79
2.	3 months to 3 years	233320	26870	0.18	0.03
3.	Above 3 years	370353	42906	1.09	Nil
4.	Pooled	625540	72300	0.17	0.04

It may be seen from the table 2 that pooled mortality rate during 1975-85 was 0.17 per 1000 camel days per day but in 1986, it was reduced to 0.04 per 1000 camel days per day. The sexwise mortality was 0.0812 for males and 0.0209 for females per 1000 camel days per day.

The mortality data from 1975-86 (Table 3) revealed that out of 109 deaths, 17.40% were due to digestive system, 19.25% due to respiratory system, 1.80% due to urinary system, 22.00% due to general debility, nutritional causes and other systems, 10.00% due to surgical causes, 6.40% due to accident and 23.50% due to unspecified causes. The overall pooled mortality rate classified according to age and months (Table 4) indicated that highest mortality risk was in 0 to 3 months age group animals.

The pooled mortality data when classified according to months revealed that the mortality risk was highest during May, June and July and lowest during August, September and October. The mortality amongst calves in the age group of 0 to 3 months was conspicuously more during peak summer months and peak winter months. For animals in the age group of 3 months to 3 years, the high mortality risk months were also summer months.



TABLE : 3.  
AGE, SEX AND YEAR-WISE MORTALITY IN CAMELS (1975 - 86)

Age group	Sex	1975	76	77	78	79	80	81	82	83	84	85	86
0-3 months	Male	Mortality 01 Camel days 1115 (0.8969)	00 1845	04 0864 (4.6296)	02 1069 (1.8709)	00 0531	00 1205	00 0522	05 1559 (3.2072)	01 1373 (0.7283)	03 0903 (3.3223)	03 1160 (2.5862)	01 0962 (1.0395)
	Female	Mortality 00 Camel days 0863	0887	01 1109 (0.9017)	01 1304 (0.7669)	02 0950 (2.1053)	00 1209	00 0654	01 1166 (0.8576)	04 1015 (3.9409)	02 0848 (2.3585)	01 0482 (2.0747)	01 1562 (0.6402)
3 months to 3 years	Male	Mortality 01 Camel days 10361 (0.0965)	01 12277 (0.0815)	04 11471 (0.3487)	02 10972 (0.1833)	00 08108	02 11707 (0.1708)	01 10560 (0.0947)	00 11510	04 12849 (0.3113)	10 11737 (0.8520)	01 10802 (0.0926)	00 14232 (0.0700)
	Female	Mortality 01 Camel days 11071 (0.0903)	01 09178 (0.1090)	00 07776	03 10743 (0.2793)	00 11241	02 15162 (0.1319)	00 12795	00 10802	03 09401 (0.3191)	05 07345 (0.6807)	01 06534 (0.1530)	00 12638
Above 3 years	Male	Mortality 02 Camel days 6094 (0.3282)	00 6441	00 7245	02 7942 (0.2518)	00 5277	02 5691 (0.3514)	01 7967 (0.1255)	00 7106	01 7556 (0.1323)	02 9182 (0.2178)	01 8966 (0.1115)	00 9436
	Female	Mortality 01 Camel days 21147 (0.0473)	03 23445 (0.1280)	01 23846 (0.0419)	01 23392 (0.0427)	00 26427	02 27395 (0.0757)	02 29637 (0.0675)	00 31371	07 31068 (0.2253)	03 25464 (0.1178)	02 25906 (0.0772)	00 33470
Pooled	Mortality 06 Camel days 50643 (0.1185)	05 54073 (0.0925)	10 52311 (0.1912)	11 55362 (0.1987)	02 52534 (0.0381)	08 62369 (0.1283)	04 62135 (0.0644)	06 63514 (0.0945)	06 63262 (0.3161)	20 55479 (0.4506)	25 53850 (0.1671)	09 72300 (0.0414)	03

Note : Figures in parenthesis denote mortality risk per 1000 camel days per day.

TABLE 4  
MORTALITY IN CAMELS MONTHWISE (1975 - 85)

Groups	Jan.	Feb.	Mar.	Apr.	May.	June	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Calves	7	8	2	2	5	2	-	-	-	-	-	3
0-3 months	3437	5602	2275	3816	2017	314	30	18	40	92	129	1112
No. of deaths												
Camel days												
Mortality/												
1000 camel days	2.0367	1.4281	0.8791	0.5241	2.4789	6.3694	-	-	-	-	-	2.6978
3 months to to 3 years	1	1	5	6	4	8	8	1	1	2	4	1
No. of deaths												
Camel days	19223	15594	18009	19283	20564	20975	21145	20988	19866	18590	18794	19742
Mortality/												
1000 camel days	0.0520	0.0641	0.2776	0.3112	0.1945	0.3814	0.3183	0.0476	0.0503	0.1076	0.2128	0.0507
Adults	3	-	3	2	5	1	6	2	3	3	5	-
No. of deaths												
Camel days	31100	29860	33265	31816	32880	31359	31697	31499	30040	27011	28400	31514
Mortality/												
1000 camel days	0.0965	-	0.0902	0.0629	0.1521	0.0319	0.1893	0.0635	0.0999	0.1111	0.1761	-
Pooled	11	9	10	10	14	11	14	3	6	5	9	4
No. of deaths												
Camel days	53760	51056	53549	54915	55461	52648	52872	52505	49946	45693	47323	52368
Mortality/												
1000 camel days	0.2046	0.1763	0.1867	0.1821	0.2524	0.2089	0.2648	0.0571	0.1201	0.1094	0.1902	0.0764

## 4. RESEARCH PROJECTS

### 4.1. Project No.P.I.86/1-ICN/L-50/5220

Title: To study work standards in camels and to associate the work standards with physical, physiological and biochemical parameters.

(A.K. Rai, N.D. Khanna, H.K. Jindal, S.N. Tandon and U.K. Bissa).

4.1.1. One of the major mission of the Centre is to establish work standards with physical, physiological and biochemical parameters and to develop selection criterion for improving working capacity. The main thrust during the year under report was to collect base line data on various attributes. The project was initiated in the middle of 1986.

#### 4.1.2. Training of animals

(a) For draught: Four adult males of Bikaneri breed and an Arabian camel were used. 2 Bikaneri camels were castrated for comparison with the whole camels. The animals were put on a training schedule for pulling load of 4 q. It was gradually increased to a maximum of 20 q. by adding 2 q. after 2 days run on each load each time. The animals were made to pull a loaded cart on a typical kutchra road of the desert area covering a distance of 20 km in 4 hr. (9.00 a.m. to 1.00 p.m.) continuously. The animals moved approximately at an average speed of 5 km/hr.

(b) Riding: Jaisalmeri and Bikaneri adult males were also trained for the studies on work standards for riding. The animals were allowed to cover a set distance in a given time with the rider on its back. They were also trained by allowing them to move on a circular path covering a periphara distance of 126 ft in each round.

(c) Camel drawn carts were routinely used for watering the plants, transportation of feed and fodder and also for other agricultural operations.

#### 4.1.3 Special Camel Carts

Action was taken to modify existing camel carts for fixing the load cells/dynamometer at an appropriate place for measuring the draught. Such carts were under fabrication. A small sized camel cart suitable for young growing animals (about 2 to 2 1/2 years) was also fabricated (Fig. 1).



TRAINING OF A YOUNG CAMEL CALF FOR TRACTION.

#### 4.1.4 Castration of camel by open surgical method:

For studying the effect of castration on draughtability, 2 camels aged 4-5 years were castrated by open surgical method. These



animals were trained for pulling carts. Comparative studies on their behaviour during traction and their draughtability potential are in progress.

#### 4.1.5 Physiological Response

The pulse rate, respiration rate and rectal temperature of the camels of different age groups were recorded in the experimental animals twice a month throughout the year (Tables 5, 6 and 7). The pulse rate was found to be relatively lower in the animals above 3 years of age. The sex differences were not significant. It was considerably stable during different months in animals above 3 years.

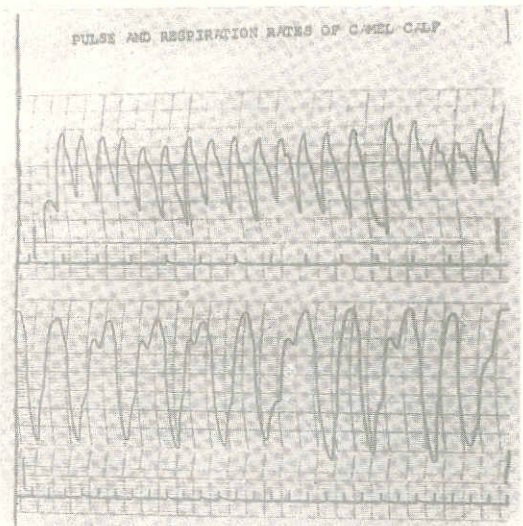
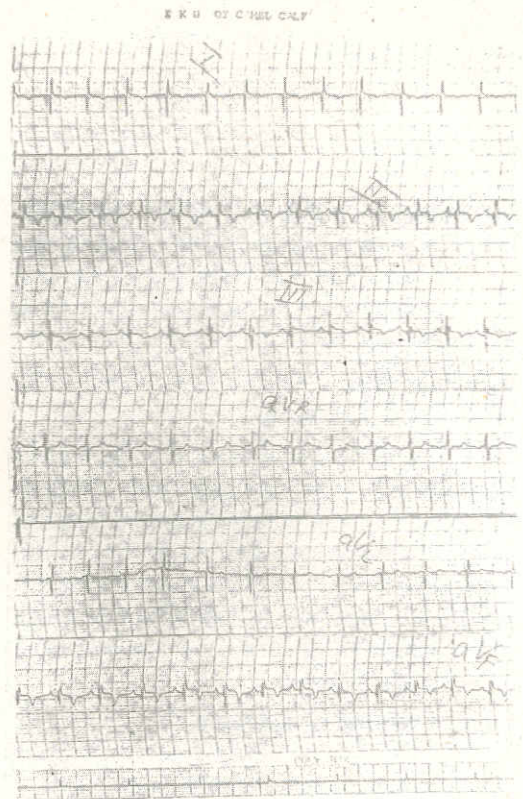
The respiratory frequency of the camels ranged from 7-20 per min in different months of the year. The animals up to 6 months of age had respiratory frequency ranging from 15-20 per min, whereas the animals above 3 years of age had lower respiration rate (7 to 9 per min). The respiration rate increased during summer in animals up to 1 year of age, but such increase was not so well marked in the animals aged 3 years and above.

The rectal temperature ranged from 35.8°-38.1°C in different age groups in different months. The rectal temperature, in general, was lower in animals above 3 years (35.8°-37.5°C) than the animals belonging to lower age groups (36.5°-38.2°C). The sex effect on rectal temperature was non-significant.

Recording of physiological attributes like electro-encephalogram, electro cardiogram, blood pressure, pulse, respiration, rectal temperature etc., were initiated using multichannel physiograph (Fig. 2).

#### 4.1.6. Haematological studies

For haematological studies, 96 blood samples were collected from animals belonging to 4 different age groups of both the sexes during October and November 1986. The samples were employed for the estimation



POLYGRAPH SHOWING ECG, PULSE AND RESPIRATION RATE

**TABLE : 5**  
**PULSE RATE PER MINUTE IN CAMELS, AGE AND SEX-WISE**

Sl. No. Months	0-6 months		6 months to 1 year		1 year to 3 years		Above 3 years	
	Male	Female	Male	Female	Male	Female	Male	Female
	1. January	77.5	81.0	72.5	72.0	65.5	67.0	53.5
2. February	72.5	83.0	71.0	70.0	71.0	72.0	47.5	47.0
3. March	81.0	77.0	69.0	57.0	74.0	65.0	51.0	52.0
4. April	78.0	80.0	58.0	55.0	71.0	68.0	50.0	53.0
5. May	84.0	81.0	51.0	51.0	52.0	55.0	50.0	48.0
6. June	86.0	88.0	48.0	48.0	56.5	51.0	55.5	42.5
7. July	83.0	84.0	51.0	47.0	55.0	52.5	58.5	37.0
8. August	78.0	76.0	52.0	48.0	59.0	55.0	54.0	39.0
9. September	70.0	67.0	64.0	70.0	66.0	64.0	50.0	41.5
10. October	-	-	59.0	62.0	48.0	48.0	37.0	39.0
11. November	-	-	62.0	62.0	52.0	49.0	42.0	43.0
12. December	-	-	60.5	65.0	54.0	56.0	42.0	45.0

TABLE : 6  
RESPIRATION RATE PER MINUTE IN CAMELS, AGE AND SEX-WISE

Sl. No.	Months	0 - 6 months		6 months to 1 year		1 year to 3 years		Above 3 years	
		Male	Female	Male	Female	Male	Female	Male	Female
1.	January	15.5	15.5	14.0	12.75	13.0	12.5	7.00	7.00
2.	February	17.5	16.5	14.0	14.5	15.0	12.5	6.75	6.75
3.	March	16.5	16.0	14.0	13.5	13.0	11.5	6.75	6.75
4.	April	16.0	18.0	13.0	13.5	16.0	12.5	7.25	6.50
5.	May	17.5	17.75	13.0	12.0	12.0	10.0	7.25	7.75
6.	June	19.5	19.0	15.0	13.0	14.75	11.5	8.25	6.75
7.	July	17.25	19.0	12.0	11.5	13.0	11.5	8.25	6.75
8.	August	16.0	17.0	12.0	10.0	12.0	11.0	8.00	7.00
9.	September	17.0	16.0	13.0	15.0	13.0	12.0	9.00	7.50
10.	October	-	-	12.5	12.5	11.25	10.75	7.75	6.75
11.	November	-	-	13.0	12.0	11.0	09.5	6.50	7.50
12.	December	-	-	13.5	12.0	11.0	11.25	6.75	7.00



TABLE : 7  
RECTAL TEMPERATURE (°C) IN CAMELS, AGE AND SEX-WISE

Sl. No.	Months	0-6 months		6 months to 1 year		1 year to 3 years		Above 3 years	
		Male	Female	Male	Female	Male	Female	Male	Female
1.	January	37.65	37.55	36.98	37.08	37.65	37.55	36.15	36.30
2.	February	37.55	37.63	36.68	37.05	37.55	37.63	36.00	35.80
3.	March	37.25	37.35	37.48	37.35	37.25	37.58	37.00	37.23
4.	April	38.05	37.70	37.68	37.60	38.05	37.70	37.50	37.05
5.	May	37.43	37.25	37.33	37.13	37.43	37.25	37.03	36.45
6.	June	37.68	36.95	37.83	37.28	37.68	36.95	37.15	36.60
7.	July	37.58	38.28	37.45	36.65	37.80	36.95	37.40	36.55
8.	August	37.65	38.10	37.35	36.50	37.50	37.50	37.20	36.60
9.	September	37.80	37.95	38.25	38.15	37.50	37.65	36.95	36.60
10.	October	-	-	37.73	38.13	37.60	37.03	36.65	36.48
11.	November	-	-	37.63	37.75	36.93	36.98	36.08	36.58
12.	December	-	-	36.70	37.53	37.00	37.30	36.15	36.30

of Erythrocyte (RBC) and Leucocyte (WBC) counts, packed Cell volume (PCV), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin Concentration (MCHC) and Haemoglobin (Hb) content (Table 8).

The RBC count ranged from 7.8 to 18.4 x 10<sup>12</sup>/l in different age groups of both the sexes. The WBC count ranged from 6.0 to 11.5 x 10<sup>9</sup>/l in males and females of above 1 year of age while it tended to be higher (6.5 - 20 x 10<sup>9</sup>/l) in animals below 1 year.

The packed cell volume ranged from 24.9 to 49.9% in the animals of different age groups. The range of MCV was 25.0 to 49.0  $\mu\text{m}^3$ . Although, PCV was high but it compared well with the RBC count and the Hb content. It was more true when the respective values of individual animals were taken into account.

The MCH and MCHC ranged from 9.9. to 15.8 pg and 29.0 to 55% respectively. The concentration of haemoglobin ranged between 8.2 to 18.0 g%. It was found to be higher in growing animals, i.e. 0 to 3 years. The high value of Hb in general was fairly comparable to other related haematological attributes.

The statistical differences due to age and sex were not significant in any of the haematological attributes presently studied. However, there was a tendency for increase in RBC, PVC, MCV and Hb and a decrease in WBC, MCH and MCHC with the increase in age up to 3 years. In general, all the haematological values were lower in animals above 12 years than the other age groups except for MCV.

#### 4.1.7 Biochemical constituents of blood of camel

Blood samples were collected from 36 males and 48 females for estimating alkaline phosphatase, lactate dehydrogenase (LDH), glutamic oxalacetic transaminase (SGOT),

glutamic pyruvic transaminase (SGPT) and bilirubin. The differences between the two sexes were non-significant. The average values of alkaline phosphatase and SGPT activities tended to be higher in males than in females and LDH, SGOT and bilirubin in females than in males (Table 9).

The ranges of different biochemical constituents in the blood of camels estimated during the year are presented in Table 10.

**TABLE : 10**  
**RANGE OF SOME BIOCHEMICAL**  
**CONSTITUENTS OF BLOOD OF CAMELS**

Biochemical Constituents	Range
Alkaline Phosphatase	22-199 IU/l
Acid Phosphatase	1-48 IU/l
Lactate dehydrogenase	44-116 IU/l
SGOT	3.5-26 IU/l
SGPT	1.3-53 IU/l

#### 4.1.8 Sodium and Potassium levels in camel serum

The sodium and potassium contents were estimated by flame photometry in 96 serum samples of the camels of 4 different age groups of both the sexes (Table 11). The level of sodium ranged from 125 to 175 m eq/litre and that of potassium from 5.0 to 8.6 m eq/litre. Although, the average values of sodium and potassium were higher in the males up to 3 years of age than in females of the similar age group but were not statistically significant. The levels of both these electrolytes tended to be higher in females than in males with the advancement of age after 3 years.

#### 4.2 Project no.P.I.86/2-ICN/L-10/5220

Title : Studies on quantitative and qualitative genetic parameters in Indian camels.

TABLE : 8  
SOME HAEMATOLOGICAL PARAMETERS IN CAMELS, AGE AND SEX-WISE

Age group	Sex	No. of Observation	R.B.C. (x 10 <sup>12</sup> /l)	W.B.C. (x 10 <sup>9</sup> /l)	P.C.V. (%)	M.C.V. (μm <sup>3</sup> )	M.C.H. (Pg)	M.C.H.C. (%)	Haemoglobin g%
0-1 year	Male	5	12.95 ±1.77	11.92 ±3.58	36.30 ±5.29	26.54 ±1.12	12.20 ±0.72	43.69 ±3.78	15.82 ±2.48
	Female	19	13.80 ±1.22	10.70 ±1.82	38.52 ±3.50	25.90 ±0.28	12.08 ±1.46	43.25 ±4.83	16.60 ±1.76
1-3 years	Male	20	13.05 ±2.20	9.25 ±1.77	39.96 ±5.21	28.49 ±1.72	12.47 ±1.34	41.53 ±5.56	16.56 ±1.76
	Female	4	14.05 ±1.64	8.87 ±1.18	40.80 ±6.59	27.87 ±2.35	12.05 ±1.28	41.91 ±4.86	16.95 ±2.66
3-12 years	Male	15	12.35 ±2.85	8.15 ±1.70	37.32 ±7.92	29.97 ±1.32	11.85 ±0.97	39.91 ±2.28	14.41 ±2.36
	Female	21	12.10 ±1.43	8.29 ±1.33	36.91 ±4.96	29.51 ±4.07	11.08 ±1.24	36.52 ±4.52	13.29 ±0.84
12 years and above	Male	2	14.10 ±1.55	9.75 ±0.35	44.35 ±7.85	32.87 ±4.42	10.91 ±1.10	35.20 ±5.88	15.30 ±0.14
	Female	10	11.56 ±2.05	7.05 ±1.09	34.88 ±6.29	31.22 ±3.99	10.68 ±1.85	35.35 ±6.58	12.12 ±1.66



TABLE : 9  
SOME BIOCHEMICAL CONSTITUENTS OF BLOOD OF CAMELS

Sex	Alkaline Phosphatase (IU/l)	Lactate Dehydrogenase (IU/l)	Serum Glutamic Oxalacetic transaminase (IU/l)	Serum Glutamic Pyruvic transaminase (IU/l)	Bilirubin (mg %)
Male	87.25 ± 46.31 (40)	96.80 ± 14.45 (5)	19.25 ± 12.77 (24)	8.85 ± 2.76 (20)	0.68 ± 0.17 (14)
Female	66.59 ± 43.98 (50)	103.56 ± 9.00 (25)	22.52 ± 13.32 (26)	7.58 ± 2.50 (35)	0.81 ± 0.30 (11)

(No. of observations have been presented in parenthesis)

**TABLE : 11**  
**SERUM SODIUM AND POTASSIUM LEVELS IN CAMELS**

S. No.	Age groups	Sex	No. of observations	Mean value	
				Na <sup>+</sup> (meq/lit)	K <sup>+</sup> (meq/lit)
1.	0-1 year	Male	5	145.63 ± 8.01	7.07 ± 0.80
		Female		138.40 ± 9.63	6.20 ± 1.10
2.	1-3 years	Male	20	155.90 ± 7.64	6.97 ± 1.08
		Female		143.00 ± 8.98	5.97 ± 0.78
3.	3-12 years	Male	15	157.75 ± 5.34	7.42 ± 1.39
		Female		168.81 ± 7.57	7.55 ± 0.92
4.	Above 12 years	Male	2	148.50 ± 16.27	5.95 ± 1.20
		Female		164.20 ± 8.59	6.96 ± 0.81

(N.D. Khanna, S.N. Tandon, A.K. Rai, H.K. Jindal and U.K. Bissa).

The information on quantitative and qualitative parameters is very scanty in Indian camel and therefore, this project was initiated.

#### 4.2.1 Physical traits

Eight physical measurements, viz., leg length, girth, height at wither, neck length, distance between the eyes, face length, tail length and circumference of fore and hind foot, were measured in 62 growing animals divided into 8 age groups from 6 months to 4 years. The animals were further divided according to sex (Table 12, 13). The preliminary observations indicated that animals kept under similar feeding and management regime, the pattern of growth in both the sexes was quite comparable up to 4 years of age. The project is in progress and collection of data and analysis will be continued next year.

#### 4.2.2 Quantitative traits

The data available at the farm from 1961 to 1980 were collected and statistical analysis was conducted on birth weight, gestation period, age at first calving and age at first service. Least square analysis was applied for studying non-genetic variability and the heritability was estimated by parental half sib correlations from data corrected for significant non-genetic effects. Some correlations were also worked out. No data were available for 1980-84. It may be mentioned here that the farm during 1961-84 had passed through a variety of managerial practices and feeding schedules.

##### 4.2.2.1 Birth weight

The available data on 532 calvings from 1961-1980 were included in this analysis (Table 14). The effect of years, parity of dam and sex were highly significant. Table 15 presents yearwise mean birth weight which was highest in 1968-69 (46.36 kg) and lowest

TABLE : 14

#### LEAST SQUARE ANALYSIS OF VARIANCE FOR FACTORS AFFECTING BIRTH WEIGHT IN CAMELS

Source of variation	df	M.S.S	F
Between Periods	16	218.75	9.44**
Between parities	4	178.43	7.70**
Between sexes	1	330.57	14.27**
Error	500	21.16	—

\*\* Significant at 1% level.

TABLE : 15

#### AVERAGE BIRTH WEIGHT IN CAMEL CALVES

S. No.	Year	Average birth weight (Kg.)
1.	1961-62	38.67
2.	1962-63	39.12
3.	1963-64	42.30
4.	1964-65	40.64
5.	1965-66	36.75
6.	1966-67	37.59
7.	1967-68	42.75
8.	1968-69	46.36
9.	1971-72	41.20
10.	1972-73	38.73
11.	1973-74	41.23
12.	1974-75	43.32
13.	1975-76	41.52
14.	1976-77	39.30
15.	1977-78	42.77
16.	1978-79	43.00
17.	1979-80	42.93
AVERAGE BIRTH WEIGHT		41.02/± 0.2012



**TABLE 12**  
**AVERAGE BIOMETRICAL PARAMETERS OF MALE CAMELS AT DIFFERENT AGE GROUPS ( cm.)**

Sl. No.	Body parameters	Age groups							
		6 months (14)	1 year (14)	1½ years (22)	2 years (9)	2½ years (10)	3 years (8)	3½ years (8)	4 years (8)
1.	Leg length	118.21 ± 5.50	122.14 ± 6.06	130.64 ± 5.81	134.56 ± 5.08	139.00 ± 4.58	140.88 ± 6.81	144.62 ± 3.85	146.30 ± 4.38
2.	Girth diameter	141.79 ± 6.90	153.71 ± 7.78	168.64 ± 8.39	175.22 ± 6.70	182.89 ± 5.69	187.13 ± 9.11	191.88 ± 7.59	198.00 ± 6.46
3.	Height at Withers	—	160.93 ± 3.85	169.14 ± 5.15	179.33 ± 5.15	186.30 ± 6.11	188.25 ± 6.20	191.12 ± 2.29	202.00 ± 2.78
4.	Neck length	84.36 ± 4.24	86.64 ± 4.03	93.55 ± 5.09	98.50 ± 3.32	100.89 ± 3.41	103.88 ± 6.42	110.38 ± 5.76	111.60 ± 4.59
5.	Distance between eyes	22.64 ± 1.34	24.00 ± 0.96	24.35 ± 0.98	24.58 ± 0.90	25.22 ± 0.67	27.50 ± 0.76	28.38 ± 1.06	28.90 ± 0.98
6.	Face length	29.79 ± 1.58	31.93 ± 1.33	35.32 ± 1.67	34.67 ± 1.49	39.22 ± 1.48	40.75 ± 1.75	41.13 ± 1.36	41.10 ± 1.17
7.	Tail length	46.64 ± 3.00	49.36 ± 2.51	51.65 ± 2.53	52.08 ± 2.35	55.00 ± 3.57	57.00 ± 1.51	57.00 ± 5.37	58.40 ± 4.67
8.	Circumference of foot	—	50.64 ± 1.74	51.09 ± 1.85	54.22 ± 1.09	55.40 ± 2.63	56.00 ± 2.07	57.12 ± 1.64	61.00 ± 1.07
	Fore leg	—	46.00 ± 1.62	45.86 ± 1.83	49.11 ± 0.93	49.80 ± 2.57	50.62 ± 1.85	51.12 ± 1.25	55.37 ± 1.57
	Hind leg	—	—	—	—	—	—	—	—

Figures in parenthesis indicate number of observations in each age group.

TABLE : 13  
 AVERAGE BIOMETRICAL PARAMETERS IN FEMALE CAMELS AT DIFFERENT AGE GROUPS (cm.)

S.No.	Body parameters	Age groups							
		6 months (6)	1 year (3)	1½ years (12)	2 years (8)	2½ years (8)	3 years (6)	3½ years (3)	4 years (3)
1.	Leg length	111.75 ±5.56	114.66 ±8.33	126.08 ±6.25	129.50 ±4.80	136.67 ±2.45	139.83 ±4.26	144.00 ±1.00	145.00 ±4.37
2.	Girth diameter	134.00 ±4.62	151.66 ±5.50	162.33 ±5.37	168.63 ±6.21	180.96 ±7.32	187.83 ±2.99	193.67 ±5.51	206.00 ±6.41
3.	Height at withers	—	157.66 ±2.52	170.66 ±4.36	181.00 ±4.17	188.37 ±3.89	189.83 ±2.40	191.00 ±3.00	202.33 ±1.53
4.	Neck length	80.75 ±2.81	84.66 ±1.53	93.42 ±4.08	97.25 ±4.43	101.21 ±5.56	106.83 ±2.86	113.67 ±4.04	114.60 ±3.73
5.	Distance between eyes	22.50 ±2.38	23.66 ±1.15	24.17 ±0.94	24.88 ±0.35	25.44 ±0.73	27.33 ±0.52	27.00 ±0.00	28.00 ±1.26
6.	Tail length	47.25 ±2.65	50.33 ±3.21	51.25 ±2.18	53.78 ±2.47	53.88 ±1.36	54.17 ±1.84	55.33 ±4.51	56.30 ±3.58
7.	Face length	29.50 ±2.38	32.33 ±0.57	34.75 ±0.87	36.86 ±1.35	38.67 ±1.12	39.83 ±0.98	41.00 ±1.50	42.00 ±1.39
8.	Circumference of foot	—	46.00 ±1.00	51.08 ±1.88	55.00 ±2.65	59.87 ±1.80	59.66 ±1.51	57.66 ±1.15	60.33 ±0.58
	Fore leg	—	41.66 ±1.15	45.83 ±2.25	49.25 ±2.56	54.25 ±1.28	54.50 ±1.05	52.00 ±1.00	54.33 ±0.58
	Hind leg	—	—	—	—	—	—	—	—

Fingers in parenthesis indicate number of observations in each group.

in 1965-66 (36.75 kg). The overall mean birth weight was  $41.02 \pm 0.2012$  kg. The data classified according to parity, revealed that there was a trend of increasing birth weight from 1st to 5th parity (Table 16). Sufficient data after 5th parity was not available. The sexwise mean birth weight was 41.95 kg for male calves and 39.97 kg for female calves.

**TABLE : 16**  
**PARITY WISE MEAN BIRTH WEIGHT IN CAMELS**

S. No.	Parity	Mean birth weight (in kg)
1.	Ist	38.84
2.	IInd	41.61
3.	IIIrd	41.70
4.	IVth	42.35
5.	Vth	44.39

#### 4.2.2.2 Gestation length

Period had significant effect on gestation length while parity had no effect (Table 17). The period when classified yearwise revealed that highest gestation length was 395.5 days (1967-68) and lowest 377.8 days (1971-72) the overall mean being  $389.3 \pm 0.0781$  days (Table 18).

**TABLE : 17**  
**LEAST SQUARE ANALYSIS OF VARIANCE FOR NONGENETIC FACTORS AFFECTING GESTATION LENGTH**

S. No.	Source of variation	df.	MSS	F
1.	Between periods	16	8.900	2.797**
2.	Between parities	4	0.905	0.284
3.	Between sexes	1	0.790	0.248
4.	Error	501	3.181	-

\*\* Significant at 1% level

**TABLE : 18**  
**YEAR, PARTY AND SEX-WISE GESTATION LENGTH IN CAMELS**

S. No.	Year	No. of observation	Mean gestation length (days)
1.	1961-62	30	388.8
2.	1962-63	55	392.4
3.	1963-64	25	383.8
4.	1964-65	14	389.3
5.	1965-66	69	391.6
6.	1966-67	22	391.8
7.	1967-68	60	395.5
8.	1968-69	47	390.4
9.	1971-72	69	377.8
10.	1972-73	15	394.7
11.	1973-74	31	395.2
12.	1974-75	26	387.3
13.	1975-76	23	388.1
14.	1976-77	10	384.7
15.	1977-78	13	386.4
16.	1978-79	8	382.5
17.	1979-80	15	386.5

Parity-wise	1	2	3	4	5
	387.9	391.1	389.0	387.9	387.8

Sex-wise	Male	Female
	389.7	388.8

Overall Means :	$389.3 \pm 0.0781$
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#### 4.2.2.3 Age at first service

The age at first service was significantly affected by the period while the parity of dam and season did not show any effect (Table 19). The period/class consisted of groups of four year from 1966-69, 1970-73, 1974-77, 1978-81 and 1982-1985. The overall mean was  $1390 \pm 25.00$  days (Table 20). The age at



first service was much higher during earlier years of establishment of the farm.

**TABLE : 19**

**LEAST SQUARE ANALYSIS OF VARIANCE FOR FACTORS AFFECTING AGE AT 1st SERVICE**

S. No.	Source of variation	d.f.	M.S.S.	F
1.	Between parities	6	2.051	0.56
2.	Between seasons	4	3.514	0.97
3.	Between periods	4	12.345	3.40**
4.	Error	43	3.627	

\*\* Significant at 1% level.

**TABLE : 20**

**PERIOD WISE AVERAGE AGE AT 1st SERVICE**

S. No.	Period	Average Age at 1st service (days)
1.	1966-69	1483
2.	1970-73	1492
3.	1974-77	1240
4.	1978-81	1275
5.	1982-85	1306

Average age at 1st service (days) =  $1390 \pm 25.00$

**4.2.2.4 Age at first calving**

The parity and period had no effect while there was significant month effect (Table 21). It was lower in animals which calved during February and March and higher in those animals which calved during December, January and April (Table 22). The average age at first calving was  $1882 \pm 28.67$ .

**TABLE : 21**

**LEAST SQUARE ANALYSIS OF VARIANCE FOR FACTORS AFFECTING AGE AT 1st CALVING IN CAMELS**

S. No.	Source of variation	d.f.	M.S.S.	F
1.	Between parities	6	10.511	1.37
2.	Between seasons	4	22.176	2.89*
3.	Between periods	4	16.069	2.10
4.	Error	78	7.649	

\* Significant at 5% level.

**TABLE : 22**

**MONTH-WISE AVERAGE AGE AT 1st CALVING IN CAMELS**

S. No.	Months	Average age at 1st calving (days)
1.	December	1943
2.	January	1916
3.	February	1724
4.	March	1732
5.	April	2153

Average age at 1st calving (days) =  $1882 \pm 28.67$

**4.2.2.5 Genetic factors.**

The heritability estimates for birth weight, gestation length, age at first service and age at first calving are presented in Table 23. The  $h^2$  estimate for gestation length was of high order while it was of low order for age at first calving.

The correlations between birth weight and gestation length revealed that environmental correlation was 0.4586 while the value for phenotypic correlation was  $0.0136 \pm 0.0523$

and genotypic correlation was  $-0.2389 \pm 0.2125$  (Table 24).

**TABLE : 23**  
**HERITABILITY ESTIMATS OF SOME TRAITS**  
**IN CAMELS**

S. No.	Traits	Heritability
1.	Birth weight	$0.5666 \pm 0.1940$
2.	Gestation length	$0.7035 \pm 0.2087$
3.	Age at first service	$0.3114 \pm 0.5597$
4.	Age at first calving	$0.1984 \pm 0.0737$

**TABLE : 24**  
**CORRELATION BETWEEN BIRTHWEIGHT AND**  
**GESTATION LENGTH**

Correlations	Estimated Value
Phenotypic	$0.0136 \pm 0.0523$
Genotypic	$-0.2389 \pm 0.2125$
Environmental	0.4586

#### 4.2.2.6 Copulation time

An analysis was conducted to study variability in the copulation time. The data were classified according to sire and season. The results indicated highly significant effect of these two factors (Table 25). The mean copulation time of 11 sires was studied (Table 26). The shortest mean copulation time by a sire was 2/36 minutes/seconds-m/s (sire No.1037). The monthwise mean copulation time ranged from 2/11 m/s in October to 7/04 m/s in February (Table 27). The overall copulation time was  $5/37 \pm 0.1249$  m/s.

During initial phase of reproductive season,

the camel males took lesser time while during the peak rutting season, i.e. during January and February, they took longer copulation time. The copulation time tended to reduce as the weather became warmer.

**TABLE : 25**  
**LEAST SQUARE ANALYSIS OF VARIANCE FOR**  
**FACTORS AFFECTING COPULATION**  
**TIME IN CAMELS**

Source of variation	df	MSS	F
Between sire	10	38.196	6.168**
Between season	5	78.81	12.726**
Error	381	6.19	

\*\* Significant at 1% level.

**TABLE : 26**  
**SIRE-WISE MEAN COPULATION**  
**TIME IN CAMELS**

S. No.	Sire No.	Mean copulation time (minutes/seconds)
1.	608	6/45
2.	912	7/12
3.	1048	5/53
4.	1037	9/21
5.	1047	6/07
6.	1012	7/40
7.	590	4/30
8.	40	3/50
9.	144	2/36
10.	1041	5/09
11.	587	5/15



**TABLE : 27**  
**MEAN COPULATION TIME IN**  
**DIFFERENT MONTHS**

S. No.	Month	Mean copulation time (minutes/seconds)
1.	October	2/11
2.	November	3/12
3.	December	4/16
4.	January	6/09
5.	February	7/04
6.	March	5/57

Overall Mean Copulation time = 5/37 ± 0.1249

#### 4.3 Project No.P.I.86/3-ICN/L-05/5220

Title: To develop suitable managemental practices for rearing camels.

(S.N. Tandon, U.K. Bissa, A.K. Rai, N.D. Khanna and H.K. Jindal).

Following is the information on management practices which were being followed at the initial stage of establishment of the NRCC and some improvements brought about therein. Information on behavioral ontogeny in camel calves from birth to 1 month of age and descent of testicles in the male calves is also presented.

##### 4.3.1 Breeding

There were 71 breedable females in the beginning of the year. Of these 65% were pregnant, 22.5% were with the calves and 12.5% empty. In all 32 females were provided natural services resulting in 26 confirmed pregnancies. A total of 78 services were given which amounted to 3 services per conception. Two pregnant animals were culled during the year. The calving rate during the year was 60%. 18 calves were born, of these, 7 were males and 11 were females. 10 calves were

born in January, 1 in February, 6 in March and 1 in April.

The sex ratio for male and female was 39:61. This was significantly different than last year's ratio (1985) which was 62.5:37.5. The sex ratio based on calvings of last 16 years was 54:46.

The average birth weight of calves was 39.4 ± 3.04 kg, gestation period 384.34 ± 20.21 days and the age at first calving (6 heifers) was 1681.17 ± 198.80 days.

##### 4.3.2 Average body weights

Table 28 provides average body weights age group-wise as on 1.1.1986 and 31.12.1986. Table 29 gives the information on average daily weight gain in growing calves in the age groups 0-6 months, 6-12 months, 1-2 years and 2-3 years. The comparison of body weights of the animals as on 5.7.1984 when the farm was taken over by the ICAR with weights as on 31.12.1986 reveals marked improvement due to changed managemental practices.

**TABLE : 29**  
**BODY WEIGHT GAIN PER DAY**  
**(FROM 1.1.1986 to 31.12.1986)**

Sl. No.	Age group	No. of observation	Average daily Wt. gain (grams)
1.	0-6 months	16	610
2.	6-12 months	29	381
3.	1-2 years	11	244
4.	2-3 years	17	236

##### 4.3.3 Mating

The breeding season in camel starts from October. It was observed that the rate of



**TABLE : 28**  
**AVERAGE BODY WEIGHTS OF BIKANERI CAMELS**

Age group	No. of observations	Average weight as on 5.7.1984 (kg)	No. of observation	Average wt. as on 31.12.1986 (kg)
0-6 months	—	—	—	—
6-12 months	19	114.4	31	243.0
1-2 years	19	191.4	9	317.3
2-3 years	13	249.0	10	376.7
3-4 years	14	294.8	9	517.4
4-5 years	15	411.2	7	527.1
5-6 years	8	440.0	9	546.2
6-7 years	14	493.0	11	606.0
7-8 years	6	539.3	5	607.8
8-9 years	6	552.6	16	647.2
9-10 years	2	579.0	4	686.5
Above 10 years	33	587.1	28	686.6



MATING IN CAMEL.

successful matings was comparatively lesser at the initial period of breeding season (Fig. 3). The males also came in optimum rut during mid November. It is presumed that perhaps, the conception rate improved after males had given a few initial services. The number of successful services increased when the female was provided two consecutive services from the same male within 24 hr. Two cases of congenital defects were recorded in 1984 where farm bred sires were used. Therefore, precaution was taken to avoid matings between relatives to check in-breeding.

#### 4.3.4 Hormonal Studies in she-camels.

A study was initiated to find out the levels of oestrogen and progesterone in the blood of adults and growing females. Blood samples were collected from 6 females for 2 days before matings, for 3 consecutive days after mating and thereafter on alternate days up to 2 months.

Another experiment was initiated to find out the effect of different levels of follicular stimulating hormone (FSH) on the initiation of fertile oestrus in young heifers. 9 heifers, 2-3

years of age were bled for 2 consecutive days in the mid December. The animals weighed on an average 338 kg (range 322-439 kg). These animals were injected intramuscularly with folligon (FSH predominant gonadotrophin) as per schedule given below:-

Group	Dose	Days	Total Dose
1	1,000 IU	2	2,000 IU
2	1,000 IU	3	3,000 IU
3	2,000 IU	2	4,000 IU
4	2,000 IU	3	6,000 IU

Group 1 had 3 animals and the rest had 2 animals each. The females showed interest in males after about 72 hr. The typical heat signs observed were, females coming closer to male, neck pressing and biting, mounting on other females. The animals were mated a week after the last injection.

The blood samples for hormones estimation, were collected daily from the day the Folligon treatment was started and continued up to 3 days after the service and thereafter, on alternate days for 20 days. The study is in progress.

#### 4.3.5 Housing

The herd in general was kept under open shed system. These camel sheds were provided with 1.5 m high barbed wire fencing and common manger of 16 m x 1.2 m x 0.6 m internal dimensions. The stocking rate was 30-35 m<sup>2</sup> per animal. Studs and those experimental animals which required individual feeding were, however, kept under roofed sheds separately. Each animal was provided with 30-35 m<sup>2</sup> space and a manger of 75 cm x 75 cm x 40 cm internal dimensions. Pregnant and recently calved animals were kept in a separate open type shed. Sick animals were housed in sick boxes of 5.75 m x 5.75 m dimension.



#### 4.3.6 Grazing

The animals were sent for grazing every day to the Centre's range land area with two attendants in service for each group of 60-70 animals.

#### 4.3.7 Feeding

The animals were provided with supplementary feeding as per recommended feeding schedule given in Table 30. The rate of feeding was reduced to half or one fourth as per the availability of fodder in the range land area during rainy season and thereafter.

**TABLE : 30**  
**RECOMMENDED SCALE OF RATION**  
**FOR CAMELS**

Sl. No.	Age group	Fodder (Kg/day)	Concentrate mixture (Kg/day)	Remarks
1.	0-6 months	2.5	0.5	Salt to be given
2.	6-12 months	2.5	0.5	at the rate
3.	1-2 years	5.0	1.0	of 30 g. to
4.	2-3 years	8.0	1.5	90 g. per
5.	Above 3 years	12.0	2.5	animal per
6.	Studs	14.0	3.0	day

The supplementary fodder consisted of Moth chara (*Phaseolus aconitifolius*), Guar phalgati (*Cyamopsis tetragonoloba*), Chana ki khar (*Cicer arietinum*) and Pala (*Zizyphus nummularis*). Generally mixed fodder was given to the animals. Animals were fed collectively. The green fodder was also given as per availability.

Concentrates @ 3 kg per day was given to the studs. The growing calves and lactating mothers were also given concentrate mixture according to their body weights and age.

#### 4.3.8 Watering

The animals were provided with clean drinking water *ad lib* twice a day in the morning and evening.

#### 4.3.9 Management of new born calves and their dams

Animals in advanced stage of pregnancy were not sent for grazing and kept in a separate shed. The new born calves were given antibiotic cover for three days and a single dose of vitamin A.

Proper health cover was given to prevent diarrhoea, constipation and respiratory infections. Antiseptic dressing was given to check naval infections. Some cases of agalactia were successfully treated by administering Leptaden.

#### 4.3.10 Behavioural pattern of camel calves from birth to four weeks of age

The study of behaviour of domestic animals is important from the point of view of proper upkeep of animals and their variety of uses.

##### (1) At birth

The calf in a normal parturition assumed sternal position with head slightly dropping towards the ground. The eyes were generally covered by mucous membrane and opened up after the calf was born. The dam nosed and smelled the calf again and again but did not lick the young one (Fig. 4).

The new born calf made repeated attempts to stand up until finally the hind legs flexed sufficiently to support the calf. On an average, it took about 35 to 50 min for the calf to stand (range 20 to 90 min). The heart rate at birth was about 130-140/min and after 1 hr it reduced to 100-120/min. The rectal temperature at the time of birth was 36-38°C and became 37°-38°C after one hour. The rectal temperature stabilised between 36.5° to 38°C at about 1 month of age depending up on ambient temperature. Similarly, respiration rate at the time of birth was found to be





DAM WITH NEWLY BORN CALF.

30-42/min and became 28-36/min after one hr and 18-22/min at 1 month of age. At birth, the pulse rate was about 116-128/min and got stabilised to 65-75/min after 1 hr postpartum.

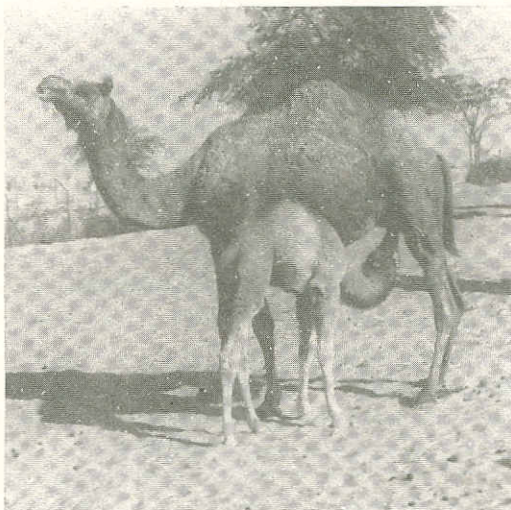
### (2) Locomotion

Shortly after birth, calf made efforts to stand and took about 30-60 min to stand. At the initial instance the movement of calf was unsteady with staggering gait, shifting frequently to maintain balance and kept forelegs forward with slopes and hind legs stretched behind the forelegs.

The movement became normal after 10-12 hr and the calf started following the mother by walking by its side or behind. The first urination and defecation was noted between 60-80 min. and 10-45 min postpartum, respectively.

### (3) Suckling - Maternal bond

Initially, the calf searched the teats, licked and nosed around the chest, abdomen, between the forelegs until it reached the right place (Fig. 5).



CLAF SUCKLING THE DAM.

In general, pluriparous females showed immediate maternal instinct as compared to she-camels calved for the first time. It was generally a practice to encourage the dams to smell the new born calf and foetal membranes immediately after birth so as to initiate maternal instinct. If the calf was not allowed to be with the mother in the first hour after parturition, the maternal attraction was not readily displayed. In such cases when the dams refused permission to the calf to suckle, the corrective measure adopted was to keep dam under mild sedatives and house the dam with the calf in a separate box and handfeeding was resorted to if the dam did not permit the calf to suckle.

The camel calf generally suckled between 60-90 min postpartum. The time interval for suckling was 1-3 hr. The period of interval between sucklings became more, i.e. 3-6 hr as



the calf advanced in age. The teats heavy with milk or larger in size were generally left in the initial stages and there was tendency to suck the same teat on same side again and again. As the calf gathered strength, the milk was sucked from all the four teats.

#### (4) Investigative behaviour and play

At the end of one hour after birth, the camel calf showed some basic abilities in righting itself, investigative behaviour, standing, moving about, care seeking, agnostic withdrawal when restrained or approached.

The play in the camel calves consisted of running single or in groups. While running, the calf threw hind legs backwards or jumping, chasing, pushing, nipping with frisky movements towards and away from mother. As the calf grew, the interaction with other fellow calves became more common.

**(5) Sleep** Camel calves were observed to be poly-phasic in their rest, play and sleep behaviour. Brief naps, then play or period of activity followed by sleep was common feature in the early life. The posture of sleep was that of lateral recumbency. The mother sat or stood guarding the calf while it slept. The direction of mother's sitting was generally such that it protected the calf from high wind or sunlight. As the calf grew, it also relaxed at times squatting on chest pad by the side of dam.

#### 4.3.11 Descent of testes in camel calves

The testes in camels are externally not palpable at birth. The scrotal sac is also not developed at birth, however, there is a median raphae just below anus where scrotal sac developed in due course of development (Fig. 6). Studies on 12 calves made on the development of the scrotal sac and descent of testes indicated that the development of the scrotum took place approximately  $86.83 \pm 16$  days after birth (Table 31).



SCROTAL FOLD AT ABOUT ONE MONTH OF AGE.

The descent of testes did not show any uniform trend (Table 32). In 50% of total animals which were included in the present study, both the testes descended almost together and the average time taken was  $170.66 \pm 23$ , the range being 130 to 197 days.

In 25% cases, the left testicle descended first and in such animals, the time taken for descent of both the testicles was  $271.33 \pm 29.18$  days. In rest 25% cases, the right testicle descended first, the average time taken for the descent of both the testicles in this group was  $225.00 \pm 44.50$  days. The average time taken for the descent of right testicle was  $193.08 \pm 54.70$  days (range 130 to 296) and for the left testicle the average was  $195.17 \pm 37.43$  days (range - 130 to 276).

There was no uniform pattern in respect of time taken for development of scrotal pouch,

**TABLE : 31**  
**DEVELOPMENT OF SCROTAL POUCH IN**  
**CAMEL CALVES (days)**

Sl. No.	Brand No.	Development of scrotal pouch
1.	153	80
2.	155	71
3.	159	102
4.	164	95
5.	166	104
6.	167	75
7.	168	105
8.	172	94
9.	173	106
10.	182	78
11.	183	66
12.	185	66
Average		86.83±15.74

descent of testicles and age of the calf. On the other hand there was strong evidence that descent of testicles was completed in the majority of calves during summer months of May and June with the result that calves born

later in the breeding season had taken less time for scrotal development and descent of testicles.

**TABLE : 32**  
**DESCENT OF TESTES IN CAMEL**  
**CALVES (days)**

S.No	Brand No.	Descent of testes		
		Right testicle alone	Left testicle alone	Both testicles simultaneously
1.	153	296	243	—
2.	155	—	—	165
3.	159	—	—	169
4.	164	214	276	—
5.	166	250	209	—
6.	167	—	—	187
7.	168	—	—	197
8.	172	268	191	—
9.	173	—	—	176
10.	182	133	205	—
11.	183	—	—	130
12.	185	132	194	—
Average		215.5	219.66	170.66

## 5.

### LAND RESOURCES AND FODDER DEVELOPMENT

#### 5.1. Land and Range Resources

The farm land spreads over an area of about 824 hectares. The land form is undulated alluvial with interdunal plains. Sand dunes of

varying size both parabolic and longitudinal are present. The soil at the farm is predominantly sandy, light textured, loose/weak structured and calcareous. The



regional elevation of the area above mean sea level in about 234.9 m.

**5.2** The climate of the Bikaner District is arid characterised by large extremes of temperature, erratic rainfall and high evaporation. The mean rain fall is 247 mm. The year to year variability in the rainfall is very high. During the summer months the temperature exceeds 40°C reaching upto or above 45°C. During the summer, dry hot winds and dust storms occur frequently. In winter, the temperature may fall upto 2°C with probability of occurrence of frost. The mean wind velocity for the year is 6.7 km/hr, range 2.6 to 13.5 km/hr. The average annual humidity is 54%, range 30 to 70%.

The farm ranges are desert thorn forest. The total plant cover is very poor, i.e. 8-10% only. There is significant variation in fodder availability, the peak being August to November.

**5.3 Development work of the area undertaken during the year is detailed below:-**

### **5.3.1 Development of Silvipasture**

Silvi pastoral development was undertaken in 150 ha. About 6000 plants of different species were planted. Due to the extreme drought conditions and lack of irrigation facilities the survival rate of plants was not very good. An area of about 10 ha is being intensively developed with the plantation of *Zizyphus*.

### **5.3.2 Natural Pasture and Range land Management**

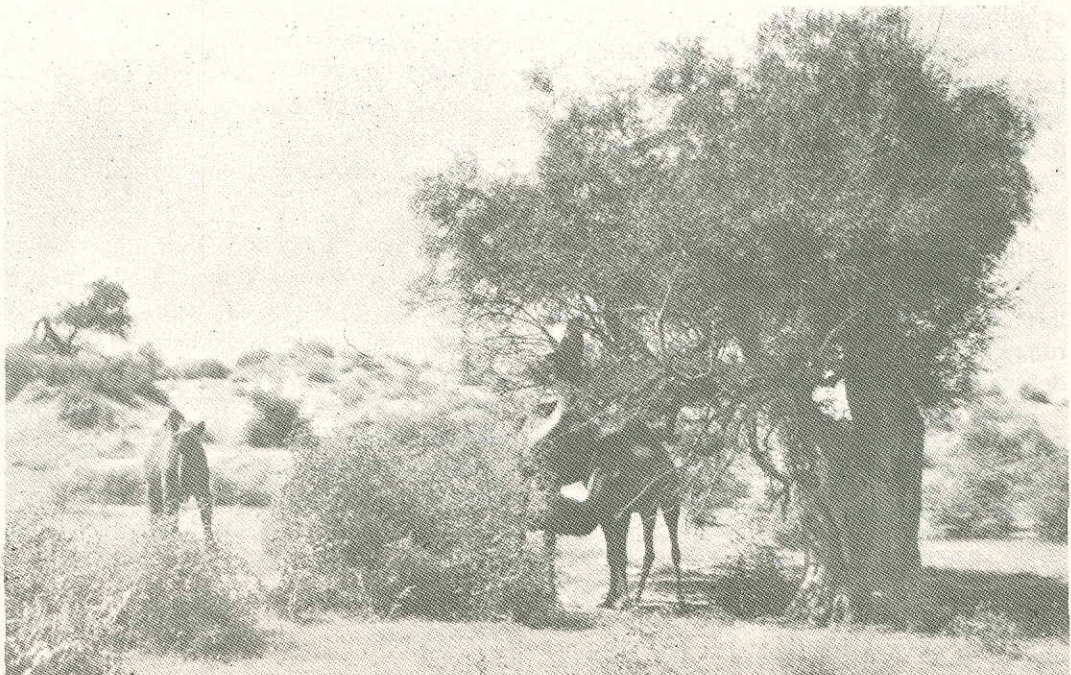
Action was taken to improve the natural pastures and rangeland management by taking proper measures. An area of about 2 ha was developed by intensive cultivation of *Cenchrus* and *Lasiurus* species of grasses (Fig. 7).

### **5.3.3 Fodder Cultivation**

About 24 ha of land was developed for rainfed cultivation and was sown with moth (*Phaseolus aconitifolius*) and guar (*Cyamopsis tetragonaloba*).

An area of about 1 ha of land was put under irrigated cultivation where *Medicago sativa*, *Brassica campestris* and *Pennisetum typhoides* etc., were sown.

CAMELS BROWZING IN THE RANGE LAND AREA.





### 5.3.4 Sand dune Rehabilitation

Sand dunes covering about 2 ha of land was rehabilitated by planting drought resistant hardy species, e.g., *Acacia tortilis*, *Lasiurus sindicus*, *Calligonum polygonoides*.

5.3.5 Necessary action was taken to develop our own nursery for top feed plants, perennial grasses and ornamental plants. Steps were initiated for farm development, fencing the range land in phases, development of farm roads and development of garden etc.

## 6.

### INTER-INSTITUTIONAL COLLABORATION

The following are brief summaries of the work done at different Universities/Institutions who had utilized animals/facilities of NRCC, Bikaner.

#### 6.1 Hormonal studies in camels

Report by Dr. S.P. Agarwal, Professor, Department of Veterinary Physiology, Haryana Agriculture University, Hissar.

Blood samples from 16 male camels, 1 to 16 years old were collected during rutting and non-rutting seasons. Sera were analysed for testosterone, progesterone, oestradiol, thyroxine ( $T_4$ ) and triiodothyronine ( $T_3$ ) using radio-immunoassays (RIA) technique. The data revealed that the levels of testosterone, progesterone and oestradiol increased with age particularly during breeding season while there was no spectacular effect of age on thyroid hormone levels. Season had a marked effect on hormone levels.

The steroid hormones were significantly higher during rutting season whereas, the thyroid hormones were higher during non-rutting season but  $T_4:T_3$  ratio was almost double during rutting season.

Blood samples from 12 pregnant camels were collected at monthly interval commencing from 60 days post-service till last month of gestation. The average length of

gestation was 398.4 and 372.0 days in camels carrying male and female foetus, respectively, with an overall mean of  $383 \pm 9$  days. Sera were analysed for oestradiol-17 beta, progesterone,  $T_4$  and  $T_3$  by radioimmunoassay. The oestradiol levels progressively increased from a basal level of 20 pg/ml at 60 to 120 days of pregnancy to about 450 pg/ml at final stages of gestation. The camel bearing male foetus had relatively lower estradiol concentration ( $76.5 \pm 10.8$  pg/ml) than those carrying female foetus ( $112.3 \pm 19.6$  pg/ml). The progesterone levels were somewhat higher (4 to 5 ng/ml) during early and terminal stages of pregnancy with lowest value ( $2.5 \pm 0.27$  ng/ml) at 271 to 300 days of gestation. On an average, camels carrying male foetus had higher progesterone levels ( $5.13 \pm 0.69$  ng/ml) than those carrying female foetus ( $4.45 \pm 0.28$ ).

The data suggested that the steroid hormone levels are influenced by the stage of pregnancy and sex of foetus. Cases of unsuccessful services and unnoticed abortions could be identified. The thyroid hormone levels were somewhat higher during early stages of pregnancy. However, there was no significant effect of age of dam or sex of foetus on thyroid status of the animal.

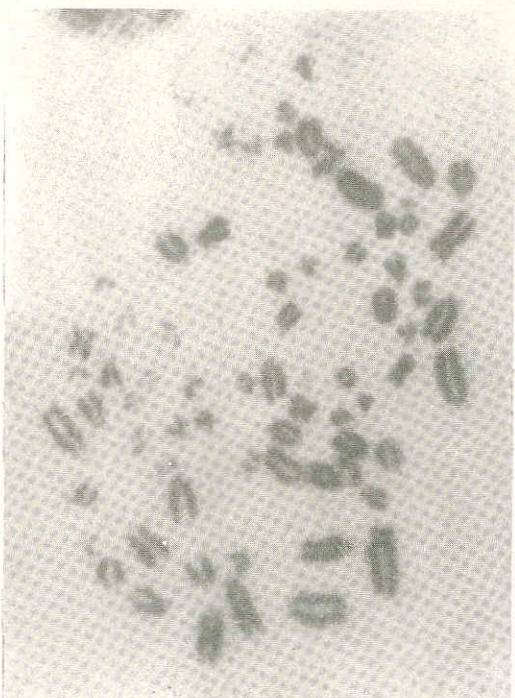


## 6.2 Cytogenetics studies in camels

Report by Dr. R. Sahai, Scientist S-3, National Institute of Animal Genetics, Karnal.

Blood samples of 12 males and 13 females of Bikaneri breed were collected from National Research Centres on Camel, Jorbeer Bikaner.

The somatic chromosome complement of Bikaneri breed was found to be 74 (fig. 8). The karyotype of the dromedarian camel consists of 1 pair of metacentric, 5 pairs of submetacentric and 30 pairs of acrocentric chromosomes.



CHROMOSOMES IN METAPHASE STAGE OF A MALE CAMEL.

The X and Y sex chromosomes have distinctly different morphological attributes. The X is a large metacentric and Y is small acrocentric. The chromosome of the *Camelus dromedarius* showed C positive bands indicating the heterochromatic (Constitutive)

region. The G bands were also quite distinct. The localisation and intensity of constitutive heterochromatin was screened along with the characterisation of the A-T rich region of the chromosomes. The karyotype of the animals were prepared. The localisation of the nucleolus organiser region of the chromosome are currently in progress.

## 6.3 Subabul Feeding - Preliminary observations

Report by - Dr. G.N. Mathur, Pool Officer, College of Veterinary and animal Science, Bikaner.

This experiment was divided in two stages viz. (i) to observe the influence of subabul feeding on acceptability and palatability, body weight changes in camels, general health and vitality and (ii) to conduct digestion-metabolism trial with subabul and observe the biological responses such as the skin and hair follicle structure and serum level of mimosine.

For the preliminary experiment, 2 male camels of same age and similar physical conformation were selected. The subabul was introduced into the regular feed of mothchara and slowly the proportion of subabul in the mixture was raised up to 30%.

Once the subabul was incorporated in the diet, the feeding of concentrates was completely stopped.

The animals were offered feed *ad lib* and feed consumption was recorded. The palatability score were also recorded. From the preliminary observation it was concluded that subabul was well accepted by the camel. The body weights were recorded every month. There was normal increase in body weights. The general health of camels remained normal throughout the period and animals invariably showed good drive towards the feed.



10 male camels of 2-3 year of age and 340 ± 20 kg body weights were put under feeding trials containing subabul as a supplementary ingredient for approx. 4 weeks. The experiment is in progress.

6.4 One doctoral candidate of Dungar College, Bikaner (Rajasthan University), One

M.V.Sc. student from Department of Veterinary Physiology, College of Veterinary and animal Science, Bikaner and 1 M.V.Sc. Student, College of Veterinary & Animal Science, Mathura were provided blood samples and other material for research projects towards partial fulfilment of requirements for their degrees.

## 7.

### STAFF POSITION

The details of staff position in various categories during 1986 is detailed below:-

#### 1 Research Management

Project Director Dr. N.D. Khanna

#### 2 Scientific

i) Scientist S-3 (Animal Physiology) Dr. A.K. Rai 22.07.1986\*

ii) Scientist S-1 (Animal Genetics & Breeding) Dr. S.N. Tandon

iii) Scientist S-1 (Animal Bio-chemistry) Dr. H.K. Jindal 28.07.1986\*

#### 3 Technical

i) Farm Manager(T-6) Sh. R.D. Prasad

ii) Vety. Officer (T-6) Dr. U.K. Bissa

iii) T-2 (Livestock) Two posts Filled

#### 4 Administrative

i) Asst. Adm. Officer Sh. Santokh singh 04.12. 1986\*

ii) Asst. Accounts Officer Sh. G.R. Bhansali

iii) Superintendent Sh. Balwant Rai

iv) Jr. Stenographer One post Filled

v) Sr. Clerk One post Filled

vi) Jr. Clerk One post Filled

#### 5 Supporting

SSG-1 Eleven post Filled

#### 6 Auxiliary

Vehicle Driver Two post Filled

\* Date of joining NRCC during 1986.

\*\* One post of Administrative Officer was temporarily transferred to NRCC from IVRI, Izatnagar. Shri Nand Kishore was posted against this post. The post has since been transferred back alongwith the incumbent.

8.

## **SPORTS AND EXTRA CURRICULAR ACTIVITIES**

The Centre has a staff club. Opportunities were provided for sports and extra-curricular activities.

Games and get together were organized on

different occasions. The centre also participated in different events in the ICAR Zonal Sports meet held at Jodhpur.

9.

## **VISITORS**

During the year 1986 about 3200 visitor came to NRCC, Bikaner. These included

prominent citizens, scientists, educationists, administrators, general visitors and tourists.

10.

## **FINANCIAL STATEMENT**

The detailed budget allocations and expenditure during 1986-87 and allocation for

1987-88 are presented in table 33.

11.

## **PUBLICATIONS**

- i Annual Report, NRCC, 1985, pages: 24.
- ii Brochure, NRCC, (Hindi & English) Pages:

- 16.
- iii Agarwal, S.P., N.D. Khanna, V.K. Agarwal

**TABLE : 33**  
**STATEMENT OF BUDGET AND EXPENDITURE (Rs. in lakhs)**

Sl.No.	Head of account	PLAN (1986-87)		NON PLAN (1986-87)		1987-88	
		Bdgt. Est.	Expr.	Bdgt. Est.	Expr.	Bdgt. Est. (PLAN)	Bdgt. Est. (NON-PLAN)
1.	Establishment charges	5.11	2.03	4.70	3.67	3.25	6.90
2.	Travelling Exp.	0.10	0.10	0.25	0.25	0.20	0.25
3.	Leave, Salary, Pension & Provident Fund Contribution	0.05	—	—	—	—	—
4.	Other charges	4.00	4.72	7.25	8.57	3.00	6.25
5.	Equipment	4.74	6.99	—	1.21	5.00	—
6.	Works	8.00	8.16	2.00	—	8.55	—
TOTAL		22.00	22.00	14.20	13.70	20.00	13.40



- and P.K. Dwaraknath, 1986. Thyroidal status of male camel (*Camelus dromedarius*) during breeding and non-breeding seasons. Indian J. Anim. Sci. 56(10) 1036-1038.
- iv Khanna, N.D. 1986. Camel as milch animal. Indian Farming 36 (5) 37-40.
- v Khanna, N.D. 1986. Camel, the model desert animal. Indian Farming 36(7) 31-35.

#### Submitted for Publication

- i. Agarwal, S.P., N.D. Khanna, V.K. Agarwal and P.K. Dwaraknath. Profiles of steroid hormones in male camel (*Camelus dromedarius*). Indian J. Anim. Sci. Vol. 57.
- ii. Kohli, I.S. and N.D. Khanna. Agalactia in she-camel and its response to leptaden therapy. Indian Vet. J.
- iii. Khanna, N.D. Camel, the work animal. Indian Farming
- iv. Khanna, N.D. and R.D. Prasad. Oont marusthal ka ek adarsh Pashu (Hindi), Kheti
- v Tandon, S.N., U.K. Bissa and N.D. Khanna. Camel meat, present status and future prospects. Ann. arid Zone CAZRI, Jodhpur).

## 12.

### ANNEXURE

**Camel Hair:** Summary of work done on camel hair, its fibre and yarn properties by N.P. Gupta, A K Pokharna, R.K. Arora and S. Sugumar, at Central sheep and Wool Research Institute, Avikanagar.

Camel hair fibre was procured from National Research Centre on Camel, Bikaner. Four grades viz., Light brown, Brown, whitish & Black were made according to colour. The fineness of camel hair ranged between 26.00 to 38.0  $\mu$ . The co-efficient of variation of the fibre fineness ranged between 55.8 and 60.4% indicating very high variability between the fibres. The proportion of medullated fibres was also very high in the camel hair which ranged between 53.5 to 78.0% contributing to high variability.

Light brown and brown coloured camel hair had lower percentage of hairy fibres viz., 38.7 and 37.7% respectively. It was, however,

higher in white and black camel hair, i.e. 50.3 and 54.4% respectively.

The length increased with the decrease in fineness.

The light brown and brown coloured fibres had a fibre length of 51.3 and 59.7 mm with 27.3% and 27.5% co-efficient of variation, respectively. The fibre length of coarser whitish and black coloured camel hairs were slightly better, which were 63.1 mm and 67.3 mm respectively. The vegetable matter content of the camel hair ranged between 4 and 5.5%. The initial pH was 7.02 indicating mild alkalinity. The single fibre tenacity of the camel hair was better as compared to wool. The camel hairs exhibited the tenacity of 14.75, 19.35, 16.76 and 16.96 g/tex for light brown, brown whitish and black types respectively. The wet strength loss in camel hair was lower than wool which generally showed a wet

strength loss of over 50% compared to dry strength.

The camel hair-wool-blended slivers exhibited highest sliver strength of 19.0 and 13.0 g although twist of the sliver was totally absent. 40% camel hair blend with 60% silk and 60% Polyester exhibited a sliver strength of 10.12 and 11.50 g. The strength of camel hair yarns were 1.63, 1.85 and 2.24 g/tex for light brown, brown and black colour fibres, respectively. Despite higher cohesive properties of camel hair-wool blends, the yarn strength was 3.08 and 2.68 g/tex for 60/40 and 40/60 camel hair wool blended yarns, respectively.

The strength of camel hair blended yarns with polyester staple fibre, PFY waste staple and silk wastes were much higher as compared to camel hair and its blended yarn with wool. The elongation properties of the camel hair and their blends had not shown significant differences. A maximum of 18.6% elongation at break was noted in 60/40 camel hair-wool blended yarn. The elongation at break of all other blends and pure camel hair yarns were found to be in the region of 12 to 16% except the 40/60 camel hair polyester blends. All the blended yarns were comparable to all wool yarns.

## NATIONAL RESEARCH CENTRE ON CAMEL

The National Research Centre on Camel is located in the Jorbeer area at a distance of about 10 km from Bikaner city. The area is arid undulating desert with vast ranges of sand dunes. The soil is mostly loose and sandy. The climate is dry with 58-60% average yearly

humidity. The average yearly rainfall is around 26.5 cm. The temperature varies from 2° to 46°C during the year. The geographical location of the area is 28.3° North latitude and 73.5° East longitude at MSL of 234.84 m.

**TELEGRAM** : CAMCENTRE, BIKANER.

**TELEPHONE** : OFFICE : 5489  
FARM : 5683  
RESIDENCE : 5152

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BIKANER : 334 001 (RAJASTHAN).

**PROJECT DIRECTOR** : DR. N.D. KHANNA.

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