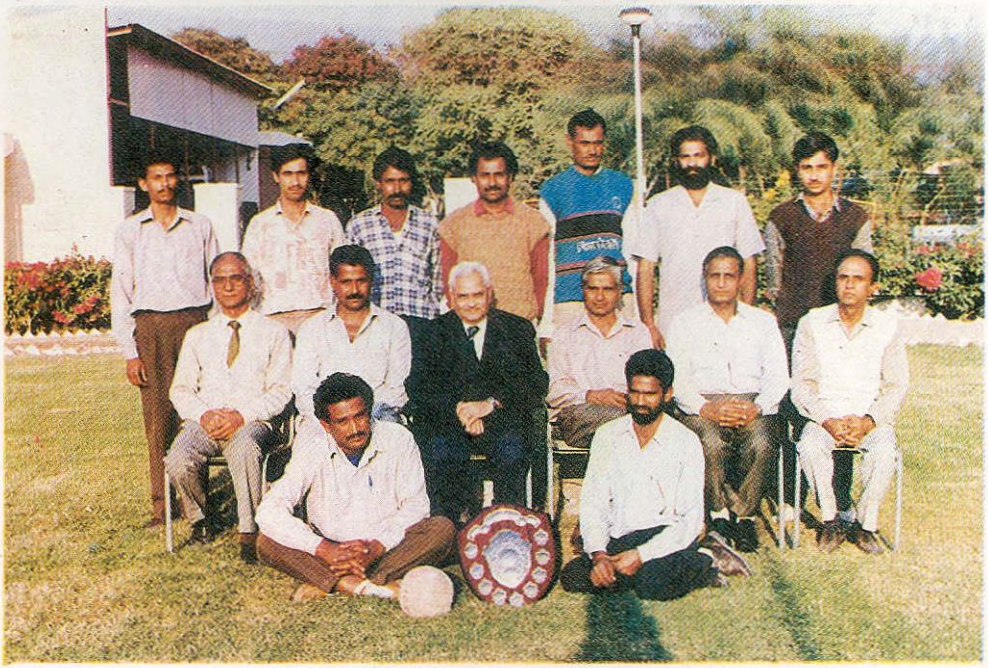
ANNUAL REPORT 1993 - 94

NATIONAL RESEARCH CENTRE ON CAMEL
BIKANER

Desert Camel Safari Team of N R C C and Army



Vollyball (Shooting) team of N R C C, Championship I C A R,
Zonal Tournament, 1994

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ANNUAL REPORT 1993-94

(Estd. 5th July, 1984)

PROJECT DIRECTOR : DR. N.D. KHANNA

NATIONAL RESEARCH CENTRE ON CAMEL
BIKANER

CONTENTS

1.
PREFATORY REMARKS

India has third highest camel population in the world. Out of total world camel population estimated to be 17.019 m, India has 1.5 m (FAO, 1992). There are varied type of indigenous camel resources available which have genetic potential to further improve its their utility for specialized purposes namely, draught, milk, wool, race animal and for specific eco-system viz. hot and cold deserts. The camel have many unique qualities to survive under harsh climate and utilize low quality feed resources which other species cannot consume. Dromedaries represent integral facet of the Indian arid and semi arid rural scene. In fact camels are life line of the rural population in the remote villages. Any development programme for livestock production system to which local people are well adapted, has much greater chance to succeed.

There are apparently no weakness in encouraging the camel development except that camel has low reproductive efficiency, slow herd growth and seasurd breerder. However, these weaknesses can be overcome through proper research and better management practices.

Camels are generally considered environmentally friendly and are not associated with environmental degradation. No negative environmental impact is expected from increased use of camel. There will be benefit in terms of reduced soil compaction if camels rather than motorised power resources are used for transport and agricultural operations. This will also save upon precious foreign exchange on petroleum products. Development of camel based livestock system will increase income generating capability of the local rural population. Camels are renewable natural resource and require renewable natural resource to survive and substantiate.

Many important problems in camel development impinge on the socio- economic conditions of resource poor dry land farmers. An understanding of traditional husbandry practices is important before research priorities are established. Camel husbandry systems are in a state of flux as pastorilists move from their traditional extensive mode to more restricted feeding grounds and semi-intensive and sometimes almost sedentary conditions. These changes need urgent evaluation against established baseline. This rapidly changing scenario creates need for multidisciplinary studies for investigating effect of such changes on the camels and their owners, and the effect of new husbandry systems and related problems arising thereof. The emphasis

would be on developing a national livestock policy, to develop research programmes linking various institutions of the region.

The camels are becoming very popular as game animals, particularly in the gulf countries where very remunerative prices are paid for good racing animals. There is also very good export potential for milk and meat animals. There is genetic potential in the Jaisalmeri camels to be developed as racing camel thoroughbred strain. Kachchhi have very good milch potential & Bikaneri breed is one of the finest draught breeds of the world. The goods made out of camel hide and hair could become very popular to the tourists. Thus, improved camel development programmes are likely to open high export potential for the Indian camel breeders.

The major benefits of a successful research programme to improve camel production systems in the country would be of technical as well as socio-economic nature. Increased food production from arid and semi-arid rangelands; reduced drought susceptibility of camel rearing societies, utilization and recovery of degraded rangelands, development of technically sound and financially attractive packages for camel production; and particularly, more efficient draught and milk production are some of the benefits which would accrue in the medium term. These benefits would not only represent the introduction of new technology, but would have a direct impact on the income-generating capacity of the beneficiaries.

Achievements in the above directions would allow the continued utilisation of rangelands by economically vulnerable groups. Of special importance would be, the benefits derived from the dissemination of technology developed through camel research network, and efforts would have to be made to establish appropriate linkages between the two. Thus, specific technical messages will emerge from the research projects which shall include camel owners as a part of the project target group, with the objective of improving their capacity to generate income and enhance their economic food security. Without the research input, more efficient camel production technologies would not be forthcoming and a large proportion of the present camel owners would, thus, are likely to give up their traditional occupation due to ever increasing difficulties in obtaining essential income for their sustenance.

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 are in position and two scientific posts are vacant.

Table 1.
Staff position during 1993-94

Staff categories	Positions		
	Sanctioned posts	Filled	Vacant
R.M.P.	1	1	—
Scientific	8	6	2
Technical			
Category I	4	4	—
Category II	3	3	—
Category III	3	3	—
Administrative	11	11	—
Auxiliary	5	5	—
Supporting	24	24	—
Total	59	57	2

The names of the members in position during 1993-94 are given below :

Project Director	:	Dr. N.D. Khanna
Scientific		
Principal Scientist (Animal Physiology)	:	Dr. A.K. Rai
Senior Scientist (Anim. Gen. & Breeding)	:	Dr. M.S. Sahani
Senior Scientist (Animal Nutrition)	:	Dr. R.C. Jakhmola
Scientist Sr. Scale (Anim. Gen. & Breeding)	:	Dr. S.N. Tandon
Senior Scientist (Animal Reproduction)	:	Vacant
Scientist Sr. Scale (Animal Nutrition)	:	Dr. A.K. Nagpal
Scientist (Animal Physiology)	:	Sh. A.K. Roy
Scientist (Animal Biochemistry)	:	Vacant
Technical		
Senior Velty. 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	:	Dr. K.L. Mehrara (relieved on 26.2.94)
Library Asstt., T-4	:	Sh. Ram Dayal (promoted w.e.f. 1.1.94)
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. Santokh Singh (Upto 14th November, 93)
Asstt. Fin. & Account Officer	:	Sh. N.D. Sharma

Superintendent	:	Sh. Ashok Mallick
Stenographer	:	Sh. P.K. Nair
Junior Stenographer	:	Sh. Ram Kumar
Senior Clerk	:	Sh. Kanwar Pal
Senior Clerk	:	Sh. Ashok Yadav
Senior Clerk	:	Sh. Jamil Ahmed
Junior 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

Supporting

SSG I to IV	:	24

3.
FINANCIAL STATEMENT

During the year 1993-94, Rs 80.60 lakhs were sanctioned under Plan and Rs 33.50 Lakhs under Non Plan. The expenditure during the year under Plan was 80.06 lakhs and under Non Plan was 33.50 lakhs. The details are provided in the Table 2.

Table 2.
Statement of expenditure

(Rs in Lakhs)

S.No.	Heads of Account	1992-93				1993-94			
		Plan		Non Plan		Plan		Non Plan	
		Budget	Exp.	Budget	Exp.	Budget	Exp.	Budget	Exp.
1.	Estt. Charges	3.00	—	24.49	23.70	3.00	—	28.69	28.61
2.	T.A.	0.20	0.20	0.40	0.40	0.10	0.10	0.40	0.40
3.	Other Charges (Including equipments)	20.00	33.69	4.81	5.84	40.00	42.39	4.01	4.09
4.	Works	16.80	6.11	0.30	0.40	37.50	37.57	0.40	0.40
	Total	40.00	40.00	30.00	30.34	80.60	80.06	33.50	33.50

4.
CAMEL HEALTH MANAGEMENT

4.1. Clinical cases

During the period 182 clinical cases of the farm camels were treated at the veterinary dispensary of the National Research Centre on Camel, Bikaner. The highest morbidity was due to surgical affections and wounds (33.0%) followed by skin affections (28.5%) and digestive disorders (16.0%). It was observed that surgical affections, skin and digestive disorders were maximum in the adult camels as compared to young camels. Anaemia (2.7%), polioencephalomalacia (1.0%), dsystocia and mastitis (2.0%) were also recorded, The age, sex and breed wise morbidity is presented in table 3.

4.2. Prophylactic measures :

(I) All the camels were sprayed with Deltamethrine (0.4%) solution twice during the year (May/June and October/November) in order to control the ectoparasites. The sheds were also sprayed with insecticides twice a year.

(II) Farm camels were administered broadspectrum anthelmintic twice a year before and after rains. Representative samples were screened for worm load and mange.

(III) Quinapyramine sulphate and chloride were injected subcutaneously before and after rains as prophylactic measure against trypanosomiasis.

Table 3.
Age, sex and breed wise morbidity at the N R C on Camel during 1993-94.

		Sex		Age Group			Breed				Total	Percent Morbidity
		Male	Female	0-3 Months	3-36 Months	Above 3 yrs	Bikaneri	Jaisalmeri	Kachchhi	Cross-bred		
1.	DIGESTIVE SYSTEM											
	i. Enteritis	13	9	11	6	5	15	5	2	–	22	12.08
	ii. Ruminal atony	–	3	–	–	3	2	–	–	1	3	1.65
	iii. Ruminal impaction	–	1	–	–	1	1	–	–	–	1	0.55
	iv. Simple indigestion	1	2	–	–	3	1	2	–	–	3	1.65
												15.93
2.	RESPIRATORY SYSTEM											
	i. URI	1	–	–	1	–	–	–	–	1	1	0.55
	ii. Pneumonia	–	1	–	–	1	–	–	–	1	1	0.55
												1.10
3.	CARDIO-VASCULAR SYSTEM											
	i. Anaemia	–	5	–	2	3	3	1	1	–	5	2.75
	ii. Anasarca	1	–	–	1	–	1	–	–	–	1	0.55
												3.30
4.	NERVOUS SYSTEM											
	i. Poleoencephal -omalacia	2	–	2	–	–	2	–	–	–	2	1.10
	ii. Blindness	–	1	1	–	–	1	–	–	–	1	0.55
												1.65
5.	REPRODUCTIVE SYSTEM											
	i. Dystocia	–	2	–	–	2	–	–	1	1	2	1.10
	ii. Retention of placenta	–	1	–	–	1	–	–	–	1	1	0.55
												1.65
6.	SKIN AFFECTIONS											
	i. Mange	38	12	–	20	30	20	12	14	4	50	27.47
	ii. Fungal infection	2	–	–	2	–	1	1	–	–	2	1.10
												28.57
7.	INTERNAL PARASITIC INFESTATIONS	2	5	–	3	4	3	2	2	–	7	3.84
8.	SURGICAL AFFECTIONS											
	i. Wounds & Injuries	36	7	1	2	40	19	10	8	6	43	23.63
	ii. Abscess	1	1	–	1	1	1	1	–	–	2	1.10
	iii. Saddle gall	4	–	–	–	4	1	1	2	–	4	2.20
	iv. Camel bite	3	–	–	–	3	2	–	1	–	3	1.65
	v. Fracture	1	–	–	–	1	–	–	–	1	1	0.55
	vi. Lameness	6	1	–	2	5	5	1	1	–	7	3.84
9.	MISCELLANEOUS											32.97
	i. Mastitis	–	2	–	–	2	–	–	2	–	2	1.10
	ii. Pica	1	2	–	2	1	–	1	2	–	3	1.65
	iii. General debility	8	1	–	3	6	3	3	3	–	9	4.94
	iv. Others	3	3	–	–	6	3	1	2	–	6	3.30
												10.99
	TOTAL	123	59	15	45	122	84	41	41	16	182	

4.3. Mortality

Age and sex wise mortality per 1000 camel days was highest in 0- 3 months age group followed by above 3 years age group and, 3 months to 3 years age group. Mortality was on higher side in males as compared to females. Specific death rate (SDR%) in Bikaneri breed was 6.0%, Jaisalmeri 4.09% and Kachchhi 3.28%. While pooled SDR percentage was 4.48% at the camel farm (Table 4 & 5).

Table 4.
Age and sex wise mortality during 1993-94

Age groups	Sex	Camel Days	No. of Animals died	Mortality per 1000 camel days/day
0-3 Months	Male	1183	03	2.5359
	Female	738	01	1.3550
	Pooled	1921	04	2.0822
3 Months to 3 Yrs	Male	13860	01	0.0721
	Female	14363	01	0.0696
	Pooled	28223	02	0.0709
Above 3 Years	Male	15820	04	0.2528
	Female	41416	02	0.0483
	Pooled	57236	06	0.1048
Overall	Male	30863	08	0.2592
	Female	56517	04	0.0708
	Pooled	87380	12	0.1373

Table 5.
Breed wise mortality during 1993-94

Breed	Camel days	No. of Animals died	Mortality per 1000 camel days/day	SDR %
Bikaneri	36231	07	0.1932	6.00 %
Jaisalmeri	24533	03	0.1223	4.09 %
Kachchhi	21269	02	0.0940	3.28 %
Arab Cross	5347	—	—	—
Pooled	87380	12	0.1373	4.48 %

5.
RANGELAND MANAGEMENT

The range resources of the farm is spread over in 824 ha of desertic area. Developmental activities are mainly confined to the fenced area.

About 43 ha area has been sown as a rainfed crop of guar (*Cyamopsis tetragonoloba*) in the month of July. Due to failure of sufficient subsequent rain, the crop was offered for camel grazing.

Mixed crop of berseem + mustard and lucerne + mustard during winter, and bajra in summer was cultivated in about 2 ha area under irrigation condition as a source of green supplementation for the camels.

About 2000 new plant-seedlings were introduced in the farm area in between paddock No.–1 and new residential area, seedlings were mainly comprising of 4 species namely, *Ailanthus excelsa, Acacia tortilis, Azadirachta indica, Parkinsonia aculeata.* Old plants in paddock No.1 and 2 and in office complex surroundings were maintained.

The annual survivability of plants was around 47% for newly introduced seedlings.

The transplantation work of grass blue panic (*Panicum antidotale*) was being undertaken in block No. 1 along with the roadside leading to paddock No. 2. About 3 ha area was brought under pasture development with this grass during the year. The requisite agricultural operations like weeding, inter-culture, plant protection, application of manure / fertiliser and providing of irrigation etc. were performed in the pasture. Other farm work related with maintenance and development were being performed.

The upper portion of sand dunes in paddock No. I were levelled and stabilised with suitable combination of grasses, legumes and trees.

The farm area supported partial feeding of about 200 camels round the year under report.

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
Associate	:	N.D. Khanna

6.1.1. Investigation on draught performance of Bikaneri camel

The work was conducted on Bikaneri breed of camels well known for the draught. Adult male camels (6 nos.) maintained under semi intensive management system on twice weekly schedule of watering, trained for draught and work performance were used. A four wheel camel cart specially designed by the centre for measurement of the draught was used on a typical desert track with payload @ 2.5 Kg / Kg bwt. The camels were put to a work schedule of 6 h carting viz. 3 h in the morning and 3 h in the evening with 5 h rest in between. The observations were recorded on two consecutive days.

The ambient temperature, cardinal physiological responses, haematological and biochemical parameters which are well recognised on their impact of draughtability were studied for assessing the draught performance.

The physiological responses namely, respiration, pulse rate, rectal temperature and skin temperature were significantly affected by the draught stress (Fig. 1 and 2). All the physiological responses were positively correlated with each other.

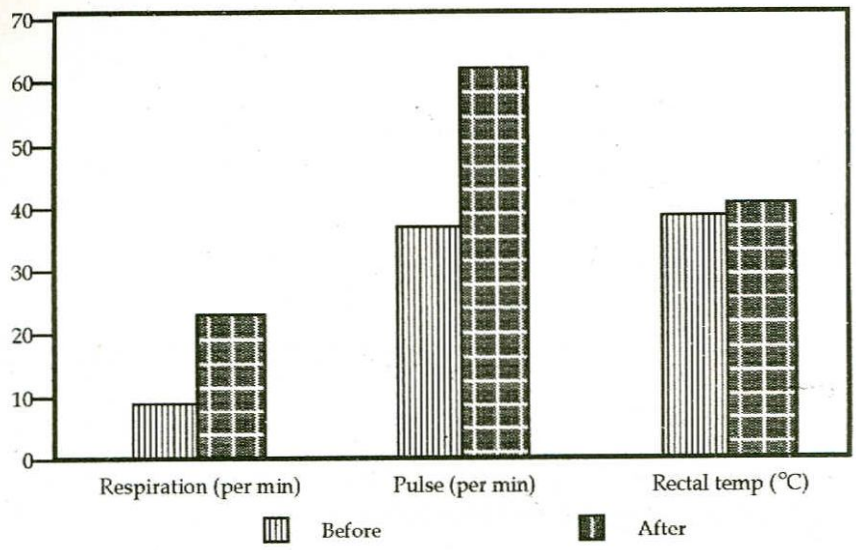

Fig. 1 Changes in physiological responses of camel on 3 h carting

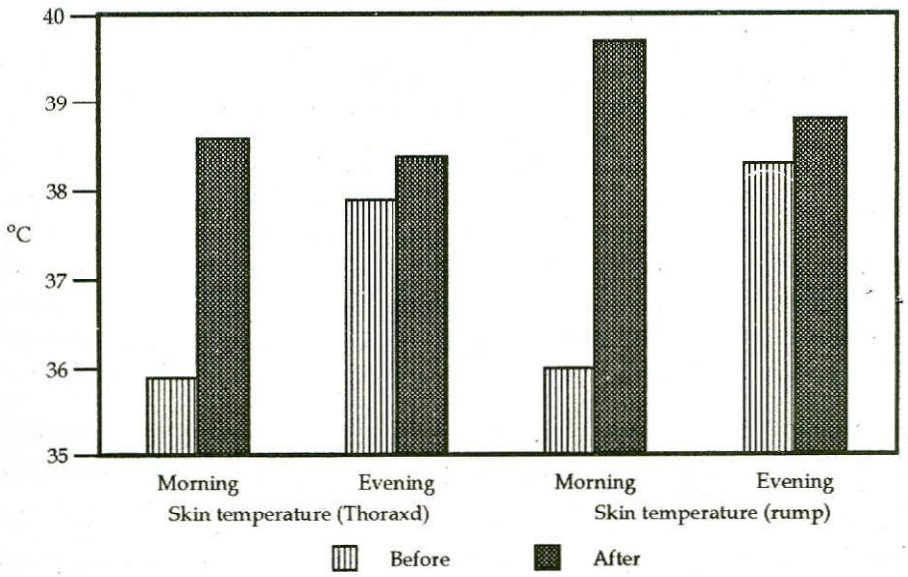

Fig. 2 Changes in skin temperature of camel on 3 h carting

The haematological parameter studied were TC, WBC, Platelets, MCV, PCV, haemoglobin, MCH and MCHC. The WBC count was affected by the time as well as draught stress and exhibited a fall in the count. Other haematological attributes remained unaffected.

The serum samples collected before and after the carting were analysed for alkaline phosphatase, lactate dehydrogenase, creatine kinase, glucose, total proteins, albumin (A), urea, creatinine, cholesterol, and tri-glycerides. The values of globulin (G) and A:G were derived by calculation. Among the various serum biochemical parameters studied the CK, creatinine and tri-glycerides increased while the glucose decreased due to the stress of carting. The urea levels exhibited gradual and continuous increase on each subsequent carting i.e., it was affected by the time and stress both but the level of change did not attain statistical significance.

The camels lost 1.75 to 2.3% body weight after 3 h carting. The draught performance of the camels during two days carting showed a decreasing trend on each subsequent work performance for the distance covered in 3 h duration. The speed also followed the trend.

The camels generated draught force varying from 459.2 ± 16.12 to 468.7 ± 15.45 N, work output 1469.2 ± 94.97 to 1993.0 ± 157.21 KJ, work output (on unit weight basis) 2.33 ± 0.07 to 2.62 ± 0.10 KJ/Kg and power output 0.65 ± 0.200 to 0.73 ± 0.027 Nm/Sec/kg.

The force was not affected by the day and time of the draught. The variation was only 1 to 3%. The work and power output did not exhibit significant effect of day and time.

The Bikaneri camels could cover upto 11.66 ± 0.425 km in 3 h. It was observed that the camels may be used for 6 h work in a day with 4-5 h rest. The camels did not show any sign of stress during the carting. Twice a week schedule of watering did not hamper the draught efficiency of the camels.

6.1.2 Camel Safari :

National Research Centre on Camel, Bikaner participated in a camel safari across Thar desert covering Bikaner, Jaisalmer, Jodhpur, Bikaner. It was a joint venture with the Indian Army. Starting on 22nd Nov., 1993 from Bikaner approximately 950 km distance was covered in 29 days which included 7 days rest at different places. Seven camels were used in this expedition. The camels covered distance ranging from 24 to 70 km per day with an average speed of 43.2 km/d. The animals maintained their body weight and each consumed on an average 13 kg feed daily. The data have been generated on the endurance, physiological and metabolic changes and behavioural aspects. The expedition achieved its objectives.

(a) Feed consumption

The camel enroute were offered dry fodder as per the availability. It consisted of mothchara (*Phaseolus aconitifolius*),guar phalgati (*Cyamposis tetragonoloba*). The average daily dry matter consumption ranged from 9.05 to 10.73 kg/d/camel (13.8 to 18.2 g/kg b.wt.).

(b) Cardinal physiological responses

The respiratory frequency was 8 per min in the morning and it increased to 12 per min on an average after the days movement. The pulse rate varied between 38 to 51 per min in the morning. The increase in pulse rate after travelling was higher upto 6th day (24 to 50%) and the rate of increase subsequently declined over the days (9 to 30%). The average rectal temperature in the morning was 36.7°C and in the evening after covering the distance it was 38.2°C. The variation in feed intake, respiration and rectal temperature was not significant during the period of safari.

(c) Haematological attributes :

The blood samples were collected from the camels immediately before start of safari and the day camels reached Bikaner completing the safari. The samples were analysed for red blood corpuscles, white blood corpuscles, mean cell volume, packed cell volume, haemoglobin content, platelets, mean corpuscular haemoglobin and mean corpuscular haemoglobin concentration. There was marginal increase in WBC count and MCH, on comparing the initial values and the values recorded after completion of safari. Other haematological attributes did not exhibit any marked change.

(d) Biochemical attributes :

The serum samples were analysed for creatine kinase activity, lactate dehydrogenase, triglycerides, glucose, total protein, albumin, globulin, A:G ratio, cholesterol, urea, creatinine, sodium and potassium. There was a sharp decline in the creatine kinase activity and marginal decrease in the level of triglycerides, glucose and urea, whereas, Na and K exhibited increasing trends. The change in rest of the biochemical parameters was not marked.

6.1.3. Draught camel as a source of livelihood

A survey on the use of camel for draught purposes for earning livelihood or their contribution to augment income of the family was conducted. The information on social and economic status of the persons engaged in the profession was also collected. For this purpose, the cart owners from different areas of Bikaner town and the villagers coming to Bikaner with raw material such as fodder, fuelwood etc. for sale were interviewed.

The people engaged in this vocation were mainly Jats, Muslims, Raikas and Rajputs. The camels were used for carting alongwith agricultural operations by 75% owners, whereas, 25% owners used camels only for carting.

The average cost of camel ranged between Rs 4000 to 10000 and camel cart costed Rs. 8000 to 12000. The maintenance cost of camel was estimated to Rs 25 to 40 per day.

The economic analysis of camel carting revealed that the materials were transported from a distance of 100 to 200 km to Bikaner town for sale. The camel carts were used to transport a variety of items viz. water, sand, gas cylinders, food grains and building material etc., within the city. The net income ranged from Rs. 2000 to 5000 per month.

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
Technical Assistance	:	U.K. Bissa

6.2.1. Herd structure

The camel herd strength at the start and close of the year was 244 and 254, camels comprising of mainly three breeds and crossbred group (Arab x Bikaneri). The breedwise opening and closing strength of Bikaneri, Jaisalmeri, Kachchhi and Crossbreed (Arab x Bikaneri) and Marwari was 105, 66, 58, 14 and I and the closing strength in the same order was 105, 72, 60, 16 and I respectively (Table 6). In all 37 calving were there, which comprised of 62% males and 38% female calves. The reduction due to sale / auction was 15 and from deaths was 12 camels. Sexwise composition of herd indicated 37% male and 63% females and the age wise percentage of calves (birth to 3 months) 3-12 months, 1- 3 years and adults above 3 years of age was 12.6, 6.0, 21.6 and 59.8% respectively (Fig. 3 and 4).

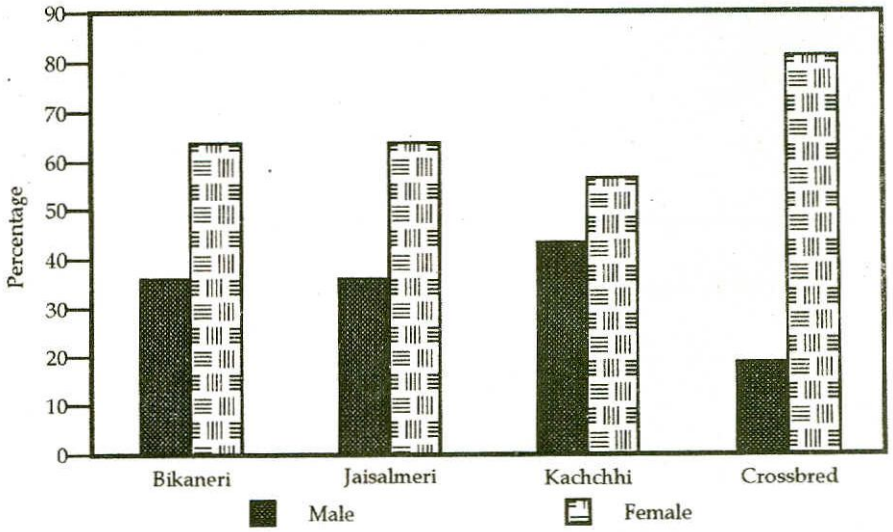

Fig. 3 Breed and Sex-wise percent herd strength

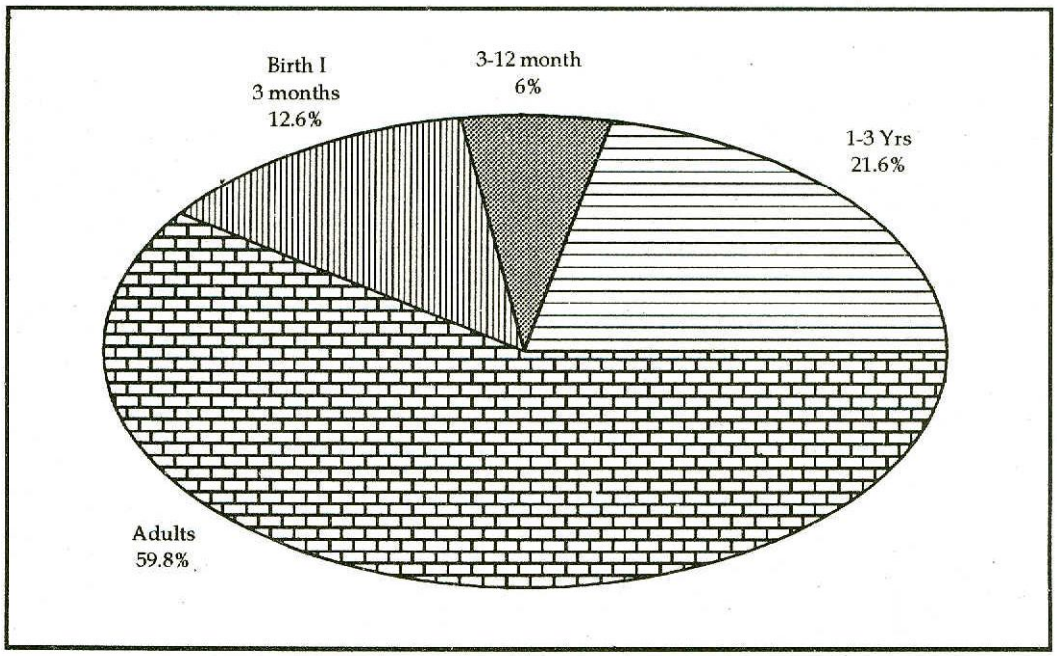

Fig. 4 Age-wise percent composition of camel herd.

Table 6
Breed, age and sex-wise camel herd strength during 1993-94

Breed / Age	Opening		Calving		Total		Deaths		Disposal		Closing	
	M	F	M	F	M	F	M	F	M	F	M	F
Bikaneri												
0-3 Month	1	2	14	5	15	7	2	1	—	—	11	4
3-12 Month	7	10	—	—	7	10	—	—	—	—	2	2
1-3 Yrs.	11	15	—	—	11	15	—	—	3	3	9	14
Above 3 Yr.	17	42	—	—	17	42	4	—	3	3	16	47
Total	36	69	14	5	50	74	6	1	6	6	38	67
Overall Total	105		19		124		7		12		105	
Jaisalmeri												
0-3 Months	4	—	4	6	8	6	—	—	—	—	4	6
3-12 Months	7	1	—	—	7	1	—	—	—	—	4	0
1-3 Yrs.	3	9	—	—	3	9	1	—	1	—	8	6
Above 3 Yr.	10	32	—	—	10	32	—	2	—	—	10	34
Total	24	42	4	6	28	48	1	2	1	—	26	46
Overall Total	66		10		76		3		1		72	
Kachchhi												
0-3 Months	3	3	4	2	7	5	1	—	—	—	3	2
3-12 Months	1	1	—	—	1	1	—	—	—	—	3	3
1-3 Yrs.	8	9	—	—	8	9	—	1	—	—	8	5
Above 3 Yr.	12	21	—	—	12	21	—	—	1	1	12	24
Total	24	34	4	2	28	36	1	1	1	1	26	34
Overall Total	58		6		64		2		2		60	
Crossbred (Arab X Bikaneri)												
0-3 Months	—	1	1	1	1	2	—	—	—	—	1	1
3-12 Months	—	—	—	—	—	—	—	—	—	—	0	1
1-3 Yrs.	—	5	—	—	—	5	—	—	—	—	0	5
Above 3 Yr.	2	6	—	—	2	6	—	—	—	—	2	6
Total	2	12	1	1	3	13	—	—	—	—	3	13
Overall Total	14		2		16		—		—		16	
Marwari												
Above 3 Yr.	1	—	—	—	1	—	—	—	—	—	1	—
Grand Total	87	157	23	14	110	171	8	4	8	7	94	160
Overall Total	244		37		281		12		15		254	

Note—No addition was there from purchase of Camels.

6.2.2. Quantitative parameters

(A) Body weights and growth

The breedwise least squares means of birth weight in Bikaneri, Jaisalmeri and Kachchhi calves was 41.38 ± 1.18, 37.87 ± 2.01 and 35.0± 2.45 Kg respectively. The analysis of birth weight data indicated significant variation due to breed (P<0.01), Bikaneri calves weighed about 9.2% heavier over the Jaisalmeri, and 18.2% over the Kachchhi calves (Table 7, Fig. 5). The biometery at birth indicated similar trend. The average height, body length and heart girth in Bikaneri was 112.46 ± 1.58, 73.6 ± 0.90 and 89.2 ± 1.32 cm, Kachchhi 106.4 ± 2.06, 71.0± 0.95 and 88.0 ± 1.48 cm and in Jaisalmeri 111.25 ± 1.54, 75.87 ± 0.58 and 88.87±1.06. The correlation of birth weight with body height and heart girth were found to be significant (P<0.o1). Regression analysis indicated that height contributed 80.46% variation in the birth weight of Jaisalmeri calves and contribution of heart girth for the birth weight was 74.6% in Kachchhi calves. The birth weight over the years showed significant influence (P<0.01) of breed and year effects.

The contribution of year effect was found to be significant (P<0.01) on the six month weight whereas the 12 month weight indicated significant (P<0.01) influence of breed and year effects. The analysis of body weights at 15, 21st and 27th month of age showed significant contribution year. The contribution of sex was observed to be significant with advancement of age at 36th and 48th month of age.

The analysis of average daily gain from birth to 3 months interval indicated significant influence of breed and sex (P<0.05). The average daily gain from birth to 3 months, 3-6 months, 6-9 months and from 9-12 months was 581.8 ± 21.11, 566.24 ± 23.66, 352.87 ± 23.39 and 243.73 ± 26.10 g/d respectively. The contribution of sire was observed to be significant at 1 and 2 years of age.

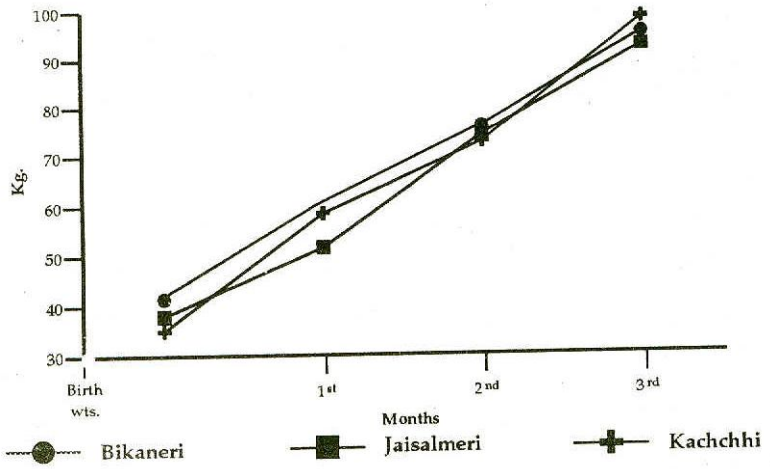

Fig. 5 Breed-wise monthly body weights of camel calves up to three months.

Table 7
Breed-wise L.S.Q. means of body wi eights Birth to 3 month (kg) and biometrical measurements (cms) of camel calves at birth.

Breed	Birth weight	Ist Month	IInd Month	IIIrd Month	Body hight	Heart girth	Body length
Bikaneri	41.38	53.333	75.91	95.0	113.466	89.2	73.6
	± 1.180	± 1.045	± 1.729	± 1.960	± 1.588	± 1.329	± 0.904
	(17)	(12)	(12)	(10)	(15)	(15)	(15)
Jaisalmeri	37.875	51.571	74.0	92.28	111.25	88.875	75.875
	± 2.013	± 2.730	± 3.697	± 4.99	± 1.544	± 1.608	± 0.580
	(8)	(7)	(6)	(7)	(8)	(8)	(8)
Kachchhi	35.00	58.5	72.5	98.0	106.4	88.0	71.0
	± 2.45	± 8.381	± 7.599	± 4.004	± 2.069	± 1.487	± 0.951
	(6)	(4)	(4)	(3)	(2)	(5)	(5)

(B) Reproductive performance

During 1993-94 total 31 females were available for breeding (Bikaneri 11, Jaisalmeri 7, Kachchhi 10 and Crossbred 3). The per - cent conception in Bikaneri, Jaisalmeri, Kachchhi and Cross - bred famales was 72.7, 60.0, 85.7 and 66.6 per-cent respectively with an overall conception of 71%. The per-cent calving on the basis of conception was 100% in all the breed groups. The calving rate of herd varied from 33.3 to 48.7 % with an overall calving rate of 41.6 %. The average gestation length in Bikaneri, Jaisalmeri, Kachchhi and crossbred was 388.66 ± 1.86, 390.27 ± 2.26, 389.8 ± 1.47 and 387.4 ± 4.2 days respectively. Mature females showed slightly longer gestation over the primi para females but the difference was not significant. The calving interval ranged from 683.0 ± 18.05 to 724.5 ± 9.29 days with an overall calving interval of 717.7 ± 8.84 days. The age at first calving was 1853.3 ± 2.40 days.

6.2.3. Milk production

The daily milk production in four Kachchhi camels maintained on mothchara (*Phaseolus aconitifolius*) without any supplementation was studied. The milking was done with machine at an interval of 8 and 16 hrs. The daily milk production during different months of lactation varied from 2.18 ± 0.356 1/day in November to 5.4 ± 0.199 1/day in July (Fig 6). The daily milk production indicated increasing trend upto first 6 month of lactation there after it started declining. The monthly body weight of lactating females showed continuous decline from March to October month and then increasing trend. The total milk production during 9 month & of lactation was observed to be 1133.5 litres.

The colour inheritance of calves in different breeds revealed primarily four main colours viz. brown, light brown, dark brown and black. The colour of Bikaneri calves varied from brown to dark brown and black. All the Jaisalmeri calves were of light brown colour and the Kachchhi calves were of dark brown colour.

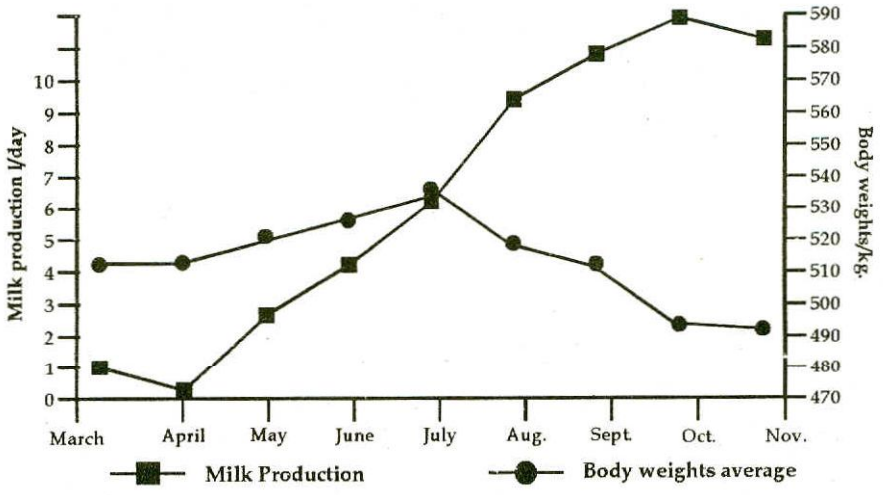

Fig. 6 Monthwise daily milk prodution and body weights in Kachchhi camels.

6.2.4. Biochemical Genetics

Blood samples from 103 camels were collected from three places :

1. National Research Centre on Camel	:	74
2. Gadwala Village	:	16
3. Amarpur Village	:	13

(a) Serum proteins/enzymes :

The serum samples were investigated for protein/enzyme polymorphism using standard techniques of starch gel and polyacrylamide gel electrophoresis. The following 8 systems were studied in sera viz.; albumin, transferrin, amylase, alkaline phosphatase, lactate dehydrogenase, malate dehydrogenase and serum esterases.

(b) Red cell proteins/Enzymes :

The washed red blood cells were haemolysed and were subjected to electrophoresis for investigating haemoglobin polymorphism. A number of enzyme systems viz.; acid phosphatase, phospho-hexose isomerase, phospho-glucomutase, glucose-6-phosphate dehydrogenase, 6-phospho-gluconate dehydrogenase and carbonic anhydrase were investigated.

The staining procedures, number of bands/zones and the polymorphic loci. of different protein/enzyme systems have been presented in table 8.

(c) Milk proteins :

The technique for the separation of different milk proteins on starch gel was standardized. Twenty one milk samples were collected. Fat was removed by centrifugation and electrophoresis was carried out in Tris-EDTA-Boric buffer system acid with urea at a pH 7.8 acid.

The four milk proteins viz; β & κ caseins and β-lacto-globulins were separated. No variation in any of the milk protein was recorded.

Milk and colostrum samples were also studied for lactoferrins. The lactoferrins were separated by the technique of column chromatography. After removal of fat and casein and binding the protein using ion-exchange chromatography, the purification of lactoferrins was done through CM-Sephadex column with a slow gradient. Lactoferrins were further eluted through sephadex G-200 column. The lactoferrins were hydrolyzed at 30°C for 3 hrs in 0.9% NaCl (pH 3).

Table 8.
Bio-Chemical polymorphism of serum proteins and erythrocyte enzymes in camel

Protein/enzyme systems	Buffer system		Band pattern
	Gel buffer	Tank Buffer	
A. Serum			
1. Albumin	Tris-citric acid, pH 5.4	Boric acid NaOH, pH 8.4	Thick single band. Higher mobility than that of sheep.
2. Transferrin	Tris-citric acid, starch gel pH 7.6, PAGE, pH 8.5	Boric acid NaOH, pH 8.6	Three bands. 3 samples exhibited additional fastest band.
3. Amylase	Tris-citric acid, pH 6.8	Boric acid NaOH, pH 8.0	Two bands. Slower band is just at the point of charging.
4. Alkaline phosphatase (Aip)	phosphate buffer, pH 7.0	Phosphate buffer, pH 7.0	Two bands. Faster is deeply stained. While slower band faintly stained.
5. Lactate dehydrogenase (LDH)	Tris-citric acid, PAGE pH 7.6	Phosphate buffer, pH 7-6	5 bands in serum. The slowest band was not very clear. The second from slower was very sharp. The other 3 fast bands were close to each other.
6. Malate dehydrogenase (MDH)	Tris-citric acid pH 7.6	Boric acid NaOH, pH 8.5	Two pink bands, very close to each other. Faster one is deeply stained and sharp.
7. Esterases	Tris-citric acid, PAGE pH, 8.5 Starch gel pH 8.6	Tris-glycine, PAGE 8.6, Starch gel pH 8.6	Fast and slow activity in calves but only slow activity in adults.
B. Red blood cells			
8. Haemoglobin	Tris-Boric acid EDTA, pH 8.9	Tris-boric acid EDTA pH 8.9	Single band
9. Acid phosphatase (Acp)	Phosphate buffer, pH 6.8	Phosphate buffer pH 6.8	Single pink colour band. Disappears within 10-15 minutes after developing.
10. Phosphogluco mutase (PGM)	Phosphate buffer pH 6.8	Phosphate buffer pH 6.8	Thick single band very close to the charging region. it appears that two bands clumped with each other.
11. Glucose-6 phosphate dehydrogenase (G-6-PD)	Tris boric acid-EDTA, pH 8.0	Tris-boric acid EDTA, pH 8.0	Two bands fused with each other (unstable).
12. Carbonic anhydrase	Tris-citric acid, pH 6.8	Boric acid NaOH pH 8.0	Single band, when developed with protein stain.

6.3. To develop suitable management practices for rearing camels

Project code	:	P.I. 86/3-ICN/1-05/5220
Project leader	:	S.N. Tandon
Associate	:	N.D. Khanna
Technical Assistance	:	U.K. Bissa
	:	N. Sharma

A survey of three villages was conducted to record the different management practices adopted by the camel owners. The villages selected were Amarpura, Nada and Gadwala. The village Amarpura is about 5 Km. from Indira Gandhi Canal. The camels are used both for baggage and milk.

While village Nada is only about 1 to 1.5 Km from Indira Gandhi canal. The breeding practices are confined within the village with the available studs. Because of the I.G. canal, a large area is under cultivation and there is no scarcity of feeds, fodder and water. The animals possess good health.

The village Gadwala is about 18 Km from Bikaner and water source is only deep well. The camel population in the village comprises of about 20% males and 80% females. The males are generally used as baggage animal where as females are used for work as well as for breeding. The yearly percentage of breeding was reported to be almost 40% and the conception rate was reported to be very high (over 80%). The females are generally brought to NRCC for stud service any time during breeding season. Due to poor vegetation, the camels are sent to nearby places where fodder and water is available during lean period (November - June). An analyria of swrvey have been presented in (table 9).

Table 9.
The comparative analysis of sample survey in different villages

	Amarpura	Nada	Pooled	Gadwala
Camel : Human ratio	1:12	1:8	1:9	1:5
Camel no : other herbivora	1:44	1:2.5	1:6	1:1.7
Income per animal/year (low due to more number of sheep and goat) Income ratio	Rs. 139	400/-	250/-	508/-
Animal husbandry : Agriculture	44:56	51:49	48:52	67:33
Number of cattle per camel	2.36	0.41	0.60	0.26
% land irrigated : non-irrigated	18:82	35:65	27:73	0:100

An experiment was planned to study " Use of camel milk for milk products". Experiments were carried out to prepare curd out of camel milk and also to prepare cheese (paneer). The work is in progress.

6.4. STUDIES ON CAMEL NUTRITION

Project code No.	:	P.I.-90/4-ICN/L-5220
Project leader	:	R.C. Jakhmola
Associate	:	A.K. Nagpal
	:	A.K. Rai

6.4.1. Studies on pregnant animals :

Nine adult pregnant camels (average body wt. 478 ± 64.68) at 9 months of pregnancy were randomly divided into 3 groups of 3 animals each. The camels were housed in individual stall and were offered mothchara *ad lib.* while each camel in group 2 (T-2) and group 3 (T-3) respectively received 1.0 and 2.0 Kg concentrate (Co-operative Cattle Feed Plant, Bikaner), daily. The camels in group 1 (T-1) were not provided concentrate.

The chemical composition of feeds is given in (Table 10.) In this experiment, as the concentrate was fed as an additive, the obvious effect was on the intakes of DM, CP and ME which increased significantly with the increasing level of concentrate in the diet of camel (Table 11). The body weight gain (g/day) in camels in T-1, T-2 and T-3 were 0.44, 0.50 and 0.82, respectively, during last quarter of pregnancy. The concentration of cholesterol, total protein, albumin and globulin in serum did not differ between treatments (Table 12). The negligible effect of diet on these serum constituents was also indicated as non significant correlation existed between intake (g/Kg $w^{0.75}$) of DM, CP and ME and serum constituents (Table 13).

Table 10.
Chemical composition of roughage and concentrate

	Mothchara	Concentrate
CP	10.5	18.8
NDF	30.6	46.1
ADF	22.4	21.3
Hemi-cellulose	8.2	24.8
Cellulose	14.4	13.7
Ad-lignin	4.59	5.02
A.I.A.	3.48	2.63
Organic matter	82.0	89.23

Table 11.
Mean intake of nutrients (g/ $W^{0.75}$) by camels under different plane of nutrition (Mean ± SD)

	T – 1	T – 2	T – 3
DM	79.57 ± 8.08	86.27 ± 4.38	89.80 ± 10.35
CP	8.28 ± 0.775	9.51 ± 0.624	10.50 ± 1.603
ME (kcal)	156.10 ± 14.36	173.01 ± 9.68	183.81 ± 20.99
ME : CP ratio (Kcal/g)	18.86 ± 0.006	18.22 ± 0.449	17.62 ± 0.951

Table 12.
Effect of diet on different blood constituents of pregnant camels (Mean ± SD)

	T–1	T–2	T–3
Cholesterol	25.346 ± 13.011	24.819 ± 12.443	23.324 ± 9.961
Total protein	6.118 ± 0.467	6.552 ± 0.554	6.349 ± 0.598
Albumin	2.962 ± 0.483	3.312 ± 0.364	3.165 ± 0.363
Globulins	3.156 ± 0.676	3.241 ± 0.624	3.211 ± 0.649
Urea	24.60 ± 10.739	29.23 ± 14.556	31.310 ± 14.922

Table 13.
Relationship between intake of nutrients and various serum constituents

	Cholesterol	T. Protein	Album in	Globulins	Urea
DMI	– 0.213	– 0.027	0.108	–0.098	0.038
MEI	– 0.180	0.0	0.158	–0.106	0.080
CPI	– 0.030	– 0.013	0.222	–0.160	0.183
ME/CP	– 0.294	0.011	–0.314	0.219	–0.398*
Days in Pregnancy	0.637*	– 0.206	0.112	–0.272	0.548*

* Significant correlations ($P < 0.05$)

The effect of advancement of pregnancy on cholesterol content in serum was significant (Table 14). The concentrations of protein, albumin and globulin did not show any definite trend. Urea concentration in serum increased significantly ($P<0.05$) during 12th month of pregnancy and maximum value was attained immediately after parturition.

Table 14.
Effect of advancement of pregnancy on serum constituents of camel (Mean ± SD)

	Months of pregnancy				
	9	10	11	12	After parturition
Cholesterol (mg/dl)	15.60 ± 12.58	17.23 ± 7.29	31.52 ± 6.86	33.64 ± 5.40	43.72 ± 14.29
T. Protein (g/dl)	6.643 ± 0.594	6.340 ± 0.466	5.880 ± 0.551	6.532 ± 0.554	6.204 ± 0.937
Albumin (g/dl)	2.850 ± 0.473	3.260 ± 0.252	3.061 ± 0.316	3.413 ± 0.434	3.000 ± 0.214
Globulins (g/dl)	3.793 ± 0.736	3.080 ± 0.413	2.818 ± 0.451	3.119 ± 0.500	3.204 –
Urea (mg/dl)	20.53 ± 8.934	23.90 ± 7.472	21.38 ± 5.119	47.71 ± 7.875	50.199 ± 20.64

6.4.2. Studies on growing animals :

Nine camels of 2 years of age were given mothchara ad libitum either alone (NS) or with concentrate at the rate of 1.0 Kg/head/day (MP) or 2.0 Kg/head/day (HP) for a period of 100 days. During this period daily feed intake and fortnightly body weight were recorded. Camels gained 277 g, 264 g, and 266 g in HP, MP and NS respectively. Dry matter and organic matter digestibilities were 61.2 and 67.4 % on HP, 58.9 and 65.4% on MP and 57 and 69% on NS respectively. Chemical and statistical analyses are in progress.

6.4.3. Studies on rumen metabolism :

The camel's rumen population was devoid of holotrichs. On the basis of size of ciliates, these were divided in to 3 groups (1) small spirotrichs (mainly entodinia with average size of 43.8 x 27.9 μm). (2) medium sized spirotrichs (dominated by epidinia, average size 103.3 x 46.7 μm) and (3) large spirotrichs (mainly metadinia with average size of 190.0 x 128.3 μm). Small spirotrichs were mainly starch fermenting where as other two have ability to digest hemicellulose/cellulose.

The effect of nature of feed on total and comparative ciliate population was studied. Mothchara diet was supplemented with guar seed meal at the rate of 1.0 Kg/head/day and 2.5 Kg/head/day. Camel's reticulorumen had large proportion of small spirotrichs (57.83%) on mothchara diet. However, after increasing guar meal upto 2.5 Kg the number of small spirotrichs declined sharply to 1.89×10^4/ml which was merely 27% of total ciliate population.

After guar meal supplementation, medium and large spirotrichs out numbered small spirotrichs. The relationship between medium and large spirotrichs was positive (r=0.598). The metadinia which dominated large spirotrichs population had negative correlation (-0.466) with small spirotrichs. The relationship between small and medium spirotrichs was non-significant (0.143).

6.4.4. Studies on unconventional feed for camel

The sewen grass hay is not preferred by camel. The study to observe effect of feeding sewen hay on intake and digrshbitity of nutrients is in progress.

6.4.5. Comparison of three roughages as sole source of nutrients to camel

Crop residues of *Phaseolus aconitifolius* (MCH) *Cyamposis tetragonoloba* (GPH) and *Cicer arietinum* (CKK) were given to 9 camels during early/mid pregnancy. Daily intake, fortnightly weight, rumen degradability parameters and pattern of feed intake were recorded. The serum constituents were also analysed at 30 and 60 days after feeding.

The amount of rumen degradable dry matter (RDDM) was 80.5% in MCH, 59.5% in GPH and 49.6% in CKK (Table 15) and of it 52.4% in MCH, 28.7% in GPH and 44.6% in CKK was instantly soluble in rumen. The slowly degradable dry matter content (SDDM) content in MCH and GPH was similar and it was about 40% more than SDDM content of CKK. The dry matter and SDDM of MCH degraded at a faster rate in the rumen than that of GPH and CKK.

The intake of roughage by ruminants depends to a greater extent on the rate of feed degradation in the rumen because undegraded particles remain in the rumen for a longer period. In the present set of experiments relationship between rate of dry matter degradability (% / h: Kdm) and DM intake (DMI, g/Kg $W^{0.75}$) was positive (DMI = 72.69 + 83.2 Kdm: r= 0.807).

Camels tend to eat at regular interval. During first hour of feeding, the intake of MCH was about 60% higher than both GPH and CKK. Camels ate MCH at a consistently higher rate than GPH and CKK.

Table 15.
Dry matter degradability pattern of roughages in the rumen of camel

	Roughages		
	MCH	GPH	CKK
Rumen degradability parameters			
RDDM	80.5	59.5	49.6
ISDM	42.2	17.1	22.1
SDDM	38.3	42.4	27.5
RUDM	19.5	41.5	50.4
Rate of degradability			
Kdm	0.168	0.086	0.084
Ksd	0.184	0.079	0.085

RDDM = Rumen degradable dry matter (%)
ISDM = Instantly soluble dry matter (%)
SDDM = Slowly degradable dry matter (%)
Kdm = rate of degradation of dry matter in rumen (%/n)
Ksd = rate of degradation of slowly degradable dry matter in rumen (%/n)

6.4.6. Mineral Studies in Camels

(a) Effect on water restriction on nutrient and mineral utilization in pack camels under hot humid conditions

Six adult male camels of Bikaneri breed aged 8-11 years were maintained on mothchara (*Phaseolus aconitifolius*) and twice weekly schedule of watering for 3 months. The camels loaded with 100 kg baggage walked daily for 2 hours in the morning. The animals were divided into 2 groups of 3 each. Group I on twice weekly watering schedule served as control while group II (experimental) was deprived of drinking water for 10 days. The dehydrated camels were offered *ad. libitum* water on 11th day. The experimental camels lost 21.8% body weight on 10 days dehydration. The initial overall DM digestibility of control camels was 54.85 ± 7.11% as compared to 60.87 ± 2.29% in experimental group (Fig. 7). On dehydration a progressive decline in DM digestibility was observed and day 4^{th} onwards it was negative (-80.95 ± 57.81 %). Consequent to rehydration, the average DM digestibility ranged between 60.7 and 94.8%. The digestibility of DM, CP, CF and NFE followed pattern similar to that of DM digestibility. The digestibility of EE was variable and negative from first day onwards. After 72 hours of rehydration, the normal initial level of the digestibility of all the components was restored.

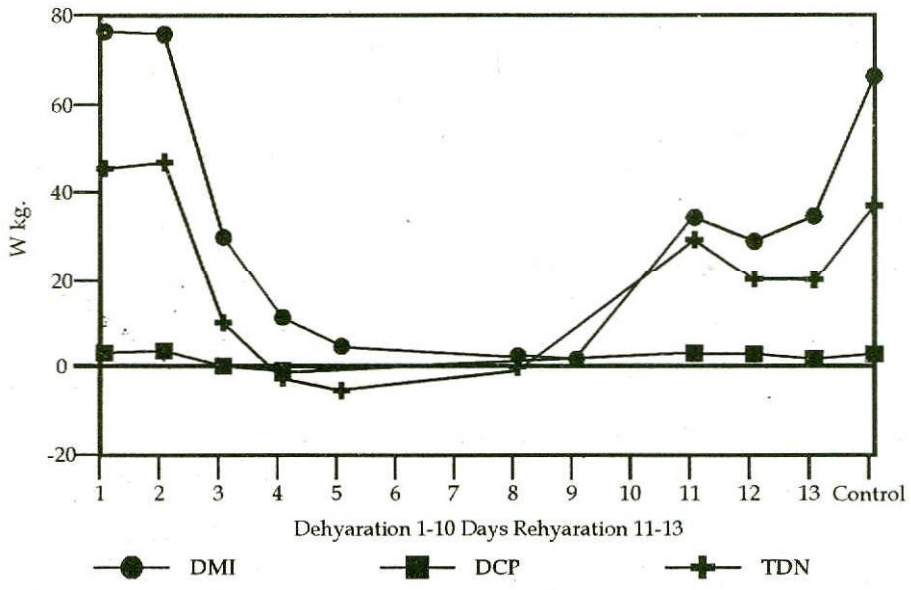

Fig. 7 Nutrient intake in pack camels during dehydration and rehyaration under hot humid conditions.

The nitrogen intake in the control group was 117.4 ± 6.94 g where the losses through faeces and urine were 58.3 ± 2.62 and 37.2 ± 7.33 g/d respectively and the animals were in a positive balance (Fig. 8). The experimental group exhibited a positive N-balance only upto 2nd day and thereafter it decreased from 39.7 ± 13.26 g/d to -39.0 ± 5.62 g/d on 4th day. The percent N-retention also varied accordingly. After 72 hours of rehydration, the intake, excretion and balance of nitrogen did not reach the initial levels.

The DCP and TDN declined from 3.10 ± 0.3 to -1.1 ± 0.3 g/kg $W^{0.75}$ and 45.4 ± 2.3 to -2.9 ± 2.8 g/Kg W 0.75 respectively on 4th day (Fig. 9). Accordingly ME intake (MJ/kg $W^{0.75}$) also reduced. On rehydration after 72 hours, the intake of DCP (g), TDN (g) and ME (MJ) /kg $W^{0.75}$ reached upto 54.8, 43.8 and 43.7% respectively of the first day intake. Consequent to reduced voluntary intake, total intake of both Na and K (g/d) decreased by 94.81 and 85.80% respectively on 4th day of dehydration and was nil on 6th day onwards. On last dehydration day, the faecal and urinary excretion of Na (g/d) decreased by 86.61 and 51.89% respectively and that of K (g/d) by 92.48 and 84.40 respectively resulting in negative Na and K balance. While rehydration after 72 hours could not bring about positive Na balance (-7.85 g/d), it promoted positive balance of K by 36.34% compared to first day values.

The results suggested that camels were efficient in maintenance of normal metabolic profile consequent to dehydration upto 4th day and could restore normal physiological functions on rehydration after 10 days dehydration.

(b). Nutrient utilization and diurnal variations in serum electrolytes and cardinal responses in pack camels

Three adult male camels of Bikaneri breed weighing 634.3 + 31.3 Kg after completing safari of about 950 Km in the Thar desert during winter season were used for this study. After a period of 3 days rest, the camels were sent daily on 40 Km journey, fastened with faecal and urine bags, carrying either 100 Kg pack load or two riders (114 Kg) on their back in turn.

The animals started at 9.00 am and returned at about 12 noon covering to and fro distance of 20 Km. After a rest of 2 hours, the animals again covered 20 Km distance and returned at about 5.00 pm. The camels were kept in open enclosure and offered fresh water at 1.30 pm and dry mothchara (*P. aconitifolius*) ad. libitum.

Daily intake of nutrient on metabolic body weight basis was 73.2 g DM, 3.41 g DCP and 0.59 MJME. Digestibility coefficients of DM, OM, CP, CF, EE and NFE were 53.66, 63.10, 47.10, 26.88, 13.76 and 78.54 % respectively. The average daily retention of N, Na, K, Ca, P and Mg in safari camels was worked out to be 18.41, 8.97, 32.96, 9.21, 13.96 and 0.24% respectively indicating no deficiency problem. While serum Na and Ca showed continuous decline from 8.30 am to 5 pm (5.71-2.31%), the serum K and P showed rise from 8.30 am value to 12 noon values declining at 2 pm and again showing rise at 5 pm. The cardinal responses behaved almost similar to diurnal fluctuation. The camels could cope up with the work stress which was mild.

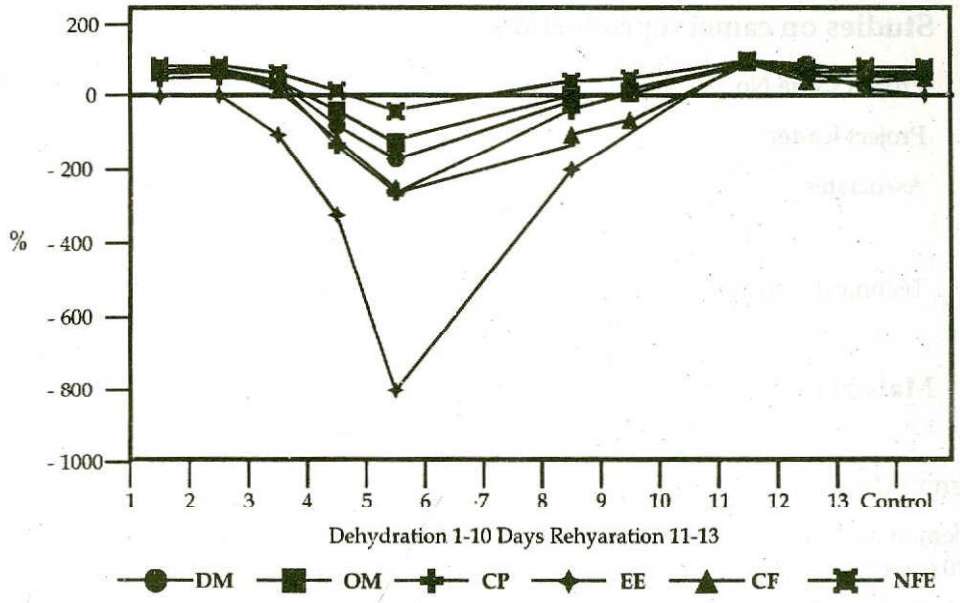

Fig. 8 Digestibility coefficient of nutrients in pack camels during dehydration and rehydration under hot humid conditions.

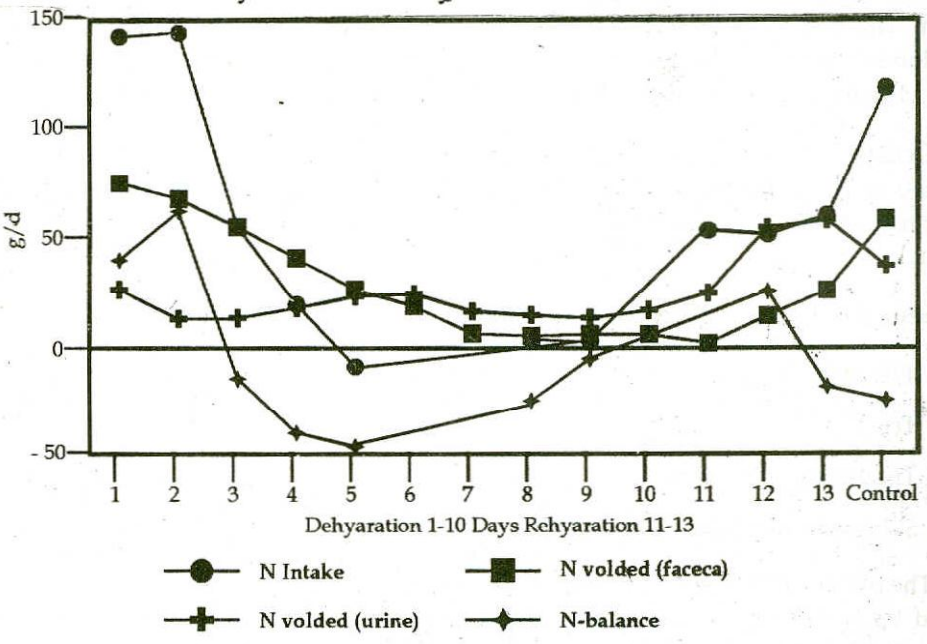

Fig. 9 Nitrogen intake and balance in pack camels during dehydration and rehydration under hot humid conditions.

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
	:	N.D. Khanna
Technical Assistance	:	N. Sharma

6.5.1. Male reproduction

Semen collection, evaluation and preservation

Semen was collected from 10 camel studs aged 6 to 14 years in different months of the year. In all 70 semen samples were collected and evaluated. The frequency of collection was generally twice a week. All the camels donated semen during the breeding season (Nov-March) and non-breeding season except for 1 or 2 occasions in the latter season. The ejaculation time was almost similar (4.3 to 6.2 min) in both the seasons but the volume decreased during off-breeding season. The colour, consistency and other physical characters did not show any marked variation in semen collected during different months. The pH of the semen was slightly lower (7.7 ± 0.17) during hot dry months as compared to breeding season (8.2 ± 0.09).

Occasionally, the sperm motility was observed in a few neat semen samples but the semen collected in tris buffer showed the average motility of ++++ (Range +++ to +++++). The sperm concentration and live dead count did not exhibit any marked difference during different seasons.

Semen preservation studies were conducted using extenders as below:-

1. Tris citrate glucose
2. Tris EYCG
3. Tris citrate with serum
4. Skimmed milk with tris citrate

The pH of all the extenders was 6.8. The semen samples with ++++/+++++ motility were diluted 1:3 with extender and preserved in a refrigerator. The sperm motility +3 was found in all the sample upto 48 h in Tris citrate glucose. At 72 h, the motility was ++ to +++. In a few samples +++ motility was observed upto 96 h.

In other extenders the motility was only ++ upto 48 h. Season had no effect on quality of semen and its preservation.

6.5.2. Female reproduction

(a) Ovarian follicular status of camel :

Ovarian status of camel through the year by rectal palpation revealed that the development of follicle was perceptible in Nov. and almost 90% camels had growing/matured GF on either or both ovaries. Such condition prevailed upto March (fag end of breeding season) and thereafter follicles had a tendency to become oversized and thick walled.

In the month of April, in majority of the camels follicles were over sized and thick walled. The GF was palpable in 80% of dry camels by the end of June and it continued upto first half of August. No GF was available in the months of September and first half of October.

(b) Non-seasonal breeding

(i) Ten empty she camels were kept in close vicinity of camel studs for a month during summer (May/June). These females were then kept in an enclosure with the male exhibiting rutting behaviour. All the females were covered. Six females were found pregnant as indicated by tail lifting after 15 days. The rectal palpation examination conducted after 3 months confirmed pregnancy in 4 animals.

(ii.) In the month of July, twelve she camels ; 6 lactating and 6 dry were examined for ovarian status. In lactating camels no GF was palpable, whereas, in dry group, 5 camels had palpable GF (++ or +++). None of the camels conceived on mating.

(c) Studies on ovulation in camel

She camels aged 8-12 years having calved at least once were divided in to 2 groups of 3 each. The camels of group I were examined per rectum and GnRH (Receptol-Hoechst) 0.5 mcg was injected I/M if matured GF was palpable. No ovulation was detected upto 4th day on per rectal examination.

In group II on palpating matured GF 3000 IU. L.H. (Chorulon) was injected I/V and these animals were examined for ovulation upto 4th day. No ovulation was detected.

(d) Breeding camels immediately after involution

Two months post parturient nine camels were divided into 3 groups of 3 each. All the camels were examined for the ovarian status and no GF was available in any of the animal.

Group "A" was injected I/M PMSG (Folligon) 1000 IU daily for 2 days.

Group "B" was injected I/M Progesterone 250 mg and after 3 days PMSG 1000 IU daily for 2 days.

Group "C" was injected with 5 ml NSS for 2 consecutive days and served as control.

All the camels were examined on 5th day of last injection. In group "A" in one camel immature GF (+) were present on both ovaries and the other two camels were without any GF. In group "B" in one camel 3 medium size GF (++) were present on left ovary, in the second animal one medium size GF was present on each ovary and there was no GF in the third camel.

No GF was present in Group "C".

All the camels of group "A" and "B" were mated on 5th and 6th day and 1500 IU LH was given I/V immediately before first service.

Pregnancy diagnosis by tail lifting method indicated one camel of group B with medium sized GF to be pregnant. None of the other camels conceived as per this test.

SCHEMES/PROJECTS

7.1 Studies on poll glands of camel

Principal Investigator : A.K. Rai

The project was initiated under A.P. Cess fund scheme in March, 1993 with the following objectives :

1. Histological changes in poll gland of camel studs during breeding and non-breeding seasons using scanning and transmission electron microscopy.
2. Histochemically the enzymes of the poll gland will be localized at different intervals/seasons.
3. To assess poll gland activity under altered levels of sex steroids through sequential biochemical changes in the poll gland secretion.
4. To compare the hormonal profile (Sex steroids viz. testosterone, estrogen and progesterone) of poll gland secretion as well as blood of adult camel.
5. To record the changes in the serum electrolyte concentration as per the hormonal fluctuation.
6. Related changes in the composition of urine.
7. Evaluation of semen quality with poll gland activity.

The biochemical composition of poll gland secretion (PGS), the physical evaluation of semen and the behavioural aspect of studs and she camels have been observed during breeding season (Nov- Feb) of the camel. The Specific gravity and biochemical composition of PGS are presented in table 1 and compared with the data of non-breeding season. The general trend showed an increase in the concentration of all the biochemical parameters studied during breeding season.

The physical evaluation of camel semen was studied from 4 studs on 8 different days. On an average the camel produced 4.31 ± 0.78 ml semen per ejaculate (range 2-10 ml). The colour varied from white to creamish and the consistency varied from thin watery to thick gel. The sperm motility and live spermatozoa were 66.94 ± 1.46 and 68.92 ± 14.18 per cent respectively. The sperm concentration was 258.88 ± 33.99 x 10^6/ml. The ejaculation time varied from 2-5 minutes and the number of jerks per collection varied from 10-25.

The behaviour of camel studs was recorded by observing 1) male in isolation 2) in close proximity of she camels and 3) by introducing stud into coral of females. The male secreted copious poll gland secretion. Other features were salivary frothing at the mouth, gurgling sounds, flehmen posture, frequent micturition, soft palate ejection, flapping of the tail, neck biting and sniffing of the females.

The females surrounded the male studs, sniffed the hind quarter, produced gurgling sound and often sat in mating posture. Some of the she camels mounted on other she camels.

When the adult she camel or male calves of 1 to 2 years old, smeared with poll gland secretion were introduced in the female herd, the females aggregated towards the female or calves smeared with PGS and sniffed the smeared area. The common behaviour such as neck biting and sniffing of the smeared females or calves were observed. The effect lasted for 13 to 15 minutes.

Preliminary investigation on separation of proteins in PGS was attempted. The study is in progress.

The biopsy samples of poll gland were obtained during breeding and non-breeding season. The tissue have been processed. The blocks are ready for further process.

7.2. Blood groups and biochemical polymorphism studies in Indian camels

Principal Investigator	:	N.D. Khanna
Associate	:	S.N. Tandon

During the period research work was initiated to develop the blood group reagents. The technique of iso and hetero immunization was adopted to develop polyvalent sera. For this purpose 22 adult camels (male 10, female 12) were selected on the basis of their relations (collateral relatives) to carry out iso- immunization.

The immunization was carried out in three phases. In the first phase 10 male camels were selected. In all 7 immunizations were given in increasing doses, starting from 50 ml whole blood

to 150 ml at a weekly interval. The response was looked for using the technique of haemolysis and agglutination. The immunization was stopped because the immunized animals failed to produce any antibody response.

In the second phase 6 female camels were selected and immunization was carried out intravenously by injecting 250 ml whole blood at a weekly interval for 6 times. At the time of 4th immunization Freund's adjuvant (complete in 3 animals and incomplete in 3 animals, 1 ml dose) was given. A booster dose after a lapse of 1 month was also given intravenously. But this also failed to produce any titre.

Injections 200 ml whole blood were given. Adjuvant was given with fourth immunization, but titre could not be obtained.

Hetero-immunization was carried out in two animals of each species viz, cattle, sheep, goat and rabbit. In cattle and goats 4 immunizations were given at weekly interval, as intravenously and intramuscularly both. The washed red blood cells were used for intramuscular injections, the penicillin and streptomycin were given intramuscularly to avoid any abscess formation at the sight. In rabbits the immunzation was done by S/C route. The level of titre was recorded by making double fold dilution of serum. The titre recorded in goat was 1:8 while in cattle it was 1:64. The antiserum was collected from both the goats 200 ml approximately,, cattle 150 ml.

The two sheep immunized earlier which did not show any antibody titre were given single booster dose after a gap of about 4 months. Titre was achieved in one sheep 1:64. About 100 ml antiserum was collected from this animal.

In rabbits 6 immunizations at weekly interval were given. In one rabbit after 3rd immunization 1:64 titre was achieved and about 50 ml serum was collected from this rabbit.

Haemolysis and agglutination tests were carried out. The antisera developed in sheep, cattle and goat ultimately resulted in reagents when antisera were subjected to unitary tests by absorption and re-absorption with camel RBC.

Blood/serum from 20 cattle were collected to isolate anti-j. The anti-j was present in 4 cattle. The cattle anti-j will be utilized to match and find the presence of anti-j in camel.

7.3 Emeritus Scientist Research Project :

Hormonal manipulations for improvement of reproduction in camel

Professor Emeritus : Dr. S.P. Agarwal

Objectives :

The project aims at :

1. To induce off-season breeding in camel.
2. To induce early puberty in female camel.
3. To reduce intercalving period by early post-partum breeding.
4. To augment fertility in camel.

Experiment :

For inducing off-season breeding in female camels, sixteen female camels were selected and examined rectally for complete involution of uterus, condition of genital tract and ovarian activity. These animals will hormonally be treated to induce ovarian activity and ovulation. The females will be mated with virile studs and their reproductive status will be monitored. Blood samples will also be collected at various stages and analysed for estrogen and progesterone.

Simultaneously semen from few bulls will be collected and evaluated for physical attributes.

8.
INTER INSTITUTIONAL COLLABORATION

8.1. Lactotransferrin from camel milk/colostrum

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

Lactotransferrin is an iron binding protein. This protein together with the homologous serum transferrin serves to control iron levels in body fluids by solubilizing ferric ion. Its presence in leucocytes and many exocrine secretions i.e. milk, saliva, tears, mucosal and genital secretions together with its ability to bind to wide variety of cells, has further been associated with other postulated functions. These include roles in the immune and inflammatory responses, as an antibacterial agent and as a growth factor. The aim of this project is to determine the molecular basis of the remarkable binding properties of lactotransferrin including.

(i) extremely tight ($k=10^{-20}$) but reversible binding of two Fe^{3+} ions per molecule

(ii) the absolute requirement of bound anion (normally CO_3^{2-}) with each Fe^{3+} ions.

(iii) the possibility of binding of other metal ions in place of Fe^{3+} and other anions in place of CO_3^{2-}

(iv) the characteristic differences between different lactotransferrins and transferrins.

(v) the functional viability of the two binding lobes.

The lactotransferrin has been isolated from camel milk/colostrum of the camels maintained at the National Research Centre on Camel, Bikaner. Skimmed colostrum/milk diluted three times with distilled water was adjusted to pH 4.6 using 10% HCL and lactotransferrin was prepared and purified using CM-Sephadex and Sephadex G-200 (Pharmacia).

The purified protein samples were dissolved in 0.01 M Tris HCL (pH 8.0) to a final concentration ranging from 50 mg/ml to 100 mg/ml. These were dialysed against the same buffer with 10% ethanol (V/V) at 10°C. The crystals grew within a week having shinning faces but irregular edges. Using diffraction experiments on the protein, the structural information will be exploited to carry out the site specific engineering on lactotransferrins to enhance its useful antibacterial activity. Further work is in progress.

8.2. Biochemical and hormonal studies of poll gland secretion and its relation with seminal attributes

Parveen Kumar Soni,
Department of Vety. Physiology, CCS, HAU, Hisar,
(Major Advisor, Dr. V.K. Agarwal)

The poll gland secretion was collected from four camel studs during breeding season. Six samples were collected from each bull and analysed for biochemical constituents, electrolytes and steroid hormones. The overall mean values of glucose, total proteins, cholesterol, G-6-phosphatase, sodium and potassium were found to be 4.63 ± 0.47 mg/dl, 0.62 ± 0.06 g/dl, 5.30 ± 1.08 mg/dl, 0.069 ± 0.020 ug/min/ml, 103.3 ± 4.8 meq/l and 556.5 ± 26.0 meq/l, respectively, with wide variations between samples from the same bull as well as between bulls. The mean testosterone and progesterone concentration in poll gland secretion was found to be 132.99 ± 12.19 ng/ml and 2.67 ± 0.39 ng/ml, respectively.

Eight semen samples from each of the four bulls were also collected in artificial vagina and evaluated for their physical attributes and hormone concentrations. The overall average volume, mass motility, sperm concentration/ml, sperm number/ejaculate and percent live spermatozoa were found to be 5.24 ± 0.52 ml, 4.09 ± 0.06, 258.90 ± 11.16 x 10^6/ml, 998.79 ± 68.48 x 10^6 / ejaculate and 79.95 ± 1.15%, respectively, with lot of variation between and within bulls. The overall mean testosterone and progesterone concentration in seminal plasma was found to be 6.9 ± 1.24 ng/ml and 0.26 ± 0.06 ng/ml, respectively.

The effect of poll gland secretion on sexual behaviour of the females was studied. It was observed that the females expressed more or less similar symptoms to a teaser stud as exhibited to a virile stud.

8.3. Studies on gastrointestinal nematodes in camel

Dr. Anil Kumar Partani
Department of Parasitology,
College of Vety, & Animal Sci., R.A.U., Bikaner.
(M.V.Sc. Advisor - Dr. D. Kumar)

Farm camels of various age groups and sexes were examined in summer, rainy and winter seasons for the prevalence of gastrointestinal (GI) nemato doses. Out of 469 faecal samples examined, 393 (83.79%) were found positive for GI nematodoses with intensity ranging from epg 50-28000 (780.40 ± 126.17). Prevalence of strongyle was highest (71.25%) followed by *Nematodirella* (49.11%), *strongyloides* (27.73%) and Trichuris (23.4%). Amongst the strongyle infection *Haemonchus longistipes* was main contributor followed by *Trichostrongylus spp.* The rainy season showed maximum prevalence (95.54%) and intensity (1605.00±317.90 epg) of GI nematodoses and summer season showed minimum prevalence (68.75%) and intensity (207.27 ± 16.95 epg.).

The per cent infection of various species of nematodoses also varied with the season. The results indicated that sex had no significant effect on the prevalence and intensity of GI nematodoses. However, age of the farm camels significantly influenced the prevalence of GI nematodoses. The maximum (92.63%) prevalence was in the camels of age 1-3 years and minimum (64.44%) in the animals ageing below 1 year.

Field camels had higher prevalence of GI nematodoses than the camels kept under semi intensive management at NRCC, Bikaner. It was also observed that rate of infection varied from place to place in the district and season to season within same region.

Total erythrocytic count, haemoglobin,, packed cell volume and total leucocyte count were significantly lower by 40.59, 37.19, 50.25 and 29.16 per cent respectively, and the values of MCHC, neutrophils, monocytes and eosinophils were higher in GI nematodoses infected camels indicating normocytic normochromic anaemia. Biochemical estimations revealed significantly lower total serum proteins, serum albumin, serum globulin and serum urea nitrogen by 18.59, 18.97, 18.21 and 26.23 per cent, respectively, in infected camels.

Ivermectin showed maximum efficacy (98.96 - 99.43%) followed by albendazole (98.95 - 99.30%), levamisole (98.03 - 98.78%), fenbendazole (94.23 - 99.65%) and tetramisole (96.40 - 98.50%). A suspected resistance to fenbendazole and tetramisole was also observed.

8.4. Some studies on the host-parasite relationship of *Trypanosoma evansi* in albino rats

Geetika Raisinghani
P.G. Department of Zoology,
Dungar College, Bikaner.
(Ph.D. Project, Advisor - Dr. M.L. Gupta)

Studies were conducted on the course of infection, haematobiochemical alterations, effect of immunomodulatory drugs on the course of infection, sites of predilection of *parasites* during paroxysmal and non-paroxysmal phases of *T.evansi* infection in albino rats. In addition, the evaluation of DID, CIEP and Sandwich-ELISA at different paroxysmal and non-paroxysmal phases of infection for the detection of *T. evansi* antigen in the serum was also carried out.

Haematological studies revealed significantly lower values of Hb, PCV and TEC in paroxysmal phases of infection. Significant difference in these values between paroxysmal and non-paroxysmal phases was also observed. Significantly higher values of TLC, neutrophils and eosinophils and significantly lower values of lymphocytes and monocytes were observed in both the paroxysmal phases and healthy control rats.

In biochemical studies serum glucose level and A/G ratio were significantly decreased in all the phases of infection and a significant decrease in total serum protein and SGPT values only in paroxysmal phase of infection was noticed. SGOT values showed no marked variation in the different phases of infection.

The site of predilection of trypanosmes was found to be lungs, liver, kidneys and heart in paroxysmal and non-paroxysmal phases of infection, however, the trypanosomes were rarely seen in the brain, spleen and bone-marrow.

The Sandwich-ELISA was found to be the most sensitive technique to detect *T.evansi* antigen in different phases of infection and it could even detect antigen in non-paroxysmal phase of infection.

It was concluded that the present study of *T.evansi* infection in albino rats would be useful and rewarding to understand clinicopathology and immune response against the trypanosomes in paroxysmal and non-paroxysmal phases of infection.

8.5. Effect of variation in calorie intake on growth performance of camel (Camelus dromedarius) calves

Neeraja Sandoo,
Department of Nutrition, College of Veterinary and Animal Science, R.A.U. Bikaner
(M.V.Sc. Advisor-Dr. G.R. Purohit, (Co-Advisor-Dr. R.C. Jakhmola)

Nine yearling calves were randomly divided into 3 groups receiving 3 different levels of energy on a isonitrogenous diet. There was significant ($p < 0.01$) effect of treatment on the gain in body weight and body measurements. Haematological parameters did not show any appreciable variation due to energy levels, period or their interactions. There was a significant effect of treatment on digestibility of nutrients. The intake of nutrients exhibited a significant ($p < 0.01$) effect of treatment and period. Correlation of body weight gain with body measurements and body weight gain with various intakes were found to be positive and highly significant ($p < 0.01$).

It was concluded that supplementation by barley at 40% level was superior and most effective to enhance growth and body weight gain in camel calves.

8.6. Comparative studies on *in situ* degradability of some top feeds in different rumen environments of camel (*Camelus dromedarius*)

Anand Raj Purohit
Department of Nutrition, College of Veterinary & Animal Science, R.A.U., Bikaner
(M.V.Sc., Advisor-Dr. G.R. Purohit), (Co-Advisor-Dr. R.C. Jakhmola)

The extent of dry matter, nitrogen, organic matter degradability were determined by *in situ* technique, of top feeds like subabul, neem, sirus, kikar, pala, khejri and jal. The degradability was estimated by the natural log transformation using equation - p=a+b (1-e-kt).

The mean degradability of dry matter, nitrogen and organic matter was found to be lowest in khejri followed by pala and sirus while jal had highest degradability on the analysis of variance of all parameters in both the RD-1 & RE-2 revealed highly significant difference between environment, feed, feed x environment and period x feed x environment, however, no significant differences were observed in feed x environment in case of nitrogen and organic matter digestibility.

The results of investigation suggest that the degradability of dry matter, nitrogen and organic matter of top feed is greatly influenced by changing rumen environment with high concentration diet.

8.7 Investigations on The Cytogenetic Profile of Indian Camel

Dr. R.K. Vigh
National Institute of Animal Genetics, Karnal

Whole blood cultures were set up from 20 animals of Indian camel (*Camelus dromedarius*) during the period under report. The cultures were doubly synchronised with methotexterate and 5'- Fluorouracil. The first block of mehtoexterate was released with folinic acid. The second block which was introduced with 5'- fluorouracil was released with thymidine for the production of GTG bands and the block was released with 5'- Bromodeoxyuridine for the production of RBG banding pattern. The metaphase spreads have been processed for the GTG and RBG banding patterns and photomicrographs have been taken. The idiograms of the individual chromosome are being prepared for both GTG and RBG bandings.

9.
PUBLICATIONS

9.1. List of articles published during 1993-94

1. Agarwal, S.P., Rai, A.K. and Khanna,N.D. 1993. Effect of low dose FSH administration on ovarian activity during non-breeding season in the camels. (Indian J. Anim., Sc.,) 63(4) : 387-390.

2. Bissa,U.K., Sharma, N., Sahani, M.S. and Khanna, N.D. 1993. A case of heat stroke in an adult camel. (Indian Vet. J.,) 70:753-754.

3. Khanna,N.D. and Rai, A.K. 1993. Traditional camel production in the Indian desert eco-system and its perception in changing socio-economic scenario. Asian Livestock, 18 (10): 127-131.

4. Khanna,N.D. and Rai,A.K. 1993. Milk production potential of Indian Camels. Asian Livestock, 18 (2): 19-21.

5. Khanna,N.D. and Rai,A.K. 1993. Camel draught power for rural energy. Journal of Rural Energy, 2:33-41.

6. Khanna,N.D., Rai,A.K., Agarwal, S.P. and Agarwal, V.K. 1993. Endocrine profile of certain hormones in the Indian camel under different physiological and experimental conditions. Proceedings : National Symposium on Recent advances in Vet. Science & Animal Production, 2-3 Dec., 1993, IVRI,Mukteshwar.

7. Nagpal,A.K., Rai,A.K. and Khanna,N.D. 1993. Nutrient utilization in growing camel calves kept at two watering schedules. (Indian J. Anim., Sc.,) 63 (6) : 671-673.

8. Nagpal,A.K. and Rai,A.K. 1993. Evaluation of guar phalgati (*Cyampoststetra gonoloba*) as maintenance ration for camels. (Indian J. Anim., Sc.,) 63 (5) : 580-581.

9. Nagpal,A.K., Rai,A.K., Sahani,M.S. and Prasad, T. 1993. Macro and micro nutrient utilisation in dry and pregnant camels. VI Animal Nutrition Res. Workers Conference, Bhubaneshwar, 13-16th Sept., 1993. (Abstract No. 264).

10. Nagpal,A.K., Rai,A.K., Sahani,M.S. and Prasad, T. 1993.Mineral absorption in dry and lactating Bikaneri camels. VI Animal Nutrition Res. Workers Conference, Bhubaneshwar, 13-16th Sept., 1993. (Abstract No. 265).

11. Nagpal,A.K., Sahani,M.S., Rai,A.K. and Prasad, T. 1993. Mineral absorption in suckling and growing camel calves. VI Animal Nutrition Res. Workers Conference, Bhubaneshwar, 13-16th Sept., 1993. (Abstract No. 264).

12. Pande, A.M., Agarwal,S.P., Rai,A.K. and Khanna, N.D. 1994. Studies of minerals and electrolytes in peripartum female camels (*Camelus dromedarius*) and their neonates. Proceedings, National Symposium on Livestock Production and Management, Feb., 21-23, 1994. College of Veterinary and Animal Science, Gujarat Agriculture University, Anand.

13. Pande, A.M., Agarwal,S.P., Rai,A.K. and Khanna, N.D. 1994. Studies of biochemical constituents in peripartum female camels (*Camelus dromedarius*) and their neonates. Proceedings, National Symposium on Livestock Production and Management, Feb., 21-23, 1994. College of Veterinary and Animal Science, Gujarat Agriculture University, Anand.

14. Rai,A.K. Sharma,N. and Khanna,N.D. 1993. Ovarian follicular status per rectal examination during breeding season in Indian camels. (Indian J. Anim., Sc.,) 63:830-831.

9.2. List of articles submitted for publication during 93-94

1. Agarwal,S.P., Rai,A.K. and Khanna,N.D. Thyroid status of female camels following mating. (Indian Vet. J.,)

2. Jakhmola,R.C. Effect of watering schedule on intake and digestibility of nutrients in camels. (Indian J. Anim., Sc.,)

3. Khanna,N.D. and Rai,A.K. Sustainable camel energy in Indian context. Indian Farming.

4. Khanna,N.D., Rai,A.K., Tandon,S.N. and Sahani,M.S. Camel genetic resources in India. Proceedings, National Seminar at NBARR & NIAG, Karnal.

5. Pathak,K.M.L. and Khanna,N.D. Trypanosomiasis in camel (*Camelus dromedarius*) with particular reference to Indian sub-continent. International Journal of Animal Science.

6. Rai, A.K. and Khanna,N.D. 1993. Draught performance of Indian camels of Bikaneri breed. (Indian J. Anim., Sc.,)

7. Rai, A.K., Nagpal,A.K. and Khanna,N.D. Effect of water deprivation on nutrient utilization in Indian camels (*Camelus dromedarius*) during winter. (Indian J. Anim., Sc.,)

8. Rai, A.K., Nagpal,A.K. and Khanna,N.D. Effect of water restriction on nutrient utilization in Indian camels during summer. (Indian J. Anim., Sc.,)

10.
OTHER ACTIVITIES

1. Two short courses on Camel Management and Health were organised at the Centre from 13-18th September, 1993 and from 3-8th January, 1994. The first course was attended by 5 veterinarians from Rajasthan State Animal Husbandry Department while in the second course 7 officers representing Remount Veterinary Corps, Border Security Force and State Animal Husbandry Department, Rajasthan were enrolled.

2. Dr. Mahamodou Saley, a veterinarian from Niger was deputed to the National Research Centre on Camel, Bikaner, India by CIARD-EMVT, France for under going post graduate training at this Centre towards practical fulfilment of the Diploma of specialised superior studies in Animal Production in warm regions (CIARD-EMVT France). He sucessfully completed 4 months practical training with effect from 1st May to 31st August, 1993 and submitted a dissertation entitled "Survey of draught camel for carting in an Indian town-Bikaner". He also carried out investigations on draught performance of Bikaneri camel.

3. Camel Safari : National Research Centre on Camel, Bikaner participated in a Camel Safari across Thar desert Bikaner, Jaisalmer, Jodhpur, Bikaner. It was a joint venture with the Indian Army. Starting on 22nd Nov., 1993 from Bikaner approximately 950 Km distance was covered in 29 days which included 7 days rest at different places. Seven camels were used in this expedition. The camels covered distance ranging from 24 to 70 Km per day with an average speed of 43.2 Km/d. The animals maintained their body weight and each consumed on an average 13 Kg feed daily. Data have been generated on endurance, physiological and metabolic changes and behavioural aspects. The expedition achieved its objectives.

4. The Centre's Volly Ball Team took part in the ICAR Inter Zonal Tournament at Bhopal and achieved number one position. The staff also participated in other events.

11.
VISITORS

The National Research Centre on Camel, Bikaner received 7,870 visitors. The visitors included Scientists, Educationists, Administrators, Defence Officers, Indian and Foreign tourists.

12.
MANAGEMENT COMMITTEE OF NATIONAL RESEARCH CENTRE ON CAMEL, BIKANER.

1.	Project Director, N.R.C. on Camel, Bikaner	Chairman
2.	Director, Animal Husbandry Dept., Govt. of Rajasthan Jaipur (Raj.)	Member
3.	Director, Animal Husbandry Dept., Govt. of Gujarat, Ahmedabad (Gujarat)	Member
4.	Dean, College of Veterinrry & 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, Gauri, 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, Senior 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, N.R.C. on Camel, Bikaner (Raj.)	Member
9.	Administrative Officer, N.R.C. on Camel, Bikaner (Raj)	Member Secretary

13.
सारांश

वर्ष 1993-94 के दौरान केन्द्र हेतु स्वीकृत पदों की संख्या 59 थी जिसमें दो पद वैज्ञानिक के रिक्त रहे। इस दौरान परियोजना निदेशक, वैज्ञानिक 6, तकनीकी 10, प्रशासकीय 11 तथा वाहन चालक 5 व सहायक कर्मचारी 24 कार्यरत थे।

बजट

वर्ष 1993-94 की कुल स्वीकृत राशि-योजना मद में 80.60 लाख रूपये थी जिसमें से 79.99 लाख रूपये का व्यय हुआ। गैर-योजना मद में स्वीकृत राशि 33.50 लाख रूपये थी जो पूर्ण रूपेण उपयोग में ली गई।

उष्ट्र फार्म

इस वर्ष के शुरू में केन्द्र पर कुल ऊँटो की संख्या 244 थी। इसमें मुख्यतः बीकानेरी, जैसलमेरी, कच्छी, अरब x बीकानेरी व मारवाड़ी नस्ल के थे।

वर्ष 1993-94 के दौरान केन्द्र पर नजदीक के गांवों के ऊंट पालकों व किसानों द्वारा प्रजनन हेतु लाई गई ऊंटनियों को केन्द्र पर उपलब्ध उत्तम नस्ल के नर ऊंट उपलब्ध कराये गये व इसके अतिरिक्त नर ऊंट राज्य की ग्राम पंचायतों को नस्ल सुधार हेतु राज्य सरकार के माध्यम से निशुल्क वितरित किये गये। चरागाह विकास कार्यक्रम के तहत करीब तीन हैक्टेयर भूमि में घास प्रत्यारोपण किया गया इसके अतिरिक्त 43 हैक्टेयर भूमि में वर्षा-आधारित ग्वार की खेती की गई।

वृक्षारोपण कार्यक्रम के तहत 2000 नये पौधों का वृक्षारोपण किया गया।

वर्ष 1993-94 के दौरान किये गये शोध कार्यों का सारांश

ऊँट की बोझा ढोने की क्षमता पर अध्ययन छः नर वयस्क बीकानेरी नस्ल के ऊँटो पर शारीरिक भार से 2.5 किलो वजन/किलो शारीरिक भार के अतिरिक्त डालकर अध्ययन किया गया। ऊँट गाड़े को 3 घन्टे प्रातः व 3 घन्टे सायं 5 घन्टे के विश्राम/अन्तराल पर कच्चे रास्ते पर किया गया। इस प्रकार किये गये 3 घन्टे के कार्य से ऊँटो के शारीरिक भार में 1.75 से 2.3% कमी पाई गई। दो दिन इस प्रकार निरन्तर कार्य से ऊँटो की कार्य-क्षमता व कार्य गति में कमी आंकी गई। बोझा ढोने हेतु गाड़ा खींचने के लिये ऊँट द्वारा लगाया खिंचाव बल 459.2 ± 16.12 से 468 ± 15.45 न्यूटन अंकित किया गया व कार्य क्षमता 2.33 ± 0.07 से 2.62 ± 0.10 किलो जूल प्रति किलो शरीर भार पाई गई। कार्य के दौरान लगाये जाने वाले बल में 1 से 3% अन्तर देखा गया। कार्य एवम् शक्ति पर दिन व समय का प्रभाव नहीं पाया गया। बीकानेरी नस्ल के ऊँट को छः घन्टे तक गाड़े में प्रयोग करने पर थकान का प्रभाव नहीं पाया गया तथा सप्ताह में मात्र दो बार पानी पिलाने पर भी भार ढोने की क्षमता में कोई प्रभाव नहीं देखा गया।

मरुस्थल में लम्बी ऊँट यात्रा

वर्ष के दौरान केन्द्र द्वारा रेगिस्तान में 950 किलोमीटर की 29 दिवसीय ऊँट-यात्रा आयोजित की गई। यह यात्रा मरुस्थल में कच्चे रास्तों पर सात ऊँटों द्वारा की गई। इसमें केन्द्र के एक अधिकारी तथा 3 कर्मचारी थे तथा भारतीय सेना के एक मेजर सहित अन्य सहभगी थे। यह दल बीकानेर से जैसलमेर, जोधपुर होता हुआ बीकानेर लौटा। इस यात्रा के दौरान 24 किलोमीटर से 70 किलोमीटर तक की दूरी प्रतिदिन तय की गई। औसत दूरी 43.2 किलोमीटर प्रतिदिन तय की गई। इस यात्रा के दौरान ऊँटों की चलने की क्षमता शरीर क्रिया, व्यवहार, खाने तथा उपाचय व रूधिर में होने वाले परिवर्तन व जैव-रासायनिक बदलाव आदि विषयों का अध्ययन किया गया।

ऊँट द्वारा बोझा ढोकर जीविका उपार्जन

वर्ष 1993-94 के दौरान ऊँट गाड़े द्वारा बोझा ढोकर जीविका उपार्जन करने वाले लोगों से जानकारी हासिल कर अध्ययन किया। जिसमें उनकी आर्थिक व सामाजिक स्थिति के बारे में जानकारी एकत्र कर संलग्न किया। इस धन्धे में मुख्यतः जाट, मुसलमान, राईका व राजपूत लोग है, जिनमें से 75% लोग ऊँट से खेती व गाड़े में कार्य लेते हैं तथा 25% लोग ऊँट केवल गाड़े में बोझा (सामान) ढोने का कार्य करते पाए गये हैं।

उनके यहां ऊँट के रखरखाव का खर्च 25 से 40 रूपये प्रतिदिन तक देखा गया। ऊँट गाड़े को मुख्यतः पानी, मिट्टी, लकड़ी, अनाज, गैस सिलेन्डर, भवन निर्माण सामग्री व पशुओं का चारा आदि लाने ले जाने के कार्यों हेतु उपयोग में लेते है तथा 2000 से 5000 रूपये प्रतिमाह तक कमा लेते हैं।

ऊँट प्रजनन पर अध्ययन

(1) नर ऊँट का प्रजनन सम्बन्धी अध्ययन ऊँट के वीर्य का एकत्रण एवं सरंक्षण विषयों पर अध्ययन किया गया। ऊँट वीर्य एकत्रण वर्ष भर भिन्न-भिन्न काल में किया गया। प्रजनन-काल व अन्य काल के दौरान एकत्रित वीर्य में कोई विशेष अन्तर नहीं पाया गया। वीर्य को विभिन्न मात्रा वर्धक सरंक्षण माध्यमों में मिलाकर सरंक्षण सम्बन्धी अध्ययन किया गया। अड़तालिस घन्टे तक प्रयुक्त चारो वीर्य मात्रा वर्धक सरंक्षण माध्यमों में शुक्राणु गति + + + पाई गई। ट्रिस साइट्रेट ग्लूकोज माध्यम के कुछ नमूनों में 96 घन्टे तक शुक्राणु गति + + + तक पाई गई।

मादा ऊँटनी में वर्ष भर स्पृश्यता द्वारा डिम्बकोश की संरचना व डिम्ब उपलब्धी संबंधी अध्ययन किया गया तथा पाया कि प्रजनन काल के दौरान 90 वयस्क ऊँटनियों के एक या दोनों डिम्ब कोश पर डिम्ब होता है जो प्रजनन काल के अन्तिम चरण में बड़े व कठोर होने लगते है। जून माह के अन्त से अगस्त माह तक पुनः 80 मादा ऊँटनियों के डिम्बकोश पर डिम्ब पाये गये। सितम्बर व अक्टूबर मध्य तक डिम्बकोश पर डिम्ब नहीं पाये गये।

गैर-ऋतु प्रजनन :

दस मादा ऊँटनियों को ग्रीष्मकाल (मई-जून) के दौरान नर ऊँट के साथ रखा गया। इनमें से 6 ऊँटनियों ने पूंछ उठाकर ग्याभिन होना दर्शाया। तीन माह पश्चात गुदा स्पृश्यता द्वारा 4 ऊँटनियां ग्याभिन पाई गईं।

डिम्ब स्खलन पर अध्ययन :

Gn RH व L.H. हारमोन द्वारा डिम्ब स्खलन सम्बन्धी अध्ययन किया गया, इसके अतिरिक्त गर्भाशय अंतरभिमुख होने पर प्रजनन सम्बन्धी अध्ययन किये गये।

ऊँट की आनुवांशिकी विषयों का गुणात्मक व मात्रात्मक अध्ययन :

बाकानेरी, जैसलमेरी व कच्छी नस्ल के बच्चों का जन्म के समय शरीर-भार तथा इसमें होने वाली वृद्धि का अध्ययन किया गया, बीकानेरी नस्ल के बच्चों का जन्म-भार अधिक पाया गया। शरीर-भार वृद्धि में छः माह की आयु तक वर्ष का प्रभाव पाया गया, 12 माह के शरीर-भार में नस्ल व वर्ष दोनों का प्रभाव अधिक पाया गया। जबकि 3 से 4 वर्ष के शरीर-भार में लिंग भेद का प्रभाव देखने को मिला।

जनन-सम्बन्धी विषयों का अध्ययन

ऊँटनियों मे ग्याभिन दर 71% पाई गई । ग्याभिन ऊँटनियों में बच्चा जन्म दर 100% पाई गई, दो बच्चों के मध्य जन्म अन्तराल 717.7 ± 8.84 दिन आंका गया, पहला बच्चा जन्म की उम्र 1853.3 ± 2.40 दिन पाई गई ।

दुग्ध उत्पादन

चार कच्छी नस्ल की ऊँटनियों को मोठ चारा खिलाकर दुग्ध उत्पादन का अध्ययन किया तथा पाया कि दुग्ध उत्पादन प्रथम छः माह बढ़ता है तत्पश्चात् घटने लगता है । प्रथम नौ माह में कुल दुग्ध उत्पादन क्षमता 1133.5 लीटर देखने को मिली ।

ऊंट के रखरखाव पर अध्ययन

वर्ष 1993-94 के दौरान इस विषय पर किया गया अध्ययन नहरी व बारानी क्षेत्र के गांवो जहां लोगों द्वारा किये जाने वाले रखरखाव, ऊँट की उपयोगिता एवं प्रजनन सम्बन्धी विषयों की एकत्रित जानकारी पर आधारित है ।

ऊँट के पोषण पर अध्ययन

ग्याभिन ऊँटनियों में नौ माह के गर्भकाल में केवल मोठ चारा, मोठ चारा व 1 किलो पशु आहार तथा मोठ चारा व 2 किलो पशु आहार खिलाने पर उनके शारीरिक भार में वृद्धि तथा रक्त के घटकों में होने वाले परिवर्तन का अध्ययन किया गया ।

इसी प्रकार का अध्ययन दो वर्ष की आयु वाले बच्चों में भी किया गया तथा उनके शरीर भार में वृद्धि का अध्ययन किया गया ।

ऊँट के रयूमन उपापचय का अध्ययन किया गया । ऊँट के रयूमन पाये जाने वाले जीवाणु व प्रोटोजेआ का अध्ययन किया गया । ऊँट को खिलाए जाने वाले चारे व दाने की संरचना का बैक्टीरीया व प्रोटोजेआ पर पड़ने वाले प्रभाव देखे गये । इसके अतिरिक्त आमतौर पर ऊँट को न दिये जाने वाले चारे के बारे में अध्ययन किया जा रहा है । मोठ चारा, ग्वार फलगटी व चने की खार को खिलाकर उनके रयूमन उपापचय, चयापचय आदि विषयों का तुलनात्मक प्रभावो के अध्ययन किये गये । उष्ण आद्र मौसम के दौरान कम पानी देने पर लवण उपापचय का अध्ययन किया गया ।

हारमोन द्वारा प्रजनन-क्षमता में सुधार विषय पर भी कार्य शुरू किया जा रहा है जिसमें असामयिक प्रजनन, कम आयु में वयस्कता, जन्म अन्तराल में कमी व ऊँट की जनन क्षमता को बढ़ाना है ।

परस्पर सहयोगिक कार्यक्रम

राष्ट्रीय उष्ट्र अनुसंधान केन्द्र ने अखिल भारतीय आयुर्विज्ञान संस्थान एवं कृषि विश्वविधालयों के साथ विभिन्न विषयों पर सहयोगिक अनुसंधान कार्य किया । इस कार्यक्रम मे डाक्टरेट व स्नातकोतर विधार्थियों द्वारा किया गया अध्ययन कार्य भी सम्मिलित किया गया है,

(1) इस केन्द्र व अखिल भारतीय आयुर्विज्ञान संस्थान, दिल्ली के सहयोग से ऊँट के दूध व कोलेस्ट्रम से लेक्टोट्रांसफरिन निकाल कर उसे परिष्कृत किया गया । लेक्टोट्रांसफेरिन में रोग जीवाणुओं को समाप्त करने के गुण होते है । इस विषय पर विस्तृत अध्ययन किया जा रहा है ।

(2) श्वेत चूहों व ट्रिपेनोजोमा इवानसाई के मध्य मेजमान व परजीवी सम्बन्धों का अध्ययन किया गया । रोग के दौरान रूधिर, जैव रासायनिक परिवर्तनों का अध्ययन भी किया गया ।

(3) पोल ग्रंथी के स्त्रावों का जैव-रासायनिक व हारमोन का अध्ययन तथा वीर्य द्रव पर इसका प्रभाव विषय पर शोध कार्य किया जा रहा है ।

(4) ऊँट की आंतो व पेट में पाए जाने वाले परजीवीयों (निमेटोड) का अध्ययन किया गया ।

प्रकाशन

इस सत्र के दौरान 14 शोधपत्रो का प्रकाशन किया गया व 8 शोधपत्र प्रकाशन हेतु भेजे गए ।

अन्य

वर्ष 1993-94 के दौरान इस केन्द्र द्वारा उष्ट्र प्रबंध एवम् स्वास्थ्य विषय पर दो अल्पावधि पाठ्यक्रम आयोजित किये गये । जिसमें भारतीय सेना, सीमा-सुरक्षा बल व राज्य के पशु-पालन विभाग से प्रशिक्षु प्रशिक्षण हेतु आए ।

फ्रांस की एक संस्था के सहयोग से एक विदेशी पशुचिकित्सक अपने स्नातकोत्तर पाठ्यक्रम के प्रायोगिक, प्रशिक्षण व अनुसंधान कार्य हेतु आया ।

इस केन्द्र द्वारा सेना के सहयोग से थार रेगिस्तान में 950 किलोमीटर दूरी की ऊँट यात्रा की गई । यह 29 दिवसीय यात्रा सफलतापूर्वक/लक्ष्य प्राप्ति के साथ सम्पन्न हुई, केन्द्र की वॉलीबाल टीम ने भारतीय कृषि अनुसंधान परिषद् द्वारा भोपाल में आयोजित अन्तर-प्रांतीय मुकाबलें में विजेता रही ।

इस वर्ष केन्द्र को देखने 7870 आगन्तुक आए, जिनमे मुख्यतः वैज्ञानिक, शिक्षाविद्, प्रशासक, सेना अधिकारी तथा देश व विदेशों के पर्यटक थे ।

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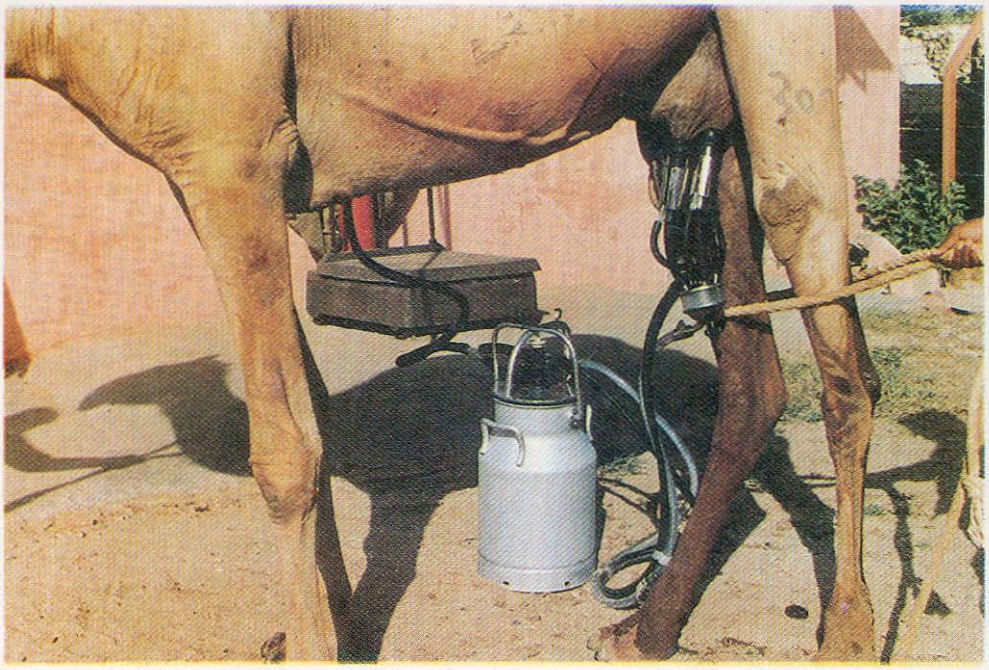
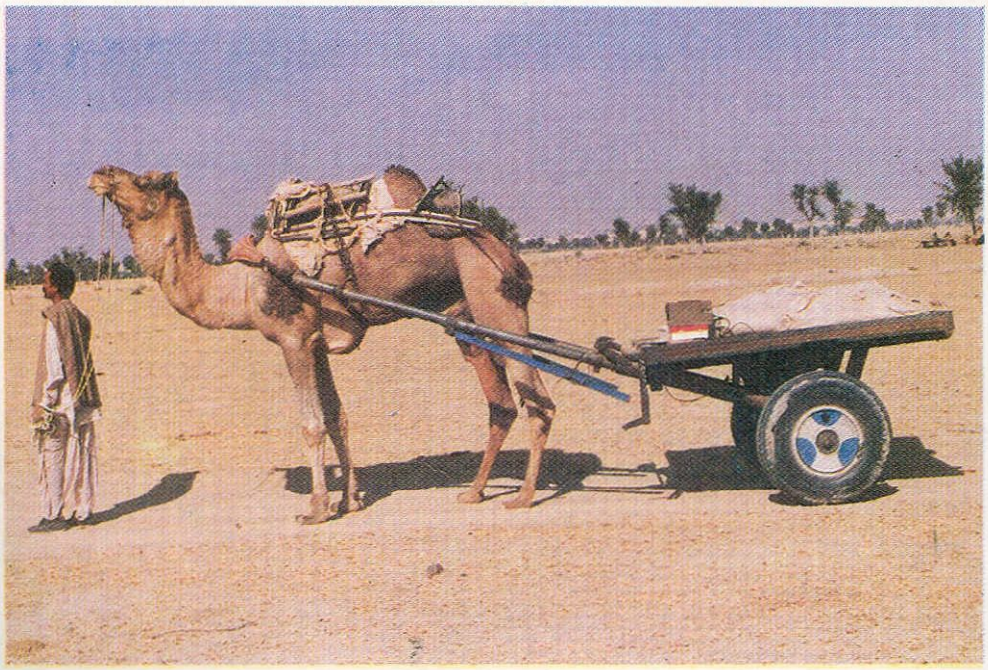


Machine Milking of Camel



Measurement of Draughtability using Two Wheel Cart