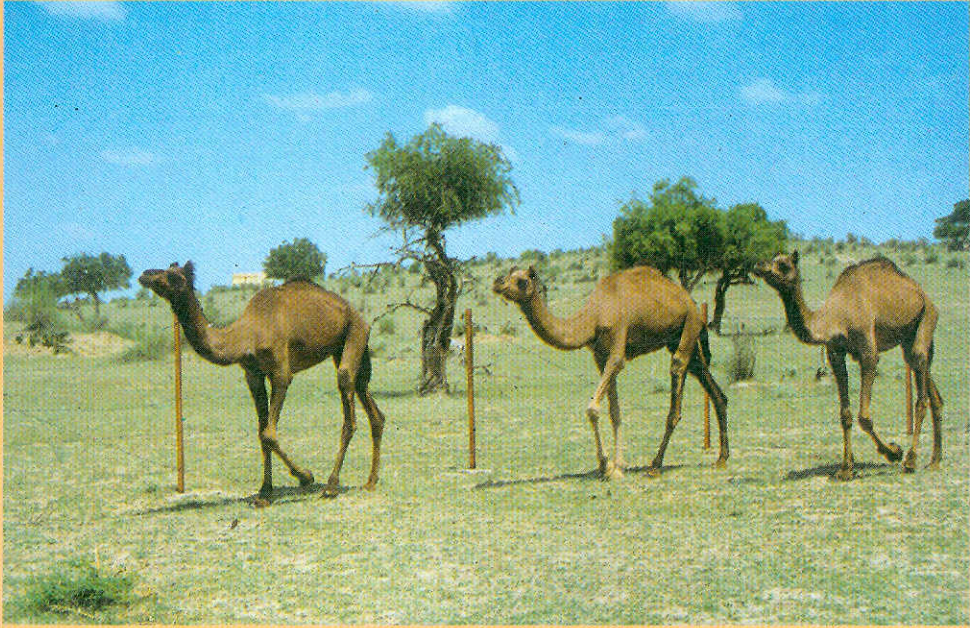


वार्षिक प्रतिवेदन

ANNUAL REPORT

1999-2000



राष्ट्रीय उष्ट्र अनुसन्धान केन्द्र

जोड़बीड़ बीकानेर

National Research Centre on Camel

Jorbeer, BIKANER



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capacity experiment in
the farm rangeland
Back : Double Humped camels
in the rangeland of
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Director : Dr. M. S. Sahani



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PREFACE

I have a great pleasure in presenting the Annual Report (1999-2000) of National Research Centre on Camel (NRCC), Bikaner. The report provides a overview of various ongoing research projects, organizational set up, infrastructure development, man power, budget account, adhoc schemes, collaboratives programmes both at National and International level along with extension activities. Indigenous camel breeds were evaluated for race potential and other related parameters as a part of major programme. Cryo preservation of camel semen was attempted for the first time and the results were encouraging. The reproductive efficiency of farm camel herd during the regular breeding season indicated significant improvement in overall percent conception by adopting improved research techniques. Random amplification of polymorphic DNA (RAPD-PCR) was carried out using six oligo nucleotides primers. Anthelmintic and acaricidal trials were conducted against gastro intestinal nematodosis and sarcoptic mange, respectively. The utility of camel raw milk as nutritional adjuvant in faster recovery of tuberculosis was continued in collaboration with S.P. Medical College and State Government TB Hospital, Bikaner by incorporating new parameters. Economics of early weaning of camel calves through supplementation was compared with traditional system of management. Comparative economics and role of camel cart as source of employment was undertaken both at rural and Krishi Upaj Mandi, Bikaner. Four new research projects were initiated at the centre under NATP during the year.

Under infrastructure development work on front side boundary wall was completed. Camel corrals, dispensary, fodder manger and water channels were constructed in farm area (Block No. 2). Agriculture farm office cum store was started (Block No. 1). The campus tube well and farm area tube wells were interconnected beneath the Railway line after obtaining permission from Northen Railway Department in order to overcome water supply problem. A new set up for camel museum and renovation of Genetics laboratory were completed.

The NRCC has also taken concrete steps to act as National Repository of scientific informations regarding camel. The dissemination of knowledge and technology, human resource development and staff welfare activities have been given due priority.

Besides, during Golden Jubilee year of Hindi various activities, *Hindi Pakhwara*, *Vad-Vivad Pratiyogita* and other functions were organized.

As many as four students of State Agricultural Universities and All India Institute of Medical Science were provided necessary laboratory as well as other facilities for completion of their Doctoral programme.

I express my sincere gratitude to Dr. Kiran Singh, DDG (Animal Science); Dr. Arun Varma, ADG (AN&P) and other officials of ICAR headquarter for their cooperation, guidance and support from time to time. The credit for overall implementation and activities goes to all the Scientists, Technicals, Administrative staffs, Incharge Technical Cell, Publication Committee, Computer Unit and other staff members.



(M.S. Sahani)

Director

EXECUTIVE SUMMARY

NRC on Camel was established on 5th July, 1984. Prior to 1984 the Centre was known as Camel Breeding Farm under the aegis of College of Veterinary and Animal Science, Rajasthan Agricultural University, Bikaner and before that with the Department of Animal Husbandry, Government of Rajasthan. Over the years the Centre has developed good infrastructure facilities and modern laboratories.

During the year 1999-2000 the sanctioned staff strength was 76 and staff in position was 67 consisting of 1 RMP, 13 Scientific, 22 Technical, 10 Administrative and 22 Supporting Staff. The budget allocation under Plan was 150.20 lakhs and under Non-Plan was 114.50 lakhs and expenditure under plan was 144.79 lakhs and under non-plan 88.36 lakhs during the year.

The farm herd at the beginning and close of year was 260 and 272. The herd comprised mainly of Bikaneri, Jaisalmeri, Kachchhi and few cross-breeds (Arabi X Bikaneri).

The total number of books in the Library of the Centre stands as 1360 including 251 in Hindi. Books procured during the year 1999-2000 stands at 105 including 28 new Hindi books, 40 journals were subscribed in library.

The research agenda of National Research Centre on Camel, Bikaner, was pursued through institutional research projects, ad-hoc research schemes under AP-CESS fund and collaborative research programmes.

Highlight of Research

The comparative study on race potential of 2 breeds of indigenous camels aged 4-5 years for a distance of 3 km kachchha track indicated that the average race speed was greater in Jaisalmeri as compared to Bikaneri for trials of all distances. Blood glucose and lactate levels exhibited significant increase after race while increase in creatinine, glucose 6-PD, ICD and lipase were non-significant. Guar phalgati alone as a sole feed was found sufficient to meet the maintenance requirements of the race animals.

Attempts to collect semen from camels by bovine artificial vagina method have been successful to an appreciable level. Difficulties like refusal to serve into artificial vagina,

ejaculation of aspermic bulbo urethral secretions, incomplete ejaculations, lack of sperm motility, incomplete liquefaction of semen and dust contamination have been observed. Microscopic picture of camel semen coagulum revealed that it may resemble human semen coagulum in which the spermatozoa are enmeshed into a fibrous network and the space between the network is too narrow to allow any sperm movement. Progressive individual sperm motility seems to develop after liquefaction. Cryo preservation of camel semen in Tris citric acid fructose glycerol extender was attempted for the first time and an appreciable degree of success was obtained as indicated by individual motility testing and acrosome integrity in post thaw semen samples. The procedures need to be optimized further and the efforts are continued in this direction.

Attempts to induce super ovulation in 8 female camels with progestagen ear implant, PMSG and hCG treatment resulted in no ovulation in 3/8, ovulation followed by early regression of corpus luteum in 1/8 and ovulations in 4/8 animals. No embryo could be recovered following non-surgical uterine flushing of 6 of these camels.

Guar phalgati impregnated with 2% urea or supplemented with khejri leaves resulted in higher body weight gain, greater dry matter intake, greater digestible DM and OM were recorded than controls. In addition higher levels of blood urea nitrogen were recorded in the group fed with phalgati impregnated with 2% urea. Weaning of camel calves at 4-5 months age and feeding them with restricted amount of concentrate and doob and ad-lib feeding of guar phalgati resulted in moderate growth rate of 403.8 gm/day with the feed utilization efficiency of 8.87 kg/kg.

Restriction enzyme digestion of camel genomic DNA with *Hind* III, *Pst* I and *Pvu* II resolved 10, 6 and 2 repetitive DNA bands, respectively. PCR-random amplification of polymorphic DNA was carried out using six random oligonucleotide primers. Reproducible polymorphic bands with varying frequencies among the three breed of camel were obtained with five primers (GT-10, GC-10, G-2, OP-08 and G-1) and breed informative bands were resolved.

A total of 39.34 and 24.39% camels were found to be infected with helminths in areas around Bikaner and Jaisalmer, respectively and major helminthic infections were *Haemonchus*, *Nematodirella*, *Nematodirus* and other strongyles. Treatment of infected camel with 1% ivermectin injection @ 1 ml per 50 kg body weight subcutaneously injection or Albendazole @ 7.5 mg/kg body weight per os or Fenbendazole @ 5 mg/kg body weight per os resulted in 96.02, 96.05 and 94.03 per cent reduction in epg count.

Supplementation of raw camel milk to tuberculosis patients along with routine medicinal treatment resulted in faster recovery as compared to control group.

Under the AP Cess fund scheme "Evaluation and conservation of double humped camel in cold desert region of Ladakh" investigation on hair quality attributes revealed that low fibre diameter of hairs of the thigh region may be useful for village cottage industry. Chemical composition on camel fodders available at Ladakh region indicated highest crude protein content in the leaves of Chhowk tree followed by Alfaalfa. Biochemical polymorphism was observed in amylase and transferrin in double humped camel while these biochemical were non-polymorphic in single humped. Mineral profiles of calcium, phosphorus, zinc, iron and copper were significantly greater in double humped camel than single humped.

During scarcity of grazing fodder in the field feeding of guar phalgati along with green Jall both @ 5 kg /camel/day sustained the body weight of the grazing camel calves.

A pilot survey was conducted in city and village area of Thar Desert to study the various aspects of camel carting and its economics. The study revealed that 78.75 to 85.65% camel keeper were themselves involved in camels carting. The primary activity of camel cart owner was agriculture (84.16% to 95%) followed by business. Bikaneri breed of camel was predominantly used for carting followed by Jaisalmeri breed. The per day average income from camel carting was Rs. 137.20±26.17 to Rs 299.25±31.72. The average cost of camel rearing was Rs. 40/camel/day.

Four NATP projects have been initiated at this Centre during the year:

1. Improving shelf life of milk and milk products of camel and goats.
2. Environmental stress and its amelioration through shelter management.
3. Evaluation of locally available feed and fodder to improve quality and formulate complete rations with high roughage diets.
4. Characterization and conservation of Jaisalmeri camels.

Extension activities:

NRCC organised animal health camps at adopted villages. The health related problems were solved during these camps. Three Kishan goshies were also organised. The farmers visited the camel farm and were demonstrated about the camel management practices. The

different specialists of the Centre delivered seven different radio talks in Hindi on different aspects of camel husbandry. The Centre participated in two National level camel breed competition and won many prizes. Three scientific exhibitions on camel husbandry practices and latest technology know - how achieved by the Centre were organised/participated which included camel festival - 2000 at Bikaner, Krishi Expo - 2000 at Pragati Maidan, Delhi and "47th All India Livestock and Poultry Show" at Jaipur.

During the Rajbhasa Golden Jubilee year, the Centre organised Hindi *Pakhwada/Chetna* Month, 1999 from 14.9.99 to 28.9.99. During this period, programmes such as Hindi Essay competition, Notes and Draft writing competition and Hindi Quiz were arranged. In addition, a *Vichar Gosthi* on "*Rajbhasa Hindi Ka Prayog*" was also organised. Hindi section of this Centre also organised a Hindi debate on "*Ish Sadan Ki Ray Mein Hindi Ko Hi Mahatav Milna Chahiye*".

Infrastructure

Farm camel corrals, mangers and water channels were constructed along with dispensary in farm area (Block No. 2) and work on agriculture farm office cum store was started (Block No.1). Boundary wall work on the front side road was completed. The campus tube-well was interconnected with farm area beneath the railway line after seeking permission from Railway Department. Modification work in two existing garage for converting into camel museum and genetic laboratory was carried out.

1. INTRODUCTION

1.1. HISTORY

The National Research Centre on Camel was established on 5th July 1984. Prior to this, the Centre was known as Camel Breeding Farm under the aegis of College of Veterinary and Animal Science, Rajasthan Agricultural University, Bikaner and before that with Department of Animal Husbandry, Government of Rajasthan. Over the years NRCC has developed modern laboratories with very good infrastructural facilities and a museum. The Centre has generated substantial scientific data on various aspects in Indian camels.

The National Research Centre on Camel, Bikaner is located in the Jorbeer area at a distance of about 10-km from Bikaner City. The geographical location is 28.3° North Latitude and 73.5° East Longitude at MSL of 234.84 m. The topography of the area is arid undulating desert with vast range of sand dunes. The soil type is mostly loose and sandy. The climate is mostly dry and hot with average annual rainfall of around 260-270 mm. The temperature ranges between 30°C to 45°C in summer season and between 4°C to 28°C in winter season. The Centre maintains a came herd of about 270 camels of different age groups mainly belonging to three indigenous breeds Bikaneri, Jaisalmeri and Kachchhi.

1.2. PAST ACHIEVEMENTS

- ❖ NRC on Camel has developed an elite camel herd consisting of Bikaneri, Jaisalmeri and Kachchhi breeds.
- ❖ Genetic parameters have been estimated for several traits viz. biometry, growth, milk and hair production.
- ❖ Reduction in early calf mortality from 20-30% under field conditions to around 5.0-7.0% under farm condition through improved management practices.
- ❖ Breeding efficiency of camel herd has been improved significantly in terms of mean conception, age at first calving and calving interval.

- ❖ Random amplification of polymorphic DNA technique showed genetic variability in Indian dromedary camel.
- ❖ Useful baseline data have been generated on draughtability, ploughing capacity and fatigue index of Indian camel.
- ❖ Camel milk as nutritional adjuvant indicated significant role in faster recovery of tuberculosis in human.
- ❖ Centre has produced 2 Embryo transplanted camel calves in year 1998-99.

1.3. MANDATE

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

1.4 ORGANOGRAM

The Organogram is shown in Fig. 1.4.

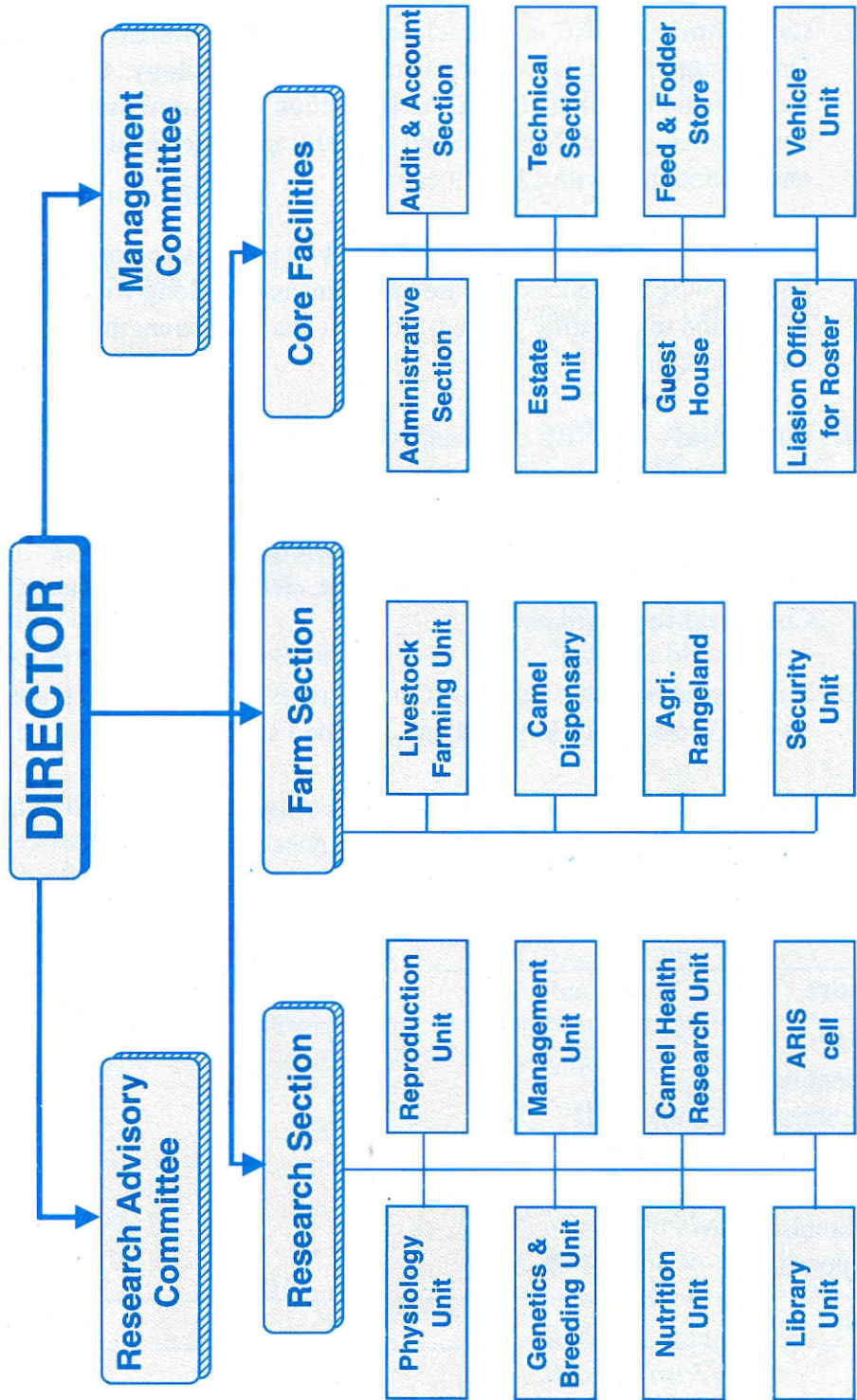
1.5. INFRASTRUCTURE

The NRC on Camel has a Livestock unit, Research Laboratories, Range land, Residential complex and Guest House as a part of infrastructural facilities. The total area of NRCC is 824 ha.

1.5.1. Livestock farm : The farm maintains a herd of about 270 camels mainly comprising of three indigenous breeds viz. Bikaneri, Jaisalmeri and Kachchhi camels. The unit is equipped with one Camel dispensary and a Disease Diagnostic Laboratory, 6 sheds, 3 camel boxes, 1 metabolic shed and a shed with provision of individual feeding. The farm also has fodder and feed godown, and two weigh bridge, one mechanical and other electro-mechanical weigh bridge. Three camel corrals, camel dispensary have been constructed and agriculture farm office is under construction in the range land area.

Fig. 1.4 ORGANOGRAM

NATIONAL RESEARCH CENTRE ON CAMEL, BIKANER



- 1.5.2. Laboratories :** NRC on Camel has modern laboratories in 2 different complexes. One complex has laboratories for Camel Physiology, Camel Genetics, Camel Reproduction, Camel Health, ARIS Section and Administrative Wing. The other complex has Camel Nutrition and Camel Reproduction labs. The research unit has one seminar hall with 120 seat capacity.
- 1.5.3. Library :** The library subscribes around 40 journals and other abstracting services. Subject-wise reference database has been created along with photocopying facility. In addition to scientific journals/books it has been strengthened in Hindi books and other literature.
- 1.5.4. Rangeland :** The NRC on Camel has 824 ha land partitioned in 5 blocks with 3 tube wells. About 650 ha of area has been fenced and 35 ha of land has been brought under perennial silvipasture comprising of grasses, shrubs and trees. Main grasses are sewan (*Lasiurus indicus*) and Blue panic (*Panicum antidotale*). Pasture development and tree plantation have also been under taken under Network Collaborative Programme.
- 1.5.5. Residential complex :** NRC on Camel has residential colony comprising of 2 type V, 4 type IV, 5 type III, 9 type II and 13 type I staff quarters.
- 1.5.6. Guest House :** Centre has one small guest house with 4 rooms which includes two rooms with AC. It can accommodate 8 guests.

1.6. Staff position (1999-2000)

Cadre	Sanctioned	In position	Vacant
RMP	1	1	-
Scientific	20	13	7
Technical			
Category III	4	4	-
Category II	8	7	1
Category I	11	11	-
Administrative	10	10	-
Supporting	22	22	-
Total	76	67	9

Name of staff members (1999-2000)

Director	:	Dr. M.S. Sahani
Scientific		
Principal Scientist (Animal Nutrition)	:	Dr. G.P. Singh (Joined on 14 th June, 1999)
Sr Scientist (Animal Reproduction)	:	Dr. Aminu Deen (Joined on 11 th June, 1999)
Sr. Scientist (Animal Nutrition)	:	Dr. A.K. Nagpal
Scientist Sr Scale (Animal Physiology)	:	Sh. A.K. Roy
Scientist (Animal Reproduction)	:	Dr. Sumant Vyas (on study leave)
Scientist (Animal Biochemistry)	:	Dr. Raghvendar Singh
Scientist (Animal Biochemistry)	:	Sh. Gorakh Mal
Scientist (Veterinary Parasitology)	:	Dr. Rajender Kumar
Scientist (Animal Genetics & Breeding)	:	Dr. B.P. Mishra
Scientist (Animal Biochemistry)	:	Miss Poonam Jayant
Scientist (Livestock Production Management)	:	Dr. Champak Bhakat
Scientist (Veterinary Medicine)	:	Dr. D. Suchitra Sena
Scientist (Animal Nutrition)	:	Dr. Nirmala Saini

Technical

Senior Veterinary Officer, T-8	:	Dr. U.K. Bissa (on study leave)
Livestock Farm Superintendent, T-7	:	Dr. N. Sharma
Farm Manager, T-7	:	Sh. Ram Kumar
Veterinary Officer, T-6	:	Dr. B.L. Chirania
Technical Officer, T-5 (Library)	:	Sh. Ram Dayal
Computer Programmer, T-4	:	Sh. Dinesh Munjal
Agriculture Assistant, T-II-3	:	Sh. M.K. Rao
Lab. Technician, T-II-3	:	Sh. Anand Bhati
Hindi Translator, T-II-3	:	Sh. Nemi Chand
Jr. Engineer, T-II-3	:	Sh. Manjeet Singh
Livestock Assistant, T-II-3	:	Sh. Mohan Singh
Livestock Assistant, T-I-3	:	Sh. Ram Chander
Lab. Technician, T-2	:	Sh. Nand Kishore
Livestock Assistant, T-2	:	Sh. Radha Kishan
Lab. Technician, T-I	:	Sh. Rameshwar Vyas

Annual Report 1999-2000

Drivers	:	Sh. Shivji Ram
	:	Sh. Prabhu Dayal
	:	Sh. Mehboob Hussain
	:	Sh. Rafiq Alam
	:	Sh. Mani Lal
Tube Well Operator	:	Sh. Satnam Singh
	:	Sh. Suraj Bhan Singh

Administration

Asstt. Admin. Officer	:	Sh. A.K. Mallick
Asstt. Fin. & Accounts Officer	:	Sh. N.D. Sharma (on deputation)
Assistant	:	Sh. Kanwar Pal
Stenographer	:	Sh. Ram Kumar
Jr. Steno	:	Sh. Harpal Singh
Sr. Clerk	:	Sh. Ashok Yadav
Sr. Clerk	:	Sh. Jamil Ahmed
Sr. Clerk	:	Sh. Anil Kumar
Jr. Clerk	:	Sh. Vishnu Soni
Jr. Clerk	:	Sh. Krishan Kumar

Supporting : 22

Casual workers with temporary status : 21

1.7. FINANCIAL STATEMENT AND REVENUE RECEIPT (1999-2000)

(Rs. in lakhs)

S.N.	Head of accounts	Plan		Non-Plan	
		Budget	Expenditure	Budget	Expenditure
1	Estt.Charges	5.00	-	90.50	78.79
2	Wages	11.00	1.09	-	-
3	T.A.	-	-	1.00	1.00
4	HRD	1.00	0.90	-	-
5	Other charges including				
	Equipments	108.20	108.21	20.00	5.65
6.	Works	25.00	24.98	3.00	2.92
Total		150.20	144.79	114.50	88.36
Revenue Receipt			Rs. 2.15 lakhs		

2. RESEARCH PROGRAMMES

2.1. Improvement of working efficiency of camel under arid and semi arid conditions

Project Leader : Raghvendar Singh
Associates : Nirmala Saini
M.S. Sahani

Sub Project - 1 : Evaluation of race potential using physiological and biochemical tools in female racing camels

A total of six female camels, three each from Bikaneri and Jaisalmeri breeds were selected randomly in age group of 2-3 years. The camels were given basic riding for eight months followed by race endurance (1-3 km) training for four months. The final race trials of 1,2 and 3 km were conducted on 3 km straight kachha desert track. The average environmental temperature during race trial at 7.00 AM was $17.5 \pm 1.8^{\circ}\text{C}$. Biometrical observations (Table 2.1.1) average race speed, cardinal physiological responses, blood glucose, glucose-6-phosphate dehydrogenase (G-6-PD), isocitrate dehydrogenase(ICD), creatinine, lipase, lactate were monitored during trials. The average race speed of different trials in two breed of camels have been presented in Table-2.1.2 which indicated that the average race speed was higher in Jaisalmeri as compared to Bikaneri for trials of all distances. The data on cardinal responses are presented in Table-2.1.3, which indicated that race resulted in significant increase in pulse, respiration and osmolality. Increasing trend have also been recorded for pCO_2 and pO_2 but these were non significant while blood pH exhibited a decreasing pattern. The level of blood glucose, lactate, G-6-PD, creatinine, ICD and lipase were given in Table-2.1.4 which showed significant increase in glucose and lactate due to race while non-significant increase in creatinine, G-6-PD, ICD and lipase were observed. Correlation coefficient on pCO_2 , pO_2 , blood glucose and lactate were greater than 0.9, while blood pH exhibited negative correlation. So, these blood attributes can be used to assess race potential in camels.

Table 2.1.1. Biometrical observations of female racing camels

Parameter (cm)		Bikaneri	Jaisalmeri
Body length		130±0.6	134±1.5
Neck length		101±1.2	107±3.0
Height at wither		187±3.5	182±1.5
Heart girth		186±0.4	183±0.4
Leg length	Fore	140±0.6	145±0.5
	Hind	149±1.2	134±1.5
Cannon circumference	Fore	19±0.6	17±0.6
	Hind	18±0.6	17±0.5
Foot pad circumference		53.6±0.5	52.7±1.7
Foot pad shape		Convex	Convex

Table 2.1.2. Average race speed of Bikaneri and Jaisalmeri female camels during trial

Breed	Speed (km/h)		
	1	2	3
Jaisalmeri	37.1±6.52	30.0±3.15	28.7±2.64
Bikaneri	29.6±1.75	28.8±1.11	25.3±3.24

Table 2.1.3. Physiological attributes of Bikaneri and Jaisalmeri female racing camels

Attributes	Breed	Race distance (km)			
		0	1	2	3
Respiration (/min)	Bikaneri	7.0±1.0	27±7.5	27±0.6	26.3±3.3
	Jaisalmeri	7.3±1.15	25±7.2	26±4.2	26±3.46
Pulse (/min)	Bikaneri	54.7±3.1	87±2.6	91.3±4.2	91.7±10.3
	Jaisalmeri	56.7±3.1	90±5.7	94±6.7	94.7±4.1
Osmolality (mmol/kg)	Bikaneri	316±5.6	319±7.2	320±8.0	330±8.7
	Jaisalmeri	315±4.0	313±8.6	320±7.8	342±7.0
pH	Bikaneri	7.33±0.02	7.16±0.07	7.18±0.05	7.19±0.06
	Jaisalmeri	7.21±0.09	7.08±0.11	7.12±0.09	7.13±0.09
pCO ₂ (mmHg)	Bikaneri	37.1±0.85	41.23±3.61	46.96±2.20	47.70±0.61
	Jaisalmeri	40.03±5.67	42.3±5.23	44.37±7.69	45.4±8.97
pO ₂ (mmHg)	Bikaneri	19.66±4.04	26.33±2.52	27±2.00	29.00±2.64
	Jaisalmeri	20.66±1.52	34.66±3.05	34.66±4.04	36.66±3.05

Table 2.1.4. Blood biochemical attributes of Bikaneri and Jaisalmeri female racing camels

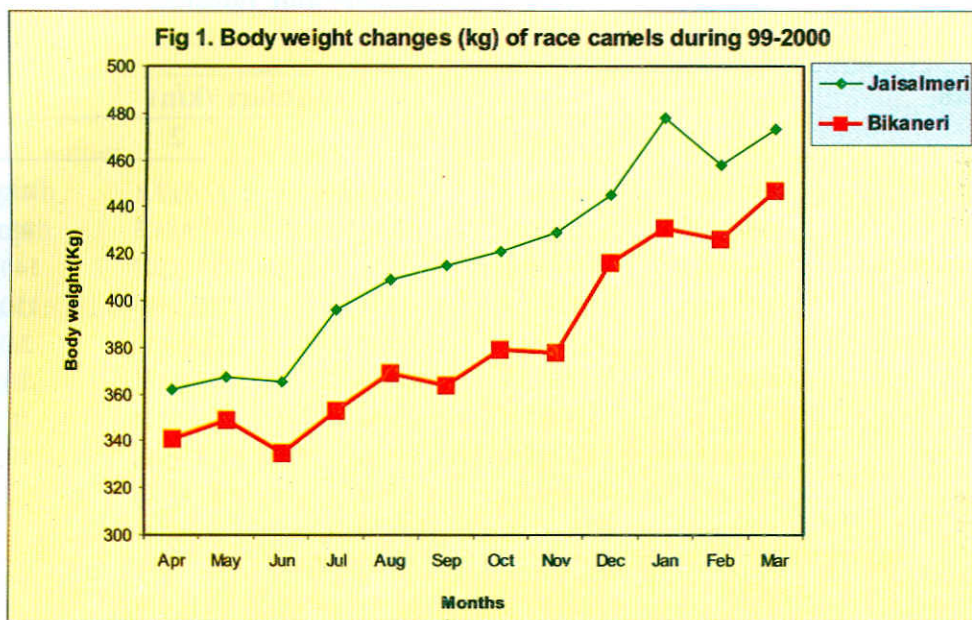
Attributes	Breed	Race distance (km)			
		0	1	2	3
Lactate (mg/dl)	Bikaneri	4.0±0.17	25.3±2.9	32.7±3.1	41.0±4.4
	Jaisalmeri	4.13±0.61	32.0±5.1	37.3±4.3	45.6±7.9
Glucose (mg/dl)	Bikaneri	80.7±9.2	105±3.8	119±12.2	140±15.5
	Jaisalmeri	79.5±4.8	108±3.5	126±35.5	150±16.7
Creatinine (mg/dl)	Bikaneri	1.6±0.15	1.9±0.10	2.00±0.10	2.0±0.10
	Jaisalmeri	1.52±0.15	1.9±0.72	2.0±0.11	2.1±0.15
G-6-PD (U/g Hb)	Bikaneri	15.9±1.9	16.6±1.2	17.1±1.4	18.7±1.3
	Jaisalmeri	16.2±2.1	16.4±1.1	18.7±1.1	18.1±3.0
ICD (U/L)	Bikaneri	0.99±0.26	0.98±0.08	0.93±0.11	1.2±0.39
	Jaisalmeri	0.94±0.20	0.95±0.21	1.14±0.03	1.2±0.48

Sub project 2 : Evaluation of nutritional requirement of racing camels

Race animals were fed Guar Phalgati as a sole feed. The nutritional composition of Guar phalgati has been presented in Table 2.1.5. Average daily feed intake by race animals was 7.15, 7.22, 7.06 and 7.05 kg/day during December, January, February and March, respectively. Body weight changes over the different months have been presented in Fig. 1 which indicated that the Guar phalgati feeding alone is sufficient to meet the maintenance requirements of the animals.

Table 2.1.5. Chemical composition of Guar phalgati

Parameter	Percentage
Dry matter	91.09
Organic matter	88.71
Total Ash	11.28
Crude protein	6.90
Ether extract	0.51
Crude fibre	32.63
Nitrogen free extract	48.67



2.2. : Genetic characterization, evaluation and conservation of indigenous camel breeds

Project Leader : B.P. Mishra
 Associates : M.S. Sahani
 C. Bhakat
 Gorakh Mal

Sub Project 1 : Studies on qualitative and quantitative genetics parameters in Indian Camel

Body weight and growth

The breed and sexwise LSQ means of the body weights from birth to adult are presented in Table 2.2.1. In general similar trend in body weight was observed in different age groups among the three indigenous breeds as that of previous years. The adult Bikaneri camels were found heavier followed by Kachchhi and Jaisalmeri.

Reproductive parameters

The per cent conception, number of services per conception, gestation length and calving interval of farm herd are presented in Table 2.2.2. Overall conception rate during the year 1999-2000 was found 75.8% which was about 15% higher than the average conception

percentage of previous years and number of services needed per conception were 2. Service-wise conception percent was found maximum in third service followed by second and first service (Table 2.2.3). A total of 25.8%, 25.8%, 22.6% and 1.6% female camels were conceived at I, II, III and IV service, respectively.

Table 2.2.1. Breed age and sex wise LSQ means of body weight (kg) in Indian camel breeds

	M	F	Pooled	M	F	Pooled	M	F	Pooled	M	F	Overall
Birth Weight	35.89 ± 1.15 (9)	38.28 ± 2.07 (7)	36.94 ± 1.11 (16)	37.2 ± 0.99 (10)	36.75 ± 1.22 (8)	37.00 ± 0.75 (18)	36.33 ± 3.76 (3)	35.00 ± 0.00 (2)	38.8 ± 2.08 (5)	36.54 ± 0.77 (22)	37.18 ± 1.02 (17)	36.82 ± 0.62 (39)
1 month body weight	41.00 ± 1.91 (4)	40.5 ± 2.5 (2)	40.83 ± 1.38 (6)	44.8 ± 1.37 (10)	49.12 ± 3.72 (8)	46.72 ± 1.83 (18)	49.33 ± 4.81 (3)	49.5 ± 12.5 (2)	49.4 ± 4.75 (5)	44.70 ± 1.32 (17)	47.75 ± 3.05 (12)	45.96 ± 1.47 (29)
1 year body weight	203.25 ± 8.32 (4)	204.00 ± 10.00 (2)	203.5 ± 5.86 (6)	220.29 ± 6.89 (7)	238.00 ± 0.00 (1)	222.5 ± 6.37 (8)	204.00 ± 20.00 (2)	134.00 ± 0.00 (1)	180.67 ± 26.03 (3)	212.54 ± 5.39 (13)	195.0 ± 22.23 (4)	208.41 ± 6.48 (17)
2 year body weight	268.4 ± 10.96 (5)	268.00 ± 9.16 (3)	268.25 ± 7.20 (8)	282.50 ± 19.31 (4)	274.00 ± 37.47 (3)	278.86 ± 17.61 (7)	238.00 ± 4.00 (2)	283.00 ± 5.00 (2)	260.50 ± 13.25 (4)	268.00 ± 9.32 (11)	274.00 ± 12.85 (8)	270.53 ± 7.45 (19)
3 year body weight	319.00 ± 25.00 (2)	337.00 ± 30.34 (4)	331.00 ± 20.6 (6)	339.25 ± 8.16 (4)	328.00 ± 4.00 (2)	335.5 ± 5.77 (6)	312.00 ± 0.00 (1)	NA	NA	329.57 ± 8.39 (7)	334.00 ± 19.31 (6)	331.61 ± 9.54 (13)
4 year body weight	386.20 ± 30.18 (5)	427.14 ± 9.62 (7)	410.08 ± 21.31 (12)	409.50 ± 3.50 (2)	426.86 ± 14.73 (7)	423.00 ± 11.55 (9)	369.67 ± 6.06 (3)	381.00 ± 18.17 (3)	375.33 ± 8.93 (6)	385.90 ± 15.04 (10)	418.88 ± 13.98 (17)	406.67 ± 10.70 (27)
Adult body weight	660.56 ± 18.02 (13)	595.84 ± 12.61 (40)	611.72 ± 11.10 (53)	582.52 ± 17.35 (14)	573.90 ± 10.57 (31)	576.58 ± 8.97 (45)	633.13 ± 45.21 (5)	534.07 ± 17.37 (10)	567.09 ± 21.90 (15)	622.14 ± 13.77 (32)	579.82 ± 7.97 (81)	591.80 ± 7.11 (113)

Table 2.2.2. Breedwise reproductive parameters of farm camel herd

Parameters	Bikaneri	Jaisalmeri	Kachchhi	Overall
Percent conception	80.0	72.6	71.4	75.8
Average No. of services/ conception	1.92	2.11	2.0	2.0
Gestation length(days)	389.64+3.39 (14)	382.24+2.96 (17)	381.00+5.87 (5)	384.94+2.12 (36)
Calving interval(days)	728.00+5.62 (5)	741.9+9.83 (10)	743.4+14.53 (5)	738.8+6.14 (20)

Table : 2.2.3. Service wise per cent conception rate during breeding season

Breed	I	II	III	IV	Pooled
Bikaneri	30	50	71.4	100.0	80
Jaisalmeri	24	21	57.1	-	72.6
Kachchhi	14.3	75	-	-	71.4
Overall	25.8	39	63.6	33.3	75.8

Production parameters

I. Hair quality attributes

The hair samples of annual clip were collected from 15 adult camels of 8-9 years of age from three breeds viz. Bikaneri, Jaisalmeri and Kachchhi. A total of sixty hair samples were analysed for staple length, hair diameter and percentage of hair types viz. pure, hetero, hairy and kemp. The samples were compared from four different major body sites viz. shoulder, mid-side, hump and neck region. The mean along with standard error are presented (Table 2.2.4). The overall mean hair staple length was maximum in Bikaneri breed followed by Jaisalmeri and Kachchhi breed. The mean staple length was found to be longer in the hump region, followed by shoulder, mid and neck region in all three breeds. The overall mean hair diameter was minimum in Bikaneri breed, followed by Jaisalmeri and Kachchhi breed. The mean hair diameter was minimum in hump region, followed by neck, shoulder and mid region in all breeds. Similar trend was found in case of different types of hair i.e. pure, hetero, hairy and kemp in all three breeds. The overall mean hair diameter was minimum in pure type followed by hetero, hairy and kemp type in all the breeds. The overall mean percentage of pure and kemp type was maximum in Kachchhi, followed by Jaisalmeri and Bikaneri breed. But, the overall mean percentage of hetro type was maximum in Kachchhi, followed by Bikaneri and Jaisalmeri breed, whereas, the overall mean percentage of hairy type was maximum in Jaisalmeri followed by Bikaneri and Kachchhi breed. The presence of mean percentage of pure type was maximum at mid side in all breeds. The data indicated that Bikaneri breed is superior in hair quality attribute as compared to Jaisalmeri and Kachchhi camel. Similar trend in hair quality attributes was observed earlier also.

Seven hair samples were collected from seven young female camel calves (5 to 6 months aged). The hair samples also were taken from their mid portion of their body site and samples were analysed for staple length, hair diameter and presence of hair types viz. pure, hetero, hairy and kemp. The mean \pm SE are presented in Table 2.2.5. The overall mean hair staple length was 5.39 ± 0.07 cm and mean hair diameter was minimum and it was followed by hetero, hairy, kemp type diameter in all animals. The overall presence of non-medulated hair was maximum (48.57%) and kemp hair was minimum (1.67%). The hetero type fibre varied from 31.67% to 40.0% where as hairy types varied from 9.67% to 20.0%. The hair quality of young camel calves was found to be superior in terms of hair diameter and presence of maximum pure type and minimum kemp hair.

Table 2.2.4. Breedwise Least square mean \pm SE values for hair quality attributes of Adult dromedary camels:

	Breed			Sex			Site			Overall
	Bikaneri	Jaisalmeri	Kachchhi	Male	Female	Shoulder	Mid	Hump	Neck	
Staple Length (cm)	6.27 ^a \pm 0.36 (24)	6.06 ^b \pm 0.39 (20)	4.42 \pm 0.51 (16)	5.44 ^d \pm 0.44 (40)	5.72 ^c \pm 0.28 (40)	5.39 ^e \pm 0.46 (15)	5.22 ^e \pm 0.45 (15)	7.45 ^x \pm 0.45 (15)	4.27 ^h \pm 0.45 (15)	5.59 \pm 0.25 (60)
Hair diameter (μ)	42.13 ^b \pm 1.37 (24)	45.84 \pm 1.46 (20)	48.48 ^c \pm 1.91 (16)	43.54 ^d \pm 1.63 (20)	52.10 ^e \pm 1.06 (40)	46.22 ^f \pm 1.72 (15)	43.90 ^g \pm 1.72 (15)	52.95 ^h \pm 1.72 (15)	48.21 ⁱ \pm 1.72 (15)	47.82 \pm 0.93 (60)
Pure Diameter (μ)	29.97 ^a \pm 1.14 (24)	38.43 ^b \pm 1.22 (20)	42.80 ^c \pm 1.59 (16)	33.49 ^d \pm 1.36 (20)	40.65 ^e \pm 0.88 (40)	36.43 ^f \pm 1.43 (15)	33.96 ^g \pm 1.43 (15)	40.42 ^h \pm 1.43 (15)	37.76 ⁱ \pm 1.43 (15)	37.07 \pm 0.78 (60)
Hetro Diameter (μ)	38.49 ^a \pm 1.39 (24)	40.92 ^b \pm 1.95 (20)	45.88 ^c \pm 1.49 (16)	38.89 ^d \pm 1.67 (20)	49.97 ^e \pm 1.08 (40)	44.17 ^f \pm 1.76 (15)	40.42 ^g \pm 1.75 (15)	48.44 ^h \pm 1.75 (15)	44.70 ⁱ \pm 1.76 (15)	44.44 \pm 0.95 (60)
Hairy diameter (μ)	51.44 ^a \pm 1.80 (24)	65.25 ^b \pm 1.93 (20)	59.44 ^c \pm 2.52 (16)	55.34 ^d \pm 2.16 (20)	62.08 ^e \pm 1.39 (40)	58.45 ^f \pm 2.27 (15)	56.33 ^g \pm 2.27 (15)	60.56 ^h \pm 2.27 (15)	59.51 ⁱ \pm 2.27 (15)	58.72 \pm 1.23 (60)
Kemp Diameter (μ)	81.62 ^a \pm 2.04 (24)	86.01 ^b \pm 2.19 (20)	84.23 ^c \pm 2.86 (16)	78.23 ^d \pm 2.45 (20)	89.67 ^e \pm 1.58 (40)	83.69 ^f \pm 2.57 (15)	77.84 ^g \pm 2.58 (15)	88.61 ^h \pm 2.57 (15)	85.67 ⁱ \pm 2.57 (15)	83.96 \pm 1.39 (60)

Table 2.2.5. Least Square Mean \pm SE values for different composition of hair

Attributes	Hair Types (%)			
	Pure	Hetero	Hairy	Kemp
Bikaneri	27.03 ^a \pm 1.17(24)	46.06 ^a \pm 0.95(24)	24.64 ^a \pm 1.10(24)	2.30 ^a \pm 0.29(24)
Jaisalmeri	27.54 ^b \pm 1.26(20)	38.68 ^b \pm 1.01(20)	31.20 ^b \pm 1.18(20)	2.51 ^a \pm 0.31(20)
Kachchhi	33.26 ^c \pm 1.65(16)	47.34 ^c \pm 1.32(16)	16.58 ^c \pm 1.54(16)	2.77 ^a \pm 0.41(16)
Sex- Male	28.85 ^d \pm 1.41(20)	45.34 ^d \pm 1.14(20)	23.61 ^d \pm 1.32(20)	2.14 ^b \pm 0.35(20)
Female	29.69 ^d \pm 0.91(40)	42.72 ^d \pm 0.73(40)	24.66 ^d \pm 0.85(40)	2.88 ^b \pm 0.23(40)
Site - Shoulder	28.52 ^e \pm 1.48(15)	44.95 ^e \pm 1.19(15)	24.84 ^e \pm 1.38(15)	1.67 ^c \pm 0.37(15)
Mid	33.16 ^f \pm 1.48(15)	40.50 ^f \pm 1.19(15)	24.22 ^e \pm 1.38(15)	2.03 ^d \pm 0.37(15)
Hump	29.96 ^g \pm 1.48(15)	44.95 ^g \pm 1.19(15)	22.22 ^e \pm 1.08(15)	2.82 ^c \pm 0.37(15)
Neck	25.46 ^b \pm 1.48(15)	45.71 ^b \pm 1.19(15)	25.27 ^e \pm 1.39(15)	3.58 ^f \pm 0.37(15)
Overall	29.27 \pm 0.80(60)	44.03 \pm 0.65(60)	24.14 \pm 0.75(60)	2.53 \pm 0.20(60)

Similar superscripts of a quality parameters do not differ significantly

II. Milk Production in Bikaneri Camels

In order to study the extent of lactation length in Bikaneri camels milk production performance of 6 lactating camels belonging to 3rd-5th parity through hand stripping at 12 hour intervals has been presented below (Table 2.2.6). These data indicated that these camels produced milk at an average of 3.08-3.79 liters per day. Morning production was significantly higher as compared to evening production. It is also evident that lactation in camel may continue upto 15 months without any supplementation.

Table 2.2.6. Monthwise daily milk production (L/day) in 6 Bikaneri Camels

Month of lactation	Morning	Evening	Pooled
10th	1.676 \pm 0.08 ^a	1.405 \pm 0.07 ^b	3.081 \pm 0.014
11th	1.734 \pm 0.034	1.648 \pm 0.032	3.382 \pm 0.063
12th	1.913 \pm 0.018 ^A	1.777 \pm 0.017 ^B	3.688 \pm 0.028
13th	2.040 \pm 0.020 ^A	1.753 \pm 0.019 ^B	3.792 \pm 0.029
14th	1.943 \pm 0.012 ^A	1.737 \pm 0.011 ^B	3.680 \pm 0.025
15th	1.712 \pm 0.09	1.615 \pm 0.08	3.327 \pm 0.016

A,B -P<0.01

a,b -P<0.05

Sub Project 2 : Molecular genetic studies in Indian camel**DNA cleavage profile of *Camelus dromedarius***

Genomic DNA from 3 camel breeds viz. Bikaneri, Jaisalmeri and Kachchhi maintained at NRC on Camel was isolated from blood leukocytes. The blood samples were taken from both male and female camels of the above 3 camel breeds. The purity of genomic DNA samples was checked by spectrophotometry and integrity was checked in 0.7% agarose gel electrophoresis which showed single intact high molecular weight genomic DNA band.

Genomic DNA samples of both male and female animals from 3 breeds (Table 2.2.7.) were cleaved with restriction enzymes viz. with *Hind III*, *Pst I* and *Pvu II*. These enzymes revealed 10, 6 and 2 repetitive bands, respectively of variable sizes in camel genomic DNA. It was observed that probably camel has higher equimolar concentration of repetitive DNA in its genome with internal periodicity.

Table 2.2.7. Breed and sex wise distribution of samples collected for isolation of genomic DNA

SEX	Camel breed		
	Bikaneri	Jaisalmeri	Kachchhi
Male	15	13	8
Female	28	20	14
Total	43	33	22

Genetic variability in *Camelus dromedarius* using polymerase chain reactions (PCR) based random amplification of polymorphic DNA (RAPD) technique

In continuation earlier research trials PCR random amplification polymorphic DNA was carried out using six random oligonucleotide primers. Reproducible polymorphic bands with varying frequencies among the three breeds of camel were obtained with five primers (GT-10, GC-10, G-2, OP-08 and G-01) and breed informative RAPD bands were resolved.

2.3. Improvement of reproductive efficiency and to study the causes of reproductive failures in camel

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Sub Project 1. Collection of camel semen, its refrigeratory and deep freeze preservation

Collection of semen was attempted from 6 adult male camels of 6-11 years of age at regular intervals of 2-5 days with bovine artificial vagina from last week of Nov. 1999 to first week of March 2000. A total of 193 collections from 6 males were attempted during this period. Gross and microscopic examinations of semen were conducted and refrigeratory and deep freeze preservation were attempted.

Collection of semen

Copulation in camel takes place with the female in a squatting posture, the intromission of penis is nearly at ground level and the duration of copulation is long. As such one has to adopt an unusual posture to grasp the erect penis and direct it into the artificial vagina. Flexing the limbs as to rest operators knee joints on the ground appear to be the suitable posture for the operator to collect the semen from camel. Operator has to be on the left side as the male usually falls on the right side after copulation. One assistant is usually required to stand caudal to the operator to keep a pushing force over the back of the camel to prevent it from falling on the operators side. Some males copulate in artificial vagina very gently and the process of collection of semen in them seems much easier. On the contrary, few males vigorously move forward and backward while copulating which makes it difficult to hold the penis into the artificial vagina for complete course of copulation. Moreover, the operator is hurt several times with the limbs and belly parts of the male when it thrusts cranially.. It is felt that operator has to flex his leg as to put the knee joints on the ground to comfortably and satisfactorily accomplish the procedure.

The major difficulties encountered with collection of semen in camel have been :

1. Refusal to serve in A.V.
2. Ejaculation of aspermic bulbo-urethral secretions
3. Incomplete ejaculations

4. Difficulty to ascertain occurrence and completion of ejaculation
5. Incomplete liquefaction of semen
6. Dust contamination

Refusal to serve or ejaculate in to artificial vagina

On an average 27/193 (13.98%) times, the males have either refused to serve into the artificial vagina or did not ejaculate. This varied between the animals as one camel (J-58) has never refused while two other males (A-273 & J-56) have refused to serve as many as 31.03 to 33.33% times, respectively. For remaining males J-322, K-311 and Sanchori-04, it has not been a great problem. Of the 2 males which had greater percentage of refusals, J-56 appeared to have exhibited a sort of fear or hesitation toward the accumulation of persons and deviation of its penis by the operator. This particular condition can be called as psychic impotence. The greater refusal in these males can be due to inexperience. Training and reinforcement of positive responses can improve their service behaviour.

Incomplete ejaculations and ejaculations of aspermic bulbourethral secretions

Ejaculations of aspermic bulbourethral secretions have been observed in all the males at some stages but one male (K-311) has almost always ejaculated azoospermic bulbourethral discharge with little or no spermatozoa throughout the period of study. Only once (3.33%) it had ejaculated semen with acceptable number of spermatozoa. Another male (Sanchori-04) also ejaculated aspermic bulbourethral secretions for 25.8% of times but in this particular animal it was limited to early part of breeding season. During peak breeding season, the situation improved significantly. In the literature, we find certain male camels which otherwise had normal testicular size and consistency, but ejaculate semen with low progressive sperm motility, low sperm concentration and low total sperm count.

Incomplete ejaculation has been the major problem, which itself is difficult to define and determine. In the present study, those copulations which yielded no or little ejaculate and had short copulation time were considered as incomplete ejaculates. On an average 34.19% of total ejaculates from 6 males were graded as incomplete ejaculate. Proportion of incomplete ejaculates varied greatly between males. It was lowest in J-56 in which it measured 2/18 (11.1%) while K-311 did it 100% times. Literature also tells incomplete ejaculation to be very common in camel and constitutes 60% of all attempted collections. The highly mobile urethral process on the camel penis may need to gain entry to the cervix to stimulate ejaculation during the copulation. Failure to mimic this particular condition in artificial

vagina may be responsible for high percentage of incomplete ejaculations. A purse string type of ligature tied around the inner line in the AV to mimic the cervix was tried by some workers and pulsation pump used in Boars AV by others, but how far these methods would be helpful to reduce frequency of incomplete ejaculations, remains to be studied.

Difficulty to ascertain occurrence and completion of ejaculation

Although male seems to have developed tenesmus in thigh and abdominal region it vigorously pressed on its hocks while it ejaculates but still it is felt that the occurrence and completion of ejaculation cannot be ascertained accurately in camel.

Incomplete liquefaction

Liquefaction may or may not occur. When it occurs it may or may not be complete. With the results we find persistence of thin gel even after a day or few days of storage of semen. This has been particularly troublesome in packaging the semen into cryoampoules for preservation.

Dust contamination

Dust contamination of ejaculates spoil many semen samples. Failure to hold penis into the artificial vagina is said to be the major cause of sand contamination. But, this has been observed during present study that the sand contamination may also occur even if the penis is satisfactorily held into the artificial vagina throughout the course of copulation. This seems to be due to intrapreputial sand and copulatory pattern in camel in which it withdraws and thrusts the penis into the vagina 3-4 times during a single copulation.

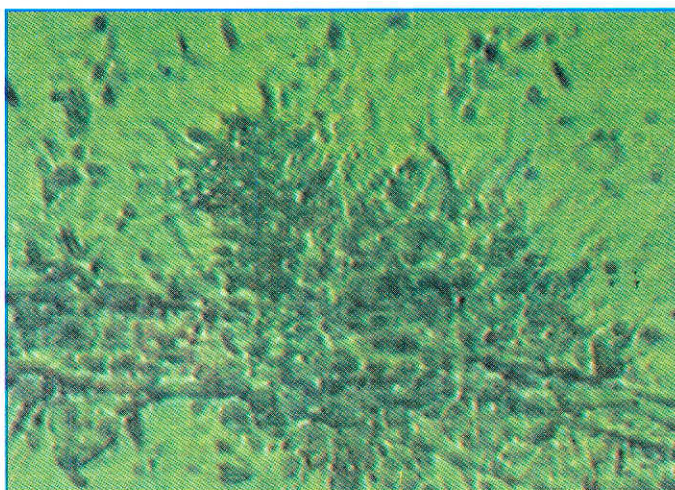
Gross examination of semen

Typical camel semen is sparkling white. Dull white colour is observed when it is contaminated with dust. Lot of pre-ejaculate discharge is also secreted in camel. The pre-ejaculate is of watery colour. Usually the pre-ejaculate gets stuck to the A.V. and we get homogenous white semen in the collection tube. But, sometimes different proportions of pre-ejaculate and semen were observed intermixed. The volume varied greatly from 0.5-20 ml. In general, volume lesser than 2.5 ml indicated incomplete ejaculate. Camel semen is highly viscous and does not mix well with extenders till it liquifies.

Microscopic examination of semen

We did not observe mass activity in camel semen. Literature also tells that the mass activity is generally poor in camelidae semen. Several workers have reported no motility in neat semen. The most probable cause of absence of mass activity may be the coagulation of camel semen. It is worthwhile to mention here that human semen also coagulates at the time of ejaculation and does not liquify until about 20 minutes later. Under scanning electron microscopy, a freshly formed semen coagulum presents a dense network of long fibers approximately 0.15 micromillimeters in diameter, separated by spaces too narrow to allow free movement of the enmeshed spermatozoa, as liquefaction gets underway amorphous material consisting of small globules appears on the fiber surface until the fibers disappear and the globules take over. Microscopic pictures of mini coagulum of camel semen also reveal similar sort of picture in which spermatozoa appear to have enmeshed in fibrous network and cannot develop progressive individual motility till it liquifies.

As regards individual sperm motility 18/122(14.75%) semen ejaculates exhibited high grade, 23/122(18.85%) fair grade, 28/122(22.95%) low grade and 54/122(44.26%) no motility. Among the six males used in present study, the percentage of semen samples with fair to high grade motility varied greatly. Male K-311 yielded only 1/30(3.33%) samples which had fair grade of motility, while male J-56 yielded 12/18 (66.66%) samples which had fair to high grade motility. Other males J-322,A-273, J-58 and Sanchori-04 yielded 12/37(32.43%), 6/20(30%), 7/24(29.16%) and 3/22(13.63%) ejaculates of fair to high grade motility. Several workers observed no motility of spermatozoa either in fresh or upto 12 hrs. Of collection. Some others reported that progressive sperm motility in raw semen examined 15 minutes after collection ranged from 30-50%. At this Centre 10/24(41.66%), 14/40(35%) and 7/20(35%) semen samples collected during 1995-96, 1996-97 and 1997-98 were found to exhibit motility(Annual progress report).

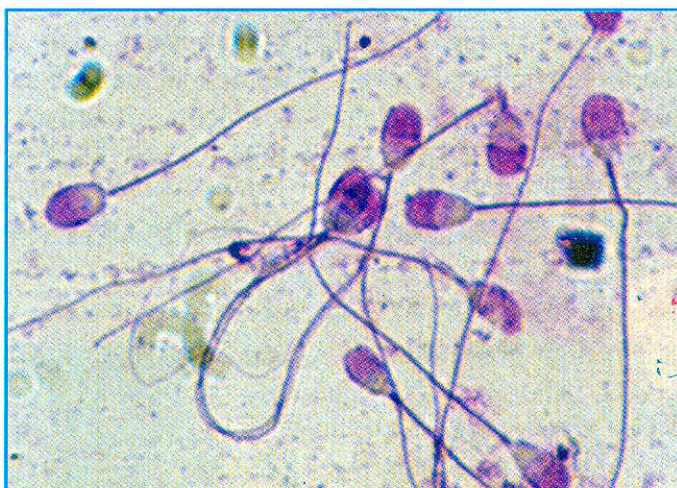


Micro photograph of camel semen showing sperm partially released from liquefying coagulum

There are several references which indicated that initial motility is very low(5%) and increases as the ejaculate becomes more liquid. Thus this evaluation is only possible when the semen has completely liquified. Individual motility ranging from 0-85% were observed by them in 125 semen samples from 5 males of proven fertility. Scientists were of opinion that this parameter is affected by conditions of semen collection and state of liquefaction. Type of rubber in artificial vagina and length of time semen stays in contact with the liner is said to have great effect on individual motility of spermatozoa. Dilutor containing caffeine has been shown to have beneficial effect on regaining motility in non-motile samples, which led them to think that rubber tended to paralyze the spermatozoa rather than killing them.

Semen preservation

31 semen samples which exhibited fair to high grade individual sperm motility were also extended with tris egg yolk dilutor and slowly cooled to 4°C. Results of periodical monitoring indicated that 13/31 (41.93%) samples did not maintain motility upon refrigeratory preservation while 7/31(22.58%), 4/31(12.90%) and 7/31(22.58%) samples maintained motility for 24, 48 and 72 hrs or longer. During this



Acrosome integrity of post thaw camel semen

study, it was observed that one semen sample maintained appreciably high motility for more than one month period under refrigeratory preservation. Deep freeze preservation was also attempted and fair amount of success was attained in preserving camel semen as indicated by post thaw motility and acrosomal integrity. Work is under progress to evaluate the efficiency of the technique employed to cryo-preserve the semen and find out means of optimizing the preservation technique.

Sub Project : 2. Biochemical investigation on camel semen plasma

Semen samples were obtained during rutting season and the seminal plasma was separated by centrifugation. Biochemical parameters, viz; Cholesterol, Total protein, Albumin, Calcium, Phosphorus and Magnesium were estimated using standard analytical procedures. The concentration of Cholesterol, Calcium, Phosphorus (mg/dl) was 10.80 ± 2.008 ,

8.69±0.791 and 3.46±0.509 respectively. Total protein and Albumin (g/dl) was 1.22±0.102 and 1.22±0.076. Magnesium concentration in seminal plasma was 5.47±0.755 mEq/L.

Sub Project : 3. Superovulation response to progestagen ear implant, PMSG and hCG treatment in female camels

A total of 8 female camels were subjected to superovulation treatment with Crestar ear implant*, Folligon** and Professi***. Crestar injection-2 ml was administered i/m once along with Crestar ear implant which was kept *in situ* for 5-7 days followed by its removal. Injection Folligon 2000-4000 i.u. was administered i/m at the time of withdrawal of Crestar ear implant. The animals were monitored for their follicular growths in their ovaries and were bred at appropriate times. Injection Professi-5000 i.u. HCG was administered i/m at the time of breeding. Recto-genital palpation in conjunction with endocrine profiles of progesterone (P_4) and estrogen(E) were regularly monitored at appropriate times to assess the ovulation response and follicular growth, respectively. P_4 profiles indicated that the superovulation treatment resulted in no ovulation in 3/8 (37.5%) females (Fig. (s) 1, 4 and 8). Of the remaining 5 females, 1/8 (12.5%) exhibited early regression of corpus luteum (CL) before uterine flushing can be accomplished (Fig. 3). Recto-genital palpation indicated that the ovulation response was not great in the remaining 4 animals too. It varied from 1 CL to 3-5 CLs. Thick walled bilateral cysts were observed in one female while one more female had unilateral thin walled cyst which got ruptured during ovarian palpation.

Estradiol profiles in these animals are difficult to be understood as estradiol profiles indicative of follicular growth after PMSG administration were observed in 5/8(62.5%) animals (Fig. (s) 1,2,3,4 and 8) but only 2(Fig. 2 and 3) of them ovulated as indicated by their peripheral plasma progesterone profiles. On the other hand, remaining 3 (Fig. (s) 5,6 and7) of the 8 animals ovulated despite lack of high estradiol profiles after PMSG administration.

Embryos could not be recovered from these females with nonsurgical uterine flushing. Loss of fluid into vagina during flushing of uterus is a great problem in this species which would have been due to improper fixation of bulb of catheter into the uterine horn or else it is pushed back under the pressure of infused fluid and act of retraction of uterine horns during flushing. It is concluded that embryos could not be recovered due to poor superovulation response and to a little extent due to loss of fluid into the vagina.

* Norgestomet ear implants alongwith estradiol plus norgestomet injection, Intervet, Boxmeer, Holland

** PMSG injection, Intervet, Boxmeer, Holland

*** HCG injection, Serum International Ltd.,Pune, India

Fig: 1 Estradiol (pg/ml) and progesterone (ng/ml) profiles of a female camel under superovulation treatment (Animal No. 9)

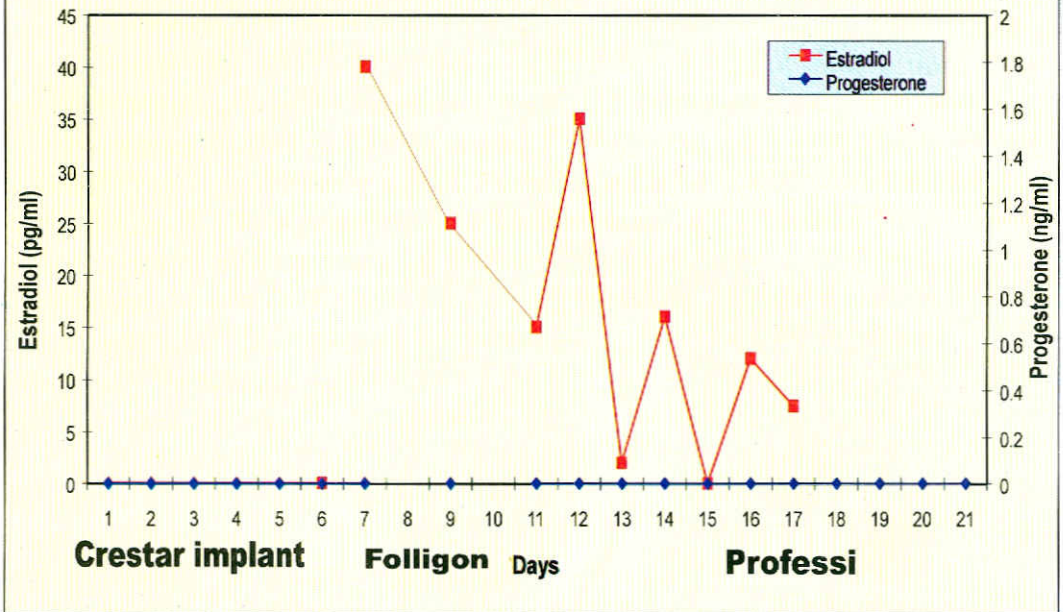


Fig: 2 Estradiol (pg/ml) and progesterone (ng/ml) profiles of a female camel under superovulation treatment (Animal No. 10)

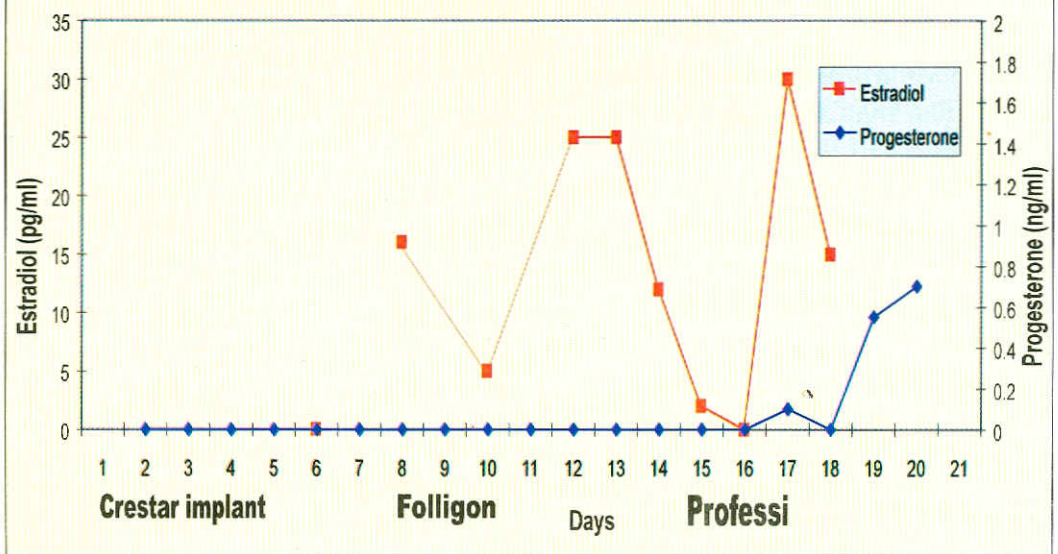


Fig: 3 Estradiol (pg/ml) and progesterone (ng/ml) profiles of a female camel under superovulation treatment (Animal No. 11)

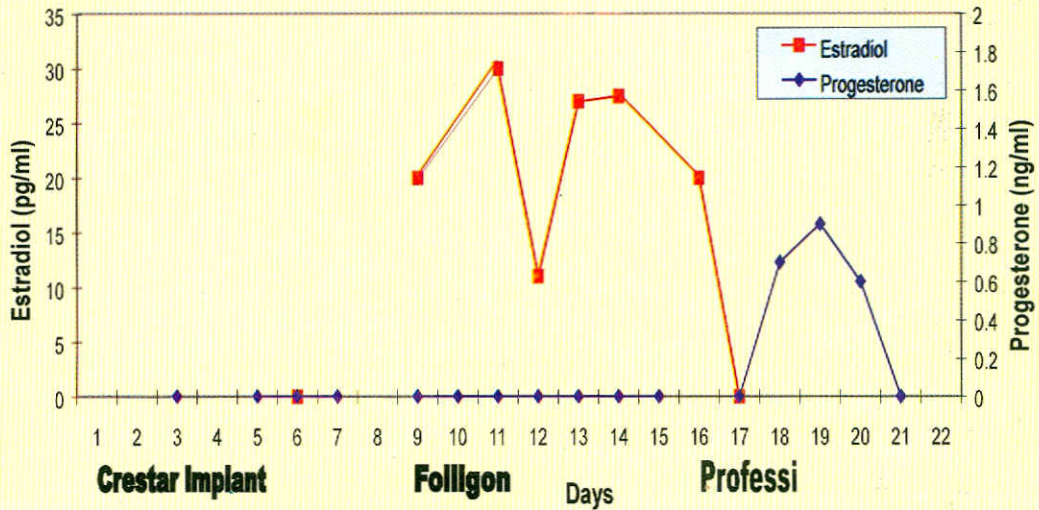


Fig: 4 Estradiol (pg/ml) and progesterone (ng/ml) profiles of a female camel under superovulation treatment (Animal No. 12)

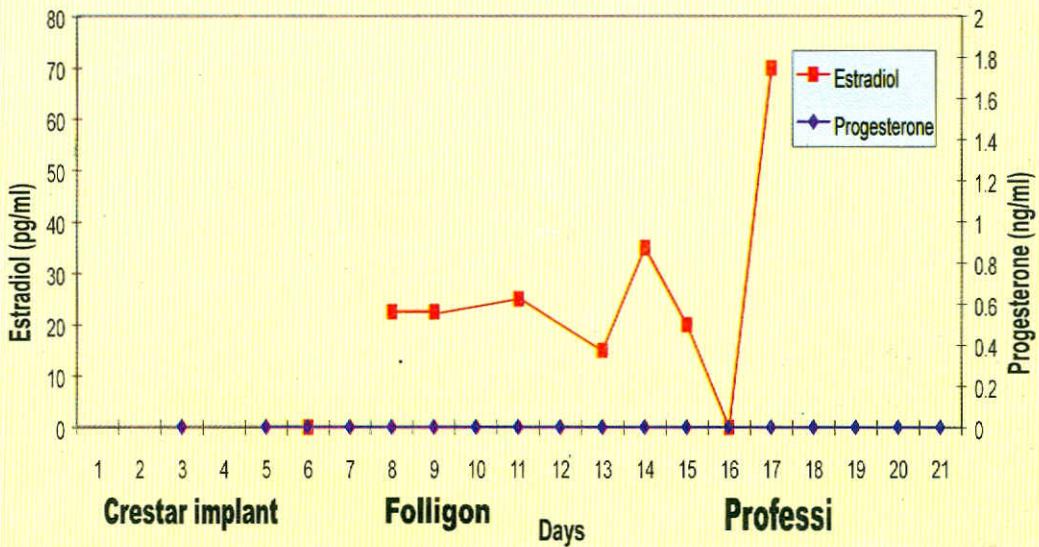


Fig: 5 Estradiol (pg/ml) and progesterone (ng/ml) profiles of a female camel under superovulation treatment (Animal No. 13)

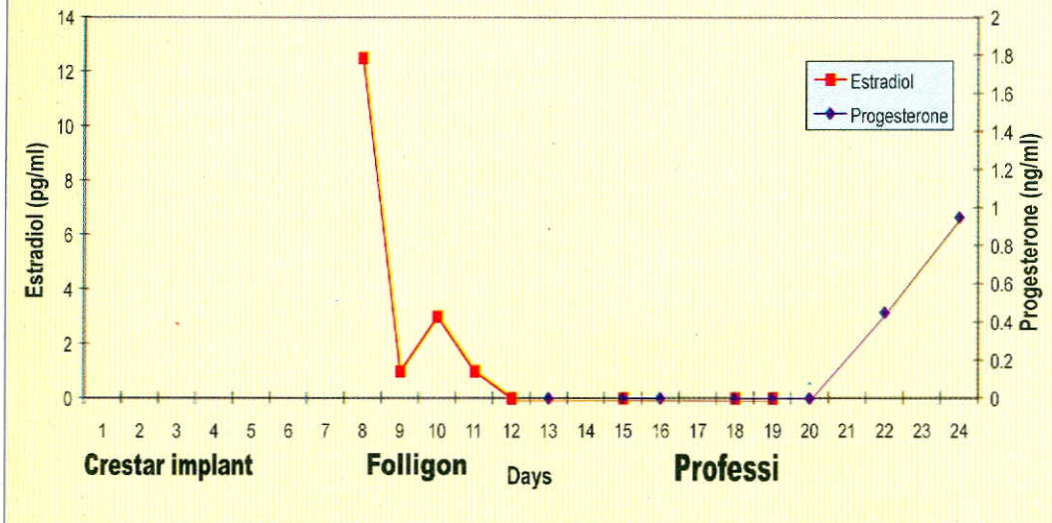


Fig: 6 Estradiol (pg/ml) and progesterone (ng/ml) profiles of a female camel under superovulation treatment (Animal No. 14)

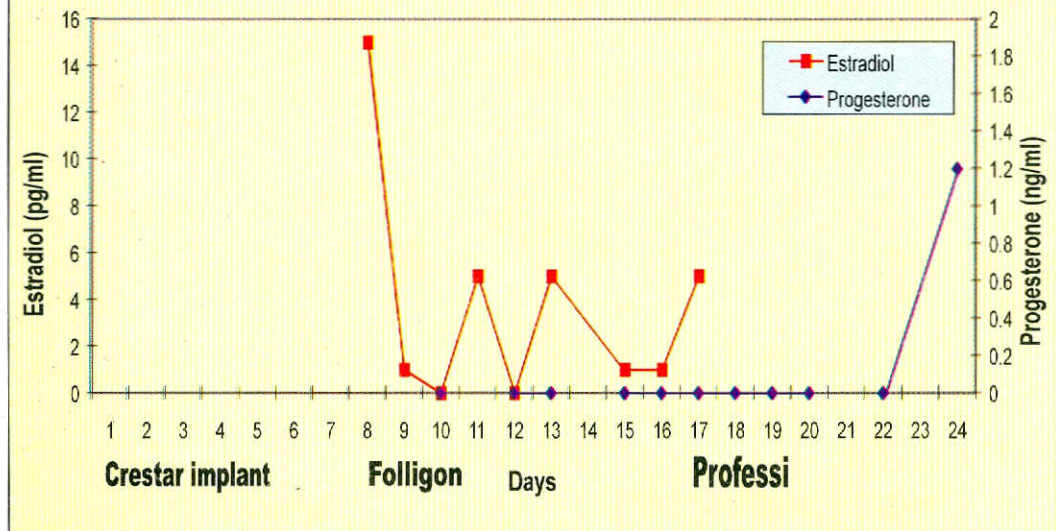


Fig: 7 Estradiol (pg/ml) and progesterone (ng/ml) profiles of a female camel under superovulation treatment (Animal No. 15)

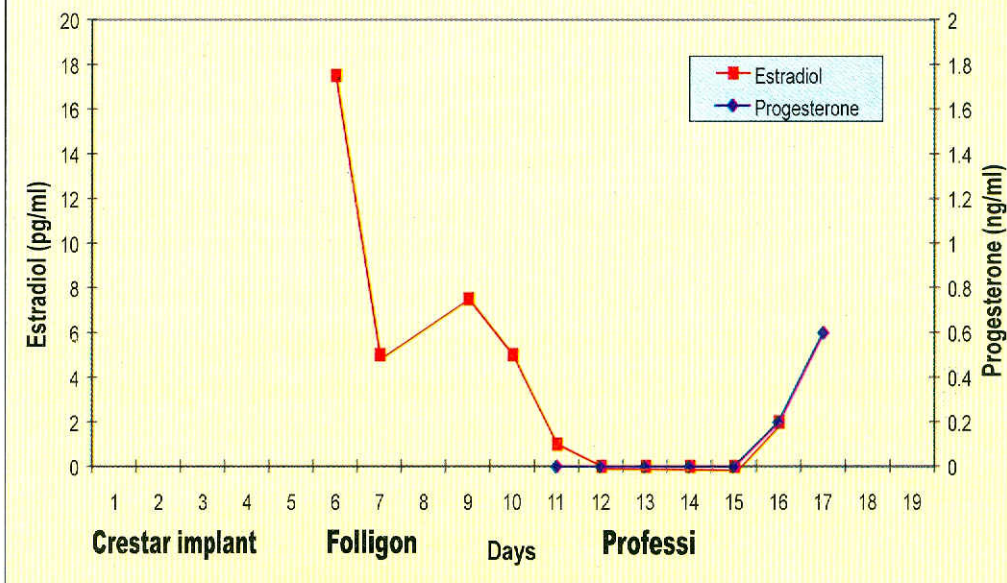
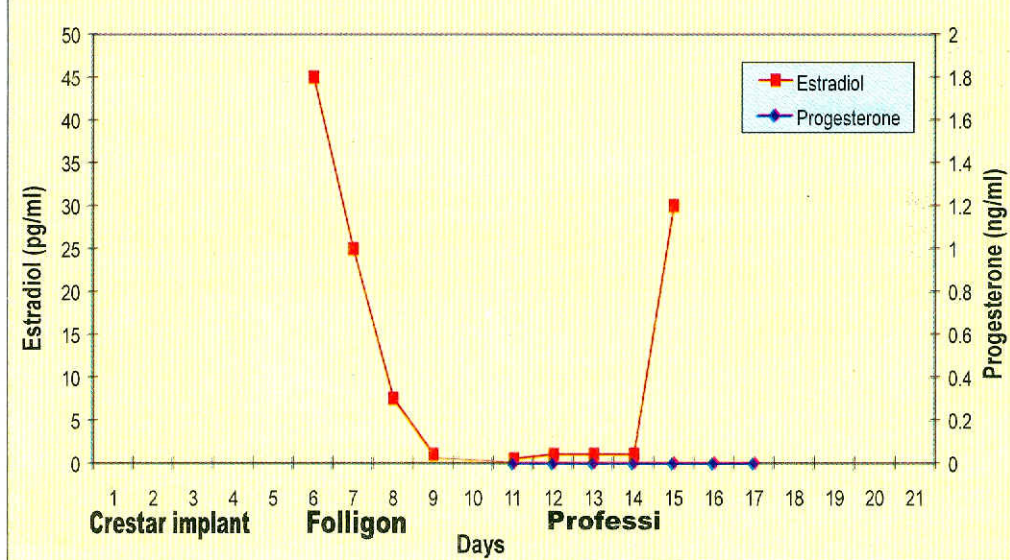


Fig: 8 Estradiol (pg/ml) and progesterone (ng/ml) profiles of a female camel under superovulation treatment (Animal No. 16)



2.4. : Studies on feed requirement and feed resource evaluation for optimum production

Project Leader : G.P. Singh
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Nirmala Saini
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Sub Project 1 : Effect of source of nitrogen on body weight gain, digestibility and passage rate of digesta

A total of 9 camels (6 females and 3 males) of 3-4 years age group were randomly divided into 3 equal groups (n=3, 2 females and 1 male) and were subjected to one of the following feed schedules.

Group I : Guar phalgati impregnated with 2% urea,
Group II : Guar phalgati supplemented with Khejri leaves to provide nitrogen equal to that in Group I.
Group III : Guar phalgati as a sole feed.

Guar phalgati treated with Sudan - III dye was fed to camels and grabe samples were collected for estimation of passage rate. Digestibility trial was conducted after adaptation period of 21 days.

Effect on body weights

Data in regards to average total body weight gain for 3 groups have been presented in Table 2.4.1. which indicated that the weight gain was significantly higher in group I and II which were supplemented with urea or Khejri leaves for nitrogen than group III of Guar phalgati alone as a sole diet.

Effect on dry matter intake

Dry matter intake (DMI) in terms of total, kg/100 kg body weight and $g/w^{0.75}$ kg have been presented in Table 2.4.2. These data indicated that total DMI intake was significantly

greater in group II than in group I and III, which did not exhibited significant differences among them. However, data on DMI based on kg/100 kg body weight indicated that the DMI was not only significantly higher for group II than group III but it was also significantly higher for group I than group III. This beneficial effect on greater DMI intake may be due to nitrogen supplementation in group I and II in form of urea or Khejri leaves which might have provided greater ammonia for microbial growth in rumen.

Effect on the digestibility and intake of digestible nutrients

Data regarding digestibility and intake of digestible nutrients have been presented in Table 2.4.3. These data indicated that digestibility of DM and OM were significantly greater for group I and II as compared to Group III. However, difference between group I and II not significant, similarly digestible OMI values were found significantly greater for group I and II than group III while digestible DMI values were found to be significantly greater for group II as compared to groups I and III which did not differ significantly in this respect.

Effect on blood biochemicals

Blood biochemical parameters viz. glucose, total protein and urea have been presented in Table 2.4.4. These data indicated that glucose and protein did not differ between 3 groups while urea levels were higher for group I and that seems obviously due to supplementation of diet with urea in this particular group.

Table 2.4.1. Effect of Nitrogen source in diet on the body weight gain

Group	Initial Body wt. (kg)	Final Body wt. (kg)	Gain	
			Total (kg)*	g/day*
I	341.1	348.3	7.2 ^a	288 ^a
II	353.0	359.3	6.3 ^a	252 ^a
III	386.8	388.3	1.5 ^b	60

Figures bearing different superscript in a column differ significantly.

*P<0.05

Table 2.4.2. Effect of source of nitrogen in diet on dry matter intake

Groups	Animal No.	Body weight	Metabolic body wt.	Dry Matter Intake		
				Total*	kg/100kg bw**	g/w ^{0.75} kg**
I	473B	297.0	71.5	5.75	1.92	80.4
	85K	408.0	90.8	7.74	1.90	85.2
	114M	340.0	79.2	6.42	1.88	81.1
	Average	348.3	80.5	6.64 ^a	1.90 ^a	82.2 ^a
		±32.3	±5.61	±0.58	±0.01	±1.49
II	496B	384.0	86.7	7.63	1.99	88.0
	87K	363.0	83.2	7.44	2.05	89.4
	455B	331.0	77.6	6.99	2.11	90.1
	Average	359.3	82.5	7.35 ^b	2.05 ^b	89.2 ^b
		±15.41	±2.65	±0.19	±0.03	±0.62
III	85J	364.0	83.3	6.10	1.68	73.2
	83K	458.0	99.0	7.63	1.66	77.1
	86K	343.0	79.7	6.16	1.79	77.3
	Average	388.0	87.3	6.63 ^a	1.71 ^c	75.87 ^c
		±35.36	±5.92	±0.50	±0.04	±1.33

Figures bearing different superscript in a column differ significantly.

*P<0.05 **P<0.01

Table 2.4.3. Digestibility of nutrient and intake of digestible nutrients

Parameter	Groups		
	Guar phalgati + urea (I)	Guar phalgati + Khejri Leaves (II)	Guar phalgati (III)
	Digestibility %		
DM*	58.0 ^a ±2.37	62.5 ^a ±0.69	53.4 ^b ±1.02
OM*	63.3 ^a ±1.89	65.1 ^a ±1.09	56.97 ^b ±0.64
	Digestible Nutrient Intake		
DDMI*	3.88 ^{ab} ±0.50	4.60 ^a ±0.08	3.55 ^b ±0.33
DOMI*	3.73 ^a ±0.22	4.19 ^a ±0.06	3.03 ^b ±0.08

Figures bearing different superscript in a row differ significantly.

*P<0.05

Table 2.4.4. Biochemical parameter as affected by source of nitrogen

Parameter	Group		
	I	II	III
Urea (mg/100ml)**	29.92 ^a	19.90 ^b	17.75 ^b
Total Protein (g/100ml)	3.99	3.94	3.56
Glucose (mg/100ml)	90.09	89.00	90.17

Figures bearing different superscript in a row differ significantly.

**P<0.01

Sub Project 2 : Effect of weaning of camel calves on growth performance and economics of camel calves rearing

Six camel calves, three each of Jaisalmeri and Kachchhi breeds were weaned at an approximate age of 4-5 months. The calves were fed guar phalgati, doob grass and concentrate* mixture in groups as a whole and body weight measurements were recorded fortnightly to monitored their growth.

Feed intake

Data regarding average intake of concentrate ration, doob grass and guar phagati have been presented in Table 2.4.5. which indicated that under restricted feeding of concentrate ration and doob grass, the average consumption measured 0.77 and 0.086 kg/day/calf respectively. The consumption of guar phalgati averaged 2.76 kg/day/calf. Total dry matter intake averaged 3.60 kg/day/calf for a period of 9 weeks. Dry matter intake was increased with increase of body weight and varied between 1.77 to 2.54 kg/100kg body weight with an average of 2.31 kg/100 kg body weight. It seems to be slightly lower as compared to the established standards.

Table 2.4.5. Dry matter intake during nine weeks of feeding experiment of weaned calves

Age (Months)	Conc.	Dry Matter Intake				
		Doob grass (kg/day)	Guar phalgati	Total	kg/100 kg body wt.	g/w ^{0.75} kg
5.0	0.69	-	2.03	2.72	2.03	68.26
5.5	0.80	-	1.65	2.45	1.77	60.20
6.0	0.78	0.06	2.10	2.96	2.04	68.96
6.5	0.78	0.09	2.43	3.30	2.06	73.23
7.0	0.78	0.09	2.93	3.80	2.31	81.32
7.5	0.78	0.09	3.11	3.98	2.34	83.90
8.0	0.78	0.09	3.68	4.55	2.54	90.33
8.5	0.78	0.09	3.58	4.42	2.36	86.60
9.0	0.78	0.09	3.35	4.22	2.23	82.63
Average	0.77	0.086	2.76	3.60	2.31	77.27

Growth of weaned calves

Average body weight increased from 132.14 kg to 189.50 kg during nine weeks of experimental period. The total body weight gain averaged 56.00±6.09 kg while the daily body weight gain averaged 402.83±43.72 g/day.

Dry matter intake and growth of weaned calves

The relationship between dry matter intake and growth of weaned calves seems positively correlated.

Feed utilisation efficiency

Requirement of feed per kg body weight gain was 8.78 kg which is economical and normal in the present study.

Effect on serum biochemicals parameters

Blood biochemical parameters are presented in Table 2.4.6. Glucose level in blood was not affected at 6 and 9 months of age. The total protein and cholesterol were decreased with the increase of age and serum urea and triglyceride increased with the advancement of age.

Economisation due to weaning of calves

From the feeding records and prevailing prices of feeds, cost of feeding was calculated and it was observed that Rs.2.80/animal per day can be saved on cost of feeding by weaning of animals at the age of 4-5 months.

Table 2.4.6. Serum biochemicals of weaned camel calves

Parameters	6 months age	9 months age
Glucose (g/dl)	110.45±3.67	105.54±0.80
Total protein (g/dl)	5.71±0.21	5.01±0.15
Albumin (g/dl)	3.74±0.06	3.71±0.12
Urea (mg/dl)	20.08±1.14	25.37±0.74
Cholesterol (mg/dl)	35.75±3.41	28.05±1.45
Triglyceride (mg/dl)	28.27±1.32	48.44±2.75
Calcium (mg/dl)	10.94±0.26	11.11±0.48
Phosphorus (mg/dl)	8.66±0.41	6.95±0.58
Chloride (mmol/L)	114.46±1.20	101.98±3.56

Sub Project 3 : Evaluation of Guar phalgati as a sole ration for camel

Five female camels of about 4 year age were fed *ad-lib* guar phalgati as a sole ration. After adaptation a digestibility trial for 5 days was conducted.

Dry Matter intake

Average dry matter intake in terms of total intake, per 100 kg body weight and as per the metabolic body size of animal were recorded as 6.46 kg/day, 1.80/100 kg b.wt. and

78.48/W^{0.75} kg, respectively. Since the camels maintained their body weight at the intake rate as low as 1.80%, it is quite probable that the dry matter requirements of camel may be low as compared to the established standards for other species.

Digestibility of nutrient

Average digestibility of DM, OM, CP, EE, CF, NFE and total carbohydrate for guar phalgati have been presented in Table 2.4.7. These values for guar phalgati are higher than that of other roughages.

Table 2.4.7. Digestibility of nutrients

Parameter	% Digestibility
DM	54.1
OM	56.9
CP	78.9
EE	43.1
CF	46.5
NFE	61.4
Total Carbohydrate	56.0

Intake of digestible nutrients

The data for DCP, TDN, DDMI and intake of DOM have been presented in Table 2.4.8.

The data indicated that guar phalgati alone as a sole ration was sufficient to meet the maintenance requirement of camel.

Table 2.4.8. Intake of Digestible nutrient

Parameters	kg/day	% of body weight
DDMI	3.47	0.97
DOMI	3.27	0.91
Total Carbohydrate	2.95	0.82
DCP	0.348	0.10
TDN	3.33	0.93

Sub Project 4 : Fermentative changes in camel milk

Titration acidity is a valuable index for measuring extent of growth of acid producing bacteria in evaluating shelf life of milk. Pooled camel milk samples were collected from the camel herd maintained at NRCC to see changes in acidity of raw and pasteurised camel milk on storage at ambient temperature (39-40°C) (Table 2.4.9). Acidity was calculated as per the method of AOAC.

Table 2.4.9. Changes in acidity of camel milk kept at ambient temperature

Hours	Acidity of raw camel milk	Acidity of pasteurised camel milk
One	0.091 ±0.007	0.11 ±0.008
Two	0.095 ±0.005	0.10 ±0.008
Three	0.097 ±0.01	0.11 ±0.002
Four	0.102 ±0.021	0.10 ±0.002
Five	0.104 ±0.024	0.10 ±0.002
Twenty-four	0.544 ±0.089	0.39 ±0.137
Forty-eight	0.684 ±0.097	0.54 ±0.043

Mean ± SD of three observations

Sub Project 5 : Coagulative studies in camel milk

Camel milk poses several problems regarding coagulation probably because of its low k-casein content. Attempts were made to find out a suitable method for coagulation of camel milk for processing applications. Pasteurised camel milk admixed with cow milk in the ratio of 3:1, 1:1 and 1:3 respectively was used for coagulative study. Pure camel milk was also used. Citric acid, acetic acid and rennet were used in different concentrations and temperatures for coagulation. Pure camel milk precipitated in the form of fine precipitate that dispersed on shaking and exhibited problems during filtration on using the above mentioned coagulants. Among all ratios, admixed camel milk with cow milk in the ratio of 3:1 showed best coagulum

when treated with rennet at 42°C. Equal part of camel and cow milk was best for obtaining coagulation by citric and acetic acid. However, by varying storage condition for two days at refrigerated temperature, pure camel milk could be successfully coagulated using same amount of rennet as for cow milk which in future can be utilised for manufacture of product.

This coagulated product, which can be used for cheese preparation was evaluated for its acceptance. On a Hedonic scale of 1 to 9 rating on the basis of taste, flavour and acceptability, the percent of acceptance was evaluated from fifty persons. 35 % people ranked it good and only 2% ranked it poor.

The overall average score was approx. 7 which showed general public acceptance.

2.5. To study the economics of different camel management practices under arid and semi arid eco-system

P.I. : Champak Bhakat
Associate : M.S. Sahani

Sub Project I : The comparative study on use of camel under carting in city and village area

A pilot survey was carried out on comparative study of camel used under carting in Krishi Upaj Mandi (KUM), Bikaner and in village Gadwala. A total of sixty nine camel keepers from KUM, Bikaner and fortyfive camel keepers from Gadwala were interviewed. Camel keepers residing in the Bikaner or greater part of city area, used their camel cart to transport different agricultural commodities (grain bags and oils) from Mandi to purchaser point and farmers inhabiting at village Gadwala, used their camel cart to transport different materials (viz. fuel wood, crop yield, fodder, water etc.) in the village or surrounding villages and accordingly they were earning money in their day to day life. The popular fodders (crop residues) used for feeding the cart camel are moth chara (*Phaseolus aconitifolius*), guar phalgati (*Cyamopsis tetragonoloba*). Some farmers from Gadwala village were providing Muffali chara (*Arachis hypogea*) and camel from this area also browse Jhal, Khejri and Pala leaves in the rangeland. As a special feeding, farmers offered molasses, oil (ground nut / seasm), alum (hydrated aluminum potassium sulfate) and very few progressive farmers

offered ghee. The major use of camel were carting, ploughing, water carrying and breeding etc depending upon season and requirement.

In general the maximum camel carting was done by the camel owner himself in both places. The primary activity of camel cart owner was agriculture followed by business. Although few farmers were working as labourers (daily wage basis) where as no report regarding this was available from KUM, Bikaner. The average age of camel used for carting purpose was 7.59 ± 3.21 years in Bikaner KUM and 8.69 ± 2.90 years in Gadwala village. Different age groups of camel used for carting purpose were presented in Fig 2.5.1. The Bikaneri breed of camel were predominantly used for carting, followed by Jaisalmeri and some non-descriptive camel in both places. Maximum male camel was used for carting than female in both places. The average working hours (per day) of camel were 7.59 ± 2.13 and 8.88 ± 1.64 where as the working days per years were 235.57 ± 4.85 and 247.51 ± 5.39 for KUM, Bikaner and Gadwala, respectively. The cost of male camel was found to be higher than female camel in both places. The average cost of male camel were Rs. 10030 ± 353.40 and Rs. 11500 ± 560.45 where as average cost of female camel were Rs. 8000 ± 460.55 and Rs. 9150 ± 250.00 in KUM (Bikaner) and Gadwala village, respectively. The per day average income from camel carting were Rs. 299.25 ± 31.72 and Rs. 137.20 ± 26.17 in KUM (Bikaner) and Gadwala village, respectively. The income from camel carting was estimated to be higher in city area as compared to village area because camel keepers of city area were getting more opportunities to transport different agricultural commodities than village area. Most of the farmers were purchasing their camel cart on cash payment basis (Fig 2.5.2). In KUM the charges were based on the total numbers of bags transported. The average carrying cost of each grain bag was 4.50 ± 1.12 , average round /day was 3.50 ± 1.50 , average bags carried out in each round was 19.00 ± 4.21 bags and average distance covered by cart camel was 20.5 ± 5.11 Km/day. But in the Gadwala the charges were based on each round.

Fig. 2.5.1. Different age groups of camel (%) used for carting purpose

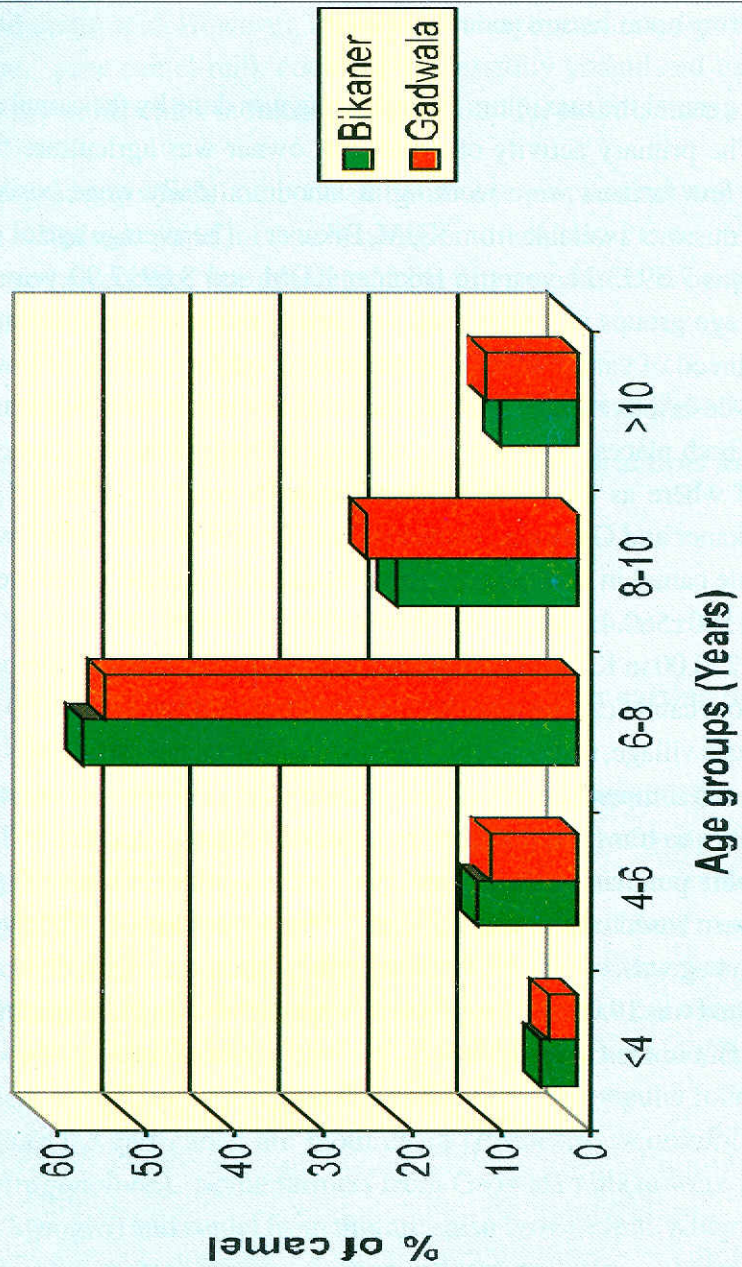
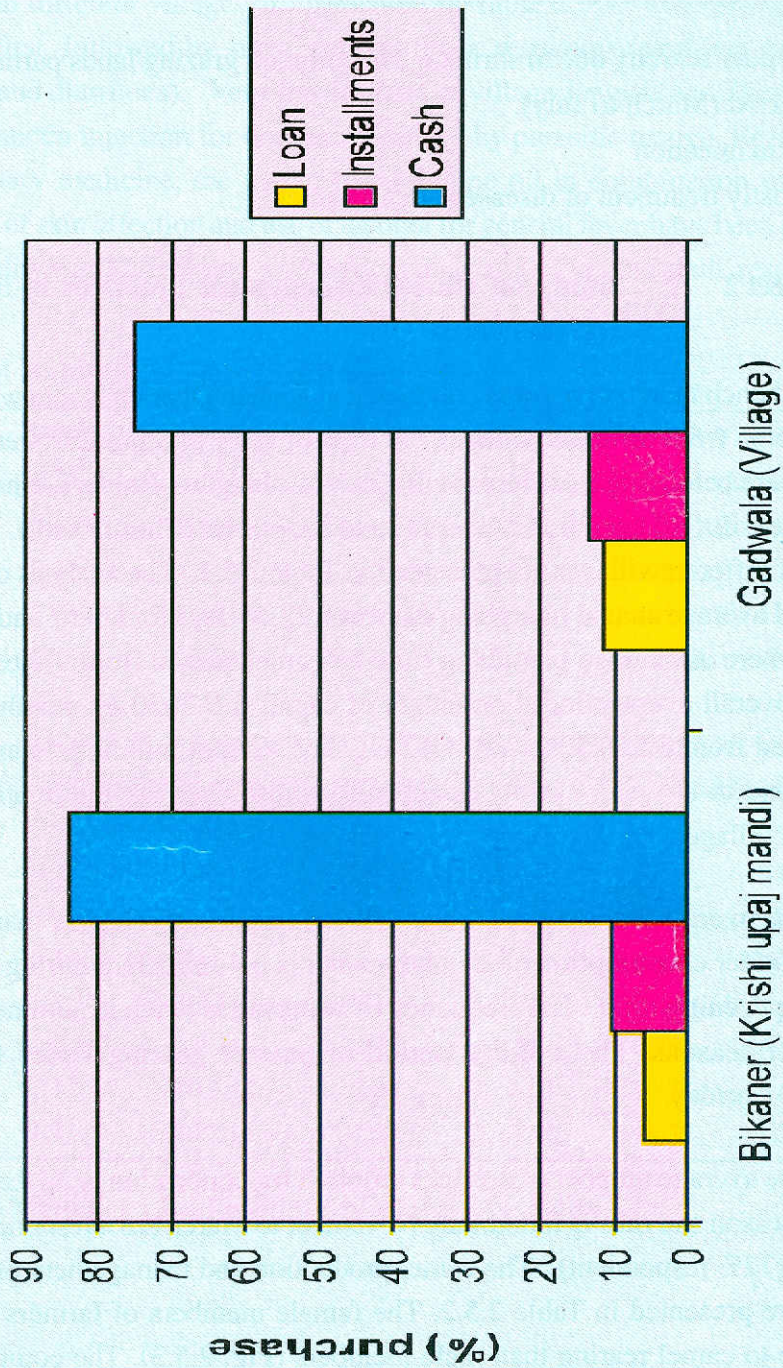


Fig 2.5.2. Purchasing of camel cart (%)



This study identified three major problems viz.

1. Fodder scarcity due to shrinkage in common grazing lands particularly during lean period (March to July).
2. Skin infection
3. Costly treatment of diseases of cart camels.

Sub project 2 : Study on Camel management practices in irrigated and non-irrigated area

A bench mark survey was conducted at Kishan Dharam Kanta where camel workers used to come from different villages. A total of sixty two farmers were interviewed. The farmers were belonging to different villages viz. : Jangloo, Rajpura, Kheendasar from three different tehsils (Bikaner distt.), Sheruna and Sanwatsar (Churu Distt.). The social status of farmers of different villages are presented in Table 2.5.1. The analysis of data revealed that the overall average annual ploughing days was 22.46 days for kharif and 24.19 days for rabi seasons where as average ploughing time by camel ranged from 9.00 ± 2.11 to 10.55 ± 4.22 hrs. The overall average lactation length of camel is 9.76 ± 0.49 months and average milk yield varied from 3.5 ± 0.50 to 4.8 ± 1.12 Kg/day. Camel milk is primarily utilised for calf feeding and to a small extent camel milk is also used for the treatment of enteritis in Sanwatsar village.

The overall average annual hair yield of camel calf is higher than adult. The overall average fodder consumption of an adult camel is 6.43 ± 0.23 Kg during day and 5.61 ± 0.22 Kg during evening time. The frequency of watering is twice in summer but once in rainy and winter seasons. The average period of pasture grazing varies from 6.25 ± 0.43 to 10.54 ± 0.31 hr/day.

The average number of services required for conception is 2.10 ± 0.14 . The common breeding season and rutting months are November to March (28% respondent) and December to March (72% respondent). The camel production and management practices in different villages are presented in Table 2.5.2. The female members of farmers family contributed more time to camel rearing than male members (Fig. 2.5.3). The comparative analysis of

camel health status in different villages are presented in Table 2.5.3. The skin infections (dermatitis) ranked first, followed by surra, general fever, respiratory problem and others (digestive problems and diarrhoea). Very few farmers of village Jangloo and Sheruna used Butox spray or Ivermectin injection for dermatitis caused by parasitic mange. Besides, as a part of ethno-veterinary medicine, the use of burnt engine oil in combination with boric powder for treatment of skin affection and use of alcohol for general fever have been practised in villages. The mortality was 32.26% and 8.05% for young calf (<1 yr) and adult, respectively.

Table 2.5.1. Social status of farmers in different villages

Parameter	Jangloo (11)	Rajpura (14)	Khendasar (12)	Sheruna (14)	Sanwatsar (14)	Overall
No. of farmers						
Av. Family Size (IND)	7.60±0.52	8.54±2.66	5.25±1.33	5.88±1.24	6.23±1.56	6.7±0.59
Av. Male/Family	3.7±0.81	4.24±1.89	2.13±1.00	2.88±1.02	3.09±1.21	3.21±0.36
Av. Female/Family	3.9±1.02	4.3±1.55	3.12±1.24	3.00±1.11	3.14±1.23	3.49±0.26
Literacy (%)	29.36	26.22	28.54	32.11	30.85	29.42±1.01
Av. Land holding (ha)						
Irrigated	15.23±5.11	12.11±7.89	14.27±5.21	16.23±8.22	18.25±7.11	15.22±1.02
Non Irrigated	30.52±6.25	28.42±6.43	26.77±4.11	31.55±7.23	32.26±6.23	29.9±1.01
Category of Farmers (%)						
P (>30 ha)	5.77	7.45	3.86	7.5	4.77	5.87±0.72
M (<30ha)	94.23	92.55	96.14	92.5	95.23	94.13±0.72
LL(0)	NA	NA	NA	NA	NA	NA
Camel : Cattle	1:8.57	1:9.38	1:8.81	1:8.06	1:8.00	-
Camel : Buffalo	1:0.31	1:0.38	1:0.27	1:0.33	1:0.26	-
Camel : Sheep & Goat	1:13.77	1:13.42	1:12.88	1:12.03	1:10.33	-
Camel : Herbivora	1:22.65	1:23.18	1:21.96	1:20.42	1:18.59	1:21.36A

P = Progressive; M = Marginal, LL= Land less; NA = Not Available

Table 2.5.2. Camel production and management practices in different villages

Parameter	Jangloo (11)	Rajpura (11)	Khendasar (12)	Sheruna (14)	Sanwatsar (14)	Overall
Av.Ploughing (hrs/day)						
Kharif	9.21±2.11 (20.55Days)	10.24±1.98 (21.45Days)	11.24±1.22 (25.00Days)	10.55±4.22 (23.15Days)	9.5±2.11 (22.17Days)	10.15±0.36 (22.46Days)
Rabi	10.25±3.55 (19.23Days)	10.31±2.22 (22.55Days)	9.00±2.11 (28.72Days)	8.11±2.31 (24.22Days)	8.65±1.22 (26.23Days)	9.26±0.44 (24.19Days)
Av. Milk Yield (kg/Day)	3.5±0.50	4.11±1.50	3.95±0.42	4.8±1.12	3.69±1.11	4.01±0.22
Av. Length of Lactation (month)	9.12±1.23	8.65±0.86	9.24±0.31	10.52±0.43	11.27±0.43	9.76±0.49
Use of Camel Milk	CF	CF	CF	CF	CF	
Medical use	NK	NK	NK	NK	21.43% Enteritis	
Mean Hair Yield (kg/yr)	Calf 1.82±0.51 Adult 1.00±0.42	1.52±0.32 1.11±0.91	0.99±0.34 0.80±0.22	1.62±0.21 1.03±0.35	1.00±0.29 0.91±0.11	1.39±0.17 0.97±0.05
Av.no.of services/conception	1.78±0.28	2.00±0.25	2.25±0.31	1.93±0.24	2.56±0.27	2.1±0.14
Common BS/RM						
December to March	72.73	64.64	58.33	78.57	85.71	72.00±4.86
November to March	27.27	36.36	41.67	21.43	14.29	28.00±4.94

CF- Calf feeding, NK - No knowledge, BS-Breeding season, RM- Rutting months

The productivity of two major crops and their cost of cultivation along with the return was recorded under the survey (Table 2.5.4). Per hectare average cost of cultivation of guar and Desi moth was worked out to be Rs.3200 & 2525, respectively. The net returns per hectare obtained from these crops were more in case of Guar as compared to Desi moth. The same pattern was observed in case of returns per rupee invested for the above crops. Due to high production potential and high market price, Guar cultivation is more profitable than traditional moth cultivation. In similar way the economic return from animal husbandry was worked out (Table 2.5.5). When the average return from cattle and buffaloes was 10 Kg milk /day /animal than net return was Rs. 45/day/animal. The average cost of rearing (feeding) was Rs. 40/camel/day when it used under carting and net return comes to Rs. 36/camel/day. In all villages sheep were rearing in almost zero input. The net return from selling of wool was Rs 0.58/sheep/day.

Table 2.5.3. The comparative analysis of camel health status in different villages

Disease incidence	Jangloo (11)	Rajpura (11)	Kheendasar (12)	Sheruna (14)	Sanwatsar (14)	Overall	Ranking
Skin infection	80.14	73.44	72.11	78.53	75.00	75.84±1.52	Ist
Surra	11.20	15.00	12.24	10.5	14.92	12.77±0.94	2nd
Suspected general fever	3.52	5.21	6.15	5.14	4.00	4.80±0.47	3rd
Respiratory problems	2.99	3.35	5.70	4.16	3.50	3.94±0.48	4th
Digestive disorders	2.15	3.00	3.80	1.67	2.58	2.64±0.36	5th
Percent mortality							
Adults	5.23±1.44	9.15±1.5	10.16±2.6	6.2±2.53	9.51±3.54	8.05±0.98	
Calves (below 1 year)	28.26±2.55	35.56±3.51	39.24±2.11	27.00±1.89	31.25±1.25	32.26±2.28	

Table 2.5.4. The economic gain of camel keepers from agriculture

Major crop	Average productivity (q/ha)	Average cost of cultivation (Rs./ha)	Gross return (Rs./ha)	Net return (Rs./ha)	Return/Rs. Invest.(Rs.)
Guar	4.89	3200	10758.00	7558.00	3.36
Desi moth	2.75	2525	5775.00	3250.00	2.29

Table 2.5.5. The economic return of camel keepers from animal husbandry

Animal	Average return	Average cost of rearing (Rs./animal/day)	Gross return (Rs./animal /day)	Net return (Rs./animal /day)
Cattle & buffalo	Milk-10 kg/day/animal	55.00	100.00	45.00
Sheep	Wool-2.5 kg/yr/animal	0.00	213/animal/yr	0.58
Camel	Carting	40.00	76.00	36.00

Market prices: guar @ Rs2200/q, moth @Rs 2100/q, milk @ Rs 10/kg

2.6. Surveillance, monitoring and control of camel diseases

Project Leader : Rajender Kumar
Associates : D. Suchitra Sena
Gorakh Mal
V.K. Jain, Govt. T.B. Hospital, Bikaner

Sub project 1 : Investigations on parasitic diseases of camel

Incidence of parasitic infections around Bikaner & Jaisalmer

Helminths

The field survey of camels was carried out in villages around Bikaner for helminthic infection. A total of 144 camels were found positive out of 366 camels screened i.e. 39.34%. Major helminthic infections were *Haemonchus*, *Nematodirella*, *Nematodirus* & other strongyles. Around Jaisalmer 41 faecal samples were screened and 10 were found positive i.e. 24.39%. Major helminthic infections were *Haemonchus* spp. & other strongyles.

Arthropods

Around Bikaner 382 camels were screened for different arthropod infestations. A total of 56 (14.66%) camels were found positive for *Sarcoptes* mite on skin scraping examination. *Hyalomma dromedarii*, *H. anatolicum anatolicum* and *Ornithodoros* were the major ticks infesting camels. *Chrysomya* spp fly was found to be the main causative agent of maggot wound in camel. Around Jaisalmer 170 camels were screened a total of 37 camels were found positive for sarcoptic mange i.e. 21.76% and major arthropod infestations were found to be *Sarcoptes scabiei* (mite) and *Hyalomma dromedarii* (tick).

Protozoa

Around Bikaner *Balantidium coli* was found as common intestinal protozoan infection. Blood samples were found negative for any protozoan infection. Around Jaisalmer out of 41 camels none was found positive for any blood or intestinal protozoan infection.

Sub project 2 : Acaricidal trial against sarcoptic mange in camel

Four acaricides were used viz. fenvalerate, deltamethrin, amitraz and ivermectin to know the efficacy against sarcoptic mange in camel. 15 camels were divided into five groups

of 3 each. Four groups were kept as treatment groups where as fifth group kept as control. The camels in group I were sprayed with fenvalerate @ 500 ppm 3 times at an interval of 7 days to clean the infection. The camels in group II were sprayed with deltamethrin @ 50 ppm. A total of 3 sprays were needed at a interval of 7 days to clean the infection . The camels in group III were sprayed thrice with amitraz @ 500 ppm to treat the camels suffering from mange. The camels in group IV were administered subcutaneously for a single dose with ivermectin @ 1 ml/ 50 kg. body weight The total expenditure to treat one camel with different drugs i.e. fenvalerate, deltamethrin , amitraz and ivermectin came to be Rs. 18-20, Rs 75-80, Rs. 55-60 and Rs. 600, respectively.

Sub Project 3 : Therapeutic trials against gastro intestinal (GI) nematodosis in camel

A total of twenty four camels having high levels of infection (>2000 epg) were selected and randomly divided into four groups of six animals each and the following treatments were given.

Group I-Ivermectin 1% w/v @1 ml/50 kg body weight s/c

Group II-Albendazole @7.5 mg/kg body weight per os

Group III-Fenbendazole@ 5 mg/kg body weight per os

Group IV- Control

The blood and serum samples were collected on day 0 (before treatment) and day 15 (after treatment) for haematological and biochemical estimations.

The haematobiochemical parameters are presented in Table 2.6.1. The camels infested with GI nematodes exhibited lower levels of haemoglobin and lymphocytes while total leucocytes count, neutrophils, monocytes and eosionophils had higher values than expected for a normal camel. Similarly an increase in serum glucose and globulin and decrease in total serum proteins, albumin and A/G ratio were recorded in infested camels than expected for a normal. Following treatment the haematobiochemical picture improved and the changes recorded were found significantly ($P<0.05$) different from pre-treatment values.

The mean e.p.g. count in the groups prior (BT) to and after therapy (AT) are presented in Fig. 2.6.1. The per cent reduction in e.p.g. count was 96.02, 96.65 and 94.03 among group I,II and III, respectively.

Table 2.6.1. Haemato-biochemical changes in GI nematodes in camels

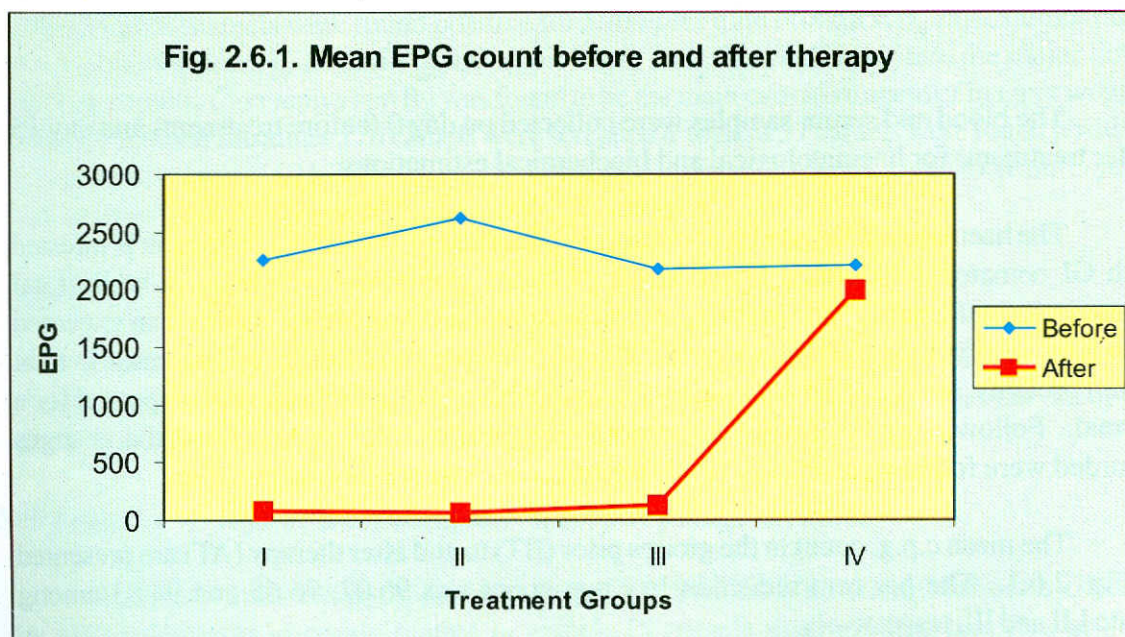
Parameters	I		II		III		IV	
	B.T.	A.T.	B.T.	A.T.	B.T.	A.T.	B.T.	A.T.
Hb*(g/dl)	11.03	14.06	8.50	13.56	10.83	14.10	11.93	11.00
TLC*(C.mm)	8758	7575	9300	7467	9058	7808	9016	8833
Neutrophils* (%)	54	47.5	51.66	46.5	52.16	49.66	53.33	48.66
Lymphocytes* (%)	33.66	44.5	36.83	45.66	35.66	41.83	34	42
Eosinophils* (%)	7.66	4.83	6	4.33	6.83	4.83	7	5.33
Monocytes* (%)	4.33	2.66	5.5	3.16	5	3.16	5.33	3.33
Basophils (%)	0.33	0.5	0.0	0.33	0.33	0.5	0.33	0.66
Serum glucose* (mg/dl)	94.68	58.41	111.95	68.60	97.76	81.07	98.32	88.86
Total Proteins* (g/dl)	5.92	6.56	6.08	6.86	6.24	7.46	6.31	6.51
Total Albumins*(g/dl)	3.02	4.55	3.13	4.25	3.08	4.64	3.25	3.23
Total Globulins*(g/dl)	2.90	2.01	2.95	2.61	3.14	2.82	3.06	3.27
A/G ratio	1.04	2.26	1.06	1.62	0.98	1.64	1.06	0.98

*Significant at 5% level

B.T.: Before treatment

A.T.: After treatment

Fig. 2.6.1. Mean EPG count before and after therapy



Sub project 4 : Effect of diet supplementation of raw camel milk in multiple drug resistant (MDR) tuberculosis patients

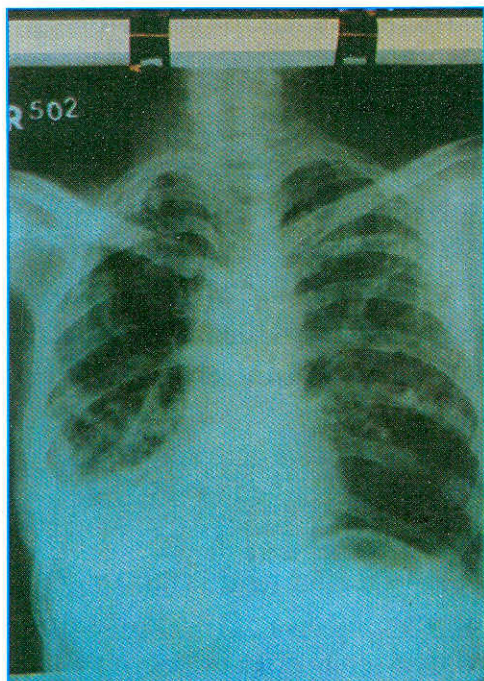
A trial was conducted in collaboration with Department of TB and Chest diseases (SP Medical College, Bikaner) to study the beneficial effect, if any, of diet supplementation of camel milk on Multiple Drug Resistant (MDR) tuberculosis patients. A total of 11 patients were included which were divided into 2 groups and were given either camel milk (group T₁, n=6) or cow milk (group T₀, n=5) at the rate of 1 kg milk/day. The clinical symptoms, bacteriological, radiological, haematological, biochemical parameters and immunoglobulin status were monitored at monthly intervals and the body weight was recorded at fortnightly intervals.

The patients in group T₁ exhibited increase both in appetite and body weight gain. Radiological observation showed improvement in terms of lung expansion. Clinico-haematological results showed increase in haemoglobin gm % ($p < 0.01$), reduction in both TLC and ESR (57.27% vs. 51.57%). Serum LDH and CPK values were found in decreasing trend in treated group of patients. There were also increase of zinc and iron and decrease in calcium in blood of patients of the same group. The levels of infection specific IgG and IgA in serum of the patients in this group also decreased in comparison to patients not treated with raw camel milk. As regards IgM antibody status, 4/6 (66.66%) patients of group T₁ were found to be negative at the end of the trial as compared to 0/5 (none) of the patients of group T₀. It was concluded that supplementation of diet with camel milk in multiple drug resistant tuberculosis patients was beneficial over cow milk supplementation (Table 2.6.2).

Table 2.6.2. Immunoglobulin studies in Multiple Drug Resistance Patients(TB)

Parameters	Groups	Before trial	After trial
IgA(U/ml)	T ₀	606.00±91.50(+) ^a	394.00±37.31(+) ^b
	T ₁	675.00±78.26(+) ^A	370.00±42.81(+) ^B
IgG(U/ml)	T ₀	1290±89.57(+) ^A	754.00±134.12(+) ^B
	T ₁	1200±163.39(+) ^A	417.00±114.49(+) ^B
IgM	T ₀	+ve	+ve
	T ₁	+ve	-ve/+ve

A, B-P<0.01 , a, b-P<0.05



X-ray picture of lungs prior to trial



X-ray picture of lungs after supplementation of camel milk in diet

Sub Project 5 : Therapeutic utility of camel milk as nutritional supplement chronic pulmonary tuberculosis patients

Ten patients suffering from tuberculosis for past 5-7 years and who did not receive regular treatment of tuberculosis were divided into two groups viz. T_1 and T_0 having 6 and 4 patients, respectively. T_1 patients were supplemented with raw camel milk @ 1kg/day while T_0 were given dairy milk at similar rate thrice a day. Both the groups were subjected to similar tuberculosis treatment along with regular meals from the T.B. hospital.

Data on clinical symptoms, radiological, bacteriological aspects of sputum and haemato-biochemical parameters and body-weight were recorded at monthly interval for 3 months.

The important clinical symptoms and bacteriological attributes are presented in Table 2.6.3. which indicate that the T_0 patients had persistence of cough and breathlessness where as T_1 patients exhibited no clinical signs. Increased appetite was noticed among T_1 patients

compared to T_0 . Both the groups revealed negative status of acid fast bacilli after the supplementation. Radiological examination revealed haziness in the pulmonary region of the chronic tuberculosis patients which reduced in both the groups after therapy but the reduction in the radiological reflections is more pronounced in T_1 as evident from x-ray film.

The haematological parameters as well as the body weight prior to and after supplementation are presented in Table 2.6.4. which indicated increase in % haemoglobin content in both T_1 (48.92%, $P<0.01$) and T_0 (32.51%) groups, decrease in ESR (58.96% in T_1 group ($P<0.01$) and 42.87% in T_0 group) and TLC (49.23 and 35.04% in T_1 and T_0 groups, respectively ($P<0.01$)). The biochemical parameters are presented in Table 2.6.4 which indicated significant ($P<0.01$) increase in ALP, protein and Zinc while triglycerides showed a significantly declining trend in T_1 group. Other biochemicals did not exhibit significant changes.

Table 2.6.3. Clinical and Bacteriological findings in MDR (TB) Patients

Parameters	Groups	0 Day	After trial
Cough	T_0	++	+
	T_1	++	-
Expectoration	T_0	++	++
	T_1	++	-
Breathlessness	T_0	++	+/-
	T_1	++	-
Haemoptysis	T_0	-	-
	T_1	-	-
Chest pain	T_0	+	+/-
	T_1	+	-
Fever	T_0	+	-
	T_1	+	-
Appetite	T_0	Poor	Fair
	T_1	Poor	Increased
Status of AFB	T_0	++	+
	T_1	+	-
Mantoux test(mm)	T_0	21.8±0.82 ^A	17.2±0.91 ^B
	T_1	16.0±1.15 ^A	9.77±0.51 ^B

Table 2.6.4. Haematological Parameters and body weight changes in Multiple Drug Resistance

Parameters	Groups	Before trial	After trial
Hb(gm%)	T ₀	8.30±0.41	10.75±0.90
	T ₁	8.60±0.50 ^A	11.56±0.68 ^B
ESR(mm/hr)	T ₀	108.2±8.72 ^A	52.40±3.63 ^B
	T ₁	99.70±6.60 ^A	42.60±4.15 ^B
TLC(/cmm)	T ₀	9012±763.14	8085±519.20
	T ₁	9065±459.70 ^A	7210±366.11 ^B
Body Weight(Kg)	T ₀	46.67±2.66	48.25±2.64
	T ₁	45.60±1.53	49.80±2.41

A, B-P<0.01

Table 2.6.5. Biochemical parameters in Multiple Drug Resistance Patients (TB)

Parameters	Groups	Before trial	After trial
ALP(IU/L)	T ₀	185.56±26.01	270.63±32.32
	T ₁	207.15±15.95 ^a	295.81±32.91 ^b
GOT(IU/L)	T ₀	22.94±2.24	24.99±2.29
	T ₁	25.49±2.11	19.67±2.50
GPT(IU/L)	T ₀	14.37±1.80	10.09±0.94
	T ₁	14.91±2.94	12.18±1.51
LDH(IU/L)	T ₀	307.72±31.96 ^a	220.60±22.36 ^b
	T ₁	329.49±20.22 ^A	195.86±12.61 ^B
CPK(IU/L)	T ₀	170.51±8.21 ^a	140.29±5.65 ^b
	T ₁	108.11±29.28 ^a	70.12±10.57 ^b
Protein(G/DL)	T ₀	8.61±0.62	7.90±0.49
	T ₁	8.36±1.05	6.76±0.64
Albumin(g/dl)	T ₀	3.22±0.26	2.98±0.30
	T ₁	3.72±0.36	2.87±0.20
Glucose(mg/dl)	T ₀	106.52±4.90	99.62±3.19
	T ₁	132.10±5.62 ^A	95.10±2.93 ^B
Triglycerides (mg/dl)	T ₀	77.64±8.04 ^a	52.72±5.39 ^b
	T ₁	65.08±2.71 ^A	25.65±2.92 ^B
Mg(meql/l)	T ₀	1.24±0.16	1.26±0.12
	T ₁	1.61±0.22	1.42±0.07
Zn(feql/dl)	T ₀	52.90±2.11	58.61±2.27
	T ₁	54.07±1.49 ^A	69.50±1.88 ^B
Fe(feql/dl)	T ₀	48.65±1.16	52.05±1.35
	T ₁	50.60±1.65 ^A	58.15±1.14 ^B
Cu(feql/dl)	T ₀	255.07±17.91 ^a	200.12±14.76 ^b
	T ₁	272.73±22.69 ^A	135.67±28.62 ^B

A, B-P<0.01, a, b- P<0.05

2.7. Service project on extension, communication and human resource development

Project Leader	:	Champak Bhakat
Associate	:	Rajender Kumar B.L. Chirania Ram Kumar M.S.Sahani

Animal health camps

NRCC organised 2 animal health camps at adopted village Gadwala (Bikaner Distt.) during the reporting period. In this camp a substantial number of animals were treated and medicines were distributed free of cost among the poor farmers. The animal species comprised mainly of camels and other viz. cattle, sheep, goat and very few buffalo were also there. Farmers thoroughly discussed and consulted regarding their animal health problems with scientists attended the camps. The health related problems were solved during these camps.

Kishan gosthies

During the period, three kishan gosthies were organised, two at the adopted village Gadwala and one at the Centre. In these Gosthies the problems under camel management practices and diseases were discussed and answered by the subject matter specialists. The N.G.O., namely "Lokhit Pashu Palak Sansthan" (A society for indigenous Livestock Research

and development from Sadri, Pali Distt, Rajasthan) along with farmers, farm women, youth participated in the Gosthies which was conducted at Centre. The farmers visited the camel farm and were demonstrated about the camel management practices followed at an organised farm and were explained about the functioning of various laboratories, the farmers were apprised about advance breeding practices, camel diseases, and other modern management practices. The scientists of the Centre also gathered feedback from the farmers about the traditional camel husbandry practices.



Demonstration of camel research achievements to the farmers

Radio talk

In all 7 radio talks were delivered during the period by different subject matter specialists viz. Camel health, breed, feeding of Camels, Camel milk, draught power, Camel management and extension.

Participation in Livestock and Poultry Show



Hon'ble Agriculture Minister, Sh. Nitish Kumar observing camels during 3rd National Livestock & Poultry Show

Centre took part in the **Third National Livestock and Poultry show** held at Delhi, from 26-1-2000 to 2-2-2000. An exhibition was installed depicting various uses of camels and research highlights. The camels of the centre won 3 first prizes in various events.

Centre also participated in **47th All India Livestock and Poultry show** which was jointly organised by Department of State Animal Husbandry, Jaipur and Ministry of Agriculture, New Delhi. A paper entitled “Trend of

Change in Camel Population and their productivity” was presented by Dr. M.S.Sahani, Director in the seminar. Camels of the centre won 5 prizes in different events viz. breed, sex, calf etc.



A group of farm women visiting the camel exhibition during Krishi Expo-2000

Scientific exhibition

Three scientific exhibitions on camel husbandry practices and latest technology know-how achieved by the centre were organised/ participated which include “Camel Festival-2000” at Bikaner, “Krishi Expo-2000” at Pragati maidan, Delhi and 47th “All India Livestock and Poultry Show” at Jaipur (Raj). A sufficient number of different handouts on different aspects of camel research achievements and

brouchers were distributed among the farmers and visitors. In this connection 40 posters/ display charts etc. were prepared.

Demonstration of Centre's research activity

The Centre demonstrated ongoing research activity, camel management practices and latest technology know-how to various trainees, scientists, students (from SAUs, Medical colleges, Veterinary Colleges, Schools, Universities), N.G.Os, Farmers, Farm women, Youths, Livestock owners, Administrators, Defence officers, Indian & Foreign Educationists etc.

2.8. RESEARCH SCHEMES

2.8.1. Network collaborative programme on crop based animal production system

P.I.	:	M.S. Sahani
Project leader	:	A.K. Nagpal (up to Sept., 1999)
Associates	:	Nirmala Saini
		Ram Kumar
		Raja Purohit
		Baldev Kiradoo

Experiment 1 : Performance of camel calves kept on silvipastoral browsing/grazing management system

The climatic conditions of Bikaner during the period are presented in Table 2.8.1.1. The annual rainfall of 178.5 mm was recorded this year which was low and erratic as compared to the previous years. The minimum (3.4 mm) and the maximum (83.0 mm) rainfall was recorded in the month of June and July respectively. The soil fertility status (Table 2.8.1.2) of the land under silvipasture at the beginning of the experiment showed pH 8.34 ± 0.002 , EC 0.423 ± 0.055 mmhos/cm, Carbon % 0.134 ± 0.039 and P_2O_5 445.0 ± 33.375 kg/ha. The summer spell was noticed to be little longer than the normal, thus resulting in poor growth of the vegetation. The various components of silvipasture are depicted in Table 2.8.1.3.

Table 2.8.1.1. Month wise meteorological data at Bikaner 1999-2000

Months	Temperature °C		Relative humidity (%)		Rainfall mm
	Max.	Min.	8.30 AM	5.30 PM	
April 1999	45.6	15.6	27	7	-
May 1999	45.7	22.0	52	20	72.9
June 1999	43.6	23.0	86	17	3.4
July 1999	43.6	24.2	65	43	83.0
August 1999	39.4	25.2	72	40	-
September 1999	40.4	25.2	66	31	15.0
October 1999	39.5	18.6	46	19	-
November 1999	37.0	12.0	43	18	-
December 1999	32.5	4.5	55	22	-
January 2000	29.4	1.4	72	29	4.2
February 2000	30.5	5.1	74	32	-
					178.5

Table 2.8.1.2. Soil fertility status of silvipasture

Parameters	
Number of soil samples	12
pH	8.340±0.002
EC (mmhos/cm)	0.423±0.055
Carbon (%)	0.134±0.039
Available phosphate (Kg/ha)	20.000±1.872
Available potash (Kg/ha)	445.000±33.375

Table 2.8.1.3. Species wise vegetative composition of silvipasture

S.No.	Plant	Botanical Name	Number of Plants	
			Above 5 Feet	Under 5 Feet
TREES				
1.	Jaal	<i>Salvadora oliodes</i>	270	-
2.	Kiker (Israeli)	<i>Acacia tortilis</i>	480	1210
BUSHES				
3.	Pala	<i>Zizyphus nummularia</i>	1250	2260
4.	Phoag	<i>Calligonum polygonoides</i>	-	1543
5.	Murli kakni	<i>Lycium barbarum</i>	-	1184
6.	Ker	<i>Caparis decidua</i>	-	361
7.	Kheemp	<i>Leptadenia pyrotechnica</i>	125	900
SHRUBS				
8.	Sinio	<i>Crotolaria burhia</i>	-	3890
9.	Bui	<i>Areva tomentosa</i>	-	3570
			2125	14918
Total			17043	

As per the objectives of the project, the study on performance of male camel calves aged 2-3 years kept on silvipasture plot of 16.0 hectare containing various trees, bushes, shrubs and grasses was initiated in the month of June 1999, so as to determine the sustainability of growing camels on existing established silvipasture.

The chemical composition of all the fodder viz., trees, bushes and grasses are presented in Table 2.8.1.4

The body weight changes recorded are presented in Table 2.8.1.5. During initial period of study (June to August) an overall increase in % body weight was recorded, indicating that the sufficient edible biomass was available to the growing camel calves through browsing/ grazing in the silvipasture plot. But, during September to October months decline in body weight was observed, indicating that biomass available to the camels in the area was not sufficient to sustain the body weight of growing calves. The low availability of edible biomass to growing camels could be attributed to the poor growth of various components of silvipasture and annual grasses which might be due to low and erratic rainfall as well as comparatively longer summer spell. Consequent upon the drop in body weight, supplementation with Guar phalgati was done at the rate of 5 Kg/camel/day along with green Jaal at the same rate. This supplementation along with browsing/grazing in the silvipasture indicated an increasing trend in the body weight and growth of experimental calves up to February, 2000. It is therefore concluded that the camel calves could easily sustain under silvipasture system with little supplementation during the lean period in arid region.

Table 2.8.1.4. Proximate composition of vegetation of silvipasture

S. No.	Plant	% DM	% CP	% EE	% CF	% TA	% NFE
A.	GRASSES						
1.	Boor (<i>Andropogon lamiges</i>)	33.12	7.45	2.96	32.32	7.58	50.51
2.	Bachab (<i>Cyperus rotundus</i>)	45.99	7.85	1.95	30.35	20.55	40.02
3.	Dhaman (<i>Cenchrus setigerus</i>)	27.91	8.71	2.79	31.15	17.62	39.97
B.	BUSHES						
1.	Bui (<i>Areva tomentosa</i>)	28.90	14.50	2.12	16.42	14.80	51.70
2.	Kheemp (<i>Leptadenia pyrotechnica</i>)	31.00	10.60	-	18.70	21.35	-
3.	Murali Kakni (<i>Lycium barbarum</i>)	29.05	23.02	3.40	9.27	15.70	48.32
4.	Pala (<i>Zizyphus nummularia</i>)	54.66	14.03	3.54	16.79	15.80	47.95
5.	Phog (<i>Calligonum polygonoides</i>)	26.05	10.72	1.54	22.10	9.32	57.06
C.	TREE LEAVES						
1.	Jaal (<i>Salvadora oleodeus</i>)	30.22	15.40	2.15	8.43	28.40	45.70
2.	Kikar (<i>Acacia tortilis</i>)	50.18	15.90	6.26	7.52	8.28	62.26

Table 2.8.1.5. Month wise average daily gain in growing camel calves in silvipasture system

Years/Months	Daily gain (gm/day/month)
1999, July	172.03±7.60
1999, August	197.12±8.40
1999, September	-99.99±14.69
1999, October	-69.88±16.28
1999, November	236.23±18.10
1999, December	241.09±15.47
2000, January	275.98±13.29
2000, February	291.05±6.08

The browsing/grazing behaviour of 4 growing male camels during the experiment is presented in Table 2.8.1.6 which showed that maximum time (33.92%) was spent for browsing.

Table 2.8.1.6. Average total time spent and average % w.e.f. Nov., 1999 to February 2000

Time: 8.00 AM to 6.00 PM

Parameters	Average Total Time % (min)	Average %
Only Walking	108.25	18.17
Walking while grazing	28.00	4.66
Only standing	57.25	9.54
Only sitting	35.00	5.83
Rumination while standing	44.25	7.37
Rumination while sitting	33.75	5.62
Browsing	204.00	33.92
Feeding (Supplementation) of dry fodder	87.50	14.62
Drinking	1.75	0.28
Total	600	100.00%

Further, it was also recorded that out of various pastoral activities i.e. watering, walking while grazing, only standing, only sitting etc. the maximum period was spent by camels on walking alone followed by standing and rumination while sitting.

Experiment 2 : Efficiency of utilisation of Guar phalgati (*Cyamopsis tetragonoloba*) in combination with Jaal (*Salvadora oleoides*) in growing camel calves

This experiment was undertaken in 4 camel calves in the month of February with the objective of determining the efficiency of utilisation of Guar phalgati in combination with Jaal which was offered as supplementary feed to camel calves during previous study when pasture did not appear to be sufficient to sustain body weight of growing camels. These camels were offered dry guar phalgati (*Cyamopsis tetragonoloba*) and green Jaal (*Salvadora oleoides*) leaves both @ 5 kg/camel/day for 21 days pre experimental feeding period. The average dry matter intake (DMI) was recorded to be 5.21 ± 0.09 kg/day or 1.45 ± 0.06 kg/100 kg b.wt. After 21 days feeding period a digestion trial of 7 days were conducted with experimental camels to determine the digestibility of dry matter and grass nutrients as well as nutritional worth i.e. DCP, TDN experimental feed (Table 2.8.1.7).

Table 2.8.1.7. Dry matter intake, nutrient digestibility of growing camel calves given GPH in combination with Jaal leaves

Parameters	Results
Dry Matter Intake	
Guar phalgati (Kg/d)	3.78
Jaal (Kg/d)	1.43
Total DMI (Kg/d)	5.21 ± 0.09
DMI (Kg/100 Kg body weight)	1.45 ± 0.06
Nutrient digestibility	
DM	49.53 ± 1.08
OM	57.56 ± 2.43
CP	44.95 ± 1.78
EE	25.01 ± 1.87
EF	33.97 ± 2.63
NFE	57.54 ± 3.29
Practical Nutritional Worth	
DCP	2.89%
TDN	35.55%
Nutrient Intake	
DCP (g/d)	0.151
TDN (g/d)	1.852

The mean digestibility of dry matter, OM, CP, CF, EE and NFE were found to be 49.53 ± 1.08 , 57.56 ± 2.43 , 44.95 ± 1.78 , 25.07 ± 1.87 , 33.97 ± 2.40 and 57.54 ± 5.29 respectively. However, the DCP and TDN contents of experimental feed were 2.89 and 35.55% respectively.

These findings suggested that Guar phalgati in combination with green Jaal leaves could be used in the diet of camel calves as supplementation during lean period when nutritionally adequate biomass is not available to the camels from range land.

2.8.2. Evaluation and conservation of double humped camel (*Camelus bactrianus*) in cold desert region

Principal Investigator :	M.S. Sahani
Associates :	B.P. Mishra
	Gorakh Mal
	A.K. Nagpal
	Rajender Kumar
	R. Singh
	Banmali Yadav
	M.C. Pandey*
	Mohammad Baqir**
	Mohammad Ali***

During the period a team of scientists visited Partapur area (Ladakh) to conduct survey and collected research material viz. (blood, hair, faecal, feed and fodder samples). The team visited near by villages/towns in the Nobra Valley viz. Partapur, Skampuk, Diskit, Sumur etc, and basic information regarding the distribution of camel, breeding, management practices etc. were collected. The present population of *Camelus bactrianus* is around 90 camels comprising of about 40 males and 50 females. Bactrian Camel can carry load up to 1 quintal as baggage and can work for 6-8 hrs daily, for a period of 20-30 days during winter months. Some of the adult camels are utilized for transportation of fuel wood, stones, bags and manure for a period of 20-30 days during winter from agricultural fields to village houses. The camels are also used as baggage animal carrying load to army posts in high

* Scientist D, DRDO, Officer-in-charge, Det-Partapur.

** Manager, Yak Breeding Farm, Disket, Nobra, Ladakh (J & K).

*** Livestock Development officer, Disket, Nobra, Ladakh (J & K).

altitude and under difficult terrain. The rate paid for such camel is equivalent to 3 Ponies. The annual hair clip is done in the month of March and yield per animal varies from 2-3Kg./ camel. Hair is used for preparation of various items viz. Shawl, pull-over, sweater, winter garments and caps. It was comparable in quality as that of pashmina. The breeding season is similar to that of single humped camel i.e. during winter.

Management practice

The management system followed in the region is mostly extensive type under rangeland except for winter months (October to March) when the new born calves and their mothers are being kept under semi intensive system.

Collaboration

In addition to Defense Research Development Organisation, Field Research Laboratory, Leh, an effective collaboration was established between NRC on camel Bikaner and the Department of Animal Husbandry, Govt. of J&K under which sampling was carried out from double humped camel herd maintained at Yak Breeding Farm, Diskit.

Production parameters

Hair quality attributes:

In all 56 hair samples from 4 calves (below 6 months) and 9 adult camels (above 3 years of age) were collected from five body sites viz. shoulder, mid-side, hump, neck and thigh region during the month of September 99 (early winter). The hair samples were analysed for fiber quality attributes viz. staple length, mean fiber diameter and mean fiber diameter of different types of hair fibers. Sex and site wise least square means are presented in Table 2.8.2.1 while, age group wise least square means of hair quality attributes of bactrian camel are presented in Table 2.8.2.2. Comparison of different sites indicated that the difference were found to be significant ($P<0.01$) in most of the hair quality attributes but the difference were not significant between the sex. The staple length was found to be highest in the hump region 13.25 ± 1.03 cm. followed by neck 10.45 ± 1.15 cm., shoulder 8.38 ± 1.29 cm., mid-side 5.37 ± 1.16 cm. and thigh 3.15 ± 1.44 cm. The mean fiber diameter of thigh was found to be

Table 2.8.2.1. Sex and Site wise least square means of hair quality attributes of bactrian camels.

SEX	No. of Obs. (n)	Staple Length (cm)	Mean fiber diameter \pm SE (μ)	Least square mean fiber diameter (μ)		Percentage of Fibers			
				Pure	Hairy	Pure	Hairy		
Male	15	8.42 \pm 1.18	23.03 \pm 2.92	18.99 \pm 2.42	27.03 \pm 3.03	42.38 \pm 3.98	65.18 \pm 3.80	26.53 \pm 2.90	8.13 \pm 1.92
Female	41	7.82 \pm 0.92	23.77 \pm 2.29	18.20 \pm 1.90	28.09 \pm 2.37	43.73 \pm 3.12	61.52 \pm 2.99	28.49 \pm 2.28	9.60 \pm 1.50
SITE		**	**	**	**	**	**	**	NS
Shoulder	12	8.38 \pm 1.29	26.41 \pm 3.19	20.29 \pm 2.65	30.74 \pm 3.31	45.61 \pm 4.35	60.52 \pm 4.16	28.53 \pm 3.17	10.10 \pm 2.10
Mid-Side	12	5.37 \pm 1.16	16.38 \pm 2.88	13.55 \pm 2.39	22.11 \pm 2.99	34.86 \pm 3.93	72.31 \pm 3.76	19.79 \pm 2.87	8.20 \pm 1.90
Hump	12	13.25 \pm 1.03	30.74 \pm 2.54	24.41 \pm 2.11	34.26 \pm 2.63	53.33 \pm 3.46	59.94 \pm 0.31	29.80 \pm 2.52	9.76 \pm 1.67
Neck	12	10.45 \pm 1.15	28.90 \pm 2.86	22.70 \pm 2.37	33.50 \pm 2.97	48.49 \pm 3.90	56.56 \pm 3.73	36.41 \pm 2.84	6.68 \pm 1.88
Thigh	8	3.15 \pm 1.44	14.56 \pm 3.56	12.01 \pm 2.95	17.20 \pm 3.69	33.00 \pm 4.86	67.41 \pm 4.64	23.03 \pm 6.54	9.60 \pm 2.34

** p<0.01, * p<0.05

Table 2.8.2.2. Age group wise least square means of Hair quality attributes of bactrian camels.

Age	No. of Obs. (n)	Staple Length (cm)	Mean fiber diameter \pm SE (μ)	Least square mean fiber diameter (μ)		Percentage of Fibers			
				Pure	Hairy	Pure	Hairy		
Below 6 Month	16	8.92 \pm 1.63	15.82 \pm 3.67	13.06 \pm 0.94	20.13 \pm 2.21	35.46 \pm 7.75	70.08 \pm 9.13	23.24 \pm 3.85	6.58 \pm 5.34
Above 3 years	40	7.32 \pm 0.58	30.97 \pm 1.77	24.13 \pm 1.07	34.99 \pm 1.76	50.65 \pm 2.07	56.62 \pm 2.63	31.78 \pm 1.97	11.15 \pm 0.61
Overall	56	8.07 \pm 1.02	26.23 \pm 2.51	21.12 \pm 2.01	28.75 \pm 2.61	43.31 \pm 3.43	56.08 \pm 3.28	27.51 \pm 2.31	8.87 \pm 1.53

** p<0.01, * p<0.05

lowest $14.56 \pm 3.56 \mu$ followed by mid-side $16.38 \pm 2.88 \mu$, shoulder $26.41 \pm 3.19 \mu$, neck $28.90 \pm 2.86 \mu$ and hump region site having highest fiber diameter of $30.74 \pm 2.54 \mu$. The mean fiber diameter of pure hetero and hairy type followed the similar trend. The higher percentage of non-medullated fiber was found in the mid-side 72.31 ± 3.76 , followed by thigh 67.41 ± 4.64 , shoulder 60.52 ± 4.16 , hump 59.94 ± 3.31 and neck 56.56 ± 3.73 percent. The percentage of hetero fiber was observed higher at the neck region 36.41 ± 2.84 and lower in the mid-side 19.79 ± 2.87 . The percentage of hairy fiber was found lower in the neck region 6.68 ± 1.88 and higher in shoulder region 10.10 ± 2.10 percent.

Comparison between two age groups reveals that staple length of calves was slightly higher 8.92 ± 1.63 cm. than the adults 7.32 ± 0.58 cm. but mean fiber diameter indicated significant difference ($p < 0.01$) it was $15.82 \pm 3.67 \mu$ in calves as compared to $30.97 \pm 1.77 \mu$ in adult. Mean fiber diameter of pure hair fiber was $13.06 \pm 0.94 \mu$ in calves and $24.13 \pm 1.07 \mu$ in adult. Similarly the diameter of pure, hetero, and hairy fibers of calves and adults were $13.06 \pm 0.94 \mu$ & $24.13 \pm 1.07 \mu$, $20.13 \pm 2.21 \mu$ & $34.99 \pm 1.76 \mu$ and $35.46 \pm 7.75 \mu$ & $50.65 \pm 2.07 \mu$ respectively. Percentage of pure, hetero and hairy fibers were observed 70.08 ± 9.17 , 23.14 ± 3.85 and 6.58 ± 5.34 in calves and 56.62 ± 2.63 , 31.78 ± 1.97 and 11.15 ± 0.61 percent in adults respectively. Mean fiber diameter of different types of hair varies significantly ($p < 0.01$) in respect of age. The percentage of pure and hetero fibers were also found significant ($p < 0.05$) while, percentage of hairy fibers did not show any significant difference between the age groups.

The high staple length and quality of wool fiber indicated its usefulness in fiber processing for the village cottage industry.

Biometrical observations

Biometrical data from 15 adult bactrian camels (5 years and above) were recorded covering 13 parameters. Least squares mean of various biometrical parameters are presented in Table 2.8.2.3. A significant difference in body length ($p < 0.01$), height at wither ($p < 0.01$), face length ($p < 0.05$), leg length ($p < 0.01$), distance between eyes ($p < 0.01$), hump circumference [front] ($p < 0.01$) and muzzle diameter ($p < 0.05$) was observed between the two sexes. Similar findings were observed during the previous years.

Biochemical polymorphism

Biochemical polymorphism study in double humped camel was carried out using 7 systems viz. Haemoglobin (Hb) Transferrin, Albumin, Amylase, Phospho-Hexose- Isomerase (PHI) Glucose 6- phosphate dehydrogenase (G-6-P-D) and Acid –phosphatase (ACP). Red blood cells (RBC) or sera samples were used to investigate the above markers in double humped camel and also to compare with that of single humped. Analysis of the results indicated no polymorphism in Hb, PHI, G-6-P-D and ACP while, polymorphism was observed with serum Amylase and Transferrin. It was reported that Amylase and Transferrin were non-polymorphic in single humped camel, while preliminary data indicated polymorphism within and between the two species of camel. Further, investigation on a large number of samples will substantiate the above findings.

Disease prevalence

During the period 18 faecal and 9 blood samples were collected from various area in the valley to study the incidence of parasitic infections in bactrian camels. All samples were found negative for any parasitic infections. The important diseases prevalent in bactrian camels in Nobra valley are actinobacillosis, parasitic infestations, pneumonia, eye diseases associated with blindness, hydropericardium and ectopic pregnancies etc.

Comparative study on haematological and mineral profiles in single and double humped camel

Haematological and minerals studies of 9 single humped camels and 6 double humped camels were undertaken during September, 1999 (Table 2.8.2.4). The blood samples were collected in sterile tubes by adding di-sodium EDTA @ 1 mg/ml of blood for estimation of Hb, ESR and DLC. Ca, P, Mg, Zn, Fe, Cu, Co, Mn and Mo were estimated by Atomic Absorption Spectrophotometer. Among haematological parameters ESR, neutrophils (%), eosinophils (%) and lymphocytes (%) revealed significant differences. The concentration of Ca, P, Zn, Fe and Cu was significantly higher in bactrian camels. However, the levels of Co and Mn were found to almost similar in both the groups. Mo could not be detected in these samples. Higher amount of Hb and Fe are associated with adaptive measures of the double humped camel to withstand the harsh climate of the high altitude.

Table 2.8.2.3. Least squares means (cm) of certain biometrical parameters of double humped camel (*Camelus bactrianus*)

Parameters	Male (n= 3)	Female (n=12)	Overall (n = 15)
1. Body length	174.00±3.80	150.08±1.90	162.04±2.12**
2. Height at wither	172.66±3.96	154.25±1.98	163.45±2.21**
3. Heart girth	201.66±7.22	196.66±3.61	199.16±4.03
4. Neck length	95.66±4.85	93.75±2.42	94.70±2.71
5. Face length	61.00±1.88	56.00±0.94	58.50±1.05*
6. Leg length	135.66±3.94	122.00±1.97	128.83±2.20**
7. Distance between eyes	31.33±1.30	24.75±0.65	28.04±0.73**
8. Distance between ears	26.33±1.36	23.83±0.68	25.08±0.76
9. Ear length	11.66±0.54	11.41±0.27	11.54±0.30
10. Muzzle diameter	50.00±1.92	43.91±0.96	46.95±1.07*
11. Hump circumference (Front)	96.33±4.12	81.33±2.06	88.83±2.30**
12. Hump circumference (Rear)	103.00±8.61	102.41±4.30	102.70±4.81
13. Distance between humps	17.00±2.82	19.08±1.41	18.04±1.57

*-Significant $p < 0.05$, **Significant $p < 0.01$

Table 2.8.2.4. Haematological and minerals profile of dromedary and bactrian camels

Parameters	Single humped	Double humped
Hb(g/dl)	10.75±1.08	12.50±1.17
ESR (mm/hr)	1.73±0.09 ^A	2.47±0.15 ^B
Neutrophils (%)	53.44±0.72 ^a	56.50±0.57 ^b
Eosinophils (%)	4.12±0.20 ^A	6.17±0.28 ^B
Lymphocytes (%)	35.22±0.62 ^a	33.00±0.74 ^b
Monocytes (%)	3.78±0.49	4.17±0.28
Calcium(Ca) mg/dl	9.73±1.12 ^a	15.09±2.26 ^b
Phosphorus(P) mg/dl	5.55±0.53 ^A	8.54±0.86 ^B
Magnesium (Mg) mg/dl	2.85±0.31	3.08±0.65
Zinc (Zn)µg/dl	113.60±10.52 ^A	197.75±16.75 ^B
Iron (Fe))µg/dl	118.50±4.53 ^A	145.00±5.12 ^B
Copper (Cu))µg/dl	123.00±5.3 ^A	187.00±7.80 ^B
Cobalt (Co))µg/dl	1.18±0.47	1.06±0.31
Manganese (Mn))µg/dl	18.43±2.33	17.86±3.26
Molybdenum (Mo))µg/dl	Very low	Very low

A,B-P<0.01 a,b-P<0.05

Chemical composition of locally available fodders

Chemical composition of commonly used camel feeds /fodders were collected from Partapur area and was analysed at NRC on Camel, Bikaner (Table 2.8.2.5). The highest crude protein content was found in the leaves of Chhowk tree followed by Alfaalfa, Changama and Beecho however, crude fiber was higher in Alfaalfa grass followed by longtol.

Table 2.8.2.5. Chemical composition of camel feeds of Ladakh region

Plants	CP	CF	EE	TA	NFE	NDF	ADF
A. Trees							
1. Changma (leaves)	14.00	6.67	2.61	11.47	65.25	28.30	16.96
2. Chhowkchang (leaves)	12.43	9.33	4.55	8.18	65.51	32.25	22.74
3. Chhowk (leaves)	18.55	8.63	5.82	7.39	59.61	30.92	16.53
4. <i>Mericaria gallica</i> (Jantik , leaves)	10.50	10.76	5.50	11.76	61.48	-	-
B. Creeper							
1 Beecho (Whole)	13.13	22.40	5.73	15.25	43.49	38.88	29.18
C. Crop							
<i>Medicago sativa</i> (Alfaalfa ,whole)	15.23	33.00	1.93	9.10	40.74	51.85	40.62
D. Grass							
1. Longtol (Whole)	6.65	32.14	3.80	9.41	48.00	63.35	42.35
2. Burche (Whole)	11.20	31.85	3.63	8.42	44.90	64.81	44.38

2.8.3. NATP Projects

Following four projects were sanctioned under NATP during the year

1. Improving shelf life of milk and milk products of camel and goats. NRCC, Bikaner is the lead centre for this project.
2. Environmental stress and its amelioration through shelter management. NDRI, Karnal is the lead centre and NRCC, Bikaner is cooperating centre.
3. Evaluation of locally available feed and fodder to improve quantity and formulate complete rations with high roughage diet. CSWRI, Avikanagar(Rajasthan) is the lead centre and NRCC, Bikaner is cooperating centre.

4. Characterization and conservation of Jaisalmeri camel. NBAGR, Karnal (Haryana) is the lead centre and NRCC, Bikaner is the cooperating centre.

Characterization and conservation of Jaisalmeri camel

CCPI : B.P. Mishra
 Co-CCPIs : Rajender Kumar
 N. Sharma

As per the objective stratified sampling survey for breed characterization, preliminary survey was conducted in the breeding tract of Jaisalmeri camel covering 2 districts viz. Jaisalmer and Barmer. Four strata were defined in each district covering the geographical region and breeding tract and also based on discussion with animal husbandry officials and local input. Various stratas are as follows:

JAISALMER District:

Strata	Location	Area
Strata-1	West	Habur-Asutar-Ghotaru- Bachiya -Shahgarh
Strata-2	North West	Kishangarh-Tanot-Ranau-Ramgarh- -Sultana
Strata-3	North East	Mohangarh-Ghatiyali-Nachna-Bharewala-Sutarwala
Strata-4	South East	Phalsoond-Pokhran-Hamira-Jaisalmer-Sam-Devikot

BARMER District:

Strata	Location	Area
Strata-1	North	Shiv-Balesar-Nimbla-Bhiyad
Strata-2	North East	Khokhsar-Banod-Baitu-Pachpadra-Magana
Strata-3	East	Siwana-Asotra-Asada-Bhuka-Chada ki Dhani
Strata-4	South West	Ratasar-Chadi-Chahtan-Dhanau-Dhorimana

Village wise camel population data was collected for Jaisalmer and Barmer districts from Animal Husbandry Department based on 1992 and 1997 Livestock census.

2.9. INTER INSTITUTIONAL COLLABORATIONS

Ph.D. Scholar	:	Nalini Kataria
Major Advisor	:	V.K. Agarwal, Head, Dept. of Veterinary Biochemistry, CCSHAU, Hisar
Co-advisor	:	Raghvendar Singh

2.9.1. Hormonal and renal regulation of fluid retention in dromedary camel

The study was conducted on 8 healthy adult female camels (*Camelus dromedarius*) to determine the hormonal and renal regulation of fluid retention during water restriction and rehydration in winter and summer. Same camels were used in each season and each camel served its own control. The control phase in each season comprised of 10 days when camels watered *ad libitum*. Dehydration phase was of 24 days in winter and 13 days in summer. The rehydration phase was of 5 days in each season.

In the hormone profile aldosterone, cortisol, thyroxine and triiodothyronine levels were determined. During dehydration the levels of aldosterone and cortisol increased while T_4 and T_3 decreased. After 48 hrs of rehydration, all the four hormones touched the control levels.

For collection of urine samples all the camels were catheterized. The catheter was connected to a graduated urine bag which was anchored to the tail. To carry out the study on renal physiology glomerular filtration rate, effective renal plasma flow, kidney solute loads, phenolsulphonphthalein test, intravenous glucose tolerance test, glucose loading, thiosulphate clearance test, creatinine clearance test, urea clearance test and transfer function of the kidney were determined. Inulin clearance was employed to determine GFR while para amino hippuric acid clearance was used to determine ERPF. During winter dehydration the GFR was declined by 74.74% and in summer by 84.84%. The normal values were attained on hour 96 of rehydration in each season. ERPF also followed the same pattern. PSP disappearance curves were obtained to determine the PSP fractional clearance. It reflected the proximal tubule epithelial cell activity. It was much higher during summer and dehydration phase. The glucose disappearance rate decreased during dehydration in IVGTT which reflected the fluid retention ability of camels. Glucose loading during dehydration resulted in an increase in plasma glucose and the amount of glucose excreted in urine reduced. Thiosulphate clearance reflected the GFR. The creatinine clearance was declined by 72.99% and 86.50% during winter and summer dehydration, respectively.

The renal clearance of urea was actively regulated. Transfer function of the kidney showed the water retention ability of the kidneys.

The study of haemato-biochemical status revealed that all the constituents were not similarly or equally affected by dehydration or rehydration.

With the progression of dehydration the urine volume decreased by 92.55% in winter and 97.41% in summer. Rehydration gradually resulted in restoration of normal urine volume. The dehydration resulted in an increase in the mean values of plasma and urine osmolalities.

Water compartmentalisation comprised of the determination of total body water, plasma volume, blood volume, red cell volume, extracellular volume, intracellular fluid volume and interstitial fluid volume. The rate of decrease in TBW was higher during summer dehydration.

As the dehydration progressed mean values of body weights declined by 31.56% in winter dehydration and 34.49% in summer dehydration. The mean water intake rose to 24.56% and 23.74% of body weight upon rehydration, immediately after dehydration during winter and summer, respectively.

2.9.2. Antimicrobial components from goat and camel milk for extension of shelf life of selected dairy products

Research Workers : Rajesh Bajaj*
Raghvendar Singh

Camel colostrum/ milk samples were collected from healthy lactating camels at NRCC, Bikaner for the study. The lactoperoxidase activity in crossbred goat milk samples was observed to range from 0.53 - 2.0 Units/ml, with an average 1.06 Units/ml using 2,2' azinobis (3-ethylbenzthiazoline) -6-sulphonic acid as chromogenic substrate at pH 6.0. The average lactoperoxidase concentration was determined to be 3.97 mg/L. During preparation of rennet whey and acid whey from skim milk, a 5-9% loss of activity was observed.

The lactoperoxidase was isolated from goat skim milk using Amberlite CG-50-NH₄⁺ at pH 6.8 and purified over CM-Sephadex C-50 using NaCl gradient (100-200 mM) and finally purified on Sephadex G-100. The enzyme was purified to 1254 fold with a specific

* Scientist, Dairy Chemistry, NDRI, Karnal

activity of 34 Units/mg and Rz value greater than 0.9. A single band was observed on SDS-PAGE of purified fraction and it gave a characteristic absorption spectrum with a peak at 412 nm and 280 nm.

Preliminary investigation of antimicrobial activity of purified lactoperoxidase showed inhibition of *Escherichia coli* and *Staphylococcus aureus* at a concentration of 500 µg/ml.

2.9.3. : To study the physical, physiological and biochemical attributes to assess work performance in Indian and French donkeys.

Research Workers : M.K. Singh*
Raghvendar Singh

A total of 12, healthy, adult, male donkeys of 4-6 years of age (6 each from local and French origin) were randomly selected to assess work performance as a pack animal. The biometrical parameters and body weights were recorded before training of animals are shown in Table 2.9.3.1.

Table 2.9.3.1. Biometrical Parameters :

Parameters	Indian	French
Wither Height (cm.)	101	124
Body Length(cm.)	106	128
Heart Girth(cm.)	109	141
Face Length(cm.)	42	52
Height at Knee(cm.)	32	38
Height at Hock(cm.)	37	49
Body Weight (Kg.)	101	214

A total of 8 donkeys 4 each from local and French groups were given basic training and endurance of walking daily without load on a selected natural desert track on a normal pace (3-4 km/hr.) for 3 hours for the period of 6 months. After works all the animals were loaded of their 30 per cent body weight and were given endurance for 8 weeks on above said conditions. The final trial was conducted on the last day of 8th week of work. Data on physical, physiological and biochemical were recorded before and after work. The experiment was further extended and above said parameters were recorded on 50% of the body weight of the animals.

* Scientist, NRC on Equines, EPC, Bikaner

During the work trial, leg incoordination, sweating, reluctant to move (work) and occasional eye tearing were observed in both categories. Significant increase was observed in pulse, respiration/minute and rectal temperature after work. Further, the percent change were higher in French donkeys. Blood samples were collected before and after trial and processed for different biochemical analysis. Data on different biochemical observations i.e. ACP, LDH, CK, SGOT, SGPT, Glucose, Creatinine, Cholesterol, Tryglycerides, Blood Urea, Nitrogen, Uric acid, total protein, albumin, Inorganic phosphorus, chloride and calcium recorded. Marked change in CK, LDH, Glucose, creatinine, Tryglycerides, uric acid and calcium were observed in both categories. Further study on different load is on progress for final findings.

2.9.4. Structure of camel milk Lactoferrin

Ph.D. Scholar : J.A.Khan
Major Advisor : T.P.Singh , Deptt. Biophysics, AIIMS, New Delhi,
Co-Advisor : Raghvendar Singh, NRCC, Bikaner

Camel lactoferrin is the first protein from the transferrin superfamily which displays the characteristic iron binding and release of functions of transferrin and lactoferrin simultaneously. It is amazing to observe a clean demarcation in the release of iron that it releases 50% iron at pH 6.8 and the remaining iron goes off only at pH 3.2. In order to establish the structural basis of this observation the purified camel apo-lactoferrin was crystallized from its 100 mg/ ml solution in 0.01 M Tris-HCl, pH 8.0 by equilibrating it against the same buffer containing 24% ethanol(v/v) in a microdialysis set up. The crystals belong to monoclinic space group C2 with unit cell dimensions $a=175.8\text{\AA}$, $c=56.4\text{\AA}$ and $z=8$. The structure has been determined by molecular replacement and refined to an R-factor of 0.198(R-free=0.268) using all the data in the resolution range of 20.0-2.6Å. The overall structure of camel apolactoferrin folds into four distinct domains. The arrangements of domains are different than those observed in other lactoferrins and transferrins. In the structures of mare apolactoferrin both lobes are identical in which domains N1, N2 and C1,C2 adopt closed conformations. The release of iron leaves the protein structure unchanged. In human lactoferrin, N lobe is found in the open conformation while C lobe remains in the closed conformations. The low resolution structures of duck apo-ovotransferrin and hen apo-ovotransferrin display open conformations in both the lobes. The camel apolactoferrin, on

the other hand, shows open conformations for both lobes. A detailed comparison of the N lobe shows that N lobe of camel apolactoferrin is in open conformation which is very similar to the one observed in human apolactoferrin is quite different than the one in other lactoferrin. Similarly, the C lobe of camel lactoferrin adopts an open conformation similar to those observed in duck apo-ovotransferrin and hen apo-ovotransferrin. The dispositions of the various protein ligands in the iron binding clefts in the N lobe of camel lactoferrin is similar to those observed in human apolactoferrin while the corresponding residues in the C lobe do not match with those in human lactoferrin but shows a striking similarity to those in the C lobes duck and hen apo-ovotransferrins. It suggests that the C lobe loses iron at a pH higher than transferrins while N lobe retains iron to pH as low as 2.5.

2.9.5. Evaluation of Propofol as an anaesthetic in Dromedary (*Camelus dromedarius*)

- Ph.D. Scholar : C.K. Sharma
Major Advisor : D.S. Chauhan, Department of Surgery & Radiology, College of Veterinary and Animal Science, RAU, Bikaner.
Co-Advisor : Raghvendar Singh

The study was conducted in three groups of camels of 6 camels each. A double blind trial for finalising minimum anaesthetic dose of propofol was conducted in the camels of one group (Group A) at NRCC, Bikaner. The camels were kept off feed and water for 24 hours prior to conduction of the trial. The minimum anaesthetic dose of propofol was found to be 1 mg per Kg body weight intravenously, ultrashort acting anaesthesia of 8 minutes duration was produced at this dose rate suitable for minor surgical and diagnostic studies in camels. The dose thus finalised was used in the camels of Group B at NRCC, Bikaner to determine effects of propofol anaesthesia on some physiological, haematological and biochemical parameters. There were no significant changes in the mean values of all the studied parameters during anaesthesia and after recovery from anaesthesia till 72 hrs. The significant increase in blood glucose and decrease in blood urea nitrogen was recorded as the animals were allowed to take feed and water after 30 minutes of the test period. A study of the effect of propofol anaesthesia on haemodynamic parameters in the camels of group C was conducted in the

extramural laboratory at College of Veterinary Science, Hisar. Details of the study will be presented in Ph.D. thesis of C.K.Sharma, RAU, Bikaner.

2.9.6. Comparative utilization of groundnut (*Arachis hypogea*) chara and guar (*Cymopsis tetragonoloba*) phalgati alone or in combination by camel (*Camelus dromedarius*)

Scholar : Niranjan Lal Chirania
Major Advisor : O.P. Mathur*
Co - Advisor : A.K. Nagpal

An experiment was planned and executed to study the comparative utilization of groundnut chara and guar phalgati alone and in combination by camel, in a completely randomized design taking 9 male adult camels. The 3 dietary treatments fed were T₁ (Groundnut chara alone), T₂ (Guar phalgati alone) and T₃ (Groundnut chara and guar phalgati in 50 : 50 combination).

The nutritional evaluation were made by determination of dry matter intake per kg W^{0.75} / palatability score, digestibilities of dry matter and gross nutrients, balances of nitrogen and minerals, practical nutritional worth, body weight gain and feed efficiency. In addition to this haematobiochemical parameters were also studied to see the effect of feeding experimental feeds on physiological status of animals.

Significant effect of treatments were observed on dry matter intake (per kg W^{0.75}) palatability score and feed efficiency. Whereas, effect on digestibilities of dry matter and gross nutrients, balances of nitrogen as well as minerals and body weight gain were statistically non-significant. Likewise, haematobiochemical parameters were also not found to be effected significantly due to dietary treatments. However, the economics of feeding calculated revealed lowest per day cost of feeding in T₃ group followed by T₁ and T₂.

The soil fertility status (Table 2.8.1.2) of the land under silvipasture at the beginning of the experiment showed pH 8.34±0.002, EC 0.423±0.055 mmhos/cm, Carbon % 0.134±0.039 and P₂O₅ 445.0±33.375 kg/ha. The soil fertility status (Table 2.8.1.2) of the land

* Department of Animal Nutrition, College of Veterinary and Animal Science, RAU, Bikaner

under silvipasture at the beginning of the experiment showed pH 8.34 ± 0.002 , EC 0.423 ± 0.055 mmhos/cm, Carbon % 0.134 ± 0.039 and P_2O_5 445.0 ± 33.375 kg/ha.

2.10. Camel Health Management

Clinical Cases

During the period 108 clinical cases were treated. Among the different cases, 21 were of digestive disorders, 50 surgical affections and other including skin affections were 37. Age, sex and breed wise morbidity are presented in Table 2.10.1.

Prophylactic measures :

1. Control of Trypanosomiasis

For prevention and control of trypanosomiasis quinapyramin methyl sulphate and chloride were injected twice in a year in the months of August - September and in February-March. No case of trypanosomiasis was detected.

2. Control of external parasites

The camels were sprayed with insecticides regularly during the year for prevention and control of mange and other ectoparasites.

3. Control of internal parasites

The camels were given broad spectrum anthelmintics twice in a year during the month of September-October and March-April.

Mortality

The specific death rate (SDR%) was 8.11 during the year 1999-2000. The breed wise mortality per cent in Bikaneri, Kachchhi, Jaisalmeri and cross bred (Arab x Bikaneri) was 11.47, 5.31, 3.78 and 16.68 respectively. Age, sex and breed wise mortality per thousand camel days per day are presented in Tables 2.10.2 and 2.10.3.

Table 2.10.1. Age, Sex and breed wise morbidity

System	Sex		Age group			Breed				Total
	M	F	0-3 m	3-36 m	> 3 yrs	B	J	K	AxB	
Digestive system										
Simple indigestion	4	8	1	2	9	6	4	2	-	12
Impaction	-	1	-	-	1	-	-	-	1	1
Diarrhoea	2	2	-	-	4	1	2	1	-	4
Enteritis	2	-	1	-	1	1	1	-	-	2
Respiratory system										
Pneumonia	1	-	1	-	-	-	1	-	-	1
Cardiovascular system										
Anaemia/ Anasarea	-	1	-	1	-	-	-	1	-	1
Urogenital system										
Retention after birth	-	1	-	-	1	1	-	-	-	1
Surgical affections										
Amputation of tail	-	1	-	-	1	1	-	-	-	1
Soft plate injury	1	-	-	-	1	1	-	-	-	1
Wounds	30	17	2	1	44	23	16	5	3	47
Swelling in chest	1	-	-	1	-	1	-	-	-	1
Others										
Pyrexia	3	6	1	4	4	4	4	-	1	9
Rabies	2	-	2	-	-	1	1	-	-	2
Conjunctivitis	2	2	-	-	4	-	4	-	-	4
Lameness	4	5	1	1	7	4	4	-	1	9
Ecthyma	1	2	-	3	-	-	2	-	1	3
Mastitis	-	2	-	-	2	1	-	-	1	2
Weakness	2	1	-	1	2	2	1	-	-	3
Difficult milking	-	4	-	-	4	2	2	-	-	4
Total	55	53	9	14	85	49	42	9	8	108

M - Male; F - Female; B - Bikaneri; J - Jaisalmeri; K - Kachchhi ; AxB-Arab x Bikaneri;
m - Months

2.10.2. Age and sex wise mortality

Age	Sex	Camel days	No. of animal died	Mortality per 1000 camel days/day
0-3months	M	942	01	1.0616
	F	784	02	2.5510
	Pooled	1726	03	1.7084
3 months-3yrs.	M	11416	06	0.5256
	F	8261	05	0.6052
	Pooled	19677	11	0.5590
Above 3yrs.	M	23657	06	0.2536
	F	47483	03	0.0632
	Pooled	71140	09	0.1265
Overall	M	36015	13	0.3609
	F	56528	10	0.1769
	Pooled	92543	23	0.2485

2.10.3. Breed wise mortality

Breeds	Camel days	No. of animal died	Mortality per 1000 camel days/day	SDR%
Bikaneri	40356	14	0.3469	11.47
Kachchhi	12557	02	0.1593	5.31
Jaisalmeri	33067	04	0.1209	3.78
ArabxBikaneri	6563	03	0.4571	16.68
Pooled	92543	23	0.2485	8.11

2.10.4 Camel herd strength

Breed/ Age	Opening		Calving		Total		Death		Disposal		Closing	
	M	F	M	F	M	F	M	F	M	F	M	F
BIKANERI												
Up to 3 months	-	-	12	10	12	10	1	2	-	-	11	8
3-12 months	4	6	-	-	4	6	-	1	-	-	4	5
1-3 Years	11	9	-	-	11	9	3	1	-	-	8	8
Above 3 years	27	57	-	-	27	57	4	2	4	2	19	53
Total	42	72	12	10	54	82	8	6	4	2	42	74
JAISALMERI												
Up to 3 months	-	-	11	9	11	9	-	-	-	-	11	9
3-12 months	8	1	-	-	8	1	1	-	-	-	7	1
1-3 Years	10	7	-	-	10	7	1	1	-	-	9	6
Above 3 years	20	44	-	-	20	44	2*	-	1	1	17	43
Total	38	52	11	9	49	61	4	1	1	1	44	59
KACHCHHI												
Up to 3 months	-	-	3	2	3	2	-	-	-	-	3	2
3-12 months	2	1	-	-	2	1	-	-	-	-	2	1
1-3 Years	4	2	-	-	4	2	1	-	-	-	3	2
Above 3 years	13	14	-	-	13	14	2*	-	3	-	8	14
Total	19	17	3	2	22	19	3	-	3	-	16	19
ARAB X BIKANERI												
Up to 3 months	-	-	1	-	1	-	-	-	-	-	1	-
3-12 months	1	1	-	-	1	1	-	-	-	-	1	1
1-3 Years	-	5	-	-	-	5	-	2	-	-	-	3
Above 3 years	2	9	-	-	2	9	-	1	-	-	2	8
Total	3	15	1	-	4	15	-	3	-	-	4	12
MARWARI												
	1	-	-	-	1	-	-	-	-	-	1	-
SANCHORI												
	1	-	-	-	1	-	-	-	-	-	1	-
OVERALL	104	156	27	21	131	177	15	10	8	3	108	164

* 1 Male camel of Jaisalmeri and one Kachchhi male were euthanised.

2.11. RANGE LAND MANAGEMENT

The land resources of the Centre is spread over in an area of 824 ha. The area is predominantly sandy, light textured, calcareous and having sand dunes of varying sizes.

The operational activities are mainly confined in about 150 ha in paddocks of farm area. Previously established pasture and silvi-pastoral area was renovated and kucha road along with farm fences were graded.

During kharif season about 24 ha area was sown with guar (*Cyamopsis tetragonoloba*) as a rainfed crop and bajra in 5 ha. Due to failure of rain the area was being offered for camel grazing.

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

NRCC jointly with Forest Department and District Administration planted about 200 tree-seedlings during Van Mahotsav. Additionally, 3350 plant seedlings were also planted under Environmental plantation by forest department. There was about 70 percent survivability rate of new plantation during the year.

3. TECHNOLOGY ASSESSED AND TRANSFERRED

- 3.1. Package of practices to improve reproductive efficiency.
- 3.2. Package of practices to reduce early calf mortality.
- 3.3. Package of practices for improving camel health.

4. EDUCATION AND TRAINING

- 4.1. Dr. Champak Bhakat, Scientist, attended a training programme on "Faculty Development Programme in Educational Technology" at NAARM, Hyderabad from 5 May-2 June, 1999.
- 4.2. Dr. Rajender Kumar, Scientist, attended a training programme on "Insects and Acarines of Veterinary and Medical importance" at Centre of Advance Studies, Dept. of Parasitology, Univ. of Agricultural Sciences, Bangalore, from January 17-31, 2000.

- 4.3. Dr. Rajender Kumar, Scientist, attended a training on "Modern Technologies for Information handling" at All India Institute of Medical Sciences, New Delhi, from February 7-11, 2000.
- 4.4. Sh. Ram Dayal, Technical officer (Library) attended a short term training course on "Library Automation" at Indian National Scientific Documentation Centre, New Delhi, from February 14-18, 2000.

5. LINKAGES AND COLLABORATIONS

5.1. National

- ◆ AIIMS, New Delhi : Milk protein especially lactoferrin
- ◆ RAU, Bikaner : Research work of MVSc and Ph.D students
- ◆ CCSHAU, Hisar : Research work of Ph.D. Students
- ◆ NDRI, Karnal : Camel milk analysis
- ◆ CSWRI, Avikanagar : Camel hair
- ◆ CIAE, Bhopal : Camel drawn implements
- ◆ S.P. Medical College, Bikaner : Camel milk as nutritional adjuvant in treatment of tuberculosis
- ◆ DRDO, Ministry of Defence : Evaluation and conservation of double humped camel

5.2. International

- ◆ CIRAD-EMVT, France : Research and training

6. LIST OF PUBLICATIONS

ARTICLES PUBLISHED

- 6.1. Sena, Suchitra, D., Mal, G., Kumar, R., Singhvi, N.M., Chirania, B.L. and Sahani, M.S. 1999. Clinico-haematological and therapeutic studies on mange in camel. *Indian Veterinary Journal*, **76**:998-1000.

- 6.2. Hari Ram Angasaria, P.K. Pareek, Aminu Deen, Mahesh Datt and G.N. Purohit. 1999. Sperm quality changes during lapses in handling of bovine semen. *Ind. J. Dairy Sci.* **11** (4): 265.
- 6.3. Banmali Yadav, B.P. Mishra, C. Bhakat and M.S. Sahani 2000. Hair quality attributes of *Camelus dromedarius*. *Ind. J. Anim. Sci.* **70**(2):211-12.
- 6.4. Mal, G., Rajender Kumar, Suchitra Sena, D., Jain, V.K. and Sahani, M.S. 1999 . Untni ke doodh ki bishestayen ba TB rog main upyogita. Handout in Hindi, NRCC, Bikaner
- 6.5. Mal, G. and Sahani, M.S. (1999). Untni ka doodh Vit. C se Bharpur. *Unnta Krishi*, **3** : 31.
- 6.6. Raghvendar, S., Mishra, B.P. and Sahani, M.S. 2000. Biochemical attributes of double humped camel of Ladakh. *Indian J. Anim. Sci.* **70**(1) 54-55.
- 6.7. Asit Das and G.P. Singh. 1999. Eating behaviour, VFA production, passage rate and nutrient digestibilities in cattle fed on wheat straw supplemented with different levels of Berseem. *Asian Australasian J. Anim. Sci.*, **12**:1040-1048.
- 6.8. G.P. Singh and Madhu Mohini. 1999. Effect of different level of rumensin in diet on rumen fermentation nutrient digestibility and methane production in cattle. *Asian Australasian J. Anim. Sci.*, **12**:1215-12221.
- 6.9. Asit Das and G.P. Singh. 1999. Effect of different levels of *berseem (Trifalium alexdium)* supplementation on wheat straw on some physical factors regulating intake and digestion. *Anim. Feed Sci. Tech.*, **81**:133-149.
- 6.10. Asit Das and G.P. Singh. 1999. Effect of berseem supplementation to straw diet on nitrogen metabolism and nutrient utilisation in cattle. *Indian J. Anim. Sci.* **69**:243-247.
- 6.11. Asit Das and G.P. Singh. 1999. Degradation kinetics of wheat straw mixtured with different proportion of berseem. *Indian J. Anim. Nutr.* **16**:107-111.
- 6.12. Madhu Mohini, G.P. Singh and Neelam Kewalramani. 1999. Effect of bentonite on growth in cross bred calves fed diet containing urea. *Indian J. Anim. Sci.* **69**:823-826.

- 6.13. A.K. Nagpal, B.D. Kiradoo, Raja Purohit, A.K. Roy and M.S. Sahani. 1999. Camel production system under 3 tier silvi pasture in arid eco system. *Indian J. Anim. Prod. Mgmt.* **15**:59-63.
- 6.14. A.K. Nagpal, Raja Purohit, B.D. Kiradoo and M.S. Sahani. 1999. Studies on stall feeding vis a vis 3 tier silvi pasture grazing in arid eco system. *Journal of Camel Practice and Research.* **6**:93-96.
- 6.15. A.K. Nagpal and M.S. Sahani. 1999. Effect of dietary phosphorus supplementation on growth and nutrient utilization in camel calves. *Indian J. Anim. Nutr.* **16**:326-331.

ARTICLES ACCEPTED FOR PUBLICATION

- 6.16. Kasturi, M., Raghvendar, S., Tandon, S.N., Raisinghani, G. and Khanna, N.D. Studies on haemolytic complement activity of camel through alternate pathway. *International J. Anim. Sci.* (Accepted).
- 6.17. Raghvendar, S., Arora, S., Tandon, S.N. and Sahani, M.S. Milk enzymes in different breed of Indian camel. *International J. of Animal Science* (Accepted).
- 6.18. Bhakat, C. and Sahani, M.S. Camel carting : A subsidiary source of income of camel keepers in the hot arid Bikaner district of Rajasthan. *Ind. J. Anim. Prod. Mgmt.* (Accepted).
- 6.19. Bhakat, C. and Raina, V.S. The effect of antibiotic treatment in bacterial load and cryopreservation of bovine semen. *Ind. J. Anim. Prod. Mgmt.* (Accepted).
- 6.20. Bhakat, C. and Sahani, M.S. The comprehensive study of camel production system in North West coastal zone of Egypt. *Livestock International.* (Accepted).
- 6.21. Mal, G, Sena, Suchitra D., Kumar, R. and Sahani, M.S. A study on clinical, histological, haemato-biochemical aspects of mange in camels. *J. Vet. Parasitol* (Accepted).
- 6.22. Mal, G., Sena, Suchitra, D., Kumar, R. and Sahani, M.S. (1999). Serum biochemical observations on mange in camels. *Indian Vet. J.* (Accepted).
- 6.23. Suchitra, D., Mal, G., Kumar, R. and Sahani, M.S. 1999. Studies on epizootiological, haemato bicochemical and various therapeutic aspects of gastrointestinal nematodes among camels. *J. Vet. Parasitol.* (Accepted).

- 6.24. Mal, G., Sena, Suchitra, D., Jain, V.K. Singhvi, N.M. and Sahani, M.S. Role of camel milk as an adjuvant nutritional supplement in tuberculosis patients. *Livestock International* (Accepted).
- 6.25. Mal, G. and Sahani, M.S. Chemical composition and Vit. C content of milk in Indian Camel managed under farm conditions. *Ind. Vet. J.* (Accepted).

7. LIST OF APPROVED ON GOING PROJECTS (IXth PLAN)

- 7.1. Genetic characterisation, evaluation and conservation of indigenous camel breeds.
- 7.2. Improvement of the working efficiency of camel under arid and semi arid conditions.
- 7.3. Improvement of reproductive efficiency and to study the causes of reproductive failures in camel.
- 7.4. Studies on feed requirement and feed resource evaluation in camel for optimum production.
- 7.5. Surveillance, monitoring and control of camel disease.
- 7.6. To study the economics of different camel management practices under arid and semi arid eco-system.

8. MANAGEMENT COMMITTEE, SRC, QRT, RAC MEETINGS WITH SIGNIFICANT DECISIONS

8.1. Management Committee Meeting :

A meeting of Management Committee was held under the chairmanship of Dr. M.S. Sahani, Director on 29th July, 1999 at National Research Centre on Camel, Bikaner at 11.00 AM. The following member attended the meeting :

1. Sh. Tara Singh Sidhu, Leader CPI, Jaipur
2. Dr. U.K. Thanvi, Jt. Director, Dept. of Animal Husbandry, Govt of Rajasthan, Jaipur
3. Dr. N.T. Mehta, Director, Dept. of AH, Govt of Gujarat, Ahmedabad.
4. Dr. M.A. Malik, Dy. Director, Dept. of Animal Husbandry, Govt. of Gujarat, Ahmedabad

5. Dr. G.R. Purohit, Dean, CVAS, Bikaner
6. Sh. O.P. Nagar, Sr. Finance & Accounts Officer, CIRG, Makhdoom (UP)
7. Dr. A.K. Nagpal, Sr. Scientist, NRCC, Bikaner
8. Dr. Sumant Vyas, Scientist, NRCC, Bikaner
9. Sh. Ashok Mallick, AAO, NRCC, Bikaner (Member Secretary)

Following decisions were taken. The committee approved the proposals of :

1. Condemnation of mini bus after obtaining condemnation certificate from RTO.
2. Purchase of 28 equipments.
3. Purchase of electric pulley for lowering/inlowering of motor and pump in tube well.
4. Works at the Centre.
5. Provision for enhancement of the budget.
6. Purchase of camels for breeding and replacement.
7. Setting up a recreation club and children park.

New Management committee

Director General, ICAR has nominated following as new management committee to be effective from 11-1.2000 for a period of 3 years.

- | | | | |
|----|---|---|------------------|
| 1. | Dr. M.S. Sahani, Director
National Research Centre on Camel, Bikaner | : | Chairman |
| 2. | Dr. G.P. Singh, Principal Scientist
National Research Centre on Camel, Bikaner | : | Member |
| 3. | Dr. Rajender Kumar, Scientist
National Research Centre on Camel, Bikaner | : | Member |
| 4. | Dr. Raghvendar Singh, Scientist
National Research Centre on Camel, Bikaner | : | Member |
| 5. | Dr. A.K. Nagpal, Senior Scientist
National Research Centre on Camel, Bikaner | : | Member |
| 6. | Dr. Arun Varma, ADG (AN&P) | : | Member |
| 7. | Assistant Administrative Officer
National Research Centre on Camel, Bikaner | : | Member Secretary |

8.2. SRC meeting

During the year 1999-2000, one annual Scientific Review Committee meeting and one half yearly Scientific Review Meeting were held under the chairmanship of Director of the institute . The annual scientific review committee meeting for the year 1998-99 was held on 13th May, 99. Experts from different disciplines viz., Dr. Arun Varma, ADG (AN&P), ICAR, Dr. D.S. Balian, Ex-DDG (AS), ICAR, Dr. B.C. Patnayak, Ex-Director, CSWRI, Avikanager, members of QRT also attended in addition to Dr. G.R. Purohit, Dean, CVAS, Bikaner, Dr. K.M.L. Pathak, CVAS, Bikaner and Dr. R.S. Gahlot, CVAS, Bikaner attended the meeting along with Scientific and Technical Staff.

The half yearly SRC meeting for 1999-2000 was held on January, 10, 2000 at 11.00 AM. The progress of various research projects were presented and future plan of work were discussed.

8.3. RAC meeting

The new research advisory committee is under constitution.

9. PARTICIPATION OF SCIENTISTS IN CONFERENCES, MEETING, WORKSHOP, SYMPOSIA ETC. IN INDIA AND ABROAD

1. Miss Poonam Jayant, Scientist, attended fourth meeting of Scientific advisory panel for Arid Agro-ecosystem held on 20-21 September, 1999, representing lead Institute for revising NATP project. CAZRI, Jodhpur.
2. Dr. Raghvendar Singh, Scientist participated in Hindi workshop from 25th to 30th November, 1999 at NAARM, Hyderabad.
3. Dr. G.P. Singh, Principal Scientist, attended a Indian Dairy Association (North Zone) seminar from 12-13th August, 1999 at NDRI, Karnal.
4. Dr. Champak Bhakat, Scientist, visited Egypt from August 29th to September 5th, 1999, as an Indian Expert in the field of Management of Camel. He visited 4 different research stations under the Ministry of Agriculture, Egypt.

5. Dr. G.P. Singh, Principal Scientist and Dr. D. Suchitra Sena, Scientist, attended International Conference on sustainable animal production, health and environment : Future challenges. November 24-27, 1999 at CCS HAU, Hisar, India.
6. Dr. G.P. Singh, Principal Scientist, Dr. A.K. Nagpal, Sr. Scientist & Dr. Nirmala Saini, Scientist attended IX Animal Nutrition Conference on Emerging Trends for Livestock and Poultry Feeding beyond 2000 AD. December 2-4, 1999. Acharya N.G. Ranga Agricultural University, Rajendra Nagar, Hyderabad.
7. Dr. G.P. Singh, Principal Scientist and Sh. Gorakh Mal, Scientist attended Rastriya Sangosthi, "Bhartiya Krishi mein Anusandhan Krantiya", March 6-7, 2000. CSSRI, Karnal.
8. Shri Kanwar Pal Sharma, Office Assistant attended technical workshop on reservation in service/post(SC/ST/OBC and Ex-servicemen) from 18th August to 20th August, 1999 organised by Centre for Research- Planning and action, New Delhi.
9. Shri Krishan Kumar, Junior Clerck attended Composite workshop on FR/SR and financial rules from 21st July 1999 to 23rd July 1999 organised by Institute of Socio Economic Research and Action, New Delhi.
10. Shri Ashok Mallick, Assistant Administrative Officer attended refresher course on Improving Administrative and Financial Management in ICAR for the benefit of A.O., Finance &A.O., A.A.O., A.F.&A.O. from 30.11.1999 to 06.12.1999 at NAARM, Hyderabad.

10. WORKSHOPS, SEMINAR, SUMMER INSTITUTE, FARMERS DAY ETC. ORGANISED AT THE INSTITUTE

Kishan Gosthies as mentioned under project 2.7 were organised by the Centre.

VAN MAHOTSAV CELEBRATED

On 31st July, 1999, Van Mahotsav was celebrated at NRCC jointly with Forest Department and District Administration and about 200 tree-seedlings were planted, on this occasion Principal Chief Conservator, Forest, Rajasthan State - Shri D.C. Sood, District Collector - Shri Niranjan Arya, DIG BSF - Shri V.P. Singh and Chief

Conservator of Forest IGNP, Bikaner - Shri Abhijit Ghosh were among the distinguished guests present. Additionally, 3350 plant seedlings were also planted at NRCC under Environmental plantation by forest department.

11. DISTINGUISHED VISITORS

The following distinguished personnel visited the Centre during 1999-2000



**Minister of State of Small Industries, Govt. of India,
Mrs. Vasundhara Raje Scindia, observing
Camel Museum**

- ◆ Mrs. Vasundhara Raje Scindia, Central Minister of State of Small Industries, Govt. of India.
- ◆ S.K. Dev Verma, Deputy Secretary, Ministry of Social Justice and Empowerment, Govt. of India.
- ◆ Justice C.S. Rajan, Judge High Court of Kerala, Kochin
- ◆ D N Bhargava, CE (N2) III, CPWD, Jaipur
- ◆ Justice S. Rajendra Babu, Supreme court of India, New Delhi
- ◆ L.R. Thapar, CCM/FM/Northern Railway, New Delhi
- ◆ Shashi Kant Sharma, District and Session Judge, Bikaner
- ◆ S.N. Thanvi, Divisional Commissioner, Bikaner
- ◆ V.P. Chandan, Addl. General Manager, Northern Railway, Baroda House, New Delhi
- ◆ Sarla Maheshwari, 18 Windsor Place, New Delhi.

राष्ट्रीय उष्ट्र अनुसंधान केन्द्र

कार्यकारी सारांश

भारतीय कृषि अनुसंधान परिषद द्वारा बीकानेर से 10 किलोमीटर दूर जोड़बीड़ में 5 जुलाई, 1984 को केन्द्र की स्थापना की गयी। इससे पूर्व यह केन्द्र पशुपालन विभाग (राजस्थान-सरकार) एवम् पशुचिकित्सा एवम् पशु विज्ञान महाविद्यालय (राजस्थान कृषि विश्वविद्यालय) के आधीन था। समय के साथ केन्द्र ने अति आधुनिक प्रयोगशालाएँ एवम् आधारभूत सुविधाएँ विकसित की हैं। वर्तमान में केन्द्र में बीकानेरी, जैसलमेरी और कच्छी नस्ल के कुल 270 ऊँट हैं।

उपलब्धियाँ :

- ❖ बीकानेरी, जैसलमेरी एवम् कच्छी नस्ल के ऊँट समूहों का विकास।
- ❖ शारीरिक माप, वृद्धि, दूध, बाल-उत्पादन जैसे महत्वपूर्ण अनुवांशिक गुणों का विकास।
- ❖ उचित प्रबन्धन द्वारा मृत्युदर को 20-30 प्रतिशत से 5 प्रतिशत कम करना।
- ❖ प्रथम ब्याँत तथा दो ब्याँत के अन्तराल को कम कर, औसत गर्भधारण संख्या बढ़ाकर प्रजनन क्षमता में सुधार।
- ❖ भारतीय ड्रोमेडेरी ऊँटों में जैवरसायनिक और रूधिर अध्ययन में अनुवांशिक विभिन्नता नगण्य/परन्तु आर. ए. डी. पी. तकनीक द्वारा विभिन्नता विद्यमान।
- ❖ बोझा ढोने, खेत जोतने की क्षमता, थकावट चिन्ह पर महत्वपूर्ण आधारभूत आंकड़े एकत्रित किये गये।
- ❖ प्रचलित औषधि के साथ ऊँट का दूध देने पर टी. बी. मरीज के स्वास्थ्य में तेजी से सुधार।
- ❖ भ्रूण प्रत्यारोपण तकनीक द्वारा दो बच्चों का जन्म।

अधिदेश (मिनडेट) :

- (1) ऊँट सुधार एवम् विकास पर आधारभूत/प्रायोगिक अनुसंधान करना।
- (2) ऊँट अनुसंधान एवम् विकास के लिए सूचना-संग्रह केन्द्र की तरह कार्य करना।

- (3) स्थानीय विशेष तकनीक के लिए राज्य कृषि विश्वविद्यालय के साथ सहयोग एवम् नेतृत्व प्रदान करना।
- (4) ऊँट में विकसित अनुसंधान विधियों के लिए प्रशिक्षण देना।
- (5) ऊँट अनुसंधान एवम् विकास के लिए राष्ट्रीय एवम् अन्तर्राष्ट्रीय स्तर पर परामर्श उपलब्ध कराना।

संगठनात्मक स्वरूप :

केन्द्र में उष्ट्र फार्म इकाई, अनुसंधान प्रयोगशालाएं, चर भूमि, आवासीय खण्ड और अतिथि-गृह सहित 824 हेक्टेयर भूमि हैं। केन्द्र में वर्ष 1999-2000 में स्वीकृत पदों की संख्या 76 थी। केन्द्र में निदेशक तथा 13 वैज्ञानिक, 22 तकनीकी अधिकारी/कर्मचारी, 10 प्रशासनिक और 22 सहायक कर्मचारी कार्यरत हैं।

बजट :

योजना-मद में कुल बजट 150.20 लाख और गैर-योजना मद में 114.50 लाख रुपये था। इसमें से क्रमशः 144.79 एवम् 88.36 लाख रुपये खर्च किये गये।

केन्द्र में ऊँट के विभिन्न पहलुओं पर अनुसंधान, केन्द्र की स्वयं अनुसंधान परियोजनाएं, कृषि उत्पादन राजस्व की तदर्थ अनुसंधान योजना एवम् सहयोगिक अनुसंधान कार्यक्रम के अन्तर्गत जारी हैं।

परियोजना 2.1 : शुष्क एवम् अर्धशुष्क परिस्थितियों में ऊँट की कार्यक्षमता में सुधार

उप परियोजना 1 : मादा ऊँटनी में भौतिक शारीरिक क्रियाओं तथा जैव रसायनिक विधियों द्वारा दौड़ क्षमता का मूल्यांकन :

तीन किलोमीटर कच्चे रास्ते पर बीकानेरी और जैसलमेरी नस्ल के (4-5 वर्ष) ऊँटों में दौड़ क्षमता का तुलनात्मक अध्ययन करने पर, जैसलमेरी नस्ल में औसत दौड़ गति अधिक पायी गयी। दौड़ के पश्चात् रूधिर शर्करा एवम् लेक्टेट सान्द्रता में सार्थक वृद्धि जबकि क्रिएटिनिन, जी-6-पीडी, आई सी डी और लाईपेज में वृद्धि सार्थक नहीं पायी गयी।

उप परियोजना 2 : दौड़ने वाला ऊँटों में पोषकता का मूल्यांकन - मादा दौड़ ऊँटों के अनुरक्षण रखरखाव में ग्वार फलगटी को पर्याप्त पाया गया।

परियोजना 2.2 : भारतीय नस्ल के ऊँटों में अनुवांशिक गुणों का निर्धारण, मूल्यांकन एवम् संरक्षण

उप परियोजना 1

शारीरिक भार एवम् वृद्धि :

नस्ल व लिंग में जन्म एवम् व्यस्क भार का न्यूनवर्ग औसत भागफल पूर्ववत् परिणामों के अनुरूप पाया गया। बीकानेरी नस्ल के ऊँटों का भार जैसलमेरी और कच्छी की तुलना में अधिक पाया गया।

प्रजनन परिमापी :

प्रजनन की गयी मादा ऊँटनियों में ग्याभिन होने की प्रतिशत दर 75.8 थी जो पूर्व की तुलना में 15 प्रतिशत अधिक हैं। ग्याभिन होने के लिए दी गयी सर्विस 2 थी। गर्भधारण करने की प्रतिशत तीसरी सर्विस में सबसे अधिक, दूसरी सर्विस में कम तथा पहली सर्विस में सबसे कम पायी गयी।

बाल गुणात्मक गुण :

बाजू, मध्यतरफ, कूबड़ तथा गर्दन से प्राप्त, 60 बाल नमुने तीनों नस्लों के ऊँटों से लिये गये। औसत माध्य तन्तु लम्बाई बीकानेरी नस्ल में तथा तन्तु व्यास कच्छी में अधिक पाया गया। शुद्ध और केम्प बालों की औसत माध्य प्रतिशतता सर्वाधिक कच्छी में उसके पश्चात् बीकानेरी एवम् जैसलमेरी नस्ल में पायी गयी। शुद्ध बालों की औसत प्रतिशतता : सभी नस्लों में मध्य तरफ अधिक पायी गयी।

बीकानेरी ऊँटों में दूध उत्पादन :

तीन और पांच ब्यांत की 6 दूधारू ऊँटनियों का दूध 12 घण्टे के अन्तराल पर औसतन 3.08 – 3.79 लिटर प्रतिदिन पाया गया। सुबह का दुग्ध उत्पादन शाम की तुलना में सार्थक रूप से अधिक पाया गया। दुग्धकाल की अवधि बिना पूरक आहार के 15 महीने पायी गयी।

उप परियोजना 2

भारतीय ऊँटों में आणविक अनुवांशिक अध्ययन केमेलस ड्रोमेडेरियस ऊँटों में डी.एन.ए. क्लीवेज परिच्छेदिका एन्जाईम्स कैचिया *Hind III*, *Pst I* और *Pvu II* का प्रयोग करके ऊँट के जीनोमिक डी. एन. ए. से क्रमशः 10, 6 और 2 पुर्नावत डी. एन. ए. बैंड प्राप्त हुए हैं।

6 प्राइमरों का प्रयोग कर डी. एन. ए. प्रवर्धन किया गया। ऊंटों की तीनों नस्लों में पांच प्राइमर (GT-10, GC-10, G-2, OP-09 और G-1) से नस्ल पहचान सम्बन्धी डी. एन. ए. बैंड प्राप्त हुए हैं।

परियोजना 2.3 : प्रजनन क्षमता में सुधार और प्रजनन अक्षमता के कारणों का अध्ययन :

उप परियोजना 1 : ऊँट वीर्य का एकत्रण, प्रशीतन एवम् हिमीकरण :

गायों के समान कृत्रिम योनि द्वारा ऊँट में भी वीर्य एकत्रण करने के प्रयासों में सफलता मिली है। पर योनि में स्त्रवण न करने, शुक्राणुरहित ब्लबोयूरिथ्रल स्त्रावण, अपूर्ण वीर्यदान, अगतिशील शुक्राणु, वीर्य का द्रवीकरण, धूल मिट्टी का प्रदुषण आदि मुख्य कठिनाईयां सामने आयीं। ऊँट वीर्य थक्का का सुक्ष्मदर्शी अध्ययन करने पर मानववीर्य थक्के के समान पाया गया। शुक्राणु रेशनुमा जाल में फंसे पाये गये। रिक्त स्थान न मिलने पर शुक्राणु गति नहीं कर पाते। शुक्राणु की तीव्र गति द्रवीकरण के बाद शुरू होती प्रतीत होती है।

वीर्य का हिमीकरण ट्रिस साइट्रिक एसिड एवम् ग्लिसरॉल वीर्यवर्धक द्वारा किया गया। हिमीकरण पश्चात् वीर्य द्रवीकरण में शुक्राणु की गति एवम् एक्रोसोम अखंडता को देखकर पाया गया कि काफी वीर्य नमुने सफलतापूर्वक हिमीकृत हो गये हैं इस विधि को और अधिक श्रेष्ठ बनाने की दिशा में प्रयास जारी हैं।

उप परियोजना 2 : कान निरोपण प्रोजेस्ट्रॉन, PMSG और HCG उपचार द्वारा बहुअण्ड जनन :

उपचार द्वारा तीन/आठ में अण्ड स्फूटन नहीं हुआ। एक/आठ में अण्ड स्फूटन के बाद कार्पस ल्यूटियम समयपूर्व प्रतिपायन और चार/आठ में अण्ड स्फूटन पाया गया। मादा ऊँटों से बिना सर्जरा गर्भाशय प्रक्षालन पर भूष प्राप्त नहीं किये जा सके।

परियोजना 2.4 : अनुकूल उत्पादन के लिए पोषक आवश्यकताओं और आहार साधनों के मूल्यांकन पर अध्ययन :

उपपरियोजना 1 : नाइट्रोजन स्रोत का शारीरिक भार वृद्धि, पचनीयता और मार्ग की दर पर प्रभाव :

समूह एक को दो प्रतिशत यूरिया घोल छिड़काव वाली ग्वार फलगटी, समूह दो को ग्वार फलगटी + खेजड़ी पत्तियाँ तथा समूह तीन को सिर्फ फलगटी खिलाई गयी। समूह एक और दो में समूह तीन की अपेक्षा शारीरिक भार में अधिक वृद्धि एवम् शुष्क पदार्थ अर्न्तग्रहण, कार्बनिक पदार्थ और शुष्क पदार्थ पाचन में अधिकता पायी गयी। यूरिया फलगटी समूह में रूधिर यूरिया नाईट्रोजन अन्य समूह की तुलना में अधिक सार्थक पाया गया।

उप परियोजना 2 : कम उम्र में ऊँट के बच्चों को माँ के दूध से अलग करने पर वृद्धि पर पड़ने वाले प्रभाव का अध्ययन :

ऊँट के बच्चों को 4-5 महीने पर माँ के दूध से अलग कर उन्हें निश्चित मात्रा के सान्द्र ठोस आहार, दूब और फलगटी (भरपेट) खिलाया गया। औसत 403.8 ग्राम प्रति दिन शारीरिक भार में वृद्धि तथा भोज्य पदार्थ उपयोग क्षमता 8.78 किग्रा प्राप्त की गयी। 4-5 महीने पर दूध से अलग कर 2.8 रुपये/पशु/दिन की बचत की जा सकती है।

उप परियोजना 3

ऊँट के दूध में किण्वन का अध्ययन कमरे के तापक्रम (39-40°C) पर किया गया। कच्चे दूध एवम् पाश्चुरीकृत दूध में 1 घण्टे से 48 घण्टे पर अम्लता क्रमशः 0.091±0.007 से 0.684±0.97 तथा 0.11±0.008 से 0.54±0.043 पायी गयी।

उप परियोजना 4

ऊँट दूध के थक्के पर अध्ययन :

k केसीन कम होने के कारण साधारणतया दूध का थक्का नहीं बनता। 40°C पर रेनेट से उपचारित ऊँट का दूध गाय के दूध के साथ 3:1 मात्रा में मिलाने पर अधिक थक्का प्राप्त हुआ।

परियोजना 3.5 : शुष्क और अर्धशुष्क परिस्थितिकी में विभिन्न उष्ट्र प्रबन्धन विधियों का आर्थिक स्तर पर अध्ययन :

उप परियोजना 1 : ऊँट गाड़े में ऊँट के उपयोग का शहर एवम् गांव में तुलनात्मक अध्ययन :

कृषि उपज मंडी बीकानेर (शहर) एवम् गाढवाला (गांव) में ऊँटों का गाड़े में उपयोग और उससे जुड़े अन्य पहलुओं पर सर्वे किया गया। अध्ययन के अनुसार 78.75 से 85.65 प्रतिशत ऊँट पालक

ऊँट को गाड़े में काम लेते हैं। ऊँट गाड़े का उपयोग मुख्यतया खेती में उसके पश्चात् रोजगार हेतु लिया जाता है। गाड़े में बीकानेरी नस्ल का ऊँट काम लिया जाता है। ऊँट गाड़े से प्रतिदिन औसतन 137.20 ± 26.17 से 299.25 ± 31.72 रुपये की आमदनी हो जाती है। जबकि ऊँट पर प्रतिदिन का खर्चा 40 रुपये आता है।

उप परियोजना 2 : सिंचित एवम् असिंचित क्षेत्रों में उष्ट्र प्रबन्धन विधियों का अध्ययन।

62 किसानों से उनकी आर्थिक स्थिति, खेती, ऊँट पालन पद्धति, आय तथा परिवार के बारे में जानकारी प्राप्त की गयी। ऊँट से खेती में औसतन 9.00 ± 2.11 से 10.55 ± 4.22 घण्टें काम लिया जाता है। दुग्धकाल 9.76 ± 0.45 महीने तथा औसत दुग्ध उत्पादन 3.5 ± 0.50 से 4.8 ± 1.12 कि./दिन होता है। प्रतिदिन 6.25 ± 0.43 से 10.54 ± 0.31 घण्टें/दिन चराई के लिए छोड़ा जाता है। बच्चों में मृत्युदर 32.76 एवम् व्यस्क में 8.05 प्रतिशत पायी गयी। पशुपालन से प्राप्त आमदनी गाय और भैस से 45 रुपये/दिन/पशु एवम् ऊँट 36 रुपये/दिन/पशु पायी गयी।

परियोजना क्रमांक 2.6 : ऊँट बीमारियों का पर्यवेक्षण, निगरानी एवम् नियंत्रण :

उप परियोजना 1

बीकानेर तथा जैसलमेर क्षेत्रों के सर्वेक्षण पर 39.34 और 24.29 प्रतिशत ऊँट उदर आंत्र कृमि से संक्रमित पाये गये। मुख्य कृमि हिमॉनकस, निमेटोडिरेला, निमेटोडायरस और दूसरे स्ट्रॉगाइलोसिस पाये गये। बीकानेर के ऊँटों में 14.66 प्रतिशत तथा जैसलमेर के ऊँटों में 21.76 प्रतिशत खुजली परजीवी पाये गये। बीकानेर क्षेत्र में वेलेन्टिडियम कॉलई मुख्य आँत प्रोटोजोआ पाया गया।

उप परियोजना 2

खुजली रोग के विरुद्ध कीटनाशक दवा का परीक्षण में चार दवाईयों फेनवलेरट, डेल्टामेथरिन, अमृतराज, आईवरमेक्टिन का खुजली रोग के विरुद्ध प्रभाव तथा आने वाले व्यय का अध्ययन किया गया। फेनवलेरट दवाई अधिक प्रभावी एवम् मितव्ययी पायी गयी।

उप परियोजना 3 : उदर आंत्र निमेटोडोसिस के विरुद्ध उपचार परीक्षण :

निमेटोड संक्रमित (>2000 epg) 24 ऊँटों के चार समुह (प्रत्येक समुह में छः) में से तीन समुह को आइवरमेक्टिन, एल्बेन्डाजोल, फेनबेन्डाजोल से उपचारित किया गया। रूधिर रसायनिक में उपचार

के बाद सुधार पूर्व की रूधिर रसायनिकी से ($p < 0.05$) सार्थक रूप से भिन्नता पायी गयी। एक ग्राम मल में अण्डों की संख्या 96.02, 96.65 और 94.03 क्रमशः समुह 1, 2, 3 में पायी गयी।

उप परियोजना 4 : बहुलित औषध प्रतिरोध क्षय रोग के मरीज में ऊँटनी का कच्चा दूध देने पर पड़ने वाले प्रभाव का अध्ययन :

सरदार वल्लभ पटेल चिकित्सा महाविद्यालय, बीकानेर के क्षय एवम् छाती रोग विभाग के सहयोग से दो तरह के क्षय रोगियों ने ऊँटनी के कच्चे दूध का एवम् गाय के दूध का प्रभाव देखा गया। रोगियों की संख्या क्रमशः 6 एवम् 5 थी। 1 किलो दूध दिन में तीन बार दिया गया। ऊँटनी का दूध पीने वाले समुह के शारीरिक भार में वृद्धि, भूख में बढ़ोत्तरी, एक्सरे नतीजों में सुधार, हिमोग्लोबिन में वृद्धि, जिंक और लोहा तत्वों में वृद्धि, प्रतिरक्षित IgG और IgA में कमी पायी गयीं। इसी तरह गाय के दूध की तुलना में ऊँटनी का दूध पीने वाले बहुलित औषध प्रतिरोध क्षय रोगी में लाभप्रद सुधार पाया गया।

उप परियोजना 5 : चिरकालीन फेफड़े क्षय रोग से ग्रसित मरीज को पोषक आहार के साथ ऊँटनी के दूध द्वारा उपचार की उपयोगिता :

पिछले 5-7 वर्ष से पीड़ित क्षय रोगी के समुह टी1 (6 मरीज) को ऊँटनी का कच्चा दूध, टी2 (4 मरीज) को गाय का दूध प्रचलित दवाईयों के साथ 1 किलो प्रतिदिन तीन महीने तक दिया गया। टी1 समुह में टी0 की तुलना में एक्सरे नतीजों में सुधार, भुख में बढ़ोत्तरी, सांस और कफ में सुधार तथा भार में वृद्धि पायी गयी।

2.7 विस्तृत, संचार एवम् मानव विकास संसाधन पर सहायता परियोजना :

ऊँट स्वास्थ्य शिविर :

अंगीकृत गांव गाढ़वाला में दो ऊँट स्वास्थ्य शिविर लगाये गये। जिसमें मुफ्त दवाईयों का वितरण किया गया। तथा स्वास्थ्य सम्बन्धी समस्याओं का निराकरण किया गया।

किसान गोष्ठी :

इस वर्ष दो गोष्ठियाँ, गाढ़वाला में एवम् केन्द्र में आयोजित की गयीं। ऊँट प्रबन्धन एवम् बिमारियों से संबन्धित समस्याओं का विशेषज्ञों द्वारा समाधान किया गया। लोकहित पशुपालक संस्थान

के सदस्यों तथा किसानों को केन्द्र का भ्रमण करवाकर ऊँट के विभिन्न पहलुओं से संबन्धित विषयों के बारे में जानकारी दी गयी।

2.8 रेडियो प्रसारण : विषय विशेषज्ञों द्वारा विभिन्न विषयों पर सात रेडियो वार्ताएँ प्रसारित की गयी।

- ❖ तीसरे राष्ट्रीय पशुधन और मुर्गी प्रदर्शनी, दिल्ली (26.1.2000 – 2.2.2000) में "ऊँट के उपयोग और अनुसंधान पर प्रकाश" शीर्षक से प्रदर्शनी लगायी गयी तथा केन्द्र ने तीन प्रथम पुरस्कार जीते।
- ❖ 47 वीं अखिल भारतीय पशुधन और मुर्गी प्रदर्शनी जयपुर में 5 पुरस्कार केन्द्र द्वारा जीते गये।
- ❖ ऊँट पालन विधियाँ और आधुनिक तकनीकी, केन्द्र की प्रगति-कैसे शीर्षक से ऊँट उत्सव 2000, बीकानेर, कृषि एक्सपो 2000 प्रगति मैदान, दिल्ली में केन्द्र द्वारा प्रदर्शनी लगायी गयी।

2.8.1 अनुसंधान योजनाएँ : फसल आधारित पशु उत्पादन नेटवर्क सहयोगिक योजना :

अनुसंधान 1 : वन वृक्ष चरागाह में चराई प्रबन्ध पद्धति पर ऊँट के बच्चे की क्रिया :

16 हेक्टेयर चराई भूमि में ऊँट के बच्चों (2-3 वर्ष) की पोषण संबंधी आवश्यकताओं की चरागाह से पूर्ति का अध्ययन करने के लिए माह जून, 1999 से चराई हेतु रखी गयी। माह अक्टूबर एवम् नवम्बर में चरागाह में घास-पात न होने के कारण शारीरिक भार में कमी हुई। 5 किग्रा. प्रति ऊँट प्रति दिन ग्वार और जाल की पत्तियाँ खिलाकर शारीरिक भार को स्थिर बनाया गया। अतः अध्ययनानुसार शुष्क क्षेत्रों में वनवृक्ष चरागाह में पर्याप्त चारा न होने पर पूरक आहार देकर शारीरिक भार को बनाये रखा जा सकता है।

2.8.2 अनुसंधान योजनाएँ : ठण्डे मरूस्थल में दो कूबड़ वाले ऊँटों का मूल्यांकन एवम् संरक्षण :

56 बालों के नमूनों का विश्लेषण करने पर शरीर के विभिन्न भागों से प्राप्त (बाजू, मध्यतरफ, कूबड़, गर्दन, जांघ) बालों की गुणवत्ता में सार्थक अन्तर ($p < 0.01$) जबकि लिंग आधार पर अन्तर सार्थक नहीं पाया गया। तन्तु की लम्बाई कूबड़ पर अधिक 13.25 ± 1.03 सेमी. एवम् औसत तन्तु व्यास जांघ के बालों में 14.56 ± 3.56 सेमी. पाया गया। अधिक तन्तु लम्बाई और ऊन तन्तु की गुणवत्ता गाँव के लघु उद्योग में तन्तु पसंस्करण में ऊँट के बालों की उपयोगिता दर्शाती हैं। Hb, PHI, G-6-P-D और ACP में बहुरूपता नहीं पायी गयी, जबकि एमाईलेज और ट्रान्सफेरिन पूर्व अध्ययन के विपरीत बहुरूपता

पायी गयी। दो कूबड वाले ऊँटों में Ca, P, Zn, Fe, Cu सार्थक रूप से अधिक पाये गये। इन ऊँटों द्वारा खाये जाने वाले पेड़-पौधों का रासायनिक संघटन भी देखा गया।

2.9 अंतर-संस्थान सहयोग :

2.9.1 ड्रोमेडेरियन ऊँटों में तरल धारण का हारमोन व वृक्क द्वारा नियंत्रण :

आठ ऊँटनियों को गर्मियों में 13 दिन एवम् सर्दियों में 24 दिन तक बिना पानी (निर्जलीकरण) तत्पश्चात् 5 दिन तक पानी पिलाकर (रिहाइडेटेड) अध्ययन किया गया। मुत्र निष्कासन नलिका द्वारा मुत्र एकत्रित किया गया। निर्जलीकरण अवस्था में ऐल्डोस्टीरोन एवम् कार्टिसाल स्तर में वृद्धि एवम् T_4 , T_3 के स्तर में कमी पायी गयी। इनुलिन निकासी परीक्षण द्वारा गुल्माकार (ग्लोमेरुलर) निस्पंदन दर निर्जलीकरण स्थिति में 74.74 प्रतिशत सर्दियों में तथा 84.84 प्रतिशत गर्मियों में पायी गयी। प्रत्येक ऋतु में रिहाइड्रेशन के 96 घण्टे पश्चात् सामान्य स्तर पाया गया। यूरिया निकासी वृक्क द्वारा सक्रिय नियंत्रित पायी गयी। वृक्क का स्थान्तरण कार्य तरल धारण से संबन्धित पाया गया। निर्जलीकरण में मुत्र सर्दी एवम् गर्मी में क्रमशः 92.55 प्रतिशत व 97.41 प्रतिशत कम हुआ। सर्दी में 31.56 प्रतिशत तथा गर्मी में 34.99 प्रतिशत की शारीरिक भार में कमी पायी गयी।

2.9.2 बकरी एवम् ऊँट के दूध से बने डेयरी उत्पादों का जीवनकाल बढ़ाने के लिए जीवाणुरोधी अंश का अध्ययन :

औसत लाइपोपरआक्सीडेज की मात्रा बकरी के दूध में 3.97 मि.ग्रा. प्रति लीटर पायी गयी। इसकी सक्रियता में रनेट व्हे और एसिड व्हे बनाने पर 5-9 प्रतिशत की कमी पायी गयी। बकरी के दूध के ऊपरी भाग (सिक्म दूध) से लाइपोपरआक्सीडेज को पृथक किया गया SDS-PAGE पर एकल बैंड पाया गया। शुद्ध एन्जाइम्स में विशेष सक्रियता 34 यूनिट प्रति मि.ग्रा. और RZ 0.9 से अधिक पायी गयी। आरम्भिक अनुसंधान में शुद्ध लाइपोपरआक्सीडेज 500 माइक्रोग्राम/मिली सान्द्रता पर लाइपोपरआक्सीडेज ई कोलाई एवम् स्टेफाईलोकॉकस के लिए जीवाणु रोधी पाया गया।

2.9.3 भौतिक, कार्यकी, जैव रसायनिक गुणों द्वारा भारतीय और फ्रेंच गधों में कार्यक्षमता का निर्धारण :

आठ गधों (4 भारतीय एवम् 4 फ्रेंच नस्ल) को 3-4 किमी/घण्टा से प्रतिदिन 3 घण्टे 6 महीने तक बिना बोझा चलने का अभ्यास दिया गया। तत्पश्चात् शरीर के भार का 30 प्रतिशत एवम् 50 प्रतिशत भार लादकर 8 सप्ताह तक चलाया गया। श्वसन दर/मिनिट, तापक्रम, नाडी दर में सार्थक

रूप से बढ़ोत्तरी पायी गयी। यह बढ़ोत्तरी फ्रेंच नस्ल में अधिक पायी गयी। तथा CK, LDH शर्करा, क्रिएटिनिन, ट्राईग्लिसराईड, केलशियम में भी अधिक अन्तर पाया गया।

2.9.4 ऊँट लेक्टोफेरिन्स संरचना पर अध्ययन :

ट्रांसफेरिन्स से प्राप्त प्रथम प्रोटीन लेक्टोफेरिन्स में ट्रांसफेरिन्स और लेक्टोफेरिन्स के समान आयरन जोड़ने एवम् मुक्त करने के गुण एक साथ पाये गये। 50 प्रतिशत आयरन pH 6.8 पर शेष आयरन pH 3.2 पर मुक्त की जाती हैं। शुद्ध एपोलेक्टोफेरिन्स को रवेदार बनाने पर चार अलग डोमन् प्राप्त हुए। C खण्ड ट्रांसफेरिन्स की अपेक्षा अधिक pH पर जबकि N खण्ड 2.5 से कम pH पर आयरन मुक्त करता हैं।

2.9.5 प्रोपोफोल निश्चेतक का ड्रोमेडेरी ऊँटों में मूल्यांकन :

छः ऊँटों को तीन समुह बनाकर 1 मिग्रा/शारीरिक भार से नाड़ी में प्रोपोफोल दिया गया। आठ मिनट की अवधि का यह निश्चेतक रोग निदान एवम् छोटी शल्य चिकित्सा के उपयुक्त पाया गया। निश्चेतक के कारण पड़ने वाले प्रभाव का कार्यकी, रूधिर एवम् जैव-रसायनिक स्तर पर अध्ययन किया गया।

2.9.6 मूँगफली चारा, ग्वार फलगटी तथा ग्वार फलगटी + मूँगफली चारे का तुलनात्मक अध्ययन :

टी₁ समुह को मूँगफली चारा, टी₂ को ग्वार चारा, टी₃ को मूँगफली + ग्वार चारा, (50:50 की मात्रा में) दिया गया। शुष्क पदार्थ अन्तर्ग्रहण (कि.ग्रा./W^{0.75}), स्वादु संरचना, आहार क्षमता में उपचार से सार्थक अन्तर पाया गया। शारीरिक भार में सार्थक अन्तर नहीं पाया गया। आर्थिक रूप से टी₃ समुह का चारा खर्चा टी₁ एवम् टी₂ की तुलना में कम पाया गया।

ऊँट स्वास्थ्य प्रबन्धन :

वर्ष 1999-2000 में 108 पीड़ित ऊँटों का उपचार किया गया। जिसमें 21 पाचन संबन्धी, 50 शल्य तथा 37 चमड़ी रोग से संबन्धित थे। इस वर्ष विशिष्ट मृत्यु दर (SDR %) 8.11% रही।

चारागाह भूमि प्रबन्धन :

केन्द्र की 824 हेक्टेयर भूमि रेतीली तथा ऊंची, नीची है। अतः अधिकतर गतिविधियाँ

150 हेक्टेयर भूमि में की गयी। पूर्व स्थापित चारागाह और वनवृक्ष चारागाह की देखभाल की गयी। कच्ची सड़क के साथ-साथ बाड़ लगायी गयी। 24 हेक्टेयर भूमि पर ग्वार एवम् 5 हेक्टेयर भूमि पर बाजरा की खेती की गयी।

तकनीक विकसित एवम् प्रसार :

- ❖ प्रजनन क्षमता में सुधार के लिए पद्धति।
- ❖ बच्चों में मृत्यु दर कम करने की पैकेज पद्धति।
- ❖ ऊँट स्वास्थ्य-सुधार पद्धति।

राष्ट्रीय-अन्तर्राष्ट्रीय सहयोग :

संस्थान

अनुसंधान कार्य

- | | | |
|--|---|---|
| 1. अखिल भारतीय आयुर्विज्ञान संस्थान, दिल्ली | : | दूध प्रोटीन विशेषतया : लेक्टोफेरिन्स |
| 2. राजस्थान कृषि विश्वविद्यालय, बीकानेर | : | एम.वी.एस.सी., पी.एच.डी. अनुसंधान कार्य |
| 3. सी.सी.एस. हरियाणा कृषि विश्वविद्यालय, हिसार | : | पी.एच.डी. कार्य |
| 4. राष्ट्रीय डेरी अनुसंधान संस्थान, करनाल | : | ऊँट दूध विश्लेषण |
| 5. सी. आई. ए. ई., भोपाल | : | ऊँटनी के दूध की विश्लेषण |
| 6. एस.पी. मेडिकल कॉलेज, बीकानेर | : | ऊँटनी दूध पर (टी.बी. उपचार) |
| 7. डी.आर.डी.ओ., रक्षा मंत्रालय, लद्दाख | : | दो कूबड़ वाले ऊँटों का मूल्यांकन एवम् संरक्षण |

अन्तर्राष्ट्रीय सहयोग :

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|------------------------------------|---|-------------------------|
| सी.आई.आर.ए.डी.-ई.एम.वी.टी., फ्रांस | : | अनुसंधान एवम् प्रशिक्षण |
|------------------------------------|---|-------------------------|

प्रकाशन :

इस वर्ष 15 शोध पत्र प्रकाशित हुए। वर्ष 1999-2000 में नयी प्रबन्ध समिति (तीन साल) के लिए बनायी गयी। वैज्ञानिक शोध समिति की दो बैठकें सम्पन्न हुई।

हिन्दी अनुभाग :

केन्द्र में राजभाषा स्वर्ण जयन्ती वर्ष के तहत हिन्दी पखवाडा मनाया गया। इस अवसर पर हिन्दी निबन्ध लेखन, टिप्पणी एवम् प्रारूप लेखन परीक्षा, श्रुति लेखन परीक्षा आदि प्रतियोगिताओं का आयोजन किया गया।



Celebration of Hindi Pakhwara



Tree Plantation during Van Mahotsav



राष्ट्रीय उष्ट्र अनुसन्धान केन्द्र

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