



ANNUAL REPORT 1994 - 95



**NATIONAL RESEARCH CENTRE ON CAMEL
BIKANER**



Camel Polo team of N.R.C. on Camel.
(Camel Festival, Bikaner 1994)



Exhibition stall of N.R.C. on Camel.
(Camel Festival, Bikaner, 1994)



ANNUAL REPORT 1994-95



ESTD. 5TH JULY, 1984

PROJECT DIRECTOR : DR. N.D. KHANNA

**NATIONAL RESEARCH CENTRE ON CAMEL
BIKANER**

CONTENTS

	Page No.
1. PREFATORY REMARKS	3
2. STAFF POSITION	5
3. FINANCIAL STATEMENT	8
4. CAMEL HEALTH MANAGEMENT	9
5. RANGELAND MANAGEMENT	13
6. RESEARCH PROJECTS	14
6.1 To study work standards in camel and to associate work standards with physical, physiological and biochemical parameters	14
6.2 Studies on quantitative and qualitative genetic parameters in Indian camels	18
6.3 To develop suitable management practices for rearing camels	29
6.4 Studies on camel nutrition	31
6.5 Studies on camel reproduction	34
7. SCHEMES / PROJECTS	39
8. INTER INSTITUTIONAL COLLABORATION	45
9. PUBLICATIONS	46
10. OTHER ACTIVITIES	48
11. MANAGEMENT COMMITTEE OF NATIONAL RESEARCH CENTRE ON CAMEL, BIKANER.	49
12. PEN SKETCH OF NEW ENTRANTS	50
13. VISITORS	50
14. SARANSH	51

1.

PREFATORY REMARKS

Ecologically, The camel is very well adapted and suited to life in the arid lands. It can tolerate extreme dry and hot weather and can move to much longer distances under extreme scarcity of water and fodder as compared to any other domestic livestock. It is environmentally friendly and causes minimum damage to scanty vegetation in the dry lands. Camel can sustain on coarse spiky fodder which is generally not consumed by other domestic animals, thus does not come in much competition with other domestic animals for food and space. It can provide milk of very high nutritive value almost all the year round and bioenergy for agriculture and transport in quantities which are economically viable. However, changing social and economic scenario in the present days are causing extensive strain on the traditional camel rearing. It is a basic question for researchers to answer. Therefore, it is important to focus greater attention to assess the kind of support required for existing camel production systems and such alternatives are to be formulated which do not risk damaging and destroying well adapted camel rearing systems which are in vogue now. Although camel is regarded considerably resistant to drought and fairly constant resource to substantiate in the dry land fragile ecosystem, yet slow reproduction and low productivity of family herds causing risk linked situation. There is shortage and deterioration of range land areas where camels used to be raised on almost zero input. Thus camel production will be going to be comparatively much more costlier and labour intensive. It is therefore important to develop such production systems which are economically viable. Two basic problems when deeper insight of perspective planning connected with sustainable camel production sought are :

- i. Lack of basic data
- ii. Lack of financial support for research and development to uphold long term perspective plan for camel improvement.

The comprehensive sustainable camel development programmes have to base on basic/fundamental model consisting of land, people and animals.

People involved with camel rearing have to be studied from social and cultural

dimensions and their traditional knowledge, economics and ecological security have to be ensured. The land on which camel rearing is undertaken has to be studied for detailed vegetative resources, seasonal fluctuation, carrying capacity, alternative capacity, extensive farming versus animal rearing and proper land and water management. The ecosocial researches have to be planned so that low natural resources are utilized at the grass root level for optimum sustainability.

For undertaking camel development programmes, participatory approach with the camel rearing societies have to be adopted. It has to be recognised that herders and farmers are very skilled at making the best of their resources, investing time and efforts in their vocation. A flexible approach to base interventions on the skills and resources available locally, awareness raising, need based programmes and joint analysis and reflections are likely to prove successful in achieving objectives of economic uplift of camel and for camel improvement.

N.D. KHANNA
PROJECT DIRECTOR

2.

STAFF POSITION

The sanctioned strength in different categories at this centre was 59 out of which 57 staff members were in position during the year under report :

Table 1.
Staff Position during 1994-1995

Staff categories	Positions		
	Sanctioned posts	Filled	Vacant
R.M.P.	1	1	—
Scientific	8	8	—
Technical			
Category I	4	3	1
Category II	3	3	—
Category III	3	3	—
Administrative	10	10	—
Auxiliary	8	7	1
Supporting	22	22	—
Total	59	57	2

Names of the staff members in position during 1994-1995

Project Director : Dr. N.D. Khanna

Scientific

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
 (Joined on 1.8.94)
 Scientist (Animal Biochemistry) : Dr. R.S. Yadav
 (Joined on 23.8.94)

Technical

Senior Veterinary officer, T-7 : Dr. U.K. Bissa
 Livestock Farm Supdt. T-6 : Dr. N. Sharma
 Farm Manager (Agril), T-6 : Sh. Ram Kumar
 Veterinary officer, T-6 : Vacant
 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

Administrative

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

Stenographer	:	Sh. Ram Kumar
Junior Stenographer	:	Sh. Harpal Singh (Joined on 27.1.95)
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
Tube Well Operator	:	Sh. Suraj Bhan Singh

Supporting

SSG I to IV : 22

3.

FINANCIAL STATEMENT

During the year 1994-95, Rs. 90.00 lakhs were sanctioned under Plan and Rs. 32.00 lakhs under Non Plan. The expenditure during the year under plan was 89.98 lakhs and under Non Plan was Rs. 31.99 lakhs, the details are provided in the Table-2.

Table 2.
Statement of expenditure

		(Rs. in Lakhs)							
		1993 - 94				1994 - 95			
S.N.	Heads of Accounts	Plan		Non Plan		Plan		Non Plan	
		Budget	Exp.	Budget	Exp.	Budget	Exp.	Budget	Exp.
1.	Estt. Charges	3.00	—	28.69	28.61	—	—	28.19	27.48
2.	T.A.	0.10	0.10	0.40	0.40	0.20	0.10	0.40	0.40
3.	Other Charge (Including equipment)	40.00	42.39	4.01	4.09	44.80	53.76	3.41	4.11
4.	Works	37.50	37.57	0.40	0.40	45.00	36.12	—	—
Total		80.60	80.06	33.50	33.50	90.00	89.98	32.00	31.99

CAMEL HEALTH MANAGEMENT

4.1 Clinical cases

During the period 179 cases belonging to camel farm of National Research Centre on Camel, Bikaner were treated for various ailments viz. digestive disorders (23), reproductive (4), cardiovascular (1), respiratory disorders (5), surgical affections including injuries and wounds (49), skin affections (49), contagious ecthyma (22) and others (26). The age, sex and breed wise morbidity is presented in table 3.

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 anthelmintic twice a year before rains and after rains.
- (iii) For prophylactic measures against surra, quinapyramine sulphate and chloride salts were injected twice a year in the month of June-July and Nov.-Dec.
- (iv) Pregnant females and new born calves were given vit. A as a prophylactic measure against hypovitaminosis A.

4.3 Screening of camels for worm load, Trypanosomiasis and Brucellosis

The faecal samples of 60 camels were randomly screened and the worm load (epg) was found within safe limit. The camel herd was screened for Trypanosomiasis by making blood slides. No positive case was observed. The herd was also screened for Brucellosis by Brucella abortus coloured antigen and plain antigen. No positive case was recorded.

4.4 Mortality

The specific death rate (SDR%) at the N.R.C.C. was 8.07% during the year. The breed wise mortality in Bikaneri, Kachchhi, Jaisalmeri and crossbred (Arab X Bikaner) was 7.48%, 13.75%, 3.78% and 13.70% respectively. Age, sex and breed wise mortality per 1000 camel days per day have been provided in Tables 4 & 5.

TABLE 3
AGE, SEX AND BREED WISE MORBIDITY (1994-95)

		Sex		Age Group			Breed				Total	Percent morbidity
		Male	Female	0-3 Month	3-36 Months	Above 3 Years	Bikaneri	Jaisalmeri	Kachhi	Cross bred		
DIGESTIVE SYSTEM												
1.	i. Enteritis	7	7	5	7	2	6	3	4	1	14	7.82
	ii. Simple indigestion	1	4	-	2	3	-	3	2	-	5	2.79
	iii. Impaction	2	2	-	1	3	2	1	1	-	4	2.23
RESPIRATORY SYSTEM												
2.	i. URI	1	4	1	-	4	1	2	-	2	5	2.79
CARDIO - VASCULAR SYSTEM												
3.	i. Anaemia & Anasarca	-	1	-	1	-	1	-	-	-	1	0.55
REPRODUCTIVE SYSTEM												
4.	i. Metritis	-	1	-	-	1	1	-	-	-	1	0.55
	ii. Abortions	-	2	-	-	2	1	1	-	-	2	1.11
	iii. Retention of placenta	-	1	-	-	1	1	-	-	-	1	0.55
SURGICAL AFFECTIONS												
5.	i. Wounds & injuries	21	10	-	8	23	13	13	4	1	31	17.31
	ii. Sprain	6	4	-	-	10	3	7	-	-	10	5.58
	iii. Arthritis	4	-	-	-	4	2	2	-	-	4	2.23
	iv. Torticollis	1	-	-	1	-	1	-	-	-	1	0.55
	v. Fracture	1	-	-	-	1	-	1	-	-	1	0.55
	vi. Peritonitis	-	1	-	-	1	1	-	-	-	1	0.55
	vii. Excision of soft palate	1	-	-	-	1	1	-	-	-	1	0.55
SKIN AFFECTIONS												
6.	i. Allergic dermatitis	2	-	-	-	2	1	1	-	-	2	1.11
	ii. Mange	14	33	-	10	37	21	12	12	2	47	26.25
OTHERS												
7.	i. Contageous ecthyma	15	7	-	22	-	13	7	2	-	22	12.29
	ii. Heat stroke	4	1	-	5	-	2	2	1	-	5	2.79
	iii. Mastitis	-	1	-	-	1	1	-	-	-	1	0.55
	iv. Agalactia	-	1	-	-	1	1	-	-	-	1	0.55
	v. Corneal opacity	1	1	-	1	1	-	2	-	-	2	1.11
	vi. General debility	1	1	-	2	-	1	1	-	-	2	1.11
	vii. Pyrexia	9	6	1	5	9	9	1	4	1	15	8.38
	Total	91	88	7	65	107	83	59	30	7	179	

4.5. Incidence of Brucellosis in farm and near by villages

The serum samples (161) were collected from the camels of N.R.C.C. and near by villages viz. Tanwarwala, Bajju, Gadwala and Amarpura the test was performed with coloured antigen and plain antigen of *Brucella abortus* using standard plate agglutination and tube agglutination test respectively. One animal from Amarpura village showed presence of 80 IU agglutinin titre while 3 other animals (2 from Amarpura and 1 from Tanwarwala) showed presence of 20 IU agglutinin titre in STAT. None of the farm animals showed any agglutination titre. There was history of abortions in camels along with other ruminants in village Amarpura. The cause of abortions was believed to be grazing of a local grass by the villagers. But this study using the limited available diagnostic tools with us, provides a positive indication of the presence of Brucellosis among camels.

Table 4.
Age and sex wise mortality (1994-95)

Age Group	Sex	Camel Days	No. of Animals died	Mortality per 1000 camel days/day
0-3 months	M	1461	03	2.0533
	F	760	03	3.9474
	Pooled	2221	06	2.7015
3 months to 3 yrs	M	13040	03	0.2301
	F	6237	04	0.6413
	Pooled	19277	07	0.3631
Above 3 years	M	20466	04	0.1954
	F	49257	05	0.1015
	Pooled	69723	09	0.1291
Overall	M	34967	10	0.2859
	F	56254	12	0.2133
	Pooled	91221	22	0.2412

Table 5.
Breed wise mortality (1994-95)

Breed	Camel days	No of animals died	Mortality/ 1000 camel days/day	SDR%
Bikaneri	41567	9	0.2165	7.48%
Jaisalmeri	23926	3	0.1254	3.78%
Kachchhi	20642	8	0.3876	13.75%
Arab Cross	5086	2	0.3932	13.70%
Pooled	91221	22	0.2412	8.07%

5.

RANGE LAND MANAGEMENT

Out of the total farm area of 824 ha about 40 ha was sown as rainfed crop of Guar (*Cyamopsis tetragonoloba*) and was offered for camel grazing.

Mixed crops of berseem + mustard and lucerne + mustard during winter and bajra in summer were cultivated in 4 ha area under irrigated condition. These crops were utilized as green supplementation to the stall fed camels.

About 3000 plants of Ber (*Zizyphus nummularia*), Ardu (*Ailantus excelsa*), Neem (*Azadirachta indica*), Isareli babool (*Acacia tortilis*), Vilayati babool (*Prosopis juliflora*) and Sares (*Albizia lebbek*) etc. were planted in the rangeland area.

For maintenance of about 20,000 plants, various operations like providing of insecticide, fertiliser/manure, water and earth work with proper pruning etc. were routinely conducted.

About 3 ha area in paddock No. 1 was transplanted with bule panic (*Panicum antidotale*) grass. *Panicum antidotale*, *Lasiurus indicus* and *Cenchrus ciliaris* were maintained in 20 ha and used for camel grazing.

Road maintenance : Kachcha roads along the boundary and from paddock no. 1 to paddock no. 3 were maintained from time to time for easy watch and ward and other transport work.

The farm area supported partial supplementary maintenance of about 200 camels round the year for semi-extensive management system.

6.

RESEARCH PROJECTS

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

Project code	: P.I. 86/1-ICN/L-50/5220
Project Leader	: A.K. Rai
Associates	: Raghvendar Singh
	: N.D. Khanna

6.1.1. Investigation on fatigue index in Indian camels :

Two trials were conducted on seven male camels aged 5-12 years. The observations on behaviour, physical and physiological responses were recorded during the course of carting @ 2.8 kg/kg bwt. The blood samples were collected during different hours of carting for the analyses of pH, pO₂ and pCO₂ and biochemical attributes.

During the 1st hour of carting all the camels defecated and micturated frequently and their frequency increased with the progress of time of carting. The watery ocular discharge and frothing were the other two symptoms observed during the first hour. There was scanty discharge from the poll gland which increased to profuse discharge during 3rd hr. onwards.

The camels showed reluctance to move further on completion of third hour, had tendency to sit during fourth hour and beyond. The in-coordination of movements and muscular tremors appeared on completion of fourth hour.

The increase in respiratory frequency after 2-3 hr. carting was 1.6 to 2.7 folds and it was 2.8 to 5.2 folds between 3.5 to 5.5 hr. In general the respiratory frequency increased with the hours of carting (Table 6). There was not much variation in the increase of pulse rate between 2 to 5.5 hr. of carting. The increase ranged between 79 to 131 per cent. The increase in rectal temperature during 2-4 hr. of carting ranged between 2.4 to 3°C, however, at 5.5 hr the increase was 5.5°C. The blood samples collected after fatigue exhibited rise in pH, pO₂ and

decrease in $p\text{CO}_2$. The calculated parameters TCO_2 , BEb , SBC , BEecf and HCO_3 showed an increase over the basal level. The carting stress increased metabolic activity. The pulse rate and rectal temperature were stabilized on carting for 2 hr. but the respiratory frequency remained increasing showing demand of oxygen at a greater pace with increasing hr. of carting.

Glucose, pyruvate, total protein, albumin and globulin did not exhibit appreciable change. The level of creatinine marginally increased. Marked increase in CK activity and lactate was observed which returned to initial levels after 24 h. The increase in CK and lactate may be used as reliable markers in studying fatigue index (Table-7).

The animal covered distance varying from 9.44 to 22.02 km before complete fatigue. It was observed that the camels who were used for carting for longer time before conducting the experiment had better endurance and could cover more distance than the camels being on carting for short time period. The speed varied from 1.13 ± 0.024 to 1.28 ± 0.296 m/sec. The average work done (KJ/kg) and power output Nm/sec/kg ranged from 1.54 ± 0.023 to 1.70 ± 0.011 and 0.76 ± 0.016 to 0.98 ± 0.032 respectively (Table-8).

The endurance of animal affected the potential of work performance but it did not affect the fatigue symptoms.

Table 6.
Cardinal physiological responses

	Hours	Respiration/min	Pulse/min	Rectal temp ° C
Initial % increase	0	7.0 ± 0.51	46 ± 1.61	36.4 ± 0.15
	2.05	166	89	2.4
	2.50	163	79	2.4
	3.10	271	121	2.9
	3.35	283	123	2.8
	3.55	320	131	3.0
	4.35	517	118	3.2
	5.25	371	96	5.5

Table 7.
Biochemical attributes for fatigue index

	Time (hr)					
	0	4	4 $\frac{1}{2}$	5	5 $\frac{1}{2}$	24
Glucose (mg/dl)	84.80 ± 6.76	75.63 ± 5.14	66.50 ± 5.31	100.41	101.22	87.47 ± 4.02
Total protein (g/dl)	6.34 ± 0.02	6.33 ± 0.01	6.32 ± 0.05	6.41	6.44	6.3 ± 0.01
Albumin (g/dl)	2.93 ± 0.02	2.94 ± 0.02	2.92 ± 0.02	2.90	2.91	2.92 ± 0.02
Globulin	3.42 ± 0.01	3.40 ± 0.01	3.40 ± 0.07	3.50	3.53	3.40 ± 0.45
Lactate (mg/dl)	4.40 ± 0.41	9.50 ± 1.47	8.59 ± 2.58	5.08	7.91	4.56 ± 0.23
Pyruvate (mg/dl)	0.47 ± 0.02	0.60 ± 0.04	0.54 ± 0.01	0.62	0.66	0.51 ± 0.02
Creatinine (mg/dl)	1.68 ± 0.09	1.83 ± 0.18	2.27 ± 0.20	2.53	2.18	1.71 ± 0.07
Creatine kinase (IU/L)	45.98 ± 6.33	134.20 ± 25.13	104.63 ± 21.77	132.71	235.67	44.47 ± 3.68
Na (mEq/l)	143.00 ± 5.73	152.40 ± 3.27	156.60	145.60	142.80	152.21 ± 5.34
K (mEq/l)	4.97 ± 0.19	6.27 ± 0.16	6.60	6.20	5.70	5.10 ± 0.24

Table 8.
Draught performance @ 2.8 kg/kg body weight on a two wheel cart

Camel No.	Distance (km)	Time (hr)	Speed (m/sec)	Force (N)	Work done (KJ/kg)	Power (Nm/sec/kg)	HP
1.	9.438	2.05	1.28	586.0	1.54	0.76	1.02
			± 0.296	± 8.788	± 0.023	± 0.016	± 0.041
2.	14.157	3.17	1.25	715.1	1.66	0.98	1.21
			± 0.023	± 4.580	± 0.010	± 0.032	± 0.022
3.	14.157	3.48	1.13	791.0	1.62	0.91	1.23
			± 0.024	± 7.950	± 0.016	± 0.015	± 0.037
4.	17.303	3.95	1.22	716.1	1.58	0.82	1.19
			± 0.017	± 4.658	± 0.010	± 0.010	± 0.020
5.	20.449	4.54	1.27	735.6	1.70	0.86	1.27
			± 0.043	± 4.694	± 0.011	± 0.032	± 0.039
6.	22.022	5.43	1.14	593.0	1.55	0.85	0.93
			± 0.038	± 5.260	± 0.014	± 0.037	± 0.038

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
	:	U.K. Bissa

6.2.1. Herd strength

The opening and closing strength of farm herd during the year were 254 and 241, respectively, comprising of three indigenous breeds and crossbred group (Table-9). The breedwise closing strength of Bikaneri was 99, Jaisalmeri 73, Kachchhi 52, Crossbred (Arabi X Bikaneri) 14, Sanchori 2 and Marwari 1. The addition due to calving and purchase was 20 and 2 camels respectively. The reduction due to deaths/disposal and sale was 22 and 13 camels, respectively. The composition of herd indicated calves upto 3 months 6.2%, 3-12 months 11.2%, upto 3 years 13.3% and adults 69.1%, respectively. The ratio of the male and female calves born was 3:1. The overall percentage of males and females in the herd varied from 37.0 to 39.1 and 61.0 to 63.0, respectively. Monthwise calving over the years was December 12.12%, January 33.0%, February 32.0%, March 16.0% and April 3.9%, respectively.

6.2.2. Quantitative parameters

(a) Body weight and growth : The breedwise LSQ means at birth in Bikaneri, Jaisalmeri and Kachchhi calves were 36.2 ± 0.73 , 36.1 ± 0.88 and 33.9 ± 0.79 kg respectively (Table-10). The contribution of breed was found to be significant ($P < 0.05$) at birth. The parity, year and sex effects also contributed significantly ($P < 0.01$) on birth weight. The camel calves from second parity weighed 8.0% heavier over the calves from first parity.

The LSQ means for 3 months weight in Bikaneri were 98.6 ± 1.89 , Jaisalmeri 90.3 ± 2.23 and Kachchhi 91.6 ± 2.42 kg., respectively. The contribution of breed group and sex was observed to be significant ($P < 0.01$). The parity effect was also found to be significant ($P < 0.05$). The 6 monthly body weight in three breeds viz. Bikaneri, Jaisalmeri and Kachchhi was 145.6 ± 3.80 , 137.5 ± 4.67 and 140.9 ± 4.85 kg., respectively. Bikaneri calves weighed slightly heavier than Jaisalmeri and Kachchhi calves though the breed differences were non-significant. The 9 and 12 months weight in all the three breed showed similar trend and the contribution of year was found to be significant ($P < 0.01$).

The analysis of body weight at 18 months indicated significant ($P < 0.05$) influence of parity and year. The body weight at 24 months of age was significantly influenced by breed and parity ($P < 0.05$). The LSQ means for subsequent weight at 30th and 36th months was significantly ($P < 0.05$) influenced by breed effects. Bikaneri camels were found to be heavier followed by Kachchhi and Jaisalmeri camels. (Fig .1)

The sire-wise analysis of body weight (Table-11) indicated significant ($P < 0.05$) contribution of sire at 6 and 12 months of age. The heritabilities for birth, 3 and 6 months weight were 0.31 ± 0.281 , 0.40 ± 0.329 and 0.82 ± 0.615 , respectively. The values of certain

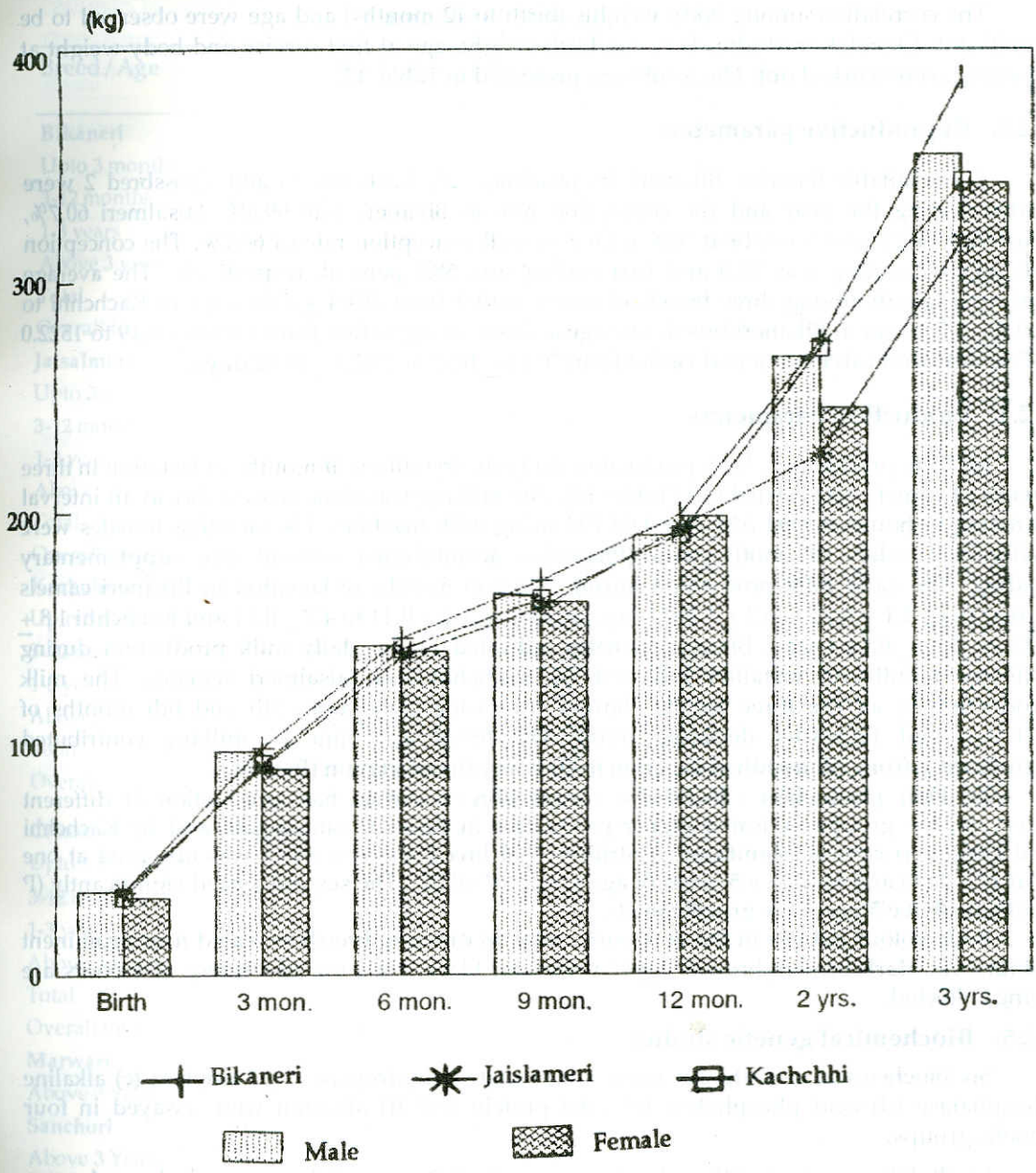


Fig 1. Breed and sex wise body weights of camel from birth to 3 years

economic traits have been recorded (Table-12).

The correlation among body weights (birth to 12 months) and age were observed to be significant. Correlation studies between birth weight, age at first service and body weight at breeding were worked out. The results are presented in Table-13.

6.2.3. Reproductive parameters

The available females, Bikaneri 36, Jaisalmeri 28, Kachchhi 16 and Crossbred 2 were mated during the year and the conception rate in Bikaneri was 69.4%, Jaisalmeri 60.7%, Kachchhi 81.2% and Crossbred 50% with a overall conception rate of 68.2%. The conception rate of first mating was 78.0 and two mating was 58.5 percent, respectively. The average gestation length among three breeds of camel varied from 384.4 + 3.66 days in Kachchhi to 389.5 + 2.75 days in Bikaneri breed. The age at first calving varied from 1484.0 + 8.19 to 1522.0 + 7.96 days and calving interval varied from 704.4 + 10.47 to 742.5 + 10.42 days.

6.2.4. Production parameters

(a) Milk production : Milk production study during different months of lactation in three breeds of camels was carried out (Table-14). The milking was done twice a day at an interval of 8 and 16 hours at 8.00 AM and 4.00 PM using milk machine. The lactating females were maintained solely on moth chara (*Phaseolus aconitifolius*) without any supplementary feeding. The daily milk production during different months of lactation in Bikaneri camels varied from 2.1 + 0.12 to 6.2 + 1.16 l/day, Jaisalmeri, 1.2 + 0.11 to 4.7 + 0.11 and Kachchhi 1.8 + 0.12 to 5.8 + 0.11 l/day. Bikaneri females indicated higher daily milk production during different months of lactation followed by Kachchhi and Jaisalmeri females. The milk production in all the three breeds showed increasing trend upto 5th and 6th months of lactation and thereafter declining trend. The breed and time of milking contributed significantly from 5th month of lactation to 10th month of lactation ($P < 0.01$).

(b) Hair production : Breedwise comparison of annual hair production at different intervals/age groups indicated higher production in Bikaneri camels followed by Kachchhi and jaisalmeri camels. Significant contribution of breed and sex effect was observed at one year ($P < 0.01$) and in above 5 years of age group ($P < 0.05$). The sex influenced significantly ($P < 0.05$) in above 5 years age group camels.

Body colour pattern in the new born calves in different breeds revealed four prominent colours viz. dark brown, brown, light brown and black. Data on inheritance of colours are being collected.

6.2.5. Biochemical genetic studies

Six biochemical constituents namely (a) lactate dehydrogenase (b) amylase (c) alkaline phosphatase (d) acid phosphatase (e) total protein and (f) albumin were assayed in four genetic groups.

In all 100 camels of different age groups viz. 0-2 years, 2-4 years and above 4 years belonging to both the sexes were included in this study. The sex and age group wise levels of biochemical constituents were analysed sex and age group wise (Tables 15 & 16). Breed comparisons are presented in Tables 17 and 18.

Table 9.
Camel herd strength (1994-95)

Breed / Age	Opening			Calving			Total		Deaths		Disposal		Closing
	M	F	M	F	M	F	M	F	M	F	M	F	
Bikaneri													
Upto 3 months	-	-	8	1	8	1	2	-	-	-	6	1	
3-12 months	11	4	-	-	11	4	1	1	-	-	10	3	
1-3 years	8	10	-	-	8	10	1	1	1	2	6	7	
Above 3 years	19	53	-	-	19	53	1	2	2	1	16	50	
Total	38	67	8	1	46	68	5	4	3	3	38	61	
Overall total	105		9		114		9		6		99		
Jaisalmeri													
Upto 3 months	-	-	4	1	4	1	1	-	-	-	3	1	
3-12 months	4	6	-	-	4	6	1	-	-	-	3	6	
1-3 years	10	1	-	-	10	1	-	-	-	-	10	1	
Above 3 years	12	39	-	-	12	39	-	1	-	1	12	37	
Total	26	46	4	1	30	47	2	1	-	1	28	45	
Overall total	72		5		77		3		1		73		
Kachchhi													
Upto 3 months	-	-	3	2	3	2	-	1	-	-	3	1	
3-12 months	3	2	-	-	3	2	-	1	-	-	3	1	
1-3 years	3	3	-	-	3	3	-	1	-	-	3	2	
Above 3 years	20	29	-	-	20	29	4	1	2	3	14	25	
Total	26	34	3	2	29	36	4	4	2	3	23	29	
Overall total	60		5		65		8		5		52		
Crossbred (Arab X Bikaneri)													
Upto 3 months	-	-	-	1	-	1	-	1	-	-	-	-	
3-12 months	1	1	-	-	1	1	-	1	-	-	1	-	
1-3 years	-	3	-	-	-	3	-	-	-	-	-	3	
Above 3 years	2	9	-	-	2	9	-	-	1	-	1	9	
Total	3	13	-	1	3	14	-	2	1	-	2	12	
Overall total	16		1		17		2		1		14		
Marwari													
Above 3 Years	1	-	-	-	1	-	-	-	-	-	1	-	
Sanchori													
Above 3 Years	-	-	-	-	2*	-	-	-	-	-	2	-	
Grand Total	94	160	15	5	111	165	11	11	6	7	94	147	
Overall total	254		20		276		22		13		241		

* 2 Male camels of Sanchori breed were purchased

Table 10.
Breed, Age, Parity and yearwise least square means of body weight (kg) in camels

Effect/groups	Birth weight	3rd month	6th month	9th month	12th month
Overall mean	35.4 ± 0.48 (109)	93.6 ± 1.28 (77)	141.38 ± 2.56 (71)	163.83 ± 3.55 (58)	194.0 ± 3.97 (48)
Breed					
Bikaneri	36.2 ± 0.73 (46)	98.8 ± 1.89 (36)	145.6 ± 3.80 (34)	170.58 ± 5.09 (28)	198.8 ± 6.31 (29)
Jaisalmeri	36.1 ± 0.88 (30)	90.3 ± 2.33 (23)	137.5 ± 4.67 (20)	158.7 ± 6.18 (15)	193.2 ± 6.95 (12)
Kachchhi	33.9 ± 0.79 (33)	91.6 ± 2.42 (18)	140.9 ± 4.85 (17)	162.2 ± 6.37 (15)	190.0 ± 8.64 (7)
Parity					
Ist	33.3 ± 0.82 (33)	87.5 ± 2.36 (20)	141.1 ± 5.01 (18)	164.2 ± 6.03 (17)	188.5 ± 7.88 (8)
IInd	36.0 ± 0.98 (23)	96.8 ± 2.87 (12)	142.3 ± 5.47 (13)	157.0 ± 8.13 (8)	200.7 ± 7.43 (9)
III rd & above	36.9 ± 0.69 (53)	96.4 ± 1.58 (45)	140.6 ± 3.46 (40)	170.1 ± 4.29 (33)	191.9 ± 5.05 (31)
Year					
1992	36.9 ± 0.82 (36)	91.7 ± 2.17 (29)	142.9 ± 4.16 (30)	148.7 ± 6.0 (18)	176.2 ± 5.29 (25)
1993	32.6 ± 0.2 (24)	93.8 ± 2.62 (19)	136.9 ± 5.43 (17)	164.5 ± 6.3 (17)	190.7 ± 10.9 (5)
1994	38.1 ± 0.81 (34)	95.2 ± 2.0 (29)	144.2 ± 4.28 (24)	178.1 ± 5.55 (23)	215.1 ± 6.10 (18)
1995	34.9 ± 1.17 (15)	—	—	—	—
Sex					
Male	36.6 ± 0.58 (63)	97.5 ± 1.55 (33)	142.6 ± 3.11 (41)	166.0 ± 4.21 (34)	189.9 ± 4.63 (26)
Female	34.2 ± 0.71 (46)	89.6 ± 1.82 (44)	140.1 ± 3.74 (30)	161.7 ± 5.1 (24)	198.1 ± 5.48 (22)

Contd

Table 10 Contd. . . .

Effect/groups	18 th month	24th month	30th month	36 month
Overall mean	228.0 ± 6.95 (24)	256.1 ± 10.8 (21)	303.8 ± 11.7 (20)	348.3 ± 17.2 (16)
Breed				
Bikaneri	247.2 ± 13.1 (11)	273.1 ± 16.8 (10)	321.6 ± 15.6 (11)	387.2 ± 20.9 (8)
Jaisalmeri	221.9 ± 12.8 (6)	224.8 ± 17.7 (7)	268.9 ± 13.7 (7)	315.6 ± 17.5 (7)
Kachchhi	214.9 ± 11.3 (7)	270.5 ± 13.2 (4)	302.4 ± 12.6 (2)	342.2 ± 0.0 (1)
Parity				
Ist	211.5 ± 18.25 (3)	281.9 ± 18.34 (2)	319.9 ± 0.0 (1)	366.5 ± 0.0 (1)
IInd	259.8 ± 12.7 (7)	260.0 ± 16.5 (6)	310.1 ± 12.47 (6)	354.3 ± 16.49 (6)
IIIrd	212.7 ± 9.9 (14)	226.0 ± 13.04 (13)	281.5 ± 10.58 (13)	324.2 ± 19.56 (9)
Year				
1992	206.6 ± 10.7 (18)	286.5 ± 9.70 (21)	303.0 ± 11.74 (20)	348.3 ± 17.25 (16)
1993	249.1 ± 12.6 (6)	—	—	—
Sex				
Male	223.7 ± 10.66 (9)	267.1 ± 11.54 (11)	308.8 ± 13.65 (12)	354.5 ± 19.86 (11)
Female	232.3 ± 8.98 (15)	245.2 ± 13.9 (10)	298.8 ± 13.97 (8)	342.1 ± 20.79 (5)

Table 11.
Sire wise least square means of body weights (kg) of camel calves of
different breeds along with heritability value

Breed	Sire No.	Birth Weight	3 months	6 months	12 months
Bikaneri	363	30.44 ± 3.83 (7)	88.39 ± 10.23 (6)	105.67 ± 17.0 (6)	192.83 ± 7.30 (6)
	365	35.15 ± 4.38 (4)	84.40 ± 11.04 (4)	111.96 ± 19.22 (4)	216.66 ± 10.33 (3)
	415	35.02 ± 3.91 (7)	77.33 ± 09.56 (7)	115.05 ± 18.33 (5)	218.0 ± 8.96 (4)
	416	38.29 ± 3.77 (12)	77.8 ± 09.45 (8)	117.66 ± 17.76 (8)	214.4 ± 8.00 (5)
Heritability		0.31 ± 0.281	0.40 ± 0.329	0.82 ± 0.615	—
Jaisalmeri	66	38.62 ± 3.34 (3)	87.53 ± 8.12 (3)	114.2 ± 16.23 (3)	180.25 ± 12.2 (2)
	268	38.11 ± 3.24 (9)	112.05 ± 10.27 (7)	171.93 ± 15.29 (6)	210.0 ± 8.94 (4)
	373	36.43 ± 3.23(10)	104.52 ± 9.9 (8)	142.56 ± 15.85 (7)	—

Table 12.
Average values of certain economic traits

	Means		
	Birth weight	Age at first service	Body weight at breeding
Bikaneri	39.05 ± 0.99	1167.09 ± 33.26	383.50 ± 11.26
Kachchhi	32.70 ± 1.56	1256.00 ± 55.25	342.20 ± 7.97
Jaisalmeri	42.75 ± 2.43	1432.75 ± 6.65	388.75 ± 10.11
Crossbred	37.60 ± 0.93	1120.20 ± 69.15	396.40 ± 24.63
Pooled	35.06 ± 1.56	1208.93 ± 26.87	375.56 ± 5.36

Table 13.
Phenotypic correlations between birth weight, age at first service and body weight at breeding in camels

	Birth weight	Age at first service	Body weight at breeding
Birth weight	1.000	0.1068	0.1832
Age at first service	—	1.0000	0.1177
Body weight at breeding	—	—	1.0000

Table 14.
Month and time wise least square means of daily milk
productions (l/day) in three breeds of camel

Month of lactation	Bikaneri			Jaisalmeri			Kachchhi		
	Morning	Evening	Total	Morning	Evening	Total	Morning	Evening	Total
3rd	2.8±0.08	2.4±0.10	5.2±0.16	2.1±0.08	2.1±0.10	4.2±0.16	2.7±0.08	2.3±0.10	5.0±0.16
4th	3.8±0.14	2.3±0.8	6.1±0.11	2.4±0.14	2.2±0.08	4.6±0.11	2.9±0.14	2.4±0.08	5.3±0.11
5th	3.4±0.06	2.8±0.07	6.2±0.11	2.7±0.06	2.0±0.07	0.7±0.12	2.5±0.07	2.4±0.08	4.9±0.13
6th	2.8±0.07	2.3±0.08	5.1±0.13	2.1±0.07	1.5±0.08	3.6±0.13	3.2±0.06	2.6±0.07	5.8±0.11
7th	2.2±0.09	1.5±0.10	3.7±0.15	1.8±0.09	1.2±0.10	3.0±0.16	1.8±0.09	1.4±0.11	3.2±0.15
8th	2.0±0.10	1.2±0.11	3.2±0.17	1.5±0.10	1.0±0.12	2.5±0.17	2.2±0.12	1.6±0.10	3.8±0.17
9th	1.9±0.08	1.2±0.08	3.1±0.12	1.0±0.08	0.6±0.08	1.6±0.12	1.8±0.08	0.90±0.08	2.7±0.12
10th	1.2±0.09	0.73±0.07	1.93±0.12	0.84±0.09	0.43±0.05	1.2±0.11	1.1±0.09	0.75±0.05	1.8±0.12

Table 15.
Sex wise level of biochemical constituents in camel (1994-95)

Constituents	Male	Female
Protein (g/dl)	6.09 ± 0.10 (50)	6.11 ± 0.12 (38)
Albumin (g/dl)	3.00 ± 0.05 (49)	3.21 ± 0.07* (38)
Lactate dehydrogenase (IU/l)	362.16 ± 14.90 (63)	385.29 ± 8.89 (35)
Acid phosphatase (KA units)	4.06 ± 0.17 (57)	3.08 ± 0.106** (38)
Alkaline phosphatase (KA units)	27.42 ± 2.20 (59)	24.82 ± 1.67 (35)
Amylase (IU/dl)	131.88 ± 4.88 (55)	112.23 ± 2.40** (39)

* Significant at 5%

** Significant at 1%

Table 16.
Age wise level of biochemical constituents in camel (1994-95)

Constituents	Age group	Breeds		
		Bikaneri	Jaisalmeri	Kachchhi
Protein (g/dl)	0-2 yrs	5.05 ± 0.21 (4)	6.30 ± 0.46 (5)	6.55 ± 0.75 (4)
	2-4 yrs	6.13 ± 0.37 (5)	5.94 ± 0.22 (8)	5.77 ± 0.33 (5)
	Above 4 yrs	5.91 ± 0.11 (31)	6.24 ± 0.15 (26)	6.19 ± 0.17 (26)
Albumin (g/dl)	0-2 yrs	3.63 ± 0.16 (4)	3.37 ± 0.14 (4)	3.40 ± 0.22 (4)
	2-4 yrs	2.90 ± 0.04 (4)	2.82 ± 0.06 (7)	2.75 ± 0.08 (5)
	Above 4 yrs	3.05 ± 0.08 (22)	3.17 ± 0.14 (15)	3.12 ± 0.09 (17)
LDH (IU/l)	0-2 yrs	479.52 ± 20.09 (7)	475.83 ± 43.11 (7)	454.35 ± 23.83 (6)
	2-4 yrs	377.49 ± 49.13 (5)	466.80 ± 25.16 (8)	382.42 ± 45.44 (5)
	Above 4 yrs	300.50 ± 15.15 (22)	373.94 ± 14.32 (15)	326.12 ± 20.42 (14)
Acid phosphatase (KA units)	0-2 yrs	4.77 ± 0.34 (7)	5.51 ± 0.32 (7)	5.12 ± 0.44 (6)
	2-4 yrs	4.49 ± 0.64 (5)	4.37 ± 0.32 (8)	4.63 ± 0.17 (5)
	Above 4 yrs	3.03 ± 0.14 (22)	2.82 ± 0.24 (14)	2.71 ± 0.18 (17)
Alkaline phosphatase (KA units)	0-2 yrs	48.78 ± 4.38 (7)	51.62 ± 4.94 (7)	47.91 ± 4.39 (6)
	2-4 yrs	26.29 ± 4.29 (5)	29.29 ± 3.12 (8)	26.18 ± 4.11 (5)
	Above 4 yrs	17.61 ± 1.69 (22)	18.62 ± 1.82 (14)	17.72 ± 1.39 (15)
Amylase (IU/dl)	0-2 yrs	167.19 ± 2.33 (7)	156.49 ± 4.09 (5)	163.36 ± 1.96 (4)
	2-4 yrs	144.33 ± 14.59 (5)	151.10 ± 8.16 (8)	158.94 ± 0.68 (5)
	Above 4 yrs	107.62 ± 3.31 (23)	104.90 ± 4.31 (15))	102.04 ± 4.67 (17)

Table 17.
Breed wise level of biochemical constituents in camel (1994-95)

Constituents	Breeds			
	Bikaneri	Jaisalmeri	Kachchhi	Cross bred
Protein (g/dl)	5.91± 0.11 (31)	6.24 ± 0.15 (26)	6.19 ± 0.17 (26)	6.07 ± 0.12 (5)
Albumin (g/dl)	3.11 ± 0.07 (30)	3.11 ± 0.09 (26)	2.46 ± 0.07 (26)	2.95± 0.05 (5)
LDH (IU/l)	348.68 ± 17.70 (34)	399.60 ± 17.47 (32)	358.34 ± 18.41 (27)	394.37 ± 38.59 (5)
Acid Phosphatase (KA units)	3.60 ± 0.19 (31)	3.90 ± 0.27 (29)	3.62 ± 0.22 (28)	3.32 ± 0.23 (4)
Alkaline phosphatase (KA units)	25.53 ± 2.57 (34)	40.22 ± 2.75 (29)	45.55 ± 2.63 (26)	19.51 ± 3.55 (5)
Amylase (IU/dl)	125.06 ± 5.26 (35)	127.30 ± 5.67 (28)	122.42 ± 6.64 (26)	103.12 ± 7.63 (5)

Table 18.
Breedwise comparison of biochemical constituents (t- value)

	Bikaneri v/s Jaisalmeri	Bikaneri v/s Kachchhi	Bikaneri v/s Crossbred	Jaisalmeri v/s Kachchhi	Jaisalmeri v/s Crossbred	Kachchhi v/s Crossbred
Protein	1.74	1.47	0.465	0.252	0.487	0.344
Albumin	0.00	6.33 **	0.865	6.12 **	0.856	3.155 **
LDH	2.13*	0.414	0.984	0.002	0.116	0.763
Acid Phosphatase	0.99	0.065	0.442	0.880	0.910	0.470
Alkaline Phosphatase	4.165 **	5.508 **	0.901	1.415	3.065 **	3.822 **
Amylase	0.292	0.336	1.519	0.594	1.632	1.304

* Significant at 5% level

** Significant at 1% level

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
Associates	: N.D. Khanna
	: N. Sharma

Under this project, investigations on traditional management system were continued. The bench mark survey conducted by personal contact with the camel owners were carried out in four villages namely Tanwarwala, Bajju, Morkhana and Gadwala. The detailed analysis of survey report of the four villages is presented in Table-19.

The camel population as compared to other herbivora was maximum in village Gadwala which is deprived of irrigation facilities and animal husbandry is the major occupation in this village. The income ratio of the four villages indicated that it was second highest as compared to income from agriculture in village Gadwala.

The mortality risk in camels at NRCC, Bikaner kept under semi-intensive management system was worked out for last decade 1985-1995 (Table-20). The mortality risk was comparatively more in the camel calves aged 0-3 months (range 0.814 to 3.217 per 1000 camel days per day). While pooled mortality at the farm ranged from 0.041 to 0.241 per 1000 camel days per day.

Table 19.
The Comparative analysis of sample survey in different villages

	Tanwarwala	Bajju	Morkhana	Gadwala
Village population	300	3600	1500	2000
Camel no. : other herbivore	1:9.8	1:41.6	1:4.8	1:1.7
Camel : Human ratio	1:1.3	1:2.4	1:1.5	1:5
Ratio of land irrigated : non irrigated	1:23	1:4.5	0:1	0:1
Number of cattle per camel	0.44	1.88	0.13	0.26
Income ratio Animal production : Agriculture	1:73	1:2.4	1:10	1:3.8

Table 20.
Age wise mortality risk per 1000 camel days per day (1985-95)

Year		0-3 months	3 months to 3 year	Above 3 years	Pooled
1985-86	Camel died	4	2	3	9
	Riski	2.436	0.115	0.086	0.167
1986-87	Camel died	2	1	—	3
	Riski	0.792	0.030	0.000	0.041
1987-88	Camel died	2	2	6	10
	Riski	0.814	0.099	0.156	0.186
1988-89	Camel died	4	3	3	10
	Riski	1.110	0.270	0.060	0.150
1989-90	Camel died	3	3	3	9
	Riski	1.866	0.078	0.056	0.096
1990-91	Camel died	2	5	—	7
	Riski	2.992	0.169	0.000	0.116
1991-92	Camel died	5	2	8	15
	Riski	1.198	0.068	0.180	0.168
1992-93	Camel died	7	4	8	13
	Riski	3.217	0.079	0.105	0.226
1993-94	Camel died	4	2	7	13
	Riski	2.082	0.071	0.105	0.137
1994-95	Camel died	6	7	9	22
	Riski	2.702	0.363	0.129	0.241

6.4. STUDIES ON CAMEL NUTRITION

Project Code no.	: P.I. 90/4-ICN/L-30/5220
Project leader	: R.C. Jakhmola
Associate	: A.K. Nagpal

6.4.1. Nutritional evaluation of sewan grass

The present experiment was conducted to evaluate dry sewan grass (*Lasiurus indicus*) as feed for camel. Sewan grass was mixed with moth chara in the ratio of 30:70 (T-2) and 50:50 (T-3) on DM basis. These diets were compared with mothchara (T-1). Relative chemical composition (Table-21) shows that sewan grass is poorer in CP content while it contained higher amount of ADF, cellulose and AD-lignin than moth chara. Intake of DM, OM and CP (g/kg W^{0.75}) decreased progressively with increasing proportion of sewan grass (Table-22). The digestibilities of OM and CP also adversely affected by increasing proportion of sewan grass in camel's ration.

Table 21.
Chemical composition of sewan grass and moth chara.

	Moth Chara	Sewan grass
OM	81.7	90.1
CP	7.44	4.37
ADF	21.76	37.58
Cellulose	16.94	27.23
AD-Lignin	2.49	9.42
AIA	2.38	0.93

6.4.2. Nutritional evaluation of *Prosopis juliflora* pods

Four male animals were divided into groups of two animals each. Animals were provided ad-lib guar phalgati with or without *Prosopis juliflora* pods @ 1.0kg/animal/day in a 2x2 latin square design, replicated twice. The experimental feeding continued for a period of one month. During the last week, a digestibility trial was conducted. Animals consumed 5.55 kg and 5.03 kg guar phalgati in T-1 (guar phalgati only) and T-2 (1 kg pods along with guar phalgati) respectively. Total DM intake was however higher in T-2 (Table-23). Chemical composition is in progress.

Table 22.
Effect of feeding sewan grass on intake and digestibility of nutrients (Mean \pm SE)

	T1	T2	T3
Daily intake (kg)			
DM	3.77 \pm 0.085	3.59 \pm 0.709	3.81 \pm 0.421
OM	3.08 \pm 0.069	3.03 \pm 0.597	3.28 \pm 0.359
CP (g)	280.1 \pm 6.30	234.2 \pm 46.18	224.9 \pm 24.31
Daily intake (g/kg w^{0.75})			
DM	59.39 \pm 0.029	54.74 \pm 9.70	51.68 \pm 2.73
OM	48.48 \pm 0.025	46.11 \pm 8.17	44.41 \pm 2.35
CP	4.41 \pm 0.002	3.57 \pm 0.631	3.05 \pm 0.161
Digestibility (%)			
OM	57.47 \pm 5.39	56.49 \pm 7.29	50.31 \pm 11.50
CP	52.88 \pm 2.77	38.95 \pm 22.29	18.72 \pm 5.05

Table 23.
Effect of feeding *P.juliflora* pods on intake of nutrients.

	T1	T2
DM intake (daily)		
kg	5.55 \pm 0.371	5.88 \pm 0.630
g/kg w ^{0.75}	70.24 \pm 12.88	73.62 \pm 6.28
OM intake (daily)		
Kg	4.63 \pm 0.309	4.84 \pm 0.525
g/kg w ^{0.75}	58.65 \pm 10.753	60.65 \pm 5.225
Digestibility (%)		
DM	59.69 \pm 7.669	65.09 \pm 3.591
OM	60.126 \pm 9.531	66.27 \pm 4.07

6.4.3. Mineral studies in camel (A.K. Nagpal, A. K. Rai)

(a) Effect of feeding 3 ratios of calcium and phosphorus on growth and nutrient utilization in growing camel calves.

Nine camel calves of 2 years of age were randomly divided into 3 groups of 3 each. All the animals were individually offered guar phalgati (*Cyamopsis tetragonoloba*) ad lib and 0.5 kg guar seed meal. Common salt was mixed in the guar seed meal @ 2% in all the 3 groups. In addition sodium dihydrogen phosphate (Glaxo) was added to the guar seed meal to adjust Ca:P in group II & III. The Ca : P ratios in the diet of group I, II and III were 5.06, 2.22 and 1.28 respectively.

There was no significant difference among 3 groups in respect of growth, digestibility coefficients of proximate principles (except EE) and nutrient intake of DCP, TDN and ME/Kg $w^{0.75}$. The dietary Ca:P ratio did not significantly affect the absorption of Na, Ca, Mg, Cu, Co and Zn from the GI tract. Potassium absorption in GI tract significantly ($P < 0.05$) increased from 90.7% in group I to 96.0% in group III. The intestinal absorption of phosphorus first increased ($P < 0.01$) from 29.1% in group I to 74.4% in group II and then decreased to 57.5% in group III. Phosphorus supplementation enhanced the blood haemoglobin from 10.3 in group I to 14.0 g% in group III. An increase in RBC and WBC was also observed on narrowing the dietary Ca:P ratios. Differential leucocyte count revealed nonsignificant decrease of 5.6% in lymphocyte count and an increase of 4.5% in neutrophil count.

The serum electrolyte profile revealed nonsignificant decrease in Na from 148.4 meq/l in group I to 143.7 meq/l in group III but an increase in serum levels of K, Ca, P in group I, to III by 2.6, 6.2, and 30.1% respectively. The enzyme activities of both ACP and ALP behaved similarly. Acid phosphatase activity first declined ($P < 0.05$) from 3.23 IU/L in group I to 1.84 IU/L in group II which increased to 3.09 IU/L in group III. Alkaline phosphatase activity also decreased ($P < 0.05$) from 340.7 IU/L in group I to 186.6 IU/L in group II which rose again to 219.4 IU/L in group III.

The results indicated the Ca:P ratio of 2.22 optimum for nutrient utilization and growth for young camel calves.

(b) Growth performance and nutrient utilization in growing camel calves fed guar phalgati only.

Three growing camel calves (278+6.8 kg) of 3 years of age were individually offered guar phalgati (*Cyamopsis tetragonoloba*) ad-lib as sole roughage ration during winter for 3 months. No growth was observed.

The digestibility coefficients of guar phalgati were 59.0% for OM, 39.6% for CP, 24.9% for EE, 53.2% for CF and 66.6% for NFE. The nutrient intake worked out to be 78.7 g DM, 2.16 g DCP, 42.4 g TDN and 0.64 MJ ME/kg $w^{0.75}$. The mean daily water intake was 12.3 l/d and 121.9 ml/kg $w^{0.82}$. The intestinal absorption of Na, K, Ca, P and Mg from drinking water and guar phalgati sources was 27.5, 77.4, 77.3 and 8.5 and -25.3% respectively. The average serum values of growing calves were 119.7 meq/l Na, 6.4 meq/l K, 12.04 mg/dl Ca and 5.46 mg/dl P.

The results indicated the need for CP, Na and Mg supplementation in the diet of camel calves fed guar phalgati.

(c) **Effect of supplementation of urea molasses mineral block (UMMB) on nutrient utilization in growing camel calves.**

Three young camel calves of 3.3 years of age were individually offered basal ration of guar phalgati (*C. tetragonoloba*) ad-lib and 100 g guar seed meal and 100 g UMMB (supplied by NDDB Anand). The digestibility trial conducted on 2 camel calves showed the digestibility coefficients of OM, CP, EE, CF and NFE as 63.4, 62.6, 36.8, 58.5 and 68.8% respectively. The nutrient intake of 2 calves was 68.0 g DM 4.1 g DCP and 40.0 g TDN/kg w^{0.75}. Daily water intake was 23.2 l/d and 214.3 ml/g w^{0.82}. The intestinal absorption of Na, K and Phosphorus was 78.2, 84.0 and 20.8 percent respectively. Further study is in progress.

(d) **Blood profile of male camels of three different breeds**

Blood was collected from 40 male camels of 3 different breeds maintained at NRCC farm and analysed for haemoglobin, serum Na, K, P and whole blood trace elements viz., Zinc copper and cobalt. No significant difference was observed among 3 breeds of Camel, viz Bikaneri, Kachchhi and Jaisalmeri for any of the above parameters except cobalt. Camel needed dietary supplementation of zinc and copper. (Figs. 2 & 3)

6.5. Studies on camel reproduction

Project code no.	: 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

(a) **Semen evaluation** - The semen was collected from 3 adult camels at weekly interval and evaluated for various physical and biochemical attributes. The ejaculation time (min.) Volume (ml), sperm concentration ($\times 10^6$ /ml) total sperm in ejaculate ($\times 10^6$), per cent live sperm were 5.11 ± 0.263 , 3.70 ± 0.241 , 492.6 ± 17.94 , 1987.5 ± 343.60 and 80.73 ± 0.959 respectively. The PH of the semen was 7.41 ± 0.039 from April to June and it ranged from 8.36 ± 0.125 to 8.48 ± 0.023 during other months.

The total protein, calcium and activities of AST, ALT, ALP, ACP and LDH in seminal plasma were estimated to be 1.521 ± 0.1238 g/dl, 7.17 ± 0.541 mg/dl, 9.76 ± 0.462 U/l, 0.85 ± 0.770 U/l, 1088.42 ± 74.107 U/l, 59.01 ± 17.496 U/l and 246.74 ± 29.44 U/l respectively.

(b) **Cryo - preservation of semen** : The laboratory facilities are being created to undertake the work on this aspect.

(c) **Studies on camel testes** : The testis from one year old calf has been collected and being processed for histological studies.

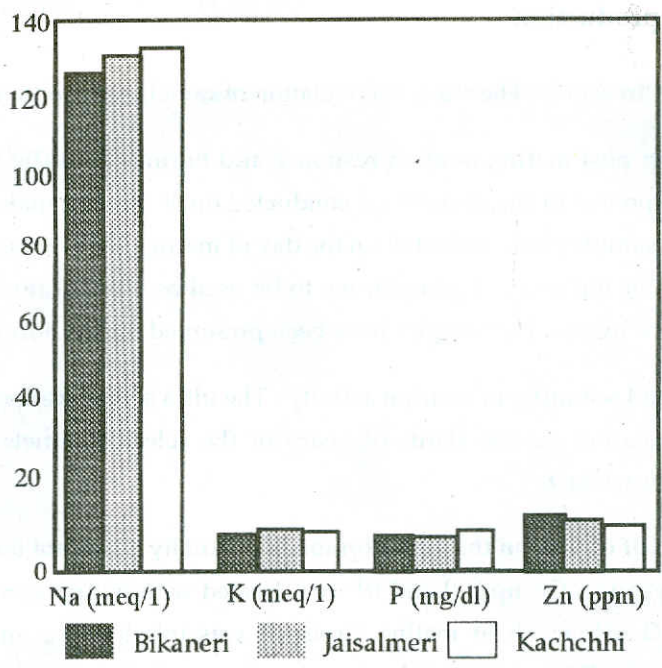


Fig. 2 Mean values of serum Na, K, P and whole blood Zn in Camels

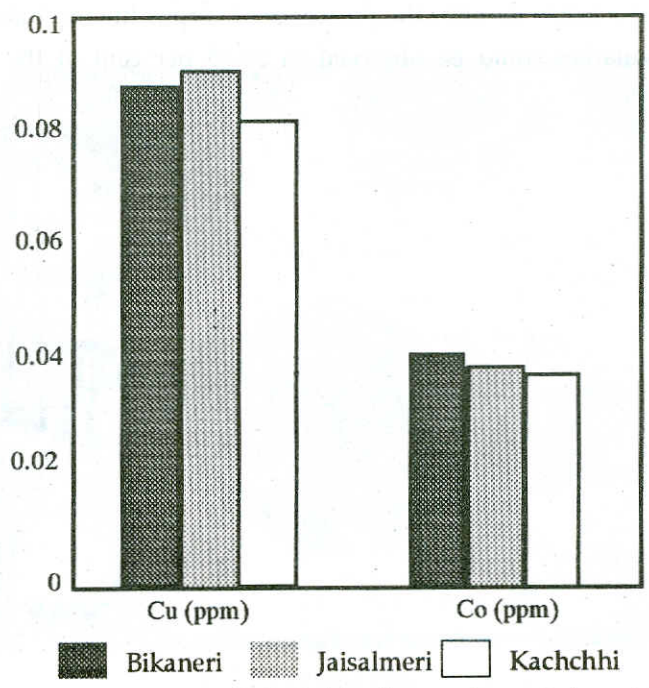


Fig. 3 Mean values of whole blood trace elements in camels

6.5.2. Female reproduction

Ovulation in camel : The study on ovulation of camel was conducted by :

(a) **Observing post mating ovarian response and hormone profile :** The study on post mating ovarian responses in she camels was conducted on 30 females mated during Dec. 94 to Feb. 95. The blood samples were collected on the day of mating (0 day), day 7, 14, 21, 30 and 45 days after mating for the assay of progesterone to be used as an indicator for the presence of corpus luteum in the ovary . The samples have been preserved for the hormone assay.

(b) **Ultra sound scanning of ovarian activity :** The ultra sound scanner has been installed and routine examination for the status of ovary of the selected camels is being made for folliculogenesis. (Figs. 6 to 9)

(c) **Induction of ovulation through hormones :** Sexually quiescent females (16 nos) were divided into four groups. Group I, II and III were treated with hydroxyprogesteronehexonate followed by PMSG. After 4 h of mating Group II was injected hcg and group III GnRH intravenously. Group IV was injected normal saline and served as control. The rectal examination was conducted to monitor the presence of corpus luteum indicating occurrence of ovulation. The ovulation could be observed in 50-75 per cent of the hormone treated animals.

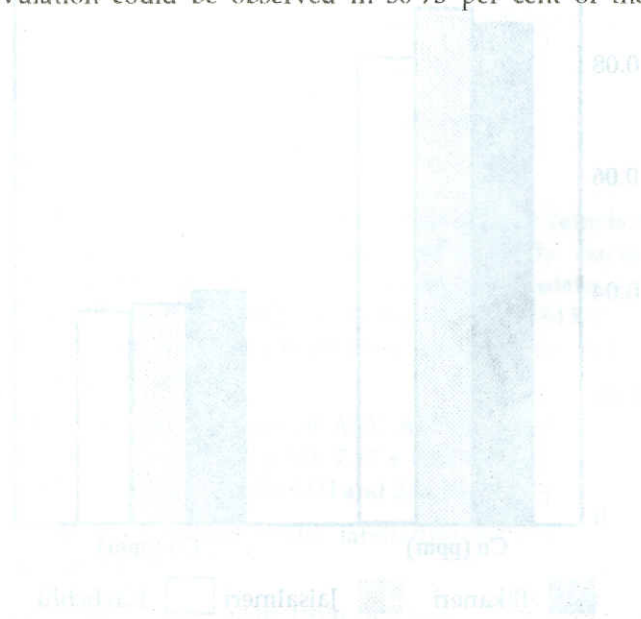




Fig. 6 Three follicles on left ovary

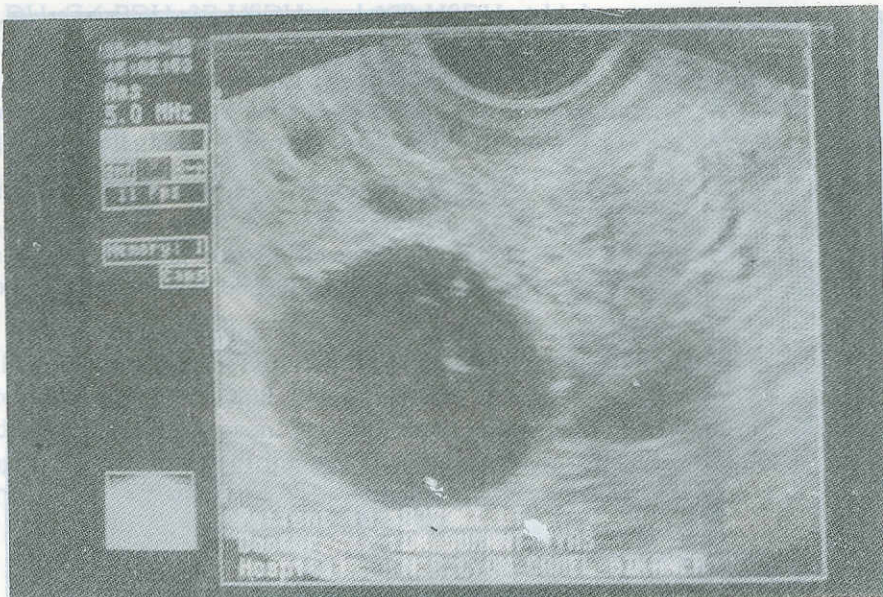


Fig. 7 Graffian Follicle - 9th day

5.3.2. Female reproduction

5.3.2.1. Ovarian status

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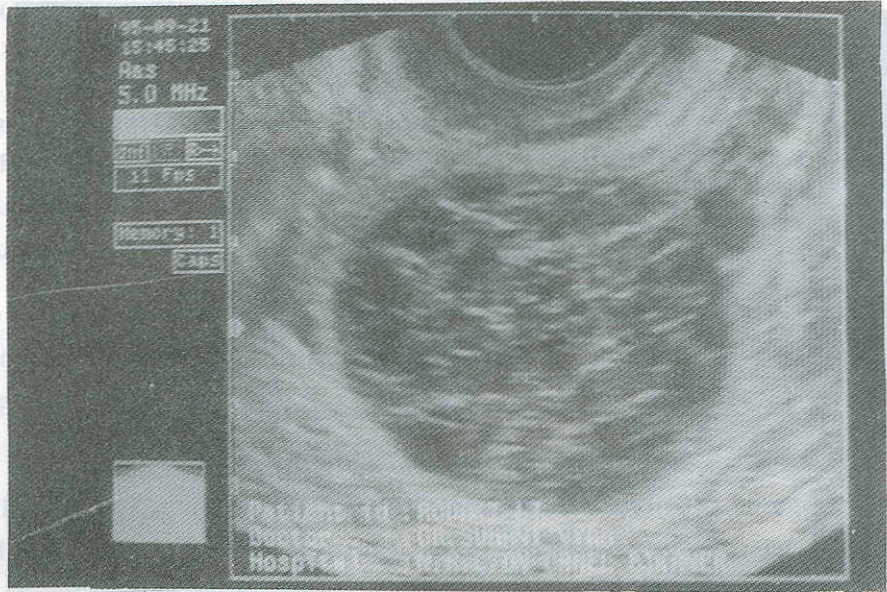


Fig. 8 Graffian Follicle - 15th day

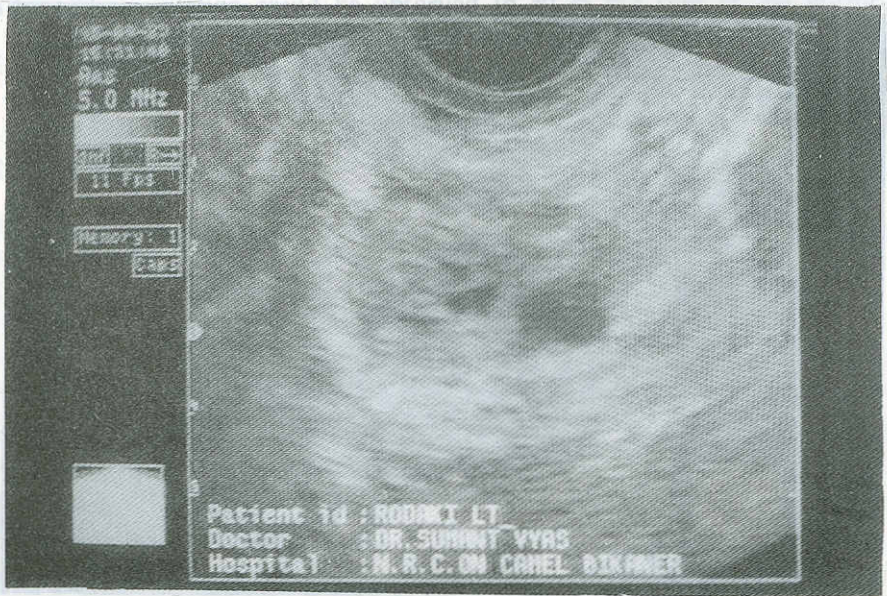


Fig. 9 Graffian Follicle - 21st day

7.

SCHEMES/ PROJECTS

7.1. Studies on poll glands of camel

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

The histological and histochemical changes of the poll glands and biochemical and hormonal concentrations of poll gland secretion during rutting season have been observed. The poll gland exhibited active secretory phase containing well developed glandular follicles during rutting season while, these follicles were rudimentary during non rutting season. Histochemical localization revealed the presence of protein, glycogen, lipids, DNA, RNA, ATPase, LDH, G-6-PDH, 3B HSDH, and 17B HSDH at higher concentration in the alveoli of the poll glands and the presence of protein, LDH, G-6-PDH and RNA in the skin region of the poll glands, while DNA was observed in traces and ATPase activity was not exhibited in the skin. The results suggested an active metabolism, particularly towards steroid biosynthesis in the alveoli of the poll glands during rutting season. (Figs. 4 & 5 inside back page)

The poll gland secretion contained 9.46 mg/dl glucose, 1.77 g/dl protein, 0.13 g/dl albumin, 14.36 mg/dl urea, 4.15 mg/dl calcium, 103.3 mEq/l sodium and 556.5 mEq/l potassium during rutting season. In addition, it contained 132.90 ng/ml testosterone, 2.67 ng/ml progesterone and 247.08 pg/ml estradiol 17 B during rutting season.

The sexual behaviour of adult camels of both the sexes during breeding and non-breeding season has been reported. The rutting in male was exhibited by restlessness, loss of appetite, grinding teeth, soft palate ejection, gurgling sound and copious poll gland secretion during breeding season. The she camel also exhibited restlessness, interest in males and willingness for mating. During non-breeding season, the sexual behaviour was subdued or indistinctive in several cases. The studies on the ultrastructure of poll glands are in progress.

7.2. Blood group and biochemical polymorphism studies in Indian camel.

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

(a) Blood group studies

Iso-immunization in eleven pairs of camel was carried out to prepare blood typing reagents. The sera were collected from immunised camels and complement fixation test was set-up to assess haemolysis. Rabbit and Guinea pig complements were used. Fresh cattle serum was also used for complement fixation but the antibody titre could not be assessed perhaps due to some species specific problems related to camel. It appeared that there was some anticomplementary activity in the camels. Titration was also done to assay agglutination.

Hetero-immunization using camel blood injected into goats was done in two animals. The antibody production was recorded in one goat when titre of antibody reached 1:64. The immune serum was collected and stored at -20°C .

Hetero-immunization in two sheep with camel as a donar animal was also carried out. The haemolysis as well as agglutination tests revealed a titre of 1:64, approximately 150 ml of antiserum was collected from each sheep.

Hetero-immunization in two cattle and two buffaloes was also carried out. Agglutinins and haemolysins were developed in both the cattle (1:64).

Hetero-immunization in two rabbits was also carried out. The titre of antibody recorded was 1:64. Approximately 30 ml serum from each rabbit was collected.

Hetero-immunization in four camels using cattle and sheep RBC was also carried out. The antibody production was 1:32 against cattle sheep cells but no titre against camel cells was recorded.

The immune sera through hetero-immunization were subjected to different absorption and titration tests to isolate unitary blood typing reagents. Three blood typing reagents were produced.

In addition, the work on complement kinetics of camel was initiated, for this purpose antiserum against camel serum globulins was raised in 2 rabbits. The titre noticed was 1:128. The camel complement in classical pathway was also tried. Goat, sheep and camel RBCs were used to raise haemolysin in rabbits. Research work in camel complement with alternate pathway was also initiated.

Efforts were also made to identify common blood group reagents of camel with those of

horse and cattle. Twenty three blood typing reagents of horses were procured from Sweden. Camels were tested for the presence of any of the reagent. Preliminary work indicated absence of horse blood typing reagents in camel.

(b) Biochemical polymorphism studies

During the year under report 141 samples were collected from three places (NRCC, Bikaner - 92, Tanwarwala - 32, and Bajju - 17) to carry out biochemical polymorphic studies. The following 13 systems haemoglobin, albumin, transferrin, amylase, esterases, acid-phosphatase, alkaline-phosphatase, lactate dehydrogenase, malate dehydrogenase, glucose-6-phosphate dehydrogenase, Carbonic anhydrase, phosphohexose-isomerase and phosphoglucosyl mutase were typed. Polymorphism was not observed in any system.

7.3. Development of embryo transfer technology in camel

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

(i) Recruitment of staff

As per the provision of the staff in the scheme "Development of embryo transfer technology in camels", research associates (two) and Senior research fellows (two) were selected. One research associate joined on 1.10.94 and two senior research fellows joined on 7.10.94 and 10.10.94, respectively.

(ii) Training of staff

Two scientists were deputed for one month training in embryo transfer technology at Sabarmati Ashram Goshala, Bidaj in the month of January, 1995. The training covered various aspects like selection of donors and recipients, superovulation, flushing and transfer procedures, embryo searching and handling and cryopreservation of embryo.

(iii) Procurement of equipment

The equipments as under were procured for the establishment of Embryo Transfer Technology laboratory :

1. Ultrasound scanner (Pie medical-200)
2. Stereozoom microscope SMZ-U Nikon with CCTV systems and microphotographic attachment.

3. Inverted microscope diaphot 300 Nikon with micro manipulator assembly.
4. Programmable embryo freezer (Planer)
5. CO₂ incubator (Juan)

(iv) Selection of animals for embryo transfer

The female camel aged 7-9 years belonging to N.R.C.C. were rectally examined for the status of ovaries and genital tract. All these animals had the history of normal calving. Ten animals with normal ovary and genitalia were selected and subjected to routine examination for the selection of donors and recipients.

The trials on the selection of suitable catheters for harvesting embryos from camels are in progress.

7.4 Network collaborative programme on crop based animal production system

Principal investigator : R.C. Jakhmola
Associate : Ram Kumar

The project was initiated from September 1994 at 6 centres viz (IGFRI: Jhansi, Mukteshwar, CSWRI, Avikanagar and IGFRI regional station, Avikanagar CIRG, Makhdom and NRCC, Bikaner). The salient objectives of the project include studies on the effect of different grazing management practices on soil and ecological changes, biomass and livestock production as well as evaluation of economics and sustainability of the system.

During the year the area for the project was demarcated and attempts have been made to enclose the area. The procurement of seeds and fertilisers and plan for pasture development were made.

7.5 Hormonal manipulations for improvement of reproduction in camel

Scientist Emeritus : Dr. S.P. Agarwal

(a) Induction of sexual activity in female camels during non-breeding season

During non-breeding season (June-July), sixteen sexually quiescent adult she - camels were randomly divided in four equal groups. Ovarian activity was induced in the animals of group I, II and III by intra-muscular injection of 250 mg hydroxyprogesterone hexanoate (Proluton depot) followed by 1000 IU PMSG (Trophovet) on two consecutive days. The animals were mated on the fifth day after the last PMSG injection. Ovulation in group II and III was facilitated by intravenous administration of 3000 IU HCG (Chorulon) and 40 mcg GnRH (Receptal), respectively. Group IV received no hormones but saline and served as control. Periodic rectal examinations were performed to explore the status of ovaries. Blood

samples were collected on eight different stages and sera were analysed for estradiol 17-B and progesterone using specific RIA kits. All animals in control as well as treated groups could be mated successfully. Levels of estradiol 17-B did not exhibit any particular trend. Blood progesterone levels suggested ovulation in two animals (50%) in group I and three (75%) each in group II and III but no animal ovulated in control group. This was confirmed by presence of CL in the ovary during rectal examination. One animal each conceived in group I and III.

The results so far have indicated that the ovarian activity in camel can be triggered by hormonal manipulations during non-breeding season.

(b) Thyroid status of female camels following mating

Adult dromedary female camels (18) were mated and blood samples were collected on day of mating (day 0) followed by day 1, 3, 6, 9, 12, 15, 18 and 21 post-mating. The animals were categorized into fertile (4), unconceived ovulatory (5) and anovulatory (9) groups as determined by estimating progesterone levels reported earlier. The sera samples were analysed for thyroxine (T4) and triiodothyronine (T3) using specific RIA kits for each hormone. The data revealed that the T4 values were highest in anovulatory and lowest in ovulatory but unconceived animals. Intermediate levels between these two extremes were observed in camels which conceived to service. Contrary to T4, the lowest T3 values were recorded in anovulatory, highest in ovulatory and intermediate in fertile camels. The ratio between T4 and T3 was highest for anovulatory, lowest for ovulatory and intermediate fertile female camels. The results suggested that a balanced concentration of T4 and T3 is beneficial for conception of female camels.

7.6 Studies on traditional camel rearing, fodder plants and socio-economic aspects of camel rearing in the rural desert eco-system in Rajasthan

Scientist Emeritus : Dr. H.P. Singh

- | | | | |
|------------|---|---|---|
| Objectives | : | i) | To study socio-economic aspects of camel rearers, camel genetic resources and economics of camel bioenergy in the area. |
| | | ii) | To study health practices, production, pastoral and fodder management system. |
| | | iii) | Nutritional evaluation of tree fodder browsed by the camels and other feeds and fodder fed to camels. |
| | | iv) | To study economic aspects of utilization of various camel products viz; milk; hair, meat, hide, skin and manure etc. |
| Progress | : | To undertake study the area was divided into three strata | |

(zones) as pastoral belt, Rainfed area and irrigated area. Multistage stratified simple random sampling technique has been adopted for selection of house holds for field data collection. Out line of selection scheme is shown below :

1.	Strata	I	II	III
2.	Selected district	Bikaner	Nagaur	Ganganagar
3.	Selected Tehsils from selected districts	Bikaner, Kolayat	Nagaur, Ladnu, Didwana, Merta	Garsana, Raisinagar, Surat-Garh, Padampur Bhadra, Nohar, Pilibanga.
4.	Selected villages from each selected tehsil	5 (2)	5 (4)	5 (7)
5.	Selected house holds from each selected village	10 (10)	10 (20)	10 (40)

Total selected house-hold for data collection $100+200+400=700$

Following schedules are being developed for data collection under the survey in the project :

- Schedule - I : For complete enumeration of selected villages.
- Schedule - II : For detailed information from selected camel keeping house holds regarding socio-economic status of the house hold, details of all the livestock including camel kept by the house holds, complete information on feed and fodder given to camel, type of fodder plants/trees grown by the house hold for camel use, information on health status and diseases, utilization of camel by-products and a number of other miscellaneous information on camel.
- Schedule - III : For detailed informations on labour employed, procurement of feed and fodder, investment on assets, equipments and recurring expenses, cost of production of camel at birth and cost of raising camel upto various ages and some other general informations.

INTER INSTITUTIONAL COLLABORATION

8.1. Lactoferrin from camel milk

*Dr. T.P. Singh, Prof. & Head
All India Institute of Medical Sciences.
New Delhi - 110029*

Preparation of Lactoferrin

The lactoferrin was isolated and purified from the milk of camels maintained at National Research Centre on Camel, Bikaner. The protein was purified by passing it through a CM-Sephadex C-50 column with a slow gradient of NaCl. The eluted lactoferrin was further purified by passing through sephadex G-200 with a 0.05 M Tris-HCl, pH 8.6. The purified samples were dialysed and lyophilized.

Preparation of Apo-lactoferrin

Purified lactoferrin solution (1%) was dialysed against excess of 0.1 M citric acid.

Preparation of Iron saturated lactoferrin

Lactoferrin was dissolved in 1 ml of 0.1 M sodium bicarbonate at pH 8.6 To this 1.2 ml of ferric chloride reagent was added and equilibrated for 16 hours at room temperature.

Crystallization

Crystallization of macromolecules, basically involved bringing the macromolecules slowly towards a state of minimum solubility. Purified iron saturated lactoferrin was concentrated and used for crystallization. The protein was dissolved as 30 mg/ml in 0.01 M Tris HCl pH 8.0. The crystals were grown by batch method in 10% ethanol in 0.01 M Tri-HCl buffer pH 8.0. The 30 mg/ml was dissolved in above buffer and equilibrated with a reservoir solution containing 8% PEG 4000 in 0.01 M Tris HCl, pH 8.0. The crystals were also obtained by vapour diffusion method using 8% PEG 4000. The crystals were also grown in 10% MPD in 0.01 M Tris HCl buffer, pH 8.0 by vapour diffusion method. The crystals were also grown in 10% ethanol using micro-dialysis method.

The intensity of data collection is in progress.

9.

PUBLICATIONS

9.1. List of articles published during the year

1. Khanna, N.D., Sahani, M.S. and Rai, A.K. 1994. Camel as a milch animal-Indian experience. Proceedings, International workshop on "Camels and dromedaries as dairy animals". 24-26 Oct., 1994. Novakchott (Mauritania) France.
2. Khanna, N.D. and Rai, A.K. 1994. "Oont ki dugdha utpadan kshmata". *Kheti*, 48(1) : 23-24.
3. Rai, A.K. and Khanna, N.D. 1994. Draught performance of Indian camels of Bikaneri breed. *Indian J. Anim. Sci.*, 64(1) : 1092- 1096.
4. Rai, A.K., Nagpal A.K., and Khanna, N.D. 1994. Effect of water restriction on nutrient utilization in Indian camel during summer. *Indian J. Anim. Sci.*, 9:131-137.

9.2. List of articles submitted for publication during the year

1. Jakhmola, R.C. and Roy, A.K. 1994. Feeding energy supplements to adult male camels during winter. *Indian J. Anim. Sci.*
2. Jakhmola, R.C. and Roy, A.K. 1994. Effect of diet and stage of pregnancy on certain blood metabolites of pregnant camel. *Indian J. Anim. Sci.*
3. Jakhmola, R.C. and Roy, A.K. 1994. Comparison of three common roughages as sole feed to camel. *Indian J. Anim. Sci.*
4. Rai, A.K., Manivannan, B. and Khanna, N.D. 1995 Sexual behaviour of camels and poll gland secretion during breeding and non breeding season. *Indian J. Anim. Sci.*
5. Rai, A.K., Manivannan, B. and Khanna, N.D. 1994. Regional differences in the structure of camel skin (*Camelus dromedarius*) at different ages. *Indian J. Anim. Sci.*
6. Agarwal, S.P. and Khanna, N.D. 1995. Current status of camel

hormones during reproductive cycle. International Journal of Animal Reproduction Science.

7. Manivannan, B., Rai, A.K. and Khanna, N.D. 1995. A note on the structure of the skin of poll glands in the Indian camels (*Camelus dromedarius*). Indian Vet. J.
8. Khanna, Deepti., Agarwal, S.P., Gupta, M.L., Rai, A.K. and Khanna, N.D. 1995. Effect of water deprivation during summer and winter on thyroid hormones concentration in Indian camels. Indian J. Anim. Sci.
9. Nagpal, A.K., Rai, A.K. and Khanna, N.D. 1995. Nutrient utilization and serum electrolytes in pack safari camels. Indian J. Anim. Sci.
10. Khanna, N.D., Uppal, P.K. Sharma, N. and Tripathi, B.N. 1995. Occurrence of pox infections in camels. Indian Vet. J.
11. Rai, A.K., Nagpal, A.K. and Khanna, N.D. 1994. Effect of water restriction on nutrient utilization in pack camels under hot humid conditions. Indian J. Anim. Sci.
12. 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.

10.

OTHER ACTIVITIES

Dr. S.N. Tandon, Sr. Scientist, and Dr. M. Kasturi, Research Associate, attended the training on "Serum Immunoglobulin separation by Gel Filtration, Ion Exchange Chromatography held at Department of Bio-Physics, All India Institute of Medical Sciences, New Delhi, during June, 1994.

Dr. S.N. Tandon, Sr. Scientist and Miss Geetika Raisinghani, Research Associate participated in one week training on "Separation and Isolation of Immunoglobulins" at Department of Microbiology, College of Veterinary Science, C.C.S., H.A.U. Hisar (Haryana) during August, 1994.

Dr. M.S. Sahani, Principal Scientist, participated in the International workshop on "Camels and Dromedaries as Dairy Animals" held at Nouakchott (Mauritania) October 24th - 26th, 1994, organised by CIARD, Paris (France).

The centre imparted one week training in the field of "Camel health and Management" to 112 Army Jawans and J.CO's in 10 batches from 19th September to 28th November 1994.

Sh. Ram Kumar, Farm Manager (T-6), participated in the International conference on "Sustainable development of Degraded Lands through Agroforestry in Asia and the Pacific" held at New Delhi from 25th-30th November, 1994 organised by Range management Society of India.

Dr. S. Vyas, Scientist and Dr. S. Sambray, Research Associate were deputed for one month training in Embryo Transfer Technology at Sabarmati Ashram, Goshala (managed by NDDDB), BIDAJ from 3.1.95 to 31.1.95. The training covered various aspects like selection of donors and recipients, superovulation, flushing and transfer procedures, embryo searching and handling and cryopreservation of embryo.

The Shooting Volleyball Team of the centre qualified the Zonal Tournament held at Bhopal and Participated in Inter Zonal Tournament held at Jhansi (UP) from 3rd to 7th October, 1994 and Won the ICAR Championship.

11.

MANAGEMENT COMMITTEE OF NATIONAL RESEARCH CENTRE ON CAMEL, BIKANER.

- | | | |
|----|--|------------------|
| 1. | Project Director, N.R.C. on Camel, Bikaner | Chairman |
| 2. | Director, Animal Husbandry Deptt. Govt. of Rajasthan Jaipur (Raj.) | Member |
| 3. | Director, Animal Husbandry Deptt. Govt. of Gujarat Ahmedabad (Gujarat) | Member |
| 4. | Dean, College of Veterinary & Animal Sciences, RAU, Bikaner | Member |
| 5. | Dr. Kiran Singh, Asstt. Director General (AN&P) ICAR, Krishi Bhawan, New Delhi. | Member |
| 6. | i) Sh. Islamuddin Gauri, S/o Late Sh. Naseeruddin, Sikar (Raj.) | Member |
| | ii) Sh. Jagdish Chaudhary, D-1, U.I.T. Colony, Bikaner | Member |
| 7. | Finance & Accounts Officer, Central Sheep and Wool Research Institute, Avikanagar (Raj.) | Member |
| 8. | 1) Dr. A.K. Rai, Principal Scientist, N.R.C on Camel, Bikaner (Raj.) | Member |
| | 2) Dr. M.S. Sahani, Principal Scientist, N.R.C. on Camel, Bikaner (Raj.) | Member |
| | 3) Dr. S.N. Tandon, Senior Scientist, N.R.C on Camel, Bikaner (Raj.) | Member |
| | 4) Dr. A.K. Nagpal, Scientist, Selection grade N.R.C on Camel Bikaner (Raj.) | Member |
| 9. | Administrative Officer, N R C on Camel, Bikaner (Raj.) | Member Secretary |

12.

PEN SKETCH OF NEW ENTRANTS

1. Dr. Sumant Vyas, Scientist

Born on 28th April, 1965. Kota (Rajasthan) passed B.V.Sc & A.H. from college of Veterinary and Animal Science, Bikaner in 1988 and M.V.Sc (Vet. Gynaecology and Reproduction) from Indian Veterinary Research Institute, Izatnagar in 1990. He served as Veterinary Assistant Surgeon, Govt. of Rajasthan for 3 years, qualified for Agriculture Research Service and joined ICAR on 3rd June, 1993. On completion of management training at National Dairy Research Institute, Karnal, he joined National Research Centre on Camel, Bikaner on 2nd August, 1994.

2. Dr. Raghvendra Singh, Scientist

Born on 6th July, 1964, Farrukhabad (U.P.) passed his B.Sc. from G.K. University, Haridwar (U.P.), M.Sc. (Biochemistry) from G.B. Pant University, Pantnagar (U.P.) in 1987 and Ph.D. (Animal Biochemistry) from National Dairy Research Institute, Karnal in 1992 qualified for Agriculture Research Service and joined ICAR on 21st July, 1993. On completion of management training he joined National Research Centre on Camel, Bikaner on 23rd August, 1994.

3. Sh. Harpal Singh Kaundal, Junior Stenographer

Born on 16th May, 1972 Village Kotla Kalan (H.P.) and joined National Research Centre on Camel, Bikaner on 27th January, 1995.

13.

VISITORS

The National Research Centre on Camel, Bikaner, received 6824 visitors. The visitors included Scientists, Educationists, Administrators, Defence Officers, Indian and Foreign tourists.

वर्ष १९९४-९५ के दौरान केन्द्र हेतु स्वीकृत पदों की संख्या ५९ थी जिसमें १ तकनीकी तथा १ सहायक कर्मचारी के पद रिक्त रहे। इस दौरान परियोजना निदेशक, वैज्ञानिक ८, तकनीकी ९, प्रशासकीय १०, सहायक कर्मचारी (ऑग्निलरी) व सहायक कर्मचारी (सपोर्टिंग) २२ कार्यरत रहे।

बजट

वित्तीय वर्ष १९९४-९५ में योजना मद में ९०.०० लाख तथा गैर-योजना मद में ३२.०० लाख रुपये की धनराशि स्वीकृत की गई थी, जिसमें से क्रमशः ८९.९८ लाख एवं ३१.९९ लाख रुपये व्यय हुए।

उष्ट्र फार्म

इस वर्ष के प्रारम्भ में कुल २५४ ऊँट थे। इनमें मुख्यतः बीकानेरी, जैसलमेरी, कच्छी, अरब x बीकानेरी, सांचोरी व मारवाड़ी नस्ल के थे।

प्रजनन काल के दौरान नजदीक के गांवों के ऊँट पालकों व किसानों द्वारा प्रजनन हेतु लाई गई ऊँटनियों को केन्द्र पर उपलब्ध उत्तम नस्ल के नर ऊँट उपलब्ध कराये गये व इसके अतिरिक्त नर ऊँटों का राज्य की ग्राम पंचायतों को नस्ल सुधार हेतु, राज्य सरकार के माध्यम से निःशुल्क वितरण किया गया।

चारागाह विकास कार्यक्रम के तहत ४० हैक्टेयर भूमि में वर्षा आधारित ग्वार की खेती की गई व करीब ३ हैक्टेयर भूमि में घास प्रत्यारोपण किया गया। वृक्षारोपण कार्यक्रम के तहत ३००० नये पौधे लगाये गये तथा लगभग २०,००० पौधों का रखरखाव किया गया।

शोध कार्य :-

ऊँट की कार्यक्षमता एवं गति पर अध्ययन

दो पहिये के गाड़े पर २.८ किग्रा/किग्रा शारीरिक भार के अनुरूप बोझ डाल कर ऊँट कितनी देर में पूर्णतया थक जाता है और थकावट के कौन से चिन्ह कब दर्शाता है, पर अध्ययन किया गया। बोझ ढोने से श्वास की गति ३.५ से ५.५ घंटे में लगभग ५.२ गुना, नाड़ी की गति १.३ गुना तक बढ़ जाती है और शारीरिक ताप में ३.० से ५.५ डिग्री सेंटीग्रेड की वृद्धि होती है।

कार्य करने की अवधि बढ़ने के साथ-साथ मल-मूत्र त्यागने की आवृत्ति में भी निरन्तर वृद्धि हुई। आंखों से पानी बहना और मुँह से झाग पहले घंटे के पूरा होते-होते दृष्टिगत हुआ। पोल ग्रन्थियों से स्राव की तीव्रता तीसरे घंटे तक निरन्तर बढ़ती रही। अधिकतम ऊँटों ने तीन घंटे के बाद रूक-रूक कर चलना और चार घंटे के बाद बैठने का उपक्रम किया। इसके उपरान्त चाल में लड़खड़ाहट और मांसपेशियों में कंपन स्पष्ट दिखाई दिया। रक्त रासायनों के विश्लेषण के आधार पर लैक्टेट और क्रिएटिन काईनेज को थकावट के चिन्ह का उपयुक्त प्रतीक पाया गया।

विभिन्न ऊँटों ने पूर्ण थकावट तक ९.४ से २२ किमी दूरी तय की व उनकी चाल की गति १.१३ से १.२८ मी/सैकण्ड रही। कार्य एवं शक्ति क्रमशः १.५४ से १.७० कि. जूल/किग्रा और ०.७६ से ०.९८ न्यूटन मीटर/सैकण्ड/किग्रा मापे गये।

ऊँट की आनुवांशिकी विषयों का गुणात्मक एवं मात्रात्मक अध्ययन

केन्द्र में वर्ष के अन्त में ऊँटों की संख्या २४१ थी जिनमें से बीकानेरी ९९, जैसलमेरी ७३, कच्छी ५२, अरब x बीकानेरी, १४, सांचोरी २ व मारवाड़ी १ थे। नवजात बच्चों का लिंग अनुपात ३:१ रहा। ऊँटों के नवजात बच्चों में शारीरिक भार व बढ़ोतरी पर अध्ययन किया गया। जन्म भार पर नस्ल, वर्ष, ब्यांत व लिंग का प्रभाव पाया गया। कच्छी की तुलना में बीकानेरी व जैसलमेरी बच्चों में जन्म भार अधिक पाया गया। दूसरे ब्यांत के बच्चों का जन्म भार पहले ब्यांत के बच्चों की तुलना में अधिक पाया गया। तीन व ६ माह की उम्र में बीकानेरी बच्चों का शारीरिक भार जैसलमेरी व कच्छी नस्लों से अधिक रहा। यही परम्परा ३ वर्ष की उम्र पर भी देखी गई। प्रजनन में काम लिए गये नर ऊँटों का प्रभाव बच्चों के १२ माह के शारीरिक भार पर देखा गया।

जनन सम्बन्धी विषयों पर अध्ययन

ऊँटनियों में ग्याभिन दर ६८.२३ पाई गई तथा दो बच्चों के मध्य जन्म अन्तराल ७०४.४ से ७४२.५ दिन का आंका गया। पहले बच्चे के जन्म की उम्र १४८४.० से १५२२.० दिन देखी गई।

दुग्ध उत्पादन

उपलब्ध तीन नस्लों बीकानेरी, जैसलमेरी व कच्छी में मोठ चारा खिलाकर दुग्ध उत्पादन क्षमता का अध्ययन किया गया। सभी नस्लों में प्रथम ५ से ६ माह के काल में दुग्ध उत्पादन बढ़ने के पश्चात घटने लगता है। दुग्ध उत्पादन पर नस्ल व दूध निकालने के समय का प्रभाव देखा गया। बीकानेरी व कच्छी नस्ल में दुग्ध उत्पादन दर अधिक (२.१ से ६.२ किग्रा प्रति दिन) जबकि जैसलमेरी में सबसे कम देखी गई।

बाल उत्पादन

नस्ल व उम्र के आधार पर वार्षिक बाल उत्पादन क्षमता सबसे ज्यादा बीकानेरी ऊँटों में पाई गई, उसके बाद कच्छी व जैसलमेरी में आंकी गई।

ऊँटों के रक्त समूह व जैव-रासायनिक पररूपता पर अध्ययन

रक्त समूह अभिकर्मक बनाने के लिए ग्यारह जोड़ी ऊँटों में समजातीय टीकाकरण किया गया। उत्पन्न एन्टीसीरम द्वारा हीमोलिसिस देखने के लिए पूरक-स्थायी परीक्षण किये गये जिसके लिए खरगोश व गिनी पिग के पूरक के साथ-साथ गाय का ताजा सीरम भी उपयोग में लिया गया। ऐसी सम्भावना व्यक्त की गई कि ऊँटों में अपूरक प्रक्रिया पाई जाती है।

विभिन्न जातियों (बकरी, भेड़, गाय, भैंस व खरगोश) के दो-दो जानवरों में ऊँट को दाता मानकर विषम-जातीय टीकाकरण किया गया। सभी जातियों में एन्टीबॉडी उत्पादन मापा गया।

गाय व भेड़ की लाल रक्त कणिकाओं द्वारा ऊँटों में भी विषम-जातीय टीकाकरण किया गया।

एकीय रक्त प्ररूपी अभिकर्मकों के पृथक्करण के लिए विषम-जातीय टीकाकरण से प्राप्त प्रतिरक्षण सीरम विभिन्न अवशोषणों व अनुमापक परीक्षणों द्वारा जाँचे गए व तीन अभिकर्मक तैयार किए गए।

ऊँटों में पूरक गतिकी कार्य भी प्रारम्भ किया गया जिसके अन्तर्गत प्रतिष्ठित व वैकल्पिक पूरक पथमार्ग पर अनुसंधान कार्य शुरू किया गया ।

स्वीडन से प्राप्त २३ अश्व रक्त प्ररूपी अभिकर्मकों की ऊँटों में उपस्थिति के लिए परीक्षण किए गए । प्रारम्भिक अध्ययन के दौरान अश्व रक्त प्ररूपी अभिकर्मक ऊँटों में अनुपस्थित पाए गए ।

वर्ष के दौरान ३ विभिन्न स्थानों (राष्ट्रीय उष्ट्र अनुसंधान केन्द्र, बीकानेर-९२, तंवरवाला-३२, व बज्जू-१७) से एकत्रित सीरम के १४१ नमूने विभिन्न प्रोटीनों व एन्जाइमों में जैव-रासायनिक पररूपता के लिए जाँचे गए । निम्नलिखित १३ तंत्रों - हीमोग्लोबिन, एलब्यूमिन, ट्रांसफेरिन, एमाईलेज, एस्टरेजेज, एसिड-फास्फेटेज, एल्केलाइन-फास्फेटेज, लैक्टेट-डीहाइड्रोजिनेज, मैलेट-डीहाइड्रोजिनेज, ग्लूकोज-६-फास्फेट-डीहाइड्रोजिनेज, कार्बोनिक एन्हाइड्रेज, फास्फोहैक्सो-आइसोमरेज व फास्फो-ग्लूको-म्यूटेज में जैव-रासायनिक पररूपता स्थापित करने के प्रयास किए गए । उपरोक्त किसी भी तंत्र में पररूपता नहीं पाई गई ।

ऊँट के पोषण पर अध्ययन

सेवण घास को मोठ चारे के साथ अलग-अलग अनुपात में मिलाकर इसकी पौष्टिकता का अध्ययन किया गया ।

विभिन्न अनुपातों में कैल्शियम और फास्फोरस की मात्रा को मिलाकर ऊँट के बच्चों की वृद्धि एवं उपयोगिता पर पड़ने वाले प्रभाव का अध्ययन किया गया ।

ग्वार फलगटी का बढ़ते हुए ऊँट के बच्चों की देह भार वृद्धि एवं पोषण संबंधी उपयोगिता पर भी अध्ययन किया गया ।

ऊँट के बच्चों को चारे के साथ यूरिया, शीरा एवम् खनिज लवण देने पर उनके पोषण पर पड़ने वाले प्रभाव का अध्ययन किया गया ।

विभिन्न तरह की तीन नस्लों के नर ऊँटों की रक्त प्रोफाइल बनाई गई ।

जनन सम्बन्धी विषयों पर अध्ययन

ऊँटनियों में ऊँट के वीर्य का मूल्यांकन कर उचित रखरखाव देखा गया (क्रायो प्रिजर्वेशन) एवं जाँच आदि का अध्ययन किया गया।

मादा ऊँट के गर्भाधान के बाद अण्डकोष बनने एवं इसके बहिर्गमन की अल्ट्रा साउण्ड स्केनिंग तथा हारमोन्स द्वारा डिम्ब स्वलन के बारे में अध्ययन किया गया।

ऊँट के ग्रन्थियों के स्त्राव पर अध्ययन करने पर पाया गया कि “जूट” (रटिंग सीजन) के दिनों में ग्रन्थियों में अत्यधिक स्त्राव होता है।

ऊँटों में भ्रूण-प्रत्यारोपण तकनीक का शोध कार्य प्रगति पर है।

अन्तर-संस्थान सहयोग

राष्ट्रीय उष्ट्र अनुसंधान केन्द्र में अखिल भारतीय आयुर्विज्ञान संस्थान, नई दिल्ली व कृषि विश्वविद्यालयों के साथ मिलकर/सहयोगिक अनुसंधान कार्य किया गया। इसमें मुख्यतः ऊँट के दूध में लेक्टोफेरिन पर अध्ययन किया गया।

प्रकाशन

वर्ष के दौरान 4 शोध लेख प्रकाशित हुए तथा 12 शोध लेख प्रकाशन हेतु विभिन्न पत्रिकाओं को भिजवाए गए हैं।

उष्ट्र पालन पर अध्ययन

इस परियोजना के अन्तर्गत आस-पास के चार गाँवों के ऊँट पालकों में परम्परागत तरीके से ऊँट पालन पर सर्वे/विचार-विमर्श किया गया तथा पाया गया कि स्थानीय गाँव गाढ़वाला में अन्य पशुओं की तुलना में मुख्य व्यावसायिक पशु ऊँट है। यहाँ ऊँट पालकों की अन्य तीन गाँवों से तुलनात्मक रूप से आय अधिक है।

चारों गाँव के आय अनुपात को देखने पर पाया कि गाढ़वाला गाँव में ऊष्ट्र व्यवसाय से प्राप्त होने वाली आय का कृषि से प्राप्त आय के बाद दूसरा स्थान है।

अन्य गतिविधियाँ—

डॉ.एस.एन. टंडन (वरिष्ठ वैज्ञानिक) एवं डॉ.एम. कस्तूरी (अनुसंधान सहायक) ने अखिल भारतीय आयुर्विज्ञान संस्थान, नई दिल्ली से “सीरम इम्यूनोग्लोबिंस सेपरेशन बाई जेल फिल्टरेशन, आयन एक्सचेंज क्रोमेटोग्राफी एण्ड फ्रैक्शन कलेक्टर” विषय पर प्रशिक्षण प्राप्त किया।

डॉ.एस.एन. टंडन (वरिष्ठ वैज्ञानिक) और कु. गीतिका रायसिंघानी (अनुसंधान सहायक) ने पशु चिकित्सा विज्ञान महाविद्यालय (हरियाणा कृषि विश्वविद्यालय), हिसार द्वारा “सेपरेशन एण्ड आइसोलेशन ऑफ इम्यूनोग्लोबिंस” विषय पर एक सप्ताह का प्रशिक्षण प्राप्त किया।

डॉ. एम.एस. सहानी (वरिष्ठ वैज्ञानिक) ने दिनांक 24 से 26 अक्टूबर, 1994 तक मोरीटानिया में “केमल्स एण्ड ड्रोमेडेरिज एज डेयरी ऐनिमल्स” विषय पर आयोजित अन्तर्राष्ट्रीय स्तर की कार्यशाला में भाग लिया।

केन्द्र द्वारा सेना के 112 जवानों को “केमल्स हेल्थ एण्ड मैनेजमेण्ट” विषय पर 10 समूहों में एक सप्ताह का प्रशिक्षण दिया।

श्री रामकुमार (फार्म मैनेजर) ने रेंज मैनेजमेंट सोसाइटी आफ इंडिया द्वारा “सस्टेनेबल डवलपमेंट ऑफ डिग्रेडेड लैंडस थ्रो एग्रोफोरेस्ट्री इन एशिया एण्ड द पेसिफिक” विषय पर आयोजित अन्तर्राष्ट्रीय सम्मेलन में भाग लिया।

डॉ. एस. व्यास (वैज्ञानिक) और एस. सांभ्रे (अनुसंधान सहायक) ने साबरमती आश्रम गोशाला, बिडज (गुजरात) से दिनांक 3.1.95 से 31.1.95 तक भ्रूण-प्रत्यारोपण तकनीक पर प्रशिक्षण पर प्राप्त किया।

केन्द्र की वॉलीबाल टीम (शूटिंग) ने भारतीय कृषि अनुसंधान परिषद, नई दिल्ली द्वारा आयोजित इन्टर जोनल टूर्नामेंट (दिनांक 3 से 7 अक्टूबर, 1994) में चैम्पियनशिप प्राप्त की।

फार्म में कुल 6,824 आगन्तुक आए जिनमें वैज्ञानिक, शिक्षाविद, प्रशासक, रक्षा अधिकारी तथा भारतीय एवं विदेशी सैलानी प्रमुख थे।

डॉ. सुमन्त व्यास ने वैज्ञानिक, डॉ. राघवेन्द्र सिंह ने वैज्ञानिक एवं श्री हरपाल सिंह कौडल ने कनिष्ठ आशुलिपिक पद पर कार्य भार ग्रहण किया।

ईसर राम देवासी

गाँव - गाढ़वाला

उष्ट्र सवार, राष्ट्रीय उष्ट्र अनुसंधान केन्द्र, बीकानेर के द्वारा उष्ट्र पर रचित कविता

सोनो घणो साथ, बीकाणे री जोड़ में।
ऊँट नीपजे वाह, बीकाणा वाह।
खाण्ड जाण खोपरा, बीज जाण हीरा।
बीकाणे रे देश में, मोटी चीज मतीरा।
काँई दफा दीनों,
साठा रुपीया लीन्हो,
कोरी कूतर छीन्हो।
ऊँट बडो आल गोपाल,
कूद गयो भगताले री पाल।
दोनू नाका बालियाँ, सेईयां देवे तालियाँ।
ऊँट बडो डबियो, बहते पीण-घर ढबियों।
ऊँट बडो चम्पियो, बहते सूरज तपीयों।
काम आगे कांम्पे, जूहीं जमी हाम्पे।
मोरी आगे माने, नस नाखे हाने।
पग दीजो पागड़ा, हाथ दीजो हाने।
टोडियों वीराणों पटकणों,
दोष मत दीजो, खन्ना साहब म्हाने।
गढ़ दिल्ली, गढ़ आगरो, गढ़ बीकानेर।
भलो पियाणो भाटियाँ, सिरह जैसलमेर।
सियाले खाटू भली, उन्याले अजमेर।
नागणो नित भलो, सावण भलो बीकानेर।
एक लावर की लूमबी ही।
पाटण को एक फून्दो हो।
डब्बे में डब्बो हो।
उणमें सगला गेहणा हा।
काँई जाणू कितणे रा हा।
और काँई-काँई हा।
ऊँट फार्म में आच्छी नसल, म्हारा खन्ना साहब,
कच्छी, बीकानेरी, जैसलमेरी, आच्छी नसल वपराई।
बहुत आच्छी उन्नति करि और ऊँट फार्म री बहुत बढोतरी करी।

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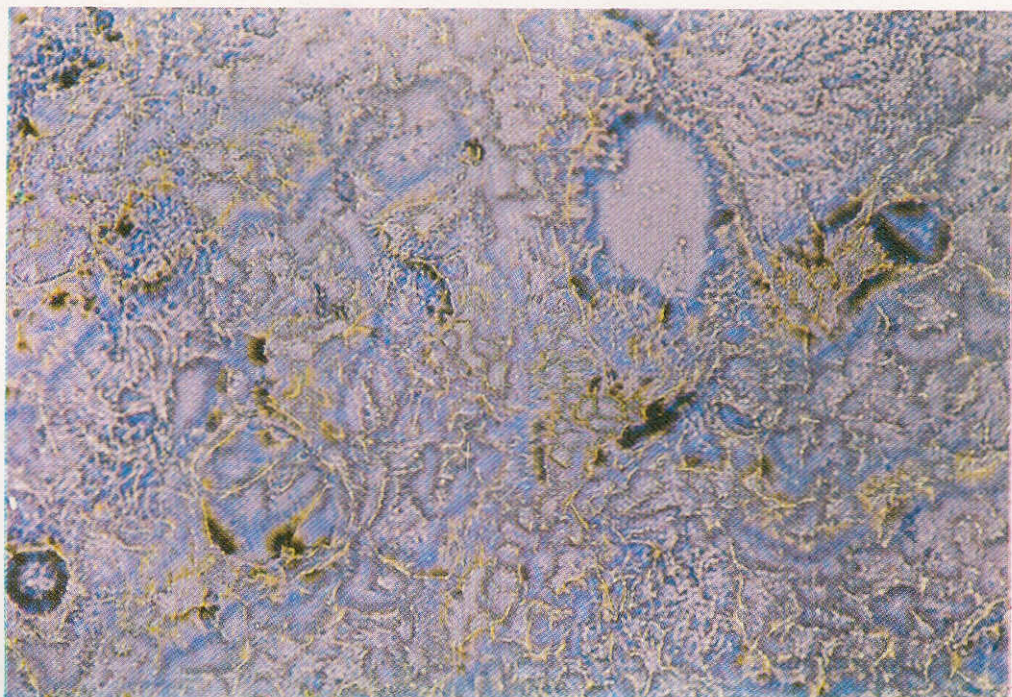


Fig. 4 : 3 β HSDH activity in the poll gland alveoli X50

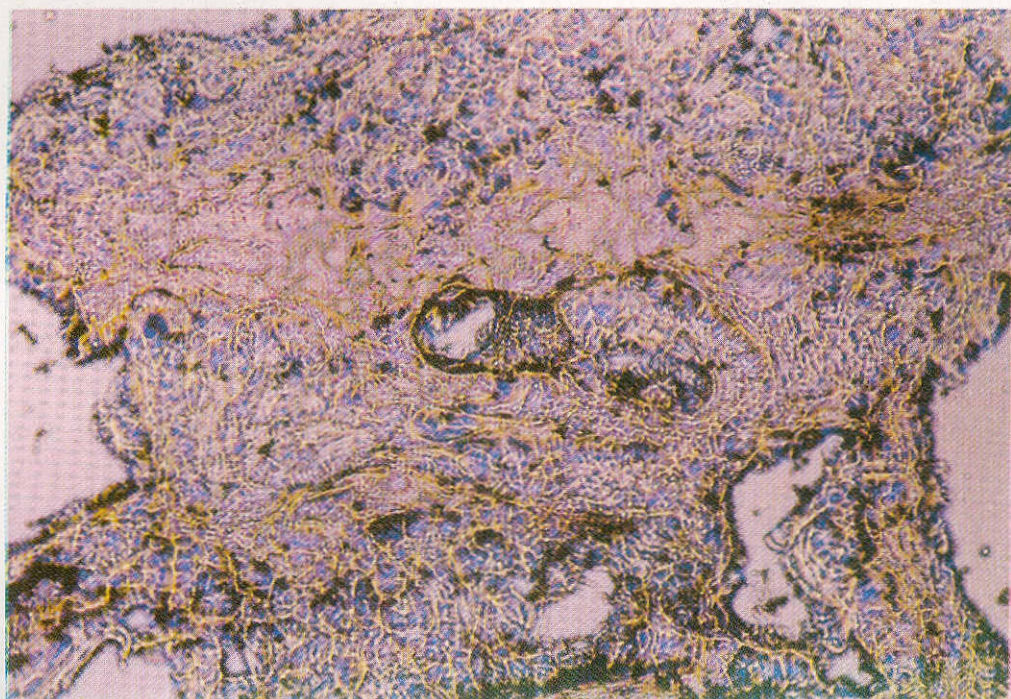


Fig. 5 : 17 β HSDH activity in the poll gland alveoli X50

